Automated Attendance System Based on Facial Recognition

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***Abstract*—Nowadays Educational institutions are concerned about regularity of student attendance. This is mainly due to students' overall academic performance is affected by his or her attendance in the institute. Mainly there are two conventional methods of marking attendance which are calling out the roll call or by taking student sign on paper, both were more time consuming and difficult. Hence, there is a requirement of computer-based student attendance management system which will assist the faculty for maintaining attendance records automatically, the paper titled "Automated Attendance System Based on Facial Recognition". The functions include face identification, which saves time and eliminates chances of proxy attendance because of the face authorization. Hence, this system can be implemented in a field where attendance plays an important role. The system is designed using MATLAB platform. The proposed system uses Principal Component Analysis (PCA) algorithm which is based on Eigen face approach. This algorithm compares the test image and training image and determines students who are present and absent. The attendance record is maintained in an excel sheet which is updated automatically in the system**

***Index Terms*— Principal Component Analysis (PCA), Cascade Object Detector (COD), Graphical User Interface (GUI), Excel toolbox (EX)**

I. INTRODUCTION

Attendances of every student are being maintained by every school, college and university. Empirical evidences have shown that there is a significant correlation between students' attendances and their academic performances. There was also a claim stated that the students who have poor attendance records will generally link to poor retention. Therefore, faculty has to maintain proper record for the attendance. The manual attendance record system is not efficient and requires more time to arrange record and to calculate the average attendance of each student. Hence there is a requirement of a system that will solve the problem of student record arrangement and student average attendance calculation. One alternative to make student attendance system automatic is provided by facial recognition. Face recognition can be applied for a wide variety of problems like image and film processing, human-computer interaction, criminal identification etc. This has motivated researchers to develop computational models to identify the faces, which are relatively simple and easy to implement. The important fact which is considered is that although these face images have high dimensionality, in reality they span very low dimensional space. So instead of considering whole face space with high dimensionality, it is better to consider only a subspace with lower dimensionality to represent this face space. The goal is to implement the system for a particular face and distinguish it from a large number of stored faces with some real-time variations as well. The Eigenface approach uses Principal Component Analysis (PCA) algorithm for the recognition of the images. It gives us efficient way to find the lower dimensional space.

II. LITERATURE REVIEW

"Eigen faces for recognition'' (Mathew Turk and Alex Pentland) [1], here they have developed a near-real time computer system that can locate and track a subject's head, and then recognize the person by comparing characteristics of the face to those of known individuals. "Fast face recognition using eigenfaces" (Arun Vyas and Rajbala Tokas) [2], their approach signifies face recognition as a two-dimensional problem. In this approach, face reorganization is done by Principal Component Analysis (PCA). "Face recognition using eigenface approach" (Vinay Hiremath and Ashwini Mayakar) [3], this paper is a step towards developing a face recognition system which can recognize static images. "Face recognition using eigenfaces and artificial neural networks" (Mayank Agarwal, Nikunj Jain, Mr. Manish Kumar and Himanshu Agrawal)[4], this paper presents a methodology for face recognition based on information theory approach of coding and decoding the face image.

III. METHODOLOGY

The block diagram as shown below describes the proposed system for Automated Attendance System Based on Facial Recognition. The system requires a camera installed in the classroom at a position where it could capture all the students in the classroom and thus capture their images effectively. This image is processed to get the desired results.

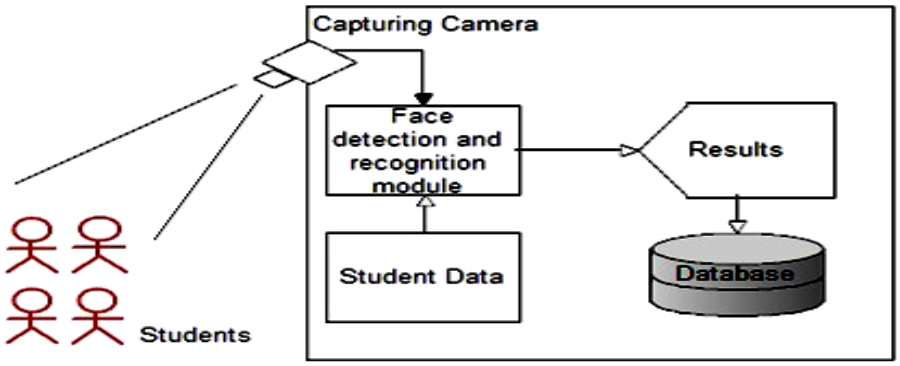

Fig.3.1 Block diagram

The system working is explained in brief below:

1. Capture Image: Camera is installed in a classroom to capture the face of the student. The camera has to be places such that it captures the face of all the students effectively. This camera has to be interfaced to computer system for further processing either through a wired or a wireless network. In our prototype we use the in-built camera of the laptop.

2. Image Processing: Facial recognition algorithm is applied on the captured image. The image is cropped and stored for processing. The module recognizes the images of the students face which have been registered manually with their names and ID codes in the database. We use MATLAB for all the image processing and acquisition operations. The whole process requires the following steps:

- **Train Database:** Initially we take facial image of the enrolled students. In our system we have taken three images each. This data is used later used in the facial recognition algorithm. It is done using Image Acquisition Toolbox of the MATLAB. All the cropped image of the face is resized to a 240 X 300 image.

- **Face Detection and cropping:** The captured image of the classroom is initially scanned to detect faces. This is done using Computer Vision Toolbox by the function vision. Cascade Object Detector (COD). This function work on the basis of Viola-Jones algorithm. This algorithm focuses more on speed and reliability. The detected faces are cropped and resized to a 240 X 300 image, same as the train database.

- **Face Recognition:** For recognition, the feature locations are refined and the face is normalized with eyes and month in fixed locations. Images from the face tracker are used to train a frontal Eigen space, and the leading three eigenvectors are retained. Since the face images have been warped into frontal views a single Eigen space is enough. Face recognition is then performed using the Eigen face approach with additional temporal information added. The projection coefficients of all images of each person are modeled as a Gaussian distribution and the face is classified based on the probability of match.

- **Attendance Recording:** We use Excel spreadsheet to store the recorded attendance for easy-to-use output format, which is also the software which is familiar to majority of the institution staffs. This is done using Spreadsheet Link EX toolbox. If a student is recognized, the corresponding cell is updated with '1', else a '0'. Using the formatting in the Excel, we can effectively retrieve the information effectively.

Here, system marks attendance automatically by using image processing technique. An efficient face recognition PCA algorithm has developed which can recognize students efficiently. Also for image processing MATLAB platform to test our algorithm. MATLAB gives the best set of libraries for image processing programs..

IV. IMPLEMENTATION

The first step in implementing the system is to create a database of enrolled students' database. In actual implementation this step must be a part of the admission process where we collect the necessary information of the students. This set of images is referred to as train database for the algorithm. The facial recognition algorithm (here we use Eigen faces method), then uses the database to calculate the eigenfaces for face recognition. Fig 4.1 and Fig 4.2 gives the flow of operation and function 'training.m' does the function as indicated in the flowchart in addition to that it functions as follows

- Capture the image of the student
- Using the function 'vision Cascade Object detector' of the Computer vision toolbox, detect the face from the image. This function works on the basis of Viola-Jones algorithm.
- The detected faces are cropped and saved in the database.

'training.m' function has to be in the folder where the main code is saved. Also the train database is saved in the folder 'TrainDatabase' which is also stored in the same folder for best results. After this step the system is ready for recording the attendance of the registered students.

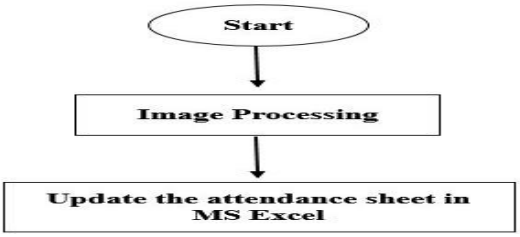

Fig.4.1 system flow chart

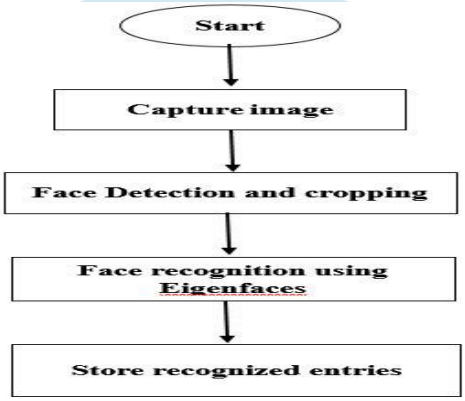

Fig.4.2 Image processing flow

The program modules or functions for each of the blocks in the standard MATLAB file, i.e., in '.m' format. This helps us in defining the different aspects of the program, easier debugging and in the later phase the creation of Graphical User Interface (GUI) also. The following are the modules we have created and its description.

a. **Training.m –** Capture a predefined number of images of the candidate (in our case it's three), crop the face and store the image in the TrainDatabase folder automatically.

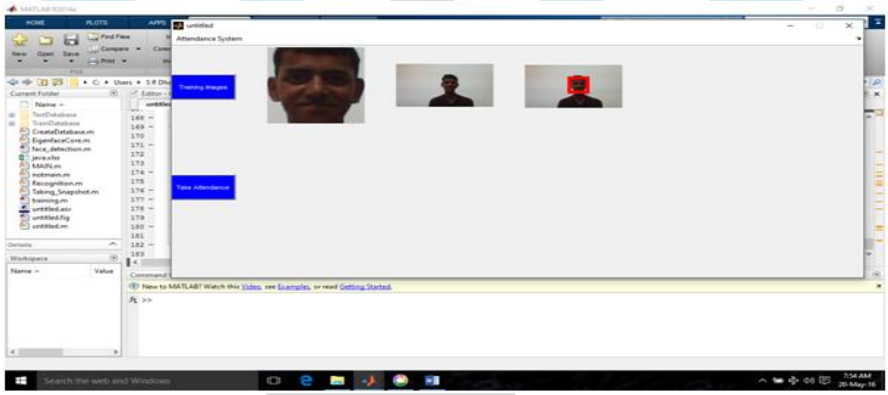

Fig.4.3 capturing training images using the GUI

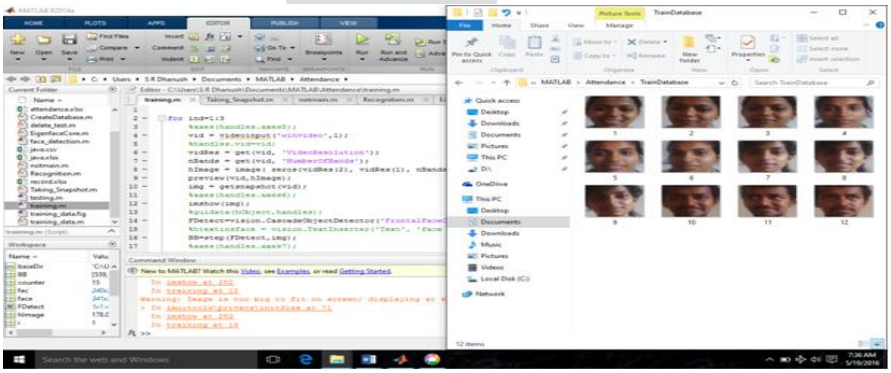

Fig.4.4 set of training images

b. **Face_detection.m –** After the camera captures the students' image in the classroom, this function detects the faces of the student, crops them and uses these variables as the input argument for the function which does the face recognition part. Initially this module also serves as the main program in our code.

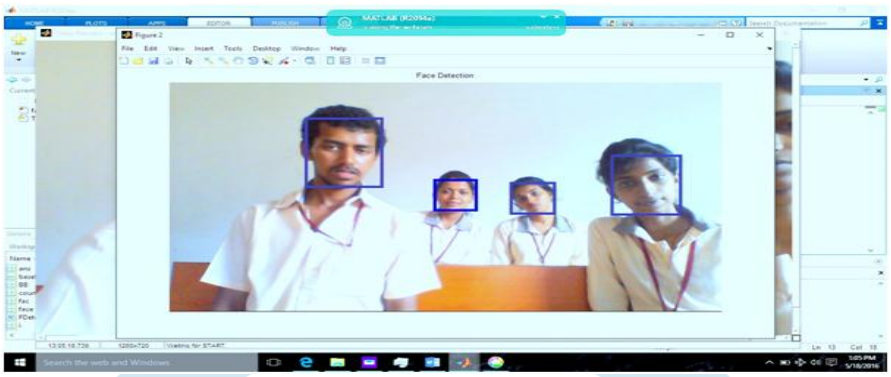

Fig.4.5 capturing of the classroom image and face detection

c. **Taking_Snapshot.m –** The laptop camera is initialized and starts capturing the video. Then it takes a snapshot of the video and returns it to the called function.

d. **CreateDatabase.m** – The eigenface algorithm requires that we create one-dimensional array from the database of images. This function does this task.

e. **Eigenface.**m – Eigen face algorithm requires various characteristics of the face images in order for efficient recognition which are the mean, average and the eigenfaces. This function performs all these functions.

f. **Recognition.m –** The detected faces are compared with the parameters from the training database and give the name of the image, which is a number to which it matches satisfactorily.

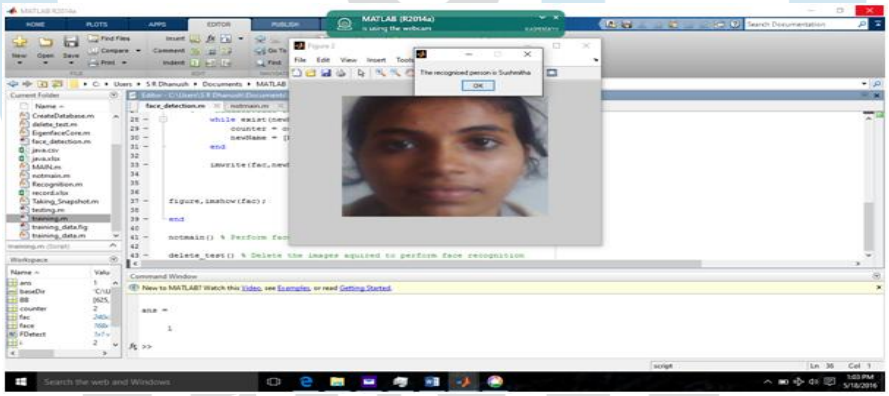

Fig.4.6 student recognized and appropriate message displayed

g. Record_attendance.m – Based on the number obtained from the recognition module, we determine to which student the image belongs using a switch case and update the field in the excel sheet.

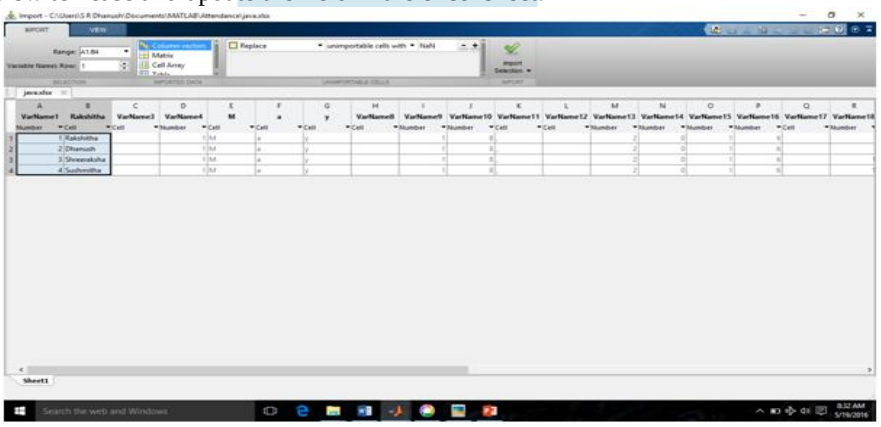

Fig.4.7 Output obtained in the excel format (.xlsx)

h. **Delete_test.m –** Finally the images captures during the process has to be deleted to avoid unnecessary wastage of the memory. This function does the same.

V. CONCLUSIONS

An attendance system for a lecture, section or laboratory by which lecturer or teaching assistant can record student's attendance. It saves time and effort, especially if it is a lecture with huge number of students. Automated Attendance System has been envisioned for the purpose of reducing the drawbacks in the traditional (manual) system. This attendance system demonstrates the use of image processing techniques in classroom. This system can not only merely help in the attendance system, but also improve the reputation of an institution.

VI. ACKNOWLEDGMENT

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