Lecture Notes in Electrical Engineering 690

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Advances in Power Systems and Energy Management

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Foreword

The 2nd International Conference on Emerging Trends and Advances in Electrical Engineering and Renewable Energy (ETAEERE-2020) which was held at Kalinga Institute of Industrial Technology (KIIT) Deemed to be University, Bhubaneswar, Odisha, from 5 to 6 March 2020. It brings together the latest research in smart grid, renewable energy and management, electronics, communication, computing, systems, control and automations. The aim of the conference was to provide a platform for researchers, engineers, academicians and industry professionals to present their recent research works and to explore future trends in various areas of engineering and management. The conference also brings together both novice and experienced scientists and developers, to explore newer scopes, collect new ideas and establish new cooperation between research groups and exchange ideas, information, techniques and applications in the field of electrical, renewable energy, electronics and computing.

The aim of this book (i.e. *Advances in Power Systems and Energy Management*) is to introduce technological advancement in power system and energy management to provide the energy utility with set points to optimize the current power system state online with respect to various objectives. The objective of this book is to provide a thorough study of the power system and energy management, and the methods commonly used in analysis of power systems utilizing computer software. The following types of studies are covered: short circuit, load flow, motor starting, cable ampacity, stability, harmonic analysis, switching transient, reliability, ground mat, protective coordination, power system modeling. The combine theme of "Advances in Power Systems and Energy Management" is to embrace research, development, planning, design, construction, maintenance, installation and operation of equipment, structures, materials and power systems for the safe, sustainable, economic and reliable conversion, generation, transmission, distribution, storage and usage of electric energy, including its measurement and control.

Our sincere thanks to School of Computer Engineering and School of Electrical Engineering of KIIT Deemed to be University for the combine effort for making this ETAEERE-2020 as a successful event and we would like to record our appreciation to the whole committee members of ETAEERE-2020. We are also

thankful to all the participants and our keynote speakers, who have presented scientific knowledge and foresight scope for different tracks.

We have received more than 450+ research articles and thanks to our peer reviewing team for selecting quality papers for each volume. The participants have presented their work in these main tracks: Systems, Control and Automations, Smart Grid, Renewable Energy and Management, Electronics, Communication And Computing and Advanced Computing.

We would also like to acknowledge our technical partners i.e. Sikkim Manipal Institute of Technology, India, and Baekseok University, South Korea, for the continuous technical support throughout the journey. Sikkim Manipal Institute of Technology (SMIT) deserves a special mention, for holding the 1st edition of ETAEERE-2016 and proving a collaborative opportunity to host ETAEERE-2020 at KIIT University.

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Contents

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Dr. Neeraj Priyadarshi received his M.Tech. in Power Electronics & Drives in 2010 from Vellore Institute of Technology (VIT), Vellore, India, and his PhD from Government College of Technology and Engineering, Udaipur, India. His current research interests include power electronics, control systems, power quality, and solar power generation. Currently, he is associated with BIT Ranchi, India. In previous postings he was with MIT Purnea, JK University, Geetanjali Institute, Global Institute and SS Group, Rajasthan, India. He has published over 40 papers in journals and conferences. Dr. Priyadarshi is a reviewer of IEEE Systems Journal, International Journal of Modeling and Simulation, International Journal of Renewable Energy Research, International Journal of Power Electronics and Drives.

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Comparative Study of Job Scheduling Algorithms in Grid Computing

M. Ashok Kumar, T. Sai Srinivas, and Raksha Pandey

1 Introduction

The objective of grid computing is to facilitate, optimize and improve the usage of resources that are spatially placed to perform a large single task or a number of tasks with a common goal which would be difficult for a single machine. Grid computing aims to decentralize the administration of resources with varied potentials in speed, computing power to perform complicated scientific applications [1]. It scrutinizes certain parameters like availability, usage cost, capability and other quality of services to share, aggregate and select the resources. Grid scheduler manages the resources and is responsible for assigning suitable resources to the user applications [2].

Working of grid computing is simple. It is done with four basic steps: First user submits job to grid, second scheduler distributed the jobs as per user needs and resources condition, third Jobs are executed in resources and last result received by the user. In this paper, we have discussed various job scheduling algorithms and presented a comparative study on them.

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2 A Novel Algorithm for Fault-Tolerant Job Scheduling and Load Balancing in Grid Computing [ANAFTJSLBG] [3]

This research paper proposes an algorithm for scheduling of jobs in grid computing. Main goal of this paper is to arrive at job tasks that will deliver in minimal response time and optimal utilization of computing nodes. The various job scheduling algorithms. Job scheduling is needed to utilize resources effectively in different areas of science and technology.

Advantages

- Dynamic load balancing algorithm doesn't any processing time.
- Whenever a load imbalance is detected, they change system state, information, location and selection of a process.
- For reducing failures, they proposed two approaches (a) Active replication (b) Passive replication.

Disadvantages

- Complex scheduling will lead to greater load impact on the system.
- There is an overload in the nodes due to unpredictable job arrival.
- There is an issue of task allocation and load balancing for most of the grids.

3 A Flexible Frame Work for Fault Tolerance in the Grid [FFFTG] [4]

Failure detection plays an important role in Grid Execution. This paper focuses on Failure Detection Service and presents a fault tolerance mechanism.

Advantages

- It helps in detection of both task crashes and user-defined exceptions.
- It allows user to achieve failure recovery in a variety of ways depending on the requirements and constraints of the applications.

Disadvantages

- This focuses on integrating only one failure type independent fault tolerance technique.
- This model doesn't work well because it can support neither task-specific failure definition detection and handling nor diverse failure handling strategies.

4 Bio-Inspired Optimization Techniques for Job Scheduling in Grid Computing [BIOTJSG] [5]

In this paper, authors' experimentally prove their feasibility to various distributed and parallel computing optimization problems. The properties like scalability flexibility, etc., allows them to perform efficiently in dynamically changing computing environments.

Advantages

- It can provide solutions for large-scale computer demands.
- It is more effective for computing optimization problem.

Disadvantages

- The cost is high.
- The process of scheduling is difficult.

5 Scheduling Jobs on Grid Computing Using Firefly Algorithm [SJGUFA] [6]

This paper presents an algorithm of job scheduling with a concept of firefly algorithm. Author nicely presented the algorithm. This new concept creates schedule in such a way the jobs can complete in minimum makespan.

Advantages

- This model handles several NP complete problems.
- This model has optimal schedule to finish the submitted job.
- This is proven to be a good search technique on continuous optimization.
- This model has lowest make-span time compared to max-min and min-min.

Disadvantages

- This method doesn't work properly for more number of jobs.
- Works good for those whose light intensity is good.

6 Incremental Checkpoint Based Failure Aware Scheduling Algorithm [ICBFASA] [7]

In grid computing, performance as well as failure factors both are important. In this environment, jobs are executed parallel so there is a need for failure-aware algorithm. Resource should not have high failure rate. Proposed algorithm considered failure factors as well as performance factors.

Advantages

- In this model, failure rate is reduced.
- The work is equally shared by all the nodes, so all nodes work simultaneously.
- Whenever a system fails is restart from the beginning which is waste of time, but in this model, it starts from where it has been stopped.
- Improved in performance ratio, failure ratio, success ratio and response time.

Disadvantages

- As it is having two copies of task, i.e. primary copy and backup copy memory consumption are high.

7 Fast PGA Based Scheduling of Dependent Tasks in Grid Computing to Provide QOS to Grid Users [FPBSDTGPQG] [8]

The fast PGA based proposed a method that covers various objectives. In this, overall execution time of jobs is minimum. Author also considered the deadline as well as budget factor. The task dependency among grid workflows is devised in DAG form. The input files are generated in standard task graph (STG) set. The implementation of proposed scheduling mechanism is done in ALEA3.0 grid scheduling simulator.

Advantages

- Many tasks are scheduled on one resource (cluster).
- One time slot is used for scheduling of each job.
- Heterogeneous resources are available to plan the schedule.

Disadvantages

- The cost of the entire system is high.
- Scheduling in such environment is crucial task.

8 An Adaptive Grouping Based Job Scheduling in Grid Computing [AAGBJSG] [9]

In this paper, author introduced job scheduling model in grid computing environments. A dynamic scheduling algorithm is proposed to maximize the resource utilization and minimize the processing time of the jobs. The proposed algorithm reduces the processing time of jobs.

Advantages

- It minimized the task communication time.
- Minimum Processing time.
- Dynamic resource characteristics are considered.
- It uses the resources sufficiently.
- Time complexity is high.
- It pays attention to network bandwidth and memory size.

Disadvantages

- The specific set of jobs that require only a specific set of resources.

9 Task Scheduling in Grid Computing Using Genetic Algorithm [TSGCGA] [10]

This paper focuses on genetic algorithms. This paper provides optimal solution.

Advantages

- It provides the optimal solution.
- Each task is taken into consideration.

Disadvantages

- It does not perform multiple tasks at the same time.

10 Grid Load Balancing Using ANT Colony Optimization [GLGBJSG] [11]

This paper proposed a technique that is based on ANT colony optimization. Load balancing plays a very important role in grid computing. This paper utilizes resources efficiently. Balanced load and takes less time for processing jobs.

Advantages

- It provides dynamic load balancing.
- It provides effective load balancing.

Disadvantages

- Ant can move only in one direction, it can't rollback (Table 1).

Table 1 Comparison of different jobs and resource scheduling algorithm

PAPER	RES.TI	RESO.UTI	LO.BL	COST
ANAFTJSLBG	LOW	HIGH	HIGH	HIGH
FFFTG	HIGH	LOW	LOW	HIGH
BIOTJSG	HIGH	HIGH	HIGH	HIGH
SJGUFA	LOW	HIGH	HIGH	HIGH
ICBFASA	LOW	HIGH	LOW	LOW
FPBSDTGPQG	LOW	HIGH	HIGH	HIGH
AAGBJSG	LOW	HIGH	HIGH	HIGH
TSGCGA	LOW	HIGH	HIGH	LOW
GLGBJSG	HIGH	HIGH	HIGH	HIGH

RES.TI response time, *RESO. UTI* resource utilization, *LO.BL* load balance

Comparative Study

We made an analysis of various papers. In Which ANAFTJSLBG paper is having low response time but efficiently utilizes resources. In FFFTG processing cost is high as well as low resource utilization but the response time is good.

BIOTJSG gives high response time and higher processing cost but good resource utilization and load balancing.

SJGUFA provides good load balancing and efficiently utilizes resources but processing cost is high. In ICBFASA, resource utilization is high but low in response time, load balance and processing cost. FPBSDTGPQG is high in resource utilization, load balancing and processing cost but low in response time. AAGBJSG gives good resource utilization but low in response time, load balance and processing cost. TSGCGA gives high response time and load balancing but processing cost is low and response time is also low.

11 Conclusion

Here we have made comparison of different algorithms using their response time, resource utilization, load balance and cost. In future, we will develop an algorithm which has high resource utilization and low cost processing.

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A Survey on Automatic Musical Chord Sequence Generation

Abraham George and X. Anitha Mary

1 Introduction

Over the years, music has proved to influence the human mind in various ways. It has the wonderful capability of influencing human emotional states. Involvement in musical activities can calm down a person's nerves, make him relax, and improve his mental healthiness. On the contrary, music can trigger even emotional outbursts. Recent studies prove that the neural activity in human brain has correlation with the reward value of music [1, 2]. By affecting our brains positively, music can thus change our lives, making it more colorful.

Today, the field of song writing and composition are held by experienced musicians. Even though musical genius is an instinct that is inborn or is heavily trained, there are a large number of people who take music for recreation and personal enjoyment. While experimenting, musicians use chord progressions played in instruments to accompany their melody [3, 4]. Individuals having very limited knowledge in musical theory might have ideas in surplus, but are unable to experiment their ideas, due to poor understanding in theory of chords and harmony [5]. From an untrained, non—musician point of view, an accompanying system that creates songs for what he sings into the microphone is so much desired. Even for well-experienced musicians, performing in real-time for an unknown song is difficult during the initial bars. But, they find some repetitive chord progressions and try to use them often to predict

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upcoming chords as the song progresses. This prediction mechanism is a matter of interest for all researchers in music [6].

Efforts have been made to automate music accompanying system ever since the 1990s. Time series prediction methods for predicting the upcoming chords had been done with limited success [7]. Hybrid models for chord prediction were proposed during the late 1990s [5]. Various automatic chord generation and composition schemes using Genetic algorithm [8], Artificial Intelligence [9], deep learning [10], fuzzy logic [3], Bayesian belief networks [11], n-gram model and Hidden Markov Model (HMM) [12] were proposed recently. Large number of research groups show interests in research of automatic chord generation taking into consideration their regional music [13, 14]. Recent researches show advancement in the area of music accompaniment generation based on emotion flow [15–17]. The desired chord prediction system put forward serious issues while on its implementation. First of all, the online prediction of chord sequence under zero latency is difficult to be realized. Second, a music chord progression depends on the composer, arranger style, mood, and the musician's present intentions. Another major issue of concern is that there are no universal rules for chord progressions, making it always the choice of composer. Hence, for in real-time, peculiarities of each song can be extracted and chord sequences can be generated automatically setting aside these constrains or by suppressing them. These factors provide large room for research and improvement in this area. The rest of the paper is organized in such a way that the related works are reviewed and scopes for improvements are pointed out.

2 Related Works

A few automatic chord generation systems, with different functional techniques have been evolved during the past decades. These systems use principles of Bayesian belief networks, N-gram modeling, emotional flow, neural networks, fuzzy logic, genetic algorithm, evolutionary algorithm, Hidden Markov Models (HMM), Recurrent neural networks (RNN), long short-term memory (LSTM) and deep learning, in their design. They can be categorized as rule-based models, statistical models, genetic models or hybrid models. A few of the relevant models are reviewed in the subsections.

2.1 Neural Network Based Model

Intelligent hybrid models using neural networks were used for chord prediction during the late 1990s. In this technique, a hybrid model was designed using back propagation. The system learned and used prior knowledge of chords, and had a sequence tracker, which analyzed each song to find any recurrent structures.

The neural network based hybrid model structure is explained in Fig. 1. Chord

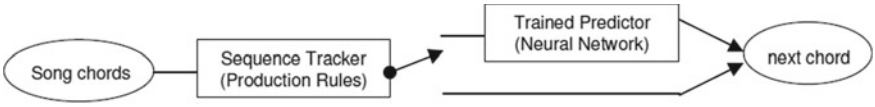

Fig. 1 Hybrid model structure

streams from songs are monitored by the sequence tracker and it assumes the control of the system, whenever a sequence repetition is detected. It then indicates which will be the next chord. By combining prior knowledge of chords and ability of on-line adaptation, this model forms a better performer among the real-time accompaniment systems [6]. Convolution neural networks are also used effectively in chord recognition and estimation process [18], whose technical essence can be adapted into chord generation process too.

2.1.1 N-Gram Modeling and Hidden Markov Model (HMM)

Automatic chord arrangement as well as key detection has been successfully executed using n-gram modeling. The melody lines are segmented and a 12-dimensional chroma vector is created based on the pitch class present in each segment. The chord synthesis is done using a Viterbi decoder (N-gram model or Gaussian Mixture Model) that maps the chroma vectors of each segment to a chord. The key is detected by finding out the correlation value of the chroma vectors and predefined key models. Viterbi decoding is done for each key depending on their chroma vectors and an optimal path with associated path score is found. These scores are sorted and chord sequence with highest path score is taken as the final output [19]. Figure 2. shows the architecture of key-independent chord synthesis.

Even probabilistic N-gram models were used for modeling musical chord sequences. This method could prove to some extent that the tonality independent chord labeling scheme and the advanced model smoothing technique used in the method showed good generalization capabilities. The perplexity of the proposed model was comparatively less when compared with Hidden Markov Models. Also, the complex chords other than the usual major/minor chords are easily modeled in this system [20].

MySong, a commercialized accompaniment generation tool, based on Hidden Markov model and Viterbi algorithm was released to the public, which automatically chooses chords to accompany a vocal melody. Any user can create songs by just singing into the microphone and can experiment with different patterns [5].

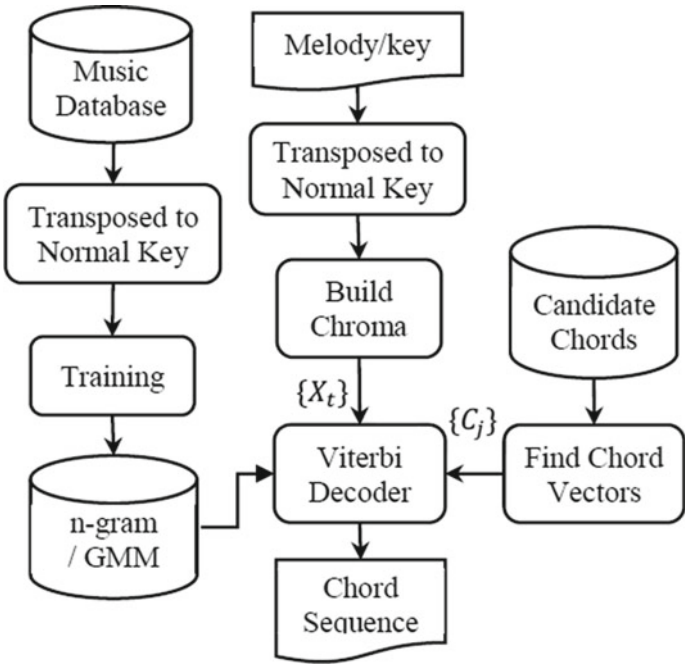

Fig. 2 Architecture for key-independent chord synthesis

2.2 Fuzzy Logic and Genetic Algorithm Based Models

Fuzzy logic has been used to identify ragas in Hindustani music [14]. Similar methodology can be applied in key detection and identifying which scale the music is composed. Genetic Algorithm has found its application in music chord generation [8]. The system is provided with a melody and chords from exemplar songs. With the help of GA, the system generates chords similar to the chords in exemplars. Figure 3 shows the dataflow of a genetic algorithm based system.

The initial populations are generated based on music rules. The chords from exemplars are considered and selected. Crossover and mutation of the chords are done based on the defined fitness function. Two fitness functions for strong and small variation cases are adopted. The fitness score will be lower if the chords in a phrase are from more than two exemplars. The combinations of higher scores are selected, thus making the generated chords sound similar to the chord progressions in exemplars.

An automatic system for generating melody and chord progression was designed using fuzzy logic controller and APEGA [3]. For different emotions, a fuzzy logic controller was designed to adjust the tempo smoothly during the transition of emotions. Melody is created by an adaptive partition evolutionary genetic algorithm

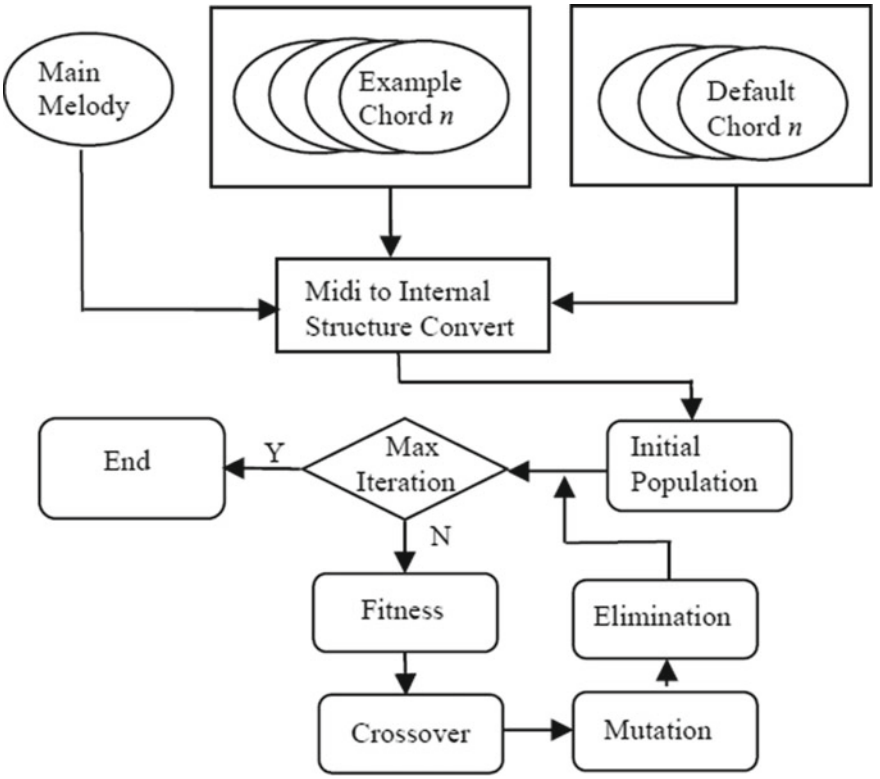

Fig. 3 Data flow of genetic algorithm based system

(APEGA). Chord progressions are generated through music theory and the instrumentation is arranged based on probability. 12 emotions based on A-V parameters, well defined in [21] are considered in this system.

The system has a well-defined FLC and APEGA for automatic accompaniment generation and the architecture is shown in Fig. 4. However, the output is based only

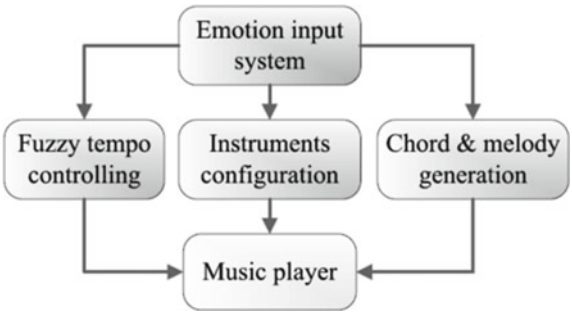

Fig. 4 Architecture of the proposed music accompaniment system

on the emotion specified. The chord progression and the melody generated are not validated completely due to the wide range of scores distributed by listeners on the performance of the system.

2.3 *Emotion Flow Guided Models*

Emotion flow guided chord progression systems are a recent advancement in the field of automatic chord generation systems. Thayer's emotion model, the most commonly adopted approach in emotion model defines emotion in terms of arousal (how exciting or calming) and valence (how positive or negative) parameters [22]. The onset rate and the harmonic progression depend on the emotion specified by these parameters. An emotion plane based on AV plot can be used to describe the emotion flow guiding mechanism and is shown in Fig. 5. The predicted chord progressions are based on the arousal - valance plane. This can be plotted into 3D planes by considering the time factor associated [6, 23].

There is a common thinking that music composed in a major key usually have a happy emotion associated with it and that in a minor key gives out sad emotions. However, this relation does not hold true with comical pieces like Mendelssohn's Scherzos, which are composed in minor scale. There are solemn pieces like the

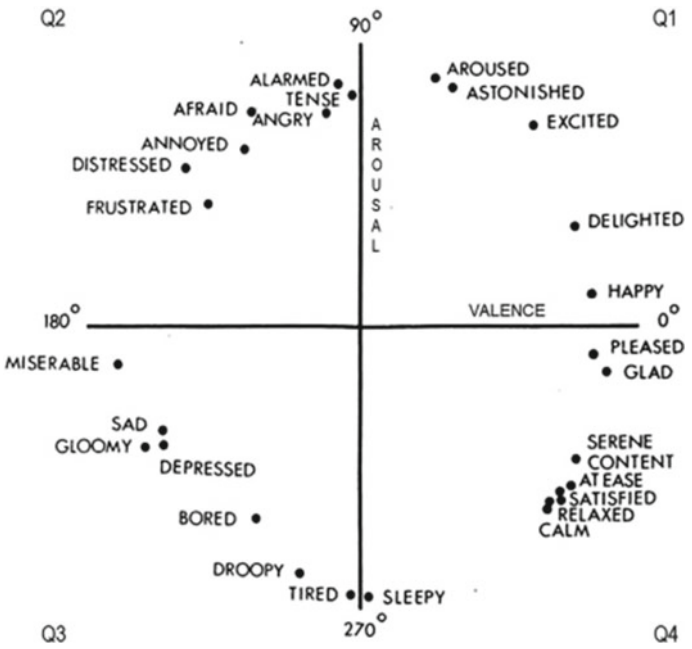

Fig. 5 A-V emotion plane

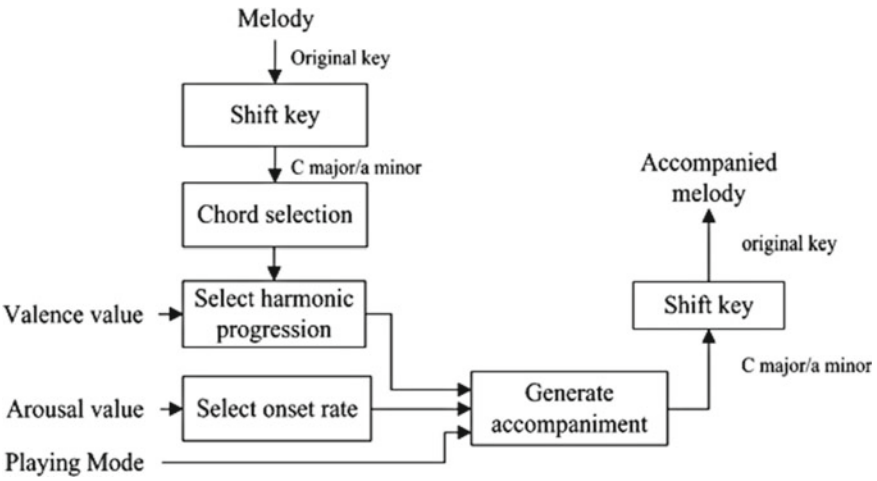

Fig. 6 Block diagram of an emotion model

"Dead March" by Handel, which are in major scale. Hence, the above assumption is not validated physically and is clearly understood that a mode or scale cannot be directly associated with the valence parameter [24]. Arousal is affected by music features like tempo, velocity (volume), articulation, rhythm, meter, and onset rate. Musical pieces those are louder, having higher onset rate and faster tempo, creates more arousal [15, 25].

The system generates accompaniment for the given melody based on valence, arousal, and playing mode of the accompaniment specified by the user. Chord progression is determined by the valance parameter and the arousal decides the onset rate. Basic block diagram of the emotion mode used in [15–17] is given in Fig. 6.

During preprocessing, melody features like pitch, rhythm, mode, meter, and tempo are extracted from the MIDI files of melodies. All melodies composed in major scales and minor scales are transposed to "C major" scale and "A minor" scale respectively for ease in chord selection. Chords are selected as in triads from the chord database based on the input melody [24]. Harmonic progression is based on the circle of fifth and valence parameter [4]. Accompaniment playing mode can be played either in block chords or in arpeggios, depending on the onset rate specified [15]. The generated accompaniment is again transposed back to the original scale to synchronize the melody with accompaniment generated. The chord progression generation technique in [16] has been optimized using three cost function and dynamic programming was used, thus making it a supreme choice over the ordinary harmonization problem. Suboptimal solutions were used in [17] to improve the computational efficiency of the system. Also, subjective tests were performed on the system to completely evaluate it.

The system discussed was able to offer accompaniments with desired emotions, exploiting the relationship of valence to harmonic progression and arousal to onset rate. However, the system lacked performance over audio input signals. Also, the preprocessing block could only deal with major scales and harmonic minor scales, whereas melodic minor scales and natural minor scales were left unattended [15]. Wider dimensions of chord data base like the diminished chords are possibilities underutilized [17].

2.4 Recurrent Neural Networks (RNN) and Long Short-Term Memory (LSTM)

LSTM was first used by Eck and Schmidhuber [26] to repeat blues chord progression and playing melodies over it. Later these models were applied in more research applications. A music theory aware chord based generation of polyphonic music based on LSTM called JamBot is discussed in [27]. The polyphonic music is generated in two steps here, both steps using the LSTM model. A chord progression based on a chord embedding is predicted by the first LSTM and the second generates music from the predicted chord progression. The presence of dissonant notes is minimal in this system, making the music sound pleasing and harmonic. During preprocessing, the chords and piano rolls are extracted from the training data. These extracted data are further used to train the first LSTM. In the next step, the chord progression generated by the first LSTM is used as an input to the polyphonic LSTM that generates the new music. The tempo and tone can be changed freely during hearing, making it extremely rewarding. LSTMs ability to learn long-term dependencies makes them a natural choice for musical compositions that are often built on themes and motifs that are repeating over time. This principle of LSTM is used to investigate the possibility of generating dynamics and expressive tempo for inexpressive MIDI files [28, 29]. The expressions generated by these systems are almost similar to the human expressions and are quite convincing for the listeners.

2.5 Based on Reinforcement Learning

The concept of automatic chord generation process is modeled as a Markov decision process (MDP) [30]. A Q-Learning algorithm learns the policies that give optimum returns when the operational environment of the agent can be modeled as an MDP and is given in Fig. 7.

Music theory concepts are used for assigning reward functions. Q—Learning is a machine learning algorithm to train the agent. 200 chords sequences were used for training the agent. The MIDI sequences generated by the model were monitored.

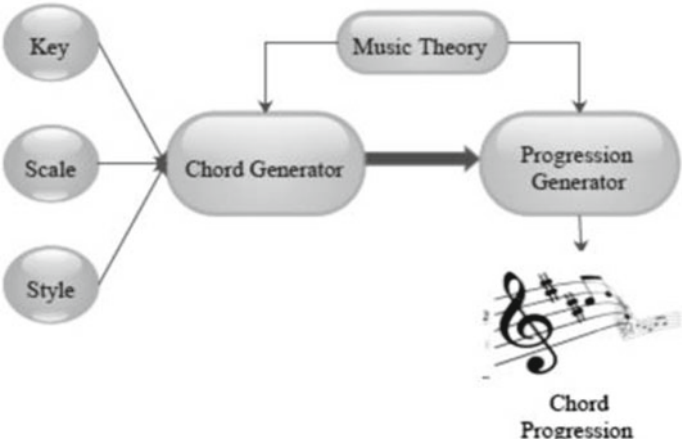

Fig. 7 Chord progression generator using Q—learning

Out of the 1300 songs being utilized, a large number of songs in the database used the same progressions given by the proposed method.

An artificial immune system (AIS) called opt-aiNet can be used to search for candidate chords by optimizing an objective function that encodes desirable musical properties of chord progressions as distances in the Tonal Interval Space (TIS) is given in Fig. 8.

The system puts forward multiple good quality candidate chords which can be added by the user into the progression. On a listening test conducted, most listeners

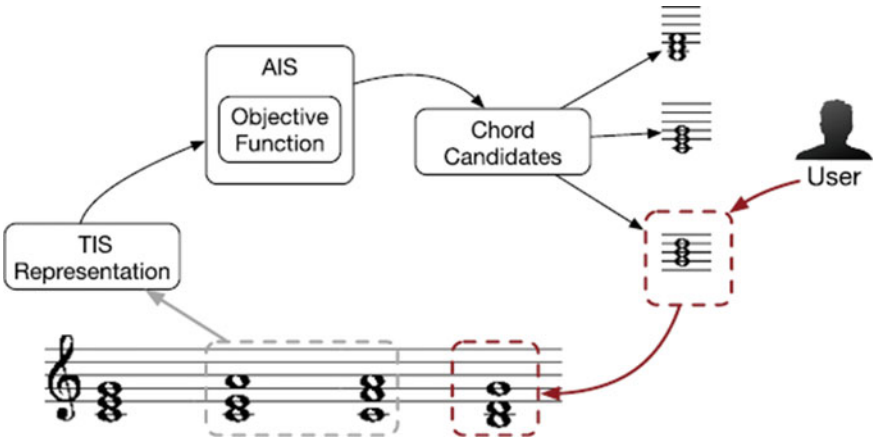

Fig. 8 Overview of the approach proposed in ChordAIS

rated chords proposed by ChordAIS as better ones when compared with those chords discarded by them. Comparisons were also made with two other systems called as ConChord and ChordGA, making ChordAIS outperform the other two [31].

3 Results and Discussion

The chord prediction process involves training the system with huge quantities of data. The prediction of basic chords was done on the scale of C major by taking into consideration the natural progressions that an amateur pianist might usually use. The training set contained three basic chords that are used in the scale of C major. Naïve Bayes classifier, classification tree, and k nearest neighbor methods were used to predict the chords for the present notes played. Figure 9 shows the results of predicted chords.

The figure shows that the classification tree and KNN approaches provided better results when compared with the Naïve Bayes approach for prediction. The dataset under consideration had a few combinations from which the models predicted the respective chords. As in other examples, once the chord vocabulary is increased for other complicated chords, the Naïve Bayes approach can be more accurate as hyperparameters for smoothing are available. Even though these models showed competent performance, their behavior cannot be predicted when complex chords are introduced into the system. In that case, other prediction techniques should be devised.

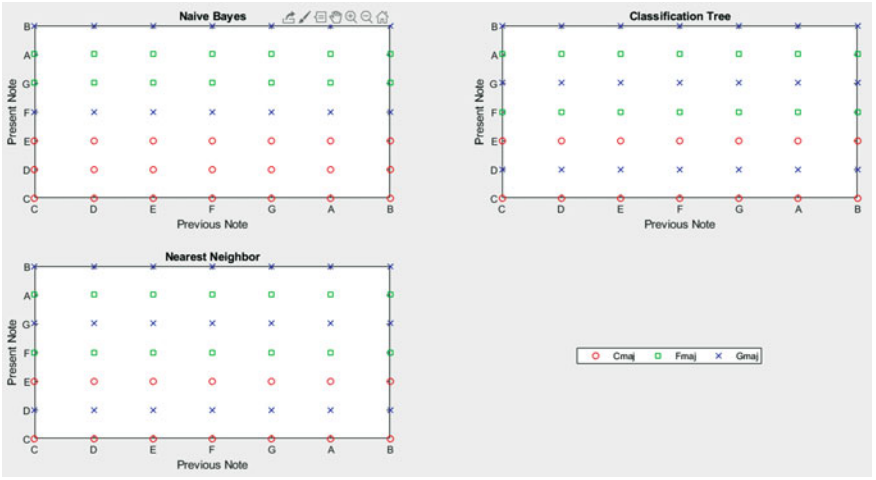

Fig. 9 Chord predictions of basic chords for C major scale

4 Summary

In this paper, we discussed various automatic chord sequence generation systems, listing out the different core modeling techniques used. A simple chord prediction methodology was designed to predict the basic chord progressions for C major scale. K—Nearest neighbors, Naive Bayes classifier, and classification tree methods were used for the prediction and the performance of these methods were compared. The KNN and classification tree were found to outperform the Naïve Bayes method, since the data under consideration were very limited.

Even though the models were successful in achieving the goals to some extent, there are huge possibilities of modifications and researches further. Quite a large amount of researches focuses on MIDI data input. The challenges of working with monophonic audio data input are least explored in the researches. If possible, the correlation functions used in literature should be validated physically. The limited range of generated chord data set is another area for improvement. Researches considered chords as triads, where a chord is made of only three notes. Use of complex chords like major seventh or diminished seventh, using more than three notes is to be encouraged. Joint probability calculation would be desired instead of single note probability calculation so that dissonant notes can be avoided to a greater extent, making the system behave as humans compose music.

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Assessment of Benefits for Wind Integration in Three-Phase Unbalanced Radial Distribution Network

Manas Ranjan Nayak, Diptimayee Behura, and Saswat Nayak

1 Introduction

Wind energy has become one of the most extensively used renewable sources of energy in the world. It is naturally distributed worldwide and is relatively small. Traditionally, wind has been regarded as non-dispatchable energy source due to wind speed uncertainty and variable availability of wind energy. With the advancement in technology, the integration of distributed windmills and farms to the unbalanced radial distribution network is possible [1].

Some authors have proposed a solution for load flow to interpret URDN. Zimmerman and Chiang [2] have developed load flow problem as a function of the bus voltage, which is a set of nonlinear power mismatch equations. Newton's method has been used to solve these equations. Three-phase power flow algorithms have been proposed by Thukaram et al. [3] which is based on the forward backward concept. The method deals with detailed load modelling and also the three-phase modelling of branches. The three-phase current injection method (TCIM) has been developed in recent years [4] which is based on the current injection equations. Further TCIM developments give information of control devices [5, 6]. Other methods have also been proposed by Miu and Chiang [7], Kasturi et al. [8–10] for solving three-phase

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radial distribution networks. A little research has been done on DG deployment and size distribution in URDN. PV nodes for three-phase unbalanced system are designed by Cheng and Shirmohammadi [11]. The three-phase unbalanced power flow algorithm is developed by Khushalani and Schulz [12] which also provides modelling DG as PQ and PV node. Modelling of transformers and DG is proposed by Chen et al. [13].

This article first identifies voltage-sensitive nodes for the placement wind generation. The combination of constant current, constant power, and constant impedance load models has been incorporated into the power flow of the backward forward sweep. The effects of integration of wind generation on unbalanced radial distribution network have been discussed.

In Sect. 2, modelling of the unbalanced radial distribution network is illustrated. Section 3 presents algorithm for backward forward sweep power flow. In Sect. 4, modelling of distributed wind energy generation is discussed. In Sect. 5, simulation result and analysis are represented. Conclusions from the obtained are detailed in Sect. 6.

2 Modelling of the Unbalanced Radial Distribution Network

2.1 Modelling of the Unbalanced Three-Phase Line

The general form of presenting the branch voltage of the three-phase line model between bus 'p' and bus 'q' is given by

$$\left[V_{pq}^{RYB}\right] = \left[Z_{pq}^{RYB}\right]\left[I_{pq}^{RYB}\right] \tag{1}$$

where Z_{pq}^{RYB} is the series impedance matrix in which the self and mutual coupling effect are taken into account represented by

$$Z_{pq}^{RYB} = \begin{bmatrix} Z_{pq}^{RR} & Z_{pq}^{RY} & Z_{pq}^{RB} \\ Z_{pq}^{YR} & Z_{pq}^{YY} & Z_{pq}^{YB} \\ Z_{pq}^{BR} & Z_{pq}^{BY} & Z_{pq}^{BB} \end{bmatrix} \tag{2}$$

Shunt admittances (capacitances) are also taken into consideration, which is the combination of the shunt admittances connected to each phase and the admittances connected between the phase and ground. The injections of current at nodes 'p' and 'q' can be written as

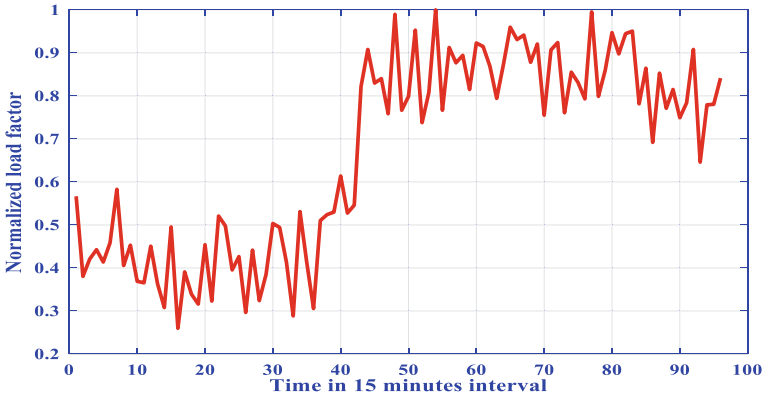

Fig. 1 Average normalized 15 min load factor for a day

$$\begin{bmatrix} I^R_{sh_q} \\ I^Y_{sh_q} \\ I^B_{sh_q} \end{bmatrix} = \frac{1}{2} \begin{bmatrix} -\left(y^{RR}_{pq} + y^{RY}_{pq} + y^{RB}_{pq}\right) & y^{RY}_{pq} & y^{RB}_{pq} \\ y^{YR}_{pq} & -\left(y^{YR}_{pq} + y^{YY}_{pq} + y^{YB}_{pq}\right) & y^{YB}_{pq} \\ y^{BR}_{pq} & y^{BY}_{pq} & -\left(y^{BR}_{pq} + y^{BY}_{pq} + y^{BB}_{pq}\right) \end{bmatrix} \begin{bmatrix} V^R_q \\ V^Y_q \\ V^B_q \end{bmatrix} \tag{3}$$

2.2 Modelling of the Load

The 15 min average normalized load profile in a day of a group of ten selected houses is used for IEEE 37-bus test feeder as the whole demand gives a similar profile for all feeders on a given day (Fig. 1).

The desired active and reactive loads at bus p at any preferable time t in *RYB* phase can be determined as follows:

$$P^{RYB}_{\text{Load},p}(t) = W_m(t) \times P^{RYB}_p \tag{4}$$

$$Q^{RYB}_{\text{Load},p}(t) = W_m(t) \times Q^{RYB}_p \tag{5}$$

where $W_m(t) = 15$ minutely weight factor, P^{RYB}_p is the peak active load, and Q^{RYB}_p is the peak reactive load at bus 'p' in phase *R*, *Y,* and *B,* respectively.

2.3 Line Equations for Current and Voltage

The total current through the line 'pq' is given by

$$\left[I_{pq}^{RYB}\right] = \begin{bmatrix} I_{pq}^{R} \\ I_{pq}^{Y} \\ I_{pq}^{B} \end{bmatrix} = \begin{bmatrix} \sum_i IL_{qi}^{R} + \sum_i I_{sh_{qi}}^{R} + \sum_i I_{\text{exit}_{qi}}^{R} \\ \sum_i IL_{qi}^{Y} + \sum_i I_{sh_{qi}}^{Y} + \sum_i I_{\text{exit}_{qi}}^{Y} \\ \sum_i IL_{qi}^{B} + \sum_i I_{sh_{qi}}^{B} + \sum_i I_{\text{exit}_{qi}}^{B} \end{bmatrix} \tag{6}$$

where IL_q^R, IL_q^Y and IL_q^B are the load currents at the 'q' node in phase *R*, *Y,* and *B,* respectively, Ish_q^R, Ish_q^Y, and Ish_q^B are the shunt currents at the 'q' node in phase *R*, *Y*, and *B,* respectively, $I\text{exit}_q^R$, $I\text{exit}_q^Y$, and $Iexit_q^B$ are the currents of branches that are the exits from 'q' node in phase *R*, *Y,* and *B,* respectively. The equation of the voltage is given by

$$\begin{bmatrix} V_{pq}^{R} \\ V_{pq}^{R} \\ V_{pq}^{R} \end{bmatrix} = \begin{bmatrix} Z_{pq}^{RR} & Z_{pq}^{RY} & Z_{pq}^{RB} \\ Z_{pq}^{YR} & Z_{pq}^{YY} & Z_{pq}^{YB} \\ Z_{pq}^{BR} & Z_{pq}^{BY} & Z_{pq}^{BB} \end{bmatrix} \begin{bmatrix} I_{pq}^{R} \\ I_{pq}^{Y} \\ I_{pq}^{B} \end{bmatrix} \tag{7}$$

2.4 Transformer Models

Transformer models include core loss and copper loss which is the function of voltage of each phase of the transformer's secondary terminal. Core losses of the transformer are presented in the form of per unit in the network. The winding connections, phase shifting between primary and secondary windings, system imbalance characteristics, and the off-nominal tap ratios of the transformers are also taken into account.

3 Algorithm for Backward Forward Sweep Power Flow

The algorithm of the backward forward sweep load flow is the excellent method to study unbalanced radial distribution systems as it is a detailed analysis method of three phase that takes mutual impedance between phase conductors into the consideration. The first step of the backward forward sweep method is to calculate currents in all nodes for each iteration 'k' [14, 15]:

$$\left[I_p^{RYB}\right]^{(k)} = \sum_i \begin{bmatrix} IL_p^{R} \\ IL_p^{Y} \\ IL_p^{B} \end{bmatrix} - \sum_i \left[Y_p^{RYB}\right] \cdot \left[V_p^{RYB}\right]^{(k-1)} \tag{8}$$

The next step consists of the backward sweep begins from the end node which sequentially moves to the source node. The currents can be calculated as

$$\left[I_p^{RYB}\right]^{(k)} = \sum_j \left[I_{qj}^{RYB}\right]^{(k)} + \sum_i \left[I_{\text{exit}_{qi}}^{RYB}\right]^{(k)} \tag{9}$$

After the second step, the forward sweep is done which starts from the source node and moves towards the end node. The node voltages are calculated by using

$$\left[V_q^{RYB}\right]^{(k)} = \left[V_p^{RYB}\right]^{(k)} - \left[Z_{pq}^{RYB}\right] . \left[I_{pq}^{RYB}\right]^{(k)} \tag{10}$$

In the final step, voltage mismatch for every node of each iteration 'i' is calculated

$$\Delta\left[V_i^{RYB}\right]^{(k)} = \left[V_i^{RYB}\right]^{(k)} - \left[V_i^{RYB}\right]^{(k-1)}, \quad i = 1, 2, \ldots, \text{n} \tag{11}$$

If the voltage mismatch for every node in all phases is lower than the tolerance limit, then the iteration stops there.

The power loss of the actual feeder in 'pq' branch is given by

$$\begin{bmatrix} P_{L_{pq}}^R \\ P_{L_{pq}}^Y \\ P_{L_{pq}}^B \end{bmatrix} = \begin{bmatrix} P_{LP_{pq}}^R + jP_{LQ_{pq}}^R \\ P_{LP_{pq}}^Y + jP_{LQ_{pq}}^Y \\ P_{LP_{pq}}^B + jP_{LQ_{pq}}^B \end{bmatrix} = \begin{bmatrix} V_p^R \left(I_{pq}^R\right)^* - V_q^R \left(I_{qp}^R\right)^* \\ V_p^Y \left(I_{pq}^Y\right)^* - V_q^Y \left(I_{qp}^Y\right)^* \\ V_p^B \left(I_{pq}^B\right)^* - V_q^B \left(I_{qp}^B\right)^* \end{bmatrix} \tag{12}$$

where P_{Lpq}^R, P_{Lpq}^Y, and P_{Lpq}^B are the apparent power losses in phase *R*, *Y,* and *B,* respectively, P_{LPpq}^R, P_{LPpq}^Y, and P_{LPpq}^B are the active power loss in phase *R*, *Y,* and *B,* respectively, and P_{LQpq}^R, P_{LQpq}^Y, and P_{LQpq}^B reactive power loss in phase *R*, *Y,* and *B,* respectively.

4 Modelling of Distributed Wind Energy Generation

This study used the real power generation data of an actual wind turbine manufactured by India. Eight numbers of wind turbines having 800 kW of wind generation capacity are connected to the URDN. The real and reactive power ratings of each turbine are 100 kW and 45 KVAR, respectively. Eight numbers of wind turbines are installed in the IEEE 37-bus test feeder at single bus. Eight concentrated locations for wind generation have been considered at a single bus. Wind generation at constant power factor is considered. In the process of power flow, wind generation bus is taken as negative load bus.

5 Problem Formulation

The objective of optimal placement of distributed wind generation in URDN is to minimize power loss of the feeder within the system operational constraints limit.

5.1 Objective Function

$$\text{Minimize} f = \sum_{t=1}^{n_t} \sum_{pq=1}^{nb} P_{\text{Loss},pq}^{RYB}(t) \tag{13}$$

$$P_{Loss,pq}^{RYB}(t) = R_{pq}^{RYB} I_{pq}^{RYB^2}(t) \tag{14}$$

where pqth is the branch number, R_{pq}^{RYB} is the resistance of pqth branch in the phase R, Y, and B, I_{pq}^{RYB} is the current in a pqth branch at time 't' in the phase R, Y, and B and $P_{Loss,pq}^{RYB}$ is the active power loss of pqth branch at time 't' in the phase R, Y, and B, 'n_t' is the time slot, and nb is the total branch number.

5.2 Constraints

The system operates within the scope of equality and inequality as described below.

$$P_{\text{sub}}^{RYB}(t) = P_{\text{Load}}^{RYB}(t) + P_{\text{Loss}}^{RYB}(t) + P_{\text{Wind}}^{RYB}(t) \tag{15}$$

$$Q_{\text{sub}}^{RYB}(t) = Q_{\text{Load}}^{RYB}(t) + Q_{\text{Loss}}^{RYB}(t) + Q_{\text{Wind}}^{RYB}(t) \tag{16}$$

$$V_p^{RYB,\min} \leq V_p^{RYB}(t) \leq V_p^{RYB,\max} \tag{17}$$

$$I_{pq}^{RYB}(t) \leq I_{pq}^{RYB,\max} \tag{18}$$

where $P_{\text{sub}}^{RYB}(t)$ and $Q_{\text{sub}}^{RYB}(t)$ are the substation active and reactive power injection at time 't' in R, Y, and B phase, respectively, $P_{\text{Loss}}^{RYB}(t)$ are the active power losses and $Q_{\text{Loss}}^{RYB}(t)$ are the reactive power losses of branch at time 't' in R, Y, and B phase, $P_{\text{Load}}^{RYB}(t)$ and $Q_{\text{Load}}^{RYB}(t)$ are the active and reactive loads of bus at time 't' in R, Y, and B phase, $P_{\text{Wind}}^{RYB}(t)$ and $Q_{\text{Wind}}^{RYB}(t)$ are the active and reactive power of wind energy generation at time 't' in R, Y, and B phase, $V_p^{RYB}(t)$ is the voltage at bus pth at time 't' in R, Y, and B phase, $V_p^{RYB,\max}$ and $V_p^{RYB,\min}$ are the upper and lower limits of voltage at pth bus in R, Y, and B phase, $I_{pq}^{RYB,\max}$ is the maximum current at pqth

branch in *R*, *Y*, and *B* phase, and $I_{pq}^{RYB}(t)$ is the current at *pq*th branch at time '*t*' in *R*, *Y*, and *B* phase.

6 Simulation and Result Analysis

The IEEE 37-bus test system is an actual radial distribution system with highly unbalanced loads located in California which contains only delta configuration lines and transformers with nominal voltage level of 4.8 kV. The line and load data are given in [16]. The peak load of the feeder is about 2500 KVA. In this analysis, a wind energy penetration of 30% of the maximum feeder load has been considered on a 15 min basis for a period of 24 h. The 1.05 p.u. and 0.95 p.u. are the upper and lower limits of voltage for each bus, respectively. The base values taken for the calculation of power flow are $S_{\text{base}} = 25$ MVA and $V_{\text{base}} = 4.8$ kV.

It is recognized from the voltage-sensitive analysis that 32-bus is the suitable position for the wind integration. Table 1 gives the results which are compared between without wind integration (Base case) and with wind integration for 37-bus URDN.

Figures 2, 3, and 4 depict voltage profile of each bus in phases *R*, *Y,* and *B* of 37-bus URDN, respectively, for without wind integration (base case) and with wind integration. The results show after integration of wind generation, the minimum voltages in phases *R*, *Y,* and *B* are enhanced from 0.9806 p.u., 0.9877 p.u., 0.9800 p.u. (base case) to 0.9886 p.u., 0.9930 p.u., 0.9888 p.u. (with wind), respectively. Also there is an upgradation of voltage profile in all phases of each bus after integration of wind.

Figures 5, 6, and 7 give current flow of each branch in phases *R*, *Y,* and *B* of 37-bus URDN, respectively, for without wind integration (base case) and with wind

Table 1 Performance analysis of the 37-bus URDN

Description	Base case (Without wind)			With wind		
	R phase	Y phase	B phase	R phase	Y phase	B phase
Minimum voltage/Bus No.	0.9806/32	0.9877/14	0.9800/34	0.9886/32	0.9930/14	0.9888/34
Active power loss (KW)	13.930	12.897	18.323	10.474	9.305	13.066
Total active power loss reduction (%)	–	–	–	24.80	27.85	28.69
Reactive power loss (KVAr)	4.3489	2.8625	8.5278	3.4690	1.9832	5.9461
Total reactive power loss reduction (%)	–	–	–	20.23	30.71	30.27

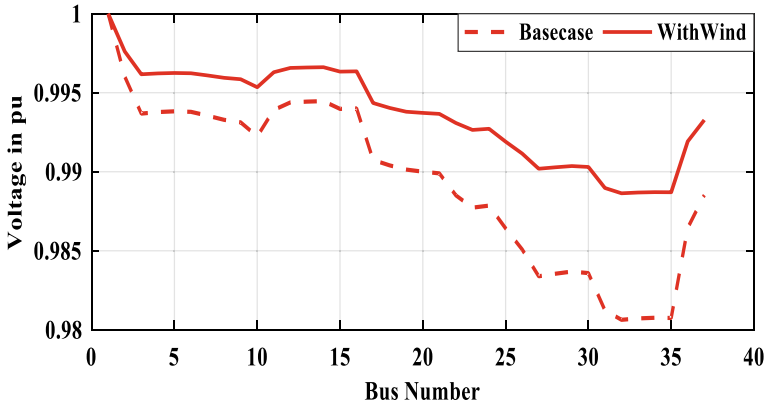

Fig. 2 R phase voltage of three-phase URDN

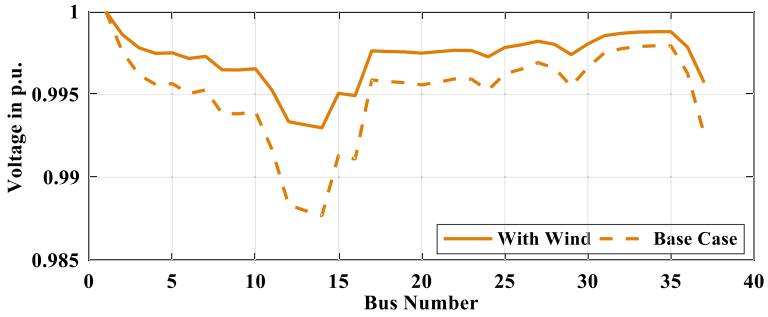

Fig. 3 Y phase voltage of three-phase URDN

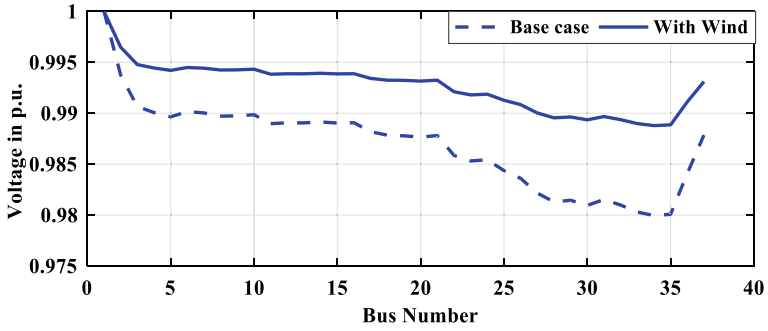

Fig. 4 B phase voltage of three-phase URDN

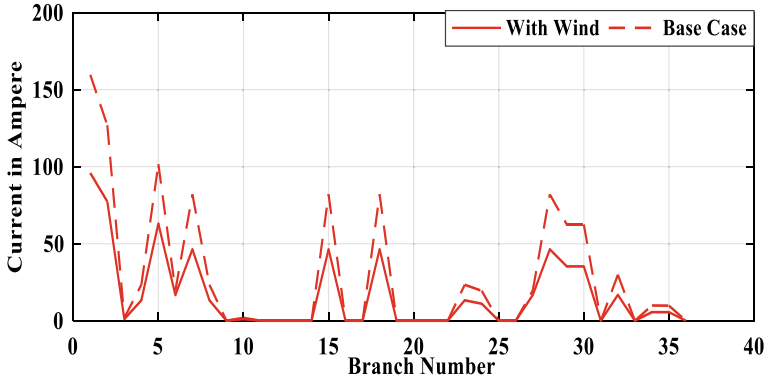

Fig. 5 R phase current of three-phase URDN

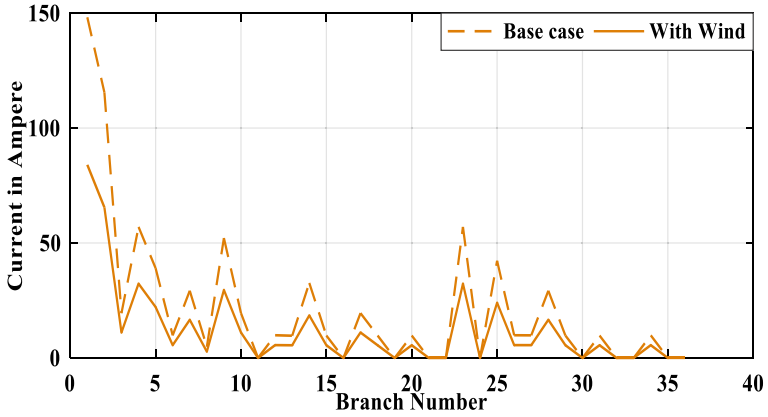

Fig. 6 Y phase current of three-phase URDN

integration. It is observed that there is a reduction of current flow in all phases of each branch after integration of wind.

Figures 8, 9, and 10 represent active and reactive power losses of each branch in phases *R*, *Y,* and *B* of 37-bus URDN, respectively, for without wind integration (base case) and with wind integration. It is concluded that the integrating wind generation to the network results in 24.80, 27.85, 28.69% reduction of active power loss in phases *R*, *Y,* and *B* and 20.23, 30.71, 30.27% reduction of reactive power loss in phases *R*, *Y,* and *B*.

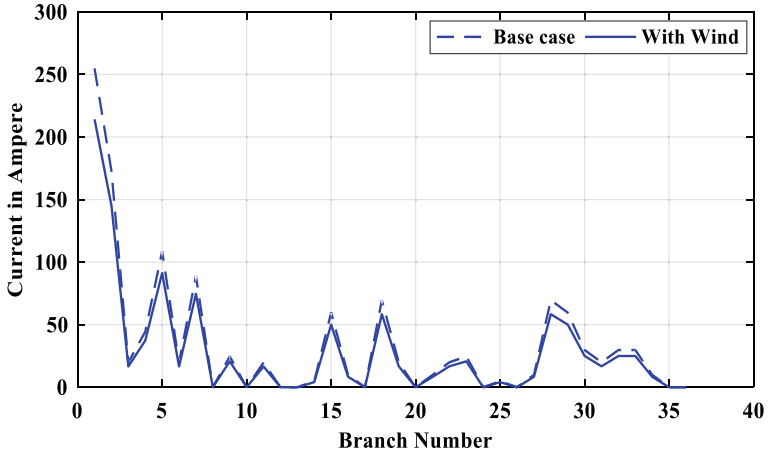

Fig. 7 B phase current of three-phase URDN

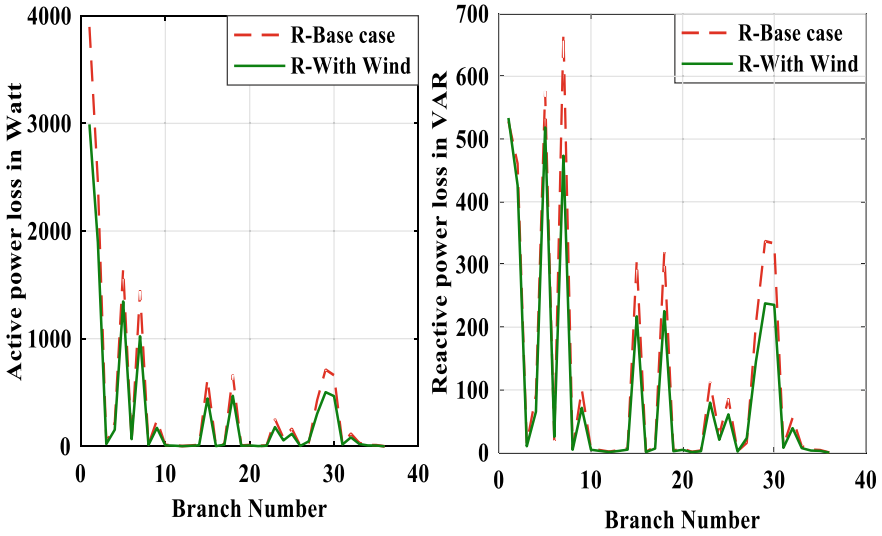

Fig. 8 R phase power loss of three-phase URDN

7 Conclusion

The power flow operation in a three-phase unbalanced radial distribution network with dynamic load intervals which regulates wind generation has been investigated in this research. This paper presents the right placement of wind through voltage index analysis and right amount of penetration of wind generation. The potency

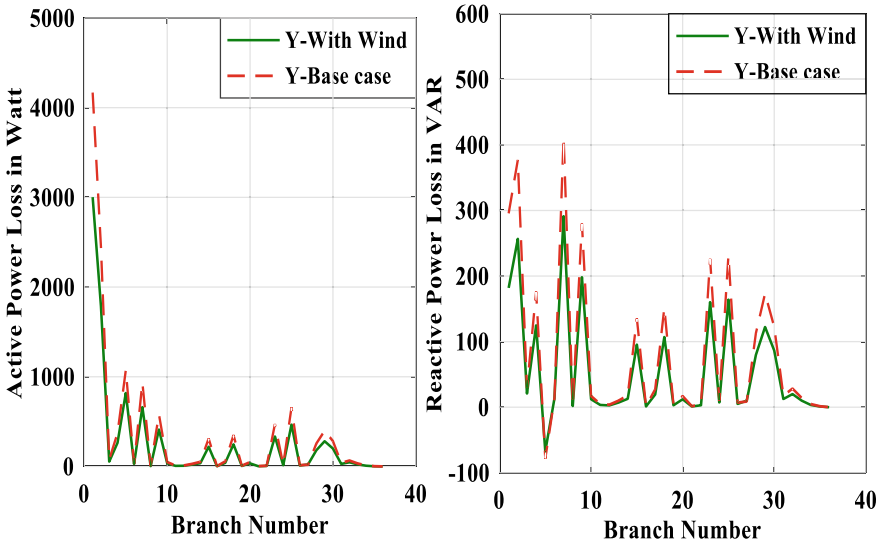

Fig. 9 Y phase power loss of three-phase URDN

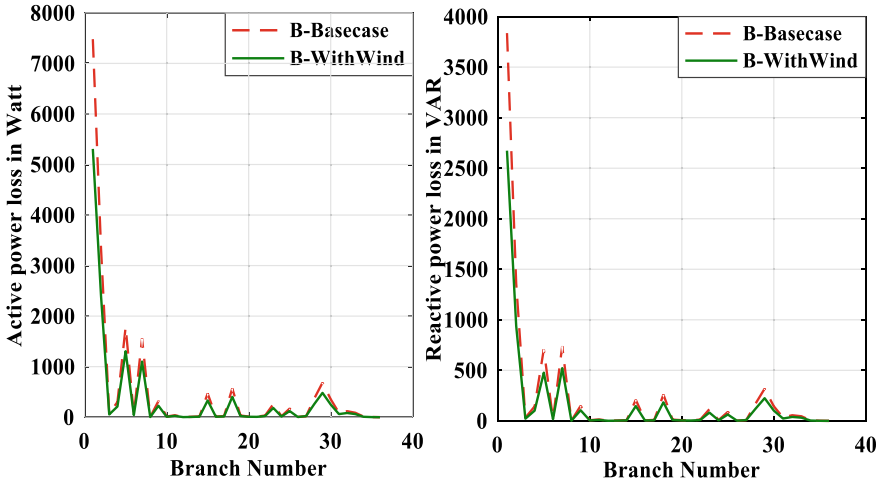

Fig. 10 B phase power loss of three-phase URDN

of the methodology has been established and tested in IEEE 37-bus URDN. The integration of wind energy into URDN has shown beneficial results.

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A Hybrid Sequential Model for Text Simplification

Sandip Sarkar, Dipankar Das, Partha Pakray, and David Pinto

1 Introduction

In recent years, we can obtain any information at our fingerprint with the help of internet technologies. This advantage is very useful for students to learn any subject. Besides, reading is one of the basic methods for learning subjects. However, students whose native language is not English face major problems if the texts presented in the web are in complex form. It will be very difficult to understand the meaning of the text if it contains uncommon words and if the sentence contains complex structure. Thus, Text Simplification (TS) plays an important role to help the people who are poor in literacy [1]. Text simplification does not change the meaning of the text rather it minimizes the complexity of the text [2–4].

In the past two decades, many researchers have started working on text simplification using lexical and syntactic approaches. However, the accuracy of text simplification does not improve so much using traditional methods. In the present work, we build an encoder-decoder model for our text simplification task. However, proper

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Table 1 Example of PWKP dataset

Sentence pair	Source sentence	August's flower is the gladiolus or poppy, and its birthstone is the peridot.
	Target sentence	August's flower is the Gladioli with the birthstone being Peridot.
Sentence pair	Source sentence	It was first published in 1935 under the title International Symbolic Script and a year later using the name Speedwords.
	Target sentence	It was first published in 1935. It was called International Symbolic Script. A year later, it was called Speedwords.

text simplification dataset is not available. The well-known dataset for text simplification is Wikipedia dataset. But this dataset contains many errors like alignment error and most of the sentences are not simplified. The main reason is because of Wikipedia works like an encyclopaedia and those data are collected from different users. Besides, there is no proper guideline to create those data. We used PWKP dataset for our experiments. Table 1 shows the format of these datasets which consists of types of sentences, one is complex sentence and another is simple sentence.

Further, to improve the accuracy of our system, we used a popular Named Entity Recognition (NER) module. NER is mostly used in information extraction and search engine task where entities such as person, organization and location information play an important role. It contains two main phase entity detection and entity classification.

Next, we have used two different approaches, one is character-level seq2seq approach and another is word-level seq2seq approach. Both approaches are trained using LSTM and bi-LSTM model.

The remainder of the paper is structured as follows: we discuss about related work in Sect. 2. Section 3 discusses about the challenges and differences between text simplification and machine translation. The detailed architecture of our proposed methods is mentioned in Sect. 4. We present the description of the corpus and training details in Sect. 5 and Sect. 6, respectively. The evaluation metrics of our proposed model is discussed in Sect. 7. Besides, Sect. 8 and Sect. 9 describe the results and observations, respectively. We conclude our works and point to the future work in Sect. 10.

2 Related Work

Text simplification can also be treated as a monolingual machine translation work and several researchers used phrase-based machine translation [5, 6] on Simple English Wikipedia dataset [7]. Besides, some researchers used tree-based MT [8] and syntax-based MT [9] for text simplification. NER plays an important role in many monolingual and multilingual Natural Language Processing (NLP) tasks. It is also useful

to understand the sentence structure for machine translation. It is also noticed that how NER is used to improve the accuracy of machine translation [10, 11]. On the other hand, it is found that standard LSTM-based Seq2seq model gives better performance than PBMT, SBMT, and unsupervised lexical simplification approaches [12, 13]. Text simplification is different from machine translation because it consists of lexical and syntactic operations [14]. Normally, TS needs some reprocessing and post-processing modules to improve the performance.

3 Challenges of Text Simplification

As discussed before, we can consider text simplification as mono-lingual machine translation task. There are some differences between normal machine translation and text simplification. In machine translation, the relation between source and target sentences is one to one whereas in text simplification, there are many relations like merging splitting or replacing [15]. Text simplification task is very difficult because of those variations of relationship. There is no sharing of word between source and target sentences in machine translation whereas in text simplification, most of the sentences are same [16]. Sometimes, the words of source and target sentences may same in text simplification.

4 Proposed Method

Our proposed method consists of different modules. At first, we pass our dataset to the pre-processing module. It is observed that NER module plays an important role in machine translation and search engine related jobs and here we used NER module to recognize name entities. For this reason, we use NER module after pre-processing module. Afterwards, we pass it to the seq2seq module because it has been found that it is effective in solving complex sequence related problems in many research domains. At the same time, character-based and word-based sequential models are popular in machine translation, we also take those two approaches. For learning process, we consider two learning algorithms: one is LSTM and other one bi-directional LSTM. Figure 1 discussed the detailed description of our proposed architecture.

4.1 Prepossessing Module

Pre-processing is an important module in any NLP system because the characters, words and sentences are the fundamental units of texts and those contain different kinds of noise. Our normalization techniques contain some operations like converting

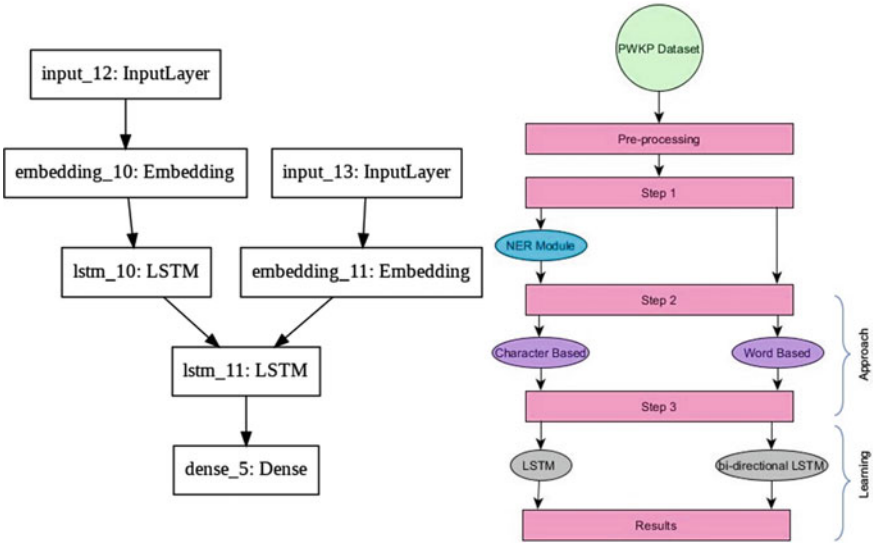

Fig. 1 Architecture of Proposed method

all letters to lower case, converting numbers into words, removing punctuation and removing white spaces.

4.2 NER Module

Named Entity Recognition (NER) is very popular in the field of Natural Language Processing (NLP). The main aim of NER is to find specific information like proper names of persons or organizations and dates. NER can be used for different important tasks. It is mainly used in search engines and information extraction tasks. Name entities generate serious problems in machine translation as well as text simplification task [10, 11]. As we are working in text simplification task in which both source and target language are in same language, NER plays an important role. For our experiments, we used SpaCy,[1] an open-source software library which is written in Python and Cython. Figure 2 shows the presence of name entities in source and target sentences. Normally, named entities will be same in source and target language. Thus, at first, we identify name entities and directly pass it from source language to target language. After that, we pass the remaining part of source language to our Seq2seq model and generate target language.

[1] https://pypi.org/project/spacy/.

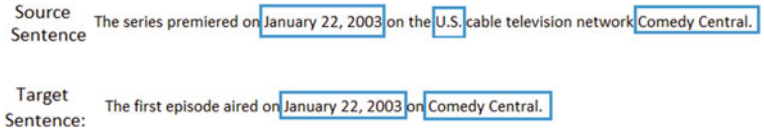

Fig. 2 Name entities in source and target sentence

4.3 Seq2seq Module

Seq2seq models are a special type of Recurrent Neural Network to solve complex NLP problems. The most commonly used architecture to build sequence to sequence model is encoder-decoder architecture. For our method, we used sequence to sequence model to predict the simple sentence. In this paper, we discussed how encoder-decoder model is used to solve sequence to sequence problems. The main idea of encoder-decoder model is to use a LSTM to read the input complex English sentence, one time step a time to get the context vector and used another LSTM to extract the output simple English sentence form that context vector. The main advantage of LSTM is that it can convert an input sentence into a fixed-dimensional vector called context vector. Context vector captures the information of input sentence so that decoder makes accurate predictions.

(A) **Encoder**
Encoder reads one after another sentence. If the sentence length is l, then the encoder reads the sentence in l time steps. In Fig. 3, Xi denotes the input at time step i (in our example X denotes each word). Similarly, encoder has two states hidden state cell state. Both denote the internal state of the encoder at time step i. On the other hand, encoder has one output for each time step. Encoder reads the input sentence word by word and preserves the internal states after the last time step. We only take the output after reading the entire sequence, so the output of the Encoder at each time step is discarded.

(B) **Decoder**
Decoder plays the same role as Encoder. Encoder reads the input sequence word by word, similarly, the decoder produces the output in sequence i.e. word by word. For decoder, we use interface algorithm. During interface, one word is generated at a time. For this reason, the decoder is executed in a loop and every time it processes a word. The final states of the encoder are the initial states of the decoder. The initial input to the decoder is always the START token. The states of the decoder are preserved at each time step and make it as initial state for the next time step. At each time step, the predicted output is fed as input in the next time step. Finally, the decoder predicts the END token. In Fig. 3, Y_i denotes the output of decoder of at time step i.

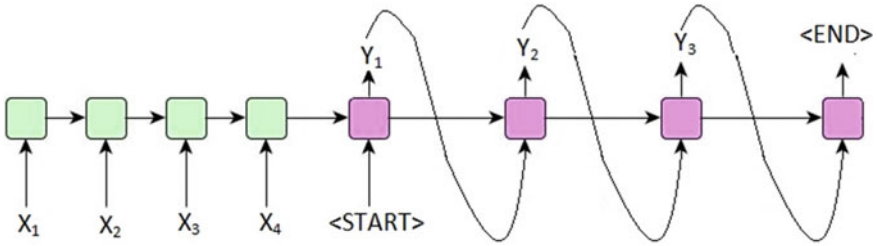

Fig. 3 Encoder-decoder model

4.4 Approaches

(A) **Character-Based Seq2Seq Model**
In our first approach, we used a character-based Seq2Seq model for multiple reasons. First, it can deal with unseen words (i.e. out of vocabulary words) which are mainly occurs for morphological variation of observed words. On the other hand, the vocabulary size of source and target language is minimal because it only considers English alphabets. For this reason, the time required for experiments reduces because of better computational speed and small memory requirements.

(B) **Word Based Seq2Seq Model**
Word-based Seq2Seq model is similar to the character-based Seq2Seq model. We are taking words rather than characters. As we discussed in-text simplification most of the words may be the same in source and target sentences. In machine translation, there is one to one relationship (i.e. word relation) between source and target language. Similarly, the variation of words between source and target is minimal. For this reason, it gives better results than character-based seq2seq model.

4.5 Bi-directional LSTM

We use bidirectional LSTM (BiLSTM) in order to get annotations for each word that summarize the information from both directions of the message. A bidirectional LSTM consists of a forward LSTM that reads the sentence from left to right and a backward LSTM that reads the sentence from right to left. Final result is produced after the combination of both two LSTM (i.e. Forward and Backward).

5 Dataset

Parallel Wikipedia Simplification Corpus (PWKP) is one of the popular datasets for evaluating text simplification [8]. These datasets are mainly created from English Wikipedia and Simple Wikipedia. It contains 108,016 sentence pair of complex and simple sentences. The average word length of complex sentence and sentence are 25.01 and 20.87, respectively. For our experiments, we use 80% of the dataset for training and 20% for testing.

6 Training Details

LSTM plays an important role in many fields of NLP like machine translation, text categorization, question answering system and many more. For this reason, we used LSTM for our training purpose. In our previous section it is also mentioned that we used encoder-decoder model for our experiments. As we know for text simplification the vocabulary of input and output sentences is the same. For our experiments, we merge the vocabulary of source and target sentences. After that, we create the index of that marge vocabulary using one-hot vector encoding. The size of the marge vocabulary is 77,764. Similarly, we also find the word length size of source and target sentences, which are 47 and 40 respectively. The batch size for training is 128 and the number of epochs to training is 50. Besides the latent dimension of encoding space is 256. Next, we use bidirectional LSTM for encoding and decoding to improve the accuracy.

7 Evaluation Metrics

Automatic Evaluating Metrics have been receiving more importance as it is much faster, easy to use and cheaper than human judgment. To find the accuracy of our model we used BLEU automatic evaluation Metrics. BLEU is the most commonly used Automatic Evaluating matrix and it is created by IBM in the year 2002 [17]. BLEU is simple and mostly used in Machine Translation. It is also claimed that the score calculated by BLEU Metrics is similar to the score calculated by human judgment.

8 Results

As discussed in our previous section we have used two modules: one is with NER module another one without NER module. After that, both Modules use two types of approaches (i.e. character and word Seq2Seq model). For learning we used two

Table 2 Result of hybrid sequential model

			Character based Encoder decoder		Word based Encoder decoder	
			LSTM	Bi-LSTM	LSTM	Bi-LSTM
Without NER module	Training	BLEU 1	0.21	0.33	0.24	0.35
		BLEU 2	0.48	0.56	0.50	0.58
		BLEU 3	0.64	0.72	0.67	0.75
		BLEU 4	0.69	0.75	0.72	0.78
	Testing	BLEU 1	0.20	0.31	0.23	0.33
		BLEU 2	0.45	0.53	0.48	0.56
		BLEU 3	0.63	0.69	0.64	0.72
		BLEU 4	**0.68**	**0.72**	**0.69**	**0.75**
With NER module	Training	BLEU 1	0.39	0.41	0.40	0.42
		BLEU 2	0.63	0.65	0.65	0.67
		BLEU 3	0.75	0.76	0.67	0.75
		BLEU 4	0.80	0.81	0.83	0.85
	Testing	BLEU 1	0.37	0.39	0.38	0.40
		BLEU 2	0.61	0.63	0.63	0.64
		BLEU 3	0.74	0.75	0.75	0.78
		BLEU 4	**0.78**	**0.80**	**0.79**	**0.82**

types of deep learning model one is LSTM and another is Bi-LSTM. The details description of our experiments is given in Table 2. To evaluate our model, we used BLEU score. Table 2 shows the comparison of results between those two approaches. This table also shows that word-based encoder-decoder model using Bi-LSTM gives better results. Best score of our model is 0.80 and 0.82 BULE score using NER module with character-based and word-based bidirectional encoder-decoder model, respectively.

9 Observations

Results of our proposed method show that NER module enhances the accuracy of our system. On the other hand, our system suffers when the length of the sentence is huge. Tables 3 and 4 show the comparison between actual sentence and predicted sentence using NER and without NER respectively. We observed that for first 10–12 words our proposed module gives better result whereas if gives poor performance when the word length of the sentence is above 15. Our proposed method gives better result using word-based encoder-decoder model as complex and simple sentence contains many similar words.

Table 3 Prediction without NER module

Sentence pair	Source sentence	As of 2000, the population was 11,411.
	Target sentence	In 2000, the population was 11,411.
	Predicted sentence	in 2000 the population was 13,106.
Sentence pair	Source sentence	Ilova 85 km 85 km Lonja-Trebež 19.
	Target sentence	Ilova 85 km Lonja-Trebež 19.
	Predicted sentence	Language square km the rt.

Table 4 Prediction with NER module

Sentence pair	Source sentence	As of 2000, the population was 11,411.
	Target sentence	In 2000, the population was 11,411.
	Predicted sentence	in 2000 the population was 11,411.
Sentence pair	Source sentence	Ilova 85 km 85 km Lonja-Trebe˘z 19.
	Target sentence	Ilova 85 km Lonja-Trebe˘z 19.
	Predicted Sentence	language 85 square km the rt 19.

10 Conclusion and Future Work

In this paper, we introduce an innovative model for text simplification. Our proposed model consists of two modules: one is NER module and another is Seq2seq module. In seq2seq module, for learning process, we used two types of approaches (i.e. word and character Seq2Seq model). The comparisons of those two approaches are also discussed in our paper. We also discuss the problems of text simplification and its differences with machine translation. Our experiments show that proposed model gives better results using NER module. On the other hand, for learning process in seq2seq module, word-based encoder-decoder model with bi-directional LSTM deep learning architecture gives better results for PWKP dataset. In future, we want to implement attention-based encoder-decoder model for text simplification. We also observed that most of the sentences of PWKP are not simplified or not similar. For this reason, we are trying to find a better dataset for text simplification.

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Natural and Unnatural Energy Management Systems

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1 Concept of Natural and Unnatural Energy

The nature in the entities, such as space, sun, air, water and earth, expanding its omnipresence in the form of star light, atmospheric air sound, seawater or fountain sounds, underwater currents, atmospheric electromagnetic radio wave, solar ray light particles and various states of matter in non-living and living bodies. The colour light, supersonic and subsonic sound and audio video signals are regulated form of the unnatural light. The solar ray transformed fire hiding materials such as plant tree wood phosphorous ignitor materials, coal, seawater under earth sedimentary layer explored petrochemicals are transformed form of heat energy regulating the overall industries, domestic and corporal consumers need.

The engineering science and techno craft designer instruments are appliances to propagate, transmit and regulate unnatural energy transform modes for befitting utilization of the natural energy. Electric generation from hydro stream motion or gas fuelled fire hot air mass transformed cooler air pressurized armature rotational motion inside a magnetic field causes the electric energy propagation. The electric field current transmittance through the conductive metal wire covering protective insulating materials is the common practice for transmitting generated electric energy from the source to destination transformer consumer units. The circuits, switch

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system materials those protect or pass the electric current are regulating propagated or transformed electric energy.

The hydroelectric energy management mainly depends on cloud rain at the water reservoir connecting upstream fountains. The fountain water pouring potential and gravitational force, reservoir dam rigidity, dam connector canal cross-sectional orifice exiting water stream impedance wall inductance are secondary managerial items. The natural hydroelectric plant regulators are turbine motion controller water stream pressure. The water stream in control parameters are water reservoir surface area, reservoir water depth and dam canal intersection orifice height from the sea level.

The sun rays pump moisture from water surface to cloud forms in atmosphere and air wind displace cloud to fountain above sky, and natural lightening charges the hydro oxy bonding within the moisture and cooling effect in cloud forms rainwater drops. Thus, natural forces are regulating the hydroelectric in massive level. However, the material devices such as turbines connecting circuits conducting electro-motive forces are unnatural forces regulating electric energy supply and protect switch systems.

The thermal electric plant furnace burns coal or hydrocarbon gas to create hot air, the atmospheric cool air pressure changes and massive air injected into the combustion chamber, and the air force rotates the armature turbine located within the field magnet and generates electric energy. The protective switch circuits smoothen the electric energy transport control system.

The coal dig operation, coal transport to plant furnace site and convey to furnace chamber are the plant managerial routine tasks. Thousand machines are employed in the Indian coal mine and thermal plants to supply coal and hydrocarbon gases to the thermal plants for propagation of electricity.

The electric transmission wireline holding towers are made up with elementary metals or alloyed metals, and the transmission line materials that manufacture plants supplies the necessary materials as much as required by the existing electrical transmission service system. There is a compulsion of expanding the transmission wireline and grid maintenance facilities as material transporter vehicle oil and usable minerals are costing day by day and mines are reducing the stocked minerals also.

The sea coastal electrical service continuation may not suffer if the seaports located in India should setup electrical energy generation units within the port locality using seawater wave tide pulsations.

The battery energy operated vehicle transport system is growing but the discharged battery shell disposes inconvenience is restricting the wide use of the battery system energy in the regions beyond the sea coast locality.

The solar photovoltaic panel operated electric generators are providing certain needful energy services to reduce the load of massive power transmission grids. The materials used in the solar photovoltaic panel fabrication are costly, and materials availability and processing technology are difficult to improve at developing states like Odisha in India. Moreover, the solar photovoltaic panel panels are standby energy transforming units in the absence failure of hydroelectric, or thermos electric plant energy supply grids. Thus, electric energy operational management system needs

much more attentions to supply electric energy in efficient generating, effective transporting and maximum distributing to the industry consumers in order to sustain the human civilization.

2 Role of Inductor in Industrial Electric Energy Transportation

In electromagnetism and electronics context, an inductor is also named as choke, coil or reactor, which is a passive two terminal electrical component that stores energy in a magnetic field and electrical current flows through it. This definition is mentioned in Charles et al. [1]. An inductor is a material consists of an insulated wire bounded into a coil around a core.

When the current flowing through the inductor varies, the time-varying magnetic field induces an electro-motive force in units of volt in the conductor, and this is known as Faraday's law of induction. According to Lenz's law, the induced voltage has a polarity direction and changes the current that was passing in the circuit. In the consequence, the inductor conjunctive in the circuit opposes further changes in current passing through it.

An inductor is conjunctive in an electric circuit has inductance, which is the ratio of the voltage quantifying number with the number that represents the rate of change of current with respect to time. The unit of inductance is named Henry or H. In context of magnetic circuits, an inductance is equivalent to weber/ampere. Inductors have values that typically range within 1 micro Henry or 10^{-6} H and 20 H. Some inductors have magnetic core made of iron or ferrite inside the coil and serve to increase the magnetic field as well as inductance. Conjunctive with capacitor, and resistor, the inductor forms three element linear circuit and constitute an electronic circuit to filter alternating current in the equipped electronic devices, to monitor radio wave.

The capacitor, resistor and inductor combination circuits block the alternating current and allow direct current to pass through the conductive material, and such inductors are called chokes The electronic cloud filtering process of inductor is used to separate signals of different frequencies wavelets and combining with the capacitor circuit tune wavelets passing through the circuits to tune radio sound card and TV audio video signal wave receiver.

3 Inductor Stores Electrical Energy

The following few lines are the explanation of how inductor stores electrical energy. The electric potential difference induced through an inductor causes a change of current in an inductor, which can be interpreted as follows:

A change in current through an inductor causes a change in the strength of the magnetic field. That means if the current is increased, the magnetic field increases due to containing potential energy, and increasing in the field strength requires more energy to be stored in the field. This energy comes through the inductor from the electric current provider EMF, and it appears as a voltage drop across the conductor windings as long as the current increases. Once the current is no longer increased and is held constant, the energy in the magnetic field is constant and no additional energy comes to the conductive material from the source, so the voltage drop across the windings disappears.

In case, the electric current through the inductor decreases, the magnetic field strength decreases, as a result the energy in the magnetic field decreases. This decayed energy enters to the circuit in the form of an increase in the electric potential energy of the moving charges, which causes a voltage rise across the windings.

Derivation

From the physics text, it is known the work and energy are of same dimensional form, so work and energy are coexistence entities. Let the work performed per unit charge passing through an inductor can be denoted as $-\varepsilon$. The negative sign indicates the work performed against the EMF. The current I is the variation charge per unit fraction of time passing through the inductor. Therefore, the variation rate of work W performed by the charges against the EMF is directly proportional to the product of charges passing through the inductor and the current. Thus, $\frac{\mathrm{d}W}{\mathrm{d}t} = -\boldsymbol{\varepsilon}.\boldsymbol{I}$.

The charges passing through the inductor is mathematically denoted as $-\varepsilon = L\frac{\mathrm{d}I}{\mathrm{d}t}$. So $\frac{\mathrm{d}W}{\mathrm{d}t} = \frac{L\mathrm{d}I}{\mathrm{d}t}.I$ or $\mathrm{d}W = LI.\mathrm{d}I$.

In the ferromagnetic core inductor, when the core's magnetic field approaches a constant level, the inductance will begin to change. It will be a function of $L(I)$. Neglecting the losses, the energy W stored by an inductor with a current I_0 passing through it is equal to the amount of work required to establish the current through the inductor. This is represented by the integral form $W = \int_0^{I_0} L(I).\mathrm{d}I$.

In an air core inductor if the cored air temperature pressure changes the inductor maintains balance, the inductance is constant, so the stored energy is $W = L\int_0^{I_0} I.\mathrm{d}I = \frac{1}{2}LI_0^2$.

For the magnetic cored inductor, the above-mentioned equation is only valid for liner regions of the magnetic flux, at the currents below saturation level of the inductor, where the inductance is approximately constant as the inductance is not at constant.

4 Mathematical Description of Two Coils of an Induction Coil is Identical with Resistance *R* Inductance *L*, Mutual Inductance *M* and a Battery with Electro-Motive Force *E* Inserted in the Primary Coil

Transformer is a fundamental component of every electric power grid. An electrical transformer consists of two or more inductors proximity in coupled magnetic flux or mutual inductance. The efficiency of a transformer is effective if the current through the battery connected primary coil circuit is equal to the current frequency in the concatenated secondary coil. This statement is observed from the following lines and descriptive mathematical explanation. The differential equation used in the description is cited from the reference citation [2].

Let I_1 and I_2 be the current flowing through the primary and secondary coil at any instant as shown in Fig. 1. Then using Kirchhoff's law, we have $(R + LD)I_1 + MDI_2 = E$ for primary coil and $(R + LD)I_2 + MDI_1 = 0$ for the secondary coil. Here $D = \frac{\mathrm{d}}{\mathrm{d}t}$ is the differential operator. Eliminating I_2 from both the equations, we obtain $\left[\left(L^2 - M^2\right)D^2 + 2LRD + R^2\right]I_1 = RE$.

This is a non-homogeneous second-order differential equation. The complementary function is $I_c = c_1 e^{\frac{-Rt}{L+M}} + c_2 e^{\frac{-Rt}{L-M}}$, where c_1 and c_2 are two arbitrary constants. The particular integral is

$$I_p = \frac{1}{\left[\left(L^2 - M^2\right)D^2 + 2LRD + R^2\right]}RE = \frac{REe^{0t}}{\left[\left(L^2 - M^2\right).0 + 2LR.0 + R^2\right]} = \frac{E}{R}$$

Thus, the induced current in the first coil is $I_1 = c_1 e^{\frac{-Rt}{L+M}} + c_2 e^{\frac{-Rt}{L-M}} + \frac{E}{R}$.

From the second equation, $I_2 = \frac{MD}{LD+R} I_1$. Substituting I_1 value in the equation I_2, we get

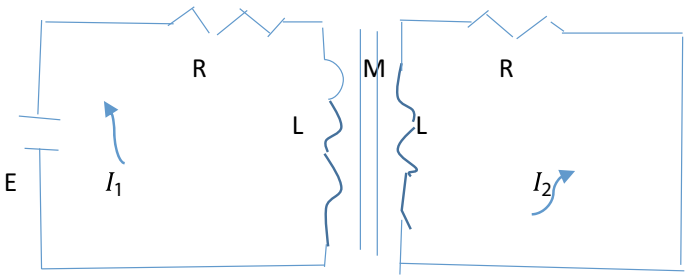

Fig. 1 Two coils of an induction coil are identical with resistance R inductance L, mutual inductance M and a battery with electro motive force E inserted in the primary coil

$$I_2 = \frac{MD}{LD+R}c_1 e^{\frac{-Rt}{L+M}} + \frac{MD}{LD+R}c_2 e^{\frac{-Rt}{L-M}} + \frac{MD}{LD+R}.\frac{E}{R}$$

$$= \frac{c_1 M}{L\left(-\frac{R}{L+M}\right)+R}De^{-\frac{R}{L+M}t} - \frac{c_2 M}{L\left(-\frac{R}{L+M}\right)+R}De^{-\frac{R}{L-M}t} - \frac{M}{R}D\left(\frac{E}{R}\right)$$

Thus, $I_2 = c_1 e^{\frac{-Rt}{L+M}} + c_2 e^{\frac{-Rt}{L-M}}$.

5 Applications of Inductor

Inductors are used extensively in analog circuits and signal process instruments. Inductors in conjunction with filter capacitors remove ripple in the main switch mode power supplied current frequency from the direct or alternating current sources to output a direct current. The small inductance through the inductor in the shape of ferrite bead or torus installed around a cable occasionally prevents radio frequency interference wavelets from being transmitted to down the wire.

Different sized inductors conjunctive with capacitors are used as energy storage device in different main switched mode power supplies systems to produce direct current through the conductor's downstream connectives. The electric inductor supplies energy to the conductor circuit to keep current flowing during the "off" switching periods and enables topographies if the outflow current potential is higher than the inflow current potential.

A sound card pulse tuner circuit, consisting with an inductor connected to a capacitor, acts as a resonator for oscillating the direct current pulse frequently. Tuned circuits are widely used in radio frequency equipment such as radio transmitters and receivers, to narrow a band-pass wave bundle filtering action to select a single frequency from a composite signal and to generate sinusoidal signals in an electronic oscillator.

6 Conclusion

The inductor is a device that manages electric potential energy as well as magnetic potential energy in unnatural ways. Large inductors are used in power supplies. The readers those are interested to know more about the inductors can find from the web URL reference [3].

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A Review on Characteristic of Li-Ion Battery for Electric Vehicle

Snehaprava Swain and Naran M. Pindoriya

1 Introduction

The Battery Electric Vehicle (BEV) is having a battery which provides the required electrical energy for its operation. Hence battery is interpreted as the soul of the vehicle. The soul of each individual is having eight powers. The capability of living a harmonious life differs from each other due to variation of these powers [1]. Similarly, each type of EV battery has eight common characteristics [2]. These are the significant requirements of a battery, little variation of which affects the battery property chemically and electrically. It must satisfy these characteristics to be used as an energy storage device and also for market acceptance. These characteristics are (1) High Specific Energy, (2) High Specific power, (3) Affordable price, (4) Long Life, (5) Safety, (6) Wide operating range, (7) Fast Charging, (8) Toxicity [2].

The different types of batteries that are used in EV are: (1). Lead-Acid, (2) Nickel Metal Hybrid, (3) Nickel Cadmium, (4) Lithium-ion, (5) Lithium-ion polymer, (6) Zinc air and (7) Molten state batteries.

Out of all these batteries, the Li-ion battery is the most preferred ones due to the advantages of: (1) High energy density, (2) Light weight, (3) Production of high voltage output, (4) More reluctant to overcharge, hence more safe, (5) Quick charging and discharging, (6) Easy installation.

A qualitative comparison of the EV batteries is presented in Table 1where 'p' refers to poor, 'a' refers to average and 'g' refers to good.

The Li-ion batteries are classified into two main types, based on the type of electrolyte used in its making: (1) Li-ion liquid type and (2) Li-ion polymer type. The

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Table 1 Comparison of EV Batteries with respect to quality [3]

Attributes	Lead acid	Ni–MH	Zinc air	Li-ion
Specific energy	p	a	g	g
Specific power	p	g	p	g
Capacity	p	a	g	g
Discharge power	g	a	p	g
Charging power	p	a	p	g
Cold temperature performance	g	a	a	p
Shallow cycle life	a	g	p	g
Deep cycle life	p	g	p	a
Cost	g	p	p	p
Recyclability	p	p	a	a

most preferred one for electric vehicle is the liquid type. There are three types of Li-ion- liquid type batteries: (1) Lithium Cobalt oxide ($LiCoO_2$)–LOC, (2) Lithium-ion Titanium Oxide ($Li_4Ti_5O_{12}$)–LTO, (3) Lithium Manganese ($LiMn_2O_4$). Examples of Li-ion-polymer type are: (1) Lithium-ion Iron Phosphate ($LiFePO_4$)–LFP and (2) Lithium-ion Nickel Cobalt Manganese ($LiNiMnCoO_2$)–NMC.

In Table 2, a comparison of different characteristics of various Li-ion batteries are presented.

2 Different Characteristics of Li-Ion Battery

A battery can be specified mainly by three important characteristics. These are the chemistry, specific energy (capacity) and voltage rating of the battery.

2.1 Chemistry

The most adopted battery chemistries by the manufacturers are lead (Pb), nickel (Ni) and lithium (Li). Different designated chargers are required for the three different types. In electric vehicle, mostly the Li-based batteries are used.

2.2 High Specific Energy

Specific energy of a battery is defined as the capacity of a battery in weight. The unit of it is (Wh/kg). It is sometimes depicted as energy density, gravimetric energy

Table 2 Comparison of different characteristics of Li-ion battery [4]

Characteristic	LFP	NMC	LCO	LMO	LTO
Voltage	3.2 VPC (Operating range 2.5–3.65 VPC)	3.6 VPC (Operating range 3–4.2 VPC)	3.6 VPC (Operating Range 3–4.2 VPC)	3.7 VPC (Operating Range 3–4.2 VPC)	2.4 VPC (Operating Range 1.8–2.85 VPC)
Specific energy (Wh/kg)	90–120	150–220	150–200	100–150	50–80
Energy density (Wh/l)	333	580	560	420	177
Charge rate (C)	1	0.7–1	0.7–1	0.7–1	1
Charge voltage (VPC)	3.5–3.65	4.2	4.2	4.2	2.85
Discharge rate	1 C, 2.0 V Cut-off	1 C, 2.5 V Cut-off	1 C, 2.5 V Cut-off	1 C, 2.5 Cut-off	10 C, 1.8 V Cut-off
Cycle life	2000–4000	1000–2000	500–1000	300–700	3000–7000
Thermal runaway	270 °C	210 °C	150 °C	250 °C	NA
Prone to thermal runaway	No	Yes	Yes	Yes	No
Applications	Motive power and for stationary needing high current	E-bikes, EVs, medical devices	Mobile phones, laptops	Power tools, medical devices, Electric power trains	UPS, Electric Power trains, Solar Street lighting
Cost	$	$	$$	$$	$$$

density and volumetric energy density representing volume in liters (Wh/l). The higher is the specific energy of a battery, it can support long run time with moderate load. In Fig. 1, the specific energy versus flow depth curves are shown for three different charging/discharging q_1, q_2 and q_3 where ($q_1 < q_2 < q_3$). When the specific

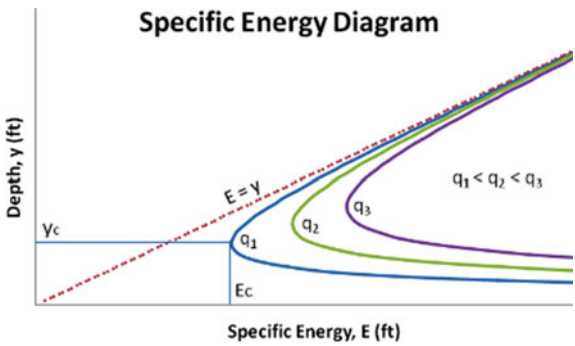

Fig.1 Specific energy

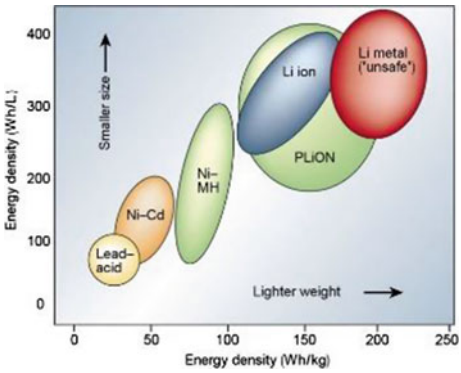

Fig.2 Energy density of different batteries [5]

energy is equal to the depth, we get the straight line denoted by ($E = Y$). Similarly Fig. 2 depicts the variation of the volumetric energy density with the specific energy for different EV batteries.

Mathematically it can be expressed as

$$E_i^{\mathrm{Sp},T} = -\Delta G_i^T / m_1 \tag{1}$$

where The quantity *m,* denotes the mass of one mole formula unit of either reactant or product [4]. T represents to the absolute temperature and ΔG represents to the Gibbs energy.

2.3 Voltage Rating

The voltage rating marked on any battery always refers to the nominal voltage rating. But except this, every battery has two more technical voltage ratings: the open-circuit voltage (OCV) rating and the closed-circuit voltage rating (CCV). The OCV of a completely charged battery is usually (5–7)% higher than the nominal voltage. The series connection of multiple number of same cells and the chemistry provides the OCV of the battery. Similarly, the closed circuit voltage (CCV) is the operating voltage. One must always inspect the exact nominal voltage before making a battery connection.

In Fig. 3, the change in voltage/cell of a battery with temperature is shown. Two cases are analyzed. In one case voltage during charging is considered and the other case is when the battery is in the floating condition. In both cases, it is found that with increase in temperature, the voltage/cell decreases.

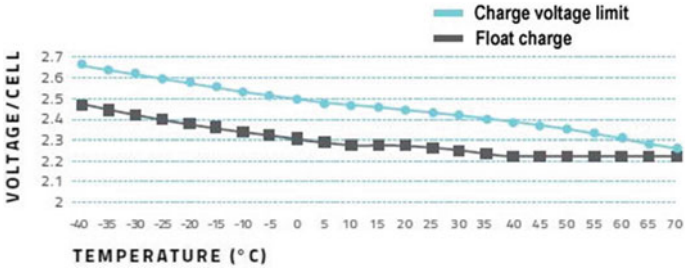

Fig.3 Cell voltages on charge and float at various temperatures [3]

3 Other Important Characteristics of Li-Ion Battery

The other characteristics which also affect the performance of the battery are described in the following sub-sections.

3.1 Watts and Volt-Amps (VA)

The active power or the real power is denoted in terms of Watts. The apparent power is represented in VA. These notations are same for resistive loads whereas, for reactive loads, a phase shift is added between voltage and current which reduces the power factor from 1 to 0.7 or less. The electrical wiring and the selection of circuit breakers are done based on VA power.

3.2 Reasonable Price

In the manufacturing of battery, the total cost to the manufacturer includes the cost towards materials, refining process, quality control, cell matching, and manufacturing. A large volume of production assists in the reduction of the manufacturing cost. Similarly, in case of the single-cell used in mobile phones does not require cell matching and hence reduces the overall cost.

3.3 Long Life

Life of battery is a very important characteristic of it. Longevity is more important than the size and cost. For expensive battery packs and large size battery packs, priority is always given to longevity. The electric vehicles are costly than the conventional vehicles, if the life of the battery of the vehicle could be extended from let 8 to

20 years, then it will be affordable for an driving an EV could be justified despite of its high cost. Longevity of a battery depends not only on the battery design but also on the way the battery is used. Limitless temperature, the frequency at which it undergoes fast charging and rapid discharging also reduces the battery life. EV batteries are perishable in nature. The expected life of alkaline battery is 10 years with 70% of its original energy. The capacity of the secondary batteries is lost permanently with age, even if the battery is not in use.

3.4 Safety

Lithium-based batteries have high specific energy, but unstable and reactive. Metallic lithium and Nickel-based Li-ion batteries are having such issues hence manufacturers are discouraged for production of these. Contrary to this pure Li-ion is very safe during manufacturing as well as drive.

3.5 Wide Operating Range

Batteries perform best at moderate room temperature (0–45 °C) as cold temperatures (below −20 °C) the electrochemical reaction of all batteries become sluggish. Li-ion battery charging is not possible below freezing, and in such conditions, the heating blankets are used to facilitate charging. Very high temperature also shortens the battery life and safety cannot be warranted.

In Table 3, the permitted temperature limit for charging and discharging for different battery types are presented.

Table 3 Permissible temperature limits for various batteries [3]

Battery type	Charging temperature (°C)	Discharging temperature (°C)	Charging precautions
Pb-acid	−20 to 50	−20 to 50	Charge at 0.3 C or less, below 0 °C
NiCd, NiMH	0 to 45	−20 to 65	Charge at 0.1 C, (−18 to 0 °C) Charge at 0.3 C, (0 to 5 °C) Charge permitted at 45 °C is 70%, at 60 °C is 45%
Li-ion	0 to 45	−20 to 60	No charging below 0 °C Charge/discharge profile is good Charge flow possible at higher temperature but shorter life

3.6 C-Rate

The charging or discharging speed of a battery is denoted as C-rate. For example, at 1 C, the charging and discharging resembles a current same as the marked 'Ah' rating. Similarly, at 0.5 C, the current of charging becomes half and hence the time duration increases to double. At 0.1 C-rate, the current of the battery becomes one-tenth and the time required to charge or discharge becomes tenfold.

3.7 Fast Charging

Li and Ni-based batteries are permissible to be charged at rate of 1 C or slower. At 1 C, a Ni-based battery takes hardly 90 min to get charged completely and Li-ion takes 2–3 h. Lead (Pb) acid battery charging should be done at a slower rate and fast charging is not recommended for this. The charging time for Pb-acid type is nearly 8–16 h. Fast charging is possible for Ni and Li type batteries only.

For fast charging below are the precautions that have to be taken care:

1. The battery must be made for fast charging,
2. It must be electrochemically in a good condition,
3. The charging must be done at room temperature or moderate temperature.
4. Mismatched and aged cells should not be permissible for fast charging.

Other safety precautions that have to be considered during charging are:

No battery should be charged above 1 C otherwise it creates unwanted stress on the cell, and it must be avoided.

3.8 Toxicity

Cadmium (Cd) and mercury (Pb)-based batteries have disadvantages of creating pollution in the environment. The leaders and authorities in European countries are trying to ban lead-acid type but appropriate and economically feasible alternate battery systems are not available. Lithium-based batteries and Nickel batteries are little toxic in nature, but they are hazardous if carelessly disposed.

4 SoH, SoC, and SoF

4.1 State-of-Health (SoH)

There are three main indicators of state-of-health of a battery:

1. Capacity that is the energy storing ability of the battery
2. Internal resistance which is the current delivering capability of the battery
3. Self-discharge, which indicates the mechanical fatigue and integrity of the cell.

Under normal conditions, the three indicators become low and hence the SoH of Li ion is low. SoH of a battery can be classified as [6]:

- Absolute state-of-health (ASoH) and Relative state-of-health (RsoH). The ability to store the specified energy when the battery is new
- AsoH and RsoH are the capabilities of the battery to store the specified energy when the battery is new and broken, respectively.

SoH is indicated by the changes in the battery parameters. SoH varies with the change in the capacity of the battery over time and use. Hence mathematically, SoH can be is represented as [7]:

$$\mathrm{SoH_c} = \frac{C_{\mathrm{act}}}{C_{\mathrm{cap}}} \times 100\% \tag{2}$$

where $\mathrm{SoH_c}$ represents to State of health w.r.t capacity. C_{act} is the battery maximum capacity. C_{cap} is the highest capability of the battery to store the current when it is new.

4.2 State-of-Charge (SoC)

The level of charge in the battery is well denoted by SoC. SoC can be classified into Absolute and Relative state-of-charge respectively (ASoC, RsoC). AsoC is the capability of the battery to hold the specified charge when the battery is new and broken, respectively. In general, RsoC refers to SoC.

$$\mathrm{SoC} = \mathrm{SoC_o} - \frac{1}{C_{\mathrm{cap}}} \int_0^t \eta I_{\mathrm{batt}} \mathrm{d}t \tag{3}$$

$$\mathrm{SoC} = -\frac{\eta I_{\mathrm{batt}}}{C_{\mathrm{cap}}} \tag{4}$$

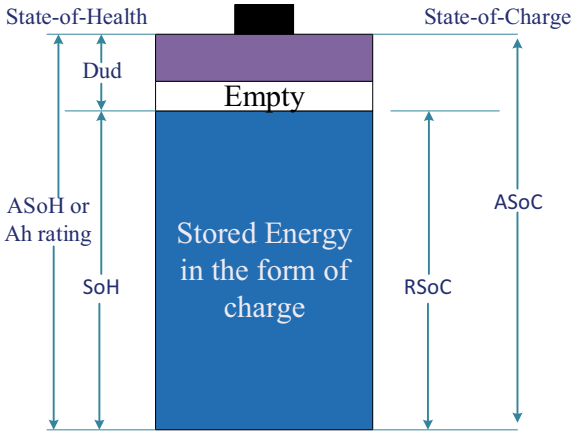

Fig.4 Relationship of battery state-of-health and state-of-charge

where η is coulombic coefficient which is a constant value that defines charging and discharging process. SoC_o is the starting value of SoC before the battery flow into the battery or from the battery. C_{cap} is the highest ability of the new battery to keep the current [6, 7].

The relationship between the SoH and SoC is presented in Fig. 4.

4.3 State-Of-Function (SoF)

SoF represents to the preparedness of a battery in terms of serviceable energy by noticing SoC in comparison to the available energy. SoF can be presented through tri-state fuel gauge.

5 Summary

In this paper, different characteristics of Lithium ion battery for Electric Vehicle market are analyzed. A comparative study is presented on different types of batteries on these characteristics. It is found that the performance of Li-ion batteries is comparatively superior than the other types of batteries. Specific energy, specific power, capacity, discharge power, and charging power are the main characteristics in which the Li-ion battery are preferred over other types of batteries. Out of all the five types of Li-ion batteries, LMO is the best one based on voltage of the battery. Similarly, NMC is the best one if specific energy is considered. It is also best selection on the basis of energy density. Based on charging and discharging voltage, NMC, LCO and LMO can be equally preferred. Hence keeping all these comparative study points into account, Li-ion battery can be decided to be the best selection for EV industry.

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A Review on Personality Prediction

Sourav Mishra and Santwana Sagnika

1 Introduction

Today, as we already entered into the digital age which is also known as the society of information, we are now able to put our opinions through social media or any information sites which can be accessed over the Internet. So the volume of information on the Web is increasing day by day. The rapid growth in the volume is due to the unquenchable desire for sharing information. Through social media, many people interact with each other and invite them to give their opinions. So there is an explosion of information in blogs and different social media platforms, review and services of products. As online media platform gives an option to people to give their views and discuss their ideas, it becomes the main source for maintaining a smooth relationship between seller and customers. To get quick answers for different queries, people and many organizations are using this podium. For instance, there are 330 million users who remain active on Twitter every month and about 40% or 134 million people use this on a daily basis. More than 500 million tweets posted every day. So Twitter becomes an important source to extract heterogeneous opinions posted by different people or different organizations for different purposes. In any social media platform, opinions of people may vary from location to location. For example, reviews of other countries may differ from reviews of India about a movie [1].

There is a growing need for information extraction due to the high volume of data is being generated through different mediums. According to the definition, it helps in extracting information from unstructured data. It extracts structured information from unstructured sources. This activity involves natural language processing technique

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(NLP). Recent activity such as automatic annotation and content extraction from audio/video/images/documents comes under information extraction. For example, consider a sentence "Yesterday US-based Walmart announced, their acquisition of Flipkart." So this kind of sentence can be extracted in the form "Merger Between (Company1, Company2, date)." On the long run, it gives permission to past unstructured data for calculation. If we can understand the deep meaning of IE systems, it is one and only aim is that it permits logical reasoning to draw interfaces which is actually dependent on the relational information of the input data. Unstructured data can be transformed into understandable for with the help of the intelligent system, which is basically based on IE. Some of the application includes audio/video/image extraction [2].

Nowadays, people are showing more interest in studying human learning capabilities through computer programs. To transfer intelligent activities from human to machine, Samuel in 1950s used the term machine learning. The actual target of machine learning is to find relationships among data and analyze the process to extract such relations. When a job/duty/subject is expounded by a number of instances or examples preferably than by deliquesced rules, then only machine learning problem occurs. Different fields such as engineering applications which include robotics, recognition of patterns (recognition of faces, handwriting, and speech), applications which depend on Internet (categorization of text), and application related to medical (delivery of drugs, diagnosis, and prognosis) can have such problems. If there are several "training" examples given, then machine learning is capable to identify whether any relationship exists between patterns and the outcomes or outcome is independent upon pattern.

This is how machine learning often motivates feature extraction and its sub-tasks. Extraction of features must start from the given dataset and then it will build descriptive value which must be instructive and not permissible. We can relate it to dimensionality reduction. So basically, it is a procedure to reduce dimensionality where a starting set of underdone data is reduced to more feasible groups for proceeding. It is simply a name of the method that selects or combine a number of features into a small group which significantly reduced the amount of data, but it still can relate to original data set effectively (Fig. 1).

Feature extraction has four characteristics:

- Constructing feature
- Generating feature subset (or strategy for searching)
- Evaluating the definition for each criterion
- Evaluating the estimation of each criterion (or method for assessment).

The last three features are known as feature selection and briefly summarized in Fig. 2.

The thing that differentiates filter from wrappers is the evaluation criterion. Criteria that involve any learning machine cannot be used by filters but when a subset of feature is being given to learning machine wrappers gets benefitted [2]. Search

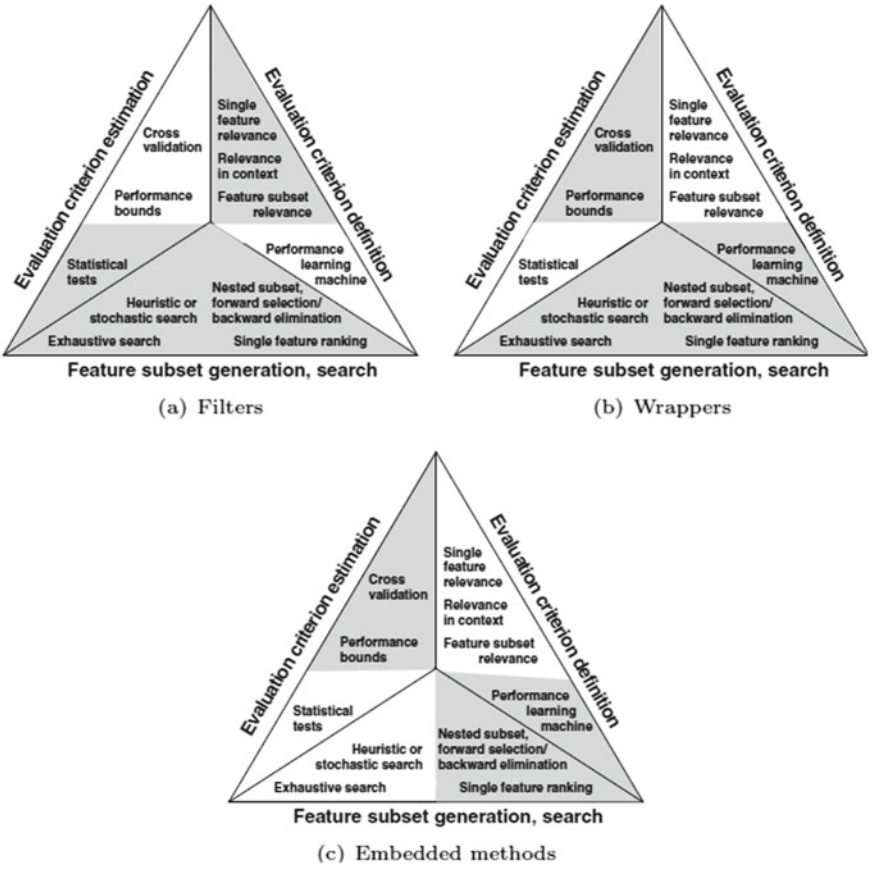

Fig. 1 Feature selection

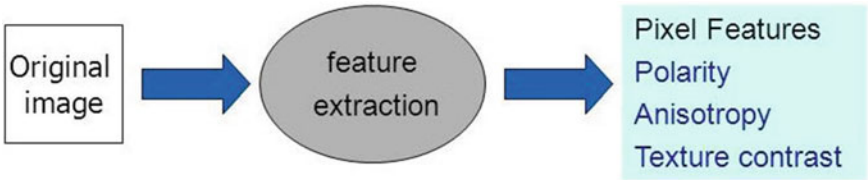

Fig. 2 Image processing

methodologies can be used by both filter and wrapper to explore all possibilities of future combinations that are always much larger to be explored comprehensively. A ranked list of features is generated by using the filter in hybrid methods. Classes of embedded methods help in generating subset and also useful for evaluation in the training algorithm.

Several questions strike our mind while studying about feature extraction topic.

1. What is the difference between feature selection and feature extraction?
   Ans. The reason behind the differences between feature selection and extraction is that selection process builds a new model, whereas extraction keeps a subset of old features.
2. What are the practical uses of feature extraction?

   I. Ans. Autoencoders—autoencoder comes under unsupervised learning which is responsible for efficient data coding. From the original data, key features are recognized by using feature extraction with the help of learning methods to derive a new set of features.
   II. Bag-of-words—it is a natural language processing (NLP) technique that extracts the words (features) used in a sentence, document, Web site, etc., and classification is done on the basis of frequency. It is also very much helpful in image processing.
   III. Image processing—different algorithms are used which helps in detecting features such as shaped, edges, or motion in a digital image or video.

One more important area of application of feature extraction is predicting trait. In general, trait defines different features (personality or characteristic) of human. For example, when a mother tells her son/daughter that he/she got the best trait from her. That means he/she might have the same charming smile or intelligence inherited for his/her mother. According to trait, theorist traits are aspects of personality that are relatively stable over time, but differ across individual (e.g., some people are friendly, whereas some people are introvert), are relatively consistent over situation and influence behavior.

Basically, there are three kinds of speaker traits such as personality, likability, and pathology. The main idea behind personality trait is that each person has the individual stable characteristics that make them different from other people. So when we are doing research on personality we have to focus on two goals, one is to identify characteristics and second is to establish an informal link between personality and behavior [3]. Therefore, nowadays, almost every theory is adopting individual characteristic as a personality basis. Personality theory succeeds when it effectively predicts measurable aspects of the life of people (e.g., professional success, amount and quality of social contacts, engagement in criminal activities, etc.). So if personality theories based on trait and large dimensions that are eligible to identify major differences between individuals then it is termed as successful.

In some experiments, trait theories faced some criticism that traits are purely descriptive and are not in touch with an individual characteristic and some other experiment shown that the same trait shockingly consistent across cultures, individuals, situations, etc. For this, researchers started studying more about big five (BF) traits. These traits can be considered as "the dominant paradigm in personality research, and one of the influential models in all of the psychology" [4]. The big five traits are as follows:

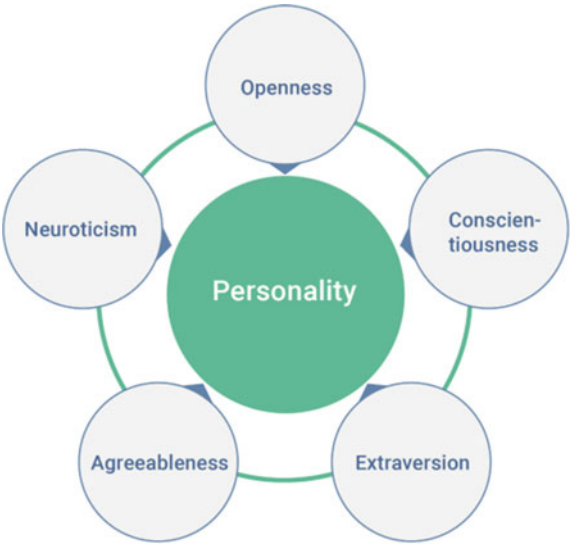

Fig. 3 Big five personality trait

- Openness: decorative, peculiar, inventive, perceptive, indigenous, extensive, curiosity, etc.
- Conscientiousness: efficient, organized, dependable, responsible, etc.
- Extroversion: dynamic, determined, passionate, responsive, talkative, etc.
- Agreeableness: obligated, kind, unselfish, humane, ingenious, etc.
- Neuroticism: uneasy, desolation, tense, irritable, volatile, agonize, etc. (Fig. 3).

The big five framework while accessing the personality of individual measures how well adjectives above can answer to the assessment of the subject.

Likability: It means how much attractive or likeable the person is. Within a particular relationship, the perspective of an individual toward a speaker that constitutes a particular aspect of a person defines likability. Some of the familiar examples of likability are: "We think that he/she could be very good team member," "It is difficult to contact him/her," "He/she will definitely fit into our friend circle." Adjectives like "likeable," "friendly," "relaxed," etc., clearly defines likability.

Pathology: According to the definition, it is the study of the essential nature of diseases and especially of the structural and functional changes produced by them. Diseases can affect our communication. This can differ from language-related disorder among children because they are not developed according to their age.

In the next few sections, we will make a summary of some papers related with trait prediction and will describe briefly about the techniques used by them and why such topics need serious attention and more research must be done in that field.

2 Literature Review

2.1 Big Five Personality

Personality can be defined as the combination of a person's characteristics such as behavior, emotion, motivation, and thought process. A large share of our life choices, comfort, and numerous other choices are affected by it. Big five personality trait is the appropriate term to describe personality. Here, we discuss two main computing approaches to deal with a personality trait, namely automatic personality recognition (APR), which main target is to map behavior into self-questioning traits, and automatic personality perception (APP), which will help in mapping behavior into traits assigned by others.

2.1.1 Automatic Personality Recognition

Pramod et al. [5] proposed a big five-factor model for automatic recognition of personality. Openness, agreeableness, conscientiousness, extraversion, and neuroticism all these five calculable traits are included in the big five-factor model. The proposed model contains two datasets: essay dataset (2469 essays) and my personality dataset (about 10,000 Facebook status update of 250 users). It contains several steps such as dividing the collected data into sentences, constructing parse tree tokenization, stemming and removing redundant terms. In the end, the final score is calculated which is the percentage difference between matched words in positive polarity and negative polarity with respect to positive polarity. For each five trait, authors calculated precision, recall, and F-score. It was found that openness was having high F-score, whereas agreeableness scored minimum. This is the much-developed approach which gave a better result than earlier methods. However, there are still some flaws to calculate an accurate score of big five traits. So in the future, authors proposed to use artificial intelligence technique and a more robust process for better result.

2.1.2 Automatic Personality Perception

Mohammadi et al. [6] have proposed a prosody-based approach for automatic personality perception. So far only a few problems have been discussed on the APP. There are a different proposed model for personality test but questioner-based method became state of the art. Mainly it consists of three sub-approaches which are extraction of low-level prosodic feature from the speech signal, estimation, and mapping of the statistical feature. The dataset used here is publicly available which consists of 640 clips of 322 individuals. A total of 11 judges are assigned to listen to all clip and give a score to each clip based on 10 questioners. Finally, the score is calculated by taking

the average of the scores assigned by each of the judges individually. Logistic regression is used for further confirmation. Variability among different judges is the key problem addressed here. The range of the performance was between 60 and 70%. Conscientiousness and extraversion are the two traits which were predicted with better accuracy. One of the important difficulties faced by researchers while going through this approach is a large number of corpora which is almost impossible to access. APP approach can contribute more to society by building socially intelligent machines that could interact with people like human interaction with others.

2.1.3 Some Other Applications

To preserve a relationship between sociability and social connection Rang et al. [7] have proposed a new model. A total of 299 samples belong to all participants were collected by a research firm located in South Korea. Virtual currency incentives provided by the firm to all participants. After studying the relationship between big five traits and the use of selfies researchers find out three outcomes and that is how individuals involved in each other's responses, how they observe others' selfies and their involvement in comments and likes in different posts. For each of these three outcome series of multiple regression was conducted and it was found that 12% of users involved in others' responses, 9% of total users observed other's responses, and 13% of them like to post likes and comment on others' selfies. Extraversion was found to be the best predictor of posting likes or comments on others' selfies. For all three outcomes, agreeableness was proved to be the best predictor. Among all big five personality traits openness was considered as negative predictor. As all data are collected from the social media sites, for which the output is not that much precise. So more error-free data should be collected for a more accurate result.

As there is an increasing demand in the field of artificial intelligence, a large number of researchers showed interest in this field and try to analyze video interviews to identify different personalities. To perform automatic analysis of video interviews, Suent et al. [8] have developed an AI interviewing system with Tensor Flow AI engine where a sample of 120 real job applicants was taken for analysis purpose. In the first stage, data were preprocessed. The extracted feature of 120 job applicants combined with personality labeled data. Advanced CNN, Python, and Tensor Flow engines are the three factors used to build a trained APR model. Before assessing the performance of APR, the statistical package used in IBM for social sciences examined the construct validity and internal consistency that are authentic for disclosed personality traits. DL engine learned and successfully predicted all features of the big five traits. APR predicted the score of all the five self-assessed personality trait. The range for each dimension is between 0.966 and 0.976 and the Pearson's correlation varies between these ranges. The R2 for each attribute range from 0.933 to 0.952. All the correlation was found to be significant, while the MSE for each dimension was between 0.053 and 0.120. Estimator gives a better result when R2 becomes higher (100% perfect) and estimator gives zero error when MSE becomes lower. Additionally, the classification accuracy of the classifier was 95.36%.

Listeners having nonverbal practices recognized the method proposed by Jothilakshmi et al. [9] which will be able to predict the personality of speakers. The relationships between speech signal are modeled by frequency domain linear prediction technique. A collection of the personality of speakers evaluated by SSPNet. In psychology, big five traits are assessed by BFI-10 questioner. 11 individual judges listen to each clip in the corpus from different places and provide scores by filling up whether they strongly disagree or agree. Dynamic speech defines frequency domain linear prediction (FDLP) as one of its parameters. The temporal envelope which exists in the signal extracted by using a single FDLP. FDLP features are extracted. Different pattern classification techniques like support vector machine (SVM), multilayer perceptron(MLP), and K-nearest neighbor (KNN) with different values of K are applied on the extracted feature. WEKA tool is used for implementation purpose. It was found from the result that KNN classifier performing better with an accuracy range between 90 and 99%.

Joo et al. [10] build a model which can successfully classify the outcome of two political events only by collecting faces of politicians. A hierarchical model was developed by researchers. Facial photographs of US politicians (491 Male and 159 Female) were taken for consideration. Rank SVM was used to train model because it tends to preserve the pairwise ranking orders which have been specified earlier. The model states that traits like "confidence," "attractive," "energetic," and "masculine" have a positive impact for governor race, whereas "old" is negatively correlated. In the case of the senatorial election, the trait "old" is positively related. Proposed model actively classifies winners of the election with an accuracy of 67.9% (Governors) and 65.5% (Senators). On the other hand, it also categorizes political party affiliations of politicians, i.e., democrat versus republican with an accuracy of 62.6% (Male) and 60.1% (Female). To improve accuracy, authors suggest collecting more reliable source of information.

Celikatan et al. [11] have introduced a novel multi-modal framework to automatically predict the impression of big five personality along with attractiveness and likeability continuously in different time and situations. Before any analysis feature normalization was applied to scale feature values to $[-1, 1]$. Maximum of determination coefficient and minimum square error (MSE) were taken into consideration for best prediction results. External observer listened to each clip individually and give their opinions. In this way, multiple annotations were collected for different content for different subject separately. BLSTM was used by researchers to plot audio and video features with the audio-visual label and later all the features combined together. Conscientiousness dimension was predicted to be the best using decision level fusion ($R^2 = 0.50$). There are several limitations that are highlighted by authors are difficulty in gathering observations in a sequential manner by giving the task to external observers to rate each clip, a limited number of annotators and there are a restricted number of clips and subjects. To avoid such problems in the future, authors proposed to use crowdsourcing platforms.

3 Discussion

We reviewed seven papers from which we found that though the research community searched and published many methodologies for trait prediction, still less amount of work has been done for automatic personality perception approach. Different methodologies giving different results. With the big five-factor model, openness is having high value, whereas in prosody-based approach conscientiousness and extraversion is having high F-score. Overall, we found that semi-supervised deep learning-based approach giving more accuracy for all the big five trait more than 90%.

4 Conclusion

Until now, many researchers have come up with the idea of trait prediction. The majority of reviewed studies have outperformed previous one. Most of the E-commerce company and through social media organization are targeting choices of people to sell products. For that they are using trait prediction to know how people react to different situation and read people mindset. Even after so much research, there are some limitations and less research has done in the automatic personality perception (APP) approach. With rapid work going in the field of trait prediction, it is important that we should collect more precise corpora to allow progress. The objective of doing this review paper is to outline the scope of the topic and provide a brief overview of the current state of knowledge and also to show future direction on different areas of personality prediction.

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License Plate Detection for Smart Parking Management

Shiwani Bhatta, Harshit Srivastava, Santos Kumar Das, and Poonam Singh

1 Introduction

The first and foremost course for the recognition and detection of a license number plate is done by extracting information regarding the same from image or video in real-time, then segmenting the characters of the plate and finally recognizing each character. License plate detection plays a crucial role in both parking areas as well as toll collecting areas for monitoring the traffic near airports and crowded areas in big cities. In this work deep learning object detection algorithms for detecting the license plate region and Tesseract OCR for recognizing each character on the plate have been done. The overall process also includes some image processing techniques such as binarization, grayscale conversion, etc.

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1.1 Neural Networks

Neural networks are the multi-layer networks of neurons that comprise three different layers and they are input layer, hidden layer and outer layer and are used for classifying things, make predictions, etc. For the better prediction system generally, we have several hidden layers.

1.2 Deep Learning

It is a broader concept of machine learning. Neural networks are part of deep learning. In deep learning to we take a large number of datasets to perform some training and testing and finally make the predictions. The major difference between machine learning and deep learning is that in latter technique we have to accumulate vast dataset for training purpose (i.e., more amount of datasets better accuracy) and also the networks of the deep learning algorithms should be deep which means there should be a large number of hidden layers in the neural networks. There are different object detection algorithms in deep learning for better prediction and they are Convolutional Neural Networks (CNN), Region-based CNN (RCNN), Fast RCNN, Faster RCNN, YOLO, etc.

2 Literature Survey

Li et al. [1] proposed a deep neural network for license plate detection from an image, recognizing the characters all at once. They trained the model end-to-end with only the images, plate positions and labels. Laroca et al. [2] presented their work by using a YOLO detector based on real-time license plate detection. The model has been trained for each ALPR stage and for recognizing digits and letters, separate convolutional neural networks are used.

Silva et al. [3] has shown their work on deep learning for automatic license plate recognition for Brazilian license using convolutional neural networks. Selmi et al. [4] proposed their work using deep learning. Here for detecting license plate and recognizing characters different CNNs model were used. Yadav et al. [5] have shown work on deep learning for recognizing characters from multimedia documents. For extracting features, classification and recognition, they have used convolutional neural networks. Mahesh Babu et al. [6] have shown their work on detecting the number plate and recognizing the characters using the bounding box method. The template matching method has been used for recognizing separate characters of the plate. Agbemenu et al. [7] presented their work on the ANPR technique with the help of the OpenCV and Tesseract OCR engine. For detecting the license plate region edge

detection, feature detection combined with mathematical morphology was used. And for recognizing characters of the detected plate, Tesseract OCR is used.

3 Proposed Model

This model is for detecting and recognizing a license plate, which is sub-divided into three sections. License plate detection, segmenting those characters and recognizing those characters. Here, YOLO deep learning algorithm is used as shown in Fig. 1 for license plate detection, for segmenting the characters basic image processing and for recognizing the characters the Tesseract OCR is used.

3.1 License Plate Detection

Object detection helps us in detecting the license plate. By detection, we mean selecting the required region i.e. license plate in this case from the image. There are different object detection algorithms such as edge-based detection, deep learning algorithms, etc. Yolo is an object detection deep learning algorithm for detecting objects from an image or videos. In this algorithm, a single neural network is responsible for predicting bounding boxes and finding probabilities of a class from a full

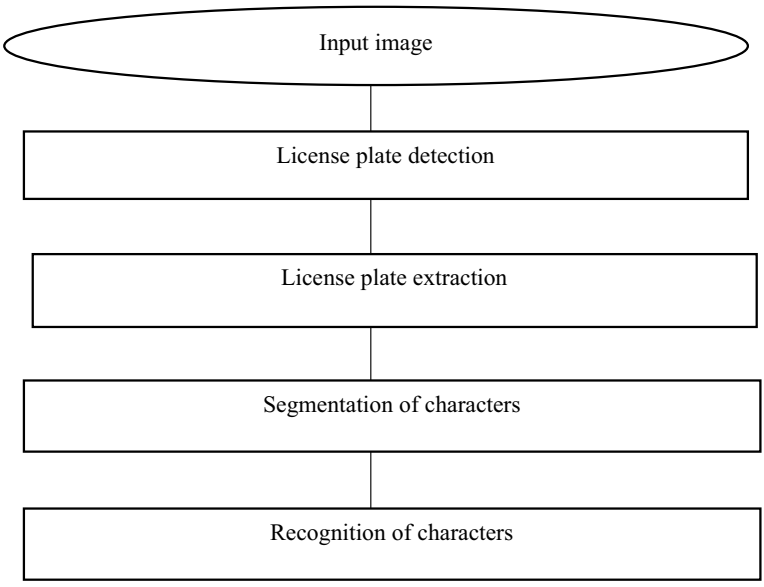

Fig. 1 Flowchart

image at once. The purpose of using YOLO is its performance speed. It divides our input image into the *S*S* grid. It predicts the object whose center falls inside the grid cell. A fixed number of bounding boxes is predicted by each grid cell. The confidence score shows how confident our model is:

$$C_c = C_b * P \tag{1}$$

$$C_u = P_r(\text{object}) \cdot I_u \tag{2}$$

$$\text{conditional class probability} = P_r(\text{class}_i/\text{object}) \tag{3}$$

where C_c is the class confidence score, C_b is the box confidence score, P is the conditional probability,P_r (object) is the probability that the box contains an object, I_u is the intersection over union, P_r (class$_i$/object) is the probability of the class where object is given.

When there is no object in the grid cell, the confidence is zero. The bounding box consists of five predictions x, y, w, h and confidence (c). (x, y) coordinate represents the center of the box and (w, h) is the width and height.

For detecting the license plate region, the Yolo darknet 53 models are used which is the most accurate among others. Plate network is trained over 1500 iterations with a batch size of 64 which is over 30 epochs.

3.2 Character Segmentation

After the detection of a license plate from the image, the next step involves the segmentation of characters from the plate. Before that, license plate is extracted from the detected plate. By segmentation, we mean separating each character as a separate entity. The goal of segmentation is to represent an image into smaller parts. There are different types of segmentation as:

- Line segmentation
  In this, we extract only lines or differentiate the lines from the image.
- Word segmentation
  It is a process of dividing a string into its component words.
- Character segmentation
  In this process, characters are only extracted from the word. If character segmentation is not done properly, then it leads to incorrect character recognition.

Recognition of characters can be done in two ways. One is segmentation based and the other is segmentation free. Here segmentation based means we are segmenting the characters and recognize each character, whereas in segmentation free, we are not performing any segmentation directly; we recognize the characters. For character

segmentation, some basics image processing is done such as grayscale conversion, binarization, thresholding, and finding contours.

- Grayscale conversion
  First, the conversion of colored image to grayscale image takes place using computer vision functions.
- Thresholding
  Image thresholding (binary thresholding where the image is represented as black and white color only) was also done for finding the contours on the image. For finding the threshold value, the OTSU threshold (which calculates itself the threshold value and provides the best value required) is used in OpenCV. Proper segmentation results in a good recognition of characters.
- Find contours
  Contours are the curve joining all the continuous points of the objects in an image. By performing this character can be separated. Since finding contours works well for binary image and finding contours in OpenCV means finding white objects from the black background, we perform threshold before finding the contours.

3.3 Character Recognition

Now, final step comes recognizing the characters of the plate. Character recognition is a process in which the computer recognizes characters such as numbers or letters. CNN can be used for recognizing a single character in an image. But here for recognizing the characters, we are using Tesseract OCR instead of CNN because it can recognize all the characters of the plate at one time.

Tesseract is an open-source OCR. A tesseract (v4), the latest version of tesseract supports deep-learning-based OCR, is more accurate. It utilizes a Short-Term Long Memory (LSTM) network, which is a part of the Recurrent Neural Network (RNN). We can give segmented characters to the tesseract algorithms as well as the whole detected plate region. After that, the characters are recognized by algorithm itself giving us the output.

4 Results and Discussions

After performing above all the steps, we obtained some results for detecting the license plate of the car. Here, Fig. 2 shows the input image which we have considered and Fig. 3 shows the detected license plate; further license plate extraction is done through the detected image and is shown in Fig. 4.

Since the extracted license plate is a little bit blurred image as depicted in Figs. 4 and 5 respectively, so we are not getting the segmented characters as in Fig. 6. Hence, we have tried with some clear threshold image, as shown in Figs. 7 and 8, for which it is showing clear segmented characters.

Fig. 2 Input image

Fig. 3 Detected image

Fig. 4 License plate extraction

Fig. 5 Threshold image

Fig. 6 Character segmentation

Fig. 7 Threshold image

Fig. 8 Segmented image

```
C:\Users\Dell\AppData\Local\Programs\Python\Python3
[INFO] loading text detector...
OCR TEXT
========
DL 3C AM 0857


Process finished with exit code 0
```

Fig. 9 License plate recognition when input is a grayscale image

After the segmentation of the characters, we are giving each segmented character to the Tesseract OCR for recognition. In the recognition process, we are getting some errors like some characters are recognized incorrectly i.e. '4' is recognized as '&,' 'M' is recognized as '*i*,' '9' is recognized as ':,' etc. Next, we have performed tesseract on the whole image as well as extracted image. For which we are getting better results when we provide a grayscale image as the input to the tesseract program as in Fig. 9. But in the case of a color image, the license plate number is not recognized in a single instant which is shown in Fig. 10.

5 Conclusion

In this paper, a license plate is detected and recognized as the characters of the plate from an image. Yolo is one of the fastest deep learning algorithms which we have used here for detecting the license plate. We have also recognized the single character after segmentation using Tesseract OCR. Further, the detection and recognition in real-time videos, as well as normal videos, can be done. For doing that, first, we have to detect the car from the video and then we will be applying all the above processes to that image (frame).

```
C:\Users\Dell\AppData\Local\Programs\Python\Python37\py
[INFO] loading text detector...
OCR TEXT
========
1919

OCR TEXT
========
MH 02 CL

Process finished with exit code 0
```

Fig. 10 License plate recognition when input is a colored image

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Open Phase Fault Analysis of a Three-Phase Induction Motor

Priyanka Singh, Rudra Narayan Dash, and Chinmoy Kumar Panigrahi

1 Introduction

In industry, the induction machine is the widely used electrical machines due to their hardness, reduced cost, small size, quickly available, power supply and reduced maintenance. The failure can lead to unknown downtime, a huge loss in profit, etc. Hence, it is required to monitor the system regularly because it provides enough warning about the failure. These external faults are phase failure, mechanical overload and asymmetry of the main supply. Recent fault detection helps for maintenance to be scheduled during downtime and reduces the period of downtime which leads in easy functioning of the plant.

The different major faults of the induction motor are divided into two types, rotor faults and stator faults. Rotor faults involve a cracked end ring or broken bar faults for cage machines and rotor-winding short or open circuits for wound rotor machines. Stator faults which involve stator inter-turn faults and stator winding short or open circuits [1–15].

The three different fault detection technique of induction motor are:

(a) Model-based technique
(b) Soft computing technique
(c) Signal processing technique.

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The model-based technique which needs the least idea of the induction machine parameters such as rotor and stator resistances and inductances, which may be readily calculated using different tests of an induction motors. The change in the residues which produced, by individual or a mixture of parameters are applied for describing different types of fault [4, 5, 10, 12, 14, 15].

In this idea, this work analyzes various signal processing techniques utilized for broken fault detection of induction machines. Motor current signal analysis has been generally applied, as a general data acquisition method, to complete various diagnosis techniques, because the current signal is received by a non-invasive method. In this context, short-time Fourier transform (STFT), Hilbert transform (HT) and discrete wavelet transform (DWT) are usually used for fault detection of induction machines [1, 2, 8, 11, 13, 15].

Soft computing techniques (SCT) are newly having an important impact on motor drives and power electronics, which is now a multidisciplinary technology and complex that is working through dynamic growth in current years. Neural networks (NN), fuzzy inference system (FIS) and evolutionary computations are the core methodologies [6, 9].

The situation is similar to "single phasing" that follow in the operation of an induction motor which produce more heat in the motor windings. In such conditions, the induction motor must be equipped with protection which disconnects the motor from the system before permanently disabled. An induction machine working in the normal condition will continue to work even when a difference in the system will produce the voltage across the terminals to convert single phase.

The open phase may be due to three possible disorders in the system.

1. Due to the single phasing of the primary winding of a distribution transformer.
2. Due to the single phasing the terminals of the motor
3. Open phase on the substation transformer primary.

This paper represents the applications of the DWT method for the detection of open phase fault of a three-phase induction machine. Here, the current signature with healthy as well as faulty condition has been implemented to detect the above fault. The current signatures have been taken from the experimental test bed is shown in Fig. 1. By analyzing the current signatures, the fault severity can be determined.

2 Experimental Setup

We set up our experimental test bed in our machine laboratory with 1 H.P, star connected, 1.9 A, 415 V inductions motor as shown in Fig. 1. First, we run the induction motor with no load under balanced voltage in each phase. After 831 samples, the B-phase of the motor is kept open circuit, i.e., the current in the B-phase becomes nearly to zero. At the same time, the current in the other two phases increases which is shown in Fig. 2.

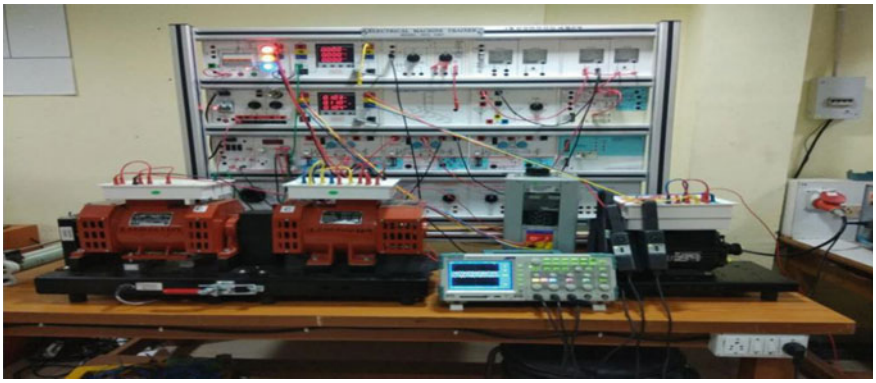

Fig. 1 Experimental setup test bed

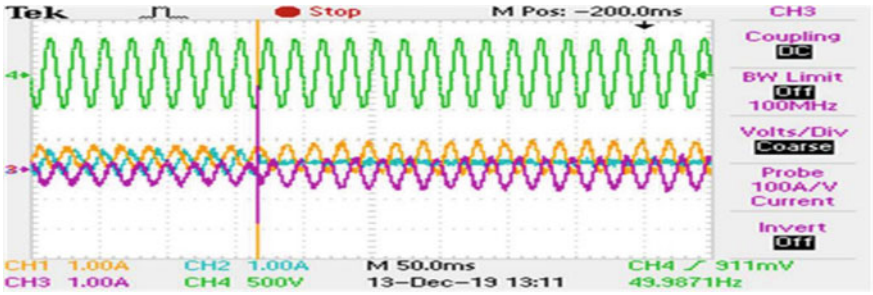

Fig. 2 Experimental setup result

3 The Use of the Discrete Wavelet Method in Induction Machine

The use of the discrete wavelet transform (DWT) in induction machine are:

1. The Mother Wavelet's Selection: Mother wavelet selection is an important step carried out for the analysis and review process. Those wavelets are Morlet, Mexican, Gaussian, Hat, Coiflet, Daubechies, Meyer, biorthogonal, etc. The fault components can be extracted by a huge test that shows a huge assortment of wavelet spectrum which provides suitable outcomes. The Daubechies-45 mother wavelet has been used in this paper.
2. The number of decay levels: The decay level is decided by the small-frequency elements. For extracting, the frequency elements are created by an open phase fault. The estimated coefficients applied to build the criterion should composed of the non-faulty and faulty frequencies as minimum as possible [11].

The DWT method is an effective, economical and persuasive method which implements a time-frequency description of a non-stationary signal. This technique gives

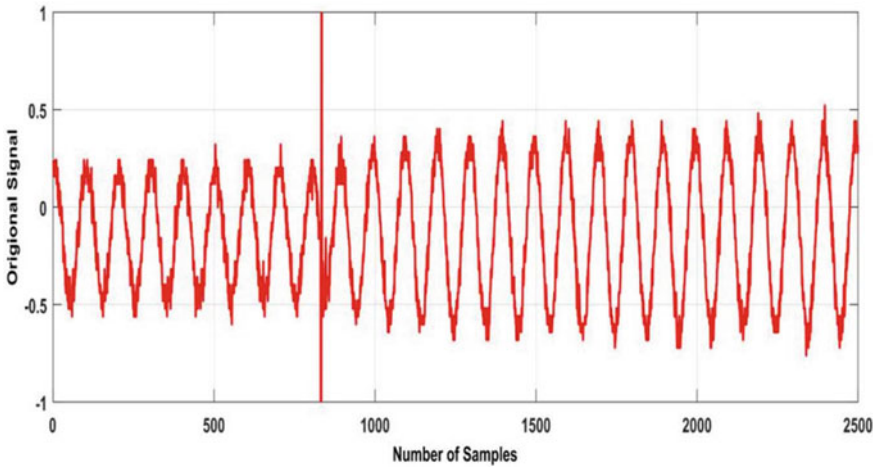

Fig. 3 Original R-phase signal with B-phase single phasing

an excellent time resolve as compared with a Fourier transform (FT). This technique is the expansion of the short-time Fourier transforms (STFT) with regular window length. DWT provides high-frequency and low-frequency elements are examined with respect to a low-time interval and high-time interval.

The main purpose of the DWT is to carry the bandpass filtering of the sampled current signatures as given in Figs. 3, 5 and 7. The DWT decays the current signatures into different wavelet signals (an approximation Am and detail signals Di, respectively) [5]. At a particular frequency, the frequency band is incorporated with individual wavelet signal. These signal exhibits the time growth of the frequency elements of the current signatures which includes within their allied frequency band [5]. Figures 3, 5, and 7 represent the current signature signals under the faulty and healthy situations which are used in diagnosis purposes.

The detail signal D_i involves the signal elements with frequencies in the period.

$$f(D_i) \in \left(2^{-(i+1)} \times f_s, 2^{-i} \times f_s\right) \text{Hz} \tag{1}$$

The approximation signal A_m involves the low-frequency basic of the signal relating to the period.

$$f(A_m) \in \left(0, 2^{-(m+1)} \times f_s\right) \text{Hz} \tag{2}$$

The equation of decay level N_f is presented by:

$$N_f = \text{integer}\left[\frac{\log(f_s/f)}{\log(2)}\right] \tag{3}$$

Table 1 Wavelet signal of frequency band

Level signal	Signals	Frequency band $f_s = 5000$ Hz (Hz)
D_1	Detail signal	1250 – 2500
D_2		625 – 1250
D_3		312.5 – 625
D_4		156.25 – 312.5
D_5		78.12 – 156.25
D_6		39.06 – 78.12
A_6	Approximation signal	0 – 39.06

The bands of frequency connected with all wavelet, signals are presented in Table 1

Characteristic faulty frequencies are included in detail signal D6, as shown in Table 1.

4 Result Analysis

Figure 3 shows the current signature under both healthy and open phase fault condition. From the 0 sample to samples 830, the current signature under healthy condition. The current in the R-phase from the 831 sample increases from its original magnitude. Figure 4 shows the wavelet D_6 current signature where the current magnitudes

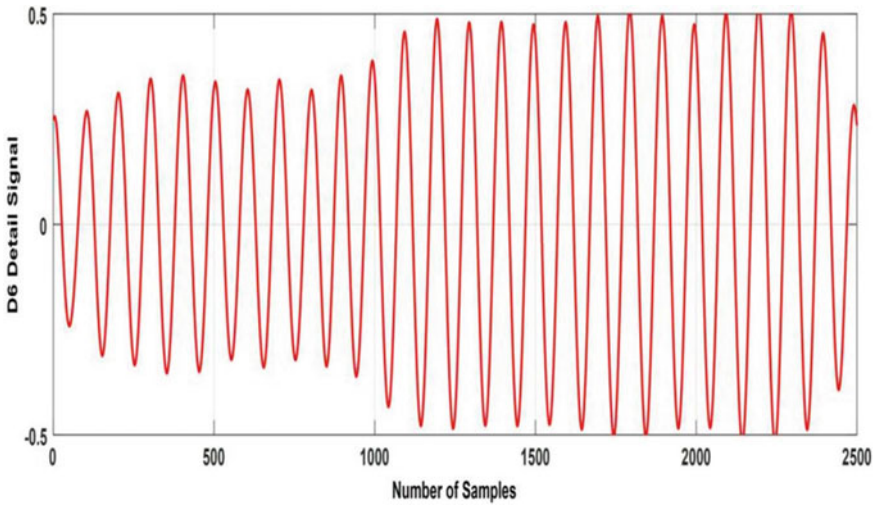

Fig. 4 D_6 R-phase signal with B-phase single phasing

in all the phases are constant from 0 to 830 samples. When the open phase fault occurs in the B-phase has some effects on the R-phase and the current in the R-phase increases from its original value. The energy level increases from 62.33 to 184 db when a open phase fault occur in the B-phase.

Figure 5 shows the current signature under both healthy and open phase fault condition. From the 0 sample to samples 830, the current signature under healthy condition. The current in the Y-phase from the 831 sample increases from its original magnitude. Figure 6 shows the wavelet D_6 current signature where the current magnitudes in all the phases are constant from 0 to 830 samples. When the open phase fault occurs in the B-phase has some effects on the Y-phase and the current in

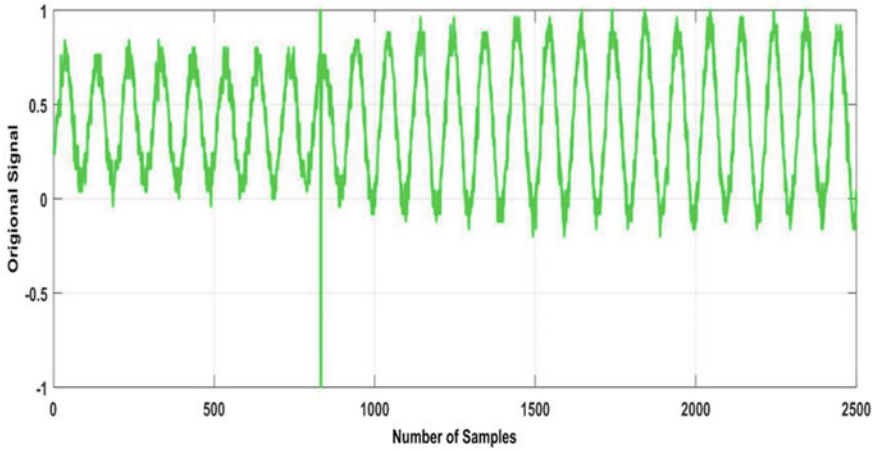

Fig. 5 Original Y-phase signal with B-phase single phasing

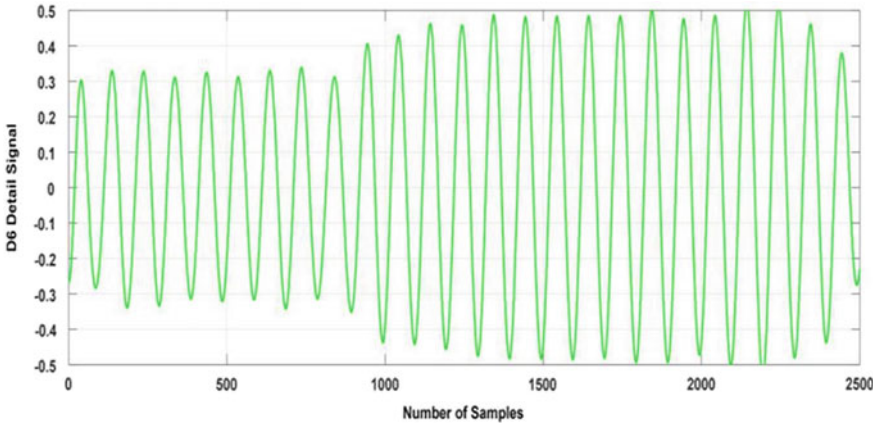

Fig. 6 D6 Y-phase signal with B-phase single phasing

the Y-phase increases from its original value. The energy level increases from 62.33 to 181 db when a open phase fault occur in the B-phase.

Figure 7 shows the current signature under both healthy and open phase fault condition. From the 0 sample to samples 830, the current signature under healthy condition. The current in the B-phase from the 831 sample decreases from its original magnitude. Figure 8 shows the wavelet D_6 current signature where the current magnitudes in all the phases are constant from 0 to 830 samples. When the open phase fault occurs in the B-phase, the current in the B-phase decreases from its original value. The energy level decreases from 62.33 to 1 db when a open phase fault occur in the B-phase.

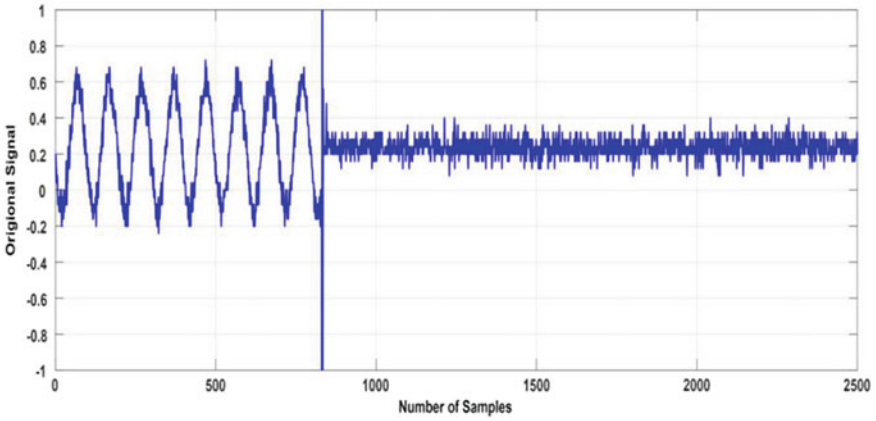

Fig. 7 Original B-phase signal with B-phase single phasing

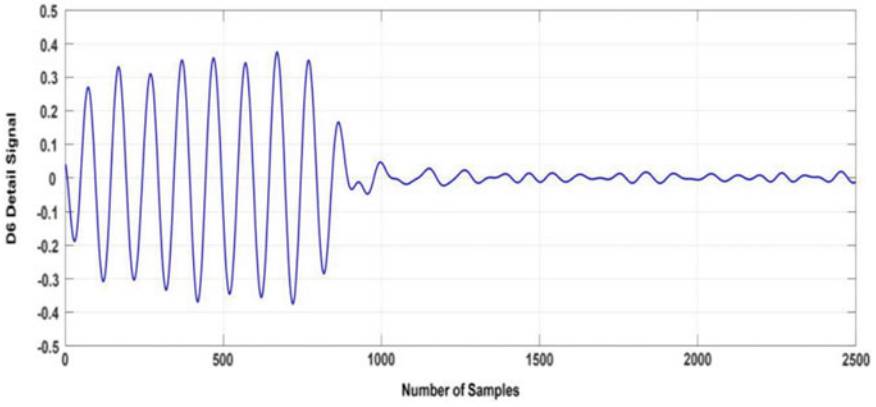

Fig. 8 D6 Y-phase signal with B-phase single phasing

5 Conclusion

In this paper, we created a methodology, open phasing the stator winding under no-load conditions. The discrete wavelet transform technique's applications are presented in this paper for the analysis of the fault of a three-phase induction machine for the open phase. Here, the current signature under the fault and the health conditions are used to detect the open phase fault. The stator current signature has been used for the diagnosis of the fault analysis. The experiment and simulation results manifest the capability of the method for the disclosure of the fault in the open phase. The energy level in the open phase decreases, whereas increases in the other two phases.

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Analyze Energy Consumption in a Building by Energy Audit

Shubham Soni and Inderpreetkaur

1 Introduction

Energy is basic need of every country for continues development, growth of country depends upon how much energy used by a country and actually energy converts into useful work and how much energy is wasted to that energy audit is required, energy audit is a very beneficial tool to calculate the energy consumption. The demand of energy depends upon the type of building. Building may be residential and non-residential. Non-residential buildings generally characterized by cooling and heating loads for buildings. Energy audit is useful for pollution control as well as energy saving. If we replace exited equipments, those consumptions are very high with latest technology equipments, for example, replace a normal bulb (tungsten) with LED bulb payback periods can be calculated by using energy audit and how much power is wasted in specific period of time also be a part of energy audit and by using which techniques we can resolve these problem with help of energy audit without effecting exiting system. In this paper, energy audit made in non-residential building for calculating the power consumed and power wasted in it.

Data were collected in the month of January 2019 by observing and every room to calculate the actual load, there are seven floor in this building and each level has their own electrical load values. On the basis of energy consumption in last two years we can forcast load of buulding for next years.

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2 Data Analysis

Data collection was at January 2020, because primary need of energy audit is electrical load data. Energy consumption of building in KWh to analysis of data some step is required.

In data analysis, most important part is collect the data and analyze the collected data to draw significant conclusions and find the particular areas to work on. After collection of data, analysis of power consumed in the building and how much power is actually used by equipments and how much power is wasted.

Some steps are followed by team to analyze the data:

- Data of equipments and prepare report, analyze the data of the basis of location wise
- Prepare database and represent data in graphical form

This is required to find the areas where maximum energy saved.

Energy analysis of Building

Building is located in Mohali (Punjab), it is big building and 180 employees are in the building, this is academic building, and 2000 students daily come in building.

Layout of building (Fig. 1).

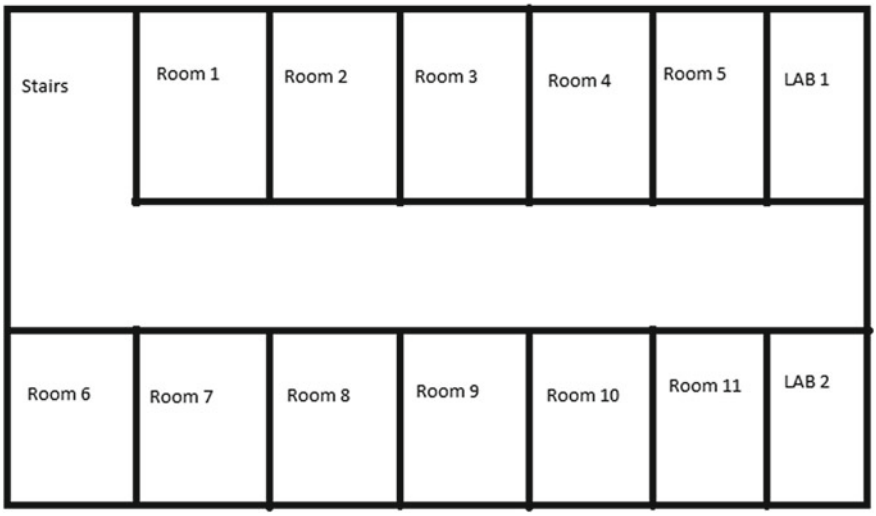


Fig. 1 Layout of building

3 Recommendation

Energy and cost are two main factors in energy audit; each electrical appliance has their own energy consumption value and cost so recommendation on the basis of installation cost and payback period or recovery time.

Some steps are followed for this:

- Collect the data how much energy is required.
- Calculate the installion cost and payback period by using mathematical calculations.
- Compare installion cost and energy saved cost that is helpful for calculation of payback period.
- If the capital cost payback time is less than product life, then move can supported.

4 Barriers to Energy Efficiency

The demand of energy increases rapidly because of increasing number of equipments day by day in commercial and non-commercial sector; however, efficiency of some equipments is very less but still we have time to look into this matter to improve efficiency of exiting system; replacement of all system is not a easy task but if is it possible to improve the efficiency of system without any disturbance in the circuit. But lot of barriers are there and barriers are defined as suggested mechanism that prevents initial cost for latest technology that is economically efficient and energy-efficient.

There are two types of countries in our world—developed and developing country; our country (India) is a developing country unfortunately factories and industries in our country are not look into energy-efficient management so India missing benefits of such technologies only because of initial cost for latest technologies. Some companies started to look in this matter regarding energy efficiency and pollution but rate of this is very slow, still government makes it compulsory to all industries. Government require some changes in previous policies and implement new polices in a strict way is we still waste time for implementation result are good in future and the effect of these are already started like environmental change which effect human life. Air filters are required in some cities of India because of pollution and goes up day by day and reason is energy management is proper.

Some barrier in energy efficiency

Lack of awareness Awareness is major factor because peoples are not aware with energy efficiency; there are some industries have no energy audit and energy efficiency departments and mangers are also not aware. So government considers these point and pays penality to these companies which pollute environment. Industries are very important for every country growth but they must be aware about energy efficiency and submit report to government on time.

Lack of financing Some sectors do not want spent any single rupee for energy efficiency, if some polices are there by government then they definitely invest some money on energy efficiency of machines or equipment they used in their organization.

Shortage of widespread education and training Due to lack of training and auditors in market for energy efficiency and education in energy management are not available.

Lack of effective co-ordination A act enacted by government of India in 2001 (Energy Conservation Act- 200) to reduce the gap between energy demand and energy supply; this act provides very firstly aware people regarding energy but still requirements are there to improve the system.

Lack of standardization of equipments The energy consumption rate increases on daily basis but to fulfill some standard rate is very less; this one is also a barrier in energy efficiency.

If energy efficiency policies are strictly applicable by government, then surely there is reduction in electricity bill and further improve energy efficiency by sing maximum demand meters installation should be required on each feeder and SCADA system can be use for continues monitoring of the system and improve the performance of the system. Hence, the monthly or yearly electricity bill cost of the academic building reduced by decreasing the maximum demand of load and the saving per month will be nearly 20,000 or more depends on load.

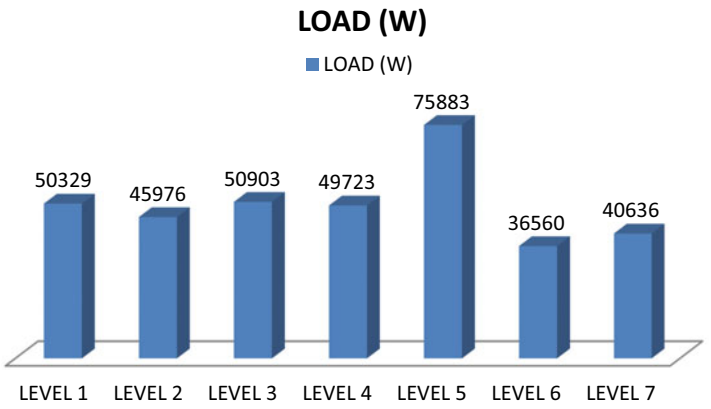
The consumption of energy is increasing day by day. I am writing this paper; it is just one step to understand the people to achieve the efficiency of energy. We all know that energy is a continuous process; all people use energy in different forms. Some uses solar energy, some uses wind and some uses other forms of energy. Energy saving is necessary for our present as well as our future use. In this paper, we discuss our ideas or actions toward energy; first thing that comes in our mind is that "how we utilize our resources or how we efficiently use our resources and saving energy," second thing is that "how we implement this important thing in it." We are studying about the energy audit of plant and we identify the methods for saving the energy. We also determine how and where the energy is used. The renewable resources that exist are used efficiently so that consumption is less and these are used by using proper technologies, better instruments, efficient machinery and most importantly by improving existing techniques.

As we all know, the economic development of any country merely depends upon the energy. In the developing countries like India, energy is important. The increase in energy needs investments to achieve the energy for energy sectors. The energy conservation, management and audit is used for the increasing efficiency and reducing cost. The energy utilization is achieved by using energy management. We can say that it is the objective of energy management to better utilization of energy with reduced costs for organizations so that organization can work more with low costs. Energy audit is a key for energy management in decision-making process and it serves energy streams for facility or plant. So, in last but not the least, we can say that energy is very much important for our present as well as future use; we can use less energy resources with increased efficiency and reduced cost.

5 Analysis of Power Consumption

With the use of the mathematical calculations, we have analyzed the power consumption by equipment, application as well as location. Here is the summary of the analysis presented in form of charts for better understanding.

Collect data by visiting each room of building and data show in graphical form as in diagram.



6 Analytical Results

By using the analysis of data (electrical load), some important actions are suggested and recommended for enhancing the energy efficiency of academic building. Also, a number of step should be taken to enhance the energy efficiency; these steps are discussed below. Some significant recommendations for improving energy efficiency of academic building are proposed.

Replacing light source (fluorescent tube lights) with LED bulb

Change normal light source (fluorescent tube lights) with light emitting diode tube

- Cost analysis of replacing fluorescent tube lights with LED tube
- Total **Fluorescent tube lights** in building = 243
- FTLs power = 40 W
- LED tube power = 20 W
- Saved power by replacing FTL by LED tube light = (40 W − 20 W) = 20 W
- Total power saving = 243* 20 W = 4860 W = 4.86 KW
- Average power per year use by FTL = 270 × hour = 2160 h
- Energy saved in a year = 4.86 × 2160 h = 10,497KWh
- Money saved in rupees per year = 10497*7 = Rs. 73,483

- LED tubes cost (Crompton) = Rs. 414
- Initial investment on LED tubes = 243*414 = Rs. 100,602
- Payback period = 100,602/73,483 = 1.36 yr
- Payback period of replacing **Fluorescent tube lights** of campus is 1.36 years (497 days).

Installation of motion sensors in campus toilets and corridors
Minimizing repair works in fans
Rating of AC Install air conditioners having five- or six-star rated.
Place main switches outside wall of room All the equipments are switch off directly by one main switch

Use individual switches for each appliance in class rooms
It has been observed that in large building, one switch controls two or more appliances, for example, more than one fan controlled by one switch which is major issue of power wastage so to reduction in power wastage use a individual switch for each appliance so consumer can use only those equipments they actually want.

7 Conclusion

To protect our earth from energy crises all human must be aware about energy conservation if we cannot generate energy we save energy, energy saving is equal to energy generation so people know how to save energy to that energy audit is require on the basis of energy audit classification of building on rating basis is also easy. Renewable energy is mow in trending because of awareness of energy demand. If the power is not generated by solar power plant in bad weather condition on that time, consumer can take power from power station but when energy generation is more by solar power plant, then consumer can send power to electrical grid tariff is based on calculation how much power sent and received by electrical board so building is now prosumer which can take or send power to the grid.

8 Future Scopes

- In future, we connect the batteries with PV module and then integrate with grid; in any case like night hour, solar and grid supply are failed, then battery provides back-up energy to the electrical equipments.
- Improvement of energy efficiency can we improve if we design building under the guidance of energy auditor.

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Auto-switching of Batteries in Electric Vehicle to Achieve an Extended Travel Range

Bishwa Pradip Das, Srikanth Allamsetty, Deepak Kumar Yadav, and Manoj Kumar Maharana

1 Introduction

Petrol and diesel are the things of the past; the electric vehicle is going to be the future of the world. Electric vehicles use batteries to propel the motor, unlike conventional combustion engine-based vehicles, which need fuel to run. Electric vehicles also possess properties such as low emission, low fuel cost, lower noise, and greater safety. The major factors such as global warming and climate change due to the excessive emission of carbon dioxide (CO_2) is passively fuelling the adoption of electric vehicles throughout the world. However, factors such as expensive price, lower travel range, limited battery lifetime, poor battery performance at low temperatures and absence of required charging stations pose limitations for the reliable operation of electric vehicles. Even though the electric automotive industries are facing many challenges, the most predominant among them is the energy storage system (ESS). In that aspect, lithium-ion batteries (LIBs) are the optimum solution for the ESS in battery electric vehicles (BEV), because of their exceptional showing in terms of energy density.

A novel battery pack modelling is proposed in [1], which utilizes single-cell information in order to make the battery pack highly efficient for the usage in the battery management system (BMS). The paper also represented the modelling procedure of the battery pack and analysis of cell-to-cell variation for higher model accuracy. To get the estimation value of the battery pack SOC, the SOC estimation algorithm has to estimate the cell-to-cell variance. This involves the comparative analysis in the initial SOC, the battery parameters, the capacity, and the SOC-VOC profile. A battery pack co-estimation algorithm is proposed in [2] is to reduce the computation burden

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by calculating the battery pack SOC by mapping from single cell from the pack. The studies [3, 4] shown that the safety of the battery pack increases by increasing the number of cells in parallel connection in a battery pack. However, it also increases the temperature in the battery pack. A comparative review of various parallel combination of cells (14S1P, 14S3P, 14S4P, 14S6P) are analysed in [4]. Among them, 14S4P was found to be the most safety parallel combination.

In [5], a novel BEV concept is taken where one smaller capacity fixed and a larger capacity swappable lithium-ion battery pack is taken in the place of a single large-capacity battery. The paper tells this solution will help the owner to achieve a longer travel range, where starting investment is lower, and power consumption is comparatively low at short ranges. The paper has shown a comparative difference between their model and a direct owned single larger capacity battery pack-enabled electric vehicle, where their model provides better results on fuel economy (up to 20%).

Another study [6] shows a comparative difference between conventional PWM and digital PWM controls. The paper says digital PWM control can be used in low-cost application-specific integrated circuit (ASIC). It is also efficient for applications where speed/torque is not of prime importance. With the use of a fuzzy logic controller (FLC) in the analysis of the BLDC drive system, the desired real speed and torque values can be achieved in a shorter time period. The analysis of phase current, mechanical torque, and rotor speed are given in [7]. In paper [8], the speed control of brushless DC motor is experimented by fuzzy logic controller with the help of bidirectional converter. This study focuses on the regenerative breaking; during breaking modes of operation; the wasted kinetic energy is being stored in the battery. With the simulation results, excellent speed control and efficient conversion of energy is shown.

In this present paper, a proposal has been made to extend the travel range of the electrical vehicles. Instead of using one larger capacity lithium-ion battery, usage of two batteries with different capacities is proposed to facilitate switching between them as shown in Fig. 1 as per their SOCs. A MATLAB model has been built to show the feasibility of this operation. A BLDC motor is used on the load side due to its smaller size, lighter weight, low maintenance, and higher efficiency. A six-step voltage source inverter is used to supply the current from battery to the motor. This model can be implemented on two, three, or four-wheelers lightweight vehicles.

2 Battery Switching Methodology

In this section, different parts of the simulation model, switchable batteries, and BLDC motor have been explained in the following subsections.

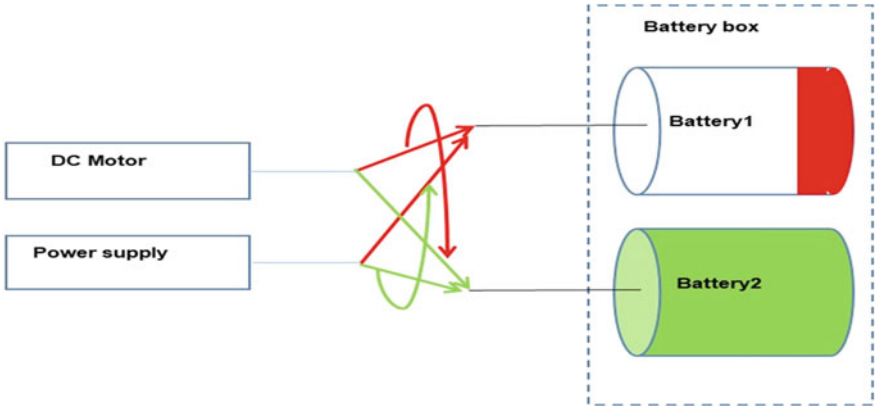

Fig. 1 Schematic diagram

2.1 Switchable Batteries

In this model, two lithium-ion battery pack of different capacities (Battery-1 = 300 v, 15 Ah and Battery-2 = 300 v, 33 Ah) are proposed instead of going with one larger battery pack as shown in Fig. 2. The initial SOC of the Battery-1 is given as 22% and the initial SOC of Battery-2 is 80%. A MATLAB code is written in the MATLAB function block to switch the battery from Battery-1 to Battery-2, whenever

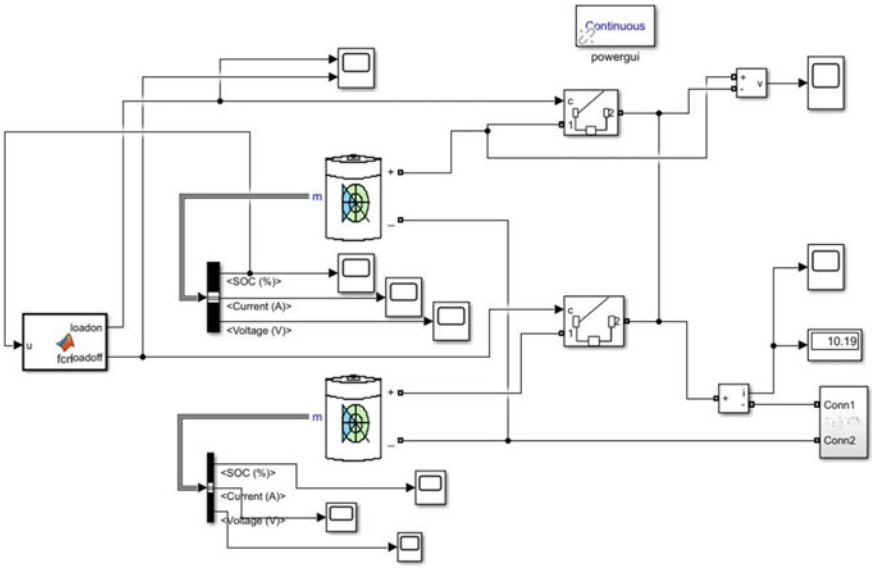

Fig. 2 Simulation diagram of the proposed battery switching

the SOC of Battery-1 drops to 20%. By doing this, the Battery-1 is prevented from complete draining and in the meantime, Battery-2 operates and feeds power to the load. The discharge characteristics of the lithium-ion batteries are also studied. If possible either of the battery can be charged by any external power supply which is left for future studies.

2.2 BLDC Motor Design

Permanent magnet DC Synchronous motor commonly known as BLDC motor is one of the frequently used motor types due to its better performance and characteristics.

The windings of the stator are *Y*-connected in this motor to a neutral point and as per the construction, the rotor is a cylindrical type where the flux pattern is trapezoidal type in the air gap. The actual rotor speed and the hall signals are derived from the motor output [9]. In paper [10], the equivalent brushless DC motor modelling and the mathematical formation is analysed. The phase 1 terminal voltage with respect to the star point of stator V_1 is represented as

$$V_1 = R_1 I_1 + L\frac{\mathrm{d}i_1}{\mathrm{d}x} + e_1$$

Similarly, other equations can be written for phase 2 and 3.

$$V_2 = R_2 I_2 + L\frac{\mathrm{d}i_2}{\mathrm{d}x} + e_2$$

$$V_3 = R_3 I_3 + L\frac{di_3}{dx} + e_3$$

In three-phase BLDC motor, the back EMF can be expressed as an equation where rotor position (θ_e) is a variable and the back EMF is shifted by 120° in phase angle.

$$E_1 = K\omega f(\theta_e)\omega\pi$$

$$E_2 = K\omega f\left(\theta_e - \frac{2\pi}{3}\right)\omega\pi$$

$$E_3 = K\omega f\left(\theta_e + \frac{2\pi}{3}\right)\omega\pi$$

where $K\omega$ = Back EMF constant/phase (V/rad s^{-1}); θ_e = Rotor angle in radian (expressed in electrical form); ω = Rotor speed in rad/s.

The electromagnetic torque can be represented by

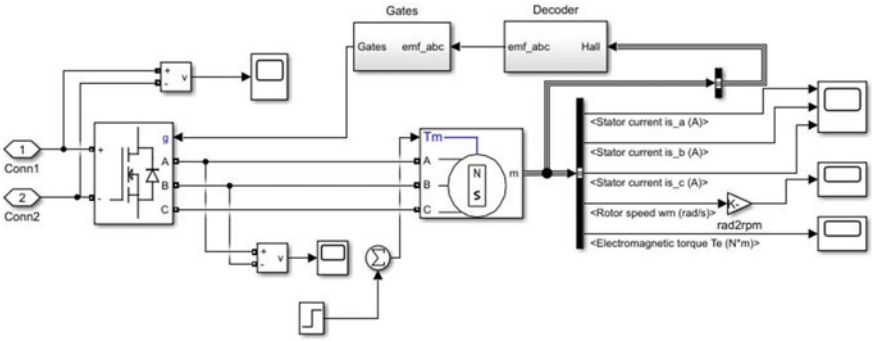

Fig. 3 Simulation diagram of motor load for the proposed battery switching

$$T_e = \frac{(e_1 i_1 + e_2 i_2 + e_3 i_3)}{\omega}$$

The mechanical torque can be represented by

$$T_m = J\frac{d\omega}{dt} + D\omega + T_L$$

where e_1, e_2, e_3= Back emf of phase 1, 2, 3; D = Damping constant; J = Inertia constant of rotor; T_L= Load torque.

The three-phase BLDC motor rated 300 Vdc, 4500 RPM, 6 Nm is fed by a six-step voltage source inverter as shown in Fig. 3. The inverter is a MOSFET/diode bridge of the specialized power system simulation library. A lithium-ion battery pack is connected to the input side of the inverter. The output three-phase of the inverter is connected to the permanent magnet BLDC motor. The load torque to the motors shaft is first set to 0 and steps to its nominal value 6 Nm at $t = 10$ s. One control loop is used. The close loop synchronizes the inverter gate pulses with the emf.

3 Results and Discussion

The MATLAB simulation of battery switching in an electric vehicle with brushless DC motor is performed using MATLAB/Simulink model. Two lithium-ion batteries are proposed to supply power to the motor load. Two circuit breakers and one across each battery are connected. The six fed inverter is used to supply a three-phase supply to the brushless DC motor. The specifications of the batteries and motor are given below.

Motor rating—300 Vdc, 4500 rpm, 6 Nm.

Battery-1 Rating—300 V, 15 Ah, Initial SOC-22%.

Battery-2 Rating—300 V, 33 Ah, Initial SOC-80%.

Initially, Battery-2's SOC was 22%. When connected to the load (breaker1 in close condition), the SOC of the Battery-1 decreases as it supplies power to the motor. When the SOC of the Battery-1 reduces to 20%; Battery-1 stops operating (Fig. 4a) and breaker1 is open. Following this Battery-2 starts operating (Initial SOC = 80%) and breaker2 is close at the time and supplying power to the load (Fig. 4b). The switching of battery from Battery-1 to Battery-2 is shown in Fig. 5. The operation period of Battery-1 is shown in blue colour and for Battery-2 it is shown in red colour.

The rotor speed and electromagnetic torque of brushless DC motor is shown in Figs. 6 and 7. At $t = 10$ s, torque = 6 Nm. It can be seen that with increasing torque the speed of the rotor decreases. And at $t = 128.33$ s, the speed increases due to the shift of load from Battery-1 to Battery-2 which is of larger capacity.

Also, the three-phase stator current of brushless DC motor is shown in Fig. 8. The simulation shows while running in constant load the stator current remains constant.

While switching of batteries from Battery-1 to Battery-2, there is a spike at 128.33 s, which can be seen in Fig. 9. Recharging the battery1 is possible in simulation but appropriate power supply has to be available in real time.

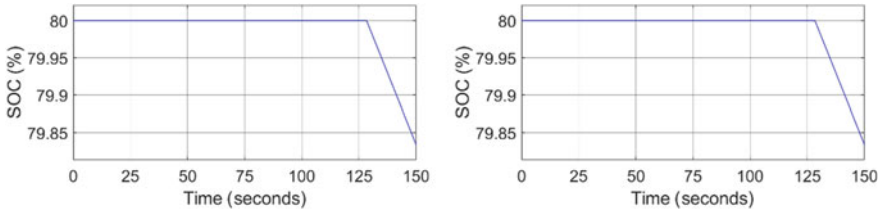

Fig. 4 Soc of **a** Battery-1 **b** Battery-2

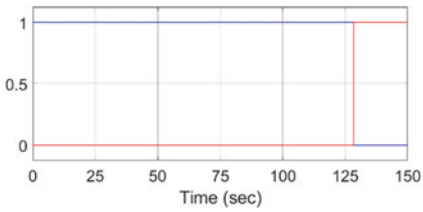

Fig. 5 Diagram of battery switching

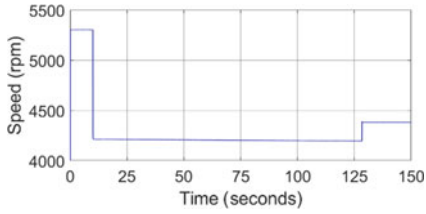

Fig. 6 Rotor speed of the brushless DC motor

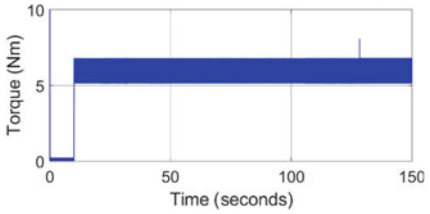

Fig. 7 Torque response of brushless DC motor

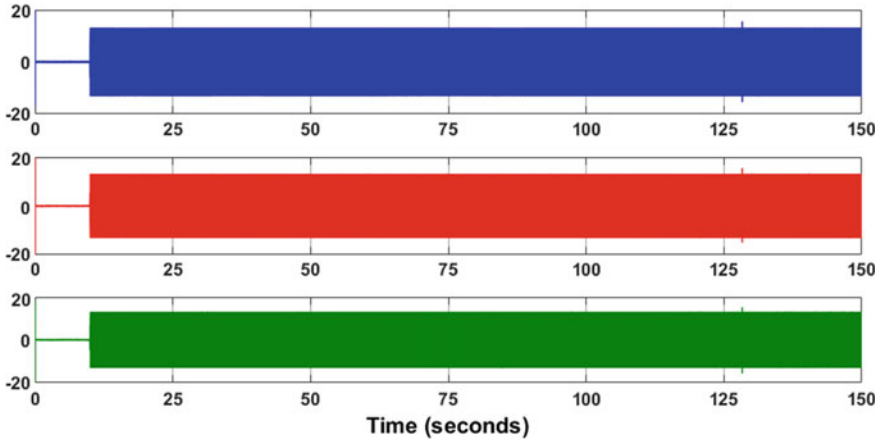

Fig. 8 Three-phase stator current of brushless DC motor

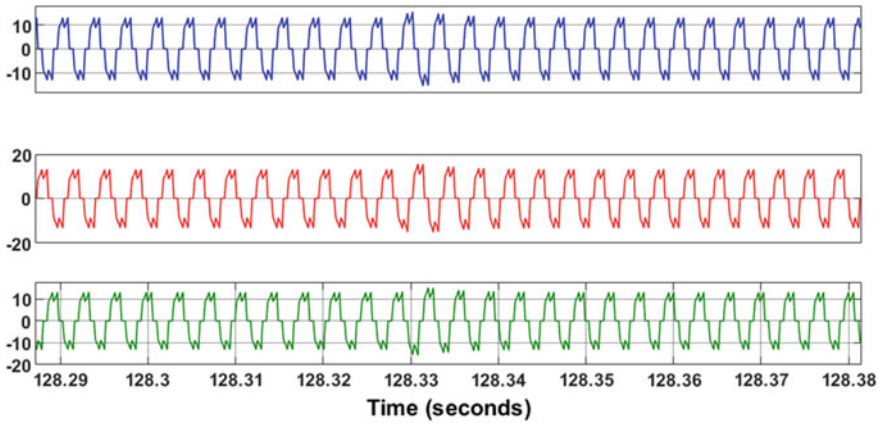

Fig. 9 Three-phase stator current of brushless DC motor while switching

4 Conclusion

In this paper, an effective method for battery management in electric vehicles is proposed. The discharge characteristics of the battery and the effect of the battery switching on the stator current, rotor speed, and electromagnetic torque are analysed using the MATLAB/Simulink software. The proposed method can be advantageous for those owners who prefer long commutes. An automatic switching can be achieved among the batteries when SOC of the first battery comes down as explained in the model. Some notable and selective suggestions for further technological development have been highlighted as follows;

- Further, the improvements can be done by using this design in the hybridization of various energy storage systems, charging from battery to battery, or dynamic charging.
- The wasted energy can be stored in the non-operating battery in the vehicle by adaption of regenerative breaking in the model so that the overall range can be increased.

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A Literature Survey on Biomedical Named Entity Recognition

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1 Introduction

With the escalation of data in different sector like medical and health industry connoted different techniques to uncover the hidden information from a huge volume of data, which are predominantly in textual form. The preterm 'birth' remains unclear but it can be viewed as a result of the natural evaluation of information technology. The following Sects. 1.1, 1.2 and 1.3 introduce Data Mining, Information Extraction and Biomedical Named Entity Recognition along with their subfields.

1.1 Data Mining

Data Mining is an interdisciplinary subject and often refers to as knowledge discovery from data or KDD process. The interactive process comprises data cleaning, data integration, data selection, data transformation, pattern discovery, pattern evolution, and knowledge presentation stages. Where pattern interestingness plays an important role in validating the resultant pattern. The support and confidence are two important objective measures of rule interestingness along with the lift, which reflect the

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certainty of discovered rules when used with the subjective measure that specifies the need and the interest of the user. Text Analysis, on the other hand, is an automated process that allows text parsing to extract and classify machine-readable information from textual data. The core idea is to "separate the potentially useful information from the textual contents through statistical pattern learning". It is a multi-facet idea and research in the same can delve into any relevant areas. Natural Language Processing (NLP) is a subfield of artificial intelligence, which accepts natural language as an input to drive some insight. NLP task is not limited to any particular kind of data and uses different aspects of text mining to make sense out of it. NLP is divided into two different components, i.e. Natural Language Understanding (NLU) and Natural Language Generation (NLG). The process of producing the meaningful phrases and sentence in the form of natural language is referred to as NLG whereas the process of mapping given input to useful representation is referred to as NLU, and it harder compared to NLG because there are lots of ambiguity and that too in different levels. The biomedical named entity recognition is one such type of task, where text processing plays an important role, and for that these terminologies need to be understood.

- Tokenization: It is one of the common pre-processing tasks of natural language processing. It breaks the complex sentences into words or tokens, understand the importance of word w.r.t the sentence and produce a structural description on an input sentence. Tokenization may seem simple but selecting a proper tokenizer is non-trivial task, as there are lots of issues in different domain, even Common English complexities like Hyphenated Compound Word, Word with letters, slashes and apostrophes, etc. need to be addressed, e.g. "The maximal effect is observed at the IL-10 concentration of 20 U/ml".
- Sentence Segmentation: It is the process to identify sentence boundaries between words in different sentences. The performance of both word and sentence segmentation deteriorate if performed individually because punctuation marks like a period ".", for example, are quite ambiguous as they can denote something like a decimal point, an abbreviation, sentence boundary, etc.
- Stemming: It is a crude heuristic process. Which aims to reduce terms to their stems by chopping of the affixes, e.g. 'affects', 'affected', 'affecting' are converted to its base form 'affected'. It is successful on some occasion but not always as it produces stem that are not a word and often difficult for the user to interpret.
- Lemmatization: It also reduces inflection or variant form to base form but it is different from stemming. Lemmatization considers the morphological analysis (MA) of the word for pre-processing and to-do so it is necessary to have detail dictionary. The output of lemmatization is a proper word, e.g. for the token 'saw', lemmatization would attempt to return either 'see' or 'saw' depending on whether the use of token was verb or noun.
- Word Sense Disambiguation: It computationally determines which sense of the word is activated by its use in a particular context. There are a variety of methods for the same like word sense disambiguation using conceptual density, which

measures the relatedness of the word-sense in terms of conceptual distance using a structured hierarchical semantics net.

- Part-of-Speech Tagging: It indicates how a word function in meaning as well as grammatically within the sentences. Words can have more than one part of speech based on the context in which it is used, which helps to understand the meaning of a sentence, extract relationship, or to build a knowledge graph by chunking, e.g. "The [DT/Determiner] acute [JJ/Adjective] traumatic [JJ/Adjective] aortic [JJ/Adjective] rupture [NN/Noun, Singular or Mass]".

1.2 Information Extraction

Information Extraction (IE) has registered significant growth because of his ubiquitous demand in data analysis. The goal is to find and understand the limited relevant part of the text to produce a structured representation of relevant information, e.g. it is helpful in learning "drug-gene product interaction from medical research literature". Although the information extraction processing rule addresses its core task yet it is useful for general NLP tasks. The processing rule or chain typically includes both domain-independent and domain-specific component. The domain-independent usually perform linguistic analysis on language-specific component whereas domain-specific processing is based on user requirement. In IE system, named entity recognition a.k.a. NER plays an important role as lots of relations have been associated with named entities, e.g. "Doppler echocardiographic diagnosis acquired stenosis". NER is a method to identifies the entity form semi-structured or unstructured text, where entity categories can vary from person name to something specific like a biomedical term. In order to classify named entity, IE system follows a three-step process, which involves identification of the proper name within a text followed by the classification based on the pre-defined category of interest and named entity disambiguation at the end. The core domain-specific subtask such as Named Entity Disambiguation (NED) link named entities to an instance in a knowledge base, Co-reference Resolution (CR) determines entities based on the noun phrases, Temporal Information Extraction (TIE) extracts the structural information from the unstructured one based on interrogatives sentences, and Relation Extraction (RE) detects and classifies the extracted entity based on their relationship.

1.3 Biomedical Named Entity Recognition

Biomedical Named Entity Recognition or BNER task is important areas of biomedical text mining, which aims to mine knowledge based on user interest and identifies the chunk of text that refers to specific entities type like genes, chemicals, proteins, disease names, etc. It plays a crucial part in handling clinical and biomedical document because of the challenges it involved.

Challenges:

1. It's hard to construct a biomedical name entities dictionary because of a non-standard naming convention, e.g. "thioredoxin H-type 1". The Thioredoxin protein is also known by different names like ATTRX H1, ATTRX1, etc.
2. The clinical report has many forms of writing. It varies from doctor-to-doctor or hospital-to-hospital as there is no standard document structure.
3. The same word, phrase, or terminology can represent the different biomedical entities. As a result, context is getting critical in the biomedical named entity recognition task.
4. A wide variety of medical jargon and terminology makes the task difficult, e.g. medical jargon FX means bone fracture.
5. The clinical report is not grammatically sound. The document has incomplete phrases and the style of writing is not clearly understood by the individual.
6. The abundant use of abbreviations makes it hard to recognize the item, e.g. "tumour growth factor" is expressed as TCF.
7. The major challenge of biomedical named entity recognition is the cascaded use of the entity, e.g. "adenylate cyclase activating polypeptide 1" is a biomedical named entity, but at the same time "adenylate cyclase" is also a biomedical named entity.
8. The clinical report has an array of transcription errors. As the cause, symptoms, etc. are dictated by the doctor.

Apart from that various biomedical named entities that are composed of symbols, nouns, adjectives, adverbs and conjunctions make the extraction process a difficult one [1].

In a short span of time, biomedical named entity recognition has observed a two-fold growth. The basic feature along with some advance word representation feature such as clustering-based word representation, distributional word representation, and word embeddings have proven to be beneficial.

- Basic Feature: It has been categorized into four categories namely morphological features, lexical features, similarity or distance-based features, and dictionary-based features based on its use in biomedical named entity recognition process. The Boolean, Nominal, and Numeric features are collectively known as morphological features. It performs morphological analysis at the word level. Boolean Features checks the morphology of a word according to "Is-Capitalized", "Contain-Digit", and "Contain-Punctuation" conditions. The "Is-Capitalized" examines the case of a word. This is a good indicator to identify the biomedical named entity. The "Contain-Digit" examines the word that contains digits in their name, e.g. CO_2. The "Contain-Punctuation" feature examines the word in terms of punctuation or special character like dash and underscores, e.g. 94-kDa protein. Nominal Features checks the specific morphological aspects of the word. Where prefix and suffix feature help in identifying the chemical compound, e.g. a common prefix 'acy' is observed in acylglycerol and acyclonucleosides

compound. Numeric Features represents characteristics using integers or numerical values. It calculates the Biomedical Named Entities (BNEs) length, determines the term frequency, and identifies the co-occurrence of the term such as "Hydro" and "Oxide".

The lexical feature focuses on grammatical aspects to identify the word syntactic. Where part-of-speech (POS) tagging helps to identify the clues for BNEs. In the biomedical field, the chemical compound with an "ic" suffix could be tagged as an adjective, e.g. Anthelmintic. The Distance-Based Feature calculate the similarity between two words using Cosine, Dice, and Jaccard distance measure. At last, the dictionary-based feature has been used frequently to identified and assign the biomedical instance. It deals with 'Modifier' that is used before BNEs, 'Family' that show part-of-relationship, Trivial compound names such as ethyl instead of ethanol, Molecular Formula and Abbreviation [1].

- Clustering-Based Word Representation: The core idea is that it induces clusters over words in an unlabelled corpus. As the word can be categorized into a different cluster based on syntactically or semantically similarity measures.
- Distributional Word Representation: It is based on the word co-occurrence and distributional hypothesis, i.e. the word used in the particular context seems to have a similar meaning.
- Word Embedding: It is also known as distributed word representation. Word Embedding is a compact, dense, and low dimensional representation where the word represented by the vector denotes the distinct property.

The distributional word representation features are memory intensive tasks and easy to construct. Linear decomposition, such as latent semantic analysis works efficiently on a low-rank co-occurrence matrix. Whereas distributed word representation is a computationally intensive task. It uses deep learning methodologies to lower the training complexity. These features along with different text mining model have significant contribution in entity extraction.

2 Material and Methods

So far, several text mining models have been designed using different approaches, be it traditional dictionary matching model or modern LSTM-CRF based model aims to reduce time and effort overhead in biomedical named entity recognition process. Those approaches are broadly categorized into three categories, namely, dictionary-based approach, rule-based approach, and statistical or machine learning-based approach.

The dictionary-based approach or list-lookup approach is the most straightforward approach that recognizes only entity stored in its gazetteers while rule-based approach on the other hand largely depends on the domain-specific named entity. Which effectively deal with the morphological structure of the word. Gong et al. [2] present a hybrid approach for biomedical named entity recognition, with an aim

to achieve high accuracy using the rule-based and dictionary-based approach. The author has divided the task into three main phases, at first, part-of-speech tagging is used to map an individual word to their lexical classes, followed by noun phrase identification, and dictionary-based matching using biomedical ontology at the end. The noun phrase extraction follows some discrete steps to determine the noun boundary. It utilizes heuristic rule to determine noun phrase, which can later be used match and tag the concept based on meta thesaurus entries of GO (Gene Ontology) and DO (Disease Ontology) dictionary. This process achieved 66% recall, 78% precision and 71.5% F-score on GENIA 3.03 corpus yet it is not considered an efficient one due to limited working dictionary. Muzaffar et al. [3] has presented a hybrid feature set for relationship classification. In the proposed framework, verb phrases along with the noun phrase are implemented. As verb phrase are immensely helpful in finding relation-based words and overall improve the performance. The MetaMap is used to map the free text to medical concepts in UMLS. The variant generated by them is later evaluated by ranking algorithm and represented as a vector. They used Support Vector Machine (SVM) and Naive Bayes (NB) algorithm to classify the three main relations, i.e. cure, prevent, and side effect. The overall system achieved an F-Score of 98.05, 93.55 and 88.89% for those three different types of relation. Perhaps the simplest way of doing relation extraction is using hand-built patterns as relation often hold between specific entities, e.g. relation cure mostly found between drug and disease entities. The hand-built pattern tends to be of high precision and easily tailored to specific domain yet pattern have low recall value.

Mostly rule-based and supervised tools are genre and task-dependent, as a result, some changes are hard to accommodate. Zhang and Elhadad [4] proposes an unsupervised approach to extract biomedical entities from textual data. This method differs from other methods as it doesn't rely on the hand-built rule or annotated entities, instead uses the noun phrase chunker and inverse document frequency-based filtering. This unsupervised named entity recognition approach performs seed collection, boundary detection, and entity classification in three different stages respectively. The seed terms are extracted from a UMLS meta thesaurus, which is based on the mapping between entity class and domain representation. In order to detect entities boundary, noun phrase (NP) chunker are used, as they assumed entities are mostly noun phrases. The inverse document frequency (IDF) is used to filter the candidate noun phrases, which have lower IDF value compare to pre-defined the threshold value. They used signature vectors to denote internal and contextual words for a certain single term or multi-word term. Once the signature vector of all entity class is computed and candidate entities are generated, then the similarity is calculated by the help of the cosine metric. This system has outperformed when compared with base-line dictionary match approach on both i2b2 and GENIA corpora but not as efficient as other supervised systems since this system has weak supervision. Apart from that, different research has also shown the usefulness of different algorithm in BNER process. Munkhdalai et al. [5] uses the Co-training algorithm. The core idea of Co-training is that, it classifies entity based on two different views if the assumption is satisfied, i.e. the feature sets F1 and F2 of classifiers C1 and C2 respectively should be conditionally independent, and instance distribution with target function should

acknowledge the importance of both feature set. The example classified by only one classifier is viewed as a random training example and helpful in achieving learning advancement for others. The scalable feature processing schema used with the Co-training algorithm will help to extract features from unlabelled data and convert into the feature set. The output of the feature processing schema relies on an orthographic feature that matches the token. However, if more than one token is there than they are matched with lexicons. The classification model C1 classifies in IOB format and C2 classifies candidate into "true" or "false". It supplies a batch of new training sample to improve F-Score in a few rounds but the result shows that it fades away after some point in further rounds. It is because there is no informativeness control in Co-training though the base result shows that it gained significant improvement from unlabelled data.

In bioinformatics sequence learning is very important, for example, correctly identifying Extron & Intron from a gene sequence is relevant for drug design. Sequence learning is different from multiclass classification because multiclass classification somehow just not incorporate information within the sequence. It cannot do the joint classification of that sequence, although it can only do the individual classification of the various token. That's why we can use a probabilistic sequence model. It allows integrating uncertainty over multiple, interdependent classification and collectively determines the most likely global assignment. Hidden Markov Model (HMM) and Conditional Random Field (CRF) are two standard models. HMM solve the sequence labelling problem as a collective classification task by probabilistically weighing the previous and the next label in the sequence, although learning, decoding and evaluation problem are some of the problems which are related to HMM. It is memoryless because at every step t, the only thing that affects x_t is the current state π_t.

$$\begin{aligned} & P(x_t = \text{b} \mid \text{“whatever happened so far”}) \\ & = P\left(x_t = \text{b} \mid \pi_1, \pi_2, \ldots \pi_{t-1}, x_1, x_2, \ldots, x_{t-1}\right) \\ & = P(x_t = \text{b} \mid \pi_t) \end{aligned} \tag{1}$$

CRFs are a generalized version of HMM, they are much more expressive in nature, in the sense that they can capture the whole large number of feature for sequence labelling but another thing is that HMM is easy to learn and algorithm are not so complicated. In CRF learning and decoding itself is difficult especially because of the partition function. Which is best understood by CRF formulation, given an observation sequence O (i.e. from O_1, O_2, …, O_n) the score for the label sequence S (i.e. from S_1, S_2, …, S_n) is calculated by equation mentioned below [6]. The denominator is referred to as the partition function and each f_i is a feature function with weight λ_j.

$$P(S|O) = \frac{\exp(\text{Score } (S|O))}{\sum_{S'} \exp(\text{Score } (S'|O))}$$

$$\text{where, Score}\,(S|O) = \sum_{i=1}^{k}\sum_{i=1}^{n}\sum_{i=1}^{n}\lambda_j f_i\left(O, i, S_i, S_{(i-1)}\right) \tag{2}$$

The CRF is preferred over HMM because it can define a much larger set of features with feature function and appropriate weights. The inference/decoding problem in CRF is same as that of HMM, which aim is to find the best state sequence from the given observation and parameter but the solution to that is very difficult just like other general CRF. However, gradient descent iterative solution or Quasi-Network method like Limited-memory BFGS (L-BFGS) can be used for chain/tree CRF. Li et al. [7] proposed a MapReduce Conditional Random Field (MRCRF) algorithm to work on Hadoop environment. The input data is divided into smaller chunks. These chunks are run in parallel to minimize the replication need and balance the workload. The Limited-memory BFGS algorithm is used to enhance the parameter estimation and the Viterbi algorithm is used to find probable state sequence according to the MapReduce framework. They created a GO-DO corpus from "biological-process and disease", "cellular-component and disease", and "molecular-function and disease" groups of keywords using GoPubMed for the experiment, and result shows that with larger dataset, proposed algorithm can achieve better speedup compared to sequential CRF implemented on single machine due to dominant nature of computation cost, which ultimately affects the communication cost. The design adopted by them for the parallel algorithm is similar to that of Li et al. [8] two-phase CRF approach. It identifies biomedical named entities with the help of seven different basic features in the first phase but the window size is limited to three. The second phase CRFs model differs from the previous one as two additional feature such as noun feature and input feature are employed for Named Entity Classification (NEC) task but window size is reduced to one. Hence, better performance can be achieved and overall training time can be reduced through two-phase CRF approach but one has to compromise with the precision as it is lower than the recall percentage.

The state-of-the-art domain-independent method is mostly based on LSTM-CRF model as it doesn't rely on background knowledge for named entity recognition. Habibi et al. [9] used a bi-directional LSTM to process the input in both directions. The proposed three-layer architecture employs the word embedding layer at the top, to capture word meanings based on the context. The word-level embedding and character-level embeddings are the fundamental elements of the embedding vector, which are retrieved from the list-lookup table and bi-directional LSTM method, respectively. The word representation feature is then fed to another individual bi-directional LSTM layer, followed by a CRF layer. The word embedding is trained on different gold-standard corpus for different entity types such as CHEMDNER patent are used for the chemical and gene-protein entity, NCBI corpus is used disease name, Gellus corpus is used for cell lines and S800 corpora is used for species. All corpora are converted to a uniform format and stored in a single file during text pre-processing. The LSTM-CRF model with word embedding reduces the need for post-processing in multi-token entities, although the performance on the single token entities is considerably better than multi-token entities. Kanimozhi and Manjula [10]

tried to improve the disease and named entity recognition by biomedical knowledge. It employs the disease dictionary matching methodology and UMLS semantic type filtering to extract the concept. It uses different three different categories of feature set, namely orthographic features, Morphological features, and Contextual features. The main motivation for this proposal is the use of CRF model as it avoids label biased problem which explicitly present in Maximum Entropy Markov Models (MEMM). The overall comparison with BioText golden-standard corpora (GSC) shows that gene and protein entity recognition task using BioCreative II corpora have outperformed the other, as the limited size of BioText GSC cause data sparseness and out-of-vocabulary issue and provide one annotation, which is not the case with BioCreative II. However, silver-standard corpora (SSC) can solve the limited corpora size problems related to golden-standard corpora.

A hybrid multistage CNN-RNN learner model presented by Phan et al. [11] is an inventive multistage BNER scheme to concurrently identifies the biomedical concept, which is used by both CRF and Deep Learning. In level-1, less complex BNER task is used to design the CRF model. Initially, Word2Vec and TF-IDF feature assisted in the pre-processing step, later Regular Expression (RegExp) is incorporated to generate another rich feature, which combinedly submitted to the CRF algorithm, where test dataset is evaluated and prediction file is produced. The resultant output is later compared with the reference text to produce the expected result percentage. The level-2, employ deep learner to solve complex BNER task, which is based on Feed-forward Neural Network (FNNs), Recurrent Neural Networks (RNN), and Convolutional Neural Network (CNN). The BioNLP/NLPBA 2004 dataset has been used to build hybrid CRF, which mainly contain the CNN model along with character and word embedding for features processing. The resultant outcome from the same is fed into two hidden bi-directional RNN layer for further processing. The research indicates that with improved performance, Hybrid CNN will provide accurate intuition and support the biomedical named entity recognition task. Besides that, different new research has come up. Giorgi and Bader [12] demonstrated how transferring deep neural network trained silver-standard corpus (SSC) to a smaller gold-standard corpus (GSC) can improve the BNER process. The idea of silver-standard corpus development depends on multiple systems as annotations are performed by the computerized system and it could compensate the time and effort required for gold-standard corpus. The experiment is conducted on twenty-three corpora of four different entity type, namely Chemical, Disease, Species, and Gene/Protein, with transfer learning. It aims to gain knowledge by solving the problems and use the same on the related task. Thus, eleven percentage average reduction in error is noted but performance diminishes as the size of the database grows has also been reported. However, this approach can be optimized by determining the optimal size of the source database, developing a robust technology to reduce noise, and extensive hyper-parameter tuning.

3 Discussion

Till now various research related to biomedical named entity recognition has been carried out and state-of-art approach have been proposed where features played an important role in improving the effectiveness of the recognition process. But it should be able to generalize well to can discriminate the new datasets. In past, features are defined by the individual to recognize entities but recent studies have shown that method based on neural network model doesn't require feature engineering and generally depends upon on input representation. The escalation of biomedical resources gives rise to difficulty in accurately extracting biomedical entities. As a result, there is no standard format used by the individual but number of experiments has been conducted to efficiently process enormous information like Li et al. [7] used a parallel conditional random fields algorithm, and Giorgi and Bader [12] used transfer learning to improve the average out-of-corpus performance. Moreover, we assume combinations word representation feature can further enhance the performance on widely diverse articles by adopting both character and word level embedding as every corpus share some information. Thus, reduce the human effort and speed up the process.

4 Conclusion

This paper attempts to provide an overview of the progress made in the field of biomedical named entity recognition. Besides, readers will get informative insights into issues and challenges associated with different techniques. A lot of new technologies like transfer learning, multitask learning, variational dropout and their combination has emerged to compensate for these limitations. However, we observed that most of the evaluations have been carried out on a small corpus with limited named entity types. Which ultimately affect the result by overfitting and leads to the wrong conclusion.

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Design and Comparative Analysis of Induction Machine Using FPBO

Ranjit Kumar Bindal, Inderpreet Kaur, and Pardeep Kumar

1 Introduction

The three-phase induction motors are the almost working in every field of engineering and non-engineering as of their rough structure, simple design and low cost. To limit the torque and flux of the AC machine different technique are existing. Direct torque control is one of the techniques that are utilized in variable occurrence drives for the limit of the AC machine [1, 2]. In DTC of induction motor, the output is controlled directly, by controlling the torque and flux values. The PID controller in DTC system gives the controlled output and it is considered as reference torque value. The PID controller gain values tuning is essential to get optimum output. Optimized DTC can better the system presentation by continuous alteration the K_p, K_i and K_d values. Optimization system set numerous restrictions while generating the arithmetic and operational research techniques. Many explanations in conventional optimization algorithms are mainly dependent relative on the type of purpose and restriction functions to enhance the capabilities of PID controller. Pollination-based algorithm technique selected for best optimal tuning for DTC system [3–5].

Flower pollination based algorithm is presented to regulate the values of the PID controller is arranged to reduce torque ripple, flux ripple and improve the speed presentation of three-phase induction motor. Pollination-based optimization is easy to execute and speedily find solutions and has stable convergence characteristics. Flower pollination based algorithm/optimization has been productively useful to

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explain an ample range of mathematical optimization difficulties and also responsible for getting the optimum tuned gain values [6–8].

1.1 Mathematical Replica of Three-Phase AC Machine Model

The mathematical model of three-phase AC machine is proposed with different electrical motor equations which are required for working of the machine is as under [8–10]:

$$V_{\mathrm{qs}} = R_s i_{\mathrm{qs}} + \frac{\mathrm{d}}{\mathrm{d}t}\left(\Psi_{\mathrm{qs}}\right)_s \tag{1}$$

$$V_{\mathrm{ds}} = R_s i_{\mathrm{ds}} + \frac{\mathrm{d}}{\mathrm{d}t}\left(\Psi_{\mathrm{ds}}\right) \tag{2}$$

$$0 = R_r i_{\mathrm{qr}} + \frac{\mathrm{d}}{\mathrm{d}t}\left(\Psi_{\mathrm{qr}}\right) - \omega_r \Psi_{\mathrm{dr}} \tag{3}$$

$$0 = R_r i_{\mathrm{dr}} + \frac{\mathrm{d}}{\mathrm{d}t}\left(\Psi_{\mathrm{dr}}\right) - \omega_r \Psi_{\mathrm{qr}} \tag{4}$$

$$\mathrm{Te} = \frac{3}{2}\frac{\mathrm{P}}{2}\left(\Psi_{\mathrm{ds}}\mathrm{I}_{\mathrm{qs}} - \Psi_{\mathrm{qs}}\mathrm{I}_{\mathrm{ds}}\right) \tag{5}$$

where

V_{qs} Stator voltage quardature axis
V_{ds} Stator direct voltage axis
I_{qs} Stator quardature current axis
I_{ds} Stator direct current axis
I_{qr} Rotor quardature current axis
I_{dr} Rotor direct current axis
Ψ_{qs} Stator flux quardature axis
Ψ_{ds} Stator flux direct axis
Ψ_{qr} Rotor flux quardature axis
Ψ_{dr} Rotor flux direct axis
R_s Stator resistance
R_r Rotor resistance
T_e Electromagnetic torque
P Power.

2 Voltage Vector Model and Voltage Source Inverter for Three Phase Induction Motor

The voltage vector model consists of DC supply and six switches which are working as IGBT and three-phase induction motor. The switches switch S_1 and S_4 are on the same leg similarly switch S_3, S_6 and S_5, S_2. The switches are connected in such a way that the switches S_1 and S_4 are not operated simultaneously, if it happens there will be short-circuited in the circuit. The yield of voltage source inverter is connected to the three-phase induction motor. The voltage V_{ab} is the voltage across the phase a and phase b, the voltage V_{bc} is the voltage across the phase b and phase c, the voltage V_{ca} is the voltage across the phase c and phases a [11–14] (Fig. 1).

$$V(t) = \frac{2}{3}\left[V_a(t) + ZV_b(t) + Z^2V_c(t)\right] \tag{6}$$

where

$$Z = \mathrm{e}^{i2/3\pi} \tag{7}$$

V_a, V_b and V_c are the per phase instantaneous voltages.

Direct torque control technique is used worldwide for industrial applications to curb the torque, speed, flux and stator current of induction motor. DTC techniques are becoming more popular because of many advantages i.e. simple structure, strong, simple configuration, easy to apply and fast transient response. The fundamental block drawing of DTC is displayed in Fig. 2.

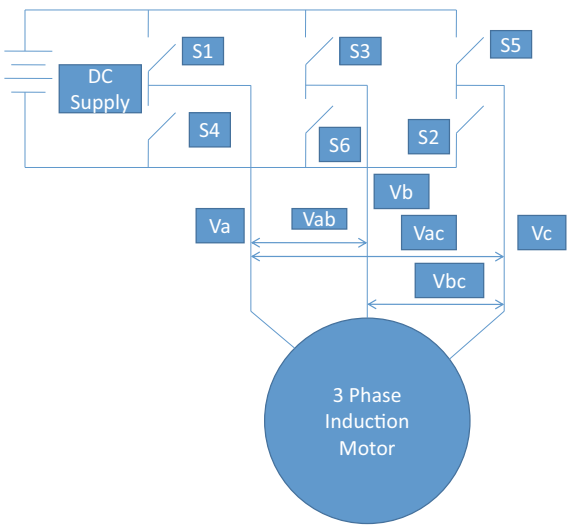

Fig. 1 Three-phase voltage source inverter model

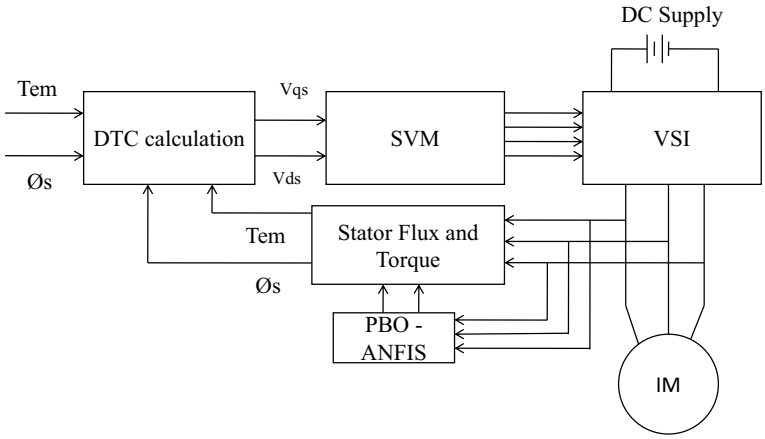

Fig. 2 Block diagram of DTC

Induction machine fed by three-phase voltage source inverter containing six different insulated gate bipolar transistor switches. A switching chart is produced that conclude the voltage vector which is being utilized. The assortment of the voltage vector depends on the location of the stator flux and torque. Voltage vector chart can be prolonged to comprise extra number of power vectors by three-level inverter. Six non-zero vectors (V_1–V_6) shape the axis of a hexagonal as shown in diagram 2.3 and Table number 1 display voltage vector miscellany according to stator flux and torque errors. In general, V_2 and V_3 vectors can be selected to improve the torque and V_5, V_6 and V_0 vectors will reduce the torque [15–18] (Fig. 3; Table 1).

Normally V_d and V_q are known flux and torque apparatus of voltage vector. The flux of the organization is limited by V_d whereas V_q is accountable to control torque of the system. The voltage source inverter is utilized to limit the voltage efficiently [5–7].

3 Flower Pollination

The propagation in plants occurs by association of the gametes. The dust grains delivered by mannish gametes and ovules bear by female gametes are created by various elements and it is fundamental that the dust must be moved to the shame for the association. This procedure of move and testimony of dust particle from anther to the shame of bloom is fertilization. The procedure of fertilization is for the most part encouraged by a specialist. The fertilization is an after-effect of treatment and it is shall in farming to create products of the soil [8–10].

There are two types of pollination:

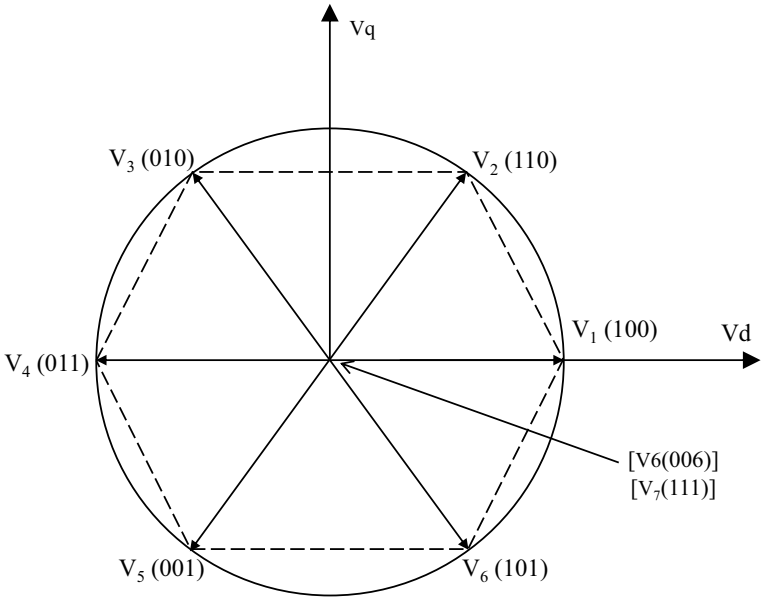

Fig. 3 DTC with space vector V_1–V_6

Table 1 Voltage vector table

E_Ψ	E_{T_e}	1	2	3	4	5	6
Increasing (+1)	Increasing	V_2	V_3	V_4	V_5	V_6	V_1
	Zero	V_0	V_0	V_0	V_0	V_0	V_0
	Decreasing	V_6	V_1	V_3	V_2	V_4	V_5
Increasing (−1)	Increasing	V_3	V_4	V_5	V_6	V_1	V_2
	Zero	V_0	-	-	-	-	-
	Decreasing	V_6	V_5	V_1	V_2	V_3	V_4

1. Self-pollination.
2. Cross-Pollination.

Self-pollination: The pollen when pollinates with a similar type of flower of the similar type of green trees or plant the procedure is known as self-pollination. It happens as the same flower consist of mutually masculine gametes and lady gametes [11].

Cross-pollination: It is the process when pollen grains moves from one plant to another plant. This process occurs by the use of abiotic or biotic agents for example birds, bug, snail etc. [12].

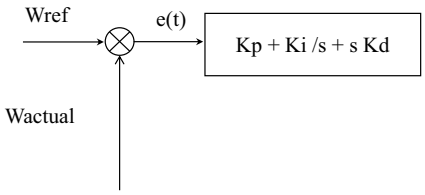

Fig. 4 PID controller

3.1 Flower Pollination Based Optimized Algorithm Using PID

Flower pollination based optimized algorithm was based on flower pollination process has been used for optimization of three-phase induction machine. The main process of the flower pollination is the great replication of trees in terms of large values. It is totally a novel optimization model for flower pollination individuality. The idealized performance of flower pollination algorithm (FPA) or rules are as under [13–15].

1. Biotic and cross-pollination is assuming a worldwide pollination procedure through pollen transporting pollinators performing arts impose flights.
2. A biotic and self-pollination are assumed as limited pollination.
3. Flower dependability can be well-thought-out as the replication chances are directly proportional to the resemblance sandwiched between two same plants.
4. The switch probability is limited the Local and worldwide pollination by using equation $p \in [0, 1]$.

Owing to the substantial immediacy and additional factors such as storm, limited pollination can include a considerable fraction in the in general pollination behaviour (Fig. 4).

$$e(t) = W_{\text{ref}} - W_{\text{actual}} \tag{8}$$

Within authenticity, each tree can have numbers of tree flowers and each tree blossom scrap often liberate more than millions of pollen gametes. Though for effortlessness let's suppose that everyone and every plant produce single pollen gamete per flower. Consequently, in the present, no requirement of differentiating a pollen gamete, a bloom, a plant or resolution to it. For effortlessness, the solution x_i is used to solve the equitation of a bloom and a pollen gamete. To solve this we are having follows the flow chart as shown in figure number 3.2 [16–20] (Fig. 5).

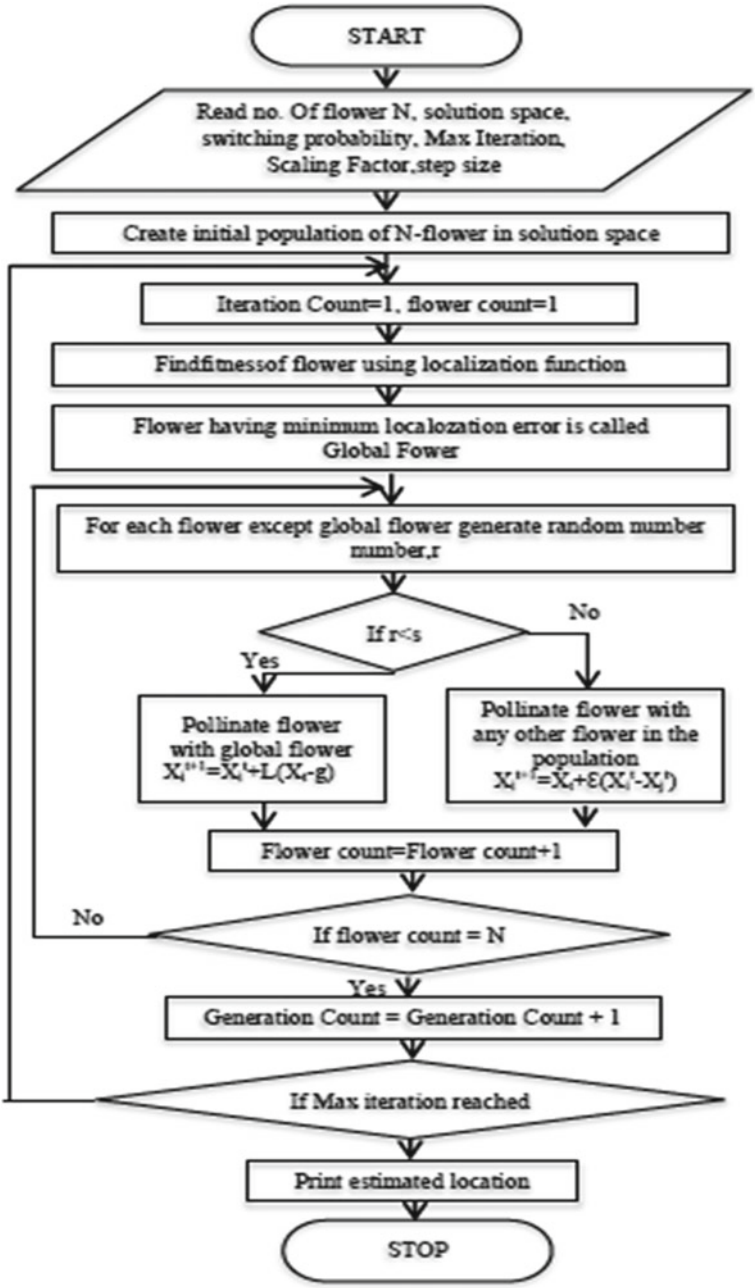

Fig. 5 Flow chart of flower pollination algorithm

4 Results and Discussion

On a basic level, blossom fertilization procedure can occur at both nearby and worldwide levels. In any case, in all actuality, blossoms in the neighbourhood have advanced odds of accomplishment pollinated by dust from nearby blossoms than persons which are far away. To mimic this element, vicinity likelihood can be estimably used to switch between serious neighbourhood fertilization to basic worldwide fertilization (Table 2).

In this paper, a three-phase induction motor is compared on the foundation of rising time, settling time and maximum overshoot time with conventional and FPBO technique to limit the speed and torque of the machine.

The results obtained using PID with and without FPBO technique are as under (Figs. 6, 7, and 8; Table 3).

Table 2 Parameter of Nalai

S. No.	Parameter	Nilai
1	Population size	40
2	Probability switch	0.8
3	Iteration parameter	100
4	Dimension	3
5	Bats Atas [K_p K_i K_d]	[80 60 0.1]
6	Batas Bawah [K_p K_i K_d]	[40 60 80]

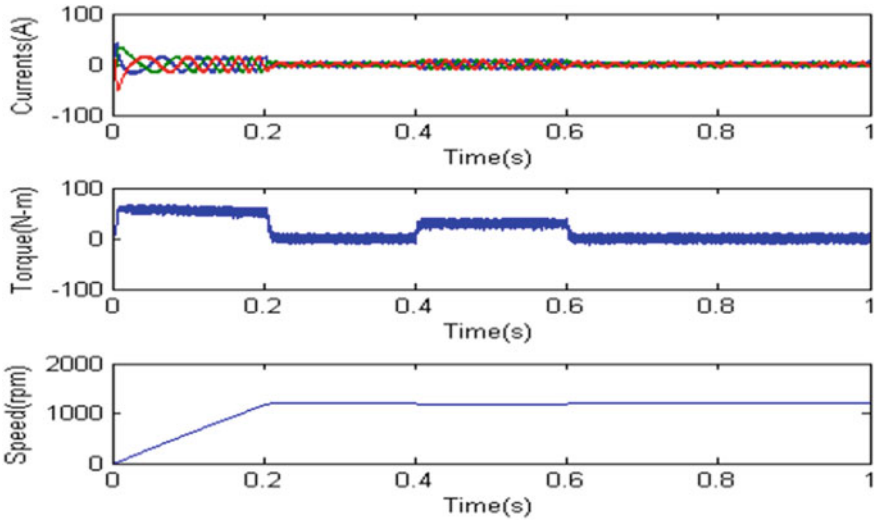

Fig. 6 Output of conventional DTC

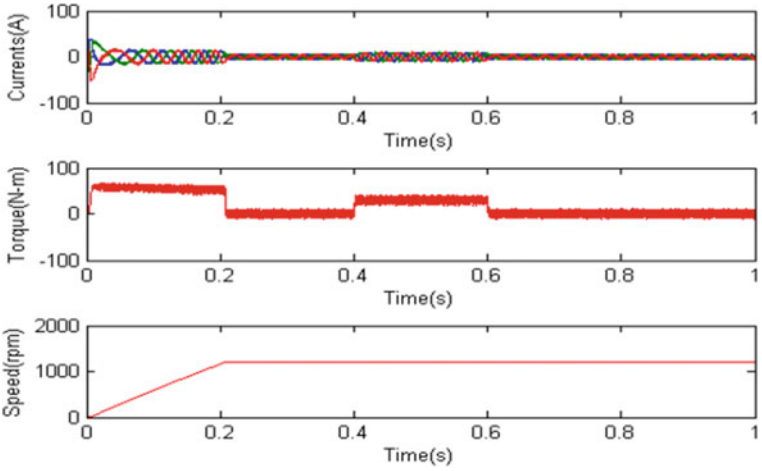

Fig. 7 Output of DTC with FPBO

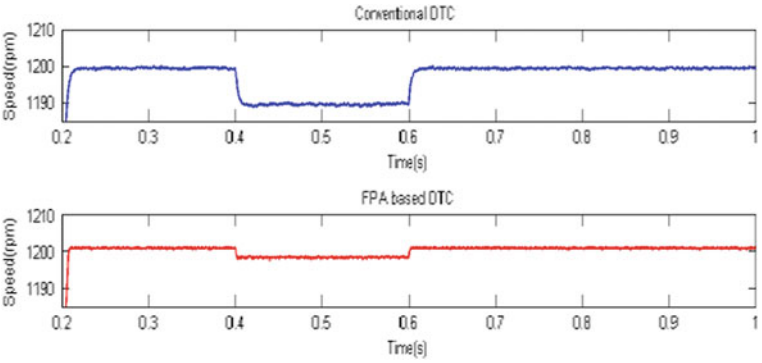

Fig. 8 Comparison of conventional DTC and FPBO with DTC

Table 3 Result comparison

Parameter	Conventional DTC with PID	FPBO with DTC PID
Speed in rpm	1197	1202
Torque in Nm	76	80
Current in A	0.1249	0.0444
Rise time in s	0.2 s with distortion	0.2 s without distortion
Settling time in s	0.6 s with distortion	0.6 s without distortion

5 Conclusion

The behaviour of flower-based pollination with direct torque control is adjusting the parameters of speed control (K_p, K_i and K_d) in order to remove the disadvantages of direct torque control and to enhance the presentation of the entire system with PID controller is proposed. The PID controller limits the speed by reducing the speed error sandwiched between the reference of rotor speed and real speed. The simulation results of flower based pollination optimization with direct torque control for the performance of three-phase AC machine by reducing torque and flux ripples and also noted that the speed performance is improved when comparing this FPBO technique with conventional DTC. FPBO with DTC tuned with PID controller enhance the speed ability of the DTC system and also an enhanced torque and flux response was achieved.

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Design and Implementation of Hybrid Solar E-Rickshaw

Rahul Singh, Naveen Kumar, Vikash Kumar, and Ranjit Kumar Bindal

1 Introduction

In today's scenario, the pollution rate is increased gradually day by day and a large amount of pollution is caused by the contaminated air which is produced by the vehicle, the fuel is burnt automobiles and it exhausts polluted air in the atmosphere, which causes air pollution. So to overcome this problem we have the alternate Path that we can use the Electric-vehicle instead of using diesel and petrol operated vehicles. The cost of gasoline and diesel is also growing day by day. So solar is the best method to overcome this problem and it is the only way to protect our environment from the harmful air. Solar is completely eco-friendly to our nature. Solar is a totally renewable source of energy and pollution-free. Solar energy is also called green energy. The predictable energy utilization via using renewable energy in India is mostly formed by utilizing thermal power plants. These coal power plants is the main cause of CO_2 gas production resulting in superior greenhouse result [1–4]. A 500 MW coal power plant can generate upto1 kg/KWh generation of electric energy. So, by using solar, we can reduces the consumption of our natural resources like coal, water, and other natural resources so it is the best and suitable method to save

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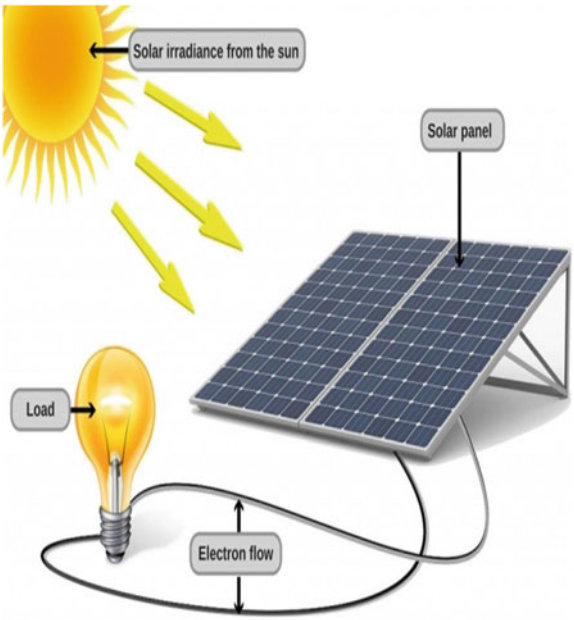

Fig. 1 Circuit diagram of solar panel

the natural resources for our future. Solar only works when the sun is there and we know that the sun is a good source of energy to produce the electricity from the solar after seeing all these advantages we are making the solar e rickshaw of 48 V/355 W which will charge the battery from the solar [5–8] (Fig. 1).

2 Methodology and Working

Solar panel is that which converts the light energy into electricity or electrical energy. Basically, solar panel is made up of semiconductors and converts the light energy into electrical by photovoltaic phenomenon. In this, when the sunlight falls on the photovoltaic cells having photons of light or bundles of photons fall on the atom it releases or excites the electrons from the atoms. Now, the electrons are free to move from one plate to another of the semiconductors. Thus, the conduction occurs in the semiconductors by the movement of electrons and holes of the atom. In the solar panel many semiconductors are there when light fall on these semiconductors electrons flow between them and current is produce by the solar panel [9–12].

Installing or constructing the solar panel on the roof of the Electric-Rickshaw works on the same phenomenon [13, 14]. When the sunlight falls on the solar panel the photons excite the electrons of the semiconductors and start move thus the flow of electrons occurs and the light energy is converted into electrical energy. We store this energy in the battery and our battery is charged. Now after charging the battery

Fig. 2 Designed and implemented solar E-rickshaw

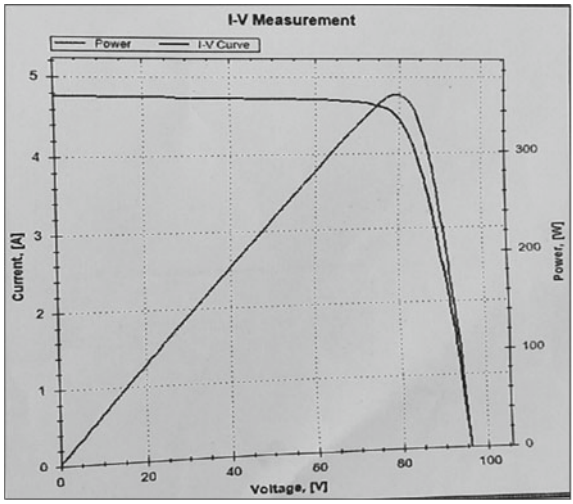

Fig. 3 Output characteristics of solar panel

we use the rickshaw and our rickshaw is run or operated by instant energy produced by solar plat from sunlight [15–18] (Figs. 2, 3 and Table 1).

Test Conditions:
Modle Temperature: 26 °C.
Ambient Temperature: 29.1 °C.
Irradiance: 791 W\m^2.

Table 1 Description of conventional E-rickshaw

Seating capacity	6 (50 kg luggage)
Battery ranking	100 AH
Battery sort	LEAD acid
Electricity utilization\charge	5–6 unit
Charge of time	6–7 h
Range per charge	100 km & above
Maximum power of motor	1140 W & 48 V (input)
Type of motor	BLDC
Maximum speed	25 km\h
Controller	24Tube 50
Charger	15 A
Steering	Hand bar type
Organization voltage	12 V (DC)
Total vehicle load	321 kg
Presentation	Excellent

3 Results

See (Table 2).

Other Information:
Total Number of cell: 72.
Cell Type: POLY.
Module Area: 2.02m^2.
Module Efficiency: 17.6%
Cell Area: 0.0246m^2.
Cell Efficiency: 20.01%.

Table 2 Result obtained

Maximum power	355.8 W
Peak Maximum Voltage	79.3 V
Imp	4.49A
VOC	96.0 V
ISC	4.76A
Fill Factor	77.8%
Rsh	1086.2 Ω
Rs	1.886 Ω

4 Scope of Solar Panel

1. The engine being used here is an old one. The efficiency of the E-vehicle systems can be improved by using a solar panel.
2. A new energy generation modified technology is used in solar E-Rickshaw.

Future scope of solar energy:

1. Solar-powered spacecraft:
   Solar energy is frequently utilized to supply energy for satellite and spacecraft in service in the solar scheme since it can supply power for a long time lacking surplus fuel mass.
2. Communications satellite:
   A communications satellite contains multiple radio transmitters that operate frequently all through its life. It would be unprofitable to operate such a vehicle (which may be on orbit on year for years) for primary batteries and fuels cells, and refueling in orbit is not useful.

5 Summary/Conclusion

In this paper, a solar panel is designed and implemented on conventional E Rickshaw by implementing this we having saving many things at one time, first saving the electrical energy, second saving the economy of the country, third saving the environment by using solar energy directly, fourth saving of money as we do not need the converter in this solar e rickshaw.

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Fault Zone Identification and Fault Classification in a Series Compensated Transmission Line Using Decision Tree

Prasad Ranjan Ghosh, Subodh Kumar Mohanty, and Srikanta Mohapatra

1 Introduction

The ultimatum supply of electric power is increasing day by day. So there is a huge demand for constructing transmission lines but there is a restriction to build a new transmission line because of right-of-way act [1]. So to fulfil the demand of huge power transfer capability, an alternative way is implemented in the system. Inclusion of series capacitor, shunt capacitor like TCSC, UPFC, FSC (Fixed Series Capacitor) in the existing transmission line not only increases the system stability but also increases the capacity of electricity transfer and also reduce losses from the system [2]. From the protection point of view, it is a very difficult task to move from a transmission line which is uncompensated to a transmission line which compensated one. It is very much important to know the importance of series compensation to protect the transmission line for designing proper schemes because inclusion of compensation in the line affects the execution of distance relaying based protection of the transmission line due to frequent change in impedance [3]. So, it is very much required to know the faulted place against the fault zone to accomplish overall decision of a distance-based relay. To increase system stability, faulted phase selection is very much important [4]. Inclusion of compensator will improve the transient stability of the system and switching overvoltage will be reduced in the system.

Thyristor Controlled Series Capacitor based series compensation has thyristor controlled reactor which is guarded by a MOV and an airfilled gap [5]. There is a limitation for conventional scheme which is based on fixed settings because the MOV is used to protect the capacitors and the air filled gap medium in this system make the system very much critical from protection point of view. For protection purpose of the compensated network, it is very much important to know the type of fault and

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to recognize the fault zone and these two approaches are very much necessary in an accurate manner [6]. It is a very difficult task to know the faulty zone correctly and to predict fault type in presence of TCSC or UPFC in a transmission network.

Faulted voltage and faulted current samples data from the point of relay are utilized for fault zone detection and classifying the type of fault, which is involved in the transmission network consisting with or without Rf. There is a direct approach for detection of the fault that to compare of the current signal sample and also other some techniques available in the literature using wavelet transform, Kalman filtering which are more complicated process for fault detection [7]. These techniques take more than half a cycle for protective relay to start and also trip accurately. Radial Basic Function, Back Propagation Algorithm, Neural Fuzzy Sets are very much sensitive to frequency changes of the system and it requires huge training sets, large number of neurons and also these techniques need more computational time.

Throughout this paper work, an approach that is basically based on Decision Tree algorithm is used to classify the fault and zone identification of fault in a compensated transmission line. Decision Tree algorithm is more human friendly and transparent with respect to other pattern classification techniques. This proposed method is tested with large number of variations in parameters and found that it is fast and accurate to identify and to classify various faults in long transmission network.

2 Proposed Method

2.1 Decision Tree

Decision Tree is a supervised learning technique. This algorithm is considered as a solution for a classification application in the Machine Learning application tool [8]. DT algorithm is basically used for pattern classification where the dimension of the pattern is high. This algorithm distinguishes data sets into smaller number of subsets which looks like a tree shape structure [3]. This Decision Tree breaks the input data into two or more sample data. Mainly there are three types of nodes present in the Decision Tree—Root Node, Leaf Node & Internal Node. In a classification problem, the procedure of making conclusion starts from the upper-most node of the tree which denotes as ‘Root Node’ in that tree-like structure [9]. Each ‘Internal Node’ of a tree represents possible results of the experiment and class label of the tree is represented by each ‘Leaf Node’. The basic algorithms are ID3, C4.5, and CART by which this DT work. From these, ID3 is the most popular one where Entropy criterion and Information Gain is used to build DT.

2.2 Entropy

Entropy is defined as the degree of randomness of the sample data. Decision Tree involves to breakdown the sample data into different subsets that contain similar value. ID3 algorithm is used to calculate the uniformity of the data sample. Entropy becomes 'Zero' when the data sample is purely uniform and the Entropy becomes one when the data sample is divided equally.

We have to calculate two types of entropy to build a new DT

$$E(S) = \sum_{i=1}^{c} -p_i \log_2 p_i \tag{1}$$

where the number of attributes is one. Here the probability of frequency of element 'i' is denoted by "p_i".

$$E(T, X) = \sum_{c \in X} P(c)E(c) \tag{2}$$

where the number of attributes is two.

2.3 Information Gain

Mainly Decision Tree is to find the attribute which returns the maximum Information Gain. Here, the Information Gain of a Decision Tree basically based on reduction in Entropy when the data set breaks on an attribute. The Information Gain is denoted by (Figs. 1 and 2).

Gain(T, X) = Entropy(T) – Entrophy(T, X)

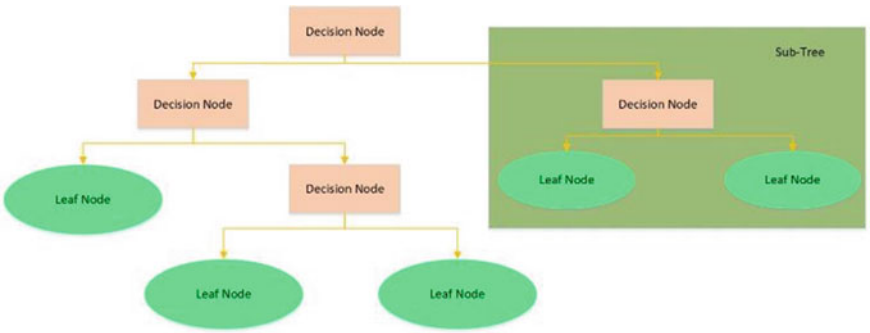

Fig. 1 Flow chart diagram of decision tree

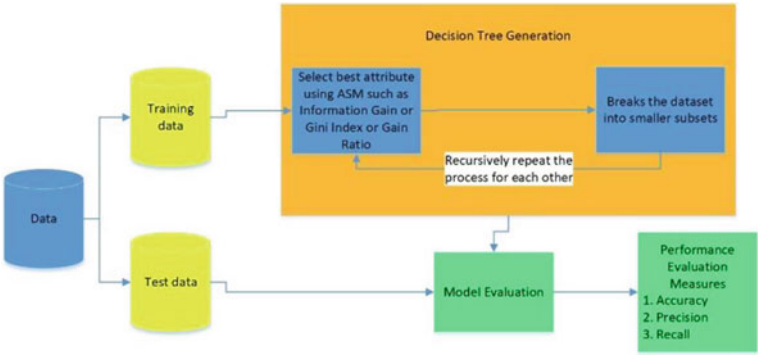

Fig. 2 Data chart diagram of decision tree

There are so many standard classification methods are used to classify the data like Naïve Bayes, Support Vector Machine (SVM), K-Mean Classifier. Among them, this suggested DT algorithm is faster than other Neural Networks when we consider training time as a parameter [10]. This DT method can handle large dimensions of data with better accuracy. Decision Tree uses non-parametric technique which does not depend on probabilistic assumption. Generally, it follows the same step as human being generally follows for decision making. This feature makes this method different from others.

3 System Studied

In Fig. 3, the studied network is shown. The design and simulation of the system is carried in PSCAD/EMTDC software.

In this series compensated system, a TCSC is pointed at the middle point of the transmission network which is 300 km long in distance. This transmission network consists of sampling frequency 1.0 kHz, two 400 kV sources and a Thyristor Controlled Series Capacitor with minimum to maximum compensation pointed at the

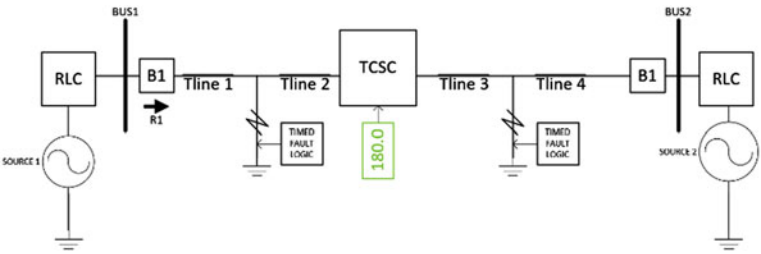

Fig. 3 Series compensated network

middle of transmission network [11]. The transmission network has zero sequence impedance $Z_0 = 37.956 + j14.37\ \Omega$ and positive sequence $36.29 + j5.031\ \Omega$. Source end voltage $E_s = 400°\angle 0°$ kV and receiving end voltage $E_r = 400\angle\delta$ kV.

Thyristor Controlled Series Capacitor is composed of MOV, a nonlinear resistor. MOV made up of several zinc oxide plate and those discs are connected electrically [9]. Main purpose of MOV is to restrict the over voltage in the examined system. This situation happened mainly at the time of the fault occurs on a compensated line. Metal Oxide Varistor draws a significant amount of I_L, to make lower amount of voltage across the line capacitor when instantaneous voltage comes across that capacitor with a dangerous value [12]. A bypass switch is connected parallely over the compensative device which is automatically close in abnormal condition that causes significant current flow in the air gap. Basically, TCSC works in capacitive mode but if there is any fault occurs then TCSC works in inductive mode and faulted current goes around through this inductor.

4 Results and Discussion

Post fault current samples of three-phase are extracted at sampling frequency of 1.0 kHz at the point of the relay. These three-phase current samples are fed to proposed Decision Tree platform.

4.1 Fault Zone Identification Using Decision Tree

To identify the faulted zone by the proposed Decision Tree method, current and voltage samples after fault are fed as an input to the Decision Tree with respect to target output 'Post' for those faults which occurred after TCSC and 'Pre' for the faulted data which is occurred before TCSC. A large amount of data which is simulated, is used for training and testing in Decision Tree algorithm with 70–30, 60–40, 50–50, 80–20%.

The sample sets of data are created under different operating conditions in the transmission network as follows:

- Variation of R_f from 0 to 200 Ω.
- Locations of fault: 10, 30, 40, 48, 52, 60, 70, 80, 85%.
- Variations in Fault Inception Angle: 30°, 45°, 60°, 75°, 90°.
- Variations in Firing Angle: 150°, 155°, 160°, 165°, 170°, 175°.
- Types of fault: 'ag', 'bg', 'cg', 'abg', 'bcg', 'cag', 'ab', 'bc', 'ca', 'abc' (Fig. 4).

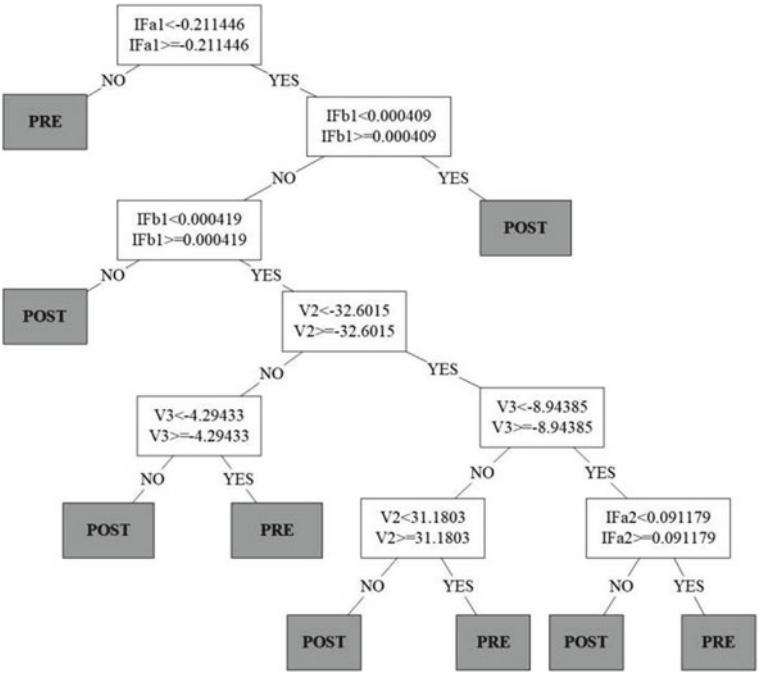

Fig. 4 DT for fault zone identification

Different condition	DT O/P
'ag' type of fault at 10% of the line, $R_f = 0\ \Omega$, F.I.A = 30°, F.A = 180°	PRE
'ca' type of fault at 30% of the line, $R_f = 20\ \Omega$, F.I.A = 45°, F.A = 165°	PRE
'ab' type of fault at 40% of the line, $R_f = 100\ \Omega$, F.I.A = 30°, F.A = 155°	PRE
'bc-g' type of fault at 48% of the line, $R_f = 200\ \Omega$, F.I.A = 90°, F.A = 150°	PRE
'ca-g' type of fault at 52% of the line, $R_f = 50\ \Omega$, F.I.A = 45°, F.A = 155°	POST
'ab-g' type of fault at 60% of the line, $R_f = 150\ \Omega$, F.I.A = 90°, F.A = 170°	POST
'cg' type of fault at 70% of the line, $R_f = 50\ \Omega$, F.I.A = 45°, F.A = 155°	POST
'bc' type of fault at 80% of the line, $R_f = 60\ \Omega$, F.I.A = 60°, F.A = 175°	POST

In Fig. 5, a confusion matrix is shown which is nothing but the estimated conditions in respect of actual condition to identify the faulted zone in a TCSC based transmission network. This confusion matrix of DT is based only on testing data sets. Different data sets are found to generalize the proper training–testing data to get the best results. It is found that 70–30% training testing sets give us the most accurate result for this confusion matrix, where $(9934 + 7930) = 17{,}864$ cases are classified one and $(70 + 66) = 136$ cases are misclassified cases which provide 94.9% classification accuracy. It is observable that Decision Tree provides better accuracy with respect to existing SVM and all other neural network systems. The classification accuracy is increased at 70–30% data sets and the classification accuracy is decreased

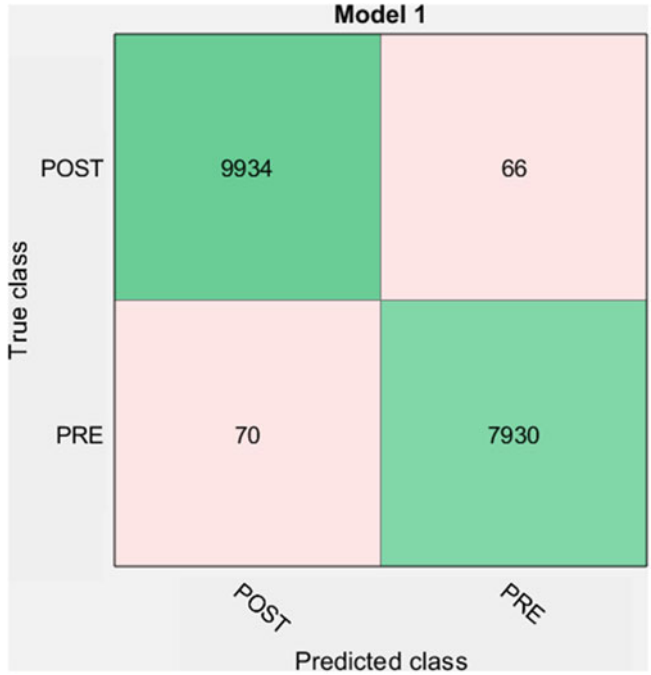

Fig. 5 Confusion matrix for the zone identification of fault

in case of 80–20%, and 90–10% of data sets. This kind of event happens because of over fitting of data in case of algorithm which is used for classification.

4.2 Decision Tree Based Fault Classification

In case of classification of fault, data samples of current and voltage after fault along with the zero sequence currents are likely to be used as an input with respect to various types of faults as the pre-determined output for Decision Tree. The faults are basically divided into two types—(i) Symmetrical Fault, (ii) Unsymmetrical Fault.

These fault types are further divided as (i) Line to Line fault, (ii) Line to Line to Ground fault, (iii) Line to Line to Line fault and (iv) Line to Ground fault. The simulation had been implemented with different operating parameters like different fault resistance, different fault positions.

In Fig. 6, the confusion matrix is acquired to classify the types of faulted conditions for the TCSC based transmission network where training and testing data sets are in 70–30% ratio. In Fig. 7, the estimated value with respect to actual value is given for all kinds of faulted conditions. For 'a-g' class 1995 cases are denoted as classified one and 6 cases are denoted as misclassified data with respect to all other class. Similarly,

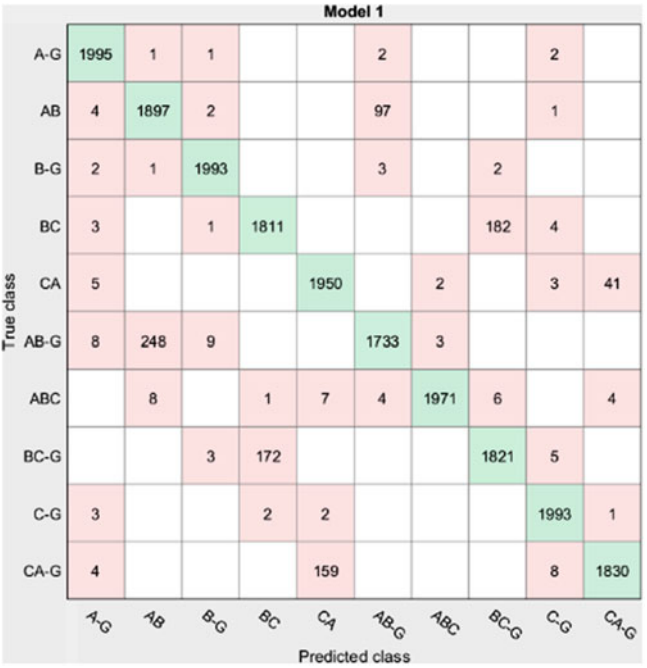

Fig. 6 Confusion matrix for fault classification

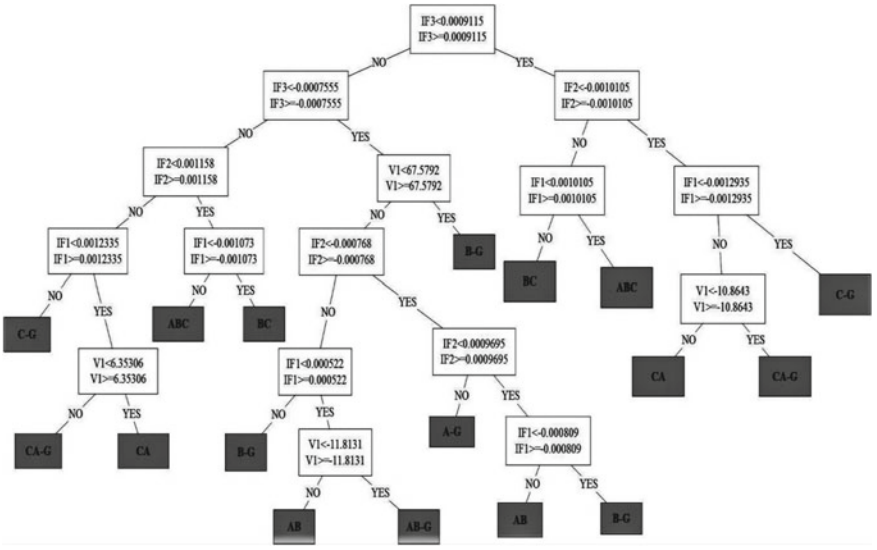

Fig. 7 Decision tree based fault classification for TCSC

for 'b-g' fault 1993 cases are classified data and 8 data are denoted as misclassified data with respect to other faults. The accuracy of this confusion matrix to classify the fault is 94.9% which is better in comparison with the existing techniques. The processing time is also not so much with respect to other techniques.

5 Conclusion

Throughout this paper, suggested Decision Tree algorithm provides a unique system for better protection of a compensated network by identifying the fault zone and by classifying the fault type. To identify the faulty zone and to classify the fault type, three-phase currents after fault are used as an input data sample which are delivered to DT with respect to pointed vector 'pre' for those faulted data which is occurred before TCSC and target vector 'post' for those faulted data which is happened after TCSC. When it comes to the term fault classification, three-phase currents with the zero-sequence current after fault are likely to be used as a sample input data in Decision Tree to classify all 10 types of fault. This proposed algorithm provides better accuracy with less computational time for identifying the fault and its classification with respect to existing SVM, RB function and all other neural network systems. This proposed Decision Tree approach is tested with wide variations in input parameters and the suggested DT algorithm is strong enough to allow its capacity in case of protection for the series compensated large power system.

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Urban Resilience and Inclusion of Smart Cities in the Transformation Process for Sustainable Development: Critical Deflections on the Smart City of Bhubaneswar in India

Bhubaneswari Bisoyi, Biswajit Nayak, Biswajit Das, and Srinivas Subbarao Pasumarti

1 Introduction

With the development of smart cities in the present scenario, a major change has been focused in the field of information and communication technology (ICT). One of the engineering consultant firms in UK Arup has expected the global market for a smart city to be valued up to 400 billion GBP by the year 2020. Building a smart city involves changes in engineering in multiple disciplines and several areas. The idea of a smart city is gaining momentum due to advancement of new technologies such as application of technology related to IoT, for instance, RFID (radio frequency identification), sensors used for environment, actuators, artificial intelligence, cloud computing, wearable sensors. The standard of living in smart cities are improved by involving the deep integration of ICT in every aspect of city life. The initiatives taken for the feasibility of a smart city will depend on an expansion in the expansion of big data with application of IoT in various areas [1].

The world's population residing in the urban area is anticipated to be 66% by 2050 and thereby, raising significant challenges that include pollution, carbon footprint, greenhouse effect, and degradation in human health. Currently, the major percentage

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of world resources and energy are being utilized by cities and that accounts to be 75%. This accounts for 80% of greenhouse gas emission with serious impact on the ecological system at local, district and worldwide. With the increase in the maturity level of IoT, cloud computing, big data, 4G/5G and other technologies in concurring with an impending crisis that arises from overpopulation, global warming, socio-economic instability, stimulating many countries to explore the advancement in the concept of smart cities to address the issues and giving a solution. It has been pointed by Cisco that one of the prime obstacles for the development of a smart city is the complexities present in the cities itself. The involvement of various organization and people in formulating strategy about smart city also creates intricacies as they have different opinions on the project of a smart city. It is vital to recognize the role of every individual in the development of smart city project [2, 3].

It is claimed that smart cities are based on effective models that involve successful administrative competencies supplemented by the stimulus and location for the resourcefulness and modernization of the world by providing a better standard of living and low impact on the ecological system leading towards achieving sustainable development. It has been observed by researchers that smart cities are 'smart' when there is a combination of investment in human and social capital and transport and in ICT that acts as a fuel for sustainable socio-economic development and better management of renewable resources, through the action of sharing and involvement [4–6].

2 Literature Review

2.1 Smart City

Earlier the goal for urban development was basically focused on sustainability. The idea of the smart city instigated to get pull from the year 2010, with augmented research and debates about the implementation of policies. The advancement of smart cities and sustainable growth in smart cities do not defer in the concept but several studies suggest there exists a convergence between them. Researcher Fu and Zhang proposed in their study that smart cities represent the technical innovation to the socio-economic life [7, 8]. The model of the smart city basically focused on developing a potential model of sustainability that highlights on certain facets of urban development. There is a close association or connectivity between smart cities and sustainable cities. It is vital to understand the association between them and analyze the two complementary processes during development [9, 10].

The concept of IoT was proposed by Anthopoulos to increase the level of comfort offered by smart cities from various aspects, thus attracting more tourists. On the other hand, the three major aspects that have to be looked upon for the development of smart cities are performance, intellect and effectiveness. Technological advancement has helped in the era of big data. The operations that are essential for the functioning

of the smart city are data activation and application analysis. Other than providing the residents with better living, the British Standard Institute in the year 2014 recommended that significance of smart city development is the about effective integration of physics, facts and manhood to create sustainable richness. It is believed that the concept of building smart cities appeared in order to counter the social challenges such as pollution, population, health problems, bearings of disrupting technologies and develop sustainability. The core technology used for the development of smart cities relies on various types of technologies, equipment and collecting data that is further transmitted through a different communication network and thereafter compiled and consolidated to be analyzed in the cloud environment. The result of this analysis in a cloud environment helps in improving the administration and in decision making [11, 12]. The advancement of IoT has elevated the prominence for smart city practises and developing a trend in both urban and industrial areas. Still, a clearly defined framework is required for providing standards towards the development of a smart city. A survey was carried out by Frost and Sullivan regarding the development of smart city projects around the globe and the common factors were identified and based on these factors a smart diamond framework was proposed that can predict the future trend of smart city development [13]. The smart diamond structure consists of eight fundamental phases such as governance, Energy, building or infrastructure, technology, healthcare and citizens. Similarly, another model was proposed by IBM that focused on the ecosphere outline consisting of three aspects. The first aspect is handled by law enforcement and public safety, second by government and administrative agencies and the last aspect is buildings and city planning for producing a smarter city [14–16].

In the year 2013, a framework that acts as an indicator for providing a broad and deep valuation of attributes for the smart city was developed by Boyd Cohen [17]. This framework focuses on six broad aspects namely government, economy, environment, mobility, people and living. The assessment for finding out the level of smartness achieved by the individual city is done by critically analyzing each aspect by 62 indicators. The most effective possible way for evaluating a smart city is to divide it on the basis of the above-mentioned aspects [18, 19].

This research paper applies the framework proposed by Cohen as mention in Fig. 1 and it incorporates all of the arenas in most of the framework for the existing smart cities. Additionally, the complied cases of smart cities can be accurately presented with the help of factors mentioned in the framework [18].

By using all the important factors presented in the framework (Fig. 1) we can analyze the importance of IoT in all the field through this paper [18]:

1. Smart Government: The transparency in getting the information and enhancing the communication process essential between government, organizations and citizen. Thus, IoT helps in delivering the right information to maintain transparency and responsiveness.
2. Smart Economy: New products and services are developed to harness entrepreneurship and services; this also boosts productivity. The integration with the global economy increases the spirit of competition.

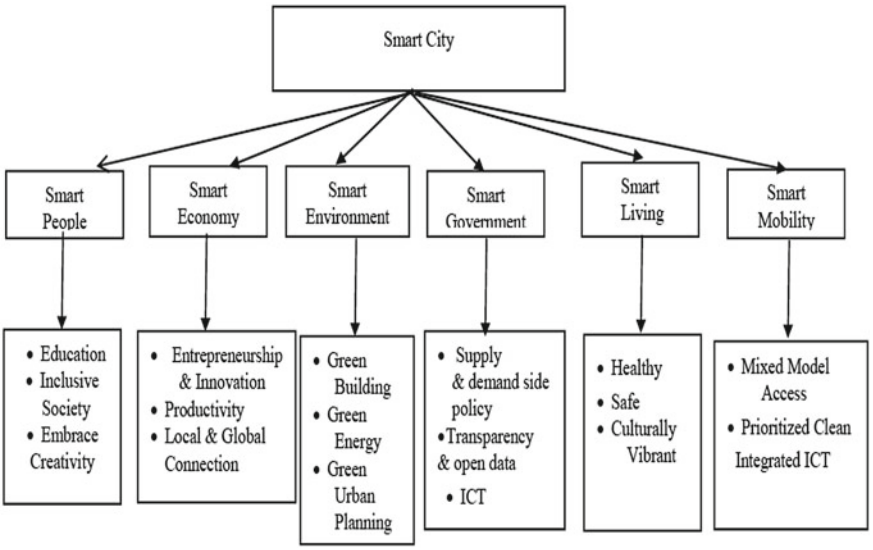

Fig. 1 Smart city wheel

3. Smart Environment: Eco-friendly buildings, generating power from natural resources and urban planning. Monitoring the distribution of power in green areas, public lands and other public areas can be carried out through telemonitoring technology. This shall help in reducing energy waste, carbon emission, and lift environmental sustainability.
4. Smart Mobility: The technologies like telemonitoring and visual databases are used to deliver instantaneous answers to the flow of public, goods and automobiles. The use of multiple modes of transportation is used and also encouraged.
5. Smart People: The prominence is on building an environment for pursuing lifelong knowledge for management of human resource through the application of IoT and facilitated by ICT by innovation. Citizens use the online medium for collaborating and participating in public dealings. These activities promote a sense of conjoint recognition and perseverance.
6. Smart Living: Gives emphasis on improvising the quality of life for the residents. IoT sensors help the residents to manage their households with affluence and be responsible for their safe, enjoyable and healthy life.

3 Major Expansions in Smart Cities

We need to find out what is different today and the impact of recent changes on the emergence and dissemination of the smart city idea. The key advancement is that current technology is reasonable, wireless communication, increased performance

in terms of public transportation, safety, trustfulness, and functions on a real-time basis. The application of big data can be used as a mean to identify developments and come to a conclusion about the urban atmosphere and the cases that occur or are about to happen therein and eventually let the management of cities in a more efficient, rightful and smartly. The sinking price and aggregating performance of technology protect that it shall continue to be implemented in the operation of the economy. With reference to researchers Schumpeter in 1947 and Schmookler 1996, we can consider the recent development in economy and innovation theories have shaped the smart cities and the two major forces that play a major role are a technological push and demand-pull [20–23]. Drive in the technology points towards that a new product/resolution is ushered into the market due to fast advancement in science and technology, i.e. it is backed by sources, irrespective of the current demand assessment of the product introduced in the market. The demand-pull refers to the commercialization of the products/solutions that are accepted by the public and demanded by society. With the support of this theory, the recent development in the smart city can be explained and justified [24].

3.1 Solution for Smart City Through Technology

In recent year's technological advancement have made it achievable the development of solutions and products that play a major role in building a smart city. The major areas that are improvised for better urban management are the mode of communication, power sector, health care, water and waste management. The ICT products are used for giving a better life in smart cities [25]. Consequently, a growing number of sellers and consultants have been looking for a unique position in the product market of smart cities. The different forum created for pushing the products are mentioned below:

- Events and global platforms such as summits.
- Development of prototypes by academic research groups and displaying it as a solution to the problems in smart cities.
- Finding programs that can generate funds for stimulating growth in smart cities.

There has been a remarkable significant development in the area of product manufactured for a smart city. With reference to the research carried out by Navigant research, 2011 it is estimated that over $100 billion shall be spent on technology to support the development of products for smart cities. By 2020, the projected spending on technology is expected to be $16 billion as mention in Fig. 2. There are several reports carried by various research agencies and consultancies such as IDC government Insights, ABI Research, Nikkei BP Cleantech Institute and many more [18].

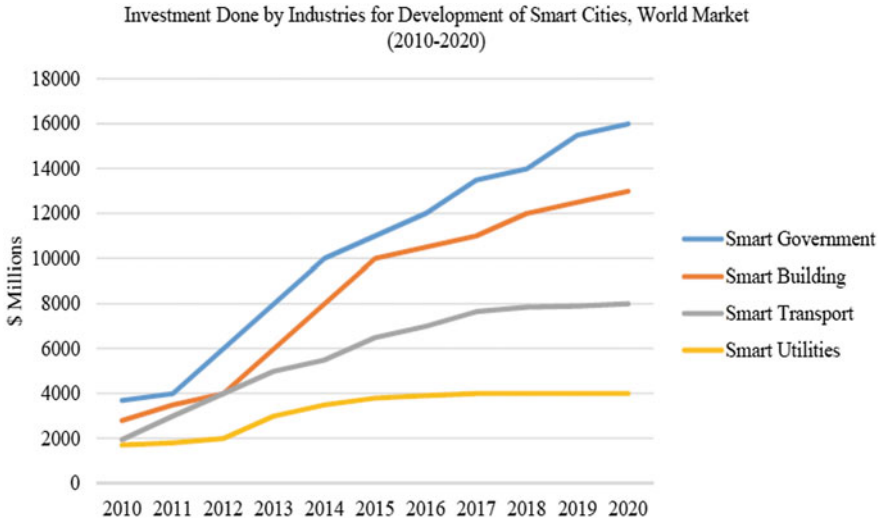

Fig. 2 Investment is done by industries for development of smart cities, world markets: 2010–2020

3.2 Pull Side of Demand for Smart Cities

The concept of a smart city has been popularized in order to overcome the challenges that arise in the city such as the poor economy, need of the city. The first need for a smart city is urbanization. Already since 2008, the global urban population is considerably higher as compared to the rural area, and valuation expects that this drift is expected to discontinue but be strengthen too as reported by United Nations, 2012. The impact of this trend seems to create challenges in terms of resource efficiency and social sustainability. The other major challenge is the impact of urbanization on climate change and the use of non-renewable resources [26–29]. The scarcity of non-conventional energy resources has become the talk of the town. Furthermore, the recent financial crisis acts as a bottleneck for narrowing down the spending on urbanization. Ultimately, in the era of worldwide products/services, people, and data flow, the perpetual standing competition among the cities have become more intense. The smart cities contest to appeal to investors, foreigners, travellers and international events. Overall, the government will have to deal with more improved and services that are customized in a preview of attracting and sustaining vital resources [30].

4 Sustainable Development of Smart City—Bhubaneswar

4.1 About Bhubaneswar

Bhubaneswar is the capital city of state Odisha that is rich in its culture, tradition, contemporary architecture and is the soul of incredible India. However, the modern city was premediated in the year 1946 by German architect 'Otto Konihsberger', long back in the second century B.C the foundation of the city was traced during Chedi dynasty. This city is also known as 'Temple City' as all most 500 temples have been found that includes the prominent Lingaraj Temple, Rajarani Temple and Mukteswar Temple. Other than these prominent temples the city also has Buddhist and Jain destination that attracts traveller to the city. Apart from a tourist destination, Bhubaneswar has been emerging out as a hub for education, healthcare, ICT. The city holds the fame of one of the 'Information technology investment regions' and holds one of the top five Indian companies. Bhubaneswar has also been certified by the World Bank as the third best place to do business. According to the 2011 census data, the population of Bhubaneswar has drastically increased by 160% during the span of 30 years from 1981 to 2011. The conceptualization of smart city and to Bhubaneswar into this category was done in the year 2015 when the population was 9.74 lakhs and out of this 52.9% were male and 47.1% were female. The population density of this city is very low as compared with other proposed smart cities. Majority of the population reside in the rural area [31].

After listing of the smart cities by the government the next step is to look for the development of the smarty city project. Therefore, the government of India proposed the formulation of Special Purpose Vehicle's (SPV) as per the guidelines mentioned in the Smart Cities Mission Statement and Guidelines. SPV is the nodal agencies for implementing smart city projects. The SPV's formed to have the power to execute actions such as arranging for funds for investment, coming up with an agreement through private player for joint ventures, selling off assets with permission from the state government [31].

4.2 Smart City Development—Bhubaneswar

- **Non-conventional Energy and Sustainable Solutions**
  The essential requirement for a smart city is to ensure that 10% of the total power consumption is generated from renewable resources. This is a step towards harnessing renewable resources in all the listed smart cities. To meet this prerequisite, a 'Solar City Program' has been proposed by Bhubaneswar. This program shall consist of generating 11 MW of power supply, which is expected to be around 11% of the total energy consumption by the city in 2020.

- **Sustainable Option for Developing Transportation Facility**
  The shortlisted cities have started concentrating on improvisation in mobility and transportation. The steps taken by Bhubaneswar city for mitigating this point has been very innovating in nature. The city has adopted a public bicycle sharing system to cultivate a transportation system that is sustainable for the city. This step shall reduce traffic congestion. This step shall strength the look of the city by providing wide roads and retrofitting of circular roads [32].
- **Provision of Housing**
  The smart city proposals documented previously focused on providing housing to lower-income group (LIG). The provision for providing housing was under the national schemes or under the state-specific programs. The city like Bhubaneswar ensured developing "Slum-Free City Plans of Action" for accessing the resources allocated under the discontinued scheme of Rajiv Awas Yojna (RAY). Under the provision related to homelessness, the central government has allocated funds to all the state government across India for constructing and maintaining a shelter for the homeless. The spending in this area has been very low and it is claimed that there would exist diversion of funds to few states. As per the report generated in September 2017 of the aggregate central capital of Rs. 1029 crores intended for SUH-NULM (National Urban Livelihoods Mission). The total amount that has not been spent by states is about Rs. 412 crores [33].

4.3 Enforced Dislodgments, Enforced Acquisition of Land and Transposition

Reportedly, enactment of the plan for a smart city in Bhubaneswar was anticipated to result in the dislodgement of 10,000 families or about 50,000 people for settlement. Approximately, 50% of the city population is surviving in the lower-income group. The state government of Odisha has still claimed that the evicted people have been planned to be given space in four locations at Saheed Nagar, Shanti Nagar, Kharavela Nagar, and Bapuji Nagar. The transportation lodging for the affected families has been provided in the areas namely Niladri Vihar, Gadkana, Patia and Ragunathapur. Thus, we can say that relocation of these family has adversely affected them by loss of livelihood, adverse effect on the education of children. A few cities have shown interest in giving priority for sustainable development by focusing on disaster mitigation. Bhubaneswar has committed to employing a strategy for management of disaster and restoration [33].

4.4 Dependency on Investment by Other Countries

The main objective of the Mission for a smart city is to block investment by foreign countries in the projects and development of a smart city. With the commencement

of the various smart city projects, foreign investment is one of the major concern. Several foreign governments along with international agencies have shown interest and committed to investing in the smart city projects for supporting the mission. Few countries that have shown their interest in investing in the smart city include Canada, China, France, Taiwan, Singapore, United States of America (USA), United Kingdom. The discussion with different foreign banks such as the World Bank and the Asian Development Bank (ADB) has carried out for acquiring a loan worth 500 million pounds and one billion each from each of these banks. The foreign bank that has assured to assist Bhubaneswar in the smart city development is the Asian Development Bank by funding a project worth Rs. 210 crore and to offer methodological support.

4.5 Advancement of Smart Cities

Apparently, one of the proposed smart cities Bhubaneswar has been doing rapid progress in the implementation of Smart City Mission projects. As per the American Planning Association, the planning of Bhubaneswar city has been awarded as the best "smart" city. It has also got the place amongst the top 20 worldwide smart cities by a British Research Agency named Juniper Research. Newscast reports show one of the projects that the bicycle-sharing system has already been completed along the path for the pedestrian as presented in Table 1 [33].

5 Challenges in Execution of Smart City Mission—India

It has been reported that out of the 99 selected smart cities majority of these have witnessed challenges in the implementation of smart city projects and goals identified for the proposal of smart city and also faced resistance from the residents. The other major challenge faced by the few 'smart cities' is related to the water supply. One of the projected smart city is Shimla that perceived a critical water crisis during the period May–June 2018 that resulted in protest from the residents. The next challenge in the projects of a smart city is the inadequate drainage system that leads towards water logging in low-lying areas. The lowland areas are majorly occupied by the lower-income groups and the marginalized sections get flooded. The cities that face major water logging problems every year are Delhi, Bhubaneswar, and Bengaluru. The other external environment challenges for the development of proposed smart cities consist of official challenges, marketplace and commercial-linked challenges, and area-precise challenges. With reference to the survey carried out by World Economic Forum's India, it has been observed that majority of the states were least prepared for the transformation planned by the government of India [32, 33].

Table 1 Strategy for marginalized groups in the selected smart city proposals

S. No.	Particulars	Description
1	Proposed smart city	Bhubaneswar
2	The acres of land that is proposed to be developed	985 acres Depiction: It is planned to develop Bhubaneswar Town Center District nearby the main railway station area that is considered to be the heart of the city
3	The total area of the city covered in percentage	3%
4	The population of the city affected by area-based development in percentage	4.7%
5	Slum/settlement living population (%)	It is 18.52% with reference to the census report
6	SWOT analysis in terms of the city's housing	Informal settlement in Bhubaneswar has increased due to the deficiency of reasonable accommodation that has been considered as a 'weakness'
7	Strategic intermediations for considering housing for demoted clusters, comprising the homeless	Safeguarding neighbourhoods have varied housing selections to come across the requirement by different income groups. Revitalize comfortable clearances with an endowment for basic services Some strategic works comprise of: • Utilizing the scheme under the mission Abaas, 'slum' redevelopment for construction 6000 houses • Developing hostels for working women and providing shelter to needy families under project Kutumb
8	Other significant provisions for marginalized groups	• Development of Project Samman basically focusing on women sanitation • Infrastructural development for disable persons • An endowment of supported cooked lunchtimes through Aahar Scheme and providing decontaminated water through water Automated Transfer Machine (ATMs) • Formation of crèches through a model of Anganwadi centres. 40 such centres have been formed for child care that reassures sensible primary juvenile growth

6 Recommendation and Conclusion

The proposed smart cities today need an adequate amount of data for their completion of operations if the cities target to achieve sustainable development this requirement will increase with time. Therefore, focus on IoT and ICT is vital along with technological development as discussed in this research paper. Smart city applications need to have the potential in reducing the urban energy use, reduction in greenhouse gases, and developing a better urban environment for the existence of life and also to help in mitigating global warming. This research paper has also focused on the challenges faced by smart cities for implementing the planning and proposed strategy. The strategies formulated for smart cities play a decisive role in the cities plan to take the advantages of the technology, innovate resources and dynamic economy. This is why it is essential to study the methodology and interconnectivity between policy design and policy implementation for the development of a smart city. Therefore, it is essential to study all the goals in the development of the smart city for attaining sustainability. To achieve tangible socio-economic and urban advancement results, smart cities need to be planned strategically. Further research can be carried out in this aspect.

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Selfie Sign Language Recognition with Shape Energy Features and Mahalanobis Distance Classifier

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1 Introduction

Sign language is based on hand moments along with facial expressions. It helps the hearing impaired to communicate with normal people. The gesture is either dynamic or static. The better sign language recognition (SLR) requires tracking and orientation of head and hand. [1].

P. V. V. Kishore proposed video segmentation methods to detect hand shape and head positions using wavelets [2].

N. Tanibata et al. [3] used orientation of hand portion, the flatness and area of hand portion.

Parul et al. [4] used height of hand portion, centroid and area of hand portion and distance of the centroid of hand portion from origin of the frame

In SSLR, the videos recorded by the smart phone front camera are converted into text or voice. Pre-filtering is to remove video capture noise during video recording. Hand and head portions are segmented from the frames which are used to generate feature space. Features are generated in two methods. The performance of SSLR is

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verified with two feature extraction models by applying to Mahalanobis classifier individually [5].

This paper consists of methodology and mathematical models to extract hand shape and contour, results and discussions, conclusion of proposed SSLR in the following chapters.

2 Feature Models and Classification

The smart phone front camera is used to capture selfie sign videos with the help of selfie stick. Video database of 18 Indian signs for ten different signers is created.

2.1 Hand Shape and Contour Generation

Gaussian filter $f(x) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{\frac{-(x-m)^2}{2\sigma^2}}$ with zero mean and standard deviations $\sigma = 0.01, 0.1, 0.15$ are used to remove the capture noise (Fig. 1).

The 2D gradient sobel edge operator is applied on every pre-filtered frame which gives the information regarding the data change in the maximum change direction. Gradients g^x and g^y in the directions x, y for every frame are calculated by

$$g^x = \sum_{m=1}^{N} f(x-m, y)g(\mathrm{k})$$

$$g^y \sum_{m=1}^{N} f(x-m, y)g^{\mathrm{T}}(\mathrm{k})$$

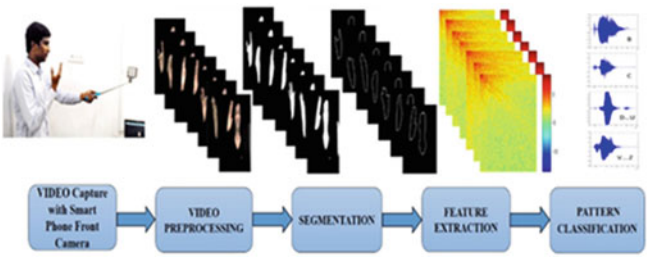

Fig. 1 SSLR flow chart

where gradient operator g is [+ 1, −1]. Gradient magnitude is given by $\sqrt{((g^x)^2 + (g^x)^2)}S^x = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$ and $S^y = \begin{bmatrix} -1 & -2 & -1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}^T$ are the Sobel 2D convolution masks used to generate binary image with block thresholding.

$$B^x = \sum_{x=1}^{M} \sqrt{(S^x \otimes f^x)^2 + (S^y \otimes f^y)}^2 \geq \sum_{i=1}^{s} \sum_{x=1}^{M} \sqrt{(S^x \otimes f^x)^2 + (S^y \otimes f^y)}^2$$

where size of block is s. It is a faster method which decreases background variations automatically. Figure 2 shows block thresholding and global thresholding (0.2) binary images.

Morphological gradients on the binary image with connected component analysis generate hand head contours given in the following expressions.

$$h^c(x) = \left\{ z \middle| \left(\hat{M}_{3H} \right)_z \cap B^x \neq \emptyset \right\} - \left\{ z \middle| \left(\hat{M}_{3H} \right)_z \subseteq B^x \right\}$$

$$h^c(x) = \left\{ z \middle| \left(\hat{M}_{3v} \right)_z \cap B^x \neq \emptyset \right\} - \left\{ z \middle| \left(\hat{M}_{3v} \right)_z \subseteq B^x \right\}$$

$$h^C(x, y) = h^C(x) \oplus h^C(y)$$

where M_{3V}, M_{3H} are line masks in vertical and horizontal directions (Fig. 3).

Fig. 2 **a** Block thresholding binary image. **b** Global thresholding binary image

Fig. 3 Frame No. 78 Binary Frame, hand portion Cont. head portion Cont. head and hand contours

Four neighborhood pixel operations are used to separate hand and head contours from the contour, i.e., $h^c(x, y)_{\text{hand}}$ and $h^c(x, y)_{\text{head}}$.

3 First Feature Extraction Model

As most of the sign are based on hand gestures [6], the hand and head portions are separated. The following features are extracted using region props. Feature vector generated for each frame.

i. Average Height (AH) of a Sign: AH of a hand segment in the segmented hand frame based on pixel scanning method is given by
AH = P/Q.

   where P is no. of black pixels of hand shape frame and Q is no. columns which have more than 0 black pixel. Now, the feature vector is given by the above four samples.

ii. Area A: A is white pixels count (pixel value '1').

iii. Centroid = X_h, Y_h) = [Round (Σ(white boundary pixels x coordinate values x_p)/A), Round (Σ(white boundary pixels y coordinate values Y_p)/A)] i.e., $X_h = \Sigma\, x_p/A$ and $Y_h = \Sigma\, y_p/\text{A}$

iv. The Euclidian distance between the top left pixel to centroid is given by $d = (X^2 + Y^2)^{½}$.

4 Second Feature Extraction Model

Hand contour DCT $h^C(x)$ is given by

$$F_{uv}^{V} = \frac{1}{4} C^u C^v \sum_{x=1}^{M} \sum_{y-1}^{M} h^c(x, y)_{\text{hand}} \cos\left(u\pi \frac{2x+1}{2M}\right) \cos\left(v\pi \frac{2y+1}{2M}\right)$$

here $C^u = C^v = \frac{1}{\sqrt{2}} \forall (u.v) = 0$ and 1 elsewhere. The color coded DCT of hand contour is shown in Fig. 4.

The maximum energy is concentrated in first 50 × 50 matrix. These 2500 costs more execution time. To reduce the execution time 50 × 50 feature matrix is optimized with PCA to generate feature vector with 50 samples [7].

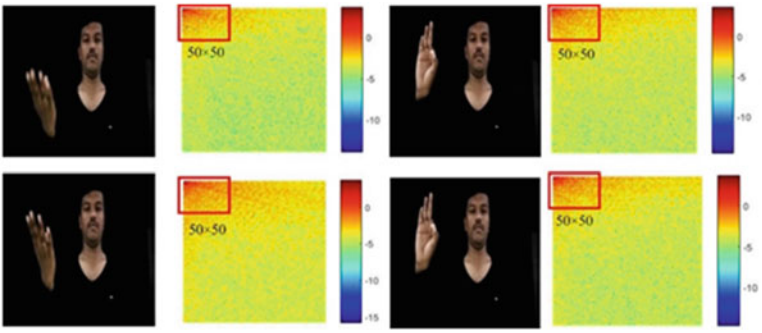

Fig. 4 Hand contour energy (DCT)

4.1 Classification

Mahalanobis distance classifier is used for the sign classification. The extracted feature vectors are used to train and test the distance classifier. The word matching scores are observed compared for the two feature models.

5 Results and Discussion

The smart phone front camera is used to capture selfie sign videos by holding the mobile phone with selfie stick. We created the video database of 18 Indian signs for ten different signers.

Visual Analysis
The selfie sign video database is created for 'Hai,Good, Evening, Nice, To, Meet, YOU, I, Am D,H,R,U,V,A,Thank, You, Bye.' These eighteen words are kept sequential for training and different order for testing video. The sample frames and segmented hand head portions, contours are shown in Figs. 5 and 6.

In the next section, the performance of SSLR with the two feature models is analyzed using Mahalanobis distance classifier.

Performance of SSLR system with Mahalanobis distance classifier
Word matching score is given by

$$\text{WMS}, \%M = \frac{\text{Correct Classifications}}{\text{Total tested Signs}} \times 100$$

The results of classification are presented in this section. Training and testing is done with 18 signs of ten different signers (180 signs).

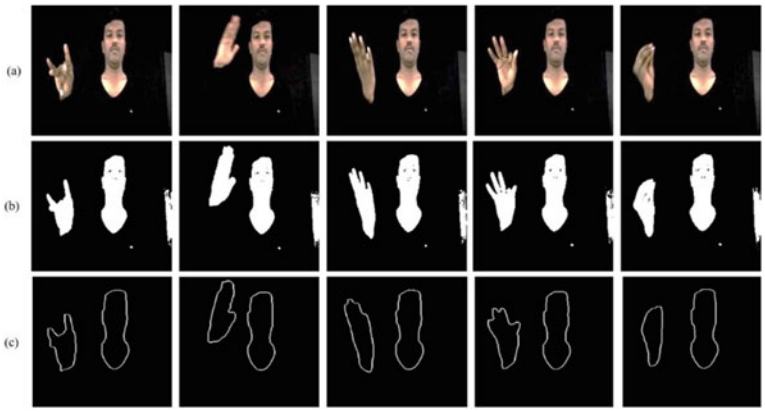

Fig. 5 Row-1: RGB frames Row-2: Segmented hand and head. Row-3: Hands and head contours

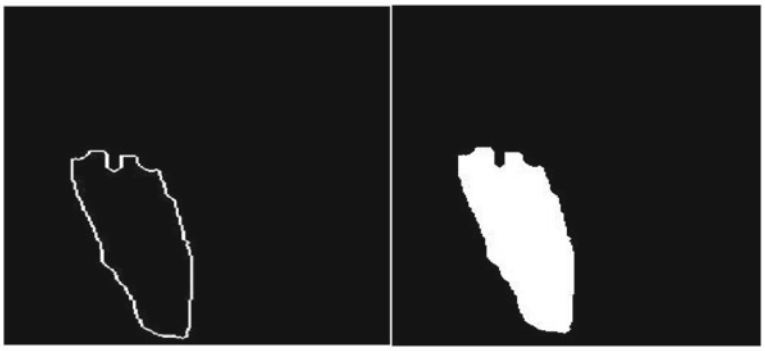

Fig. 6 Separated hand portion (left) and contour of the separated hand portion

The word matching score obtained with first and second method of feature extraction models is presented in Table 1.

We observed the recognition rates with different number of sets for training and testing. The average recognition rate achieved with the first method of feature extraction is 74.11% and with the second method of feature extraction is 85.88% which are presented in Table 1. % Recognition with the proposed feature generation methods is shown in Fig. 7.

6 Conclusion

The SSLR system is simulated and tested. Created video database of 18 Indian signs for ten different signers. The hand shape and contours are generated. The features

Table 1 The performance of SSLR for two methods of feature extraction using distance classifier

SIGNS	First method of features	Second method of features
HAI	77	80
GOOD	73	77
EVENING	50	75
NICE	50	75
TO	70	90
MEET	58	80
YOU	62	78
I	90	85
AM	79	85
D	90	90
H	85	100
R	90	100
U	85	100
V	90	95
A	90	98
THANK	58	80
YOU	60	80
BYE	57	80
Average WMS	74.11	85.88

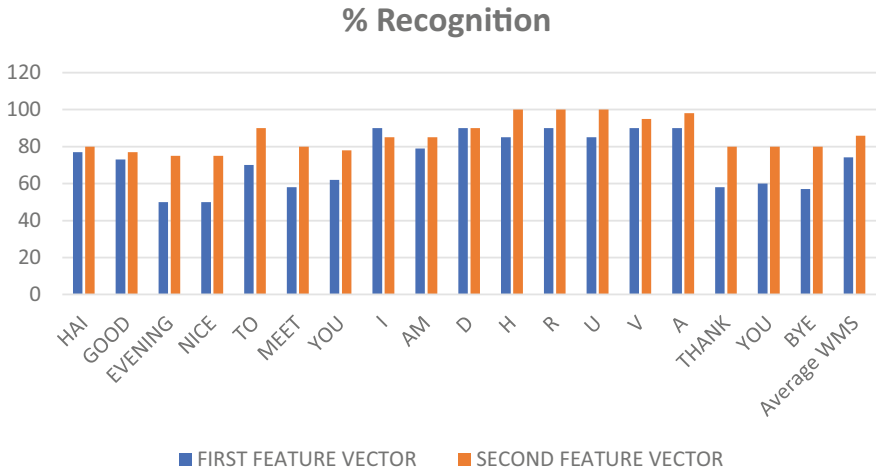

Fig. 7 % Recognition with the proposed feature generation methods

vectors are obtained in two methods, one with the height of hand shape, centroid and area of hand shape and distance of the centroid of hand portion from origin of the frame and the other with hand contour energies optimized with PCA. The performance of SSLR system for the two methods of feature vector generation is compared with the word matching score using Mahalanobis distance classifier. The word matching score with the contour energy features is improved by 10% compared to that of the feature vector with height of hand shape, centroid and area of hand shape and distance of the centroid of hand portion from origin of the frame. Further work needs the improvement in feature set and the classifier models.

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Centralized Intelligent Authentication System Using Deep Learning with Deep Dream Image Algorithm

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1 Introduction

Biometrics contribute significantly to the field of information security and play a cardinal role in the area of authentication and access control. Biometric is metrics concomitant with human attributes. Biometric authentication is a mark of identification [1] and is channelized into a wide arena of applications both for personal and industrial needs. Biometric authentication is an encapsulation of biometric identifiers and high-end processing algorithms. Biometric identifiers are classified into various characteristics. One such type of characteristic deals with body shape such as Finger vein recognition, palm print, etc. The other type of characteristics deals with the behavioural patterns. Examples include gait, voice, typing rhythm, etc.

Multi-biometric system is an advanced technology that fuses various biometrics [2] or different sets of the same biometrics in order to tighten the security and prevent the system from spoof attacks. Multi-biometric systems have a higher rate of security [3] when compared to the unimodal biometric systems. The fusion of the different biometrics or different sets of the same biometric takes place in different stages of the processing stage. These algorithms strengthen the core of the entire system.

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Various algorithms are used for processing the biometric input. CNN is one of the most enhanced and highly accurate algorithms that has a higher rate of recognition and accuracy. It works on the principle of biological visual cortex. The neurons in the brain are the study pattern and origin sets the base of this algorithm. These neural networks are used in various arenas of a processing stage such as object detection, image classification, image enhancement, etc. It consists of many layers that have their own specific functionalities and process the image gradually taking care of the minute features of the image. CNN has a specific workflow that includes loading the data, analyzing the data, data pre-processing, creating the network, modelling the data, training the model, model evaluation of the test set, predicting labels, and finally creating the classification report. Once the image input has been processed and matched, the processed and matched input [4] were mapped to the user-specific application or the industry-specific application.

Biometrics has a wide space of applications that includes specific and combined applications [5]. Specific applications include recognition and matching whereas combined applications include recognition, matching and transmission of the data. Data transmission plays a vital role [6] in various varieties of application-based needs. GSM is one of the most common means of transmission. The security breach has been notified via sending a message to the authorized person using GSM.

The distinct characteristics of the proposed can be described in three-fold, namely first to propose a combination of Vein and Iris biometrics. Secondly, the input images are processed using CNN algorithm. The deep dream algorithm accompanies CNN to help the network reduce categorical errors. Thirdly, GSM along with an alert system has been used, which effectively helps in notifying the supervisory authority, if the system is being trespassed without proper authentication.

The paper contains the introduction of Centralized Intelligent Authentication System using Deep Learning with Deep Dream Image Algorithm. Section 2 gives a list of all the related works that have been used in this paper to make it more informative. Section 3 contains the System Architecture and the usage of components that have been used in the following system. Section 4 discusses the Results where an overall experience on the possibilities of the various optimizers used and the alert system. Section 5 concludes and discusses the future work.

2 Related Work

A new multi-biometric system with many traits such as face, voice and iris are integrated [7] with a multi-model biometric system to overcome the limitations of unimodal biometric systems. ROC curves of the three single biometric were plotted to compare the accuracy rate of each system. The result obtained from the ROC curves states that the multi-model system provides better accuracy than the individual system.

In [8] the authors had proposed a new concept in the year 2018 that is CNN for extracting the features and identifying the user. The authors observed that in the

field of authentication of biometrics, CNN produces a result with a roughly 100% accuracy rate. The layers which have the capacity to produce high-quality results are fully connected and convolutional.

In [9] various biometric systems are compared. The extraction of features has been done by CNN. According to the author, the multi-model gives a result of high accuracy along with excellent performance as compared to the unimodal. It has also determined the score level fusion gives 100% accuracy than feature level fusion that gives only a rate of 99.22%. In [10] the system which uses both CNN and SVM based on a different level fusion has been proposed, where CNN is used for high accuracy whereas SVM is used for classification. The authors have concluded that the system is robust, reliable compared to the existing ones

3 System Architecture

The Proposed System Architecture of multi-biometric with an alert system is as shown in Fig. 1. The entire system has been divided into three parts. In the first part,

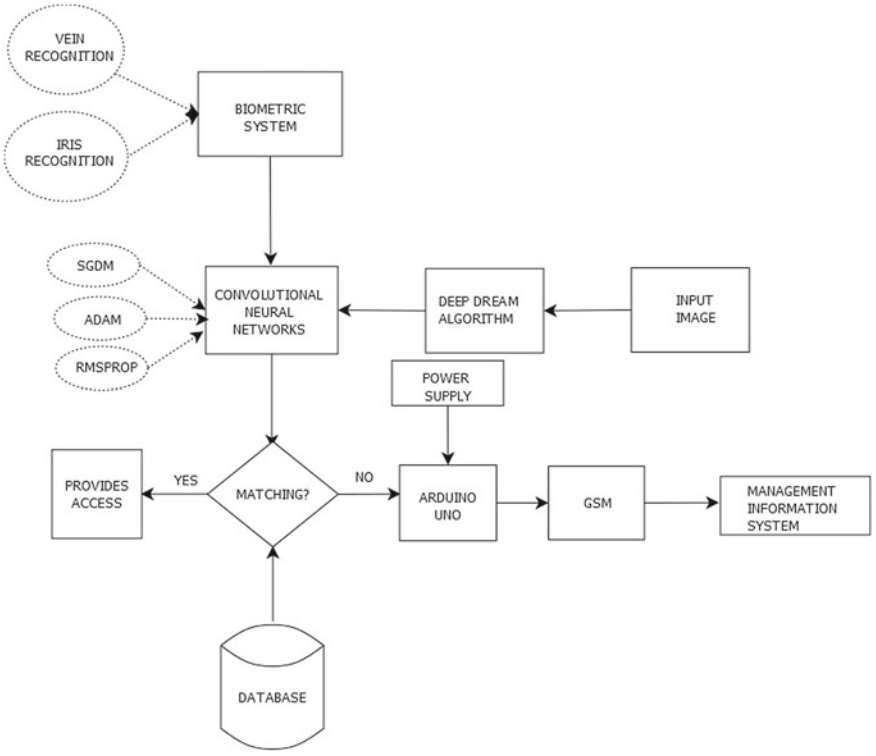

Fig. 1 Architecture of multi-biometric with an alert system

the input images of iris and finger veins are obtained using the biometric devices, and the images are pre-processed, cropped, resized and then integrated with CNN. In the second part, three different optimizers are used and they are varied with each simulation to obtain the most efficient optimizer. Some of the hyperparameters has been changed to calculate the loss and gain accordingly. In the third part, GSM along with an alert system is used, which effectively helps in notifying the supervisory authority, if the system is being trespassed without proper authentication.

The process of the system considers the input image of the vein and iris biometric has been taken with the help of biometric devices, respectively. The image is sent to the pre-processing stage that helps in cropping and segmenting the given input image to a constant size. The input image after getting pre-processed [11] gets converted from RGB to grayscale to make extraction easier as it doesn't have any colour information. After the input image was pre-processed, converted, and then operated by CNN. Next, the image has been processed by the deep dream image algorithm that highlights the important features. This highlighted image has been passed to the layers in the CNN. The training of CNN was done with three different optimizers namely: SGDM, RMSPROP, ADAM [12] for the comparison of the best system in terms of speed, accuracy, etc. These processed trained input images are matched with biometric images of the authorized person from the database and thereby the results are obtained. While matching takes place, the system has been subdivided into two parts based upon the results of matching. If matching takes place successfully for all the mentioned biometrics, the person was given access to the system. Else, the system passes through the security control that triggers GSM present in the system. The GSM helps in transmitting messages to the concerned authority if the security breach takes place.

3.1 Deep Dream Image Algorithm

Deep Dream Image is a visualization technique that deals with the features of a specimen by processing images in the network layer. The algorithm uses gradient ascent [12] that is set equal to the activations from that layer done on the image. Therefore, this maximizes the activations of that layer. The way deep dream algorithm can be used is: (1) The given input image is passed to the deep dream algorithm where the network has been trained along with backpropagation to modify the input image in turn to diminish categorization errors. (2) When the image input has been given into the network, this algorithm utilizes to emphasize the essential features in the specified input image. These layers can extract out those features exactly rather than focusing on the other features. The important advantage with the latter one is that the weights are not mandatory to be changed when the classification error occurs. Instead of varying the weights of the network, it can also be rectified by highlighting the other features which are not highlighted before. Therefore, the proposed work prefers to go with the latter use.

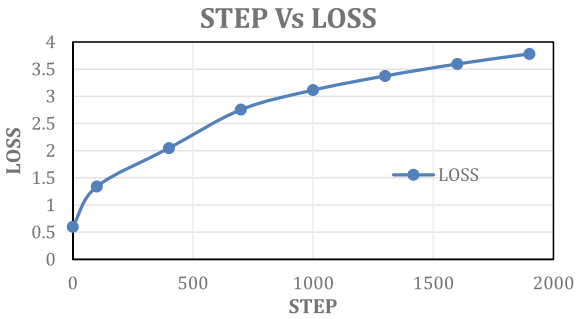

Fig. 2 Graphical representation of step versus loss

Fig. 3 Feature extraction at different steps in the process

Generally, the proposed work tries to decrease the loss using a gradient descent algorithm. But in this case, the loss is increased by using gradient ascent. The step is initialized to 100 and step size to 2000 as referred in. As the step increases, the loss to gets increased in gradient ascent.

The graph between step and loss has been observed as shown in Fig. 2. It has been noticed that as the step is getting increased, so does the loss as per the requirement of a deep dream image algorithm. As the loss has been increased, the features that are not required for pattern matching were removed and the ones that are required for matching only will be present. This could be inferred from the pictures below as shown in Fig. 3. The proposed work has experimented with the total steps of 2000 and was successfully able to verify the algorithm with the proof that loss has been increased with the step.

3.2 CNN Architecture

The architecture that the proposed work consists of input layer, three convolution layers namely (conv1, conv2, conv3) and one fully connected layer. Conv1 is the first layer that has 32 kernels of filter size 3X20 followed by ReLu (Rectified Linear Unit), Batch Normalization and Dropout layer with probability 0.5. The other layers

Table 1 Layers of ConvNet and parameters

Model	Conv1	Conv2	Conv3	FCL
4 Convolution layers & 1 Fully connected layer	32 × 3 × 20 ReLu Batch Normalization Dropout (0.5)	64 × 3 × 20 ReLu Batch Normalization	64 × 3 × 20 ReLu Batch Normalization	Dropout (0.75) SoftMax

Table 2 Optimizers used and its hyperparameters

Optimizers	Hyperparameters
• SGDM • RMS Prop • Adam	• Momentum: 0.9000 • Initial Learning Rate: Varies • L2 Regularization: 1.0000e-04 • Max Epochs: 20 • Mini Batch Size: 64 • Verbose: 1 • Verbose Frequency: 50 • Validation Frequency: 50 • Validation Patience: Inf

are conv2, con3 which are followed by ReLu, Batch normalization. Fully connected layer has a by Dropout (0.75) and a Softmax classifier. The parameters of the network are as shown in Table 1.

The Iris and Finger vein biometric are experimented with three different optimizers [13] as shown in Table 2 and learning rates i.e., 0.0001, 0.5, 0.9 are as shown in Table 3. The time elapsed to train the network using the optimizer and mini-batch accuracy is noted.

4 Results and Discussions

The experimental outcome discussed in the proposed work gives clarity about the feature extraction at different layers, Mini batch accuracy over the Learning rate and activation strength variations for iteration level.

4.1 Activations of CNN Layers

CNNs are networks where consecutive layers are processed based on output of the preceding layer. The input image is directly operated by the foremost convolutional layer. Irrespective of the work the CNN is assigned for, this layer will comprehend to identify cosy patterns from images, such as edges and colour and therefore the strides are more spacious. In comparison with the previous layer, the following layers tend to comprehend to identify difficult patterns, such as corners and textures. Hence, the

Table 3 Performance analysis of optimizers used and its parameters for multi-biometric

Biometric type	Optimizer	Learning rate	Time elapse (s)	Mini batch accuracy (%)	Mini batch loss	Output status
Finger Vein	SGDM	0.0001	30	100	0	Matched
		0.5	25	35	1.3761	Unmatched
		0.9	30	30	1.4104	Unmatched
	RMS Prop	0.0001	34	100	0	Matched
		0.5	25	30	1.4034	Unmatched
		0.9	28	25	2.0468	Unmatched
	Adam	0.0001	54	100	0	Matched
		0.5	30	35	1.3755	Unmatched
		0.9	30	20	2.0789	Unmatched
Iris	SGDM	0.0001	10	100	0	Matched
		0.5	8	30	2.0546	Unmatched
		0.9	7	30	2.0984	Unmatched
	RMS Prop	0.0001	10	100	0	Matched
		0.5	6	25	2.1675	Unmatched
		0.9	7	25	2.2567	Unmatched
	Adam	0.0001	10	100	0	Matched
		0.5	6	40	1.9346	Unmatched
		0.9	7	35	2.0789	Unmatched

layers get congested in order to extract the complex features. The final set of layers comprehends to identify difficult patterns in relation to the duty CNN is assigned for and the strides become colourful and these strides help in classifying.

As shown in Figs. 4 and 5, the image has been taken as the input and is converted to a binary image by thresholding the ROI to avoid the inter-class variations. The input image is passed to the convolution layer to extract the important features that are necessary. The ReLu activation is then applied to the image to increase the non-linearity thereby removing negative values from the image. As seen, Max pooling layers are dark in nature to grab maximum value in the image and also to avoid

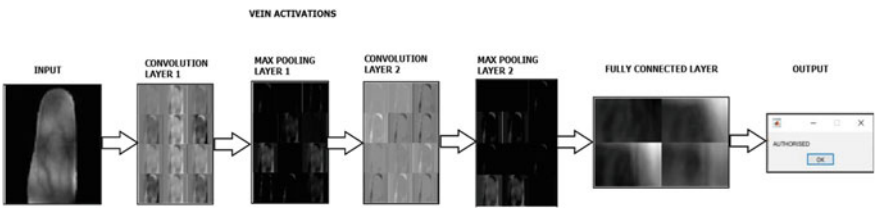

Fig. 4 Activations of finger vein input at various layers of the network

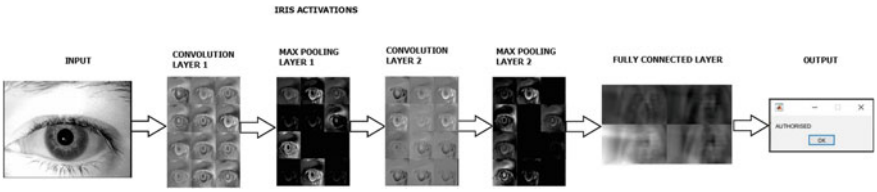

Fig. 5 Activations of Iris input at various layers of the network

areas that are not the features of the images. By this, the parameters are reduced and therefore the model won't overfit on that information. The interconnection between the neurons of the consecutive layers is done by a layer named fully connected layer that results in an 'N' dimensional vector. The desired classes are quantized in this layer. After the processing of the image by this layer, the image is classified on the basis of softmax classifier and the matching output has been displayed.

4.2 Graphical Results

The graphs obtained show the efficiency of three different optimizers namely SGDM, Adam and RMS prop plotted against learning rate and mini-batch accuracy. The comparison between these optimizers obtained represents the most efficient and accurate optimizer for different input images.

The input images are trained and iterated more than 20 times. The mini-batch size for the training of layers is set as 64. The layers are trained with the above-said optimizers with different learning rates. The input image as finger vein is shown in Fig. 6 and iris is shown in Fig. 7. Adam optimizer gives the peak value of accuracy rate for iris recognition. SGDM optimizer gives the peak value of accuracy rate for finger vein as the mini-batch accuracy rate is one hundred percent for the first three learning rates (0.0001, 0.001, and 0.01) and gradually decreases for the rest of the learning rates. The other optimizers show a hundred percent accuracy only for the first two learning rates (0.0001, 0.001) and show a steep decrease for the rest of the

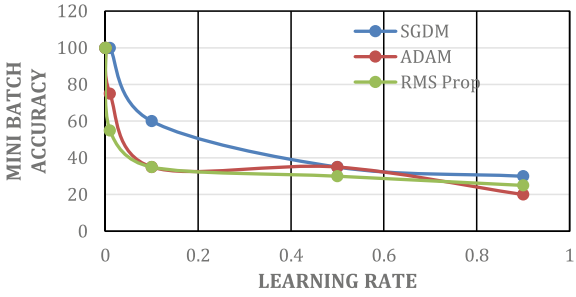

Fig. 6 Mini batch accuracy versus learning rate for finger Vein biometric

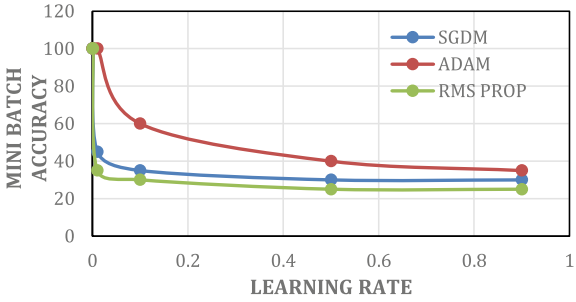

Fig. 7 Mini batch accuracy versus learning rate for Iris biometric

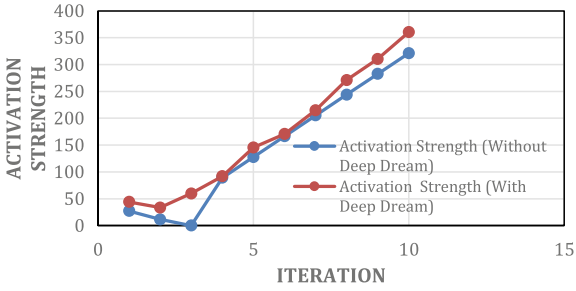

Fig. 8 Graphical representation of activation strength variations

learning rates. The loss is minimized for Adam optimizer in case of iris biometric and SGDM optimizer in case of finger vein. The time elapse for finger vein biometric is comparatively lesser than iris biometric.

The Activation strength was varied with respect to iterations is shown in Fig. 8. The result was observed with convolution layer 1. The proposed work clearly infers from the graph that Activation strength with deep dream has been increasing when compared to activation strength without deep dream. It was also observed that the frequency of categorical errors has been very much decreased when using deep dream algorithm.

5 Conclusion and Future Work

Combination of various biometrics quiets the concern of security in secured places. The network that the proposed work experimented on contains 4 convolutional layers and 1 fully connected layers. The problem of overfitting was not observed due to the hidden layers. CNN algorithm has been used for processing the acquired images and for classifying the images. The Deep dream image algorithm has been applied and concluded by its graphical representation that it improves the activation strength of layer thereby reducing the frequency of categorical errors at the output. Three optimizers namely Adam, RMS prop, SGDM has been used for simulation and its performance was compared based on learning rate and their accuracy. From the above

results, it can be concluded that Adam provides higher stability in the network with respect to increase in learning rates. An alert system is adjoined with the biometric system for warning the security breach and a message has been sent to the authorized person via GSM. In the future, Learning rates can be increased therefore the time elapsed for the training could be increased. The net can be stimulated further by using other optimizers such as Adagrad, Adadelta, etc. GSM can be replaced by any other faster means of communication.

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Automatic Threat Sensing and Monitoring System for Woman Safety—RAKSHAK

Shivam Pandey, Rahul Kumar Barik, Somya Gupta, and R. Arthi

1 Introduction

In today's scenario, the safety of women is the major concern, and if we consider India, it needs immediate attention. In our country, rape is the fourth most common crime against women; most of these cases go unreported because the victims fear humiliation and retaliation. According to a study by the United Nations of 57 countries, only 11% of several rape and assault cases worldwide are ever reported. The study and numbers are more than enough [1] to motivate anyone to do something against it.

The rate at which cases such as harassment, absconding, rape, molestation, eve-teasing, domestic violence and kidnapping that are increasing shows a clear indication toward the breach of women safety. Certain actions and programs have been taken by many bodies but are still not effective. The laws and regulations are firm but the number of cases reaching the law is less. Now for such incidents, it is necessary that all cases get filed for further investigation.

On the implementation of such a system as shown in Fig. 1., the proposed work promises the female society a comfortable environment, where they can feel safe

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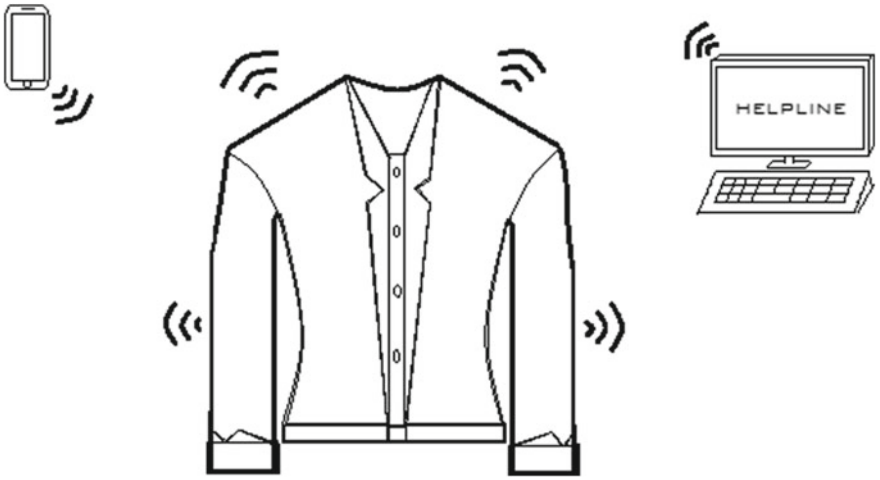


Fig. 1 Schematic of the safety jacket

even at the odd hour's late night. The safety system comprises of a skeleton of piezo-sensors placed in all the sensitive areas where the molester is likely to make impact. When such a situation arises, the system makes sure it records all the impacts and touches and segregates into healthy or unhealthy touches.

Now, if the number of unhealthy touches exceeds the threshold impact, it sends an automatic danger signal to the nearest police station as well as to the emergency contact numbers with the exact latitudinal and longitudinal co-ordinates which can be further traced via the Google maps. With such an approach, it is made sure that no cases go unreported and so that each of them gets filed. It eases the work of police as the search perimeter of the victim decreases, and hence, the search can be made more precisely. The sole purpose of such an initiative is to make sure that safety will never be compromised.

The proposed contains the introduction to the automatic threat sensing and monitoring system where the user gets to know about the actual application of this technology. Section 2 gives a list of all the related works that have been used in this paper to make it more informative. Section 3 contains the methodology and the usage of components that have been used in the following system. Section 4 discusses about the results where an overall experience on the possibilities of the safety jacket proves to be more secure. Section 5 concludes the proposed work about the safety of women and children.

2 Related Work

The existing work discusses about a wearable device [2] for the safety of women and children where a touch sensor was used to detect a touch from a stranger and the

GSM, GPS were used to send a SMS. In [3], a paper with women safety jacket where a switch on the jacket when activated would send a SMS via the GSM. A paper on an electronic jacket that consists of a push button [4] which when pressed activates the entire system, thereby sending a SMS along with live location using GSM and GPS. In [5], a work with a mobile application wherein the woman can contact the required people via the SOS key press module which sends a SMS. In [6], a paper on woman safety using a vibration sensor which when receives vibrations triggers the GSM and GPS to send a SMS along with the last location. A paper for women safety using smart band consisting of pulse sensor, temperature sensor and motion sensor; when these sensor readings reach a threshold a message [7] is sent along with the co-ordinates using GSM and GPS connected to the smart phone. In [8], a paper on safety device for women consisting of a panic button which when pressed sends a SMS consisting of co-ordinates to the concerned people. Another work on safety device sends an SOS message and call to the concerned people along with live tracking of the woman's location [9]. A wearable smart gadget for women is connected to the smart phone; when the pulse sensor in the wrist band detects high pulse, a SMS is sent via GSM and GPS to the mobile phone [10].

3 Methodology

The safety concern for today's women is the very reason of making this safety jacket. This safety jacket is equipped with piezo-plates distributed in multiple regions along with a heartbeat sensor which detects danger or an attack on a woman and sends a SMS via GSM to the concerned people and the nearest police station server. The safety jacket's main function is to detect a touch which is made possible via the piezo-plates connected inside it. The piezo-plates can differentiate a friendly and non-friendly touch. A friendly touch being light and for a short duration, the piezo-electric signals would be small in value, but in a non-friendly touch, the touch is hard and for a long duration resulting in the piezo-signals to be high which is sent to the Arduino.

The micro-controller then checks for the pulse readings via the heartbeat sensor; if the pulse rate is high, the micro-controller uses the GSM module to send a SMS to the concerned people and the nearby police station servers stating that the woman is in danger along with the location which is got using the GPS module. At the same time, a buzzer is activated to alert the nearby people, and hence, the women can get help.

The overall system is designed as shown in Fig. 2, in such a way that it can monitor major body vitals such as pulse and is portable and wearable integrated with a quick response system.

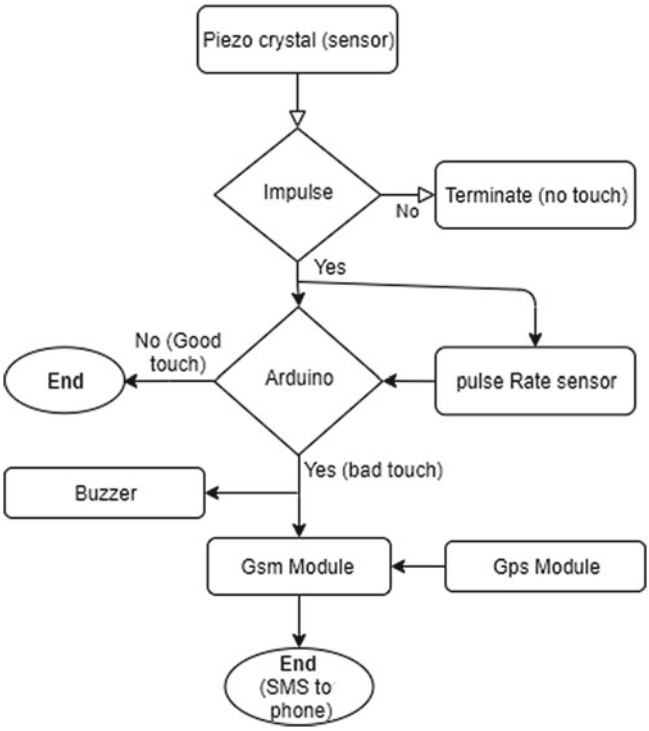


Fig. 2 Flow diagram of Rakshak

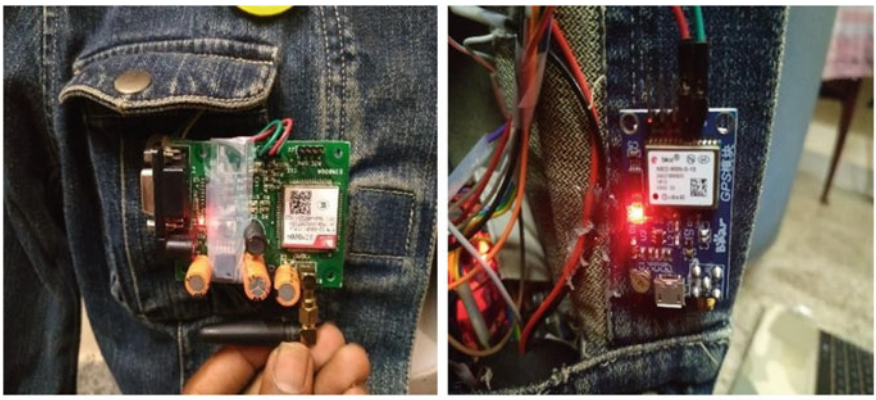
3.1 Hardware Required

Arduino Uno R3: It is the heart of the system. The micro-controller carries out all the processing functions. The sensors are connected to the Arduino board which give the input data and actuate the output via the code fed to the micro-controller written on the Arduino IDE. This board is cheap and has high functionality.

Piezo-Buzzer: It is a device that emits sound. It works on the principal that when a voltage is applied across the piezo-material; there will be a variation in pressure. It used an alert system indicating that the woman is in danger or under attack.

GSM Module: The GSM module which is the global system for mobile communication is used for sending a SMS or making phone calls over 2G network similar to a mobile operator. The version used here is as shown in Fig. 3a. GSM SIM 900A which accepts a 2G Macro sim card. It is a crucial part in this safety jacket as it sends a SMS to the concerned people and the nearest police station server when a danger is detected.

GPS Sensor: The global positioning system (GPS) gives the exact latitudinal and longitudinal co-ordinates of a particular location as shown in Fig. 3b. The version used here is GPS NEO 8 M which is highly accurate and consumes less power. This



a b

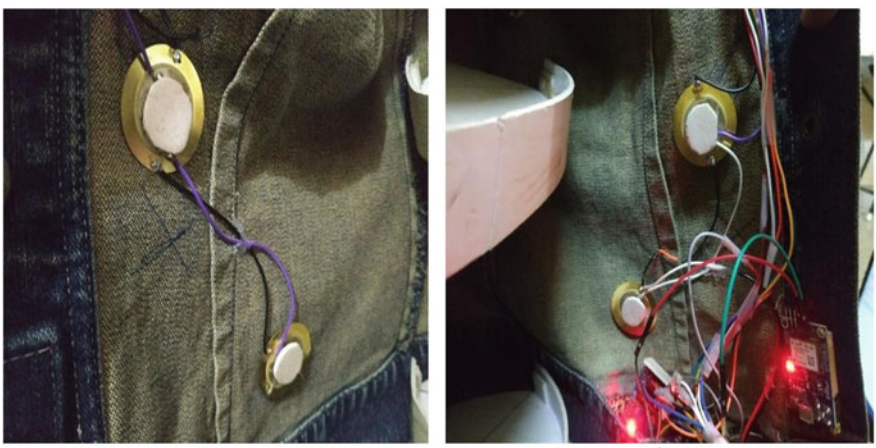
Fig. 3 **a** GSM module,. **b** GPS module

sensor is crucial in the safety jacket as it will notify the concerned people with the exact location of where the woman has been attacked.

Mobile Phone: Used for receiving an alert SMS from the safety jacket.

Wiring System: Copper wires (strips) are used for connecting all the various components and sensors. The wires are fabric-friendly so that the cloth is not affected and comfortable to be worn as shown in Fig. 4a.

Here, multiple piezo-plates are placed at different regions of the safety jacket and are interconnected in a parallel configuration via wires as shown in Fig. 4b. The piezo-electric sensors placed all over the jacket send signals to the Arduino



a b

Fig. 4 **a**Wiring system. **b** Interfacing with GPS module

Fig. 5 Heart rate sensor

Uno whenever there is a touch. The harder and longer the touch is on the cloth, the piezo-electric plates keeps sending high electric signals indicating a danger.

Heartbeat Sensor: The pulse rate of the woman can be detected and monitored by the heartbeat sensor as shown in Fig. 5. The heartbeat can be sensed from the radial nerves of the wrist. The heart beat sensor consists of a detecting photo-diode and a light emitting diode. The pulse sensor gives the heartbeat as a digital output when a finger except the thumb is placed on it. The pulse sensor is essential as it feeds the live pulse rate of woman to the micro-controller.

This is essential because when a woman gets attacked by a stranger, her heartbeat would increase to a higher value which will be sent to the Arduino indicating a danger. The pulse readings and the piezo-electric signals are integrated, which is then received by the micro-controller.

3.2 Software Required

Arduino IDE: Arduino IDE is an open source platform. It is where all the lines of code for an Arduino program is written. This is used for integrating various sensors with the micro-controller. The various data received from the sensors are processed by the Arduino IDE for different functions and applications.

4 Results and Discussion

Figure 6 is the fully scaled jacket (Rakshak) with the sensor fitted in pattern according to research. The pulse sensor with green light indicates the continuous monitoring of the pulse and sending of the data to the micro-controller. GPS and GSM module

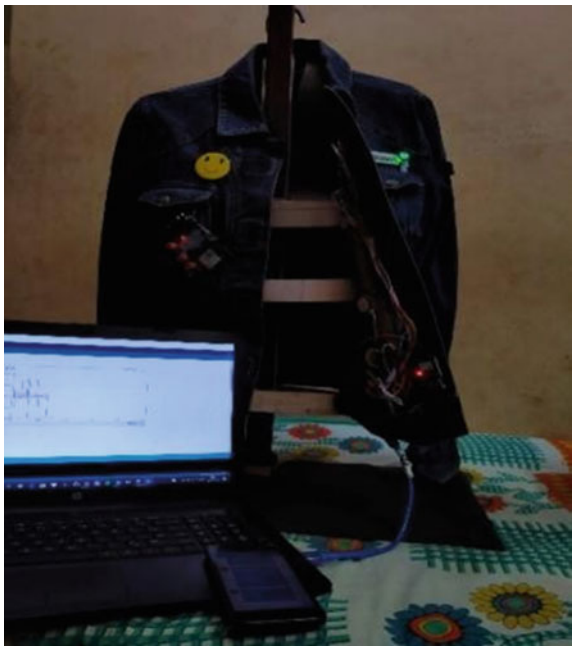


Fig. 6 Overall full scaled setup

is attached with a very sophisticated and fiber-friendly circuit lining. GPS, GSM and micro-controller module are perfectly blended with the jacket and occupy very less space. Time delay involved in signal processing and sending the signal in case of rough touch is noted as 1.5–2 s.

SMS from the GSM is sent to the authorized phone and nearby help line service (women's safety patrol, police); the GSM interacts with the GPS and produces an alert message with latitude and longitude co-ordinates which will help the authority to reach the site as soon as possible.

The output of pulse sensor is represented using a graph which indicates the condition of heart beat; this data is further used to distinguish between a good touch and a bad touch as shown in Fig. 7a. In case of increased heart beat and continuous touch, the system was able to send a proper message to authorized person in no time. The contents of the message are shown in Fig. 7b.

5 Conclusion

Taking considerations from all aspects of human safety against unethical measures, Rakshak is probably the scope changing innovation that has been inculcated in the present safety scenario being the first of its kind wearable safety equipment not only it is capable of pointing the exact location of the victim but at the same time also points out important body vitals such as pulse. When one asks for invisibility of a system,

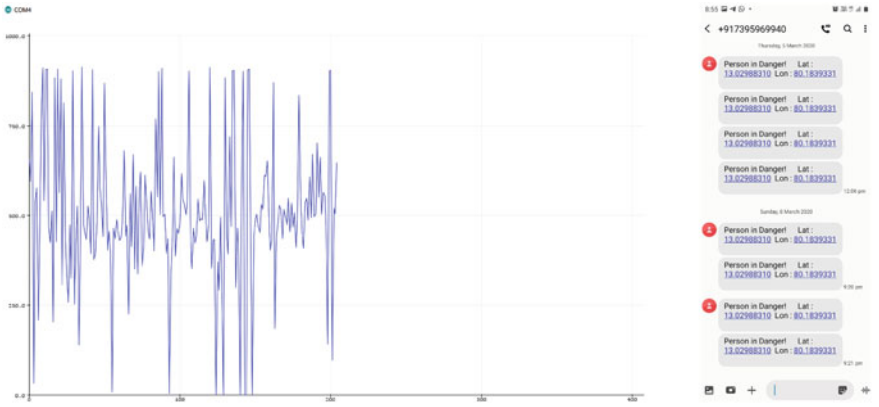


Fig. 7 **a** Pulse sensor output. **b** Danger SMS received

Rakshak is the ideal choice due to its capability to be integrated with any wearable fabric or material. Considering all the factors mentioned above Rakshak happens to become a system which will particularly take care of three factors which point toward safety such as location, vitals and alarm system. Like a last nail, Rakshak is also capable of sending out SOS messages to the nearest safety quarantine.

This system has many upgrades which are just in phase such as implementation of printed circuits, noting of better vitals, high rated waterproofing and dust resistance, real-time tracking in real dimensions, anti-wear and tear and multiple SOS. If the above-mentioned parameters are implemented, Rakshak happens to provide for a safer tomorrow.

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Face Detection: An Effort to Accomplish an Analysis in the Archaeological Field

Ishani Sengupta, Subhashree Mishra, Bhabani Shankar Prasad Mishra, and Manoj Kumar Mishra

1 Introduction

Face plays a key role in human being's interactions. By identifying the facial expressions from the images of face, a number of applications in the human–computer interaction area will get simplified. In the past, many research works had been carried out on the problems of the different facial expressions of the modern human being in FR analysis [1, 2]. The pioneer studies of Ekman [3] in late 70s have given a proof to the classification of the basic facial expression. Face detection (FD) is stated as the process of obtaining faces from scenes. So, in a positive way the system captures a certain region in the image as a face. This procedure has many implementations on face detection and poses estimation. Face location is an interpreted approach of face detection (FD). Its aim is to establish the position of a face where there is only one face in the image. Current works on facial expression and recognition vary mainly in the selected facial features and the classifiers that are used to discriminate amongst the various facial expressions. There are many techniques which are planned for modern human face appearance identification from still pictures (database of images) to image scenes (video recorder).

In the literature survey, most of the researchers attempt to classify basic facial expressions by using different algorithms such as Haar cascade [4], multi-task

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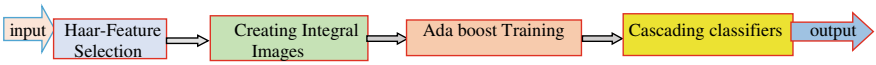


Fig. 1 Haar cascade algorithm

convolutional neural network (MTCNN) [5], Naive Bayes [6], SVM [7], HMM [8]etc.

The target of our paper is

- To identify and track face from a static image of ancient skulls.
- To recognize an early man's face.
- A comparative analysis of different machine learning-based classification approach for face detection in the area of archaeological field.

2 Details of Facial Detection Techniques

2.1 Haar Cascade

Haar cascade is an algorithm used in detecting objects in the artificial intelligence (AI) field to detect matter in an representation or videocassette which is based on the domain projected by Viola–Jones in 2001 [9]. A Haar cascade is basically a classifier detecting objects as it has been trained for. In this machine learning (ML) technique, a cascade function is skilled here by overlaying the positive images over a collection of negative images. Now the Haar-like features are different image features, and they owe their name to their inherent Haar wavelets. Cascading is a specific case of the whole learning based on a series of interconnected several classifiers using all information that gets collected from the output, from a given classifier which becomes an additional information for the next classifiers in the cascade.

The four levels of Haar Cascade algorithm have been shown in Fig. 1.

Input Haar feature creating integral AdaBoost training cascading classifiers output.

Selection images.

It is popular about Haar Cascade algorithm that it can detect faces in an image, but can be trained to identify almost any type of object.

2.2 Multitask Cascaded Convolutional Neural Network (MTCNN)

One of the popular approaches is MTCNN, described by Kaipeng Zhang et al. [10]. The MTCNN is well-known as it is achieved then state-of-the-art resulting on a range of benchmark data sets and also popularly called landmark detection because of its

capability to recognize other facial feature types like eyes and mouth. The system uses a cascade structure consisting three networks.

2.3 Analysing Face Detection Depending on Facial Features

Various performances applied on the facial features detecting modern human being by using different classification techniques to recognize a face, emotions, age-gender, etc. The face detection process has been shown in Fig. 2.

Captured Extracting Matching Comparing Graphically Representing

2.3.1 Captured

Algorithms of face detection spotlight on the detection of front human faces. The first step is face exposure, i.e. capturing. Capturing means record accurately in words or pictures. Face capturing means obtaining or trapping only the facial part from the taken data. In this paper, we have captured face of early man, skull, and mummies using Haar cascade classifier and MTCNN classifier.

2.3.2 Extracting

Face features extraction is the action of extracting face fundamental character like the left side of eye and right side of eye, nose, left side of mouth and right side of mouth etc.from face images. It is very significant for the initialization procedure methods such as face identifying, face appearance detection, or face identification. In this paper, while using Haar cascade, we extracted eyes from face images and while using MTCNN, we extracted eyes, nose, and mouth.

2.3.3 Matching

A face matching algorithm is a set of systems that a computer uses to identify a face in an image and then to match up to that face to another face (or features) to establish whether there is a match. In this paper, we have tried matching the face of an early man to the human face (i.e., reconstructed or a 3D model made), skull to an early man or human (reconstructed).

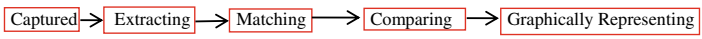


Fig. 2 Face detection process

2.3.4 Comparing

When we make a comparison, we consider two or more things and discover the differences. In this paper, once collected results by using Haar cascade classifier and MTCNN classifier, we compared them and tried getting better results which would give us a good collection of information regarding early men, skulls and mummies.

2.3.5 Graphically Representing

Representing data graphically is one of the most commonly used approaches of presentation. The idea of graphical communication is to deliver message or information to the receiver in a valid way.

In this paper, the parameters of both eyes, nose, both sides of mouth based on the feature extraction of skull, group of early men by MTCNN classifier has been represented graphically (Fig. 3).

2.3.6 Face Detection PseudoCodes

3 Discussion of Proposed Work

We collected facial images of different categories like early man, ancient skull, mummy's (ancient) face and ancient sculptures, to detect facial features. We used OpenCV software version-4.1.2 and two classifiers, namely Haar cascade classifiers and MTCNN classifier, and compared the results.

3.1 Haar Cascade Classifier

A Viola–Jones detection algorithm-based classifier, i.e. Haar cascade classifier, flowchart has been shown in Fig. 4.

A very basic line up used to exhibit an image using Haar-like features and OpenCV can be written as follows:

```
import numpy as np
import cv2
cv2.imshow ('img',img)
cv2.waitKey ()
cv2.destroy All Windows ()
```

```
This program of Open CV is to detect faces from images as input
INPUT:
Assign “haar cascade_frontal faces_default.xml” to faces_cascade
Assign “haar cascade_eyes.xml” to eyes_cascade
#Reading frames from images
Assign the name of the picture file in .jpg format to img
#Converting to gray scale of each frames
Assign gray the two parameters img and ‘CV2.COLOR_BGR2GRAY’
#Detecting faces of different sizes in the input images
Assign the different sizes to faces as gray,1.3,5
PROCESS:
FOR (x,y,wi,hei) IN faces
        Draw a rectangular box on a face, taking the region of interest
        Assign eyes the different sizes of the input image
        FOR (eyx,eyy,eywi,eyh) IN eyes
              Draw rectangle in eyes
        ENDFOR
ENDFOR
OUTPUT:
Display image in a window
```

```
This program of deep learning is using to detect faces
INPUT:
#This functions show the picture and then draws a box around each bounding
box that was detected
Function draws_images(Argument one,Argument two)
            #loading the images
            Assign Argument one to load the image to data
            #ploting the image
              Plot the image using data
            Assign ax the context for drawing boxes
            #plotting each box
            FOR results IN Argument two
                  #To get the coordinates
                  Assign results to x,y,wid,hei
                  Assign the rectangular shapes to rect and create
                  Creating box using rect
                  #Draw the dots then
                  FOR keys, values IN results
                        Assign dot with value to create and draw dot
                  ENDFOR
            ENDFOR
            Showing the plotting
Assign Argument one the file name of the image like in .jpg format
Assign pixels the loaded image from file
Assign detector using weights and create it
Once the model has been shaped and loaded , it can now be used precisely to
detect respective faces in pictures
Assign faces the detector function which will return a list of objects, each giving
number of keys together with: ‘box’, ‘confidence’, ‘key points’
#Display faces on the original photo
Call the draws_images(Argument one,faces)
FOR face IN faces
        OUTPUT face
ENDFOR
```

Fig. 3 Commands using two classifiers to detect face

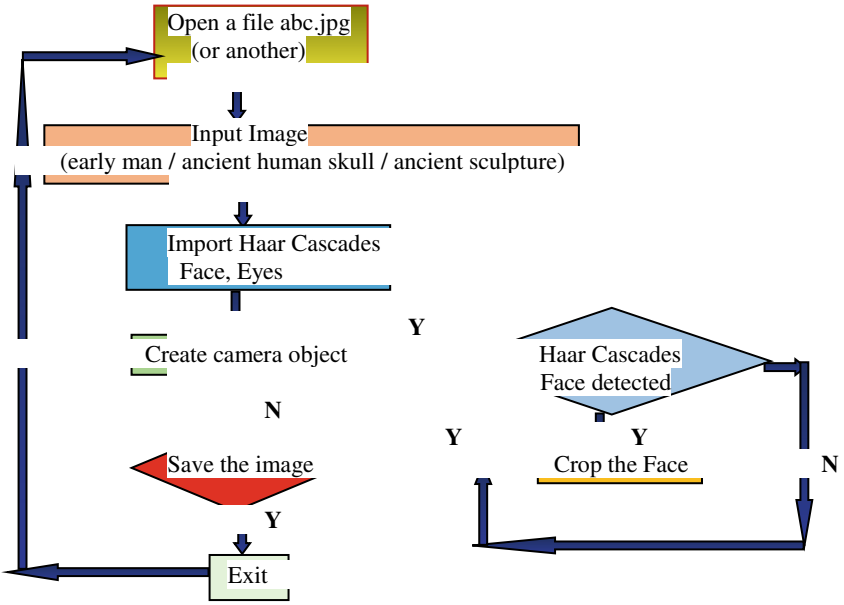


Fig. 4 A flowchart showing Haar cascade classifier mechanism

3.2 MTCNN Classifier

The multitask cascaded convolutional neural network (MTCNN) algorithm works in three steps where one neural network is used for each.

Steps are:

I. Firstly, it will figure the possible face location and their rectangular region like an attention network in faster regional convolutional neural networks (RCNN). The outcome of this stage is tones of face detection and large number of fake detection.
II. Here, the images and outcomes that were predicted at first are used. It creates a clarification of the obtained consequence to erase mainly fake detection and aggregate rectangular region.
III. This is the last stage, which purifies even more the forecast and adds facial marker predictions.

Now, a very basic line up used to demonstrate an image and its plotting using OpenCV, matplotlib can be written as follows:

```
import tensorflow as if
import cv2
import mtcnn
import matplotlib
From matplotlib import pyplot
From matplotlib patches import Rectangle
From matplotlib patches import Circle
From mtcnn.mtcnn import MTCNN
```

3.3 Details of the Images

See Table 1.

3.4 Comparison Analysis I

Table 2 summarizes the difference between the observations obtained from the ancient skulls, fossils, early man, 3D model (face reconstruction), mummy (Egypt), sculptures face images using the two classifiers, viz. cascade classifier and MTCNN.

3.5 Comparison Analysis II

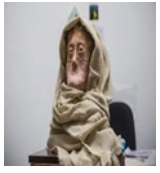
Very few facial images are detected by cascade classifier only but they are not detected by MTCNN. Again most of the facial images are detected by MTCNN only. This comparison analysis has been shown in Table 3.

3.6 Graphical Representation Analysis

In this paper, it has been shown that only MTCNN provides different parameters of the facial images obtained from various ancient skulls, early men, mummy and sculpture. The parameters (left side of eye (LE), right side of eye (RE), nose (N), left side of mouth (ML), right side of mouth (MR)) of two images are described graphically in Table 4.

In the first picture, only one skull's face image has been taken which is detected using MTCNN classifier, whereas in the second picture, a group of eight early men face images has been taken, but only seven face images are detected. So graphically, the parameters of seven face images are plotted together. Also graphically the

Table 1 Description of various early man, ancient skull, sculpture and mummy's images

	This picture belongs to an early man's face reconstruction		Adivans who roamed the savannah plains of Africa ate grass like cows 3.5 million years ago		This picture is an early human fossil, found out of an African cave
	The face of one of Scotland's oldest woman, nicknamed Hilda died 2000 years ago		This is the mask of Tutankhamun which was made of gold		This is a remarkable skull of human ancestor of the genus *Australopithecus*
	This picture belongs to a caveman which was sculpted over a plaster cast of an actual Neanderthal skull		A skull of an Egyptian mummy of a child was around 1000 B		A plastic cast of Kennewick Man's skull, A New History of the First Peoples in the Americas

(continued)

Table 1 (continued)

	The archaeological record shows that this image is 35,000 years old		This picture belongs to Nefertiti who was Egyptian queen around the mid of 1300s B.C.		The pictures of skulls are around 92,000 years old
	This is a sculpture which shows the face of Homo floresiensis, from the Indonesian island of Flores		This picture belongs to a woman who lived in Greece around 7000 B.C.		The mummy of Tutankhamun was over 3300 years old
	Early Humans—History—LibGuides at Loreto Mandeville Hall		This real Peruvian elongated mummy head was around 800–100 BCE		

Table 2 Comparison analysis I of various face images using cascade classifier and MTCNN

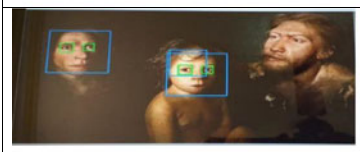
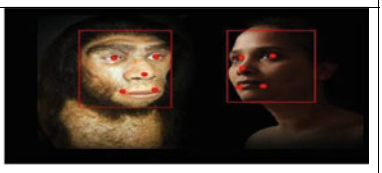
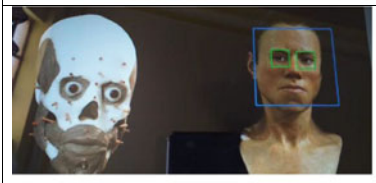
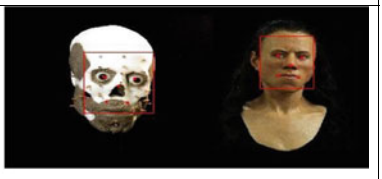
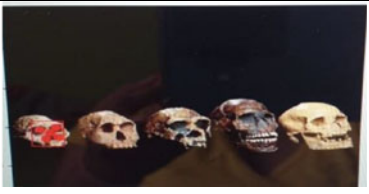
Face detect by Cascade Classifier	Face detect by MTCNN Classifier
	
	
	
Neither of the two were detected	
	
	
	

Table 3 Comparison analysis II of various face images using cascade classifier and MTCNN

Image detect by MTCNN Classifier only whereas Cascade classifier does not	Image detect by Cascade Classifier only whereas MTCNN classifier does not
	
	
	
	

parameters of one face image of first picture are plotted. This graphical representation analysis is described in Table 4.

4 Conclusion and Future Scope

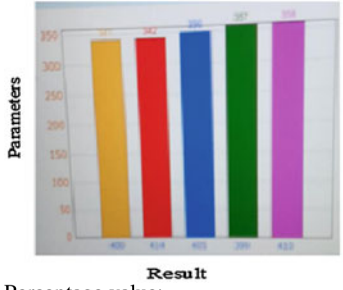
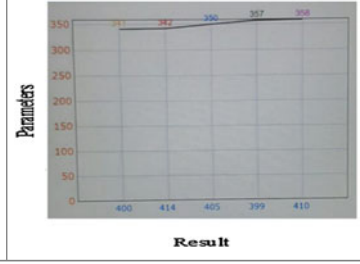
Face detection is the challenging aspects in the research area of artificial intelligence, computer vision (CV), where it analyses the present mankind's face images.

In this paper, we tried a new idea and implemented face detection methods on ancient skull images, early man, mummies (Egypt) face images, sculptures and 3D face models (i.e. reconstructed ancient faces).

The focus in the direction of the face detection has been increased in the previous years due to its vast applications in the real world. The research conducted in this field leads to encouraging results but still we are incapable to find the face detection technique which is able to execute resourcefully in the various situations of daily lives.

We hope that the study of this paper will help and opens a new gate for not only archaeologists with their research works [11], but also in computer vision field.

Table 4 Graphical Representation analysis

Parameters of first image: (LE): (400, 341), (RE): (414, 342), (N): (405, 350), (ML): (399, 357), (MR): (410,358)  Percentage value: LE: 19.5%, RE: 19.6%; N: 20%; ML: 20.4%; MR: 20.5%	 

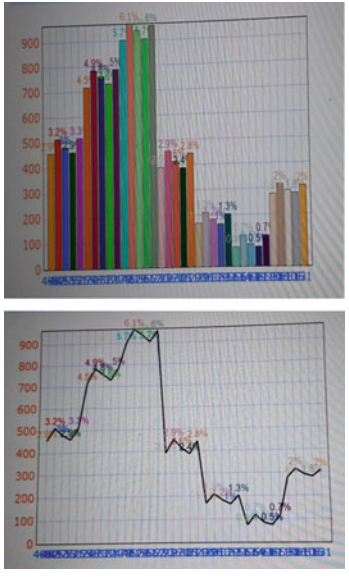
(continued)

Table 4 (continued)

Parameters of second image: (1) (LE): (456, 468), (RE): (513, 462), N: (479, 497), (ML): (459, 535), (MR): (515, 531); 2) (LE): (716, 255), RE: (782, 248), N: (759, 273), (ML): (729, 327), (MR): (786, 317); 3) (LE): (901, 479), (RE): (965, 481), N: (939, 529), (ML): (905, 561), (MR): (957, 562); 4) (LE): (391, 230), (RE): (453, 236), N: (413, 270), (ML): (387, 305), (MR): (444, 311); 5) (LE): (168, 290), (RE): (208, 296), N: (182, 313), (ML): (164, 329), (MR): (202, 333); 6) (LE): (74, 563), (RE): (118, 564), N: (85, 593), (ML): (75, 609), (MR): (118, 611); 7) (LE): (279, 590), (RE): (316, 586), N: (292, 610), (ML): (282, 635), (MR): (310, 631).	

(continued)

Table 4 (continued)

	Percentage value: 1. LE: 2.99 %, RE: 3.2 %, N: 3 %, ML: 2.99 %, MR: 3.3 % 2. LE: 4.5 %, RE: 4.9 %, N: 4.8 %, ML: 4.6 %, MR: 5 % 3. LE: 5.7 %, RE: 6.1 %, N: 5.9 %, ML: 5.7 %, MR: 6 % 4. LE: 2.5 %, RE: 2.9 %, N: 2.6 %, ML: 2.4 %, MR: 2.8 % 5. LE: 1 %, RE: 1.3 %, N: 1.2 %, ML: 1 %, MR: 1.3 % 6. LE: 0.5 %, RE: 0.7 %, N: 0.5 %, ML: 0.5 %, MR: 0.7 % 7 LE: 1.8 %, RE: 2 %, N: 1.8 %, ML: 1.8 %, MR: 2 %

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Event-Triggered Fractional-Order PID Control of Fractional-Order Networked Control System

Sunil Kumar Mishra, Avadh Pati, Bhargav Appasani, Amitkumar Vidyakant Jha, Mano Ranjan Kumar, Vipin Chandra Pal, and Mayank Kumar Gautam

1 Introduction

The integer-order proportional–integral–derivative (PID) controller has been widely researched and applied in numerous control systems [1]. Many modified forms of PID have also been proposed in the past. But nowadays fractional-order systems and fractional-order PID (FOPID) controllers have been developed which are more flexible in nature than the conventional PID controller [2–4]. The fractional calculus is the base of FOPID control, wherein fractional derivative and integral terms are used instead of integer-order derivative and integral terms [5]. Both frequency-domain and time-domain approaches of analysis of fractional-order derivatives and integrals have been proposed [6, 7]. The toolboxes such FOMCON in MATLAB have also been designed which make the analysis of fractional-order systems and FOPID very easy [8].

Many approaches to obtain the optimized FOPID parameters and its modified forms have been proposed [9–13]. In [9, 10], a particle swarm optimization-based tuning of FOPID controller and conventional PID controller was proposed, and the performance of FOPID was compared with the PID. A chaotic atom search optimization algorithm was employed in [11] to optimally tune FOPID. Similarly, [12] 13

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Lecture Notes in Electrical Engineering 690,
https://doi.org/10.1007/978-981-15-7504-4_21

presented the cloud-model-based quantum genetic algorithm and bat optimization algorithm, respectively, for tuning the FOPID parameters.

The FOPID has been applied in many interesting control systems such as robotic manipulator control [14], power system control [15–17], vibration and noise control [18], control of inverted pendulum [9, 19], etc. A detailed review on FOPID controllers can be found in [20].

In present scenario, most of the control systems are being integrated with communication networks so as to facilitate the control of plant dynamics from distant places. The issue of efficient bandwidth utilization of communication network is one of the widely discussed topics of the research these days. In this regard, the controllers are being designed based on non-uniform sampling of system output data. This approach is also called as event triggered control of networked control system (NCS) [21–23]. In this approach, the controller updates are minimized to lowest possible number without disturbing the system performance. To best of author's knowledge, the fractional-order systems and FOPID controllers have not been tested on NCS platform. Hence, in this paper, a fractional-order networked control system (FONCS) with FOPID controller has been considered. The stabilization of system output has been implemented using FOPID controller. A Nelder–Mead-based simplex optimization algorithm has been used to tune the FOPID controller for FONCS. Then, an event triggering rule has been proposed to minimize the control updates. The quantization error is maintained at lowest possible level while minimizing the control updates. To achieve this, a detailed analysis has been executed for selecting the triggering constant of the event triggering segment. The simulation results have been presented with a numerical example of FONCS with step signal as reference input.

The rest of the discussion will be as follows: description of NCS with FOPID and fractional-order system is given Sect. 2. In Sect. 3, the FOPID design using Nelder–Mead approach has been discussed. Section 4 discusses the design of event triggering rule, where Sect. 5 presents the numerical simulation followed by concluding remarks and future scopes in Sect. 6.

2 Description of NCS with FOPID and Fractional-Order System

The block representation of proposed FONCS with FOPID control scheme is shown in Fig. 1 The block representation consists of four segments: fractional-order system, FOPID controller, event triggering rule, and communication network.

The output $y(t)$ of fractional-order system is first passed through a comparator block where it is subtracted from $y_{ref}(t)$. The comparator output is error $e(t)$ which is given as:

$$e(t) = y_{ref}(t) - y(t) \tag{1}$$

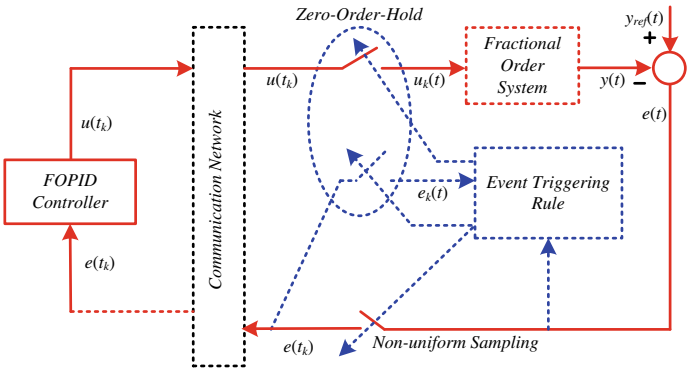


Fig. 1 Block representation of FONCS with FOPID controller

Next, the $e(t)$ is passed through a non-uniform sampling block which is based on occurrence of triggering events. A discrete error signal $e(t_k)$ is obtained which is passed through a communication channel and reaches to the FOPID controller. Where, k represents the k th triggering instant. The FOPID processes the $e(t_k)$ and provides the discrete control output as $u(t_k)$. The $u(t_k)$ is then passed again via communication channel and works as the input the zero-order-hold (ZOH) block. The ZOH block provides the continuous signal $u_k(t)$ which works as the final input to the fractional-order system. The sample and hold process is driven via event triggering block which delivers triggering pulses as and when required. The input to the event triggering blocks is the $e(t)$ and $e_k(t)$ which are used to define the event triggering error or quantization error $\xi(t)$ as follows:

$$\xi(t) = |e_k(t) - e(t)| \tag{2}$$

The output of the triggering block is the triggering pulses denoted by $p(t)$. The generalized differential equation of fractional-order system is given as follows:

$$\left.\begin{aligned} a_0 \tfrac{d^{n1}y(t)}{dt} + a_1 \tfrac{d^{n2}y(t)}{dt} + \ldots + a_i \\ = b_0 \tfrac{d^{m1}u(t)}{dt} + b_1 \tfrac{d^{m2}u(t)}{dt} + \ldots + b_j \end{aligned}\right\} \tag{3}$$

where b_0, b_1,…, b_j are constant coefficients of the input fractional derivative terms and a_0, a_1,…, a_i are constant coefficients of the output derivative terms. The $n1$, $n2$,… and $m1$, $m2$,… are the fractional orders of the input and output derivative terms, respectively. Also, $n1 > n2 > \ldots$.; $m1 > m2 > \ldots$. and $n1 > m1$.

The generalized transfer function of fractional-order system from Eq. (3) is given as follows:

$$\frac{Y(s)}{U(s)} = \frac{b_0 s^{m1} + b_1 s^{m2} + \ldots + b_j}{a_0 s^{n1} + a_1 s^{n2} + \ldots + a_i} \tag{4}$$

where $Y(s)$ and $U(s)$ are the Laplace transform of system output $y(t)$ and input $u(t)$, respectively.

3 FOPID Tuning for FONCS

The block diagram of fractional-order FOPID is shown in **Fig. 2**.

The FOIPD has three terms (as proportional + fractional integral + fractional derivative) in its differential equation given as follows:

$$u(t) = K_p e(t) + K_i \frac{d^{-\lambda} e(t)}{dt} + K_d \frac{d^{\mu} e(t)}{dt} \tag{5}$$

where K_p, K_i and K_d are the proportional, integral, and derivative gains, respectively, whereas λ and μ are the fractional integrator and differentiator orders where $0 < \lambda, \mu < 1$.

The transfer function of the FOPID controller from Eq. (5) is given by:

$$\frac{U(s)}{E(s)} = K_p + \frac{K_i}{s^{\lambda}} + K_d s^{\mu} \tag{6}$$

When the communication network is involved, the $u(t)$ becomes $u_k(t)$ and is given as follows:

$$u_k(t) = K_p e_k(t) + K_i \frac{d^{-\lambda} e_k(t)}{dt} + K_d \frac{d^{\mu} e_k(t)}{dt} \tag{7}$$

There are five parameters of FOPID controller to be tuned in such a way that the following integral squared error (*ISE*) index is minimized:

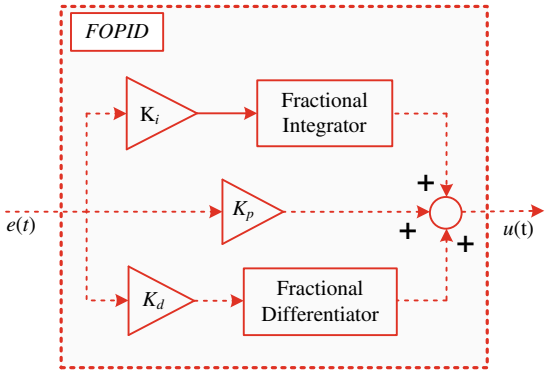


Fig. 2 Block representation of FOPID controller structure

$$ISE = \int_0^\infty e^2(t)dt \tag{8}$$

In order to minimize the *ISE*, the Nelder–Mead optimization method (also known as simplex optimization method) [24] has been applied in this study. The reason for this lies in the simplicity of the approach because the tuning of the controller is not the main focus of the paper rather it is the design of event-based FOPID for FONCS. The inbuilt application of FOPID tuning in FOMCON toolbox [8] in MATLAB has been utilized for this purpose.

4 Event Triggering Rule

The event triggering rule is very important in non-uniform sampling of output data. The error signals, $e(t)$ and $e_k(t)$, are inputs to the event triggering block which are compared to give a quantization error $\xi(t)$. An upper limit on $\xi(t)$ is very much required to keep the system output on stable trajectory. Hence, an upper bound on $\xi(t)$ is forced as follows:

$$\xi(t) \leq \alpha \tag{9}$$

where α is the user-defined nonzero constant that decides the level of error which can be allowed on system performance while working with event triggered approach. It should be noted here that smaller values of α would require more control updates as compared to larger values of α. However, for relatively high values of α would create the quantization error which in turn would increase the number of control updates. Therefore, a suitable value of α should be taken into consideration while implementing event triggering rule. Also, the lower bound on quantization error is zero. Therefore, the Eq. (9) can be written as:

$$0 \leq \xi(t) \leq \alpha \tag{10}$$

Whenever there is breach of the condition given in Eq. (10), an event is triggered. A triggering pulse $p(t)$ is then generated and is given to sample and hold circuit. It updates the controller output $u_k(t)$. The details of event triggering rule are given in Table 1.

Table 1 Event triggering algorithm

if $\xi(t) \geq \alpha$
then
(i) trigger the event and
(ii) update the control command
else
(i) no event triggering and
(ii) no update on control command
end

5 Simulation Results

The proposed event triggered scheme for FONCS is validated with a numerical example as given below:

$$\frac{Y(s)}{U(s)} = \frac{5}{s^{2.4} + s^{1.3} + 2s^{0.2} + 1} \tag{11}$$

The FOPID was tuned using Nelder–Mead optimization method. The optimization parameters were: number of iterations = 100, $ISE = 5.2469 \times 10^{-1}$, $0 < K_p, K_i, K_d < 100$ & $0 < \lambda, \mu < 1$.

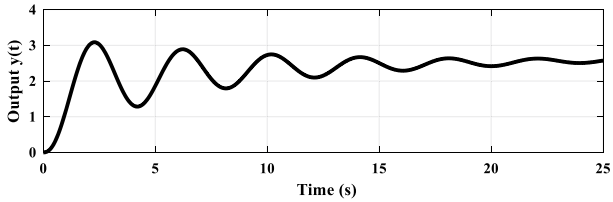
Next, after tuning the FOPID parameters, the FOPID transfer function is given by:

$$\frac{U(s)}{E(s)} = 0.04 + \frac{8.144}{s^{0.502}} + 38.242s^{0.501} \tag{12}$$

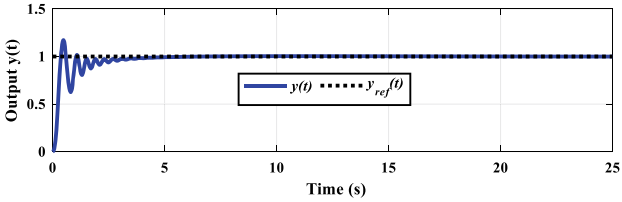
The simulation results are obtained open-loop and closed-loop systems as shown in Fig. 3. The open-loop step response of the fractional-order system as depicted in Fig. 3(a) has oscillations in its transient phase and high steady-state error. The closed-loop step response as shown in Fig. 3(b) becomes faster with less transient phase oscillations and with no steady-state error when implemented using FOIPD controller as given in Eq. (12). Similarly, the control effort signal in Fig. 3(c) initially has higher levels, but after 5 s, it becomes almost negligible. The constrained put on FOPID is ± 10.

Next, the event triggered FOPID controller is implemented with FONCS as shown in Fig. 4. The closed-loop step response has been evaluated for different values of α, e.g.$\alpha = 0.01$, $\alpha = 0.001$ and $\alpha = 0.0001$. As shown in Fig. 4(a), a very oscillatory response is achieved with relatively larger value of $\alpha = 0.01$. When α is increased to $\alpha = 0.001$, the closed-loop response of FONCS becomes more smoother which with $\alpha = 0.0001$ becomes very much close to the output response obtained in Fig. 3(b). Similarly, control effort required is lower in case of $\alpha = 0.0001$ as compared to $\alpha = 0.01$. The zoomed version of Fig. 4 is reproduced in Fig. 5 with a shorter time duration between 13 and 14 s to provide more clarity on results.

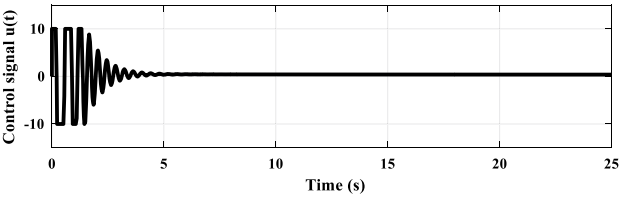
Finally, the waveforms related event triggering rule are presented in Figs. 6, 7 & 8. Figure 6 presents the quantization error waveform (in Fig. 6(a)) and corresponding



(a) Open loop step response



(b) Closed loop step response

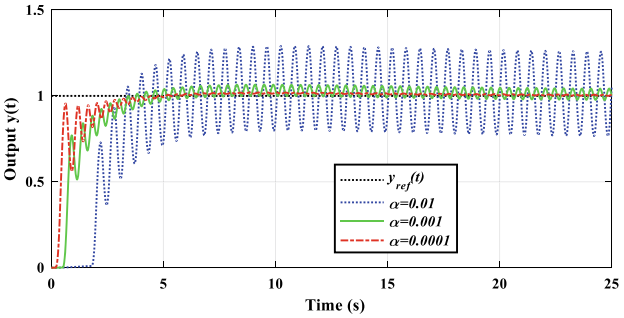


(c) Control signal

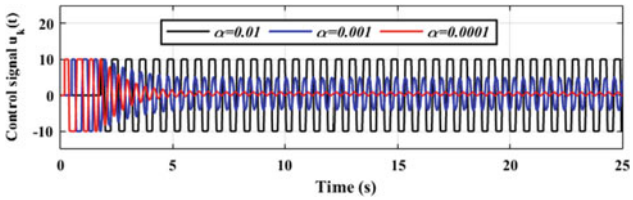
Fig. 3 Response of fractional systems with FOPID controller without NCS

triggering pulses (in Fig. 6(b)) for $\alpha = 0.01$. It is observed that the whenever there is violation of triggering rule as given in Table 1, a triggering pulse is generated and send to sample and hold circuit for updating the FOPID values. Again, a shorter duration has been shown in the figure to have more visible clarity of the triggering principle.

Similarly, the zoomed diagram of quantization error and triggering pulses is shown in Fig. 7 for $\alpha = 0.001$ and in Fig. 8 for $\alpha = 0.001$. It is again clearly shown that for smaller values of α, number of triggering pulses increases significantly which in turn increases the number of control updates. Hence, a further decrease in α is not suggested due to generation of higher number of triggering samples which would increase communication bandwidth requirement. However, the optimization approach can be applied to select the best possible value of α.

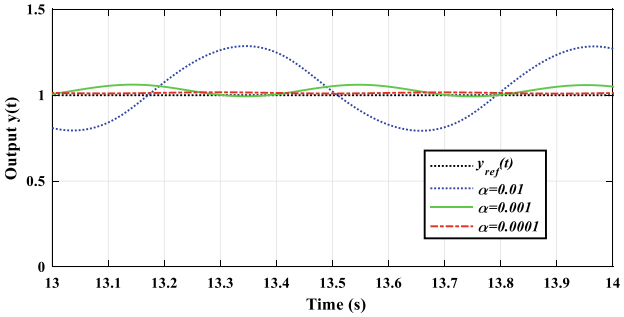


(a) Closed loop step response

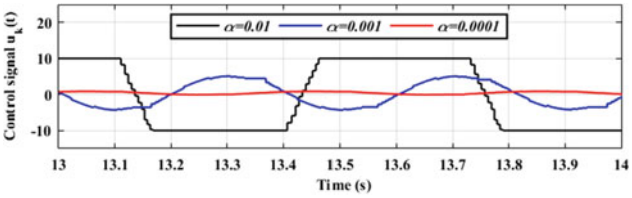


(b) Control signal

Fig. 4 Response of FONCS with FOPID controller

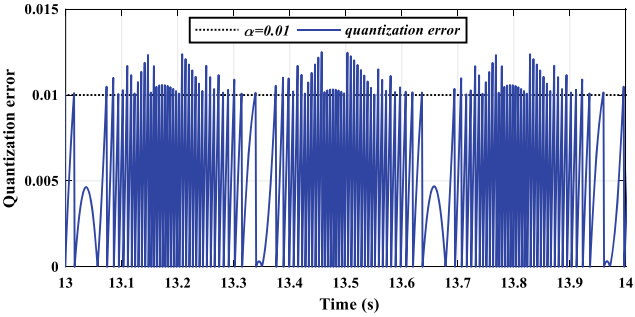


(a) Zoomed closed loop step response

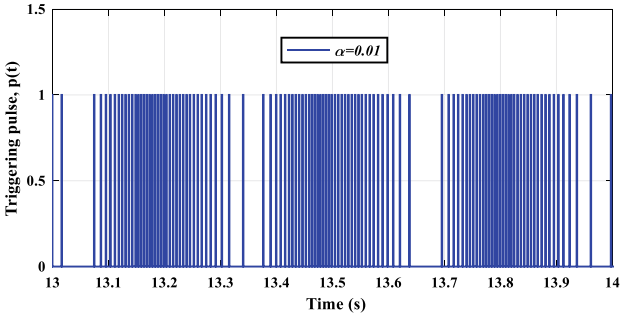


(b) Zoomed control signal

Fig. 5 Zoomed versions of response of FONCS with FOPID controller

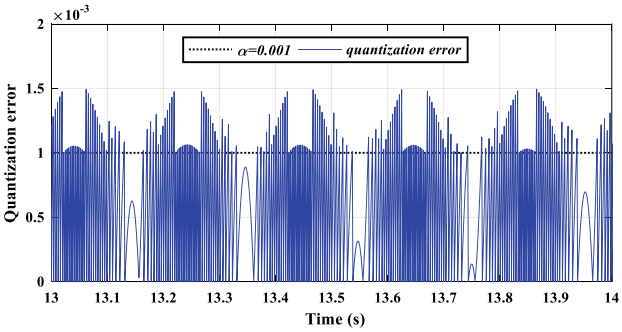


(a) Zoomed quantization error for $\alpha = 0.01$



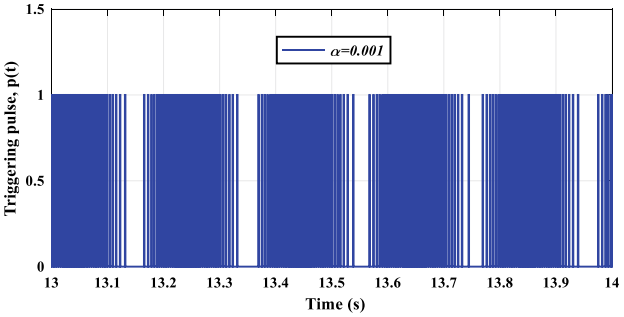
b) Zoomed triggering pulse for $\alpha = 0.01$

Fig. 6 Zoomed versions of response of FONCS with FOPID controller for $\alpha = 0.01$



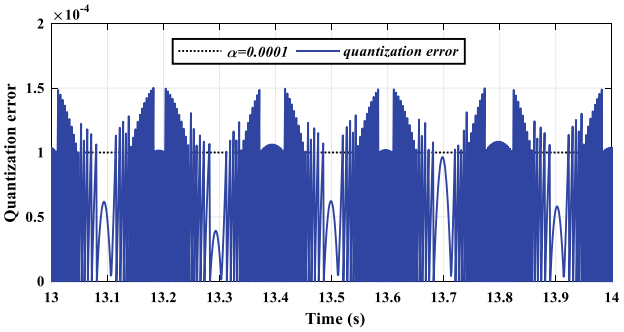
(a) Zoomed quantization error for $\alpha = 0.001$

Fig. 7 Zoomed versions of response of FONCS with FOPID controller for $\alpha = 0.001$

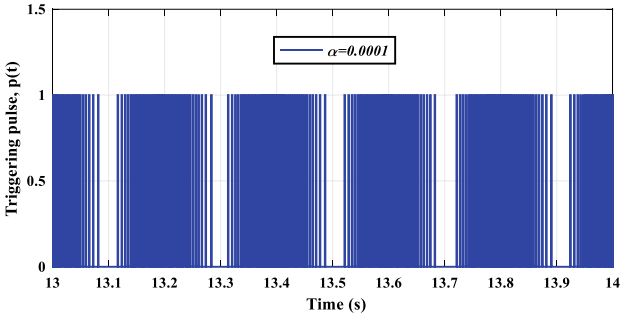


b) Zoomed triggering pulse for $\alpha = 0.001$

Fig. 7 (continued)



(a) Zoomed quantization error for $\alpha = 0.0001$



b) Zoomed triggering pulse for $\alpha = 0.0001$

Fig. 8 Zoomed versions of response of FONCS with FOPID controller for $\alpha = 0.0001$

6 Conclusion

An event-based FOPID controller for FONCS can be an effective approach for several real control systems. This paper presented the event triggering approach with a numerical example of fractional system with FOPID controller. The performance has been evaluated with different levels of triggering or quantization error. The FOPID controller works satisfactorily for all conditions although with different control efforts and number of triggering pulses. In future, a real control system can be taken as a case study for designing FOPID for FONCS systems. Also, optimization-based approach can be applied for selecting the triggering parameter.

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Power Quality Review of Efficient Controlling Techniques for an AC Grid-Tied Hybrid System

Harvinder Singh, Inderpreet Kaur, and Akhil Gupta

1 Introduction

Importantly, an optimal controlled solar photovoltaic (SPV) system is designed to generate a pure sinusoidal waveform for an AC utility-connected load. In order to achieve this, it becomes more important to develop an efficient controlling technique capable to generate a good quality of electric power. Normally, a SPV system is an ordered arrangement of solar panels capable to absorb sunlight and convert it into electric power. Especially, in the past twenty years, enormous growth has been done in converter. The selection of best power converter to fulfill various demands has a great effect on ideal execution in renewable energy system [1]. A three-phase AC utility grid-tied SPV system comprises a SPV module, a smoothing inductor, a voltage source inverter (VSI) and a DC-to-DC voltage booster [2]. SPV system is famously utilized as distributed generation (DG) which coordinated with grid to fulfill the demand of power needs at distribution side. DG is an approach in which the small-scale power generation system is employed near to the load end. DG mostly uses renewable energy resources for the generation of power. Sun energy is mostly used as a distributed generation system as it is present in abundance and also the cleanest sources of generating power. SPV system topology has various issues like power fluctuations, storage and protection issues, short-circuit-level change, reverse

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power flow, absence of sustained shortcoming current and islanding. The decision of the correct sort of intensity converters to meet the various necessities for any application impacts the ideal execution, particularly in SPV systems.

When a DG system is connected with the main grid, then there occurs a condition where the micro-grid is detached from the main grid. This condition is known as islanding. In islanding, a segment of electrical power system area is empowered alone by more than one remote electrical power systems through the related point of common coupling (PCCs). SPV module is combination of PV cells in string and shunt, and factors affecting the characteristics of SPV system (current, output power and voltage) are temperature and irradiance, and both the parameters vary according the climatic conditions. The grid-connected SPV system comprises SPV module, smoothing inductor, VSI, DC-to-DC voltage booster and grid source with three-phase AC supply. At primary level, intense power is extricated from the SPV system with MPPT technique adapted to DC voltage booster. At subsequent level, proportional–integral (PI) controller kept DC link voltage within confined value which controls VSI. Identification of islanding is primary goal for grid-tied SPV system to shield the utility operators from empowered lines along with SPV system [3].

To expand different PQ issues like harmonic distortion, voltage imbalance and power loss, different types of power electronic converters are related to the AC utility grid system which is responsible for injecting harmonics in the system. Total harmonic distortion (THD) is a noteworthy estimating parameter, which directly relates to the overall PQ estimation of a grid [2]. Figure 1 shows the battery energy storage system (BESS), which is installed in hybrid system due to the shortfall of

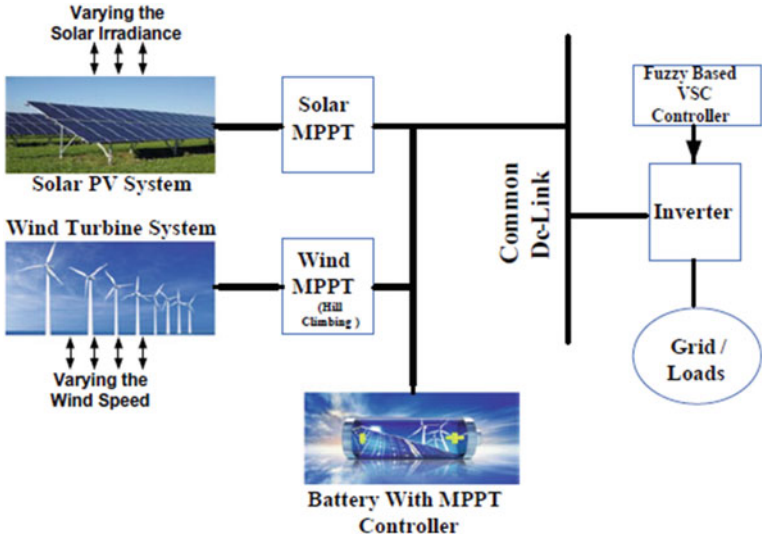

Fig. 1 Outside format of a hybrid system and control design

SPV system and wind system. Wind turbine system [2] with PMSG unit can change wind power into electrical power (for the most part change over AC-to-DC power with a converter bridge circuit). The SPV system employed with converter circuit converts the SPV power into DC power after that; then, wind and solar generation system is connected with MPPT to increase power. Both the wind-SPV powers fed into common DC link, which is connected through voltage source converter (VSC), where a battery reinforcement system also joined. BESS is introduced to give necessary load power during the shortage of wind-PV generation conditions (Fig. 1).

2 Technology Used in a SPV Cell

There is a vital role of buildings in balancing the global energy, because they are responsible for 20–30% of the industrialized countries' energy consumption. The technology of SPV can contribute significantly toward an environmentally friendly design of buildings. SPV can generate electricity from sunlight using cells. SPV modules are devices that convert solar radiation into electricity without producing any pollution or do not require any kind of fuels for their operation. SPV technology can generate electric power from mW to MW, and it is cost-effective for remote applications. At present, SPV modules have a life about 25–30 years. Due to the rapid improvement in technology and the need for sustainable energy design, the use of SPVs in buildings shows promise of great growth [2].

Solar cells are the fundamental unit of a panel, and thus, this is used as the component for converting the rays of sun into electric power. The layout of grid-connected SPV system consists of DC step-up converter, SPV module, VSI with three legs and three-phase alternating source and loads [2]. *PN* union is used by the SPV cell, which has different attributes vary from that of a diode; the Shockley Eq. (1) represents it. So, the method of modeling the SPV is fabricated by using Eqs. (1), (2) and (3).

$$Id = Io[e^{\frac{vcq}{aktck}} - 1] \tag{1}$$

where V_C–cell voltage (V), I_0–diode's saturated current (A), a–diode's ideality constant, k–Boltzmann constant, q–charge on electron (C), T_{ck}–temperature of cell and I_D–diode current (A).

The resultant current of a SPV cell so calculated is given by subtracting normal diode current I_D from photocurrent I_L, which is illustrated in Eq. (2).

$$I = I_L - I_D \tag{2}$$

Moreover, Eq. (3) shows the work which represents the simplified model.

$$Id = IL - Io[e^{\frac{(v+IR)q}{aktck}} - 1] \tag{3}$$

Hence, the ideal solar cell can be represented by anti-parallel connection of a current source along with diode. The effect of series and shunt resistances is included for the improvement of SPV cell model.

3 Designing a Propounded PV-System

For the propounded SPV module which is attached with the grid having various components such as SPV cell, capacitor and inductor are selected and assembled according to the requirements [4]. In the propounded system, the solar panel for grid integration is used which provides the highest efficiency, robust, reliable and also provides 50% extra power per unit area. Here, the selection of 20 parallel and 6 series panels is there for PV array [4]. Mostly, there is occurrence of 85% of peak power at no load voltage, and peak power at short-circuit current is also 85%. The parameters so used for SPV cell at 1000 W/square meter and 25 °C are:

Hence, the fundamental Eq. (3) does not entitle the *V-I* attribute of the solar panel. Moreover, we can also say that the panel comprises various resistances and cells connected to panel. Therefore, surveying of the attribute at the ends of the SPV module needs the incorporation of more criteria, which is further represented in Eq. (4).

$$Id = IL - Io[e^{\frac{(v+IR)q}{aktck}} - 1] - \frac{(V + IR)}{Rsh} \tag{4}$$

Therefore, Eq. (4) entitled the current so generated on the output side of the cell depends on the voltage of SPV module, irradiance due to sun on SPV module, speed of the wind and ambient temperature.

4 Solar Cell Characteristics Equations

A SPV cell edifice is indistinguishable with the diode. Moreover, its attribute must be homogeneous for the exponential attribute of the semiconductor. Consider the panel which is made up of the set of cells, which record current to cell. The model so obtained is based on the photocurrent and diode's inverse current at the saturated region. Basically, this division represents the most fascinating equations which flourish the sun cell module. Moreover, the current so developed is photoelectric which depends on variation in temperature and actual irradiation of cell.

$$I_L = I_L(T_1) + K_0(T - T_1) \tag{5}$$

Knowing that,

$$I_L(T_1) = I_{SC}\left(T_{1/nom}\right)\frac{G}{G_{nom}} \tag{6}$$

$$K_0 = \frac{I_{SC}(T_2) - I_{SC}(T_1)}{T_2 - T_1} \tag{7}$$

Moreover, the current of the diode which is inversely saturated is considered in Eqs. (8) and (9):

$$I_0 = I_0(T_1)\left(\frac{T}{T_1}\right)^{\frac{3}{n}} e^{\frac{qV_q(T_1)}{nk\left(\frac{1}{T}-\frac{1}{T_1}\right)}} \tag{8}$$

$$I_0(T_1) = \frac{I_{sc}(T_1)}{\left(e^{\frac{qVoc(T_1)}{nk(T_1)}} - 1\right)} \tag{9}$$

The ideality of diode or quality factor value is considered to be approximately equal to 1.2 or 1.62. The voltage of band gap taken is equal to 1.12, for silicon, although the band gap may vary depending on the choice of material type. In case of Ga-As, the band gap is 1.42, the band gap 1.5 is taken for Cd-Te, and 1.75 band gap is considered for amorphous silicon. Considering temperature coefficient of $I_{SC,}$

$$a = \frac{I_{SC2} - I_{SC1}}{I_{SC}(\frac{1}{T_2 - T_1})} \tag{10}$$

$$K_0 = \frac{I_{SC}(T_2) - I_{SC}(T_1)}{T_2 - T_1} \tag{11}$$

Photoelectric current (I_L & I_{Ph}) is equal

$$I_L = I_{SC}T_1.Suns(1 + k_0(TaK - T_1)) \tag{12}$$

$$I_L = I_{SC}T_1.Suns(1 + a(TaK - TrK)) \tag{13}$$

$$I_a = I_a - \frac{I_a - I_{ph} + I_r(e^{\frac{V_C + I_a R_a}{VtT_a}} - 1)}{\frac{I_r R_s(e^{\frac{VC + IARA}{VtTa}} - 1)}{Vt\_Ta} + 1} \tag{14}$$

5 Literature Review

Mainly, literature discusses power quality, different issues and challenges, reliability in renewable energy generation, along with various forecasting viewpoints concerning harmonics reduction which have been featured. To fulfill the requirement of SPV system like good power quality, high efficiency, reduction in total harmonics, good power decoupling and compact size, many inverter topologies introduced. In [1] this study, detailed investigation and classification about all the inverter attributes are introduced for the 45 inspected topologies, which expected to serve as an expedient reference for choosing best power converter for a particular necessity in PV systems. A [4] Synchronous reference frame (SRF) hypothesis-based control procedure is utilized to improve the PQ of grid-connected SPV system. When SPV system treats like shunt active power filter, then results of simulation show that the grid voltage and current waveforms are in same phase, and percentage of THD of current is diminished from 16.29 to 4.8%, which affirms the great filtering capability of harmonics and hence improving the PQ. In [2] this examination, a fast Fourier transform (FFT)-based total harmonic distortion (THD) investigation has been done to obtain the harmonic scales at load side. Fuzzy logic controller (FLC) technique for pulse width modulation (PWM)-based voltage control inverter is suitable for giving power balance to the micro-grid. The investigation of simulation result indicates that wind energy system and SPV system with an emergency battery reinforcement system are adequately suitable to give the power continuously to keep load level of utility. In [3] this investigation, a model was contemplated in MATLAB/Simulink to decrease the THD of proposed power system by decreasing the reactive power delivered by SPV source. With the assistant of controller, non-sinusoidal waveform of source voltage, source current and burden voltage also becomes sinusoidal. The voltage at PCC increment is 29.2% with the utilization of controller. A [5] flexible multi-objective space vector pulse width modulation (SVPWM) algorithm for MLIs was implemented. The outcomes obviously show the generality of the proposed algorithm, and it can improve distinctive performance limitations of MLI such as accomplishing a quick balance of the capacitors voltages with decrease power losses. This investigation has achieved up to 21.6% faster balance in voltage with 17.6% decrease in the power losses contrasted with regular SVPWM technique. In this investigation [6], a particle swarm optimization (PSO) technique is used to improve time response specification when compared with PI controller during the transient conditions. This [7] investigation reviews about the installed maintainability parameter classification of center region toward advanced development in the sun-based PV system. The [8] least mean mixed norm (LMMN) control technique improves

the power quality at common point of interconnection (CPI). This control technique has fast response. Sensorless vector control (VC) increases system reliability and low cost for speed control of synchronous generator. Test outcomes acquired under relentless state and dynamic conditions show the adequacy of control systems. Also, the network flows under the upheld conditions has their THD underneath 5% affirming to the IEEE-519 standard. This [9] paper proposed improved control procedures utilizing fuzzy gain scheduling of proportional–integral–derivative (FGS-PID) controller for a half-breed SPV and battery energy storage (BES) framework with various barometrical conditions. The reenactment results give quick transient reaction under MATLAB/Simulink which shows that the recommended control systems are vigor and appropriate relentless state execution in the grid-associated mode in correlation with other given techniques. The aftereffects of reenactments demonstrated an expansion at the yield of the PV framework utilizing the versatile FGS-PID. The recommended control methodologies are heartiness, quick transient reaction and legitimate relentless state execution in matrix-associated mode in examination of other exhibited strategies. This [10] paper shows another improved feed-forward appropriated MPPT method for Multilevel inverters (MLIs) based three-phase grid. A contextual analysis is executed for 15 kW SPV framework to research the exhibition of the proposed method. The proposed system depends on utilizing a feed-forward control strategy for separating the MPPT of individual modules through adjusting the rate sharing of every module. The proposed technique is predominant answer for SPV framework grid hybrid because of its straightforward execution. A [11] twofold cascade H-bridge MLIs is actualized to improve the exhibition of intensity switches of SPV inverters. Right now, a [12] predictive direct power control (PDPC) technique dependent on Lyapunov work approach was presented for control of grid-tied SPV converter. The prescient control calculation utilizes the discrete model of the PV converter and predicts the future dynamic and responsive intensity of the framework by assessing a cost capacity for all voltage vectors. This [13] study developed the hysteresis controller for the inverter. Hysteresis controller used right now two different ways: (i) voltage control mode and (ii) current control mode. Utilizing MATLAB/Simulink, a model is reproduced for the proposed framework. Further, the examination presents the overall evaluation of the display of both control procedures reliant on the degree of THD with the points of confinement dictated by the guidelines.

6 Results and Comparative Analysis

The output power of solar array at different irradiance with different controller is given in Table 1 and for different temperatures is given in Table 3.

The response time, oscillation around MPP and efficiency of tracking power at peak level are given in Table 2 for different controllers. It is clear that FGS-PID (scaling factor) controller is best among all controllers (Table 3).

With the review of simulation results for different controller, the improved efficiency and reduction in THD is given in Table 4 for hybrid system.

The performance of HVC technique is found much better than HCC technique as given in Table 4. The overall PQ of grid-connected three-phase system using FFT is given in Table 5.

Table 1 Output power for solar array at different irradiance for different controllers

Time (second)	P&O	FLC	INC	ANN	FGS-PID	FGS-PID (scaling factor)	PID	ANFIS	Real value (watt)
0–3	4827	4914	4832	4940	4925	4949	4892	4939	4953
3–7	4142	4201	4148	4241	4214	4250	4172	4241	4254
7–11	5708	5781	5718	5808	5793	5815	5771	5805	5820
11–14	7228	7265	7235	7281	7274	7295	7253	7278	7300

Table 2 Efficiency, response time and oscillation for different controllers

	P&O	FLC	INC	ANN	FGS-PID	FGS-PID (scaling factor)	PID	ANFIS
Tracking efficiency (%)	94.69	97.95	94.91	98.91	98.14	99.17	95.54	98.88
Response Time (s)	0.28	0.17	0.24	0.14	0.16	0.12	0.25	0.14
Oscillation around MPP (W)	75.65	40.1	64.1	5.7	35.16	3.57	47.14	5.5

Table 3 Output power for SPV array at different temperatures for different controllers

Time (second)	P&O	FLC	INC	ANN	FGS-PID	FGS-PID (scaling factor)	PID	ANFIS	Real value (watt)
0–5	3661	3695	3669	3715	3702	3721	3684	3710	3725
5–8	4916	4953	4923	4980	4962	4987	4941	4974	4991
11–14	2894	2923	2899	2942	2931	2954	2914	2933	2956

Table 4 Total harmonic distortion for solar and wind system

Controller	Name of controlled parameter	RES
SRF controller	THD is reduced 16.20% to 4.84%	Solar
LMMN controller (SGC, UGC)	THD is below 5%	Wind
SVPWM	Power losses reduce up to 17.6% and voltage balance much faster, i.e., 21.6%	Hybrid (solar and wind) with BESS
Hysteresis current control (HCC)	THD (voltage) = 0.279% and THD (current) = 42%	Solar
Hysteresis voltage control (HVC)	THD (voltage) = 0.169% and THD (current) = 2.9%	Solar
Phase shift PWM (PS-PWM)	THD is reduced 0.6% to 0.45%	Hybrid (solar and wind)
Double-cascade H-bridge (CHB^2)	Improve MPPT efficiency by more than 50%	Solar
Double-cascade H-bridge (CHB^2)	Losses reduce at least 20%. Voltage THD of less than 5%	Solar
Predictive direct power control (PDPC)	Power error reduced from 4% to 1%	Solar

Table 5 Power quality analysis using FFT

THD of load (%)	Time (second)				
	1.1–1.9	2.1–2.9	3.1–3.9	4.1–4.9	5.1–5.9
V_a (V)	2.52	2.13	2.69	2.47	2.49
V_b (V)	2.45	2.20	2.96	2.44	2.40
V_c (V)	2.50	2.55	2.69	2.46	2.50
I_a (A)	2.52	2.13	3.05	2.27	2.49
I_b (A)	2.45	2.07	4.53	2.44	2.40
I_c (A)	2.50	2.56	4.86	2.46	2.50

7 Conclusion

By reviewing the result of different controllers employed on AC utility grid-tied hybrid system, it has been observed that FGS-PID control technique gives outstanding result of improving power quality. The overall dynamic performance of AC utility grid-tied hybrid system with BESS is achieved using fuzzy-based controller. HVC technique gives better result than HCC technique. Maximum power tracking efficiency is very high using FGS-PID (scaling factor) controller when compared with P&O control technique. The response time and overshoot around MPP have been reduced very fast using FGS-PID controller. The simulation results are more effective with ANFIS controller and ANN controller as compared to other controller.

Future scope

The result may be more effective with employing the different control strategies using anti-windup control, discrete SVPWM, selective harmonics techniques, sliding mode control, so that the overall power quality of hybrid-type grid-connected system is improved.

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SVM-Based Temporal Compression Techniques for Video Compression

Anupama S. Budhewar, Milind V. Bhalerao, and Dharmpal D. Doye

1 Introduction

Artificial intelligence gives the power to learn and improve from expertise automatically without expressly programmed. Machine learning is used to focus on the event that will access knowledge. A SVM is employed to permit labeling to a variable. Such as in a given video it detects the action and recognizes that action cycling, driving, etc. Also, SVM is used to classify the objects from its absolute boundaries. SVD is the process to decompose the matrix. Similarly, the SVD is used to suppress the pixels which are not part of the ROI. SVD uses a Kronecker product in which every element of a given matrix gets multiplied with a complete matrix. Consider a_{11}, a_{12}, a_{21}, a_{22} are the elements of matrix A, in Kronecker product, a_{11} gets multiplied with elements of matrix B. Similarly, a_{12} gets multiplied with elements of matrix B and goes on. Due to this method, averaging the intensities is possible. Easily foreground and background are distinguished. This method removes noise in the image also. The accuracy of the method is more. To compress video and image find out the motion-containing pixels. Once the pixels are detected with motion, easily no motion pixels can be distinguished and removed from image and video. The approach is represented as follows: Sect. 2 briefs a review of existing compression

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techniques. Methods used to distinguish foreground and background are compared. Section 3 clarifies the execution of the proposed technique with various different criteria and alternatives not thought about before. Section 4 depicts the proposed technique for lossless sight and sound pressure utilizing the ideal forecast. In Sect. 5, a few outcomes are introduced; lastly, the ends are attracted Sect. 6.

1.1 Literature Survey

To find temporal similarities and motion dissimilarities in angular directions, Zhou et al. [1] proposed method and also used spectral clustering to classify trajectories into two parts. High-intensity pixels are recognized as foreground and low-intensity pixels as background. It is easy to distinguish the motion-containing pixels of an image. The method requires more time, and computation complexity is more for large frame videos. Budhewar et al. [2] represented HSI-based to distinguish foreground and background. HSI-based method recognizes the foreground and background efficiently. HSI finds out the intensities of pixels in an image. The minimum and maximum intensity pixels are distinguished using the threshold factor. The method requires less time for images and videos. SVC is used to empower the encoding of a high-quality video bit-stream that contains at least one subset bit-streams that would themselves be able to be decoded with an intricacy and reproduction quality like that accomplished utilizing the current [3, 4]. The block size of the SVC system can be varied to match the motion estimation that is used to reduce temporal redundancy between frames. It has seven modes for inter-prediction in multiples combinations of 2×2, 4×4, 8×8, and 16×16 macro-block size. The large size images require more space to store also bandwidth to transmit across the network. Higher-order interpolation is readjusted in various directions to accelerate the rate distortion. The approach performs various types of refining and sampling methods and substitution methods. This helps to detect the change, and dissimilar frames are captured and stored in buffer, and similar frames are removed to gain good compression [1]. Rank of the matrix is used to find out the minimum intensity pixels which contain background only. It recognizes the minimum intensity pixels and the pixels which are not the part of foreground pixels [5, 6]. Clustering regions are used to recognize the spatially coherent clusters. These clusters contain the motion-containing foreground objects [7]. Block structure is a method to find incorporation between the spatial prior [8, 9] and sparsity structure which does not require the block size. Whether the block size is maximum or minimum that detects the foreground object efficiently [10, 11]. The method maintains the balance between sparsity and group clustering priority. But the main advantage of these methods is that it detects minimum foreground pixels. So it requires less time for temporal compression. Satkin et al. [13] proposed technique to naturally perceive the transient distinction of the activity important to improve the exactness of activity acknowledgment. Be that as it may, this technique overlooked spatial editing, along these lines, may incorporate people performing superfluous activities during preparing. Right now content is used to identify frontal

area pixels. This strategy learning spatial or worldly degree of activity may neglect to recognize its accurate degree in a video, and for the most part, lead to incidental video substance from either fleeting or spatial space. The recognition execution is accordingly corrupted because of the incorporation of insignificant video substances in the preparing stage.

2 Proposed Method

SVM and rank of the framework used to discover frontal area pixels. There are numerous applications such as marking the information set. SVM forestalls the overfitting. Here SVD is a decay of a network into 3 grids, for example, S, U, V, where S is the inclining lattice of particular qualities and U and V are the left and right; the position of a network is a proportion of the interesting data put away in a grid. Higher the position, the more the data put away in a network. Eigenvectors of a grid are headings of the greatest spread or change of information. These days clicking photographs through the advanced cell is interest and enthusiasm; however, sparing these photographs of the web is cerebral pain. To store the pictures with less memory, SVD assists with limiting the size of a picture in bytes to a satisfactory degree of value. SVD assists with cutting the picture into three frameworks dependent on the initial scarcely any solitary qualities and gets a compacted guess of the first picture. There are some packed images which indistinguishable from the original by human eyes. At the time of decompression matrix, completion operation is carried out to fill the missing entries. In frameworks of pictures since a picture is adjacent to the estimations of most pixels that rely upon the pixels around them. In this way, a low-position lattice can be a decent estimate of these pictures. Eigenvalues of the eigenvectors help to find directions of maximum variance of eigenvectors. High rank matrices store maximum information, so the approach selects high rank features and discards low rank features to achieve compression. Here in this approach, spectral clustering is also used, and it is grouping of similar objects. It is an unsupervised machine learning technique. K-means clustering is a simple and powerful algorithm to classify similar objects. But there are certain situations where it does not work more accurately. Like in image compression, there are some pixels which are not part of ROI; but they present in the compressed image, and some of them are part of ROI but not in the compressed image. Here in this approach to find the higher similar intensity pixels, affinity matrix is used. Affinity matrix is used to represent how similar one object is to another. Here in this approach, affinity matrix is used to higher the high-intensity pixels and lower the low-intensity pixels. Affinity matrix first finds the occurrences of the intensities of the pixels. Then it groups first similar intensities rows and columns. Affinity score is high if objects are very similar. Distance score is very small if objects are close to each other. Here distance is inversely proportional to affinity. Existing methods finds searching points for fixed number of frames. Loss of information was more, finds specific actions only, more noise, and detects more frames with no motion. To find the minimum intensity pixels, rank of the matrix

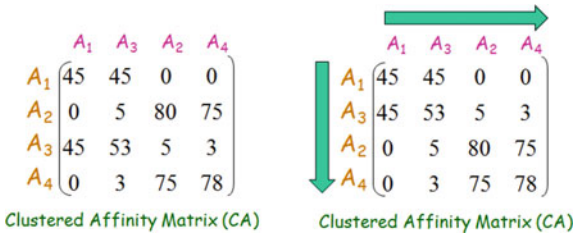

Fig. 1 Example of affinity matrix

is used. In this, rank will give us all nonzeros matrix rows and columns using the following equation.

$$\text{Affi}(a_i, a_j) = \text{Cost}\,(Q_k) * \text{Freq}\,(Q_P) \tag{1}$$

where Cost (Q_k) is the cost of the matrix element. Freq (Q_P) is a number of occurrences of that element. Affinity matrix gives the sum of all nonzero row elements. So it gives all maximum intensity pixels. Affinity matrix finds clustered affinity matrix as follows (Fig. 1).

The affinity score is high if objects are very similar. The distance score is very small if objects are close to each other. Here distance is inversely proportional to affinity. Existing methods find searching points for a fixed number of frames. Loss of information was more, finds specific actions only, more noise, and detects more frames with no motion.

To find the minimum intensity pixels, rank of the matrix is used. This rank will give us all nonzeros matrix rows and columns using the following equation.

$$\text{Rank}\,[A] \leq \min\ \text{int} \tag{2}$$

$$\text{Let}\left[A^{-1}\right] = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}^{-1} = \frac{1}{|A|}[r][(a_{22} - a_{12}) * (a_{21} - a_{11})] \tag{3}$$

We find the rank of matrix A mathematically as follows
Rank of matrix $Q = \text{UU}^T$

$$\text{A}=\begin{bmatrix} 1 & 0 & 1 \\ 2 & 1 & 2 \\ 1 & 0 & -1 \end{bmatrix} \xrightarrow[R_3\text{-}R_1]{R_2\text{-}2R_1} \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & -2 \end{bmatrix} \xrightarrow{\frac{-1}{2}R_3} \begin{bmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix} \xrightarrow{R_1\text{-}R_3} \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

If we get identical matrix, then rank of the matrix will be the number of nonzero rows.

If we get identical matrix, then rank of the matrix will be the number of nonzero rows.

Spectral clustering is a technique with roots in graph theory, where the approach is used to identify communities of nodes in a graph based on the edges connecting them. The method is flexible and allows us to cluster non-graph data as well. SVM produces an accurate classification for new videos and also distinguishes between maximum and minimum intensity pixels. Here below to rank of the matrix number will be treated as negative or minimum intensity pixels and above to that will be maximum intensity as follows

$$\min_{w,b}\left(\frac{1}{2}||\omega||^2 + c\sum_{i=i}^{m}\xi_i\right) \tag{4}$$

where ω a nonzero vector, c is a constant used to control the trade-off between margin maximization and error minimization [5], $\xi_i \geq 0$ is a function of the distance from the margin hyperplane to the points which have slack.

The rank of the matrix reduces eigen-noise. It is a nonzeros row of a matrix having determinant zero. An affinity matrix is used to find the similarity between elements of a matrix.

Spectral clustering is applied to segment all boundaries into two clusters. Lower intensity clusters will treat as background, and it is removed. The pixels with high intensity are getting higher values as it gets multiplied with occurrences. For example, if any four rows of matrix have number of occurrences 5 or 6 times, its intensity value is 99, it gets multiplied with frequency so it gets boosted to 99*6 = 594. And likewise, higher intensity pixels get higher values and lower values become negative, i.e., less than zero values get discarded. The support vector machine uses labeling to variables of the training dataset. It is also used to find the absolute distance between boundaries and x-elements. Singular vector decomposition is used to reduce the matrix to its constitutes. It is a major factor for the analysis of principal component decomposition and empirical orthogonal function.

It is a method of decomposing a matrix into three other matrices.

$$A = \mathrm{USV}^T \tag{5}$$

where A is m*n matrix, U is m*n orthogonal matrix, S is m*n diagonal matrix, and V is m*n orthogonal matrix.

$$\mathrm{U}^T\mathrm{U} = \mathrm{VV}^T = I \tag{6}$$

where I is an identity matrix. Here rank and affinity matrices are used to find out minimum and maximum intensity pixels. To suppress noise and the pixels which are not part of ROI, SVD is used. SVD used Kronecker product in which the individual elements of the first matrix are gets multiplied with the next matrix such as a_{11} is

matrix B, a_{12} with matrix B, and so on. R min (m, n) is used to decompose the given matrix. It finds all minimum intensities pixels. So temporal comparison requires less time. To detect the action, affinity matrix is used. Affinity matrix gives all maximum intensities pixels. The benefit of this method is that we get a sum of two matrices.

For example, if A is 2×2 and B is also 2×2 matrix, then Kronecker method gives 4×4 matrices, whereas normal matrix multiplication gives 2×2 as output matrix.

For even–odd numbers matrices, it shows index exceed error. The proposed method finds minimum foreground pixels and reduces time to find dissimilar frames. Due to minimum foreground pixels, accuracy is improved by spatial compression as compared to other methods. Noise removal quality of an image is better than other methods.

3 Results

Accuracy of proposed method is analyzed based on the following parameters (Table 1 and Figs. 2, 3, 4)

PCC is percentage of correct classification (Table 2)

$$\text{Specificity} = \frac{\text{TN}}{\text{TN} + \text{FP}} * 100 \tag{7}$$

$$\text{Recall} = \frac{\text{TP}}{\text{TP} + \text{FN}} * 100 \tag{8}$$

$$\text{Precision} = \frac{\text{TP}}{\text{TP} + \text{FP}} * 100 \tag{9}$$

Table 1 Comparative analysis of SVM with existing methods

Sr. No.	Image	Method 1(HSI)	Method 2(Edge)	Method 3(SVM + Rank)	Detected FG pixels
1.	News	76,800	485,604	48	76,800
2.	Lena	262,144	262,144	107	262,144
3.	Cricket	833,578	833,684	47	833,625
4.	Parrot	168,710	169,701	130	168,840
5.	Cartoon	709,241	712,360	329,524	1,038,765
6.	Sports	828,321	41,913	24	2,485,035
7.	News	688,080	476,709	4887	1,032,120
8.	News2	3187	16,671	9415	1,438,920

Fig. 2 Comparative analysis of SVM method with existing methods the number of foreground pixels detected in **a** HSI-based approach detected the pixels, **b** edge-based approach detected the pixels, and in **c** SVM-based approach detected the pixels

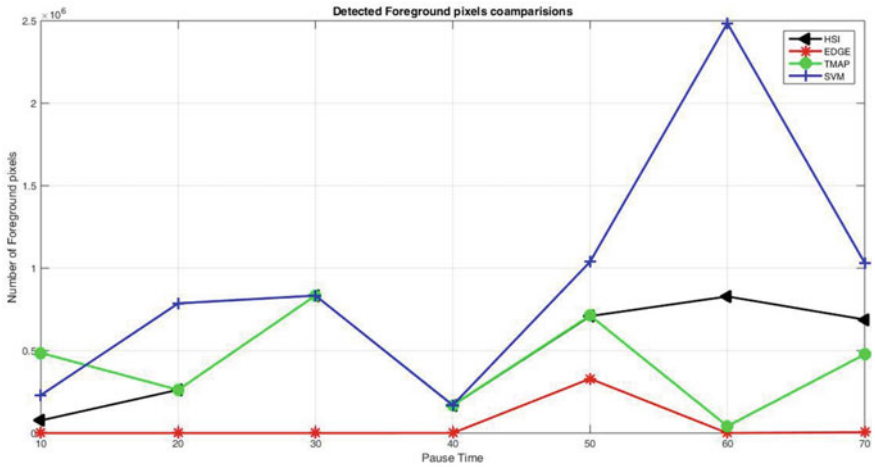

Fig. 3 Graphical analysis of SVM method with existing methods the number of foreground pixels detected

$$\mathrm{F1} = \frac{2 * \mathrm{Precision}}{\mathrm{Precision} + \mathrm{Recall}} \tag{10}$$

Here represented method incorporates five saliency maps generated from different stages to obtain the final saliency map. It includes $S_c S_c^d$, S_d^d, S_c^{3-D}, S_d^{3-D} (Table 3 and Figs. 5, 6, 7, 8, 9, 10).

4 Conclusion

This paper represents the approach to detect foreground pixels using SVM. There are various block matching algorithms, among them, FS searches 225 points for the best match and other methods require less. The proposed method achieves good compression in less time, and it finds the best match in 9 checking points only. Computation

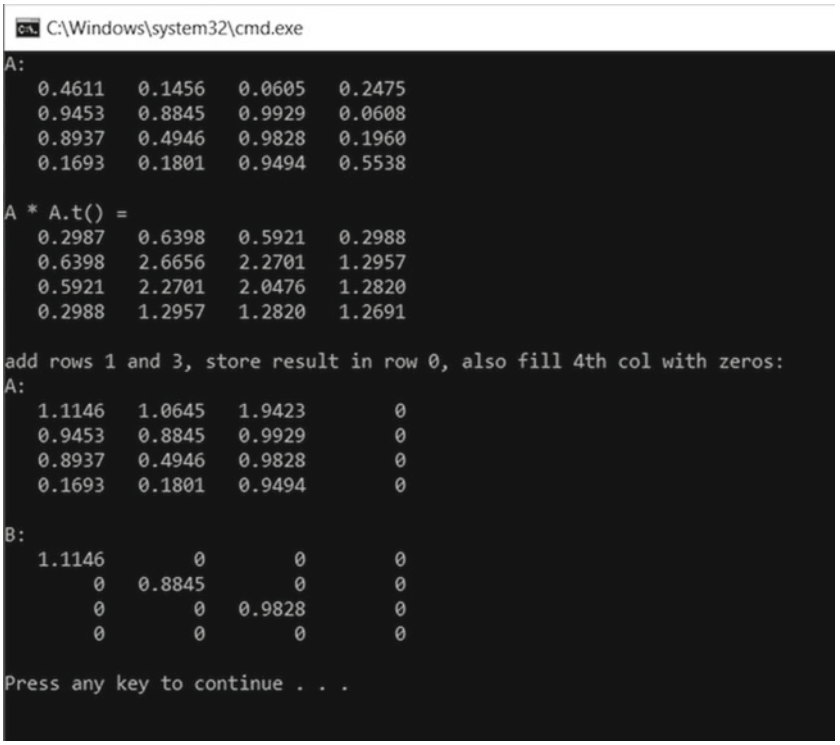

Fig. 4 Matrix values

Table 2 Comparative analysis of SVM with existing methods

Sr. No.	Image	PCC	Recall	Precision	F1	Specificity
1.	News	6.62	5.26	9.82	6.66	1
2.	Lena	6.64	5.23	9.87	6.66	1
3.	Cricket	6.62	5.31	9.8	6.66	1
4.	Parrot	6.65	5.02	9.9	6.66	1
5.	Cartoon	6.69	5.28	9.9	6.66	1
6.	Sports	6.68	5.31	9.2	6.66	1
7.	News	6.67	5.21	9.82	6.66	1
8.	News2	6.61	5.24	9.83	6.66	1

Table 3 Comparative analysis of proposed method based on the following parameters

Comp	S_c	S_c^d	$S_c^3 D$	S_d	S_d^d	S_c^{3-D}	S_d^{3-D}	Proposed method
Precision	0.606	0.667	0.701	0.475	0.588	0.666	0.694	0.982
Recall	0.786	0.733	0.697	0.567	0.652	0.708	0.717	0.523
F-measure	0.613	0.652	0.671	0.466	0.568	0.645	0.669	0.66

Fig. 5 Comparative results of compressed image with original image

complexity and time complexity are less than other methods. The proposed method finds averaging foreground pixels, so it requires less time for comparisons. The proposed method finds minimum foreground pixels and reduces time to find dissimilar frames. Due to minimum foreground pixels, accuracy is improved by spatial compression as compared to other methods. Noise removal quality of an image is better than other methods.

Fig. 6 Comparative results of compressed image with original image

Fig. 7 Comparative results of compressed image with original image

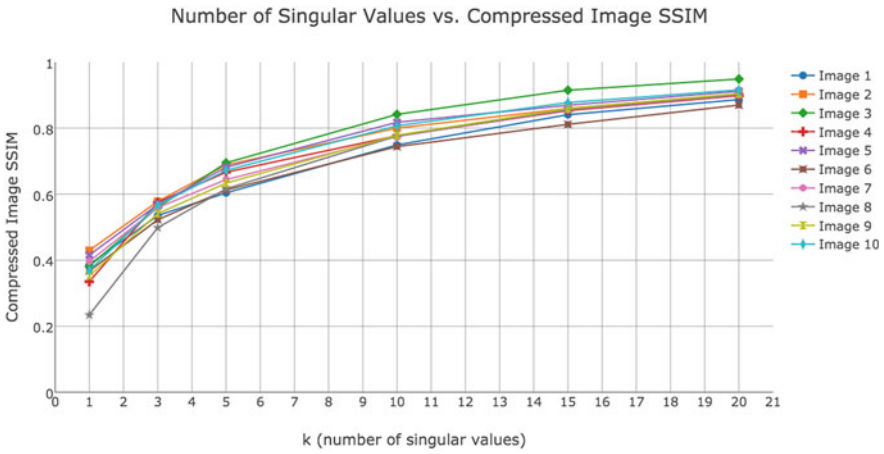

Fig. 8 Comparative results of compressed image with original image based on SSIM

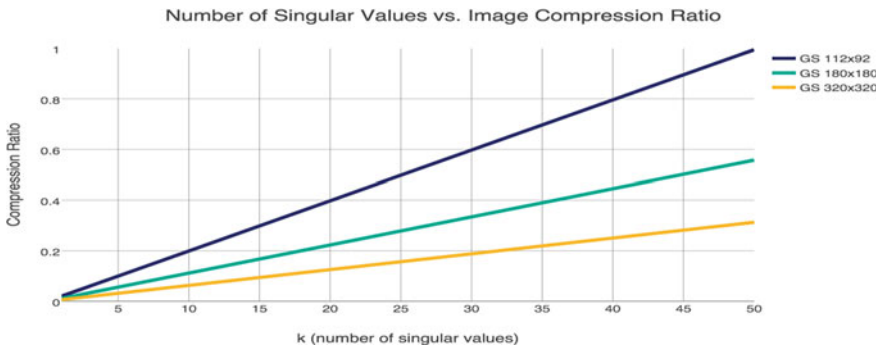

Fig. 9 Comparative results of compressed image with original image based on SSIM

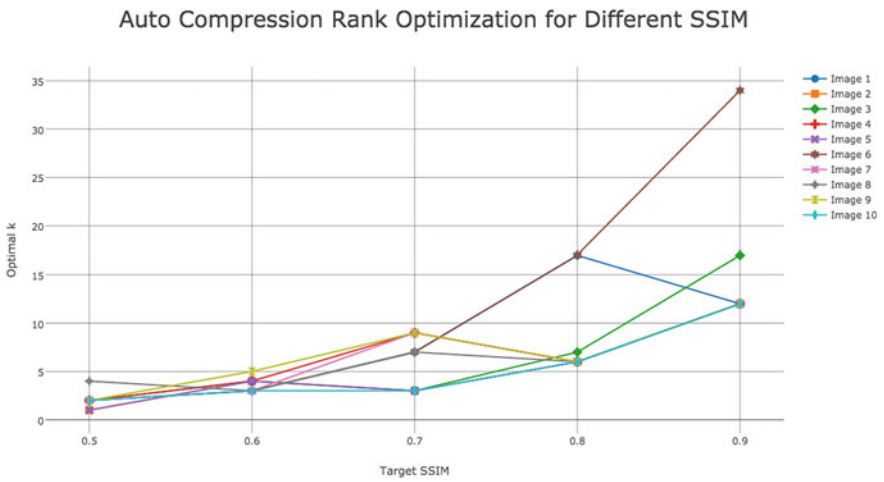

Fig. 10 Comparative results of compressed image with original image based on SSIM

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Design and Determination of Various Methods of PID Controller for Networked Control Systems

Mayank Kumar Gautam, Avadh Pati, Ramashis Banerjee, and Sunil Kumar Mishra

1 Introduction

The theory of control networks is expanding to new dimensions day by day. The idea of using a closed-loop network with COTS hardware using LAN networks has emerged and is being explored extensively. The traditional control loop is expanding over giant communication networks [1]. Cable costs are saved with wireless control networks, the location of sensors is flexible since the detector needs no cables, and it is easy to use devices in the network.

Control over the net is that the final case has no boundary between the floor of the manufacturing plant and therefore the world. Sometimes a traditional control style takes on constant delays, thereby developing new techniques is required. The findings thus far provide stability requirements for delays lower than the sampling time and stability below the dropout of the packet [2]. Model predictive controllers are intended to handle different time delays [3] but are highly sophisticated to implement. Dynamic programming is another approach [4].

This paper discusses various methods of PID controller for NCS. A third-order PID controller model is selected as a controller for simplicity. Firstly, design of conventional P, PI, and PID controllers has been done. Afterwards conventional PID with different types of controllers is used so that we can see the comparison of conventional PID with other controllers.

The rest of paper is designed in this way. Section 2 addresses different types of controller development techniques. The simulation tests of different controllers

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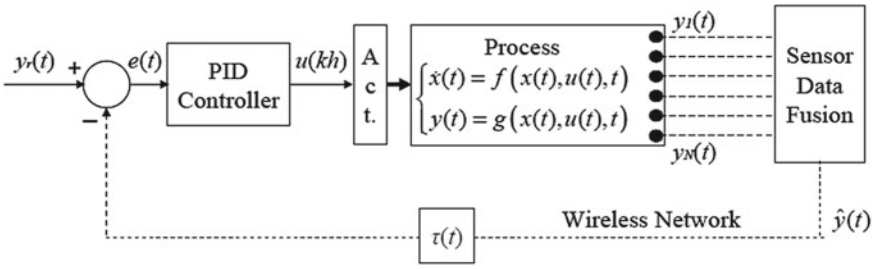


Fig. 1 PID controller in NCS

are addressed in Sect. 3. Section 4 discusses comparing the PID with the design of optimum controller and fractional controller. Ultimately, the conclusion is illustrated in Sect. 5.

2 Controller Design

2.1 Networked Control System

Development in the field of network technology is evolving a phenomenon of network control technology [4–6]. With the advancement if the field of communication and technology, the phenomenon of networked control technology is evolved. The control of systems with the help of networking has gained so much attention from the people of control background. This networking can be called as networked control systems as shown in Fig. 1. All the components are connected to each other via a communication network.

Firstly, the measured data is refined and then added in order to get reliable information of the states of system. The resulting signal is then sent to the PID controller for further calculation of the new control signal for the proceeding actuator.

2.2 Conventional PID Controllers

PID controllers are one of the oldest and finest control strategies of past times [7]. During earlier days, PID is implemented in air-operated devices, vacuum, and solid state electronics, instead of implementation as in today's digital microprocessors. It is simpler in structure and very easy to tune up in plant operators. Because of its simplicity, it is been widely used in industrial control as well in vehicular control. In a survey conducted during 80s era, it has been found the application of PID controllers

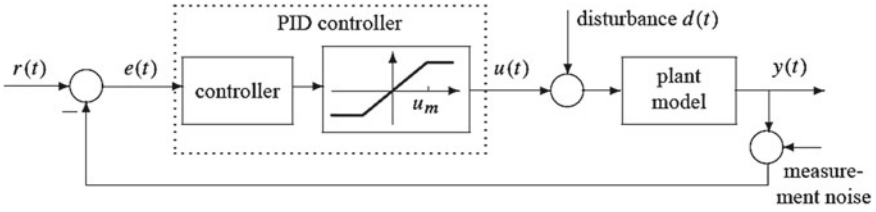


Fig. 2 A conventional PID control structure

have more than 90% of the control loops [8]. It is a booming as well as active research topic for researchers as described in [8–12].

Figure 2 shows that the *e(t)* is responsible to produce the P, I, and D control actions which added with the disturbance signals and feedback signals to form *u(t)* which is then fed to the plant.

Common mathematical expression for above structure as—

$$u(t) = K_p e(t) + \frac{1}{T_i}\int_0^t e(\tau)d\tau + T_d\frac{de(t)}{dt} \tag{1}$$

where $u(t)\rightarrow$ input signal, $e(t)\rightarrow$ difference of ref input and output and $r(t)\rightarrow$ ref input.

Taking the parameters related to Eq. (1) as—

$$K_p = K, K_i = \frac{K}{T_i}, K_d = KT_d \tag{2}$$

Equations (3)–(6) can be obtained by Laplace transform of Eq. (1). The gain of the $D(s)$ is restricted because of application of the proper approx. method [13].

$$U(s) = P(s) + I(s) + D(s) \tag{3}$$

$$P(s) = Ke(s) = K_p e(s) \tag{4}$$

$$I(s) = \frac{K}{T_i s}e(s) = \frac{K_i}{s}e(s) \tag{5}$$

$$D(s) = KT_d e(s) \approx K\frac{T_d s}{1 + \frac{T_d}{N}s}e(s) = \frac{K_d s}{1 + \frac{K_d}{K_p N}s}e(s) \tag{6}$$

where N is a filter time constant.

Due to limitation during low freqs, the proper approx. method is precise up to some extent, but at high frequencies, when there is the presence of measurement noise, ultimately the gain becomes limited. Hence, $N = 3 < N < 20$. [13].

2.3 Optimal Controller Design

The optimal controller design method has been presented here. The process for which the controller is designed along with its delay characteristics is modeled here, as they affect the enactment of the control system. The performance criterion is to assess firstly as it plays vital role in any type of optimal controller. There are various optimization criteria which are modified for different optimization tasks. Various cost criteria and optimization problems are discussed next.

Considering the unconstrained optimization problem which can be mathematically termed as

$$\min F(x) \tag{7}$$

where vector $\boldsymbol{x} = [x_1, x_2, \ldots, x_n]^T$.

To find the vector x is the sole aim so that we can minimize the objective func $F(\boldsymbol{x})$. If there is the situation of max problem then $F(x) \rightarrow -F(\boldsymbol{x})$ in order to convert the above problem to a min problem.

Next, considering the constrained optimization problem which can be mathematically termed as

$$\min F(x)$$

where the x is subjected to different conditions such as,

$$\begin{cases} Ax \leq B \\ A_{eq}x = B_{eq} \\ x_m \leq x \leq x_M \\ C(x) \leq 0 \\ C_{eq}(x) = 0 \end{cases} \tag{8}$$

where vector $x = [x_1, x_2, \ldots, x_n]^T$.

2.4 Fractional Order Design

Fractional calculus which was discovered almost three hundred years ago. But due to mathematical complexities, it was ignored for a long time [14]. Recently it is found that fractional calculus is the generalization of classical calculus and natural phenomenon can be defined better through fractional calculus rather than its classical counterpart [15]. Nowadays, fractional calculus is extensively used in physics, chemistry, sociology, finance, control theory, signal processing, and its applications are increasing day by day [16]. It is also found that fractional systems provide better stability as compared to integer counterpart. The motivation behind the design of FOPID as compared to conventional PID controller is there are two extra parameters present in FOPID controller which make the design process more flexible as well as the performance is more improved as compared to conventional PID controller. There are many explanations of fractional derivative including RL, Caputo, and these derivatives can be approximated by using Grunwald–Letnikov method, Oustaloup approximation [17, 18]. FOPID was introduced by Igor Podlubny who was able to proof the superiority of FOPID after adding two more parameters λ and μ which makes the controller more flexible in design perspective. Fractional calculus was born three hundred years ago when 'L Hospital' interrogated to 'Libnitz' that what would happen when order of the derivative will become ½. In this way, one can find the derivative of a function when the order of the derivative is non-integer, which attracts the scientists and researchers to get the insight of fractional calculus. It is not easy to visualize but its existence cannot be neglected. Fractional calculus go hand in hand with classical calculus.

Fractional Integral–Differential operator ${}_aD_t^{\alpha}$ can be defined [19] as

$$ {}_aD_t^{\alpha} = \begin{cases} \frac{d^{\alpha}}{dt^{\alpha}}, \alpha > 0 \\ 1, \alpha = 0 \\ \int_a^t (d\tau)^{-\alpha}, \alpha < 0 \end{cases} \tag{9} $$

FOPID is the generalization of conventional PID by taking five parameters including $K_p, K_i, K_d, \lambda, \mu$. Transfer function of FOPID [20, 21] can be written as

$$ \frac{C(s)}{R(s)} = K_p + K_i s^{(-\lambda)} + K_d s^{(\mu)} \tag{10} $$

FOPID is implemented in MATLAB by using FOMCON toolbox [14, 15]. Here, the comparison between the two controllers has been shown. Improved performance and better stability are achieved when FOPID is used.

3 Simulation Results

In this section, the numerical simulations have been obtained by considering a system given below:

$$G(s) = \frac{1}{(s+1)^3} \tag{11}$$

The process for designing controllers for wireless network has been adopted from [6].

3.1 Conventional PID Controller

Example 1 Considering $G(s) = \frac{1}{(s+1)^3}$.

Taking only K_p, i.e., the value of $T_i \rightarrow \infty$and $T_d = 0$, responses are shown in Fig. 3a, and here in this figure, it can be seen that as soon as the value of K_p increases, the response speed and overshoot increases, but in turn the steady-state error will decrease. If K_p>*1 (from previous case)*, this results in unstable system. Figure 3b shows root locus, where K_p is not in range of (0, 8), and this results in unstable system.

But when $K_p = 1$, considering different T_i, the response is presented in Fig. 4a. Here, steady-state error is nil. But if the value of $T_i < 0.6$, the above system will ultimately become unstable. Taking $K_p = T_i = 1$, with different T_d is shown in Fig. 4b. Hence, with the increase in $T_{d,}$ response has overshoot very small with a slightly slower T_r & T_s.

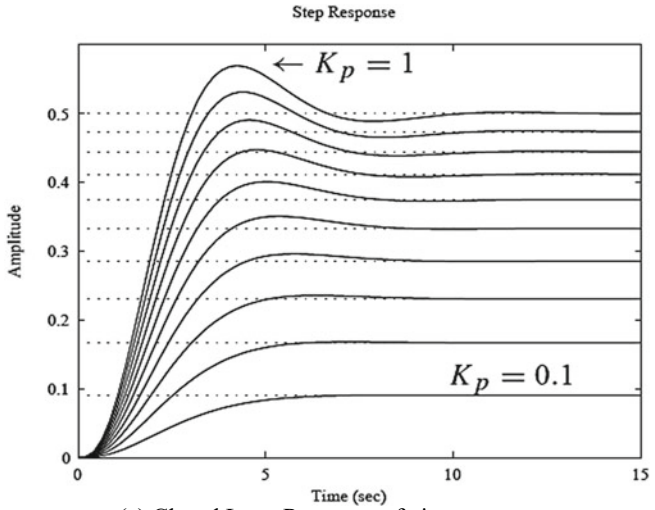
3.2 Optimal Controller

Example 2 Considering $G(s)\frac{1}{(s+1)^4}$. Figure 5a shows the Simulink model for the optimal PID control:

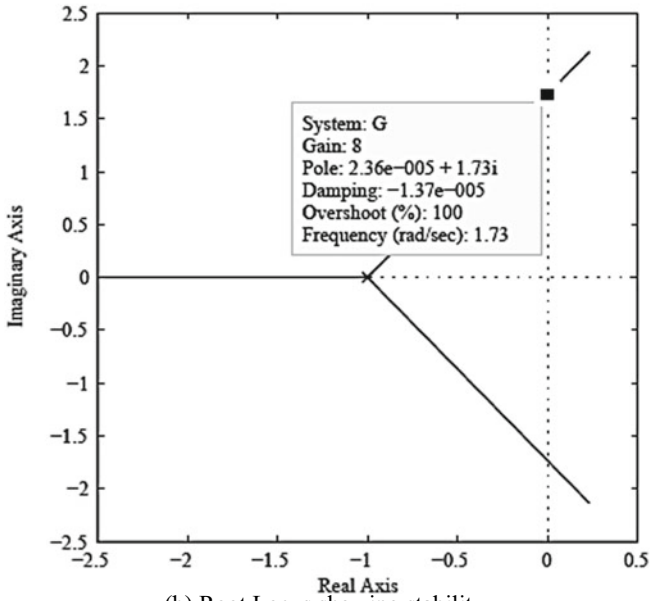
After doing optimization, the transfer function obtained is as follows:

$$G_c(s) = 0.2583 + \frac{0.0001}{s} + \frac{0.7159s}{0.01s+1} \tag{10}$$

due to which the ITAE cost criterion is minimized. From the above, we conclude that the value of $K_i = 0.0001$ which can be neglected as it is very small. The closed-loop step response which shows the comparison of different controllers is shown in Fig. 5b.



(a) Closed Loop Response of given system

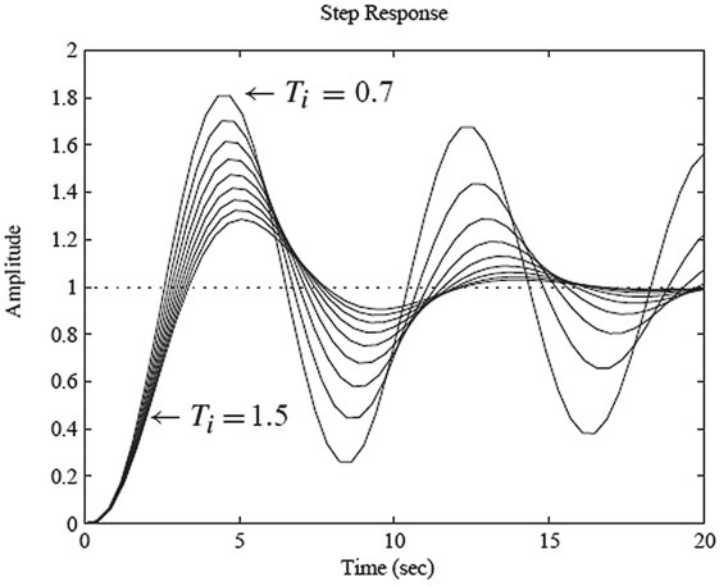


(b) Root Locus showing stability

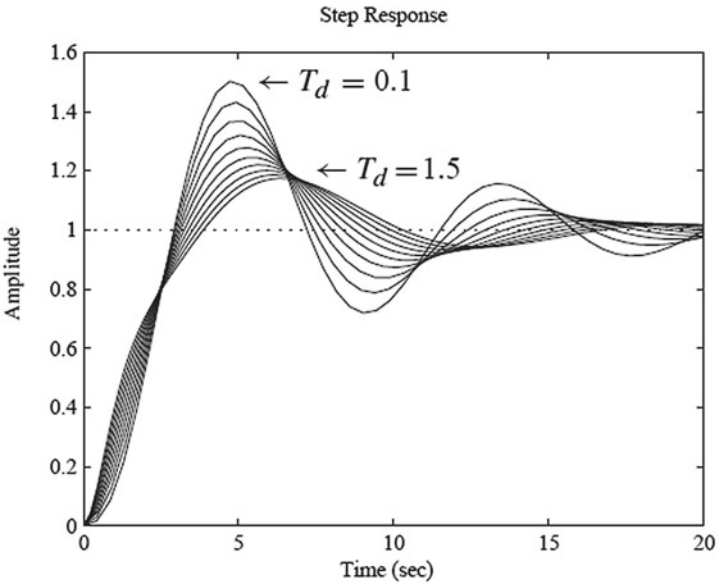
Fig. 3 Closed-loop step responses and root locus of given system

3.3 Fractional Order Controller

Example 3 Considering $G(s) = \frac{1}{(s+1)^3}$, the Simulink diagram of FOPID is as shown in Fig. 6. The FOPID parameters are: *Kp=2*, $K_i = 2$, $K_d = 2$, $\lambda = 0.8$ & $\mu = 0.7$. The PID parameters are: $K_p = 1$, $K_i = 1$, $K_d = 0$.

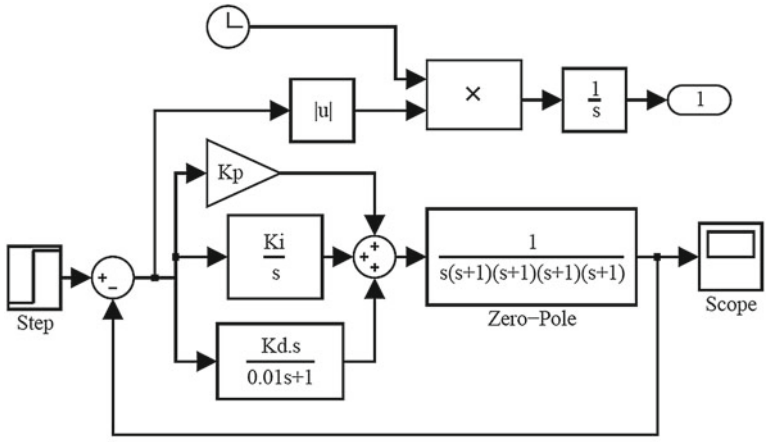


(a) PI Controller

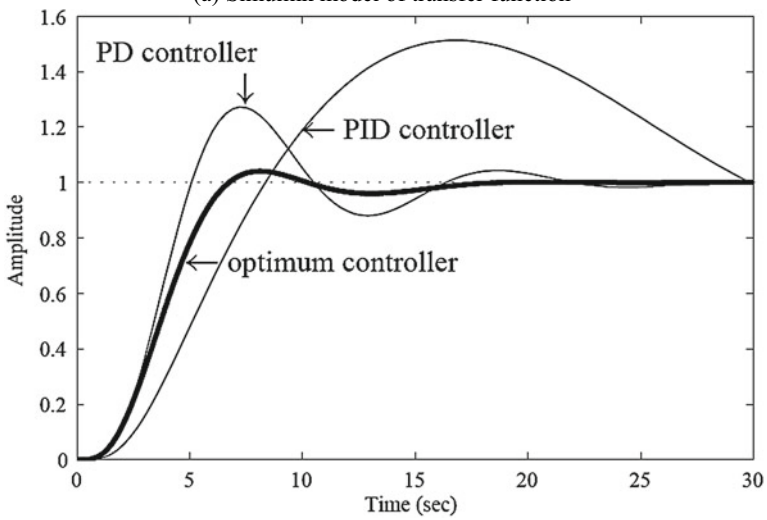


(b PID Controller

Fig. 4 PI and PID controllers' responses



(a) Simulink model of transfer function



(b) Comparison of different controllers

Fig. 5 Simulink model and comparison of different controllers

The above figure explains that in case of FOPID, the settling time is faster and overshoot is reduced as compared to conventional PID. Stability is achieved earlier in FOPID. Classical control is a conventional approach using P, PI, and PID controller. The best thing about this controller is that it gives robust performance. The problem occurs when dealing with multivariable case; hence, modern control theory was established. Optimal control is describing that the control loop is optimized in such a way that max output is obtained with min output, i.e., cost function is made and parameters are optimized so as to give required results with minimum input. The main

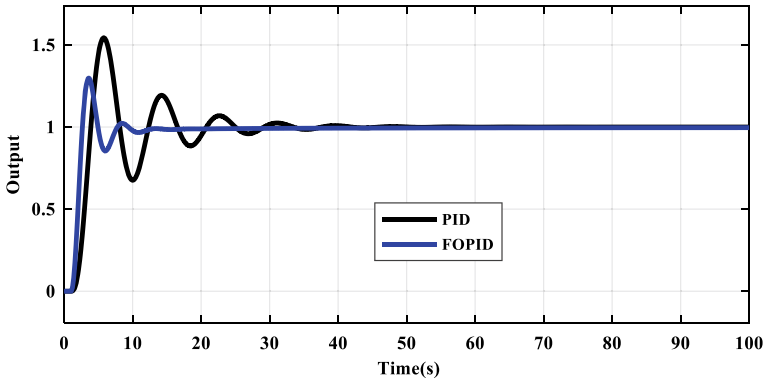


Fig. 6 Comparison between PID and FOPID controller performance

benefit of FOPID controller is that it provides larger adjustable time and frequency response which results in the better performance.

4 Conclusion

This paper presents different methods to design a PID controller especially for networked control systems. Various results are obtained from the analysis of PID with conventional, optimal as well as with FO controllers. The optimal control shows the better waveform than traditional controllers. Similarly, in case of FOPID, the system reaches to stability at very faster pace than conventional PID. All the controllers are tested with time varying delays as presented in the paper. As time varying delays are important in any communication or computer network, there are also other possible issues which have to minimize in order to have better functioning of NCS.

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A Power Quality Review for a Multi-level Inverter-Controlled Grid Interfaced PV System

Sachin Thakur, Inderpreet Kaur, and Akhil Gupta

1 Introduction

These days, the major overall issue is of contamination control and vitality emergency. The grid-associated photovoltaic (PV) framework is one of the promising options for maintainable and autonomous vitality asset. The power electronic innovation assumes a significant job in distributed generation (DG) and sustainable power sources to electrical network. It is generally utilized and quickly extending [1]. Biofuel, sun-based, hydro and wind are the significant candidates of sustainable power source. Among these, sunlight-based and winds are progressively unmistakable. Sun-powered vitality establishment has become rapidly in the progression of current years in India, and explanation for this progress is the different points of interest gave by sun-based, for example, scaled down value, non-contaminated, low upkeep cost and ceaseless accessibility during the daytime [2]. David sovereign distributed their article termed as "Inverter" in 1925. At first, these had been utilized to power for lightening burden. However, in recent times, it has been seen that these inverters are finding their numerous applications in utilization of electric power for distributed generation systems [3].

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In high power applications, multi-level inverter (MLI) has drawn colossal enthusiasm because of its attributes giving stairs yield voltage wave [4]. The primary idea of MLI is guess of an undulation to a stairs wave involving a few stages and stages existence provided as of various DC levels that might be upheld via arrangement associated battery storage system or sustainable power sources. MLI accomplishes high power appraisals and benefit of empowering the interconnection of sustainable power source [5] and thus improves the vitality use of the system [6]. In present-day situation, PQ [7] issues are getting a lot more grounded because of essence of extremely delicate types of equipments which leads to deprived power factor and low efficiency. MLI begins as of two-levels and *N*-levels may be taken via the prerequisite as appeared in Fig. 1. Unlimited MLI designs have been developed, and few are proposed during the last not many years [9]. Primarily, MLI can be ordered into three sorts portrayed underneath and appeared in Fig. 2

The principle kind of MLI in which the unique vital assets that are capacitors, batteries may be completely isolated DC assets is cascaded H-bridge (CHB), and this topology is used in various applications like mechanical drives, electric powered vehicles and PV-cell time structures [11].

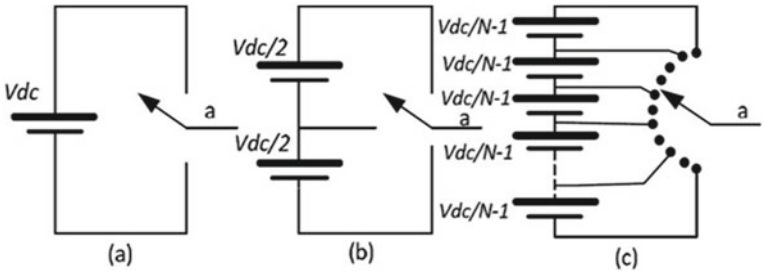

Fig. 1 **a** MLI with two-levels. **b** MLI with three-levels **c** MLI with *N*-levels [8]

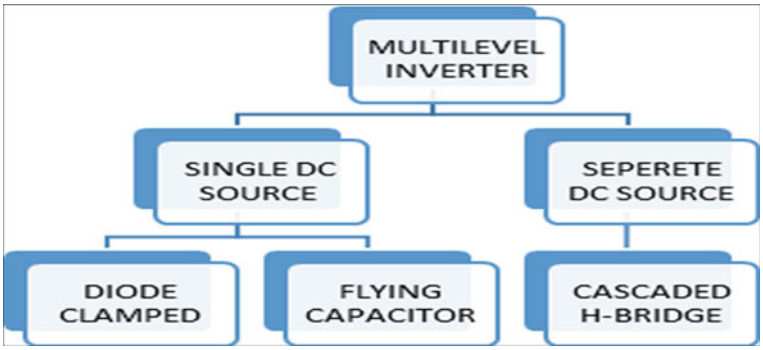

Fig. 2 Different MLI topologies [10]

2 A Solar PV System

Sun-powered PV is logically turning into the most proper hot spot for electric power technology among all different sustainable power resources because of its benefits, for example, plenitude, contamination free (known as efficient power vitality), no pivoting parts, lower operational expenses [12–14]. Also, typically the DC voltage of sun-powered PV module is less, starting from 30–60 V. To fulfill the voltage demand (325 V for single phase and 565 V for three phase) of AC loads, there is a requirement for boosting the voltage, though it is reliant on constraints like module efficiency over series connection and unwavering quality over parallel connection [15–17]. The presentation of PV technology is exceptionally influenced by way of adjustments in temperatures and sunlight-based illumination power of individual cells that point of confinement the yield intensity of PV modules [18]. These fractional concealing issues lower the current of cascaded linked PV module at output, and at the time of specific "Maximum Power Point Tracking" (MPPT), the unshaded bit of PV modules unequipped for working and results in decreased yield intensity of PV technology [19, 20].

The PV display is gathering of photovoltaic cells related in parallel and direction of movement as demonstrated by requirements. Regular structure of PV cells contains a DC current source, diode, in addition shunt resistance related in parallel. The flow of charges remains deterrent from n side to p side whereas its convergence realizes obstruction for shunt resistance, and leakage current [21] (Fig. 3).

Here, I (ampere) represent PV current, V (volt) represent cell voltage, T(Kelvin) represent temperature, and n represent ideality factor of diode.

$$I = I_{sc} - I_{DC} \tag{1}$$

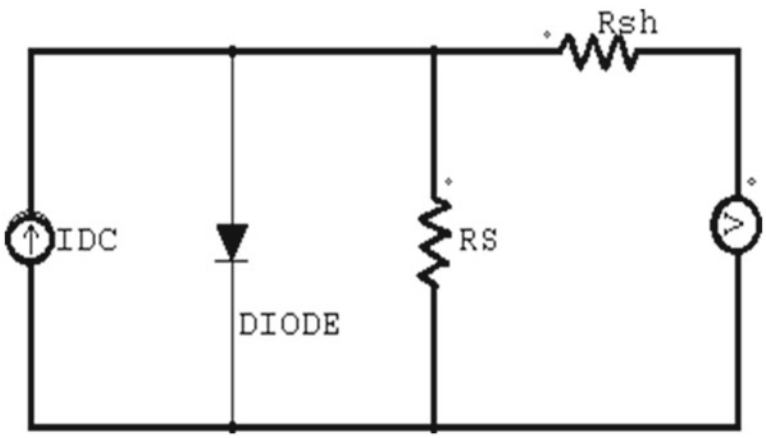

Fig. 3 PV schematic diagram [21]

$$I_{DC} = I_0\left(e^{\frac{qv_d}{kT}} - 1\right) \tag{2}$$

Here, I_O represent diode reverse saturation current, q represent charge on electron, V_d represent voltage across the diode, and K represent Boltzmann constant (1.38×10^{-19} J/K) [22]

$$I = I_{sc} - I_0\left(e^{\frac{qv_d}{kT}} - 1\right) \tag{3}$$

3 Configurations of MLI Systems

In this section, typical topologies of MLI systems are enumerated below:

3.1 Diode-Clamped MLI

As reported in [3, 23], this topology utilizes the diodes which clips voltage and smothers it under the weight on power gadgets. The principle plan is the structure of diode-clamped MLI to generate various voltage levels and improves PQ [24]. In [25], a practical method is proposed for adjusting DC-link voltages. The consecutive connection of multi-level rectifier with MLI permits the parity of DC-interface capacitor voltage which furthermore offers power factor amendment ability. In references [26, 27] for static compensator (STATCOM), a five-level diode-clamped MLI is applied. The reactive power remuneration has been practiced via controlling float of dynamic power among AC systems and MLI circuits at point of common coupling utilized with STATCOM. As depicted in Fig. 4, to integrate five-level voltages over *a* and *0,* combinations of five switch combinations with three-level converter are utilized [28].

- For voltage level $V_{a0} = \frac{-1}{4}V_{dc}$, switch on S_4, S_1', S_2' and S_3'.
- For voltage level $V_{a0} = \frac{-1}{2}V_{dc}$, switch on S_1', S_2', S_3' and S_4'
- For voltage level $V_{a0} = 0$, switch on S_3, S_4, S_1' and S_2'.
- For voltage level $V_{a0} = \frac{1}{4}V_{dc}$, switch on S_2, S_3, S_4 and S_1'.
- For voltage level $V_{a0} = \frac{1}{2}V_{dc}$, switch on S_1, S_2, S_3 and S_4.

In Table 1, S_1, S_2, S_3 and S_4 are upper switches, and S_1', S_2', S_3' and S_4' are lower switches of diode-clamped MLI. The switch is on at state condition 1 and off at state condition *0*. It must be noted that individually switch is just exchanged once for every cycle and in every stage, there exist four complimentary switch matches. The four complementary pairs are (S_1, S_1'), (S_2, S_2'), (S_3, S_3') and (S_4, S_4'), and each

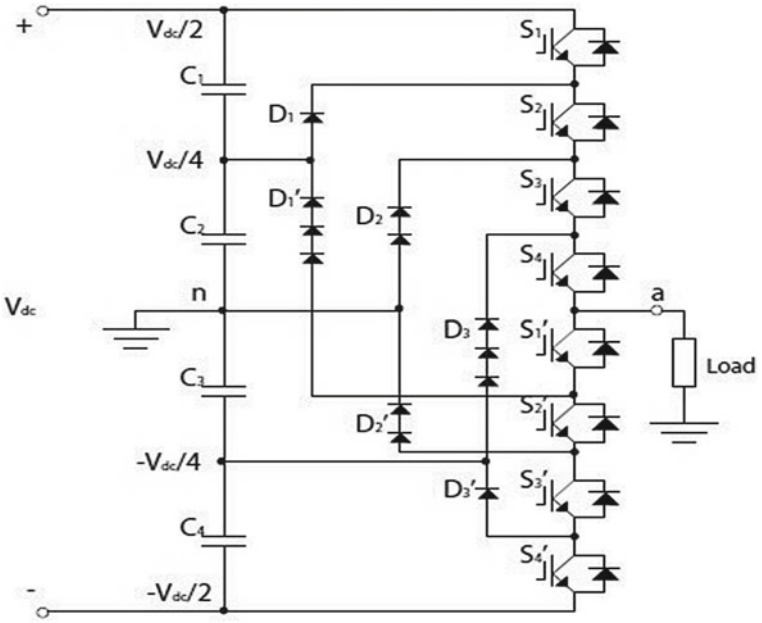

Fig. 4 Three-level inverter single-phase leg [3, 23]

Table 1 Single-phase leg of three-level inverter voltage levels and switching states [3, 23]

Output (V_{a0})	S_1	S_2	S_3	S_4	S'_1	S'_2	S'_3	S'_4
$\frac{-1}{4}V_{dc}$	0	0	0	1	1	1	1	0
$\frac{-1}{2}V_{dc}$	0	0	0	0	1	1	1	1
0	0	0	1	1	1	1	0	0
$\frac{1}{4}V_{dc}$	0	1	1	1	1	0	0	0
$\frac{1}{2}V_{dc}$	1	1	1	1	0	0	0	0

complimentary switch pair is characterized with the end goal that switching on one of the pair switches will prohibit the other from being switched on.

Among the negative aspects, the most important is the immoderate clamping in diodes. It increases with the increase in the number of levels which makes it difficult for real power flow in inverter systems [28].

3.2 Flying Capacitor MLI

In this type of topology, capacitors are utilized for clamping instead of clipping diodes and having tree shape of DC facet capacitors in which each capacitor voltage contrasts from that of following capacitor [10]. In reference [29], it is proposed about the delicate exchanging system in the flying capacitor. The operating voltage of this inverter is very low. In [30], a proposed snubber is implemented for flying capacitor MLI. Number of switches utilized in snubber circuit are very less which decreases switching losses and ultimately improves efficiency. In [31], it is proposed that the pulse width modulation (PWM) technique for DC capacitor charging and discharging can be called as the bearer rotation technique. [32] proposed the combination of flying capacitor or diode-clamped MLI with legs of two-level converter. For equivalent number of stages, this structure needs a smaller amount of switching diodes and switches when contrasted with traditional MLI.

Figure 5 [10] shows single-phase five-level flying capacitor MLI. Expecting that every capacitor has a similar voltage rating and the capacitors arrangement is to demonstrate the level of voltage between clamping points. C_1, C_2 and C_3 are inner-loop balancing capacitors, and the identical DC-link capacitor C_4 shares all phase legs.

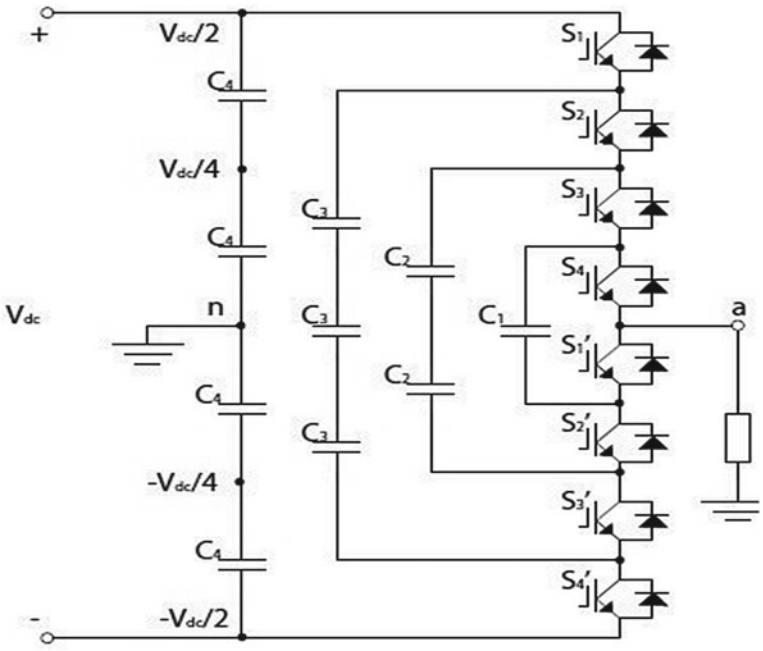

Fig. 5 Single-phase five-level flying capacitor MLI [10]

Table 2 Voltage levels and switching states of single-phase five-level inverter [10]

Output (V_{a0})	S_1	S_2	S_3	S_4	S'_1	S'_2	S'_3	S'_4
$\frac{-1}{4}V_{dc}$	1	0	0	1	1	1	1	0
$\frac{-1}{2}V_{dc}$	0	0	0	0	1	1	1	1
0	1	1	0	1	1	0	0	0
$\frac{1}{4}V_{dc}$	1	1	1	0	1	0	0	0
$\frac{1}{2}V_{dc}$	1	1	1	1	0	0	0	0

The voltage level characterized for flying capacitor topology is similar to diode-clamped topology. For m-level converter, the phase voltage and line voltage have m-levels and $(2\ m\ -\ 1)$ levels, respectively. For m-level converters, it is expecting that every capacitor used as the switching device has a similar voltage rating, and for DC bus, there are $(m\ -\ 1)$ capacitors. The voltage amalgamation in a flying capacitor topology has maximum adaptability. Utilizing Fig. 5 [28] as the model, the voltage of single-phase five-level flying capacitor MLI can be orchestrated by the accompanying switch combinations.

- For voltage level $V_{a0} = \frac{-1}{4}V_{dc}$, switch on S_4, S'_1, S'_2 and S'_3.
- For voltage level $V_{a0} = \frac{-1}{2}V_{dc}$, switch on S'_1, S'_2, S'_3 and S'_4
- For voltage level $V_{a0} = 0$, switch on S_3, S_4, S'_1 and S'_2.
- For voltage level $V_{a0} = \frac{1}{4}V_{dc}$, switch on S_2, S_3, S_4 and S'_1.
- For voltage level $V_{a0} = \frac{1}{2}V_{dc}$, switch on S_1, S_2, S_3 and S_4.

The negative aspects of this inverter are, immoderate capacitors needed for more numbers of levels and this results in increased cost due to need of a greater number of capacitors. Also, the control of inverter is very complex and it's tough to manage the actual power flow for particular inverters because of high switching losses and high switching frequency (Table 2).

3.3 Cascaded H-Bridge (CHB) MLI

Ongoing investigations assessed the utilization of series connected CHB inverters, also the hi-tech basis of modular multi-level converters, as a topology for interfacing PV components with the grid [33–36]. Because of higher efficiency, availability and expandability to the medium-voltage level, CHBs were especially invaluable for large, utility-scale systems [37].

It is developed via separate detached DC resources and series connection of single-phase H-bridge inverters of AC terminals [38], and resources may be a capacitive DC-interface, battery bank, transformer tapping's rectified DC or sustainable power resource like PV. By utilizing distinctive quantity of cells per stage, various levels

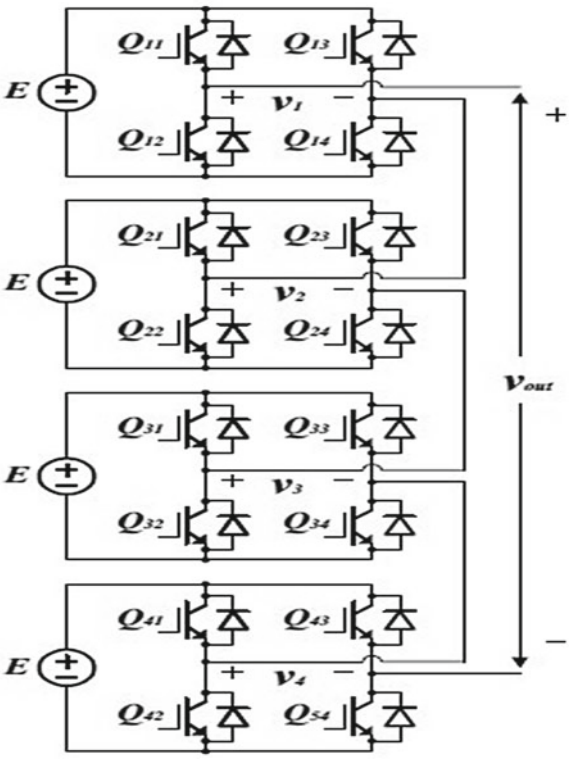

Fig. 6 Circuit configuration of a general CHB MLI synthesizes nine output voltage levels [39]

may be gotten from CHB MLI because of detached measured shape of the inverter, it is simple to displace the broken cell without closing the entire gadget. Figure 6 shows a circuit design of a general CHB MLI. Each output terminal is linked in series, and every [39] H-bridge unit has an autonomous DC voltage wellspring of E. Output voltage can be acquired via Eq. (4).

$$V_{\text{out}} = \sum_{n=1}^{k} V_n = V_1 + V_2 + V_3 + V_4 \tag{4}$$

Furthermore, k implies the quantity of H-bridge cells, and the number of output voltage levels is given via (5).

$$N = 2k + 1 \tag{5}$$

In (4), V_n may be E, 0 or $-E$; accordingly, V_{out} may create $-3E$, $-2E$, $-E$, 0, E, $2E$, $3E$ via blending of every output voltage. We will see that this sort of MLI has worthwhile as far as measured quality and straightforwardness. Be that as it may, to integrate nine levels in the output voltage, it needs sixteen switches and four unbiased DC resources.

Table 3 Contrast of aspect required in keeping with phase for generating *m*-levels via topologies of MLI [40]

MLI configurations	Diode-clamped MLI	Flying Capacitor MLI	CHB MLI
Number of switching apparatus	$2(m-1)$	$2(m-1)$	$2(m-1)$
Number of freewheeling diodes	$2(m-1)$	$2(m-1)$	$2(m-1)$
Number of clamping diodes	$(m-1)\,(m-2)$	0	0
Number of flying capacitors	0	$(m-1)\,(m-2)$	$(m-1)\,(m-2)$
Number of capacitors used for balancing	0	$(m-1)\,(m-2)/2$	0
Voltage distortion	Normal	More	Slightly less
Utilization	Drive system of motor, STATCOM	Drive system of motor, STATCOM	Drive system of motor, solar PV, battery system

4 Results and Discussions

Table 3 shows contrast of aspect required in keeping with phase for generating *m*-levels via topologies of MLI. The assessment of various MLI is primarily based on the succeeding standards, i.e. quantity of semiconductor gadgets, DC capacitors existing and balancing capacitors manipulate complexity based totally on power switches, voltage unbalances and price estimation associated with circuit. As is evident from the results, no clamping diodes are required in CHB topology with respect to other topologies. Moreover, the output voltage also smoothens due to number of output voltage terminals connected in series. In reference [39], CHB topology has been validated through an AVR MEGA 128 type of controller. It has been found that although the none-level output voltage including a zero level resembles a pure sinusoidal waveform, it also contains some lower order harmonics. These types of harmonics can easily be mitigated by employing a low pass filter. Figure 7 shows the simulation result of nine-level CHB MLI.

5 Conclusion

The MLIs are suitable for PV system because they can offer high voltage amplification. By use of various MLI topologies instead of transformer with PV system, the PQ can be improved and by increasing the levels of MLI results in reduced harmonics contents. These days MLI improves their frame of reference of utilization in PV system and also utilized in industry for high voltage applications. In this examination, it is found that MLI is a good choice for PV fed system and helpful in PQ if

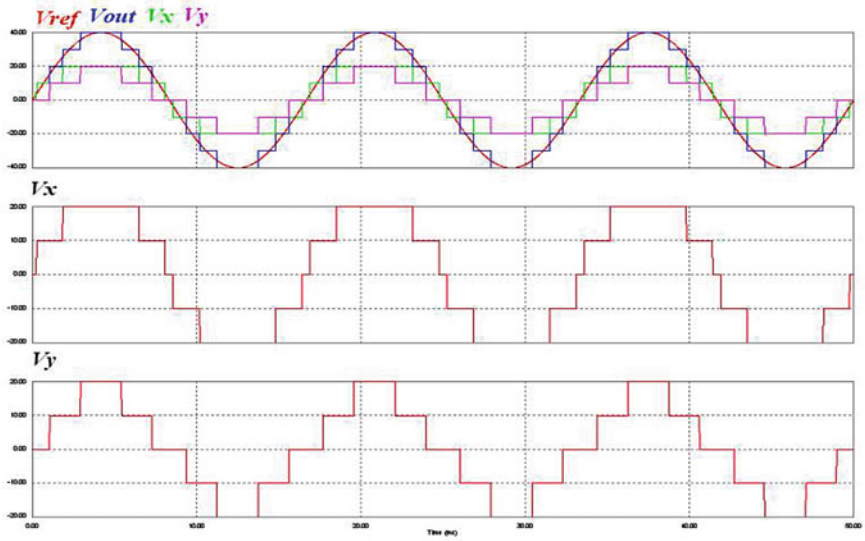

Fig. 7 Simulation waveforms of CHB MLI reference voltage (V_{ref}), output voltage (V_{out}), upper inverter output voltages (V_x) and lower inverter output voltages (Vy)

we increase the levels of MLI. The principle benefit of CHB MLI is that it makes use of fewer quantity of switches to attain *m*-level output voltage that causes control easiness and execution, small voltage stress as compared to other MLI topologies. The alternative suitable components for the usage of this sort of topology are the capability to work with low switching frequency and functionality to push better amount of energetic power to the grid which can be beneficial for HVDC application and no filter requirement in the output.

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Development of GUI Using Visual Studio to Monitor Sensor Signals

Sai Vishal Tipirneni, Upender Jalla, Supreeth Varre, Soujanya Kuchana, and J. VijayaLakshmi

1 Introduction

Nowadays in many industries, there is a huge requirement of tracking the real-time data [1]. There are multiple reasons to track real-time data; of all those reasons the main reason is to see the functioning of certain sensor or an instrument, to find the peak condition, optimum condition and the low condition of those sensors and also to check whether there are any faults occurring.

This paper deals with Arduino and its software by studying various types of statements in Arduino IDE and how to interface it with CPU and to develop a '**graphical user interface'**, using Visual Studio Software and finally how to interface the Arduino with the CPU using GUI [2] [3].

This paper also deals with how to track the real-time data from Arduino using GUI, in which the data will be appearing as a graph and as an Excel sheet to store the required data values from Arduino [4].

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2 Arduino

Arduino is an open-source hardware and software and user community that designs and manufactures microcontroller embedded kits for building digital devices and interactive objects that can sense and control both physically and digitally.

Various microprocessors and controllers are used in Arduino board, multiple designs which are comprised with collections of digital and analog input/output (I/O) pins which can be connected to several extension boards and other circuits. The boards have the attribute of serial communications interfaces, including USB on some models, which can be used to load programs from personal computers. The microcontrollers are programmed using a dialect of features from C and C ++. The Arduino project also offers an integrated development environment (IDE) based on the processing language project adding to using traditional compiler toolchains.

2.1 Architecture

Arduino Uno is an example of the Arduino board. It includes an ATmega328 microcontroller, and it has 28 pins. It consists of 14 digital i/o pins wherein six pins are used as pulse width modulation O/P's and six analog I/Ps, a USB connection, a power jack, a 16 MHz crystal oscillator, a reset button and an ICSP header. Arduino board can be supplied from USB or externally from a battery source or an adaptor. The external supply of 7–12 V is used to operate the Arduino board (Fig. 1).

2.2 Types of Arduino's

Arduino boards are available in various types

- ARDUINO NANO
- ARDUINO LILYPUT
- ARDUINO ROBOT
- ARDUINO ETHERNET
- ARDUINO ESPLORA
- ARDUINO YUN
- ARDUION DUE

2.3 Software

Any programming language with compilers generates binary code for target processor can be used to write the program for Arduino hardware.

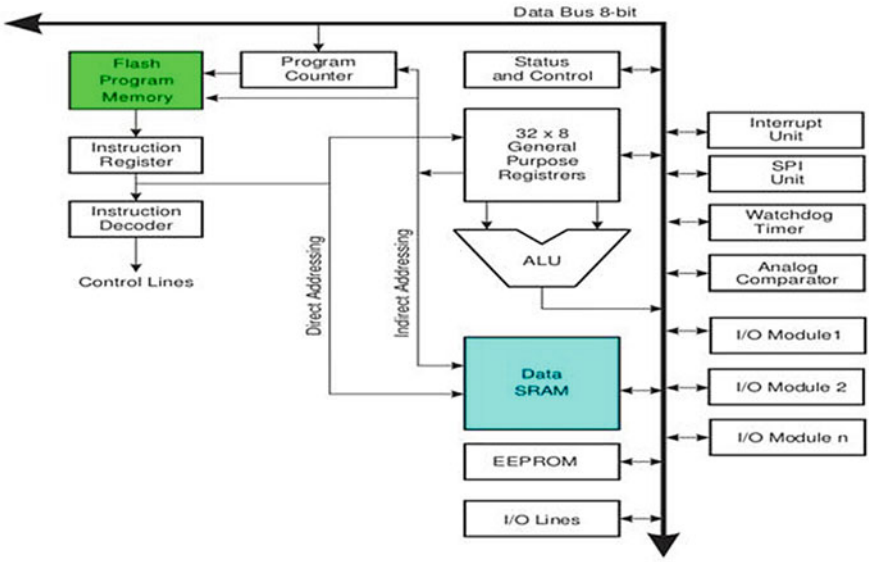

Fig. 1 Arduino architecture

(1) IDE:

The Arduino IDE is a cross-platform program written in Java. That is, it can run in multiple platforms like Windows, mac OS and Linux. It oriented from IDE for the languages processing and writing. It includes a code editor with features such as text cutting and pasting, searching and replacing text, automatic indenting, brace matching and syntax highlighting and provides simple *one-click* mechanisms to compile and upload programs to an Arduino board. It also contains a message area, a text console, a toolbar with buttons for common functions and a hierarchy of operation menus. The Arduino IDE supports the languages C and C ++ using special rules of code structuring (Fig. 2).

(2) Sketch:

A program written with Arduino IDE is called a sketch and can be saved as text file with extension .ino .pde extension is used to save Arduino Software (IDE) pre-1.0.

Arduino C/C ++ program contains the following two functions:

- Setup(): This function is called once when a sketch starts after power-up or reset. It is used to initialize variables, input and output pin modes and other libraries needed in the sketch.
- Loop(): After setup() function exits (ends), the loop() function is executed repeatedly in the main program. It controls the board until the board is powered off or is reset.

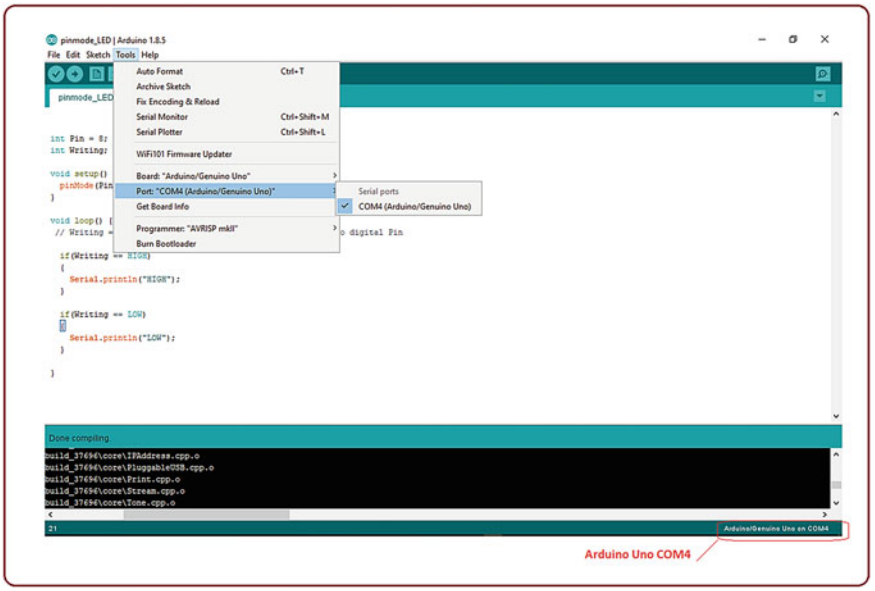

Fig. 2 Arduino IDE

3 Types of Data Transfer

Communication with Arduino can be done in two ways:

- Parallel communication
- Serial communication

A. Parallel communication:

In parallel communication, lot of data is transferred over a short distance using multiple wires to send bunch of 1s and 0s. It is quicker than serial, upfront and comparatively easy to implement. However, it requires many input/output (I/O) ports and lines. To move a project from a basic Arduino Uno to a Mega, and as, the I/O lines on a microprocessor are precious and few serial communication is preferred, sacrificing potential speed for pin real estate.

B. Serial communication:

Most Arduino boards are built with serial communication as a standard. One of the most important things regarding serial communication is protocol, which is a set of rules. Serial communication is easy and flexible way for Arduino to interact with other devices. Arduino IDE provides a serial monitor where the serial data is displayed.

4 Interfacing Arduino with CPU

MICROSOFT VISUAL STUDIO:

Visual Studio is an integrated development environment (IDE). It is generally used to develop websites, web apps, web services and mobile apps [5]. It uses Microsoft platforms such as Windows API and Windows Forms. Both native code and managed code can be produced by it.

To make code writing easier, it is provided with IntelliSense and code refactoring. IntelliSense is a code completion component which corrects typos and other basic mistakes. Code refactoring is restructuring the program without changing the external behaviour of the program. This helps in better readability of the code.

Visual Studio can support 36 different programming languages (C#, C, C ++, .NET, HTML, JavaScript, etc.). This makes it more flexible. Other languages can be used as long as the language-specific services exist.

PARALLAX DATA ACQUISITION (PLX-DAQ):

PLX-DAQ Features

PLX-DAQ is a Parallax microcontroller data acquisition add-on tool for Microsoft Excel. Any of the microcontrollers connected to any sensor and the serial port of a PC can now send data directly into Excel. PLX-DAQ has the following features:

- Plot or graph data as it arrives in real time using Microsoft Excel
- Record up to 26 columns of data
- Mark data with real time (hh:mm:ss) or seconds since reset
- Read/write any cell on a worksheet
- Read/set any of four checkboxes on control the interface
- Example code for the BS2, SX (SX/B) and propeller available
- Baud rates up to 128 K
- Supports Com 1–15.

5 Experimentation Part 1: Arduino Flow chart and Working

This part deals with the algorithm of Arduino process, i.e. flow chart of Arduino which is shown and it also deals with (Fig. 3):

1. Locating the COM (serial port number).
2. Inserting baud rate in a program and its importance.
3. Defining variables.
4. Writing an Arduino IDE program to yield required result.

1. STEPS TO SEND THE DATA TO THE CPU:

Open up the Arduino software. Click in the white area and type the following:

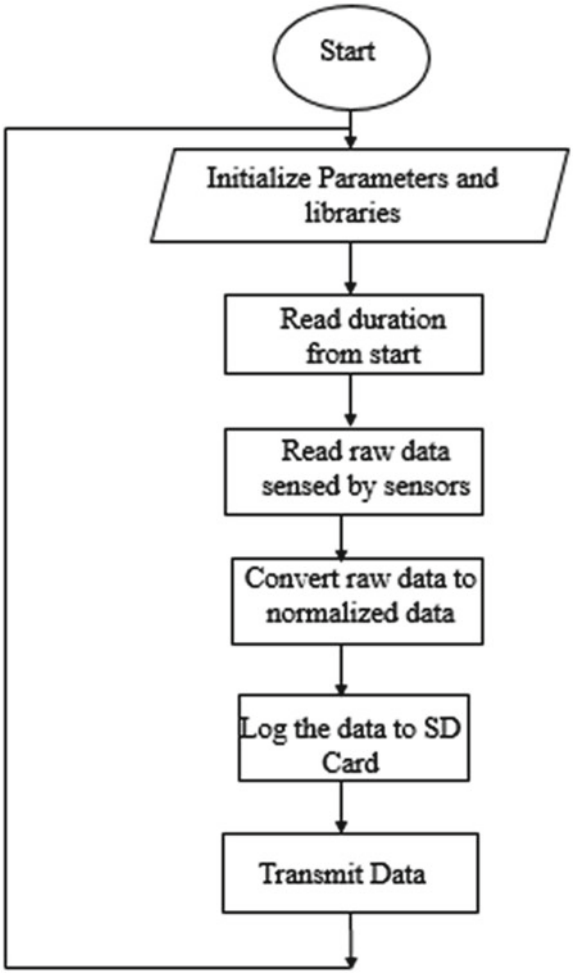

Fig. 3 Arduino working flow chart

Setup region: This is the general pattern of the setup region. The setup region is defined in this method setup. Anything in this region is executed or performed only once.

Loop Region: After setup() method, a method called loop(), which is going to repeat over and over as long as program is running.

Setting up serial communication from the Arduino and indicating it to send data every 100 ms. Plug in Arduino board, select board type (under Tools - > Board Type) and serial port (under Tools - > Serial Port) and hit the 'upload' button to load code onto the Arduino.

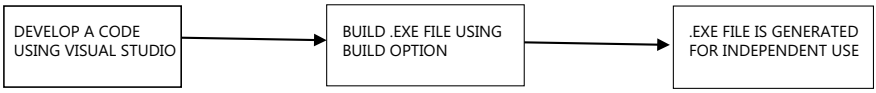

Fig. 4 Block diagram for building .exe file

6 Experimentation Part 2: Development of GUI Using Visual Studio

This part deals with various steps in developing a graphical user interface. includes

1. Visual studio: Developing the code such that the code runs successfully, then build an '.exe' file.
2. PLX-DAQ: It is used to log data to an Excel sheet directly using 'COM' and 'baud rate' (Fig. 4).

There is a need for representation of data in a user-friendly manner, and today, it is not very difficult to build a user-friendly interface as the complexities have reduced to what is mostly drag and drop. Programs such as Microsoft Visual Studio make it very easy to create a high-functioning graphical interface which is also user-friendly.

Operation:

Visual Studio makes it really comfortable to create a user providing many different languages and many pre-designed features like Windows form, Windows console app among many more [8].

High-level performance GUIs can be created using Microsoft Visual Studio as is having an improved tool to create GUIs. This integrated development environment (IDE) is compatible with many different languages, but remains simple to maintain the functionality of the application [9].

All type of GUIs consists of basic tools including: buttons, text books, labels, checkboxes, etc. The more instinctive controls that the GUI handles care is to correlate with the functionality (Fig. 5).

7 Experimentation Part 3: Interfacing Arduino with CPU

This part deals with how to interface the Arduino with the CPU using the '.exe' file and also deals with the option 'log to file', so that all the data can be stored in an Excel sheet.

Multiple Channel display:

Multiple graph display gives the advantage of controlling the display of one channel without interfering the display of other channels and is used mostly when we want to handle data with different precision. The window size is also adjustable. A channel can be viewed in full screen mode (Figs. 6, 7).

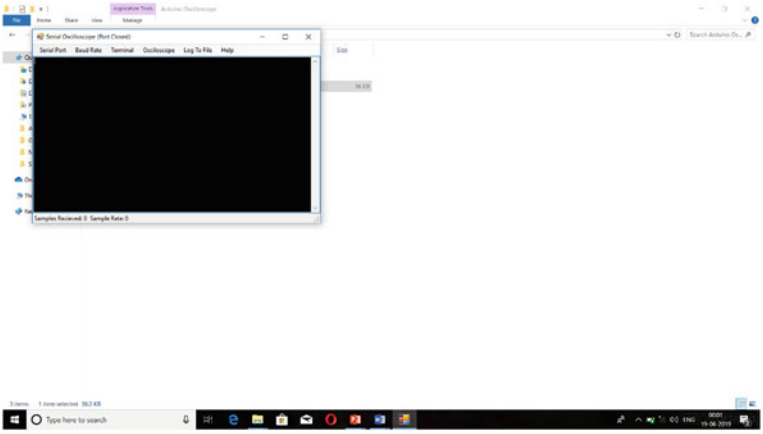

Fig. 5 '.exe' independent window

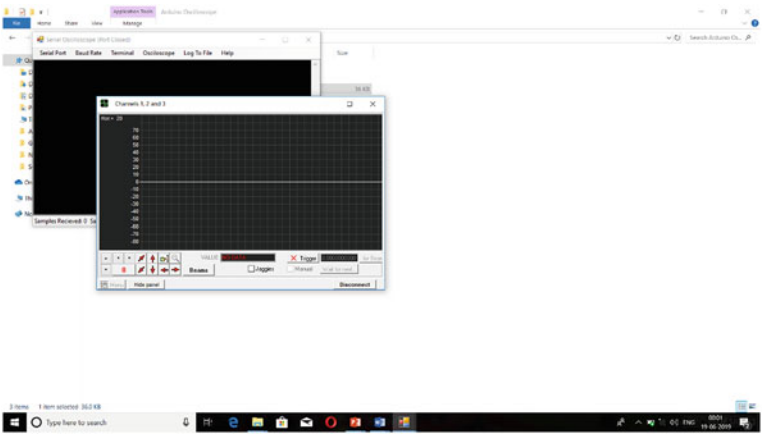

Fig. 6 .exe graph window

Fig. 7 Block diagram to carry out real-time tracing

Multiple graph oscilloscope:

Multiple channel display can show multiple channel data in single graph. It can stretch to read a maximum of three channels. If we input data from a single channel,

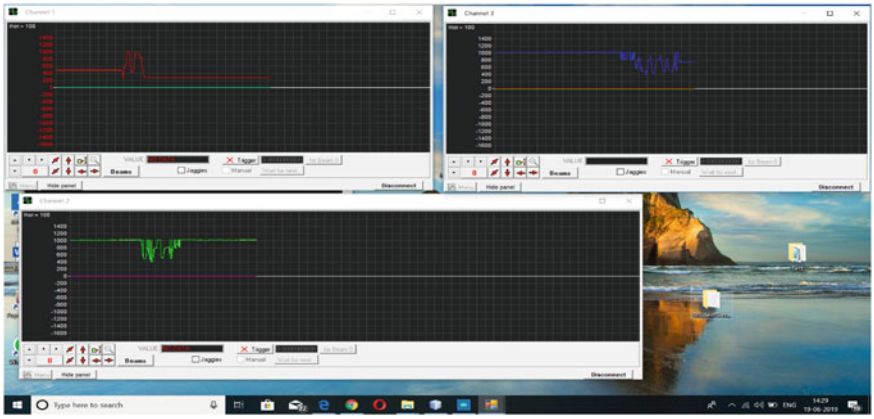

Fig. 8 Multiple channel display

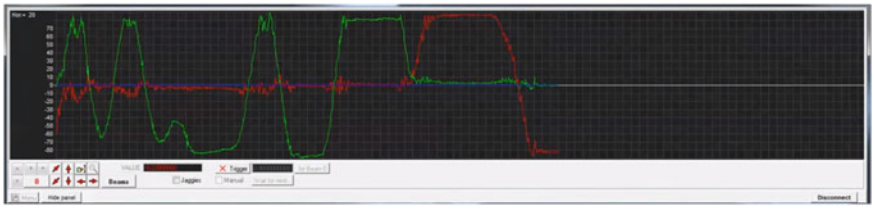

Fig. 9 Multiple graph oscilloscope

then it will work as single oscilloscope. Three inputs are operated by the same graph. Hence, any change we make in the display will affect all the channels being read and mostly used when multiple data is compared. Channels 4, 5 and 6 and Channels 7, 8 and 9 work in this fashion (Figs. 8, 9).

Logging to Excel sheet:

There may be a requirement of storing the obtained data. To do this, we can use 'log to file' option and click 'start logging'. Once we do this, the data being read is stored in an Excel format. The process will stop only after we click 'stop logging' in the 'log to file' option. An Excel file is now created in the desired location.

To store the required data in an Excel sheet, go to 'log to file' and select 'start logging'. Once this is selected, automatically the values or data from the Arduino ports is stored in an Excel sheet (Figs. 10, 11, 12).

Working Images:

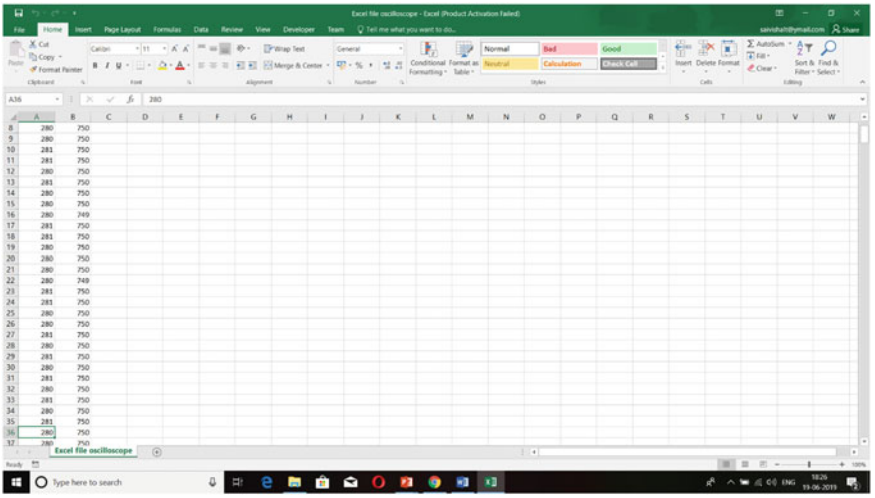

Fig. 10 Logging to excel sheet

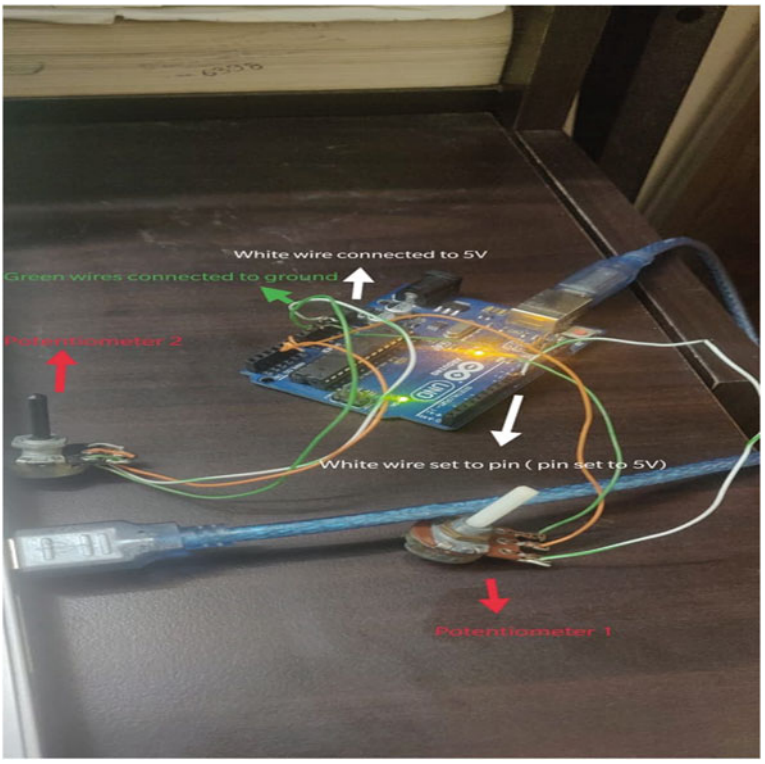

Fig. 11 Working image of hardware

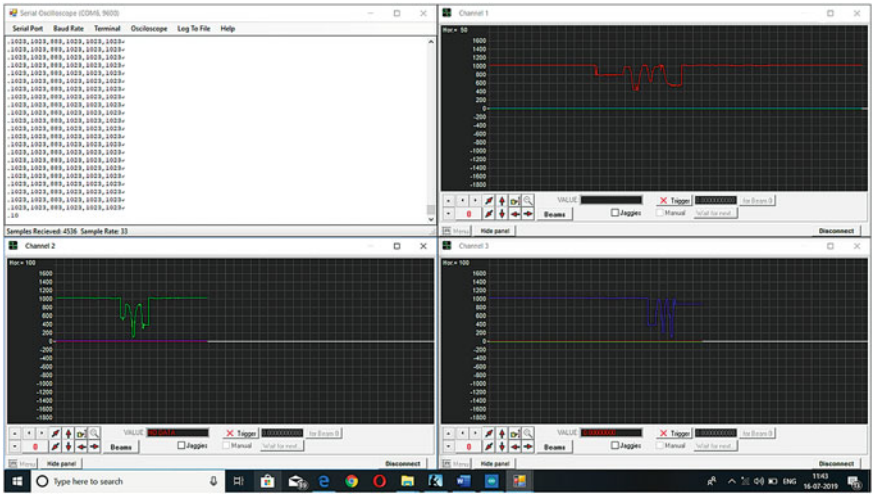

Fig. 12 Real-time tracing and digital display

8 Applications of GUI

1. It can be used in industries to trace real-time graphs.
2. Multiple sensors can be used at once.
3. Different graphs to monitor different sensor values can be obtained.
4. Comparative study of different sensor values can be made, by using single window.
5. Sensor data can be stored in Excel sheet for future uses.
6. Electronic industries which monitor atmospheric pressure, temperature, etc., can make use of this GUI.
7. In industries where monitoring of different sensors is required like power systems, etc., this GUI is useful.
8. Different monitoring equipment can be replaced by this single GUI.
9. In medical instruments manufacturing industry, this GUI can be used to get required real-time results on screen.
10. In aeronautical and nautical industries, this GUI can be used to track the essentials.

9 Conclusion

In this paper, a graphical user interface is developed using Visual Studio and Arduino and is interfaced with CPU to develop the graphical and Excel representation of real-time data which can be stored.

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Pedestrian Trajectory Prediction in Crowd Scene Using Deep Neural Networks

Jeer Zeibo, Manoj Kumar Mishra, Amiya Ranjan Panda, Bhabani Sankar Prasad Mishra, and Pradeep Kumar Mallick

1 Introduction

Collisions are due to the mistake of humans in predicting the trajectories of others. But humans have the ability to predict the trajectories of others and take appropriate measures when they walk according to the variables that surround them as shown in Fig. 1 [1]. Many works were proposed previously to mimic the behavior of movement of humans using robots. According to a report by the National Highway Traffic Safety Administration (NHTSA) in 2015, (5376) pedestrians were dead in traffic accidents in the USA.

Recently, driver assistance systems are being developed frequently to maintain the safety of both drivers and pedestrians. We can say that by avoiding direct collision, we can save pedestrians using automated systems in a vehicle. In the field of robotics, trajectory prediction by the robot is very much necessary because robots need to move without interfering with worker's movement. Robots can take the information from cameras or LiDAR sensors [2] to obtain a 3D scene, or the robot can be given

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Lecture Notes in Electrical Engineering 690,
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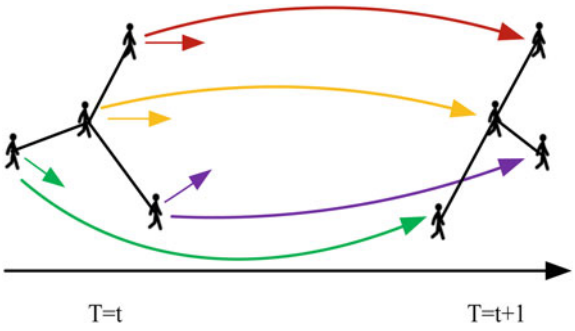

Fig. 1 Human positions during walking

a preview as an environment map. Technically, the most common method of implementing the pedestrian trajectory prediction problem is by using image processing. To extract useful features and information from the image, there are many algorithms and models already developed to predict the predictive features such as speed, acceleration, direction and appearance. But, the problem in this method is that the system incurs high cost because of complex calculations involved in discovery and classification processes and tracking entities in real time, synchronization in all images captured by the camera, especially when processing 3D video data [3]. In addition, different lighting conditions also affect the ability to detect obstructions and pedestrians and it can be seen that the quality of the images is lower during the night than in the day [4]. However, some existing models ignore the semantic information in the raw path [5]. We can extract stop points from raw paths and detect semantic information on stops.

In this paper, we study trajectory prediction methods using neural network architecture prediction approaches and datasets used for evaluation. We explain different types of neural networks for prediction methods in Sect. 2. In Sect. 3, we review datasets used in evaluating the performance of trajectory prediction. We conclude the survey in Sect. 4.

2 Prediction Models

2.1 Artificial Neural Network (ANN)

The ANN is a simulation system of artificial intelligence. Here, each neuron is connected to other neurons through a link called weight. Weight is the information about the signal input. Finding out the appropriate weights for a particular problem of neurons in the network is the challenge here, because the weight usually allows or blocks the delivered signal. Activation signal is the internal state of neuron. Output signals, produced after applying activation function for input signal, may be sent to other modules, and the neural network consists of input and output layers and

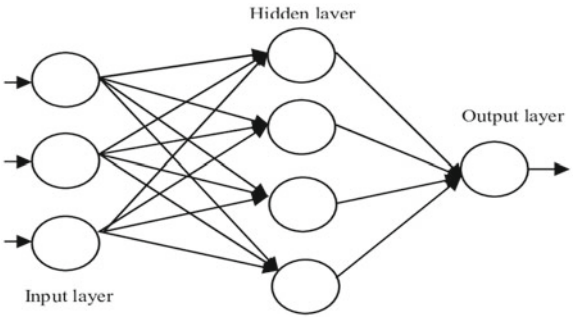

Fig. 2 ANN architecture

some hidden layers between input and output layers. Figure 2 refers to the ANN architecture.

Back-propagation is a training algorithm for the artificial neural network. It is used to tune the weights for a neural network according to the error rate. The forward propagation is the method to calculate the error, then returns and modifies the weights and iterates until it reaches an acceptable or relatively small error signal. Correct modification of weights reduces error rates, and increasing its generalization makes the model reliable. Extraction of features is very much necessary for good network training where redundant features can increase the complexity and difficulty of accessing a good model; i.e., it can lead to an increase in processing time and model processing. So, there are many ways to reduce dimensionality of the input dataset like correlation, PCA or deep autoencoder [2]. ANN classification process for pedestrian behavior prediction model is as shown in Fig. 3, where the process starts with data from detection and tracking the trajectories observed. The next step is dividing the data. It divides the data into different areas according to the distance to the intersection place and then assigning the labels to the trajectories [2]. One method is then used to reduce dimensions of data to extract features. Extracted

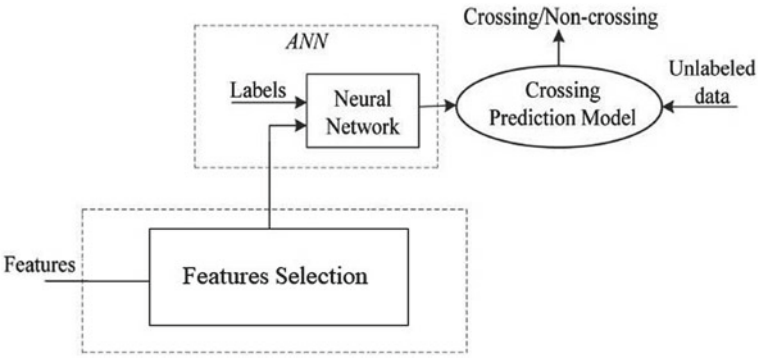

Fig. 3 ANN module

features are prepared for becoming input to the ANN model. Training dataset is used to train the ANN model, and then using the testing dataset, the model is evaluated.

2.2 *Recurrent Neural Network (RNN)*

RNN is a kind of ANN where the output signal from current steps is fed as input to the next step. So, communication between nodes is a solution for the problems of predictions related to temporary time sequences. This allows it to process and display the time series as a dynamic behavior. Unlike feedforward neural networks, the internal hidden state of RNNs can use as memory to process the input sequence. RNN includes the majority of traditional neural networks such as multilayer neural networks and Hopfield networks. The main difference between Multi-Layer Perceptron and RNN is that a feedback loop connection is present in RNA whereas in MLP does not have. The feedback loop maintains the internal hidden state, called the "hidden unit." For predicting a long time series, the traditional RNN couldn't accurate prediction [1]. Thus, RNNs for long short-term memory (LSTM) were developed to remember past sequences, which is shown in Fig. 4. Memory block in the LSTM structure is the hidden layer, which is similar to hidden units in traditional RNNs [4].

Here, a pedestrian trajectory problem is represented as a prediction problem, not a classification problem. Based on a currently observed pedestrian traffic trajectory number, pedestrian intent is to predict a possible sequence for traffic trajectories from (t) to the $(t + 1)$. Thus, RNN is used as a solution for sequence time prediction tasks [5]. Here, the aim is to find the posterior distribution of multiple pedestrians' future trajectories. One of the solutions for this is RNN encoder–decoder. It is encoding to prompt the network to recognize the velocity information from neighboring frames before passed through encoders. Then, it passes trajectories into a temporal convolution layer. As well, gated recurrent unit (GRU) is based on RNNs to learn long-term dependencies [6]. LSTM based on RNNs is modeled with two main features (direction of movement and relative distance) that are important for crowd scene. The conscious aggregation layer is added to the LSTM model to pass the information between pedestrians like the position and direction of current movement [8].

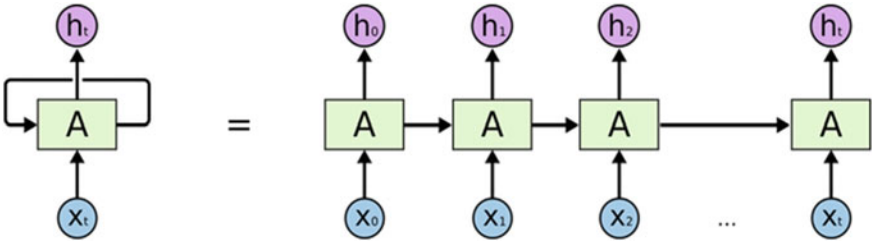

Fig. 4 Basic architecture of RNN and LSTM

2.3 Long Short-Term Memory (LSTM)

RNNs are designed to handle chronological data according to the recurrent network structure as mentioned in the previous section. But when they need to remember the information for a long time, they fail because it is based on short-term memory. Therefore, long-term memory networks are designed [4]. The LSTM block has at least one memory cell along with input, output and forget gates. These gates are shared by each cell in the LSTM block. Generally, the forget gate decides which information in memory block has to be forgotten. The input gate is processing input data to update the memory state. The output gate is displaying the result based on input and the memory of the block [5]. So, for each time step (t), is calculated and updated the state of the hidden layer of LSTM cell according to the following equations:

$$f_t = sigm(W_{xf}x_t + W_{hf}h_{t-}) \tag{1}$$

$$i_t = sigm(W_{xi}x_t + W_{hi}h) \tag{2}$$

$$c_t = f_t c_{t-1} + i \ \tan h(w_{xc}) \tag{3}$$

$$o_t = sigm(W_{xo}x_t + W_{hc}) \tag{4}$$

$$h_t = o_t * tanh(C_t) \tag{5}$$

where c_t, F_t, I_t, o_t are the activations for cell state gates at time t, $W_f, W_i, W_o, b_f, b_o, b_c$ are the weight matrices and variable biases and x_t and h_t are the memory cell input and final output at time t.

Social LSTM

When combining influence factors between neighboring pedestrians, a single LSTM model cannot be used. However, in current methods with complex scenes, the prediction errors are usually large. The pedestrian prediction error can be reduced by implementing a new method called social grid LSTM [7]. It uses a social aggregation process with the LSTM module to combine the relationship between neighboring pedestrians as shown in Fig. 5 [7]. The two-dimensional LSTM network structure is developed for the main LSTM cell structure, which differs from the general LSTM structure in the layer-to-layer data transfer mechanism. In a scene, each pedestrian uses one grid LSTM. Generally, pedestrians depend on their expectations from the neighboring pedestrian's movements, when they adjust their movements [7]. Therefore, we can say that the pedestrian environment has a strong influence on their movements and they are affected by it. For this reason, each pedestrian shares information between the adjacent two-dimensional LSTM models.

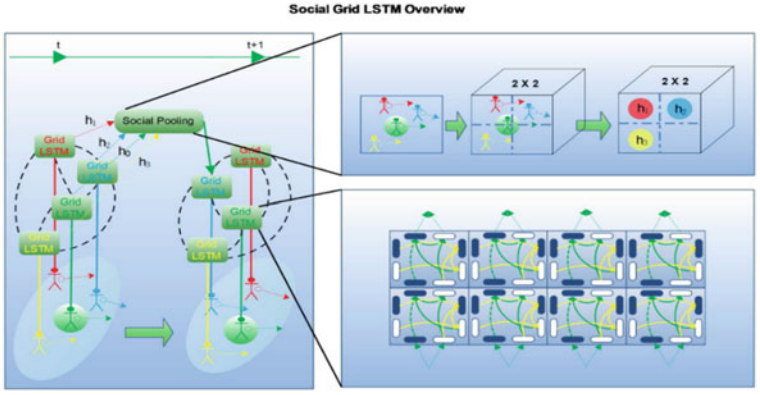

Fig. 5 Social grid LSTM model

Another model for implementing complex scene scenario in social LSTM is LSTM state refinement (SR-LSTM) [8] as shown in Fig. 6 [8]. In this method, V-LSTM is first used to extract the features from each pedestrian trajectory separately. The main difference between social grid LSTM and SR-LSTM is that the SR is used to purify cell states by passing a message between pedestrians, which is not present in other one. For all pedestrians, the SR module takes the following three sources of information as inputs: current pedestrian locations, hidden status and cell status from LSTM. The output is duplicate cell status of the SR module.

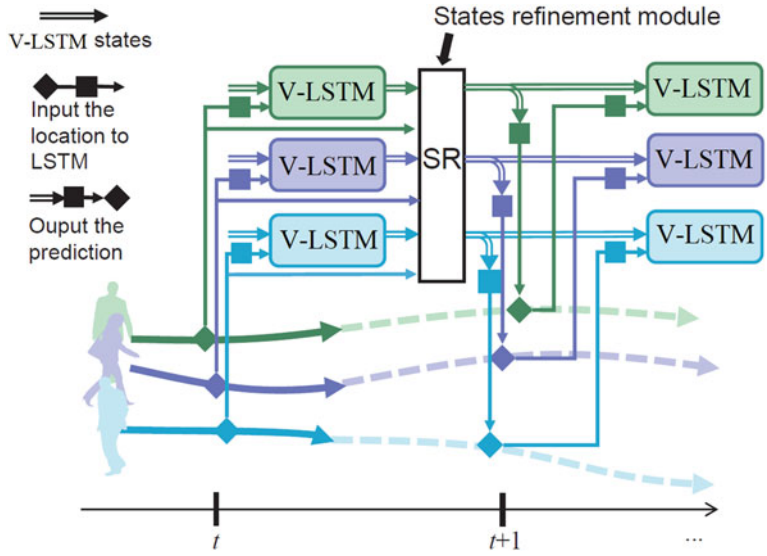

Fig. 6 State refinement LSTM model

Stacked LSTM

The architecture of this LSTM network consists of stacked layers on top of each other so that the input of the first layer is the input data collected from the pedestrian trajectories through the observations. Usually, hidden units consist of a number of input frames and then feed the output of first layer to the second layer, which also consists of hidden units. In this manner, outputs are passed from layer to layer until the output from the last layer is obtained as a result of predicting the pedestrian trajectory.

The structure of stacked LSTM shown in Fig. 7 consists of the three layers on top of each other [9]. First, a sequence of input signals from a window of side-location observations of pedestrian trajectories obtained with the help of a sensor set on vehicle is fed to the first layer of LSTM. The processed signals of one layer are passed on to the next layer and so on till it is fed to final layer. To understand a deeper temporal dependency, the last layer is inferred for their input sequence, which provides predictive trust. The last layer contains only one hidden unit and is fully connected which leads to the final result. Since the prediction has a real value representing the next position of the pedestrian in the scene, thus the fully connected activation function is the linear activation function [9]. Another structure shown in Fig. 8 for trajectory prediction is crowd interaction deep neural network (CIDNN) [10]. The CIDNN architecture contains four modules, location encoder module, motion encoder module, displacement prediction module and crowd interaction module.

Motion encoder module for each pedestrian has two LSTMs stacked together. Crowd interaction module receives signals from both the location encoder module and motion encoder module. Sequential pedestrian coordinates are passed into CIDNN like trajectory, direction, acceleration and velocity, and all pedestrians have the same stacked LSTM for motion encoding.

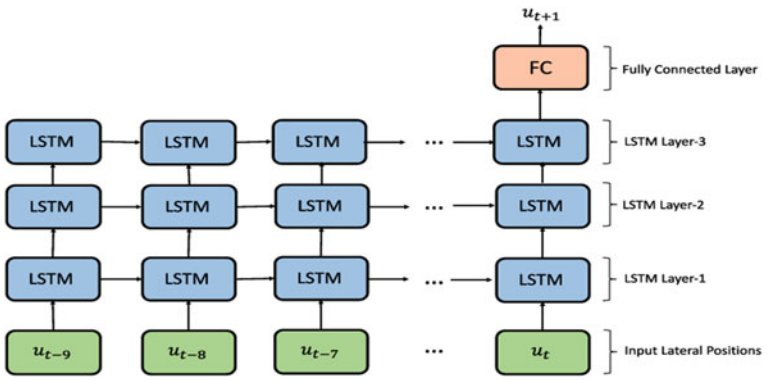

Fig. 7 Stacked LSTM model

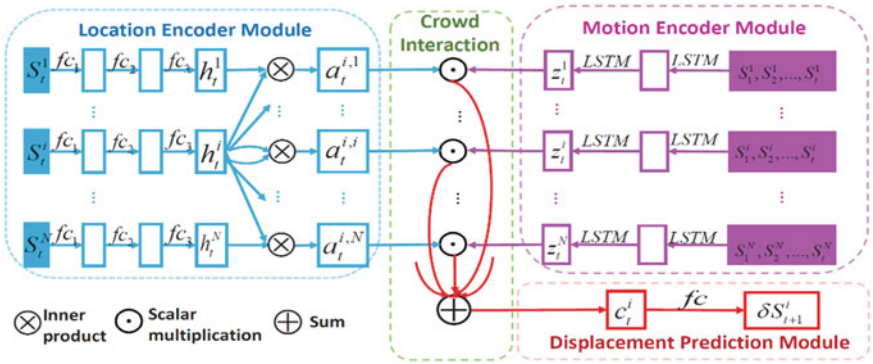

Fig. 8 CIDNN architecture for crowd interaction

Encoder–Decoder LSTM

Network structure includes encoder and decoder, respectively. The encoder encodes the observed trajectory, and the decoder does prediction. There is an "interaction" on the subnet, which encodes the interaction between the pedestrian and the neighbor [11]. This model consists of two different neural networks as shown in Fig. 9, the first being an encoder network and the second being the decoder network. It can be either a single layer of RNNs, LSTMs or multilayer stacks. The encoder network is responsible for converting the input sequence to a fixed-length vector as a global representation [11]. During the iteration process, decoder unit predicts the correct

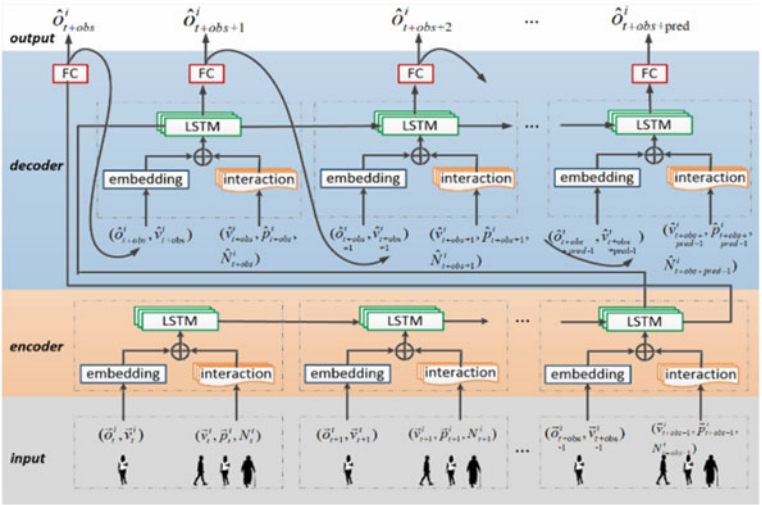

Fig. 9 Encoder–decoder LSTM module

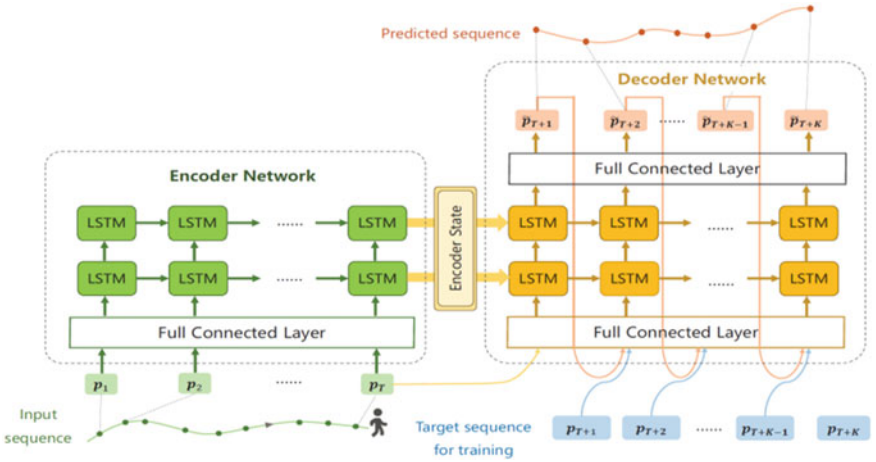

Fig. 10 Seq 2Seq framework encoder–decoder architecture

output sequence step by step. So that, the expected result represents that moment where it will be entered in the next iteration.

Existing approach based on the LSTM encoder–decoder is the Seq 2Seq framework as shown in Fig. 10 to determine the internal temporal features of the trajectory [6], such as speed and direction so that all trajectories within the specified scene are used. The input is the observed trajectory sequence, and the output is the trajectory sequence to be predicted for the target, since the target trajectory contains information on geographical constraints. The training process is a combination of two different approaches, and the first approach is the automatic approach, i.e., a regressive model, in which an inaccurate output of the previous step is presented as an input to the next step. The decoder unit ignores local prediction errors by focusing on the input trajectory global information.

The second approach would have shifted the target sequence one step ahead as an input to the decoder to learn more possible geographic information. Another approach in deep learning is called pedestrian scale information [12] where the trajectory is observed for each pedestrian as shown in Fig. 11. Here, another layer of LSTM is added for the interaction of pedestrians. Therefore, the predictive model contains of two LSTM encoders, one for pedestrian scale that encodes the detected trajectories and contains the information of basic trajectory prediction. The other one is for interaction information. The output is an LSTM decoder to predict trajectory coordinates. To integrate social information for the environment to obtain a neighborhood effect from pedestrians, the map is constructed by replacing the traditional rectangular shape with a circular shape and dividing the shape into non-overlapping units [12].

Table 1 summarizes and compares models of trajectory prediction using deep neural networks.

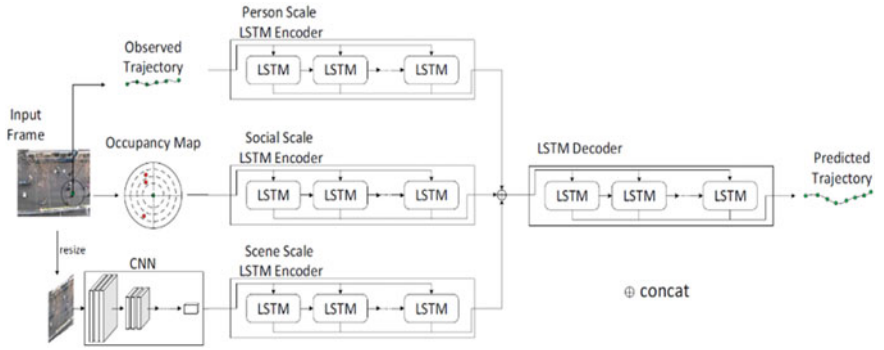

Fig. 11 LSTM module

Table 1 Model comparison

Model	Method type	Scene	Good for	Dataset	Sensor	Used by
ANN	Classification	Simple	Behavior trajectories	VLP-16 LiDAR sensor At Reno, Nevada	LiDAR	[2]
RNNs with LSTM	Prediction	Simple	Without interfering trajectories	ETH and UCY	Camera top view	[4] [5]
Social grid LSTM		Crowd	Shared information between neighbors		Camera top view	[7]
State refinement (SR-LSTM)					Camera top view	[8]
Stacked LSTM				Daimler	Stereo camera installed in car	[9]
CIDNN				(GC), ETH and UCY	Surveillance camera and camera top view	[10]
Encoder–decoder LSTM				Extremely crowded	–	[11]
SEquation 2Seq framework encoder–decoder				Simulation and GPS trajectory dataset from the Geolife project	GPS	[12]

Table 2 Dataset description

Dataset	Viewpoint	People	Scenes	Year	Reference
Stand ford drone	Top view	11,216	8	2016	[4]
UCY	Top view	786	3	2007	[6] [7] [12]
ETH	Top view	750	2	2009	[6] [7] [12]
Grand central (GC) station	Surveillance	12,600	1	2015	[10]
Oxford town center	Surveillance	2200	1	2011	[12]

3 Datasets

This section presents some of the datasets used to train models mentioned in Table 1 and evaluate the prediction methods. There is a diversity of data due to changing conditions such as different numbers of scenes, trajectories and pedestrians as shown in Table 2.

Before using the datasets, it is necessary to know from where this data comes. For predicting pedestrian trajectory problem, the most common type used is video, but there are some data used that were collected from motion capture sensors.

It uses a camera to capture the view at a wide angle in stations and markets. These scenes are used to evaluate the prediction of the trajectories because the sequence of pedestrian positions is given accurately in the video. Top view dataset has videos taken by drones flying at specific sites and provides data of any objects, such as cars, skateboarders and cyclists, as well as pedestrians moving in that sites. The video scenes are captured by surveillance cameras, which are angled downward.

Pedestrian physical features can be seen in these videos, can be used for prediction and provide the locations of objects, cars and pedestrians in the scene and activity labels.

4 Conclusion

We presented various pedestrian trajectory prediction models using neural network methods and common datasets. We first grouped prediction methods according to the approach taken. ANN classification process for the pedestrian behavior prediction model has been discussed, where the process starts to detect and track trajectory. But when we represented a pedestrian trajectory prediction as a prediction problem, according to a number of pedestrian traffic trajectories currently observed, thus RNN is the solution for sequence time prediction.

Traditional RNN could not make accurate prediction as compared to LSTM while memorizing and processing long sequences. LSTM is not sufficient to detect dependencies between relationships among pedestrians.

If given attention to know the impact of human–human interaction applying simplest methods such as ANN, RNN and LSTM models in complex scenes, the prediction errors are usually large. Finally, the paper summarized all discussed methods with their corresponding datasets.

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Condition Monitoring of Power Transformer by Dissolved Gas Analysis: A Review

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1 Introduction

A power transformer is pivotal in-stream equipment in the overall power system and suffers countless internal and external stresses throughout its lifespan [1–2]. Therefore, it must be monitored and inspected throughout the operation. The transformer has electrical windings, which embrace paper insulation soaked in oil insulation, both are important sources to evaluate incipient faults and thus reflect the health of the transformer. Transformer oil performs many functions: provides insulation, helps extinguish arcs and provides cooling [1]. Oil and paper insulation mainly decompose during thermal and electrical stresses. Consequently, the heat dissipation capacity and dielectric strength of paper and oil decreases and some gases are released [3, 4]. From the amount and composition of gases, it is evaluated whether there is an internal irregularity or not and how critical it is.

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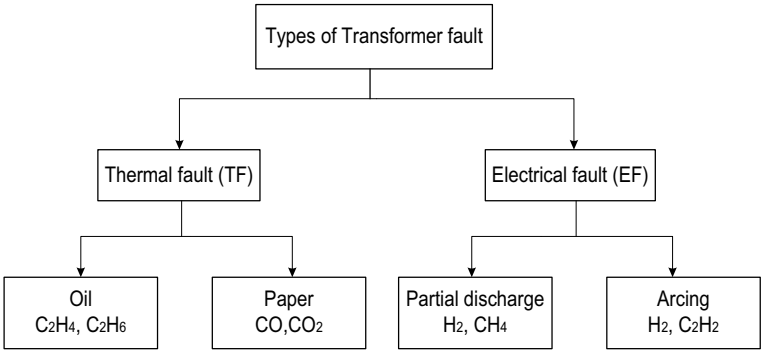

Fig. 1 Transformer fault and generated gases [5]

- Oil decomposition: Hydrogen (H_2), Methane (CH_4), Ethane (C_2H_6), Ethylene (C_2H_4), and Acetylene (C_2H_2).
- Paper decomposition: Carbon monoxide (CO) and Carbon dioxide (CO_2) (Fig. 1).

Under the normal operating condition of the transformer, it releases gases (mostly hydrocarbons) mentioned above. When a faulty condition occurs the concentration level of these gases increases and indicates a different type of electrical and thermal faults in equipment. As stated by IEC60599 and IEEE C57.104 standards electrical and thermal faults can be classified into six types, examples are shown in Table 1 [6–8].

When a fault is identified, it is necessary to keep a record of the rate of increase of gas concentration. If it is more than 10% per month from its normal concentration, then it is clear that the fault is still active [2].

Table 1 Fault classification [6–8]

Symbol	Fault	Examples
PD	EF-corona partial discharge	X-wax formation in insulating paper, discharges of cold plasma in voids and gas bubbles
D1	EF-low energy discharge	PD of the sparking type, carbonized puncher in insulating paper, accumulation of particles of carbon in oil
D2	EF-high energy discharge	Gas alarms, tripping of the equipment, metal fusion, extensive damage to paper and oil
T1	TF- $t < 300$ °C	Paper turning carbonized and brownish
T2	TF-300 °C $< t < 700$ °C	Accumulation of particles of carbon in oil, carbonization of paper
T3	TF-$t > 700$ °C	Metal coloration (800 °C) and metal fusion(>1000 °C)

2 Dissolve Gas Analysis (DGA)

DGA of the oil-immerged electrical equipment is the best way to investigate its overall health condition [9–10]. It provides important parameters for measuring the transformer's health conditions. These parameters allow simple online monitoring of an energized transformer [11]. The review analyses various DGA diagnostic methods in detail. Under these methods, there are many traditional methods, like IEC Gas ratio method [1], IEEE key gas method [6, 12], Rogers ratio method [2, 13], Dornenburg ratio method [2, 14], CIGRE ratio method [9] and Duval triangle method [8, 12]. To limit the drawbacks of the traditional methods, new models are proposed for DGA interpretation, based on Fuzzy logic [10, 15–16], and Hidden Markov model [17, 18].

Various conventional incipient fault detection DGA techniques are presented in [2, 12, 19]. These techniques can be considered as a generic way to estimate incipient faults introduced by stresses, but for some samples, it fails to differentiate between the overheating in cellulose and oil. If data falls within the range, the accuracy rate will be high, but if it falls out of the estimated range, no computation can be done, making it difficult to conduct DGA [20, 21].

As these conventional DGA diagnostic methods have limited accuracy and require necessary expert advice, some new software techniques are introduced such as Fuzzy logic, evidential reasoning, and HMM.

All the traditional DGA incipient methods give crisp results. After comparing crisp and fuzzy logic [10], it becomes evident that fuzzy logic can detect the faults with a specific 0 reliability. Fuzzy logic is one of the most simple and high accuracy DGA diagnostic techniques [10, 15–16]. The fuzzy logic technique provides a much better and accurate way to evaluate the transformers for their degradation. Fuzzy logic gives an estimated but feasible way or remaining life assessment.

Fuzzy logic technique based on the IEC gas ratio is working as a fault diagnostic method in DGA; it gives an intermediate value between 0 and 1. The Fuzzy logic operations can be understood in the following three steps [15]:

- Fuzzification: fuzzy inputs are obtained after fuzzified real values.
- Fuzzy processing: fuzzy inputs are processed as per the set of rules and generate fuzzy outputs.
- Defuzzification: generating a crisp real value from fuzzy outputs.

In the proposed Fuzzy model, Demi-Cauchy membership functions are utilized to determine the unfavourable conditions of transformers [23, 24]. The membership degree is given as:

$$\mathrm{Fz}[x \in A] = \mu_A(x) : \Re \rightarrow [0, 1] \tag{1}$$

In this fuzzy operations based on AND = min is used, because of the simultaneous appearance of inputs from different models and are reliant on each other. In Fuzzy Rules, using the "IF–THEN" type a set of knowledge-based semantic rules is evolved. After inspecting numerous transformers in their best to worst working

conditions these rules are developed. The defuzzification process is done by evaluating the weighted average of the fuzzy region using the Centroid method [22]. This model gives us a simplified and appropriate way to make the working and performance of diagnostic systems under many online/offline operating conditions. Further, this model is a cost-effective method for asset performance analysis by reducing expensive risks and providing appropriate information about the retirement time of a transformer [22].

In most of the conventional methods of DGA outcomes fall outside the preferred codes of the leading methods and thus different conclusions are formed for the same sample of oil [16, 20, 21]. To avoid these confusions, fuzzy logic is used to lessen the dependency on manpower and to support in calibrating DGA methods. The new technique talks about the amalgamation of all prevailed DGA interpretation techniques into a single proficient model [16]. The fuzzy logic models are evolved for different conventional DGA techniques. The input elements are the seven main gases (ppm) and the output is split up in five units of triangular membership function constituting fault state [25–26]. The graphical user interface tool given in MATLAB is used to develop fuzzy models, in which each input is fuzzified into a different set of membership functions. For the defuzzification of the fuzzy models, the Centre-of-gravity phenomenon is used [27]. The consistency and accuracy of these models are analyzed and the results show that the DGA interpretation is not a perfect science. To get over these drawbacks, a fuzzy logic model is proposed which is built on the integration of traditional methods (Ratio methods, Key gas method, and Duval triangle method). Based on the accuracy level of each method the gross decision (E) is measured by the below formula:

$$E = \frac{\sum_{i=1}^{5} Li\,Ei}{\sum_{i=1}^{5} Li} \tag{2}$$

where Ei is the decision of individual method measured by its accuracy level Li. The step-by-step procedure is presented in Fig. 2. To prove the validity of the model, collected DGA data and known fault samples from issued experimental papers are tested on the proposed model. The results show that the model is best suited for electrical faults, but it flunks in few samples to disintegrate thermal fault including ignition of oil or cellulose and in these cases an engineering verdict is necessary.

One of the biggest drawbacks of the gas ratio method (Dornenburg, IEC, Rogers) is that some of the outcomes of DGA analysis fall out off the ratio code and diagnosis remains unresolved. Duval triangle is the best method in such cases as it is a closed system [5, 8].

Duval triangle was developed in 1974, it includes three hydrocarbons (Methane, Ethylene, and Acetylene) [8]. The Duval triangle method is shown in Fig. 3. The 6 zones are shown in Fig. 3, which indicates transformer fault as mentioned in Table 1. There is one more intermediate zone DT which shows the mixture of electrical and thermal faults.

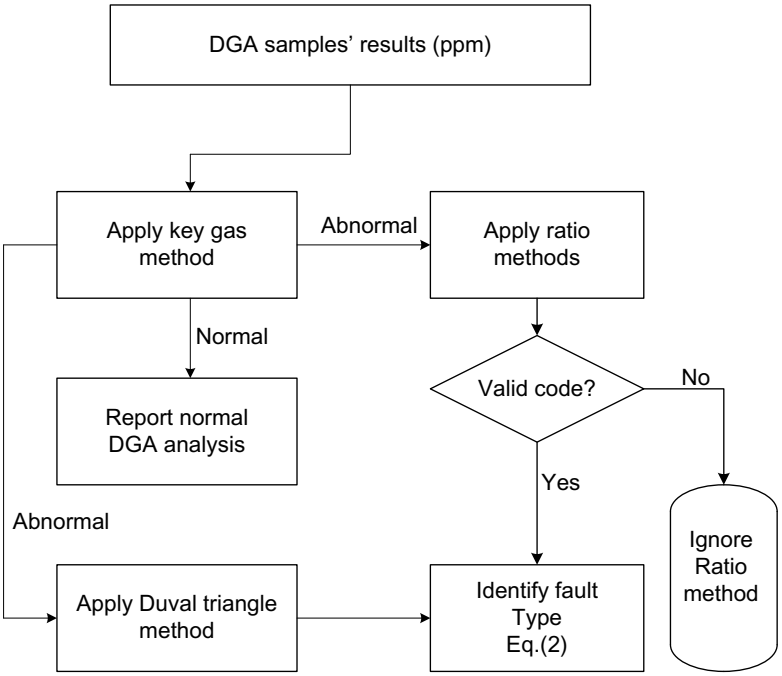

Fig. 2 Flowchart of the model [16]

Based on the Duval triangle, some advance methods have been developed for detection and monitoring faults in electrical equipment [12, 28].

Dual of Duval triangle [12], like in Duval triangle the three main hydrocarbon gases; Methane, Ethylene, and Acetylene are involved. The gases are firstly normalized such that their combined concentration lies in the range of 0 to 1. For fault identificaion, these three gases are converted into empirically obtain mathematical equations which are best suitable for fuzzy trapezoidal membership functions. The fuzzy trapezoidal membership functions for different gases in all five faults are represented in mathematical expressions. These equations form the basic belief assignments (BBAs), the BBAs are then normalized and fall under the range of 0 to 1. The three normalized BBAs obtained from the gases are regarded as 3 distinct origins of evidence indicating a fault type and are represented as $\mu_{1(M)}(CH_4)$, $\mu_{2(M)}(C_2H_2)$, and $\mu_{3(M)}(C_2H_4)$. Each one furnishes a BBA to a subset of Υ, which is $m_1(l_1)$, $m_2(l_2)$, and m_3 (l_3). With the help of Dempster-Shaffer amalgamation rule evidence combination for $l_1 \oplus l_2 \oplus l_3$ is evaluated.

$$m(\Psi) = \sum_{l_1 \cap l_2 \cap l_3 - \Psi} \frac{m_1(l_1) m_2(l_2) m_3(l_3)}{1 - k} \tag{3}$$

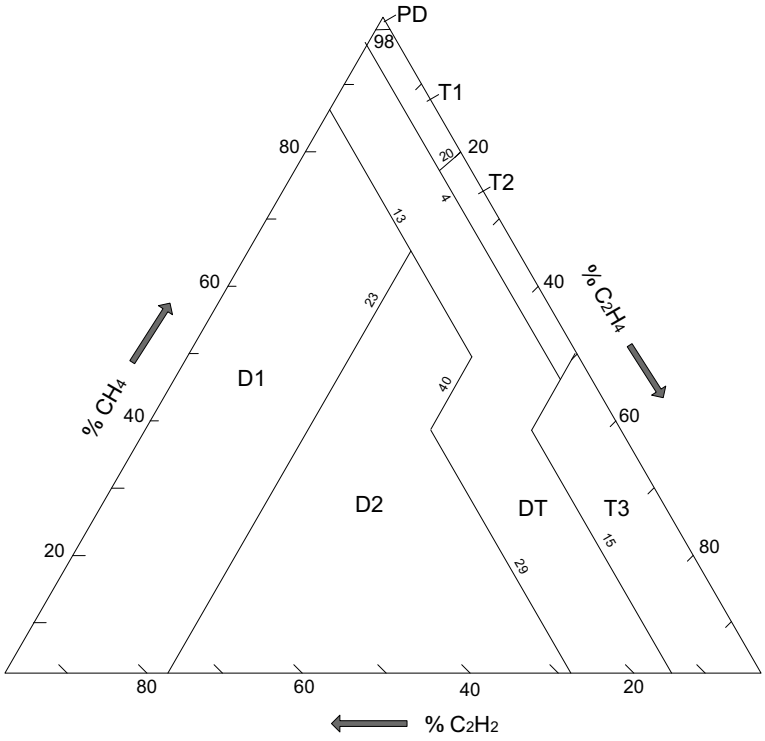

Fig. 3 Duval triangle model [12]

$$k = \sum_{l_1 \cap l_2 \cap l_3 - \Phi} m_1(l_1) m_2(l_2) m_3(l_3) \tag{4}$$

After evidence combination, the fault allied to the greater value of BBA indicates a specific fault occurring in the equipment. The advantage of this method over the conventional Duval triangle is that the same or different kind of tow or more faults overlapping each other can be anticipated at the same interval. However, unlike the Duval triangle, the anticipation of fault evolution is not possible in this method [12].

Two more new methods named Hidden Markov model (HMM) [17, 18] and advanced software provided with a DGA analyzer are developed [29]. They are different from conventional methods and have an advanced algorithm.

A model based on the HMM combined with the Gaussian mixture model (GMM) is developed for prognostic health management of oil-immersed power transformers by subdividing their in-service working stages into three parts i.e. healthy state, sub-healthy state and fault state [17, 30] as shown in Fig. 4 below:

A transition from healthy to faulty state is reflected by the sub-healthy state and then a data set containing numerous faulty and healthy cases to achieve the health-state characteristics is established. Using the GMM, the gross data is crumbled into

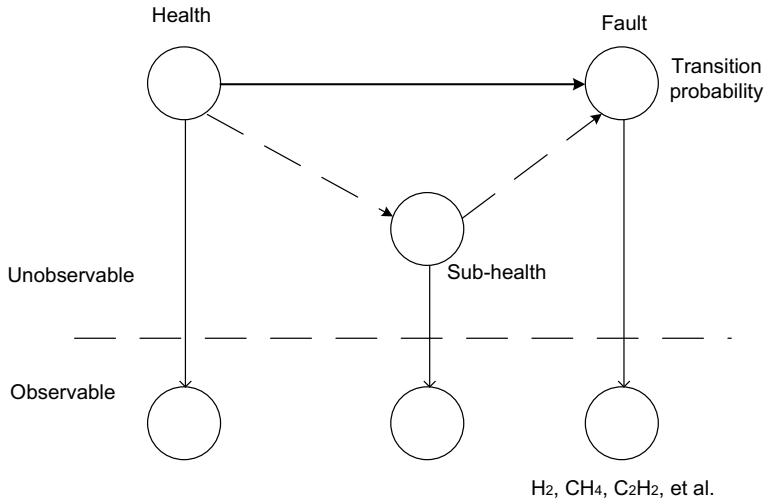

Fig. 4 Dissolved gases in transformer oil versus health index [17]

a summative form of many Gaussian probability density functions which is used to appraise the concentration distribution of gasses dissolved in oil and each one of them act like a characteristic of the group [31, 32]. This Gaussian probability density function is obtained from Bayesian theorem and is calculated by the formula:

$$P(x) = \frac{e^{-0.5(x-\mu)\sum(x-\mu)}}{2\pi^{n/2}\left|\sum\right|^{1/2}} \tag{5}$$

where $\sum$ is the $n \times n$ covariance matrix and μ is a d dimensional vector denoting the mean of the distribution. On performing assembled analysis on the library data set, health evaluation of the status of transformers is evaluated and then it is observed that lower the concentration of gases better is the health of the transformers and vice versa. Then to check the accuracy of the developed GMM model cross-validation is done. This GMM model gives static characteristics of transformers while the gas concentration keeps on varying in power transformers so to convert the static characteristics to dynamic ones and to develop a better time-based model HMM model is selected. Instead of the dependence of different states on each other, linking to states through probability distribution is the basic principle of HMM. Markov chain is the main key of HMM and has two parts [17, 18]:

- Visible part—specifications that are observable like dissolved gasses' concentration in oil-immerged transformer.
- Hidden part—invisible states like the three states of power transformers; healthy, sub-healthy and faulty states.

Baum-Welch algorithm is used to resolve the state transition probabilities in HMM and the first state. In HMM the aim is to evaluate the time for transforming from healthy to faulty state for which proper attention on the sub-healthy state must be given as shorter the time poorer the health of the transformer and repair and maintenance is required. For making HMM more efficient, iterative approach based on the Viterbi algorithm is used, thus avoiding duplicated calculations [17, 18]. HMM is a feasible method for short-term fault prediction in power transformers and hence increasing their life span.

The last method is based on advanced software provided with a DGA analyzer [29]. First of all the concentration percentage of dissolved gases concerning the sum of 5 gases (H_2, CH_4, C_2H_6, C_2H_4, and C_2H_2) and some gas ratios are measured. According to these measurements, fault type is decided, then the dissolved gas data is collected and Total Combustion Gases (TCG) is calculated (TCG is the sum of all five gases concentration). After this Gas Concentration Percentage (GCP) is calculated by the given formula:

$$\text{GCP} = \left(\frac{H_2}{\text{TCG}}\frac{CH_4}{\text{TCG}}\frac{C_2H_6}{\text{TCG}}\frac{C_2H_4}{\text{TCG}}\frac{C_2H_2}{\text{TCG}}\right)^T \times 100\% \tag{6}$$

Based on these GCP values different fault type is determined by the help of the proposed integration technique. Here an accuracy flag is introduced, when interface occurs between different types of the fault then the accuracy flag is "0.5", it is "1" if the diagnose is equal to actual fault otherwise it is "0" [29]. Now the result obtained from the new approach is compared with different traditional methods. After comparison, a visible reduction of accuracy can be seen and this is due to the interference area of different faults.

The overlap is illustrated by the help of the probability distribution function which is established on mean and standard deviation [29, 33]. To overcome this drawback now a modified edition of the new DGA interpretation method is introduced considering some new gas ratios (Table 2) and these gas ratios hinges on the empirical study.

A remarkable hike in the accuracy level is acquired as compared to traditional DGA diagnostic methods Table 10 [29].

Table 2 New gas ratio [29]

p_1	C_2H_2/H_2
p_2	C_2H_2/CH_4
p_3	C_2H_2/C_2H_6
p_4	C_2H_4/H_2
p_5	C_2H_4/CH_4
p_6	$(C_2H_4/H_2) + (C_2H_4/CH_4)$
p_7	C_2H_4/C_2H_6

3 Conclusion

A review of condition monitoring of the transformer by DGA is performed in this study. It aims to support dynamic early prediction and warning model for incipient faults in liquid and solid insulation. Several DGA diagnostic methods: traditional as well as advanced logic methods are presented. The set of fault detection and fault diagnosis methods are defined in the study, with their detailed methodology. DGA methods have dissimilarity in accuracy, reliability, measurement range and repeatability.

In this review paper comparison between distinct DGA methods is done, which clearly shows the superiority of methods from one another. The paper aims to help the selection of DGA interpretation techniques for specific electrical equipment depending on its abnormal or faulty conditions.

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An Overview of Communication System Model Using Deep Learning Techniques

K. Tamizhelakkiya, G. Shailesh, Manpreet Singh, and Pushkar

1 Introduction

Deep learning adopts deep neural network which uses class of AI framework strategy that permits us to produce new information with similar insights. Our daily communication relies very much on digital innovation which needs to convey ideal execution without bargaining the nature of transmission. Q-learning process supplies information to the system for providing absolute compensation to the square which legitimately gives yield for the framework and zero prizes to those which are not associated with framework.

In communication system transmit signal can empower the recognition of information encouraged by assortment of framework channel models like added substance white Gaussian noise(AWGN) that can help the framework in getting the genuine impacts and decides the genuine information which makes improvement in physical layer and end learning in correspondence to the framework which enhances the exhibition.

End to end framework decides the misfortune inclination in the framework that impeccably decides the channel limit and measure of message that can be transmitted from the source to goal. In point to point correspondence information trades

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between two hubs and the channel goes about as stochastic framework where yield seems to be 'y'. Likelihood appropriation work 'x' is $P(Y/X)$. Channel must permit backpropagation in the system which has been planned by utilizing neural system in physical layer which incorporates AWGN to display the parcels containing data. The presentation of profound learning based procedure has been resolved after channel examination was done and the bit error rate (BER) in the information decreased and sign to clamor proportion was improved that gave the framework an output with higher efficiency.

2 Related Work

Many methodologies are being used for noise reduction such as Deep Learning. Deep learning techniques are utilized with GAN technologies [1] to reduce the interference and noise components with the help of neural networks. This can be used for transmission of data over wired or wireless network setup. OFDM has been implemented with cyclic prefix [2] with the same principle like conventional OFDM which provides equalization and robustness against sampling synchronization. End to end communications are established using (AWGN) and (RBF) i.e. additive white Gaussian noise [3] and Rayleigh block fading to establish communication [4] over supervised learning. This helps in transfer of file over a network in [5] communication network protocol. Attack instances are produced which protects image [6] sources by conditional GAN (CGAN) for designing and training of the system to increase robustness. Complete communication system has been built over [7] a train composed by neural network using open source deep software libraries. Deep learning techniques are utilized to [8] reduce the interference and noise components with the help of neural networks. In multiplexer and demultiplexer systems for transmitting signal through [9] selected channels. Deep learning techniques have been [8] implemented with cyclic prefix with same principle like conventional neural network which provides robustness against wireless system.

3 Methodology

The proposed system architecture Module of Physical Layers utilized associated with Transmitter and Receiver part is shown in Fig. 1.

Multiple layers have been utilized comprising of various loss and active functions. Transmitter utilizes normalization technique which determines the active layers and binds the channel with receiver component and the opposite occurs in receiver module and utilizes softmax receiver layer for retrieving the information and gives it to argmax which gives optimum output for the system that is "y". The implementation of transmitter has been done by two distinctive parametric capacities that can be autonomously streamlined with assumptions and Training Models.

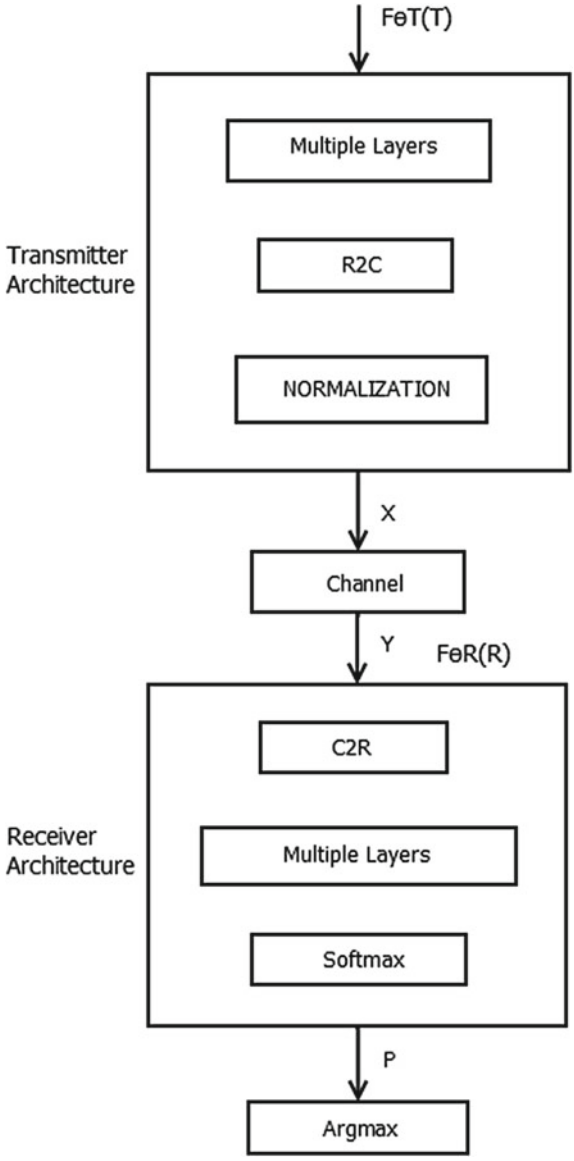


Fig. 1 Architecture module of physical layers utilized associated with transmitter and receiver part

The Transmitter and Receiver approach a succession of preparing tests are considered as assumptions whereas the Two Training models and Architectures consist of Transmitter and Receiver training. First, the receiver has been trained by keeping the transmitter in fixed position, and then transmitter training was done by fixing the receiver section. The Stochastic gradient decent (SGD) algorithm has been used because it is a simple yet very efficient approach to discriminative learning under loss

function because it supports vector machines and gives high efficiency. The learning rate has been set as 0.001 because lesser the learning rate lower are the chances of error. Epochs values range from (0–5000) because the loss starts decreasing only after 1000 epochs and as this approach involves deep learning more number of epochs are required so the trainer can achieve maximum efficiency.

3.1 Receiver Training

The receiver training undergoes Supervised Learning that involves the following steps of Probability Distribution Generation over message signal (m), Computing Loss for Cross-Entropy (CE), Optimizing (SGD).

Function: TRAIN RECEIVER ()

- Transmitter: m_T—Training source (BR), $f\Theta_T{}^{(T)}\ (m_T)\ X - f$ SEND (X).
- Receiver: Y—RECEIVE

$$P - f\theta_r^R(y) \rightarrow \text{receiver module}$$

m_T—Training source ().
SGD (θ_r^R, m_T, P)—optimizer values were determined using this parameter.
Repeat until output is determined with higher accuracy.
End function.

3.2 Transmitter Training

The main objective of the transmitter training was to produce channel images that limit a scalar misfortune given by the receiver. The reinforcement learning has two states namely Approach state space and [10] M action space. CNN Stochastic RL Policy Loss (enables investigation) means that the start to finish execution relies upon the channel elements. In this Pulse Amplitude Modulation (PAM) has been utilized for the amplification of the given input message signal.

3.3 Transmitter Formulation

The transmitter formulation accepts a neural system of k-layers. Mapping of info vector to a yield vector through k-layers take place. In this situation, $|M|$ is cardinality of message sent and N is the quantity of channel utilized.

The parametric function for transmitter utilized is:

$$f\theta_t^T, f\theta_r^R \tag{1}$$

3.4 Parametric Function of Transmitter Neural Network

The parametric function of transmitter neural network accepts a neural system of k-layers. Mapping of information vector to a yield vector through k-layers have been determined. In this situation, $|M|$ is cardinality of message sent and N is the quantity of channel utilized.

Transmitter is represented by:

$$f\theta_t^T : M \to C^N \tag{2}$$

3.5 Parametric Function of Transmitter Neural Network

The receiver receives output from the channel and returns a probability vector on message set conditioned on received signal.

Receiver is represented by:

$$f\theta_R(R) : CN \to \left\{ p\epsilon R + M| \sum_{I=1}^{M} pI = 1 \right\} \tag{3}$$

where, θ_R is the set of parameters and 'p' is probability vector.

3.6 Receiver Formulation

The purpose of recipient was to foresee genuine message "m" given "y" by assessing the restrictive likelihood $p(m/y)$.

It can be performed by learning the

$$\text{Conditionallog} - \text{likelihoodestimator} = \theta_R - \arg_{\theta_R} \min L(\theta_R) \tag{4}$$

where, L is the

$$\text{(CE) cross} - \text{entropy} = L(\theta_R) - 1 \sum_{I=1}^{S} - \log\left(\left[f_{\theta_R}^{(R)}\left(y^i\right)\right] m^i\right) \tag{5}$$

$$\text{Where } \log\left(\left[f_{\theta_R}^{(R)}\left(y^i\right)\right]m^i\right) = l_i \tag{6}$$

L assumes that the training examples are i.e. samples, 's' defines the size of training sets, $m^{(i)} = i$th training example, $l^{(i)}$ is the per unit loss, and $\mathbf{y}^{(i)}$ is the associated received signal.

4 Simulation Analysis

The proposed work has been determined using python 3.2 in Anaconda 3 (64 bit) using the Jupiter notebook. A deep learning environment has been developed by including many libraries like tensorflow and scilab. Keras has been imported from the tensorflow library. Other libraries like math.h and numpy have been used for performing mathematical operations. Matplotlib has been used to plot all the graphs in an interactive and easily understandable format. The following parameters as shown in Table 1 has been assigned for the system model.

Figure 2 shows the transmitter loss in the system which occurs due to passing of huge amount of data through the respective layer which causes interference as the capacity of the channel is unknown and large amount of data is passed through the respective channel source. The capacity of channel determination determines the loss value which in turn determines capacity of channel at receiver module. The value reaches around 500 and the loss almost becomes constant with slight fluctuations and remains constant for the rest of the epochs values

From Fig. 3, the graph shows the loss at the receiver side and has similar value to the transmitter loss. The loss for transmitter and receiver has been improved by 37.5% as the loss value changes from 1.6 to 1.0 for supervised to that of reinforcement learning as shown in Table 4.

Figure 4. shows comparative graph between the two types of deep learning methods namely supervised learning and RNN learning. From the Table 2, it can be seen that the reduction in the loss by supervised learning has been very less as the epoch's values increases. In RNN learning it has been that the loss reduction is more compared to the initial loss value.

Figure 5 shows the constellation diagram of the received signal. From the diagram, it was noted that the density of the signal along the real part has been quite high and the density of signal along the imaginary part has been quite less and this leads to the increase in the SNR values and decrease in the BER values Fig. 6 shows comparison graph between the traditional plot of the SNR versus BER of the AWGN channel with deep learning and without deep learning and it was observed that the deep learning shows better performance than the traditional method so as the method gradually decreases the BER and which leads to the increase in SNR values as shown in Table 3. For bit error rate the percentage improved is by 20% as the value of SNR is

Fig. 2 Transmitter loss

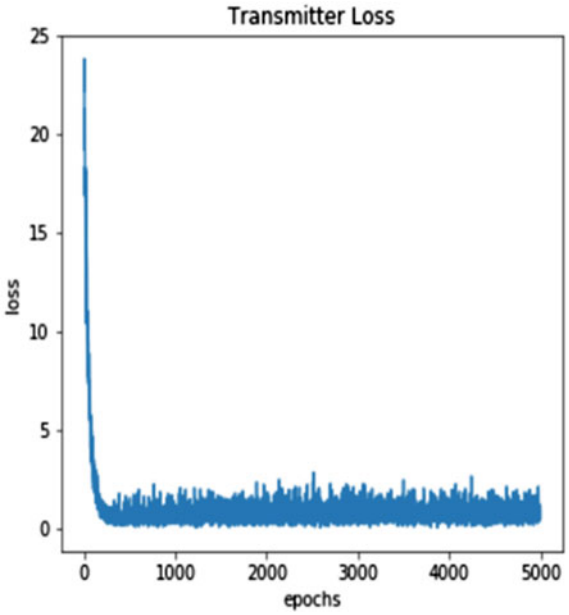
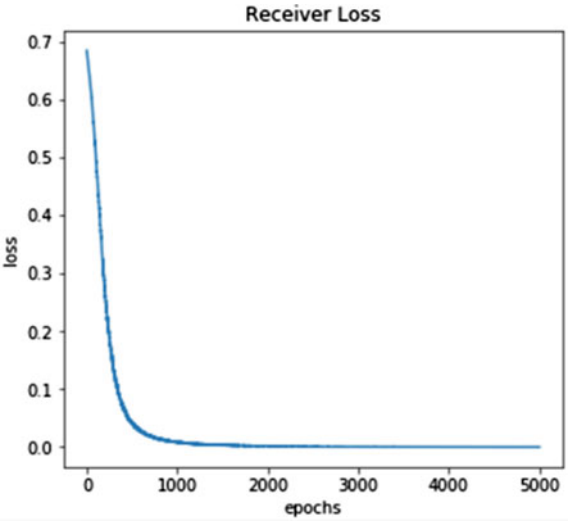


Fig. 3 Receiver loss



reduced from 0.125 to 0.100 when compared to supervised to that of reinforcement. For signal-to-noise ratio, there has been an improvement of 5% as the value increases from 4.0 to 4.2 in supervised to that of reinforcement.

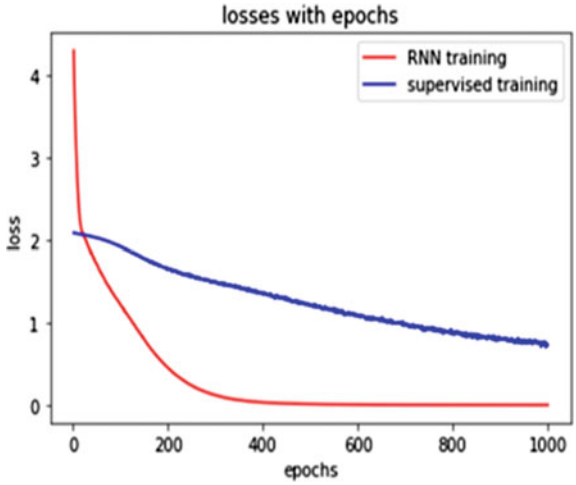


Fig. 4 Loss function value comparison for supervised and reinforcement learning

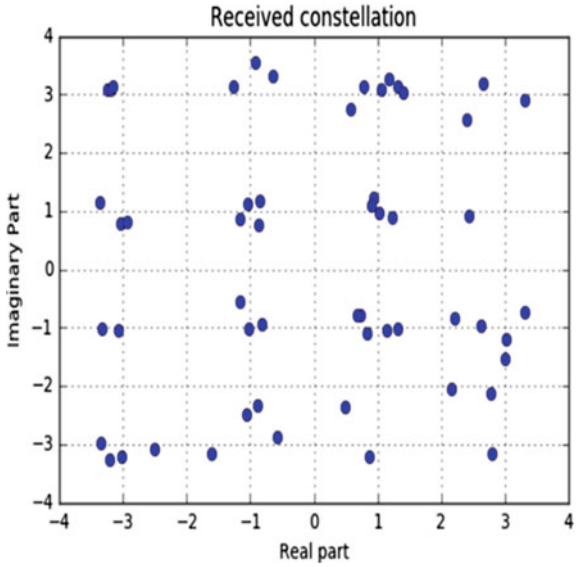


Fig. 5 Constellation diagram at receiver

5 Results and Discussions

The evaluation has been done by calculating the Bit Error Rate, SNR and Loss. Table 4 shows the evaluation parameters of the proposed method. For BER, the percentage has been improved by 20% as the value of SNR reduces from 0.125 to 0.100 when compared to supervised to that of reinforcement. For signal-to-noise ratio, there has been an improvement by 5% as the value increases from 4.0 to 4.2 in supervised to that of reinforcement. Loss function for transmitter and receiver improves by 37.5% as the value changes from 1.6 to 1.0 for supervised to that of reinforcement learning.

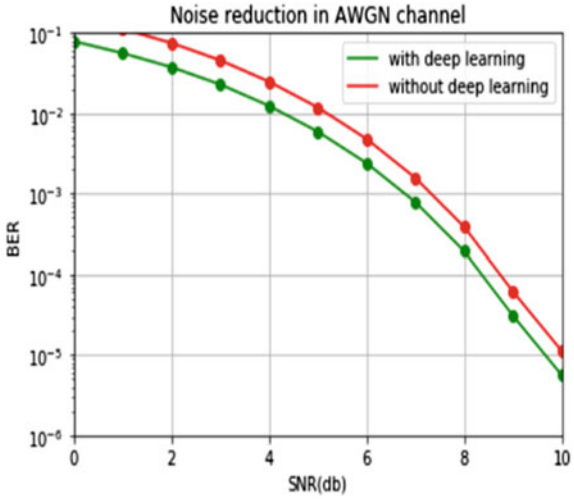


Fig. 6 BER Versus SNR graph with and without deep learning

Table 1 Basic parameters

Parameters	Values
Transmitter and Receiver hidden layers	3232
Learning rate	0.001
Optimizer	SGD
Epochs	0–5000

Table 2 Comparative observations between learning methods

Epochs	Loss(dB) with supervised learning	Loss(dB) with RNN learning
0–500	4–3	2–1.8
500–1000	2–1	1.8–1.5
1000–3000	1–0.2	1.5–1.5
3000–5000	1–0.2	1.5–1.4

Table 3 Comparative observations between traditional method and deep learning

SNR with/Without deep learning	BER without deep learning	BER with deep learning
2	0.1	0.09
4	0.01	0.1
6	0.001	0.01
8	0.0001	0.001
10	0.00001	0.0001

Table 4 Evaluation parameters

Parameters	Supervised learning	RNN with channel modelling	Percentage (%)
Bit error rate	0.125	0.100	20
SNR (dB)	4.0	4.2	5
Loss	1.6	1	37.5

6 Conclusion

The outcomes confirm the viability of proposed strategy by indicating comparative execution with customary methodologies that have been dependent on information and channel models. Capacity of channel has been determined by the loss function and continuous iterations on transmitter and receiver make the system module more robust and reliable to the unwanted noise by utilizing reinforcement technique of deep learning. Despite the fact that the recreation was found on the AWGN channel, it can be effectively stretched out to different channels such as Rayleigh model channeling but the capacity and accuracy for the channel determined has been less effective when compared to that of AWGN channel. Signal-to=noise ratio and bit error rate for the system also sees an evident increase in their efficiency and accuracy due to decrease in loss value associated with the system module. Bit error rate value gains an accuracy of 20% while that of signal-to-noise ratio increases by 5%.

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Modern Advancements and Application of GaN-Based Materials

Nitesh Kumar, Jagriti Mishra, and Rajeev Ranjan

1 Introduction

GaNs has a hexagonal wurtzite structure. Lattice parameter is $a = 3.189$ Å, $c = 5.185$ Å, $\alpha = 90°$, $\beta = \Upsilon = 120°$ [1] Semiconductors such as GaN has direct bandgap, which in return gives us the potential to manufacture LEDs. Apart from GaN Si, SiC and GaAs also contribute to the semi-conductor family, Table 1 [2–4] shows some basic properties that vary between these materials. GaN has helped us in reaching LEDs with wavelengths shorter than 450 nm for the production of blue and violet light LEDs [5]. The electron flow gives GaNs to form high electron mobility transistors (HEMTS) and heterojunction bipolar transistors (HBTs) [6]. On average 3.8 eV is the minimum amount to energy required to remove one electron in GaN-based materials. Doping, structural change and vacancy defect are few of the famous techniques to change and utilize GaNs for field emission or light-emitting devices. GaN nanowires have a light-trapping effect which with the help if electric field can enhance the carrier centers on surface of nanowire. These nanowires can be synthesized by growth from bottom or with etching starting from top. This etching which when assisted with metal under UV illumination gives us the ability for rapid preparation of GaN-based nanowires. GaNs LDs are generally synthesized with a buffer layer to control optical and electrical properties. This buffer layer tends to remove lattice mismatch and provides thermal stability. Improving thermal stability made it easier to provide red LDs which were difficult in earlier days. Eu-doped GaNs are the future of optical devices which currently shows a lot of contribution

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Table 1 Variation of properties between GaN, Si, SiC, and GaAs

Property	GaN	Si	SiC	GaAs
Band gap (eV)	3.4	1.12	3.2	1.4
Breakdown field (mv/cm)	3.3	0.3	3.5	0.4
Electron mobility (cm^2/Vs)	2000	1500	650	8500
Hole mobility (cm^2/Vs)	300	480	120	400
Saturation electron drift velocity (cm/s)	2.5×10^7	10^7	2.7×10^7	1.2×10^7
Transit frequency (Ghz)	150	20	20	150
Dielectric constant	9.5	11.9	10	12.5
Thermal conductivity	130	150	450	550

to Internet of things (IOTs). Substrate on GaNs like sapphire and silicon play major roles in LEDs. When these substrates show large mismatch between GaN and them buffer layer is introduced as said earlier. GaN properties are a great deal to human society they are highly researched but still there is a lot to discover and develop. Dense dislocation and huge polarization give rise to induced electric field in GaNs, which can be controlled by synthesizing non-polar or semi-polar GaNs in right crystal growth direction [7–9]. Barrier effects are leaking paths involving the buffer layer tackling this with proper methods may decrease the loss of current or energy in GaNs. The wide applications of GaNs involving optical and electrical advancements are on its way and will contribute to a better future yet to come.

2 GaN-Based LEDs

LEDs have reached a potential day to day use in today's generation. These LEDs are synthesized with the help of a growth substrate and a buffer layer in between GaNs and substrate. Metal-organic chemical vapor deposition (MOCVD) and hydride vapor phase epitaxy (HVPE) are usually used for the growth of substrate. There are many challenges faced in the synthesis of GaN-based LEDs starting with the selection of substrate material. Sapphire is widely used as a common growth substrate in GaN-based LEDs which has a lattice mismatch of nearly 15% that decreases the mobility and life span of carriers. Silicon and other substrate can also be used in place of sapphire which tends to increase the performance of LEDs provided they have low lattice mismatch. The lattice mismatch can be covered by the buffer layer which lowers the defect density at the interface of epitaxial film and substrate. Before adding the buffer layer surface treatment must be done to substrate involving thermal annealing and nitridation. Annealing improves the polishing damage and makes terraces on surface while nitridation improves the wetting ability of substrate. Moving ahead we get an inscribed problem named quantum-confined stark effect which is present in c-plane of GaN-based LEDs this leads to quicker efficiency wilt resulting in

decrease in internal quantum efficiency [10–12]. Scientists have proved that growing non-polar or semi-polar substrate reduces the quantum-confined stark effect giving a heavy boost in internal quantum efficiency of the device. Primarily doping is one of the best methods to improve the efficiency of GaNs resulting in the making of *n*–GaN and *p*–GaN like a *p*–*n* junction of LEDs formation. Silicon is the most widely used material for n-type doping. GaNs synthesized by MOCVD can be doped with SiH_4 for performance enhancement. Ge and Si can be doped for deep level luminescence improving band edge luminous efficiency [13]. Also, Si when used as a substrate has a work function less than wavelength of visible light resulting in absorption of nearly half the visible light generated from active region [14, 15]. Cooling cracks have also been observed due to tensile stress in GaN substrate layers caused by the lattice mismatch. Melt black etching occurs between Si substrate and Ga atoms during contact resulting in the formation of Ga-Si alloys at higher temperatures [16, 17]. Therefore, precautions are taken so that no Ga atom is etched into Si substrate, hence avoiding contact between Ga and Si atoms. Finding a perfect substrate is still on the table and widely experiments for the development of electronic industries.

3 GaN Transistors

Leading in the race of high power and high-temperature materials GaN transistors have recently been one of the most used material in the life cycle of GaN-based materials. Transistors are electronic devices that can be used as an amplifier or a switch. Transistors take tiny amount of current and manipulate a larger current where need be. GaN HEMT (High electron mobile transistor) has parasitic capacitance, less resistance while turning on and gives high cut off frequency. This makes HEMT the first choice for power amplifier. The main advantage of GaN transistors is high output power density with high operational voltage, with this property GaN HEMT can increase the power to four times as compared to GaAs transistor of same size [18, 19]. Recent technology use Doherty architecture for efficient, linear, and broadband power amplifiers. This architecture used with GaN joins two power amplifiers for the optimization of power efficiency on average and peak power. The main advantage GaN has over silicon transistors has is the charge trapping phenomenon which gives GaN clear win in device performance [20–22]. GaN-based transistors have shown a way for zero energy loss future. In recent days, experiments have been conducted to improve high-temperature stability and performance by covering GaN transistors with grapheme foam for high potential cooling. GaN transistors are technically depletion mode devices, researches have also promised to reach normally off or E-mode for the use in power electronics.

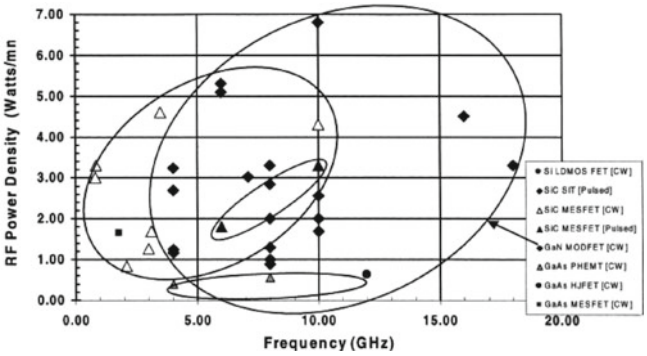

Fig. 1 Comparison between RF power density of different power technology under frequency range of 0 to 20 GHz [23]

4 GaN-Based Radars

With the rise in communication technologies, GaN serves us with greater range and better communication with its high electron carrying capacity. GaN revolutionized radars with better accuracy and precision on pinpointing a location or an enemy locomotive. Today GaN devices generally occur a failure state mostly after continuous use of few thousand hours. Different kinds of researches are going on to understand the failure mechanism associated with GaN. GaN MODFET technology is recently the most promising RF technology till date. It has a clear wide range and better performance than any other FET technology. Figure 1 shows the comparison between different power technologies considering the RF Power Density and Frequency [23].

Looking today GaN materials are well-publicized but the relative positioning of GaN Vs other technology requires careful review. New technologies such as active electronically scanned array (AESAs) play an important role with respect to sensor mesh networks. With GaN it is now possible for automotive radar to work at 24 GHz to 77 GHz. Applications of radars are on a huge rise technology which can successfully predict collisions and satellite breakage lie ahead in the near future.

5 GaN-Based Nanomaterials

Nanoparticles can be synthesized by various techniques like chemical vapor deposition, ball-milling and solvothermal method. These nanoparticles can range between 15 μm and 300 nm. These nanoparticles are one of the huge helpers in optic industries they show abstract behavior due to quantum confinement. In the synthesis, crystalline quality and performance can be tuned by durion of growth process and increase in nitrogen source [24]. With the power of nanomaterials GaN has given us a working range of UV–Vis-IR in the optoelectronics field. Experiments prove that

GaN nanoparticles exhibit intense red emission at 1.83 eV and a strong blue emission around 3.0 eV [25]. These high capacity electron carriers have even made way as electronic material for high-performance machines. According to thermodynamics the energy bandgap in GaN nanoparticles depends on size as Eq. (1):

$$E_{\text{nano}} = \left(1 + \frac{\alpha}{D}\right) E_{\text{bulk}} \tag{1}$$

Here α is a constant for different shapes of particles called the shape parameter. Solar cells have substrates made out of GaN nanoparticles that increase the efficiency. Larger surface area, increased bandgap, size-dependent properties and increased absorption coefficient improved its conversion efficiency to 3.87% and is also used for water splitting. Self-assemblies of GaN nanoparticles can be used as photovoltaic devices [26, 27] and piezoelectric nanogenerators [28]. With such modern advancements GaN can be used in batteries, capacitors and other charge related devices to increase the performance and usability but due to market economy mass production with GaN nanoparticles is an expensive trade. Nanoparticles of GaN can be self-assembled for the synthesis of nanospheres, nanotubes and composite bulk with their properties depending on surface to volume ratio and changeable bandgap [29]. Recently, experiments are being conducted on porous nanomaterials and their use in optical and electronic industry. These porous nanomaterials can be used a membrane in different devices to enhance performance and longevity.

6 Conclusion

GaN materials have found a large hole to fix in the world today. Keeping an eye over its variable bandgap and high-density electrons. Optoelectronic devices are now on their peak with its high stability and high electron carrying property. Starting with LED GaN has shown significant development in its application with outside world. Red LEDs were difficult and expensive before the entrance of GaN LEDs by giving us the option to choose substrate that makes GaN materials more flexible and reliable. Scientists today are working on the ways to avoid natural defects like quantum confined stark effect and black barrier effect associated with buffer layer. Amplifiers that use GaN technology are now available and give us better performance than the conventional ones. Other applications such as radars and nanomaterials are extensively investigated for correction of defects and improvement of quality. Wireless communications are being improved with GaN and its substrates. With the help of GaN today we can pinpoint locations with near-perfect accuracy and save power loss in conversions. Although we may have improved our quality, mass production is still a long way because of expensive materials. Work is going on to bring down the price and make it ready for commercial purposes and help humans as soon as possible in the near future.

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Detection and Classification of Different Stages of Benign and Malignant Tumor of MRI Brain Using Machine Learning

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1 Introduction

The main objective of this project is to detect and classify the Brain tumor from the human MRI images by using different image processing techniques. Brain tumor detection and classification is the important characteristics required for medical diagnosis. Because the classification of brain tumors from normal to cancerous tumors is a more important parameter for doctor's diagnosis. There are two different categories between the brain tumor that is Benign and Malignant. There are various types of MRI images that can be used such as T1, T2, and special type of T2 known as "FLAIR" but T2 and flair have been found to be best for tumor detection. In order to differentiate them as asymmetrical in shape, uneven border, large area, overspreading. For that, this paper uses image processing techniques in order to separate them. MRI plays a major role in detecting a tumor without human interference. Depending on the similarity between the images standard MRI images have been used to identify different sorts of tumors. More than a hundred and twenty categories of brain

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tumors [1] are labeled into four stages in line with the volume malignancy through the "World Health Organization" (WHO).

The classification has been on lower to higher range, i.e. (1–4) for malignancy of the tumor. Gliom as are malignant and wide-spreading in common tumors. Segmentation is one of the popular techniques used. As the K-nearest neighbor (KNN) has been getting more and more use and being precise, it seamlessly outperforms previous contemporary classical tool mastering algorithms. Numerous techniques have been used to detect the tumor accurately such that the deviation from actual input is as least as possible. Developing a technique which gives almost precise results is the main aim. Nevertheless, the exceptional take on widespread MRI patterns can be inadequate for the specific analysis. Different methodologies are invented in which some can be best at segmentation, some can be best at feature extraction and some can be used for best results in classification.

2 Related Work

Many methodologies are being used for segmentation and classification for tumors. Segmentation is the most popular [1] where active 3D contouring method has been used for segmentation for the purpose decreasing manual works. It uses different properties of the image both global and local to increase the accuracy. Image processing algorithms are also popular in the domain. K-means clustering [2] links with a two-step system with morphological operations and level segmentation. Comparison methods are also common, Daubechies, Haar, Symlet, Morlet from the different wavelet families [3, 4] has been used to denoise the MRI brain image for increase in efficiency and accuracy of the "wavelet-based thresholding method".

SNR (Signal to Noise Ratio), MSE (Mean Square Error), and PSNR (Peak Signal to Noise Ratio) has been used for analysis and performance evaluation. Multimodality MRI scans are co-recorded and brain exposed. Random forest classifier is used to foretell five grades. For increasing the accuracy, RF classifier [5]. Watershed segmentation [6] is among the available Morphological operations [7] along with fuzzy-c algorithm [8], has been used by declaring the threshold factor for the image with machine learning features [9, 10]. Factors can vary from image to image. The drawback in this process is that its highly precise for minima. Three-Dimensional Active Contour without Edge (3DACWE) algorithms have been benefitted to immaculate and regulate the gathered data. Gray-level co-occurrence matrix and Analysis of Variance (ANOVA) then engaged for selecting and extracting the features. More than one-layer perceptron neural arrangement can be produced as a categorizer, 3D-box-based heritable procedure which is bounded detects the site of diagnostic nerves in the MRI slices. Thereafter, 3DACWE has been employed to part the brain tumors in volumetric MRI scans [11].

3 Problem Statement

In the existing work, MRI has been acquired for the input and sought to abstract the tumor cells from the given input. This work consists of using different wavelet transforms for segmenting the affected tumors. The proposed technique has the region-based detection for segmenting the affected parts of the tumor. After that major classes of brain tumors such as benign and malignant have been classified. The experimental analysis has been registered as a variety of information and gives prominent implementation for the recognition of tumor condition of the people pays assuring implication in medication therapy.

4 Proposed System Architecture

This paper uses image processing techniques in order to detect brain tumors by using different algorithms. First, the image is given as input that is nothing but an MRI image input. Mixed MRI images have been used as datasets. Hence, input is given and the pre-processing is done. Pre-processing is a usual term for the initial procedure in order to improvise the image for detection. For the purpose of pre-processing various operations are performed which follow a chronological order of first resizing the image, the input images are resized into same dimensions. The resulting image could be altered, if the equal factor ratio is not the same as the input image. Next step in preprocessing is image enhancement. It is the procedure of fixing the images in order to get the resultant be extra contributive for the improvised image evaluation. The main features get extracted through this process as it reduces the noise and sharpens the edges in order to extract fine results. This is followed by segmentation. Subdivision of digital image into more than one segment (units of pixels, additionally known as super pixels) is referred to as segmentation. Segmentation exactness diagnoses the resulting success or failure of the automated assessment system. Segmentation includes various procedures starting from color space conversion then color change followed by morphological process and finally region-based segmentation. These all procedure combined together gives the final segmented image. Color space is used for colored image whereas color conversion is used to get a detailed view of the image. Morphological operations have varieties such as dilation, border correction which results in enhancing the required region. The last step in segmentation is region-based segmentation which uses only required region and rejects the rest. Then feature extraction is done. In Machine Learning, feature extraction has been used to obtain informative or useful data from the actual image. If the required input is large and redundant then it can be converted to a reduced set of features for the processing. The data selected has been appropriate for the preferred task and can be executed through the use of this shorten representation rather than the entire data. Feature extraction also uses various steps in order to distinguish the different features in an image that is required for detection of the brain tumor. These procedures involve

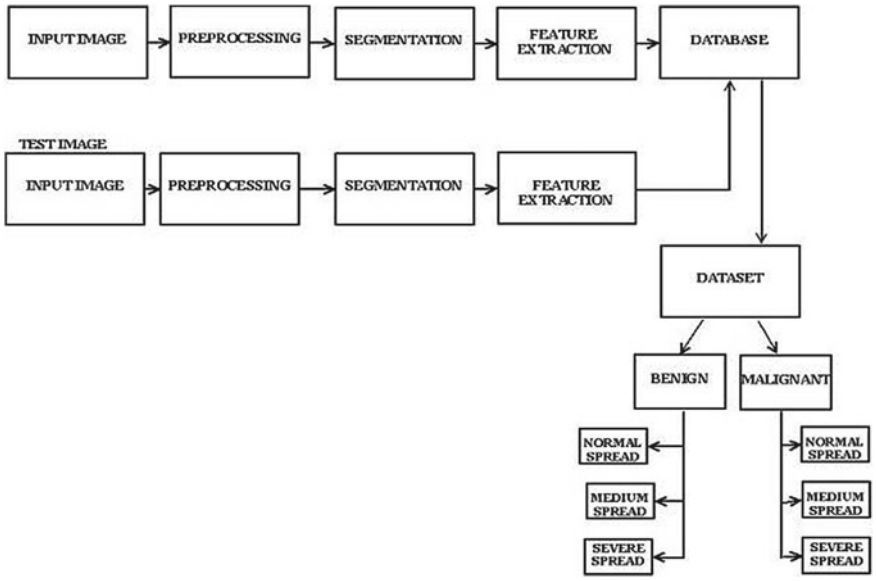

Fig. 1 Proposed ROI algorithm

abstraction of image features such as shade, structure, geometry, and texture using different segmentation techniques. Besides all these techniques and feature the main highlight in order to detect the tumor is thresholding which has been used for color conversion as well as in classification of images.

In Fig. 1 the proposed ROI algorithm of detection and classification has been shown which takes input image, follows the 4-step methodology for the result. It involves four key steps that include pre-processing, segmentation, feature extraction, and finally the classification of the image. The test data are trained using machine learning algorithm which is fed into databases. Hence, for the classification those databases are used for classification of the image.

4.1 Input Image

Figure 2 shows the input image. First, the image is given as input which is nothing but an MRI image input. We have used mixed MRI images as datasets. Hence, input is given, and the pre-processing is done.

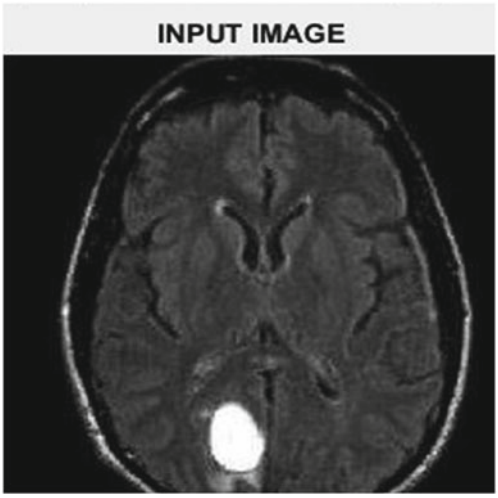

Fig. 2 Input image

4.2 Preprocessing

Initial steps to enhance the image has been done by this step. It consists of the following.

4.2.1 Resizing the Input Image

All the input images are resized into the same dimensions. The resulting image could be altered, if the equal factor ratio is not the same as the input image. In this paper, the image has been resized to 256 * 256. In Fig. 3 the resizing of input image is done by size.

4.2.2 Image Enhancement

The procedure of fixing the images in order to get the resultant be extra contributive for the improvised image evaluation. For example, the brightening of an image or removing noise enhances the feature of the image. For a detailed view of image conversion to grayscale has been done in the proposed work.

4.3 Segmentation

Subdivision of digital image into more than one segment (units of pixels, additionally known as superpixels) has been referred to as segmentation. Segmentation exactness

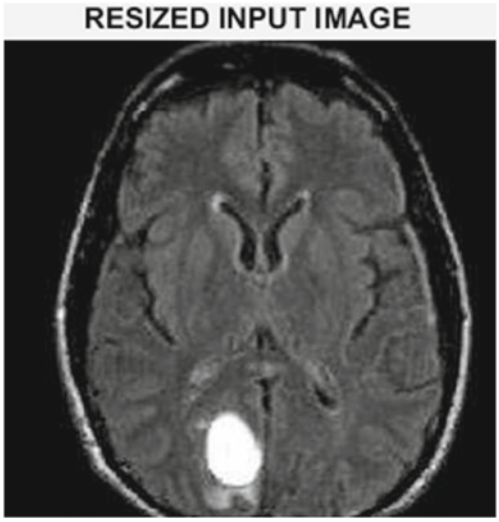

Fig. 3 Resized input image

diagnoses the resulting success or failure of the automated assessment system. In the proposed work, region-based segmentation for the MRI images has been used. Numerous ways of segmentation method are used for this purpose which has been as follows:

4.3.1 Colourspace Conversion

Color space conversion has been the transformation for illustration of coloration from one basis to another. The purpose is to make the transformed image appearance to be likely as the actual image. In this paper, RGB to GRAY conversion has been used.

4.3.2 Converting Colour Format

In image processing applications, colour information would not assist us. If you get into the enterprise of trying to distinguish colorations from each other, then one's purpose is to convert an RGB image to black and white or grayscale codecs in the image. This paper has converted colored or the gray image to black and white format for further processing. Figure 4 show the conversion of input image to grayscale image using grayscale codecs.

Fig. 4 Grayscale Image

4.3.3 Morphological Operations

It is about all the non-linear functions linked with the form or morphology capabilities in an image. In Morphology image has been processed in a large set of image processing and its operations totally on the structure. It applies the structured detail to an actual image, such that output is of the same size. It includes: Masking, Complement the image, Dilation, Border correcting, Holes filling. Dilation has been used in this paper, which results in making tumor region to binary 1 and rest to 0. Figure 5 represents the labeled image which has passed various operations such as dilation, hole filling.

4.3.4 Region-Based Detection

It is the section of an image that is required to cut off or operate the required function. You can outline multiple ROI in an image. Through the means of a binary mask, you can get the 'region of interest'. It has been quite similar to the original image although it has the binary '1' for the ROI and binary '0' for the rest of the image. Using morphological operation, one can somewhat get the desired region in the area to work. Applying ROI on that has given the segmented part of the required tumor.

Fig. 5 Labeled image

4.4 Feature Extraction

In Machine Learning, feature extraction has been used to obtain informative or useful data from the actual image. If the required input is large and redundant then it can be converted to a reduced set of features for the processing. The data selected has been appropriate for the preferred task and can be executed through the use of this shorten representation rather than the entire data. In this paper, feature extraction consists of a combination of Principal Component Analysis (PCA) of Discrete Wavelet Transform (DWT), Grey Level Co-occurrence Matrix (GLCM), and Local Binary Pattern (LBP) for higher accuracy.

4.4.1 Shape Features

Visual features of objects are referred to as the shape traits or shape features. For instance, circular or triangular items. It showed instinctively that visual features all belong to shape features. This paper uses DWT method for this purpose.

4.4.2 Color Features

It is of two types, global and local. “Global features include shade and texture histograms and color format of the full image whereas Local includes texture, color and form features for segmented areas and sub-images”. Image matching and retrieving can be done by these features extracted image.

4.4.3 Geometrical Features

Collection of data of geometric factors like points, traces, curves or surfaces leads to geometric features. Corners, edges, blobs, etc. can be detected by way of geometric feature techniques. For this region-based geometrical feature has been used.

4.4.4 Texture Features

It is the collection of data of metrics calculated in the processing of an image for evaluating the texture in an image. Data approximating can be done by the spatial arrangement of a shaded portion or intensified area in an image or selected area of an image. Here, GLCM and LBP have been used for texture function analysis.

4.5 Classification

Finding the hyperplane in N-dimensional space (N is the variety of functions) that noticeably classifies the feature points has been the main purpose of SVM. The area and density of the extracted image are used to determine the threshold for classification. Accordingly, the results have proper and appropriate datasets that can easily detect the tumor type which can be either benign or malignant type as well as the spreading behavior of the tumor which can be either normal, medium or severely spread.

5 Simulation Results

First the system accepts the image as an input image. This is the elementary stage for the systematic flow of work in order since, with no image as an input, no processing is feasible. The image that is acquired is completely unprocessed. The system then resizes the image. All the input images are resized into the same dimensions. If these criteria do not fulfil the equal factor ratio of the output same as the input image then the produced result will be altered.

After the resizing operation, the segmentation comes into play. Various methods are used in segmentation of the image. It includes color conversion, format change, morphological operations, and region-based detection. For this purpose, the first step is the conversion into grayscale image using the threshold value. In image processing applications, color information would not assist us. If you get into the enterprise of trying to distinguish colorations from each other, then one's purpose is to convert an RGB image to BLACK AND WHITE or GRAYSCALE codecs in the image. Here, GRAYSCALE conversion has been used for further purposes.

The proposed work sharpens the image, removes the noise, and uses various morphological operations on the image to label it and then get the tumor image as shown. All the non-linear functions linked with the form or the morphological capability of the image is termed as morphological operations. These operations include complementing the image, holes filling, dilation, and border correction. Then the next step is feature extraction. Here this paper use PCA OF DWT, GLCM, and LBP for feature analysis. Fig. 6 shows the procedure to detect the benign tumor whereas Fig. 7 shows the output for malignant tumor.

Figure 6 represents the classification of benign tumor which is mediumly spread. This is done by first validating the classifier and training the SVM algorithm. After the training, the classifier is educated through several files to feed the type of tumor and the level of the spread and then new data is classified by use of a trained one. Area and density measures have been used for the classification of brain tumor in the proposed work.

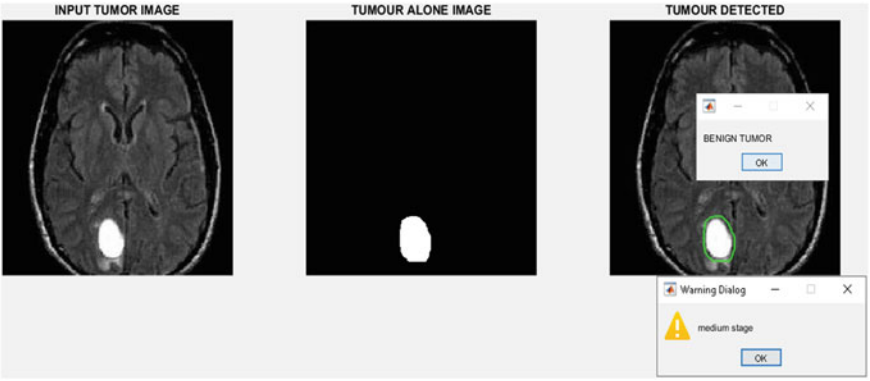

Fig. 6 Output for benign tumor

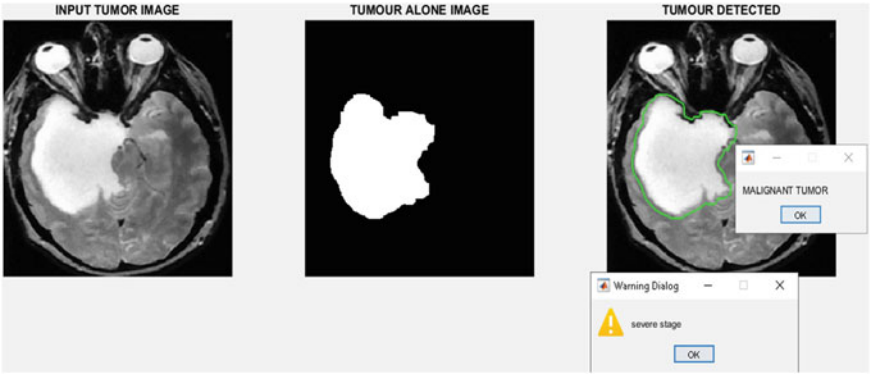

Fig. 7 Output for benign tumor

After the fixed percentage calculations, the tumor is classified using area and density by threshold and then the level of spread is displayed. Figure 7 represents the classification of a malignant tumor that has been severely spread. Similarly, for classification and reversion prediction this paper uses a device called SVM that uses ML knowledge of idea to increase the accuracy and by self-avoiding odd-fit to the information in the entire duration.

6 Conclusion

Brain tumor detection and classification into different types have been implemented using ROI and SVMs. The tumor can be detected properly through our proposed approach and can be classified into benign and malignant with spreading behavior of the tumor that can be either normal, medium, or severely spread. A mixed approach has been used for Feature extraction that consists of PCA OF DWT, GLCM, and LBP for higher accuracy which has been achieved to 98.0932%. Further SVM and different ML techniques can be considered as future work for increasing the accuracy rate near 100% and calculating the percentage of tumor spread that can help in proceeding the right direction with the treatment. In upcoming days, accuracy can be fully achieved by thorough research with time in the given system. Furthermore, different or updated tumor recognition procedures can be introduced giving various options for recognition with advanced features.

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Comparative Analysis of Different PLL Techniques Used in Grid-Connected PV System

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1 Introduction

The phase-locked loop (PLL) idea was initially distributed by Appleton in 1923 and Bellescize in 1932, which was predominantly utilized for synchronous gathering of radio sign. From that point onward, PLL procedures were broadly utilized in different modern fields, for example, correspondence frameworks, engine control frameworks, acceptance warming force supplies and contactless power supplies. The first stage bolted circle strategy was proposed by Silva in 2003. Silva's PLL strategy primary element is that it worked by handling an infused sign of the two-stage sign, and afterward choosing one sign of the two stage signal is called as "opposite stage bolted circle" method [1]. As of late, PLL methods have been utilized for synchronization between framework-interfaced converters and the utility system, and it is impacted by nearness of unbalance and bending in the lattice voltage. All productive appropriated control age frameworks utilize a portion of the numerous

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lattice-associated converter (GCC) topologies. Inside matrix-associated converter control calculation, it is important to precisely and unequivocally decide the lattice voltage stage point so as to accomplish free control of dynamic and responsive power stream between the converter input side and the network. This undertaking is performed by matrix synchronization unit. A perfect PLL can give the quick and precise synchronization data with a high level of insusceptibility and lack of care toward unsettling influences, music, unbalances, droops/swells, indents and different kinds of contortions in the information signal. In this paper, we target displaying a thorough review on different PLL synchronization systems to encourage the correct determination for explicit applications.

2 Robust Phase-Locked Loop (RPLL)

Shanikahas as of late proposed a strong PLL (RPLL) structure appeared in Fig. 1. It comprises a two-stage signal generator, a vector rotator, a low-pass channel, a stage synchronizer and a multirate test holder. The most significant and essential data required for single-stage framework-associated PV framework are phase, frequency and adequacy. At the point when moment voltage is changed over into moment voltage space vector, then the period of a moment three-stage adjusted voltage can be effectively evaluated and a moment single-stage voltage cannot be treated as a moment space vector [2]. The advantages of RPLL over other PLL procedures are that (i) all part building the framework can be effectively planned and (ii) high-request PLL controllers permitting optimizing can be steady. Not quite the same as other single-stage PLLs, the stage synchronizer depends on the "summed up vital sort PLL strategy" [2]. Shanika expressed that different kinds of two-stage signal created is superior to basic sort one-homeless people RPLL which can right away gauge the stage, recurrence and abundance in single stage. (1) Structure of robust phase-locked loop.

Figure 1 shows the assessed structure of robust phase-locked loop (RPLL), made out of two-stage signal generator, a rotor, a low-pass channel, a stage synchronizer and a multirate test holder where two-stage signal generator produces two signs from an infused single-stage signal. Vector rotor performs the processing functions. Low pass filters out the noises or disturbance and harmonies. Phase error detection samples the error in phase which then is send to the principle of the multirate test holder which at

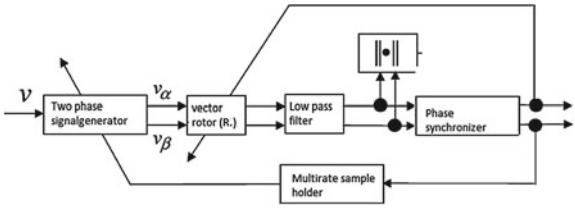

Fig. 1 RPLL structure

that point tests the stage and sends that stage to bolster the information which we get returned or nourished to the sign generator for legitimate recurrence. This technique helps in estimation quickly and heartily stage, recurrence and abundance.

Two-phase signal generator.

In two-stage signal generator, the move and in-stage signals are delivered through channel infused signal by stable channel as

$$\begin{bmatrix} A^* \\ B^* \end{bmatrix} = \begin{bmatrix} W_\alpha(s) \\ W_\beta(s) \end{bmatrix} V \tag{1}$$

From the two-stage generator, two signs A^* and B^* are infused having lead and slack period of -90 degree or 90 degree. These two are characterized as move and in-stage signals. These are characterized as the condition (1) which has $\hat{\omega}\,\alpha$, $\hat{\omega}\,\beta$ with j function.

Where "j" is the fanciful piece of complex numbers. Note that $\hat{\omega}\,\alpha$ is the yield of the multirate test holder and is consistent in a holding period. In vector rotator, here the two signals now go through vector rotor where it is forwarded to low-pass filter.

$$\begin{bmatrix} A^*_\gamma \\ B^*_\delta \end{bmatrix} = \mathbf{R}^T(\hat{\theta}_\alpha) \begin{bmatrix} A^*_\alpha \\ B^*_\beta \end{bmatrix} \tag{2}$$

where superscript "T" shows the transpose of a framework. The stage $\hat{\theta}_\alpha$ of the vector rotator $R(\bullet)$ originates from the stage synchronizer, i.e., it is indistinguishable with the last stage gauge $\hat{\theta}_\alpha$. The low-pass channel as given,

$$\begin{bmatrix} A^*_{\gamma\ell} \\ B^*_{\delta\ell} \end{bmatrix} = F\ell(s) \begin{bmatrix} A^*_\gamma \\ B^*_\delta \end{bmatrix} \tag{3}$$

Here $F\ell(s)$ is the low-pass shift which works to channel through the clamors and sullying from the sign. The given sign is used for phase synchronizer. It gives an expected stage which is bolted to the genuine stage and its subsidiary as recurrence gauge. Multirate sample holder is at the point when the last sign is acquired; it is then encouraged back to the two-stage signal generator and reused for autotuning. By this method, stability of phase signal is achieved. When the graph is drawn of the given system, we can see that the stability of the system is not necessarily achieved [1].

2.1 Characteristics

Stability: Due to presence of multirate sampler, this PLL technique filters the signal a number of times, that is why this method has stability of 67% as compared to other methods. **Error**: Error of this method is estimated to be viably zero (around the greatest estimation of the blunder is − 7.5 · 10 − 8 rad/s. **Accuracy**: As the error tends to zero, we get 89% accuracy from this PLL technique. Type of Filter: The filter used in this method is low-pass filter. **Order of the system**: First-order filter is used in this technique (Table 1).

2.2 Synchronous Reference Frame PLL (SRF-PLL)

Synchronous frame PLL (SF-PLL) strategy is to a great extent being utilized in three-stage frameworks. Figure 2 shows the square graph of SRF-PLL, in it the way toward synchronizing the PLL pivoting reference casing to the utility voltage vector is utilized to acquire the necessary quick stage point Θ. The PI controller sets the quadrature or direct hub reference voltage Vq or Vd to zero, which brings about the reference being bolted to the utility voltage vector stage point. Moreover, the plentifulness Vm and voltage recurrence f can be obtained as the results. Under perfect utility conditions or we can say with no consonant twists or unbalance, SF-PLL with a high data transfer capacity can yield a quick and exact identification of the sufficiency and period of the utility voltage vector. Then again, on the off chance that the utility voltage is misshaped with high-request sounds, the SF-PLL can in any case work if its transfer speed is decreased at the expense of the PLL reaction speed decrease so as to reject and counteract the impact of these music on the yield. In any case, on the off chance that there is uneven utility voltage present, at that point the PLL data transfer capacity decrease is not acknowledged in synchronization [3, 4]. Note that, the stage, plentifulness and recurrence esteems which are acquired by SRF-PLL are not singular stage though they are normal qualities, and in the event of single-stage frameworks, SRF-PLL cannot be applied in a direct way. In any case, for single-stage PLLs, it gives a helpful structure till the 90-degree-moved symmetrical part of the single-stage input signal is made which can be seen from (Fig. 3) .

Table 1 Specification of RPLL circuit

Parameter	Type of PLL			
	RPLL	SRF-PLL	APLL	MR PLL
Frequency	50 Hz	50 Hz	50 Hz	50 Hz
Settling time	50 ms	50 ms	50 ms	50 ms
Signal-to-noise ratio	10 dB	10 dB	10 dB	10 dB
System order	1st order	1st order	1st order	1st order

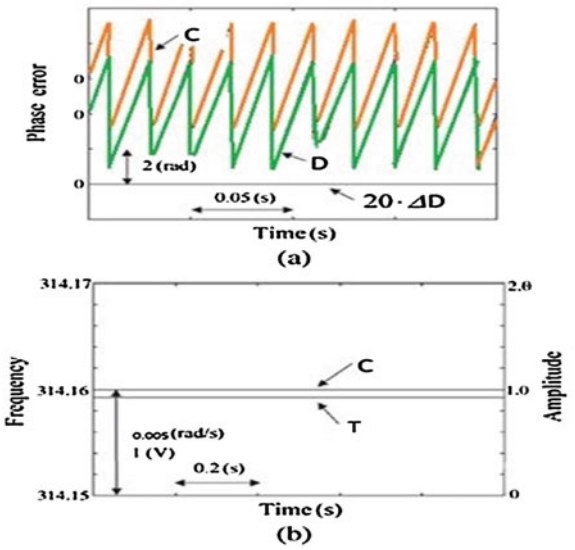

Fig. 2 **a** Actual phase and estimated phases. **b** Estimated amplitude and frequency

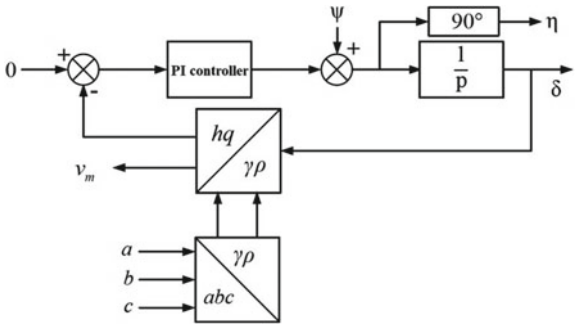

Fig. 3 Block diagram representation of SRF-PLL

SRF-PLL is constantly more straightforward to execute. In the event that DC balances are available in input, at that point the gauge stage and recurrence will have a sinusoidal wave which is at crucial recurrence. Alongside, DC counterbalances will be there in the unit vectors created by the PLL; however, it has not been measured. At the point when DC counterbalances containing unit vectors are utilized as references, there will be unwanted DC infusion to the matrix.

We have signals a, b and c which are changed over into two-stage stationary reference outline signals γ and ρ. This stationary frame transformation to obtain two phase from three-phase (abc- $\gamma\rho$). If there should arise an occurrence of essential SRF-PLL, the pre-channels are not utilized. The square which is the $\gamma\rho$ to hq turning reference outline change obstruct encouraged legitimately by γ and ρ. Response of SRF-PLL to phase and frequency errors is shown in following graph. These graphs

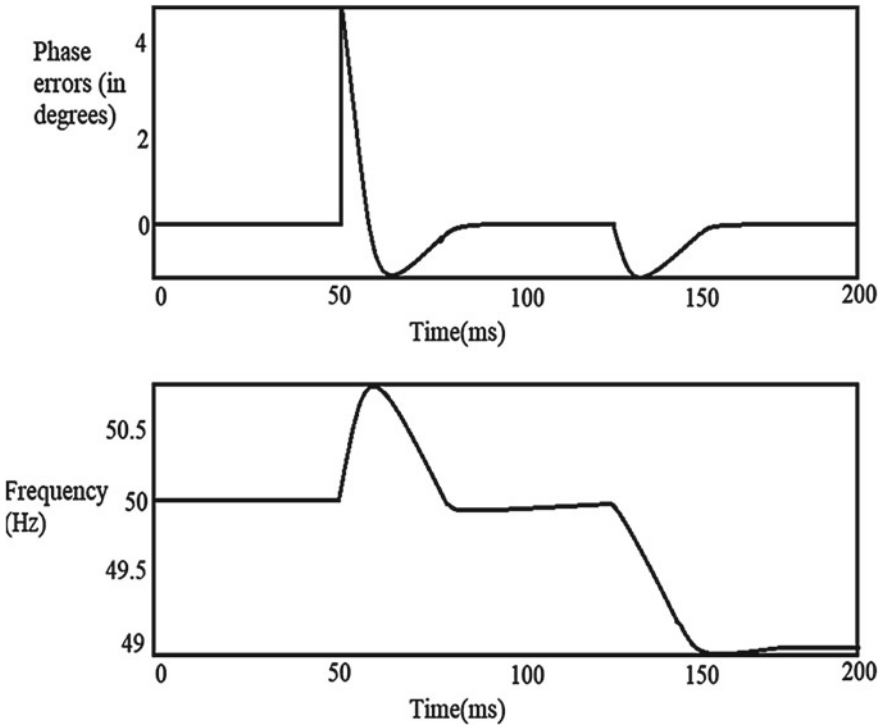

Fig. 4 Response of SRF-PLL to 5° phase jump and—1 Hz frequency jump

show the effect of presence of phase and frequency errors on response of SRF-PLL [5] which can be seen from (Fig. 4).

2.3 Characteristics

Stability: In case of ideal conditions, it gives best stability; but the moment utility vector is distorted with high-order harmonics, it becomes unstable. Error: Chances of error are little higher (approximately as high as 70%); it takes three phases as input. **Accuracy**: Accuracy reduces with increase in distortion which depends upon the reduction in distortion. Type of filter: Filter used in SRF-PLL is first-order high-pass filter. **Order**: The order of this system is first-order system.

3 Analog Phase-Locked Loop (APLL)

APLL is also known as reference signal in which gives signal to lock onto. Then, DC voltage is in manually to set VCO approximately into the right frequency. In their circuit, user which supplied a DC voltage is disconnected, and it is associated with yield of low-pass channel into the voltage-controlled oscillator. Analog phase-locked loop (APLL) worked approximately 4 to 10 MHz. In their three-voltage rails: −2.5, 0, +2.5 v. Available outputs are monitored in differential tuning voltage of voltage-controlled oscillator (VCO) and some high- and low-condition differential output of voltage-controlled oscillator (VCO) and single-ended output from difference in two outputs.

In this, the separate packages are from voltage-controlled oscillator (VCO) and Gilbert cell. First, VCO has two input voltages and differential output and second, the Gilbert cell has two inputs and differential output. In this, design and layout has been sent for fabrication through MOSIS program. The characterization will be completed in fall on 2007. There are five major parts of circuits, namely Gilbert cell, off-chip low-pass filter, differential output voltage-controlled oscillator (VCO), manually controlled startup circuit and differential-to-single-ended conversion on output which can be seen from (Fig. 5).

Analog phase locked loop is a wide assortment of high recurrence application, from basic clock tidy up circuits to neighborhood oscillators for superior radio correspondence joins, and ultrafast exchanging recurrence incorporate in vector arrange analyzers. In simple, stage bolted circle is having high recurrence collectors and transmitters. In the info +IN underneath at higher recurrence than the −IN, resultant charge siphon yield is siphoning current high, when simple stage secured circle incorporated low-pass channel, pull tuning voltage of the VCO. In the manner −IN recurrence will high as VCO high, and two PFD info will join or bolt to same recurrence. Then, −IN will high to +IN, and reverse happens. The uproarious phase noise profile of the REFIN is sifted by the low-pass channel. All the in-band commotion

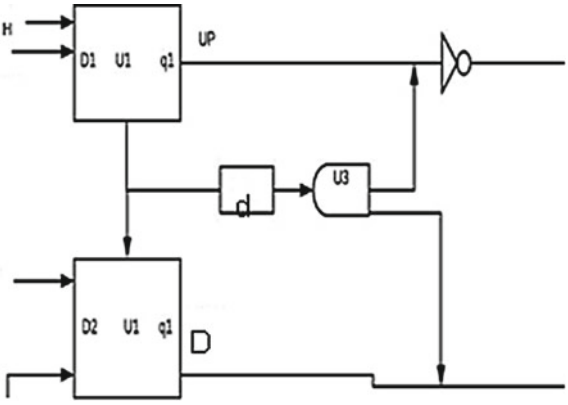

Fig. 5 Structure of analog phase frequency detector 1

contributed by the PLL reference and PFD hardware is sifted through by the low-pass channel, leaving just the much lower VCO clamor outside the circle transfer speed which can be seen from (Fig. 3).

Such an APLL is known as a clock tidy up PLL. For clock tidy up applications, for example, these thin (<1 kHz) low-pass channel data transfer capacities are prescribed [6].

Characteristics: Stability: Due to presence of Miller capacitor and zeroing resistor, the stability is fine not so high. Error: Error of this method is not fixed as it totally depends upon controllable startup scheme and controllable startup reset voltage. **Accuracy**: After the testing done in 2007, accuracy was not achieved as expected so an advanced method is introduced know as all digital phase-locked loop (ADPLL). **Type of Filter**: The filter used in this method is off-chip RC low-pass filter. **Order of the system**: First-order filter is used in this technique.

3.1 Multirate Phase-Locked Loop (MR PLL)

The multirate PLL or MR PLL uses the variable sampling rates. It takes two sample rates so the operation of this PLL also takes place on two-sample process. The one sample is having higher input signal or carrier frequency, and the other sample is having lower input signal. The carrier frequency with low frequency signal can achieve the synchronization first. The higher-order band-pass filter (which reduce defect) and its frequency response mainly classify the disturbance rejection of the sample. The filter which reduces the defect automatically takes the changes that take place in the input signal. Therefore, the sample signal passes through high-pass filter, and the desired sample rate frequency is achieved through this by changing the time processing and taking help of oversampling to input signal.

The multirate PLL or MR PLL uses the variable sampling rates. It takes two sample rates so the operation of this PLL is also take place on two samples process. The one sample is having higher input signal or carrier frequency and the other sample is having lower input signal. The carrier frequency with low frequency signal can achieve the synchronization first [7]. The higher order band pass filter (which reduce defect) and its frequency response mainly classify the disturbance rejection of the sample. The filter which reduces the defect automatically takes the changes that take place in the input signal. Therefore the sample signal is pass through high pass filter and the desired sample rate frequency is achieve through this by changing the time processing and taking help of over sampling to input signal [8] which can be seen from (Fig. 6).

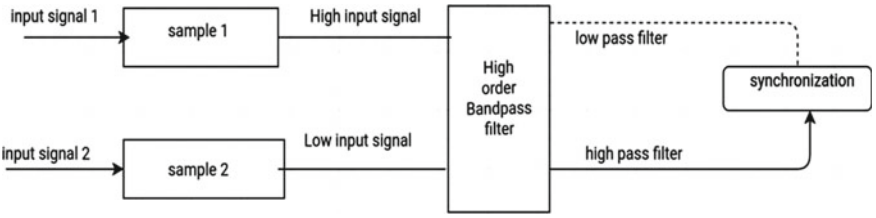

Fig. 6 Synchronization through variable input samples

3.2 Characteristics

Stability: The stability of the multirated phase-locked loop is high as it takes two signals/samples as input. **Error**: The chances of error in MRPLL are less as it takes only two input samples to produce output. The error occurs is fractional phase error. **Accuracy**: As the chances of error are less, the accuracy of MR PLL is good. **Type of Filter**: The filter used in MR PLL is high-order band-pass filter. **Order of the System**: The order of this system is first-order system.

3.3 Comparison

This comparison takes place between the all four PLL techniques which can be explained with the help of Table 2 showing comparison between the stability and type of error occur in PLL. There is also a bar graph in Fig. 7 showing the specification comparison between the all four techniques.

Table 2 Comparison table of all four techniques

Types of PLL	Stability	Error in specified PLL
RPLL	Stability is high with 67% accuracy. Due to presence of multirate sampler, this PLL technique filters the signal a number of times that's why this method has stability of 67% as compared to other methods	Noise in bandwidth error
SRF PLL	Stability is less but high than APLL. In case of ideal conditions, it gives best stability, but the moment utility vector is distorted with high-order harmonics, it becomes unstable	Harmonic error
APLL	Stability is less. Due to presence of Miller capacitor and zeroing resistor, the stability is fine not so high	Transitory error
MR PLL	Stability is better than SRF-PLL & APLL. The stability of the multirated phase-locked loop is high as it takes two signals/samples as input	Fractional phase error

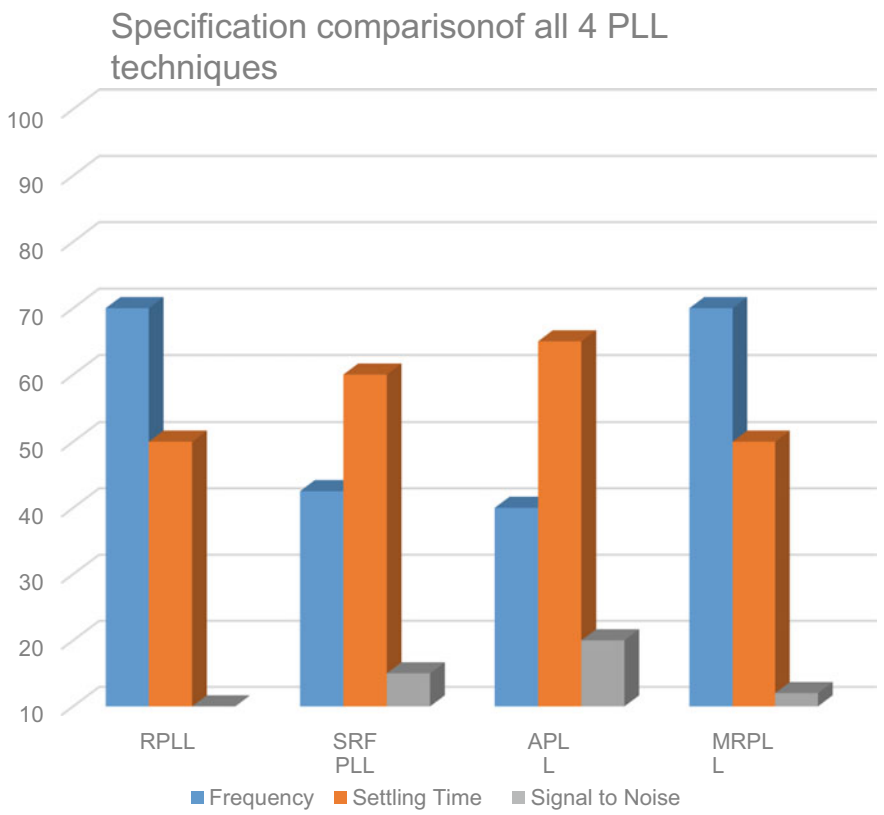

Fig. 7 Specification comparison of all PLL techniques

4 Conclusion

Robust phase-locked loop (RPLL) method proposes the phase frequency and amplitude of frequency varying signals very instantly and robustly. Even in hostile conditions such as variable frequency, phase jump like that this method can approximately estimate the correct data for PLL. SRF-PLL has the simplest structure as compared to all of the techniques discussed in this paper. The only drawback of this method is it assumes the input signal balanced and sinusoidal. There sometimes it suffers an error or has distorted output. These errors can be reduced using a low-pass filter in the loop. The APLL has been considered as operational at 4, 5 and 10 MHz with capability at working at different frequencies at this range. This method has a controlled startup scheme. The design was tested and fabricated in 2007 which resulted in good stability. It is good to make phase-locked loop when there is only two samples to filter. The chances of errors are less; therefore, efficiency is good.

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Identification of Suitable PLL Technique for Grid-Connected PV System

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1 Introduction

In 1919, two scientist, a British W.H. Eccles and an American J.H. Vincent, found that if a couple of oscillators that could be tuned for oscillating partially at different frequencies but if they were coupled with resonant circuits could oscillate at similar frequencies soon [1–3]. After this, the PLL techniques were used in various other fields for the purposes of synchronizing [4]. Phase lock loops could be used in the demodulating frequencies of the different modulated signals, in the transmitters of the radios, etc.

PLL is a method in which one of the signal tracks the other signal. It also keeps the output of the signal synchronized along with the input signal reference, with the frequency and also in phase. PLL synchronizes the different signals at a time having different frequencies, voltages, current, and phases. PLL is used for synchronizing the control loop and the power grid systems; however, there are lot of problems

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regarding the distributed systems that are connected to the grids which unavoidably gives rise to the problems of stability of the system in the power grids [5]. Various PLL techniques have been proposed and are being used due to their robustness and efficiency for the 1-Φ systems, 3-Φ systems, and also in aircraft electrical systems in case there is a need for tracking the currents and voltages [6].

2 All Digital PLL (ADPLL)

ADPLL is basically a negative feedback system of second order. The main function of ADPLL is to observe the frequency as well as phase of reference signal within margin of safety of a likely error that might occur.

ADPLL is widely known for its application in communication systems, control systems, and IOT applications. It comprises of three elements: (i) Phase detector, (ii) loop filter, and (iii) digital control oscillator [7]. By various combinations of these three components, we get to know the locking time, power consumption, and the variation in performance. ADPLL has fast frequency-locking mechanism by using a forward compensation and by refusing frequency divider [8] which can be seen from Fig. 1.

ADPLL is used for the grid-voltage phase detection, which is linked to the inverter. The speed tracking as well as vibration output can be made efficient with the help of forward control loop and variable divider ratio which is present in ADPLL [9]. The ADPLL helps to achieve a low-power operation, low voltage operation, low-power consumption, scalability, and less sensitivity to noise. ADPLL provides high performance, better phase jitter performance, larger lock in range, speed reliability, and decrease in size and cost [10].

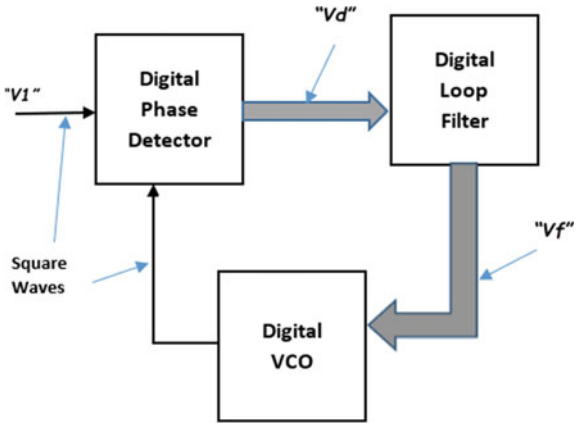

Fig. 1 Block diagram

Table 1 Specification of ADPLL circuit

Frequency	60 Hz
Settling time	75 ms
Signal-to-noise ratio	20 dB
System order	Second order

2.1 Characteristics of ADPLL

Stability: If the poles of the characteristic equation lie within the unit circle, then we can say that ADPLL is stable. Further ADPLL can be made more acceptable in actual time applications for clock recovery, frequency synthesis, and clock de-skewing if jitter and components of noise gets eliminated.

Power Consumption: The power consumption in ADPLL decreases upto 20%. The reason being current-controlled oscillators and voltage-to-current converters are not used. Power consumption also gets reduced with the help of phase frequency detector.

Errors in ADPLL: Basically there are two types of error in ADPLL which are phase error and frequency error. Various components of ADPLL minimize these errors. The frequency and phase error of the ADPLL is reduced by closed loop system when frequency and phase of input signal is unit step.

Jitter Reduction: Jitter is basically defined as the deviation of signal from its ideal position with respect to time. When ADPLL is used in clock recovery circuit, it reduces the jitter in voltage-controlled oscillator. The impact of jitter on clock can be minimized by using bandwidth of narrow loop [10] which can be referred from Table 1.

3 Double Synchronous Frame PLL (DSF-PLL)

The working of DSF-PLL is related with the transformation of positive (+ve) sequence and the negative (−ve) sequence components into the double synchronous reference frame of useful voltage. This helps in eliminating the detective errors of the conventional SF-PLL. By using this technique, for getting the exact positive (+ve) component, there is no need of reducing the PLL bandwidth in comparison with SF-PLL, due to its distinctive decoupling circuit network which cancels out double frequency oscillation [11]. In this technique, in unbalanced utility voltage condition, the control loop bandwidth must be reduced for the conventional system to permit oscillation.

When distortion of utility voltage happens, then there appear a slight oscillations in phase and utility frequency, etc. The important things about this PLL are its ability to adapt the changes when occur in utility frequency. Phase and amplitude of positive (+ve) component of utility voltage can be obtained accurately by DSRF PLL (also in unbalanced condition) [12] which can be seen from Fig. 2.

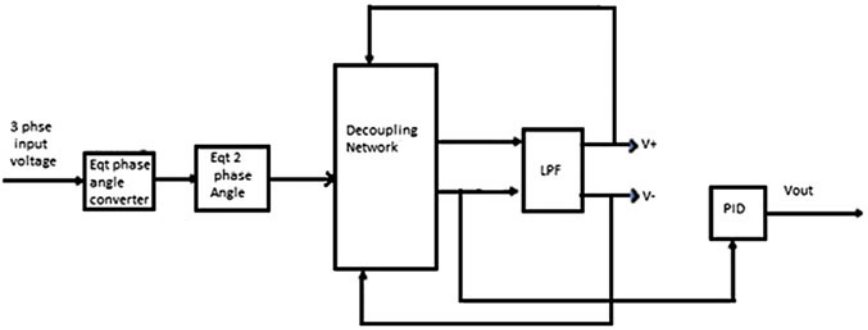

Fig. 2 Block diagram of DSF-PLL

Table 2 Specification of DSF-PLL circuit

Settling time	60 ms
Frequency range	35–50 Hz
Signal-to-noise ratio	15 dB
System order	First order

3.1 Characteristics of DSF-PLL

Stability: Stability period in DSF defined by k which is the rate of cut-off frequency of low-pass filter to the fundamental frequency. When the value of $k = 1/\sqrt{2}$, then it is perfectly stable, because at this value the quick dynamic response occurs and does not cause any oscillation in the amplitude. **Power Consumption**: DSF-PLL technique is the better or advanced than the SF-PLL technique. It is more efficient than the SF-PLL [13]. **Errors**: Some transient errors may occur in the dynamic feedback. When higher value of k will be taken, then the transient error in system feedback would also be greater, because of the quick response. **Jitter Reduction**: The waveform of the positive sequence components in DSF is occurred with a delay less than a utility period which can be referred from Table 2.

4 Enhanced Phase Lock Loop (EPLL)

The problems in the power system distribution are generally due to the occurrence of loads which are nonlinear and have power factor lagging. Hence, the problem needs installation of the various power electronic devices for consumers of the electric powers to maintain the standard of power in the system. The problems related to power quality are in terms of reactive power drawn, distortions present in the waveforms, unbalancing in the systems, fluctuations in the current, and voltages

presenting the power systems. The power devices which are used in the mitigation of the power quality problems in the distributed systems are distribution static compensator (DSTATCOM) which can help like shunt compensator, that reduces the severity of the currents which are related to the problems of power quality [14].

The big challenge has been in maintaining the electric power quality between the limits that are acceptable to grids as well as the standards given by IEEE. Generally, the poor power quality can result in the increase of power losses in the system, unusual and undesirable behavior of the equipment's connected to the system, and the interference with the lines of communication. The usage of the power electronic devices and equipment's has put more burden on the power systems network by creating harmonics in the voltage and in the currents and also the increase in the reactive current in the system [15].

The advantages of this method over other are that it is a type of notch filter which is adaptive in nature and which has its frequencies moving depending on the center frequencies of the grid systems. It avoids the sensitivity of this method in respect to all the changes in frequency that is a big problem in the other methods. EPLL being a filter which is band pass and not the all pass and therefore the positive sequence of the signal which is extracted is highly free from all the errors and the distortion occurring in the system as compared to the other techniques [16].

4.1 Characteristics of EPLL

Stability: EPLL is stable when the poles of the characteristic equation are lying inside the unit circle. If the poles of characteristic are lying on the unity circle,then it is partially stable, and it is unstable when the poles are outside of the unit circle.

Power Consumption: The power consumption reduces upto 10% because of the use of voltage-controlled oscillators which varies the capacitance along with the input voltage as it contains a variable tuning element.

Errors: The error signals gives the total distortion in the input of the voltage signals, and it also gives the harmonic distortion in the voltage. Generally, it contains errors due to distortion in the signal which can be reduced using the band pass filters. Hence, with the help of error signals the harmonic reference voltage can be calculated using the technique.

Jitter Reduction: Jitter is considered as the time variant of clock period. To reduce the jitters, the phase-locked loops are connected in cascaded form where voltage-controlled crystal oscillators are used to eliminate the input jitters [17] which can be seen from Fig. 3 and Table 3.

EPLL provides the estimation of the on line fundamental components present in the input signals along with the variation in the phases of the signal, frequency, as well as amplitude. It also gives the on line estimation of all the components (basic) including the phase, frequency, and amplitude, and it also provides 90° shift phase version of its basic component. These are some of the features which are different in it as compared to the other techniques [18].

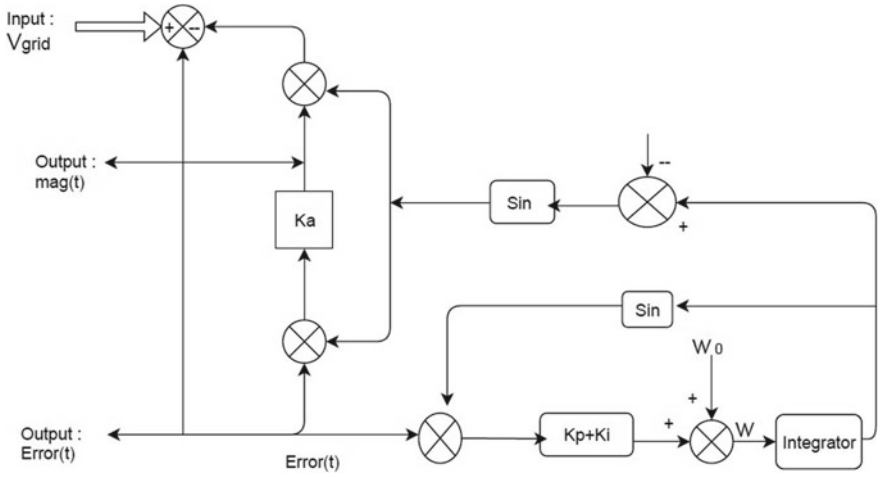

Fig. 3 Block diagram of EPLL

Table 3 Specification of EPLL circuit

Frequency	50 Hz
Settling time	170 ms
Signal-to-noise ratio	10 dB
System order	First and second order

5 Three-Phase Magnitude Phase Lock Loop (3M-PLL)

The 3MPLL is introduced in three-phase power systems which is an advanced form of three-phase PLL. An unbalanced signal can be divided into three symmetrical components. The negative and the zero sequence components add up to the distortion components, so therefore, this distortion component is removed by using 3MPLL technique [19]. The advantage of using 3MPLL is that it provides with the component that is of positive sequence. The mentioned characteristic can be used to get rid of harmonic error. It also enables the system to function as a flexible anti-aliasing filter having no phase shift. The three-phase magnitude PLL flexibly traces and approximates the magnitude of the input signal. It also estimates the frequency and phase angle of input signal. The simplicity & integrity in the 3MPLL system are its advance characteristics that make it suitable in power systems. Frequency flexibility and structural robustness are the most unique features of 3MPLL [20] which makes it higher than conventional BPF which can be seen from Fig. 4.

To have safe and smooth interface and reliable and efficient operation and control, three-phase magnitude PLL needs information about magnitude, phase, and frequency of the grid voltage. Rather than having a three different PLLs, one for each phase, a single three-phase PLL must be used for such application as the three

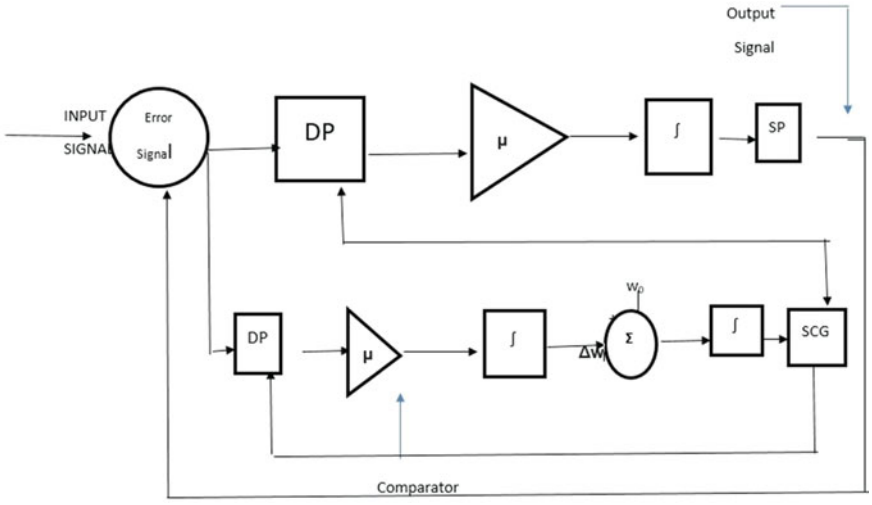

Fig. 4 Block diagram of the proposed 3MPLL

phases of the three-phase system do not operate independently or autonomously. An important application of 3MPLL is that it can be used itself as an anti-aliasing filter.

5.1 Characteristics of 3M-PLL

Stability: If the poles of the characteristic equation lies inside unit circle, then system is stable. We are neglecting the double frequency and nonlinear terms. Thus, 3MPLL is more stable than single-phase PLL. **Error Reduction**: The filtering technique involved in 3MPLL reduces the harmonic error in single-phase PLL. In the presence of filters, the performance of 3MPLL technique is improved. Transient error is generated in the fifth harmonics. This error becomes zero as upper unit of harmonic compensator reaches steady state. **Noise or Jitter Reduction**: By using digital anti-aliasing filters within computer simulations, we can reduce noise in 3MPLL. An important application of 3MPLL is that it can also be used itself as an anti-aliasing filter. Combination of both anti-aliasing filter and the considered system together increases the sound-to-noise ratio up to 7 dB. **Power Consumption**: Power consumption in three-phase magnitude PLL decreases by 10% in single-phase and double-phase PLL. Power consumption reduces due to the band pass filter of second order. Also most of the power systems are available in three phase which makes 3MPLL easy to use [21] which can be referred from Table 4.

Table 4 Specifications of 3MPLL circuit

Settling time	33 ms
Frequency range	40–50 Hz
Signal-to-noise ratio	17–24 dB
System order	First and second order

Table 5 Comparison of all four PLL techniques

Types of PLL	Power consumption	Errors in specified PLL
ADPLL	Decreases upto 20%	(1) Phase error (2) Frequency error
DSF	Better than SF-PLL	Transitory error
EPLL	Decreases upto 10%	Distortion error
3MPLL	Better than single and double phase	Reduces harmonic error

6 Comparison

Let us compare the performances of all four PLL circuits about their power consumption and errors. Table 5 shows its comparison. Let us discuss about it briefly with bar chart presentation. The transitory errors in DSF-PLL occur due to the dynamic response in the system, but it can be reduced by varying the k value. If a low value of k is selected, then the transitory error in the system can also be reduced due to which the DSF-PLL is more efficient as compared to the other PLL techniques and is used in the grid-connected photovoltaic systems in power system networks which can be seen from Fig. 5.

On the basis of the above chart, it can be observed that the frequencies of different PLL techniques does not differ much, but the settling time of the DSF-PLL is the lowest while the SNR ratio of EPLL is the lowest, but its settling time is quite high, so the DSF-PLL is having the best characteristics among the different PLL techniques studied in the paper. Hence, it can be connected in the grid systems for making the power systems more efficient.

7 Conclusion

After comparing the techniques on the basis of various parameters, we can conclude that the DSF-PLL is the most suited for the grid-connected photovoltaic system applications. The transitory error present in it can be minimized using different techniques, so it does not cause too much pollution in the system. Although, the DSF-PLL technique is complex as compared to other techniques due its complex equations and phasors, but still due to its various characteristics, it is preferred over

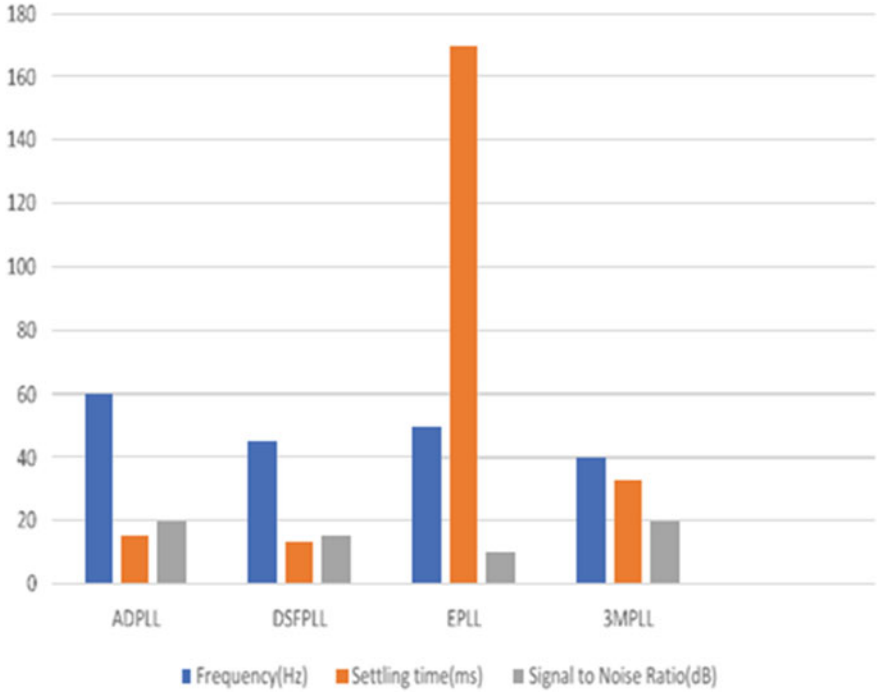

Fig. 5 Specification of PLL Techniques

the various other PLL techniques and is used in the grid-connected photovoltaic system to increase the grid stability of the system.

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Fuzzy Logic-Based Control of Autonomous Underwater Vehicle System Balance Verification Using Simulation

A. Ambikapathy, Antriksh Panwar, Ankur Bharadwaj, Ravendra Singh, Amit Agrawal, and Jay Singh

1 Introduction

Various types of frames of reference can be considered. These can be Serret–Frenet Frame or a simple set of a stagnant and a dynamic frame. According to Frenet, six formulae of space curves were sufficient to solve the problem, but Joseph Alfred Serret in 1851 gave all nine formulae of space curve which together came to be known as Serret–Frenet Frame [1]. The AUV has been an important tool of oceanic study and research. It has helped both scientific exploration as well as increasing military capabilities [2]. The experiments in this paper also revolve around modified fuzzy membership function-based neural networks (FMFNN) which are used to obtain advantages of neural networks as well as fuzzy logic control (FLC) system, which include inference and human operator-based FLC, and learning algorithms, which is done in [3].

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The single-input fuzzy logic controller is also a high order method to reduce the conventional two-input FLC to a single-input single-output (SISO) controller. It helps to decrease the effective errors and help tune system parameters [4]. The idea of FLC implementation has been utilized in Ocean Voyager, which is a project under development. The different parameters are controlled altogether by three separate fuzzy logic controllers, according to set point and its rate of error [5]. A systematic self-adaptive learning algorithm works in a similar manner. It consists of a mapping-constrained agglomerative clustering algorithm for the structure learning and a recursive recurrent learning algorithm for the parameter learning [6]. There has been significant research in the guidance strategies of AUV. Line of Sight guidance principle in two-dimensional path in marine vessels has been studied. The same has been done with disturbances from ocean currents, and nonlinear control strategies have been developed for the same in [7].

Another way is to use adaptive control method. It involves research on neural network control strategy [8]. In a 2D reference trajectory, the planning algorithm uses vehicle dynamics to find the reference orientation and body-fixed velocities. It then makes use of back stepping control to minimize the error, which can successfully be done to become almost zero [8]. In this paper, the response of the fuzzy logic system has been compared with those of PID controller. In a similar approach, proportional plus derivative (PD) control is used for feedback circuit. It includes the use of recurrent neuro-fuzzy system to find the nominal torque of the AUV along a desired trajectory [6]. The basic idea behind the implementation of the control is fuzzy logic which itself can be done in multiple ways. Some of the most effective ones include fuzzy back stepping sliding mode control and fuzzy iterative sliding mode control [9]. One of the most effective methods to realize fuzzy logic is through back stepping sliding mode control. It uses Lyapunov function to design the controller and thereby obtain the speed controller and yaw angle controller that best suits for the stability of the system [10, 11]. Sliding mode fuzzy pitch controller and a sliding mode fuzzy heading controller are used in the field of oceanic research and its development [12].

2 Problem Description

The main focus of the paper is to establish a model based on fuzzy logic that provides near to desired characteristics and parameters of the AUV. For this purpose, the fuzzy logic toolbox is used with different rules of governance. The amount of error in the following the trajectory depends on the type of path as well as the properties of the environment which in this case is assumed through the constant parameters. According to the inertia, size, and other properties of the AUV, the type of path following method could be wisely chosen and implemented to minimize the amount of error or deviation from the path. The AUV operates on six degrees of freedom. All of these are to be controlled by an efficient control strategy. Analysis of the control strategies reveals their robustness and practicability, which can then be implemented in all the control of the six degrees of freedom. The control strategy under observation

will by using fuzzy logic control. Here, only the horizontal movement of the AUV has been considered.

Therefore, it is sufficient to analyze the 'Yaw Control' strategy of the system. Heave, trim, and roll movement of the AUV have been ignored. The following parts of the fuzzy logic toolbox are used with the same values in the implementation: Transfer function: It has been obtained by careful examination and thorough study done the [16] paper. Step input: Since it is one of the most basic type input, and hence, it will help to analyze the system more thoroughly and in a simplified manner.

2.1 Development of Control Strategy

The response of the AUV for the different forms and ranges of the membership functions is analyzed and studied. When a system is to be controlled using any control strategy, then it can be described into by its transfer function. Here, we know [16] that the AUV is a second-order system whose transfer function can be described as (Fig. 1):

$$(35.62\,\mathrm{s} + 84.32)/(s\text{^}2 + 1.027\,\mathrm{s} + 0.5668) \tag{1}$$

This step function when combined with the feedback forms the input to PID function. The same is done for the fuzzy logic controller (FLC) except that the two inputs are formed by passing one of them into an integrator. The integration provides the second input as the impulse response. Hence, the two inputs to the FLC are data and data error become unit step and unit impulse response.

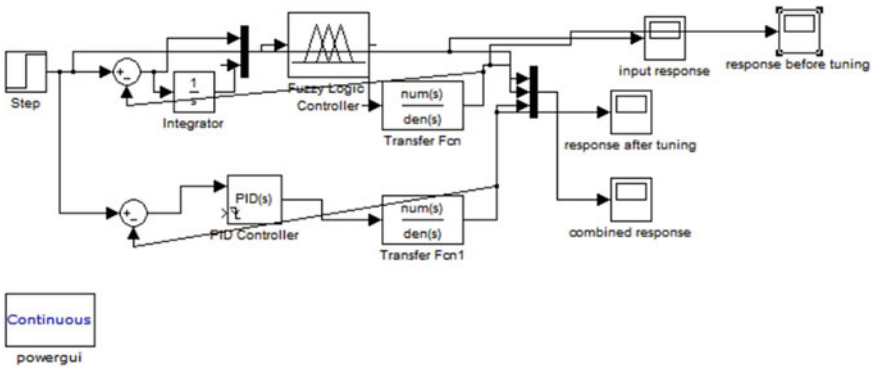

Fig. 1 SIMULINK model of AUV yaw control

2.2 Implementation of Fuzzy Logic Controller of AUV

Inputs: Two inputs are provided, 'data' and 'data error'. Membership functions: five membership functions are provided in each of the two inputs. Range of all membership functions of both inputs and output: −10 to 10 parameters of membership functions they are, NL/NM/Neg. max.(Negative maximum): [−15 −10 −5], NS/Neg. int.(Negative intermediate value): [−10 −5 0], Z/Zero(Zero): [−5 0 5], PS/Posit. int.(Positive intermediate value): [0 5 10] and PL/PM/Posit. int.(Positive Maximum): [5 10 15]. Following rules, as obtained by research by the paper [16], of the fuzzy logic controller are implemented: The membership functions are realized as shown in the figures. The MATLAB software helps to obtain visualize this fuzzy system in graphical form and in the form of rules involved (Table 1; Figs. 2, 3, 4 and 5).

The rules of the control strategy are implemented and are shown in the following figure. Also the three-dimensional surface of the graph of the fuzzy logic toolbox is obtained, as shown in Figs. 6, 7, and 8.

Table 1 Fuzzy logic rules representation

Data: Data error	Posit. max	Posit. int	Zero	Neg. int	Neg. max
Neg. max	Zero	Neg. int	Neg. max	Neg. max	Neg. max
Neg. int	Posit. int	Zero	Neg. int	Neg. max	Neg. max
Zero	Posit. max	Posit. int	Zero	Neg. int	Neg. max
Posit. int	Posit. max	Posit. max	Posit. int	Zero	Neg. int
Posit. max	Posit. max	Posit. max	Posit. max	Posit. int	Zero

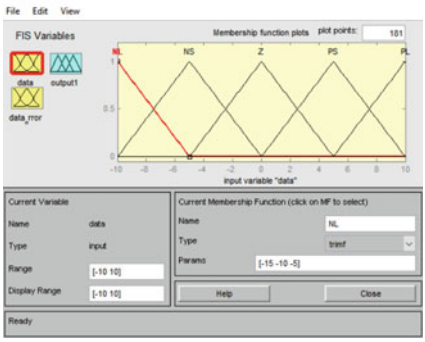

Fig. 2 Membership functions of first input 'data'

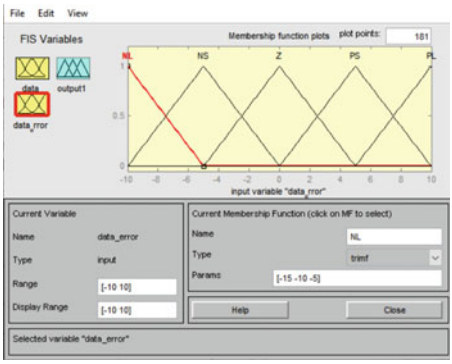

Fig. 3 Membership functions of second input 'data_error'

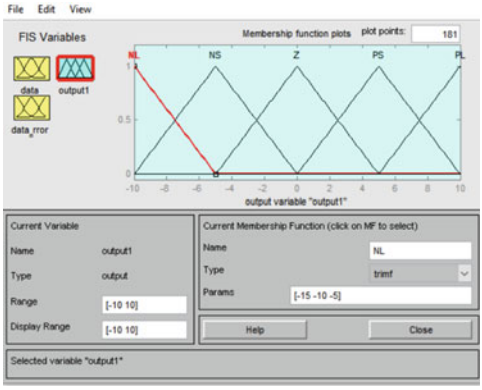

Fig. 4 Membership function of output 'output1'

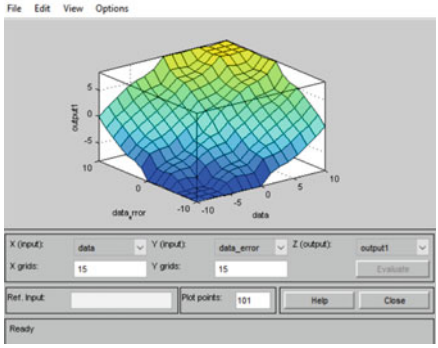

Fig. 5 The surface viewer

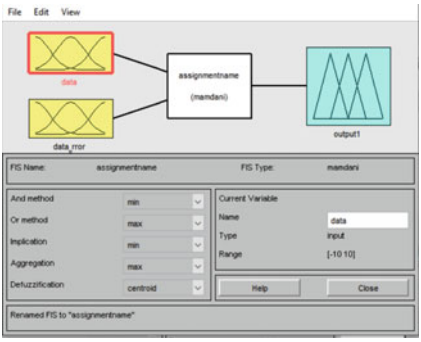

Fig. 6 **FIS** editor

Fig. 7 Rule viewer of fuzzy logic toolbox

2.3 Simulation and Result Analysis

The simulation is done through PID controller only. The response is as shown in the figure. The PID controller is tuned, and the parameters of the graph are obtained as shown in the figure (Figs. 9 and 10).

Then, the model is combined with a fuzzy logic controller toolbox along with required blocks. Then, the results are compared through the graph shown in the figure. The fuzzy logic controller has been linked to the existing file of fuzzy logic system with extension '.fis'. Again the parameters of the PID controller are tuned, and the parameters are obtained.

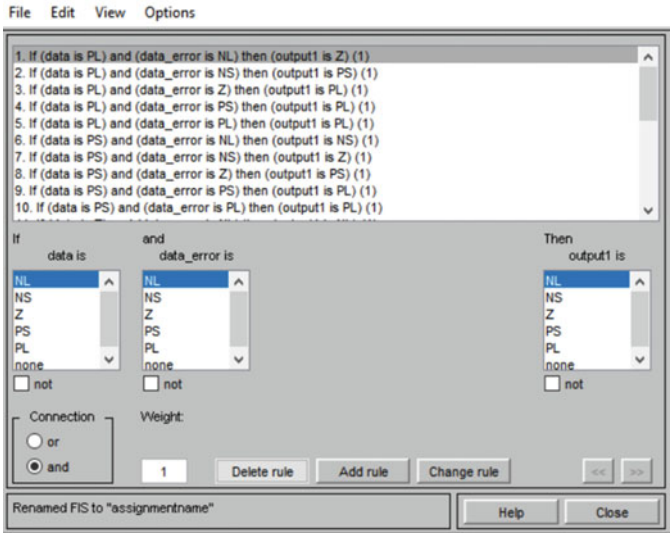

Fig. 8 Rule editor of FIS

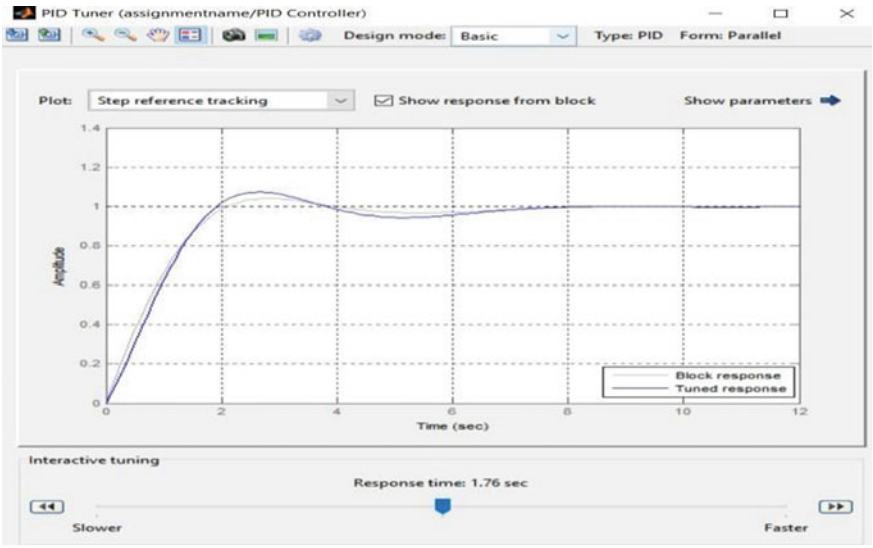

Fig. 9 PID tuner

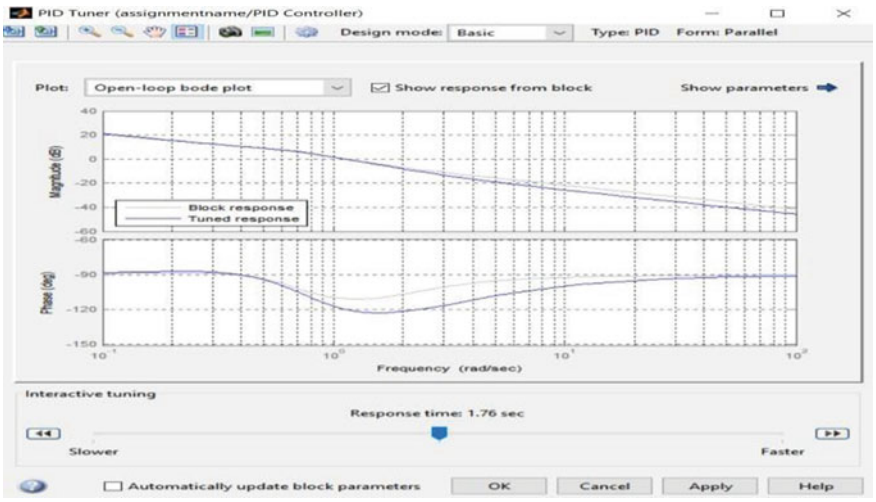

Fig. 10 Bode plot of response

2.4 *Analysis of Fuzzy Logic response with Respect to PID Responses*

In Fig. 11, the yellow line represents the input response which is the ideal case. The blue line represents the PID response which is a damped oscillating wave. It has the

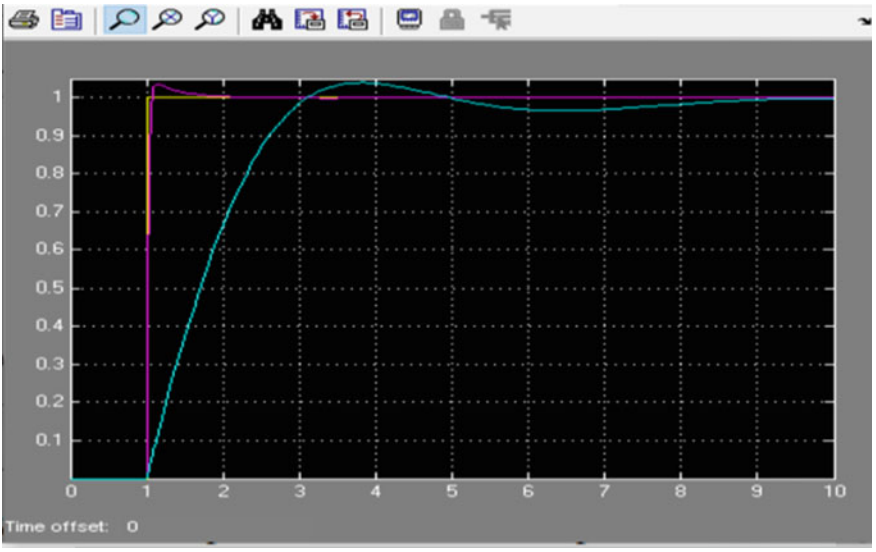

Fig. 11 Response of both fuzzy logic and PID controller

highest settling time as well as highest rise time of the three signals. The purple line shows the response of fuzzy logic controller which is near ideal. It has a low rise and settling time. However, the magnitude of both the two waves is almost the same.

2.5 *Comparison of Fuzzy Logic Response with Modified Fuzzy Logic Controller*

Another file of fuzzy logic toolbox is made. This file is similar to the previous one except the all the membership functions are 'gaussmf' instead of 'trimf'. Then, a new simulink model is built which is similar to the previous model that this model has the fuzzy logic controller linked to the new fuzzy logic toolbox file. The combined results of all the different membership functions and control strategies are compared and shown in Fig. 12. It shows that there is a significant amount of deviation of different types of control strategies (Fig. 13).

The graph in Fig. 12 shows the response of previous and the modified model. The yellow line represents the response when both the fuzzy logic and PID control strategies have been utilized. It is observed that the response is faster when only one of the control strategies is utilized as shown in the figure. Here, the response with highest settling time is when both the two control strategies are utilized, that is, fuzzy logic and PID control.

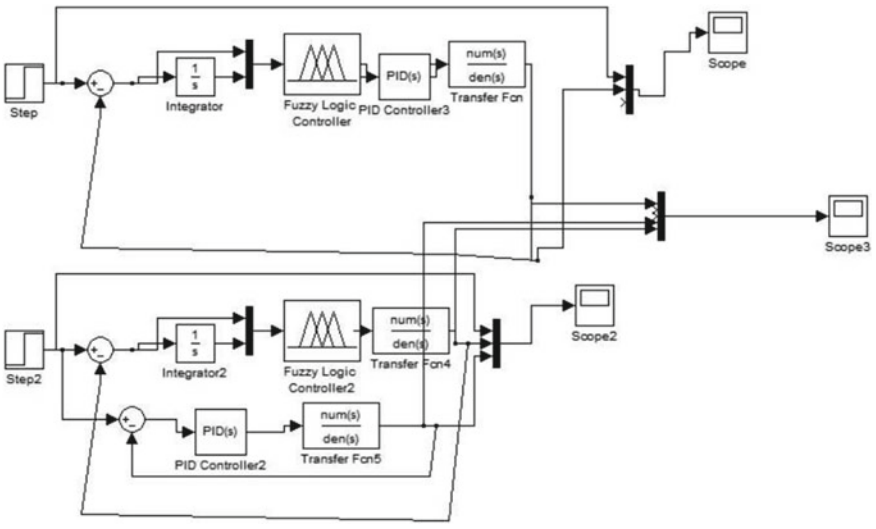

Fig. 12 Modified system model to compare the change in membership function

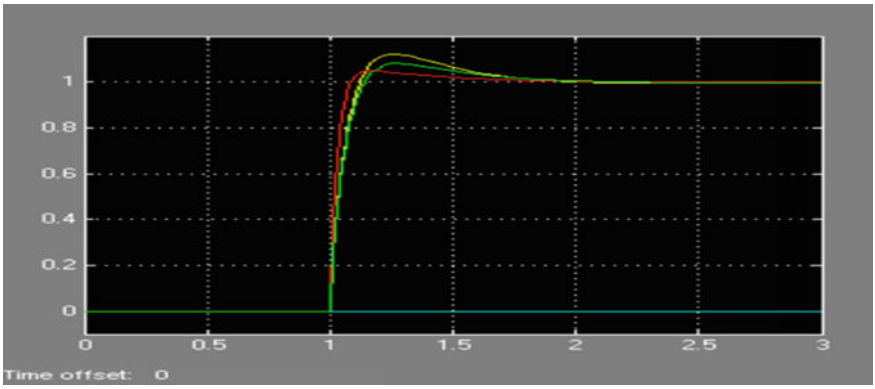

Fig. 13 Comparison of response of original and modified system

2.6 Fuzzy Logic Controller with PID Controller

In this Fig. 4, the first system describes the use of fuzzy logic controller prior to PID controller.

Hence, both the controller is utilized. This has already been described in the previous section. The graph in Fig. 14 shows the combined results of the three systems described above. The green line is the input response which is the ideal response. The red line shows the response when only fuzzy logic controller is utilized. It is the most ideal response with less overshoot and less rise time. Therefore, fuzzy logic controller is best out of all responses. The blue line describes the response of PID controller. It has largest amount of settling time. The purple and the brown colored line is that of the system when both the controllers have been utilized. Hence, use of multiple controllers in the same system leads to high overshoot. Out of all the three responses, the response of fuzzy logic controller when used alone is most ideal (Fig. 15).

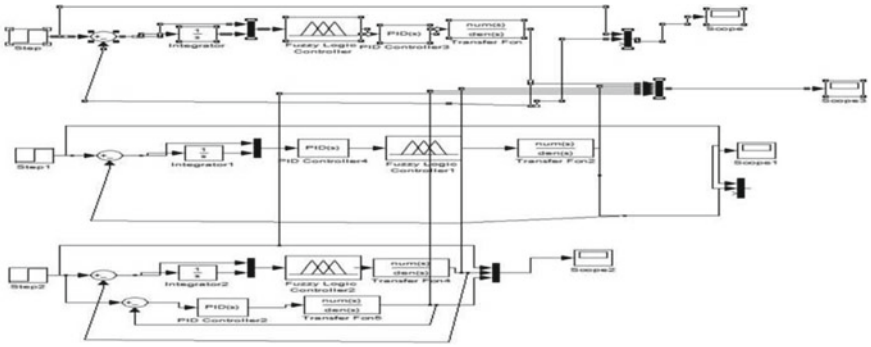

Fig. 14 Implementation of both fuzzy logic and PID controller

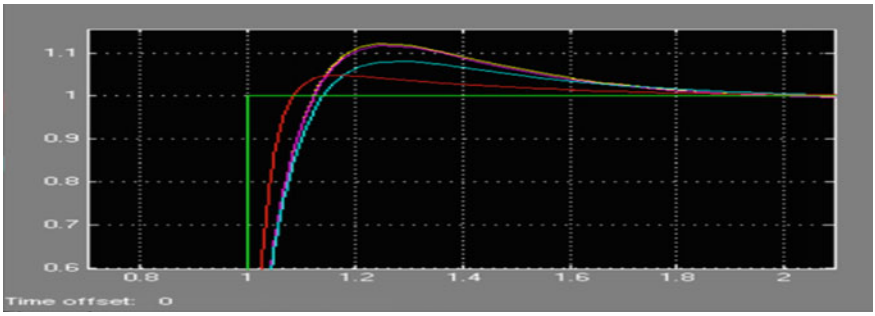

Fig. 15 Response when fuzzy logic and PID controllers are used simultaneously

3 Conclusion

The response of AUV with fuzzy logic control strategy is significantly different from the one using PID control. In PID control, rise time is higher, overshoot is higher, and the response is relatively slow. The 'trimf' type of membership function gives better response than 'gaussmf' type. The fuzzy logic controller when used alone gives better response than PID controller when used alone. The system can further be modified to be controlled by increasing the number of parameters used for the development of the fuzzy logic controller. The movement of the AUV can be considered in all three dimensions.

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Analysis of Object Following Robot Module Using Android, Arduino and Open CV, Raspberry Pi with OpenCV and Color Based Vision Recognition

A. Ambikapathy, Jyotiraditya Sandilya, Ankit Tiwari, Gajendra Singh, and Lochan Varshney

1 Introduction

An object following robot has been contemplated for giving medical assistance to the injured or medically unfit person whenever it is required. An object following robot is a computerized setup that can perceive and chase the signals around the surroundings. The signals specified is a predetermined way that could either seen as a colored (specifically black) line on a clean white surface with highly brightest and contrasting colors. Light sensitive device light-dependent resistor (LDR) is added to the robot which varies resistance with the variable light intensity [1].

The light-dependent resistor LDR when encounters with large amount of light then its resistance value is minimum or low, so we could ideally consider it to be zero and when there is no light falling on the system (LDR) then the value of resistance reaches to maximum value. So ideally it is infinite. One button or lever with Infrared sensor (IR) has been installed alongside the patients bed connected to the robot to establish communication between them.

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When the Patient pulls the lever or push the button then flag bit which is present in the microprocessor, from where the human (or line) tracking robot or person following robot, simply follow the instruction given to it in the form of signal and go through the decided path or line drawn on the surface and it goes to the patients' bed and feeds him the required medical assistance with the help of DC or driver motor. An obstacle detector sensor (ex. Proximity sensor), which have been installed in the robot, so that it can detect and avoid any obstacle or any barrier in the path and would send the signal back to the user [1, 2, 3].

A laser range finders (LRF) robot has been built by the scientists, which one is equipped with only one tracking device. They use a leg detection algorithm to detect a person to be followed. In the robot, leg detection algorithm was used to detect the human to whom it supposed to be followed. The instruction of data is given to robot by LRF, which is processed by the Algorithm in order to find out the humans foot. Algorithm presents diverseness for the relative speed of the aimed human with context to the robot.

The set of instructions will be given or sent to the fuzzy controller, which will put the required speed by the robot to follow the human's leg. Due to difficulty in dealing with mathematical models for complex and humanistic situations, so there we use fuzzy inference. Fuzzy Inference which we are using in our robot is being currently used for one of the developed cars following [2]. Researchers used a combination of a web camera and a laser ranger finder without any obstacles in its (human and robot) path. From the given two methods have tracked down and followed the human in the verandah. So we have concluded that the rate of detecting is distinct between the two methods which are obtained as 74 and 46% for the given both methods [4].

2 Using Android, Arduino and Open CV

This technique aims to enact a robot that can perform two tasks at a time, i.e., detection of the movement in the object and following the object simultaneously. The robots made by this technique is considered as the preliminary or basic step for the advancement in the field of robotic models of automated security systems in homes, buildings, workplace, etc. The robot model will be enacted by the combination of Arduino Uno R3 compatible board connected and Bluetooth connectivity with the help of direct current motor for the robot's motion in a particular and various directions [4] (Fig. 1).

3 Detection

Shah and Ab Rashid [4] in this model, the object is spotted down in the camera interface of the robot and it will calculate the outer lining or peripherical of the human or object by considering color, shape, and size of the object by android application's

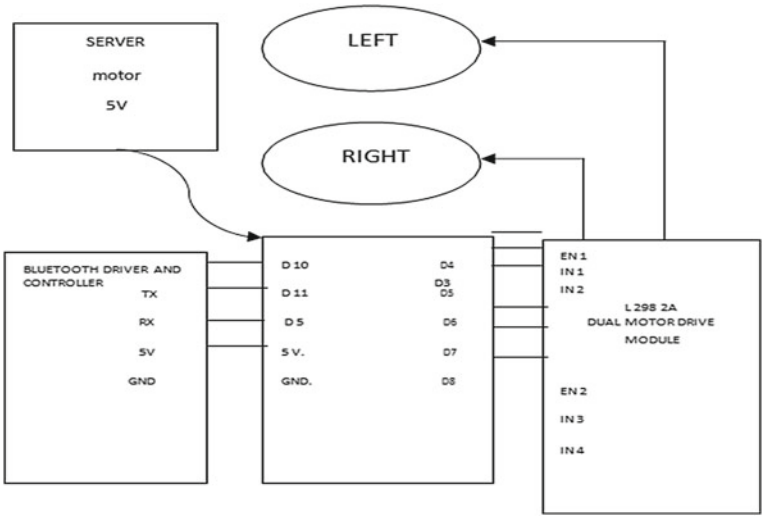


Fig. 1 Electronic circuit setup for the object following robot using Android, Arduino, and Open CV

open CV library [4]. TRACKING [4]: In this model, first the robot calculates the displacement or length between the object and itself. Then it follows an object until it comes very close to it. When it comes very close to the object then it stops there immediately to avoid collision further [4]. OBJECT LOST [4]: In this model, the technique used helps to depict object lost to the robot.

If a targeted object is very quick as compared with the robot and so robot find difficult to track it, or object is lost due to any reason, then the robot stops there immediately and takes a turn of 360 degrees, giving the indication that the object is not being tracked [4]. MULTIPLE OBJECTS ON SCREEN [4]: If there is more than one object showing on the camera screen of the robot, then also the robot will be following the pre-targeted object [4]. USER [4]: The placement of the phone on robot is done by user on top place of robot. When the Bluetooth devices are paired, then the camera interface opens up [4].

4 Advantages of O LRobot Using Android, Arduino and Open CV

It is portable. It is very simple in terms of usage. It can be easily acted for practical application. Security and monitoring at various places like home, buildings, work-places etc. are its area of applications. It is very open-source and flexible, which gives

it the advantage of being adapted to many new and different changes and implementations. In most of the different cases, the robots made for tracking and detection by different techniques are very expensive and are bulky.

But in this technique, the robots made are cheaper and lighter as compared to the traditional robots as this technique involves usage of the common electronic components which are easily and widely available. It covers a very wide field for study and research work. It has its importance in open CV progress area of work and study work on various stages. It has its importance in academic field for students. It helps them to learn about robotics [4].

5 Open CV (Computer Vision) with Raspberry Pi

Spotting and tracking the object in real-time forms a major field in CV technology. For spotting object, we first have to take down decisive and important steps to collect the instruction which forms CV applications. The idea is being used for many applications like, monitoring of military base, traffic control, surveillance purpose and interaction between humans and machines. Using this technique, the robots can rotate in right and left directions and they can move in forward or backward directions depending upon the movement of object. The robots made based on this technique maintain a fixed space or distance between the object and the robot. A raspberry camera is attached to the robots for the detection of the object. For spotting the object, linuxos with python coding with open cv is used [5] (Fig. 2).

Tracking: [5] The camera which is placed on the top of the raspberry pi kit takes the image of the object. The camera is connected through the USP port. Then the captured image is sent for the execution in the linuxos software. The captured image from the camera is sent to raspberry pi kit and for executing in python's coding program. The signals that are generated by the python program and the signals that are generated from the raspberry pi kit is transferred to the robot. And the robot tracks down the object [5].

Background Subtraction: [6] The separation of the two parts of the same image is a very difficult task in object tracking. For the separation of the foreground parts of a

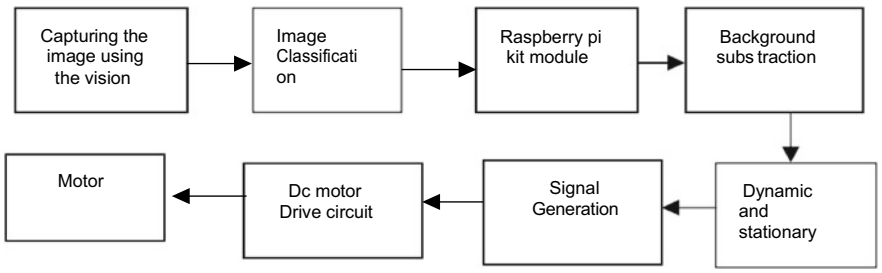


Fig. 2 Block diagram of an object following robot

figure from its frameworks parts, the framework (background) subtraction technique is utilized. Processing of the figure is a concept based on the framework subtraction and CV. In this technique, when there are changes taking place in the foreground, then the foreground is separated from the background. It is a group of techniques that analyze the videos recorded by the stationary camera in real-time. It generates a foreground mask that separates the foreground parts of the image from the background parts. The objects which are dynamically moving with respect to static cameras are detected by this technique.

There are various techniques for framework subtraction. Object in motion is identified in this approach by comparing the differences among the two frames, initial frames with moving frame even which is also known as background model [6, 7].

It's based on static background hypothesis. So, this is also known as frame or background difference model. All techniques of detection are based on the modeling of the image's background, that is, setting of the framework and compare the difference occur. As framework contains shapes, shadows, moving objects, so it becomes very efficient for us to define the background. The stationary objects are assumed to be varying in color and intensity over time while defining the background [7]. Following are the two frames Figs. 3 and 4 showcasing the difference between foreground Image and Background Image.

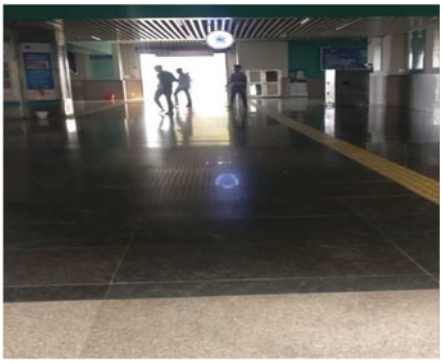


Fig. 3 Foreground image

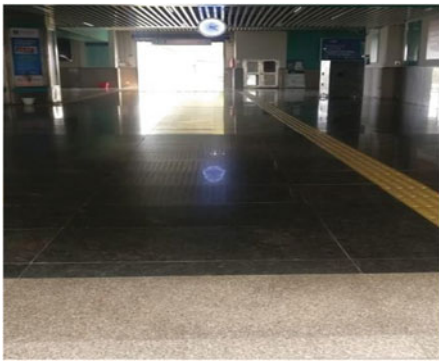


Fig. 4 Background image

Fig. 5 Static picture

Fig. 6 Dynamic picture

Figures 5 and 6 depicts the moving and stationary picture captured of a moving human which is identified by the use of image processing using the camera installed on the top of robot.

6 Shot Boundary Detection

It is also known as shot transition detection. Shot detection or boundary detection is used for the breakdown or the splitting down a film into fundamental units called shots (which is a list of consecutive images that are interrelated, taken by the camera which shows or captures the uninterrupted shots within the space, time). A human can perform all the tasks that a shot boundary detection technique can perform, but this technique saves a lot of the time [8, 3] (Fig. 7).

The shot transition detection techniques can be divided into two types, they are Abrupt Transition Technique, and this is rapid transition from one shot to another

Fig. 7 Shot boundary detection

shot. This means that the one shot is in the first frame and another shot is the second frame. It is also known as the hard cut or only cut gradual transition technique [8]. In the gradual transition technique, with the help of spatial chromatic effects, two different shots are combined in which the one shot is gradually replaced with the other. It is also known as the soft transition can be classified into any types like wipes, dissolves, fades, etc. [8] Detection of a cut suggests that the position of the cut is obtained; so, the hard cut is gained as "between frame i and frame $i + 1$" whereas a soft cut gains as "from frame i to frame j" [8].

7 Motion Segmentation

Motion segmentation is a technique of separating features and trajectories from a video film into the various or many subsets of the time and space. These subsets signify the objects that are moving in the scene. The main purpose of the motion segmentation is to distinguish and extricate the motion from the background and then analyze it [9]. This technique or process labels the pixels with a particular feature or characteristic at a certain time. Here, the segmentation of these pixels are done on the basis of the relative motion over a period of time in the video sequence. The motion segmentation can be broadly divided into various categories depending upon the algorithm used in it: image difference, wavelets, layering, factorization, etc. [9, 10]. According to the area of interest, the segmentation of different parts of the image is done by the image segmentation techniques. Since the videos are the collection of the images, the main purpose of this technique is to decompose the video into object in motion and background by object image segmentation that goes through different motion patterns (Figs. 8 and 9).

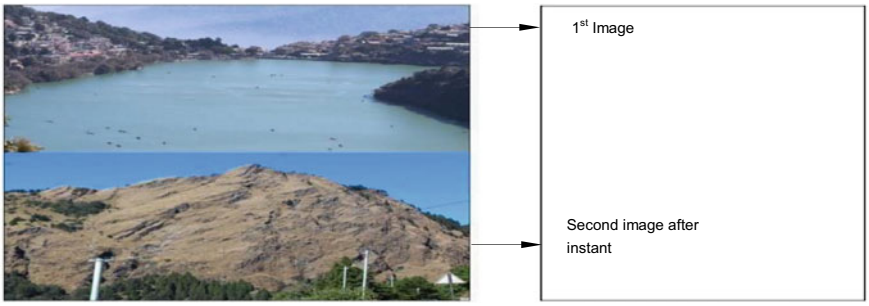


Fig. 8 An abrupt transition

Fig. 9 A gradual transition blending by transparency effect

The study of the spatial and temporal differences coming in the image sequence by the separation of the visual features into various groups from the scenes lets us extract visual information. In the simple definition, image segmentation means the extraction of the objects that are moving from a still or stationary camera. I the camera also move, and then this leads to the introduction of the relative motion of the static background [9]. On the basis of the visual features extracted, image segmentation algorithms can be broadly divided into two types. The first is the direct motion segmentation which uses the pixel intensities from the image. The illumination is assumed to be constant in such algorithms. The second type of image segmentation algorithm computes a list of features that are corresponding to the actual physical points of the objects. These features in image segmentation techniques are used to determine either the two-dimensional motion of the scene or the three-dimensional motion of the scene is there. For a good motion segmentation algorithm, there are a large number of requirements. The images can have missing data and can be affected by the noise, so it is needed to robust [9, 10]. In computer vision, it is the technique of

dividing a digital image into the multifarious fragments (resolution of object). Main purpose of image division is to change the image's enactment into little much easier to analyze. It is used to convert objects and its borderline of the appearance [10].

8 Advantages of OTR (Raspberry Pi with Open Computer Vision)

Multiple objects with different structures, sizes and colors can be spotted using the robots made based on this technique. Avoiding complexity among a large number of electronic components like many infrared rays (IR) sensors and supersonic sensors, it manages them beautifully and its calculates the real-time distance between human (moving object) and robot. The DC motor employed in the robots here can be used for accurate measurements. In this model, wired system can be reduced. Further technological modification can be done by the involvement of remote for the manual inventory operation like television, etc. [5].

9 Using Color-Based Vision Recognition

The researchers have found different methodologies for a robot to follow or track a specific object. One of these methods is object tracking and following robot using color-based vision recognition.

This technique involves the use of color recognition scheme and the movement of the robot depends upon the pixel value (which signifies area) of the specifically identified object. In this technique, the robots will move towards the object if the pixel value is lower than a certain threshold value (which indicates that the object is at a large distance) and the robot will move away from the object if the pixel value is larger than a certain threshold value (which indicates that the object is very close to the robot) and the robot will stay still if the pixel value is within these two values [11] (Figs. 10 and 11).

10 Detection and Tracking

In this technique, the object to be tracked is of the circular shape, having a diameter of 10 cm and red color. Open CV Python on the Raspbian operating system in Raspberry Pi does the processing of all the images. The primary motive of the algorithm is to identify the object and check if the color is matched by the control in the Hue Saturation Value format (Fig. 12).

Fig. 10 Motion segment analysis

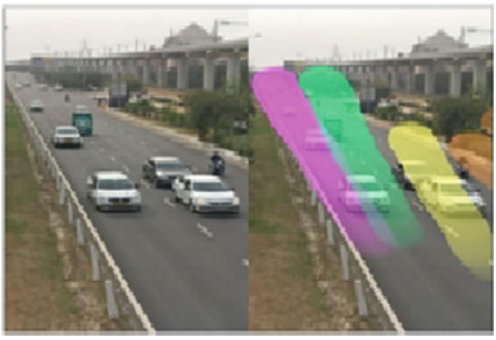
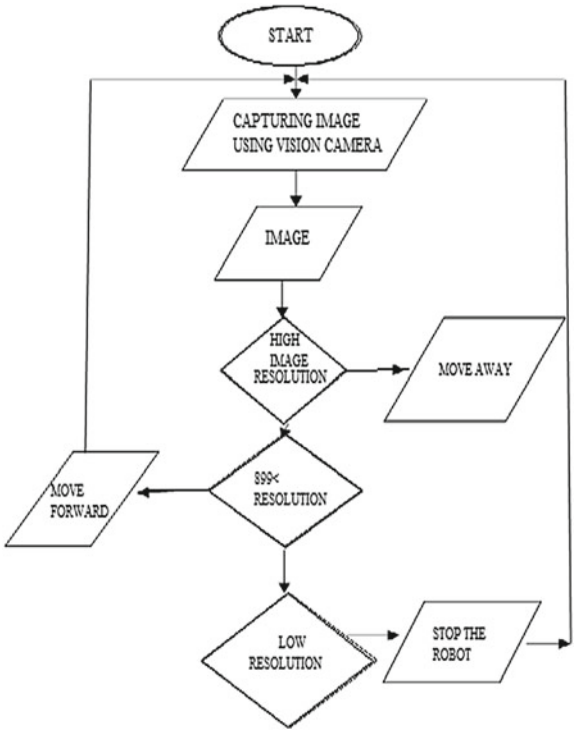


Fig. 11 Motion segmentation using mixture of dynamic textures

Fig. 12 Motion segmentation using mixture of dynamic textures

Fig. 13 Flow chart



This is executed by obtaining the image through the vision sensor, then obtaining the processed image from HSV, then generating the image's binary and filtering it out to differentiate between the image and its background the erosion technique. The HSV value for red color detection is given below in Fig. 14 and algorithm for each detection and tracking is shown in Fig. 13 [4].

As shown in the figure, there are four images for each object. They are the captured an image, HSV image, binary image, and filtered binary image [4]. From which the observation, the filtered binary image of the red shirt has an irregular shape due to which it becomes difficult to determine what the real detected object is. The lighting affecting the folded area or the angle of the shirt is considered as the main cause for this. If the shirt is worn by a user, then it will give a different effect because the lighting will change on the shirt. But, the results are viewable images that are steady and maintain the structure of the circle. This structure appears similar to that of the structure of the actual object [4]. The speed of the robot is slightly slower than the speed of the object. This is because the object is followed (by the robot steadily and sometimes it has to reverse its direction and has to stop to maintain a fixed distance. To track the object consistently, the robot's speed is slightly varied [4] (Fig. 14).

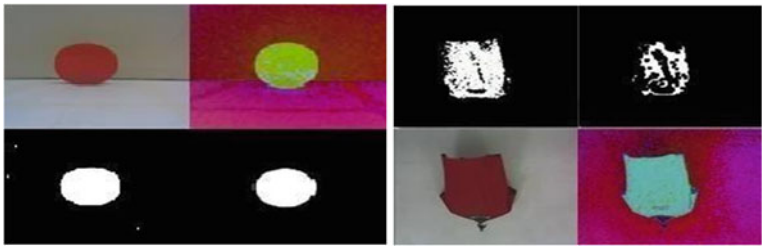


Fig. 14 Acquired and processed images of the red ball and red shirt

11 Conclusion

There are many techniques or ways to make the object following robots. Among many techniques, the three techniques, that are, using Android-Arduino and Open Computer Vision, Raspberry PI with Open Computer Vision and using Color-based vision recognition are discussed in this paper. These techniques by which the object following robots is made are discussed. All methods have their own advantages and disadvantages. Using Android-Arduino and Open Computer Vision technique aims to enact a robot which can perform two tasks at a time, i.e. detection of the movement in the object and following the object simultaneously. Raspberry PI with Open CV, the robots made maintains a fixed space from object and the robot. Using this technique, the robots can rotate in right and left directions and they can move in forward or backward directions. Using Color-based vision recognition technique involves the use of colour recognition scheme and the movement of the robot depends upon the image resolution (which signifies size) of the specific human.

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Arduino Based Accident Prevention Technique Using Eye Blink Sensor

A. Ambikapathy, Ayush Kumar, Jaspal Verma, Gajendra Singh, and Reena Sharma

1 Introduction

There are near about 1,00,000 accidents each year due to driver fatigue or drowsiness, which is a data survey done by National Highway Traffic Administration; which also tells us the number of injured people(that is near about 71,000); causing a $14.5 billion of economic loss. This data is really shocking, that shows the exact number of accidents due to drowsiness. In India about 260 people die in road accidents everyday [1]. So, in today's era, an increased amount of effort and technologies have been made and many are developing; to minimize the human related accidents (ex-ABS technology, airbags, parking sensors). Many big vehicle companies like Hyundai, Tata, Volvo; being involved in developing new technology that is "Drowsy Driver Detection Technique (DDDT), in order to minimize accidents of driver. But due to certain limitations like (costly hardware and infrared camera etc.) and level of atomicity, these studies were put to a limit. So, in this paper; we are presenting a minimal cost solution of the problem of drowsy detection. In this, basic conceptualization of electronics has been used along with the microcontroller and the infra-red

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emitter and detector for tracking the eyes of driver. The result of heart rate and IR sensor is given to microcontroller, which decides whether to sound buzzer or not; which is connected to this arduino only. There is no obstacle while driving the vehicle by wearing that goggle. This is like a normal goggle only, consisting of only some electronic equipment's [2] (Fig. 1).

Basic Model of the System:

The complete system architecture describes the overall functioning of the model. It generally has four parts: Eye Blink Sensor, LED with buzzer and heart rate sensor with dc voltage supply. Eye Blink sensor (5 V supply, OPAMP, IR emitter and detector) which constantly tracks the driver's eye [4]. The output is given to the microcontroller, which is connected to Buzzer and LED flasher. The final result is shown by LED flasher using a buzzer; which also alarms; if it satisfies according to our set predefined criterion (Fig. 2).

Heart Rate Sensor:

This is a very crucial health indicator, which is directly associated to the human cardiovascular system. Heartbeat sensor is intended to measure heart beat per minute if it (sensor) is placed at the top of the index finger. This sensor can be connected to the arduino board in order to monitor Beats Per Second (BPS) rate of human heart. It works on the principle of light modulation of light by the flow of blood in the fingers at each pulse. Little light beams pass into the blood in the finger that measures the amount of oxygen. So, it works by measurement of difference in soaking of light in deoxygenated or oxygenated blood. There is no pain in this process [5]. So, this sensor will be able to show heart rate along with measurement of oxygen saturation levels.

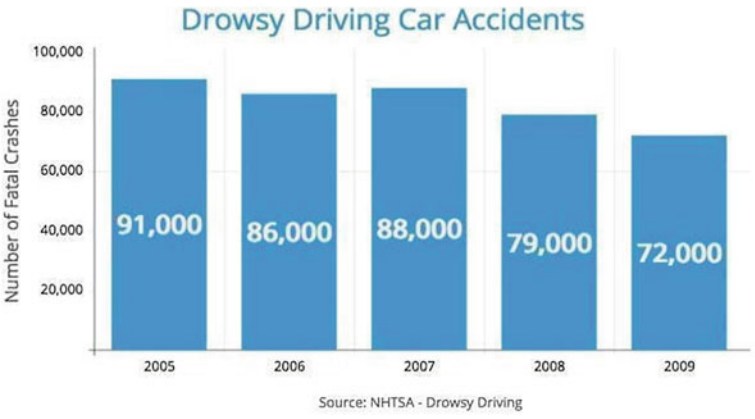

Fig. 1 Statics of drowsy driver car accidents [3]

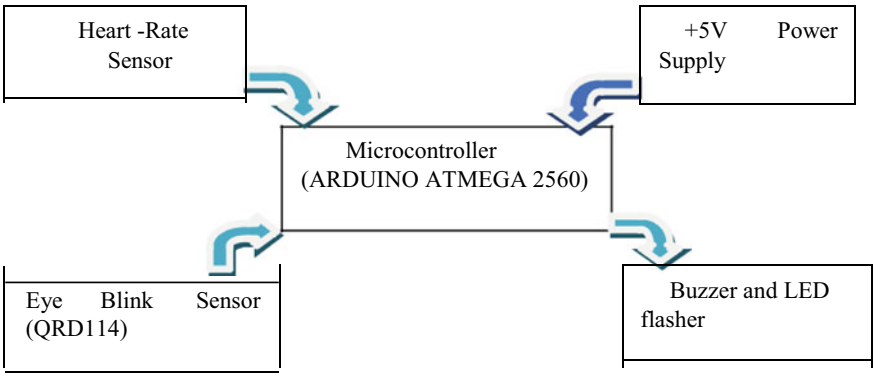

Fig. 2 Block diagram of described model

Working:

Now, when the driver is driving the vehicle, the light is constantly emitted by the IR emitter, that falls on the eyes of driver. And the IR detector detects that light which is reflected from the eye. So, increased amount of light is reflected in case of eyes are in open position; as we all know that our eye's are transparent in open position. So maximum amount of light will be detected by IR detector and its output will be maximum. Hence, logic 0 will be shown at the output of Op-Amp [6, 7].

In case of closed eyes the quantity of light reflected will be in minimal amount, as the skin part of eye is opaque. So minimum amount of light will be detected by the IR detector hence its output will be minimum. So, logic 1 will be shown at the output of Op-Amp. The op-amp output is given to microcontroller and it will wait for 3 s. These two states of output will be provided to the micro-controller to drive the buzzer circuit. Then if it finds that the eyes are still closed, micro-controller sounds the buzzer and will keep alarming the driver till 6 s and if still he is not awake, the process will get again repeated. 20 closures per minute is the normal eye blink rate of a human being. This will have no effect on the working and performance of model (Figs. 3 and 4).

Fig. 3 Visualization of eyes–(When abnormal eye blink rate is observed, the output of the system will change but in normal condition there is no effect on the output of system) [8]

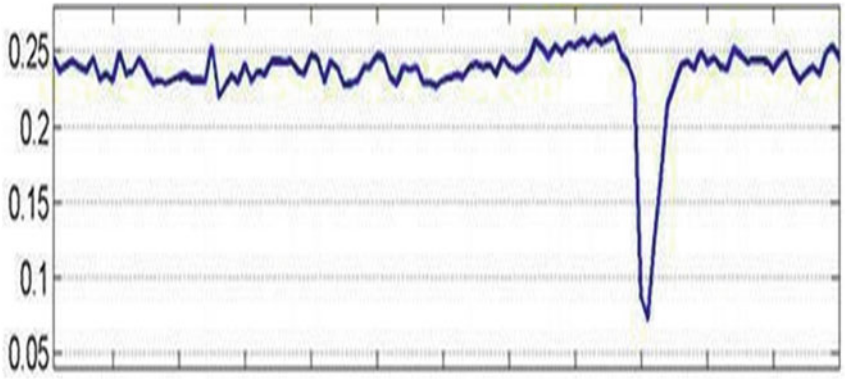

Fig. 4 Eye aspect ratio characteristics over with respect to time, Dip in this ratio indicates a blink [8]

Program for Proposed Idea:

To make this model we need to do the programming as follows, and the timing of sensors and overall output can be controlled as per our needs and specifications (Fig. 5).

```
Int Sensor data = A0;
  Int Buzzer = D6;
  Void Setup ( ) {
          Pin Mode ( Buzzer , OUTPUT );
            }
  Void loop ( ) {

            If ( Sensor data > 523 ) {

                Delay ( 3000 ) ;

            If ( Sensor data > 523 ){
                Delay(3000);
            If (Sensor data>523)
{ digital Write (
   Buzzer,
   High); Delay(
   6000);

}}
    Else {

     Digital Write ( Buzzer , LOW ) ;
}}
```

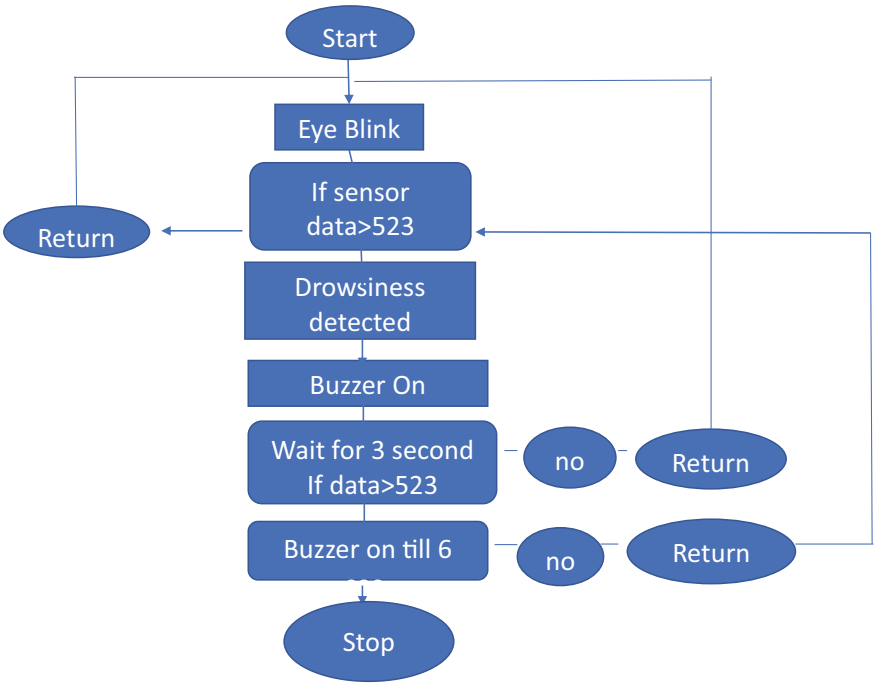

Fig. 5 Flow chart

Arduino Nano:

Arduino could be a epitome platform supported Associate as it is uncomplicated and easy to use as a hardware. A board is there, that can be programmed as per our needs and specifications. It is widely used in robotics and embedded systems, where automation is a crucial part.

This microcontroller that we have used in our model has specifications as follows: Name of microcontroller is ATmega2560P and its operating voltage is 5 V. Its flash memory is of 32 KB of which 2 KB is used by Bootloader. Its static random access memory (SRAM) is of 2 KB byte and its clock speed of crystal oscillator is 16 MHz. 54 digital input—output pins are also there in which 16 are for analog inputs [9]. DC current per I/O pins can maximum work upto 40 mA. One USB connection as well as RST button are also available and safety can be provided from electric shock by connecting a base plate to it.

Circuit Diagram of Model:

So as per our module; we have connected eye blink sensor and buzzer with the A0 (input) and D6 (output) pins respectively. 5 V pin is connected to both pins of +5 V of buzzer and eye blink sensor side. Ground pins (GND) of both the buzzer and eye blink sensor are connected to GND of Arduino (Fig. 6).

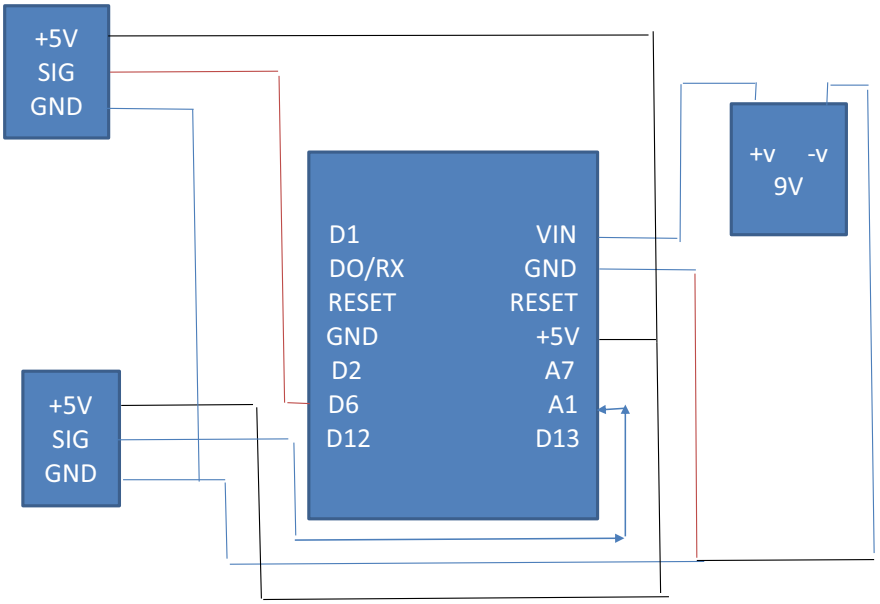

Fig. 6 Connection diagram of model [10]

It uses a 9 V DC supply for its operation. Negative terminal of the battery is connected to all the grounds of the used components, and the positive supply is given to the input of microcontroller. To use the heart rate sensor, connect all its 3 pins to its respective pins with microcontroller i.e. main heart rate sensor with A1 pin of controller and rest GND and +5 V pin with the ground and 5 V pin of microcontroller.

We can use heart rate sensor as a fingertip pulse oximeter device individually and can connect it directly to our microcontroller and then to buzzer. According to our programming of model; if eyes are closed for more than 3 s then the buzzer and LED flasher will flash upto 6 s and if the eyes are still unopened, the program gets back to its original loop and will repeat the same process again. So, after this our model is ready to be get used; as a prevention device for the major road accidents and for safety of the driver.

Conclusion:

So, finally we conclude that the model that we are going to make is cost effective and will definitely save the driver from the major accidents plus its effectiveness is guaranteed by usage of pulse oximeter that provides extra safety by guarding heart pulses by which if the rate of pulse becomes low; then it will also alarm the driver; driving the vehicle. After this our model is ready to be get used; as a prevention device for the major road accidents and for safety of the driver.

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Performance Analysis of Feature Extraction Techniques for Medical Data Classification

Soham Chakraborty and Himansu Das

1 Introduction

In recent days, machine learning algorithms [1–4] has contributed a lot in the medical and healthcare fields [5–9]. To improve the detection, prediction and prevention of disease, these machine learning algorithms [10] like NB [11], KNN [12, 13], and DT [14] should be chosen or implemented in such a way that they meet certain requirements such as higher accuracy, precision, and recall. The most important thing is to build a fine-tuned and a customized model to meet the specific needs so that it can be widely used by the industry and academic researches. To achieve this, an analysis performance using different combinations of FE techniques is done in the pre-processing stage so as to choose the best combination. The FE techniques [5, 6] filter out the insignificant features thus making the data more meaningful and relevant. These algorithms can be applied to several diseases like dermalogical disease, heart disease, tumour malignancy, liver diseases, etc. Analyzing these diseases with different machine learning is a very challenging job as the features are generally quite noisy and inconsistent. These datasets usually contain huge complex patterns within them and large number of features. Thus to reduce the number of features we have dealt with dimensionality reduction which are applied for feature extraction along with the classification [15–18] algorithms (as mentioned before) so as to project the high-dimensional data into lower dimensions. This helps in extracting the valid features which have the maximum contribution to the whole data set and thus reducing data redundancy. Further selecting the most appropriate machine learning model for a dataset can be a very cumbersome task, so in this paper, we have discussed

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the comparative analysis of different algorithms with and without the dimensionality reduction techniques. After splitting the dataset into training and testing datset we have applied all these algorithms and methods to the data. The remainder section of the paper is arranged as follows: Sect. 2 discusses the basic concepts and technology used in this article, Sect. 3 described the proposed model in detail. Sect. 4 states how our model is implemented on various datasets and what are their respective results Sect. 5 discusses the issues that should be addressed, advantages and flaws of various classification algorithms and Sect. 6 concludes the final inference of the paper along with future scope.

2 Basic Technology

In this section, a detailed discussion of the under-laying concepts of the methodologies used has been done. The components which are used in this experiment include Principal Component Analysis, Linear Discriminant Analysis, Independent Component Analysis for feature extraction. Naive Bayes, K-Nearest Neighbour, Decision Tree are used as classification techniques.

2.1 Feature Extraction Techniques

There are few several feature selection techniques such as PCA [19], LDA [20] and ICA [21] are described as below.

(A) **Principal Component Analysis**: It a matrix is calculated which contains the information on how every feature is related to each other. Then the matrix is broken into separate components—direction and magnitude. Then from the direction and magnitude, we can understand how important each direction is. Our original data in the $x - y$ plane. We will be transforming our data to make them align with the important directions (which are created by combining the original variables). The diagram below is the representation of the transformed data so the x and y axis are transformed into the "red direction" and "green direction". Again we find the line of best fit. Our original data is transformed by applying PCA. In this case, there are two dimensions but in real cases, there may be more, so to identify the important features we can compress or project our data into smaller space, we hereby reduce the dimensionality of our feature space but at the same time we are also not loosing much of our information.

(B) **Linear Discriminant Analysis**: It is another technique for dimensionality reduction. It is used to do the projections of higher dimensional data into lower dimensional space without losing much of the important information. Here LDA is used to create new axis and project data on it such that it can maximize the difference of the two categories and minimize the correlation between

them. Hence, it maps n dimensional data to its corresponding k dimensional data, where $k <= n$. Here, n is the dimensions of the data frame and k is the reduced components. The criteria to create new axis by LDA are: (1) Maximize the gap between the mean of two different classes. (2) Minimize the variation of those separate classes. But sometimes when no lines exist that make both the classes linearly separable, then LDA will fail to work.

(C) **Independent Component Analysis**: It is another dimensionality reduction techniques we have used. It is a statistical and computational technique that is used to reveal hidden factors, that signify the source from where it gets generated(or the features with minimum correlation). In this model, we consider an intuition that the data variables are a linear mixture of some unknown latent variables. ICA is related to PCA upto some extent but it is a much more powerful technique. It has the capability to find the underlying factors or sources when the classic methods even fail completely. This is referred to as cocktail party problem or blind source separation.

2.2 Classification Algorithms

There are several classification techniques such as NB, KNN, DT are discussed below.

(A) **Naive-Bayes**: This classification technique is based on Bayes' Theorem with the assumption of independent predictors. In general terms, Naive Bayes classifier assumes that the presence of a particular feature is totally unrelated to the presence of other features. Naive Bayes model is very simple to build and mainly useful for every large data sets. Along with simplicity, Naive Bayes may also prove better than other highly sophisticated classification models. Bayes theorem helps to calculate posterior probability $P(A|B)$ from $P(A)$, $P(B)$ and $P(B|A)$. The equation for Bayes' theorem is shown in Eq. 1.

$$P(A|B) = \frac{P(B|A) \cdot P(A)}{P(B)} \tag{1}$$

In the above diagram, $P(c|x)$ is class posterior probability with the given *predictor* (x, *attributes*). $P(c)$ is the class prior probability. $P(x|c)$ is the predictor given class. $P(x)$ is the predictor's prior probability.

(B) **K-Nearest Neighbour:** It can be used both for regression and classification problems. Basically, it is widely used for classification problems in industrial domains. Let's understand the algorithm with an example. In the following figure, a spread of red and green squares are displayed. The K in this algorithm is the number of nearest neighbour we want to take the vote from. The main thing that should be kept in mind is the choice of the parameter K. Next, the thought we should be concerned about is how to choose the value of the parameter K. In the last training example given that all the training examples are kept constant,

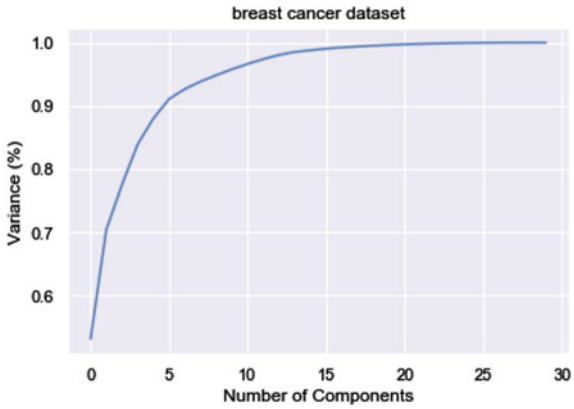

Fig. 1 Plot of variance for different number of components

with a particular K value, we can make separazted boundaries for each class. In the following diagram, the separation of the two classes are presented. On observing carefully one can see that the boundaries become smoother when the value of K is increased. Let's say when the value of K is infinity, it finally becomes all blue or all red depending on the factor of total majority. From the training error rate and the validation error rate, we can determine what to keep as the value of K. In the following plot Fig. 1, the percentage of total variance retained for different K values are shown (taking breast cancer data set as sample).

To get the optimum value of K, we can separate the training and validation data set from the initial data set. Now we can plot the validation error curve for obtaining the optimum value of K. The value of K which we finally obtained can be used for all predictions.

(C) **Decision Tree**: In this model, the regression or classification problem is first represented in a tree structure. It gradually breaks the entire set into different groups and segments and thus continues forming the tree. The tree contains different decision nodes and leaf nodes. A decision node (e.g Weather) may have two or more branches (e.g. Sunny, Overcast and Rainy). Leaf node (e.g. Play) represents a decision or classification. The decision node at the top of the tree corresponds to the best predictor is called the root node. Decision tree has the capability to handle both the numerical and categorical data. The main algorithm behind this model includes a greedy search without using backtracking. The decision tree model assumes all the predictors are somehow dependent on each other.

3 Proposed Model

The detailed steps that have been followed for analysis of disease prediction are being discussed as follows: (1) firstly, the data is collected from different sources, (2) This raw data contained lot of inconsistencies, irrelevant and null values. These irrelevant information is pre-processed and cleaned by null value imputation, Min–Max scaling. On cleaning, the noisy and redundant data are removed. This also handles the missing values by filling it up with the median values of that feature so that the impact of outliers is the least, (3) the redundant data are being removed by feature extraction techniques, henceforth converting the higher dimensional data to lower dimensional data and remove the unnecessary information. The mathematical reason behind this is to reduce the correlation and consider only those vectors that have the least correlation, (4) Then the data is divided into training and testing data set and then it has been normalized by using min–max scaler, so as to scale the range between the maximum and the minimum range of those features and bring it between 0.0 and 1.0. This helps the classification techniques perform better, also it is necessary to be done before applying Principal Component Analysis and other dimensionality reduction techniques, (5) Then we apply the different classification algorithms and find the different test scores such as accuracy score, $f1$-score, recall, and precision. The proposed method is diagrammatically presented in Fig. 2.

4 Implementation and Results

In this section, the performance of the three classifiers such as NB, KNN and DT are shown along with the implementation of different FE techniques such as PCA, LDA and ICA and their combinations. The medical datasets have been collected from UCI Machine Learning Repository [22] and kaggle. The raw data has been pre-processed (for cleaning and transforming the data) in order to make the raw data useful. Here, the missing values are also handled. As there are a variety of parameters for every observations so their range may vary a lot, gradually it may lead to poor evaluation of predictions. To handle this problem, we have used Min–Max scaler to scale the range between 0.0 and 1.0. At the beginning of fitting any model, the whole data set has been divided into training and testing set (75% and 25%) respectively. For evaluation of the final accuracy for any models, we have counted accuracy in 10 different iterations and took their mean value. After applying the classification algorithms, we have calculated the accuracy for each of them. On considering the fact that the data set may contain some features that are dependent on each other, we have used feature extraction techniques to reduce dependencies.

Figure 3 represents the heat-map signifying the correlation among the different features of the “breast cancer” data set. Here ‘zero’ means there is no correlation between those features and any value close to one signifies that there is a decent correlation between those features. From the above plot, we can see as a large part

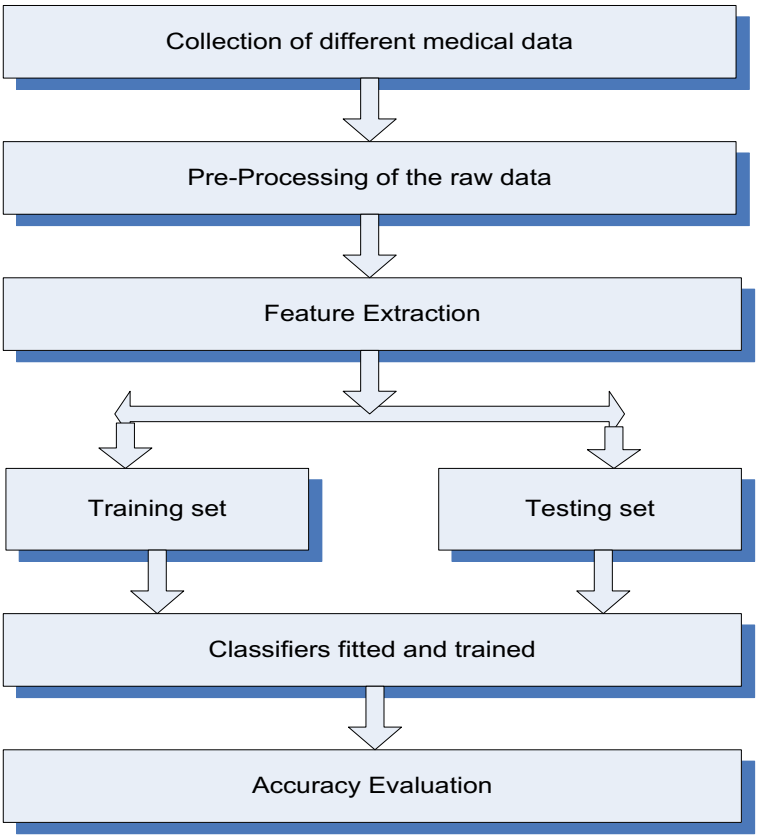

Fig. 2 Work-flow of the proposed model

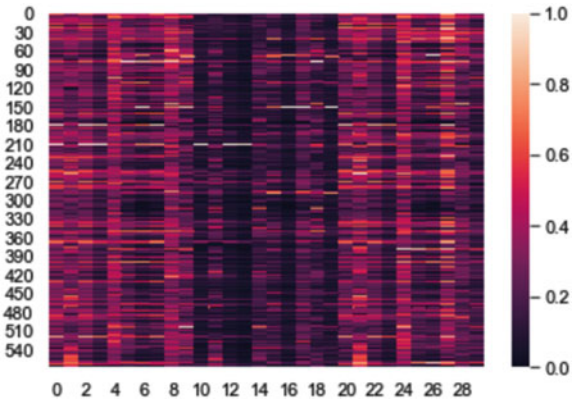

Fig. 3 Heat-map of breast cancer dataset

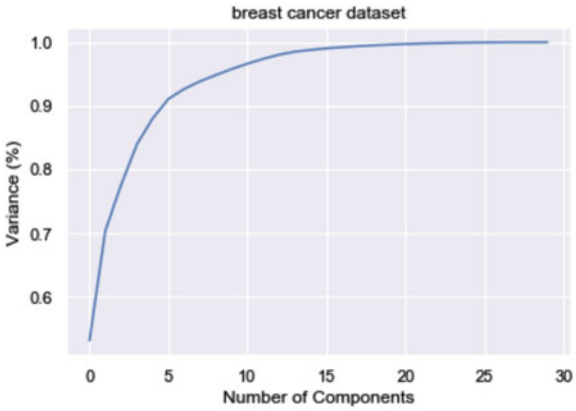

Fig. 4 Total variance retained for different number of components

of the data set is uncorrelated but still few features are correlated so to make the features almost independent and to remove the redundancy among the features we further apply different FE techniques to reduce the correlation among the features and get the components with minimum correlation. The number of components of the transformed data is obtained by plotting variance curve.

Again considering the breast cancer data set, Fig. 4 represents the variance for the respective number of components. Thus from the above curve, we take the optimum point in the "Number of component" axis where the variance reaches above 90% of the total variance. The accuracy obtained after applying each of the techniques is recorded separately to do a comparative study, to see which method gives the best result. The accuracy for different models used on the data sets are shown in the Tables 1, 2, 3 and 4.

The precision, recall and $F1$-score values are also calculated, which are eventually found to be very close to the accuracy of the respective models on the test set. FE techniques such as PCA, LDA, and ICA are used to reduce the insignificant parameters or features.

5 Discussions

In this section, we have discussed various factors and issues which has an impact on the accuracy of the classification algorithms over various data sets and the comparative analysis of the different models. The issues should be kept in mind and addressed while using these classification algorithms. First, after the data is gathered it has to be cleaned so that the outliers present in it may give undesired and unsatisfactory results. After the data is cleaned the data must be scaled so that too much difference in ranges doesn't affect the accuracy as well as the performance of the model and other feature extraction techniques. Without scaling the data we can't use those dimensionality reduction techniques. Next, while applying feature extraction techniques

Table 1 Classification accuracy of NB, KNN, DT, NB-PCA, KNN-PCA, DT-PCA

Datasets	NB		KNN		DT		NB-PCA		KNN-PCA		DT-PCA	
	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test
Mammographic	79.74	84.61	81.51	85.57	93.89	75.96	79.26	82.69	81.36	84.61	93.89	78.36
Heart-statlog	85.64	86.76	84.65	80.88	100	77.94	82.17	83.82	82.17	79.41	100	79.4
Dermatology	87.95	89.13	98.17	97.82	100	97.82	94.52	96.73	95.62	95.65	100	96.73
Hayes_roth	85.85	69.69	58.58	27.27	100	66.66	75.75	63.63	60.6	36.36	100	60.6
Haberman	76.41	71.42	76.85	71.42	98.68	66.23	75.54	70.12	76.41	70.12	98.68	64.93
Liver disorders	56.97	55.17	66.66	73.56	100	66.66	67.44	79.31	72.48	71.26	100	57.47
Ecoli	80.15	76.19	85.71	91.66	100	80.95	87.69	88.09	85.71	91.66	100	80.95
Breast cancer	93.66	95.1	98.12	97.2	100	95.8	94.83	93.7	96.71	97.9	100	94.4
Blood-transfusion	76.29	75.4	81.63	73.79	95	65.24	78.78	75.93	81.22	75.4	95	70.05
Pima Indian diabetes	76.38	73.43	80.2	67.18	100	69.79	74.82	74.47	78.47	71.35	100	67.7
SPECTF Heart data	75.09	71.59	86.2	71.59	100	85.22	75.09	71.59	83.9	72.7	100	92.04

Table 2 Classification accuracy of NB-LDA, KNN-LDA, DT-LDA, NB-ICA, KNN-ICA, DT-ICA

Datasets	NB-LDA		KNN-LDA		DT-LDA		NB-ICA		KNN-ICA		DT-ICA	
	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test
Mammographic	79.9	82.69	82.63	81.25	93.89	74.51	78.95	81.57	79.93	83.38	93.89	76.54
Heart-statlog	84.15	89.7	87.12	79.41	100	72.05	80.69	82.35	81.68	80.88	100	75.32
Dermatology	71.89	71.73	75.91	70.65	100	71.73	86.9	88.04	88.32	85.86	100	85.86
Hayes_roth	77.77	66.66	76.76	69.69	100	69.69	67.67	57.57	53.53	36.36	100	39.73
Haberman	75.98	72.72	80.34	70.12	98.68	68.83	76.41	71.42	77.04	71.42	98.68	62.62
Liver-disorders	67.44	79.31	72.48	71.26	100	57.47	57.36	54.02	68.60	64.36	100	56.19
Ecoli	71.82	66.66	71.82	64.28	100	57.14	77.42	76.19	82.53	80.95	100	71.95
Breast-cancer	97.41	97.9	97.40	98.6	100	97.9	90.6	94.4	94.36	95.8	100	93.7
Blood-transfusion	77.89	75.4	80.57	72.19	95	66.31	77.36	76.47	80.03	76.35	95	68.21
Pima Indian diabetes	77.6	72.39	80.2	70.83	100	61.97	75.55	70.37	78.81	71.87	100	64.52
SPECTF Heart data	84.67	73.86	88.5	72.72	100	88.63	71.98	69.82	84.67	76.13	100	88

Table 3 Classification accuracy of NB-PCA-LDA, KNN-PCA-LDA, DT-PCA-LDA, NB-PCA-ICA, KNN-PCA-ICA

Datasets	NB-PCA-LDA		KNN-PCA-LDA		DT-PCA-LDA		NB-PCA-ICA		KNN-PCA-ICA	
	Train	Test	Train	Test	Train	Test	Train	Test	Train	Test
Mammographic	79.58	84.61	80.88	80.82	93.89	76.44	78.86	81.89	79.29	83.33
Heart-statlog	83.66	88.23	83.66	89.7	100	83.82	80.69	82.51	81.68	80.88
Dermatology	68.61	72.83	71.89	68.47	100	66.3	85.4	85	86.13	83.69
Hayes_roth	71.71	60.6	77.77	66.66	100	63.63	65.09	51.85	54.54	39.39
Haberman	76.85	71.42	77.77	67.53	98.68	64.93	76.41	71.42	75.98	70.12
Liver-disorders	66.27	78.16	70.54	70.11	100	70.11	59.3	53.89	67.44	60.91
Ecoli	72.61	67.85	71.82	67.85	100	55.95	80.29	78.57	82.93	82.14
Breast-cancer	96.47	97.2	97.41	95.8	100	94.4	90.5	94.63	93.89	97.2
Blood-transfusion	79.67	75.93	81.69	72.54	95	68.98	77.36	77	80.03	75.93
Pima Indian diabetes	75	74.47	78.99	67.18	100	66.66	75.19	71.29	78.64	71.35
SPECTF Heart data	78.16	78.4	82.37	79.54	100	84.09	72.41	69.94	85.05	76.13

Table 4 Classification accuracy of DT-PCA-ICA, NB-LDA-ICA, KNN-LDA-ICA, DT-LDA

Datasets	DT-PCA-ICA		NB-LDA-ICA		KNN-LDA-ICA		DT-LDA-ICA	
	Train	Test	Train	Test	Train	Test	Train	Test
Mammographic	93.89	78.09	79.9	82.69	82.54	81.25	93.89	74.52
Heart-statlog	100	74.67	84.15	89.71	87.12	79.41	100	72.05
Dermatology	100	92.51	71.89	71.73	75.91	70.65	100	71.73
Hayes_roth	100	52.86	77.77	66.66	76.76	69.69	100	69.69
Haberman	98.68	64.50	75.98	72.72	80.34	70.12	98.68	68.83
Liver-disorders	100	57.72	67.44	79.31	72.48	71.26	100	57.47
Ecoli	100	75.52	71.82	66.66	71.82	64.28	100	57.14
Breast-cancer	100	94.17	97.41	95.1	98.82	95.8	100	96.5
Blood-transfusion	95	67.49	77.89	75.4	80.57	71.89	95	66.31
Pima Indian diabetes	100	65.16	77.60	72.39	80.20	70.83	100	61.97
SPECTF Heart data	100	88.88	84.67	73.86	88.50	72.72	100	88.63

we should keep in mind the fact that the value of components can't be greater than the original dimension of the data otherwise it will lead to errors. While using the classification techniques there pros and cons should be kept in mind and accordingly they should be used. In the case of NB, the pros are (1) It is a very simple and fast method to predict the class of the test data set. (2) It gives a good performance in multi-class classification. (3) Not much data is needed for this model and also it performs better than any other model when the assumption of independence holds. (4) It gives a better performance for categorical input variables than numerical variables. As for numerical variable, The distribution is assumed to be Gaussian (bell curved, which is a strong assumption). Its various cons include the following: (1) If the categorical variable has such a category in the test data which was not available in the training data set, then the model will assign a 0 value to it as its probability and the prediction will be affected and not be a correct prediction. In reality, it is almost impossible to get a set of totally independent features so here comes the other limitation of the model, where it estimates the predictors to be independent. The pros of KNN are (1) KNN does not learn anything during the training period. (2) Moreover, it does not have any training period, it just stores the data set and learns from that only during making real-time predictions. This property of KNN makes it a much faster algorithm than others which require training. (3) As we know KNN does not require training before predictions, so new data can be added seamlessly which won't impact the accuracy of the algorithm. (4) It is very easy to implement KNN that includes the value of K and the distance function(i. e. Euclidean or Manhattan etc.). The cons of KNN are (1) If the categorical variable has such a category in the test data which was not available in the training data set, then the model will assign a 0 value to it as its probability and the prediction will be affected and not be a correct prediction. (2)When the size of the data set is large enough, then KNN does not work well because with large dimensional data the calculation of the distances becomes very difficult. (3)Whenever we perform KNN, the data on which we perform must be scaled else wrong predictions may get generated. KNN is also very sensitive to noisy data. Next coming to our last algorithm DT, the pros include the following (1) Comparing to other models for classification, decision tree requires less effort as not much of the data processing is required to treat the data with this model. (2) Data need not be normalized or scaled for fitting the data into this model. Unlike other cases missing values in the data set do not affect the prediction. The cons for DT are (1) A small change in the data may cause a great change in the whole structure of the decision tree so the results may vary a lot. (2) For decision trees, sometimes calculations may become very complex compared to other algorithms. (3) Decision tree algorithm is inadequate for regression problems and continuous values. The comparative analysis has been done by calculating the accuracy of each model with different FE techniques and presented in Figs. 5 and 6.

The average accuracy is being plotted in Fig. 7 for different medical data sets and accordingly we find the overall performance for NB-PCA is the best compared to the other combination of techniques used.

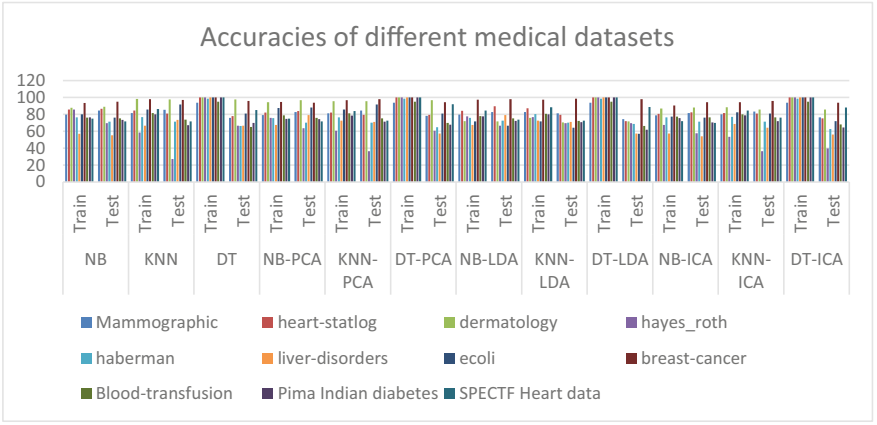

Fig. 5 Accuracy for different medical datasets applying direct FE techniques (PCA, LDA, ICA)

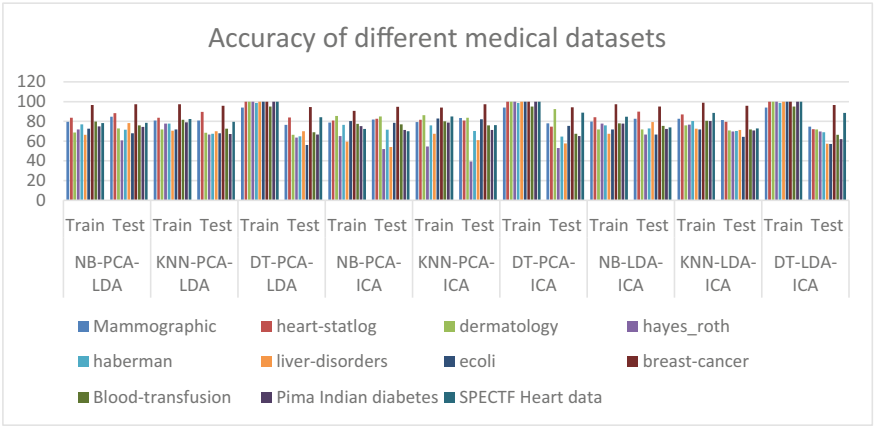

Fig. 6 Accuracy for different medical datasets applying combinations of FE techniques (PCA-LDA, PCA-ICA, LDA-ICA)

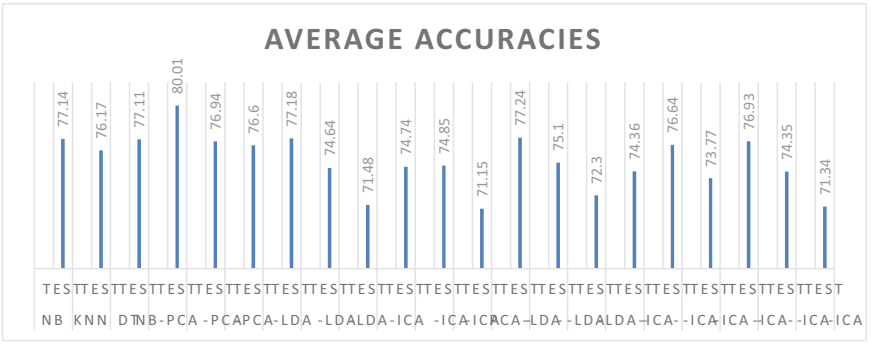

Fig. 7 Average accuracy captured for different models over all the datasets

6 Conclusion

This work basically focuses on analyzing the efficiency of different classification techniques on different data sets and impact of applying different feature extraction techniques along with those classification techniques. After experimenting with all the classification algorithms and dimensionality reduction techniques it has been found that the combination of NB and PCA outperforms than other combinations of models. Hence, we can infer NB-PCA is the best model among all the classification models used. In further studies, if more data can be gathered the classifiers can be trained with higher efficiency as well as more accurate results. In future, more number of classifiers along with FE techniques can be used for the comparative analysis in a broader sense. Then we can conclude with some more accurate combinations of models.

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FPGA-Based Analysis of Electrocardiography (ECG) Using FIR Filters

A. Ajin Roch, Ramakrishna, Varun, Poojitha, and Revanth

1 Introduction

In the recent years, cardio-based diseases including heart problems [1] and strokes are the main cause of death in the world. These can be stopped by means of pre-monitoring and pre-diagnosing. It is very valuable for clinicians to detect the early abnormalities of heart. Studying the electrocardiogram (ECG) signal [2] gives awareness to figure out the cardiac conditions which causes a threat to life. Only a few cardiovascular diseases are abnormal and dangerous, but they need a quick action to prevent further problems. A portable Holter monitor worn by the subject is used to record the subject's ECG information [3]. To store the recordings of the subject's heart rhythm over a period of 24–48 h Holter monitor uses a few electrodes. A cardiologist determines the diagnosis [4] by observing the recordings from Holter monitor. Any automated system which process ECG signals reduces the time in checking the records and helps the cardiologist to find out the respective diagnosis.

The ECG information is recorded and represented in the form of series set of electric waves so that the specific forms and duration which repeats the motion of

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each cardiac cycle with respect to the P and T waves, QRS wave Complex. The activities of cardiac muscle can be represented by these waves, which is used to analyze the nature of illness and cardiac state of the heart. Due to the non-linear ECG signals and huge variations in ECG morphologies of various patients affects, the [5] automatic ECG analysis. The difficulty occurs in automatic recognition of ECG pattern due to background noises, such as electromyogram-induced noise and electrode motion artefact. To design an automated ECG signal analysis system many researches uses a methodology mainly based on digital signal processing (DSP) techniques. Most DSP systems use denoising stages, feature extraction stages, and classification stages which are crucial stages for studying ECG signals. This work discusses the difficulty of analyzing of electrocardiography (ECG) signals.

A new system for analyzing ECG is presented. This system applies least-square linear phase [6] FIR filter (LLFE) methodology. The discrete wavelet transform methodology as the time-domain analysis used by LLFE is unable to decide the location of the frequency components with respect to time. Short-time Fourier transform (STFT) [7] has the drawback of non-optimum time-frequency precision when analyzing ECG signals. Least-square linear phase FIR filter (LLFE) uses least-square FIR filtering as a methodology to erase low-frequency noise which is embedded in the ECG signal.

2 Related Literature

The effective method for extracting ECG signal is QRS method using a Multilevel Algorithm and an Adaptive threshold Technique. As in the [8] three main steps in detecting the QRS region for the proposed model include extracting the highest peaks of the given signal also detecting the required QRS region and Q, R, S waves of the signal used. This methodology not only provides a better signal in the reception also provide the most suitable and reliable data of the modulated signal.

In wavelet coefficients are used to spot the available QRS position from ECG signal that was being used. For the performance acquiescence of QRS detection, an enhanced algorithm is proposed in [9]. The algorithm which was modulated, in this paper, is a three-level one, which includes detecting suspect QRS regions, the removal of wrong detected regions and detecting the true QRS region by extracting the highest peaks. At last, the system with full data was trailed on few MIT-BIH Arrhythmia database signals. This methodology provide the best database signal modelling which shall be implemented by Data Science.

The Xilinx system generator software based on FPGA Distributed arithmetic (DA) architecture [10] implemented in FIR filter. Multipliers with less DA are changed by FIR filter multipliers to erase high-frequency noise from input signal. Digital filters are used to analyze the low-frequency components in ECG which is achieved mainly by digital filters. Pan and Tompkins (PT) and Derivative Based (DB) [11] were the two dissimilar ECG algorithms, which are considered to be most important for detection of QRS complex in cardiovascular diseases. The accuracy and

timing performance is differentiated basically by the terms of QRS detection by implementing System-on-Chip (SoC) establish Embedded system which family is Altera DE2-115 Field Programmable Gate Array (FPGA) platform. Result of [11] shows that while retaining its QRS detection-based algorithm provides 9.5 times faster result than original MWI. Also in [12–14] the usage of wavelet transform is being studied and the implementation using SOC is analyzed.

3 System Design

The existing work uses only FIR, DWT and classifier to detect the abnormal ECG signals and it evaluate only whether it is arrythmia or not. To overcome this Support Vector Machine (SVM) technique has been introduced. It uses MUX technique to detect the type of disease caused to heart. Up to 90% of the compounds are assorted correctly by proposed system.

Figure 1 describes the proposed method for analyzing the ECG signals. To abolish the noise signal present in the input ECG signal, the FIR filtering method has been used. For the input ECG signal DWT acts as a feature extraction method. To classify the input ECG signal a neural network classifier with back propagation is implemented

By using Support Vector Machine (SVM) technique, type of disease present in the ECG signal is identified. They are implemented in the Xilinx system generator (XSG) and coded in Verilog HDL and implemented in Spartan 6 FPGA Board.

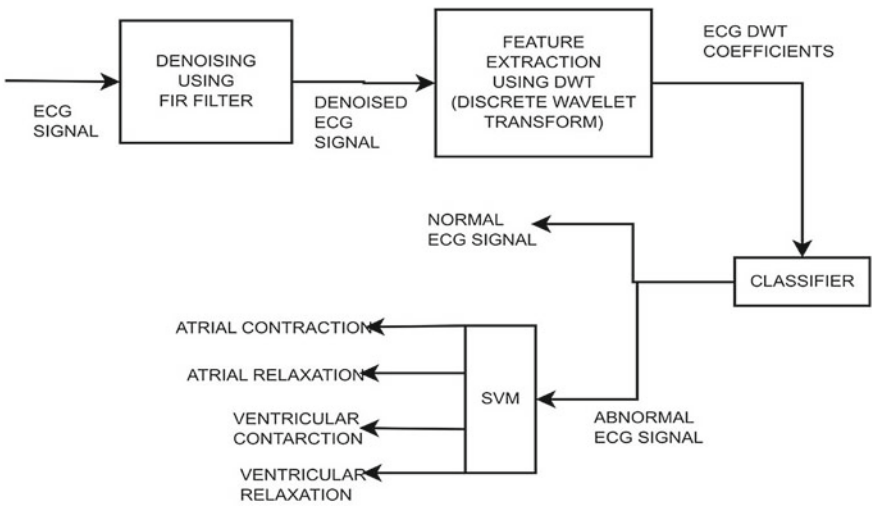

Fig. 1 Proposed system architecture

3.1 Fir Filter

In DSP, FIR is a filter having a finite period in impulse response for the given signal. The Nth order of the discrete-time impulse response of FIR filter that takes $N + 1$ sample accurately and then it resolves to zero as required. FIR filter can determine in various forms like continuous-time signal, analog or digital and discrete-time signal. These filters act as signal conditioners, it allows AC components and block DC components. Normally, filters are made up of adders, multipliers and a continuous series of delays to generate the filtered output required.

3.2 Feature Extraction Method

Discrete wave transform methodology was used for feature extraction method. LPF and HPF are used to filter the signal input. The ECG signals were converted into separate ECG beats. The width of each beat compares with the QRS complex waves in three stages. The 300-sample signal is converted into 38 samples in final stage.

3.3 Neural Network Classifier

The important block in neural network classifiers is adder blocks, activation function block and multiplier blocks. Neural network classifier is implemented using Xilinx System Generator blocks in MATLAB Simulink. The pictorial representation is being shown in Fig. 2. The functionality behavior of the neural network not only provides the required output but also depending upon the Activation function we shall enhance the optimal performance of any design in the Network Classifier.

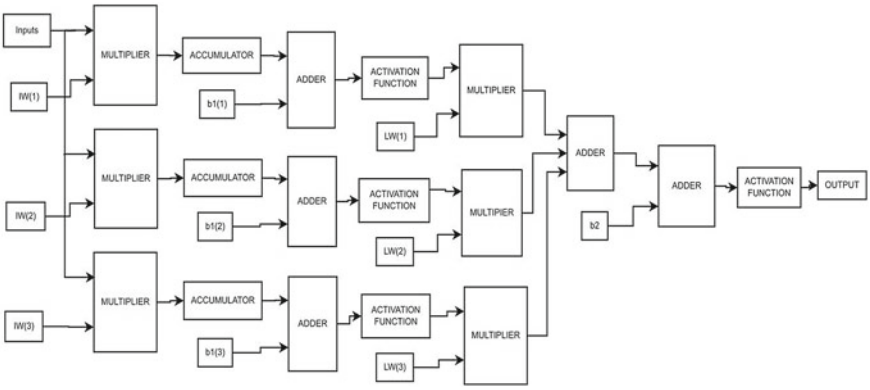

Fig. 2 Block diagram of neural network circuit

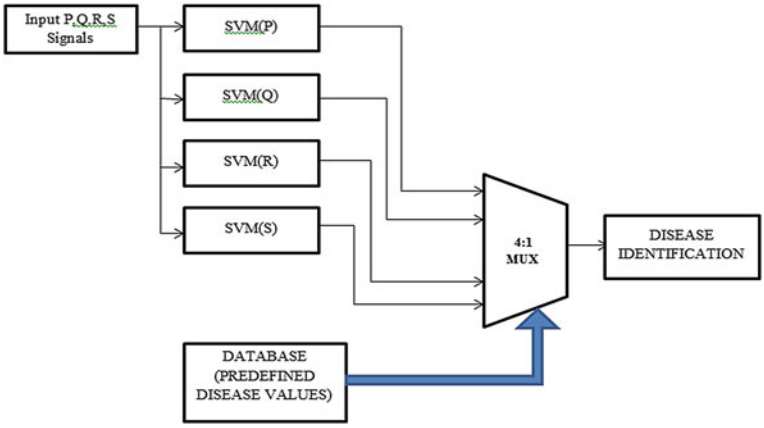

Fig. 3 SVM block diagram

These methodologies shall be even implemented with machine learning Algorithms so that the Data set used for feature Extraction depending on the application will choose the required Classifier from the available one.

3.4 Support Vector Machine

In machine learning, Support-Vector Machines (SVMs) are one of the important tools. It is associated with learning algorithms that are used for sorting and reverting the data to classify the diseases. The SVM algorithm is commonly used in the biological field and other scientific area to classify diseases up to 90% of the elements are correctly classified using Support-Vector Machines. The proposed Support Vector Machine Block Diagram is shown in Fig. 3.

In this proposed work, the predefined values of all *P*, *Q*, *R*, *S* signals in the database are stored in SVM. When signals come in, 4:1 MUX provides output based on the value stored in the predefined database.

4 Results

The performance depends on the simulation results of the system. The MIT-BIH database available is converted into the normal required signal and also with untypical and abnormal signal waveforms. The wave form generated for the given sequence is shown in Fig. 4. The Unusual waveform generated is being captured and its shown in Fig. 5.

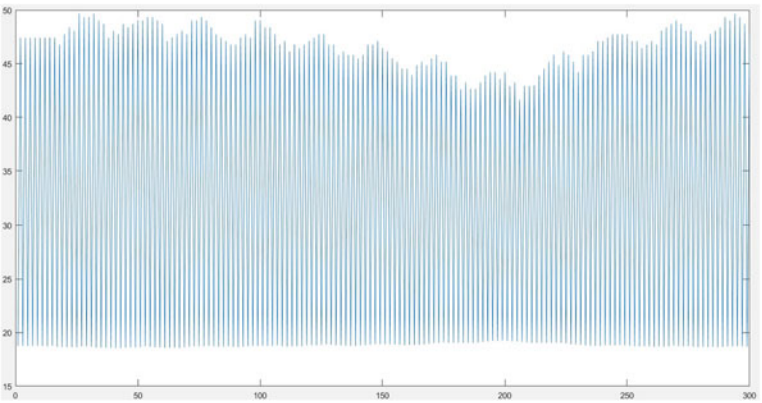

Fig. 4 Normal signal waveform

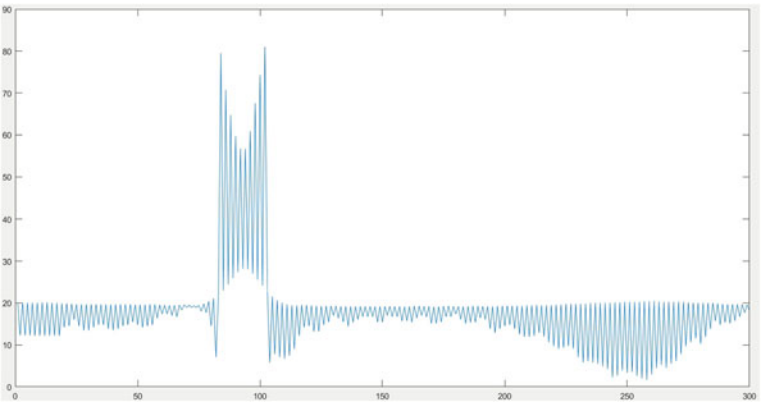

Fig. 5 Abnormal signal waveform

The block implementation is first done up to the classifier like the existing system. After getting the input signal noise is removed from it using the FIR filter. The general Denoising output is being represented and simulated waveform is shown in Fig. 6.

The feature extraction is executed by Discrete Wavelet Transform method. The input signal is filtered by both LPF and HPF. The output of low pass filter is taken as they are low-frequency components. The input signal passes through three levels of filtering technique. The continuous ECG signals are converted into separate ECG beats. The feature extracted by the DWT method is shown in Fig. 7.

The classifier imp in LFEE depends upon feedforward back-propagation neural network, the output from neural network specifies whether the sample signal provided in the input of the system design indicates whether it is normal or abnormal ECG beat. If graph is in positive region indicate abnormal signal and when it is in negative region indicates normal signal.

Fig. 6 Denoising output

Finally, the proposed SVM technique has been implemented in the Simulink and the type of disease is identified. The classified output obtained is shown in Fig. 8. For experimental purpose, four kinds of disease are indicated as *p*, *q*, *r* and *s*.

Figure 9 represents the SVM simulation model that was being obtained from Xilinx Simulink model also Fig. 9b shows the Abnormality in S block in the experiment with four kinds of disease as indicated.

5 Conclusion

For de-noising and extraction of ECG signals, the FIR smoothing filtering technique is used which has an ability to perform better than that of the linear based methodology which is identified as one of the normal techniques used for ECG signals. By modifying the order and averaging horizon of FIR smoothing filter it can be made adaptable to different parts of the ECG signal. The results have shown that features that are extracted using FIR smoothing filters are more consistent in quality and less likely to suffer large deviations from average values. On average, 90% EGC signal shall be perfectly received by the Hardware Device. By developing fast-iterative filtering algorithm and optimizing various kinds and orders of heart diseases by feature extraction of ECG signals in discrete-time state- space can be considered as future work.

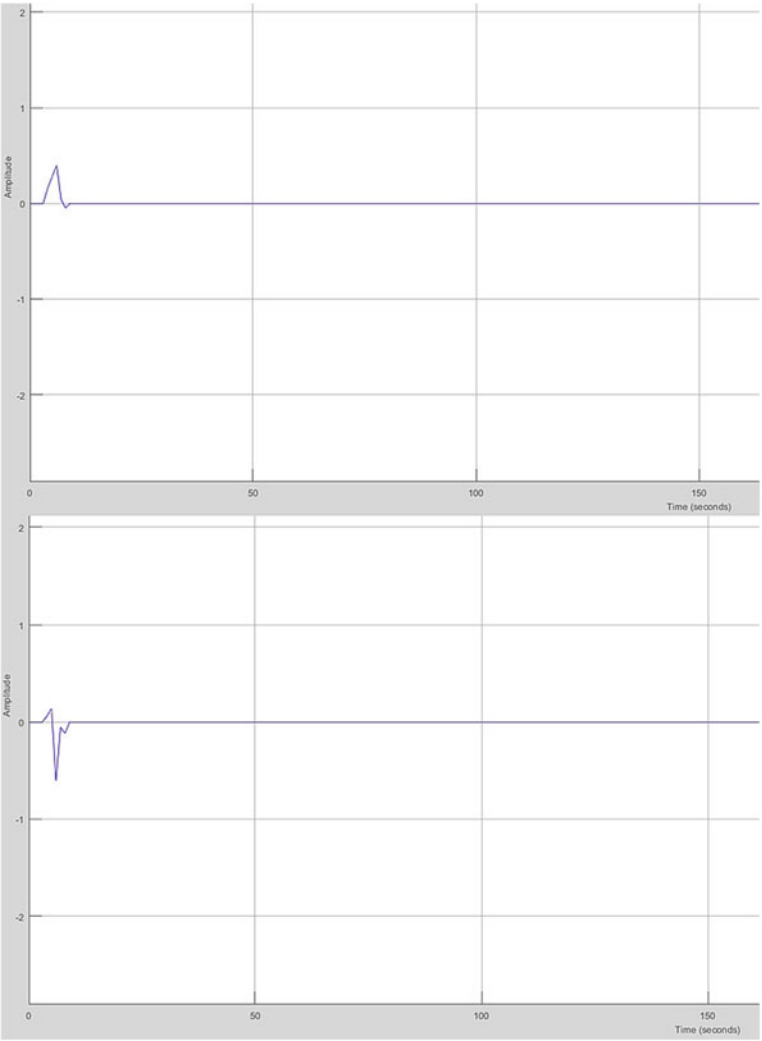

Fig. 7 DWT feature extraction

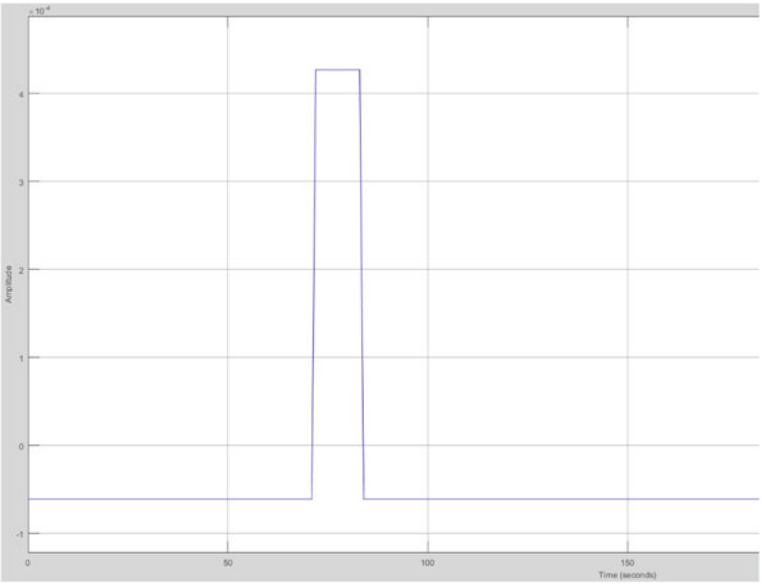

Fig. 8 Classified signal

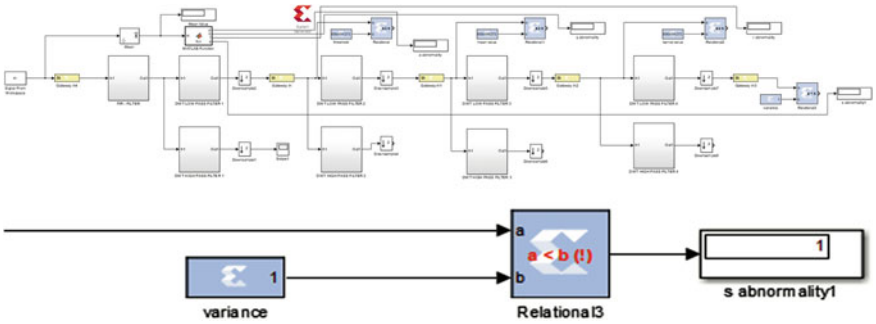

Fig. 9 **a** SVM simulation, **b** abnormality in S block

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Energy Consumption Prediction Using Light Gradient Boosting Machine Model

Shamit Roy Chowdhury, Sushruta Mishra, Annie Olivia Miranda, and Pradeep Kumar Mallick

1 Introduction

The growing concern regarding building an energy-efficient model for commercial and large buildings are at a high stake in this century. Building energy-efficient models can be useful for predicting the carbon emissions and heating issues in existing as well as new buildings which would further help in reducing the generation of these emissions as well as finding out cost optimizing solutions for energy efficiency. The prediction of building energy use is important for many different purposes, including developing baselines, improving diagnostics, optimizing building energy use, improving electric grid management.

Estimation techniques currently do not generally scale well as they assume only a specific meter type or they do not work with different types of buildings. To tackle this we have taken into consideration various types of commercial buildings and different energy meters that are chilled water, electric, natural gas, hot water, and steam meters and the data is taken from over a 1000 buildings within a time frame of three years. The associated data has been taken from The Ashrae's-Great Energy Predictor-III dataset available in kaggle. The model used for prediction is light gradient boost machine as it can deal with categorical variables as well as is well suited for large datasets and it proved to be of great value in accurate prediction of metered building

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energy usage. The prediction performance improved when prediction was made with respect to the buildings first and then aggregated to get the effect of environment on the energy consumption prediction. With better predictions, large scale builders, investors and financial sectors would be able to invest in this field and extract the maximum energy efficiency throughput which would eventually help the occupants as well as the environment.

2 Related Work

Load Forecasting is a huge field. It includes a wide range of techniques. The categorization has been done into three parts: time-series approaches, regression-based, and artificial intelligence methods [1]. One of the most utilized models is the ARIMA model among the classical time-series approaches [2]. Non-linear regression [3] and non-parametric regression [4] methods are the approaches [5] that are used a lot in the short-term and medium-term load forecasting field. Very recently, in [6] in order to predict the day-to-day consumption of electricity of academic and administrative buildings which are located at the London South Bank University campus, linear multiple regression was used by the authors. A lot of machine learning or computational intelligence techniques have been applied in the field of Short Term Load Forecasting. A few recent literature are there in [7] which has been used by the authors to predict the hourly electrical load data of the Polish power system. The recent literature is about random forest and short-term load forecasting. Whereas for predicting the residential energy consumption the similar method is used in [8]. In [9], in the purpose of ensemble probabilistic forecasting three different kinds of methods were proposed by the authors. The ensemble methods have been derived. They have been derived from individually seven machine learning models, which are random forest, among others. In the field of solar power forecasts, it has been tested. In [10] a novel ensemble model has been established by the authors. It is based on the extreme learning of machines and variational mode decomposition. The proposed ensemble model was illustrated from the data's used by the Australian electricity market. In [11], the authors discussed the impact of data replication issues in wireless sensor networks and analyzed the energy retention factors in those networks.

3 Proposed Methodology

3.1 Machine Learning-Model Flowchart

Various information-driven frameworks were developed to help in prediction of energy retention of buildings in towns and cities without relating several existing input metrics. These information-oriented models consider various input metrics in

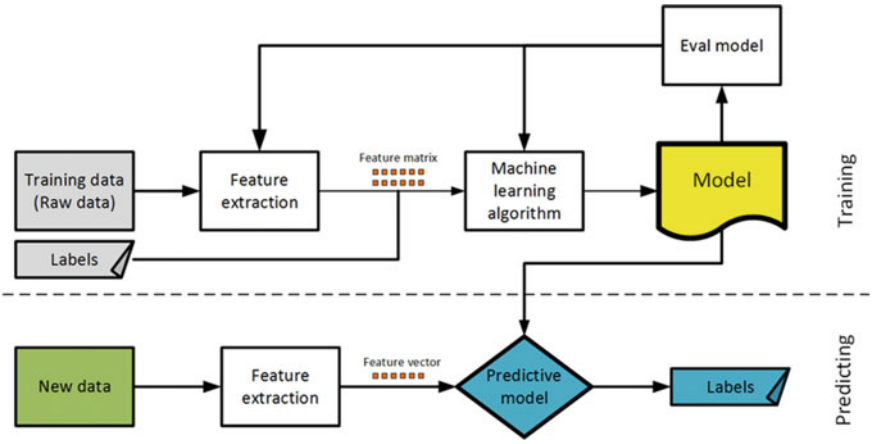

Fig. 1 Machine learning flowchart

relation to past data variables like weather data and electricity consumption data. Data gathering, pre-processing of gathered data, training of dataset and testing of trained data constitutes four major phases in the development of a data-driven framework. Data gathered during energy consumption classification and prediction can be sensor-related data records or any data samples collected from datasets available in public domain. Data pre-processing step involves data cleaning, transformation, data normalization and data interpolation. After dealing with missing and zero values, categorical values and outliers are dealt with. One way to understand the data is by looking for correlations between the features and the target. Scale errors can be avoided by normalizing the values from 0 to 1, for each building and energy aspect. After which model training is performed where the prediction system model is trained with the use of historic data records. Support Vector Machine (SVM), Back propagation algorithm, Gradient Boosting, decision table and mathematical techniques form the general training methodologies. But here LGBM is applied for training the model which is less common yet an efficient model for this purpose. The evaluation of the prediction model using some standard evaluation measures like the coefficient of variation (CV), Mean Bias Error (MBE), Root Mean Squared Error (RMSE) or Root Mean Squared Logarithmic Error (RMSLE), etc. is termed as Model testing (Fig. 1).

3.2 Light—Gradient Boost Machine (LGBM) Model

Tree-based learning algorithms are mainly used by Light GBM which is a gradient boosting framework. In the case of LGBM the growing of trees is vertical while in other algorithms trees are horizontally grown which means that in the case of Light GBM trees are grown leafwise while in case of other algorithms the growing

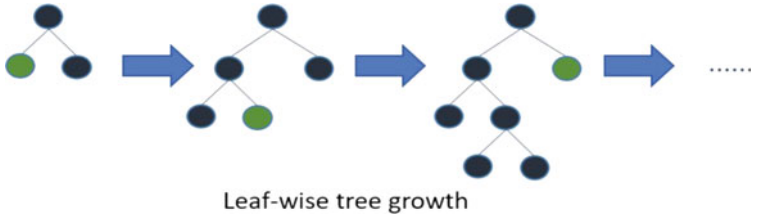

Fig. 2 In LGBM, vertical growth of tree takes place

of tress is level-wise [5]. It will select the leaf with maximum delta loss in order to grow. While growing the same leaf, more amount of loss can be reduced by the leaf-wise algorithm when it is compared to a level-wise algorithm. It is distributed and designed in a way to be efficient with the advantages listed below:

- Efficiency is higher and training speed is faster.
- Memory usage is lowered.
- More accurate.
- Support for GPU and parallel learning.
- Can handle large-scale data (Fig. 2).

4 Energy Consumption Prediction Using LGBM Model

Assessing the value of energy efficiency improvements can be quite challenging as there is no way to truly know how much energy a building would have used without the improvements. The best we can do is to build counter-factual models. Once a building is overhauled the new (lower) energy consumption is compared against modelled values for the original building to calculate the savings from the changes made. More accurate predictions would enable lower cost consumption and support less emission generation.

LGBM was applied to identify the consumption of energy in different buildings using meter readings across four energy types based on earlier usage rates and observed weather conditions [3]. Results gained from these models in two years were tested on one-year data which significantly showed better result of LGBM's to predict monthly utility bills.

The evaluation metric used was Root Mean Squared Logarithmic Error and is calculated as:

$$\in = 1n \sum i = \sqrt{1/n}(\log(pi + 1) - \log(ai + 1))^2,$$

where

ϵ is the RMSLE value (score)

n is the total no. of observations in the (public/private) data set,

pi is our prediction of target, and

ai is the actual target for i

$\log(x)$ is the natural logarithm of x.

Further, K-Fold Cross Validation technique was applied for splitting the data for testing into five folds. In the case of the first round, the initial fold is useful in testing of the framework while the subsequent folds are used in training of the model. In the case of the second iteration, second fold was applied for testing purposes while the rest served as the training data. This procedure was continued until and unless each fold of the five folds have been tested and the validation score improved and RMSE value was observed for each completed iteration (Fig. 3).

5 Results and Assumptions

According to Fig. 4, sum of meter reading of steam is maximum and the sum of meter readings of all other kinds of energy is negligible as compared to steam.

Table 1, the positive values represent how strongly the presence of one variable affects the other variable and the negative value represents how the absence of one variable would impact the other variable positively.

Figure 5 shows that the electricity meter reading was maximum for various count

```
Training until validation scores don't improve for 50 rounds.
[50]    training's rmse: 0.960659       valid_1's rmse: 1.27509
Early stopping, best iteration is:
[25]    training's rmse: 0.995612       valid_1's rmse: 1.27188
Training until validation scores don't improve for 50 rounds.
[50]    training's rmse: 0.934418       valid_1's rmse: 1.28217
Early stopping, best iteration is:
[18]    training's rmse: 0.992527       valid_1's rmse: 1.27317
Training until validation scores don't improve for 50 rounds.
[50]    training's rmse: 0.97053        valid_1's rmse: 1.10209
Early stopping, best iteration is:
[24]    training's rmse: 1.00829        valid_1's rmse: 1.09791
Training until validation scores don't improve for 50 rounds.
[50]    training's rmse: 0.935529       valid_1's rmse: 1.21572
Early stopping, best iteration is:
[18]    training's rmse: 0.995421       valid_1's rmse: 1.20769
Training until validation scores don't improve for 50 rounds.
[50]    training's rmse: 0.914365       valid_1's rmse: 1.46506
Early stopping, best iteration is:
[7]     training's rmse: 1.1067 valid_1's rmse: 1.40409
```

Fig. 3 Improvement in validation score with increase in iteration

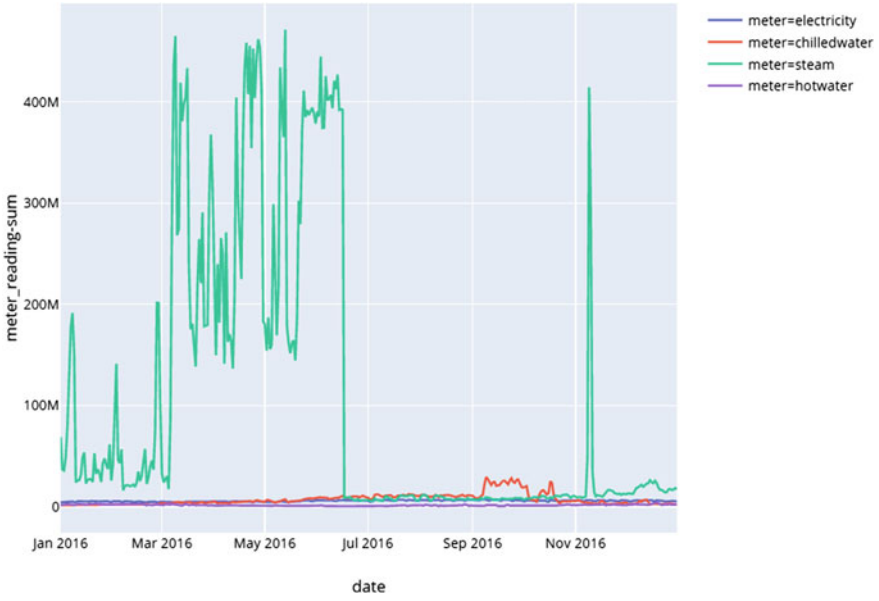

Fig. 4 Total kWh per energy aspect

of measurements which indicates that electricity was mostly consumed in all of the buildings.

In Fig. 6, it was observed that generating steam consumed maximum amount of energy which would drastically affect the cost-effectiveness in a negative sense.

6 Conclusion and Future Work

In this paper, the authors have used the LGBM model to build a leaf-based prediction model. The building energy consumption prediction's accuracy was analyzed. An assumption was made that predicting the energy consumption for different energy meters in accordance to outdoor weather conditions will increase the prediction performance. To validate this assumption, a classical case using public dataset was analyzed and compared under different weather conditions using the LGBM model. The results proved that predicting the meter energy consumption on building level first and then aggregating the prediction on an environment level can increase the prediction accuracy than making direct prediction on the whole building level. In the future, the data needs to be analyzed further on other grounds, for example, floor levels, indoor weather conditions, occupants levels and so on.

Table 1 Table to show how strongly the presence or absence of one variable affects the presence of another

Variables	Floor_count	Year_built	Age	Cloud_coverage	Precip_depth_1_hr	Sea_level_pressure	Dew_temperature	Air_temperature
Floor_count	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Year_built	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Age	0.2	1	0.0	0.0	0.0	0.0	0.0	0.0
Cloud_coverage	−0.1	−0.1	−0.1	0.0	0.0	0.0	0.0	0.0
Precip_depth_1_hr	−0.4	−0.4	−0.4	0.1	0.0	0.0	0.0	0.0
Sea_level_pressure	−0.3	−0.2	−0.2	0.1	0.4	0.0	0.0	0.0
Dew_temperature	0.0	−0.1	−0.1	0.1	0.1	0.3	0.0	0.0
Air_temperature	0.0	−0.1	−0.1	0.1	0.1	0.3	<1	0.0

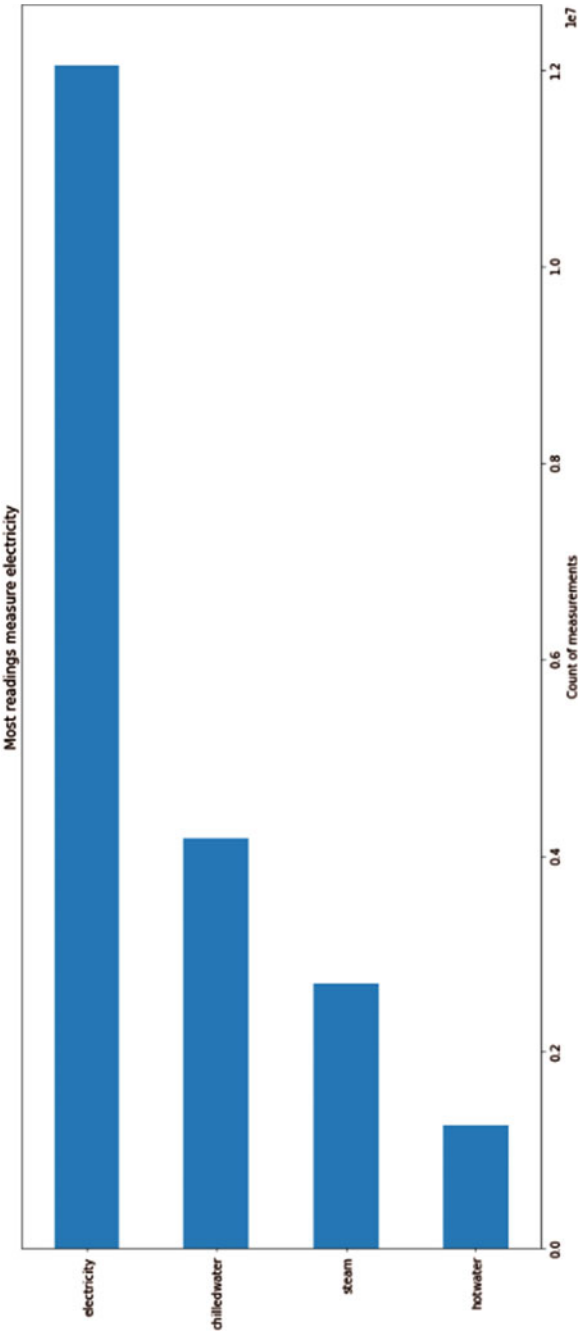

Fig. 5 Maximum meter reading according to count of measurements

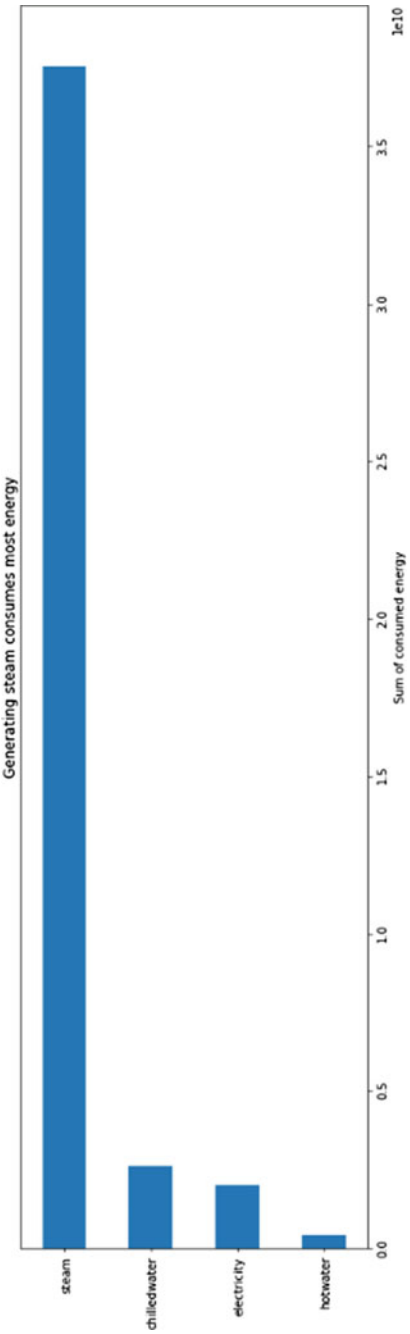

Fig. 6 Most energy consumed according to sum of consumed energy

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Analysis of Indoor Localization Algorithm for WiFi Using Received Signal Strength

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1 Introduction

In today's day and age, indoor navigation plays an integral role in large public infrastructure for better movement and coordination. Usage of WiFi hotspots in areas where indoor navigation can serve a purpose. Although GPS has been available for localization and navigation, the principle that achieves localization falls apart when the coverage area is reduced to metre scale. Localization data can be used by network designers to optimize the coverage area and push the boundary conditions of the network range. They use beacons in a network that acts like an anchor node and helps the non-anchored nodes to be localized based on different localization algorithms.

In this paper, the proposed work performs a comparative analysis of three different localization algorithms namely the multilateration method, K nearest neighbour and Minimum mean square error estimate technique. In the first method, we make use of the angle between the non-anchored node and the beacon node and use it for

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localization. In KNN method, it works by means of referencing the unknown nodes with the beacon nodes by taking into consideration the sample size of 'K'.

In this paper, the proposed work compares the method that can be used for indoor localization with great precision and accuracy. Section 2 gives a list of all the related works that have been used in this paper to make it more informative. Section 3 contains the System Architecture and the usage of components that have been used in the following system. Section 4 discusses about the Simulated Results where an overall experience on the possibilities of the various optimizers used and the alert system. Section 5 concludes the proposed work.

2 Related Work

The various applications of RSS in different domains and its working principle originated from the concepts of sensor network domain. The various concepts such as Angle of Arrival (AoA) and Received Signal Strength (RSS) [1] based on technologies such as WiFi, UltraWideband (UWB) [1] and Bluetooth has been discussed. In overcoming the minimum extraction of information in the RSS, the author has implemented an array of directional antennas [2]. The various attacks that are possible in the RSS-Fingerprinting scenario, accurate measuring techniques to identify the targets as well as the transmission power involved, the author has taken the countermeasures [3] into consideration in order to increase the efficiency of our project. TOA, TDOA and AOA [4] systems require proper time synchronization or antenna array that brings the desired result. The author has tried to understand the need of various nodes being in the region of reference in the form of reference points. The difference between indoor and outdoor localization [5] techniques and the different scope involved in them have been taken into consideration along with the parameters that are required on a small scale as well as on large-scale basis.

The various criteria involved in the performance measurement and the trade-off with an elaborate idea about the scalability and availability of various positioning techniques and their important characteristics have been referred [6]. The recent advances in the IPS field and an idea about the performance metrics in relation to the various studies about the location detection techniques and algorithms used in the IPS field by using the concepts of angle based and time-based methods [7] has been referred. The indoor WiFi localization depicts the knowledge about IPS that involves the concept of Kalman filters [8] for our localization project. A random forest based localization uses the concept of Received Signal Strength Indication (RSSI) and Basic Service Set Identifier (BSSID) [9] through means of a smart watch.

WiFi-based time-reversal indoor positioning systems (WiFi-TRIPS) [10] has been studied with the sole purpose of understanding the WiFi Fingerprinting indoor localization technique. The military applications of Multilateration (MLAT) [11] system has been used for Aircraft Traffic Control (ATC) [11] operations system. It has analysis of the hyperbolic localization of the airplane trajectory. The algorithms pertaining to the MLAT has been understood by looking into more elaborate data statistics of

airport surface surveillance [12]. In order to implement the concept of KNN [13] in our proposed work, it has been observed that the indoor WiFi positioning using the KNN fingerprinting technique was implemented. For knowing the working concept of KNN, the machine learning domain [14] that uses indoor WiFi localization with the help of IoT hardware. Finally, the effect of shadowing [15] on the localization techniques has found the importance of the location of reference nodes for the Mean Square Error (MSE).

3 Methodology

The existing work contains the implementation of WiFi-based fingerprinting using the round-trip time measurement technique combined with Kalman filters for indoor localization. In the proposed work, various localization algorithms such as the Multilateration, KNN and MMSE have been analyzed between various restriction procedures regarding range precision for different applications. Fundamentally, the correlation between various localization frameworks indicating the range, precision, and the techniques utilized for the localization frameworks and the location data are accounted for and delivered continuously.

Basically, the proposed work has intended to implement the Indoor WiFi localization using RSSI. The localization algorithm uses RSSI and manages to distinguish the best method out of the three and give valuable statistics. The Kalman filter makes an estimation of the new measurements using a weighted average method with respect to the average predicted states of the system. But the accuracy of locating the target with respect to the references is comparatively low.

In order to overcome this drawback, we have implemented Indoor localization using RSSI, taking three localization techniques into consideration. After gaining the much-needed knowledge about WiFi-based indoor localization through the reference papers, RSSI with WiFi has been considered for finding the accuracy so that the area of coverage to detect the target is increased. Hence the reference nodes (anchor nodes) are placed in positions with respect to the Multilateration concept, where the various ranges are converted into the desired position to be located. Multilateration is a technique that considers the measurement of the difference in distance between two points at known locations (anchor nodes) by disseminating the signals at known times.

The KNN algorithm that we have used has enabled the easy tracking and prediction of the target in the indoor localization field. But few error issues have been encountered while getting the data, so Minimum Mean Square Error (MMSE) has been used. Combining the KNN algorithm with MMSE gave us more accurate data and improved our statistics in getting the estimated location of the unidentified object in the WiFi Indoor localized scenario. Therefore, the successful implementation of WiFi indoor localization using RSSI combined with localization techniques has been analyzed with various methods.

4 Simulation Results

The Scenario has been set up in an area of coverage of 50 m × 50 m by considering 19 nodes in the indoor WiFi localization. There were 3 anchor nodes (Access Points) that knew its location and rest 16 nodes are non-anchored nodes to get localized for indoor localization. The Simulation Parameters are as shown in Table 1.

After simulating the indoor localization WiFi, the following comparisons depict the correctness of the algorithm. The following NAM window shows the output for different levels of indoor WiFi localization.

The above NAM window represents the process of node initialization, localization and determination phase. The deployment of nodes are as shown in Fig. 1. in the simulator are represented as green before the localization procedure starts. Once the algorithm takes its course as shown in Fig. 2. The colour of the node changes into yellow which denotes the ongoing process. As shown in Figs. 2 and 3, the blue colour nodes are anchor nodes (Access Point) that act like a beacon used to orchestrate the localization process. As the node gets localized as shown in Figs. 3 and 4, the colour of node changes to red. The process is the same for all the localization techniques where

Table 1 Simulation parameters

Simulation parameter	Values
Area of coverage	50 m × 50 m
No. of nodes	19
Propagation model	Free space
Localization method	Indoor
Localization algorithm	Multilateration, MMSE, KNN

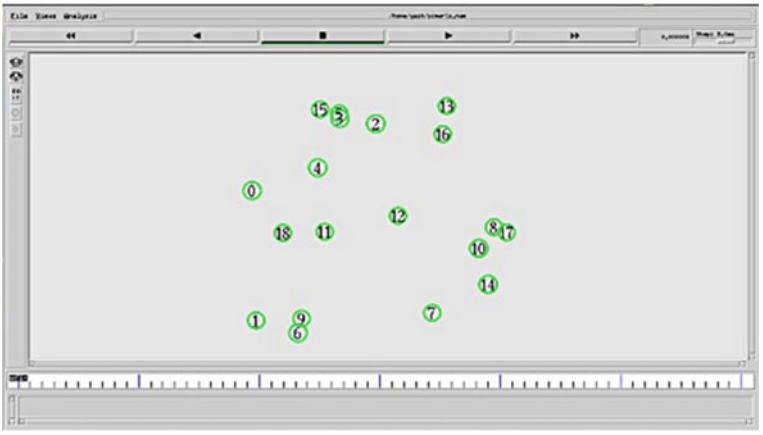

Fig. 1 Deployment of nodes

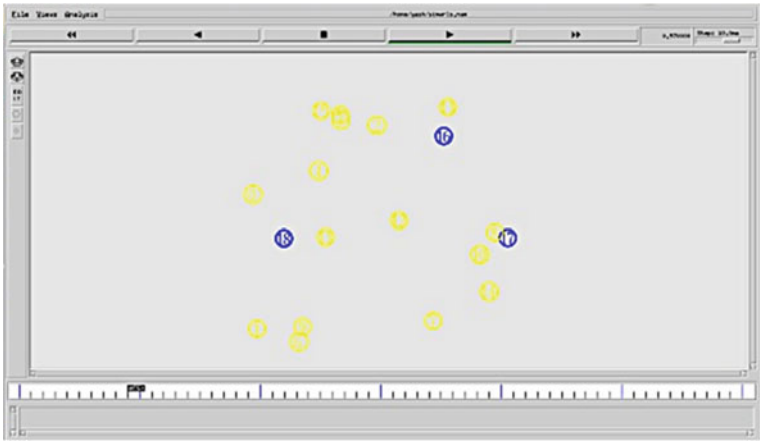

Fig. 2 Ongoing localization process

Fig. 3 Partial localized nodes

the general Multilateration technique takes 6 s while 9 s for K-nearest neighbour and Minimum Mean Square estimate technique.

The following figures comprises of the predicted coordinates superimposed on the actual coordinates to get an idea of the extent of the correlation between two data sets.

The accuracy of localization methods has been analyzed for Multilateration as shown in Fig. 5. The Minimum Mean Square Error as shown in Fig. 6 outperforms other techniques because of its refined measurement approach over the mean value of the positioning technique. It is followed by the KNN technique as shown in Fig. 7.

The following graph compares the Normalized Mean Square Error value associated with each node across all the three localization techniques.

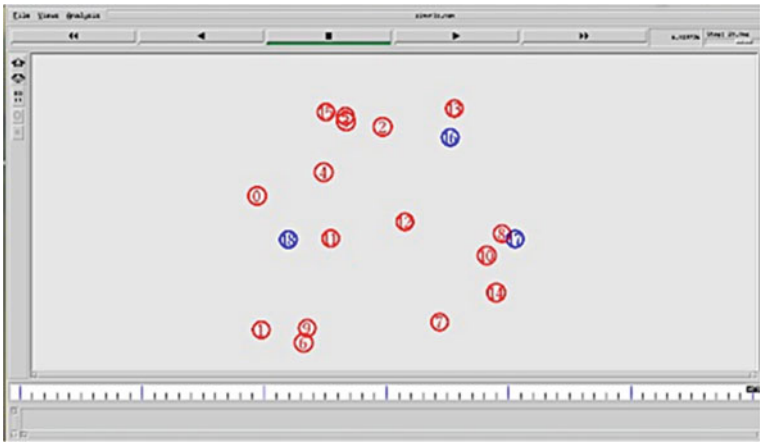

Fig. 4 Localized nodes

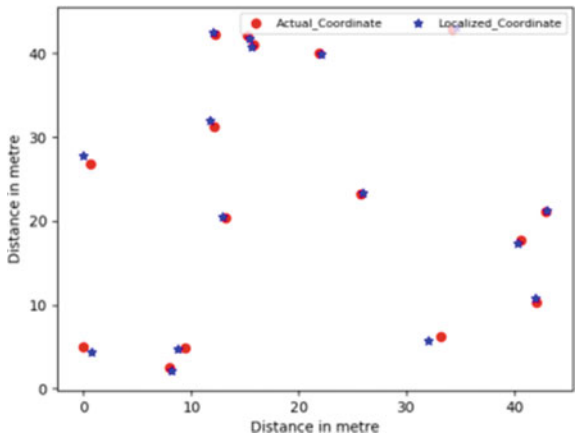

Fig. 5 Accuracy of multilateration

The comparative analysis of Normalized Mean Square Error with respect to nodes has been shown in Fig. 8. The Normalized error value exhibits that the MMSE method has considerably low error when compared to other two methods. It can be noticed that few nodes in Multilateration has greater error because they are far away from the anchor node.

5 Conclusion

Though WiFi signals have obstacles and hindrances in indoor environments due to interferences. By evaluating the performance of various localization algorithms,

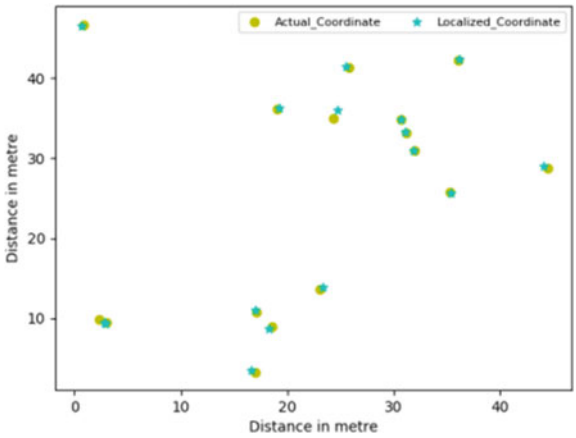

Fig. 6 Accuracy of MMSE

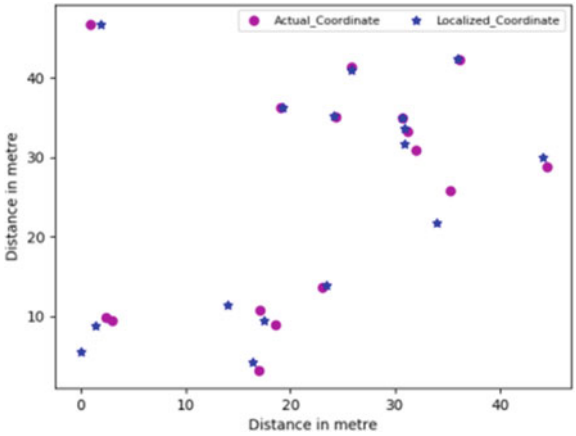

Fig. 7 Accuracy of KNN

we can draw some concrete inferences on the three different algorithms in the simulated environments. In our simulation of localization with 16 nodes of indoor WiFi, all the localization algorithm has shown promising performance but whereas the Minimum Mean Square estimate method outperforms the rest with just a few predicted coordinates out of the confidence area.

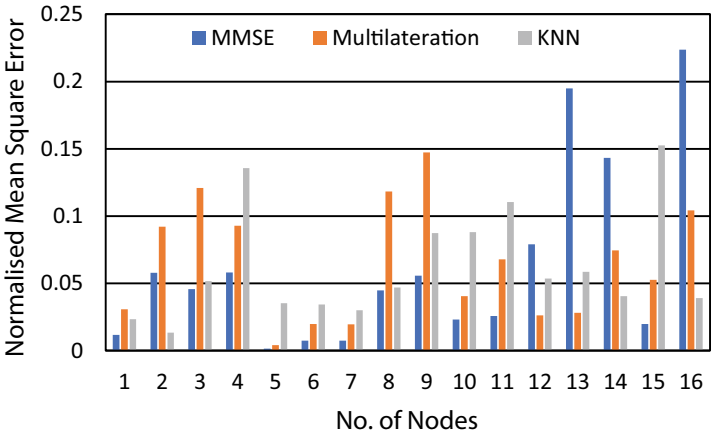

Fig. 8 Analysis of normalized mean square error

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Mining Overlapping Communities in Real-World Health Data

M. Selvi, K. Anil Reddy, and K. Venkata Manideep

1 Introduction

Future enhancement in the analysis and treatment of sicknesses has prompted an expansion in future. In each nation, the level of old age in the general public is expanding. The World Health Organisation (WHO) evaluates that by 2050 the quantity of individuals more than 60 years will surpass two billion [1]. With expanding age, individuals become progressively powerless to falls. Indeed, as the age increments from 65 to more than 70 years, the pace of falls and fall-related wounds ascends from 28 to 42% as per the WHO [2]. For individuals more than 65 years old, fall-related wounds were the main source of death in 2013 [3]. In addition, fall-related wounds cause noteworthy expenses for society, making falls a significant general medical issue around the world. The quantity of deadly falls every year is evaluated by the who to be equivalent to 420,000 every year [4]. After a fall, fast clinical consideration can essentially lessen the potential harm from fall wounds, bringing about a higher endurance rate [5, 6]. Therefore, fall recognition frameworks that can recognize and report falls as quick as conceivable are vital. During the most recent years, the improvement of fall identification frameworks has become a hot research theme. A plenty of fall identification frameworks are being created utilizing various methodologies. We can arrange the current fall identification frameworks into two fundamental classes: (i) wearable gadget based frameworks and (ii) setting mindful

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frameworks [7]. Wearable gadget based frameworks use a gadget that is worn by the client to recognize falls. These gadgets incorporate a gyrator and an accelerometer that can quantify the speeding up and the precise speed. The development and movement of the client bring about a transient variety of the deliberate increasing speed and precise speed information, leaving various fingerprints for various exercises. By breaking down the deliberate increasing speed and precise speed information, it is conceivable to decide the sort of movement performed by the client. A few examinations have explored the exhibition of wearable gadget based frameworks [8, 9, 10–12]. A major preferred position of wearable gadget based fall recognition frameworks is that they can perceive human action without trading off client security. Generally, utilized PDAs with worked in accelerometer and gyrator can likewise be utilized to gauge the speeding up and precise speed as the client moves and performs different exercises. The deliberate information can be examined progressively to detect falls. This fall discovery approach is extremely appealing on the grounds that it requires no new hardware and is along these lines financially savvy. For wearable gadget based frameworks, if the client neglect to wear the gadget, it gets difficult to screen the individual action. This speaks to the significant restriction of wearable gadget based frameworks. Setting mindful frameworks speak to the second primary classification of fall identification frameworks [13]. These frameworks rely on the sensors set in the zone around the customer to be checked. The sensors utilized for checking envelop floor sensors, pressure sensors, amplifiers, and cameras. Setting mindful structures can consolidate a single or various sorts of sensors that are sent in unequivocal domains. This makes fall disclosure immense if the customer leaves the checking zone [14, 15]. Most widely recognized kind of setting mindful frameworks is videos observation. To recognize falls, a camera is utilized to catch a progression of pictures which is in this manner prepared by an arrangement calculation to decide if a fall has happened or not. The utilisation of video observation for action acknowledgment and fall location has been broadly researched in the writing [16]. To assess the exhibition of fall recognition frameworks, we need records of genuine falls. Be that as it may, it is exceptionally hard to gather certifiable fall information, particularly for more seasoned individuals. By and large, we have to screen individuals for a little while to get records of scarcely any real falls. At last, these couple of falls are insufficient to precisely assess the presentation of the created fall location framework. In this manner, just a couple of studies have received this methodology [17–19]. Without information of real falls, most specialists use reenacted Chase conducted by professionals. Given the dropping, these veterans do step-by-step residing (ADL) exercises to test the consistency and capacity of the rendered fall area system isolate among falls and ADL. In the writing, a few movement datasets are openly accessible which permit assessing fall identification techniques and evaluating their presentation on genuine information. An ADL database which involves quickening and rakish speed information are given in [8], where a content depicting the arrangement of exercises to be completed was given to the members. A sum of 30 members of various sexual orientations, ages, and loads added to this examination [20]. The investigation comprised in performing ADL exercises including standing, sitting, amble, moving upstairs, strolling ground floor, and pratfall To gather the speeding up and

rakish speed information, an advanced cell was the guts of each part. Overall, the full time of recorded for each part was 192.0 s. It justifies referencing that datasets in excludes fall data, yet just ADL works out. Falling related data can also be founded in some open dataset. The makers of give a fallen dataset which was worked by 42 individuals. Both increasing speed and precise speed [21–23].

During this trial. The members right now youthful solid grown-ups who performed arranged falls. This reality makes the gathered information not quite the same as that of genuine falls of old individuals. Because of the trouble of social occasion enough genuine fall information from more seasoned individuals, the utilisation of mirrored fall information for exercising the exhibition discovery of fall framework is a well-acknowledged approach by the analysts on subject [24, 25].

2 System Model

Our goal is to decide the client's action dependent on the deliberate increasing speed and rakish speed information. Right now, give a review of the structure utilized for grouping ADLs just as fall occasions and clarify the activity recognition methodology. Figure 1 delineates the action acknowledgment structure which incorporates:

- Input speeding up and daring pace data procured from the mobile phone

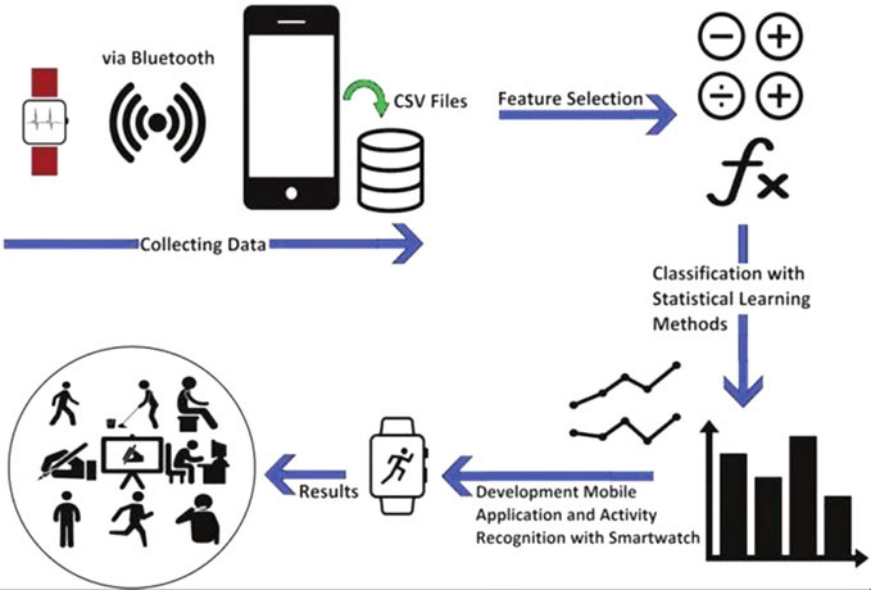

Fig. 1 Activity recognition

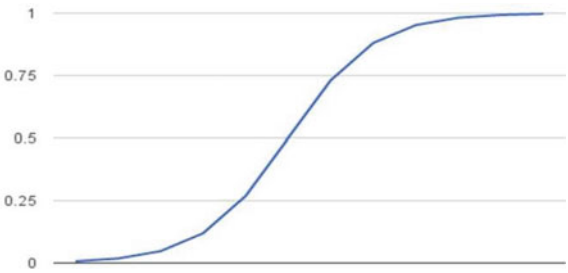

Fig. 2 linear regression curve

- Component extractions of square, and
- The request computation.

In the accompanying, we talk about every segment of this structure.

2.1 Data Acquisition and Preprocessing

The triaxial precise speed and quickening information are gotten From dual Databases Viewable. The registry in theory contains six forms of activities: amble, upstairs walking, downstairs taking a walk, resting, standing, and sleeping. With this measurement, a total of 30 people have been locked in. A mobile phone was associated with the waist of the individuals to accumulate reviving and exact speed data. The testing recurrence of the gathered information was 50 Hz. The information was then been partitioned into cradles of 2.56 s lengths with half cover. Every datum support is marked with the comparing real movement utilising the grounded truth and that contains both triaxial quickening and the triaxial precise speed of a particular member. Notwithstanding the ADL informational collection, we gained increasing speed and rakish speed information for fall occasions from the open database in. Our point is to build up a system that utilises the speeding up and precise speed information to group seven. kinds of exercises: falling, amble, Go uphill, go downwards, sit, standing, and lie. Since before the information collected from the two databases is given as a contribution to the gathering computation, this content must be ethnically diverse. The data is screened into supports of length of 2.56 s to make it compatible with the primary dataset data. In addition, we pick the downtime data from 30 individuals surrendered.

2.2 Existing System

Setting mindful frameworks speak to the second fundamental class of fall identification frameworks. These frameworks depend on sensors put in zone of the client to

be observed. The sensing device utilized for observing incorporate ground sensors, pressure sensors, receivers, and camera. Setting careful structures can join a singular or various sorts of sensor which are sent in explicit locales. This will make fall disclosure incomprehensible if the customer leaves the checking place. The most broadly perceived sort of setting careful structures is media perception. To distinguish falls, a camera is used to get a movement of pictures which is right now handled by a classification calculation to decide if a fall has happened or not.

2.3 Proposed System

The proposed framework is an AI system for fall identification and action acknowledgment. The fundamental commitment is identified with the highlights utilized for fall recognition.

All the highly specificified, we utilizing mean estimation of the triaxials increasing speed and accomplish a fall location exactness and accuracy.

Strategic relapse classifier is utilized to discover fall identification and movement acknowledgment.

Calculated Regression gauges the connection between the needy variable (our mark, what we need to anticipate) and the at least one free factors (our highlights), by assessing probabilities utilizing it's fundamental strategic capacity.

It's grossly unqualified, it wouldn't use such a large no of numerical properties, it's highly decipherable, it still doesn't involve input highlights scaling, it doesn't need any modification, it's all but impossible to regularize and it yields expected probabilities that are very much changed.

3 Feature Extraction

This segment offers a review of the idea of highlight extractions and features its significance in acquiring an exact arrangement. The speeding up and precise speed signals are given as contribution to the element extractions obstruct as appeared in Fig. 1. A while later, the yield of the component extraction square is utilized by the order calculation to perceive human exercises. It is important that on the off chance that we straightforwardly furnish the arrangement calculation with crude speeding up and rakish speed information, the characterization calculation will neglect to recognize various kinds of exercises and the grouping exactness would be poor. In order issues, the point is to recognize various classes of exercises. A decent element must accomplish this target. For example, a great element can have a particular scope of qualities for every action, and these worth extents don't cover. Right now, knowing the estimation of the thought about element, we can discover to which extend it has a place and therefore perceive the kind of the performed movement.

Also, a great feature must be general enough to such an extent that it permits recognizing the action related to fresh information. These are two criteria that might be satisfied by a decent component. Note that crude information doesn't satisfy any of these criteria. Also, crude information is commonly debased with commotion and ancient rarities which make it extremely hard for the classifier to discover any example in the information. Besides, if the crude information is utilized, the dimension component vector gets enormous and makes the handling of that highlight vector complex and tedious. Highlight extraction assists with diminishing the dimensionality of the issue and diminishes in this way its multifaceted nature. By choosing the correct highlights, we decrease the unpredictability of movement acknowledgment and improve the arrangement exactness. This renders highlight extraction a foundation in accomplishing high characterization exactness with sensible unpredictability. The assignment of highlight extraction comprises of find a limited arrangement of measured that catches quantitatively portrayals and empowers separating between the different classes of movement. Ordinary highlights incorporate factual amounts separated from the quickening signal, for example, the mean worth, the standard deviation, and higher request minutes. In the accompanying, we consider a straightforward guide to clarify how highlight extraction can assist with deciding the kind of action performed by the client. We accept for straightforwardness that the gathered speeding up information related to two exercises: lying1 and standing. Our goal is to decide the client's action dependent on the watched quickening information. Via cautiously considering the speeding up information, we discover certain information that can be utilized to see the performed movement. For example, for lying, the quickening information az(t) has a mean worth that is near 0 m = s2. Then again, for standing the mean estimation of the quickening az(t) is around 10 m = s2. We expect since we get another accelerating information cushion which could be assessed either while the client was lying or standing. Our errand is to see the movement that was performed by the client when this accelerating help was recorded. There are two potential results: (i) the client: (action is lying or (ii) the client movement is standing. A straightforward method to perceive the client action comprises of assessing the mean worth of the acceleration az(t). At that point, this means worth is given to the arrangement calculation. On the off chance that the mean estimation of the speeding up information az(t) is near 0 m = s2, the classifier would conclude that the performed movement is lying. Something else, if the mean estimation of the increasing speed information az(t) is 10 m = s2, the classifier concludes that the performed movement is standing. The crude speeding up and rakish speed signs could be used as contributions to the characterization calculation. In any case, right now, precision of the action acknowledgment would be extremely poor. To take care of this issue, it is essential to separate a lot of highlights from the speeding up and the precise speed signals. These highlights ought to have distinctive worth extents for various exercises. During the preparation stage, the order calculation is presented to an enormous arrangement of marked information. For every action, the characterization calculation needs to gain proficiency with the worth scope of each element. At the point when another increasing speed and precise speed signal is gotten, the highlights are separated and put away in a component vector which is given to the

grouping calculation. The prepared characterization calculation maps this element vector to one of the seven action classes.

3.1 Logistic Regression Classification

The determined limit, furthermore call the sigmoid limit was made by examiners to delineate property of masses improvement in nature, rising quickly and expanding at the passing on cutoff of earth. that is a S-molded Wiggle that might take any truly valued number and direct it to an opportunity anywhere between the context of 0 and 1, but never at those cutoff points exactly.

1/(1 + *e*ˆ−esteem)

Thus *e* is the origin of normal logarithms (Euler's number or EXP) (function from your spreadsheet) and value is the actual numerical value that must be changed. The following is a representation of the-5 numbers and 5 changed into the range 0 and 1 utilizing the strategic capacity.

3.2 Logistic Function

Since we comprehend what the calculated capacity is, how about we perceive how it is utilized in strategic relapse.

Representation Used for Logistic Regression.

Logistic regression employs a formula, much like linear regression, as representation. The sample values (x) are linearly multiplied using proportions or correlation values (Fig. 2).

3.3 Logistic Regression Predicts Probabilities

Calculated relapse models the likelihood of the default class (for example the first class).For model, on the off chance that we are demonstrating individuals' sex as male or female from their tallness, at that point the top-notch may have been male and the calculated relapse model could be composed as the probability of males being given the stature of a person, or even more officially: P(sex = male height) Rendered another way, we are showing the possibility that knowledge (X) would have a position with the default class. (Y = 1), we will write this formatically as:

P(X) = P(Y = 1|X).

We can move the type back to one side and compose it as:

chances = E^(b0 + b1* X) All of that makes it easier to understand that the template is still a linear input combination, however, this linear combination applies to the default class log-odds.

3.4 Learning the Logistic Regression Model

The coefficients (Beta qualities b) of the calculated relapse calculation must be assessed from your preparation information. This is finished utilizing the most extreme probability estimation. Maximum-probability estimation is a typical learning calculation utilized by an assortment of AI calculations, in spite of the fact that it makes presumptions about the dissemination of your information. The optimal correlations might function in a model that would predict an unusually close to 1 value (for example male) for the standard class, and an equally close to 0 value (for example female) for the specific class. The tendency for the most severe likelihood of measured relapse is that a search approach searches for values for just the correlations (beta qualities) which really restrict the error in the predicted parameters of the system to those in the knowledge (e.g. probability of 1 if the information is the critical class). This is frequently actualized practically speaking utilizing effective numerical advancement calculations (like the Quasi-newton technique). The goal of the characterization calculation is to perceive the client action dependent on the speeding up and gyrator information. We utilize a directed learning way to deal with accomplish this goal. As an initial step, the calculation is presented to a huge arrangement of named data2, the alleged preparing information. In view of the preparation information, the order calculation is to perceive the client action dependent on the speeding up and gyrator information. We utilize a directed learning way to deal with accomplish this goal. As an initial step, the calculation is presented to a huge arrangement of named data2, the alleged preparing information. In view of the preparation information, the order calculation can tune its inside parameters to diminish the misclassification rate anyway much as could be normal. After the preparation stage, the characterization exactness of the calculation is surveyed utilizing another arrangement of information, called the test information. To start with, we review that the information are sorted out in cradles of length 2.5 s. All of these backings are named with an activity character (ID) showing to which class the information cradle has a place. The movement IDs are numbered from 1 to 7. The movement IDs 1, 2, 3, 4, 5, 6, and 7 relate to strolling, strolling upstairs, strolling ground floor, sitting, standing, lying, and falling, separately. For instance, if the information support has an action ID equivalent to 4, this infers the information Cushion was reported while sitting on the part. The graph pad produced for the extraction square of the part contains data on rough speed up and exact speed. Those features are stacked in a matrix, known as the component matrix, in the wake of planning the estimate of each variable for the designated data pad. This vector is given to the request calculation, which will see the type of operation the customer conducts when documenting the data support. To accomplish great grouping exactness, the order calculation should initially be prepared to gain

proficiency with the basic example of every action. During the preparation stage, the grouping calculation is presented to marked information to improve its inside parameters with the end goal that the order blunder is limited. Along these lines, we can evaluate the presentation of the prepared calculation utilizing the test information. When another cradle is gotten, the comparing highlight vector is resolved and given to the classifier. This last registers the probability that this cradle has a place with one of the seven potential action classes. The calculation at that point pronounces that the cradle has a place likelihood score. For instance, in the event that Class 5 has the most noteworthy score for a given cushion, at that point, the calculation would announce that the client was standing. To see if the choice of the calculation is corrector then again off-base, we differentiate it and the ground truth (the checked data). In the test data, this approach is repeated for any support. By combining all the results, we create a cross-section of the disorder that demonstrates the precision and accuracy of the development classifier.

4 Conclusion

A strong fall location framework is basic to help the autonomous living of senior individuals. Right now, have proposed an AI approach for fall discovery and fall location and acknowledgment. We wanted to present four calculations in perceiving the activities dropping, walk, upward walking, downstairs walking, resting, standing, and lying subject to the accelerating and jaunty speed results. We have suggested integrating relative time and repeat region and have shown the significance of these capabilities and their positive result in overhauling the classifier's precision and accuracy.

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An Automated Security Approach of Image and Video Steganography

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1 Introduction

To verify the data, the burden is used on the basis that it uses less space on the plate (puts aside the cash), more information can be moved through the web [20]. Accelerates the information moving from one plate to another. The security goals meant for data are Private, Veracity, Non-Repudiation, and confirmation [6, 7]. The safety of data is a problem between data retrieval organizations [21]. In handling the indicated development problem, the data processing companies are moving in the direction of encryption to secure meaningful data [9]. Despite the above concerns about verifying storage data, information technology associations are also facing difficulties by raising expenditures needed to get enough size to encounter current as well as forthcoming requirements [10]. Info burden stays identified to reduce accumulations besides matching expenses [22]. Data encryption is recognized to protect statistics against stealthy snooping. Change the data for particular group, termed plain text, for additional configuration, named symbol set, by using a cipher value [8, 11]. Right now, the completed encoding procedures stay individually. State of encryption

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remained adequately identical by encoding, transforming data from an understandable state to transparent junk [12, 23]. Today's encryption is intensely based on scientific hypotheses [13]. Cryptographic designs remain structured throughout presumptions of calculational firmness, creating similar computations hard for disruption from enemy. The raise of cryptographic modernization results in several legitimate arguments [14]. The encryption capability is used for inspection and rebellion device which led many legislatures to portray it as a defense [24].

The job of encryption is to protect data through encoding the configuration that is not used effectively and named as figure content [15]. The indicated mysterious figure otherwise memo content should be used by people who have a mystery value. It can interpret notes in simple content. The steganography uses facility of covering data that must be given in an alternative diffuse standard [16]. The utmost frequently utilized document location for correspondence is ordinal picture for the aforementioned huge recurrence happening in the web [17]. To cover mysterious facts within the pictures, there is a wide assortment in steganography procedures a few remain extra mind-boggling apart from anything else. Each form has individual solid as well as feeble concentrates [18]. Various submissions take various needs of the steganography strategy practiced. A few requests might need outright intangibility of this mysterious data, whereas others need greater mysterious memo for covering [19, 20]. At times this is being demonstrated in what way the content is covered in the copy document and by what means a picture is covered in alternative picture.

The steganography is grouped by four kinds essentially: Auditory, Audiovisual, Copy, and Script. Picture steganography is a steganographic strategy widely used to hide information as it provides a safe and basic approach to sending data to the web. Pictures are utilized in different extents, for instance, therapeutic, soldierly, scientific, construction, promotion, schooling just like preparation. The growth of computerized procedures used for spreading and loading pictures is expanded, central question for ensuring classification, righteousness just like validity of visualizations became significant fear. Fundamental standard of picture steganography is to supplant values in picture information, with values that have a place with the objective message.

2 Related Work

In numerous new inventions of proposed approaches for LSB-based picture steganography, we can discover several procedures planned utilizing different calculations (for example symmetric-key calculation, asymmetric key calculation, pressure calculations, and so forth, for example, [3–9]. Our work is enunciated on study three significant methodologies.

Sushravya M et al. [1] presents a framework in which content is scrambled using XOR symmetrical calculation and consecutive is used to conceal information in the spread picture. The safety level given is low. Similarly, framework characterized is restricted to poor class in addition to not many kinds of pictures. Aman Arora et al. [2] presents a framework where the bits are adjusted by first piece set. In the

event that image has the same pixel rehashing over an area, at that point this strategy falls flat in light of the fact that the bit alteration will get variations towards whole pixels range, so now the adaptation of exhaustion will be perceptible effectively to the human eyes.

Utsav Seth et al. [3] This framework provides decent security under review with several documents above using AES encryption. In any case, if the nature of the picture is small then later steganography the latest pictures have extra confusion in contrast to different cards this is based on the fact that here is collected less than 1 or 2 less noteworthy bits. As a result, human eyes can identify how information is covered in the image.

Kamal deep Joshi et al. [4] This strategy requires both the sender and the collector to agree on a diffusion image available to both closures. Both as it can, this technique is annoying because it is hard to keep similar picture with identical facts such as dimensions, lenses, and so on.

YambemJinaChanu et al. [5] describes a brief review of various categories of steganography methods aimed at picture in three-dimensional and change areas and encoding procedures that the recognition of the mysterious message in the image least significant bit replacement procedure. From the system, the less important values of diffusion picture elements estimation are regulated by message bits. The simplest steganography methods are the LSB exchange for every picture element in picture. Meanwhile, the less significant values have altered, contrast among diffusion image (for example, unique) in addition cover picture is not really recognizable.

3 Steganography Techniques

In recent times, abundant steganography practices have been proposed which incorporate concealed memos into interactive program entities. It contains numerous methods to hide data or memos in pictures so that the adjustment done near picture stays imperceptible. Approaches, in general, contain less important values, hiding, and sieving, besides transformation procedures [25, 26]. Inserting less important bits (LSBs) is a humble method towards implanting data into the picture folder. Easier steganography practices incorporate message values directly into the slightest important bit level of the concealment picture in a settled arrangement. Changing slightest important value constraint outcome in perceptible social variances since heft of modification will be trivial. From the proposed method, implanting capability may occur two or more less important values. Moreover, jeopardy of building the implanted note rationally measurable escalation, likewise reliability of the image vitiates. Therefore, an implanting plan of varying sizes is presented, where plenty of LSBs utilized on behalf of implanting messages relies on resident features of picture element. The benefit of less significant values created system exists tranquil towards apparatus also great note payment capacity.

Even if less significant bit conceals the memo so that individuals can't remark them, it can be yet plausible for adversary to recover memo because of ease of method.

Hence, malevolent persons may effortlessly attempt to draw out notes amidst launch related to picture if they are apprehensive where secret information is present that has been entrenched in picture. Consequently, an arrangement called the secure information hiding system was planned to recover least significant bit schema. To overcome the problem of arrangement plotting via incorporating message towards one set of arbitrary picture elements, we need to disperse them across concealed picture. Hiding and sieving practices, typically limited to twenty-four bits besides grayscale images, conceal data via imprinting an image, alike to paper imprints. This practice performs image study, hence incorporating data into meaningful zones so the concealed memo is further an essential part of the hidden picture than simply by concealing it in sound constant.

3.1 Image Steganography

The use of bitmap images to hide confidential data is the maximum prevalent pick in steganography. A wide range of softwares are constructed to utilize this resolution. A few software utilize PIN safety to encrypt image info. To work on this software, we need to acquire "BMP" arrangement of the image. Use of any other type such as “JPEG”, “GIF” is not encouraged because the image algorithm of “BMP” for steganography is considered humble compared to other types. But most of the picture forms available in the network are of “JPEG” but not “BMP”, thus there is need to find any other alternative for this issue. The current software provide solutions for this issue, it has the ability to accept any type of picture to conceal the info document, but in the end it only gives “BMP” as an outcome that is wrapped within.

3.2 Bitmap Steganography

The straightforward and easy way of imagining would be bitmap as it nullifies the usage of any technology. Bitmap has a pixel constructed structure that has RGB (red, green, and blue) in which individual picture element defines the byte information about the density of each color. The fusion of three colors is something we are making and able to see as an image. As in computers we use MSB (most significant bit) and LSB (least significant bit) in the first bit of eight-bit structure, the same methodology is implemented in here; the least significant value is infused with all the security concerned information with help of BMP images. So, each bit now has its own significance and can be limited up to specified usage and changes. Three bits assigned for three pixels are now used for storage of high width credentials. Primarily the name and the size of the data must be informed to move further with the process. The above step can be implemented by using the first few bits of memory to this.

4 Existing System

Picture and note steganography along with cryptography utilizing mat lab. It displays the framework wherein content will be scrambled utilizing symmetric XOR calculations as well as consecutive calculation that utilizes to shroud information within spread picture. The degree of protection given is small. Additionally, the characterized framework is constrained to decrease the quality of the picture.

5 Proposed System

The anticipated system relies on video steganography to hide messages and images over the video, reclaiming wrapped messages and images from video via least significant value technique of editing. LSB technique is most widely used image in steganography based and examined under the environment where an observer can distinguish between stego-images as well as cover image. It represents two video images, first the supporting image of message and the secondary image is the stego-image that contains the message hid. To identify difference between stego-video image and original video is not possible the data are hidden inside video file with the help of less significant part value algorithm. LSB encoding technique has the benefit of low computational complexity as well as very high watermark channel bit rate. With the help of this technique, the least significant bits of individual carrier file pixels are modified with message bits, each pixel has three secret message bits; in each RGB component. To hide the 3 bits of message in color of each pixel, we use a twenty-four-bit image as a bitmap. Twenty-one bit and twenty-four-bit colors cannot be easily distinguished by human eye (Fig. 1).

5.1 Pros of the System

• The above calculation is required to store a bigger number of information than the first LSB calculation and furthermore keep up its quality.

6 AES Encryption Algorithm

AES Algorithm for Cryptography is a method assurance to transmit data across over the inconsistent system, (for example, the Internet) with the goal that simply the arranged recipient can peruse the message [8]. Numerous administrations are exhibited by cryptography, for example, classification, realness, uprightness, and security

[9]. The cryptographic framework secures the information against unapproved gatherings to change a plaintext in a hidden structure. It engages the order of correspondence through an uncertain channel [10]. Among the numerous systems, AES is one of the most remarkable procedures utilized. Encryptions are used by NATIONAL INSTITUE OF STANDARDS AND TECHNOLOGY (NIST) are Advanced Encryption Standards. Status of 128 bits combined with three types of length variants AES-128, AES-192, and AES-256 are allowed to scramble and unscramble. The key length is utilized as long as possible for all the rounds. It consists of ten strokes for 128-piece key, twelve rounds for 192-piece keys, and fourteen rounds for the 256-piece keys. The goal of structure of this document is to encrypt the content using the Calculation of AES-128 encryption. The AES calculation involves ten crypto cycles. For starters, the 128-piece key is eleven established round keys, each of the 128 sized tips. Each round fuses a change using the figure relative key to ensure the security of encryption.

7 LSB Procedure for Steganography

Concealing the matching data to other data is possible through this algorithm. There is a varied scope of low-loader report measures that might be used a spread to shroud messages like content, image, and video. Computerized images are the most famous spread documents that can be utilized to conceal mystery information. A gigantic combination of stenographic techniques is used for concealing information as a piece of images, some are more unpredictable than others and all of them have individual solid and frail focuses [15, 25, 26]. The steganography framework comprises of the installed calculation, mystery message, spread image, and stego-key [1]. The most noticeable and consistent procedure for Steganography is the Least Significant Bit embeddings. A pinch of riddle information is put at all basic piece of a pair or most of the bytes within a spread image [7]. Assume 110 is an estimation of mystery image its paired worth is 01,101,110, it is circulated in LSB of the bytes inside spread image pixels.

8 Conclusion

Right now, cryptography and steganography calculations proposed to give higher security to information correspondence. Two systems AES-LSB are proposed to guarantee secure information transmission among sender and beneficiary in unbound systems. AES calculation is utilized to scramble the content then the encoded content is covered up in image (jpg, png, gif, bmp) utilizing LSB calculation. The proposed framework stowing away scrambled information in an image with less assortment in image bits makes it secure and compelling framework. This technique will assist us with reducing danger of security while moving mystery data over the system.

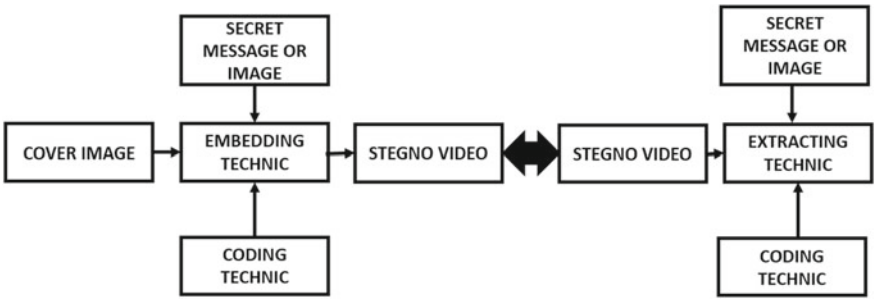

Fig. 1 Outline of the system

Proposed framework is easy to understand and anybody with fundamental PC information can utilize the framework with no troubles. In addition, the framework can be reached to numerous kinds of records like Auditory, taped so on also very well can be useful to various document organizations.

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Personality Traits Prediction in Facebook: A Review

R. I. Minu and G. Nagarajan

1 Introduction

Human personality identification using their social media comments is a complex task. As it is one of the unique characterize of human. By the concept of natural language processing the personality of a comment may be determined by identifying the linguistic cues in the lexicons. To measure the personality The general concept of OCEAN developed by Paul costa et al. (1970) can be used. The famous Big five personality traits are Openness, Conscientiousness, Extraversion, Agreeableness ad Neuroticism.

Using the concept of sentimental analysis, the personality traits of comment poster can be determined effectively.

2 Related Work

Bachrach et al. [1] used the multivariate regression model for predicting especially Extraversion and Neuroticism personality person.It is specified that the model produces low accuracy in identifying Agreeableness personality. With advancement in knowledge analysis, Facebook provides a graph API which provides a graphical model of data. In [2] the researches tried to explore the API in predicting the human

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personality trait. Using pure statistical model Julia et al. [3] study the personality traits of Facebook (FB) user behavior. They had done ground work with real data collection and analysis of the data with the statistic SPSS tool. Nowadays, the research direction goes on to identify the addiction towards social media. In [4] the behavior was analyzed using a visualization tool model. In [5] the authors tried to identify the dark triad personality in social media using semantic analysis of linguistic model. The general overview survey under this work is shown in Table 1.

Table 1 A Review on Personality Traits Prediction in Facebook

Ref.	Dataset	Feature Extraction	Feature Selection	Methodology	Purpose
[6]	FB	Questionnaire each user has assigned a trait	Chi-Square	SVM, KNN, and NB	Relate personality traits of Big Five Factor with status Updates, frequency and time of posting
[7]	FB	LIWC + Open vocabulary approach	Chi-Square	SVM + Ridge Regression Algorithms	Predict age, gender, and Big Five Personality traits
[8]	FB	LIWC,	Pearson Correlation analysis	Regression analyses	Examine the negative emotions and extraversion
[9]	FB	LIWC,	Pearson Correlation analysis	Regression analyses	Analyzed positive and negative emotion in their past status updates
[10]	FB	LIWC, SPLICE, SNA	Chi-Square	SVM Accuracy: 70.4%	Analyzed positive and negative emotion in their past status updates
[11]	FB	LIWC, SPLICE, SNA	Pearson Correlation analysis	XGB Accuracy: 74.2%	Examine the negative emotions and extraversion
[12]	FB	LIWC + CNN	Pearson Correlation analysis	CNN Accuracy: 0.76	Examine the negative emotions and extraversion

(continued)

Table 1 (continued)

Ref.	Dataset	Feature Extraction	Feature Selection	Methodology	Purpose
[13]	FB	LIWC + ARCC	–	MAE Average: 0.53162	Examine the negative emotions and extraversion
[14]	FB	LIWC, SPLICE, SNA	Feature vector and each personality trait score as target	SVM	Analyzed positive and negative emotion
[15]	Kaggle	LIWC, SPLICE, SNA		Logistic Regression	Myers–Brigg personality model
[16]	FB	sparse modeling	linguistic features thanks to a bag-of-words approach	Multinomial Naive Bayes	automatic Big 5 personality trait recognition
[17]	FB	LIWC, SPLICE, SNA	bag of words	CNN	sentence-level attention mechanism
[18]	Twitter,	LIWC, SPLICE, SNA	ReLu layer plus a final linear layer to perform regression	Char-BiRNN, withWord-Bi-RNN	RMSE on each of the five personality traits in the Big 5 model

3 Methodology

Sentiment analysis can be performed either by machine learning approach or by lexicon-based approach. From the related work section, it could be seen some researcher are worked through mathematical machine learning model or by understanding semantic of the text. In machine learning approach, through perfect training and testing phase, the personality trait can be analyzed. But through lexicon-based approach, it can be done by either dictionary or corpus-based model. Both required either semantic or statistical models.

Figure 1, emphasize the overall system design. The Facebook data with comments is available in all kinds of machine learning repositories like Kaggle and UCI. The main objective of this work is to identify the personality trait using our OCEAN Personality Trait ontology. The trained model is a semantic ontology with all characteristic lexicon which was built with the help of word net. This ontology was built using the domain knowledge of all five personalities.

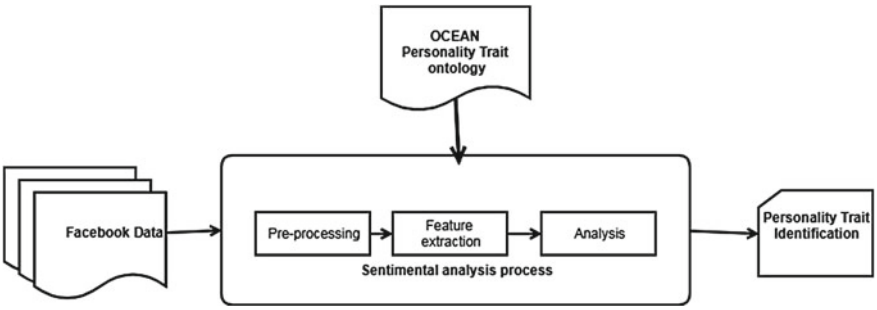

Fig. 1 Overall system design

4 Conclusion

Personality identification from the social media comments is one of the growing research area. In this paper, a framework for identifying the personality trait using sentimental analysis and ontology was proposed. The major goal of this paper is to provide an insight about the prevailing trend in this area. The excepted accuracy using this framework was around 95%. In our future research paper, the implementation with performance metric will be discussed.

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A Unified Analysis of Bank Customer Using Machine Learning

Tripuramallu Mohith, Thunuguntla Rakesh, and R. Yogitha

1 Introduction

In the banking sector, banks have large amounts of data. Then the bank uses this data to know behaviour of the consumer and to provide the services [1]. The best way to achieve this objective is to suggest an appropriate strategy to achieve the customer satisfaction and to strengthen the business benefits like proper product promotion act this can be done by using customer profiling or customer segmentation [2]. Customer profiling deals with the details of the customer and deals with the full description of customer purchases supported by a group of things [3]. Customer segmentation deals with dividing people on the basis of age, gender, behaviour, income, etc.

Banks are facing many challenges like default prediction, ways to deal with the risk, customer satisfaction, customer profiling and for various purposes to achieve higher profitability and reduce the danger [4]. It is the process of developing the own system on its own without any help from developer. It teaches pc the way to learn, the way to find the equations [5]. It has a rear end that is not useful in banking applications and it is used to make analysis among the huge amount of data and plays a crucial role improving a behaviour of consumers supported by different methods These methods are used to achieve the customer satisfaction and to increase the profits of the bank [6]. This tool is used to make unique analysis among huge amounts of data that is used to produce accurate results [7].

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2 Existing System

The existing system is to improve the profiles of bank users behaviour in supervised learning techniques. This design starts with the information, which is designed by using different techniques. Then the data is sorted and noisy data is being removed the sorted data is being trained to make accurate results by testing the data. In machine learning, all the things are been sorted in order to create a customer profile at a particular phase.

Data pre-processing is the initial step enhancing customer profiles. It is not related and sufficient data, if the data is not properly sorted or analyzed it cannot produce accurate results. Thus, sorting and analyzing the data of the bank customers are used to arrange the data in a particular order which makes the process easier. Often, data pre-processing has been the initial and important step in our existing system. Basically, the normalization process is done in the rear end. In normalizing the data there is no limit barrier for comparing the data units and it compares data from different places.

Once the data is sorted and analyzed it produces an ultimate data set. On these data set the four machine learning techniques has been applied primarily the K-MEANS technique will be applied to these data and the number of clusters will depend on the amount of data present in it. Hence the existing system achieved the aim of enhancing the profiling of uses behaviour by naming a replacement tag of non-supervised method.

Drawbacks for Existing System:

- Virtual banking strategy adoption is limited.
- High Computation Cost.

3 Proposed System

The proposed system and therefore the methodology followed for customer profiling are often easily employed by any Indian bank, because the terminologies, business benefits, rules, different types of databases, the types of transactions like amount deposited or credited, privacy on customer's account, customer satisfaction in the effective usage of the present technology and telecommunication, etc., that can be employed by all the public sector banks of India.

As the purpose of this system is to identify that there is a common behavioural pattern for customer profiles and to read out for every customer and the thing the customer is doing and to reveal the total amount of rupees spent on a particular aspect.

In earlier customer profiling is being done saying that the amount spent by the consumer in different aspects [8]. Each and every client cannot spend the amount equally to the other client. So there must be a potential barrier to each and every client such that it reflects the customers' loyalty and can increase the business benefits. The

main objective of this proposed system is to increase the privacy to the clients, satisfaction, high-quality consumer consumption behaviour and to increase the business benefits. So the bank started providing a potential barrier to each and every client such that he need not pay high interest. In such a way the bank extends more services to the consumers and the production of the right services to the customers doesn't fail [9].

Advantages of the Proposed System:

- High on privacy.
- High-quality consumer's consumption behaviour.
- High Customer Satisfaction.
- High Profitability

4 Related Work

In 2014, [10] Many operations are performing on that matter of unified analysis of bank customers using machine algorithm techniques. This operation says that the amount spent by the consumer is higher than the amount used for storing the records of the bank customers. Therefore, this analysis says that all the customers cannot spend the money equally to the other customers there must be a barrier to the customer depending upon the potential value. In 2015, [11] Many operations say that segmentation is the main process for customer's loyalty. With the help of segmentation, the banks find the easy way to characterize the people basing on their age, income, gender, place, etc. segmentation is being used to achieve the customers humbleness and where the bank finds an easy way to differentiate their behaviour and their functioning in order to extend their services inorder to increase their business benefits. In 2016, [12] the banks as faced many problems like fraud detection, unable to predict the potential barrier of the customer by using these machine learning techniques these issues as been solved by increasing level of prediction and providing more privacy to the customers such that it doesn't affect the client. In 2017, [13] The banks as started providing accurate level to the clients depending upon their transactions the credit limit will be decided such that the customer need not pay huge interest it satisfies the client and started using this services more efficiently. In 2019, [14] The objective of the proposed system is been achieved by providing more services to the clients as well as increasing the prediction level, achieving in the business benefits by using the machine algorithm techniques the existing system works more efficiently and accurately. It is similar to the working of a brain in which different layers as different functions to be performed. In the same manner, the banks have different layers and each layer is responsible for providing services to the client and achieving the business benefits of the bank. In 2015, [15] it is been trained and tested which was used for making clear analyses regarding the occupation of the employee. In 2015, [16] The precision value is being calculated by using different methods, The most constant value is above or equal to 70 percent which is taken

from the above analysis. In 2015, [17] the segments have been compared with the other labels. In 2014, [18] the survey has been taken among the various zbanks of a particular region to provide a clear analysis of commercial services to calculate an accurate value. In 2015, [19] feedback is been taken from the users inorder to upgrade a system or to extend services. In [2, 20–22] machine learning algorithms have been used to predict the house prices which gives an efficient precision rate. In [23], the same set of machine learning algorithms have been used in predicting chronic kidney disease in the medicine field which also yielded an effective precision rate. [24] helps to pick the right transfer function in the neural network used for prediction to yield higher precision rates. [25] explains how prediction can also be done using clustering techniques based on distributed architecture [26].

5 Methods

Most digital payments made by developers collect and produce huge amount of data every day. Machine learning is an important tool for prediction, sorting of data and place a crucial role in profiling, segmentation, credit and debit transactions. Machine learning upgrades the present features of the proposed system. With the help of machine learning the proposed system will be more accurate and more efficient in the real-time world.

5.1 K-Means Algorithm

This technique is frequently used in our proposed system due to its stability and accurate nature. This process is the cluster-based analysis method and it is the process of division of objects into clusters. The objects with similar features and behaviour belong to one cluster and objects with different behaviour and features belong to another cluster with the help of k-means the system will be more accurate and efficient. It is used for handling large amount of data. This clustering process works more fast and efficient while handling a large amount of data. In this process, we use variable called K which represents the number of clusters. n be the comparing factor, d be the time taken for comparing the two segments.

5.2 Improved K-Means Clustering Algorithm

It is used to increase the high precision and decrease time required to compare the two clusters. It automatically defines the quantity of segments and assigns the given segment to uncompared cluster with the help of this algorithm it becomes more accurate and efficient supported by dissimilarity which uses the dissimilarity matrix.

5.3 Fuzzy C-Means Clustering

It is the kind of clustering during which the data belongs to one cluster but these points can relate to different segments. It is the unique way of clustering which is used to remove the noisy and unwanted data. This technique achieves the precision of segments in which remove the noisy and unwanted data. Data pre-processing is the initial step for this process. The bank contains a huge amount of data by using this clustering we can eliminate unwanted data in which the data belong to one cluster and data points can belong to different clusters. In this clustering, the main objective is to remove unwanted and noisy data while comparing the other clusters. Before we had used the k-means clustering with it is used to compare the objects in which the object with the same features and behaviour comes under one cluster in this case the process becomes more easy and the system works efficiently and accurately.

5.4 Artificial Neural Networks(ANN)

Artificial neural networks work similarly to human brain neural networks. It is the process of simulating the inner connection between the neural networks. In this clustering contains many layers and east layer as different functions, each function as a specific pattern it comes under the category it is similar to the working of human brain in which the brain is divided into four parts similarly the ANN is divided into different layers and functions that as to be performed. It is the most efficient algorithm and provides support to the other clustering algorithms. The main objective is to provide a complete structure by combining all the layers with their functions such that it helps in providing accurate results. It is mainly useful for prediction as well as the decision network.

5.5 Evaluation Metrics

By using these four machine learning algorithms the proposed system will be built which aims at providing the credit limit to customers as well as the business benefits. In order to measure the prediction, performance and efficiency nature the evolution metrics are being used. It contains different factors that are used to measure the performance of the proposed system. It also helps in saving the differences between the proposed system and existing system. It gives an accurate value and says the drawbacks of the proposed system as to be changed (Table 1 and Fig. 1).

Table 1 Study of dataset

	Age	Job	Education	Balance
0	59	admin	secondary	2343
1	56	admin	secondary	45
2	41	technician	secondary	1270

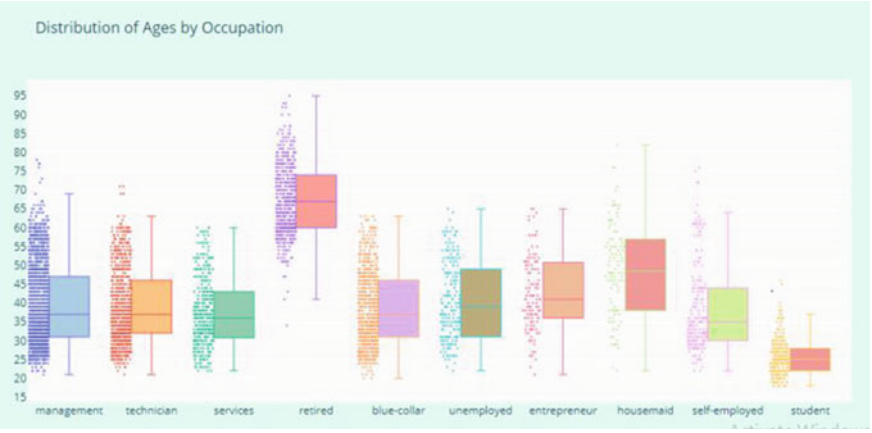

Fig. 1 Distribution of ages by occupation. Precision value = 0.7020914593583486

6 Conclusion

From these, we can say that the existing system is about customer profiling by removing the unwanted data by using data pre-processing in order to update the system the customer profiling is done with the help of the data present in the bank as well as providing credit limit to the customers, it also increases the privacy to the customers by eradicating fraud credit and as well as achieved the business benefits of the bank by using the different algorithms. The main objective of the project is to achieve customer satisfaction as well as to achieve business benefits. All these objectives are been achieved by this proposed system.

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A Model for Achieving Keyword Search on Dynamic Encrypted Cloud Data with Symmetric Key Based Verification

P. Karthika and Ramya G. Franklin

1 Introduction

Searchable Symmetric Encryption (SSE) is actually a useful method for subscribers to properly access the curious cipher texts through encrypted cloud information by means of keywords and phrases [1]. It's turned out to be a great investigation subject contained cloud computing safety measures as well as countless SSE systems are recommended. Nevertheless, nearly all of these just think about seeing keyphrase hunt of fixed encrypted cloud information. Inside training [2], the information saved on the cloud server may frequently have to become kept up to date (added, removed or even modified) by information proprietors. The update dining room table and also the update guidelines help to make the system assistance information characteristics [3]. Moreover, various other powerful key phrase research systems and they adopt tree-based index system, have been recommended [4]. All the above systems don't think about the verification of returned listings coming from the cloud server [5]. Inside training, the cloud server could go back invalid outcomes to the information pc user for preserving computational energy or maybe the software/hardware malfunctions [6]. The very first system, that uses the Message Authentication Code (MAC) to confirm the search engine results, performs adequately with fixed cloud information [7]. Nevertheless, once the information is kept up to date, the information pc user can't confirm if the returned outcomes are freshly kept up to date or perhaps not. In the event the cloud server returns an effect which includes a pair of non-updated file as well as MAC, it is able to spend the verification. Thus, it's not able to protect [8],

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from the replay episode. So as to fix the issue, the next system utilizes the timestamp performance belonging to the RSA accumulator to get the verifiability of listings [9]. It makes accumulators for those documents as well as for almost all index vector bits, that happen to be maintained with the information proprietor [10]. In the event the cloud server returns the non-updated outcomes, the information proprietor is able to identify them with the most recent accumulators [11, 13], [14].

2 Related Work

Various research works are being carried out by numerous researchers for keyword search. Some of the prominent research works are stated in this section. In, the writer has suggested a powerful searchable system which ensures ahead privacy. It simply utilizes the symmetric crucial algorithms hence cutting back on the demands for storage space as well as processing strength on the customer aspect. In addition, the recommended pattern is actually room reclaiming. The writers have built a specific tree-based index framework as well as and possesses suggested a "Greedy Depth first Search" algorithm to offer effective multi-keyword ranked research. The protected KNN algorithm is actually used to encrypt the index as well as query vectors, along with meanwhile guarantee exact relevance score computation somewhere between the encrypted index and query vectors. The suggested type in investigates the searchable encryption issue within the existence associated with a malicious server; the verifiable research skill is actually necessary to offer owners the power to identify the possible misbehavior. Design is actually suggested that's utilizes verifiable and also powerful fuzzy key phrase research (VDFS) program to supply protected fuzzy keyword the search engines, upgrade the outsourced paper compilation as well as confirm the authenticity of this the search engines effect. The program is actually proved universally composable (UC) protection by arduous protection evaluation. When it comes to, TPA just has to carry an encrypted variation of this client's key secret while performing these burdensome things on behalf of this prospect. The prospect just has to obtain the encrypted key element in the TPA when uploading fresh documents to cloud. Also, the layout additionally equips the prospect with power to additionally confirm the validity of encrypted key keys supplied by the TPA [12]. Fuzzy key phrase research is designed for accommodating several typos as well as representation inconsistencies in user that is different looking feedback for appropriate program enhancing as well as general pc user looking encounter while defending key phrase privacy. The exploration on the suggested exploration of can be one of the keys for cloud program suppliers to effectively and securely transport valuation in the cloud infrastructure to the business of theirs as well as single buyers, moreover, hence considerably motivate the adoption of cloud computing within a big weighing machine.

3 Methodology

The existing designs comprise of unquestionable SSE programs supporting info powerful update which are entirely present in a deviated crucial cryptography confirmation, this includes tiresome pursuits. The overhead of look at might become a crucial industry due to the large way of measuring cloud information. In this suggested framework, we check out attaining watchword hunt of fascinating encoded cloud information with symmetric key based affirmation as well as suggest a fair plot within this paper. To be able to assist the able examination of powerful details, we prepare a novel Accumulative Authentication Label dependent on the symmetric key cryptography to provide an affirmation tag for every catchphrase. The serious problem which continues to be proved helpful on inside this brother printer is usually to recognize, n variety of owners is actually accessing exactly the same file signifies, the cloud cannot in a position to reply thoroughly to the end-user that requires the gain access to with the file. If of accessing the identical file implies the cloud is going to be crashed or even different the server is going to be sluggish to use the file. To get over that here, we go with the moment limit. In purchase to buy the file quickly, right here we're making use of the moment cap for your every single end-user that requires the gain access to with the file. By utilizing this, the end-user is able to order the file rapidly along with cloud is going to be simple to react because of the end-user. The end-user must obtain inside time provided to pc user to use the file, in case the end-user doesn't obtain the file signifies, it'll instantly logged through the webpage. The proposed model is divided into the following modules.

3.1 User Interface Design

The key role of the end-user is to move login window to user window. With this login webpage, we've to get into the login page where the user ID as well as password is asked. It is going to check username as well as password is actually matching up. In case we get into any sort of invalid username or maybe password we cannot type in directly into login windowpane to pc user windowpane it is going to show errors.

Thus we're stopping against unauthorized user putting in access into the login windowpane to pc user windowpane. It is going to provide excellent protection for the task as in Fig. 1. Therefore, server has user ID as well as password. Server addi-

Fig. 1 User interface design

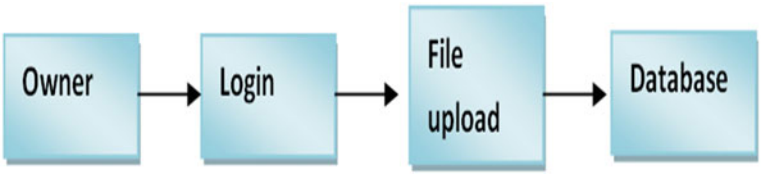

Fig. 2 File upload

tionally has a look at the authentication of this end-user. It effectively gets better protection as well as stopping against unauthorized users. It well improves the security and preventing from unauthorized user enters into the network. In our project, we are using JSP for creating design. Here we validate the login user and server authentication.

3.2 File Upload

Following the end-user login, the end-user is going to upload the file while uploading the file, file articles are going to be encrypted as well as kept placed under a repository as in Fig. 2. File contents, file sizing, just details as well as file sort information on file is going to be saved below repository.

3.3 File Search by Using Keyword

In this module, after user login, the user will search the file by using the keyword e.g., if the user is searching in the name of java means it will check with the database and retrieve the filename related to java and it will be shown to user as in Fig. 3.

Fig. 3 File search

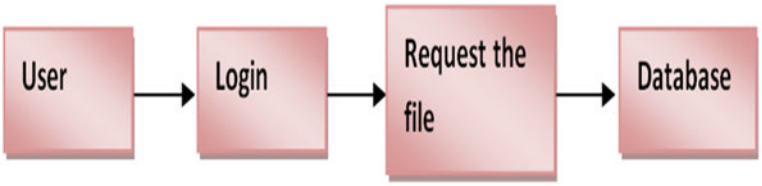

Fig. 4 Requesting file

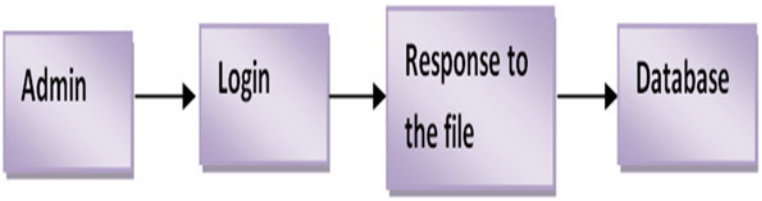

Fig. 5 Admin respose

3.4 User Request the File

In this module, after user searches the file by using the keyword if the user wants the particular file means he can send the request to access the file the user needs as shown in the Fig. 4.

3.5 Admin Response to the File

In this module, after user requesting the file, the request will be received by the admin. After that, the admin will accept the request from the user as in Fig. 5.

3.6 Download the File Within the Time Given to Download

In this module, after admin accepts the request from the end-user, the end-user can download the file by using the key given for that file and time limit will be given to download the file. Within the time limit, the user should download the file otherwise he will be automatically logged off (Fig. 6).

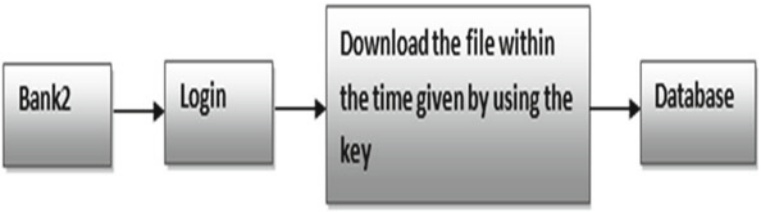

Fig. 6 Downloading file

4 Experimental Results

The system was evaluated on a real-time basis. Numerous people were asked to register and login the database. Some people were also asked to login without any registration. The application was developed using Java NetBeans. The efficiency of the application was performed using various parameters.

5 Conclusion

In this proposed model, we take a look at acknowledging catchphrase hunt of powerful encoded cloud info with symmetric key based examination. In order to assist the effective confirmation of powerful info, we structure a novel Accumulative Authentication Tag (AAT) in the deep perspective of symmetric key cryptography to produce an aggregate confirmation tag for each watchword. Also, an additional shielded shoot influenced by the symmetrical rundown and also the solely connected guidelines is meant to enhance the rejuvenated efficiency. The protection searching as well as the business presentation evaluation demonstrates that the suggested model is actually productive and secure.

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Novel Embedding Based Ranking Approach for Effective Product Marketing on E-Commerce Websites

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1 Introduction

Internet based life site is characterized as "a site that encourages meeting individuals, discovering like personalities, imparting and sharing substance, and building network"; this sort of site permits or empowers different kinds of exercises, for example, business, social, or a mix of the two [1]. Web based life classes incorporate advanced library, web based business, diversion, gathering, geolocation, social bookmark, social audit, social game, and interpersonal organization. Informal community is the Sub category of online networking, which is the social structure of individuals who are joined by normal intrigue [2]. Online life are social channels of correspondence utilizing electronic advancements, work stations, and versatile innovations [3]. These advancements make profoundly intuitive stages through which people, networks, and associations can share data, examine, rate, remark, and alter client created and online substance [4, 5]. These progressions empower correspondence among organizations, associations, networks, and people [6]. Online life advancements change the manner in which people and enormous associations impart, and they are progressively being created [7].

Wide scope of utilizations in business and open strategy utilizes assumption investigation. Nostalgic investigation is currently being utilized from explicit item showcasing to solitary conduct acknowledgment [8].

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Organizations and groups have historically been concerned about how they are perceived by the general population. This issue is the product of a number of inspirations, including advertisement and advertising [9]. Previous to the advent of the Internet, the only path for an organization is to pursue its notoriety. In the media, someone had to be hired for the unique assignment of interpreting papers and physically [10]. The collection of optimistic, negative and impartial references to the organization could include expensive overviews of questionable validity. A variety of articles are being published on the web today [11]. Some of them are distributing dedicated online releases, While others are circulating the pages of their print version in portable document format [12–14]. Not with standing papers, there are a wide scope of obstinate articles Released online in websites and other Private web based networks It opens up the possibility of automatically finding positive or negative mentions of a relationship in papers published on the internet, along these line Reducing substantially the effort needed to collect this kind of data. In the end, companies are becoming more willing to receive a fine analysis of opinion in news stories. Heavy-grained supposition examination is an incredibly testing issue as a result of the assortment of manners by which conclusions can be communicated. News stories present a considerably more noteworthy test, as they normally dodge unmistakable markers of mentalities. Not with standing, regardless of their clear few prejudices, news stories can in any case Bear severe in case they represent impartially Fair or negative occasions. Number of methods used for evaluating opinions include guide less on Methods of dependent Recognition of certain watchwords which reveal the feelings of the creator or speaker [15]. The current system has a major threat in the form of cyber bullying and have higher risk in privacy issues. This system cannot identify the fraud [16].

2 Related Work

Writing study is Most important step in the process of developing programming. It is important to decide the time factor, the economy and the quality of friends before building up the device. When these tasks are achieved, the next stage is to decide which working structure and language can be used to create the system. Before software engineers start building the device, developers need a parcel of external assistance. This assistance can be accessed from senior software developer from books and from websites. Until constructing the structure the above thinking is considered for constructing the proposed framewok. The important part of the task advancement portion takes into account and thoroughly studies all the necessary requirements for the establishment of the venture. For each undertaking. Literature study This is the most important area of programming advancement process it is important to decide and review the time factor asset requirement, labor, economy, and quality of friends before constructing the instruments and the related structuring. When these items are accomplished and are fully summarized, at which point the next stage is to agree on the specifics of the product within theindividual context,

Forexample, what kind of working framework a business should need, andwhat are on the whole the Basic programming is expected to continue at the next level, such as the production of equipment and related tasks.

Serrano-gurrero et al [17] in 'A google wave-based fluffy recommender framework to scatter data in University Digital Libraries 2.0'. These days Digital Libraries 2.0 are chiefly founded on the cooperation between clients through community oriented applications, for example, wikis, web journals, and so forth or new potential ideal models like the waves proposed by Google. This new idea, the wave, speaks to a typical space where assets and clients can cooperate. The issue emerges when the quantity of assets and clients is high, at that point apparatuses for helping the clients in their data needs are fundamental. Right now fluffy etymological recommender framework dependent on the Google Wave abilities is proposed as apparatus for conveying scientists inspired by normal research lines.

The framework permits the making of a typical space by implies a wave as a method for teaming up and trading thoughts between a few analysts keen on a similar point. Furthermore, the framework recommends, in a programmed way, a few scientists and helpful assets for each wave. These suggestions are processed after a few recently characterized inclinations and qualities by methods for fluffy semantic names. In this way the framework encourages the potential joint efforts between multi-disciplinar specialists and prescribes integral assets valuable for the association. To check the feasibility of the Structure proposed, a model of the framework has been created and tried with a few research bunches from a similar college accomplishing victories.

Zhang et al [18] 'A half and half fluffy based customized recommender framework for telecom items/administrations'. The Internet makes brilliant open doors for organizations to offer customized online types of assistance to their clients. Recommender frameworks are intended to naturally create customize recommendations of items/administrations to clients. Since different vulnerabilities exist inside both item and client information, it is a test to accomplish high suggestion precision. This examination builds up a half and half proposal approach which joins client based and thing based communitarian sifting systems with fluffy set strategies and applies it to versatile item and administration suggestion.

It especially actualizes The solution suggested in a clever recommender system programming called Fuzzy-based Telecom Product Recommender System. Trial Returns exhibit the viability. The suggested solution and the specification on which it was based demonstrate that the FTCP-RS can successfully assist clients with selecting the most appropriate portable items or administrations.

Sun et al [19] 'Recommender frameworks based on social networks'. The conventional recommender frameworks, particularly the shared separating recommender frameworks, have been contemplated by numerous analysts in the previous decade. In any case, they disregard the social connections among clients. Truth be told, these connections can improve the exactness of proposal. As of late, the investigation of social-based recommender frameworks has become a functioning examination point. Right now, propose a social regularization approach that joins interpersonal

organization data to profit recommender frameworks. The two clients' companionships and historical ratings (labels) are utilized to anticipate the missing qualities (labels) in the client thing network. Particularly, we utilize a biclustering calculation to recognize the most reasonable gathering of companions for producing distinctive last proposals. Experimental examinations on genuine datasets show that the proposed approach accomplishes better execution than existing methodologies.

Zheng et al [20] in 'A Hybrid Trust-Based Recommender System for online community of practices'. The requirements forever long learning and the fast improvement of data advances advance the improvement of different kinds of Digital Practical Group. In online CoPs, limited soundness and Metacognitive are two significant difficulties, particularly when students face data over-burden and Within the learning state there is no information authority. The analysis proposes a half breed, Trustworthy recommender framework to alleviate Issues beyond learning in online CoPs. A contextual investigation was led utilizing Overspill buffer information to test the recommender framework. Significant discoveries include: contrasting and other social network stages, students in online CoPs have more grounded social relations and will in general interface with a littler gathering of individuals just; the half and half calculation can give more precise suggestions than big name based and content-based calculation and; the Suggested recommender framework can encourage the arrangement of customized learning networks.

Colombo-mendoz et al [21] 'RecomMetz: A setting mindful information based portable recommender framework for film showtimes'. Recommender frameworks are utilized to give separated data from a lot of components. They give customized suggestions on items or administrations to clients. The suggestions are planned to give intriguing components to clients.

Recommender frameworks can be created utilizing various strategies and calculations where the choice of these methods relies upon the zone wherein they will be applied. This paper proposes a recommender framework in the recreation area, explicitly in the film show times space. The framework proposed is called RecomMetz, and it is a setting mindful versatile recommender framework dependent on Semantic Web advances. In detail, an area cosmology basically serving a semantic closeness metric changed in accordance with the idea of "bundles of single things" was created right now. Moreover, area, group and time were considered as three various types of relevant data in RecomMetz.

3 Proposed System

Recommender System (RS): Special kind of data sifting framework that gives an expectation that helps the client in assessing things from a huge assortment that the client is probably going to discover fascinating or valuable.

- Status update (micropost): Short message, partook in an online social stage, communicating a movement, perspective or conclusion.

- Folksonomy: Whole arrangement of labels that establishes an unstructured cooperative information order plot in a social labeling framework.
- This step includes recognizing and removing those particular item includes and the suppositions on them.
- The point of the venture is to mingle the closeout with the goal that individuals from far and wide and even over the landmass can take an interest in it.

3.1 Features of Proposed System

- Collaborative Filtering
- Content Based Filtering
- Clustering (Fig. 1)

4 Modules

In our product marketing on E-commerce web sites Surveys are vital for doing the Sentiment Analysis Task. For the Collection of audits there are various strategies which are utilized right now. The surveys can be an organized, semi-organized and

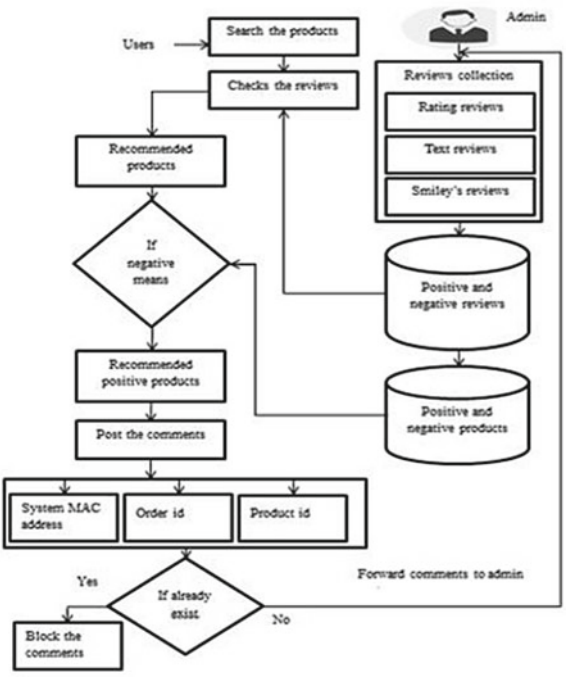

Fig. 1 Overview of the proposed system

unstructured sort. Opinion Analysis inquire about, there are open source system where specialist can get their information for the examination reason. R is one of the Implication-recording programming language and computer state And diagrams provided by the Mathematical Computing Foundation R. By introducing required bundles and verification procedure of social site, to slither the audits from that site is simple undertaking. When we have our content information with us then we can utilize that information for Pre-handling reason.

4.1 Pre-processing

In pre-handling following are a few assignments:

- Removing URLs, Special characters, Numbers, Punctuations and so on. Removing Stop words.
- Removal of Retweets (in the event of twitter dataset).

Highlight choice from pre-handled content is the troublesome errand in estimation investigation. The fundamental objective of the component choice is to diminish the dimensionality of the element space and in this way computational expense. Highlight choice will decrease the over fitting of the learning plan to the preparation information. In various AI calculations were broke down on a news audit dataset with various element choice procedures highlights are generally unigrams, bigrams and grams. POS labeling is utilized in include choice procedures.

4.2 Supposition Word Identification

Supposition word recognizable proof is an essential work in various uses of conclusion investigation and feeling mining, for example, survey mining, assessment holder finding, and audit grouping. Assumption words can be ordered into positive, negative and unbiased words.

4.3 Supposition Polarity Identification

The fundamental undertaking in SA is characterizing the extremity of a given book at the report, sentence, or highlight. The extremity is in three classification for example Positive, Negative and Neutral. Extremity distinguishing proof is finished by utilizing various vocabularies which help to ascertain conclusion score, slant quality and so forth.

4.4 Opinion Classification

Opinion arrangement of news audit dataset and item survey dataset is finished utilizing managed AI approaches like credulous Bayes, SVM, Maximum Entropy and so on. Precision is relies upon which dataset is utilized for which order techniques. On account of Supervised AI approaches Training dataset is utilized to prepare the characterization model which at that point help to order the test information.

5 Conclusion

Right now, we utilized Twitter API utilizing R device which is open source. Tweets from twitter has been gathered and provides for pre-handling task in that instrument. R open source device is utilized in content mining and furthermore to slither gushing information from web based life like twitter and Facebook and so forth. Film surveys information additionally pre-handled in R instrument for feeling examination and conclusion mining. There are distinctive regulated and solo methodologies and various vocabularies, word references and corpus based techniques which are exceptionally useful in Sentiment Analysis. Distinctive dataset are accessible for film audit, item survey, Opinions dataset and so forth. Right now score has been determined and checked number of positive, negative and nonpartisan tweets for given Hashtag and can foresee the popular assessment of specific occasion. According to above investigation of various#Hashtags tweets for estimation examination, individual and industry can locate the popular supposition behind that occasion.

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RETRACTED CHAPTER: A Novel Approach for Communication Among Deaf and Dumb People

Yalamati Mani Pratap, Modukuri Sunil, G. Rama Mohan Reddy, and K. Lakshmi Priya

1 Introduction

Deaf/dumb people use movement-based communication for correspondence reasons. Communication across the company uses movements instead of sound to transmit data [11]. Being attentive to all control, that correspondence presupposes an extremely exceptional job in our human life [12]. Loss of movement is characterized by the total loss of muscle work in any part of the body. It occurs when there is a problem with the message section between the muscles and the mind [15]. Due to the loss of movement, patients are not ready to move certain parts of their body and it is extremely difficult for them to talk to everyone about their needs and help. From now on, our company will help people with disabilities to pass on their messages to specialists or family members [16–18]. This company will help you do something on your own. It is difficult for quiet people to pass on their message to ordinary people [9].

Since normal people are not strictly prepared by gestural communication, correspondence is extremely problematic [10]. In crisis or on several occasions, when

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a quiet person traveling or between a new individual correspondence with close people or who sends a message is extremely problematic [6]. Here we have proposed a shrewd conversation framework that helps silence people to convey the message to ordinary people who use hand movements or signals. The frame uses hand movement by examining the frame provided with movement along with a speaker unit [7]. This chassis is controlled by a 15-volt battery fueled hardware component to run it. This structure offers voice to voiceless for example, voice is given to the person who can't talk [13].

At this blessing inventive world, there square measure the greater part of people World Health Organization (WHO) square measure not too sharp should ha[illegible] a minor low dream on convey as customary individuals with others is certainly [illegible] straightforward errand. An electronic glove is produced for deaf-dumb quiet correspondence mediator framework that assists the almost totally senseless people to talk with steadfastness. Here just 1 hand is utilized. Here five flex indicators are utilized, and each square measure fitted with length of each finger of glove. The hand signal assumes a key job [14]. The signals are decoded by micro-controller.

By each motion (for example making totally various plans of fingers) of the flex sensors. Right now, is utilized to take contribution from flex sensors all the information from PIC16F877 is sent to android mobile and as need be the android telephone will talk the comparing sentence which has been disposed to specific signal worth [15, 19, 20]. The work that identified with the undertaking, for example, of motion acknowledgment that assumes a key job. Right now, the techniques are glove based frameworks [8]. The additional sensors make it simple to gather hand setup and development. In any case, the gadgets are very costly and carry a lot of unwieldy experience to the clients a portion of the previous signal acknowledgment frameworks endeavored to distinguish motions utilizing glove-based gadgets that would gauge the position and joint edges of the hand is contemplated from references. These Gestures which are originated from PIC16F877 board, the Bluetooth module send that sign to Android telephone just when android telephone's Bluetooth is empower. By utilizing the portable App approaching message will change over to voice. At the point when the ordinary individuals need to speak with deaf-dumb individuals, there is likewise one App which changes over discourse to content information [16].

2 Related Work

Abhinandan Das et al. [1] In another examination proposed ISLR framework is considered as an example acknowledgment procedure has two significant modules: highlight extraction and characterization. The joint utilization of Discrete Wavelet Transform (DWT) based element extraction and closest neighbor classifier is utilized to perceive the communication through signing. The test results show that the proposed hand motion acknowledgment framework accomplishes most extreme 99.23% grouping exactness while utilizing cosine separation classifier.

Aarthi et al. [2] Introduced the static hand motion acknowledgment framework utilizing computerized picture preparing. For hand motion include vector SIFT calculation is utilized. The SIFT highlights have been processed at the edges which are invariant to scaling, pivot, expansion of clamor.

Priyanka Lokhande et al. [3] proposed a technique for programmed acknowledgment of signs based on shape based highlights is introduced. For division of hand locale from the pictures, Otsu's thresholding calculation is utilized, that picks an ideal edge to limit the inside class change of edge highly contrasting pixels. Highlights of divided hand area are determined utilizing Hu's invariant minutes that are taken care of to Artificial Neural Network for grouping. The execution of framework is assessed based on accuracy, sensitivity and specificity.

Anetha et al. [4] Other Authors introduced different technique for hand motion, and gesture based communication acknowledgment proposed in the past by different analysts. For not too sharp individuals, Sign language is the main method for correspondence. With the assistance of gesture based communication, these physical impeded individuals express their feelings or emotions to another individual.

Priyanka R Potdar et al. [5] Proposed a framework to help correspondence of almost totally senseless individual correspondence utilizing Indian communication via gestures (ISL) with typical individuals where hand signals will be changed over into fitting instant message. Fundamental goal is to plan a calculation to change over unique motion to content at constant. At long last in the wake of testing is done the framework will be executed on android stage and will be accessible as an application for advanced mobile phone and tablet pc.

3 Existing System

"Speech" and "movements" are the statements, which are mainly used in correspondence between people. The acquisition of information is the initial step. Subsequent advancement, that of perceiving the sign or movement once it has been captured, is considerably more difficult, particularly in a persistent sequence. Here two significant issues are contemplated. The initial one is deaf-dumb and unable to speak individuals speaking with ordinary individual and second one is correspondence among tragically challenged individuals. To take care of this issue, we have utilize two methods of activity right now. We are estimatiing the activities performed by the not too sharp individuals utilizing flex sensor connected to gloves in a hand of the client. When the glove is set in the hands, at whatever point an activity for communication via gestures is played out, the twisting qualities are acquired, and the comparing activity is distinguished by the microcontroller.

4 Proposed System

Our proposition will help the deaf-dumb and unable to speak individuals who can't impart or experiencing issues in correspondence. An arrangement information glove is furnished with flex sensors, every one of the flex sensors is intended to be fixed on every one of the fingers of the hand glove for the observing and detecting of static developments of the fingers of the hand. Whatever the individual needs to impart is initiated by hand motion in the gadget. This information is content is prepared utilizing a microcontroller. Further, the yield from the LCD can be perused by the imbecilic individuals and Alarm can be heard by the individuals. This gadget helps in correspondence whenever joined to both the individual associated with the correspondence who might be hard of hearing, stupid, and normal individual. The propose system removes highlight from the sign through Flex Sensor and afterward transmit that sign flags through Bluetooth to the Android Mobile. This coordinated element improves the exhibition of the framework, the framework fills in as a guide to debilitated individuals. Its application incorporates clinics, government areas and a few global organizations.

```
if(digitalRead(6)==LOW)
{
  Serial.println("Switch ON ");
 mySerial.println("Emergency ");
 lcd.print("Emergency ");
  delay(2000);
  lcd.clear();
}
```

5 System Design

As the FLEX sensor yield is simple structure, consequently on convert to computerized kind there is Analog to Digital converter (ADC). At that point ADC's yield goes in micro-controller module any place writing computer programs is done. What's more, consequently the yield is appeared on LCD. At that point after that spared database signal is then transmitted to Android gadget by utilizing HC05 Bluetooth Module, in the wake of getting that signal itwill appear on application which we have created that shows specific database signal on Display just as there will a sound yield delivered. While we have produce required database sentence concurring that we twist a few fingers and open require fingers. For coordinating given fixed worth flex sensor shifts the incentive in the wake of coordinating the fixed worth it will stop varieties and produce database doled out sound (Fig. 1).

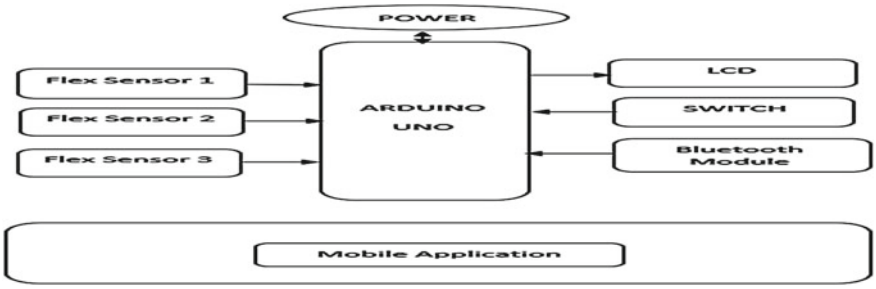
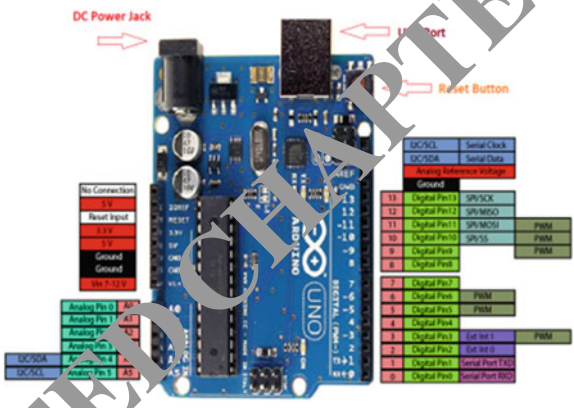


Fig. 1 External view of the proposed system

Fig. 2 Arduino Uno



5.1 Arduino Uno

Right now, informati is prepared utilizing Arduino. Here we use C language for programming A uino. Arduino will settle on choices dependent on information given in senso . ino is a smaller scale controller to which sensors are associated. It tends to e bou t either on the web or in any stores. Arduino appears as though a Mastercard estimated board. There are numerous forms of Arduino. Right now, Un board is utilized. BY utilizing link Arduino board is associated with PC to get p wer. The Arduino—UNO board is utilized right now (Fig. 2).

5.2 Bluetooth Module

The Bluetooth module is utilized to convey content from Arduino to portable/PC shown in Fig. 3. This module sends sequential information to the objective gadget and the objective gadget shows that information on the screen with the required voice or speech. The information sent to the Bluetooth module is the letters in order,

Fig. 3 Bluetooth module

numerical qualities, and so forth this information is then sequentially moved to the objective gadget and presentations the yield and further to programming of discriminate change.

5.3 Flex Sensor

Flex sensor implies adaptable sensors which change obstruction dependent on the bend made by fingers on the sensor. Flex sensors are comprised of carbon resistive component inside a slim bendable substrate as appeared in Fig. 4. At the point when the substrate is calculated the resistive component gives a resistive yield comparative with the bend span. The framework comprises of five flex sensors which are sewed on the fingers of gloves because the principal some portion of the motions are fingers so for each finger a different sensor is required. The movement of the hand is introduced into the frame by means of flexible sensors that twist around the representations of each finger as indicated in the American indication language. As the finger twists the sensors likewise begins bowing and as the sensors twist the protections additionally changes as needs be and that obstruction esteem is inputted to the Arduino Nano (Fig. 4).

Fig. 4 Flex sensor

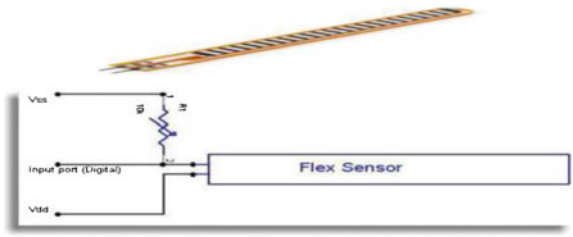


Fig. 5 LCD

Fig. 6 Output

5.4 LCD

Liquid Crystal Display (LCD) screen is connected in the using electronic grandstand module. A 16 × 2 LCD show is a crucial module and it is ordinarily used in various devices and circuits for the information display. These modules are a unit by and large notable in excess of seven fragment and multi divide LEDs. LCD locale unit economical, basically programmable and doesn't have any control of indicating exceptional and even custom characters (not at all like in seven segments), developments in this way. The request record will store the delay rules provided on the LCD display. A request is an address given to the LCD which will perform a predefined activity, clear its screen, configure the cursor position, check the function, etc. (Fig. 5).

6 Results

The connected Arduino module with, speaker and HC-05 helps to get the output of data from the flex sensors in a useful way for communication among duff, dumb and normal people (Fig. 6).

7 Conclusion

The proposed system removes highlight from the sign through Flex Sensor and afterward transmits that sign flags through Bluetooth to Android Mobile. This task

is useful for adding extra assistance of creating versatile correspondence for deaf-dumb & dumb people. Framework for helping deaf-dumb individuals has been finished with the assistance of the savvy sensors and with the help of inserted frameworks. In the work built up a convenient electronic device that go about as an excellent colleague. We structured a basic inserted framework type gadget for tackling this issue. We have use flex sensor for getting the information from the deaf-dumb and unable to speak individuals utilizing sensor-based communication and microcontroller for controlling all tasks. LCD show yield gadget to pass on the message to deaf-dumb and unable to speak individuals. Along these lines, our essential objective right now to give a proper way of life to tragically challenged people group as ordinary ones. Flex has taking a primary job right now. The help of the flex sensor variable obstruction esteem the numerous machines be controlled by interfacing with installed frameworks.

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Comparative Analysis of GUI-Based Prediction of Parkinson Disease by Speech Using Machine Learning Approach

G. Vasudha Reddy, G. Deepika, and A. Jesudoss

1 Introduction

Human stride is the procedure of motion accomplished through facilitated appendage development and the controlled removal of the person's focal point of mass. Step is a mind-boggling dynamic procedure comprising of numerous associating components over shifting time scales. Anomalies in stride are a phenotype predominant to numerous disarranges with causes going from neurological infection, mind harm, physical inabilities, or mixes thereof. The loss of walk capacity and its impact on portability can be of huge inconvenience to an individual's personal satisfaction. The determination and treatment of such an issue are fundamental to save or improve a person's portability. Unusual step work is frequently analyzed by expert clinicians utilizing a mix of past determinations, walk work perception, hereditary information, MRI, CT, and general wellbeing. The various and changing indications related to various anomalies make clinical finding troublesome. This can be additionally exacerbated as development quality can change and side effects may not be available at some random time. Explicit development issues each have their own demonstrative criteria, which to fluctuating degrees spread anomalies in walk and development. Sufferers of various sclerosis are regularly analyzed and treated by the Expanded Disability Status Scale (EDSS) created in 1983 which is as of now despite everything utilized Suffers of cerebral paralysis are frequently analyzed and treated utilizing the

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GMFCS and people with Parkinson's sickness are ordinarily treated dependent on clinical assessment. There has been an ongoing move towards the MDS Clinical Diagnostic Criteria for Parkinson's infection (MDSPD).

2 Related Work

There has been an ongoing enthusiasm for wearable sensors to advance diagnostics and treatment in human services settings with an emphasis on getting step [1]. Be that as it may, constrained work has fused AI to encourage the understanding of the information gathered [22]. An ongoing methodical survey concentrated on stride investigation over various conditions going from lower leg breaks to Parkinson's sickness and cerebral paralysis utilizing diverse wearable sensors [2]. They recognized accelerometers as well as gyroscopic measures as the most widely recognized wearable innovation [3]. AI was once in a while utilized. At the point when AI was utilized, its motivation was to observe a trademark about stride, for example, speed instead of diagnostics. It utilized the F-output and its product to process the crude information and recognize four key qualities [4]. These four criteria were then used to make a finding relating to the danger of ulceration of diabetic patients [5]. It utilized a comparable strategy anyway the investigation of the information was a lot sparser, just concentrating on the middleweight more than ten discretionarily made regions of the foot [6]. Strohrmann et al. utilized an exceptionally fabricated detecting insole to break down the developments of kids with cerebral paralysis [7]. AI was actualized as help vector machines to characterize focal point of weight (COP) directions as indicated by the Edinburgh Visual Gait Score [8]. Profound neural systems are getting increasingly applicable in health informatics. Inertial estimation units have been utilized to evaluate and characterize stride transient spatial parameters [9]. Profound learning has been effectively utilized in the recognition of freezing stride in individuals with Parkinson's ailment, and profound neural systems have been utilized to separate people dependent on walk design utilizing both video film and information from body-mounted sensors [10].

To distinguish engine examples of essential and auxiliary development issues in PD, for example, tremor, inflexibility, dyskinesia, akinesia, and dystonia in a way that is both goals and programmed [11]. To exhibit the utilization of various example learning for identifying PD engine manifestations in uncontrolled home situations. Our work tended to the definition of PD side effect recognition from pitifully marked information as a semi-directed numerous case learning issue [12]. To examine outwardly guided following the execution of both dyskinesia and non-dyskinesia PD patients and check that they can be separated utilizing the information mining method dependent on their exhibition observed under various following conditions [13]. Potential answer to this issue may emerge from the lateralization of the social insurance structure [23]. Following the relationship with the vitality age and conveyance, it has to supplement and expand incorporated top-down restorative

foundations with versatile and horizontally disseminated miniaturized scale medicinal services framework [14]. The infrequent nature of these assessments has the potential to slow the adjustment of Medication and to limit the amount of data gathered about the patient's condition [24, 25]. Additionally, the clinical assessment methods used are subjective, which can ultimately result in inconsistencies in the collected data [15]. Christy et al. (2015) proposed an algorithm for cluster-based metrics which was used for finding outliers analysis than distance-based metrics [16]. G. M. Gandhi and S. K. Srivatsa propose an architecture including attack tree construction, attack detection, and clustering of alerts. By calculating the predicted entropy for a router, alerts are raised for flows in which the predicted entropy is more than a threshold value. Then the alerts are grouped into different clusters according to their source, target, time, and attack-type. It helps to avoid group redundant alerts and to associate alerts that are of the same nature [17]. Prayla et al. (2016) have made an attempt to mitigate the botnet attacks by detecting the same in the early stage. The real network is captured and they have used botminer algorithm with K means and C means clustering to detect the attacks. Their results have shown a remarkable result in early detection [18]. Jesudoss et al. designed an attack-tolerant framework for web applications that provides various services to the web service clients. It changes the basic ws-security architecture for enhancing the performance of the application [19]. Praveena et al. (2019) proposed a system in which the face of an individual is automatically used for the purpose of attendance [20]. M.S.Roobini et al. (2019) proposed a method by using algorithms such as ANN, Naïve Bayes, KNN for classification of Diabetes Mellitus [21].

3 Proposed Work

Valuable information revelation from Web utilization information and good information portrayal for compelling Web-page suggestions are essential and testing. Existing framework gives technique to proficiently give better Web-page suggestions through semantic upgrade by coordinating the space and Web use information on a site. Two new models are proposed to speak to the space information. The primary model uses cosmology to speak to the space information. The subsequent model uses one consequently produced a semantic system to speak to area terms, Web-pages and the relations between them. Another new model, the calculated expectation model, is proposed to consequently produce a semantic system of the semantic Web utilization information, which is the reconciliation of area information and Web use information. Various questions have been created to inquiry about these information bases. In light of these inquiries, a lot of suggestion systems have been proposed to create Web-page applicants. The suggestion results have been contrasted and the outcomes acquired from a progressed existing Web Usage Mining (WUM) technique.

In the proposed system, it present an altered recommendation structure, a system that uses depictions of things and customer profiles reliant on ontologies in order to outfit semantic applications with redid organizations shown as in Fig. 1. The seman-

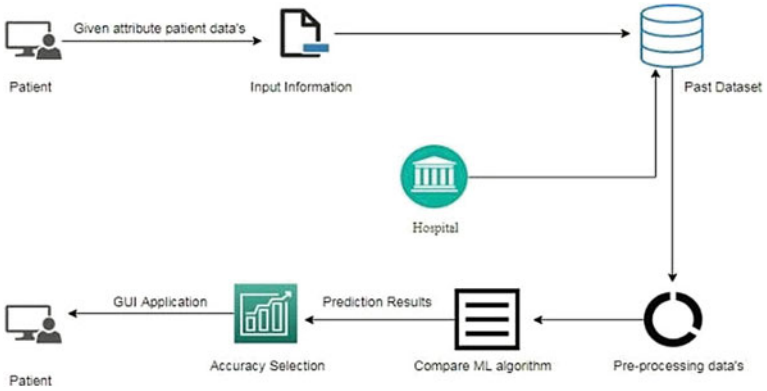

Fig. 1 Architecture of GUI-based prediction of Parkinson disease

tics procedure is achieved by using two unmistakable methodologies. A territory-based procedure makes surmising about customer's tendencies and a logical order based similarity system is used to refine the thing customer organizing figuring, improving all-around results. The recommender proposed is without space, is realized as a Web organization, and usages both unequivocal and certain analysis grouping systems to get information on customer's tendencies. Proposed recommender system is reliant on cosmology and Web Usage Mining. The underlying advance of the philosophy is removing features from web reports and creating appropriate thoughts. By then manufacture theory for the site uses the thoughts and basic terms expelled from reports. According to the semantic likeness of web chronicles to pack them into different semantic subjects, the different points surmise different tendencies.

3.1 Data Validation and Pre-Processing Technique

Approval procedures in AI are utilized to get the blunder pace of the Machine Learning (ML) model, which can be considered as near the genuine mistake pace of the dataset. In the event that the information volume is sufficiently huge to be illustrative of the populace, you may not require the approval strategies. In any case, in certifiable situations, to work with tests of information that may not be a genuine delegate of the number of inhabitants in a given dataset. To finding the missing worth, copy worth, and depiction of information type whether it is glide variable or number. The example of information used to give a fair assessment of a model fit on the preparation dataset while tuning model hyperparameters.

3.2 *Training a Model by Symptom Based Given Attributes with Visualization Process*

Information perception is significant expertise in applied insights and AI. Measurements do without a doubt center around quantitative depictions and estimations of information. Information representation gives a significant suite of apparatuses for increasing subjective comprehension. This can be useful when investigating and finding a workable pace dataset and can help with distinguishing designs, degenerate information, exceptions, and substantially more. With a little space information, information representations can be utilized to communicate and exhibit key connections in plots and outlines that are more instinctive and partners than proportions of affiliation or essentialness. Information representation and exploratory information investigation are entire fields themselves and it will prescribe a more profound plunge into some the books r referenced toward the end.

3.3 *Performance Measurements of SMLT by Speech*

It is a factual technique for investigating an informational collection wherein there is at least one autonomous factor that decides a result. The result is estimated with a dichotomous variable (wherein there are just two potential results). The objective of calculated relapse is to locate the best fitting model to depict the connection between the dichotomous attribute of intrigue (subordinate variable = reaction or result variable) and a lot of free (indicator or illustrative) factors as shown in Fig. 2. Calculated relapse is a Machine Learning characterization calculation that is utilized

Fig. 2 Parkinson disease prediction using speech

Fig. 3 Parkinson disease prediction using tremor

to anticipate the likelihood of a downright reliant variable. In calculated relapse, the reliant variable is a parallel variable that contains information coded.

3.4 Performance Measurements of SMLT by Tremor

A classifier that classifies the informational index by setting an ideal hyperplane between information. I picked this classifier as it is fantastically flexible in the quantity of various kernelling capacities that can be applied and this model can yield a high consistency rate as shown in Fig. 3. Bolster Vector Machines are maybe one of the most famous and discussed AI calculations. They were incredibly well known around the time they were created during the 1990 s and keep on being the go-to strategy for a high-performing calculation with small tuning.

3.5 Performance Measurements of SMLT by Gait

K-Nearest Neighbor is a supervised machine learning algorithm that stores all instances correspond to training data points in n-dimensional space. When an unknown discrete data is received, it analyzes the closest k number of instances saved (nearest neighbors) and returns the most common class as the prediction and for

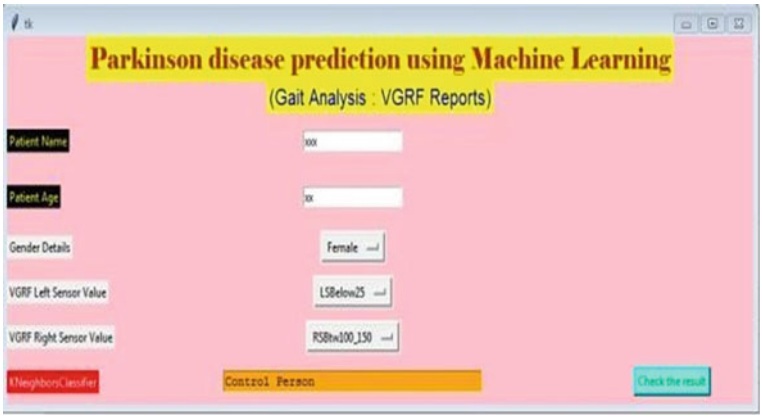

Fig. 4 Gait analysis

real-valued data, it returns the mean of k nearest neighbors. In the distance-weighted nearest neighbor algorithm, it weights the contribution of each of the k neighbors according to their distance using the following query giving greater weight to the closest neighbors as shown in Fig. 4.

4 Conclusion and Future Enhancement

The scientific procedure began from information cleaning and preparing, missing worth, exploratory examination lastly model structure and assessment. The best exactness on the given test set is a higher precision score for discourse is k closest neighbor, for step is k closest neighbor and for tremor innocent Bayes. This brings a portion of the accompanying experiences about analyze the Parkinson malady. Early finding of Parkinson's is generally significant for the patient to lessen its effect. It gave a forecast model the guide of man-made reasoning to improve over human precision and furnish with the extent of early recognition. It tends to be gathered from this model, territory investigation and utilization of AI method is valuable in creating expectation models that can enable a specialist to decrease the long procedure of determination and annihilate any human mistake. Emergency clinics need to mechanize the identifying the malady people from qualification process (continuous) in view of the record detail. To mechanize this procedure by showing the forecast bring about web application or work area application. In future work, the work will be upgraded by implementing Artificial Intelligence concepts.

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Skin Cancer Identification

Appasani Divya Tejasree, Balabhadruni Neeharika, and S. Prince Mary

1 Introduction

The greatest organ of the body is human skin. Its weight lies somewhere in the range of six and nine pounds and the surface zone is around two square yards [1, 2]. Internal piece of the body is isolated by the skin from the external condition [3]. It gives insurance against contagious contamination, microbes, hypersensitivity, infections, and controls the temperature of the body [4]. Circumstances that foil change of the skin, or damage the skin will deliver indications like increasing, consuming, and tingling. Sensitivities, specific ailments, and safe framework connected problems will produce eczema and different skin problems. Brobdingnagian numbers of skin sicknesses, for instance, skin flee, alopecia, ringworm, eczema likewise influence your look [5, 6]. Skin will likewise deliver varied styles of malignant growths. Image handling is used totally differentiate|to tell apart these infections by various ways like division, sifting, embody extraction and then on to induce associate improved image or to induce vita knowledge from an image, it's vital to vary over an image into computerized frame and afterward perform capacities onto that image [7, 8]. It's a bit of sign preparing [9, 10]. The data could be an image and it would be a video, a photograph and yield are likewise another images having the same qualities as information image [11].

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For the most half Image process models take input tests as 2-D signals and afterward they apply mounted sign getting ready techniques to them [12]. It's broadly speaking used innovation currently and its totally different applications within the region of business. It's another examination zone within building and software package engineering additionally. The scope of skin infections is wide. As you possibly square measure aware, roughly 8,000,000 people within the United Kingdom of Great Britain and Northern Ireland as of currently knowledgeable skin malady. Skin illness does not merely damage the skin. The foremost perceptibly awful circumstance is that it will even execute. Recognition of associate will depend on varied parts like that parameters square measure thought of for infection discovery [13]. Right off the bat, take an image, apply channels to expel commotion from the image, section the image to disengage vital knowledge, embody is finished supported input parameters, and afterwards prepare the maladies by utilizing appropriate classifier [14, 15].

2 Related Work

Skin picture unmistakable confirmation has gotten one of the most mentioning and appealing investigation regions in the past barely any years. Siegel et al. [16–18] Shading histogram-based credits are used to separate corrupted skin pictures in gathering to take the explanatory measures. An assist Vector with machining with RBF piece is used for the request for pictures. The preliminary outcomes gave the enabling achieves a hidden undertaking for ID of psoriasis polluted skin pictures. Picture getting ready strategy is executed in MATLAB, for skin dangerous development area. At the present time, skin cancer images are taken in this procedure by Wadhawan et al. [19–21].

Skin pictures for threatening developments of various sorts procured many pictures for BCC (Basal cell carcinoma), and SCC (squamous cell carcinoma). To empty low repeat or establishment disturbance from the picture, filtering is used. After de-noising the picture, center isolating is applied to remove some hair-like material from skin picture, if present Thresholding is the least troublesome and most regularly used system for division. Omar at this moment can separate got picture. Structure process the picture and shows the admonition for therapeutic help. This structure shows convincing outcomes and exactness. Ho Tak Lau et al. [22–24] managed a customized skin harmful development game plan. Open picture is given to the system and it encounters an assorted picture getting ready strategy. Use full information is isolated from the picture and a short time later by planning, examine the system to describe picture. Affirmation exactness of the nervous framework analysis is 90%.

Seema Kolkur et al. [14] a strategy of surface-based segment extraction for acknowledgment of skin illnesses has been shown to decide issues. In accurate surface examination, surface features are enrolled from the quantifiable scattering of viewed blends of forces at decided positions relative with each other in the picture. As demonstrated by the amount of power centers in every mix, estimations gathered into

first-demand, second demand, and higher-demand experiences. GLCM methodology is a technique for expelling second solicitation quantifiable surface features. Third and higher solicitation surfaces consider the associations among in any event three pixels. These are speculatively possible anyway not conventionally executed due to figuring time and getting inconvenience. Skin dangerous development yet various diseases like psoriasis, moles, moles, and dermatitis are in like manner considered in bits of the task. Portrayal of a picture as having sickness or not is mostly passed on by classifiers like neural frameworks and SVM.

Jyothilakshmi et al. [21] a novel framework to normally perceive the risk of skin infirmities by customary captured pictures is described. The strategy used would be of a mind-blowing bit of slack to the dermatologists as a pre-screening structure for early end in conditions where the dermo scopes are not open. This count generally centers around an early examination of the hurtful disorders since they can be reestablished at whatever point is perceived early. The proposed strategy manages concealing pictures by taking the HSV part and preprocessing was performed. An incredible division methodology is performed for the exact ID of the sore. For area reason, the morphological features like asymmetry, edge peculiarity, concealing assortment, and width are used. These evacuated characters help in perceive the perilous bruises from the undermining.

3 Existing System

Tai et al. first fragmented versatile locales of intrigue (ROIs) as suspicious zones, and afterward, ordered every rouse utilizing complex surface highlights and stepwise direct discriminant investigation. Be that as it may, these classifier-based strategies are probably going to miss injuries of "extraordinary" appearance or sizes, since it is extremely hard for classifiers to show all the preparation sores. BI-RADS highlight extraction calculation is utilized to extricate highlights of the info image and contrast the highlights and prepared highlights.

4 Proposed System

The fundamental target of the venture is to recognize the skin sickness through image preparing strategies by means of Mat lab Software. In the proposed framework we actualize SIFT Algorithm. Utilizing this calculation, SIFT calculation identifies key points from a given image. The key point area and the scale estimations of each key point are precisely decided. From that point onward, the direction of the key point is resolved dependent on the neighborhood image angle inside an image fix. We likewise convey SFTA calculation. One is two edge Binary disintegration, and another is highlight extraction. On the twofold disintegration step, ordinary SFTA utilizes staggered Otsu calculation for thresholding. It requires some investment [22]

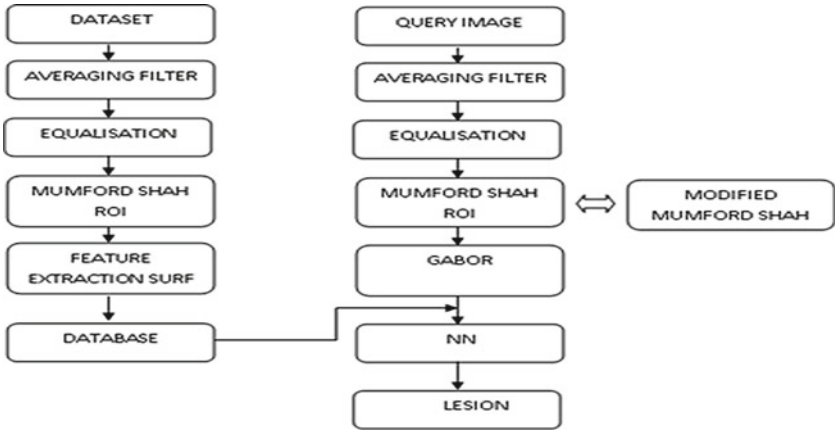

Fig. 1 Overview of the proposed system

to play out the preliminary and test for discovering the best number of edge esteem to do the component extraction procedure, which isn't proficient. Additionally, the edge esteems are not excessively much effective to perform more precision. The locale of Interest is identified after conveying SIFT and SFTA calculations. When it is a distinguished disease district is recognized and applied the artificial neural system to process all the parameters to identify malignancy cells shown in Fig. 1.

- **Matlab Interface**

Right now, programming is introduced, and UI configuration is sent in the framework. Ordinary and malignant growth informational collection is produced from the client's end for information preparation. Preparing set is created from the client end and correlation is made for skin disease location.

- **SIFT Algorithm**

The SIFT calculation distinguishes key points from a given image. The key point area and the scale estimations of each key point are precisely decided. From that point forward, the direction of the key point is resolved dependent on the nearby image angle inside an image fix. Filter calculation viably decides the key points on those profundity images and speaks to them as highlight descriptors.

- **SFTA Algorithm**

On this normal SFTA technique, the total methodology has two phases. One is two edges Binary crumbling, and another is incorporate extraction. On twofold disintegration step, standard SFTA uses amazed Otsu count for thresholding. It requires some speculation [22] to play out the primer and test for finding the best number

of edges regards to do the segment extraction technique, which isn't capable. Moreover, edge regards are less powerful to perform more precision. Again, SFTA has an issue with finding the number of matched pictures from twofold deterioration isolate. Standard procedure isn't generally particularly molded to find the number of crumbled pictures for the creation of feature vector.

- **ROI Detection**

Right now, Interest is distinguished in the wake of conveying SIFT and SFTA calculations. When it is distinguished malignancy district is recognized and applied an artificial neural system to process all the parameters to identify disease cells.

- **Cancer Detection**

Right now, malignant growth is recognized in the wake of applying artificial neural systems.

5 Results and Discussion

In Fig. 2, the comparison between the existing system and the proposed system is shown. The proposed system identifies the type of skin cancer and suggests the doctor and drug based on cancer.

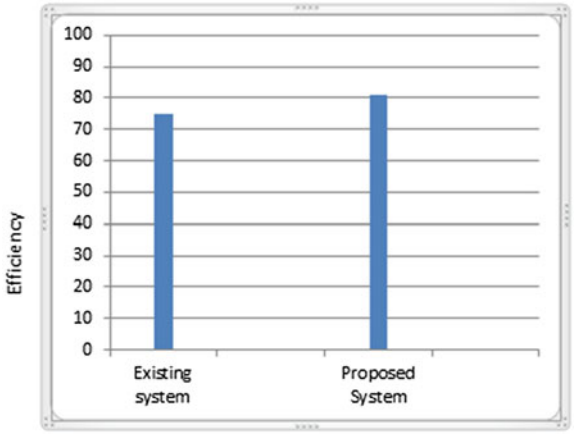

Fig. 2 Comparison graph with existing system

6 Conclusion

Right now, a robotized skin malady identification framework is proposed which will help the therapeutic culture for the early discovery of the skin sicknesses. Hazard factor is whatever influences your opportunity of getting an illness, for example, cancer. Most humans who have at least one skin disease chance factor never create skin malignancy, while numerous humans with skin malignancy have no realized hazard factors. The framework recommends the specialist and medication depending on the malady. We likewise send SFTA calculation. One is two limits Binary disintegration, and another is highlight extraction. In addition, the edge esteems are not excessively much effective to perform more precision. Locale of Interest is identified in the wake of sending SIFT and SFTA calculations. When it is recognized malignancy, locale is distinguished and applied the artificial neural system to process all the parameters to identify disease cells.

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Detection of Crop Diseases Using Agricultural Drone

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1 Introduction

India is a country where agriculture is the main objective of economic development [1]. However, the agricultural field faces lots of problems that lead to a loss in crop yield [2]. The loss of crop production is due to the presence of diseases in the crops. In the agricultural field, it is difficult to identify crop diseases [3, 4]. The traditional methodology of identifying crop diseases is by visual symptoms, which requires a lot of manpower [5]. The disadvantages that arise in this method are inaccuracy of data and consumes a lot of time, which is not suitable for vast areas. Moreover, the time consumption increases as it needs constant monitoring by the workers [6]. Therefore, the concept of image processing is employed to identify diseases in crops [7]. By the use of GPS, we can be able to determine their location. We propose this concept to collect the data and monitor the field rather than the above-mentioned traditional method. It reduces the time of farmers and is suitable for large fields [8]. However, the prediction of crop diseases seems to make the task harder because the accuracy varies for various data input [3]. In this paper, we discuss the algorithm that we use for image processing and the methodology implemented in this paper [9]. The analysis that has been taken from the past, from the paper [10] to get an idea of

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the approaches for the current problem statement. To overcome some of the defects in those systems, we have proposed our system and expect this system will solve the issues faced by the farmers [11, 12].

2 Related Work

Considering the previous research work done on this field by different researchers using several methodologies like Deep Learning and Machine Learning technologies [13]. The paper on the identification and classification of fungal disease affected agriculture/horticulture crops using image processing techniques by J. D. Pujari, R. Yakkundimath, and A. S. Byadgi. The author has focused only on finding fungal infected crops at their primary stage of development through visible marks. This work requires a model made with real-time tasks such as image collection, pre-processing of data, selection of infected part, determining the method of approach for detecting fungal diseases on various crops, and finally the create an architecture for the computer vision system [14]. We get to know that the author has differentiated various crops by their commercial uses such as food crops and collected the images of fungal infections on the crops and their symptoms which affects these selected crops. By the use of different computer vision methodologies from the obtained data, the author has proposed different methodologies for various types of crops for providing better accuracy in results such as performing K-means clustering on defects found on the fruits and stems of the fruit crops. Using k-nearest neighbor methodology to segment images of the crop leaves, neuro-kNN, Detecting the leaves present in Cereals crops using values of RGB, HSI, boundary descriptors, and detecting them through CNN(Convolution Neural Network) [10]. The author has achieved about 90% accuracy in the detection of fungal diseases in each crop.

Crop disease detection using image segmentation by T. H. Jaware, R. D. Badgujar, and P. G. Patil. The K-means clustering algorithm is used by Jaware for image segmentation. K-means algorithm provides better efficiency, scalability and covers large data sets rapidly and it also shows faster convergency but it has too many insufficiencies: the amount of clusters K requires should be initialized; the cluster centers initially are selected specifically [15]. Therefore, the noise points present in the crops influences the creation of the algorithm. The approach which is suggested by the author might be a stepwise image segmentation and recognition. At first, the RGB samples of the images are created. Then a structure is formed by transforming the colors present in their crop leaves through their images. The employment of the K-means clustering technique helps in segmenting the pictures that are obtained from the previous step. The Otsu's method helps in identifying the greenest colored pixels. At last, the cluster of infection goes under the process of conversion from the format of RGB to HIS, the recognition of the disease process is performed through the pre-trained neural network datasets. The entire procedure of research would be repeated for at least three alternate classification approaches with the usage of method including statistical classifiers, classifiers based on neural networks implemented

through the method of backward propagation, Radial basis functions with the usage of neural networks [16].

Application of UAV for Pest, Weeds and Disease Detection using open computer vision By R. L. Hari Shankar, A. K. Veeraraghavan, K. Srinivasan. The author has suggested a system that uses machine learning and ANN algorithms with the help of a drone that identifies the disease tormented area so that we are able to specifically concentrate on the affected area and spray chemicals only on this infected area. This system tends to be cost-efficient as a complete product. The UAV developed by the author uses Ardupilot and locates the diseases present in the crops through image processing techniques using python and open CV. The captured images by the UAV are transferred from R2pilot to the central system and Artificial Neural Network is used by the image processing techniques for accessing the methodology of Space Vector Machine and perform clustering by the approach of K-means [17]. The author proposes two main phases to detect the diseases which include the phases of Training and Testing [18]. Within the phase of training, the dataset is subjected to training and generates a default model which is then employed for comparison and result generation. At the testing phase, the images obtained from the real-time agricultural field compared with the default dataset module and results are determined [19].

3 Proposed System

The proposed framework follows different steps which include data collection, data preprocessing, image segmentation, Intensity variation, Threshold Identification using image processing to detect and localize the diseases present in the crops. At first, we convert the acquired image from RBG to the grayscale variant and detect the diseases by the use of image segmentation and interpolating the threshold value. This process is run faster with the help of CUDA library for better runtime. This then reduces the time complexity of the disease detection process. When the disease is recognized a timestamp is taken and saved along with the detected disease as its index. A parallel process starts to work from the start which employs the GPS module to gather the location data and then saved along with the timestamp. The location is collected at an interval of one second such that the location data of the drone is monitored. The disease detection process and location finding process are correlated to find the disease detected and the location of the disease. Thus, the final output arrives with both the infected disease and its infected location (Fig. 1).

PROPOSED ARCHITECTURE

See Fig. 2

(a) Electronic Speed Controller

An electronic circuit known as Electronic Speed Controller is employed to regulate the rotations and movement of Brushless motor present in it. ESC's are widely implemented on motors necessarily distributing a three-phase electrical power generated

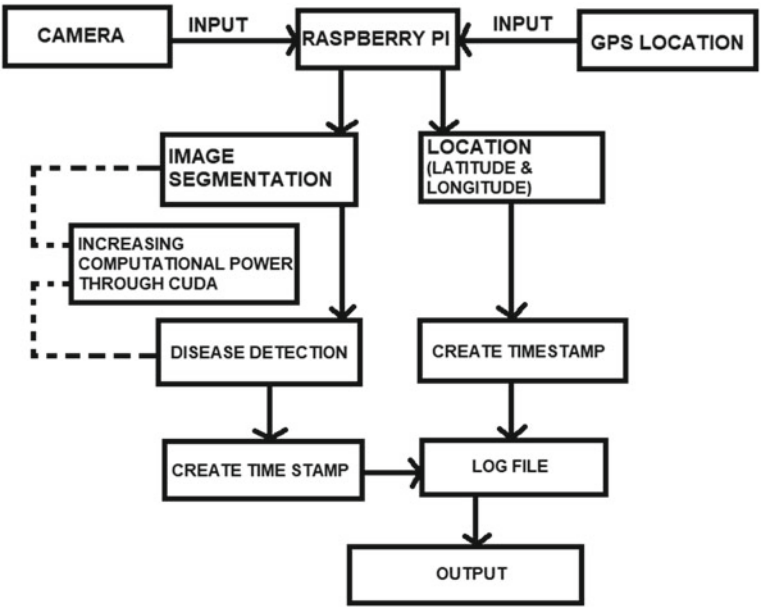

Fig. 1 Flowchart of the project

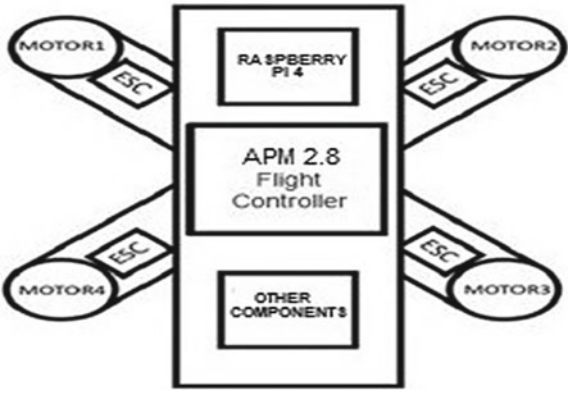

Fig. 2 Drone architure

electronically with a low source of voltage as the energy for the motor. It provides fluid and accurate variations in the speed of the motor. The performance is more adequate than that of a resistive coil of mechanical type and propelling the arm once in common use. In this project, BLHeli 20A ECS is employed sure properties like high performance with great linearity; high throttle response; and for its multiple protection features such as Low-voltage cut-off protection, protection from overheat and throttle signal loss.

(b) Brushless Motors

Brushless motor with a DC power supply also known as motors with electrical storage are run in a DC power supply via switching power supply in closed-loop controller. Rotations of the motors are regulated by the main controller by distributing the current pulses to the windings of the motor. A 2300 kV powered motor is used in this project.

(c) APM Power Module

The APM Power Module is used to monitor the battery and provide a clean power supply to the flight controller.

(d) Raspberry Pi

The Raspberry Pi 4 is used for image processing techniques and data collection process with the help of Pi Camera. Raspberry Pi 4 used for its specifications such as frequency rate of 1.5 GHz with the architecture of 64-bit quad-core processor, Wi-Fi, and Bluetooth support.

(e) Battery

Lithium Polymer Battery is also known as (LiPo Battery, Li-Poly Battery). LiPo 2200 mAh battery is used in drone architecture. It helps to give supply for APM flight controller and the Raspberry Pi.

APM FLIGHT CONTROLLER

See Fig. 3

The APM is a flight control system, it is a multifunctional system which support quadcopter, as well as aircraft of fixed-wing. Capabilities of APM flight controller board

- It supports GPS module.
- It supports data transmission of real-time data.
- It provides an anti-vibration aerial photograph.
- Supports the galvanometer to ensure stable flight.

In this project we use APM flight controller board because it gives stability to drone it helps to get clear image data of crops that help in the further process and it also has an in-built GPS module that helps to stabilize the drone effectively.

Fig. 3 APM 2.8 flight controller board

4 Techniques and Methodologies Used

The methodology is consisting of the drone architecture with their hardware components and the algorithm used for image processing to the detection of the affected crops. The drone that collects the data from the picam and stored in local folder, the stored data are processed in the image processing algorithm which consists of the Image Segmentation, Intensity, and Threshold value variation for detecting the affected crops region.

ALGORITHM USED

See Fig. 4.

We use image processing techniques such as Image Segmentation, Intensity variation, and Interpolation Threshold Value to detect the diseases. The process consists of different steps to achieve this problem statement. At first, the input is segmented in such a way that the crops alone are separated from the input field images present. They are then converted to grayscale and the intensity is varied such that particular threshold value. The image is converted as numpy array for getting the intensity

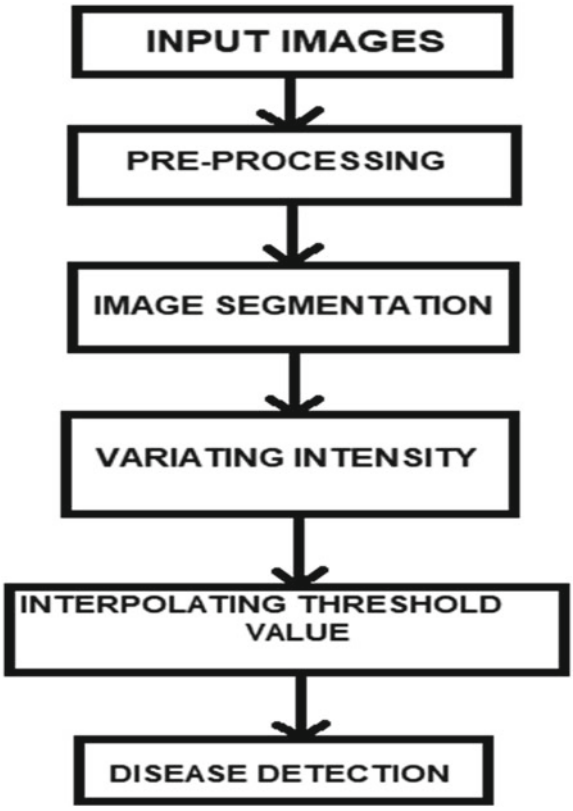

Fig. 4 Proposed algorithm

values of the image. Then they are then differentiated by highlighting the affected area present in the crops. We use image processing to find that specific threshold value which then uses various data acquired at data collection. In order to detect disease and the infected area, we required an image processing architecture between the drone and the Ground Control System (GCS). Henceforth we produce a semi-autonomous framework by which the drone navigates its way through the geographical range given by using the flight controller and Telemetry system. The camera positioned on the drone captures and sends a visual feed of the area it surveys through File Transfer networking system between the drone and the Ground Control System. The Ground Control System Instead Processes it and detected crop region is marked using the coordinates from the drone to the GCS.

5 Results and Discussion

Figure 5 itself consists of various leaves with infected symptoms. These symptoms are collected and analyzed as a graph. The graph consists of various color code which represents the color progression of the disease in the leaves.

The X, Y, and Z-axis of the above graph are represented as Red, Blue, and Green which represents the format of RBG color code. With the help of this color code, we can identify the disease color pattern. Although, the color from the image is not enough to identify the disease. So, we use HSV color code to differentiate the disease. The RGB image is converted to HSV to form a graph of the converted image.

The X, Y, and Z-axis of Fig. 6 are represented as Hue, Saturation, and Value. With this HSV Graph and RGB Graph, we can identify the specific color of the disease. Thus, the image is converted into a gray format for the identification. The color values form the graphs were used as a threshold to filter the image which results in

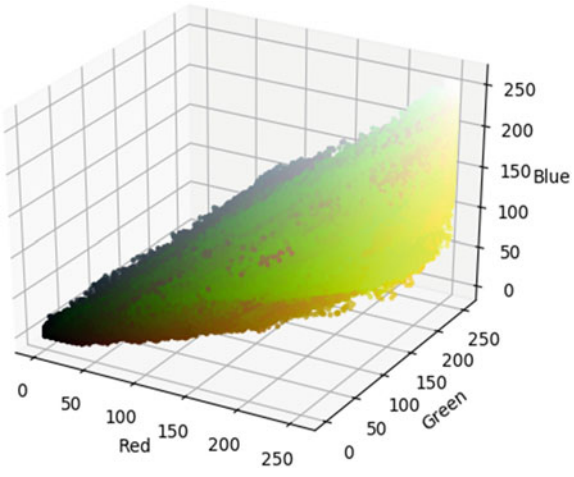

Fig. 5 Disease color pattern of the crop (RGB color code)

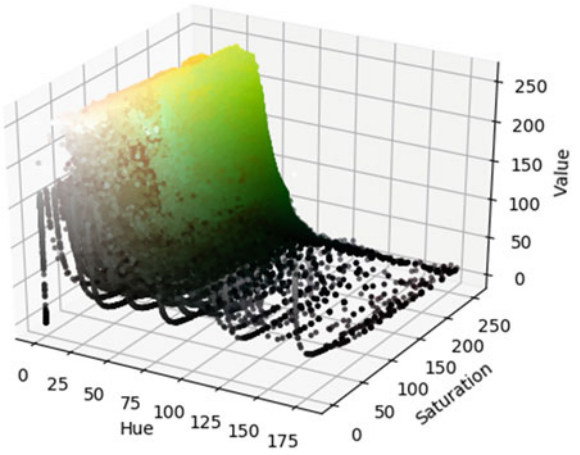

Fig. 6 Disease color pattern of the Crop (HSV color code)

the identification of the disease. A timestamp with location will be made to spot the crop with the disease in the field.

6 Conclusion

Today the detection of crop diseases helps mankind in various forms such as yield, growth, and better farming approaches, etc. The proposed system provides an efficient way to approach the handling of crop diseases. By developing this method, we can detect more diseases from vast data, and also, we can also implement stage monitoring of agricultural crops and tracking GPS with boundary marking using the GPS module. By implementing drones less human intervention is needed, and increasing accuracy with faster processing of agricultural data.

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SEAL—Security-Aware List-Based Routing Protocol for Mobile Ad Hoc Network

Serin V. Simpson and G. Nagarajan

1 Introduction

Wide acceptance of the mobile ad hoc network (MANET) is because of its dynamic topology, mobility features, and ease of deployment. MANET is not keeping any fixed infrastructure for its operations. Nodes can communicate directly if they lie within each other's transmission range. A node is responsible for the dynamic discovery of all other nodes lie in its transmission range. Intermediate nodes in communication will act as routers and those nodes are responsible for forwarding packets towards the direction of the destination node. The rapid growth in MANET offers numerous wireless applications that can be used in a wide number of areas such as military, education, entertainment, and emergency services. The increased acceptance of MANET demands high security in all its application areas. Nodes in MANETS are highly vulnerable to malicious attacks such as eavesdropping, spoofing, denial of services, and attacking routing protocols in any way [1–10].

2 Related Works

Smith et al. [11] proposed a secure framework for MANET using the Pre-Existing routing approach. This model helps the existing protocols to perform authentication, access control, and communication security mechanisms. It uses the help of a

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static trusted authority. That itself induce single point failure. This method also uses public key based certificate exchange mechanism to secure the communication by authenticating the communicating entities.

Saleem Khan et al. [12] have proposed a comprehensive trust model for the isolation and identification of malicious nodes. This paper tries to identify the reason for the packet loss to provide a secure solution for packet loss. The main contribution of this paper includes a fine-grained analysis scheme for packet loss and a trust management method for defending against malicious nodes. The fine-grained analysis uses the parameters like queue information, MAC layer information and rate of link changes to analyze the reasons for packet loss.

Ramkumar et al. [13] have proposed a hierarchical key management model using Chebyshev Polynomials for mobile ad hoc networks. This method uses the session symmetric key. The session symmetric key used here is one time usable, thus the new node is required to collect key shares for every new transaction. In the existing methods, after collecting key shares, the node will regenerate the polynomial function by using Shamir's secret key algorithm. But it cannot identify the requests from malicious nodes. The proposed method overcomes this problem by mixing the polynomial with the Chebyshev sequence.

Qiang et al. [14] have proposed a token-based adaptive MAC model to overcome the hidden terminal problem for a two-hop internet of things enabled MANET. Token-based approach on communication eliminates the packet loss due to congestion. The entire network is divided into small groups. Each group will have one token. Only the node with the token can communicate in the network. That prevents intruders from entering and capturing the network. The congestion control is achieved by limiting the communication with the help of a token.

3 Proposed System

In Security-Aware List-Based Routing Protocol for Mobile Ad Hoc Network (SEAL), the Active Centralized Authority (ACA) plays the role of a single trustworthy node. Architecture consists of two levels of clustering among the participant nodes. Node joining algorithm helps to reduce the overhead of nodes in the network. ACA helps the nodes to generate public/private key pairs. Public key of destination is required in order to encrypt data at the sender side. The use of cache memory in each node offers a fast mode of communication. Cache memory is used to save the received public keys during communication. It helps to reuse the keys in an effective manner. To prevent attacks on ACA, SEAL applies a random shift in Active CA. The proposed protocol uses a list-based approach to ensure overall security of the network. It uses 'Cluster Member List' (CML), 'Cluster Header List' (CHL), 'Freeze List' (FL), and 'Do not Consider List' (DCL) to prevent various attacks towards normal nodes.

3.1 Architecture

Architecture (Fig. 1) consists of Cluster Heads (CH), An Active Centralized Authority (ACA), Required number of Idle Centralized Authorities (ICA), and Cluster Members (CM).

ACA is considered a centralized trusted authority. ACA is responsible for generating Public/Private keys. Each node carries a Public/Private key pair, generated with the help of ACA. Architecture is designed in order to access every node in the network without a large time delay. Thus, the nodes are arranged in a clustered manner. Each cluster consists of a single CH and a number of CMs. Every node in a cluster is allowed to communicate with each other with or without the knowledge of CH. Communication is purely based on the security mechanisms. Both ACA and ICA are allowed to join the network only as a CM under a nearby CH. It is to reduce the overhead of ACA. ACA has direct access to a connected network of all CH's. The security-based monitoring of CH nodes is the main responsibility of ACA. SEAL includes the following phases.

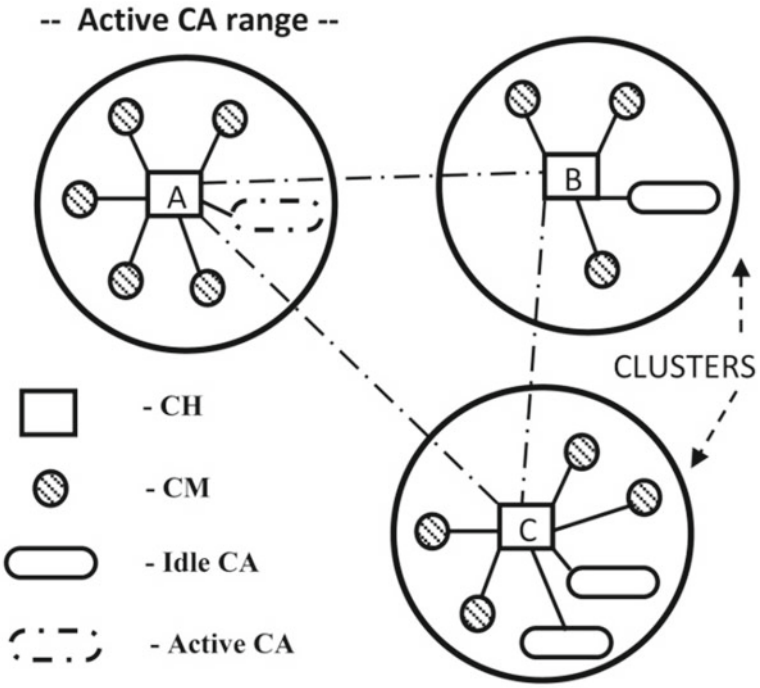


Fig. 1 Architecture of security-aware list-based routing protocol for MANET

3.1.1 Node Joining Algorithm

Nodes in the network are clustered using node join algorithm proposed in previous work [15]. Algorithm explains the way in which nodes are arranged in different clusters. Each cluster consists of a CH node and an allowable number of CM nodes under CH. A newly arriving node sends CM Hello packets to its neighboring nodes. Sender node waits a certain amount of time to receive CH Hello packets from neighboring CH nodes. If it is getting a CH Hello packet, then it will join that CH as its cluster member. Suppose the sender node gets more than one CH Hello packets then it will choose any one CH from the obtained list. Sender node will never get CH Hello packet if it is not in the range of any existing CH nodes. In such a situation, the sender node itself declares as CH node and starts sending CH Hello packets to other neighboring nodes. In order to reduce the overhead of CH nodes, both ACA and ICA nodes are not allowed to become CH nodes. Both CH nodes and ACA nodes are subjected to large computation process. Thus it is better to handle them separately. Also, ACA node is monitoring CH nodes in the network. Thus it cannot declare itself as CH node. So, ICA/ACA nodes are allowed only to become CM nodes. If a newly joining ICA node cannot find a CH node, then it will wait 't' seconds and rebroadcasts CM Hello packets to the network.

3.1.2 Centralized Public–Private Key Generation

ACA chooses a random number, $P'_A \in_R Z^*_\sigma$. It then computes Q'_A using the Eq. 3.1.

$$Q'_A = g_A^{(P)} \tag{3.1}$$

ACA transmits the obtained Q'_A to node A. Node A chooses a random number, $m \in_R Z^*_\sigma$. It then computes Q_A using Eq. 3.2.

$$Q_A = Q^*_A g^m \tag{3.2}$$

Node A transmits (ID_A, Q_A) to ACA. After getting (ID_A, Q_A), node A computes the signature parameter using Eq. 3.3.

$$\mathrm{Sign}_A = X_A h(\mathrm{ID}_A, Q_A) + P_A \tag{3.3}$$

Finally, ACA sends a signature parameter to node A. Node A computes the private key, X_A using Eq. 3.4.

$$X_A = \mathrm{Sign}_A + m \tag{3.4}$$

Tuple (Q_A, X_A) can be seen as the signature of ACA on node A's identity, ID_A. Node A verifies the signature received from ACA and calculates corresponding public key,

Y_A using Eq. 3.5.

$$Y_A = g_{\mathrm{mA}}^{(x)} = Y_A^{h(ID_{A'}, Q_A)} * Q_A \tag{3.5}$$

At the node joining phase itself, CH collects the public key, Y_A of its cluster members. Thus, CH is aware of public keys of its cluster members. CH is responsible for getting the public key of destination to the sender node. If the destination is in its own cluster then it can directly send the public key of destination to sender. CH broadcasts public key request (PREQ) to get the public keys from other Cluster Heads during 'inter-cluster communication'.

3.1.3 Caching of Public Keys

Every communication requires the public key of destination to encrypt messages. Thus, obtaining the public key of destination is an unavoidable task. It offers a certain time delay in communication. It is possible to reduce time delay if we could eliminate the public key collecting phase before communication. But, the public key of destination is required to encrypt messages at the sender side. Thus, the only acceptable way is to reuse already retrieved keys. It is possible to keep the user keys in cache memory up to a threshold [16, 17]. Every node keeps a cache memory to store the public keys of other nodes. Cache memory is limited in capacity. The keys in the cluster can be classified into local and remote category. Public keys of nodes in the same cluster come under local category and public keys of nodes in other cluster come under remote categories. Proper maintenance of local to remote category ratio is necessary to reduce the overhead. The following notations are used to denote the entities: Y_i—Public key of node I, k_i—It indicates a collection of nodes whose public keys are currently in cache memory, N_i—Set of nodes in same cluster, u—The maximum storage capacity, m—Number of public keys present in cache, γ—Limiting Threshold and γ_{cur}—Current 'local public key ratio' in cache.

Let Y_i be a new public key obtained for the current communication. Newly obtained public key has to be stored in cache memory. Update process takes place based on the limiting threshold, γ. This fixed value is predetermined based on the network structure. The cache update happens as in Fig. 2. The system discards already saved public keys in order to avoid the duplicate entry in cache memory. Public keys are allowed to save without replacement till it reaches the maximum storage capacity. Replacement of an existing key is needed whenever it reaches the maximum limit. The replacement strategy is illustrated in Fig. 2. In order to reduce the overhead of nodes, a random selection method is chosen for replacement.

For example, consider a node with the maximum storage capacity (u) of 10 public keys in its cache memory. It will directly save the coming public keys till the saved count becomes 10. After the maximum storage capacity, it will calculate current local public key ratio (γ_{cur}) before adding a newly received key to cache. Assume that, it contains three public keys in local category and seven public keys in remote category.

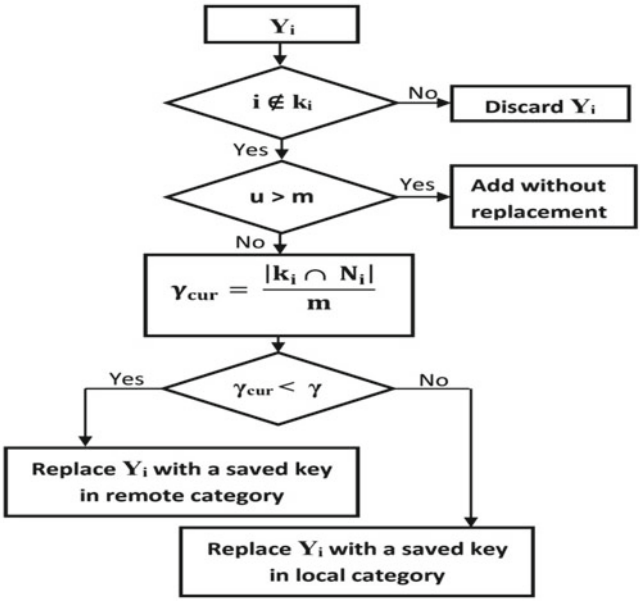


Fig. 2 Caching of public keys

The limiting threshold (γ) is set to 0.5. While calculating current local public key ratio, it will get γ_{cur} equal to 0.3. Here, γ_{cur} is smaller than γ. Thus, it will replace a public key from remote category.

3.1.4 Random Shift in Active CA

ACA is the centralized trusted authority in SEAL. It is very easy to attack if we are keeping one-point access in the network. But, centralized trusted authority is necessary to monitor the activities of the network. The following are the functionalities of ACA, Public/Private key generation, Maintaining a 'Do not Consider List' (DCL), Finding malicious nodes among Cluster Heads, To store public keys of CH nodes, and keeping the list of CH nodes in the network (CHL). Thus ACA is an unavoidable part of SEAL. On the other hand, ACA opens a one-way door to the network. It is very easy to attack the network through ACA. So, the easiest and secure way to handle this vulnerability is to apply a random shift in ACA. The architecture provides a bundle of ICA's in the network. The resource enriched nodes can act as ACA/ICA [18]. Both ACA and ICA are allowed to join the network only as a CM under any CH. It is to reduce the overhead in computation. The presence of ICA's in the network is well known to CH nodes. One ICA is randomly selected to act as ACA. It is allowed to have one ACA at a time in the network. A random shift is applied to ACA in order to prevent malicious attacks. This time-based shift in ACA is monitored by CH nodes

in the network. At the time of random shift, current ACA sends the following to the next ACA through the network of CH nodes, Do not Consider List (DCL), List of CH nodes in the network (CHL), List of Idle CA's in the network and Public Keys of CH nodes. Also, ACA sends the information regarding the next ACA to CH's in the network. The newly elected ACA will send ACA Hello packet to CH nodes. CH nodes verify the received ACA Hello packet with the information obtained from the previous ACA.

3.1.5 Communication

SEAL offers a secure trust-based communication in the network. Sender encrypts the data using public key of destination. Thus, it requires the public key to destination before communication. Sender node first checks the availability of required public key in its own cache memory. Availability of required public keys in its own cache memory offers the fast mode of communication. If the required public key does not exist in the cache, then the sender node should collect the same from the network. Based on network structure the communications can be classified into intracluster communication and inter-cluster communication. CH maintains a Cluster Member List (CML) of its own cluster members. CML contains the ID of cluster members. Sender node checks the destination node in CML. If it contains the destination node's ID, then it is an intracluster communication. In this case, the sender node will get the public key of destination directly from the CH of its own cluster. Sender node sends a Public Key request (PREQ) to CH. CH responds with the Public Key Reply (PREP). Absence of destination node's ID in CML demands an inter-cluster communication. CH node will broadcast the PREQ packets to other CH's. CH node which is having the requested public key sends back a PREP packet with the public key of destination. After getting the public key of the destination node, sender encrypts and transmits the message to the destination, through the obtained path.

3.1.6 Defending Against Malicious Nodes

If a node identifies any malicious node in its neighbors then it can accuse that malicious node. The entire network can be divided into two levels.

- Level 01: Cluster of nodes with a CH—Nodes in a cluster are permitted to send accusations regarding other CM nodes to their respective CHs. CH will immediately remove the accused node from its CML and distribute the new CML to its cluster members. The removed node will be added to the freeze list.
- Level 02: The network of CH nodes with an ACA - CH nodes are permitted to send accusations regarding other CH nodes to the ACA of the network. ACA will immediately remove the accused node from its CHL and distribute the new CHL to its cluster members. The removed node will be added to the freeze list.

Removing a node from CML, in turn, cancels the ability of that node to participate in the communication. The accusations will be analyzed in order to identify the false accusation. This process is different on both levels. In level 01, the CH will collect all the accusations from its cluster members. Once it receives the accusation, then the accused node will be removed from CML and added to the freeze list. The CH may receive the same accusation packet from different CM's. If the accused node is already added in the freeze list, then CH will keep a counter variable 'c', for that particular accused node. The counter variable is initialized with the value '2'. In level 02, the ACA will collect all the accusations from CH nodes. Once it receives the accusation, then the accused node will be removed from CHL and added to freeze list. The ACA may receive same accusation packet from different CH's. If the accused node is already added in the freeze list, then ACA will keep a counter variable 'c', for that particular accused node. The counter variable is initialized with the value '2'. After the detection of malicious node in level 01, the CH will request a DCL update to the ACA. ACA will update the DCL and distribute the newly updated DCL to all CHs. CH will exclude the malicious nodes from its CML. In the case of Level 02, the ACA can itself invokes the DCL update.

4 Simulation Results

4.1 Simulation Model and Parameters

Network Simulator (NS-2.35) is used to perform the simulation. The Ad Hoc On-demand Distance Vector (AODV) routing protocol was chosen for the simulations. The simulation results are the average of 10 runs (Table 1).

Initially, 48 nodes are simulated at the position (0, 0). Some simple node movements are applied to the nodes at 0.4 s. After those movements, nodes will be deployed in the simulation area. A random movement is applied to all nodes for producing mobility. After the successful deployment of nodes, the simulation performs the node joining process as per the proposed scheme.

Table 1 Simulation settings

Simulation time	1–50 s	Routing protocol	AODV
Transmission range	270 m	No. of nodes	48
Propagation model	Two Ray ground	Area Size	1250 × 1000
Minimal speed	5 m/s	Traffic source	CBR
MAC	802.11	Simulator	NS-2.35

4.2 Performance Metrics and Comparison

For the performance evaluation, the proposed Security-Aware List-Based Routing Protocol (SEAL) is compared with the Self-organized Key Management with Trusted Certificate Exchange in MANET (SOKMTC) scheme of [19]. Performance is evaluated according to the following metrics, Routing Overhead, End-to-end Delay, Packet Delivery Ratio, Packet Drop, and Resilience.

The routing overhead of SEAL is compared with SOKMTC and plotted in Fig. 3. The overhead has a linear progression with respect to the time. But, we can see that SEAL maintains a lower overhead than SOKMTC, due to the following reason. The caching approach on the public key in turn reduces the overhead for collecting the public key whenever it requires.

The end to end delay is plotted in Fig. 4. SEAL is able to maintain the overall delay without additive increase with respect to time, due to its proper network maintenance strategy based on trust value. As obtained through the simulation results, (Fig. 5) SEAL has a higher delivery ratio than SOKMTC. Identifying and eliminating the presence of malicious nodes helps the network to deliver the packets without a drop. The performance pattern on SEAL in the packet delivery ratio is evident in packet

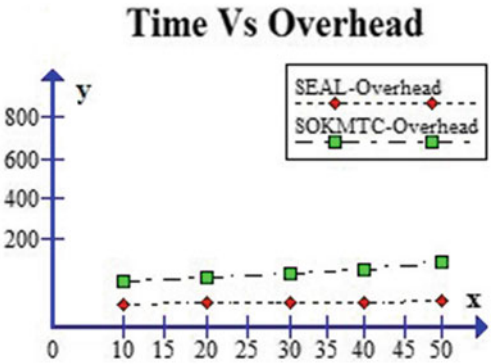


Fig. 3 Routing overhead

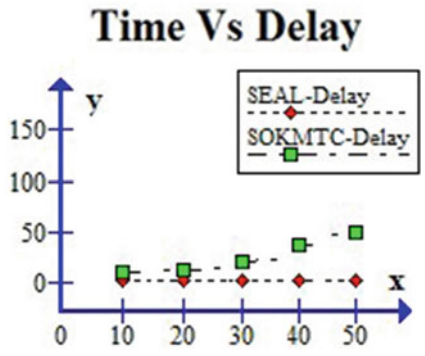
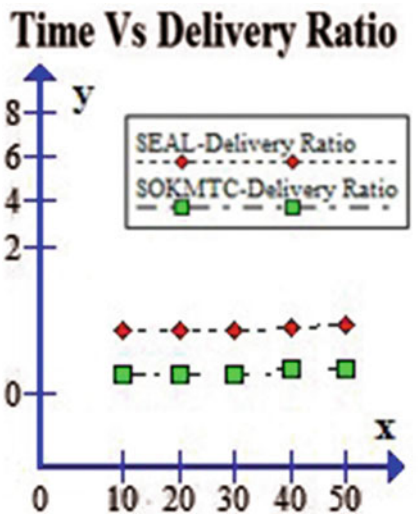


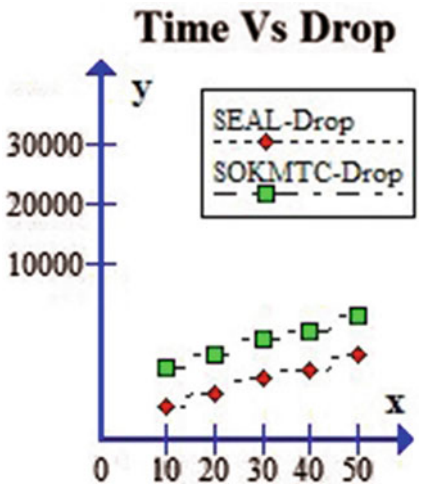
Fig. 4 End-to-end delay

Fig. 5 Packet delivery ratio



drop results. The decreased packet drop (as shown in Fig. 6) is the reason for the increased delivery ratio. The resilience metric is a performance metric to evaluate the overall performance of the network in terms of the successful delivery of packets. As shown in Fig. 7, the resilience of SEAL is lower than SOKMTC. The lower value of resilience indicates better performance of network.

Fig. 6 Packet drop



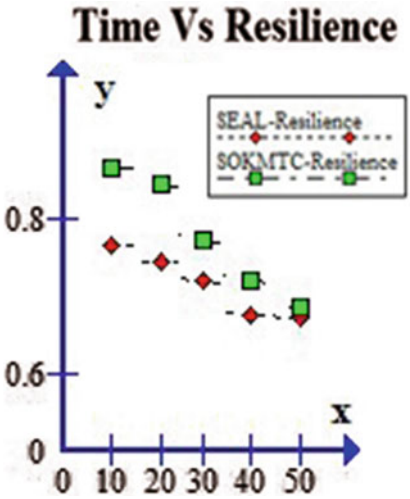


Fig. 6 Resilience

5 Conclusion

The SEAL offers a robust and efficient routing in the network with less computational overhead. It has a well-structured architecture with an efficient node joining algorithm. A public key encryption scheme is adopted to make the communication secure. Thus the public key retrieval process is an unavoidable part of SEAL. Rather than using a certificate-based system, SEAL uses a list-based approach to eliminate the malicious nodes. It uses an accusation based malicious node identification system. This approach in turn reduces the computational overhead of the CH node. Here the CM nodes calculate the trust value of their neighbors and report the malicious nodes to the CH node. CH maintains a CML with respect to the DCL received from the ACA. The list-based approach helps to find invalid accusations from a malicious node. SEAL uses four lists to defend against the malicious nodes; Cluster Member List, Cluster Header List, Freeze List, and Do not Consider List. Due to the centralized architecture of the ACA node, the network is more vulnerable to malicious attacks. Thus, the SEAL protocol introduces a random shift approach in ACA. To reduce the communication delay, SEAL reuses the received keys with the help of cache memory. SEAL can be extended to improve performance and efficiency. It is possible to apply a probabilistic based approach to find invalid accusations. That will increase the reliability of SEAL. The basic structure of SEAL can be adapted to any existing protocol to achieve an efficient performance without the further overhead.

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An Extensible Framework for Effective Visualizing and Predicting Crimes Using Big Data Analytics

K. Venkatesh, K. Hari Somasekhar, and R. Vignesh

1 Introduction

Crimes are general common problems that make a difference near full filament for a country's home, the improvement related to money and reputation [1]. Infringement is one of the essential parts that influence a couple of critical decisions in a person's life, e.g. moving to another place, wandering at the perfect time, avoiding risk areas, etc. [2, 3]. Crimes influences and condemns the image of a system [4]. Also, misconduct has an impact on a nation's economy by imposing a budget burden on the governing body because of the conditions for the police, the courts, etc. [5, 6]. More with the passionate increase in crimes, we are in an annoying phase to reduce it significantly faster [7, 8]. Practical examination of past misconduct data predicts misconduct and therefore reduces the rate of irregularity [9]. The evaluation methodology combines the analysis of reports of wrong behaviour and the perception of the creation of models, the course of action, and the examples with the maximum force that could be normal [10]. This exam includes estimates, requests, and maps on demand. It also helps to check if lousy behaviour suits a particular well-known director or if another activity is needed [11, 12]. Crimes can be expected as criminals are dynamic and work in their standard fields. The moment they are productive, they strive to reproduce incorrect behaviour in relative conditions [13]. The chance of misconduct depends on a couple of components, for example, the knowledge that a crime has, etc. [14].

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Criminals always locate a related place and period to demonstrate the crimes that accompany it [15]. Regardless of how it may not be legitimate in all cases; however, the credibility of the emphasis is high, according to the looks, this makes terrible behaviour visible. Empowering lawbreakers to focus on a wide scope of exploited people like ventures, administrative organizations, and people [7].

2 Related Work

The examination of crimes and desires is a critical development that can be rationalized using various methodologies and methodologies. Currently, several researchers are doing an incredible part of the evaluation work [16]. Existing work permits the use of data sets to perceive territories of incorrect behaviour. However, no one is considered as a type of crimes, the date of crimes as a factor. Al gives static maps without intuitive features [17]. To conquer these obstacles, the anticipated framework offers representation procedures that consider the type of incorrect behaviour to perceive the essential reasons for the wrong response and used to verify these circumstances with the properties of a correspondence using maps [18].

Hardly any reports have focused on the use of decision trees because of the desire for crimes. Ahishakiye et al. and Iqbal et. At the same time, he used the qualities of the country's masses, the ordinary family allowance, the unemployment rate of people over the age of 16, the type of misconduct, etc., which perhaps predicts if there will be a stop in a domain, medium or low degree of the horrible offense. It can happen later. The techniques they proposed did not predict the type of crimes that could occur. Nasridinov et. In addition, they anticipated a procedure for planning the irregularity that to be in high, medium, or low [19]. None describes the type of misconduct that can occur and its likelihood of it occurring [20–22].

3 Existing System

The relationships between various different attributes inside a large amount of data are defined from the techniques like data visualization and data mining. The optimal model with the highest accuracy can be obtained from the machine learning algorithms. Time series is a sequential data that is listed in the time order. The data in the time series are equally spaced so that the information is different in time. This model is used to estimate the time series data constructed on an additive model where nonlinear trends are combining with daily or weekly seasonality, plus holiday effect. It performs effectively with the time series by having a strong seasonality effect.

Drawbacks of Existing System

- Not a uniform framework
- Cannot capture the dynamics within a region

- Cannot capture future crime accurately
- Tough to find the accurate patterns
- Inter region patterns cannot be found.

4 Proposed System

Advantages of Proposed System

- Can analyze heterogenous and multi-sourced data.
- Can easily identify similarities from incidents.
- Supports time series modelling.
- Enhances the prediction accuracy for classification.

Working of Proposed System

The proposed system can offer statistics about crime deterrence selection options. The conclusion categories are made based on crime and interval forecasting data. Choice of every resolution option is based on the level of crime limit and forecasting values. Distribution frequency is used to classify the range limit. The levels of frequency are high level, medium level and low level. Based on this level, the conclusion options are made. This prediction technique provides an exact prediction for the location of the crime. And also performs the collecting and managing large volumes of accurate data.

Methodology

For an ideal examination and forecast of criminal episodes, a wrongdoing expectation and observing system dependent on a spatial investigation are presented. Right now, perception procedures are utilized to all the more likely dissect information. This structure is actualized from a GUI-based device that utilizations the R program that having different libraries. The strategy and the various stages are depicted beneath.

Data Pre-processing

The dataset that is utilized for this activity is reliable, authentic, and in good faith, the information is obtained from the UK Police Department's official website. The dataset has a summation of all the 11 qualities, from that five should be attended for the examination; they are the type, area, date, scope, and length of the irregularities. At this stage, the history of abnormalities of 2015–17 was seen as the set of preparation data. In the pre-processing phase, the elimination of conflicting information (e.g. missing qualities, excess data, etc.) and the change of data are carried out to anticipate irregularities in the accompanying structures.

Visualization Using Gmaps

This module separates late wrongdoing information from the informational collection and, in view of longitude and scope, recognizes the particular area of the city. This

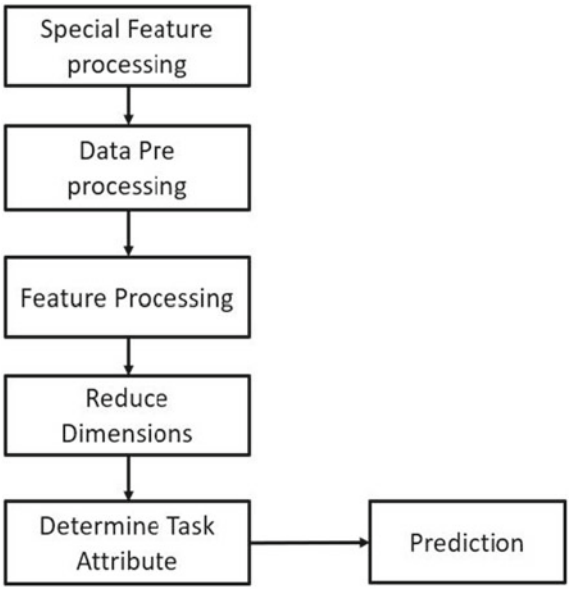

Fig. 1 Architecture

marking additionally shows the name of the wrongdoing area, the sort of wrongdoing that happened. This data is valuable for a person to find out about dangerous and hazardous territories and, consequently, can assist them with maintaining a strategic distance from such zones. The picture can assist police with improving security in zones. Figure 1 shows that the spots where the violations happened are near one another. From this, we can break down that if a spot is attainable for a criminal assault, close by places are additionally plausible for the wrongdoing to happen. This structure additionally offers the likelihood to demand data on a particular spot to show what kind of wrongdoing is probably going to happen in that spot.

5 Algorithm

Step 1: In the first step, we load the previous year's data for optimization purposes.

Step 2: Then we have to remove the duplicate attributes from object data type by data pre-processing.

Step 3: Then we can compare the primitive datatype attribute by months and weeks format and draw a graph based on the obtained data.

Step 4: Now we have to spot the areas with the high crime rate happened for both moths and weeks separately.

Step 5: Similarly, we can spot the areas based on primate datatype and the description.

Step 6: Finally, we can provide more protection where the crime is happened based on the above graph.

6 Results and Discussions

See Fig. 2.

7 Conclusion

- The algorithm we made gives a structure to survey wrongdoing network and researching them through different AI estimations using Google Maps and unmistakable R groups.
- The endeavour urges crimes inspectors to explore these crimes frameworks through various natural discernments.
- The usages of astute and visual limits will be significant for instructing and discovering criminal models. Various portrayal models can be considered and took a gander at in the assessment (Fig. 3).

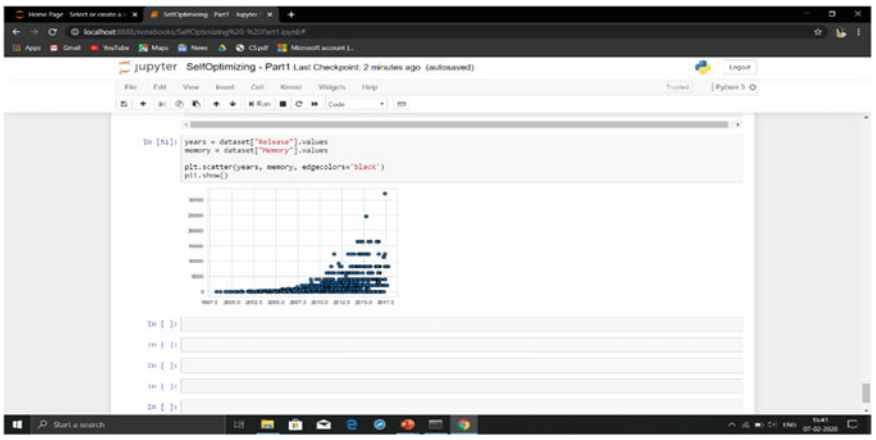

Fig. 2 Graph depicts primary datatype versus months

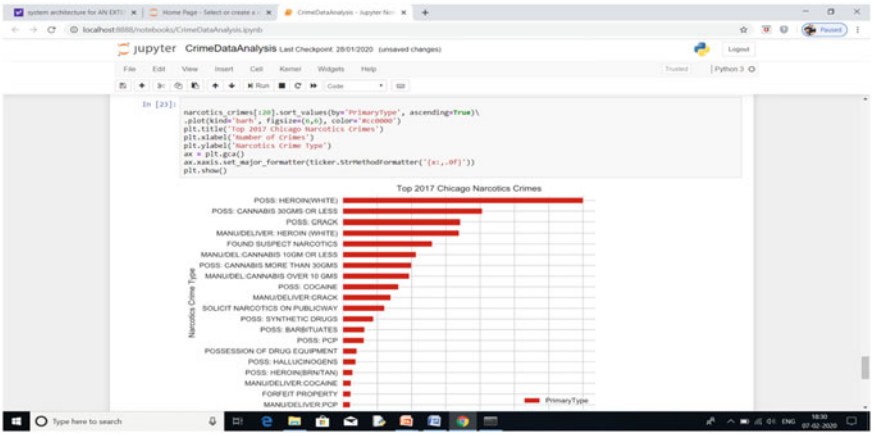

Fig. 3 Predict the areas where the crimes occur

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Event Detection from Social Media Using Machine Learning

Ruhi Ajit Patankar and A. Pravin

1 Introduction

Popularity of social media networks is increasing at a rapid pace. Posts are being generated at a much higher rate. Billions of social media users are exchanging these posts. Lots of people are using social media to share their views and information about events. Twitter has become an important information resource that incorporates enormous quantity of user-generated content.

Social media incorporates several applications that permit the users to share information and to participate in different activities. The social media platforms have become the most popular platform in the research area providing opportunities. The information generated by users can be used for detection of events in medical, educational, and social sectors.

There has been a significant advancement in social media which allows the users to share information about various events, which improves information sharing among the users. An event can be considered as an episode present in a big story and event detection can benefit from the analysis performed on social media content and enable efficient event search.

In social media micro-blogs, large amount of data is available which is present in many different forms. The availability induces many difficulties in analyzing and processing such data. Thus event detection from social media becomes a challenging task.

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The data is present in raw form which creates many difficulties in detecting events. Suitable preprocessing steps are needed to be chosen based on type of data used in event detection. Also, methods need to be developed for detection of events using images that have been shared by the posters.

2 Motivation

It has been shown by recent studies that most of the world's population is mainly active across social media. This fact grabbed the attention of many researchers present all around the world. Also, the desirability of event detection is increasing because most of the users communicate using social media posts. The different organizations are interested in event detection in order to increase their business and for many other things. The event detection from social media provides betterment in security, social studies, and news gatherings. However, the literature survey performed has shown a need for implementing a better event detection model. The event detection must be carried out utilizing all the necessary features rather than considering certain hand-picked attributes. Also, the development of new AI techniques supported by multiprocessing hardware is a big motivation. Event detection in social media has a different perspective to make significant improvements in it.

3 Event Detection

Given large streams of social media posts, the purpose of these methods is to identify unknown events in the form of sets of posts that describe them. In general, the events can be of different types, but there are certain approaches that focus on a specialized type. There are many event detection methods and algorithms to find out the current and most popular events on social media like Twitter, Facebook, LinkedIn, Instagram, and many more. They are basically of three types of approaches on which event detection models are based [1].

3.1 Topic Modeling Approach

A significant topic modeling approach is given by Shi [2]. Shi [2] proposed a HITS based method, that is Topic-Decision Method commonly known as TD-HITS.

HITS(Hypertext Induced Topic Search) is an algorithm which is basically used to discover and rank the web pages relevant for a particular search. HITS uses concept of hubs and authorities for search. Based on HITS, TD-HITS method reduces the size of the dataset by extracting high-quality posts and posters. This method filters irrelevant

and unnecessary posts and normal users from the dataset and greatly increases the accuracy of the model.

Further, it also finds the count of topic to be explored which acts as an input for the topic models.

Further Shi [2] also devised an LDA (Latent Dirichlet Allocation) model and a three-step method based on LDA which detects the highly important events based on the count of topics provided by TD-HITS and also identifies the influential spreaders that are involved in sharing this extremely important events.

3.2 Document-Pivot Modeling

Second is Document-pivot which is basically made up of the methods that represent the document as an item to be clustered using some similarity measures. Event detection is done using both images as well as text for improvement of accuracy [3]. This method greatly boosts the performance of model used for detecting the event by considering that obtained results must be relying on the information gathered. This method outperforms many other event detection techniques because of inclusion of images along with text for event detection. The method firstly extracts the text tweets and tweets which consist of only sole images from tweet stream and stores them into a database [3]. Further, a text-mining algorithm is used for detecting noticeable events. In its initial stage, the algorithm finds out the events based on text only by using the attribute of the bag-of-words which is calculated using the term frequency-inverse document frequency (TF- IDF) method [3, 4]. If a certain threshold for accuracy is not satisfied then it discovers the events based on images by using grey-level co-occurrence matrix, color histograms, and other visual features.

An improvised version of TF-IDF and threshold(based on time) has been proposed later in order to calculate the significance between various types of events. In this implementation, a supplementary dataset is used to calculate the inverse document frequency, where the documents were not known. A stage-based incremental inverse document frequency method was proposed. In this method, we consider a decay factor and time slide to measure the similarity between the events.

Zhiliang Zhu in [5], proposed an improvised TF-IDF algorithm called Time Adjusted TF-IDF, to remove the problems encountered in preliminary TF-IDF while assigning the priority to recent topics.

3.3 Feature Pivot Modeling

Feature pivot methods are based on finding abnormal patterns in the appearance of different features, such as words. Once an event happens, the expected frequency of a word will be different compared to its historical behavior, which shows the occurrence of a new event.

In [6], the method proposed is Weighted Dynamic Heartbeat Graph method is formulated to detect events. It is based on feature pivot approach. After detecting an event, WDHG method forcibly removes the keywords which are burst yin nature at upcoming time intervals. This feature enables other related information to be seen clearly and helps in finding new events. It continuously captures the changes observed in patterns in time-stamped data within Twitter stream and highlights occurrences which are most important. This method is highly sensitive to change because it forcibly removes high-frequency events after their first detection. It is an efficient method and can find out the critical events in polynomial time.

3.4 Related Techniques for Event Detection

Posts in social media are small-sized and on-topic. Thus, it is not easy to find the necessary information about events from the small-sized and noisy data of one single microblog. Under this circumstance Gao [7], proposed a model to generate an object called as micro-blog clique (MC), to represent the grouped microblogs. A MC (set of microblogs with high co-relation factor). These micro-blogs are related to the similar topic within a small span of time. Using these cliques, a bipartite graph can be constructed and is further partitioned to generate the new cliques.

In [8] GEOBURST method is proposed for local event detection. An authority measure is introduced to capture the geo-topic co-relations among tweets. This method selects tweets at a particular location as pivot in the query window. These pivots are used to generate candidate events. This method further compares the candidates against the aged events to select the spatiotemporally bursty topics. It also features an updating module which is used to find out the new pivots as the query window shifts in time.

A temporal Analysis of social media events is implemented by Aldhaheri in [9]. Aldhaheri [9] used Twitter API for Event detection. He implemented a Temporal Social Network Graphs which is used for event detection model. Using this model, a Novel Social network Transformation approach was proposed. This method was used to transform the social media streams which were taken in the JSON format into social network graph. This graph then further converted into social temporal images. Events are detected using these temporal images.

4 Event Detection Methods

4.1 HITS and LDA

HITS: First step in event detection is to extract the high-quality post, for that HITS method can be used [6]. TD-HITS method is used to reduce the size of data-set by

removing the unnecessary posts and the users having less influence. The TD- HITS method has two modules: first, the HITS algorithm finds out the important posts and users with a much greater influence from the enormous data-set of posts and users posting them. Thus, the size of the training data-set is suitably reduced. Second, a method is used to discover key posts and find out the count of topics to be explored from a data-set of large number of posts.

To create a direct link between users and their posts, matrix is constructed by using the user's operations records to keep track of link between the users and their posts. Rows present in the matrix are used to denote the posts and columns are used to denote the users. The user who forwards many influential posts can be considered as an important user [6].Similarly, a post is considered important if it is posted by important users. Auth score (authority score) is measure related to every post and hub score (hub score)is measure related to the users. Greater the auth score, greater is the importance of the post. Also, greater the hub score, greater is the importance of the user.

They are calculated using the following formulas using the mutual relationship posts and users (Fig. 1).

$$\text{post.} \cdot \text{a\_score} = \Sigma \text{user} \cdot \text{h\_score} \tag{1}$$

$$\text{user} \cdot \text{h\_score} = \Sigma \text{post} \cdot \text{a\_score} \tag{2}$$

Final values can be computed as following:

$$\text{A score}_n = \text{M}^{\text{T}}\text{M}\ \text{Ascore}_n 1 \tag{3}$$

$$\text{H score}_n = \text{M}\ \text{M}^{\text{T}}\text{Hscore}_n 1 \tag{4}$$

LDA: In microblogging network, LDA model is used- for allocating various posts into their respective topics [10]. In LDA, the topic distribution that is the probability

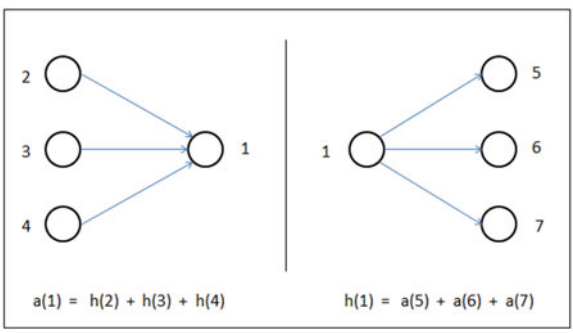

Fig. 1 Authority and hubness

distribution of each topic in the post as well as the word distribution which is the probability distribution of each word in a topic is randomly generated single values, which can also differ and have several probabilities.

Post allocation is done in the following way:

First, according to priority, choose the post and then select the topic distribution of the generated post using the Dirichlet's method for distribution. After this, the topic of word in the post is sampled from the topics polynomial distribution.

And finally, distributions of the words are generated by Dirichlet distribution and sample it in the word set.

4.2 Real-Time Event Detection Using Clustering

New events are used in real-time event detection system. To fulfill this requirement, it is important to separate out the novel events and old events. This can be achieved by using the temporal identification module which is proposed by Quanzhi Li [11], to remove the clusters of old events. The novel detection has two main parts, the event clustering component, and the post-clustering. First, the clustering module computes a score that indicates newness of each cluster. Temporal dimensions in a cluster's tweets are used to find newness of the events. In its initial stage, preprocessing is done to remove unnecessary and unimportant tweets. After that, clusters are formed by taking the tweets from the Twitter stream and assigning the same to the nearest. If no such cluster is detected, it creates new cluster with that tweet as a centroid. In the second stage, i.e. post-clustering component, the clusters are updated and maintained. After that the temporal dimensions of tweets are used to find out whether it is representing a new or an old event.

4.3 TF-IDF

In NLP,TF-IDF is used for selecting important features [12]. TF-IDF algorithm is composed of two important terms, term frequency which is the frequency related to a specific word with in the same document and inversed Document Frequency which measures the importance of words by cross document validation. IDFis used to convert a document into structured format. It specifies the importance of words in a collection of documents. In NLP, it is used as a weighting factor. It is proportional to the word occurrences in a document. The IDF value can be adjusted to a particular scale based on frequency of words in a corpus to detect the key events. The algorithm mainly consists of three steps. First step is to find the count of the terms. Secondly, documents are represented by taking the counts of top p terms for a piece of documents di. And these terms are considered as candidate hot terms, represented as

$$F(d_i) = \{T_{i1}, T_{i2}, \ldots, T_{ip}\}$$

Then, keywords for all documents is expressed as

$$FD = \{F(d_1), F(d_2), \ldots, F(d_n)\} \tag{6}$$

where n is the number of documents(tweets) in a single day. Then by using the Adjust IDF value, all these candidate hot terms are sorted, and we get the rst k is the nal hot terms, that is, HW = {T_1, T_2,..., T_k}

$$tf(t, d) = f_d(t) \tag{7}$$

$$\max_{w \in d} . f_d(w)$$

$$idf(t, D) = \ln(|D|) \tag{8}$$

$$|\{d \in D : t \in d\}|$$

$$tfidf((t, d, D) = tf(t, d)\ idf(t, D) \tag{9}$$

$$tfidf(t, d, D) = \underline{idf(t, D)} + tfidf(t, d, D) \tag{10}$$

$$|D|$$

where, $f_d(t)$: = frequency of t in document D D: = corpus of Documents.

4.4 Micro-Blog Event Detection

Posts in social media are small-sized and on-topic. Thus, it is not easy to find the necessary information about events from the small-sized and noisy data of one single micro-blog. An event detection method is proposed to cater this problem in [7]. For enriching the original micro-blog post, the co-relation between reposts and comments can be used as an important resource. To represent grouped micro-blogs an object called micro-blog clique is generated which is a middle-level object. It is necessary to formulate the relation between micro-blogs. So, for formulating the relationship among the micro-blogs, a heterogeneous micro-blog hyper-graph is constructed. Based on the Bayesian criteria the hierarchical bi-partition on the hyper-graph can be constructed. The generated hyper-graph has the n vertex. Each vertex denotes the single micro-blogs. The data with different contexts for micro-blogs are employed to measure the distance between the two micro-blogs, to develop the edges linking

between the n vertices. For generating the edges for the textual information and the visual content, every micro-blog is assumed as the centroid and the top N nearest micro-blogs are selected for the graphs. In the location information and the temporal information, the micro-blogs are connected with the neighbor micro-blogs with the geo-distance threshold and time-distance threshold respectively. Each user generates one edge, which connects all micro-blogs of this user and the related users in the social connection.

Microblogs with a similar topics are grouped by the microblog hypergraph is segmented. The hyper-graph is partitioned by the hyper-graph cut approach. The input microblog is partitioned into two by the segmentation and further the two-way partition is conducted in each new partitioned. Partitioning is continued until the optimal results are achieved.

To evaluate results of partition, i.e. to determine whether to accept the two-way partitions or not Bayesian information criteria (BIC) is used. For each micro-blog partition, the representative micro-blogs are selected. The values based on BIC criteria are calculated for these two partition results.

The final result is the result which has higher BIC value for the partition. The MCs generated can be regarded as the next level semantic entities for the event detection task after the process of partitioning. In bipartite graph, the MCs and their corresponding micro-blogs are formulated. Spectral clustering is conducted on the bipartite graph. The k micro-blog clusters are obtained by the spectral clustering but only clusters with 2% micro-blogs are selected as the event detected. These events can be selected as an optimal value for the k. To evaluate the selection of the k value, BIC is used. At the last procedure, k events are detected and finally selected as an output for event detection.

Table 4.1 shows the comparison of different Event Detection Techniques.

5 Conclusion

Several opportunities have been provided by social media to do the research. Lots of benefits are being provided by social media in the form of information passed on by users. Event detection can be used to solve many problems. It can be used to detect disasters, news, topics. It can also be used in traffic management. There is possibility that some kind of events might not have been analyzed or detected using social media. There is still a lot of scope to improvise the event detection results using novel technologies.

Table 4.1 Comparison of different event detection techniques

Sr. No.	Technique for event detection	Details	Results	
			Precision (%)	Recall (%)
1	Document Pivot Method	Document clustering LSH (Locality Sensitive Hashing) LDA	34.0	-
2	Feature Pivot Method	DECow ET (Event Detection system targeting)	76.2 57.5	- -
3	TF IDF	Stopwords filtering Text summarization	-	-
4	Microblog clique	Detecting group of highly correlated Microblogs	23.2 improvement	18.2 improvement
5	Clustering	LSH (Locality-Sensitive Hashing)	96.3	77.5
6	TD-HITS and TS-LDA	Identify influential spreaders of hot event topics	80.75	-
7	Temporal social network graphs	10 folds cross-validation Temporal analysis	98	97

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Proficient Data Retrieval Technique in Cloud Using TF-IDF Model

S. Keerthi Vasan, S. Jancy, Mercy Paul Selvan, and Viji Amutha Mary

1 Introduction

Accumulation and renovation of tremendous amount of data can easily be done using cloud computing [1]. The cloud servers can give progressively make sure about, versatile, diverse monetary related and customized services differently in relation to the local servers [2–4]. In spite of the advantages of cloud administrations, leaking the sensitive information, for instance, a person's personal information, company's monetary related data, government archives, etc. t individuals [5]. These type of activities leads to a significant threat to the data proprietors present in the cloud environment [6–8]. For the clients to access a public digital library on request, a potential philosophy is to encode the archives through attributes based encryption (ABE) framework before redistributing them to the cloud. In the meantime, the authorized clients are allocated with lot of attributes [9]. A client can only access the cloud archive if the client' attributes get correlated with the attributes of the records present in it. Cipher text–attribute-based encryption (CP–ABE) provides a versatile access control mechanism [10]. In this methodology, each document is individually encoded and clients can only access the documents only if they are authorized to do so [11].

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2 Related Work

An effective recovery framework of the encoded record assortment was planned [12]. They depicted the procedure of designing the attribute-based retrieval features tree [13, 14]. Then, a DFS algorithm is designed which can be operated flexibly in parallel fashion. It has the following disadvantages:

- In existing system, user can download only one file using the file key.
- Abuse of attribute secret key.
- Inflexible authorized keyword search. Existing system does not provide flexible secure search.

3 Literature Survey

They described techniques where encrypted documents are attempted to search remotely from entrusted server [15]. This technique has several advantages such as support controlled and unseen exploration query segregation [16, 17]. They depicted new procedures for remote searching on encoded information utilizing a untrusted server and gave confirmations of security to the subsequent crypto frameworks, stated by David Wagner et al., Practical techniques for searches on encrypted data, 2000. [18, 19]. They proposed more grounded definitions which are in opposition to existing framework that ensure security in any event, when clients perform progressively practical search process. They likewise proposed two new SSE developments [20]. They also considered multi-client SSE, which allows search capacity to other parties other than the proprietor, Stated by Reza Curtmola et al., Searchable symmetric encryption improved definitions and efficient constructions, 2011.

They proposed a CP-ABE plot along with an encrypted access structure and adaptable quality repudiation in distributed storage [21, 22]. So as to protect vulnerable and sensitive information, the access structure is encrypted partially on multi-valued attributes. Their proposition expands the adaptability of the framework, stated by Jiguo Li et al., Searchable cipher text-policy attribute-based encryption with revocation in cloud storage, 2017.

They proposed an adaptable SE plot over various levels of information to proficiently share and search encoded information by utilizing CP-ABE system. Then two plans which support multiple keywords search and client repudiation are displayed so as to increase broad applications [23, 24]. The assessment results demonstrated that the calculation overhead of their plans is influenced by the quantity of client's attributes instead of the quantity of attributes in framework. Their proposed plans are plausible and productive, stated by Qi Jiang et al. Attribute-based keyword search over hierarchical data in cloud computing, 2017.

4 Existing System

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5 Proposed System

In our proposed system we expect that cloud server and the CA centre are trusted members of the system. In particular, the CA centre can disperse legitimate features to the clients. The cloud server can perform all the commands. To believe that clients are covetous and they endeavour to acquire maximum possible plaintext documents. The clients attempt to conspire with different clients to decode the encoded records. We chiefly limit our framework regarding the procedure of encoding, document search and decoding.

5.1 Algorithm for TF–IDF

- $(TF * IDF)$ is an information revival strategy that gauges a conditions recurrence (TF) and its reverse record recurrence(IDF).
- The result of the (TF) and(IDF). achieve of a period is known as the$(TF * IDF)$ power of that period.
- Set basically, the higher the $(TF * IDF)$ score the rarer the term and the other way around.
- AES is a cryptographic fig utilizing a 128-piece square length and 128, 192 or 256-piece key length (Fig. 1).

Fig. 1 Pseudo code for TF X IDE

```
begin
whilejobDo
initializecount = 0;
for (intcount = 0; count< 100; count + +)
{
Searchingkeyword
Showfilecount
}
```

5.2 *Description*

- **Data Owner**

DataOwner needs to register with the attributes, without authorization from the CA, owner cannot login to the system. While uploading the file, owner can select the multiple files and upload in cloud. Data user needs to register initially and without getting authorized from CA, they cannot login. After login, user can search with keyword. If user needs all the documents, then he will give request to CA. Then the user receives file key in his email. By using this key, user can download all the files.

- **CA (Certificate Authority)**

CA can login using his unique username and password. CA can authorize both the user and owner and generate parse key. CA is responsible for sending input to the user's account to download the document.

- **Cloud Server**

Cloud server can login with his username and password. They can visit all the data owner and data user information. Cloud server can view uploaded files in encrypted format.

6 System Architecture

See Fig. 2.

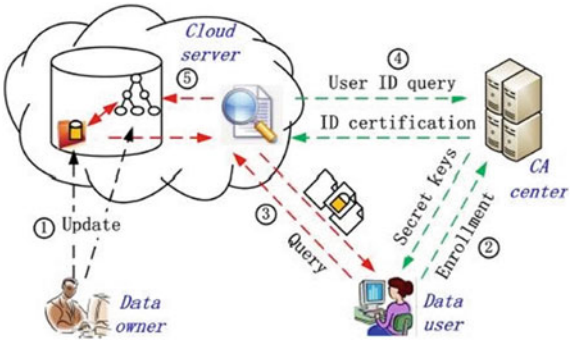

Fig. 2 System architecture

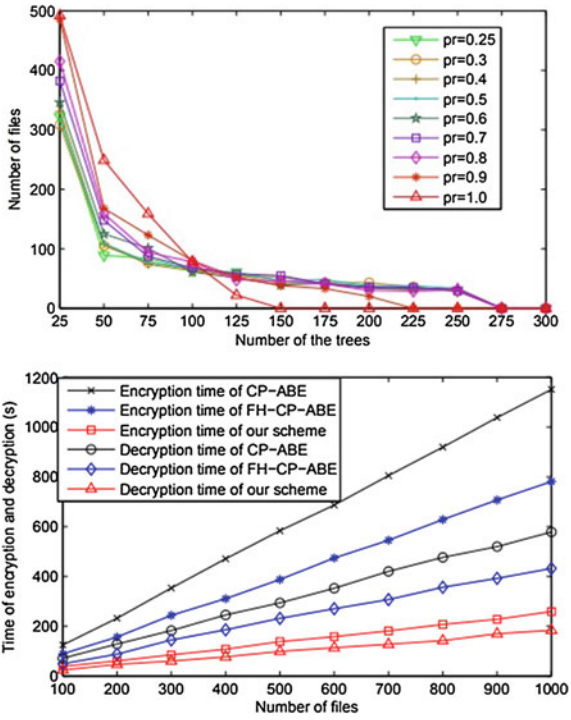

Fig. 3 Time consumption of encryption and decryption

7 Performance Analysis

See Fig. 3

8 Future Work

As the future work will endeavour of including "OR" gates inside documents access trees. The structure of access in the archive collection is produced in a covetous way and we will try to diminish the quantity of access trees. The updated technique of the access tree is ought to be proposed.

9 Conclusion

In the proposed system we consider a new encoded records assortment situation. In this data owner is responsible for controlling the authorization of archives. We planned to develop a feature based encryption mechanism to encrypt documents

then a ARF tree used for arranging report vectors based on similarities. Finally, DFS algorithm is utilized for improving search productivity.

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Data Deduplication on Multi-domain Big Data to Overcome Communication Overheads

D. Deepa, Yunus Parvez, Y. Dheeraj, Anitha Ponraj, and M. S. Roobini

1 Introduction

The significant and mainstream cloud administration is data stockpiling administration [1]. Private substance data on the CSP server farm and permit to keep this data. Also, the forfeiture of power over Private data makes high data protection and security issues, mainly data safety spills. Because of swift reproduction of data mining, different techniques advances, the topic of security gets unpretentious. In this way, a great practice is to encoded data so as to ensure the security of the data and the protection of the client [2]. Albeit merged encryption it's being used widely for secure removal of replicas, the main dispute of constructing transparent encryption is for productivity and unreliability pact with a colossal quantity of joined keys.

Solitary basic test of nowadays distributed storage administrations is the management of the regularly expanding bulk of data [3]. For making data the board adaptable deduplication we utilize synchronized encryption for safe and sound deduplication administrations [4]. Organizations, particularly new companies, SMBs, are progressively settling on redistributing data and computation to the cloud [5]. Today's business distributed storage administrations, for example, Memopal, Dropbox, Mozy, have been smearing deduplication to client data to spare upkeep costs. According to customer's view, the data restructuring projects protection and security issues [6]. We should believe outsider cloud suppliers to appropriately implement privacy, respectability checking, and get to control instruments against any insider and outcast assaults [7]. Be that as it may, deduplication, while improving capacity and data transmission effectiveness, is perfect with Convergent key administration [8].

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Different ways have been made to make sure that data in a cloud is performing both encryption and access controls appropriately. Many would agree that most of the methodologies do not work as expected and it gets invaded by intruders, for every different reason, which mostly includes insider Attacks, mal arranged administrations, flawed executions, surrey code, and the imaginative development of compelling [9]. Building a reliable distributed computing condition isn't sufficient, in light of the fact that mishaps proceed to occur, and the data is loaded the minute they do, it is extremely unlikely to revert it [10, 11].

The core idea is that we can regulate the harm caused by the information gathered on the off risk that we will reject the assessment of the data taken from the attacker.Client conduct profiling is anticipating that ingress should maintain user's data in the Cloud will show ordinary methods for getting [12]. Client profiling is a notable method which can be inherited here to determine when and in what way a client gets to their data in the cloud. Such ordinary user's conduct can be constantly monitored to predict if unfamiliar entree to a customer's data is happening. This technique for conduct base security is normally utilized in misrepresentation location applications. Such professional records would normally incorporate volumetric data, what number of reports are ordinarily perused and how regularly. These straightforward client explicit highlights can serve to identify strange Cloud get too dependent on upon the scale and extent of data move [13]. Bait data, for example, distraction records, nectar documents, nectar pots, and different sham data can be created on request and fill in as methods for distinguishing unapproved access to data and to harm the thief invaded data [14].

The genuine client, who is the proprietor of the data, would promptly distinguish when imitation data is being reoccurred in the Cloud, and consequently could adjust clouds reactions through an assortment of means, for example, Challenge questions to illustrate the protection mechanism in the cloud that an anomalous exposure is erroneously remembered. In the case of an irregular entry to the entrance, the Cloud storage system will move on to the adversary unrestricted steps of falsified data, thus protecting legitimate data from inappropriate exposure for the customer [15].

2 Related Work

Saritha et al. [16] The cloud servers in big data are getting expansive the disc storage within a cloud becomes a crucial issue. Deduplication is the technique used to eliminate the repeating data. This term improves the space complexity. During a process of analysis, the byte patterns and the chunk of data is identified. In this, the digital signature technique is taken into consideration for the ownership certification. Convergent encryption supports deduplication. By applying this technique the plain texts would change the same ciphertext.

Zhang et al. [17] Map reduce and Hadoop are the two tools of big data. The terms like HBase is used to speed up the procedure of deduplication, Hadoop is the open-source software framework develop the data processing applications. Based

on map reduce it accounts the leveraging parallelism. To provide the scalability the map reduce and HBase brought by the big data era. The artificial datasets and real-world datasets are used in this proposed approach. The secure hash algorithm-3 is employed and also the aggregation theme schema is proposed. The effectiveness of this is demonstrated in an extensive way.

Hui Cui et al. [18] Attribute-based encryption (ABE) has been used in cloud computing. Cloud service provider receives the data that is encrypted by the data provider and also shares the attributes of data to users. For the elimination of redundant data, this ABE is not efficient because it does not support the data deduplication. In a hybrid cloud setting, this ABE secures the deduplication. The private and public clouds are used for duplicate detection and storage. There are two advantages of this, one is the data is secured and confidential too. The encrypted data is shared the users. Second is security notion which is confidential. Without revealing the access policies of plaintext this methodology modifies the ciphertext of the same plaintext.

Dhokne et al. [19] The government agency and private enterprises occupy large storage space so that the communication network plays a vital role in sectors. The confidential data is also stored in the cloud. The major issue is large amount of data is stored in the cloud ie., the noisy data and also the duplicands are there because of that data space complexity is more. For the elimination of data, there are so many techniques but the standard approach is deduplication. It saves bandwidth and also reduces the space complexity in an efficient manner. For the encryption of data there are some techniques like convergent encryption, triple data encryption, RSA, etc. In these techniques the convergent encryption is standard and effective. Files are divided into shares and stores on number of nodes. These are combined and stored in a single file that is secure and reliable.

Jiang et al. [20] In data deduplication, the cross-client data deduplication is used for removing the redundant data. To identify the duplicand ciphertexts R-MLE2 is used which is the equality testing algorithm. Two schemas are introduced they are dynamic and static which adjusts the cost complexity. The static and dynamic trees use the interactive protocol. The time complexity is reduced when the interaction takes place between clients and servers. Cross user file-level and inside user block level data are also supported in this deduplication scheme.

Neelu Verma et al. [21] The cloud computing provides several services like storage, networking, analytics, etc., In this the data storage is prevalent. The user can modify and upload the data in any server. But the issue is the insecurity takes place. Usually the encrypted data is stored in the cloud for the sake of security and confidentiality. To reduce the inconsistency and insecurity the compression technique is used, i.e., Deduplication technique. The traffic and space is reduced apparently.

3 Proposed Work

Right now, tell the high-quality manner to configuration steady deduplication backgrounds with higher untiring high-quality in payout totaling. We gift the appropriated dispensed garage servers onto the deduplication bases to offer higher version to internal failure.

Figure. 1 shows the system is proposed in such a way that it overcomes the failures of the elderly versions and it uses the effective techniques to help with it. The system uses Hashing technique for the deletion of the replicas from the base system and provides cloud storage efficiency. The hashing technique provides the system to check the data in the files as chunks of pieces. Once the data is uploaded in the cloud servers the hashing technique is performed to ensure data consistency in the cloud. The system deals with the security aspect also, like it stores the encrypted data file alongside the original data file. When the user wants to access the file or view or download the file, the file is encrypted so it does not allow the user to view or download.

The user should have to make request to the file owner to view the file, so in this aspect, the system deals with the data security also. When the owner receives the request from the user to view the file then it's up to the owner to approve the request. Here we can observe that the file is secured in the cloud. Once the owner approves the request from the user then the key-based text is sent to the requested user through his mail id, then the user can enter the key provided by the cloud service provider and access the files. Here for encryption of the file, the system uses the MD5 algorithm. It's an encryption algorithm used to perform encryption of the text in ordered to secure the data. The mystery parting strategy, instead of traditional encryption techniques, is used to steady information secrecy. In particular, statistics are part into sections by way of using secure mystery sharing plans and put away at numerous servers.

- Peculiar highlight of our scheme is that statistics scrupulousness, consisting of label evenness, can be completed. To our insight, no present-day paintings on

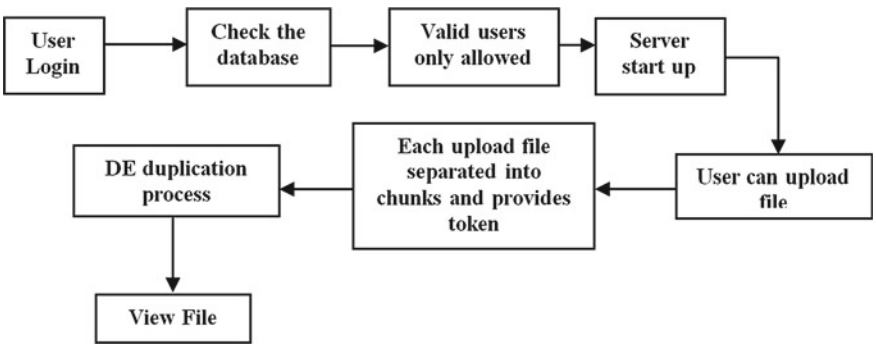

Fig. 1 Workflow of proposed system

steady deduplication can appropriately address the untiring pleasant and label evenness issue in conveyed potential frameworks.

- Our proposed trends bolster both record stage and rectangular level deduplicate. Sanctuary exam indicates that the anticipated deduplication frameworks are stable as some distance as the definitions determined within the proposed protection model. In extra subtleties, secrecy, dependability and trustworthiness may be performed in our proposed framework.
- Two sorts of arbitration violations are borne in mind in our answers. These are the conspiratorial intrusion on the documents and the compromise injection against the database. Specifically, the data remains reliable regardless of whether or not the defendant manages a set figure of possible servers. Here we are incorporating our deduplication mechanisms using the RTSS that empowers high levels of quality and transparency. Our valuation results indicate that the proposal for new innovations are high and that the severances are progressing and are extremely similar to the other hoarding system that facilitates a comparable level of unrelenting greatest performance.

4 Results and Discussion

4.1 User Login

In this module, users are required to provide their credentials to login onto the cloud platform. If the user does not have any account linked to that cloud then he can sign up for the new account y providing his basics details like name, email, address, mobile number, username and password. After the successful login, the user can upload the files or download the files which are stored in the clout. There two types of login presented one is for data owner and other login for user.

4.2 Server Start up and File Upload

The user/data owner can start using the server after the cloud environment is achieved. After the environment has achieved the user can either upload the files or else can download the files through the cloud.

4.3 Sheltered Deduplication

In this module, Fig. 2 shows that the deletion of same copies of data takes place. The data can be of any form like image, txt, video, pdf, word. The system uses the hash technique to delete the replicas from the cloud. The replicas can be saved with any

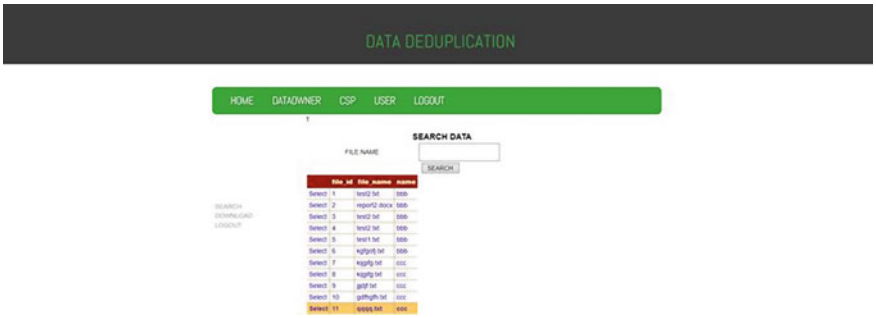

Fig. 2 Overview of secure deduplication system

name and extension the system searches the cloud and performs hashing technique and truncates the replicas of the data if they are present in the cloud. As the user uploads the file the system starts hashing function and finds and deletes the replicas from the cloud. The encrypted file is also stored in the cloud.

4.4 Download File

The consumer can download the file by requesting it. Figure 3 refers to the request notification goes to the data owner who has uploaded the file after his acceptance the encrypted key is shared via mail to the requested consumer and through entering the key the requestor can download and view the file.

The projected system works as expected, it uses hashing algorithm which is very efficient to perform deletion of the replicas from the system and the SHA perform hashing function which makes the file into chunks of pieces and then converts them into the hash text and checks for the same hash text files in the cloud, if present then it removes them from the cloud and stores the original file only. The encryption algorithm used here is message digest which is the best encryption algorithm, here

Fig. 3 Overview of downloading the file

it sends a key to the user to view or download the file uploaded by the data owners. So, the files uploaded by the data owners are safe and cannot access by the intruders without entering the key.

5 Conclusion

Right now, the idea of proposing data deduplication is to ensure storage consistency in the cloud and then provide the users the files they required without any hassle of searching different files with same content but different names. Another main aspect is ensuring security to the users and data owners who upload and download files. The proposed system mainly focuses on the two aspects of storage and security, to meet these aspects the technique provided here is a solution. Lots of users and consumers are using cloud in daily life, the main goal is ensuring their safety and providing the hassle-free experience in accessing the files. Lot of data is getting generated now a days and the cloud stores different kinds of data making it vigorous and inaccessible so deduplication ensures deleting the replicas from the cloud and making it less complex.

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Supporting Privacy Protection in Personalized Web Search

S. Vishnupriya, B. Selvaambigai, and S. Vigneshwari

1 Introduction

Queries have been submitted to the search engines for presenting the information needed by the users in the web search applications [1, 2]. Though every now and then queries may not be exactly represented the required user-specific information meanwhile the wide topic comes under the numerous abstruse queries, along with many users, demand for the information based on various features at the time of the query submission [3].

For an instance, when in a search engine, a query "the sun" is given, few users look for finding the homepage of the United Kingdom newspaper, although few wishes to study the natural specs regarding Sun [4, 5]. Then, it is very much required as well as possible to know various goals of the user search in a process of retrieving the information [6].

The search goals of the users can be well demarcated as information based on the various facts of the query that is wanted by the user to get [7, 8]. The want of the information is a must for the user for satisfying his requirements. These objectives could be assumed to be as groups of the needed information for a particular query [9]. There are a number of benefits of the inference as well as an examination of the search goals of the users in enhancing the user's experience as well as the relevance of the search engine [10].

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2 Related Work

Because of its utility, a number of works have investigated the search goals.

These can be briefly classified into three classes:

(1) Query classification
(2) Search result reorganization
(3) Session boundary detection

According to the first step, folk stray for inferring the search goals as well as targets to predefine some of the precise classes as well as executing the query cataloging consequently. Lee et al. reflected the user goals as Navigations well as Informational along with classifying the queries in further two groups. Some works emphasize the tagging queries along with some [11, 12].

Already defined ideas for improving the presentational features of the queries. Though, subsequently for a different type of the queries user's care changes very much, discovering the appropriate predefined classes of search goals is quite tough as well as unreasonable [13].

Second, a person attempts to identify web search outcomes. Wang and Zhao have learned very exciting facts regarding queries by examining the directly clicked URLs from the user click-through logs for organizing the search outcomes. Though, this technique has some demerits as the quantity of the dissimilar clicked URLs of the query might be minor. Some other researches study the search outcomes given back by the search engine at the time of the query submission [14].

Then, user feedback has not been measured, the number of noisy search outcomes not clicked by any user might also be examined [15].

3 Existing System

The data from the usage of the web useful knowledge discovery as well as for effective Web-page references, acceptable representation of the knowledge is challenging and crucial [16]. For efficiently providing an improved Web-page suggestion by semantic improvement through assimilating the domain as well as the knowledge regarding the usage of a website, the already present system offered a method. The representation of domain knowledge has been done by two new models [17, 18]. The first one is based on the ontology for representing domain knowledge. The other one utilizes the robotically produced semantic network for representing Web-pages and domain terms along with the relations amongst them.

The conceptual prediction model, a novel system is offered for producing a semantic network of the knowledge of semantic web usage, in an automatic manner which is the incorporation of the Web usage knowledge as well as domain knowledge [19]. Numerous queries are established to an inquiry regarding these knowledge basses' set of strategies for recommendation built on these queries is planned for

generating Web-page contenders. The results of the recommendation are equated with outcomes attained from the advanced present Web Usage Mining (WUM) technique [20].

4 Algorithm

STEP 1: Stemming is defined as reducing a word where the lemmatization is concerned with linguistics to the root form.

STEP 2: lemmatization is “see”, “seen”,

“seeing”, “sees”, “been” as well as “saw” stemming a word can be plummeting the word from “seen” to “see”, thus this is corresponding to some other stemmed words like “talking” stemmed is “talk”. An appropriate instance is as below:

“graduating”, “graduates”, “graduated”,

“graduate”.

These above four words will not match at the time of verification for equality, though the above-mentioned words can be reduced to a simple form by stemming them.

graduating– > graduate graduates– > graduate.

graduated– > graduate graduate– > graduate.

4.1 Caesar Cipher

It is amongst the simplestas well as the most basic known ciphers. In this substitution cipher in the plaintext, each letter is ‘shifted’ a particular place down an alphabet. For instance, with one shift of place, A could be replaced by B, similarly, B can be with C, etc. The technique is named inspiring from Julius Caesar, who seemingly for communicating with his generals utilized this method. More difficult encryption techniques like Vigenère cipher apply the Caesar cipher as 1 element of encryption. The commonly known encryption of ROT13 is merely a Caesar cipher along with an offset of 13. It proposes fundamentally no security for the communication process, as well as it can be seen that it is simply broken just by a hand.

Example For forwarding the encrypted text message from a person to the other, both the sides must possess a cipherkey, subsequently, a sender encrypt this message, as well as a receiver, decrypt the same message. In the case of Caesar cipher, the count of characters for shifting the cipher alphabet is considered as a key. An instance for encryption as well as decryption steps include along with the Caesar cipher is

displayed below. Text 'defend the east wall of the castle', with a shift of 1 is encrypted. an alphabet and decryption are also the same, by use of the -1offset.

Clearly, if a unique key is used, the cipher alphabet can be moved to a different number of places.

4.2 Mathematical Description

First, all the characters are interpreted as numbers, like 'a' = 0, 'b' = 1 to 'z' = 25. Denote the encryption function as e(x), where x is a character to be encrypted, as:

Here, k is the shift (the key) employed for every letter. Later employing this function, the output is a number that should be deciphered to the letter. The decryption function is:

5 Proposed System

The designed system presents a personalized recommendation system that uses the presentations of the items as well as user profiles depending on the ontologies for providing the semantic applications along with personalized services. This technique has been attained through two ways.

User's interests can be influenced by a domain-based method as well as similarity method based on a taxonomy that has been used for refining the item-user matching algorithm, enhancing the outcomes of the total outcome. The designed system is independent of the domain as well as is applied like a Web service, as well as utilizing both implicit and explicit feedback-collection techniques for getting information depending on the interests of the clients. The planned system is dependent on Web Usage Mining and ontology. An initial stage of the method is pulling out the characteristics from the web documents as well as building-related ideas. Formerly available ontology for the web utilizes the idea as well as substantial terms removed from the documents. As per the similarity based on the semantics of the web documents to group them in other semantic themes, various themes suggest various predilections.

6 Module Description

(a) **Creating Search History**

Any particular document like the history of browsing as well as emails on a computer of the user can be the data source for profiles of the user. This effort on limo recurrent

terms the dimensional its of documents that further offers a clear description of the interest of the users. Allows this component the search engine to better comprehend a user's session as well as according to her needs, possibly tailor that experience of the user's search. When identified was query groups, search engines can have a good depiction of the context of search late the present query utilizing queries as well as clicks in the consistent query group.

(b) **Query Clustering**

Queries of the user could be categorized into dissimilar query clusters. Concept-based profiles of users are employed in the clustering procedure to attain the effect of personalization. The maximum similar pair of concept nodes, formerly, a similar pair of query nodes is mostly merged, etc. Submitted each separate query through each user is considered as a separate node as well as each query along with the user identifier. The group has been implemented by us in the same dynamic style, which initially places the present query as well as clicks within the group.

(c) **Query Reformulation**

For assuring that every question bunch comprises firmly related as well as snaps also applicable inquiries, it is essential to have a suitable value among the current inquiry gatherings. We expect that customers for the main portion of the problem fundamentally the same as snaps as well as inquiries exclusive a short-term timeframe. The inquiry history of an enormous number of clients comprises signals through respect to query importance, for example, which explorations will, in general, be given intently composed. This catches the link among the inquiries regularly instigation taps on analogous URLs. Inquiry redevelops diagram as well as the query click chart from search **logs,** and also how they can be used to decide the relation among inquiries or inquiry bunches inside the history of the client.

(d) **History Grouping**

Question bunches initially delight every inquiry in a history of the client as a review gathering, as well as afterward combine these review bunches in an (in a k-implies) style of iterative. Be that as it may, in our condition this is illogical, for two explanations. To begin with, it may possess a bothersome effect of altering the current inquiry gatherings of the client, possibly fixing the client's specific manual endeavours in solving the history of her. Another, it contains an extensive computational expense, then it is essential to reiterate an enormous amount of questions similitude calculations for each novel inquiry.

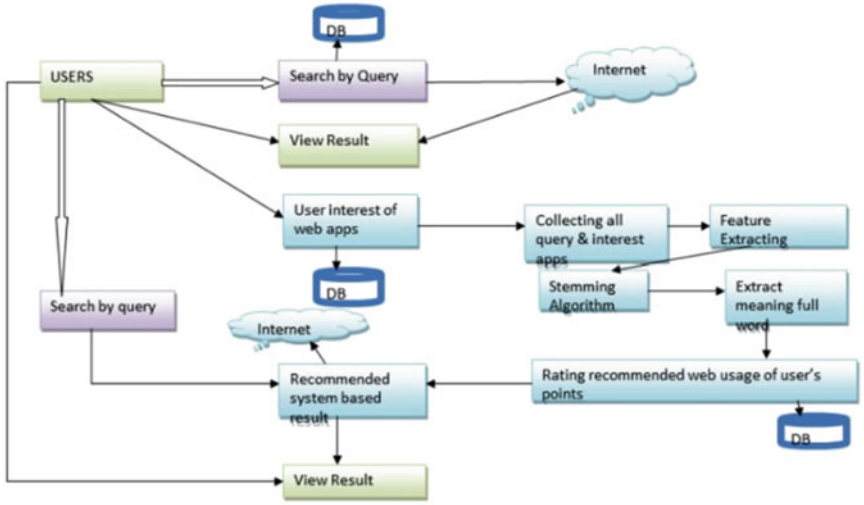

Fig. 1 Proposed Architecture

7 System Architecture

See Fig. 1.

8 Results and Discussions

Figure 2 describes the registration JSP for saving the data in the prescribed database (Fig. 3).

After enrolment of data in the database, it allows users to search the queries (Fig. 4).

User name	Query	Relevant nt	irrelevant nt
James	Java	60	40
Sachin	football	80	20
Satin	Flying shuttle	60	40
Vanishavi	Programing concepts	50	50
Natasha	Novel writing	80	10

(continued)

(continued)

User name	Query	Relevant nt	irrelevant nt
Manama	Oops concepts	90	10
Somali	Manageend concepts	40	60

The results of the queries (i.e.URLs) are displayed on this screen.

9 Conclusion

Right now, the novel methodology was offered to objectives of surmise client look for a review through bunching its involvement of sessions spoke to through pseudo-archives. To begin with, we familiarize sessions of criticism through actuality examined to induce search of client objectives as opposite to querying items or click on URL. Equally, the clicked-on URLs as well as the unclicked ones' previous snap are measured as inputs of client provable as well as required other proficiently. Next, we plan sessions of input to records of pseudo to imprecise, impartial messages in the minds of the client. The pseudo-archives could enhance the URLs along with the extra-literary substance comprising the titles as well as pieces. In light of these pseudo-records, client search purposes can be found as well as portrayed through certain catchphrases. At long last, another basis Stemming is figured to evaluate the exhibition of a client search goal initiation. From a business tool of web search exhibition, the test outcomes on the client navigate logs the possibility of the designed

Fig. 2 Registration form

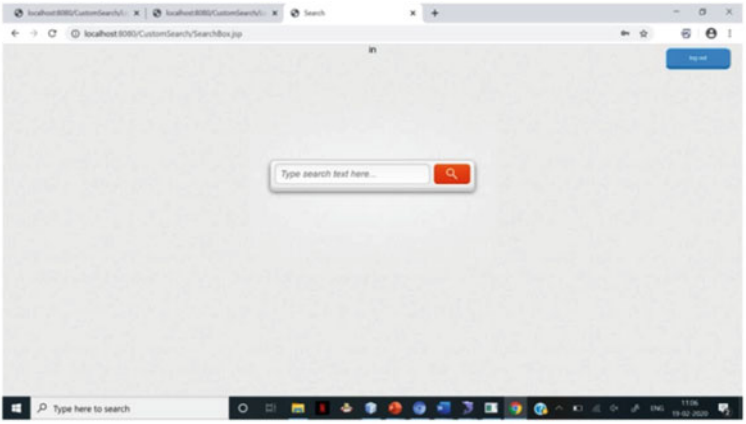

Fig. 3 Search box

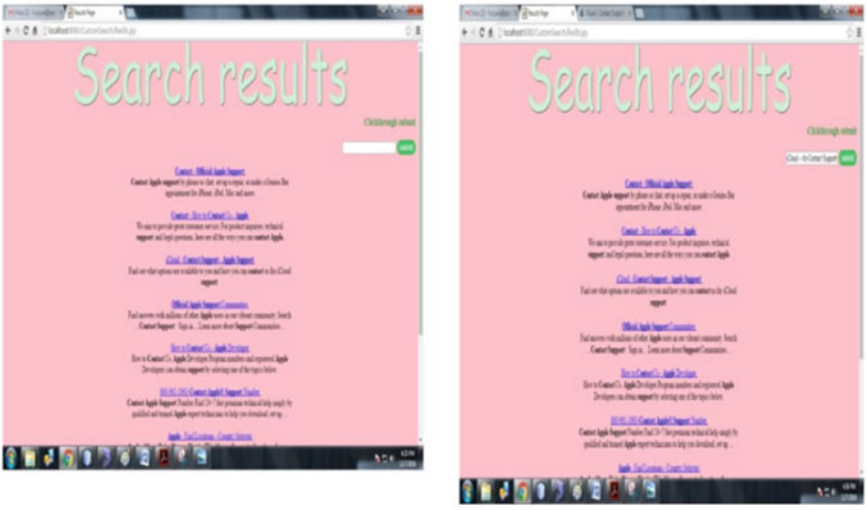

Fig. 4 Result page

techniques. The volatility of the methodology is very low as well as methodology could be used in all certainty efficiently. For all queries, the time of running is based on the count of input sessions. Be that as it may, the element of Fas in (3) as well as (5) isn't exceptionally great. In this way, the running time is classically small. In all actuality, our methodology could find client scan objectives for about famous questions detached from the start. Formerly, submit one of the questions from clients, the web crawler restores the outcomes that are classified into various classes as per

client search goals on the web. In this manner, clients could find what is essential advantageously.

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EDA-PEGASIS: A Balanced Energy Aware Routing Approach for Sensor Network to Reduce Cognitive Networking Complexities in Wireless Medium

S. Sreeram and G. Nagarajan

1 Introduction

The prominence of Wireless Sensor Networks (WSN) could hold the potential to revolutionize many segments of our life not limited to environmental monitoring and conservation, transportation, health-care management. WSN consists of sensors that are spread spatially to monitor physical or environmental conditions. The mobility of sensor nodes is not a mandatory constraint. WSN is deployed in the areas with accessibility issues. Since Sensors are tiny, portable, battery-powered devices; the energy management is considered as a major issue in QoS provisioning. It is a unique category of adhoc network in which data-centric protocols are followed to collect data from environment and optimization of node's energy [1]. The sensed data namely, pressure, temperature etc., collected from the scenario are passed to the base station [2]. The routing protocol [3, 4] for carrying out the transmissions should target to improve the life-time of the network. PEGASIS [5, 6] and its extensions, Energy Efficient PEGASIS (EEPB) [7] and Improved Energy Efficient PEGASIS (IEEPB) [8–10] are a clan of routing and information gathering protocols for WSNs.

An individual node in the network will be completely aware about the topology changes. The main responsibility of a node is to deliver the sensed data to the BS which is often addressed as a challenging task while considering the energy balancing of battery powered sensor as nodes. The network model proposed in this paper assumes the deployment of identical nodes across a geographical area. The main goal of this paper is to implement a new routing arrangement that includes energy

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aware data aggregation module and a low cost fused data delivery to the sink node. The proposed method aims implementing energy efficient protocol in WSN with the aid of PEGASIS and its improved models to minimize the broadcasting overhead and thereby enhancing lifetime of the network [11].

2 Related Work

Sharma and Shaw et al. [12] proposed a communication protocol that utilizes the ability of a single node to have the communication with other nodes in any distance without using intermediate nodes. In order to make a direct communication, the source node must have an increased transmission capacity. The main drawback of this method is wastage of energy. This method works well when the nodes are distributed sparsely. The reception happens only at the base station. The Base station must have an increased reception capacity for receiving the signals from the long distance nodes. This protocol is extremely expensive in terms of the energy consumed when base stations are far away from some nodes [13–15]. Hence the delay will be high for accessing the data. Thus, this system has to be considered as a failure in case of delay and energy consumption.

Heinzelman et al. [16] has proposed the Low Energy Adaptive Clustering Hierarchy (LEACH) protocol and its modifications by Singh et al. [10], for addressing the energy related limitations of sensor network by utilizing the advantages of clustering approach. The random selection and periodic reelection for selecting the cluster heads eliminates the risk of node failure due to the over utilization of energy from a single point. The additional energy required from a cluster head to contact the base station will be uniformly distributed to all nodes in the network by periodic cluster head selection. However, the cluster formation is difficult, if the base station situated far away from sensor nodes.

PEGASIS [5, 17–19] is proposed by Lindsey et al. and its modified version by Mahakud et.al [20] for energy aware data aggregation in the wireless sensor networks. All nodes in the network must be aware about the location of all other nodes in the network and one leader will be elected for the data aggregation process. The leader must be a one hop neighbor of sink node. This method mainly focuses on the energy consumption of nodes for the data transmission. It tries to reduce the overhead of sensor nodes by minimizing the distance need to be travelled by the individual data messages to reach the sink node. It uses a greedy algorithm for the formation of chains [5, 21–23]. The chaining process will continue till all the nodes in the network become a part of at least on chain. The leader elected from a chain is responsible for collecting the data from all the nodes in that chain. The leader directly sends the fused data to the sink node.

JinWang et al. [24], proposed an Enhanced PEGASIS (EPEGASIS) with mobile sink support for WSN. Here the authors address the issue related to nodes nearer to sink that consumes more energy than other sensor nodes (hotspot problem). This method follows usual procedures in PEGASIS for till chain construction phase with

Table 1 Comparison of various routing protocols

Parameters	Direct transmission [12]	Leach [16]	Pegasis [5]
Enery consumption	Greater	Reduced	Much more reduced
Usage	Small coverage area	Large coverage area	Large coverage area
Mode of transmission	Direct transmission	Cluster based	Chain based
Bandwidth	High	Lower	Lowest

an enhanced version to improve energy efficiency of hotspot sensor nodes. The comparison of routing protocols are depicted (Table 1) as follows:

3 Proposed System

In WSN, Sensor nodes have energy limitations [25] and hence maintaining its life time is very important. QoS provisioning is also a major issue in sensor networks. The method had reposed to extend the existence of connectivity in network by considering bandwidth as a parameter for better energy utilization. This paper proposes EDA-PEGASIS (Euclidean Distance Assisted - Power Efficient Gathering in Sensor Information System) of all nodes with Base station (BS). The proposed method ensures the participation of all nodes that are reachable from BS in the network by sensing the data and communicating to its neighboring nodes, forming a chain. This in turn will aid for improving the network retention. Here the nodes communicate with minimum bandwidth and thereby contributing to improving the energy efficiency. EDA-PEGASIS extends the basic PEGASIS protocol by considering the Euclidean distance from transmitting node to BS as a constraint. EDA-PEGASIS makes use of greedy algorithm to identify the position of nodes. The EDA-PEGASIS introduces the chaining process in cluster environment and utilizing the advantages of chaining scenario for reducing the energy consumption in clustered networks. In highly utilized networks, for minimizing the bandwidth overhead, EDA-PEGASIS should be aware of the changes in positions of moving nodes [15]. EDA-PEGASIS also applies some dynamic topology adjustments based on the knowledge about the energy status of neighboring nodes.

The basic outline of EDA-PEGASIS is depicted in Fig. 1.

Once the Leader node is elected is completed after the chaining process, the node6 will be disconnected from the chain and a direct link to base station is established based on its distance. This in turn would reduce the and prevents the algorithm from creating long chains.

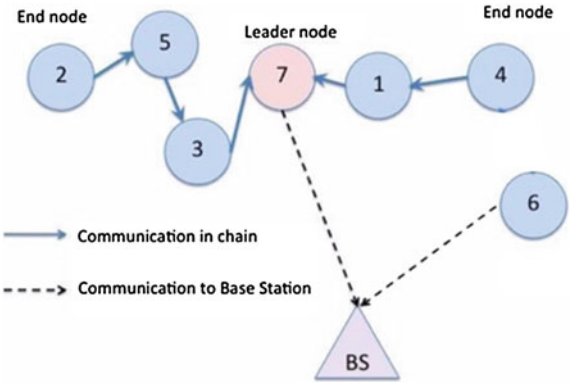

Fig. 1 Outline of EDA-PEGASIS

3.1 EDA-PEGASIS Protocol Based System

Step 1: Initially, the nodes are arbitrarily defined and alive. Position the BS stationary. Set threshold value for LN election.
Step 2: Calculate distance of other nodes in the sensing area with respect to BS using the Euclidean distance formula:

$$\mathrm{Ei} = \sqrt{((\mathrm{xs} - \mathrm{xi})^2 + (\mathrm{ys} - \mathrm{yi})^2)} \tag{1}$$

E_i—distance of i^{th} node from BS.
Xs & ys—coordinates of BS.
Xi & yi—*i*th node coordinates in the plot.
Step 3: Form node chains based on the greedy algorithm and aggregate to clusters based on relative positions.
Step 4: Elect LN, by computing its distance from BS taken from Step 2 and residual energy.

$$E_{P(LN)} = \frac{E_{init(LN)}}{E_{n(LN)}} \tag{2}$$

where $E_{n(LN)}$ denotes residual energy of LN in iteration n and $E_{init(LN)}$ representsinitial energy of LN.
From Eqs. (1) and (2), calculate the combined weight τ_i for each node as shown below,

$$\tau_i = \tau_1 E_{P(LN)} + \tau_2 E_i \tag{3}$$

where τ_1 and τ_2 are weight factors per node in which $\tau_1 + \tau_2 = 1$.
The light-weighted node among the sensing nodes in the network is taken as LN.

Step 5: From Step 2, if the difference in residual energy of nodes that are nearer to the BS and of the LN is negligibly lower than a threshold value, such nodes transmits directly to BS without overloading the LN.
Step 6: If the energy of the present LN falls below the threshold, LN re-election takes place. It is through the present LN, the data transmission occurs. Repeat Steps 2–5.
If energy of all nodes in the cluster falls below the threshold value, go to step 7.
Step 7: Re-assign the threshold value in the cluster as average residual energy of nodes in that cluster. Repeat steps 2–5.

3.2 Chain Construction Phase

In the chain construction phase nodes get added to neighboring one another forming a chain starting from the farthest node from the BS by using greedy approach [5, 8, 13, 17].

In the Fig. 2, the node c0, farthest from BS will get added to the chain first followed by nodes c6 and c1. This continues until all live nodes get connected in the chain. The nodes will be contributing to chain which counts from C0 to C6.

Each node in the network is labeled with a unique identification number. The greedy algorithm again assigns a chain index to all the nodes in the network. A node can have more than one chain index based on the number of chains including that

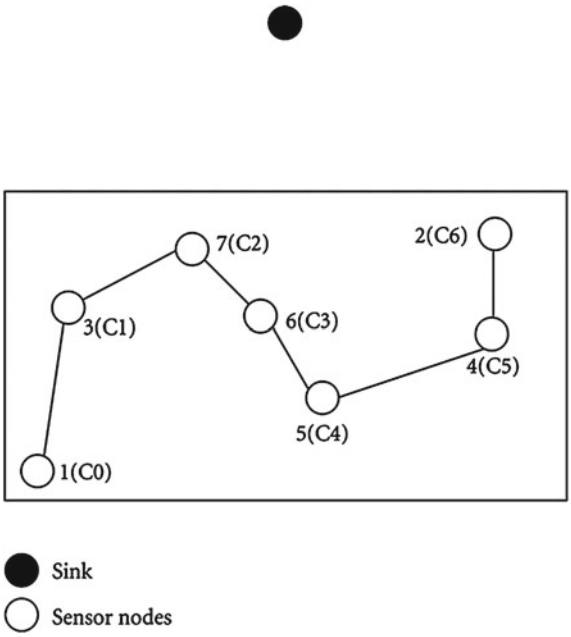

Fig. 2 Initial chain formation in PEGASIS, IEEPB&EDA-PEGASIS

node. Each node in the network must be a part of at least one chain formed from any boundary nodes to the sink node. The chain formation process will start from the farthest node away from the sink node but, terminates at sink node such that loop formation is avoided by applying certain conditions in greedy approach. In order to initiate the chain formation, the sink node must be aware about the geographical position of each node in the network. The process has to be initiated even before the first round and will continue till the last node becomes a part of chain. The chain index number will keep on changing based on the chain formation patterns. From Fig. 2, it is observed that the chain formation starts from the farthest node in the network. Thus, the farthest node 1 will be marked as C0. C0 will select its nearest node 3 as the second node in the chain and that node will be assigned C1 as chain index. Since node 1 is already joined in the network, node 3 is not allowed to select node 1 as its next chain node from its neighbor list. Greedy algorithm eliminates the chances of loop formation in this way. However, in our method the Euclidean distance between all nodes are taken from BS and thus the if the difference in energy depletion rate of nodes that are nearer to the BS and of the LN is negligibly lower than a threshold value, such nodes transmits directly to BS without overloading the LN. Hence, not all nodes will be a part of chain.

3.3 Leader Node Election and Re-Election

After the chain formation, a node will be elected and labeled as leader node (LN). A single leader election process can be called as a round. The leader will be selected on the basis of residual energy and the distance to sink node. The re-election will also be initiated after a period of time. The LN will collect and aggregate the data from the nodes in the occupying chain and initiate the process by releasing tokens to both side of the chain. The token can be considered as a request to send the data to the leader. The sending process will be initiated from the both ends of the chain after receiving the token. The end most nodes will send the data to their immediate neighbor. The next node will fuse its own data with the data received from the end node. This process will continue as a chain till the fused message reaches the leader from both ends. The LN will aggregate the data received from all the nodes in the chain and will send directly to the BS or sink node.

In this protocol, a threshold value for energy is set so as to become the LN. It is set based on the average energy required for data transmission and reception among the nodes. The LN reelection takes place when the energy of the already elected node drains out of battery. i.e., if the energy of the existing leader falls below the threshold value already set. After the reelection, the nodes rearrange in way that forms clusters containing chains.

3.4 Data Transmission Phase

The sensed data collected by the nodes in the chain is sent to its respective LN. The data aggregated by the LN is sent to the BS and this process continues till the energy of LN falls beyond a threshold. Re-election of LN within that chain is done by adjusting the connectivity in the chain and the transmission to BS gets resumed. The nodes that are not a part of the chain as mentioned in the procedure will transmit directly to BS without overloading the LN. However, in a chain during its re-election process of the LN, if the next node to be re-elected is farther from BS then an optional selection of a nearer individual node may be taken to connect with the weak LN to resume transmission to BS.

4 Results and Discussions

In this section results on the proposed protocol EDA-PEGASIS are presented. The simulation is based on MATLAB 2018a. Nodes are randomly defined in a 40 × 40 square plot. The BS is fixed at (20, 20) position of an (x, y) coordinate system. The nodes considered here are located in four quadrants. The nodes in each quadrant form chain based on greedy algorithm and are finally reaches a LN. The nodes arranged in a 40 × 40 square plot are distributed to form four regions in the plot that are densely populated with nodes. The distribution done will aid in formation of 4 clusters in which individual cluster will form a separate chain comprising of all nodes in it. The nodes nearer to the BS in that cluster are assigned as the LN using EDA-PEGASIS for that cluster to which the data is aggregated and fused which is then sent to the BS until the energy dissipation of that LN falls below a threshold in a round as in Fig. 3.

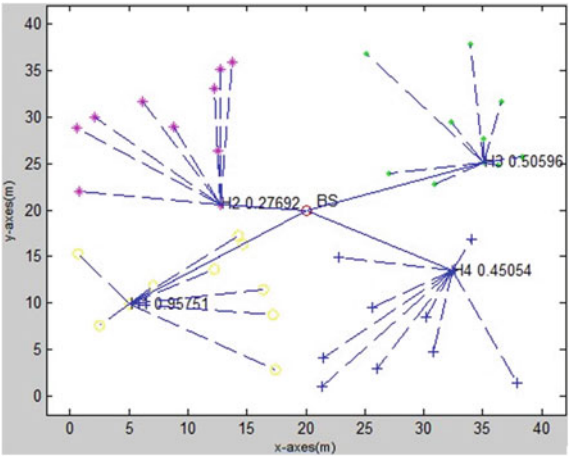

Fig. 3 Cluster nodes transmitting to BS through LN

After each round of transmitting data to the BS, the network monitors the energy depletion rate of the LNs and adjusts the topology without altering the Chain-formation model and re-elect the LN for transmission to sink, if required as in Fig. 4.

Based on the above experimentation setup, the overall performance of LEACH, PEGASIS and EDA-PEGASIS in maintaining alive nodes in the network for up to a maximum of 250 rounds is tabulated. The EDA-PEGASIS outperforms LEACH and PEGASIS protocols based on the analysis plotted as in Fig. 5 on a well-defined environment and experimental setup.

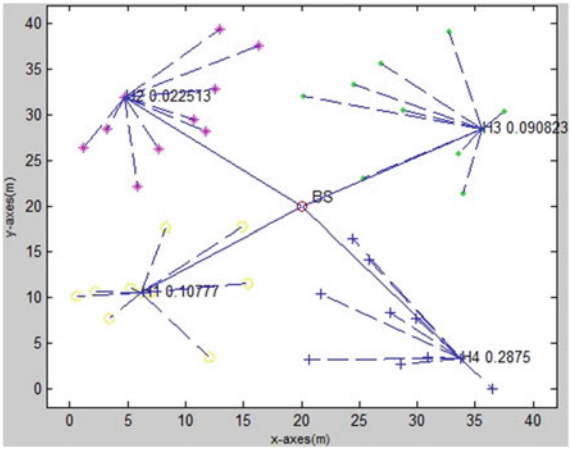

Fig. 4 Re-election of LN adopting dynamic topology adjustment

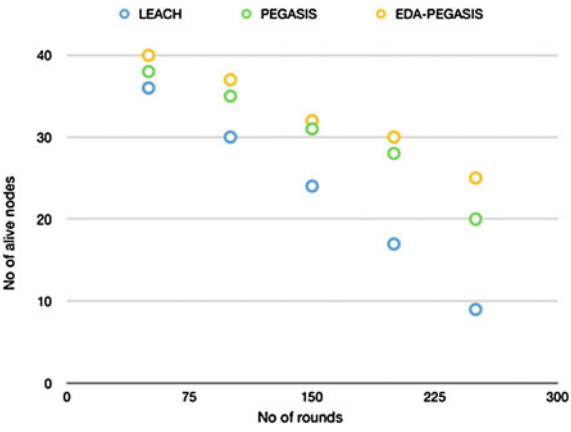

Fig. 5 Performance Comparison of LEACH, PEGASIS & EDA-PEGASIS

5 Conclusion

In this paper an energy efficient protocol, EDA-PEGASIS in WSN is implemented and analyzed on various energy concerns. Overall energy consumption of EDA-PEGASIS is lesser than the LEACH protocol. Both protocols utilizing the advantages of clustering approach. EDA-PEGASIS considers only the eligible nodes from the cluster, based on Euclidean distance and residual energy, for the LN selection process. This difference between the LEACH and EDA-PEGASIS make the difference in the life time of network nodes. The EDA-PEGASIS limits the participation of nodes in the LN selection based on the assumption that, the energy utilization will increase with respect to the distance between the communicating entities. Thus the farthest nodes need not be considered for the LN selection, until no other nodes in the cluster were left to form the chain. Further, the EDA-PEGASIS algorithm introduces a novel method to address the complexities related to wireless medium in Cognitive Networking.

The issue in PEGASIS related to formation of long chains is reduced by means of our proposed model, EDA-PEGASIS thus, reducing the rate of energy depletion in LN to a larger extent. Parameters such as delay, throughput, energy consumption and packet drop ratio can further be analyzed and compared. A properly maintained EDA-PEGASIS outperforms most of the algorithms with similar scenario. The simulation outcomes illustrate that; the proposed work justifies the aim up to an acceptable level. However, more experiments were required in future on the functioning of the proposed system with respect to inter-movement of nodes from one cluster to other.

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A Unique Extensible Framework Detection and Classification of Traffic Events Based on Deep Learning Approach

Prudhvikrishna Gangavarapu, Sandeep Gunapaneni, and K. Mohana Prasad

1 Introduction

Learning methods are carried out all over the world within an assortment of areas. Text-based website traffic removing, as well as analyzing is among the challenging duties to come down with sensible methods as a result of the multi modalities of information [1]. There's a crucial necessity for fine-grained website traffic analyzing and extracting framework. The process of removing as well as analyzing framework is challenging because of various types of cross-domain information really should be aggregated accurately. Those analyzing techniques are Coleman liau-index, Linser write formulae, dale-chall readability scale. All these techniques uses general constraints like mean, median, variance, standard-deviation etc. In addition, only a few data types are sold on a regular basis plus more man variables are involved with this specific issue. Some research has been a good introduction for our work, one of the main area for detection is Machine Learning strategies which are the extremely rapid speed with a wide selection of investigation functions particularly in motion detection as well as design recognition [2]. Motion detection plays a crucial part within detecting as well as determining behavior inside an arena or maybe a picture such as for instance it's utilized within determining the lots of cars inside a specific period over a highway [3]While design recognition plays an immersive function with regards to classifying traffic affected places in social media [4, 5] within a specific

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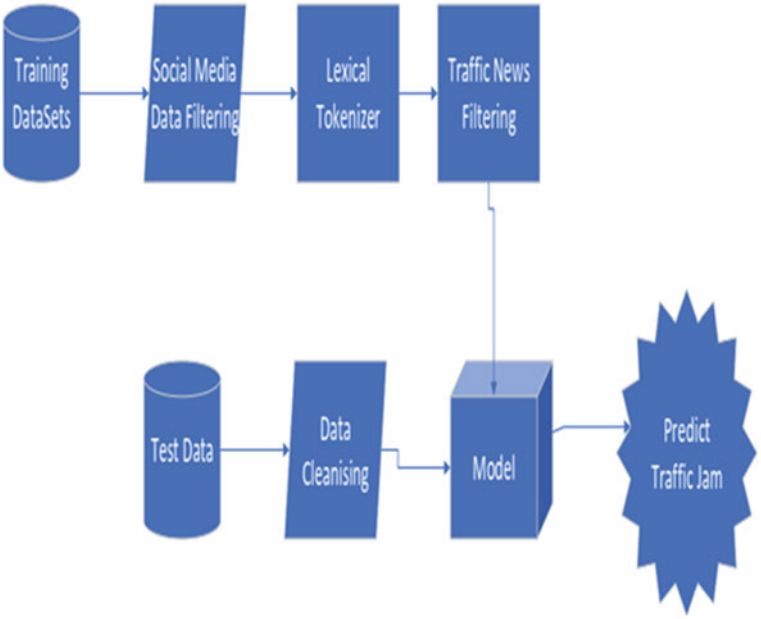

Fig. 1 Architecture

area. Text-based recognition is popular around social media aspects to keep track of the moves on the creatures within the region [6]. The activity detection is completed with the use of different networks including the SVM system, KNN system for classification accuracy [7, 8] and Neural Networks are actively playing a great part in detecting the measures [9]. Earlier scientific studies show that the usage of the SVM system within detecting behavior as well as bounding it with measures containers [10]. Many scientists have actually utilized Deep perception networks to draw out the functions from the skilled steps as well as make use of the attribute to classify the brand new steps [11]. In this paper, we have designed a model that can classify text from an social media and our work detects the information from the dataset and limits a package nearby it so that it is very easy for the spectator [12, 13] (Fig. 1).

2 Related Work

Quite a few scientists are focusing on text detection as well as behavior recognition for numerous uses. When it comes to [14], YOLO strategy is created for Text-based detection which bounds the activities having a package and also labels the title on the activity that it's determined. It's claimed it's a lot more precise in comparison with conventional methods [15]. Information recognition is locating an interesting pavement of printer mastering methods. Gomez et al. have suggested a

picky research algorithm for determining the actions in a term booklet. The algorithm creates a hierarchy of term theory and also creates a great recollection pace in comparison with various other algorithms [16]. Tests carried out on ICDAR benchmarks evidenced that the novel technique suggested within [17] extracted the actual scenes through the organic scenes in a more effective manner. In comparison with standard methods, the suggested algorithm confirmed tougher adaptability to steps in difficult scenarios. Convolutional Neural Networks utilized in Image Segmentation allow accurate localization of neuronal buildings when finding within an electron microscopic. The picky research algorithm for detecting the activities was used-to produce potential activity places. The Selective Search algorithm generated a tiny group of data-driven, high-quality locations, class-independent, yielding ninety-nine % recollection along with a Mean Average Best Overlap of 0.879 from 10,097 places [18]. A number of artificial information that was very rapidly and scalable were generated [19]. Textboxes like one photo Oriented Scene Action Detector and that detects arbitrary focused scene activity with both significant efficiency and accuracy within one community ahead pass [20]. There seemed to be simply no post-processing progression as well as had an effective non maximum suppression [21]. Rather than utilizing the unsuited symbol-based site traffic indication datasets, a difficult Traffic Guide Panel dataset was gathered up to teach as well as look at the suggested framework. Experimental outcomes with actual freeway scenarios [22]. The author recommended a cost-optimized method for measures types of detection which labored nicely for scanned documents that were caught with sheet-fed and flat-bed scanners, cell phone digital cameras, along with various other basic imaging properties [23]. Accuracy is the key for obtaining better results in traffic detection but the system fails to achieve that accuracy due to lot of flaws in the systems, this flaws are due to the underperforming algorithms used for text processing [24] .

3 Proposed Approach

The Proposed application program is going to be utilized for removing as well as analyzing the real-time website traffic info through the social networking sensor. The suggested method supplies a single end-to-end schedule visualization dash panel that empowers the authorities to better understand of automobile traffic incidents coming from social networking sensor. Through this planned program, the category, as well as impact evaluation, are the primary objective of the visitor's security control. It's a gold dig of the people that welcome the gain of comprehending public sentiment. Despite the reality that you will find plenty of ways to classify apps site traffic, DBN methodologies are steadily good at the times. This's about the justification which Machine Learning techniques tend to be more appropriate compared to pre-existing techniques for exactly what is more often, Deep Learning method might be set up of this particular issue. The very best favorable place of machine learning is able to adjust the different conditions irrespective if an additional condition occurs out of the blue. The Proposed system has many methods, like information pre-processing, including

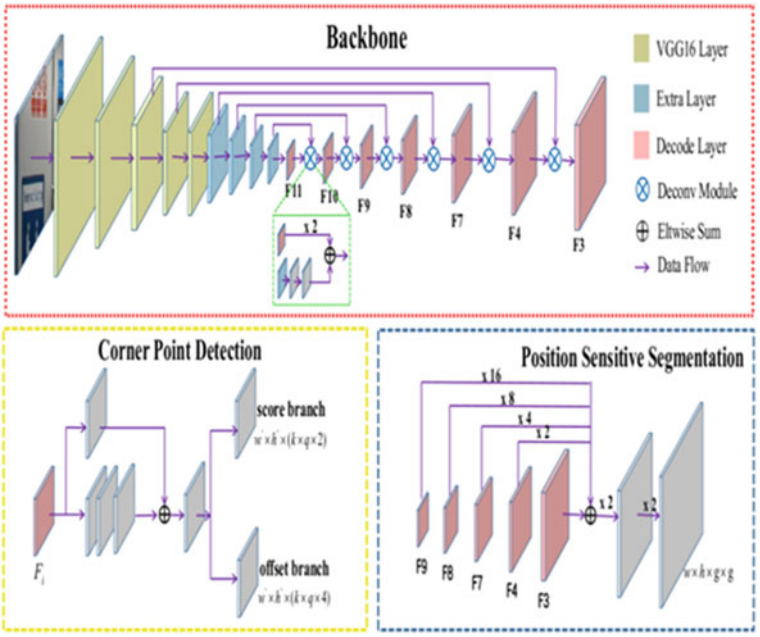

Fig. 2 Design of DBN

removal making use of company knowledge, include choice utilizing pounds of proof as well as info worth, category, in addition to unit validation as well as end result interpretation (Fig. 2).

4 Experimental Results

The experimental outcome was accomplished on a variety of datasets. The dataset was comprised of different pictures which contained behavior within it. The test was carried out by Python and query language in which a full perception system was created. The computer Vision toolbox that is within the program was used-to create the system. When the system was constructed with different levels, the dataset was packed to conduct the instruction. The Data was provided on the system in which the characteristics had been extracted. Next a new social media database was provided to the system to identify the activities and accuracy (Fig. 3).

Figure 3 reveals the training outcomes. The functionality on the system was extremely correct and also the outcomes are revealed inside that figure. The system managed to identify the activities within accuracy level and achieved on identifying the traffic in social media with good communication level. We have tested and achieved the accuracy level.

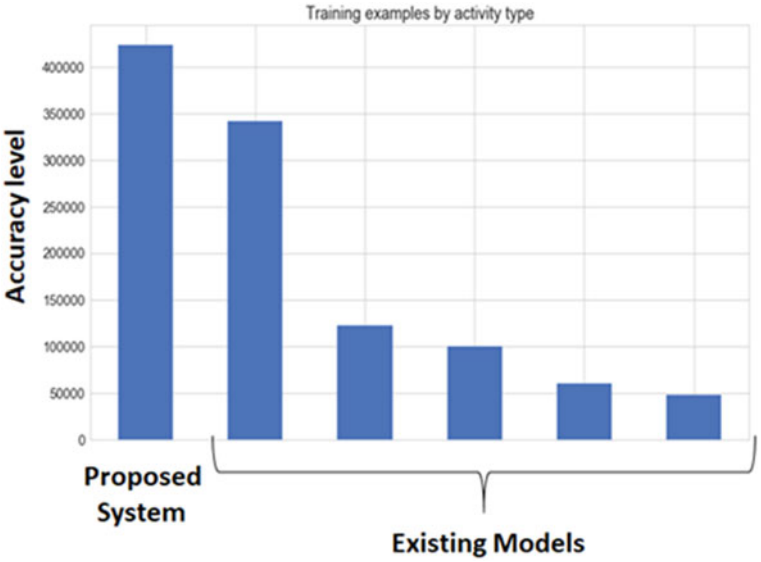

Fig. 3 Accuracy Graph

5 Conclusion

Deep Belief Networks algorithm is the best approach for obtaining better accuracy. Our suggested unit outperforms additional heavy Machine learning techniques. The reputable evidence of the applicability is illustrated by concept and also checking out social media networking results for traffic control by various graphical methods. Crucial regions within the domain, name of visitors, social networking were identified by the proposed system. These benefits are going to gain at the integration of information from other and wearable kinds of solutions.

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An Internal Adversary Model to Prevent Selective Jamming Attacks

Ankinapalli Uma Maheswara Reddy, Agepati Sai Hareesh, and B. Ankayarkanni

1 Introduction

Wireless networks are not associated with any cables. Use of these wireless enterprises to avoid post method of getting cables into structures as an association between assorted hardware [1]. These wireless networks are radio waves, an execution that happens at the corporal height of the structure. Wireless networks consume telephone waves to associate gadgets, for example, workstations for the Internet, system, and applications. When these situations workstations are combined with Wi-Fi badly-behaved areas out of them in open areas, a Combination is linked to that network system [2]. Wireless Network resources mean, i.e. exchange ideas that use nodes as an intermediate medium to transform the information between them. Nearly four kinds of networks are present [3, 4].

- Wireless Local Area Network (LAN): Relations at least with two gadgets using a wireless network, giving association through access points.
- Wireless Metropolitan Area Networks (MAN): In these, it allows with the connection of various wireless LANs. For example, buildings.
- Wireless Wide Area Network (WAN): Covers large area zones. For example, neighbouring towns and urban areas.

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- Wireless Personal Area Network (PAN): Interconnection gadgets in a limited capacity, inside with the individual's reach. For example, IR and Bluetooth have a maximum range of 30 ft.

Wireless Local Area Networks (WLANs) are used its technology gives the arena together. WLANs are used in, navy and studies [5–7]. consequently, the significance of WLAN safety is important. Anyone known styles client-server and networks. Distinction on these networks, i.e., client-server networks can get right of entry transmit facts [8]. The ad-hoc community takes part within the routing method via forwarding messages to every other. It will be simple to the jammers for sending packets with a selected frequency. Attacks try to do the network crash with the usage of getting information with useless site visitors, and sources inside the community so customers within the network don't connect the network, which is used to shut down the network systems, due to safety problems, server and ad-hoc networks have been pretend by simulation tool [9].

They were displayed the actualize excessive denial-of-carrier (DoS) attacks [10–13]. With the most effective shape for jamming, sending an uninterrupted jamming sign [14], or numerous quick jamming [15]. Generally, jamming attacks have been taken into consideration, jammer is not included in the community. This version, jamming methods within the non-stop transmission of powerful-strength signals [13, 16]. However, it is the usual strategy that has many hazards [17]. The main adversary is to burn up an extensive content of energy that is going to compress frequency bands and, the unbroken occurrence of unusually induce the interference stages will these types of assaults clean and hit upon [10, 12] (Fig. 1).

Insight of selective jamming attack. In these, we face a jamming problem with the inner combination version. Recalled an erudite opposition, aware of exchange secrets and methods. Requisition to Introduce selective jamming attacks where particular messages "excessive importance" are focused. In this method, the jammer will degenerate that cannot be recovered. Selective jamming contains Intimate will know the corpus layer, some of the specialized upper layers.

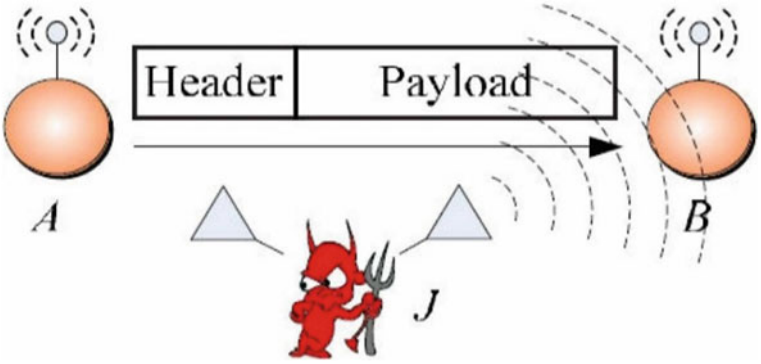

Fig. 1 Awareness of a jamming attack

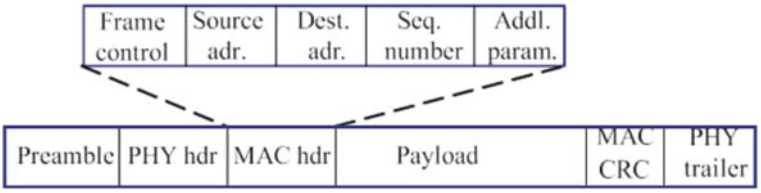

Fig. 2 A common frame for wireless network

2 Problem Statement

Think about state of affairs in Fig. 1 Two nodes *A* and *B* that can associate through wireless within range of both *A* and *B*. between the communication and have node *J* in between them. When *A* sends a data as a packet *m* to node *B*, node *J* will get only few bytes of *m*. *J* low-down m through interfering with the recipient at *B*. We deal with the situation of preventing node *J*, Node *J* is to carry out selective jamming. Jammers attack the network and prevent the network from sending the data from the sender to the receiver. Jammers can attack the network (Fig. 2).

Jamming can be done mainly in two modes:

- External Mode: In external, the jammers will attack externally and it will be easy to detect the external. In the case of internal, it will not be easy to be detected.
- Internal Mode: In Internal jamming, the jammer knows internal data and he can attack and get the data. We can prevent jamming attacks by using Selective Jamming. In the case of selective jamming, we can prevent by selecting particular packets and encrypting the packets. They are mainly three schemes. They are Cryptographic puzzle, Commitment Scheme, All or nothing transformation.

3 Types of Jammers

- Constant Jammer: Despite any jammer, the jammer will execute radio signals.
- Deceptive Jammer: In the case of the deceptive jammer, he continuously injects packets at regular time intervals.
- Random Jammer: Random jammer may vary the transmission of packets. In sometimes continuously send packets or sometimes send them randomly.
- Reactive Jammer: In the case of the reactive jammer, it comes into existence when it senses activity on the channel [18].
- Jamming Attacks: Jamming Attacks is a subset of Denial of Service in which the attacker doesn't allow communication between the sender and receiver by causing interface in communication.
- DOS Attack: In this attack, jammer flood the network.

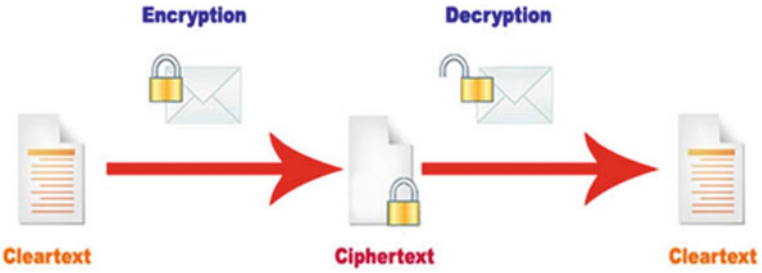

Fig. 3 Components

4 Detection of Jamming

Detection of jamming can be done mainly two methods:

1. Jump Channels
2. Jamming Detection Algorithm:

   (a) Symmetric Encryption Algorithm (Fig. 3):
      (i) Uses only one key to correct and incorrect the data.
      (ii) secret codes are shared by the sender and the receiver instead the receiver should use the same key to decrypt then he can get the original data.
      (iii) There are components like
         (a) Clear/Plain Text
         (b) Encryption.
         (c) Secret Key
         (d) Decryption Algorithm
         (e) Ciphertext

   (b) Brute Force Opposite Block Encryption Algorithm:
      (i) Nothing Transformation.
      (ii) It means it will convert a whole or nothing of data.
      (iii) It is a process converting a plain text before assume to the encryption algorithm.

5 Implementation

5.1 Existing Method

(a) In these, we rely on anti-jamming techniques of the spread spectrum. It uses slow frequency hopping which means changing frequency slowly. It can only protect from external jammers, not from internal attacks.

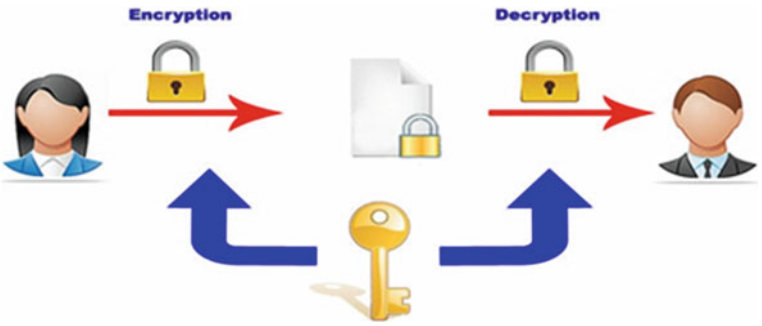

Fig. 4 Architecture

(b) In this model, different jamming strategies will occur like continuous high-power signals.

5.2 Proposed Method

(a) Mainly concentrate on the internal threat model.
(b) In this method, the jammers will be concentrating on highly important messages.
(c) Selective Jamming will be used to prevent the packet from jamming.
(d) The association of cryptographic parameters with the corpus layer is used. The architecture of the proposed method is depicted in Fig. 4.

5.3 Architecture and Modules

(a) Encryption: It is the process of encoding data in a sequence way that only identified parties. It will retrieve it. In this algorithm, contains information ciphertext that can understand only simplified.
(b) Decryption: Decryption is the manner of taking encoded information. and converts back into text or that be able to understand.
(c) Symmetric key: In these, both the encrypted and decrypted keys are identical.
(d) Public key: In this method, the encrypted key is used and identified, only received formed that authorize messages [19].

We have five modules:

(i) Network Module:

Network Module contains networks connected through wireless links [20]. There are mainly two ways in which nodes may communicate with each other. One may communicate directly with each other or it may communicate via multiple

hops indirectly. In this node can Be Communicated and checks encrypted or unencrypted. Symmetric keys are used. They also can be established using asymmetric cryptography.

(ii) Real-Time Packet Classification:

In a packet, l has been encoded, interleaved, modulated and then transmitted into wireless medium and then on the receiver side, the packet l has been demodulated, deinterleaved and decoded [21, 22]. The secret code that has been kept between them secret. In this, the plain text converted to the ciphertext getting used to a secret key.

(iii) Selective Jamming Module:

In this, within the grid are illustrated by targeting the TCP connection and then control process key should be known at the receiver side so that he can decrypt at the receiver side.

(iv) Strong Hiding Commitment Scheme:

SHCS is found on regular cryptography. Main aim is to maintain the data hides with minimal computational.

(v) Cryptographic Puzzle Hiding Scheme:

The goal of scheme that it can provide security. In this, it will execute some computations and then keep the secret in communication.

6 Conclusion

We noticed the difficulty of selective jamming in wireless networks. In this, we mainly concentrated on the internal attacks in the medium. We can overcome this by using different algorithms like symmetric Encryption Algorithm and All or Nothing Transformation. In this, we mainly concentrate on the security of sending the packets from the sender to the receiver by encrypting the messages. On the other side, we can decrypt the data.

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Real-Time Haze Removal Using Filter Function

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1 Introduction

Fog is a characteristic wonder caused because of particles in the air retaining and dissipating light. Because of this, in a dim air, light exuding from far off sources are frequently dissipated, and the onlooker sees a decrease conversely. In addition, images with dimness have diminished perceivability and shading loyalty [1, 2]. Along these lines, dimness expulsion is exceptionally looked for after where misfortune conversely and perceivability is of prime significance, for example, independent vehicles. It likewise profoundly wanted in photography and other PC vision applications [3]. The pictures of open air sights are typically debased by the muddled mediocre in the air. Dimness, haze and smoke are such marvels because of environmental assimilation and dispersing [4–6]. This event impacts the typical work of programmed (motorized) observing framework, open air acknowledgment framework and savvy transportation framework [5]. Light from the atmosphere and light reflected from a thing are disseminated by the liquid dots, coming about the perceivability of prospect to be debased [7]. The two key marvels that result dissipating are 'weakening' and 'airlight' [8, 9]. By the utilization of successful dimness or Haze expulsion of pic, we will improve the safekeeping and quality of the graphical framework. Cloudiness expulsion is troublesome assignment since mist relies upon obscure passage profundity plot data [10]. Haze impact is consequence separation among camera and article. Consequently, expulsion of Fog requires finding the air and light guide or profundity map. The present murkiness expulsion technique could

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be isolated into two classes: (a) image upgrade and (b) image reclamation [11, 12]. Upgrading the pics gained while meagre climate situations called de-enduring and it is a basic issue in apps, for example, airborne camerawork, lashing help and visual observation [11, 13, 14]. Reclamation of images is significant in a few open air applications, for example, remote detecting, astute vehicles, and so forth [9].

2 Related Work

Ancutii et al. [9] presented an elective single-image based system that can precisely dehaze images utilizing just the first corrupted data. Notwithstanding, as opposed to existing systems, they fabricated their methodology on a combination technique. They are the first to show the utility and viability of a combination put together system for dehazing with respect to a solitary corrupted image. The principle idea driving their combination based strategy is that they get two info images from the first contribution with the point of recouping the perceivability for every district of the scene in any event one of them. Moreover, combination improvement system gauges for each pixel the alluring similar based characteristics (called load plots) that controls the commitment of each contribution to the conclusive aftermath. So as to determine the pics that satisfy the perceivability suspicions obligatory for combination procedure, they examine the ophthalmic exemplary for this sort of debasement. Their procedure has a few points of interest over past single image de-hazing techniques. To begin with, their methodology plays out a powerful per-pixel calculation, unique in relation to most of the past techniques. An appropriate per-pixel procedure lessens the measure of curios, since fix based techniques have a few confinements because of the supposition of consistent air light in each fix [15]. When all is said in done, the presumptions made by fix based systems don't hold, and subsequently extra post handling periods are required. Besides, since they don't assess the profundity (broadcast) map, the multifaceted nature of the methodology is subordinate than a large portion of past procedures. At long last, their procedure performs quicker which makes it reasonable for constant applications.

Wei et al. [16] introduced the cloudiness evacuation which really considers deright of passage and de-hazing. As per the optics point of view, single-pic murkiness evacuation is technique which is utilized to expel barometrical dispersing from solitary pic having cloudiness or haze [17]. Calculation gauges the diffusion record by figuring the malicious flight path L2-standard of example opening to supplant 2 minimizing filters and lessens compute intricacy. In the mean time, in view of the absence of shading ellipsoid model through profundity brokenness, the anticipated calculation utilizes a direction strainer to rally enhance the broadcast plot t. The following publication additionally rallies unblemished appearance rebuilding to straightforwardly acquire a neat pic with satisfactory intensity. When contrasted and the conduction records evaluated utilizing a dull filter strategy, the proposed technique doesn't require two least filters. The improved image reclamation process

straightforwardly recuperates an image with enough brilliance, thusly the creator don't have to build the presentation of the recouped image for show.

Jyoti et al. [18] proposed a compelling haze-free technique to expel haze from input image. Right now, the first image is changed over from RGB to YCbCr. Furthermore, register the force part of YCbCr and key perception of all pixels of the pic. Mostly nearby fixes in fog-free open air images contain a few pixels which have extremely low powers, in any event, one shading filter. Utilizing this system with the haze image, the creator can straightforwardly evaluate the nearby snowy adjusting of the pic, worldwide adjusting of the image, middle of the image and mean of the pic. **He et al.** [4] wished-for a novel earlier dull strainer earlier for single image cloudiness evacuation. The dim filter depends on the insights of open air dimness free pics. They can find that in a large portion of the nearby areas that don't conceal the sky, a few pixels (called dim pixels) all the time have extremely stumpy power, in any event, one shading (RGB) filter. In foggy pics, the power of these dim pixels in the filter is mainly done by the airlight. In the same way, these dim-pixels straightforwardly can give a correct estimation of fog based on tangling insertion technique.

Zhu et al. [19] suggested a paper shading weakening earlier for lone image de-hazing. This straightforward and ground-breaking earlier be able to assist with making a direct exemplary for the prospect profundity of snowy image. By knowledge, the restrictions of the direct prototypical by a regulated knowing strategy, scaffold amongst the murky pic and its comparing profundity plot are fabricated viably. By the recouped profundity data, work can be without much of a rigidity expel the dimness from a solitary cloudy pic. The productivity of this de-hazing technique is drastically in height and the de-hazing adequacy is likewise better than winning de-hazing calculations. By manufacture a direct archetypal for the method profundity of dim image with the straightforward nevertheless incredible former and learning the constraints of model exploiting a synchronized knowledge strategy, the profundity data can very much get better. By methods for profundity map acquired by the recommended technique, the scene cleverness of the dim image is recuperated no problem at all.

3 Existing System

Currently, to perform operations for removing fog and noise in the pic DCP is used and also GLP along with transmission map [20, 21]. This contemplated shading pic and renovate into R.G.B configuration. Convert pic into a twofold enticement for dim filter [22]. Presently produce lattice for Dark Channel fuddled pic with 0's. Expand lattice magnitude of DC utilizing eqn-4 underneath [23, 3]. Gauge the environmental dainty utilizing least sifter. Compute the broadcast map for perceivability of an image. The estimation of the map is lesser than 1. To have safety for edges of the pic have edge strategy. The adjusting strategy improved the detectable quality of snowy pic.

3.1 Disadvantages of Existing System

- In a current framework, it produce commotion
- There is no filter work
- less precision.

4 Proposed System

Numerous calculations are created for improving the perceivability nature of an image in spatial space however in the event that these techniques are applied in recurrence area, at that point it produces better outcome and decreases an opportunity to deliver the yield. At the point, when we need to change over the spatial space contribution to recurrence area at that point utilize methods. At the point, when we obtain the recurrence of clamor, we must use separating strategies and diminish the commotion recurrence and created is upgraded yield improved image. Speak to the clamor image separating in recurrence area and without no problem at all we can get the output clear image without any noises or disturbances (Fig. 1).

4.1 Advantages

- The given proposed framework is done continuously
- Less commotion happens
- Using filter work, it decreases the commotion
- High precision.

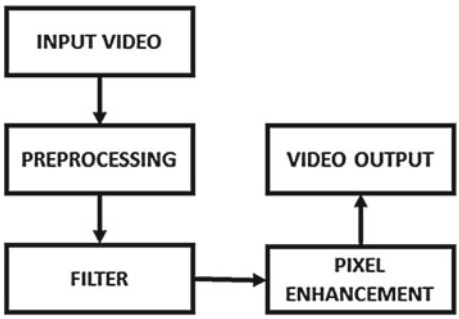

Fig. 1 Overview of the proposed system

5 Module Description

5.1 Image Pre-processing

The first thing that is done by using the image pre-processing is in the increase of contrast. Contrast is basically occupying the intensities and colours of the pic. Increasing the saturation and contrast is one of the basic operation that can be performed using this module.

5.2 Filter Types

Image filtering can be gathered in two relying upon the impacts.

5.3 Less Transmit Sieves

Less transmit sieving (also known as smoothing), is useful to change high-level relapse from advanced image. This method as a rule utilizes moving window administrator which influences each pixel of the pic in turn, fluctuating its incentive with less capacity of neighbourhood locale of pixel. The administrator helps in moving the pixel over pic to influence the other pixels in the pic.

5.4 High Transmit Sieves

An height-clearance riddle can be utilized to cause a pic to seem more honed. The above-mentioned method accentuates adequate [24] subtleties in the image—something contrary to the low-transmit sieve. High-pass separating works similarly as low-transmit sieving. It performs edge-detection and sharpening (Fig. 2).

5.5 Image Enhancement and OpenCV

The general purpose of image enhancement is that if you process a pic so that after processing the result pic is obtained which is more suitable than the original like in other words more clearly visible than original. If an image is a little bit dark or not visible more effectively then by using this process we can enhance the pic up to some extent not more than that. OpenCV is an open-source compendium this is aimed at real-time computer vision and also its library is a cross-platform and can run in any

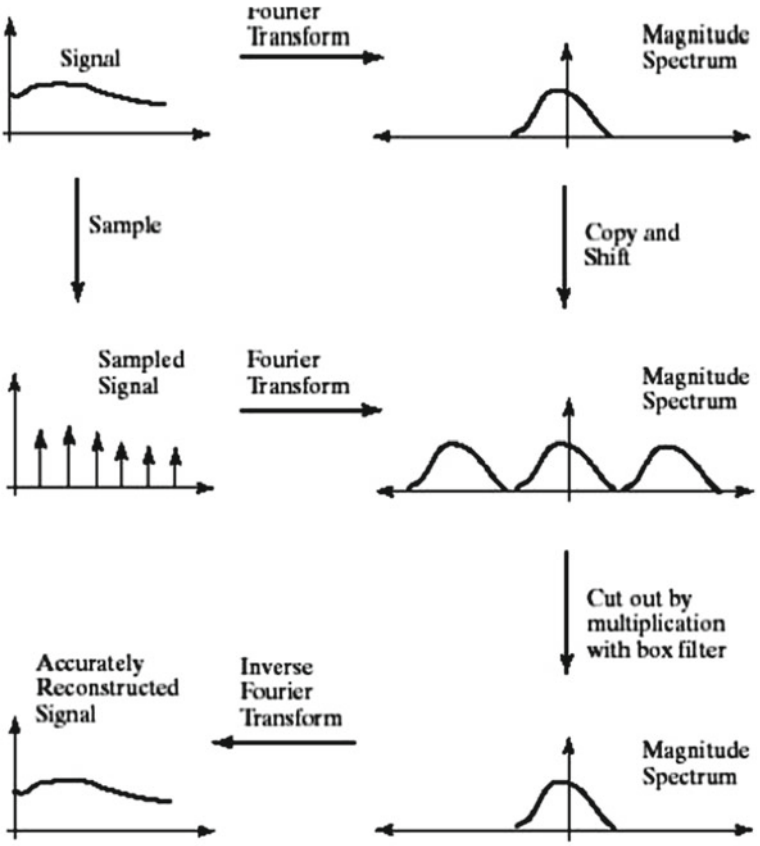

Fig. 2 Filter

programming language like Python, Java, etc. It is made by intel and is one of the most used tool for pic and video detection and enhancement. CV stands for computer vision and it is the way of teaching intelligence to the machines and making them see things just like we humans can see. Just like how we're able to recognize in the same way system can also recognize faces.

6 Conclusion

Fog because of residue, smoke and other dry particles lessens perceivability for far-off areas by causing an un-foggable dim tint in caught pics. Fog/Mist disposal is troublesome on grounds that the haze is subject to the inconclusive profundity data. All the dehazing techniques are helpful for reconnaissance, astute vehicles,

for remote detecting and submerged imaging, and so-on. Haze evacuation calculations are utilized to mend the painterly nature of pic, which is influenced by nimble dissipating concluded murkiness specks. Paper benevolences different straightforward and quicker de-fogging strategies utilized in the turf of pic handling methods, through which haze will get evaluated from foggy pics.

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Sleep Apnea Detection

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1 Introduction

Sleep comprises around one fourths of human life. It is fundamental for us to perform regular work and be dynamic unequaled. Rest is the best treatment for stress, sadness, and medical problems. Sound sleep improves the physical wellbeing and state of mind of an individual. Absence of sleep chiefly impacts the working of the mind by which the working states of the individual gets profoundly upset. The condition where the individual experiences absence of rest and noisy wheezing is called sleeping disorder. Sleeping disorder is a conceivably genuine rest issue in which breathing over and over stops and starts. On the off chance that the individual starts to wheeze noisily and feel tired following an entire evenings rest, at that point, the individual is probably going to have a rest apnea. There are two main types of sleeping disorder conditions.

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They are:

1. Obstructive sleeping disorder.
2. Central sleeping disorder.

Right now, we will examine mostly about the obstructive rest apnea, and the fundamental side effects of the obstructive rest are uproarious wheezing, trouble in breathing, sleep deprivation, and so on [1]. As the rest expect a recognizable work in an individual life cycle, watching it is incredibly unavoidable to check for any napping issue. As days voyage by, mechanical degrees of progress are extending prominently, so the devices to screen sleep apnea are growing. The gadget to screen the rest of a patient ought to be agreeable and simple to wear and furthermore ought to be far away from causing perilous mishap with headway in physiological observing gadgets it has gotten simpler to screen the rest. Numerous gadgets and application appeared that are both reasonable and compelling and can be utilized at home to screen rest for longer hours with no issue. They additionally accompany programmed identification of rest designs without a need of master. There are numerous gadgets which take readings dependent on cerebrum working, pulse, wheezing, temperature, and additionally circulatory strain [2].

2 Related Work

Many devices came into existence for monitoring sleep apnea [3]. They talked about the preponderance of the sleeping disorder in the existing population and spreading awareness about the disorder. The above papers provide important information about the spreading of the sleep apnea. They provide the people a study on the topic to create some awareness [4]. They also tell us about the effect and disorders of age on the sleep. [5–7] papers tell us the ongoing recent developments in the devices that monitor the sleep or collecting the information related to the sleep of a person using different sensors. Lots of variety of sensors have been developed to measure the quality of the sleep like ballisto cardiogram, etc. Many of them are wearable devices, and some of them are unobstrusive. [8] makes a study about the ballisto cardiography, and it recalls us that our human body moves slightly each time in response to the pumping of the blood by the heart into the arteries. [9] talks about the study of the sleep through monitoring the blood pressure of the subject. [10, 11] speaks about the quality of sleep. As so many devices that monitor the sleep work based on the electrodes that can be connected to the patient. Through connecting the wires or the electrodes to the patient, the quality of the sleep of the patient is disturbed [12]. So, the actigraphs are introduced where there is no use of physical connection using wires or electrodes. New devices are introduced which can be connected to the legs of the patient. Mack et al. [13] describes that methods like ballistro cardiography became famous because of the non-disturbing measurement of the sleep. It also describes the usage of the physiological signals for the measurement of the sleep. Mack et al. [14] introduces the development of the portable system to monitor the heart beat of the patient. Hwang

et al. [15] tells us the usage of the polyvinylidene film-based sensor to for the sleep quality measurement [16, 17]. Finally, Waltisberg et al. [18] introduce the in-bed sensors to discern the pressure changes that are made by the body movements made by the patient. Different kind of IoT applications used different types of processors [19–23] . Senaratna et al. [24] proposed the prevalence of obstructive sleep apnea in adults. Sleeping disorder in different adults with respiration problem [25, 26]. Nagarajan et al. [27] proposed the optimal nonparametric Bayesian model-based multimodal BoVW creation.

3 Proposed Work

In this paper, we are creating a sleep apnea monitor that checks roughly whether the particular person is having sleep apnea or not. In this project, we are making use of EEG sensor that is used to record the brain waves. We can have a display of the functioning of the brain in the form of readings or in the form of graphical form. By comparing the obtained graphical form with the already existing patient's brain wave forms, we can distinguish the particular person is affected by sleep apnea or not. This sleep apnea monitor will also save the information obtained from the brain waves in the cloud. We can access this data whenever we want from any device which is having stable Internet connection. We can also get alert messages when the readings taken for the patient show a major hike or differences. In this project, we are making use of an EEG sensor, Node MCU, and ESP 8266 Wi-Fi kit which are used as the hardware to take the readings of the brain waves and display them on the monitor. The Node MCU works on a voltage range of 3.3v. The ESP 8266 firmware is used to store the obtained information in the cloud and to access it from remote devices with the help of Internet connection. We will be using a mobile application named "Ubidots" to access the information of the brain waves that is stored in the cloud through remote devices with the help of Internet connection. Ubidots offers a platform to send and get the data to and from the cloud. It offers services such as getting alerts based on real-time data available. We have to make sure to install this application for getting or sending the information from the cloud.

4 Materials and Methodologies

4.1 Node MCU

Node MCU is a firmware that permits you to program the ESP8266 modules with LUA content. What is more, you will see it fundamentally the same as the manner in which you program your Arduino. We can set up the WiFi connection only with

a few lines of code and control the ESP8266 GPIOs, converting your ESP8266 into a Web server and more.

4.2 ESP 8266 Module

The ESP8266 module is used to store the data and gives access to your WiFi module. This module is attached to do either sending the data to the cloud and storing it or can manipulate the data in the cloud. Connecting this module to the Arduino makes it even more powerful, so that it can store the data obtained from the sensors into the cloud. This data present in the cloud is accessed through any remote device. This ESP8266 module is affordable to many people due to its low cost. It can be easily installed into the Arduino devices and create immense and developing network.

4.3 Arduino Uno

Arduino is an instrument having control of huge amount of data which is greater than the data that is available in your personal computer. It is a free source available in the Internet that is used for designing the programming for the Arduino board. It consists of the domain useful for the programming useful for the board. Arduino is helpful in creating amazing articles, controlling the switches and sensors. The tasks performed by the Arduino can be impressive and unique in the way of controlling things. The Arduino programming language is nothing but the execution of wires arranged in the board, a physical registering stage. It can also handle the multiprogramming condition.

4.4 Pin Configuration of Arduino Uno

This Arduino Uno can be given power by an unknown outer source or by an USB connection. The Arduino will choose the power source automatically between the given options. The power given from the outer source can be in the form of AC or DC. The board can work on an outside stockpile of 6–20 V. Whenever provided with under 7 V, be that as it may, the 5 V pin may supply under five volts, and the board might be unsteady. Every one of the pin of the present 14 advanced pins can be used in many ways and for many functions. Each pin has its own working capacity.

4.5 About Arduino Uno Firmware

As the Arduino Uno can be powered with the help of external source or a USB connection, we will build up a USB connection with the PC for the force supply required for it. As we start the Arduino Uno we need to choose 'Conventional ESP8266 Module' from the 'Devices' → 'Board:' dropdown menu. Select 80 MHz as the CPU recurrence. Select '115,200' baud transfer speed is a decent spot to begin—later on, you can attempt higher speeds; however, 115,200 is a decent sheltered spot to begin. Go to your Windows 'Gadget Manager' to discover which Com Port 'USB-Serial CH340' is appointed to. Select the coordinating COM/sequential port for your CH340 USB-Serial interface. The ATmega328 gives UART TTL (5 V) sequential correspondence, which is accessible on computerized pins 0 (RX) and 1 (TX). In any case, on Windows, an inf record is required. The Arduino Uno programming equips a screen which allows basic information to be sent and received from the Arduino board.

4.6 Embedded Systems

Generally, the computers nowadays are working properly without any real-time complexities because of the embedded systems. The embedded systems come along with the system. Implanted systems designs are prevalent today as they can control most of the basic devices nowadays. Truly, implanted frameworks can run from convenient devices, for example, advanced clocks, MP3 devices to huge established devices like traffic lights, industries, and industries producing atomic explosives. Despite the fact that cooperation with the outside world by means of sensors and actuators is a significant part of implanted frameworks, these frameworks likewise give usefulness explicit to their applications. Implanted frameworks commonly execute applications, for example, control laws, limited state machines, and sign preparing calculations.

These frameworks should likewise recognize and respond to shortcomings in both the inside processing condition just as the encompassing electromechanical frameworks.

4.7 Ubidots

Ubidots is an application that converts the graphical data to numerical data. We use the Ubidots platform to transfer the obtained data to the cloud systems. We can also get alert messages if there is any drastic change in the obtained real-time data. Ubidots provides a REST API that provides us the way to send and receive the data

to and from the cloud servers from where we can actually access our data which has been taken from the EEG sensor that is connected to the patient.

5 Implementation

As we connect the Arduino to the laptop by establishing a USB connection between them, we have to open the previously installed Arduino IDE. After opening the IDE, we have to go to tools and select the COM7 in serial port section. After selecting the port, we have to choose a suitable board (in our case it is Arduino Nano) from board section in the tools. Then, write and upload the sketch Arduino board. Then, we can obtain the recordings of the brain waves in the IDE. As we establish the connection between the Arduino and the laptop via a USB connection, it will take enough power supply, and it will turn on. Now, we have to connect the three electrodes to the patient at the back of the head to take the readings of the brain. After making necessary arrangements in the Arduino IDE, we will get the readings of the brain in the form of a graph. We can also get the readings in the form of mathematical values. This data obtained from the brain with the help of EEG sensor is directly stored in the cloud with the help of ESP8266 board. This data can be accessed from the cloud from any remote device with the help of Ubidots application which should be installed in the device from which you are accessing the data. The Ubidots application works on real-time data and can also send alert messages to the device when there is a drastic change in the readings taken from the EEG sensor that records the brain waves.

5.1 Sleep Apnea Monitor

The device consists of Arduino Uno board, ESP8266, microcontroller, and electrodes. The recommended voltage rage of the board range is 7–12 V. Each pin out of the 14 pins on the Uno can be utilized as an information using pinMode(). Microcontrollers rely upon a host PC for creating and accumulating programs. For the Arduino, the advancement condition depends on the open-source processing stage. The Arduino programming language use an open-source venture known as Wiring (wiring.org.co). The anodes are utilized to take the perusing from the cerebrum in the process which they are associated with the rear of the head. Figure 1 shows the block diagram of the system.

To perform the experiment of monitoring using the proposed system, we have taken a patient and attached the system to the patient by connecting the electrodes to the back of the head of the patient. Then, we have established an USB connection between the Arduino and the laptop. Then, the Adruino has acquired enough power to work and then produces the graph of recordings of the brain which is measured by an EEG sensor. Figure 2 shows the system for monitoring the sleep apnea.

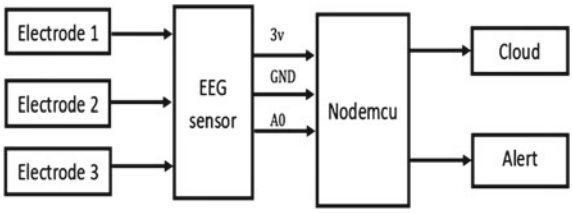

Fig. 1 Block diagram of the system

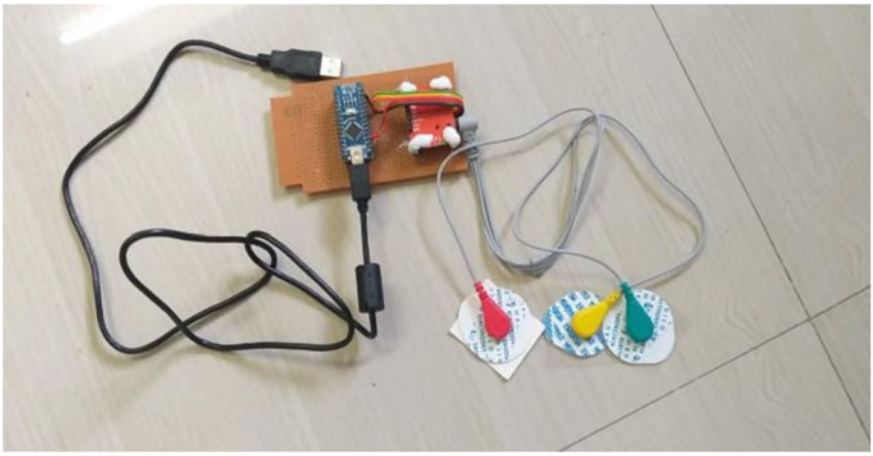

Fig. 2 Sleep apnea monitoring system experiment and result

Then, the data will be obtained in the form of readings which will be directly stored in the cloud with the help of ESP8266. We can access this data which is stored in the cloud from any remote device using Ubidots application which should be installed in the device from which we are accessing the data and that device should be having a stable Internet connection. Ubidots offers a REST API that permits you to peruse and compose information to the assets accessible: information sources, factors, qualities, occasions, and bits of knowledge. Figure 3 shows the person connected with system. The API bolsters both HTTP and HTTPS, and an API key is required. Then, the obtained readings were compared to the readings thatv we were having previously (known as dataset). In that way, we can distinguish the persons who are having sleep disorder and who is not. This system is invented to monitor the sleeping disorder before detecting it and taking preventive measures. The reading sample that is obtained by EEG sensor is shown in Fig. 4.

Figure 4 represents the reading result of the brain of a male person (age: 21) taken using EEG sensor. The reading changes as the person thinks differently every time. By removing the electrodes from the head of the patient, we can stop the reading. This reading can also be obtained in the form of mathematical numbers. Figure 3 shows the attachment of the system to the patient. To determine whether the person is having the sleeping disorder or not, we will have to take the reading for about a full

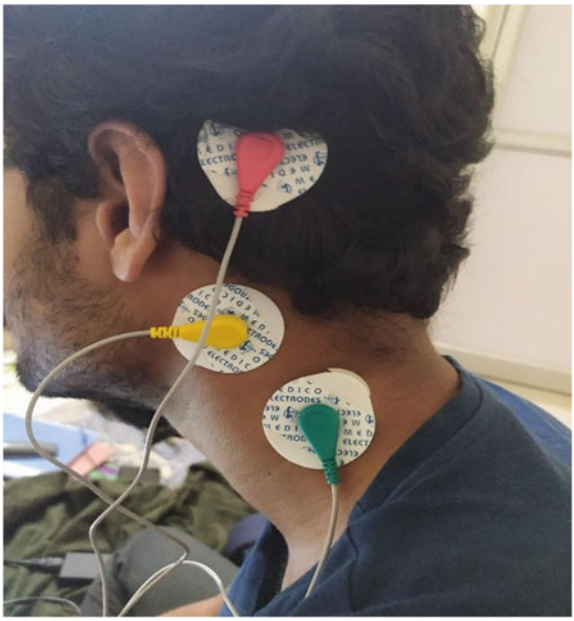

Fig. 3 System connected to a person

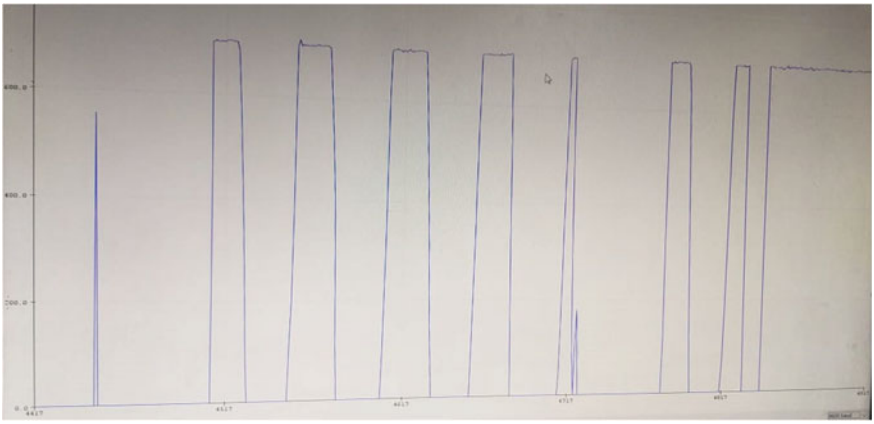

Fig. 4 Reading from brain using EEG sensor

night. Then, we can notice the changes clearly in the sleeping pattern of the patient. We cannot come to a conclusion just by going through the data obtained for a few hours.

6 Conclusion

This project shows the sleep apnea monitoring device for the measurement of brain movements and recordings through which data can be analyzed and compared to the previous datasets that are taken from the set of members having sleep apnea and determine whether the particular person is suffering from sleeping disorder or not. This data obtained from the patient can be stored in the cloud and can be accessed on any remote device which is having access to stable Internet connection.

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Developing Dynamic Functionality to Improve Chronic Wound Healing by Analyzing the Image Content

K. Sai Amruth, K. Sri Harsha, A. Sivasangari, P. Ajitha, T. Anandhi, and K. Indira

1 Introduction

The most widely recognized kind of noise is a pretty much irregular variety superimposed on the worth that speaks to the scene. The impact of noise in adjusting the splendor level of pixels. The images show adjust grain in filtering electron magnifying instrument [1]. By changing the output rate, an image can be obtained in a small amount of a second or in a few seconds, like the impacts of changing the gap and shade speed of a camera. A long presentation or moderate sweep rate gathers increasingly signal, and the factual noise varieties become a littler piece of the general worth, with the goal that little contrasts which compare to the subtleties of the dust grain can be seen. On the other hand, a quick sweep rate or shorter presentation brings about proportionately more noise in the image, which clouds a significant number of the subtleties and bargains the capacity to perform estimations. In many, presumably most, circumstances, gathering increasingly signal A few cameras can store

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uncompressed or "crude" images, and most different gadgets, for example, scanners and magnifying lens do not make a difference pressure. In any case, numerous cameras, incorporating those in phones, use pressure so as to decrease document size for capacity. Compacting images is usually used to send over images over the Web. For examination purposes, pressure is constantly an issue. There are genuinely lossless pressure techniques (LZW, for instance) that do not modify image substance, and however can create just unassuming size decreases by finding tedious examples. These happen ordinarily in content, however once in a while in images. Lossy pressure, which can lessen less more fundamentally, disposes of or changes pixel esteems, particularly shading data. The most generally utilized pressure technique is JPEG, and even the alleged "lossless" mode does really dispose of information and bargains the image substance. With a more drawn-out introduction, time lessens arbitrary image noise.

Obviously, it is not constantly down to earth or conceivable. We can manage approaches to diminish arbitrary or "dot" noise in obtained images. Another kind of noise, which regularly results from electrical obstruction, vibration, or flickering enlightenment (e.g., from fluorescent lights), is not irregular, yet occasional [2, 3]. The observation image has superimposed dull and light groups that happen when the inadequately protected microwave in the comfort store is running, a typical issue [4, 5].

Expelling or diminishing occasional noise can be performed. Pressure noise in the most broad sense is any piece of the put-away image that does not speak to the first scene. The quality of a put-away image positively relies upon noise coming about because of the measurements of the sign, in addition to encourage corruption brought about by the hardware in the camera and any obstruction from outside elements. Be that as it may, by a long shot the most significant constraint on the quality and subsequently helpfulness. The thought is to have a cost work like mean squared error that we saw during relapse model preparing. At that point, we modify the load sutilizing gradient descent in order to limit this cost work [6]. To do this, we ascertain the incomplete subsidiary of the cost work as for each weight esteem. At that point, in view of the error term, we utilize this halfway subsidiary to discover the greatness and heading of the adjustment in weight and apply the change. After each emphasis, the cost work is determined and the loads are refreshed.

Prior to beginning the preparation, we should build up a washed down and standardized preparing data set. This ought to contain information focuses with all our input features and relating expected outputs. This will be treated as something alluded to in the ML people group as the ground truth. The model we train will attempt to learn designs so it tends to be adequate to produce results comparable to the ground truth. As it were, the ground truth is the standard that our ML model will expect to accomplish. Setting up the ground truth and characterizing a decent preparing and testing set are a general beginning stage in the machine learning venture life cycle [7].

The cost capacity might be equivalent to the mean absolute error or mean squared error that we utilized before. This cost work is perfect when we are foreseeing a

worth and we can straightforwardly perceive the distance away our expectations are from genuine qualities utilizing the mean absolute error or mean squared error [8].

The other kind of inclination plummet is stochastic angle drop, where we alter loads after the go of each datum point through the system. Here, we do not store a lot of information in memory and quickly update loads. This is a quick strategy, yet we see changes in the preparation since we will in general overshoot the nearby minima [9].

2 Related Work

Wounds are those that did not continue through an organized and opportune reparative procedure to create anatomic and useful uprightness of the harmed site, for the most part staying unhealed for longer than about a month and a half [10]. Moreover, the recuperating procedure might be deferred if fitting treatment is not given dependent on precise conclusion [11]. In the USA, CW influences roughly 6.5 million patients [12]. The commonness of CW was 4.48 per 1000 of an examination populace in India [13]. Routine analysis of CW totally depends on clinician's (to be specific, consume unit nurture specialists/dermatologists) manual assessment which includes estimation techniques like ruler-based strategies, straightforwardness following, alginate throws, etc [14]. Leg ulcer districts were recognized utilizing from recognition with histogram division [15] and dynamic shape displaying [16, 17]. Zhang et al. applied locale developing technique for edge identification on digitized skin tumor pictures [18]. Endeavor was made to separate wound district utilizing surface investigation [16, 19]. Wound tissues were described utilizing various calculations, in particular, histogram thresholding, mean move smoothing, district developing, and diagrams [20]. Nagarajan et al. [21] described about optimal non parametric bayesian model.

3 Proposed Work

A. Neural Network

As of late, neural networks, or all the more explicitly profound neural networks, have won various challenges in machine learning and example acknowledgment. Profound students are primarily recognized by the pro fund it of their ways that are chains of the perhaps learnable causal connections among impacts and activities. ANN or neural network can be effortlessly introduced as a coordinated acrylic diagram in which the underlying info layer without anyone else takes in signal vectors notwithstanding including single or numerous concealed layers and afterward processes the yields of those past layers. Truth be told, the principle idea driving neural networks can be followed to 50 years prior. There is more discussion about the thought today since we

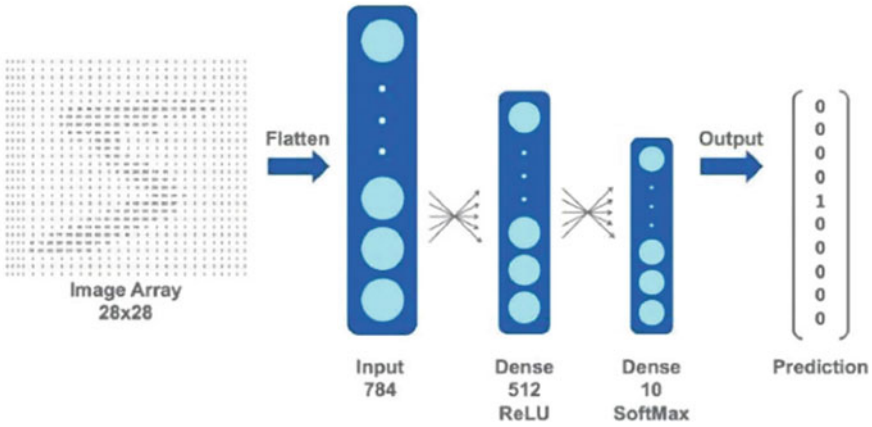

Fig. 1 Neural network model

have much more information and we have essentially progressively groundbreaking PCs, which were not accessible decades back.

A profound neural network has a lot more layers and a lot more hubs in each layer which bring about exponentially more parameters to tune. For the situation when we need more information, we are not ready to gain proficiency with those significant parameters proficiently. Likewise, without groundbreaking machines or PCs, learning would be inadequate just as excessively moderate. Figure 1 shows the neural network model.

B. **Convolutional Neural Network**

Convolutional neural networks or otherwise called CNNs are one of the most usually utilized sorts offered forward neural networks in that the availability design between neurons depends on the association of the normal visual cortex framework. Along these lines, the V1 or the essential visual cortex edges identification out of crude visual information acquired from the retina.

At that point, the V2 or auxiliary visual cortex gets the edge highlights from the essential visual cortex and concentrates straight forward visual properties, for example, spatial recurrence, direction, and shading. The visual region of V4 or another visual cortex fundamentally handles increasingly confused properties or grained objects. At that point, every one of those prepared visual highlights streams into the last unit named sub-par fleeting gyrus of IT for additional object acknowledgment. This particular alternate route between V1 layer and V4 layer, truth be told, propelled a specific kind of convolutional neural networks with associations between those nonadjacent layers named leftover net. Remaining nets contain leftover obstructs that help contributions of one layer to be promptly passed to those layers coming later. Subsequently, convolutional neural networks are normally utilized for edge location, extricating basic visual properties, for example, spatial recurrence, direction, and hues, distinguishing object highlights of middle of the road

intricacy and object acknowledgment. Convolution is ordinarily utilized in scientific terms alluding to an activity between lattices as convolutional layers which by and large have a little framework named channel or piece. As the channel or portion is sliding or convolving over these networks of information images, it is, simultaneously, registering the significant component wide duplication of explicit qualities contained in the piece framework just as contained in the first image esteems. In this manner, explicitly structured channels or pieces are fit for processing images for unmistakable purposes, for example, image honing, obscuring, edge identification, and numerous different procedures effectively and quickly.

C. **Recurrent Neural Network**

A neural network arrangement model is usually intended to change input successions into yield groupings, which live in an alternate area. Another regular sort of profound neural networks named recurrent neural network or repetitive neural networks is enormously appropriate for these reasons as they have indicated a stunning improvement in issues like discourse acknowledgment, penmanship acknowledgment, and machine interpretation. A recurrent neural network model is brought into the world with a stunning ability of processing long successive information and handling exceptionally complex errands with setting spread over a period. The intermittent model, truth be told, forms single component in the neural arrangement at that point. After the underlying calculation, this recently refreshed unit state is effectively passed down to that next time venture to encourage the calculation of each next component. Envision the situation when repetitive neural network model peruses all articles on Wikipedia character by character. Then again, basic perceptron neurons which directly join the present information components, just as the last unit state regularly, may lose those long-haul conditions. For example, we can begin a sentence with Susan is working at… Then, after an entire passage, we need to begin our next sentences with He or She effectively. In the event that the repetitive neural model overlooks the character's name we utilized, we can never know. Utilizing the intensity of LSTM and recurrent neural network cells, you can assemble a recurrent neural network character-based model that will have the option to become familiar with the particular connection between the characters to frame words and sentences with no past information on English jargon. This recurrent neural network model, actually, could accomplish a generally excellent presentation even without a huge arrangement of preparing information.

D. **Fourier Transform**

The two-dimensional Fourier transform of the image work $F(x, y)$ is characterized as

$$M(\omega_x, \omega_y) = \left[R^2(\omega_x, \omega_y) + (\omega_x, \omega_y)\right]^{1/2}$$

$$\phi(\omega_x, \omega_y) = \arctan\left\{\frac{I(\omega_x, \omega_y)}{R(\omega_x, \omega_y)}\right\}$$

The Fourier transform of the spatial autocorrelation of a capacity is equivalent to the size squared of its Fourier transform.

$$\int_{-\infty}^{\infty}\int_{-\infty}^{\infty} |F(x, y)|\mathrm{d}x\mathrm{d}y < \infty$$

A positional move in the info plane outcomes in a stage move in the yield plane:

$$O_f\{F(x-a, y-b)\} = F(\omega_x, \omega_y)\exp\{-i(\omega_x a, \omega_y b)\}$$

The focal point of Keras is a model. The fundamental sort of model form in Keras is known as a succession containing a straight heap of numerous layers. Hence, you make a grouping and continuously add layers to the model in the request you need so you get legitimate calculation. When you characterize your model, you should accumulate your model with the goal that it utilizes the particular hidden structure to enhance the whole procedure of calculation, which will be performed on your profound learning model.

The proposed strategy is executed to improve the image quality utilizing shading remedy, noise sifting, and shading homogenization. Middle channel with 5 * 5 window size is utilized to evacuate the salt-and-paper noise in the wound image. Anisotropic dispersion sifting is utilized for homogenization of shading alongside conservation of edges. Right now, you must determine the analyzer and the misfortune work, which will be utilized. When you accumulate your model, your model must fit to the information. This is done individually, each group of information in turn. Actually, this is the place all the calculation happens. When you train your model, you can utilize it to make other new forecasts on your information.

In the proposed framework derivation stage, the network loads from the very much prepared model and makes pixel-level expectations on new images (unique goals). The yield layer of segmentation network delivers a likelihood guide of a similar size as the information image. In rundown, the development of profound learning models in Keras can be clarified as characterizing your model, ordering your model, accommodating your model, and making expectations. To characterize it, you should make an arrangement and include different layers. When done, you order your model by indicating streamlining agent and misfortune capacities. At that point, you should accommodate your model by executing the model utilizing information. At long last, you make expectations on new information.

The proposed system can be partitioned into three sections including data augmentation, segmentation network, and post-processing. Information augmentation is utilized uniquely in the preparation stage to abstain from overfitting. We increased the preparation information with flip, turn, zoom, interpretation, etc. At that point, the images are haphazardly trimmed to a uniform size (512 × 512). Division network is the center part which plays out the pixel-level arrangement. With all pixels grouped

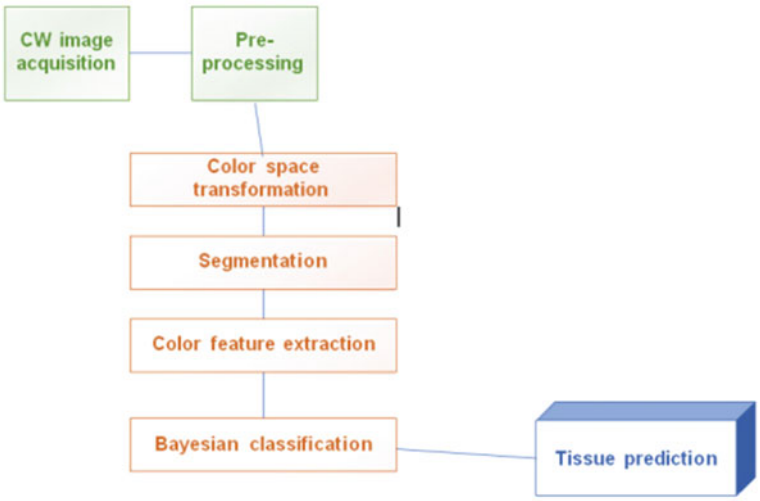

Fig. 2 Proposed model

into closer view and foundation, the wound district is then recognized. The foundation of the division network can be altered from various conventional arrangement networks with completely associated layers evacuated or supplanted by 1×1 convolutional layers . The proposed model is described in Fig. 2.

4 Performance Analysis

Created application actualizes progressed factual example acknowledgment calculation to arrange singular pixels of the wound picture dependent on shading information. Characterization parameters were found out from models displayed to the application during the learning procedure. Wound investigation is self-loader, which implies that the client should physically choose wound limits utilizing square shape, curved or freehand choice instrument, normal to the broadly useful picture handling programming. In the wake of bringing the wound picture into the wound examination programming, client should stamp the wound border and start investigation.

Contingent upon the picture goals and PC speed, examination takes somewhere in the range of one and ten seconds. In the wake of bringing the wound picture into the wound investigation programming, client should stamp the wound edge and start examination. Contingent upon the picture goals and PC speed, examination takes somewhere in the range of one and ten seconds. Figure 3 shows the original wound image. Figure 4 shows the classification of wound image.

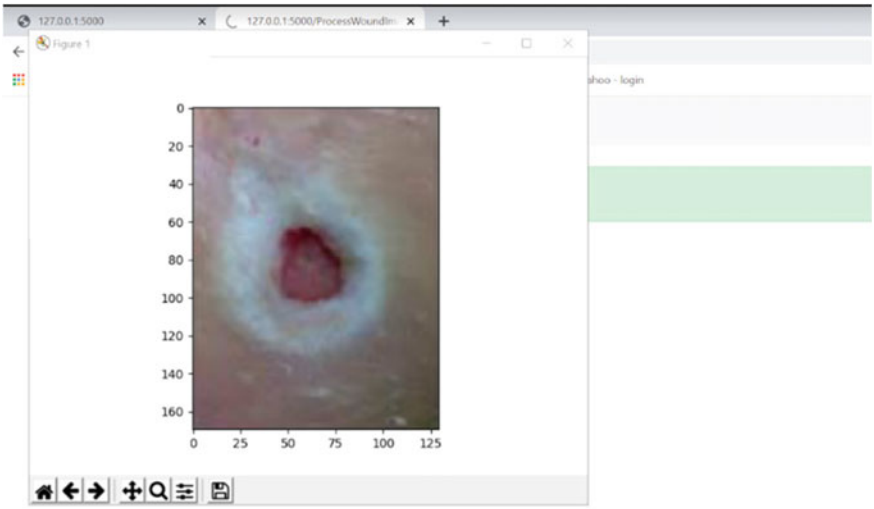

Fig. 3 Original image

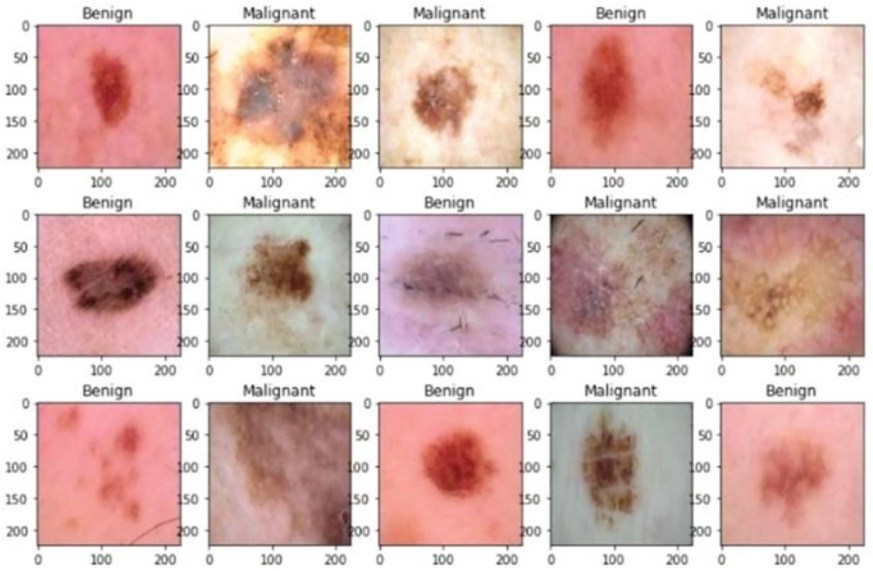

Fig. 4 Wound classification

5 Conclusion

The application proposes a wound checking framework for wound appraisal, assessment, and the board where images and clinical data gained through cell phones/gadgets. It gets huge volumes of unlabeled clinical information over a rapid network. The proposed Bayesian classifier-based wound portrayal calculation appraises the rate with better precision. We structure a viable post-processing methodology as a strengthening to profound learning. Broad examinations show that the proposed structure is effective and precise for differing wound images. By and large, wound segmentation can be viewed as a promising way to deal with supplant observational and uncertain manual estimation for wound regions which can profit the two patients and clinicians.

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Analysis of Road Fatal Accidents Using Apriori Algorithm

Vighrahala Avinash, Appala Brahmananda Gupta, and S. Prince Mary

1 Introduction

There is a great deal of vehicles driving on road consistently and traffic mishaps can occur whenever in anyplace. A few mishaps include the demise, which implies that the individuals kicked the bucket in the mishap [1, 2]. As people, we as a whole need to evade a mishap and remain safe [3]. To get some answers concerning more secure methods for driving, information mining innovation can be applied to an assortment of traffic information to discover significant data and in this manner give driving counsel [4, 5]. Information mining utilizes a wide range of methods and calculations to find the relationship in a lot of information [6]. It is viewed as one of the most significant apparatuses in data innovation in earlier decades [7]. Rule mining of affiliation calculation is a famous philosophy to distinguish the significance of relations between the information put away in huge databases and furthermore assumes a significant job in the inconsistent item set mining [8, 9]. A traditional affiliation rule mining technique is the Apriori calculation whose fundamental errand is to find visit the datasets, which are the strategy we can use to investigate the road traffic information [10]. The characterization in the information extraction technique expects to make a model (classifier) of preparing information records, by which information records with obscure class names can be grouped [11, 12]. Naive Bayes strategy is one of the exceptionally essential likelihood-based strategies for classification that

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depends on Bayes' theory with the assumption of autonomy between each pair of factors [13, 14].

We use FARS information for our exploration. The lethal mishap record contains every single deadly mishap on open streets in 2007 that have been accounted for to the National Road Traffic Safety Administration [15–17]. Informational collections were downloaded from the college of California Polytechnic State University and all the information initially originated from FARS [18]. The informational collection contains 37,248 informational indexes and 55 characteristics. Information portrayals can be found in the FARS archive [19].

2 Related Work

Car crashes including information mining systems can possibly lesser mortality. Utilizing a street wellbeing database permits passing to be decreased by executing street security programs at the nearby and national level [20, 21]. Grouping models to anticipate the seriousness of wounds brought about by auto collisions. Rules mining of affiliation calculation on a dataset about the auto collisions which are assembled from Government Traffic Department, Apriori affiliation rules calculations are applied to dataset to research the association between the recorded mishaps and the elements to mishap seriousness [22].

3 Proposed System

The seriousness of wounds because of car crashes with counterfeit neural systems and choice trees. We apply it to substantial informational collections acquired from the National General Sampling System (NES) from the National Sampling System (GASS). The test results show that choice trees are better than neural systems in all cases. Our examination investigation likewise shows that the three most significant factors in deadly wounds are: the utilization of a driver's safety belt, gentle path conditions and the utilization of liquor by the driver. Our trials likewise show that deadly and non-lethal injury models perform superior to different classes. The capacity to foresee lethal and non-deadly wounds is significant because the demise of the driver causes the most noteworthy monetary and social expenses for the network. Furthermore, the deadly injury relies upon different variables like season, perceivability of the street in morning or night, vehicle type, the purpose behind a mishap, area of the mishap. The motivation behind this investigation is as per the following: Identify the components that added to the contextual analysis dependent on the after-effects of the PTP assessment and reproduction. Apply occasion investigation to the occasion connect to represent mishap situations dependent on accessible data (Fig. 1).

Fig. 1 Architecture diagram

- **Flow Diagram**

The data flow diagram is a two-dimensional graph that depicts how the information is handled and transmitted in a framework. Charts perceive every datum source, and how it connects with other information sources to accomplish commonly advantageous outcomes. To draft an information stream chart, one must

- Identify outside sources of info and yields.
- Determine how the information sources and yields identify with one another.
- Use the chart to clarify how this connection is associated and what causes it.

Job of Data Flow Diagram

It is documentation bolster that is comprehended by the two developers and nonprogrammers. DFD proposes just what procedures are practiced not how they are performed. A physical DFD hypothesizes where the information streams and who forms the information. It allows an expert to segregate the zones of enthusiasm for the association rule mining and to study them by looking at the information provided that enters the procedure and the review of how they are adjusted when they leave.

4 Results and Discussion

We have used data sets of accidents that occur in all areas; the data set includes a type of vehicle, the type of season, reason, etc.; and it analyses the dataset and produces the graphical format.

Accident-Prone Zone Graph

Accident-prone zone graph represents the number of accidents occurs in a location; for each location, it shows unique colour and analyses the datasets, and it shows in the pie chart Fig. 2.

Statistical Information

Factual data chart dissects the datasets, and it speaks to the quantity of mishaps happens in the specific year; for every year, it shows exceptional shading. The X-hub of the diagram speaks to the quantity of the mishaps, and the Y-hub of chart speaks to the specific year shown in Fig. 3.

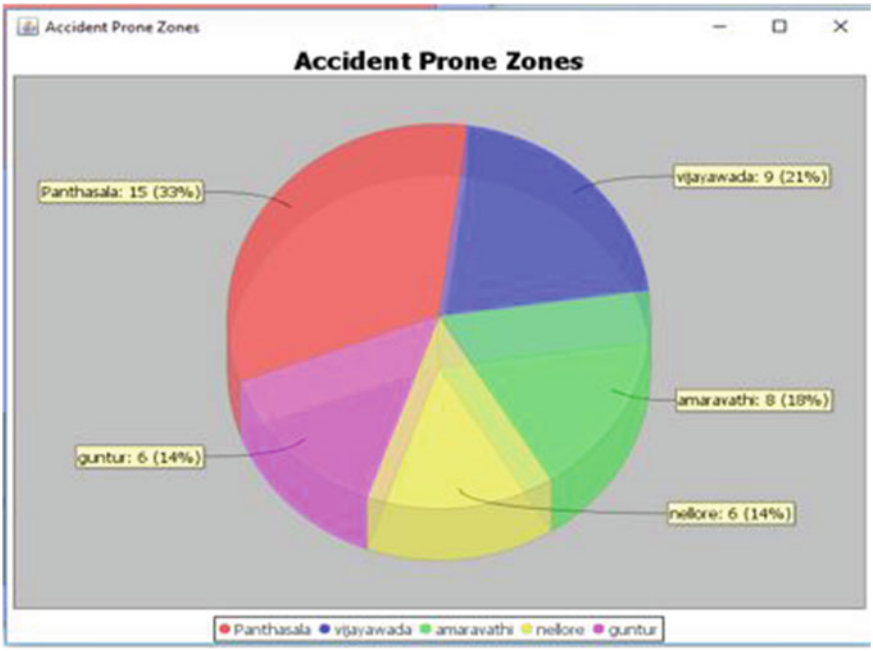

Fig. 2 Accident-prone zone

Accident-Prone Vehicle Graph

Accident-prone zone vehicle graph analyses the data and shows the highest vehicle got an accident in a location; it represents the data in the pie chart Fig. 4.

Prevention Methods

The prevention method shows the safety measures to avoid the accident. It shows the safety measures for two-wheelers separately and four-wheelers separately. Finally, it analyses the vehicle type and shows the prevention methods in table format shown in Fig. 5.

5 Conclusion

As the measurements appear, the extraction of affiliation and characterization rules, natural segments, for example, street surface, timing, light and climate condition status do not affect large death rates, though human factors, for example, movement infection or movement affliction and kind of impact have more impact on fatal rates. From the consequences of the gathering, we can see some nation's areas have the higher death rates while the others have lower death rates. We can drive cautiously

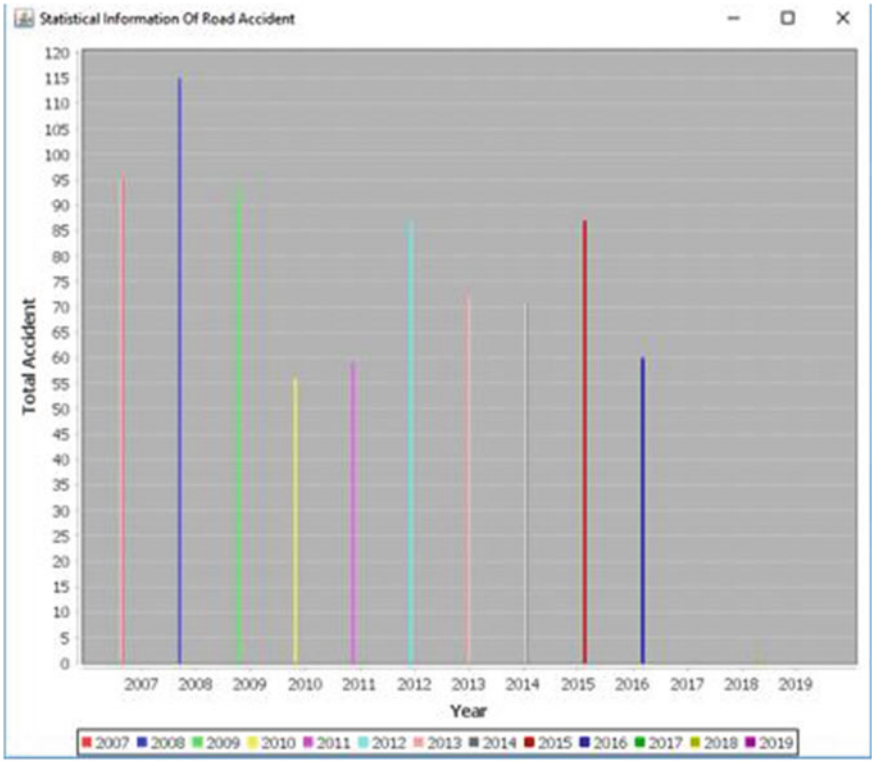

Fig. 3 Statistical information

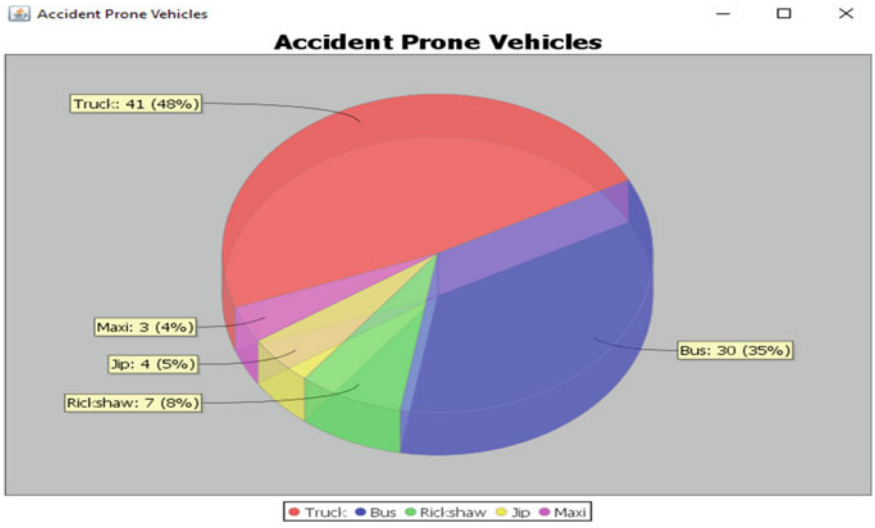

Fig. 4 Accident-prone vehicle

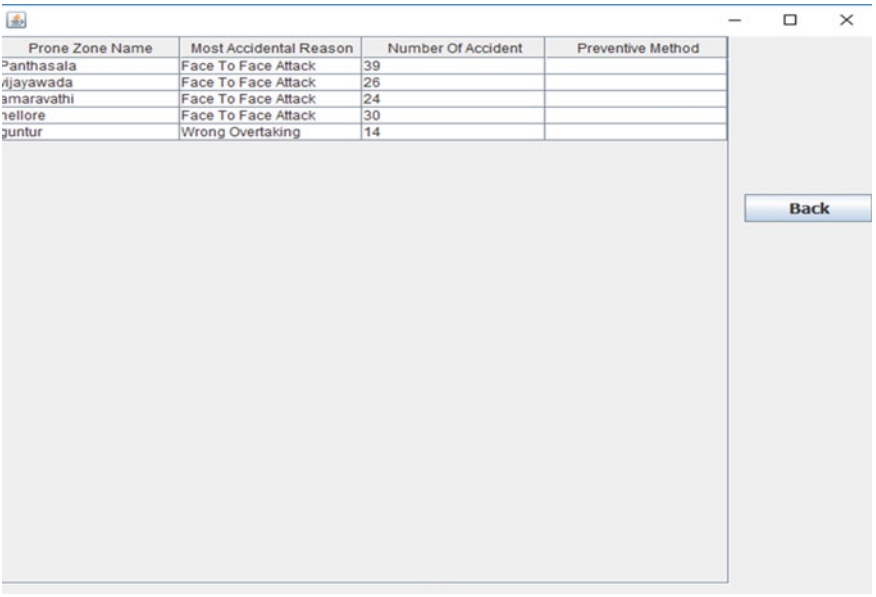

Fig. 5 Prevention methods

on that specific district or state when we realize that the zone is threat inclined region or clumsy zone. One can think about that locale by observing the deadly mishap information provided from the datasets given. It is easy to use but difficult to know the information from datasets when somebody like police, NGO's erase or delete the information. In theories, the information is like climate information, area information, time zone information, vehicle information, and so on.

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Adaptive Image Compression Projection Based on Deep Neural Network

P. Anil Naga Sai, P. Naveen Kumar, and A. Velmurugan

1 Introduction

Learning methods are carried out throughout the everywhere within an assortment of areas. Content-based image retrieval (CBIR) is popular around image processing areas aspects to keep track of them over the creatures within the region. Neural Networks are actively playing a great part in compressing the measures. Earlier existing systems show that the usage of the CNN system within detecting behavior as well as bounding it with measures containers [1]. Many scientists have actually utilized Deep perception networks to draw out the functions from the skilled steps as well as make use of the attribute to classify the brand new steps. A picture compression is needed for the picture processing uses, for instance, information saving, image recognition, etc. image classification. Next, a number of study content articles are already recommended to reserve for the subject areas. Nevertheless, the picture compression with encoder continues to be discovered for a few of all of the advancements. Thus, this particular newspaper provides a comprehensive analysis to exhibit the picture compression algorithm with a DNN [2]. The suggested algorithm comprises of (i) compressing picture with automobile encoder, along with, (ii) decoding picture. Through the results of ours, it indicates the recommended picture compression algorithm has the ability to bring down the picture dimensionality and also lets you remember the compressed picture with lower damage. In this paper,

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we have designed a model with DNN that can extract the images from multiple platforms and our work is to compress the image to the maximum level. In the literature survey, we have analyzed more paper for finding out the problem, finally we took and proposed the quality scheme for compressing. Hence we have achieved the accuracy level [3, 4].

2 Related Work

Quite a few scientists are focusing on image compression as well as behavior recognition for numerous uses [5, 6]. When it comes to [7], DNN strategy is created for text-based detection which bounds the activities having a package and also labels the title on the activity that it is determined. Pixel recognition is locating an interesting roadway of machine learning methods [8]. The author has suggested a picky research algorithm for determining the images in a term booklet. The algorithm creates a hierarchy of term theory and also creates a great recollection pace in comparison with various other algorithms [9]. Tests carried out on ICDAR benchmarks evidenced that the novel technique suggested within [10] extracted the actual images through the internet in a more effective manner. In comparison with standard methods, the suggested algorithm confirmed tougher adaptability to steps in difficult scenarios. Convolutional Neural Networks utilized in Image Segmentation allow accurate localization of neuronal buildings when finding within an electron microscopic but only one layer can operate for compression. DNN algorithm for detecting the activities was used-to produce potential activity places [11]. The Selective Search algorithm generated a tiny group of data-driven, high-quality locations, class-independent, yielding 97% recollection along with a Mean Average Best Overlap of 0.8 from 10,0 places [12].

A number of artificial images that were very rapidly and scalable were generated [13]. Text Boxes ++ like one photo Oriented Scene image predictor and that detects arbitrary focused scene activity with both significant efficiency and accuracy within one community ahead pass [14]. There seemed to be simply no post-processing progression as well as had an effective non-maximum suppression [15, 16]. Rather than utilizing the unsuited content-based site traffic indication datasets, a difficult Traffic Guide Panel dataset was gathered up to teach as well as look at the suggested framework [17]. Experimental outcomes with actual freeway scenarios [18]. The author recommended a cost-optimized method for measures types of detection which labored nicely for scanned documents that were caught with sheet-fed and flat-bed scanners, cell phone digital cameras, along with various other basic imaging property [19]. Recently available developments are making utilization of serious perception networks in DNN methods [20, 21]. DNN is popular in the majority of the apps as the hook-up involving every level is formed by them and it is employed for recognition with much less computational period [22].

3 Existing System

Pictures on the internet to be within the type of compressed bitstream you can conserve storage space. In order to satisfy content-based picture retrieval (CBIR), picture functions may also be forced to be kept in binary type. Within the suggested method, we very first practice a full community for compressing images into the bit stream, after which we gave an additional network for removing picture capabilities like a binary vector [23, 24]. We after that blend the above mentioned two networks as well as fine-tune the consolidated community with triplets of pictures for that process of CBIR. The suggested product is training a full community for picture coding to ensure that the ensuing code works both to reconstruct the picture as well as to find quite similar photographs. The way to instruct such a full community appears not remaining claimed before [25].

(1) **Feature Extraction and Selection**

Transforming the input data into a set of features is called Feature Extraction. It is a method of capturing the visual content of the image. Features are extracted from the input image which includes area, perimeter, equivalent diameter, irregularity index, mean, standard deviation, and entropy. Extracted Features are used in a DNN to train the model in such a way that it could recognize a particular image as normal or abnormal. The classifier will assign the unknown object to the correct class depending on the extracted features. Then section will be performed as per the pixel and generated.

(2) **Fine-Tuning**

As fine-tuning and pre-training have already been thoroughly used within the full mastering literature, we suggest to pre-train two individual networks which perform for compressing photos as well as removing picture functions, respectively, after which merge as well as fine-tune.

(3) **Encoder and Decoder**

The encoder/decoder system is split into a number of subnets (four subnets coming from the best to bottom part are revealed within the figure). All of the subnets have a precisely similar framework but the parameters of theirs are separately qualified. Each and every subnet has three convolutional levels accompanied by way of a binarization level, together with the encoder, after which three deconvolution levels together with the decoder. The subnets are educated sequentially.

(4) **Long Short Term Memory (LSTM) Algorithm and DNN**

LSTM is the algorithm for reducing the memory space by compressing the image using DNN method which can be utilized for later purposes. Images given to DNN will be performing in order then LSTM will utilize as per the rule. When a piece of image is considering the system, image areas are extracted by pixels and it is

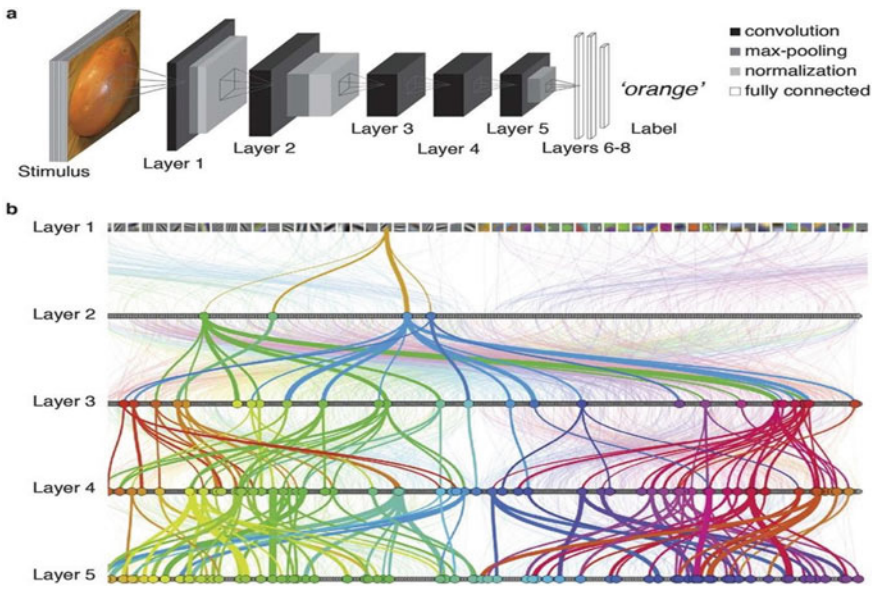

Fig. 1 Design of DNN

transferred onto the compression system in which the characteristics are extracted and also the labeling of the measures are accomplished. The quantity of levels employed within the system completely is determined by performing on the internet. Image compression is incredibly hard to do and therefore extraction is originally carried out on internet to reach learn about the characteristics. The application style of the suggested design is depicted. The picture suggests that the DNN incorporates several levels and it is completely influenced by the necessity of the application program. In Fig. 1, we can see the number layers performing from one to another, image will be operated from layer 1 to extract then at last in layer five, we can get the final image for the next level implementation (Fig. 2).

4 Experimental Results

The experimental outcome was accomplished on a variety of datasets. The dataset was comprised of different pictures which contained behavior within it. The test was carried out by Python and query language in which a full perception system was created. The computer Vision toolbox that is within the program was used to create the system. When the system [26] was constructed with different levels, the dataset was packed to conduct the instruction. The images were provided on the system in which the characteristics had been extracted. Next, a new image database was provided to the system to identify the activities and accuracy

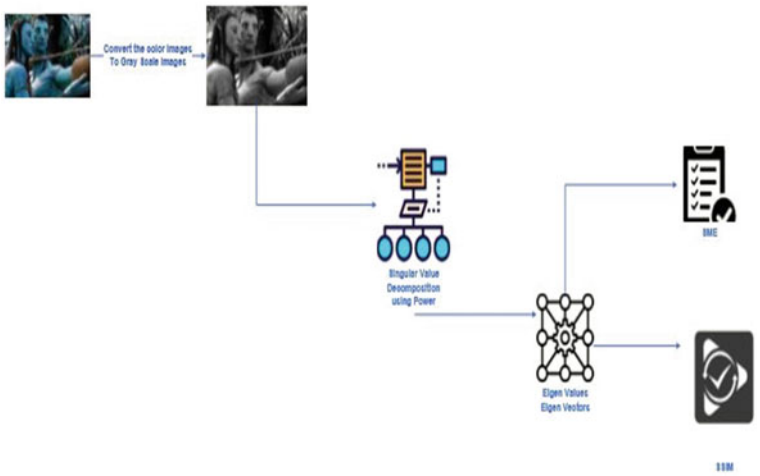

Fig. 2 Architecture diagram

Figure 3 reveals the experimental outcomes. The functionality of the system was extremely correct and also the outcomes are revealed inside that figure. The system managed to identify the activities within accuracy level and achieved on identifying the traffic in social media with good communication level. We have tested and achieved the accuracy level.

In Fig. 4, we can see the image reconstructed from the original image using DNN compression accuracy was good from the original. In Fig. 5, Mean Square Error (MSE)/Structural similarity (SSIM) was compared with singular values. Hence we have achieved the accuracy level and communication level on sighted this result.

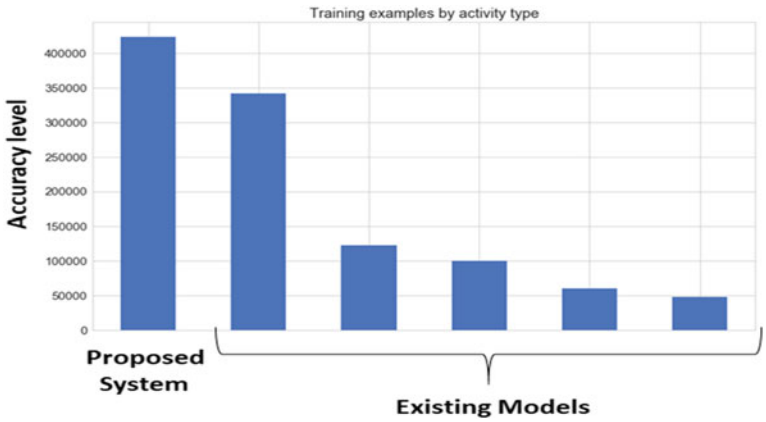

Fig. 3 Accuracy of the model

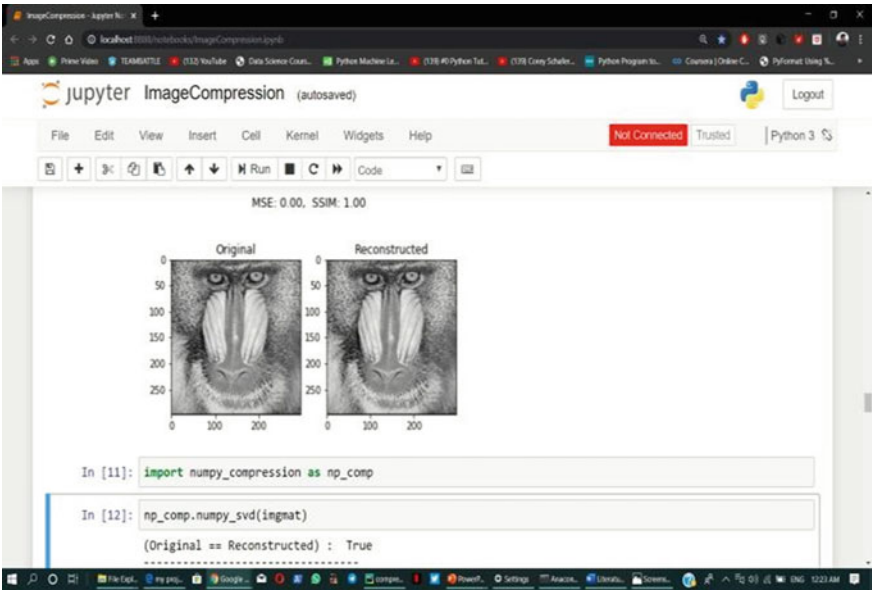

Fig. 4 Image reconstruction output

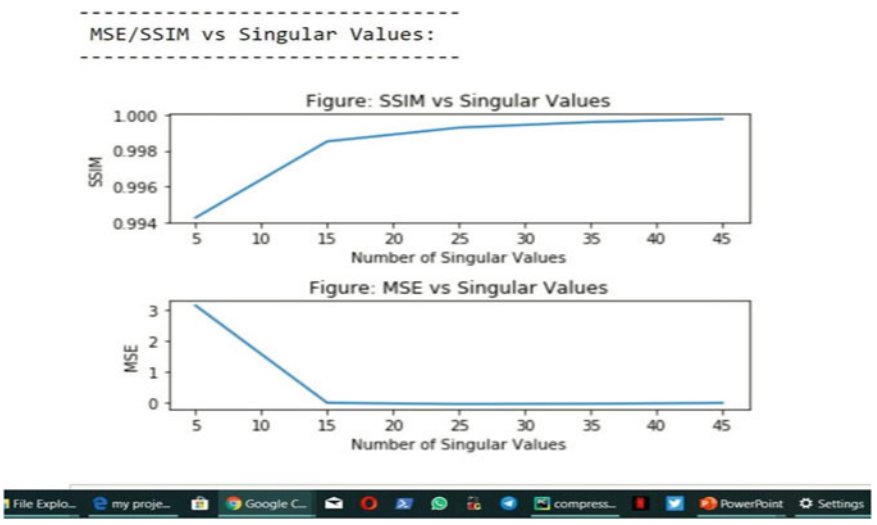

Fig. 5 MSE/SSIM vs. singular values

5 Conclusion

The Extraction was performed using Deep Neural Networks and the proposed model of LSTM had good accuracy. Our suggested unit outperforms additional heavy deep learning techniques. The reputable evidence of the applicability is illustrated by the concept and also checking out the networking results for image extraction and compression. Initially, the encoder/decoder system for compression, next the picture characteristic extractor system, along with 3rd the consolidated community fine-tuned with triplet wise instruction. Experimental results have verified the usability of the scheme as it indeed achieves the compression ratio.

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An Efficient Approach for Patterns of Oriented Motion Flow Facial Gesture Classification Using Depth Video

Akaveeti Saqhline, Varanasi Vinay Krishna, and B. Ankayarkanni

1 Introduction

Outward appearances offer non-verbal signs that region unit the portrayal of an individual's feelings or focuses. Face insistence structures have pulled in the analysts' stacks inside ongoing decades considering the expanding request inside the field of changed human-PC correspondence framework [13]. The common character of face makes it extra legitimate over different bits of information. Assistant degree redid face attestation framework proposes an ADPS that tries to examine and see the face from the visual point of view [15, 16]. All through the most recent twenty years, two or three methods are proposed for different face-related issues, any place completely unique facial segment extraction systems are presented [12].

Considering the portrayals of decisions utilized, facial segment extraction approaches will associate with coordinated into two totally various plans: geometric part based strategy combined with the appearance-based frameworks. The geometric segment based frameworks, segment vector is encompassed kept up the geometric relationship, for example, positions, edges, separations between totally exceptional facial parts (eyes, ears, nose, and so forth.). Prior techniques for facial certification were basically upheld these geometric part portrayals. For face attestation, facial development making (FACS) could be in vogue geometric part based method that every action unit addresses the physical direct of a particular musculus [17]. A

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short time later, Zhang foresaw a segment extraction strategy basically reliant on the geometric spots of thirty-four genuinely picked fiducial core interests. A comparable sort of portrayal was used by Guo and arranged workers, where they utilized applied science to perform journalist segment decision and classifier business. Valstar et al. likewise, Valstar and Pantic have pondered face assessment maintained caterpillar-followed fiducial explanation information and presumed that geometric decisions offer tantamount or superior to appearance-based techniques, all things considered, unit affirmation. Regardless, the suitability of geometric procedures is vivaciously reliant on the right area of facial parts [1, 2] that might be a hard task in control and at opportunity setting, right now geometric systems difficult to suit all things considered [18].

Altogether the complete face image or specific facial areas are considered. Two kinds of approaches are going to be settled over the appearance-based systems [10]. The first arrangement is approach endeavors that use are some segment moderation or class division techniques relay over the power regards to diminishing the component size. The second variety of approach uses any descriptor over the image power regards and produces some key decisions from the image [8]. Only if there ought to emerge an event of feature step-down or class parcel approaches Linear Discriminant Analysis (LDA), Principal Component Analysis (PCA) [11].

These approaches are made of use by applying any descriptor over the image power regards. Those styles of various approaches endeavor to deliver some beneficial data through the neighborhood locale of a picture and make the key other options. The LBP square measures some mainstream descriptors to the component extraction just in occurrence of the outward appearance affirmation system.

As significance camera gives the significance data of any image that staggeringly shows major decisions of the facial picture, therefore face appearance affirmation is in addition trustworthy and moderate on significance essentially based facial expression [3] video which is excepting the assurance of the people is likewise extremely held far-reaching video that makes it extra sensible inside this present reality [9]. During this paper, an uncommon segment descriptor that is said to be Patterns of Oriented Motion Flow (POMF) is foreseen for perceiving the outward appearance from the significance of facial expression video [4].

2 Existing System

Before starting the project, feasibility related data is to be collected and is taken to measure the viability of the system. Feasibility study is very much necessary whether to make a brand new high classified system that can be modified according to our wish of cost, technology, and time by which make these as some of the main features [14].

Technical feasibility basically is one among the numerous studies that have been made and it might also belong to one of the first studies that must have been done at

some point in time when the project is discovered. The study of the technical feasibility includes some of the hardware and software devices. The required technologies (C ++ language and CLion IDE) existed.

3 Proposed System Using POMF

The proposed POMF descriptor works in favor of the development change the photographs that are obtained by the ocular stream information and over the video image of enunciation, our drive is to register the development difference from one edge to the other. Here, the most trial of optical stream estimations is which properties to follow and the best way to deal with tail it. Later from directional development information, a solid model will be delivered using neighborhood surface model.

Optical stream Estimation characteristics have been used logically as the earlier decade over the field on any of the development recognizable proof or the article following. As that describes the various changes in the picture from packaging to plot, these days it is start used for outward appearance affirmation over the video and right now and has conveyed its own capacity and it is done by evaluating optical stream.

Even more unquestionably, it needs to follow a property which fuses development information even more capably. A couple of picture properties have been used consequently all through different optical stream estimation methodologies Through any one of the optical stream estimation, both the sorts of stream information are found and that is known to be a level stream (u) and vertical stream (v). All of both the u, v variables reveal two-directional stream data from both pictures consecutively. The positives u and negatives u address the stream data in the format from left to right and alternative to the left exclusively. Of course, the right v and the wrong v address the stream information completely and base to top independently. In our method, we have used the Luca Kanades technique to evaluate the optical stream information.

This paper propose a directional optical movement based on total descriptor named as Patterns of Oriented Motion Flow (POMF). The straightforward path of action of the POMF is to discretize the development amendment information and catch the encoded little version from those development modifications [6, 7]. From the beginning, discretized development change is extended via the nearby development changes at that factor regularly combined through the self-closeness estimations of LBP little model [8]. Taking the directional of picture information and encryption of those directional picture charges by means of LBP in the POMF descriptor, a strong model is made.

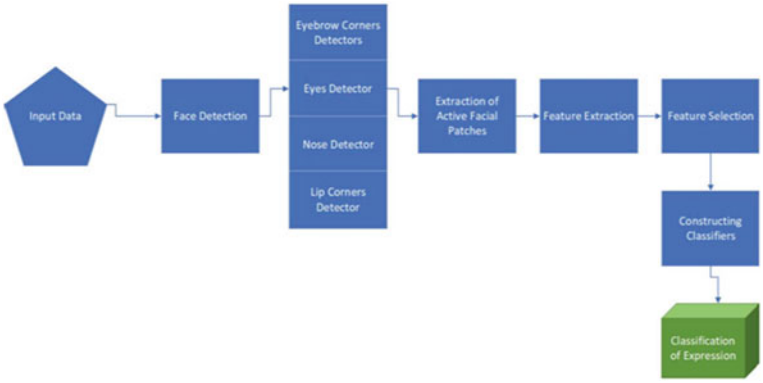

Fig. 1 System architecture

3.1 System Architecture

This is in a situation to acknowledgment RGB snapshots anyways we hold a watch out for an area unit directing. Machine's belief is truly interesting akin to a human. Right now can offer some additional information made the picture the Machine. Hence, the ideas accompany regard to importance pictures. Within the significance picture, excessive picture elements addresses a close to detachment and occasional picture element addresses a way partition (Fig. 1).

Significance data unbelievably adds to the face. Likewise, it in addition ensures the safety of the people. Deep information of face [7] that utilized in our exam became assembled abuse Stunt significance camera. Head development become relied upon to belittle and rejected. Some factors of confinement regard had been used through correct remark to cast off faces from movies supported the important data. The Depth facts become made maintained each RGB and Depth camera-primarily based image recreation plans [5]. For a whole lot of the cases, the verbalization video cuts have been started out and finished with a fair-minded enunciation. In our examinations, a mixture of one hundred and twenty video catches of variable length from all verbalizations had been used within the preliminary. To coach and check each face model, 20 and 40 photo groupings were applied. To guide HMM, the selections had been symbolized via the K-indicates bundle framework the use of a gathering length of 40 and there have been five center covered expresses throughout all of the tests have been chosen through test recognition.

4 Experimental Results

The images in Fig. 2a–e represents the output screenshot of various expressions which means that the person in front of the camera is in different moods and so

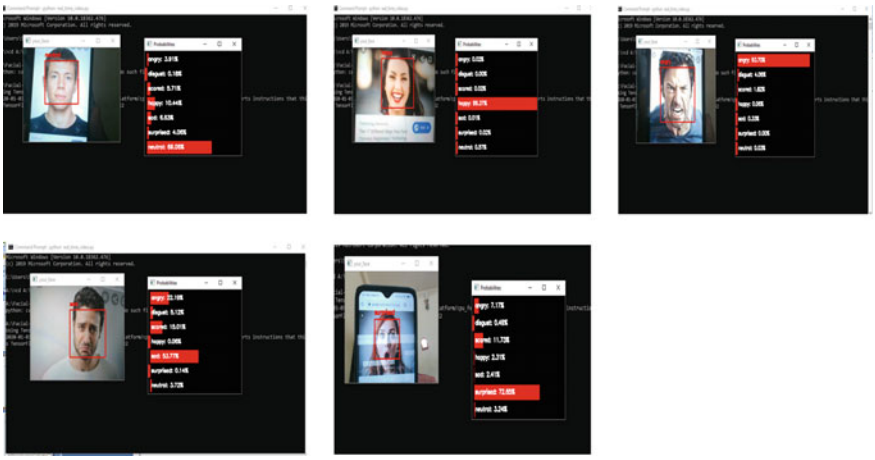

Fig. 2 **a**. Neutral Expression, **b**. Happy Expression, **c**. Angry Expression, **d**. Sad Expression, **e**. Surprised Expression

it is shown by the changes in his expression compared to the neutral expression. And besides we see percentage changes for various expressions which change with movement in the facial expression.

5 Conclusion

At this moment, an effective optical flow essentially based on face confirmation shape is foreseen anyplace the directional version encoded records are used from optical movement of regular significance pictures. This descriptors POMF visual define is made from the model edges to offer the enunciation capabilities vector. The goal groupings of the thing vectors domain unit are arranged through the HMM to present the enunciation version. Moreover, absolutely demanding situations the explanation confirmation like age, sexual direction, facial hair, and glasses will essentially be smothered. Accomplice in Nursing check assessment on every RGB and Deep camera in a well-known sense based video photos are continued similarly as some fantastic processes to control choose the character of our foreseen technique. From the exploratory results, plainly our foreseen POMF descriptor addresses a better affirmation fee for significance based face confirmation shape. Likewise, it additionally creates the impression that the depth picture shows higher execution of the RGB photographs. Our paintings, we maintain an eye out for zone unit going to improve the presentation of POMF via exhibiting the response for non-linearity when you consider that face pictures with enormous cause assortment to outline.

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IoT-Based Traffic Congestion Monitoring and Theft Alarm

A. Preetha, S. Gayathri, and A. C. Santha Sheela

1 Inroduction

Unbelievable contemplations were created for IoT in the most recent decade, now no merely for education purposes yet additionally for work regions. IoT comprises all-inclusive issues in everyday presence, e.g. phones, laptops, televisions, cars. Very healthy nature of IoT is shaping different architecture construction via organizing well-liked frameworks [5–7]. With the headway of spotting, figuring additionally, arranging devices in a similar fashion as developments, the primary piece of information is of fast growth in enormous scale city zones, including nonstop visitors data, vehicular versatility knowledge what is steady, social associations [11]. The main piece of IoT, internet of automobiles (IoV) is grown to be another investigation field for the progression of current packages in artful city networks, e.g., visitors the board and road safety. A large number of international locations are focusing on the enhancement of IoV buildings, e.g. Ertico from Belgium [12, 13]. Typically talking mechanics made tested methods reliant for vehicle to vehicle exchanges in trading [14–16]. Since extending development to the automobiles has led to air pollution and site visitors stop up all over [17, 18]. It reserved the privilege to imagine compelling traffic the board plots through taking useful workouts to direct road site visitors, by an explanation for accomplishing varieties in the vehicular congestion obstacles [10]. Various examines and practices have been synched to manage these issues by

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decreasing the interacting period for vehicular congestion controlling provider, huge part in it is in the context details to the authorities [8]. It means that a united server has prepared for information gathering [9].

2 Literature Survey

Weihai Chen, Zheng Zhao, Zhong Liu, P. C. Y. Chen [1] has presented an unusual applicable road joining dominance method to the solidity congestion control. They have prepared an ARMCON system. With the help of it, disturbance in the important vehicular congestion on the speedy manner has been reduced when an established combining measure was sustained. In [1] Ramkumar Eswaraprasad, Linesh Raja [2] has presented an upgraded brilliant vehicular method for authentic congestion control by adjusting with IoT. It focuses on suggested study architecture with gathering and examining the stoppage details. Hence, it could be managed successfully. The main focus is to execute an exotic IoT rooted vehicular congestion alimentation which could build a quick conclusion for it. In reference no. [2].

Chakraborty Susanta, Muhuri Samya, Das Debasree [3] have presented a computerized game analytical technique for collaborative pavement congestion control in an accident that was carried out for monitoring the vehicular congestion on roads and to reduce the holdback period to separate automobiles for whichever unpleasant scenario. Payment utility relies on various attributes of an automobile similar to entry time, speed, preference and congestion solidity. In, [3].

Saraswat Jaideep, N. B. Soni [4] have presented an evaluation of IoT units for the congestion control technique. It involves screening for congestion thickness, conveyance, switching to keep away from more hindrance. We have various techniques for congestion controlling. They are picture survey, sensor web, flexible congestion authority. They nearly merge all over IoT machines. In, [4].

A. **Proposed System**:

See Fig. 1.

We have designed an architecture for screening the congestion on roads, theft and emergency vehicles through the use of cloud databases. Here, an ultrasonic sensor that is away from visitor gentle area acknowledges the thickness of automobiles on that line. In view of these stipulations site, visitors light signal will sparkle (Fig. 2).

We have used ARDUINO UNO microcontroller which acts as brain of our system. Hence the entire system program is stored in it. Ultrasonic sensor is placed away from the traffic junction each line of the road so that continuously monitors the distance to the traffic lights if that distance is reduced so that we came to know that vehicle congestion takes place. Based on which traffic line congests traffic light glows green signal to it (Fig. 3).

The designed framework will work when it has the following measures. All vehicles are going to the authorization process would be given an RFID tag. Info similar to automobile's authorization digits and the variety of it saved in the tag. Alphabet

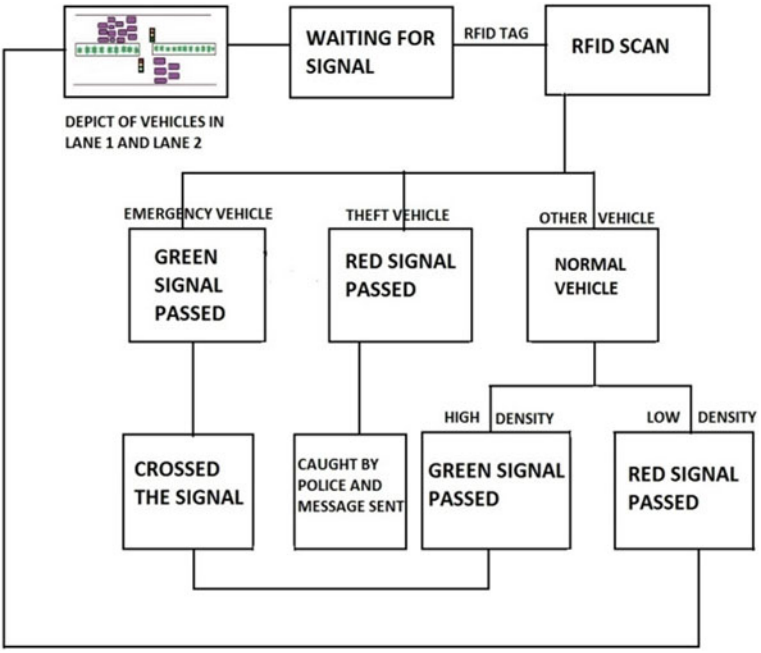

Fig. 1 Framework of IoT based traffic congestion monitoring and theft alarm

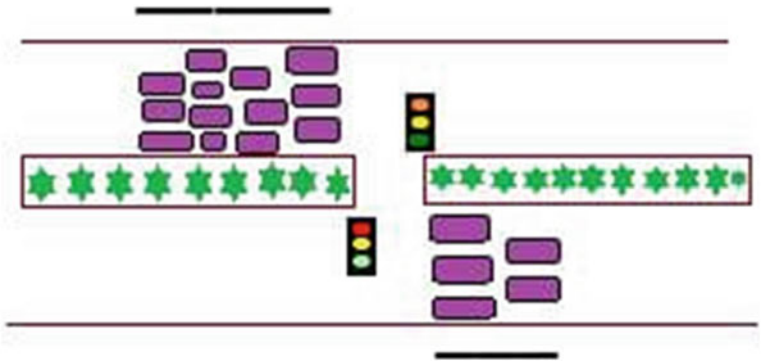

Fig. 2 Density based traffic clearance

e is for crisis automobile and n is for ordinary automobile. Those information kept saved on the source saving system of the vehicle station. We can fetch those data through RFID reader scanning process that is included in our proposed architecture. The controlling unit of the system will get notified when any type of automobile passes by the scanner. The system will show the green light to the particular path which is having a crisis vehicle on it (Fig. 4).

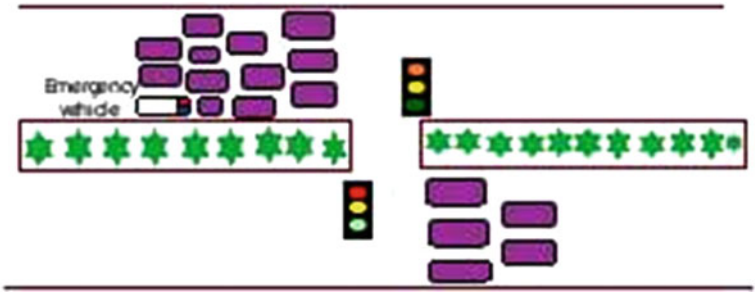

Fig. 3 Preference to emergency vehicle

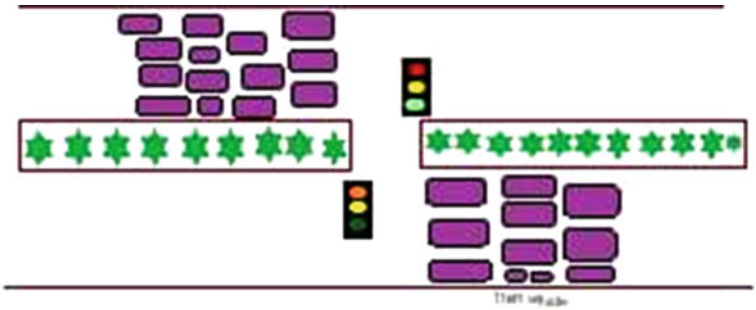

Fig. 4 Tracking theft vehicle

Whenever a vehicle got stolen the respective owner has to update their vehicle as theft vehicle in the transportation office. Alphabet t is used for it. When a theft vehicle crossing the reader, buzzer gives alarm signal also send information about the vehicle to the owner using device call GSM and IoT helps with sending the vehicle information to the transport office by means of a controlling unit which is involved in our system. To make it on a serious note that will send the data to the police station. So they will be able to identify and stop the stolen vehicle. All the data are fetched to the controller and displayed in the LCD. Hence all the information can be monitored through IoT.

3 Conclusion

This paper suggested a believable preparation for making continuous site visitors in mist founded IoV architectures for restricting a usual system interation period. First, style and moving automobile formed mist centres through queuing theory.

Afterwards, objectively determine a development factor to a fog authorized dumping factor. During that period, a dumping advancement problem got figured. A technique was build for fathoming an outlined factor through the way of making plans the message stream allotment amongst unique mist hubs.

4 Future Enhancement

Future work will be based on how it can be implemented for roads which havemore number of lanes. Theft vehicles might be also get locked automatically by having the robber inside of it. We may also find the most efficient path for the emergency vehicle by connecting all the less solidity lanes over the city.

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A Smart Sharing of Traffic Causes Information-Based Blockchain

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1 Introduction

Vehicular networks are likely to be utilized for car traffic management, parking management, accident avoidance, and so. There is a large amount of research that is ongoing on traffic information sharing and designed to offer protected verification and communications of information to thwart malicious assailants. Among the main problems to come down with vehicular ad hoc system (VANET) is note loyalty. Nevertheless, information loyalty computation of VANET is difficult because of the ephesitemeral dynamics on the system topology. Disappointment within accurate and timely dissemination of this time-critical info may result in collateral harm to neighboring cars. So, we have decided to make the system with information accuracy and communication speed. In addition, a real-time path planning algorithm according to TTE comparability by info assortment to stay away from site traffic congestion is proposed by us. The blockchain guarantees the correctness of information as well as tamper opposition within the mechanism that may fix these identical issues [1]. This particular newspaper proposes a proof-of-event opinion idea applied to vehicular networks quite compared to proof-of-authority or proof-of-work solutions [2, 3].

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The site traffic information is gathered up throughout the roadside devices and also the passing car will confirm the correctness when getting the occasion notification. Additionally, the two-phase transaction on the blockchain is brought to send out warning mail messages at the right time and region time [4, 5].

2 Related Work

Several of the problems in vehicular networks include things like basic routing issues as well as application-oriented issues as false data and attacks dissemination [6, 7]. The standard track record methods might not function effectively within vehicular networks [8, 9]. Public key infrastructure (PKI) might not be accessible all over the place throughout the original phases of vehicular community deployment close to a nation since several areas might not be discussed because of deployment bills or maybe spending budget problems [10]. In general, cryptography-based verification of note trustworthiness is computationally costly [11, 12]. It is able to safeguard against a couple of attack types out of outside nodes. Nevertheless, it will not guard against malicious nodes within the system, that currently have the necessary cryptographic secrets, as well as probably will not appropriate for ephemeral community marketing and sales communications [13]. The scheme of this author [14] does not make use of cryptography as well as centralized servers, thus, and, it does not have a thing of disappointment. Nearly all VANET airers presume the method is running, exactly where most car possess a particular loyalty rating [15]. Nevertheless [16, 17], it is not simple to learn the trustworthiness of car while not needing to have some interaction with these automobiles [18]. When it comes to extremely vehicular networks, automobiles are able to sign up and then leave a system often [7, 9]. Whenever a brand new automobile joins the system initially, there is simply no info regarding it. Among the problems experienced by VANET is the fact that the loyalty type on the VANET must think about the necessity for anonymity of cars [19]. The loyalty version needs to have little overhead of terminology of computation intricacy, in addition to storage space [20, 21]. The loyalty version must be powerful to data-centric strikes as well as be in a position to identify the episodes [2]. VANET protection frameworks must be casual, reliable, scalable, as well as secure [3, 22].

3 Proposed System

A method is created by us to calculate the going period of a path in the car traffic system. Based on various street sections, the going precious time evaluation consists of three components, i.e., going on the highway sector, waiting around within the intersection as well as bypassing the intersection. We think about the connected cars rate's impact on the accuracy of TTE. This system provides the comprehensive formulation of TTE that will be worn afterward contained real-time road calculation.

We model a real-time algorithm namely proof-of-event consensus, that may replan as well as revise the prior based on the real-time site traffic info. Although algorithm stays away from the unexpected traffic congestion throughout the going, it cannot merely lessen the overall going period coming from the source of energy to the desired destination. This algorithm exploits the drift-plus-penalty framework as well as back pressure policies to resolve the possible concern of brand new congestion development that is brought on by big periods of vehicles' exact same course choice. The considerable evaluations are able to confirm the usefulness of the algorithms of ours. Aiming to bring down the measurement errors, the fixed site traffic info is discussed among RSUs with a particular time, e.g., a number of site traffic lights times. For that powerful site traffic info, like the visitor's crash as well as the visitor's congestion, the info sharing mechanism could instantly discuss these powerful real-time visitors info, instead of the updating frequency. The standard sharing mechanism of TTE is transmitted. Nevertheless, the broadcast way of real-time info sharing has two disadvantages. Similar real-time info via the various system within the street system that causes the redundancy will be received by our scheme. Furthermore, the real-time info spreads over the general community by transmitted that has the likelihood to become ineffective for many street sections. With this paper, we have designed accurate traffic information for the people who want to go from source to destination within the time period. This system helps them to go on time. Blockchain takes the information sharing between the whole systems.

4 System Architecture

See Fig. 1

First, data will be collected from the source. After the collection of the data, event will be created. As soon as the event is created, the event is verified. There will be verifier where he will collect the information from the n different users and then he will come to conclusion [23] that the event which is created is true. So, these entire process will be done in blockchain, which will keep data protected. Once event is verified that information will be shared with different users. That is only called as announcement and notifications.

5 Experimental Results

The experiments are performed using the Python latest version. The computations are performed using Toolbox that is readily available in system. In Fig. 2, we can see the information about the traffic was shared, and Fig. 3 is an accuracy level and communication level that were created to test the security response. Every application's access was scheduled with TTE terms. The data are then trained with a proposed scheme which is widely used for all techniques. Some database is kept for

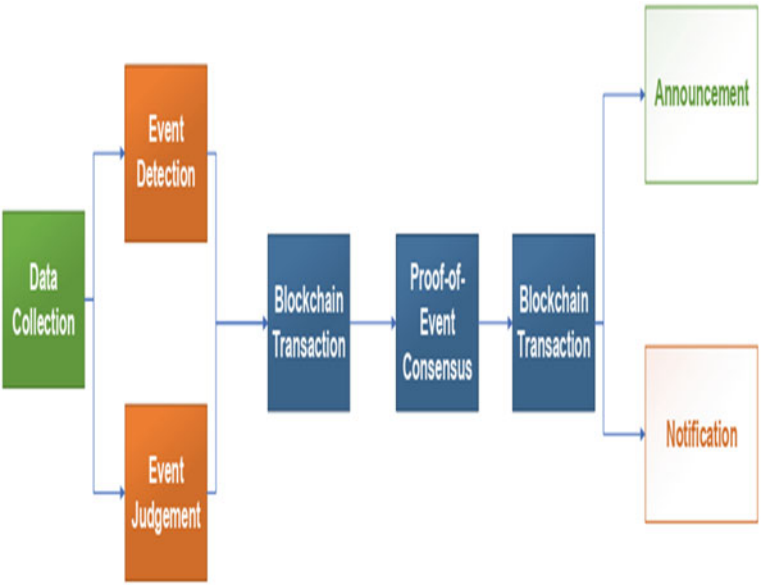

Fig. 1 System architecture

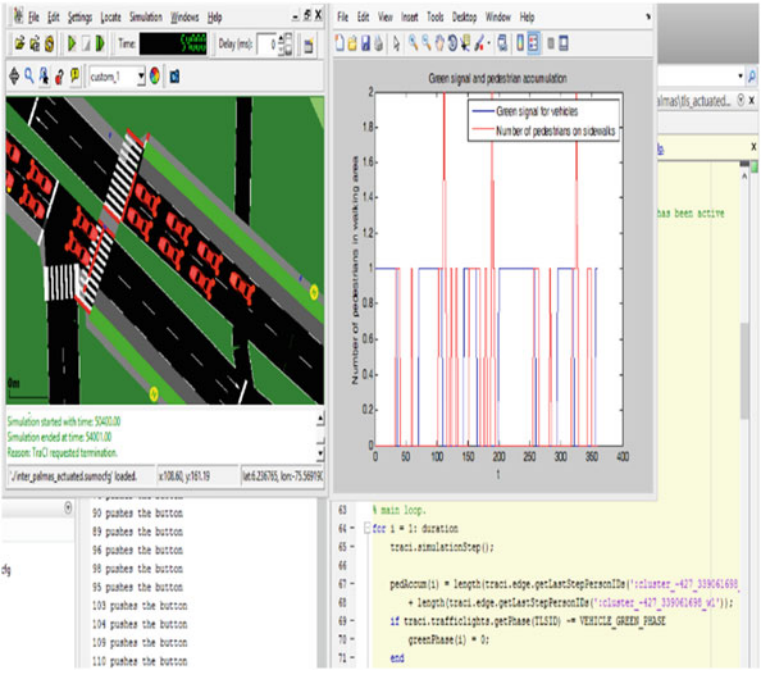

Fig. 2 Code implementation using Python

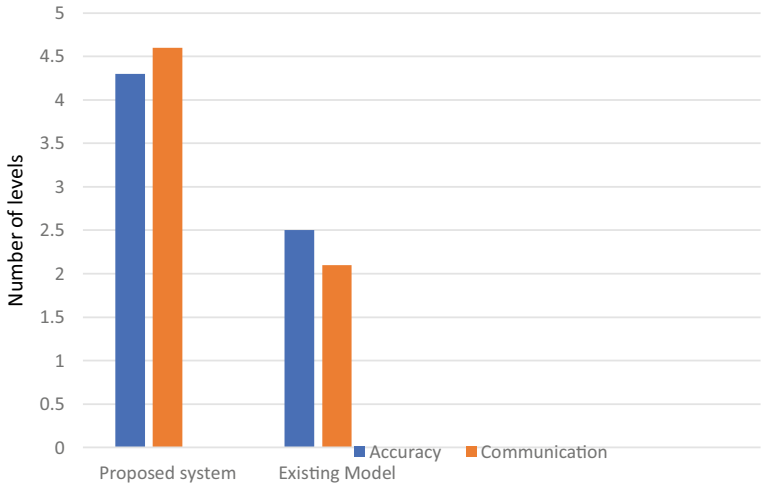

Fig. 3 Accuracy level and communication level

training, and the rest are kept for testing the proposed schemes. Hence, the result satisfies the expected output and achieved the security level on comparing with the existing model.

6 Conclusion

We suggest a real-time site traffic info for staying away from the congestion as well as real-time calculations. We deliver a highly effective real-time site traffic info discussing mechanism depending on the blockchain at giving street intersections. Our real-time info sharing mechanism is able to bring down the information's redundancy, and we have achieved the result as we expected. In the future, this scheme can be used in the Google Maps research area to bring the accurate result to the applications.

Advantages

- By implementing autonomous system in vehicle can decrease the human intervention in minor activities.
- Increasing the human efficiency in their daily lives.
- Alert the user when system predicts a collision or natural catastrophe.
- Increases the safety of the passengers.

Disadvantages

- Any errors by the proposed system might cause loss or risk of losing lives.
- Maintenance and Integrity.

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An Empirical Investigation into Gender-Based Differences of Direct to Consumer Promotion on Medication Adherence

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1 Introduction

When pharmaceutical companies promote their prescription products directly to patients, it is called Direct To Consumer Promotion (DTCP) [1]. DTC promotions can be done using television, radio, print advertisements, social media and internet. DTC advertising generally comes under the purview of ethical and regulatory concerns. It has been under intense arguments for its negative and positive consequences both for healthcare systems and patients. Supporters of DTCP claim that patients with adequate health information have greater chances of adherence and are regular visits to physicians which help in timely and apt diagnosis of medical treatment (Perez et al. [38]; Deshpande and Tiwari. [13]). Better drug compliance helps in quicker and better recovery bringing down the overall healthcare costs. However, the opponents of DTCP, argue that it can be used as a tool to offer erroneous, inadequate and unscrupulous information to patients for increasing the demand of medicines in the market which in turn results in enhanced healthcare costs, drug overuse and reduced patient-physician relationship (An [3]; Auton [4]; Leadera et al. [29]). Studies have shown a significant relationship between DTCP expenditure and drug sales (Rosenthal et al. [40]; Law et al. [28]; Dave and Saffer [11]).

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2 Literature Review

Aikin et al. [2] in his study found that 53% of the physicians thought that DTC advertisement (DTCA) improved patient–physician discussion. 73% of physicians reported that as a result of DTCA, patients have more pertinent queries. The study also reported that DTCA helps in enhancing medication adherence. A number of studies based on the physician's opinion of patient drug-adherence have been done (Choi [10]; Lee [30]; Delorme et al. [12]). The study of Murray et al. [36] reported that 81% of respondents agreed on the positive relationship between DTCP and patient medication adherence. According to Bonaccorso [7], information over the internet helps in being intake of medicine by the patients. Several other studies have found a positive relationship between DTCP and medication adherence (Donohue et al. [14]; Bowman et al. [8]; Goyal et al. [18]; Ventola [43]; Hansen et al. [19]; Herxheimer [21]; Bhutada & Rollins [5]; Wosinska [44]). The study of Mukerjee and Mukherjee [35] reported that patients become more responsible and start taking better care of their head as a result of DTCP. Working on asthma patients McRoy (2016) found a strong correlation between the rise in drug use and DTCA expenditure. The study of Bhutada & Rollins [5] also reports similar findings. The study of Kruger et al [27] reports a positive correlation between DTCA and an increase in exercise guilt and food guilt. Improved patients' information on medication management has been recognized as one of the important factors for improving medication adherence (McMullen et al. [32]). Many researchers have found weak positive correlation between DTCP and medication adherence (Donohue et al. [14]; Wosinska [44]; Hansen et al. [19]). While many researchers have reported no relation between DTCP and adherence (Herxheimer [21]; Im [22]), Cardon, Showalter [9] reported a weak negative relationship between DTCP and Patient–Physician Relationship. Lipsky & Taylor [31] and Morris et al. [33] also reported that DTCP inspires patients to follow their medication regime. Heewon [20] reported that there was a positive relationship between *DTCA* and patients' availability to precise beliefs about their illnesses, which in turn was positively correlated to drug compliance. Gender differences towards DTCP has also attracted attention of researchers (Joseph et al. [25], Kontos et al. [26], Joseph et al. [24], Bidmon and Terlutter [6], Fox et al. [16], Gauld and Williams [17], Yan [45], Turget [41], Mitchell and Boustani [34], Nam et al. [37], Vats[42]); Jayarani et al. [23]. However, the focus has been on identifying gender differences in access and use frequency of healthcare online information. It is generally noted that women have limited access to online health information, particularly in developing countries, but they emerge has more intense users of the same if access is uninhibited. Gender differences in medical adherence due to DTCP have hardly been explored. This is the motivation to undertake this study.

3 Methodology

The study is empirical in nature and conclusive in design. The objective of the study is to identify gender differences of DTCP on drug adherence. The corresponding null hypothesis has been set as t*here is no significant difference across gender in DTCP that has positive influence on medication adherence*. A survey was conducted on patients (seeking allopathic medication). The sample size was comprised of 390 respondents (190 males and 200 females). Samples were drawn from urban areas of Indian cities having a population exceeding 10 million people. The questionnaire comprised of five statements framed on a likert scale (5 point). Data was collected personally. The analysis is based on an independent sample t-test and has been undertaken at 95% CL. A significant difference, therefore, is accepted if t-value is more than 1.96 and corresponding p-value is below 0.05. p-values below 0.0001 have been shown as zero.

4 Result and Analysis

The significance of medication adherence affecting healthcare consequences has been explained by many researchers (Richardson [39]; Bidmon and Terlutter [6]). Gender difference impacting DTCP if reconnoitered aptly may help in designing strategies for improving health.

The following table shows the impact of DTCP on medication adherence. (Table 1)

(1) **With the help of online information, I am able to take my medicines properly**:

The above table shows that mean of females is 4.1 with Standard Deviation 0.8 and the mean value of male is 2.7 having Standard Deviation 0.9. The t-value obtained is greater than 1.96 (13.3). Hence, the null hypothesis is rejected as significance level is less than 0.05 (0) Thus, there is a difference across gender with respect to taking medicines because of online information. This can be explained as males are usually more biddable than females and maybe DTCP is not important to them.

(2) **Online health information helps in identification of non-drug therapies**:

The above table reveals that the mean of female is 3.9 with Standard Deviation 0.9 and that of male is 3.0 with Standard Deviation 1. Hence, we can say that the belief "online health information helps in identification of non-drug therapies" is not presumed as same by male and females. As the t-value is greater than 1.96 (7.7) and significance level is lower than 0.05(0), the null hypothesis is rejected. Women are noticeably tending to believe that online health information helps in the identification of non-drug therapies.

Table 1 Impact of DTCP on medication adherence

Sl.No	Factors	Female		Male		Value	
		Mean	S.D.	Mean	S.D	T	p
1	With the help of online information, I am able to take my medicines properly	4.1	0.8	2.7	0.9	13.3	0
2	Online health information helps in identification of non-drug therapies	3.9	0.9	3	1	7.7	0
3	Information present over the net helps in better understanding of physician instructions	3.9	0.8	3.8	1	1	0.3
4	Diet modification is better with the help of online information	3.9	0.9	3.9	0.9	0.1	0.9
5	It is easier to follow physician's instructions with the help of online information	4.2	0.8	4.1	0.8	1.5	0.1

(3) **Information present over the net helps in better understanding of physician instructions**:

From the above table, we find that the mean of females is 3.9 with Standard Deviation 0.8 and that of male is 3.8 with Standard Deviation 1. The t-value is less than 1.96 (1) and the significance is greater than 0.05 (0.3). Hence, the null hypothesis is accepted. It is supported since the significance is greater than 0.05 (0.3). Women and men do not differ significantly in the belief that Information present over the net helps in a better understanding of physician instructions.

(4) **Diet modification is better with the help of online information**:

From the table, we find that the mean of female and male both are 3.9 with Standard Deviation 0.9. Hence, we can say for the statement "diet modification is better with the help of online information" there is no significant difference between the expressed belief of men and women. It is supported since the significance is greater than 0.05 (0.9) and t- value is 1 which is less than 1.96. Thus, the null hypothesis is accepted.

(5) **It is easier to follow the physician's instructions with the help of online information**:

The data of the above table reveals that the mean of females is 4.2 with Standard Deviation 0.8 and that of males is 4.1 with Standard Deviation 0.8. Both males and females have similar beliefs. T value for this response is less than 1.96 (1.5) and the significance is greater than 0.05 (0.1). Hence, the null hypothesis is accepted. Thus, we can conclude that men and women both agree with the statement that "it is easier to follow physician's instructions with the help of online information"

5 Discussion and Conclusion

The study reveals that there is a difference of opinion between the male and female regarding the intake of medicines based on online information. We also find that men's and women's beliefs regarding the identification of non-drug therapies based on online health information significantly differ. However, women and men both believe that information present over the net helps in a better understanding of physician instructions. Both the genders again believe that diet modification is better with the help of online information and that it is easier to follow physician's instructions with the help of online information. According to Bidmon and Terlutter [6], females who actively obtain health information from internet are more conscious about their health and diet than males. According to Gough and Conner [15] and Richardson [39] men portray greater health obligations than women.

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Analysis of a Miniaturized Modified Multifrequency Printed Antenna with Broadband Characteristics for WLAN Application

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1 Introduction

As the generation of wireless communication systems is escalating to a compact world, the components incorporated into these systems must be reduced in size. Hence, as the microstrip patch antenna is a component of the wireless communication system, its size reduction becomes the foremost apprehension in this field. Several authors have achieved compactness by several design methods [1–14]. The design proposed by Bhunia et al. at [1] reported miniaturization of about 41%. The work presents a very poor frequency shifting. An equilateral triangular patch has been introduced that achieved a size reduction of about 43.47% [2]. It was reported by Chatterjee et al. [3] that dual frequency operation can be achieved with a patch area reduction of 41.8%. A slotted edge-fed patch antenna with a reduction in size by less than 40% was reported by Park and Cho [4]. In ref. [5], the maximum size reduction of about 46.2% was gained by implementing a triangular slot at the upper face of the patch. It was demonstrated in ref. [6] that by adding a cross-shaped slot on the rectangular and trapezoidal patches, the size reduction can be reached to 34%

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and 41%, respectively. Embedding three meandering narrow slots on the antenna surface and a pair of parallel slots near to the radiating edge of the patch leads to the highest miniaturization of about 45% [7]. Gautam et al. [8] proposed a design that achieved 39% compactness by inserting four slits on the square-shaped patch. Maximum compactness of 56% can be achieved by introducing meandered slots on the ground plane [9] of the radiating patch. Elsdon et al. [10] reported a 40% compact planar-fed patch antenna by inserting slots parallel to the non-radiating edge of the patch. In ref. [11], a window-shaped microstrip patch antenna offered 50% size reduction. Miniaturization of about 43.9% was achieved by Song et al. [12] using perturbation of radiating slot. Gosalia and Lazzi reported 51% size reduction by etching out symmetrical crossed slots from the radiating patch [13].

The work proposed in this paper is related to the design of a multifrequency compact (60.55%) microstrip patch antenna with 10% fractional bandwidth at a center frequency 5.58 GHz to cover the bandwidth requirements of WLAN (5.725–5.825 GHz) and HiperLAN (5.47–5.725 GHz) wireless applications. The main objectives of this work are focused on achieving the antenna's size reduction by lowering the resonant frequency, multifrequency operation, and bandwidth improvement without defecting its ground plane. The various geometrical dimensions of the proposed antenna were optimized and configured by using the method of moment or MOM-based simulator IE3D [14].

2 Antenna Configuration

The dimensions of the slots on the radiating patch have been analyzed and manually optimized by using MOM-based IE3D simulator. Both the configurations of the antenna 1 (conventional antenna) and antenna 2 (proposed antenna) are shown in Figs. 1 and 2, respectively. The antennas have the same dimension of 16 mm × 12 mm, where length is 12 mm and the width is 16 mm. It is constructed on an FR4 substrate with a thickness of 1.6 mm and the dielectric constant $(\varepsilon_r) = 4.4$. The conventional patch antenna with an unmodified ground plane can resonate only at 5.5 GHz where a coaxial probe feeding of radius 0.5 mm has been provided at the location of W/2 (8 mm) and L/3 (4 mm) from the right side edge of the patch.

Two slots complementary to each other having equal length and width have been placed at the upper left side and the bottom right side of the patch as portrayed in Fig. 2. The length and the width of these two slots are L1 = L3 = 6 mm and W1 = W3 = 0.5 mm, respectively. An additional slot positioned at the center of the patch plays a very important role to achieve the first frequency. This slot has a length and width of 9 mm (L2) and 0.5 (W2) mm, respectively. The coaxial probe feed location has been changed to (−3, −1) from the center location (0,0) where L4 = 3 mm and W4 = 7 mm.

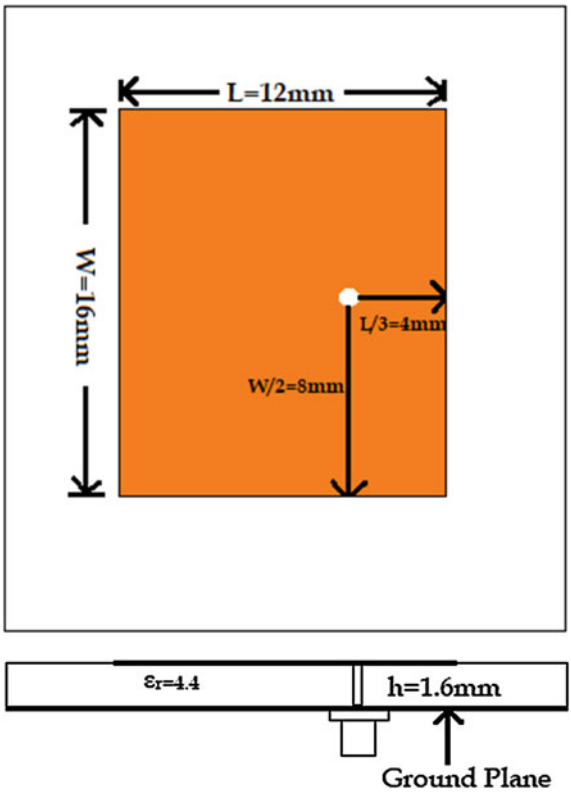

Fig. 1 Antenna 1 (conventional patch)

3 Analysis and Working of the Proposed Antenna

As we know, the conventional antenna only resonates at 5.5 GHz, hence there is a requirement of modifications on the patch to make it resonate at different frequencies. Thus, by introducing new slots and modifying them, make the antenna resonate at three different frequencies which are 3.62 GHz, 5.79 GHz, and 6.36 GHz with a significant bandwidth of 10% in between 5.30–5.86 GHz, which supports WLAN (5.725–5.825 GHz) and HiperLAN (5.47–5.725 GHz). The final structure of the proposed patch has been constructed through three different design steps shown in Fig. 3. Amid three different cases, the first one discusses only having the upper right slot placed horizontally that results in a resonating frequency of 4.20 GHz but the reflection coefficient is −3.38 dB which cannot be taken as the minimum requirement for a microstrip patch antenna to radiate at its far region, and the reflection coefficient must be below −10 dB level. But there are two more frequencies generated at this stage, one is at 5.43 GHz with 15.59 dB and the other is at 6.18 GHz with −22.20 dB of the reflection coefficient. After introducing the complementary slot to the first one, the antenna at the second stage resonates at 4.077 GHz with S_{11} of about −6.44–5.79 GHz with −24.57 dB. As we can see that the former frequency cannot be accepted as per the

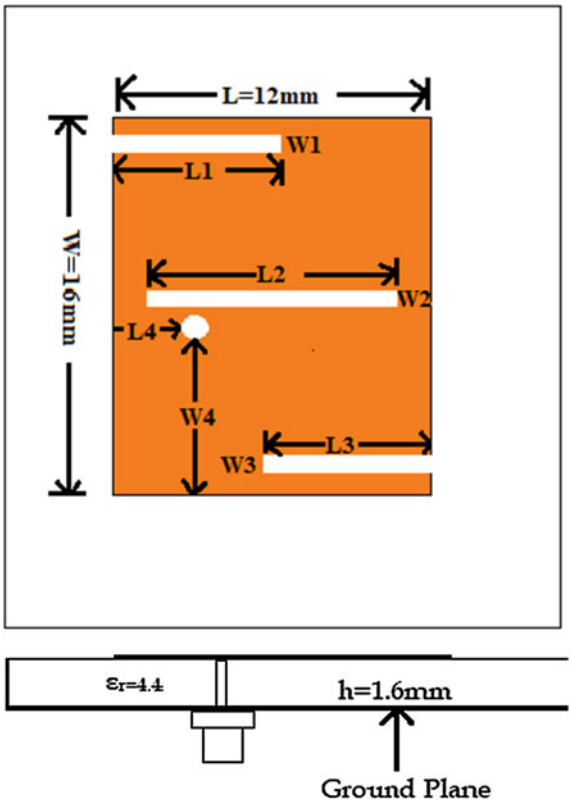

Fig. 2 Antenna 2 (proposed patch)

requirement of the S_{11} parameter, the second frequency is provided with a bandwidth of 560 MHz [5.30–5.86 GHz]. Finally, by introducing the final slot to the patch as shown in case 3, the antenna resonates at three different frequencies 3.624, 5.795, and 6.360 GHz with the reflection coefficients of −13.78 dB, −20.038 dB, and −14.342 dB, respectively. The results of the different design steps are represented in Table 1.

The advantages provided by this proposed antenna are:

I. It provides a calculated size reduction of about 60.55% by lowering the first resonant frequency. So better compactness as compared to the references [1–14].
II. It offers a broad bandwidth of 10% and the achieved bandwidth of about 540 MHz (5.3–5.86 GHz) is sufficient to wireless applications such as WLAN (5.725–5.825 GHz) and HiperLAN (5.47–5.725 GHz).
III. Proper impedance matching with the perfection of the S_{11} parameter, and VSWR makes the antenna resonate at the concerned frequencies.

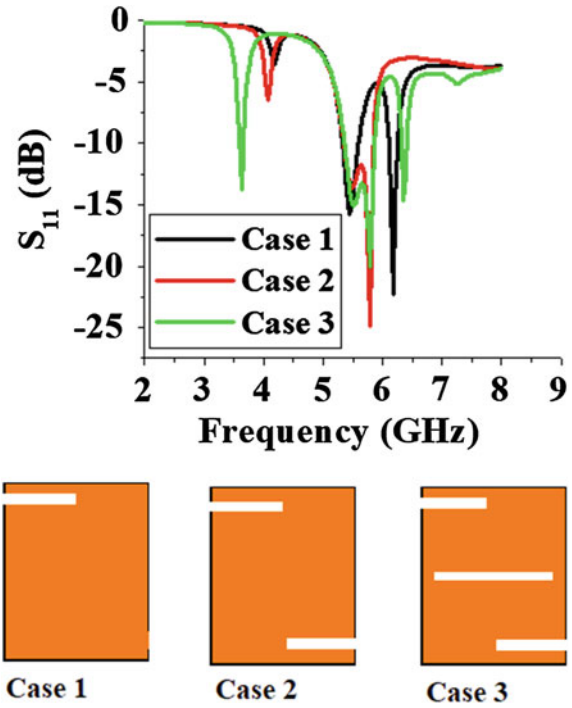

Fig. 3 Case study of S_{11} parameter of the suggested patch for different design steps

Table 1 Simulated results in different cases of the progress of the proposed antenna

Different cases	Resonant frequency (GHz)	S_{11} (dB)	Gain (dBi)	VSWR	Size reduction (%)
Case 1	f1 = 4.20 f2 = 5.43 f3 = 6.18	−3.38 −15.59 −22.20	−2.34 3.12 0.49	1.8403 1.1370 1.0943	46.57
Case 2	f1 = 4.07 f2 = 5.79	−6.44 −24.57	0.78 3.35	1.3676 1.0848	49.90
Case 3 (proposed)	f1 = 3.62 f2 = 5.79 f3 = 6.36	−13.78 −20.03 −14.34	1.32 2.91 0.13	1.1564 1.1050 1.1499	60.55

4 Parametric Study of the Proposed Antenna

The achievement of the desired frequencies is prepared by investigating various dimensions of the proposed antenna in this work through a parametric study. The variations of the slot lengths have a major influence on the resonance characteristics of the designed antenna. The governing parameters of the proposed patch have been

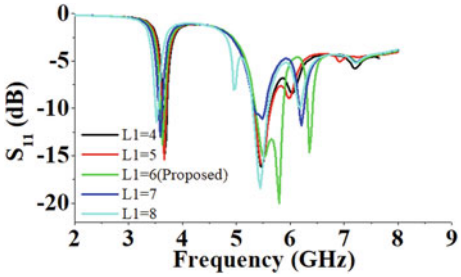

Fig. 4 Variations of S_{11} parameters for different values of L1

optimized by changing any one structural parameter of one slot at a time while other parameters are fixed as its proposed value.

4.1 Effect of Antenna Parameter L1

The parametric study of the design parameter L1 has been shown in Fig. 4. It is observed that when L1 = 4 mm, the antenna resonates at only two different frequencies which are 3.73 GHz with −14.73 dB and 5.43 GHz with −15.23 dB. As this length further increases, the frequencies shift to a lesser value. For L1 = 5 mm and 7 mm, the first resonant frequencies are noted as 3.70 GHz and 3.67 GHz, respectively. But, the S_{11} parameter for the second resonant frequency hardly reaches − 10 dB level for L1 = 7 mm without offering any impedance bandwidth, whereas when L1 is set to 5 mm, the second frequency provides a good impedance matching. The first resonant frequency shifts toward the 3.59 GHz, and the second resonant frequency becomes 5.32 GHz for L1 = 8 mm. The impedance matching is very poor at third resonance except for the proposed dimension. So, it is concluded that the designed antenna resonates triple frequencies with the best impedance matching only for the proposed value of L1.

4.2 Effect of Antenna Parameter L2

A profound elaboration of varying the dimension of the design parameter L2 has been shown in Fig. 5. It can be observed that for L2 = 7 mm and 8 mm, the first two resonant frequencies are achieved but the third resonant frequency suffers from a very poor impedance matching. As the value increases to 9 mm which is the proposed value of L2, it provides triple resonant frequencies comparatively with a very good impedance matching. Throughout the parametric study of this design parameter, it was found quite the same bandwidth for the second resonant frequency. When designed with L2 = 10 mm, three different resonating frequencies have been achieved but poor matching at 3.5 GHz. The other frequencies remain almost the same as the proposed

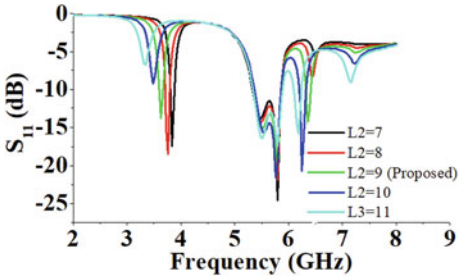

Fig. 5 Variations of S_{11} parameters for different value of L2

one. As the value of L2 increases to 11 mm, the first resonant frequency further shifts to 3.25 GHz but the reflection coefficient is only −7.125 dB, which is not acceptable for any antenna to radiate at the far region. So, increasing the dimension of L2 leads to the shifting of the first resonant frequency but the impedance matching conditions are becoming very poor. It is concluded that the best resonance response is observed for the proposed dimension of L2 = 9 mm.

4.3 Effect of Antenna Parameter L3

A clear demonstration of the parametric study of the antenna parameter L3 concerning the S_{11} parameter has been illustrated in Fig. 6. As can be observed, the first resonant frequency remains quite unchanged throughout the entire investigation for different structural dimensions. But the remaining frequencies vary accordingly. As in the case of L3 = 4 mm, the second resonant frequency resonates at 5.45 GHz with S_{11} = −13.56 dB and the third resonance at 7.25 GHz with a reflection coefficient of −7.35 dB which is not acceptable. Then, the length increases to 5 mm, and with this increment, no change is noticed in the second resonant frequency but the impedance matching has improved for the third resonance. With the further increment of L3 to the proposed value, the second resonant frequency is attained at 5.79 GHz with a bandwidth of 560 MHz (5.30–5.86 GHz) and the third resonance is achieved at 6.36 GHz with the best matching. When the value of L3 has increased to 7 mm, there is only the excitation of the first resonant frequency. Now with further increase

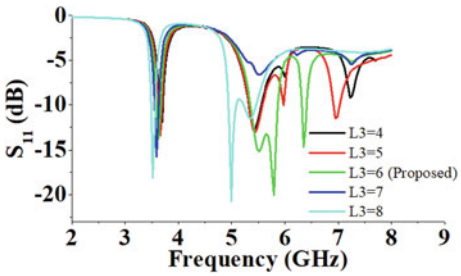

Fig. 6 Variations of S_{11} parameters for different values of L3

in L3–8 mm, the first frequency is slightly shifted toward the lower value and the second resonance is observed around 5 GHz which does not fulfill the bandwidth requirements of the intended applications. Again third resonance is not generated for this value. So, L3 = 6 mm is considered for design.

5 Surface Current Distribution of the Conventional and the Proposed Antenna

A detailed demonstration of the surface current distributions of the conventional and the proposed patch antennas are demonstrated in Figs. 7a–d. The conventional antenna resonates at 5.5 GHz, which indicates very limited current density at the radiating edges of the patch as shown in Fig. 7a. As it can be clearly observed from Fig. 7b, the main reason behind the generation of the first frequency is the slot positioned at the center of the patch. As from [7], introducing new complementary slots to the patch, the density of the surface current can be further improved. Figure 7c shows the surface current distribution at 5.79 GHz. The antenna surface current

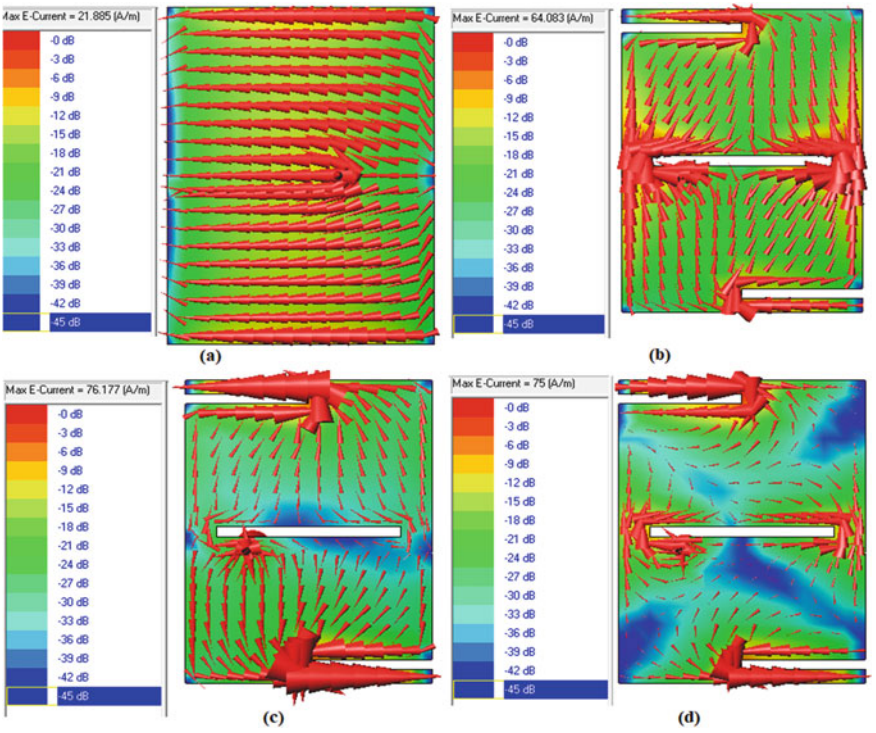

Fig. 7 Surface current distribution for the conventional antenna at **a** 5.5 GHz and for the proposed antenna at **b** 3.62 GHz, **c** 5.79 GHz, and **d** 6.36 GHz

distribution for the frequency 6.36 GHz is illustrated in Fig. 7d. It can be comprehend that the insertion of every slot plays a vital role in achieving the desired resonant frequencies. Both the complementary slots as well as the center positioned slot are important. So from overall study of the proposed structure, it can be stated that the proposed geometrical mechanism is very important to make the antenna resonate at the respective frequencies. The current distribution gets its density around the edges of the slots and in that way the path of the current gets lengthened which increases the electrical length and hence resonant frequency shifts to a lower value. Hence, it can be concluded that the compactness depends upon the proposed geometry.

6 Results and Discussion

The simulated S_{11} parameters for both the conventional and the proposed antennas are shown in Figs. 8 and 9, respectively. From the figures, it can be stated that in the case of the conventional antenna, there is only a single resonance whereas the

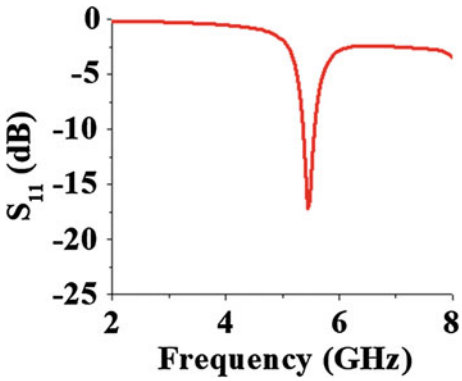

Fig. 8 S_{11} parameter of the conventional antenna

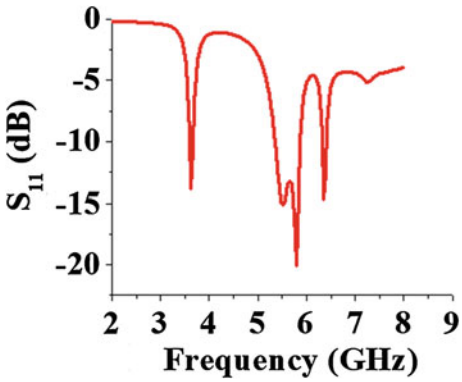

Fig. 9 S_{11} parameter of the proposed antenna

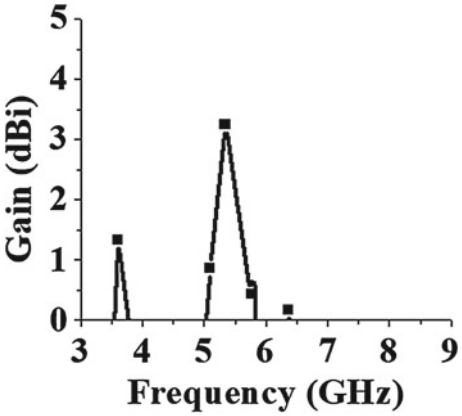

Fig. 10 Gain of the proposed antenna

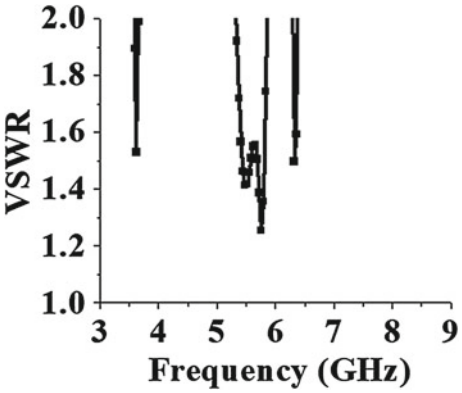

Fig. 11 VSWR of the proposed antenna

proposed structure provides triple frequencies with a very good impedance matching. The peak gain of about 2.96 dBi is quite acceptable [see Fig. 10]. The voltage standing wave ratio has been plotted in Fig. 11. As revealed in Fig. 12, the normalized E-plane radiation characteristics offer an almost indistinguishable broadside pattern for all the resonant frequencies. It is observed that almost indistinguishable steady radiation responses are found at all the working resonant frequencies.

7 Conclusion

A coaxially fed microstrip patch antenna has been proposed which resonates with three distinguished resonant frequencies at 3.62 GHz, 5.79 GHz, and 6.36 GHz with a considerable bandwidth of 560 MHz (5.30 GHz to 5.86 GHz). The designed antenna offers compactness of 60.55% which makes it attractive for miniaturized wireless

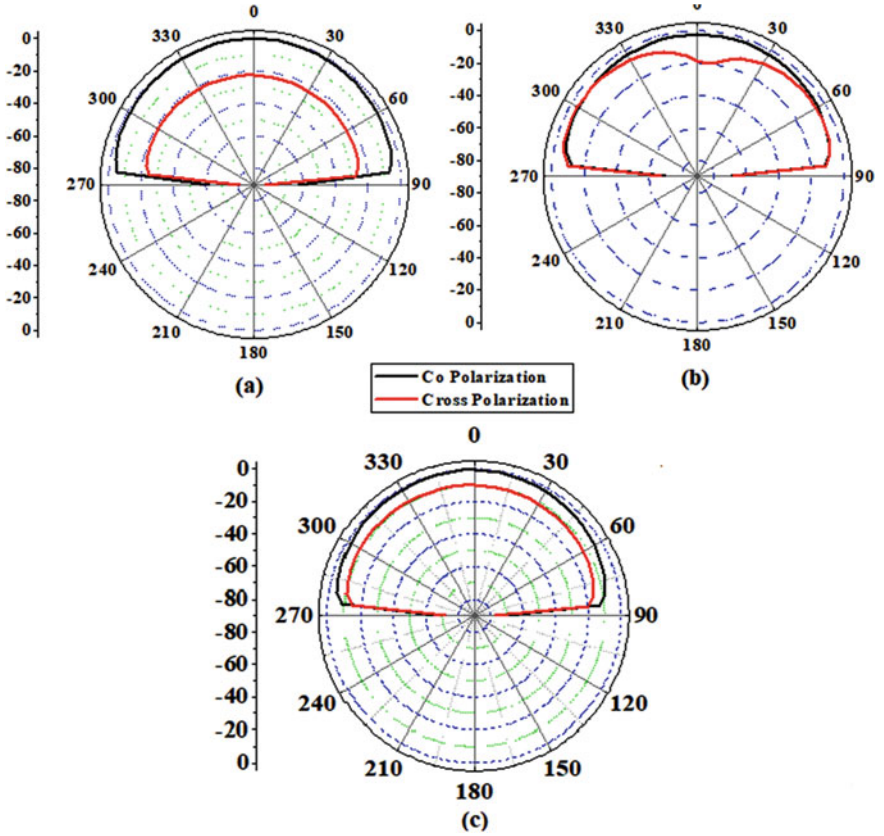

Fig. 12 Normalized E-plane radiation pattern of the proposed antenna at **a** 3.62 GHz, **b** 5.79 GHz and **c** 6.36 GHz

systems. Furthermore, low VSWR, good impedance matching, and stable radiation patterns are also for the proposed antenna. The suggested antenna is suitable for WLAN (5.725–5.825 GHz) and HiperLAN (5.47–5.725 GHz) wireless applications.

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Retraction Note to: A Novel Approach for Communication Among Deaf and Dumb People

Yalamati Mani Pratap, Modukuri Sunil, G. Rama Mohan Reddy, and K. Lakshmi Priya

Retraction Note to:
Chapter "A Novel Approach for Communication Among Deaf and Dumb People" in: N. Priyadarshi et al. (eds.), ***Advances in Power Systems and Energy Management*****, Lecture Notes in Electrical Engineering 690,**
https://doi.org/10.1007/978-981-15-7504-4_47

The editor has retracted this conference paper. Post-publication peer review showed that the conclusions are not supported by the methods as currently described. None of the authors have responded to any correspondence from the editor or publisher about this retraction notice.

The retracted version of this chapter can be found at
https://doi.org/10.1007/978-981-15-7504-4_47

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