# Face Recognition Based Attendance Management System Using Raspberry Pi

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*Abstract*—The current attendance mechanism is thought of as manual. Both teachers and students must put in a significant amount of time. Even with manual attendance, there is still a chance that there will be proxies in the class. The work's key contribution is the creation of an attendance control system that employs student faces as feed input. We have decided to use the Raspberry Pi and a webcam to make it accessible on all platforms. Connected to the Raspberry Pi module is a webcam. The web cam is used to capture student face photographs. The Qt creator IDE implements many face extraction methods utilizing the OpenCV platform. Face recognition technology is used to take attendance in this project, allowing us to identify each student's face

**Keywords-- Attendance management system, Face Recognition, Raspberry Pi.**

## I. INTRODUCTION

Among the readily available biometric styles Face recognition is a popular study area with a variety of artificial operations, including security and examination, entertainment and effective reality, and mortal- machine relations. As attendance points are added at the conclusion of the semester, maintaining attendance records in institutions is pivotal to maintaining the quality of education. preceptors generally manually mark scholars' attendance, and they must insure that the correct attendance is marked for each pupil. Due to the inviting number of scholars involved, reproduction and deputy cases aren't caught during this lengthy process. Every institute has a unique system for recording attendance. Some people mark attendance using RFID. other biometric styles, including iris, retina, and thumb. Face recognition on the other hand advantage over these above- mentioned ways as it's nonintrusive, contact-free and has natural accession. numerous ideas have been proposed by experimenters for biometric attendance system. Godswill .it aimed at developing a less protrusive, cost-effective and more effective automated pupil attendance operation system using face recognition that leverages on pall computing( CC) structure called FACECUBE. FACECUBE takes attendance by using IP camera. It recognize the image and evaluates it against the database's registered faces. The attendance record is marked as present when a registered face is found in the acquired image collections, otherwise absent.

It has been suggested to use a Raspberry Pi 2 to run a face recognition-based attendance management system using the Eigenfaces algorithm. In the project, a camera is positioned at the classroom door and connected to a Raspberry Pi 2 module to record pupils entering the classroom. The Raspberry Pi 2 houses the pictures. To operate at a high speed, the Raspberry Pi
2 module is used. Additionally, a CCTV camera system that is mounted at the entrance to a classroom has been proposed [6]. The camera automatically records a person's image as they enter the classroom and uses an Android-enhanced smartphone to match the image with the face database. The robust face recognition capabilities of the Android smartphone were utilized [6]. The automated attendance system has been studied extensively [7, 8]. However, relatively few have been put into practice using a method that is less obtrusive, like face recognition. The essay is organized as follows for the remaining portions. Section II explains the hardware component description needed to carry out the project. Section III contains a description of the software needed to carry out the project. Section IV presents the project description and outcomes, while Section V wraps up the study.

## II. HARDWARE DESCRIPTION

The main objective of this work is to develop an attendance management system that uses the face of students as the feed input. For facial recognition, we have chosen the Raspberry Pi 2 model B in order to make it available across all platforms [5]. A webcam is linked to the Raspberry Pi module. Face detection separates faces from non-faces and those countenances that can be suspected. This module can be utilized for different applications where face acknowledgment can be utilized for confirmation. In this proposed system we take attendance using face recognition which recognizes the face of each student in front of it while entering the class or nearby the webcam. The major hardware components used in the development of this work are the Raspberry Pi 3 and, web camera.

*A. Raspberry Pi 3B+ Board:*

Raspberry Pi [12] can be called a mini-computer which is of the same size as that of a credit card. We will create and develop useful IoT devices using the tiny and reasonably priced Raspberry Pi while learning about programming languages and computer hardware architectures. On top of that, you'll discover how to set up the Raspberry Pi, install the Linux operating system, and write and run some simple Python code on the device. Additionally, you will learn how to trace and debug Python code on the Raspberry Pi as well as how to use Python-based IDEs (integrated development environments).

The given Raspberry Pi specifications are:

- Model: 3B Plus
- CPU/Speed: ARM Cortext-A53/1.4 GHz
- RAM: 1GB
- Ethernet Speed: 300Mbps
- Power: 5V
- USB Ports: 4
- Integrated Wi-Fi: 2.4GHz

Figure 1. Raspberry Pi 3B+ Board

*B.USB Camera*

The camera plays a vital role in mechanization purposes. The camera is used in our work to monitor the room from a remote place and to capture video to detect faces. The camera used is a USB camera as shown in Figure 2. For interfacing the USB camera with Raspberry Pi

Figure 2. USB Camera

*B. Buzzer*

In this proposed system Buzzer gives alert to the students for detection of faces at particular time .It connected to the Raspberry Pi and set alerting time.

Figure 3. Buzzer

The buzzer is a sounding device that can convert audio signals into sound signals.

It is usually powered by DC voltage. It is widely used in alarms, computers, printers and other electronic products as sound device.

III. SOFTWARE DESCRIPTION

*A. Raspbian OS*

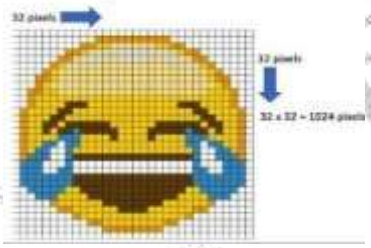
An open operating system based on Debian, Raspbian OS [12] is tailored for the Raspberry Pi device depicted in Figure 3. A functioning system is the group of fundamental applications and tools that enable your Raspberry Pi to function. Raspbian offers more than just an OS, though, as it includes over 35,000 packages that are pre-compiled pieces of software that are neatly packaged for quick installation on your Raspberry Pi. It offers pre- compiled software bundles, downloadable deb software, and some communication. SD cards must have a minimum size of 2 GB.

Figure 4. Raspbian OS

video.h264 -t 10000" at the rapid, where "video" is the name of your video and "10000" is the number of milliseconds.

*B. LBPH*

LBPH (Local Binary Pattern Histogram) is Face - Recognition algorithm which is used to recognize the face of person.



As you can see, this technique uses matrix formats, which are made up of rows and columns, to represent each and every image.

The pixel is an image's fundamental building block. Each of these tiny squares, or pixels, makes up an image. By aligning these pixels side by side, we can create the entire picture.

OpenCV [11] 'open-source computer vision library' is an open-source image processing library created by Intel and maintained by Willow Garage available for C, C++, and Python. OpenCV is needed a compiler like Dev C++, code blocks, and visual C++.This paper uses C++ language and a Dev C++ compiler. In OpenCV, there are four modules. The most often used components are high: GUI functions, image, and video I/O, key OpenCV functions, image processing algorithms, and vision algorithms. We will load camera-captured photos using OpenCV. These images are in three formats binary image, grayscale image, and colored image.

The Flow chart of the work is represented in Figure 5. The system tries to take attendance in real-time during this work. It takes a photograph of the class which includes all the students present in the class. Then face detection algorithm is applied to the photograph to detect the faces in the image. Images are subjected to face segmentation and then face recognition is done using the test image stored which tries to match with the student's database images if the match is found attendance is efficient to the attendance database and the report is generated for the attendance of that particular day. This way this paper proposes the scheme for an automated attendance scheme with the help of facial recognition [12] scheme. This is done with the help of an automated face recognition scheme for time application and attendance applications by means of the OpenCV [11] library. The system also uses the Viola-Jones [9] algorithm for face detection. The detected face is adjusted for the constructive size before being analyzed further. PCA is used for recognition while linear stretch development is used for processing [10]. Once the student has been recognized, the attendance is instantly sent to an Excel sheet where the student's name, information, and time are kept. For checking on the status of the same, a web application is utilized, which displays the attendance record for the class on a specific date. One benefit of utilizing OpenCV [11] over MATLAB is that it is open-source.

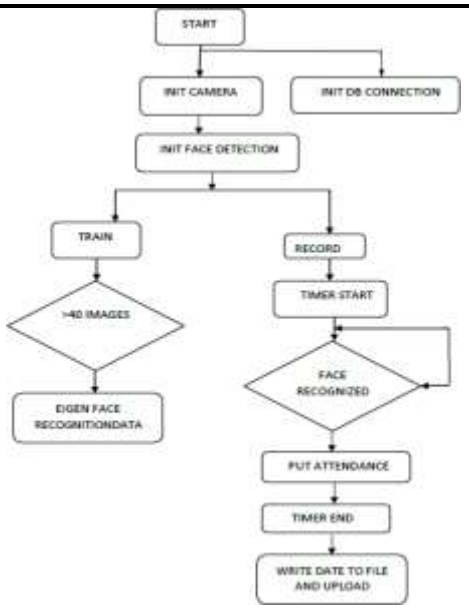



Figure 5. Flow chart for the System

## IV. EXPERIMENTAL IMPLEMENTATION

An attendance management system is developed using the Raspberry Pi and a webcam using OpenCV for the formation of student database. The system implements the following steps.

a) Video from a classroom is recorded using a web camera and stored on a Raspberry Pi so that the region of interest includes all of the students' faces. The webcam is linked to broadcast the video via a wireless connection using Wi-Fi.

b) Face Detection: The faces will be detected by the Viola- Jones [9] Algorithm implemented in Python.

c) Preprocessing of face images: The features will be extracted from the cropped detected faces after pre-processing of images. The pre-processing step will include the contrast step up, environment removal, and converting the grey-scale image into a black-and-white image with the removal of small objects from binary images.

d) Features Extraction: The features will be extracted from the processed image using PCA in terms of eigenvectors and stored in a database for face recognition.

e) Face Recognition: The features extracted from the face images will be compared with the stored features in the database with the help of SVM. If the method recognizes the features, the corresponding name with date and time will be stored in the database of students. The results of the above steps are presented as follows.Firstly, assign the Enroll Id No (for example 1) for a face and take 40 pictures for better accuracy as shown in Figure

Figure 6. Assigning ID No

We have taken two faces and for this face, we haveassign id as 1 and 2 as shown in Figure 7.

Figure 7. Adding frames to Raspberry Pi

After adding 40 pictures an icon will appear (training images are enough) as shown in Figure 8.

Figure 8. Training image

Now press the train mode icon, the Raspberry Pi will collect all the data of the faces. Wait for a while and press the Rec mode, Now the Raspberry Pi will compareand detect the face.

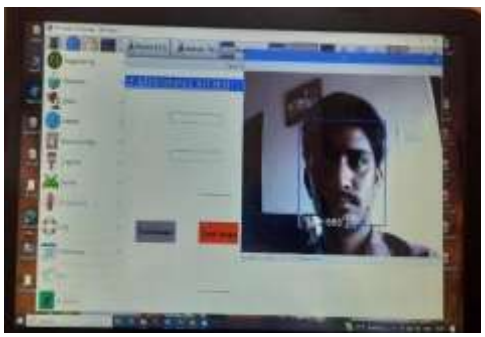


Figure 9. Recognizing

ion of Face

As soon as we click on the Recognize button it will analyze all the data which we have given and it will compare the pictures and detect it as shown in Figure 9, and Figure 10.

Figure 10. Recognition of face

Figure 11 shows the 40 images which are stored in the Raspberry Pi which is compared and detected.

## V. CONCLUSION

Despite the low precision of face recognition as compared to other biometric procedures our automatic attendance markingsystem is implementation with accuracy of 92% as out of 12 faces, 11 faces are recognized effectively and prevent time usage when attendance is performed physically. The system is user- friendly, easy to use and consistent which provides more security, privacy, and well-organized data onboard. The system also supports multi-model biometric scheme. The scope of improvement is always thereby improving the quality of the image and increasing the processor speed for real-time implementation. This system can be utilized for different applications where face recognition can be utilized for confirmation.

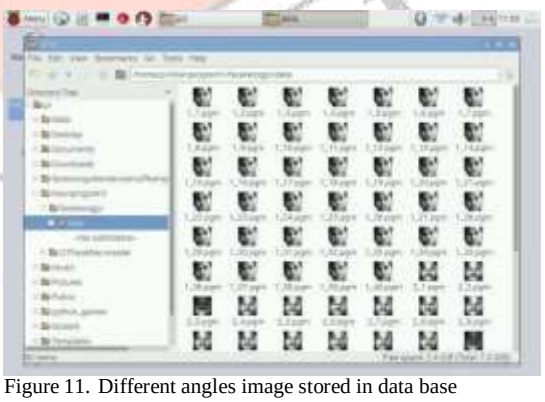


Figure 11. Different angles image stored in data base

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