Student Attendance Monitoring System Using Facial Recognition

Reshma B. Wankhade, S. W. Mohod, R. R. Keole, T. R. Mahore, and Sagar Dhanraj Pande

Abstract With the furtherance of technology, the frauds and malpractices related to it have been on the verge of happening, and technology has been a kind of savior in so many cases. Facial recognition can be considered as such a savior in terms of numerous malpractices and fraud activities. Not only in the field of fraud prevention or detection, but facial recognition and automated face detection tools and technologies play an important role in the attendance management systems, detection of criminals, etc. Document image analysis is used in detecting frauds, but the proposed model relies on the image or video. In this paper, the implementation of facial recognition techniques along with their features and application has been explained. This paper also explains how facial recognition technology is now getting introduced and applied across numerous aspects of life. This paper also highlights the drawbacks or the limitations of facial recognition technologies, and in addition, it also presents the various methods and ideas using which facial recognition technology, and its performance can be enhanced and the limitations can be overcome. A novel framework for monitoring student attendance has been implemented. A Web application based upon the Django framework has been designed for easy monitoring and maintaining the attendance of the student using the facial landmark algorithm.

Keywords Facial · Recognition · Database · Methods · Attendance management

R. B. Wankhade · T. R. Mahore
Computer Science and Engineering, DRGIT&R, Amravati, India

S. W. Mohod
Department, Computer Science and Engineer, DRGIT&R, Amravati, India
e-mail: drgitr.hodcse@gmail.com

R. R. Keole
Department, Information Technology, HVPM, Amravati, India

S. D. Pande (✉)
Assistant Professor Senior Grade I, School of Computer Science and Engineering, VIT-AP University, Amaravati, Andhra Pradesh, India
e-mail: sagar.pande@vitap.ac.in

D. Gupta et al. (eds.), *International Conference on Innovative Computing and Communications*, Lecture Notes in Networks and Systems 492,
https://doi.org/10.1007/978-981-19-3679-1_51

1 Introduction

Over the years, technology has advanced itself in an unexpected way, and the advantages of it being advanced are uncountable. Its applications are being used for numerous purposes and work on a large scale, and facial recognition technique is one such boon from the advancement of technology. Facial recognition is not only used in detecting the frauds or marking the attendance system, but it is widely used to prevent retail crime, find missing humans, to help the blind person, to protect the law enforcement, aid forensic investigations, to identify people on various social media platforms, etc.

While using facial recognition technology in identifying the criminals, the experts input the image of the person and the system, at first preprocess the image, and the preprocessing will cause not-required noise that has to be removed from the image. And after that, the images are classified on the basis of their landmarks. Landmarks for example, the length of the jaw line, the distance between the eyes, etc. After classifying the images based on their landmarks, the system runs a search process in the database in order to find the perfect match and then it displays the result.

Detection and recognition are considered the two vital parts for the success of the system. Detection of the face is the primary and the very first step in creating the facial recognition system. This is the only step where the system identifies the face and then it distinguishes and determines whether it is a human face or something else. The identification of face can be further classified into four main categories; feature invariant, appearance-based, knowledge-based, and template matching methods [1].

One such biometric method that uses a human's face and then automatically recognizes and verifies the person from an image which is digitally available or a video frame is facial recognition. Facial recognition methods are being used by various companies in their security cameras. This technology is widely used for verification, authentication, authorization, and identification. Websites like Facebook use facial recognition technology in order to create the digital profile of its users on its Website [1].

Improving the quality of education includes regular attendance as the key factor and in order to enhance the efficiency and reduce the extra time that is being wasted by taking attendance manually, facial recognition technology is used for taking the attendance automatically. In this paper, the implementation of an attendance management system has been introduced which marks the attendance without any hindrance with the regular teaching duration. This system cannot only be used for marking attendance automatically during class hours but also during exams and other activities where attendance is mandatory.

In Sect. 2, the failure of traditional methods that are used for development of facial recognition technology is elaborated. Also, detailed literature survey on facial recognition techniques, its uses, drawbacks, and limitations is explained in this section. In next section, proposed methodology for attendance monitoring systems using facial recognition system has been elaborated. Furthermore, the paper is concluded along with the future scope of the work.

Contribution of this work is specified as follows:

- Novel secured framework for attendance monitoring is proposed.
- Web application for easy maintenance of attendance is developed.
- Facial landmark algorithm is using for detection of the student's facial detection.

2 Literature Survey

Various research works developed for the detection of facial recognition have been reviewed as follows:

According to [2], the method for marking attendance, i.e., traditional way is super slow and it makes the attendance marking system tedious. Marking the attendance manually is almost a burden for the professors and it is less efficient when you consider the extra time taken [2]. The one of the biggest drawbacks that can be considered in the traditional way of marking attendance is the proxy attendance. To overcome such drawbacks and to make the attendance marking system more efficient and less time taking, technology plays a vital role. Most of the institutes have adopted and deployed other techniques that are served by technology to mark the attendance, and one such technology is facial technology.

Other technologies that are adopted and being used to mark the attendance automatically, not manually are the radio frequency identification (RFID) [2], fingerprint recognition, iris recognition, etc. Some of the technologies mentioned here are queue-based, and they might consume more time and prove to be less efficient [2]. Face verification is considered to be a 1:1 matching process. For very obvious reasons such as efficiency, correctness, less time taking, and convenient to use, facial recognition has gained wide popularity among firms and companies.

Multiple algorithms have been used for developing the attendance management system using facial recognition technology, and in [3], the system that is designed to monitor and mark the attendance of the students is based on hardware design and it included image, fast connected-component labeling algorithm, skin color detection, lip feature extraction, horizontal edge detection [3].

The model that is proposed in [4] required the input faces present in the database to be loaded into the workspace, and then, they proceed further with the detection procedure. The system that is presented in [5] does not require any special hardware for its implementation, a camera, database servers, and a PC is sufficient to implement attendance management system using the facial recognition technique.

OpenCV which is written in C/C++ is widely used along with Python to detect faces easily [6]. It provides the binding for Python and uses the machine learning algorithms to identify faces within a single photo. Around 5000 classifiers or even more a face possess, and each of them must match for a face to be identified [6].

Similarly, in paper [7], it has been mentioned that facial recognition has some limitations such as accuracy, lighting problem, and functionality, and these drawbacks will be solved by the model that is proposed in the [7].

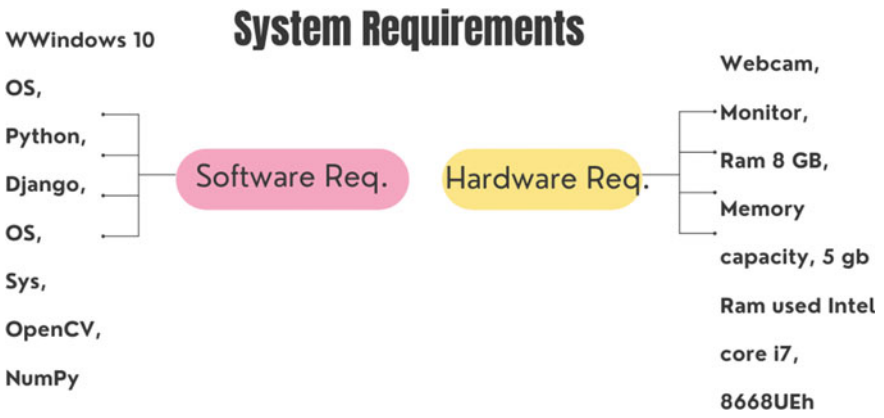

Fig. 1 System requirements

According to [8, 9], growth in face recognition has been considerably great, but there are still many unconstrained works where the illumination, occlusion, viewpoint, expression, etc., vary noticeably.

In [10], the preferred face recognition system application was built with the assistance of Python programming, and hardware and software requirements for the same are presented below in the following chart (Fig. 1).

3 Proposed Methodology

It gets very easy for human brains to detect and identify multiple faces without any equipment of any sort but when it comes to machines, they need to be trained well and require sufficient dataset. The idea and concept of a face recognition system are to provide a computer system, the capability to detect and recognize human faces efficiently and correctly in images or videos. In recent times, deep learning has been deeply explored for such systems [10]. In biometrics, facial recognition plays an integral role, and the basic traits such as length of the jaw line and color of the eyes of the image to be identified are matched with the existing data in the database. Multiple facial attributes are taken out from the images, and efficient algorithms are used to implement them, and some minor modifications and changes are done to improve and enhance the efficiency of the existing algorithms.

There are two stages in the face recognition which are depicted in Fig. 2:

- Face recognition—The input face or image is processed and compared to the already existing known faces that reside in the database.
- Generation of application.

In this paper, the proposed methodology is about a face recognition technique that has been applied in building and maintaining attendance of the student that detects

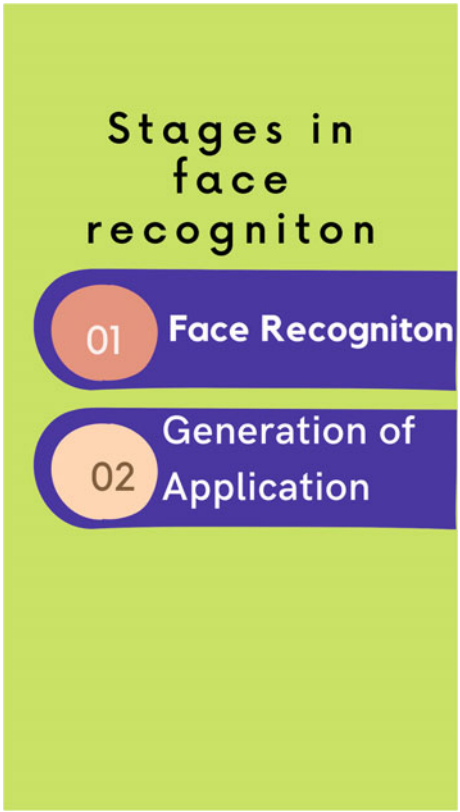

Fig. 2 Stages in face recognition

the face of a student. After processing and matching the input image with the already present images in the database, the attendance of the student is marked (Fig. 3).
Step 1: The image of the student's face is recorded with the assistance of the camera.
Step 2: The recorded image is saved in the database along with registration details of the student.
Step 3: When faculty is taking the attendance, then the image of the student's face is captured and then is the verification phase will be activated.
Step 4: Facial landmark algorithm is used for the detection and verification of the prestored face in the database.
Step 5: If the new image matches with the recorded image, then the student's attendance is verified.

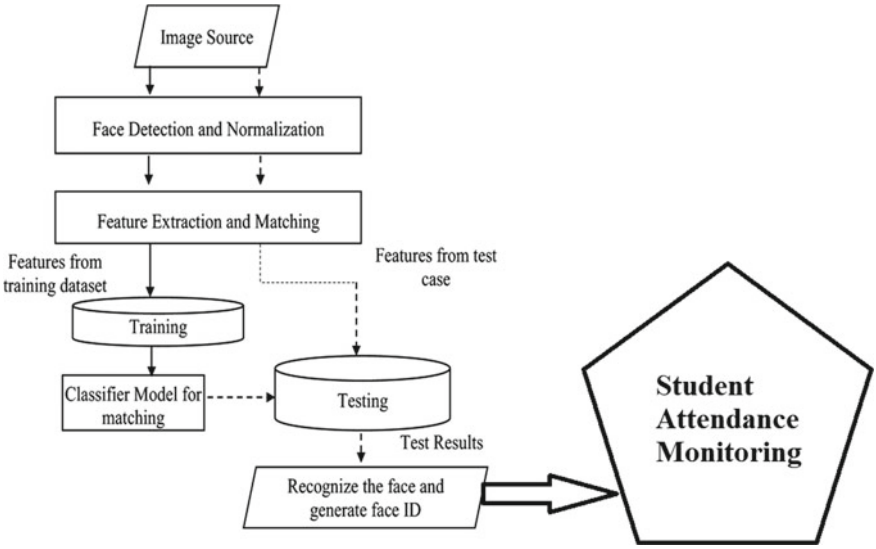

Fig. 3 System architecture

4 Result Analysis and Discussions

Webcam is used to capture the images of the students. Various images of a particular student are acquired along with their registration details. Thereafter, the images are cropped, and after cropping, the region of interest (ROI) is obtained, and the ROI is further utilized in the recognition process. The detection of faces is done using the facial landmark algorithm. The algorithm undergoes training to detect the faces of humans. This process is known as feature extraction.

After the face gets recognized, the identified faces are marked present in the excel sheet and the rest which are not identified are marked absent, and to make it more efficient for teachers, the system mails the list of absentees to the faculties. Using the GUI, the users can easily interconnect with the system. The users are given a total of three alternatives such as faculty registration, mark attendance, and student registration. The students are requested to provide all the needed details in the form and after that the Webcam starts to capture the image of the student and it captures the image of the student as depicted in Fig. 4. After that the images are stored in the database along the student's information. Further, when the faculty wants to take the attendance at that time, the image is again captured and verified using the prestored image. If the image matches with existing records, then the attendance is marked as present, otherwise it will be marked as absent. Sample of this process is depicted in Fig. 5.

Fig. 4 Student registration along with facial image

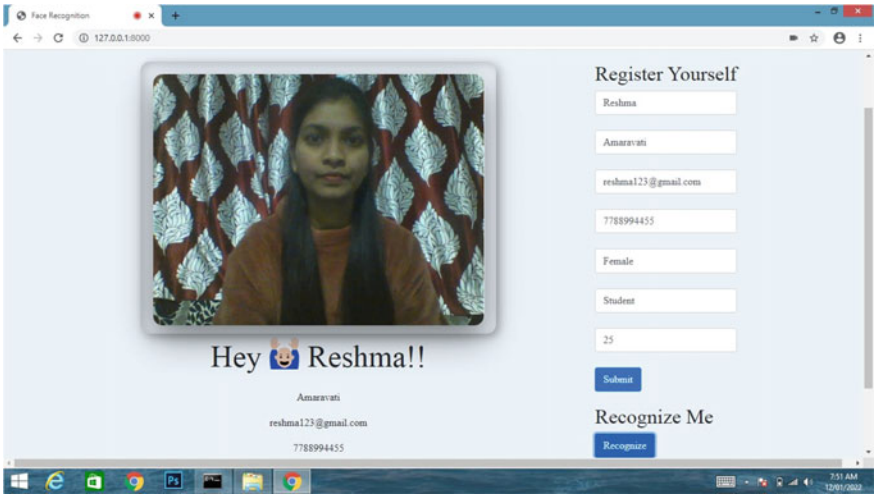

Fig. 5 Face detection and verification

The model's high configuration architecture consists of Intel® Core™ i5-2450 M Processor with 2.50 GHz CPU, 64-bit Windows 10 Operating System, and 16 GB of RAM.

5 Conclusion and Future Scope

In this paper, facial recognition technology has been introduced at first, and how the traditional methods fail to be efficient and sufficient is explained. Furthermore, the various systems that are used facial recognition technology have been reviewed. Next, the facial recognition algorithm that is used in detecting and verifying for the attendance has been explained, and the main steps involved in facial recognition technology have been also elaborated. The working and implementation flow of the attendance management system have been elaborated and described. In future, the work can be expanded by using object detection as well as monitoring based upon the advanced and recent algorithms like YOLO for getting more precise and accurate results.

References

1. Abdullah NA, Saidi MJ, Rahman NHA, Wen CC, Hamid IRA (2017) Face recognition for criminal identification: An implementation of principal component analysis for face recognition. In: AIP conference proceedings 1891, 020002 (2017); Published Online: 03 Oct 2017, https://doi.org/10.1063/1.5005335
2. Smitha PSH, Afshin (2020) Face recognition based attendance management system 9(05), May 2020
3. Fuzail M, Nouman HMF, Mushtaq MO, Raza B, Tayyab A, Talib MW (2014) Face detection system for attendance of class. Students 5(4), Apr 2014
4. Polamarasetty VK, Reddem MR, Ravi D, Madala MS (2018) Attendance system based on face recognition 05(04), Apr-2018
5. Sawhney S, Kacker K, Jain S, Singh SN, Garg R, Real-time smart attendance system using face recognition techniques, Amity University Noida
6. Amritha S (2019) Assistant professor, face recognition based attendance system using machine learning. IJEDR 7(3). ISSN: 2321-9939
7. Liyew BT, Hazari P (2017) A survey on face recognition based students attendance system 6(9), Sept 2017
8. Patil SA, Deore PJ (2013) Face recognition: a survey, 1(1), Dec 2013
9. Aherwadi NB, Chokshi D, Pande S, Khamparia A (2021) Criminal identification system using facial recognition (July 12, 2021). In: Proceedings of the international conference on innovative computing and communication (ICICC) 2021
10. Wankhade RB, Umekar PN, Mohod SW, Pande S (2021) A review on essential resources utilized for face recognition (July 12, 2021). In: Proceedings of the international conference on innovative computing and communication (ICICC) 2021