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## Smart-Log: An Iot-Driven Facial Recognition System For Contactless

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### ABSTRACT

The construction of a face recognition-based attendance monitoring system for a school or any organization is the primary goal of this project. This will make the Organization's or school's current attendance system more effective and efficient. Attendance tracking is inaccurate and inefficient due to the ambiguity of the current, out-of-date system. The conventional method of calling name of each student is time consuming and there is always a chance of proxy attendance. Numerous issues arise when the authority is unable to enforce the rules of the previous system. As a result, technology will be used in this project to improve the current system and automate most attendance-related tasks. The primary objective of this project is to construct a face recognition-based attendance monitoring system for a school or any place to improve and upgrade the existing attendance system, making it more effective and efficient than before. The current outdated system has a lot of ambiguity, which makes attendance taking inaccurate and inefficient. When the authority is unable to enforce the old system's regulations, many issues arise. As a result, this project will use technology to fix the problems with the current system and automate most of the tasks associated with attendance. The face recognition system will be the backbone of the technology. One of a person's natural characteristics that can uniquely identify them is their face. Due to the low likelihood of a face deviating or being duplicated, it is used to trace identity. Face



databases will be created for the purpose of feeding data into the recognizer algorithm in this project. After that, during the session for taking attendance, faces will be compared to the database to determine identity. When a person is identified, their attendance will be automatically recorded, storing the necessary data in a database system. Based on trained images, the LBPH face recognizer algorithm is used to recognize faces.

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## **Introduction**

The following system is based on face recognition to maintain the attendance record of students. The proposed IoT based face recognition system architecture uses Raspberry Pi as a IoT device that is considered as a processing unit and the same can be sent to the server for future usage[12]. Raspberry Pi is enabled with a camera to capture the face images[5]. On activation, the captured image is processed based the algorithm using built-in OpenCV library written by us for the purpose of attendance management[20]. Initially, the face of a student to be collected and stored in the database by the administrator, Secondly, after creating the collective facial database, it can be used for taking decisions or marking attendance of the entered user based on the comparison and analysis of the facial images[17].

The most pressing issue with the prior attendance management system was the data's accuracy. This is because a person's attendance may not have been personally recorded by the person who took it, or, to put it another way, it may have been taken by a third party without the institution's knowledge, which would compromise the accuracy of the data[19]. For instance, because student A is too lazy to attend a particular class, student B assisted him or her in signing for attendance, despite the fact that student A did not attend the class. However, the system ignored this issue because there was no enforcement in place. If the institution decides to implement enforcement, it might have to waste a lot of time and human resources, which would be counterproductive[8]. As a result, the previous system's entire attendance record is unreliable for analysis[13].

## **Problem Statement**

Assuming that it takes a student approximately one minute to sign his or her attendance on a three-to-four-page name list. Clearly inefficient and time-consuming, only 60 students can sign their attendance in one hour. The third issue concerns the legitimate party's ability to access those details[10]. For instance,



the majority of parents are extremely concerned about keeping track of their children's actual whereabouts to ensure that they actually attend school or college classes[18]. However, the parents cannot access such information in the previous system[14]. As a result, changes need to be made to the previous system in order to make it more effective, ensure the accuracy of the data, and make the information accessible to those who are legitimate[11].

## **PROJECT SCOPE AND DIRECTION**

Students and faculty of an educational establishment are the focus of the attendance monitoring system[14]. The attendance management system's database can hold up to 2000 individual records[10]. The facial recognition procedure can only be performed on a single individual at a time. After the login process, admins and non-admins will have access to two distinct webpage interfaces. Because the attendance system's database needs to be continuously updated, the project must be carried out in an area with Wi-Fi coverage[11]. In order to make the smart device more portable, a power bank powers it[15].

## **IMPACT, SIGNIFICANCE AND CONTRIBUTIONS**

Today's attendance management systems are often inefficient and do not share information. As a result, these limitations will be overcome and further improved in this project[1]. The following are the project's effects and contributions are Students will be more likely to show up to classes on time[2]. This is because a student's attendance can only be taken personally, and the system will notice any absentees. This can not only teach the student to be on time but also prevent them from violating morality by signing their friends' attendance sheets[3].

The institution can save a lot of money because enforcement is now handled by technology rather than through human supervision, which would waste a lot of people's time on a small task[4]. The attendance system is portable, allowing it to be placed in any intended location as long as there is Wi-Fi coverage[5]. The smart device can operate in any location as long as there is Wi-Fi coverage[3]. To take attendance, for instance, the device can be positioned at the classroom's entrance[7].

- ✓ It saves a lot of money because there is no longer any need for paperwork.
- ✓ Because every calculation is done automatically, the system also saves time.
- ✓ In a nutshell, the objective of the project is to address the shortcomings of the previous attendance system.



## **RELATED WORKS**

### *A. SETTING UP THE PI CAMERA MODULE*

The next step is to enable the camera module after installing it on the raspberry pi board. The raspberry pi's firmware is being updated first before that can be done. The camera module is then enabled by accessing the terminal's configuration menu[8]. The raspberry pi is then restarted. Installing a pi camera module with NumPy array support allows Python to interact with the Pi camera[9]. This is because OpenCV uses NumPy arrays to store images[10].

### *B. CONNECTING TO RASPBERRY PI REMOTELY*

Initial setup is required for future convenience before the raspberry pi can be accessed from a remote device via Wi-Fi connection. As a result, the Wi-Fi is activated to connect to a mobile phone hotspot when the desktop first appears following the initialization procedure described in the preceding section[9]. The raspberry pi will be able to remember the password entered for that particular Wi-Fi as a result of this, allowing it to connect to the wifi upon startup in the future[11]. The laptop is then set up with remote access software like VNC Viewer. Once the raspberry pi is connected to the laptop's remote viewer software (VNC Viewer), it must be in the same network as the laptop. After that, the connection can be made by entering the raspberry pi's IP address into VNC Viewer[10].

### *C. INSTALLING OPENCV INTO THE RASPBERRY PI*

In this project, facial recognition is performed with OpenCV, and the entire program will be written in Python. OpenCV's installation by itself is insufficient; consequently, Python bindings are installed to connect OpenCV to C++. To summarize, the binding is necessary for Python to call a C++ function[11].

## **Proposed system**

Students of the class must record themselves by entering the required details and then their images will be captured and stored in the dataset[15]. During each class session, hour based faces will be detected from live streaming video in the classroom [6]. The system proposed in our paper of Attendance System using Face recognition performs recording and analyzing of attendance in a class of students very efficiently with high rigidity and reliability, using multiple algorithms in an orderly fashion and stores the data of attendance of students present and absent in a class in a database[20]. Student faces are detected will be compared with images present in the dataset. If photos are match found, attendance



will be marked for the own student. At the end of each session, list of absentees will be mailed to the respective faculty handling by the session [14].

Typically this process can be divided into four stages,

### DATASET CREATION

A webcam is used to take pictures of the students. A single pupil will be captured in a variety of motions and positions.

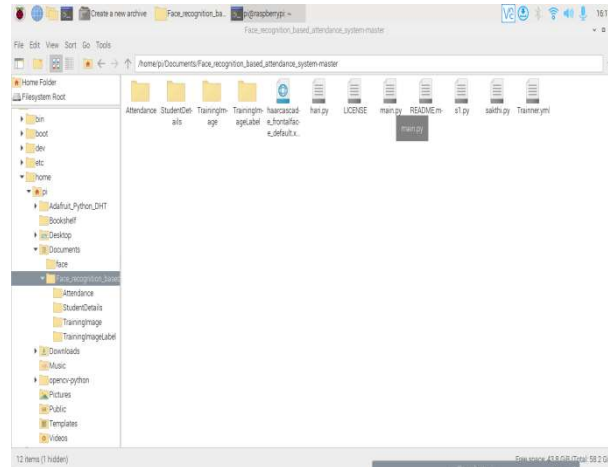


Fig.1. Face Recognition Folder Creation

These pictures are pre-processed. To acquire the Region of Interest (ROI), which will be used in the recognition procedure, the photos are cropped [11].

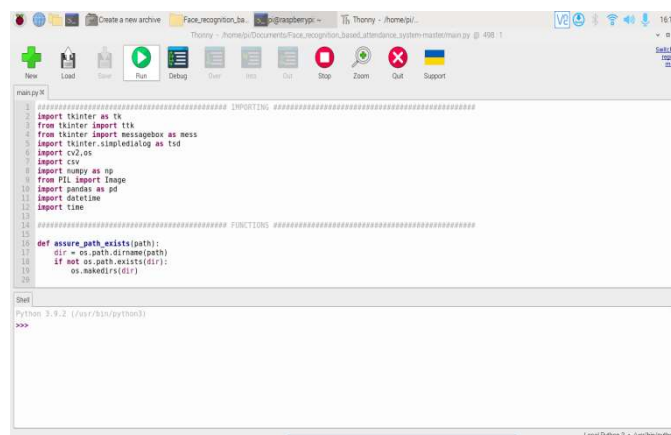


Fig.2. Raspberry pi –Source code implemented in python



The clipped photos must then be resized to a specific pixel position. Then, the RGB versions of these photographs will be transformed to grayscale versions[13]. And after that, these pictures will be saved in a folder with the names of the respective students[17].

### B. FACE DETECTION

Here, face detection is done with OpenCV and the Haar-Cascade Classifier. Before it can be utilised for face identification, the Haar Cascade algorithm must be trained to recognise human faces[16].

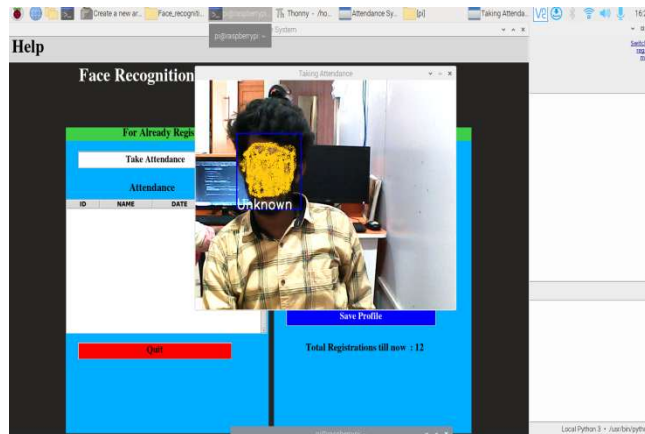


Fig.3. Face Detection

The term for this is feature extraction. The xml file `haarcascade_frontalface_default` contains the training data for the haar cascade. For feature extraction, the haar features depicted will be used[17].

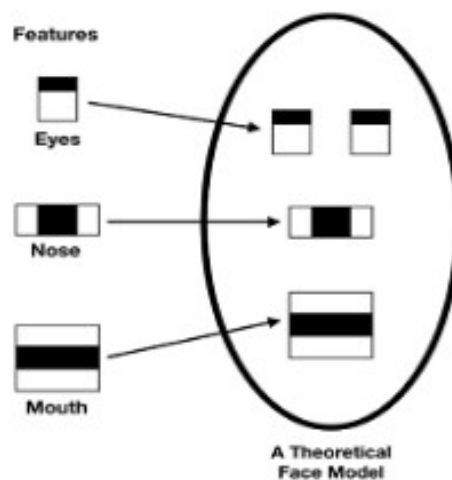


Fig.4. HAAR FEATURES



Here, we are utilising the OpenCV detectMultiScale module[18]. To draw a rectangle around the faces in an image, this is necessary. There are three variables to take into account: scaleFactor, minNeighbors, and minSize. When determining how much a picture has to be scaled down, scaleFactor is used[19]. The number of neighbours that each candidate rectangle must have is specified by minNeighbors. Greater values typically detect fewer faces but better quality images. The minimal object size is specified by minSize. It is (30, 30) [20] by default. ScaleFactor and minNeighbors, with respective values of 1.3 and 5, are the parameters employed in this system[14].

### C. FACE RECOGNITION

Prepare training data, train face recognizers, and make predictions are the three processes in the face recognition process. The photographs in the dataset will serve as the training data in this case[12]. They will be given an integer label designating which student they belong to. Face recognition software is then used to these photographs. This system uses the Local Binary Pattern Histogram as a face recognizer. First, the full face's list of local binary patterns (LBP) is compiled. Following the decimalization of these LBPs, histograms of all the decimal values are created. One histogram will eventually be created for each image in the training data. The histogram of the face to be recognised is later calculated during the recognition process, and the previously computed[17] histograms and returns the label that most closely matches the student to whom it belongs [9].

### D. ATTENDANCE UPDATION

Following facial recognition, the identified faces will be listed as present in the excel sheet, while the remaining faces will be marked as missing. The list of absentees will then be mailed to the appropriate faculties [19]. At the conclusion of each month, faculties will receive an updated monthly attendance sheet[12].

## SYSTEM ARCHITECTURE

In this project, the figure explain the system architecture and what are all the processing involve in the project[19].

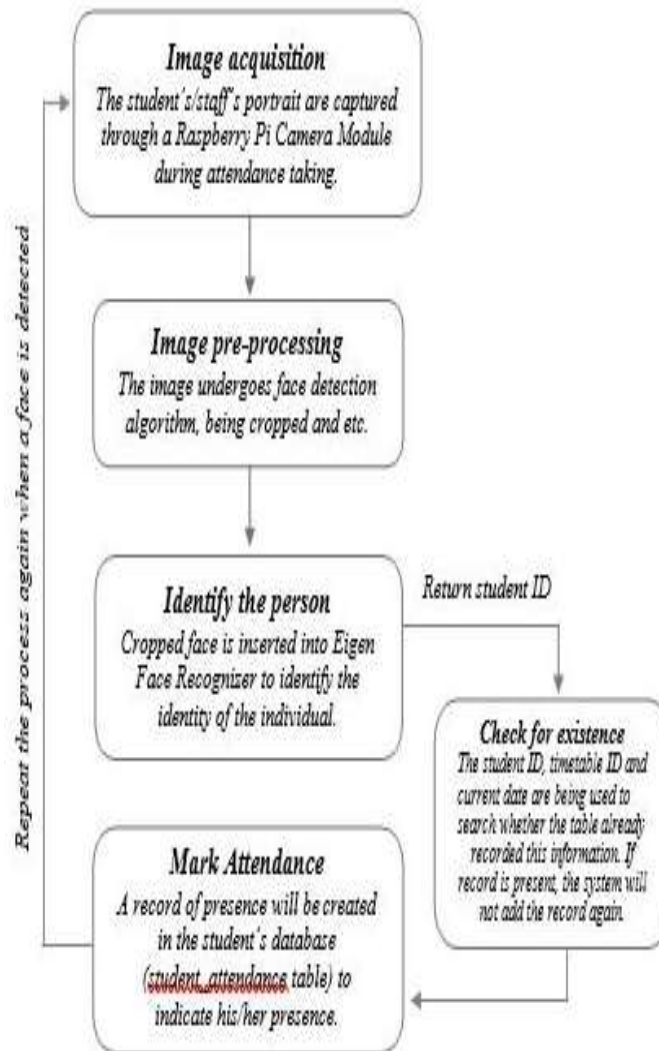


Fig.5. System Architecture

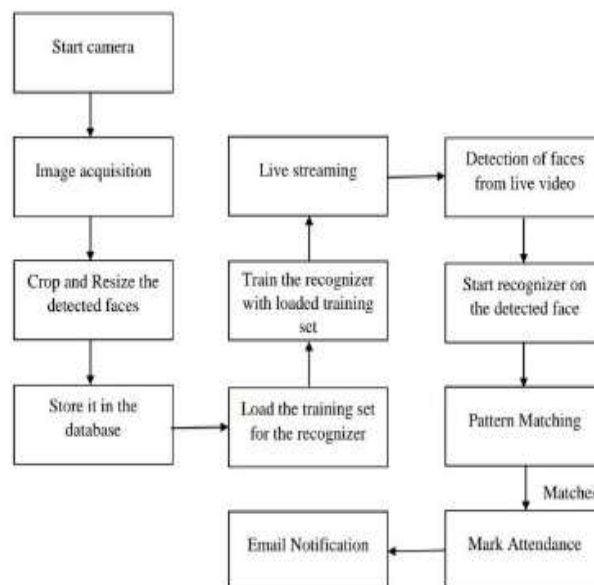


Fig.6. System Working Architecture

**Methodology**

After all of the configurations have been completed, the website can now be used. Users like the lecturer can start recording attendance by simply going to the Attendance Management System website's "Record Attendance" tab[12]. Fig.6. Raspberry pi –Source code implemented in python.

However, the user must be granted access to this tab by logging into the system with the "contributor" role.

The user will be prompted to select the current timetable ID from a table and the date to begin the attendance process after logging into the appropriate tab[14]. A PHP file called student\_attendance.php will be called when the user clicks the "submit" button. From that file, a Python script called record\_attendance.py will be run[17]. When the Python script is called from this student\_attendance.php file, two variables the timetable ID and the current date will be passed to it from the html via the POST method[18].

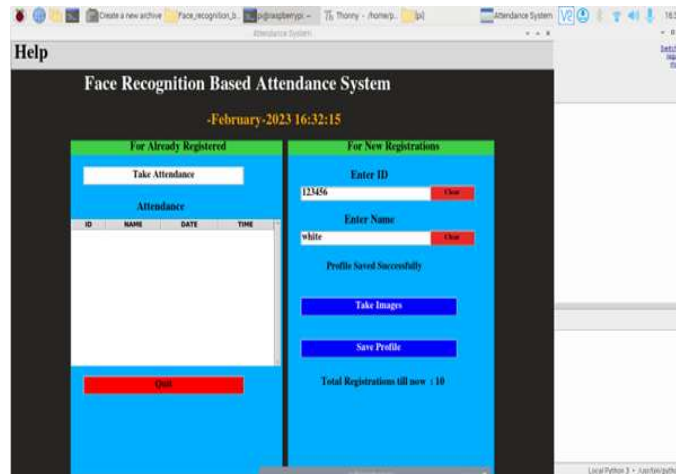


Fig.7. Input Screen

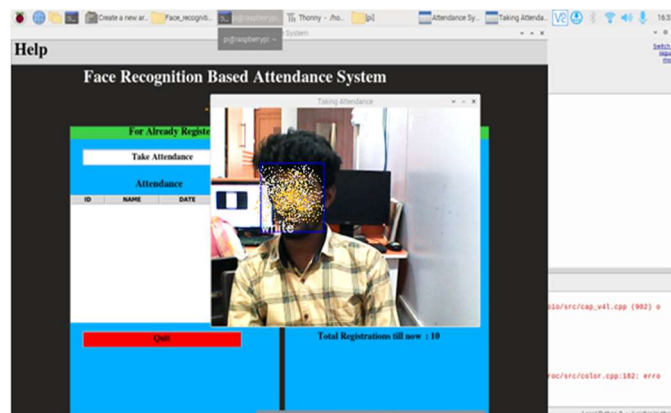


Fig.8. Face Recognition Screen

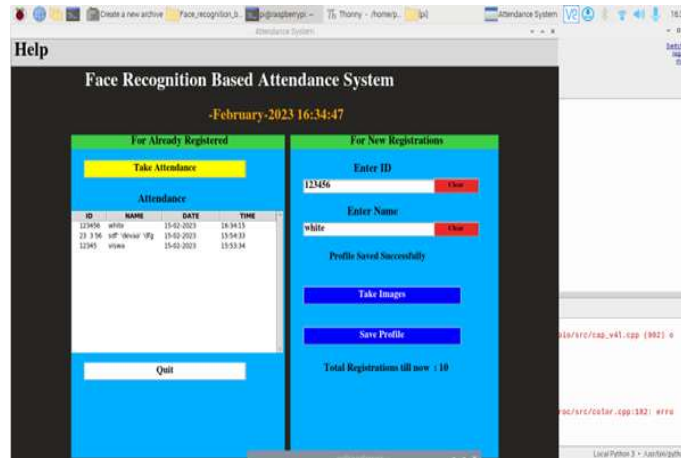


Fig.9. Face Recognition Output Screen

**Results and discussions**

Using a GUI, users can communicate with the system[12]. Users will primarily be given three options here, including student registration, teacher registration, and attendance marking. The student registration form must be filled out completely by the pupils. The webcam automatically starts up after pressing the register button, and the interface depicted in Fig. appears and begins identifying the faces in the frame. When 60 samples have been collected or CTRL+Q is pushed, it then automatically begins taking pictures[13]. The training pictures folder will then receive the pre-processed photographs.

Fig.10. Data Set Maintenance

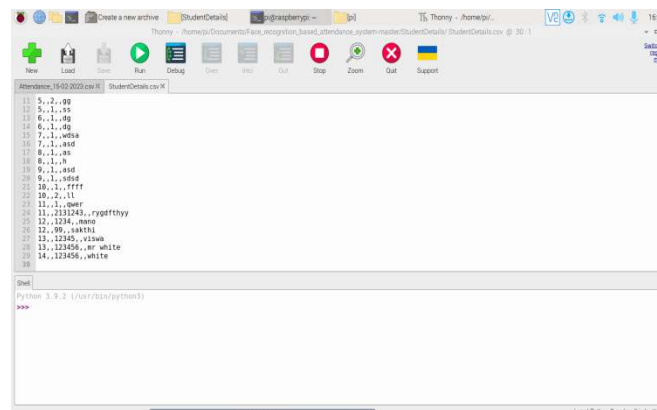


Fig.11. Student Details. CSV-Format file





(less human mistake). Because of the Raspberry Pi3 and Pi camera, the system is comparatively inexpensive. In order to create a secure system, the system uses the Linear Binary Pattern Histogram (LBPH) and Linear Discrimination Analyzer (LDA) jointly. This boosts the system's effectiveness and dependability for recognising the faces of the pupils.

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