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Automatic Attendance Marking using Face Recognition and SMS Alert using IoT

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Abstract: *The conventional method in the institutions are the faculty passes an attendance sheet or make roll calls to mark attendance of the student, which sometimes disturbs discipline of the class and the sheet further goes to the admin department, which is then updated to an excel sheet. This process is quite hectic and time consuming. The proposed solution for the current problem is through automation of attendance system using face recognition. This project describes the method of detection and recognition the face in real time. Here, the camera is fixed in the classroom and which will capture the image. The faces in the images are detected and then recognized with the database after which the attendance is marked. If the attendance is marked as absent, the message about the student's absence is sent to their parents through IoT. This project can be used to replace the manual method, which takes the time consuming, difficult to maintain and manual error. And also, for many other applications where face recognition can be used for authentication.*

Keywords: *Face Detection, Face Preprocessing, Face Training, Face Recognition, Attendance Database and IoT*

I. INTRODUCTION

Maintaining attendance is very important in all the educational institutions. But it's the most difficult task in various institutions. Every institution has its own method of attendance marking system. Some institutions use the attendance sheet, RFID reader, keystroke or biometric fingerprint techniques. The attendance sheet method has difficulty to maintaining and it has some manual errors. RFID reader technique consume more time because access is done one by one queue. Fingerprint biometric technique similar to RFID reader. These techniques are manual consumes more time and it is intrusive.

Face recognition is one of the least intrusive and fastest biometric technology. Face recognition has some special characteristics that other biometrics do not have. The Robust Real-Time Face Detection technique is used to detect faces. The algorithm consists of three major methods such as integral image, Ada Boost, and cascade detection. Verification or identification can be accomplished from the camera is fixed in the classroom and which will capture the image for further process. Then face image is compared with database using face detection, face recognition methods and the attendance is marked for recognized students. If the attendance is marked as absent the message is sent to their parents through IoT. Face recognition has potential applications in security control, office automation, prevention of fraud, automatic personalization of environments, etc.

A. Related Works

This section represents previous work done regarding attendance marking system. Attendance marking are necessary to conclude and authentication of students as well as employees of organization. Many researches have been done in this area to improve and replace the traditional system of attendance by face recognition technology. Face recognition-based attendance marking system provides several advantages over conventional method of taking attendance in class. A number of algorithms for face recognition have been proposed but most of these works deal with only single image of a face at a time. By continuously observing of face information, proposed approach can solve the problem of the face detection and improve the accuracy of face recognition.

This system aims to detect the position of each student and capture an image for that particular student in the real time environment, which is latter identified. Related system that use biometrics i.e. (fingerprint recognition, iris recognition etc...) to identify user for attendance management system in many institutions. However, installing these systems in every classroom would pose a bigger financial burden. Also subject to physical damage from their users. Therefore, they need additional maintenance. The idea proposed in this paper, removes physical access from anyone user to the system. IoT will empower students to associate with instructors and access to full time instructive tools. Implementing IoT in this work makes it unique and more effective. Here, the system informs to the parents of the students who are absent, through SMS as well as e-mail.

B. Proposed Methodology

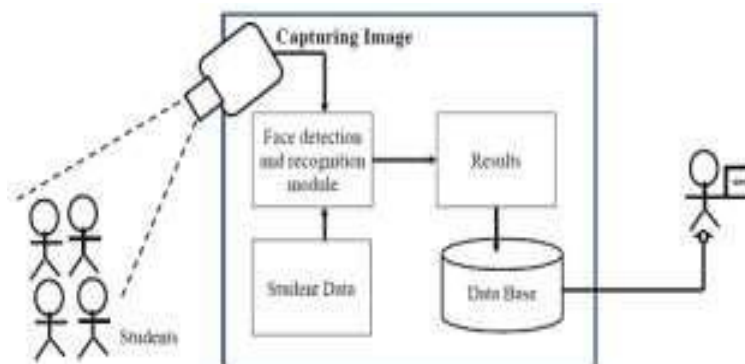


Figure 1 Block Diagram of Proposed System

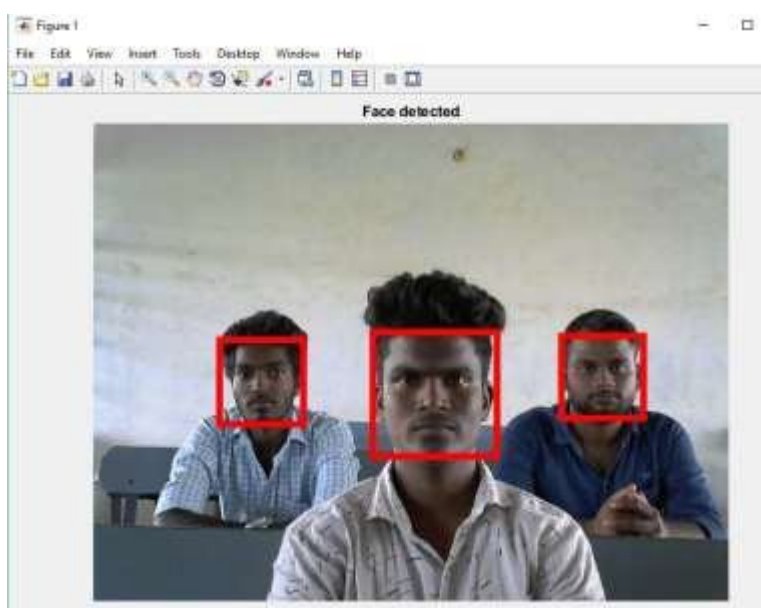


Figure 2 Face Detection Face recognition

Figure 1 describes the working principle of the proposed methodology for automatic attendance marking system

C. Face Detection

Face Detection is useful tool in biometrics, often as a part of a facial recognition system. Viola- Jones Face Detection algorithm is used for the purpose of detection of face in the image captured. Benefits of using this algorithm are:

- 1) It is the fastest technique present for the detection of face process.
- 2) Contribution a simple and efficient classifier built from computationally efficient features using AdaBoost algorithm and Integral image for feature selection.

In face detection, the face of images is marked with the help of rectangle or square shown in Figure 2. The face detected after background Subtraction is accurate as compared to the face detected from an image. The detected face is then cropped. Finally, all the face of individuals is detected and cropped from the image. Each cropped image is taken for the comparison of images in database

Face recognition technique is a computer application which automatically verify and identify a person from an image or video as shown in Figure 3. This method will compare selected facial appearance from the image or by facial database. There are many methods available for face detection. But the eigen value method is the more suitable method. The eigen face method is one that decomposes the facial images into a small set of characteristic features, which are the major components of initial train set of facial images.



Figure 3 Face recognition

D. Eigen value

The initial step is to form a training data base. Two- Dimensional image I_i can be represented as a one- Dimensional vector by concatenating rows. Image is converted into a vector form of length $N = m \times n$

$$I = \begin{bmatrix} x_{11} & x_{12} & \dots & x_{1n} \\ x_{21} & x_{22} & \dots & x_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ x_{m1} & x_{m2} & \dots & x_{mn} \end{bmatrix} \xrightarrow{\text{CONCATENATION}} \begin{bmatrix} x_{11} \\ \vdots \\ x_{1n} \\ \vdots \\ x_{2n} \\ \vdots \\ x_{mn} \end{bmatrix} = x \quad (1)$$

Let M be the vectors x_i ($i = 1, 2 \dots M$) of length N form a matrix of images X .

Examine the vector of mean values Ψ , and then subtract that vector from each image vector.

If A and B are the two eigenvectors of length D , the Euclidean distance between the eigenvectors is determined as

Follow,

$$d(A, B) = \sqrt{\sum_{i=1}^D (a_i - b_i)^2} = \|A - B\| \quad (4)$$

If the minimum distance between face testing and training faces is higher than threshold θ , the face testing is considered to be unknown, otherwise it is known and belongs to the person in the train database.

II. EXPERIMENTAL RESULTS AND CONCLUSION

Table1: Result Of Algorithm Techniques

| Algorithm | Percentage | | |
|------------------|------------|--------|-------|
| | Veil | Unveil | Beard |
| Face Detection | 60% | 95% | 85% |
| Face Recognition | 20% | 92% | 76% |

$$\Psi = \sum (2) \quad -$$

Average vectors are arranged to form a new matrix (size $N \times M$)

$$A = [\Phi_1, \Phi_2, \Phi_3, \Phi_4 \dots]$$

Then second step to calculate the covariance matrix C , and find its eigenvectors and eigenvalues

Where $C = A$

C has dimensions $N \times N$. From that get N eigen values and eigenvectors. If v_i and μ_i are eigenvectors and eigen values of matrix C , then the highest eigenvalue reflects the highest variance, and the lowest eigenvalue, reflects the smallest variance.

Therefore, the vectors should be arranged by eigen values. The first vector corresponds to the highest eigenvalue. Then these vectors

are normalized. They form the new matrix E so each vector is a column vector. The dimensions of this matrix are NXD, where D is the desired number of eigenvectors.

The final step is the recognition of faces.

Image of the person wanted to find in training set is converted into a vector P, then reduced by the mean value Ψ and estimated with a matrix of eigenvectors

$$\omega = (P - \Psi) \quad (3)$$

Classification is done by determining the distance, ϵ_i , between ω and each vector of matrix Y.

Where $Y = A$

This method can replace all the old methods and also shows some improvements as mentioned in Table 1. Automatic attendance management system and SMS alert through IoT shown in Figure 4 is introduced in this paper.

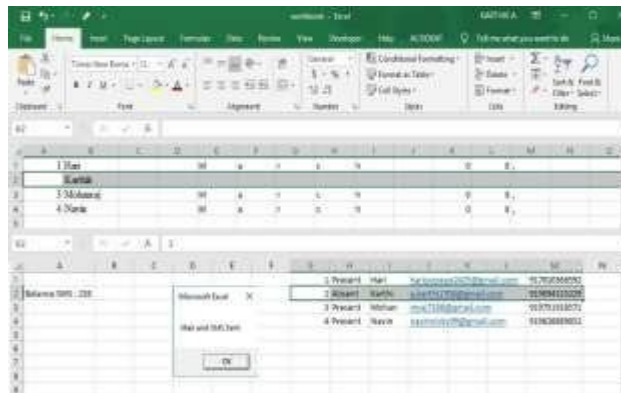


Figure 4 SMS alert through IoT

This method requires only simple hardware for installation. The management of attendance in this technique is simpler and more accuracy. One difficult task in this system is face testing is considered to be unknown; otherwise it is known and belongs to the person in the database. We are working towards it.

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