International Journal of Enhanced Research in Science, Technology & Engineering
ISSN: 2319-7463, Vol. 11 Issue 12, December-2022, Impact Factor: 7.957

Face Recognized Model Trained Automated Attendance Monitoring System

Dr. S. Selvi

Assistant Professor, Department of Computer Science and Engineering, Government College of Engineering, Bargur, Tamil Nadu, India

ABSTRACT

Nowadays, machine learning algorithms in the field of image processing have become an important part of the purpose of security and surveillance. Biometric-based techniques have emerged as the most promising option for recognizing individuals in recent years since, instead of authenticating people and granting them access to physical and virtual domains based on passwords, PINs, smart cards, plastic cards, tokens, keys, and so forth, these methods examine an individual physiological and/or behavioral characteristics in order to determine and/or ascertain his identity. The manual student attendance system is tedious, time-consuming, and inaccurate as some students -often sign for their absent colleagues. Here image processing technique is used as the main source to identify the object. It is proposed the design and use of a face detection and recognition system to automatically detect students attending a lecture in a classroom and mark their attendance by recognizing their faces. The system will analyze these data, then compute the attendance, percentage, etc.., and finally will generate the hall ticket for students. In this paper, face detection and face recognition are used. Face detection is used to locate the position of the face region and face recognition is used for marking the understudy's attendance. The database of all the students in the class is stored and when the face of an individual student matches with one of the faces stored in the database then the attendance will be recorded. Recently, security crises demand a proper security system, this system acts not only as an attendance system but also as a surveillance system. The results have shown improved performance over the manual attendance management system.

Keywords: Attendance Monitoring, Deep Learning, Face Detection, Face Recognition.

INTRODUCTION

Maintaining attendance is very important in all learning institutes for checking the performance of students. In most learning institutions, student attendance is manually taken by the use of attendance sheets issued by the department heads as part of a regulation. The students sign in these sheets which are then filled or manually logged in to a computer for further analysis. This method makes it difficult to track the attendance of the individual student in a large classroom environment. And the biometric methods of identification (such as iris scans or fingerprints) can be more accurate, students usually have to queue for a long at the time they enter the classroom.

Face recognition is chosen owing to its non-intrusive nature and familiarity as people primarily recognize other people based on their facial features. This (facial) biometric system contains an enrolment process in which the unique features of a person's face will be stored in the database and then the processing of identification and verification will take place. In these, the detected face in an image (obtained from the camera) will be compared with the previously stored faces captured at the time of enrolment. Also, face detection techniques are used by departments like crime investigation where they use CCTV footage to detect the faces from the crime scene and compare those with criminal databases to recognize them. Also, Facebook uses an algorithm called deep face whose accuracy to recognize is 97.25% which is as close as what humans have which is 97.53%.

This paper is organized as follows. Section I explains the Introduction. Section II briefs about Literature Survey. Section III explains the Problem Definition. Section IV describes the Proposed System and its implementation is explained experimentally in Section V. Section VI explains the Conclusion.

LITERATURE SURVEY

A fully software-based approach using facial recognition base authentication methods[1] has been proposed to reduce the nuisance of pen and paper-based attendance systems, proxies, and the high maintenance cost of the biometrics. The

system was portable and can be easily installed and can be used. The author [2] designed a system that helped teachers to take attendance through mobile and also keep in touch with students in some aspects. This system allowed teachers to take attendance, edit attendance, view students' bunks, send important documents in .pdf format such as exam timetable, a question bank, etc., and also helped teachers to inform students about the events that the college will organize. This system gave a prior intimation to the student as soon as his/her attendance goes below the specified attendance deadline in the form of an alert. This system improved accuracy and presented error-free attendance percentage calculation. But still, an Android phone is the major requirement for this software to work. The system consists of how effectively the student can bunk the lectures, which is demoralizing for the student to attend all the lectures.

A portable fingerprint-based student attendance system using GSM[3] has proposed a system that included a terminal fingerprint acquisition module and an attendance module. It could realize automatically such functions as information acquisition of fingerprints, processing, and wireless transmission, fingerprint matching, and making an attendance report. After taking the attendance, this system sent the attendance of every student to their parent's mobile through GSM. The attendance system facilitated access to the attendance of a particular student in a particular class. This system eliminated the need for stationary materials and personnel the keeping records. But it has required unique identification to operate and also cost-effective hardware. A wireless system [4, 5] has been developed to detect and maintain the attendance of a student and to identify the location of a student. A student ID (identification) card was tagged with a Radio-Frequency IDentification (RFID) passive tag which was matched against the database and only finalized once his fingerprint was verified using the biometric fingerprint scanner. The guardian was intimated by an SMS (short message service) sent using the GSM (Global System for Mobile Communications) modem of the same whether the student has reached the university or not on a daily basis.

Attendance monitoring using RFID technology [6] has been presented to solve the recurrent lecture attendance monitoring problem in developing countries. The application of RFID to student attendance monitoring was developed and deployed, which was capable of eliminating the manual collection of attendance and an opportunity for educational administrators to capture face-to-face classroom statistics for the allocation of appropriate attendance scores and for further managerial decisions. An attendance system [7] has been proposed to manage the attendance systems in a large and branched factory or university from the central unit. It consists of terminal units and a central unit. Each terminal unit consists of a Raspberry pi, screen GUI, RFID, transponder card with each user (like a student), and GSM board. The central unit consists of Arduino, a GSM board, and a computer. Each unit has a special program to achieve its purpose. The terminal unit is responsible for making a connection with a transponder card and making a comparison with the names listed in the database of the SQL server to get the names of the absentees' students and send their serial numbers by using a GSM message. A wireless fingerprint attendance management system [8, 9] has been proposed to take the attendance of the students. This system efficiently reduced the workload on teachers for uploading the attendance, storing lots of papers to maintain attendance records, making the defaulter list, etc.

PROBLEM DEFINITION

It is observed that the existing system is not user-friendly because the retrieval of data is very slow and data is not maintained efficiently. It required more calculations to generate the report only at the end of the session, possible to generate the same. And the students do not get a single chance to improve their attendance. These calculations to generate the report have been done manually so there is a greater chance of errors and are very time-consuming. The loss of even a single register/record led to a difficult situation because all the papers are needed to generate the reports.

The traditional methods of monitoring student attendance in lectures were tedious as the signed attendance sheets have to be manually logged into a computer system for analysis. This is tedious, time-consuming, and prone to inaccuracies as some students in the department often sign for their absent colleagues, rendering this method ineffective in tracking the student's class attendance. And chances of proxy are also one of the problems that arise in such type of attendance marking. Also, attendance marking system such as RFID, biometrics, etc. is currently not so much popular in schools and classrooms for students as they have their own advantages and disadvantages.

Biometric-based technologies include identification based on physiological characteristics (such as the face, fingerprints, finger geometry, hand geometry, hand veins, palm, iris, retina, ear, and voice) and behavioral traits (such as gait, signature, and keystroke dynamics). Almost all these technologies require some voluntary action by the user, i.e., the user needs to place his hand on a hand rest for fingerprinting or hand geometry detection and has to stand in a fixed position in front of a camera for iris or retina identification. Face recognition appears to offer several advantages over other biometric methods.

The overall objective is to develop an automated class attendance management system comprising a desktop application working in conjunction with a mobile application to perform the following tasks:

a) To detect faces in real time.

b) To recognize the detected faces by the use of a suitable algorithm.

c) To update the class attendance register after a successful match.

The proposed system introduces an automated attendance system that integrates a webcam and face recognition algorithms. Any laptop with a web camera can capture a live video for detection and recognition. The live video undergoes face detection and face recognition, the detected faces are extracted from the image. The extracted faces are then compared with the database and correspondingly the database is updated for attendance and a sheet is generated and displayed to the user.

PROPOSED SYSTEM

The proposed system is instantiated by the mobile. The image-capturing phase is the one in which the image will be captured. This is the basic phase from which the system starts initializing. The captured image from a camera is predominantly checked for certain constraints like lightning, spacing, density, and facial expressions. In this paper, individuals and different frontal postures are taken so that accuracy can be attained to the maximum extent. In the training database phase, every individual has been classified based on labels. To capture images, from all objects only frontal faces are detected. This detects only faces and removes every other part since it is exploring the features of only faces. These detected faces are stored in the test database for further inquiry. Features are extracted in this extraction phase. The detected bounding boxes are further queried to look for feature extraction and the extracted features are stored in a matrix. Features including shape, edge, color, and wavelet, are concentrated. The working flow of the proposed system and its level 2 Data Flow Diagram (DFD) are described in the following subsections.

A. Working Model of the Proposed System

The working flow of the proposed system is shown in Fig. 1. This flow consists of different stages namely; a) Generating Dataset b) Face Detection c) Face Recognition d) Attendance marking.

The face detection step consists of two stages. In stage I, the system undergoes training to save the cropped images and perform detection and recognition. Further, this data will be used to compare the detected images in all the uploaded files and update the attendance. Training of person Y is performed by taking the training image from various angles and various expressions. One can train any number of images of a particular person as required. Basically, this stage uses a webcam for capturing the live video. In stage II, Face detection is done with a live webcam. The faces are detected by using the training data stored in the database. The face of a person is detected and the message shown is "OUT OF PERIOD" as the person is present before the specified time of the lecture.

In the face recognition step, the resultant generated data are compared with the data trained in the dataset. For example, the professor can define lecture timings directly in the GUI according to his/her need. Once the lecture timing has started then the process is automatically initiated. If the student is present in the specified lecture timing and within the lecture threshold the face of the person is recognized from the trained images of the database and shown in the GUI with his/her name. If a candidate is not trained then it is displayed as "UNKNOWN".

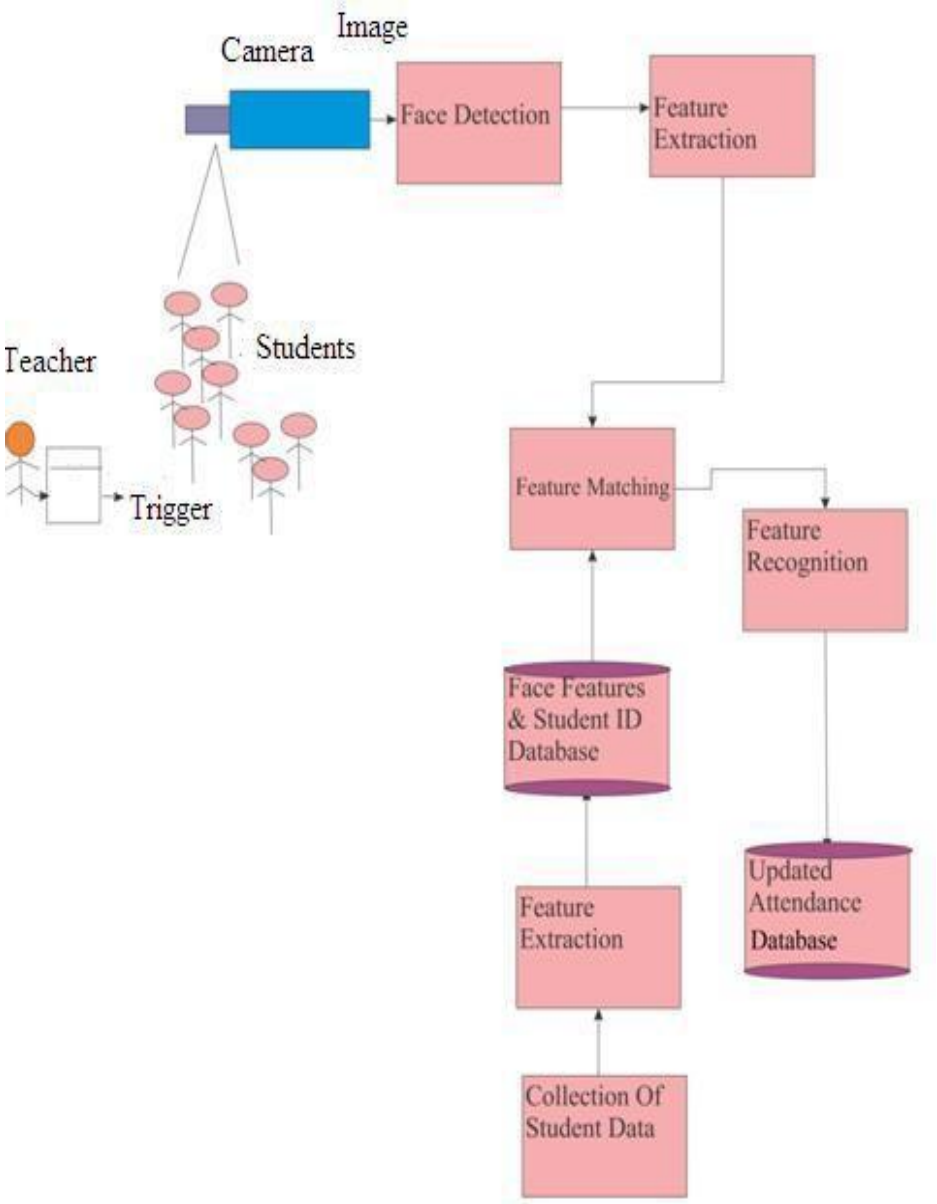


Figure 1.Working model of the proposed system.

In the final step, as soon as the name of the student is identified the attendance is updated with the current date and time. The attendance record of the students with date and time is marked if the face is matched with the trained data. Eventually, the attendance sheet is generated, and a hall ticket is generated for the eligible students (If a candidate fulfills the minimum attendance criteria ie. 80%, may be allowed to write examinations) using the information of the corresponding student available in the database.

B. Level-2 DFD of automated attendance system

Fig. 2 shows the Data Flow Diagram Level 2 of the automated attendance system. The automated attendance system uses the GUI (Graphical user interface) to improve the effective utilization of the system. A webcam is installed and is used with its driver, Face detection is done with the use of Haar cascade which is a yml/XML file, is used to detect the frontal face of the student. Then frontal faces are recognized using algorithms as follows;

PCA (Principal Component Analysis)
LDA (Linear Discriminate Analysis)
LBPH (Local Binary Pattern Histogram)

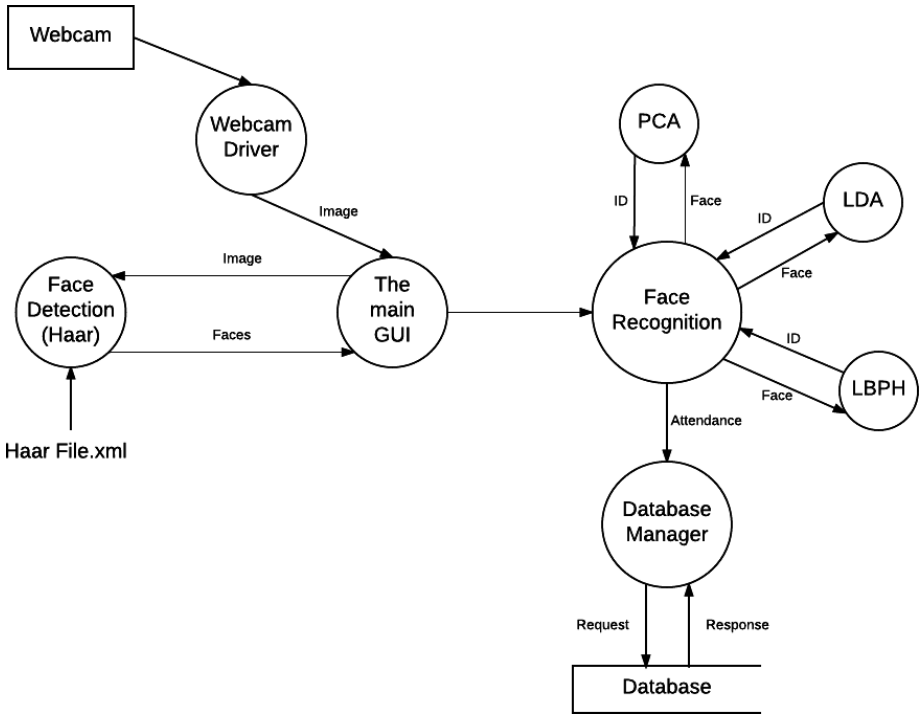


Figure 2. DFD Level2 of automated attendance system.

I. Haar Cascade

Haar Cascade is a machine learning-based approach where a cascade function is trained from a lot of positive and negative images. It is then used to detect objects in other images. There are four stages namely; 1. Haar Feature Selection; 2. Creating Integral Images; 3. Adaboost Training; and 4. Cascading Classifiers. Initially, it requires a lot of positive images of faces and negative images without faces to train the classifier. Then features are extracted from it.

First step is to collect the Haar Features. A Haar feature considers adjacent rectangular regions at a specific location in a detection window, sums up the pixel intensities in each region, and calculates the difference between these sums. During the detection phase, a window of the target size is moved over the input image, and for each subsection of the image and Haar features are calculated. This difference is then compared to a learned threshold that separates non-objects from objects. Because each Haar feature is only a "weak classifier" (its detection quality is slightly better than random guessing) a large number of Haar features are necessary to describe an object with sufficient accuracy and are therefore organized into cascade classifiers to form a strong classifier.

II. Cascade Classifier

The cascade classifier consists of a collection of stages, where each stage is an ensemble of weak learners. The weak learners are simple classifiers called decision stumps. Each stage is trained using a technique called boosting. Boosting provides the ability to train a highly accurate classifier by taking a weighted average of the decisions made by weak learners. Fig. 3 shows cascade classifier stages.

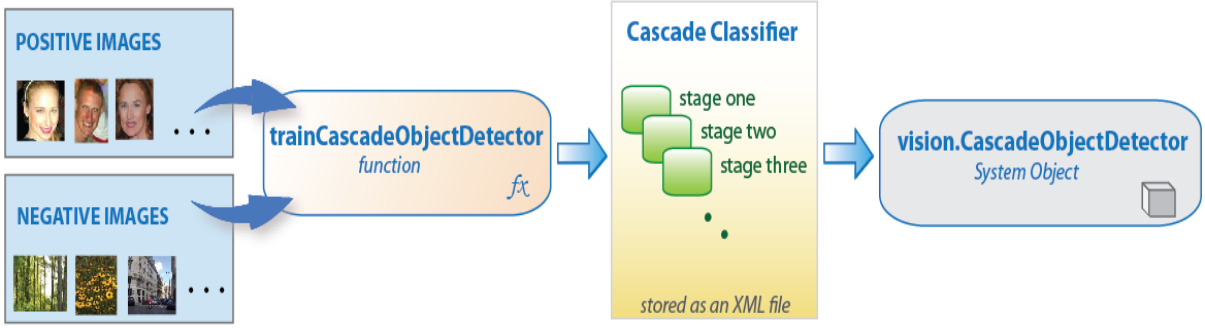


Figure. 3.Cascade classifier stages.

Each stage of the classifier labels the region defined by the current location of the sliding window as either positive or negative. Positive indicates that an object was found and negative indicates no objects were found. If the label is negative, the classification of this region is complete, and the detector slides the window to the next location. If the label is positive, the classifier passes the region to the next stage. The detector reports an object found at the current window location when the final stage classifies the region as positive.

The stages are designed to reject negative samples as fast as possible. The assumption is that the vast majority of windows do not contain the object of interest. Conversely, true positives are rare and worth taking the time to verify. To work well, each stage in the cascade must have a low false negative rate. If a stage incorrectly labels an object as negative, the classification stops, and then cannot correct the mistake. However, each stage can have a high false positive rate. Even if the detector incorrectly labels a non-object as positive, the classifier corrects the mistake in subsequent stages. Adding more stages reduces the overall false positive rate, but it also reduces the overall true positive rate.

RESULTS DISCUSSION

This paper is implemented using python. Face detection can be improved by tuning the parameters of the detector to yield satisfactory results. The parameters to be adjusted are explained. The scale increase rate specifies how quickly the face detector function should increase the scale for face detection with each pass it makes over an image. Setting the scale increase rate high makes the detector run faster by running fewer passes. If it is set too high it may jump quickly between the scales and miss the faces. The default increase rate in Open CV is 1.1. This implies that the scale increases by a factor of 10 % each pass. The parameters assume a value of 1.1, 1.2, 1.3, or 1.4.The minimum neighbor's threshold sets the cut-off level for discarding or keeping rectangle groups as either face or not. This is based on the number of raw detections in the group and its values range from zero to four.

A. Attendance Database

Recognizing a face means to identify that particular face from a list of faces on a database. The dataset includes candidate faces under a very wide range of monochromatic and lightning conditions at different poses and angles. The college at the time of admission takes pictures from every student, and those images are stored in the database. The dataset is then trained to identify the student even if there are gradual changes in the appearance of a student. The camera is set up such that it captures only frontal images so the problem of the pose is not an issue. During the detection phase, the image is converted into grayscale. The same technique is applied to faces in a student image database. Background subtraction on images is also done so that other objects do not interfere during the process.

Another issue is that faces are subject to change over time (facial hair, different hairstyles, etc.,). Whenever a face is successfully identified and a copy of that face is stored in the database which is a training set. Together with the image, it stores the time and date when this image was taken. This way it identifies the gradual appearance changes of the students on each scan for a student, the recognition operation performs a comparison of images stored in the database, sorted in descending order by date. This approach was used since the latest image of a student on the database is most likely to be more similar to the currently captured image. Of course, a sudden drastic change in a student's look cannot be identified for that particular instance. To solve this issue, it has included a module, which lists all unidentified faces and the teacher is able to manually connect a captured face with a student from the list. The corresponding image is stored as an updated picture of a particular student. The recognition process is performed only once. In a face subsequent scan, the student is identified automatically by the system.

B. Training Dataset

Separating data into training and testing sets is an important part of evaluating data mining models. Typically, a larger portion of the data is used for training, and less portion of the data is used for testing. Training datasets are up to 60-70 samples that are used to train the algorithms. Fig. 4 shows the trained dataset.

A validation dataset is a sample of data held back from a training object model that is used to give an estimate of model skill while tuning the model's hyper parameters. Fig.5 shows the validation dataset. By using similar data for training and testing, the system can minimize the effects of data discrepancies and better understanding the characteristics of the model.

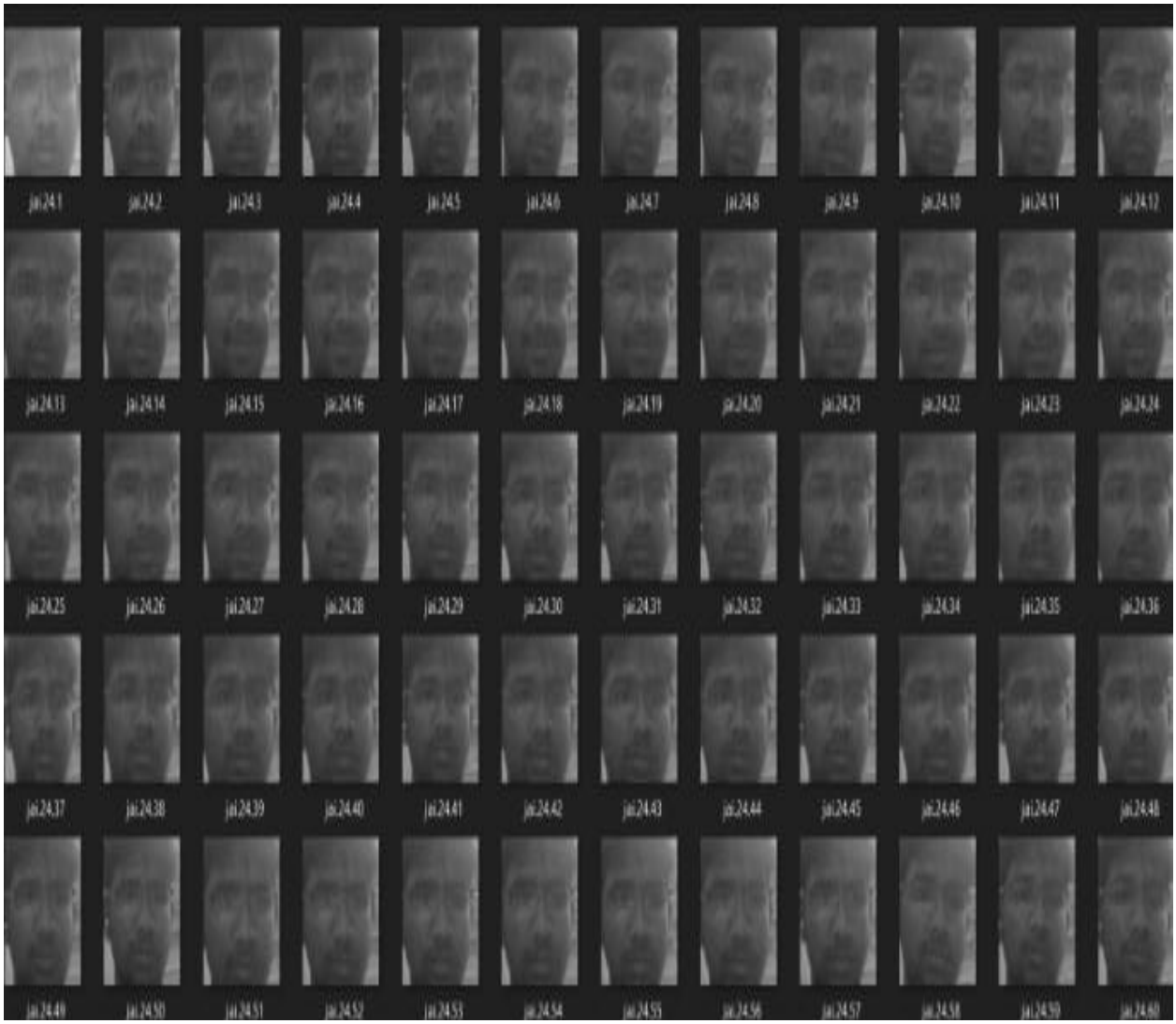


Figure 4.Trained dataset.

Figure 5. Validated Dataset.

It also sendsa message to the particular student/employee it contains information about attendance details. Fig. 6 shows the attendance generated for a student. And finally generate the hall ticket for students which is shown in Fig.7and the salary for employees, based on requirements.

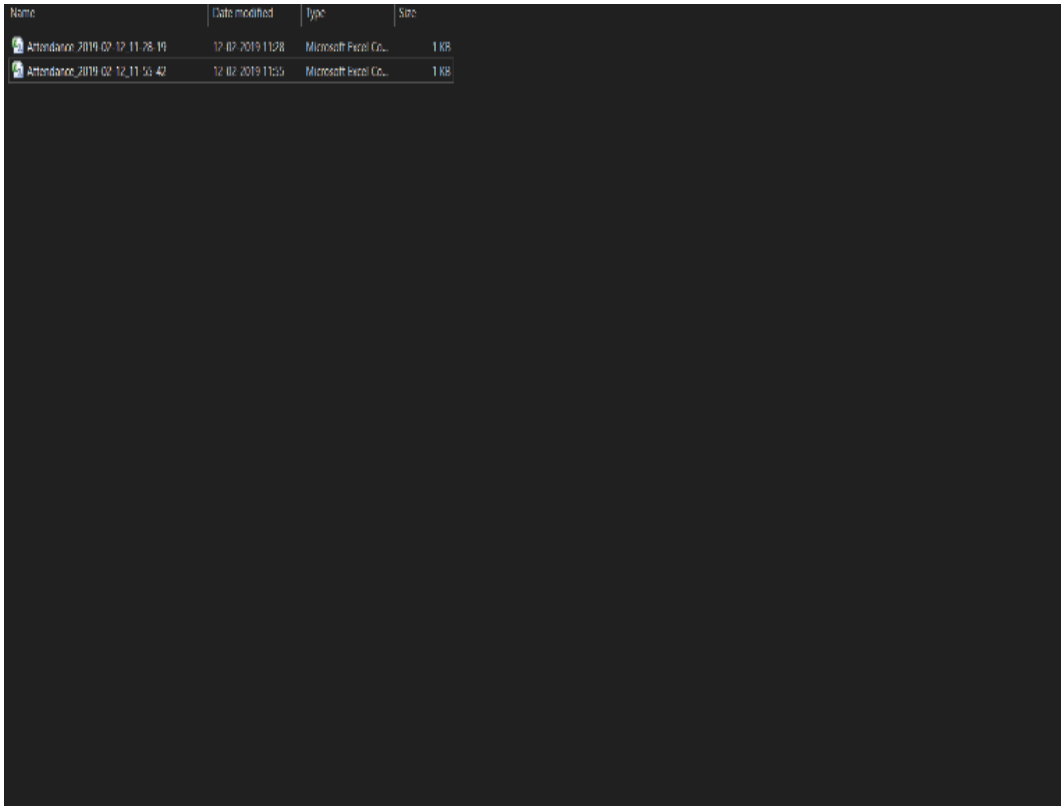


Figure 6.a. Checking attendance from CSV File.

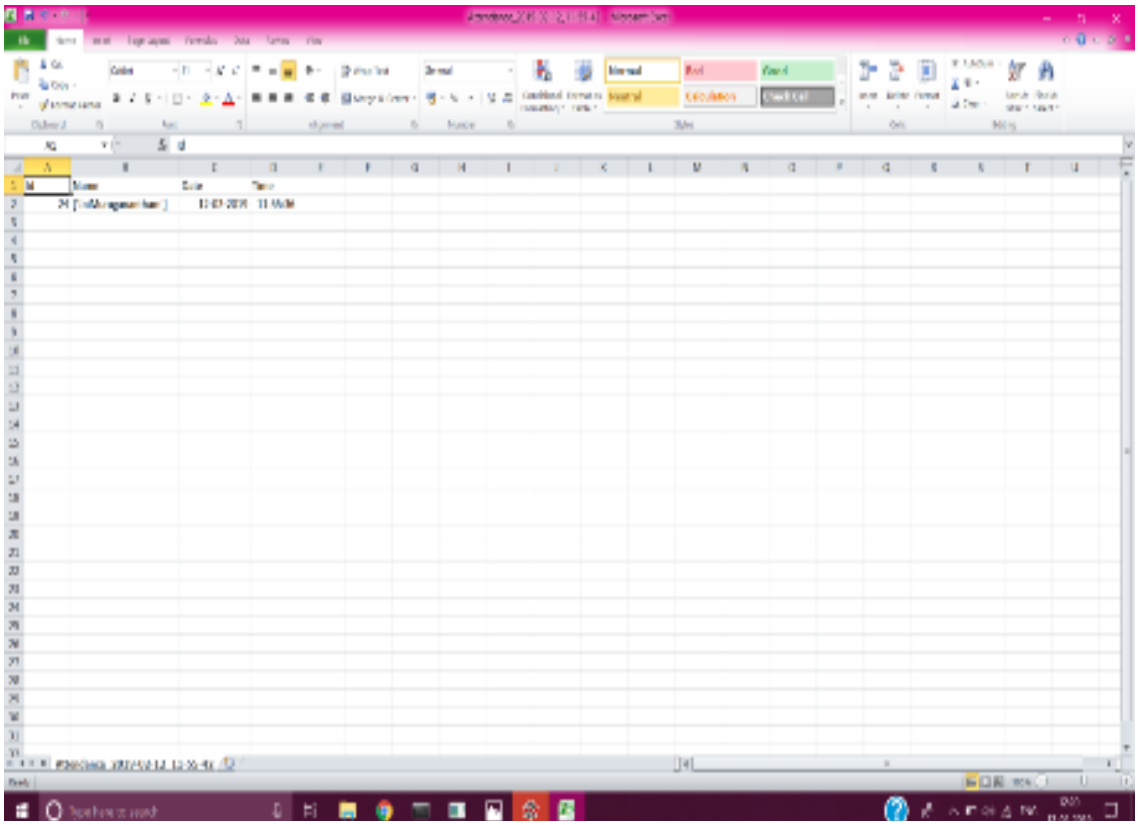
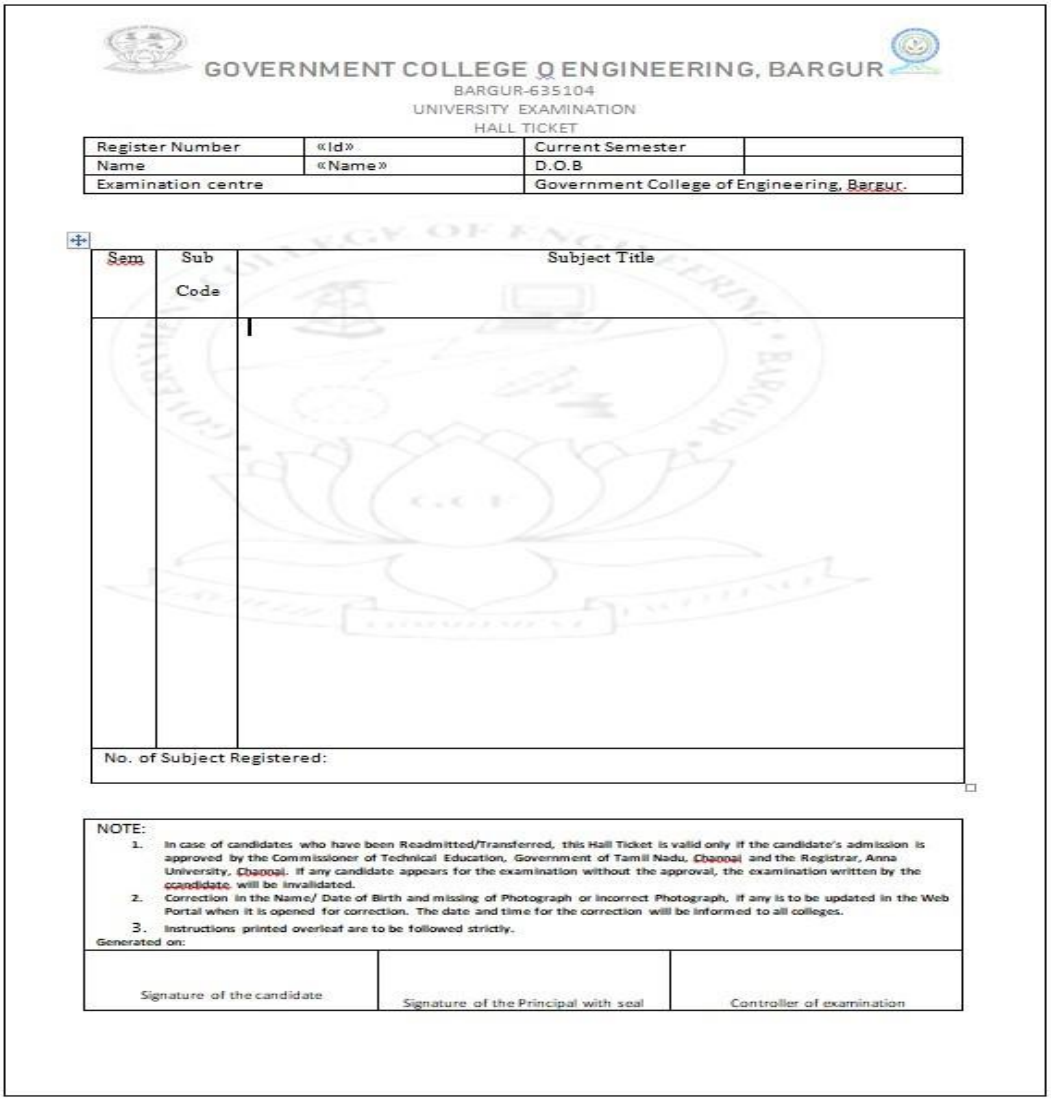


Figure 6. B. Attendance Marking.



GOVERNMENT COLLEGE O ENGINEERING, BARGUR

BARGUR-635104

UNIVERSITY EXAMINATION

HALL TICKET

Register Number	«Id»	Current Semester	
Name	«Name»	D.O.B	
Examination centre		Government College of Engineering, Bargur.	

Sem	Sub Code	Subject Title

No. of Subject Registered:

NOTE:

1. In case of candidates who have been Readmitted/Transferred, this Hall Ticket is valid only if the candidate's admission is approved by the Commissioner of Technical Education, Government of Tamil Nadu, Chennai and the Registrar, Anna University, Chennai. If any candidate appears for the examination without the approval, the examination written by the candidate will be invalidated.
2. Correction in the Name/ Date of Birth and missing of Photograph or incorrect Photograph, if any is to be updated in the Web Portal when it is opened for correction. The date and time for the correction will be informed to all colleges.
3. Instructions printed overleaf are to be followed strictly.

Generated on:

Signature of the candidate	Signature of the Principal with seal	Controller of examination

Figure 7. Generating Hall Ticket.

CONCLUSION

This system is developed for maintaining the attendance record. Hence, desired results with a user-friendly interface are developed. The algorithm has been tested with multiple students in the scene and also captured faces at different angles in the scene. The algorithm delivers quite good results but there is room to improve the algorithm performance in case of a large number of students and also in case of faces captured in a dark environment, so the proposed system can be extended in the future to cover this aspect. The efficiency of the system could also be increased by integrating various steps and techniques in the future developing stages of the system with the use of enhanced algorithms and featured technical hardware. There are still a lot of ways this system can be developed for a better safety and security system. Also, making the device more compact by adding a mobile application for dynamic entry of a new user.

REFERENCES

[1]. H. Patil, H. Khan, S.Ansari, and S.Sahu,"Automated Attendance System using Face Recognition.", Int. J Advanced Research in Science, Communications and Technology, Vol. 4(1), pp.54-62, 2021, ISSN(O): 2581-9429.

[2]. D. M.Gezgin "AWeb-Control based Student Classroom Attendance Tracking System Application: TUODS", Trakya Univ J Sci, 13(2): 109-119, 2012, ISSN 2147–0308, DIC: 007DGET1321204130413.

[3]. V. Pallavi, and G.Namit, "Fingerprint based Student Attendance System using GSM", Int.J. of Science and Research, Vol.2(10), pp. 128-131, 2013, ISSN:2319-7064,

[4]. A. N. Ansari, A. Navada, S.Agarwal, S.Patil, and B.A. Sonkamble, " Automation of Attendance System using RFID, Biometrics, GSMModem with .net Framework", IEEE Conf. Multimedia tech. 2011, DOI: 10.1109/ICMT.2011.6002032

[5]. S.Bharambe, S. Patil, O.Dixit, V.V. Singh, and S.Gudadhe, "Survey - Student Attendance Management System", Int. J. of Advance Research and Innovative Ideas in Education, Vol. 3(2), pp. 2858-2863, 2017, ISSN(O):2395-4396.

[6]. O.T. Arulogun, A. Olatunbosun, O.A. Fakolujo, and O.M. Olaniyi, “RFID-based Students Attendance Management System", Int.J. of Scientific &Engineering Research, Vol. 4(2), 2013 ISSN: 2229-5518.
[7]. H. F. Abdulsada. "Design and Implementation of Smart Attendance System based on Raspberry pi", J. Babylon University/Engg. Sciences, Vol. 25(2), pp.1610-1618, 2017.
[8]. P. Divya, P. Vidya N. Bipin, D. Swapnil, and, P. Manjiri, "Attendance Management System using Wireless Fingerprint Module", Int. J for Innovative Research in Science & Technology, Vol. 3(11), pp.101-108, 2017, ISSN(O):2349-6010.
[9]. C. Saraswat and A. Kumar, “An Efficient Automatic Attendance System using Fingerprint Verification Technique”, Int. J on Computer Science and Engineering, Vol. 2(2), pp.264-269, 2010, ISSN:0975-3397.
[10]. Adrian Kaehler, and Gary Bradski, Learning openCV: Computer Vision Library (OpenCV), O'Reilly Media, Inc. 2008.