IJARSCT
International Journal of Advanced Research in Science, Communication and Technology
International Open-Access, Double-Blind, Peer-Reviewed, Refereed, Multidisciplinary Online Journal
ISSN: 2581-9429
Volume 5, Issue 4, May 2025
Impact Factor: 7.67

Face Recognition based Attendance Management System

Pranav Shinde[1], Kartik Patel[2], Lokesh Kumawat[3], Sarthak Kamthe[4], Rashmi Tundalwar[5]
Department of School of Computing[1-5]
MIT ADT University Pune, India
[1]pranavshinde2703@gmail.com; [2]kartikpatel1806@gmail.com; [3]lokeshkumawatmbs@gmail.com;
[4]sarthakkamthe5803@gmail.com; [5]rashmi.tuptewar@mituniversity.edu.in

Abstract: *In this age of technology, face recognition system is crucial in nearly every industry. Face recognition is among the widely applied biometrics. It can be utilized for security, authentication, identification, and has numerous more benefits. Although it has low accuracy compared to iris recognition and fingerprint recognition, it is widely used because of its contactless and non-invasive process. Also, face recognition system can be utilized for attendance marking in colleges, schools, offices, etc. This system will develop a class attendance system which utilizes the principle of face recognition because manual attendance system currently in use is time consuming and it is inconvenient to maintain. And there can be possibilities of proxy attendance. Therefore, the demand for this system rises. This system has four phases- database creation, face detection, face recognition, updation of attendance. Database is developed through the images of the students during class time. Face detection and recognition is done through Haar-Cascade classifier and Local Binary Pattern Histogram algorithm respectively. Faces are detected and recognized from the live streaming video of the class. Attendance will be sent to the concerned faculty by mail at the end of the session.*

Keywords: Face Detection; Face Recognition; Haar- Cascade classifier; Local Binary Pattern Histogram; attendance system

I. INTRODUCTION

The conventional attendance marking system conducted within educational institutions involves calling out names and using face-to-face or paper registers. This system consumes a lot of time, requires considerable effort, as well as being constructed incorrectly due to oversight of the staff and lecturers working within the institution. This system also allows proxy attendance where students sign face-to-face registers without the intention of being present to claim attendance on their behalf. All these problems make it evident that the process of attendance requires a tighter, faster, simpler, and competent approach.

To solve issues of this nature, automatic systems have been designed and sophisticated over multiple years. Radio Frequency Identification Systems (RFID) use tags to check attendance but are usually labeled as highly unreliable due to their dependency on physical objects and misuse of marking attendance. Other such systems that work on biometrics such as eye or fingerprint scanners are more accurate but have a significant drawback due to their slow nature of processing because they require physical contact with the device.

Face detection systems, however, merges the best of both worlds and offers high accuracy alongside ease of use. Face recognition systems identify users remotely and in real time using high-quality image processing paired with the latest in machine learning technology, making it non-intrusive as well as unobtrusive. There's no need for physical attendance cards or robust hardware thus greatly reducing the likelihood of attendance errors that

II. LITERATURE SURVEY

Face recognition has become a critical technology for automating attendance systems, providing a contactless, efficient, and accurate solution for educational and corporate settings. Akbar et al. [3] suggested a model integrating Radio

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Frequency Identification (RFID) with face recognition, providing real-time tracking of attendance and assured logging of student activities. Okokpujie et al. [4] proposed an iris-based biometric attendance system which utilized automatic template matching of the eyes with registered data and accomplished high accuracy. Rathod et al. [5] explained the efficacy of Viola-Jones and Histogram of Oriented Gradients (HOG) algorithms using a Support Vector Machine (SVM) classifier on real-time attendance systems and manifested robustness with respect to variable illumination and pose conditions. Siswanto et al. [6] compared Eigenface and Fisherface methods for face recognition and found that Eigenface was better, as confirmed by Receiver Operating Characteristics (ROC) curves. Lukas et al. [7] applied Discrete Wavelet Transform (DWT) and Discrete Cosine Transform (DCT) for feature extraction and obtained an accuracy rate of 82% using Radial Basis Function (RBF) classifiers.

Deep learning algorithms have greatly improved recognition systems. Salim et al. [10] applied Convolutional Neural Networks (CNNs) for face detection and recognition in real classroom situations. Schroff et al. [11] proposed FaceNet, a high-end neural network extracting highly discriminative facial features that maximizes speed and accuracy. Researchers in [12] demonstrated the strength of Local Binary Pattern Histogram (LBPH) for face recognition even with changes in lighting and orientation, a frequent issue in classroom environments. Mathai et al. [13] were interested in real-time recognition through webcam-based systems with a focus on speed and processing. Haider et al. [14] created a mobile-based attendance management system that leveraged cloud storage for remote access and log management.

To offset the latency issue, Khan et al. [15] added edge computing to face recognition systems for quicker processing in real-time applications. A face recognition and speech verification hybrid system for authentication in overcrowded scenes was reported by Jain et al. [16]. The problem of occlusion was improved by Zhang et al. [17] with a sparse representation classifier, increasing dependability with partially occluded faces. Pose invariant recognition using deep learning was studied by Parkhi et al. [18], assuring dependable performance when faces were absent from the camera view. Reinforcement learning was applied by Sun et al. [19] to improve face recognition systems, increasing dependability and functioning in real-life settings enduring changes over time. Cloud computing was pioneered by Kim et al.'s [20] self-regulated face recognition, which optimally scales with demand as computation requirements are offloaded to remote servers, securing data and preserving privacy. Wong et al. [21] enhanced recognition accuracy by proposing cleaner images through noise elimination during preprocessing. Emotion recognition was added to attendance systems by Kumar et al. [22], allowing explanations for attendance behavior alongside accuracy. Low-light difficulties were resolved by thermal imaging as discussed by Li et al. [23].

III. PROPOSED SOLUTION

Every student in the class needs to sign up by providing their required information. After that, someone will take their pictures and store them in the database. During each class, the system will spot faces from the live video stream of the classroom. It will then compare these faces to the photos in the database to find matches. In case of matching, attendance of the respective student will be recorded. At the end of each session, a roll call of absentees will be forwarded to the respective faculty handling the session. The system architecture of the proposed system is given below:

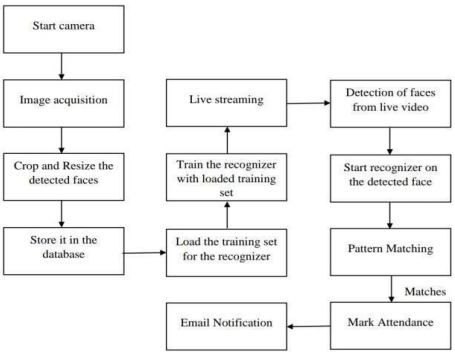

Figure 1. System Architecture Diagram

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1. Dataset Creation

Student images are taken with the help of web cam. Single student multiple images will be taken with different gestures and angles. Pre-processing is done to these images. The images are cropped to get the Region of Interest (ROI) which will further be utilized in the recognition process. Resize the cropped images to specific pixel position is the next step. Then these pictures will be resized to gray scale pictures. Then these pictures will be stored in the name of respective student in a folder.

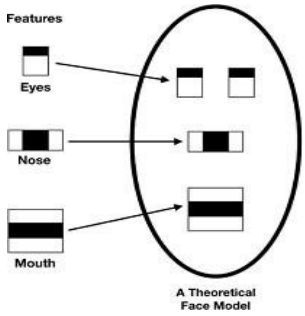

Figure 2. Face Model

Here we are using detectMultiScale module of OpenCV. This is used to draw a rectangle on faces in a picture. It has three parameters to take care of- scaleFactor, minNeighbors, minSize. scaleFactor is employed to tell us how much an image needs to be down sampled in every image scale. minNeighbors tells us how many neighbors each candidate rectangle should have. High values generally detects fewer faces but detects high quality in image. minSize tells us the minimum object size. It is (30,30) by default [8]. The parameters employed in this system is scaleFactor and minNeighbors with the values 1.3 and 5 respectively.

2. Face Recognition

Face recognition procedure can be segregated into three steps- prepare training data, train face recognizer, prediction. Training data here will be the images available in the dataset. They will be labeled with an integer label of the student it represents. These images are utilized for face recognition. Face recognizer employed in this system is Local Binary Pattern Histogram. First, the local binary patterns (LBP) of the full face are obtained. LBPs are then converted to decimal number and then histograms of all those decimal numbers are created. Finally, there will be created one histogram for each image in the training data

3. Attendance Updating

After face recognition procedure, the identified faces will be tagged as present in the excel sheet and the rest will be tagged as absent and the absentees' list will be sent to respective faculties. Faculties will be given the monthly attendance sheet at the end of each month.

IV. RESULT AND DISCUSSION

The users will be able to interact with the system via a GUI. Here users will be provided primarily with three various options like, student registration, faculty registration, and mark attendance. The students need to fill all the required information in the student registration form. Once they click on the register button, the web cam will automatically get activated and window as depicted in Fig.3. pops up and starts detecting the faces in the frame. Then it automatically starts clicking photos until 60 samples are collected or CRTL+Q is pressed. These images then will be pre-processed and stored in training images folder.

The faculties are required to register with respective course code and their email-id in the faculty registration form given. This is necessary because the roll call of absentees will be mailed finally to the respective faculties.

DOI: 10.48175/IJARSCT-26469

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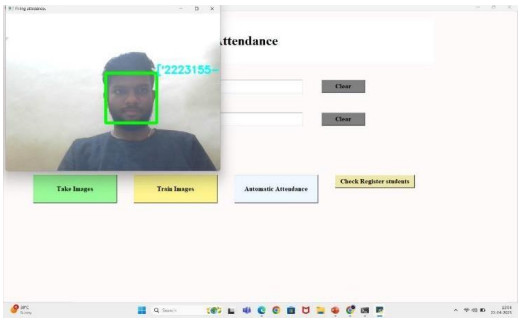

Figure 3. Real Time Face Recognition

In each session, respective faculty has to input their course code. Then, upon inputting the course code, the camera will automatically begin.

The Fig.3. represents the face recognition window where two registered students are identified and if they were not registered it would have displayed 'unknown'. By pressing CTRL+Q, the window will be closed and attendance will be updated in the excel sheet and names of absentees will be sent by mail to the respective faculty.

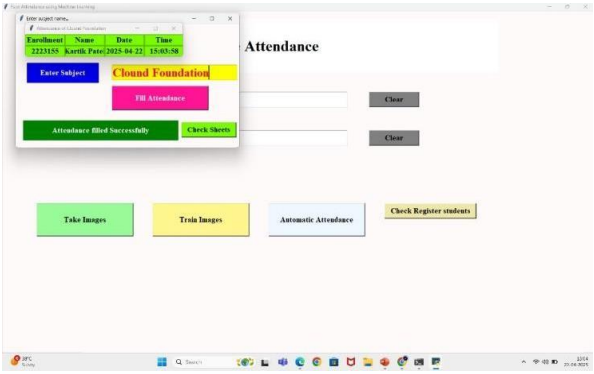

Figure 4. Attendance Updatation

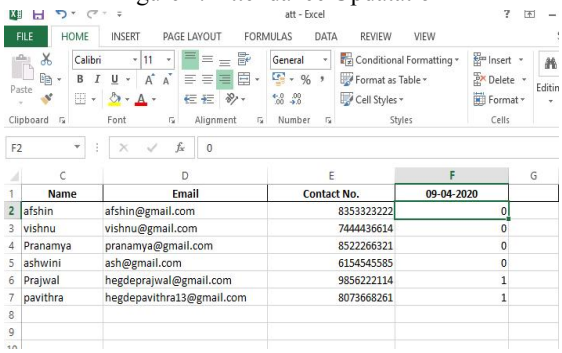

Figure 5. Excel sheet

Displays the attendance sheet updated post-recognition process. The students recognized are represented as '1' and the absent students as '0'. The absentee list will be sent to the concerned faculty email-id.

V. CONCLUSION

Creating an attendance system that operates on facial recognition technology is a great step towards automation of a tedious and error-prone activity. The system provides a modern sleek, effective and reliable solution side by side with addressing critical issues like time wastage, human error, and proxy attendance. With the use of modern technologies like Haar-Cascade classifiers and Local Binary Pattern Histogram (LBPH) algorithms, face detection and identification from real-time video streams is ensured. In general, the face recognition based attendance management system not only

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meets and immediate demands of educational institutions, it is also a scalable system that can be expanded to corporate offices, healthcare centers, and other public sector. This is an example of the transformitive impacts of modern computing technologies on work processes made amalgamated with the new face of daily life.

VI. FUTURE SCOPE

Facial Recognition Attendance System or other Biometrics, the potential for what recognition technology can do in terms of attendance system is enormous. Apart from keeping proxy attendances & unauthorised people out, they add security in many ways. This also positions attendance to be automated, which will avoid human mistakes and saves time for everyone.

1. AI Integration:

Integration of top notch AI techniques such as deep learning and neural networks, bring huge face recognition improvements even under challenging conditions (low light, unexpected angles, occlusions etc.) Attendance behavior predictive modeling can be performed as well for real time insights to get students more involved in the classroom.

2. Scalability and Cloud

Interfacing Because at a macro level this requirement needs to be solved by building the cloud based storage and computation solution, making real time data inter-operation across multiple sites secure. If we could further optimize the system so that data could be shared with other institutions or organizations then this would be possible.

3. Stay within the Range of Increased Secure Multi-Modal Biometrics:

This will be achieved by having voice recognition or fingerprint scanning as a backup to facial recognition at higher security levels and virtually reducing false acceptance.

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