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An Efficient Monitoring of Real Time Traffic Clearance for an Emergency Service Vehicle Using IOT

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Abstract

In this paper, a real time emergency vehicle tracking through architecture of instinctive emergency recognition system with high-intensity digital camera it is located in a national high way traffic signal. In a recent survey, there are thousands of people losing their lives due to the delay in the emergency services. Resent survey say that more than 4000 heart attack victims can be saved each year if the delay could be minimized and in the present scenario the number of deaths is in lakhs and this number can be effectively reduced by providing timely and accurate emergency service all the way through avoiding the unnecessary time delay near traffic jams during an emergency situation (Tagne et al. in IEEE Trans Intell Transp Syst 17(3):796–809, 2015). This method clarifies the modeling and working of different units of the emergency vehicle identification system such that optimized emergency vehicle tracking algorithm, with the traffic supervision unit. In this article confer the basic components and their function such that internet of things and their dissimilar layers of protocol, raspberry pi and its architecture, with interfacing sensors such as Siren sound detect (REES-52), the Wireless sensor (NRF905se). It is direct and the most efficient route that is asphalt construct to the central server checks for the location of the vehicle and change the traffic signal. When the emergency vehicle is approaching the traffic lights. The system generate in sequence regarding the traffic emergency situations such as ambulance and siren sound (Emergency Services Review: A comparative review of international ambulance service best practice. http://www.aace.org.uk. Accessed 28 July 2017, 2017). The processed information can be used to divert the live traffic as desirable to avoid the problems related to real time road traffic (Sundar et al. in Sens J IEEE 15(2):1109–1113, 2015).

Keywords Emergency vehicle recognition · Vehicle classification · Objects tracking · GPS device · Traffic control · IOT based automated traffic signals · Mote sensors

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1 Introduction

Today most of the road network in Asian countries is monitoring manually through video surveillance systems [1–3]. Most of the cameras are recording the video through a fixed camera for every junction point in the road network. If we want to find any vehicle movements we need to play all the recorded video and the human expert only analysis the specific vehicle movement and trace the path. This process is very time consuming process. So, in our research we take these issues and find Emergency vehicle detection and tracking algorithms [4]. Our study also takes the same issues and surveys the research work nearly thirty-five papers. But in this paper we consider the papers which are deals the methods of vehicle routing and tracking algorithm based on color based, contour based, feature based, region based and model based [5]. India being the second most populated country and recognized for its congested roads traffic at the peak hours and several lives being lost due the improper schedule in emergency vehicle services. In proposed architecture and implementation of this system is immediately centered for vehicle surveillance so that emergency vehicles on avenue get a better manner to attain their destination in shorter period, effectively and besides any interference. The surveillance unit consist of mote sensor it will automatically monitor the warning lights within the path of the emergency vehicle [6]. The emergency vehicle is monitored by through way of the surveillance unit. Which furnishes the most scanted route to the emergency vehicle and also controls the traffic signal light according to the emergency vehicle area and therefore accomplishing treatment center thoroughly emergency vehicle now no longer waits in the traffic sign. While the ambulance or emergency vehicles approach to the traffic signal it will be operate in computerized mode. While emergency vehicle crossed the traffic signal it will return to everyday mode. Because the principle results we are able to protect the affected person existence. In our proposed approach we use blob and textual content facts to apprehend emergency automobile. Figure 1 architecture of instinctive emergency recognition system. The item's life is determined with the resource of the brink stage. Experiment outcomes validate that the proposed technique is a completely fast and fantastic manner of recognizing the emergency vehicle [7].

Emergency vehicle are fundamental equipment in serving skilled revolutionary responders not entirely hastily arrive at an emergency but also furnish doubtlessly life-saving measures. These vehicles are genuinely mini hospitals on wheels which can be geared up with various healthcare equipment designed to deal with humans instantaneous. In a task in which each 2nd can be critical, emergency vehicle drivers and employees are commonly working out inside the field for 8–10 h according to day and regularly even longer. When employees are working out inside the area for long stretch of time even the seemingly reliable and sincere individuals can discover themselves involved in behaviour that can hurt the bottom line of a clinic or maybe worse, result in behind schedule response instances which could probable be the difference in an existence or death clinical emergency. This is the reason why hospitals all over the use at the moment are turning to GPS monitoring devices to provide an emergency vehicle management solution for ambulance fleet [8]. The delay in the advent of ambulance to the clinic within the golden hour. This delay is mainly brought about via manner of the ready of the ambulance within the site visitors alerts

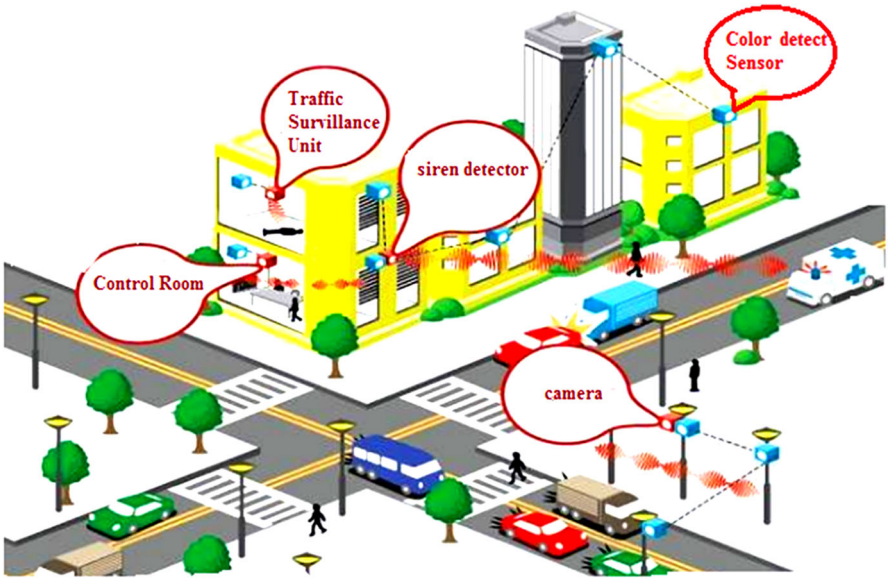

Fig. 1 Architecture of instinctive emergency recognition system

[9]. It would be of notable use to the emergency vehicle if the traffic signs in the direction of the health facility are on. Therefore we advise a brand new design for automatically controlling the traffic signal and alerts accomplishing the above said venture so that the emergency vehicle might be able to go all of the traffic junctions without waiting. Every aspect of site traffic junction may have sensors controlling the site passengers flow. While traffic junction is controlled and its visitors sign is made to be Red-Green for the ambulance to pass through barring waiting, it is stated to be in on state. Whilst emergency vehicle arrived near to Smart Surveillance Monitoring Device (SSMD) on street aspect sensor positioned a long way far from visitors signal distance about 800–1200 m from visitors signal. The internet of things is used to track and identified the emergency vehicle it uses sensor like Siren sound and variation of light detector (REES-52), Wireless sensor (NRF905se) and to obtain geographic coordinates while the GSM/GPRS module is used to transmit and update the vehicle location to a database. In internet of things (IOT) devices equipped with Wi-Fi allow the machine-to-machine communication. Using this form of industrial machines to wearable or wireless devices, Using built-in sensors to gather data and take action on that data across a network. The sensor and actuator can be setup in different place but they are working together over an internet network. Using IOT technique a vehicle tracking system can be built.

1.1 Traffic Identification Methods

The secure and capable process of a traffic monitoring system relies in the main on the application of superior technology. In the past decade we has witnessed the huge

software and communicating devices and sensing technologies are used for emergency vehicle monitoring, incident detection, disaster reaction, convoy control and tour support. There may be a requirement for effective site visitor's business enterprise, to avoid congestion and optimize visitors go with the flow at intersection [3]. In a technique to manipulate traffic flow is to make use of sensor technology. The internet of things (IOT) is a deal of unified computing gadget, it is generally linking things to the Internet and using that link to provide some kind of useful remote distant monitoring or control of those things. It is basically a Machine- to- Machine communication through which the electrical and electronics appliances are communicated [10]. However, the devices are still primarily things on the Internet that require more person communication and monitor through apps and interfaces. Internet of things is a brand new idea that has developed from the convergence of wireless technology. Wi-Fi conversation is the transfer of information or signal between two or more factors that are not connected by an electrical conductor. In IOT devices ready with wireless permit the device-to-system verbal exchange. The use of this form of commercial machines to wearable or Wi-Fi devices, using integrated sensors to acquire information and take motion on that information throughout a network. The sensor and actuator may be setup in specific vicinity however they're working collectively over an internet network. The use of Internet of Things approach as emergency monitoring system (EMS) can be constructed. An emergency vehicle tracking gadget combines the use of computerized vehicle place of person motors with software that collects those fleet records for a comprehensive picture of vehicle locations [11]. Modern-day vehicle tracking structures normally use global positioning system era for finding the vehicle, but different kinds of automated vehicle place technology also can be used. Vehicles information may be considered on digital maps via net with specialized software [10]. Within the earliest days, simplest massive, rich fleets took advantage of the technology. The cutting-edge vehicle monitoring systems gives the essential records to fleet managers hire them run their operations more efficaciously. Reports on driving force behaviour, vehicle overall performance and gasoline use all make it less complicated for the navy manager to cut charges and boom efficiencies. These structures go beyond easy reporting of every vehicles location, offering fleet managers a wealth of records approximately their vehicle and their drivers. In many countries this ATC is to be had. There is some organization like GP, ROBI gives automobile tracking carrier ATC which has some common functions like monitoring the automobile and vehicle that usage of satellite GPS and GSM communication.

2 Literature Survey

In this literature study in a real time traffic analysis models have been urbanized. This survey privately conducted in National Highway NH-47 in and around India. Personally obtained sample inputs from 400 emergency vehicle drivers and emergency responder's police and general public. The major reason for delay in response of emergency services in India. The major issue for the delay of response of emergency services is because, people don't give way to the emergency vehicles and the 'red' signals at the junctions [9]. Cause for traffic congestion on the road as mentioned

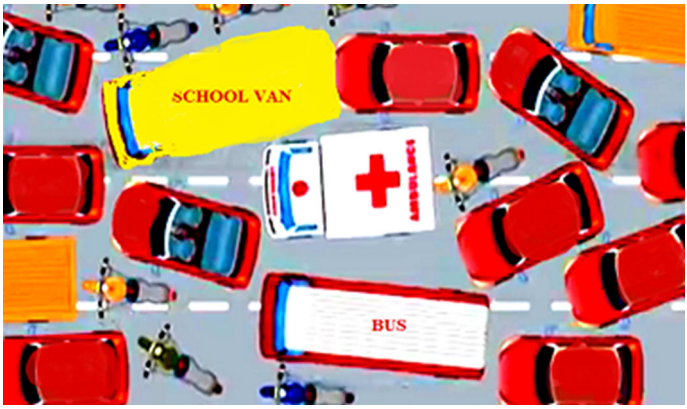

Fig. 2 Top view of traffic overcrowding

in Fig. 2. The reason is due to total lack of awareness that the emergency vehicle is behind travelling on the same road. Reason for delay at a junction. The problem at the junctions is the movement of traffic on other sections which does not have the emergency vehicle and there is an inherent doubt that if that move forward despite a 'red' signal to make way for the emergency service vehicle that might cause an accident or create a traffic jam at the junction.

2.1 Sources of Information

The literature investigate was primarily based on the following ongoing and recently completed major research studies. The literature hunt was supplemented by online searches at the Transportation Research Board database, and the Institute of transport study, University of California, Berkeley catalog. We also reviewed the documents and presentations posted at the TRB Signal Systems Committee website, particularly those relate to adaptive signal control [12]. The resources post give thorough information on the characteristics of several adaptive real time traffic signal systems including principles of the policy, structural design, data supplies, infrastructure requirements, local controller and innermost hardware supplies, plus installation, operation and maintenance costs. Additional references obtained and reviewed were from the recent IEEE ITSC symposium September 2010, and papers presented at the 90th TRB Annual Meeting January 2011. In addition, we requested from the FHWA Contract Manager unpublished documents on ongoing FHWA research studies, and he provided to us the documents available, namely documentation on the ongoing Pooled Fund study at the University of Virginia. Over 300 references were identified.

2.2 Analysis of Traffic Congestion in Cities

For the past few decades, the human population in the urban regions all over the world has radically grown-up, surpassing the corresponding value in the rural areas [13].

Figure 1 represents a graph depicting the world trends in world population from 1950 to 2050, with the abscissa representing the years and the ordinate representing the population in millions. As per 2016, the overall urban population accounts for 4.1 billion out of the 7.4 billion of the entire world population. According to predictions, the urban population would account 6 billion out of a total 9 billion [4]. Thus, the urban population has seen a huge upsurge from 1950 and is expected to skyrocket in the coming years. Internet of things based traffic management system (Mar 2018).

2.3 Challenges Faced by the Transportation Industry

In the midst of the ever increasing vehicles on road, the transportation engineering faces the following extraordinary challenges. Transportation enterprise is able to gather the speedy increase of data both in quantity and variety [14]. The records of transportation activity have prosperous sources, numerous types, and new units of records are produced continually. Dynamic facts generated by means of number sensors, such as induction coil at bayonet point, infrared detector, microwave detector, ultrasonic detector, laser detector, video detector, and so on, are of huge volumes. The information are generated by way of GPS vehicle location monitoring device and other cellular system search equipments yearly have risen over the threshold level [15]. The amount of information generated via the transportation enterprise in a metropolis per month has surpassed terabyte level, a massive statistics storage space and tools is required and it must have fault tolerance and stability. The traditional information processing structures are confronted with the lack of efficiency and accuracy. The statistics system of transportation venture has had a certain basis and scale, however technology of new business, speedy boom of data, complexity of the data processing have no longer been foreseen [16]. The site visitor's information management device the use of traditional data processing expertise can't meet the speedy increase of data, collapses and screw ups have occurred. In the direction of mission construction and maintenance, the development was emphasized, the upkeep was once overlooked, statistics have no longer been excavated deeply, with the alternate of management and lifestyles cycle of the system is shortened, as the raise in information volumes have been overlooked. With the lookup in big data developing in latest years, new tasks and renovation of the old system are being carried out in some cities.

2.4 Existing Traffic Management Systems

Though most of the cities in the world tranquil use the traditional visitor's administration system, few developed and visitor's congested cities like Mumbai and New Delhi have tried out big facts to manage traffic lights. As section of the World Bank-supported Mumbai Urban Transport Project (MUTP), a current site visitor's administration device is being brought that is quietly decreasing congestion on city roads. At the city's police headquarters a massive display screen relays stay photos from traffic junctions, while a geographic figures system renders congestion ranges onto a map veined with red, amber and green. Traffic policemen sitting at the screen consoles display some 233 junctions at a time via extra than 600 hi-tech remotely oper-

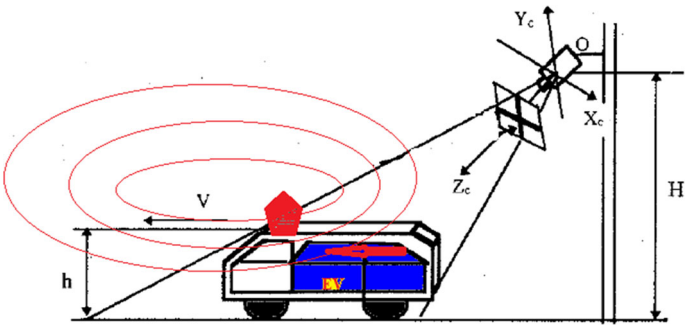

Fig. 3 High definition surveillance camera located at top of traffic signal pole. Pole Parameters: H—Height of traffic signal pole (40 feet), h—Emergency vehicle height (h: 9 – 12; w: 4 – 6; l : 15 – 25 feet), v—Velocity of siren sound, Yc, Xc, Zc—Angle coordinate. http://onlinemanuals.txdot.gov/txdotmanuals/hwi/pole_placement_guidelines.htm

able zoom cameras. Big cities have their personal problems. Mumbai traffic, though acknowledged as the most geared up one of all the large cities, nonetheless has to witness a revolution that would 1 day make the tour a lot faster in the city. Bangalore site visitors and Chennai site visitors do not have any extraordinary story to tell. There is no doubt in the fact that our lives are getting very fast these days. In each city cars are in abundance that there are now not adequate roads to cater to the developing needs of hastily growing road traffic. If we analyze the Traffic situation in Delhi, the Indian Capital, one would be able to recognize the worst variety of perils that one might also have to face whilst using on Indian roads. Even after no longer so accepted institution of new flyovers to reduce the congestion of traffic, Delhi roads, nonetheless seems too narrower to facilitate clean float of numerous sorts of motors which consists of trucks, risky blue line buses, cars, scooters, high-acceleration bikes and final however now not the least bicycles and cycle rickshaws. Most of these cars have one of kind speeds and most of the time these speed versions lead to inevitable accidents that worsens the Traffic protection in India [17]. One can imagine the state of affairs on roads with high pick-up motorbikes and slowly pushed cycles sharing the identical lanes. A separate lane can be dispensed to slow-moving vehicles to provide them with much-needed security while attaining their destinations as mentioned Fig. 3. This notion has been correctly carried out in some overseas countries and India need to analyze from their example. But the famous phenomenon of street rage in India involving abusive exchanges between the two or extra traffic users will nevertheless proceed on India roads till and unless people will start to appreciate other commuters and be patient whilst driving [18].

3 Methodology

Our proposed methodology aims to reduce the delay in emergency services response time due to traffic conditions. In India, on an average an emergency service vehicle takes about 20 min to arrive at the site of misery in urban areas compared to 6 min for

the same in the US. We are proposing a 2-prong system to improve the response time of emergency services. Optimized emergency vehicle tracking algorithm (OEVTA). It consists of following stages.

(i) Image recognition
(ii) Emergency vehicle sound detection

Optimized emergency vehicle tracking algorithm (OEVTA) software use optical character recognition capability for pursuit's detection of emergency vehicles. OEVTA lets in you consistently recognize emergency cars with limits and alerting the authorities. When EV have surpassed via emergency lane it will be check, permitting immediately action such as the size of the emergency vehicle, and permit the emergency automobile to pass by on them without any interruption. When EV passing through the camera, Optimized emergency car monitoring device get a picture of the vehicle's parameters like +, 108, 111, symbols [19] and AMBULANCE characters, registering it on an descriptions database, with date, hour and vehicle information, allowing a lot of check with and a extra environment friendly real-time site visitors surveillance systems generally use Infrared (IR) lighting fixtures to allow the High definition dig cam to gather the picture at any event of the day and night [20]. Optimized emergency automobile tracking algorithm technology tends to be region-specific, amazing to persona or symbols variation from vicinity to place [13]. In real time Traffic manipulate systems use OEVTA devices which provide details about the lobby team and flow of emergency vehicles round the road network. These details can spotlight the problem areas and assist to make tournament surveillance. The photograph of the emergency automobile and others vehicle statistics can be accumulated and saved it if there is a requirement for proof of dispute or offense situation.

3.1 Emergency Vehicle Classification

The default size of picture is taken into account to become aware of the specific Ambulance character in an emergency vehicle. This stage has serious of steps and process. As shown in the Table 1 different types of emergency vehicle that are briefly explained below.

3.2 Identifying Emergency Vehicle Parameter

The ultimate purpose of our system is to be capable to do a identifies vehicle parameters such us Length breath and height. Most of the emergency vehicle height and length varies at more than one stage of granularity. Currently we are classifying vehicles into two categories.

(i) Emergency vehicle.
(ii) Non-emergency vehicle.

Design and improvement particularly primarily based on the dimensions of the vehicles. Since we calculate the actual length and peak of the vehicles, the category of a vehicle can be decided specifically based on its length and height. Based on traditional

Table 1 Different types of emergency vehicle (Color table online)

EV image	Emergency vehicle	Dash/ texture	Identification	Parameters colors	priority
	Ambulance	Texture and dash	Light siren sound	White	High priority
	Fire brigade vehicle	Dash	Siren/ bell sound	Red	High priority
	Government official/VIP vehicle	Dash	Red reflector	White	High priority
	Defence/police vehicle	Dash	Flag blue/green	Gray	Medium priority
	School bus/van	Texture	Yellow label	Yellow	Low priority

values, vehicles having dimensioned improved than 40 feet. And height greater than 12 feet are viewed EV, at the same time as all specific vehicles are classified as non EVs. In the Fig. 3 represent emergency vehicle surveillance in a traffic lane.

In this method EV speed, time gap information is conveyed to the Emergency vehicle or control central part Short message Service mobile, walkie-talkie, land line, wireless etc. The proficiency available with Emergency personnel skilled doctor, trained paramedic, skilled registered Nurse, professional driver etc. The minimum time within which it reaches the patient site of accident. The variety of vehicle like 2 wheeler, 3 wheeler, regular ambulance, air-ambulance. Infrastructure such as exclusive service street and the popularity of the roads for emergency services like ambulance, fire engine or police vans [21]. Figure 4 shows flow chart for emergency vehicle tracking algorithm.

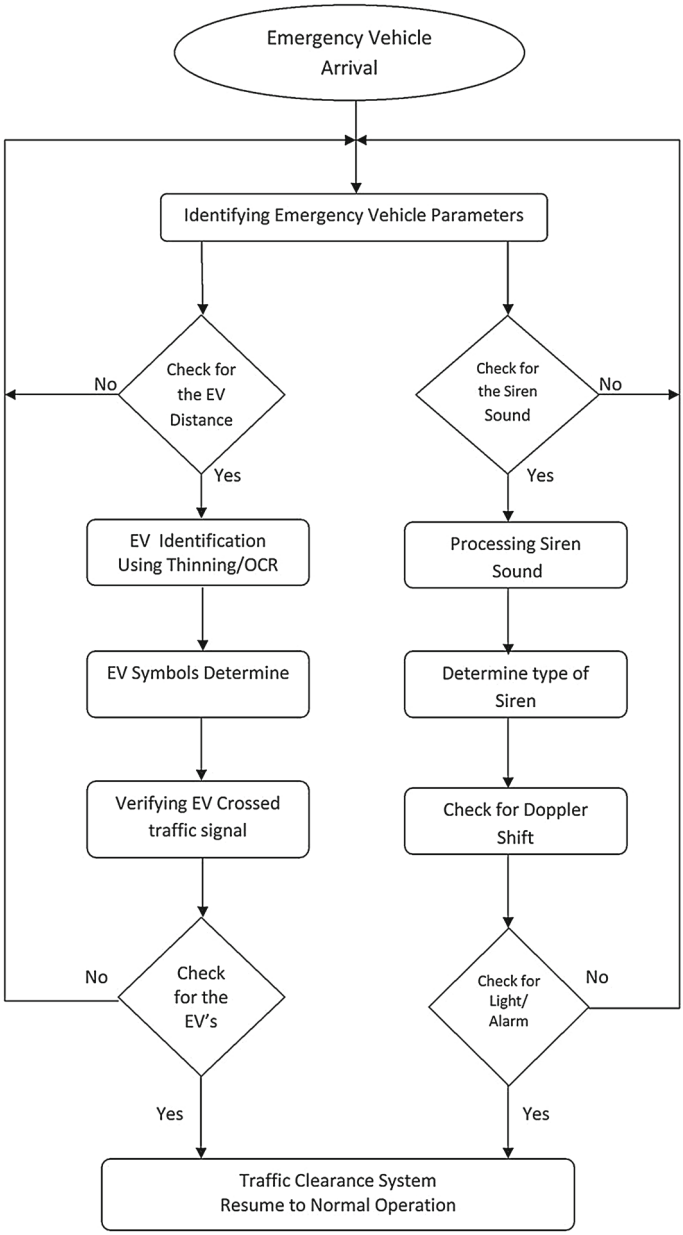

Fig. 4 Optimized emergency vehicle tracking algorithm

3.3 Emergency Vehicle Arrival Based on Image Recognition

Step 1: Formation of input video stream The video containing unique vehicle fragment beneath diverse lights prerequisites is caught. The caught video grouping is

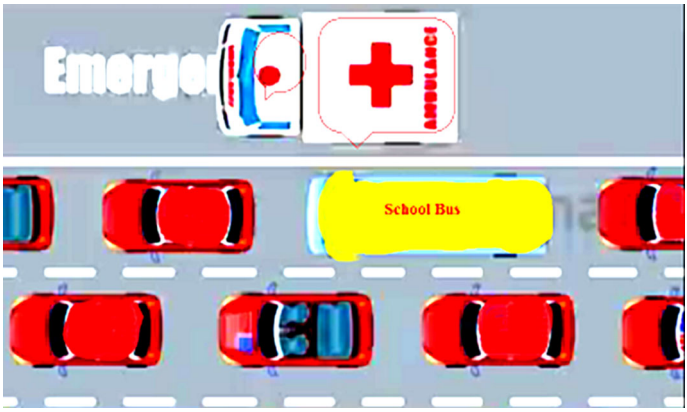

Fig. 5 Proposed model emergency vehicle arrival in national high way lane

examined to frame a quick arrangement however with numerous highlights from various conditions [22]. We listen on Emergency vehicle character or ideal representation regarded in figure.

Step 2: Lane marker positions The course markers and their feasible spots are characterized in the framework based on their point with the reference image plane. These scopes of factor are characterized considering the position of the digital camera in the vehicle and the vehicle relative position to the path.

Step 3: Lane detection and departure warning The course alternate is recognized by means of distinguishing the change in direction edges. The bearing of development and the likelihood of flight are evaluated. The intersection of direction markers triggers the route takeoff cautioning framework. Figure 5 shows proposed model EV arrival in high way lane.

Step 4: Emergency vehicle detection A development of operations is carried out to set up the image for blob investigation. Blob investigation is carried out on the picture. The special blobs are sifted one level in light of a couple dedication criteria. The road signs and symptoms are recognized by way of performing structure coordinating utilizing Thinning and Hilditch calculation. The recognized areas are proven via a jumping box.

3.4 Algorithm Description

This consists of a video clip which is a collection of EV traffic pictures in AVI format, the objectives are: to improve a vision primarily based surveillance system capable of figuring out EV in the scene. To track the emergency vehicles as they evolution along the picture sequence. To pick out emergency vehicles in the lane.

I. Algorithm for Recognize Emergency Vehicle:

Four primary features are concerned in the proposed technique. The first characteristic is to examine and divide a supply video clip into range of frames. This is established in Figure 8 Second function is to put in force the important measures like finding body variations and figuring out the history registered picture which is depicted beneath
Character Recognition Example (I): Image Pre-processing
Step 1:% labor-intensive crop

```
img = imread('Emergency vehicle.bmp');
imshow(img)
imgGray = rgb2gray(img);
imgCrop = imcrop(imgGray);
imshow(imgCrop)
```

Step 2: Resizing

```
imgLGE = imresize(imgCrop, 5, 'bicubic');
imshow(imgLGE)
```

Step 3:Rotation

```
imgRTE = imrotate(imgLGE, 35);
imshow(imgRTE)
```

Step 4:Binary Image

```
imgBW = im2bw(imgLGE, 0.90455);
imshow(imgBW)
```

Next post-processing is performed, and the background is eliminated therefore keeping only the foreground objects as indicated below. The ultimate characteristic assist in the detect objects which are described in the form.

II. Algorithm For Rear Position Image Suppression

```
//Input: d is an exact Video Frame
//Output: An image with forefront substance is store in'c'
Step1 :I=imread('cells.jpg');
figure: imshow(I);
size(I)

H =imhist(I);  %histogram equalization
figure : bar(H);
J =histeq(I);
figure: imshow(I);
J = imnoise(I,'salt & peper', 0.02);
figure: imshow(J);
f2= medfil2(J,[3 3]);
figure: imshow(f2);
J = imnoise(I, 'gaussian', 0.001);
figure: imshow(J);
H = fspecial('average',[3 3]);
f2 = imfilter(I,H);
figure: imshow(f2);

Step 2:%Thresholding
image = imread ('     ')'
[y,x] = size(image);
threshold =128;
for i=1: x
for j=1: y
if image (j,i) > threshold
image_th(j,i) = 255;
else
image_th(j,i)=0;
end
figure: imshow(J);
```

Once EVs Character of emergency sign such us +, 108 are detected it will be pre processed, back ground image suppression.

III. Algorithm for Detecting Emergency Vehicle

```
//Initialized count = 0 and Emergency Vehicle schedule buffer Identify Emergency vehicle = 0
Step 1:%figure('Emergency','Vehicle Image','numbertitle','off') %% image read & rgb to gray
    for i=1:85  im{i}=imread(strcat('snaps\',t2{i})) ;
    if size(im{i},3)>1, im{i}=rgb2gray(im{i});
  end, imshow(im{i});
  hold on
  plot([p2(2),p3(2)],[p2(1),p3(1)],'Color','r','LineWidth',2)
  plot([q2(2),q3(2)],[q2(1),q3(1)],'Color','b','LineWidth',2)
  pause(0.1);blobAnalysis = vision.BlobAnalysis('BoundingBoxOutputPort', true, ...
Step 2:    'AreaOutputPort', false, 'CentroidOutputPort', false, ...
     'MinimumBlobArea', 500);
     bbox = step(blobAnalysis, temp);000
     result = insertShape(Ix ,'Rectangle', bbox, 'Color', 'green');
     C=ZC+(size(bbox,5)/thcar);
     Zb=ZC;
      msgbox(sprintf(Emergency Vehicle= %2.3g\n',total EV));
```

Output result of an emergency vehicle detection using different algorithms are shown in the Fig. 6.

The input image study from the deal with listing with imread command. Mat lab 2010 or python the pixel values by $768 \times 576 \times 3$ uint8 matrix. Since the set of rules depends on the intensity exchange within the photo, the binary photograph is needed. The binary photograph is generated by means of changing a picture to the grey scale first after which applying area detection feature. As a 2nd step, with RGB to gray function; a brand new matrix $480 \times 640 \times 1$ uint8 length is generated by way of taking the average of red, green, blue pixel values. Then, for edge detection facet command is used. An intensity trade matrix is shaped with length 480×1 by using the edge photograph. This matrix indicates the wide variety of depth exchange in a row; that is to mention, the price of the matrix for each row is accelerated whilst the side with the aid of side three-pixel values are 0, 1, 0 or 1, zero, 1. For the next step, most price and the most index of the intensity change matrix is discovered via max command. The most value is split by way of and taking maximum index because the middle, eighty-one row of the matrix is compared with the half of most cost. The adjacent rows greater than half of price are the emergency vehicles positioned rows. The peak of the Emergency vehicle calculated as about five times the difference of most row and minimum row. For the column place of the numbered plate, this percentage is checked. At the same time as minimum and most column location more than the percentage, the set of rules searches on the rows 1, 0, 1 collection each from the proper and left aspect.

3.5 Preprocessing Stage

The default size of picture is taken into account to become aware of the specific Ambulance character in an emergency vehicle. This stage has serious of steps and process. They are briefly explained below.

Fig. 6 **a** Emergency vehicle original image, **b** gray scale image, **c** threshold image, **d** edge detector, **e** erode image, **f** background image suppression

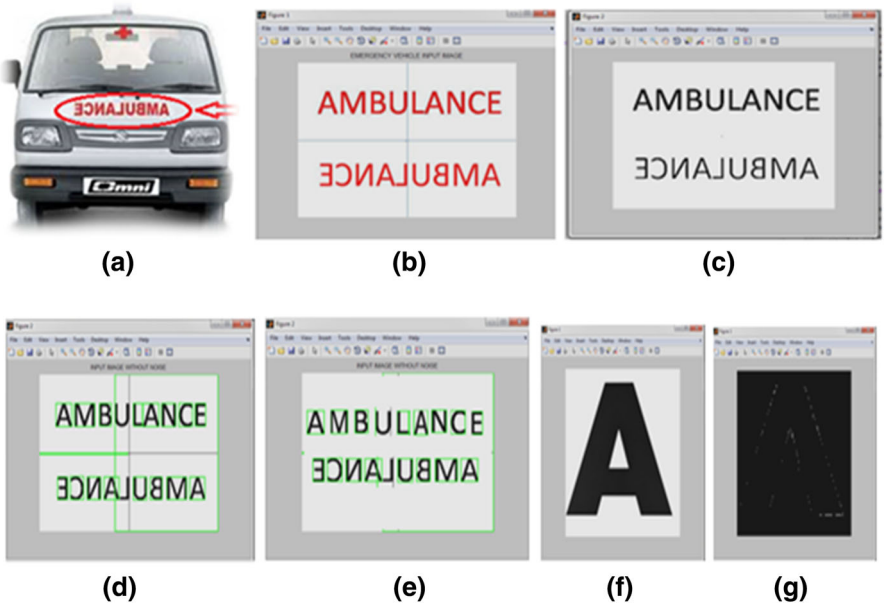

Fig. 7 **a** Emergency vehicle texture image, **b** RGB color image, **c** gray scale image, **d** character segmentation, **e** bounding box, **f** OCR A—shaped character recognition image and **g** A-Skeleton image character (Color figure online)

3.5.1 Binarisation

Binarisation is a method by which the dim scale pictures are changed over to paired pictures. The most widely recognized strategy is to choose a legitimate limit for the picture and after that change over all the force esteems over the edge power to one power esteem speaking to either "dark" or "white" esteem' Fig. 7 black and white image ambulance character.

3.5.2 Segmentation

It is the procedure of extracting the Emergency vehicle and the character from the image taken. There are specific elements that make that make this idea little difficult like noise in the image, frame of the plate, plate orientation, mild depth and space marks. Many systems have been proposed to overcome these problems. The approach that is counseled in this thesis after the result of the proposed system is Pre-processing which includes changing RGB photograph to grayscale picture into binarization. In the object enhancement algorithm consists of two steps. Firstly, the gray degree of all pixels is scaled into the vary of 0 to one hundred and in contrast with the unique range 0–255; the character pixels and the heritage pixels are each weakened. Secondly, sorting all pixels through grey level in descending order and multiply the gray stage of the pinnacle 20% pixels by way of 255. Then most characters pixels are greater whilst history pixels preserve weakening. After preprocessing and object stronger algorithm Horizontal segmentation is carried out and vertical bounds are noted to segment the characters on the EV's of the image (Fig. 7d). Character segmentation using flat and upright Projection of an image.

3.5.3 Bounding Box

Before inspecting any character, it is essential to become aware of the (pixel) boundaries of that character. Thus, a bounding container has to be recognized for each character. For this, we first calculate the row-wise horizontal projection of the whole document and discover the begin and end positions of every line, from the valleys in the projection. Two having discovered the line boundaries, we can then discover the vertical projection of each of this template, modified in MS Word 2007 and saved (Fig. 7e). Bounding box of an Ambulance character shown in above parent Fig. 7e the valleys of which exhibit the boundaries of each character in the line [4]. Since, all the characters in a line can also no longer be of equal height, what we have now is completely an approximate bounding rectangle for the characters. This is a necessary step in moment notably primarily based consciousness strategies and can be calculated from a vertical projection of the bounding rectangle.

3.5.4 Optical Character Recognition

In the wake of investigative any character, it is critical to make the (pixel) limits of that character. In this manner, a jumping box must be distinguished for each character.

Table 2 Comparison with existing and proposed algorithm

S. No.	Evaluation factor	Thinning algorithm	Hilditch's algorithm	OCR algorithm	Proposed OEVTA algorithm
1	Accurate detection	Poor	Average	Good	Good
2	Result of illumination (day/night) on a emergency vehicle	Day time only	Day time only	Day time only	Accurate on both day and night recognition
3	Result of surroundings noise on a emergency vehicle	Poor recognition	Average recognition	Better recognition	Accurate recognition
4	Effect of change in view angle of the emergency vehicle	Poor recognition	Average recognition	Accurate recognition	Accurate recognition
5	Inter vehicle communication	No	No	No	Yes
6	Information provided to the emergency center	No	No	No	Yes
7	Execution time (ms)	56.835	52.456	49.652	45.652

Since, every one of the characters in a line may not be of equivalent tallness, what we have now is just a surmised bouncing rectangle for the characters. Normalization is the process of giving exact size to each character in the identified image (Bitmap).

3.5.5 Skeletonization

Skeletonization is the way towards peeling off of an example however many pixels as would be prudent except influencing the widespread nation of the example. At the quit of the day, after pixels have been peeled off, the instance should at present be perceived. The skeleton henceforth bought must have the accompanying properties, as thin as should reasonably be predicted related focused. At the factor when these properties are fulfilled, the calculation has to stop. Following is an instance and its skeleton copy of an image Fig. 7g skeleton image of ambulance.

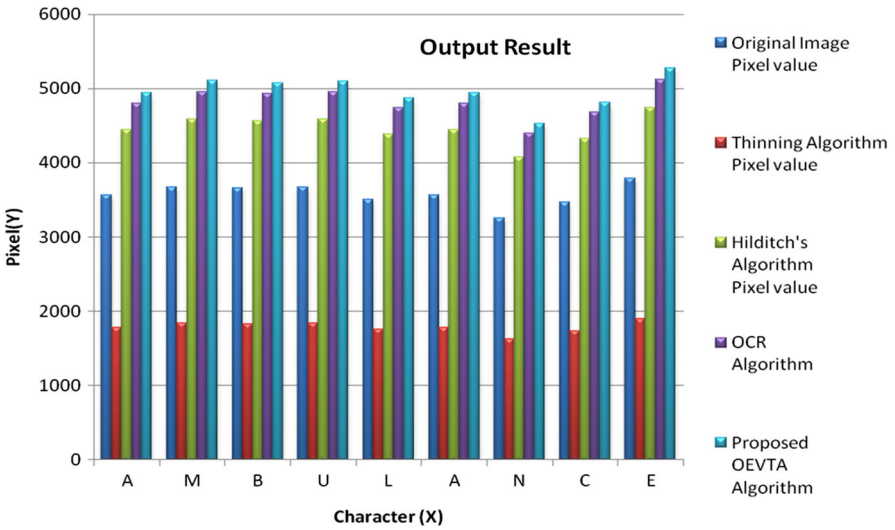

Fig. 8 Bar chart comparison of the existing and proposed OEVTA algorithm of EV

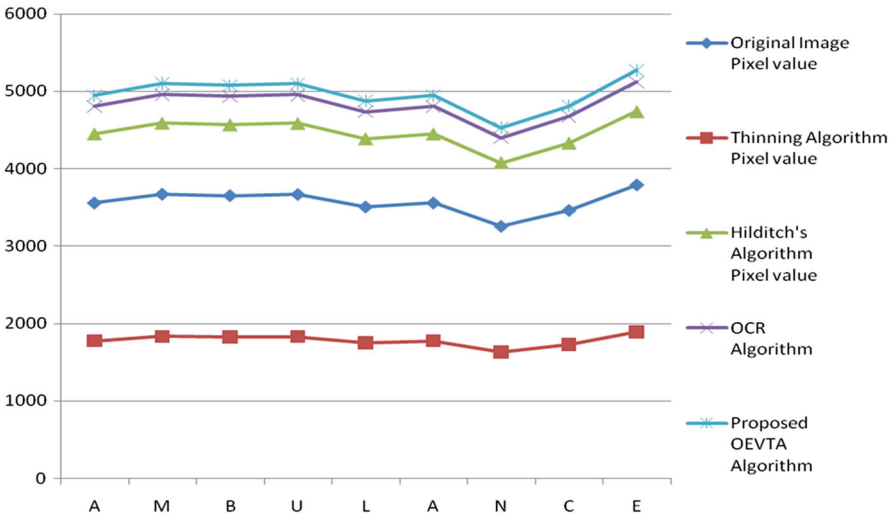

Fig. 9 Line chart comparison of the existing and proposed OEVTA algorithm of EV

As an output result compared with various algorithms such as thinning, hilditch, OCR, Proposed optimized emergency vehicle tracking algorithm are shown in the Table 2 shows the various factors of character recognition.

3.6 Output Results

See Figs. 8 and 9.

Table 3 Video information stream parameters

Input video sequence.avi file	Time (min)	Pixel dimensions	Actual no. of vehicle	No. of EV identified	Accuracy %
Video 1	20	768×576	12	1	92
Video 2	25	480×640	17	–	100
Video 3	30	768×576	21	1	95
Video 4	45	512×512	25	–	100
Video 5	60	480×640	31	2	93.54

3.7 Demonstration Using Matlab IDE

This device used EM vehicle figures concern is an array it require dimensioning length, width and height. It is a device used for formulating choices to many technical computing problems, mainly this involving matrix representation. This device emphasizes a lot of importance on entire prototyping surroundings in the answer of digital image processing [23]. We have examined the machine on photograph sequences on one-of-a-kind situations like website online traffic junction intersection, highways lane etc. The complete processing requires about 20–60 frames. Optimized emergency vehicle tracking algorithm three and video sequence are used to divulge the information discovery manner i.e., Table 3 shows video information stream parameters of emergency vehicle. Emergency automobile monitoring from site visitors video sequences the use of the proposed framework. All the movies chosen for ambulance or emergency vehicle have mild intensity and have been taken at some stage in day time. We convert the colour video frames to gray scale images. With video recording the strategies are used to depend and to discover the emergency vehicle passing through the avenue intersection in a given time duration [24]. The objects are often distant, small and their signatures have low contrast against the background. Traditional methods based on the analysis of the difference between successive frames and a background frame will do not work. In this paper, OEVTA is proposed for night-time visual surveillance. The algorithm is based on contrast analysis experiments on real scenes Fig. 10 show that the algorithm is effective for night-time object detection and tracking.

4 Emergency Vehicle Sound Detection

Emergency vehicle sirens sound is a significant module of the acoustic world, in our work designed to convey urgent information in an efficient and unambiguous manner. We are investigating automated popularity of this class of sounds of the realistic packages the other greater specially designed to take advantage of the shape of EV sounds and decrease the have an effect on of history interference. Sirens are a method of caution people when there's a chance of hazard. Everyone should realize the prevailing styles of indicators and their which means, and in particular what to do within the case of hazard. This siren sound signal we hear it suggest that there

Fig. 10 **a** In NH-47 EV identification, **b** middle level EV detection and **c** near by EV detection. Output result of OEVTA

may be a hazard or emergency and may sound at any time during the day and night time. In emergency vehicle siren sound the tones are 770 to 960 Hz, and these are recurring 1.3 s length. Table 4 show an extraordinary kind of emergency Vehicle. Siren sound waves are emitted by using a moving source or when the observer of the sound is moving, the plain frequency of the sound can alternate. This shift in frequency because of movement of the sound wave source or of the observer is referred to as the Doppler impact.

$$F' = (V + V_0)/(V - Vs)f$$

where F′ = observed frequency, V = speed of sound wave, V_0 = velocity of observer, V_s = velocity of the source.

The EV siren sound artificial by the Doppler Effect and varies its frequency. The frequency varies with time up to 1.178 s. When Emergency vehicles are approaching at a speed of 80–100 km/h each other.

4.1 Emergency Vehicles Sound Analysis

Emergency vehicles such as police force, fire engine often utilize high amplitude audio signal sirens is used to caution highway user and pedestrians that the emergency vehicle is approaching. A visual alarm provided by the detection of the emergency vehicle sound can improve the safety of guide for citizens with investigation impairments [25]. In Asian countries normative planned for emergency vehicles the use of high or low series of tones. The siren signal for emergency vehicles alternate two tonnes correspondingly at the frequencies of 395–665 Hz. The actual acoustic measurements would have some surplus things that should be eliminate or minimize by the processing algorithm: background noise, Emergency vehicle speed not stable when it increase of rate and deceleration, unknown direction of the Emergency vehicle, reflection, and hardware and sensor differences [26]. If the software makes use of stable region microphone sensor Emergency vehicle speed and path modifications would bring about the Doppler outcome. For instance, the 30–70 km/h vehicle speed would deliver approximately up to ± 8% frequency factor shift right here pace of sound 290–340 m/s [27].

Table 4 Different type of emergency vehicle acoustic and its parameters

S. No.	Description	Code	Sound samples	Frequency	Duration (s)	Priority
1.	Emergency vehicle (EV)*	1—Dead or arrival Trauma/CPR	Sirens	392–960 Hz	1.3	High
2.	Fire alarms	2—Emergency	Klaxons	2–3 kHz	4	High
3.	Horn	3—Non-emergency	Air blow	420–440 Hz	5	Low
4.	Buzzers	3—Non-emergency	Pizeo electric	8–10 kHz	8	Low

Fig. 11 Different types of emergency light representation. **A** Amber-major accident emergency, **B** blue-organ transplant, **C** red–blue police high way patrol and **D** red-minor accident emergency (Color figure online)

But, the measured acoustic noise styles of the particular automobile module may be processed to detect the transferring object from background noise and distinguish them from one another [28]. There are numerous methods to perform car noise sample popularity. One of the dependable solutions would be to use pre-recorded sound signatures of the moving object lessons and evaluate them to the actual-time measured sign. Because the measured signal is continuously converting for the more complicated systems the education principles [18] have to be carried out. We used the spectrum correlation approach in our test device which allows us to get clear of issues due to the Doppler impact. Figure 11 shows different types of emergency light representation.

4.2 Remote Traffic Surveillance Unit for Life Saving Vehicle

Every traffic junction consists of wireless mote sensor with ZigBee trans receiver and color sensor TCS3200 is located in all side of traffic signal North, East, West, and South (NEWS) zigbee Pro transmitter is fixed in the ambulance that sends the signal towards the traffic junction [29]. Color sensor is used to detect emergency vehicle or ambulance variations in light signal. With the facilitate of mote sensor is interface with road side unit it will detect the EV's prior to 800 m. When it approaches to the traffic signal, automatically traffic signal will change to emergency mode. The traffic surveillance unit is interface with raspberry Pi B+microcontroller will turn ON the traffic Signal path of the ambulance, thus the lifesaving vehicle reaches hospital in time without any delay caused by the traffic in the junction [9]. In a Mote sensor its consist of traffic direction-finding System with wireless sensor networks to scrutinize and report about the speeding vehicles and also to regulate the traffic. Figure 12 shows arrival pattern of emergency vehicle. The system is built up of wireless ZigBee Pro module 2.4 GHz IEEE 802.15.4, miniature Wireless sensor system with a remote base station are set with internet of things.

Our Proposed Traffic Junction operates in three Modes:

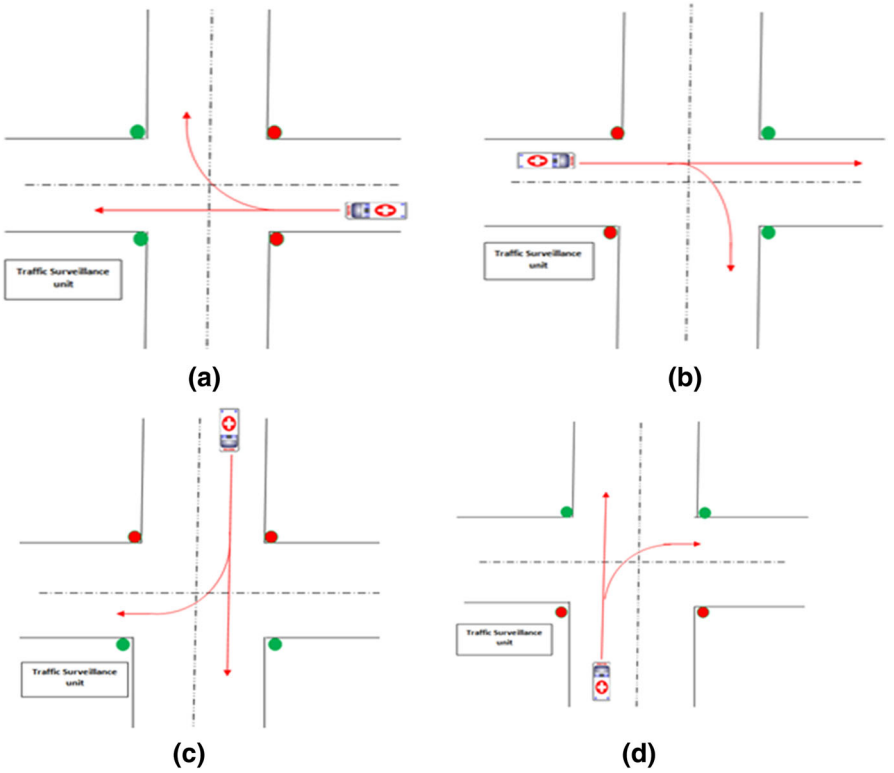

Fig. 12 Arrival pattern in emergency mode. **a** EV arrival to W–N direction, **b** EV arrival to S–E direction, **c** EV arrival to S–W direction and **d** EV arrival to N–W direction

1. Regular mode—create the timing delay in each side (NSWE) is equal 0–180 s.
2. Medium priority mode—create the timing delay accordance with density of the traffic 0–90 s.
3. High priority mode—changing the timing delay accordance with acknowledged information from Road side unit with a ZigBee coded signal.

4.3 Advanced Microcontroller

An raspberry Pi B + model is of small size single board computer, it consist of Broadcom system on a chip (SOC), which include chip graphics processing unit GPU an ARM well-matched and 32-bit CPU. The CPU speed 1.2 GHz on board memory 1 GB RAMS. An operating system is stored in the secured digital SD cards and program memory in the Micro SDHC. With the help of Internet connection we can monitor emergency vehicle in an high way lane. Figure 13 represent block diagram of emergency vehicle surveillance module.

Merits of Raspberry Pi B + vi.2V.

(i) Low power consumption (LPC) and small in size.
(ii) For server based application its best suited.

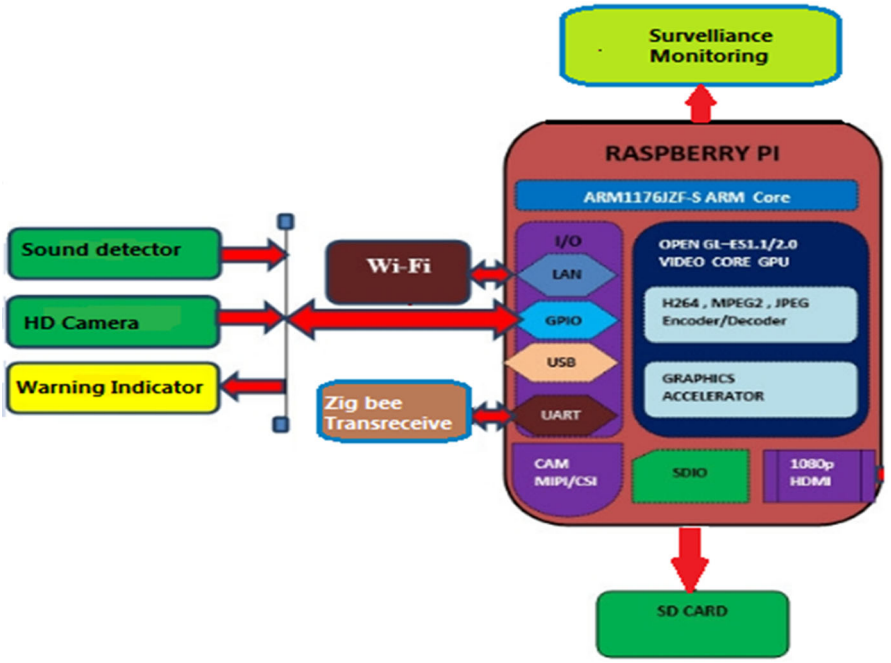

Fig. 13 Surveillance hardware module

(iii) It can be connected via SFTP and FTP.
(iv) It support SPI and I2C, to enable interfacing with various other devices.

The high definition infrared digital camera sensor and siren sound detector are interfaced with raspberry pi B + vi.2v and inputs the traffic surveillance unit it act as minicomputer, the place the uncooked site visitors records is process and analyze. The traffic controller unit receives the data like distance, velocity, traffic density, emergency vehicle counting etc. The controller executes the proposed algorithm and sends its choice to traffic signal. After the passage of an emergency vehicle, the system resumes its ordinary operation, i.e., fixed sequence optimized emergency vehicle tracking algorithm. In the following, we discuss distance measurement techniques, vehicle counting methods, a distance-based emergency vehicle dispatching algorithm and the simulation environment. ZigBee IEEE 802.15.4 standard for wireless personal area networks (WPANs). Mesh and cluster tree-topology is used distance 800 m. With three coordinates ZC, ZR, ZEND, Operating frequency range 902–928 MHz. The date rate of 250 kbps.

5 Conclusion and Future Work

In this paper traditional traffic signaling system relies purely on emergency vehicle surveillance for controlling the traffic signal for regulating the traffic based on traffic density. Our research has been carried in a different place in computing the den-

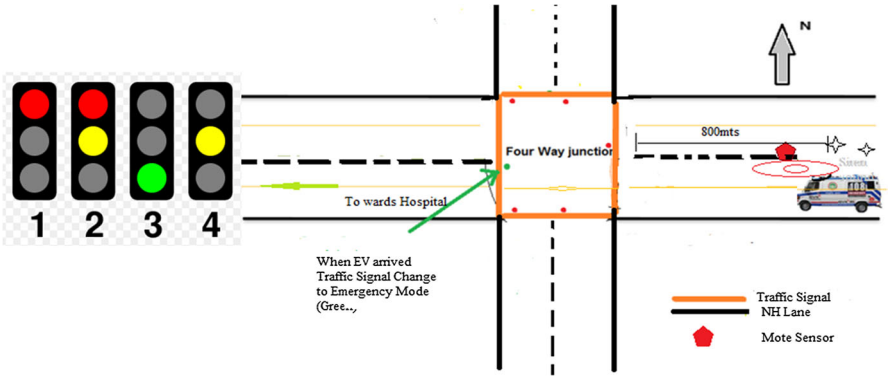

Fig. 14 Emergency vehicle identification in high way lane

sity of traffic by employing sensors for controlling the traffic light signals. We have employed image processing for controlling the traffic signals too. So accordingly with the upcoming of machine to machine communication employing using Internet of things, we here have developed IoT Based Traffic Signaling System where wireless Mote and ZigBee sensor deployed on all the sides of road every 800 m away to identify emergency vehicle [30]. The traffic density information is sent to raspberry Pi B + Minicomputer, where based on the condition the traffic signal changed accordingly by allotting time for heavy traffic and less time for normal traffic with date and time. Figure 14: 1 represent Stop, 2 represent ready, 3 represent Go and 4 represent Emergency vehicle arrival warning with flashing array of amber LED indication. This information sent to webpage of cloud server think speaks. In this we have developed a prototype for EV identification and path clearance. In future, we propose to extend the system for automatic collusion identification and avoidance traffic congestion by capturing the traffic density information. In addition the traffic density information need to be secured while transmitting the information for controlling the traffic signal. This paper also presents a detailed discussion on several issues of emergency vehicle tracking and its problem. The solution presented in the discussion were based on hardware systems. This module will give solution to real time emergency vehicle tracking application.

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