

# Face Recognition and Fingerprint based Attendance Monitoring System

Prof. Mohini Mohan Sawarkar<sup>1</sup>, Mr. Atif Imran Penkar<sup>1</sup>, Mr. Prithviraj Raju Mudaliar<sup>1</sup>,

Ms. Rituja Arun Raut<sup>1</sup>, Mr. Yash Rajendra Vispute<sup>1</sup>

<sup>1</sup>Department of Instrumentation, Bharati Vidyapeeth College of Engineering, Belpada, Navi Mumbai

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**Abstract** – This project aims to record the attendance without manual intervention. In the era of technology that changes and modifies daily, use biometrics is the most popular and trending technology. It has many applications from secure accessibility to taking attendance. In this project, fingerprint and face recognition is used together to mark the attendance of students. This is implemented using Arduino UNO and Raspberry Pi as the controllers. A fingerprint sensor is connected with Arduino and camera module with Raspberry Pi. First, finger is scanned and then the face is recognized with the help of the database. Final attendance is accessed via the internet by the authorized personnel.

**Key Words:** Fingerprint, Face recognition, Arduino UNO, Raspberry Pi, Database

## 1. INTRODUCTION

Taking attendance manually for a class of almost 60-80 students can be a time-consuming task if thought of it in a long run. To save the hassle and time, biometric systems are used extensively nowadays. Each person has a unique biometric feature such as fingerprint, face structure, iris, voice, etc. These unique features can be used to record & monitor attendance accurately and thereby decreasing chances of malpractices.

With the help of machine learning, this can be implemented.

## 2. WORKING

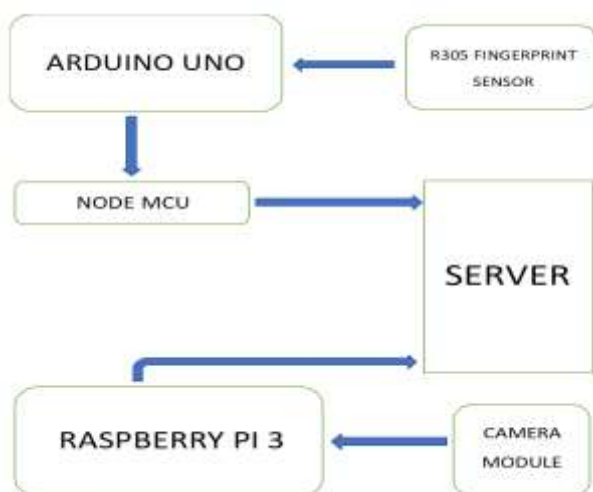


Fig -1: Block Diagram

Fig. 1 shows the basic working of the attendance monitoring system. The aim is to combine the concepts of biometrics & machine learning to record attendance. This is done by using Arduino UNO & Raspberry Pi 3. The fingerprint sensor is interfaced with Arduino UNO and the camera module is interfaced with Raspberry Pi 3. The data obtained from both the controllers is sent to php database on private web hosting. The initial step is to feed the data to the controllers. While recording the attendance both fingerprint and face data of a person should match for the attendance to be marked. The database can only be accessed by authorized personnel.

### 2.1 Fingerprint

There are 2 steps for the working of this part. Firstly, a new fingerprint is enrolled in the database along with the ID number of the person. Secondly, to record the temporary entry, when a finger is sensed by the sensor, it compares the identified fingerprint with the fingerprints already stored in the database. This temporary data is sent to phpMyAdmin. The identification is done by using the "1: N" principle.

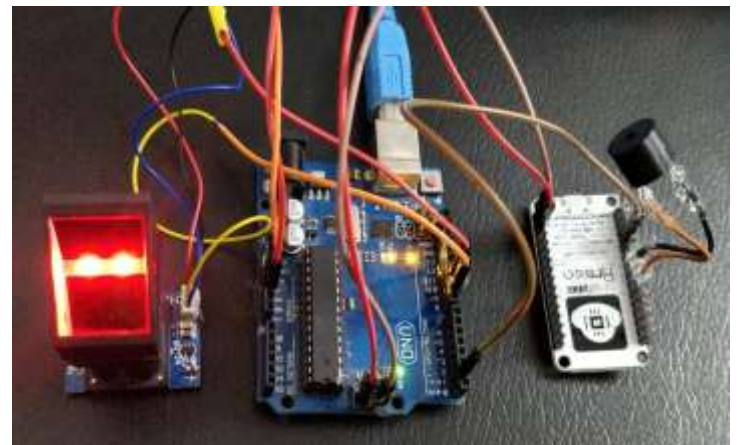


Fig -2: Arduino UNO for Fingerprint scanning, a buzzer for audio indication

The fingerprint sensor used here is R305. It is an optical sensor. When the finger is placed on the sensor, a light source (such as LED) is used to identify the dark parts (the ridge of your fingerprint pattern) and light part (valley created due to two ridges of fingerprint). This creates an image that is sent for processing and then stored in the database for identification for future use. When the finger is scanned, an indication is given by 3 buzzes via a buzzer. The data is processed using the Arduino UNO controller-enrollment and identification. Arduino is an open-source

controller that allows interfacing of fingerprint sensor. The data from the Arduino UNO is sent to the server (discussed further) via NodeMCU.

NodeMCU is an open-source IoT platform, it facilitates in transferring the fingerprint data to the server where a temporary entry along with the ID number is created.

### 2.2 Face Recognition

After the fingerprint data has been sent to the server, face recognition is the next step to mark the final attendance. With the help of a USB camera module, faces are recognized. It is to be noted that face detection and face recognition are two different things. Face detection is the identification of faces in an image. Whereas in face recognition, already stored facial images that are usually converted into grayscale are responsible for finding characteristics that best describes the image.



Fig -3 :An example of the stored image in a database

There are 3 algorithms for face recognition in Raspberry PI

- a) EigenFaces
- b) FisherFaces
- c) Local Binary Patterns Histograms (LBPH)

The drawback of EigenFaces and FisherFaces is that these are affected by the lighting conditions. As proper lighting conditions cannot be guaranteed every time, the most efficient method amongst the three is the LBPH method.

In the LBPH method, a 3x3 window is taken which is moved across the image. The pixel in the center is compared with the surrounding pixels. If the intensity value of the surrounding pixels is less than the pixel at the center, it is denoted with 0, else 1. Now a binary pattern is created when the 1s and 0s are read clockwise in the 3x3 window. This binary pattern is limited to that particular local area. In this way, we get a list of binary patterns for that particular image. This is converted into decimal to form a histogram for that particular image. After the face has been recognized, the attendance of that particular person is marked. This attendance can be accessed via a web host.

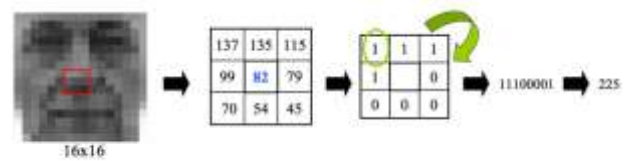


Fig-4: LBP conversion to binary.

After the face has been recognized, the attendance is marked of that particular person. This attendance can be accessed via a web host.



Fig-5 :Raspberry Pi 3 as the main controller and USB camera for face detection and face recognition.

### 3. SERVER

The fingerprint data along with ID number is sent to the server via NodeMCU. The database is created on a private web hosting, the one used here is 000webhost. This web hosting platform is based on phpMyAdmin, which allows creating databases. Initially, a temporary entry is created in the "approval" database in the server as shown in Fig-5.



Fig-6 :Temporary entry of user attendance with an ID number in "status" cloumn

The attendance is not marked at this stage, the server waits for data from Raspberry Pi to confirm whether the fingerprint data matches with the data received from the Raspberry Pi. Fig-6 shows the attendance record of the users, if both the ID number of fingerprint and face match, the attendance of the user is marked.



**Fig-7** :Attendance of users marked along with timestamp

An important thing to be noted is that when the data is entered in the fingerprint and face recognition systems, only the ID number is stored, other details such as name, roll number, phone number, and admission number are to be manually entered by clicking on the “Add Student” button. This WebHost is password protected and therefore allows only authorized personnel to access it and make changes.

#### 4. CONCLUSION

The proposed paper suggests a system for monitoring attendance without human intervention hence avoiding mistakes and malpractices. It is mainly based on machine learning and biometrics implemented using Raspberry Pi and Arduino UNO. It also makes use of a fingerprint sensor. The attendance data remains secure on the webhost and the records can be stored for a prolonged period time. Traditionally, taking attendance is a pen-paper task. By the use of this system, it eliminates the use of paper making it environmentally responsible.

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