ABSTRACT

Over decades the attendance of students has been taken using methods involving paper. The limitations of this method are widely known and clearly understood, it is time-consuming, prone to errors and there is always a chance of proxy attendance. Many techniques that are implemented in today's time are vastly unreliable and are majorly inefficient, like biometrics and Radio Frequency Identification (RFID), more importantly when there is a pandemic that majorly spreads via touch. This clearly presents an opportunity in the field of facial feature detection and face recognition. We propose an effective and modish solution to mark attendance using the face recognition technique including **Haar Cascade** and **Local Binary Pattern Histogram algorithms.** The system will recognize the face of an individual or and compare them with the predefined face encoding to make a Excel file of attendees with their details. The system is using the face recognition to Record attendance with body temperature. This system can also be used to tackle the problem of fake attendance and proxies and a user interface is developed to maintain the system.

CONTENT

Chapter 1

INTRODUCTION

1.1 Background

Personal identification is considered an important aspect in recognizing the identity of a particular individual. A person's identity can be validated through the traditional or biometric methods. There are two types of traditional methods which are token-based and knowledge-based identifications. Examples of the token-based method include possession of a passport, driving license, and different types of cards such as identity (ID) card and credit card. Although it is convenient to carry these identity documents, these documents can be reproduced, stolen, or lost. On the other hand, the knowledge-based method is related to a password or personal identification number (PIN) created by each individual for authentication. Nonetheless, it tends to be forgotten easily, especially if the person has several passwords or PINs for different applications. Another alternative method is through biometric adoption, which considers the physical or behavioral characteristics distinctive to an individual. Physical characteristics refer to inherent features of the human body part. These include the face, fingerprints, and iris. On the contrary, behavioral characteristics deal with features observed from human action. Examples of human action are gait, voice, and signature .By using biometric methods, the problems faced in traditional methods as mentioned above can be solved.

The top three sectors which embrace biometric methods are financial services, technology, and government. This is followed by the workplace, recreation, and healthcare and with the least usage in the education domain.

Our project is focused on the workplace and education domains applied biometric technology for attendance recording and also recording an individual body temperature using the MLX90614 sensor. Management of employee attendance is a major facet of the proper functioning of enterprises. There are dominantly two different methods to attain this. One includes various manual operations, which is complicated and involves roll call and paperwork that consumes a lot of time and can even lead to a plethora of errors. It can also result in proxy attendances. Another technique utilizes particular amenities such as bar code scan, IC card scan, iris recognition, and facial recognition to record employee attendance data. A verification process by RFID alone can sometimes be misused. Therefore, this model which uses face recognition can eliminate limitations. Moreover, the biometric fingerprint attendance system invokes greater risk in spreading of contagious disease, hence justifying the usage of contactless attendance system.

II. EXISTING SYSTEM OF ATTENDANCE MANAGEMENT

At present, attendance management system requires maintaining a manual attendance register which requires a plethora of effort and accuracy. With technological development, in recent times, fingerprint scanning is the most common biometric way of verification. However, considering the current pandemic situation, this cannot be preferred. There are also cases in the attendance system where time-in and time-out of an employee are noted, however, in this situation, we must prefer individual access time-based entry for each employee. Moreover, data can’t be maintained accurately as there may be multiple entrances in an organization where separate registers need to be maintained which is tedious.

A. Merits of the existing system
  - The system doesn’t require any technological expense.
  - It is easier to administer and can be effortlessly implemented.
  - It is easier to implement for fewer data.

B. Demerits of the existing system
  - Data entry is inconsistent and leads to errors.
  - The process is cumbersome and expensive to produce reports.
  - The entry of false information.

Considering the above-mentioned scenarios and the current pandemic situation, there is a need for development in the existing attendance system. Firstly, a temperature check for the employee at the entry-level is vital which should be followed by a contactless security system. This project aims to replace the traditional fingerprint scanning with a security system that consist of facial recognition.

Chapter 2

Literature survey and Objectives

2.1 Literature Survey

[1]. MAKER PRO, March 21,2018

- This paper helped us in understanding the process to connect the Raspberry pi to the laptop.

[2]. Girija Shankar, Towards Data science, Dec 24,2020

-This Paper helped us in understanding the algorithm in face detection .This website gave us understanding of the Haar cascade algorithm

[3]. Kelvin Slton do Prado, Towards Data Science, Nov 11,2017

-This paper helped in understanding the face recognition algorithm. This paper elaborates on the LBPH algorithm

[4]. Circuit Python

-This website helped us in interfacing different sensors with the Raspberry pi 4 and installation of all the required libraries.

2.2 Objectives

- To develop a contactless Attendance.
- To make the process easy for a user if body temperature is measured high , alert is raised through a audio output and also it is displayed on the LCD screen.
- To make this system cost-efficient and also a multi-purpose tool for: Automatic attendance system for companies, factories and industries, also serves the security purpose. Body temperature monitoring in public places like malls, theaters etc.

Software

- To develop a software which is handled by the admin account which has features like
  - It provides the complete days attendance history in the form of a excel sheet with exact name of the person and exact time with his body temperature.
  - It also shows the attendance status in the form of pie chart i.e how many are currently present and absent today.
  - It maintains a different list for the registered ones and the visitors or guests.
  - It captures one image and save it in the database created, if the any person who is not registered is detected for security purposes.
  - It is developed such a way that adding or registering a new member will be a very easy process.

Chapter 3

Methodology

3.1 Block Diagram

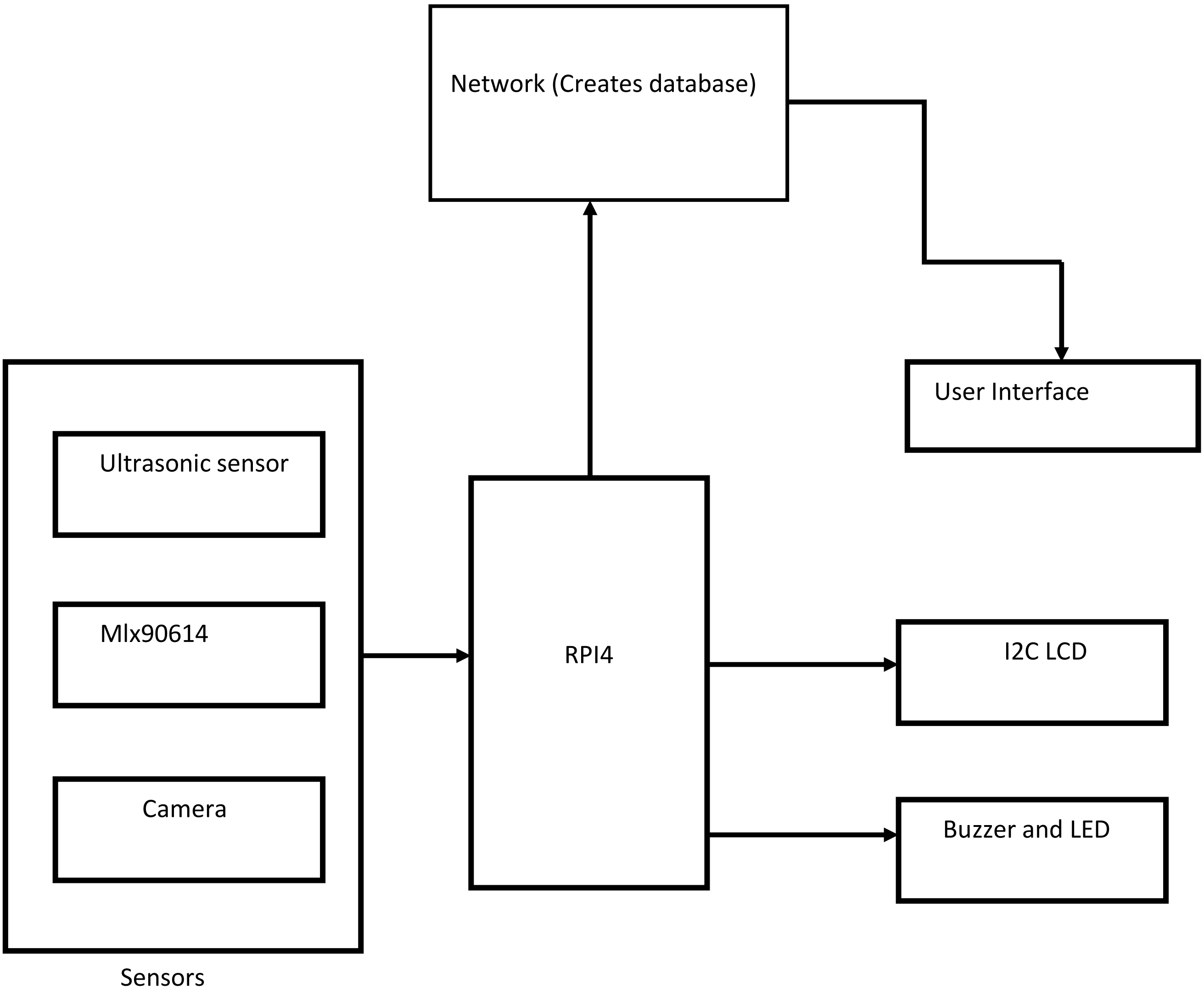


Fig3.1 Block Diagram

Fig 3.1 Shows the block diagram of the attendance management system which has sensing unit which collects the data from the physical world, followed by a processing unit i.e. .raspberry pi 4 which process the collected in a collective way and stores in the database. There is a application layer in which the user interface is present.

3.2 Components

1. Raspberry pi 4 (2GB RAM and 32GB storage)

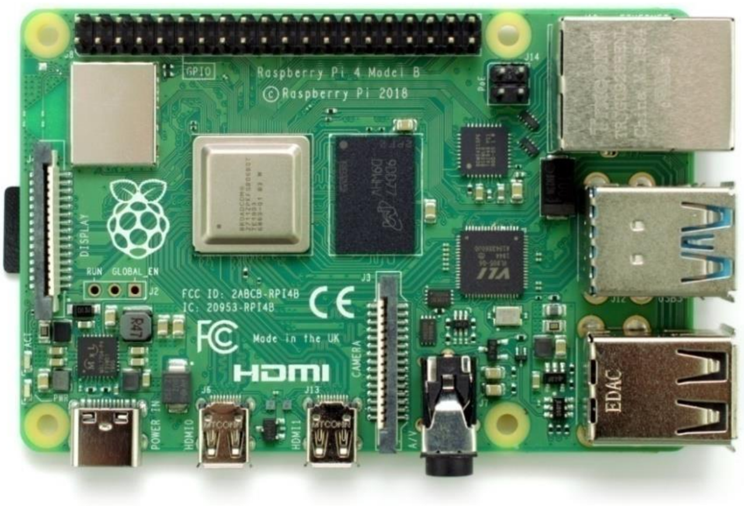
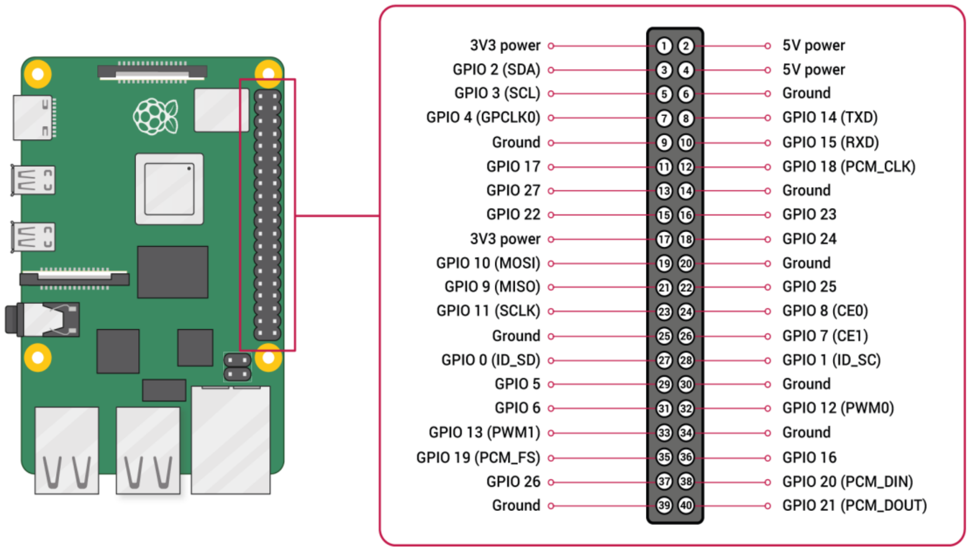


Fig3.2 Raspberry pi 4

The Raspberry Pi is a low cost, credit-card sized computer that plugs into a computer monitor or TV, and uses a standard keyboard and mouse. It is a capable little device that enables people of all ages to explore computing, and to learn how to program in languages like Scratch and Python. It's capable of doing everything you'd expect a desktop computer to do, from browsing the internet and playing high-definition video, to making spreadsheets, word-processing, and playing games.

RPI 4 PINOUT DIAGRAM:



3V3 power	1	2	5V power
GPIO 2 (SDA)	3	4	5V power
GPIO 3 (SCL)	5	6	Ground
GPIO 4 (GPCLK0)	7	8	GPIO 14 (TXD)
Ground	9	10	GPIO 15 (RXD)
GPIO 17	11	12	GPIO 18 (PCM_CLK)
GPIO 27	13	14	Ground
GPIO 22	15	16	GPIO 23
3V3 power	17	18	GPIO 24
GPIO 10 (MOSI)	19	20	Ground
GPIO 9 (MISO)	21	22	GPIO 25
GPIO 11 (SCLK)	23	24	GPIO 8 (CE0)
Ground	25	26	GPIO 7 (CE1)
GPIO 0 (ID_SD)	27	28	GPIO 1 (ID_SC)
GPIO 5	29	30	Ground
GPIO 6	31	32	GPIO 12 (PWM0)
GPIO 13 (PWM1)	33	34	Ground
GPIO 19 (PCM_FS)	35	36	GPIO 16
GPIO 26	37	38	GPIO 20 (PCM_DIN)
Ground	39	40	GPIO 21 (PCM_DOUT)

Fig3.3 Raspberry pi 4 pin diagram

2. Ultrasonic sensor

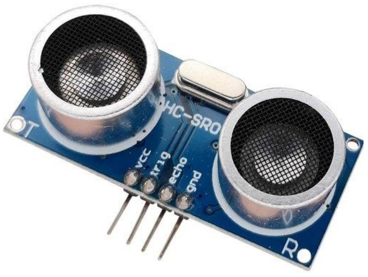


Fig 3.4 Ultrasonic Sensor

An ultrasonic sensor is an electronic device that measures the distance of a target object by emitting ultrasonic sound waves, and converts the reflected sound into an electrical signal. Ultrasonic waves travel faster than the speed of audible sound (i.e. the sound that humans can hear). Ultrasonic sensors have two main components: the transmitter (which emits the sound using piezoelectric crystals) and the receiver (which encounters the sound after it has travelled to and from the target).In order to calculate the distance between the sensor and the object, the sensor measures the time it takes between the emission of the sound by the transmitter to its contact with the receiver. The formula for this calculation is $D = \frac{T}{2} * C$ (where D is the distance, T is the time, and C is the speed of sound ~ 343 meters/second)

3. MLX90614 Sensor

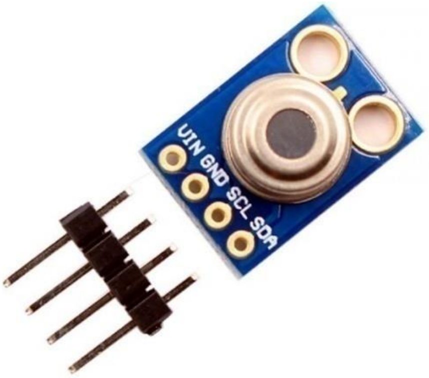


Fig3.5 MLX90614 Sensor

The MLX90614 is a **Contactless Infrared (IR) Digital Temperature Sensor** that can be used to measure the temperature of a particular object ranging from -70° C to 382.2°C. The sensor uses IR rays to measure the temperature of the object without any physical contact and communicates to the microcontroller using the I2C protocol.As mentioned earlier, the MLX90614 sensor can measure the temperature of an object without any physical contact with it. This is made possible with a law called **Stefan-Boltzmann Law**, which states that all objects and living beings emit IR Energy and the intensity of this emitted IR energy will be directly proportional to the temperature of that object or living being. So the MLX90614 sensor calculates the temperature of an object by measuring the amount of IR energy emitted from it.

4. LCD

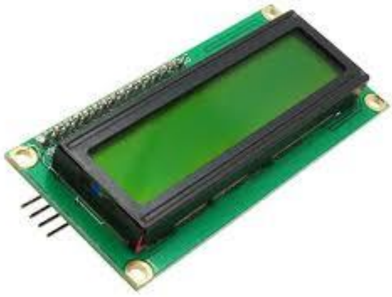


Fig3.6 LCD

An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2 LCD display is very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. This LCD has two registers, namely, Command and Data.

5. Buzzer

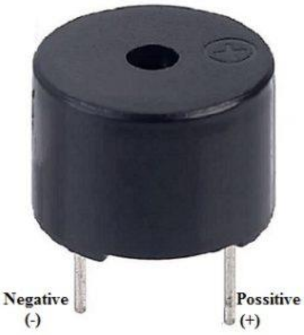


Fig3.7 Buzzer

An audio signaling device like a beeper or buzzer may be electromechanical or piezoelectric or mechanical type. The main function of this is to convert the signal from audio to sound. Generally, it is powered through DC voltage and used in timers, alarm devices, printers, alarms, computers, etc. Based on the various designs, it can generate different sounds like alarm, music, bell & siren.The working principle of a buzzer depends on the theory that, once the voltage is given across a piezoelectric material, then a pressure difference is produced. A piezo type includes piezo crystals among two conductors.Once a potential disparity is given across these crystals, then they thrust one conductor & drag the additional conductor through their internal property. So this continuous action will produce a sharp sound signal.

6. Camera

Fig3.8 Camera

Normally, whenever Raspberry pi boards are used either Pi cam or a USB webcam is used but here we are using a Smartphone camera using locally hosted server.

3.3 Interfacing of the Ultrasonic sensor with the raspberry pi 4

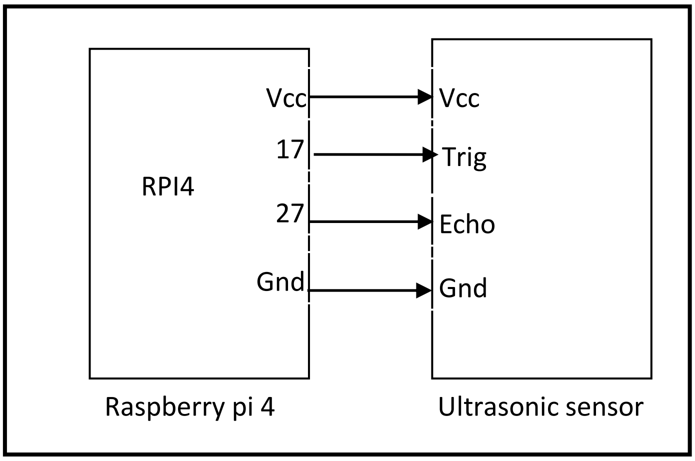


Fig 3.9 Pin diagram of Interfacing Ultrasonic with raspberry pi

There are four pins on the ultrasonic module that are connected to the Raspberry as shown fig 3.9:

- VCC to VCC
- GND to GND
- TRIG to Pin 11(GPIO17)
- ECHO to pin13 (GPIO 27).

3.3.1 Interfacing of the Ultrasonic sensor and LCD with the raspberry pi 4

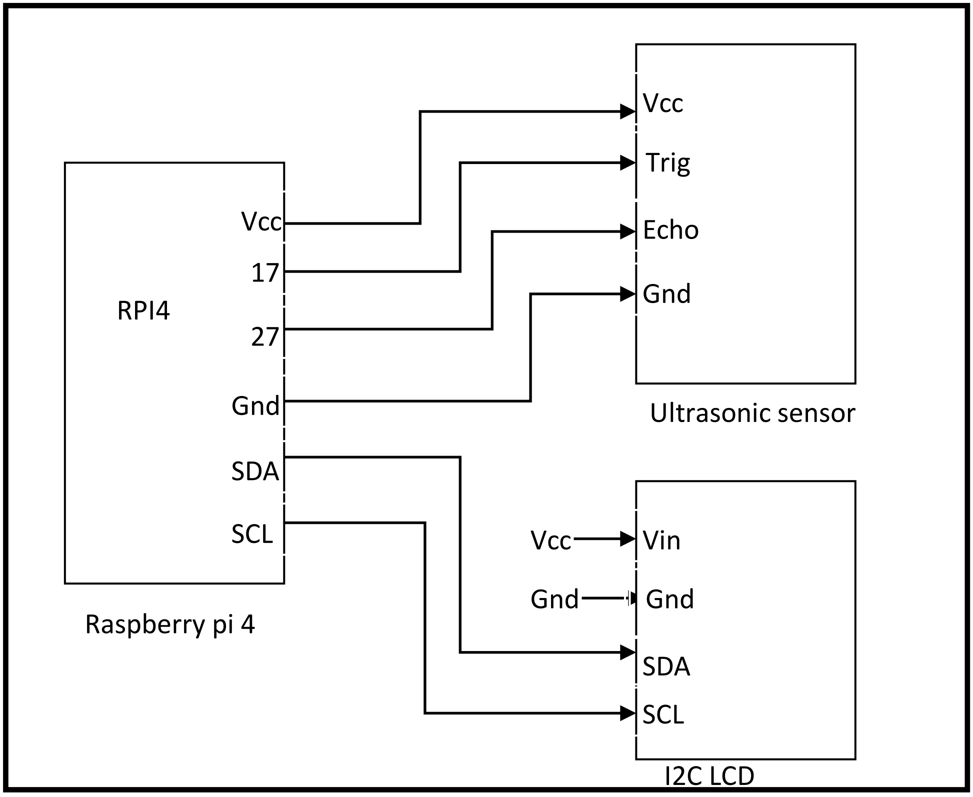


Fig 3.10 Pin diagram of Interfacing Ultrasonic,LCD with raspberry pi

There are four pins on the I2C LCD module that are connected to the Raspberry as shown in fig3.10:

- Vin to VCC
- GND to GND
- SDA to Pin 3(GPIO 2)
- SCL to pin 5(GPIO 3).

3.3.2 Interfacing of the MLX sensor, Ultrasonic sensor, LCD, buzzer with the raspberry pi 4

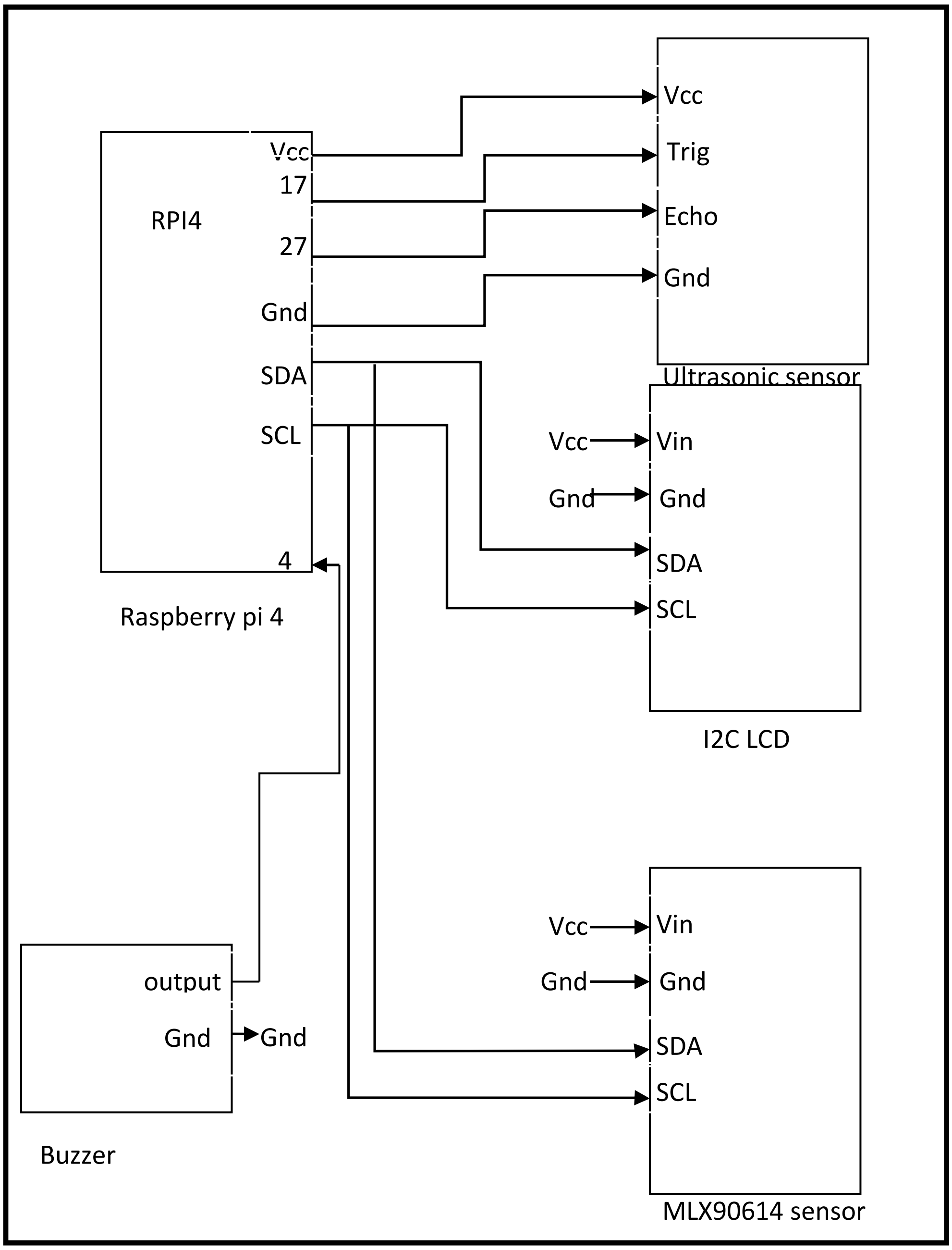


Fig 3.11 Pin diagram of Interfacing sensor with raspberry pi

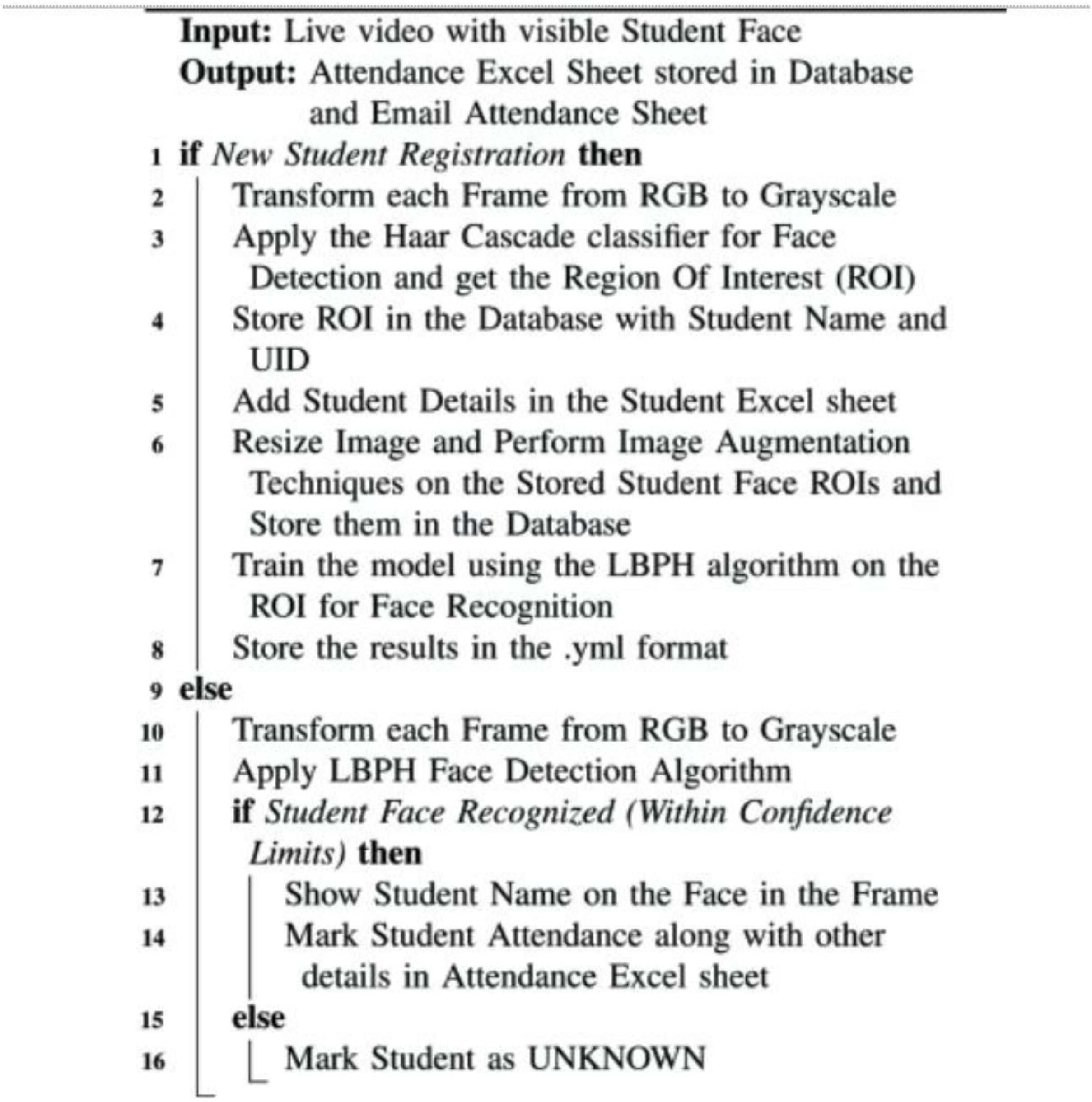
There are two pins on the Buzzer module that are connected to the Raspberry shown in fig 3.11:

- Gnd to Ground
- Output to pin 7(GPIO 4)
- There are four pins on the MLX90614 sensor module that are connected to the Raspberry:
- Vin to VCC
- GND to GND
- SDA to Pin 3(GPIO 2)
- SCL to pin 5(GPIO 3).

3.4 Face Detection

There are two types of image positive image and negative image. Positive images are those images which contain the face in that and negative images are the images which contains non-face image . Classifier is a device which decides whether the taken image is negative or positive. It is trained on hundreds of thousands of face and non-face images to learn to classify a new image as face or non-face image correctly. OpenCV provides two pre-trained classifiers Haar Classifier and LBP Classifier. Both of these classifiers process images in gray-scales as it doesn't need color information to decide if image has a face or not

The Haar Cascade classifier can be used to perform face detection in a given image or a given frame. During training, the algorithm uses haar-like features in particular edge, line and middle-surround features which are included in the basic classification and obtain value by subtracting the sum of pixels under the white rectangle from the number of pixels under the black rectangle. All training images use each feature and the best possible threshold is found to correctly classify the image. OpenCV provides us with the function cv2.CascadeClassifier() and cv2.CascadeClassifier.detectMultiScale() to find faces in the given image and return the coordinates of the detected face.



```
Input: Live video with visible Student Face
Output: Attendance Excel Sheet stored in Database
        and Email Attendance Sheet
if New Student Registration then
    Transform each Frame from RGB to Grayscale
    Apply the Haar Cascade classifier for Face
      Detection and get the Region Of Interest (ROI)
    Store ROI in the Database with Student Name and
      UID
    Add Student Details in the Student Excel sheet
    Resize Image and Perform Image Augmentation
      Techniques on the Stored Student Face ROIs and
      Store them in the Database
    Train the model using the LBPH algorithm on the
      ROI for Face Recognition
    Store the results in the .yml format
else
    Transform each Frame from RGB to Grayscale
    Apply LBPH Face Detection Algorithm
    if Student Face Recognized (Within Confidence
      Limits) then
        Show Student Name on the Face in the Frame
        Mark Student Attendance along with other
          details in Attendance Excel sheet
    else
        Mark Student as UNKNOWN
```

3.4.1 Haar Cascade Classifier for Human Face Detection

Accuracy calculation

Normally, thousands of positive images are trained and negative images more than positive images are trained

True positive (TP): It is an actual object of interest that is correctly identified. The correctly classified faces can be calculated as :
True positives rate (TPR) = TP/(TP+FP)

False-positives (FP): It is a non-object of interest which is falsely identified as the true object.

False-negatives (FN): It is an actual object of interest falsely identified as negative. False negatives rate

(FNR)=FN/(FN+TP)(3)Accuracy=(TP+TN)/(TP+TN+FP+FN)

Where,
TP: True Positive FP: False Positive

TN: True Negative FN: False Negative

By using,
Accuracy is obtained for the Haar cascade is 96.24% and for LBP classifier 94.74%.

In this project, we used Haar Cascade Classifier to detect human faces using an Open Source Computer Vision Library named OpenCV. Initially, this method was given by Paula Voila and Michael Jones. For human face detection, haar features are the main part of haar cascade classifier. Haar features are used to detect the existence of features in the given image. Each feature produces a single value that is calculated by subtracting the number of pixels under the white rectangle from the number of pixels under the black rectangle. Haar features are the rectangle features for rapid human face detection.

New Registration

In this step, we register the new students or faculty, extract the faces and train them. Also, we make a record of all the student details in the excel file. The detailed steps are discussed below:

Image Acquisition:

In a room, a camera is installed to capture students' faces. The camera has to be so positioned that it effectively captures the faces of the students. For more pre-processing, this camera is interfaced with a PC. We use the built-in laptop camera in our prototype. We use Open CV to capture frames and deal with the live video.

Face Detection using Haar Cascade:

The Frontal Face Haar Cascade classifier is used to perform face detection on a given frame. We extract 50 images from the live capture video. In these, we use the Haar cascade to detect the faces and then extract them. The coordinates of the face recognised are also returned which helps to create a box around the detected face. The extracted faces are stored using the name and ID entered during the registration process.

Pre-processing:

The extracted faces from the previous step are resized to 224x224 dimensions and then saved. Resizing is performed to optimize our space use. To generate more dataset of faces for the images captured we use image augmentation technique that helps us to make a small dataset into a larger dataset by creating extra images by involving distortion, performing shearing, varying brightness, zooming the images and rotating them as well. We have used the Augmentor python package to perform image augmentation. The Augmentor image augmentation library contains the Pipeline class which is used to create pipeline objects, which can be used to build an augmentation pipeline by adding operations like shearing, skewing, flipping, increasing brightness, zooming to the pipeline object. We generate a sample of 100 images using this technique in addition to the 50 images clicked before of an individual. The original and augmented images generated of the extracted face

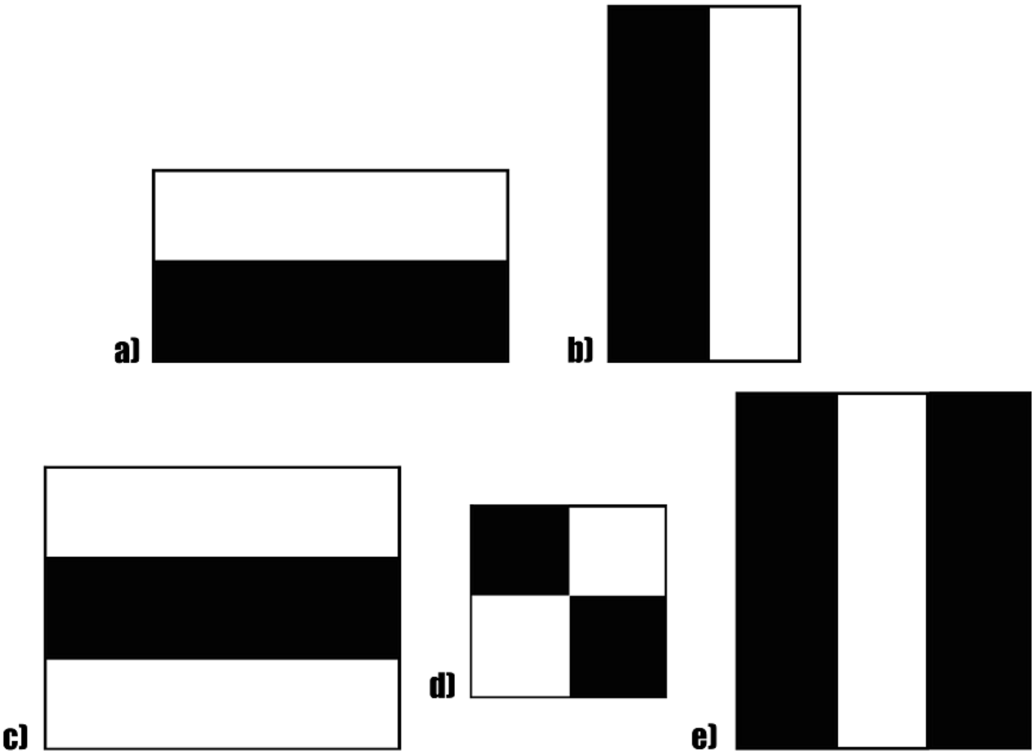


Fig 3.12 Features in haar cascade algorithm

Haar-like features scanning is done on the image to detect human faces, starting from the upper left corner and ending in the lower right corner of the image “Fig.3.12”. Scanning is done several times to detect human faces in an image.

To calculate rectangular features quickly, the concept of integral images is used. Four values are needed in the rectangular corners for calculation of the number of pixels in the given rectangle. In the integral image, the value is in pixels (x, y) is the number of pixels above and on the left (x, y). A 24x24 window as the base window size is used by the Viola-Jones algorithm to begin evaluating these features in the given image. If we consider all possible parameters of haar features such as type, position, and scale, then we have to count 160,000 features in this window. However, this is almost impossible. Therefore, using of AdaBoost algorithm become the solution to this problem. AdaBoost is a machine learning algorithm that able to find the best features among 160,000. These features are weak classifiers. Adaboost builds powerful classifiers as linear combinations of weak classifiers. Cascade using like haar feature can detect human face "Fig. 3.13 ". This system will detect the image of a human face in this process if it passes through all steps. If it does not go through one of the steps, it indicates that no human face is detected in the image.

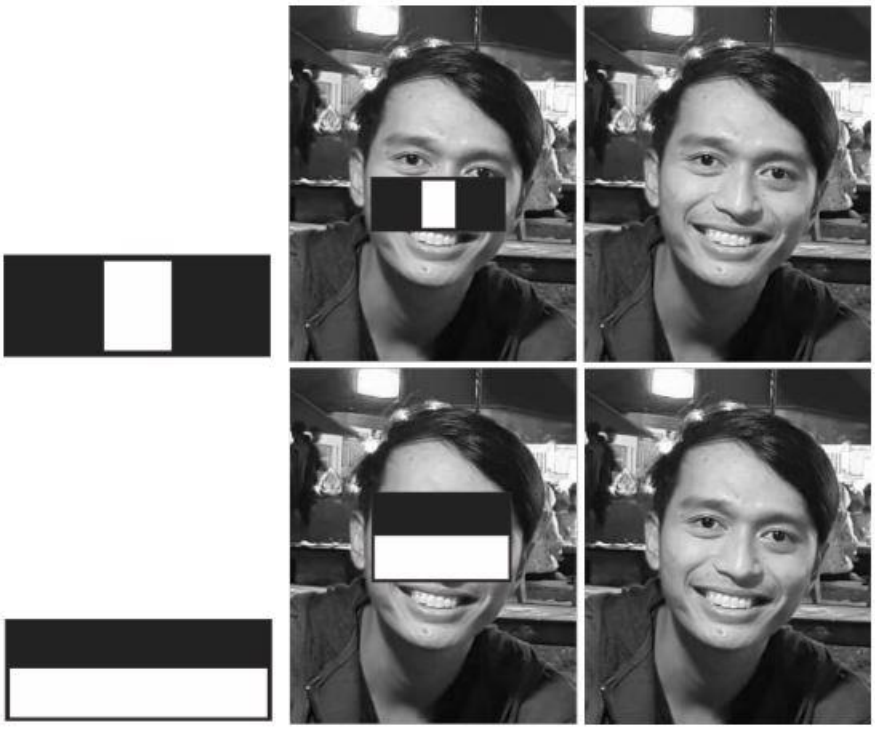


Fig 3.13 Haar like feature scan in image

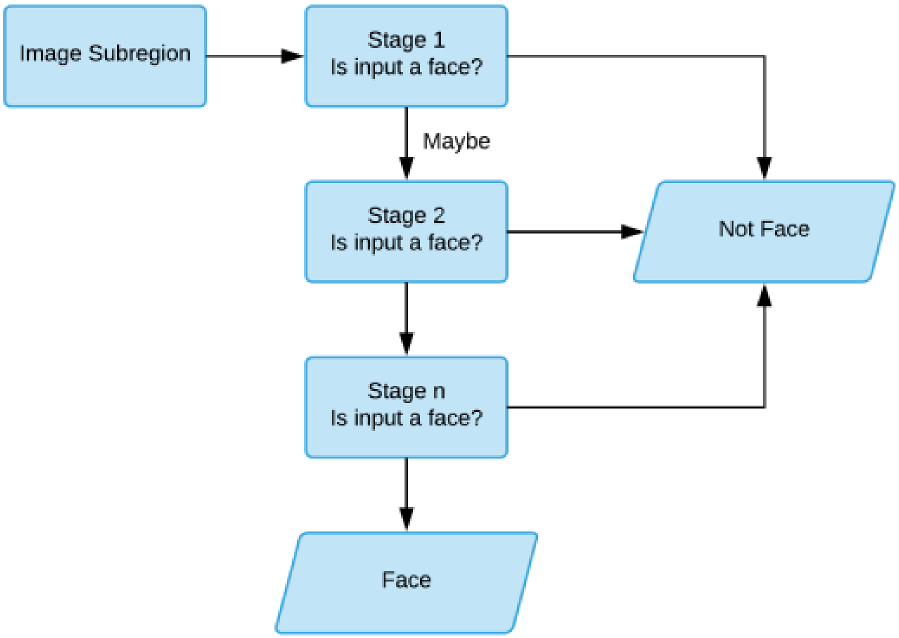


Fig3.14 Cascade classifier

3.5 Face Recognition

Human beings perform face recognition automatically every day and practically with no effort.

Although it sounds like a very simple task for us, it has proven to be a complex task for a computer, as it has many variables that can impair the accuracy of the methods, for example: illumination variation, low resolution, occlusion, amongst other.

In computer science, face recognition is basically the task of recognizing a person based on its facial image. It has become very popular in the last two decades, mainly because of the new methods developed and the high quality of the current videos/cameras.

The face recognition systems can operate basically in two modes:

- **Verification or authentication of a facial image**: it basically compares the input facial image with the facial image related to the user which is requiring the authentication. It is basically a 1x1 comparison.
- **Identification or facial recognition**: it basically compares the input facial image with all facial images from a dataset with the aim to find the user that matches that face. It is basically a 1xN comparison.

There are different types of face recognition algorithms, for example:

- Eigenfaces(1991)
- Local Binary Patterns Histograms (LBPH) (1996)
- Fisherfaces (1997)
- Scale Invariant Feature Transform (SIFT) (1999)
- Speed Up Robust Features (SURF) (2006)

In this project we have used one of the oldest and more popular face recognition algorithms: **Local Binary Patterns Histograms (LBPH)**

3.5.1 Local Binary Patterns Histograms (LBPH)

Local Binary Pattern (LBP) is a simple yet very efficient texture operator which labels the pixels of an image by thresholding the neighborhood of each pixel and considers the result as a binary number.

It was first described in 1994 (LBP) and has since been found to be a powerful feature for texture classification. It has further been determined that when LBP is combined with histograms of oriented gradients (HOG) descriptor, it improves the detection performance considerably on some datasets.

Using the LBP combined with histograms we can represent the face images with a simple data vector.

As LBP is a visual descriptor it can also be used for face recognition tasks, as can be seen in the following step-by-step explanation.:

1. **Parameters**: the LBPH uses 4 parameters:

- **Radius**: the radius is used to build the circular local binary pattern and represents the radius around the central pixel. It is usually set to 1.

- **Neighbors**: the number of sample points to build the circular local binary pattern. The more sample points included, the higher the computational cost. It is usually set to 8.

- **Grid X**: the number of cells in the horizontal direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.

- **Grid Y**: the number of cells in the vertical direction. The more cells, the finer the grid, the higher the dimensionality of the resulting feature vector. It is usually set to 8.

2. Training the Algorithm: First, we need to train the algorithm. To do so, we need to use a dataset with the facial images of the people we want to recognize. We need to also set an ID (it may be a number or the name of the person) for each image, so the algorithm will use this information to recognize an input image and give you an output. Images of the same person must have the same ID.

3. Applying the LBP operation: The first computational step of the LBPH is to create an intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameters **radius** and **neighbors**.

The image below shows this procedure:

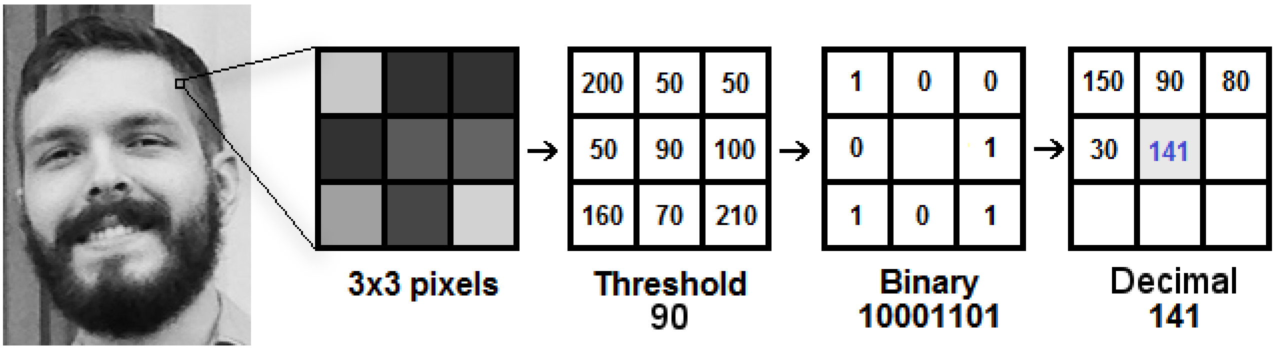


Fig3.15 applying LBPH algorithm for an image

Based on the image above, let's break it into several small steps so we can understand it easily:

- Suppose we have a facial image in grayscale.
- We can get part of this image as a window of 3x3 pixels.
- It can also be represented as a 3x3 matrix containing the intensity of each pixel (0~255).
- Then, we need to take the central value of the matrix to be used as the threshold.
- This value will be used to define the new values from the 8 neighbors.
- For each neighbor of the central value (threshold), we set a new binary value. We set 1 for values equal or higher than the threshold and 0 for values lower than the threshold.
- Now, the matrix will contain only binary values (ignoring the central value). We need to concatenate each binary value from each position from the matrix line by line into a new binary value (e.g. 10001101). Then, we convert this binary value to a decimal value and set it to the central value of the matrix, which is actually a pixel from the original image.
- At the end of this procedure (LBP procedure), we have a new image which represents better the characteristics of the original image.

4. Extracting the Histograms: Now, using the image generated in the last step, we can use the **Grid X** and **Grid Y** parameters to divide the image into multiple grids, as can be seen in the following image:

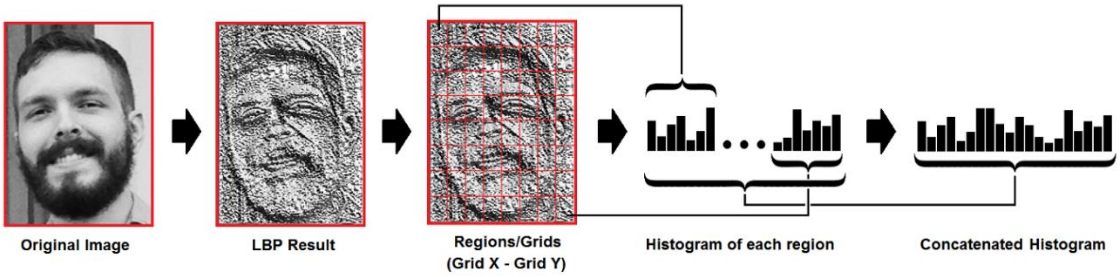


Fig3.16 LBPH applied on an image

Based on the fig 3.16 above, we can extract the histogram of each region as follows:

- As there is an image in grayscale, each histogram (from each grid) will contain only 256 positions (0~255) representing the occurrences of each pixel intensity.

- Then, we need to concatenate each histogram to create a new and bigger histogram. Supposing we have 8x8 grids, we will have 8x8x256=16.384 positions in the final histogram. The final histogram represents the characteristics of the image original image.

5. Performing the face recognition: In this step, the algorithm is already trained. Each histogram created is used to represent each image from the training dataset. So, given an input image, we perform the steps again for this new image and creates a histogram which represents the image.

- So to find the image that matches the input image we just need to compare two histograms and return the image with the closest histogram.

- We can use various approaches to compare the histograms (calculate the distance between two histograms), for example: **euclidean distance**, **chi-square**, **absolute value**, etc. In this example, we can use the Euclidean distance (which is quite known) based on the following formula:

$$D = \sqrt{\sum_{i=1}^{n}(hist1_i - hist2_i)^2}$$

- So the algorithm output is the ID from the image with the closest histogram. The algorithm should also return the calculated distance, which can be used as a '**confidence**' measurement. We can then use a threshold and the 'confidence' to automatically estimate if the algorithm has correctly recognized the image. We can assume that the algorithm has successfully recognized if the confidence is lower than the threshold defined.

Chapter 4

User Interface

4.1 Back end

Python is a popular programming language. It was created by Guido van Rossum, and released in 1991. It is used for:

- ♣ web development (server-side),
- ♣ software development,
- ♣ mathematics,
- ♣ system scripting

Uses of Python:

1. Applications: Python can be used to develop different applications like web applications, graphic user interface based applications, software development application, scientific and numeric applications, network programming, Games and 3D applications and other business applications. It makes an interactive interface and easy development of applications.

2. Multiple Programming paradigms: It is also used because of its providing continuous support to several programming paradigms as it supports object-oriented programming and structured programming. Python has features, which also support various concepts of functional programming language. It is used for dynamic type system and automatic memory management. Python language features and programming paradigms allow you for developing small as well as large applications. It can be used for complex software applications.

3. Robust Standard Library: It has a large and robust standard library to use for developing applications. It also makes the developers use Python over other languages. The standard library helps you use the different range of modules available for Python, as this module helps you add the functionality without writing any more code. To get the information about various modules, documentation on the python standard library can be referred to. While developing any web application, implementing web services, performing string operations and other usages like interface protocol, the standard library documentation helps.

4. Compatible with Major Platforms and Systems It is mainly compatible with major platforms and systems because of which it is used mainly for developing applications. With the help of python interpreters, python code can be run on specific platforms and tools as it supports many operating systems. As python is an interpreted high-level programming language; and it allows you to run the code on multiple platforms. The new and modified code can be executed without recompiling, and its impact can be monitored or checked. It means it's not required to recompile the code after every change. This feature helps in saving the development time of the developers.

5. Access of Database: The uses of Python also helps in accessing the database easily. Python helps in customizing the interfaces of different databases like MySQL, Oracle, Microsoft SQL Server, Postgre SQL, and other databases. It has an object database like Durus and ZODB. It is used for standard database API and freely available for download. 6. Code Readability Python code is easy to read and maintained. It is easily reusable as well wherever it is required. Python's having simple syntax, which allows the different concepts to develop without writing any additional code. The code should be of good quality and easy to maintain the source code and simplify the maintenance, which is required to develop the software application. It also emphasizes

FLASK:

Flask is a micro web framework written in Python. It is classified as a micro framework because it does not require particular tools or libraries. It has no database abstraction layer, form validation, or any other components where pre-existing third-party libraries provide common functions. However, Flask supports extensions that can add application features as if they were implemented in Flask itself. Extensions exist for object- relational mappers, form validation, upload handling, various open authentication technologies and several common framework related tools

USES of FLASK:

- Flask is mainly developed for web development and hosting in python
- Flask gives the developer varieties of choice when developing web applications
- It provides you with tools, libraries, and mechanics that allow you to build a web application, but it will not enforce any dependencies or tell you how the project should look like

SQLite3: SQL (Structured Query Language) is a domain-specific language used in programming and designed for managing data held in a relational database management system (RDBMS), or for stream processing in a relational data stream management system (RDSMS). It is particularly useful in handling structured data, i.e. data incorporating relations among entities and variables. SQL offers two main advantages over older read–write APIs such as ISAM or VSAM. Firstly, it introduced the concept of accessing many records with one single command. Secondly, it eliminates the need to specify how to reach a record, e.g. with or without an index.

USES of SQL:

- SQL can execute queries against a database
- SQL can retrieve data from a database
- SQL can insert records in a database
- SQL can update records in a database
- SQL can delete records from a database
- SQL can create new tables in a database
- SQL can create stored procedures in a database
- SQL can create views in a database
- SQL can set permissions on tables, procedures, and view

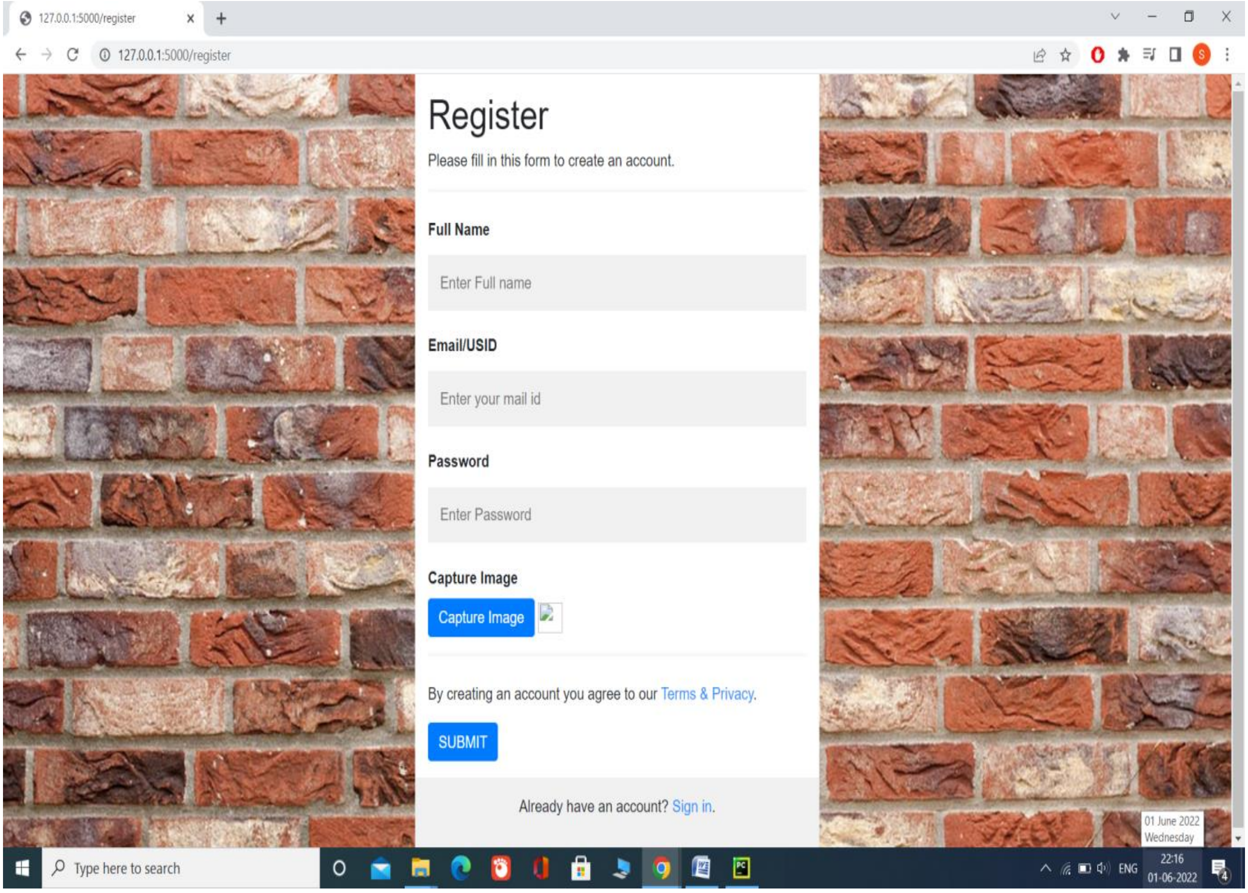
4.2 Front end

- HTML: HTML is short for Hypertext Markup Language.HTML is used to create electronic documents (called pages) that are displayed on the World Wide Web.
- CSS: CSS stands for Cascading Style Sheets .It describes how HTML elements are to be displayed on screen, paper, or in other media

BOOTSTRAP: Bootstrap is a free front-end framework for faster and easier web development, Bootstrap includes HTML and CSS based design templates for typography, forms, buttons, tables, navigation, modals, image carousels and many other, as well as optional JavaScript plugging.

4.3. Webpages

4.3.1Registration page



Register

Please fill in this form to create an account.

Full Name

Enter Full name

Email/USID

Enter your mail id

Password

Enter Password

Capture Image

Capture Image

By creating an account you agree to our Terms & Privacy.

SUBMIT

Already have an account? Sign in.

Fig 4.1 Registration page for the new users.

The Registration form collects the information of candidate regarding name, email, and password and saves it in the database. For every new candidate registration candidate photos are captured and stored as the dataset with the folder name as candidate’s name. Up to 30 images are captured and preprocessing i.e. resizing, grayscale conversion is done .The registration page is shown in fig 4.1.

Dataset of a candidate

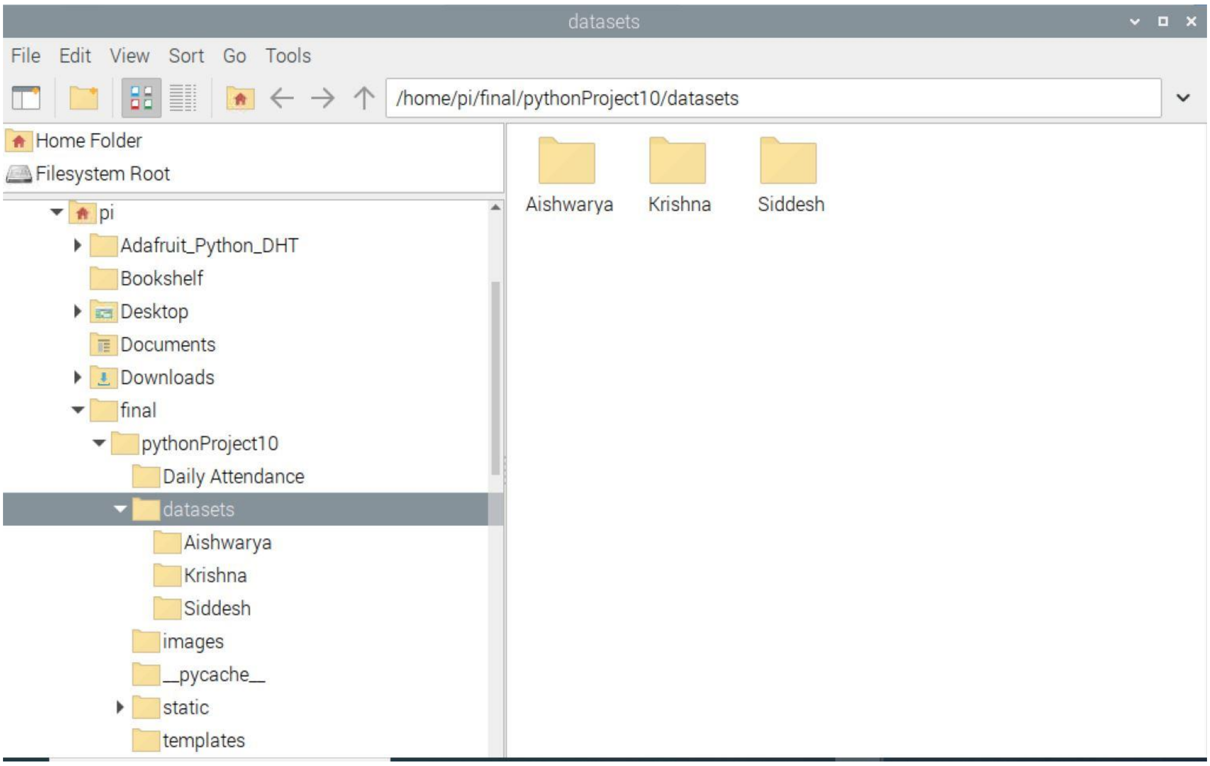


Fig 4.2 Dataset of different candidates

For every new candidate registration the candidate’s images are stored in the folder named as candidates name which is saved under the directory named dataset.

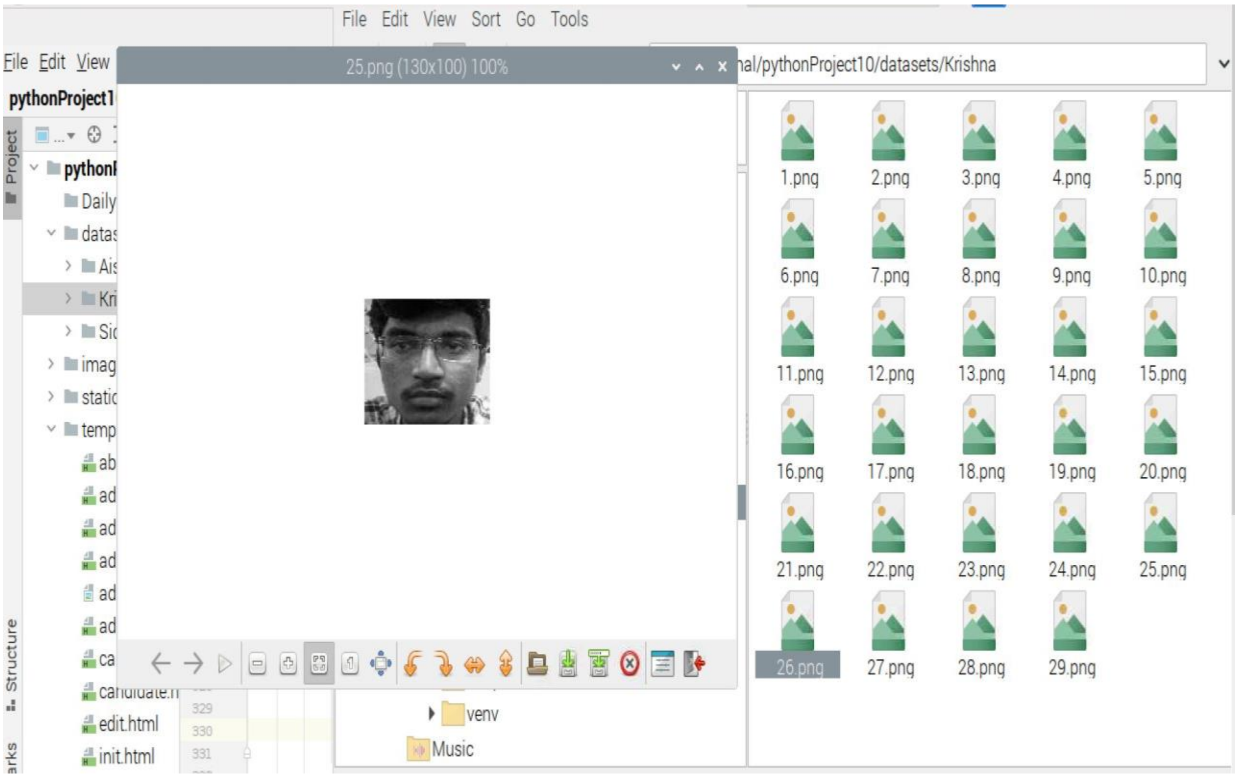


Fig 4.3 Candidate’s image stored in a folder

For every candidate there is dataset containing 30 images, which is further used in the face recognition for attendance recording. After registration a message acknowledges the successful registration.

After the registration the candidate can access his account by using his email id and password. All the candidates accounts are maintained by the admin.

4.3.2 Login Page

There are two types of User profile

- Admin
- User

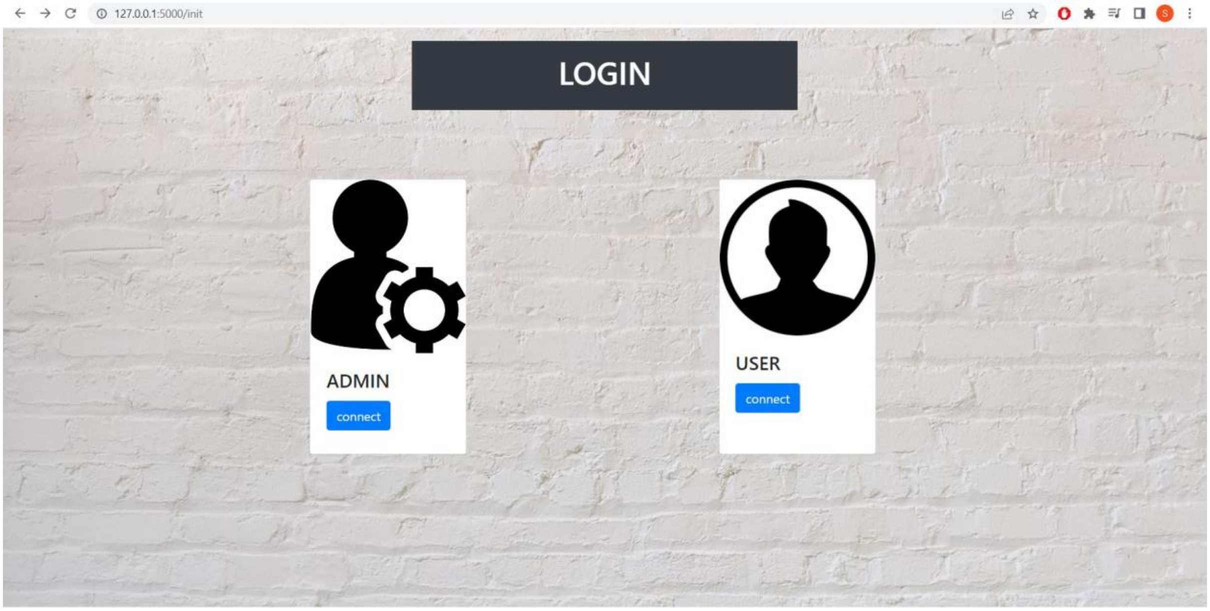


Fig 4.4 The web page showing different profiles for login.

The user interface which provides the way for both the admin and user to login. The fig4.4 shows the webpage where the separate login for two different profile are provided.

Admin Login

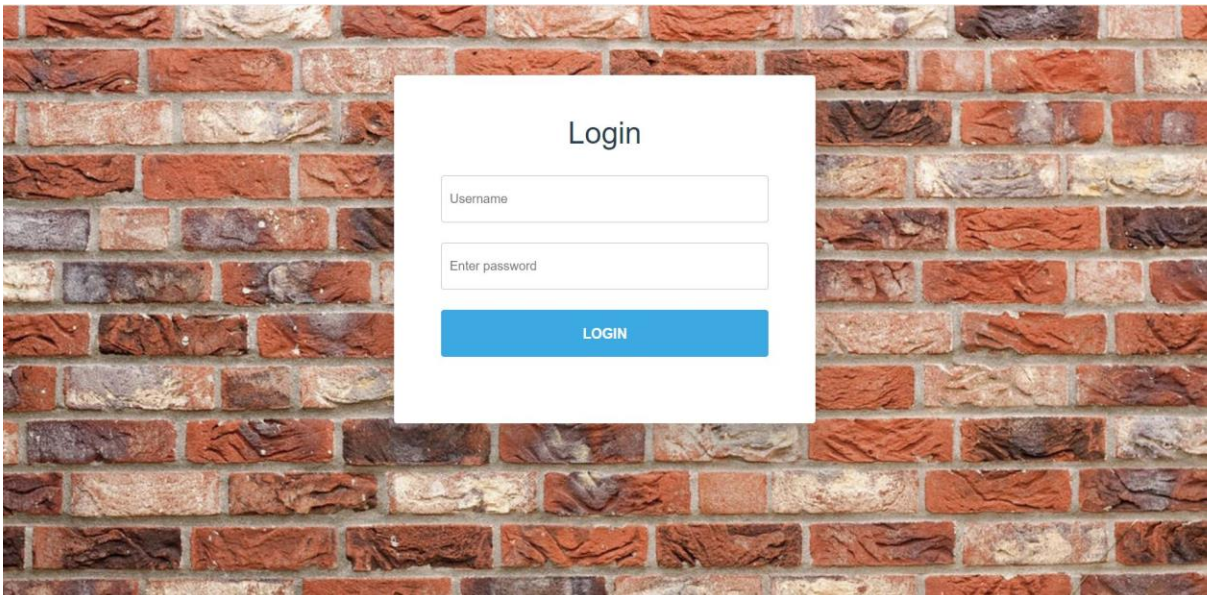


Fig 4.5 admin login page

The simple user interface for validating the admin login is shown in fig 4.5 . The backend code is written to validate the admin login.

4.3.3Admin page

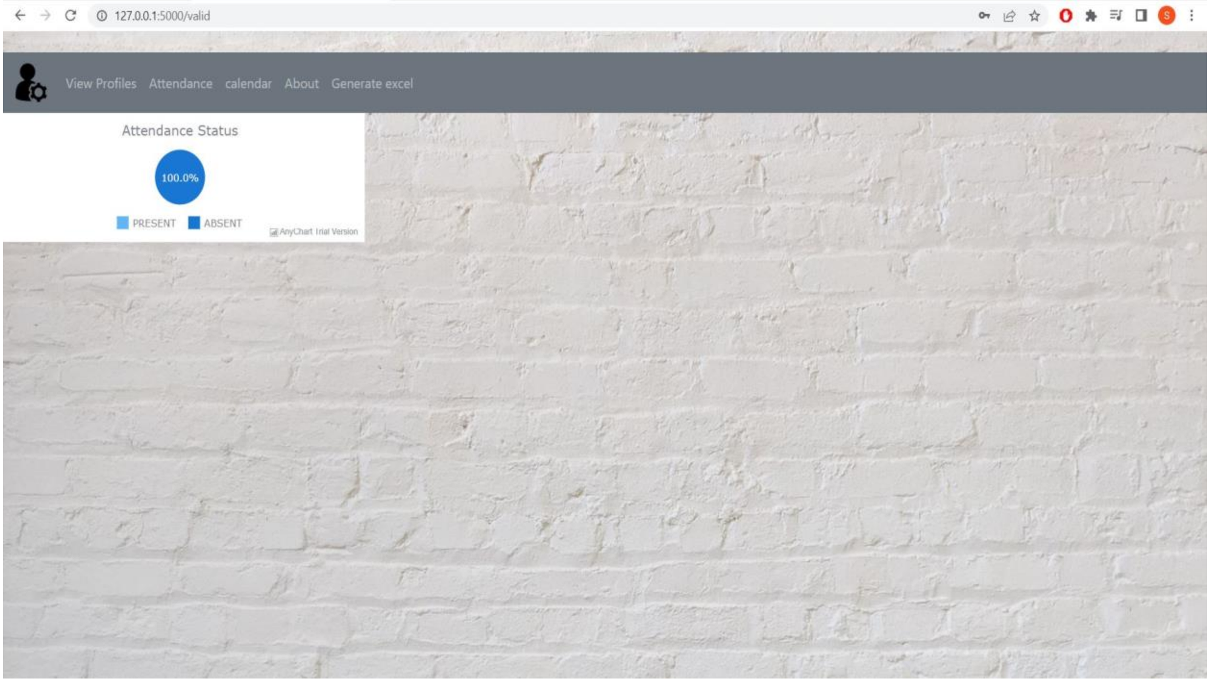
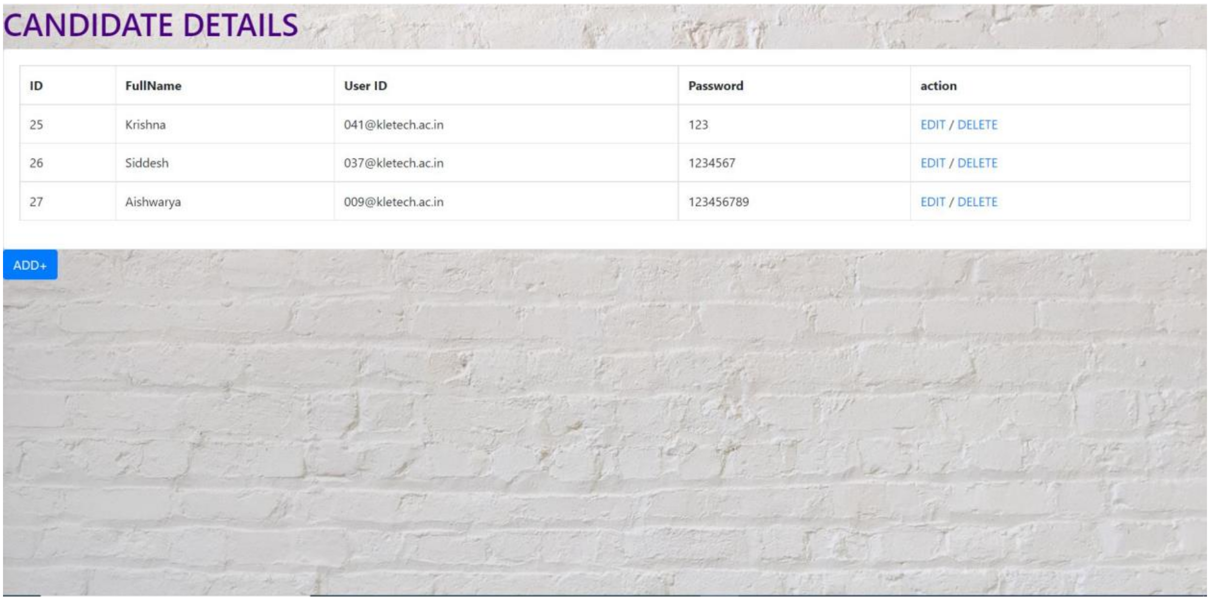


Fig 4.6 interface provided in admin in admin page

Admin is the one who takes care of whole attendance management system. Admin has a access to view all profiles. The profiles can be viewed by clicking the **view profiles** button.

4.3.4 Candidate Profiles



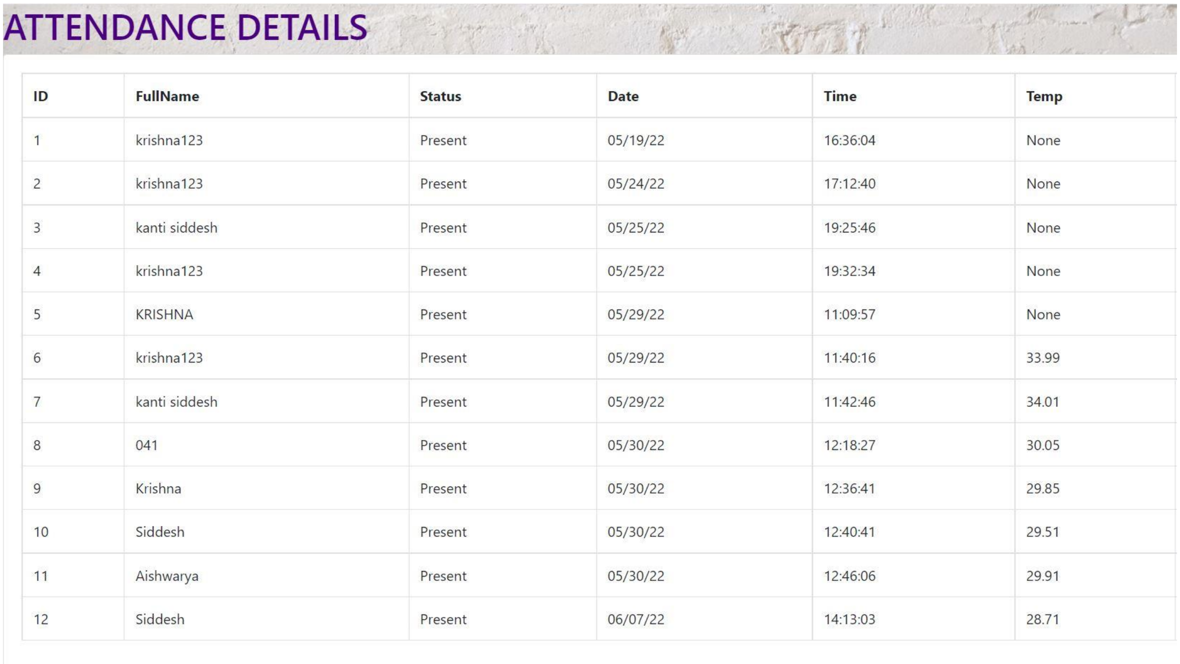
CANDIDATE DETAILS

ID	FullName	User ID	Password	action
25	Krishna	041@kletech.ac.in	123	EDIT / DELETE
26	Siddesh	037@kletech.ac.in	1234567	EDIT / DELETE
27	Aishwarya	009@kletech.ac.in	123456789	EDIT / DELETE

Fig4.7 Candidates profiles

The admin is given functions like editing the incorrect data of the registered candidates. He also has a authority to delete an account. The admin also have a option to enroll new candidates for registration by clicking **ADD** button provided as shown in fig4.7.

4.3.5 Candidates attendance

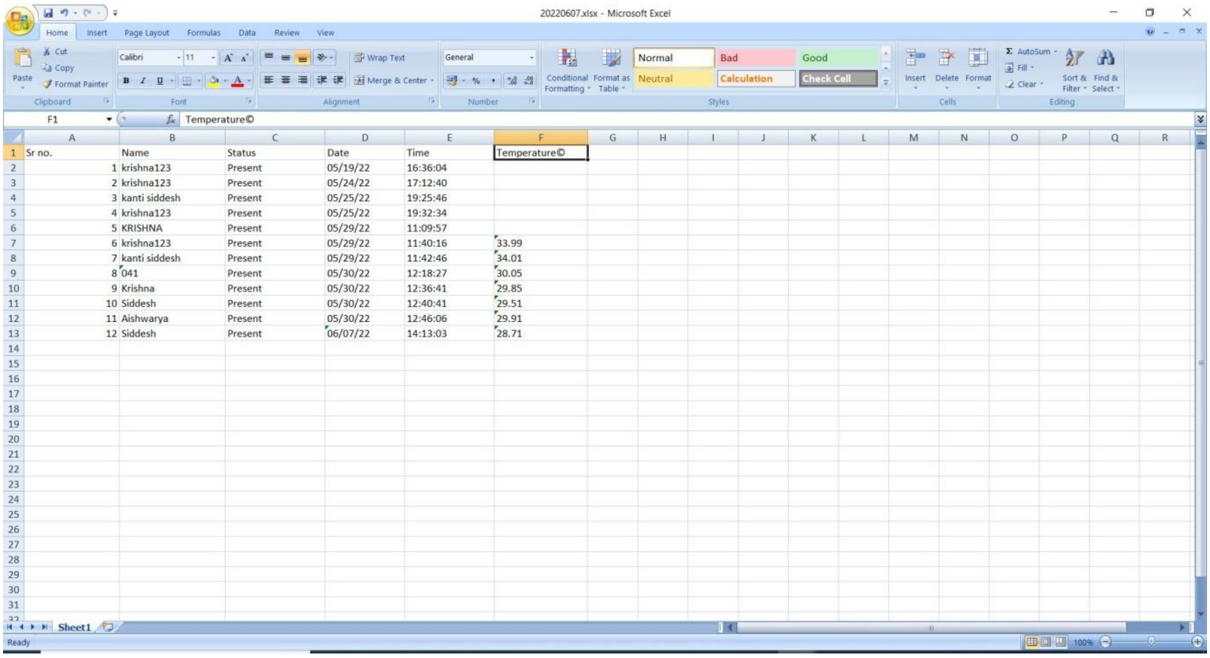


ATTENDANCE DETAILS

ID	FullName	Status	Date	Time	Temp
1	krishna123	Present	05/19/22	16:36:04	None
2	krishna123	Present	05/24/22	17:12:40	None
3	kanti siddesh	Present	05/25/22	19:25:46	None
4	krishna123	Present	05/25/22	19:32:34	None
5	KRISHNA	Present	05/29/22	11:09:57	None
6	krishna123	Present	05/29/22	11:40:16	33.99
7	kanti siddesh	Present	05/29/22	11:42:46	34.01
8	041	Present	05/30/22	12:18:27	30.05
9	Krishna	Present	05/30/22	12:36:41	29.85
10	Siddesh	Present	05/30/22	12:40:41	29.51
11	Aishwarya	Present	05/30/22	12:46:06	29.91
12	Siddesh	Present	06/07/22	14:13:03	28.71

Fig 4.8 Attendance stored in database

The fig 4.8 shows the table which stores the attendance of the registered candidates with their body temperature, date, time in a database table.


20220607.xlsx - Microsoft Excel

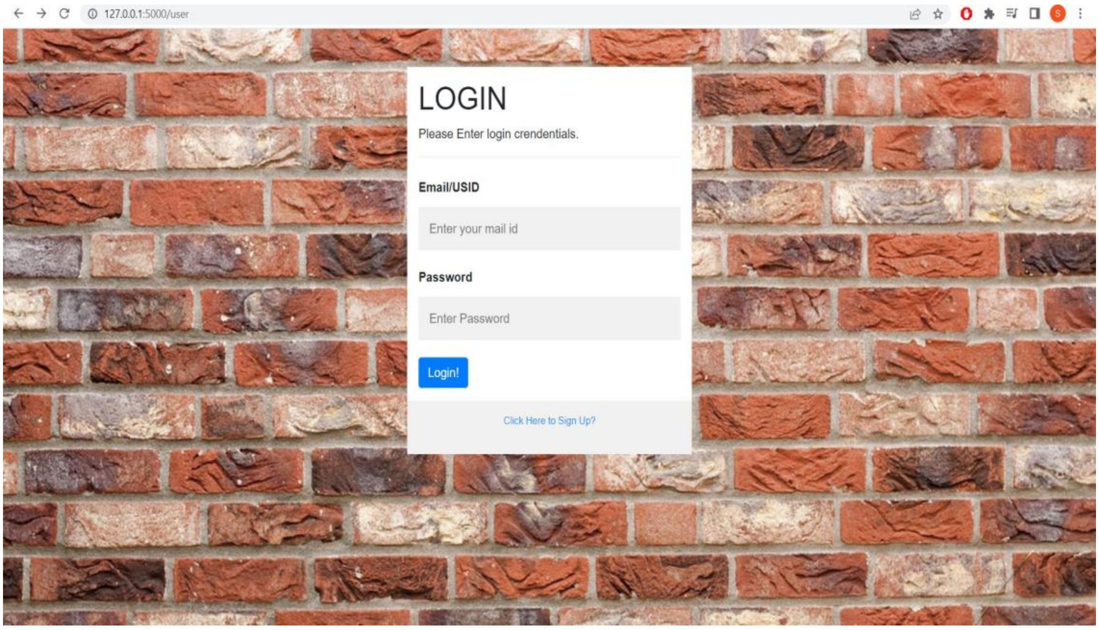
F1 Temperature©

Sr no.	Name	Status	Date	Time	Temperature©
1	krishna123	Present	05/19/22	16:36:04	
2	krishna123	Present	05/24/22	17:12:40	
3	kanti siddesh	Present	05/25/22	19:25:46	
4	krishna123	Present	05/25/22	19:32:34	
5	KRISHNA	Present	05/29/22	11:09:57	
6	krishna123	Present	05/29/22	11:40:16	33.99
7	kanti siddesh	Present	05/29/22	11:42:46	34.01
8	041	Present	05/30/22	12:18:27	30.05
9	Krishna	Present	05/30/22	12:36:41	29.85
10	Siddesh	Present	05/30/22	12:40:41	29.51
11	Aishwarya	Present	05/30/22	12:46:06	29.91
12	Siddesh	Present	06/07/22	14:13:03	28.71

Fig 4.9 Attendance of the candidate viewed in excel.

By using the **Generate excel sheet** button provided in the admin page,admin can obtain the excel spreadsheet with name as present day date. The fig 4.9 shows the attendance of the candidates viewed in excel which makes the analysis of the data easier.

User Login


127.0.0.1:5000/user

LOGIN

Please Enter login crendentials.

Email/USID

Enter your mail id

Password

Enter Password

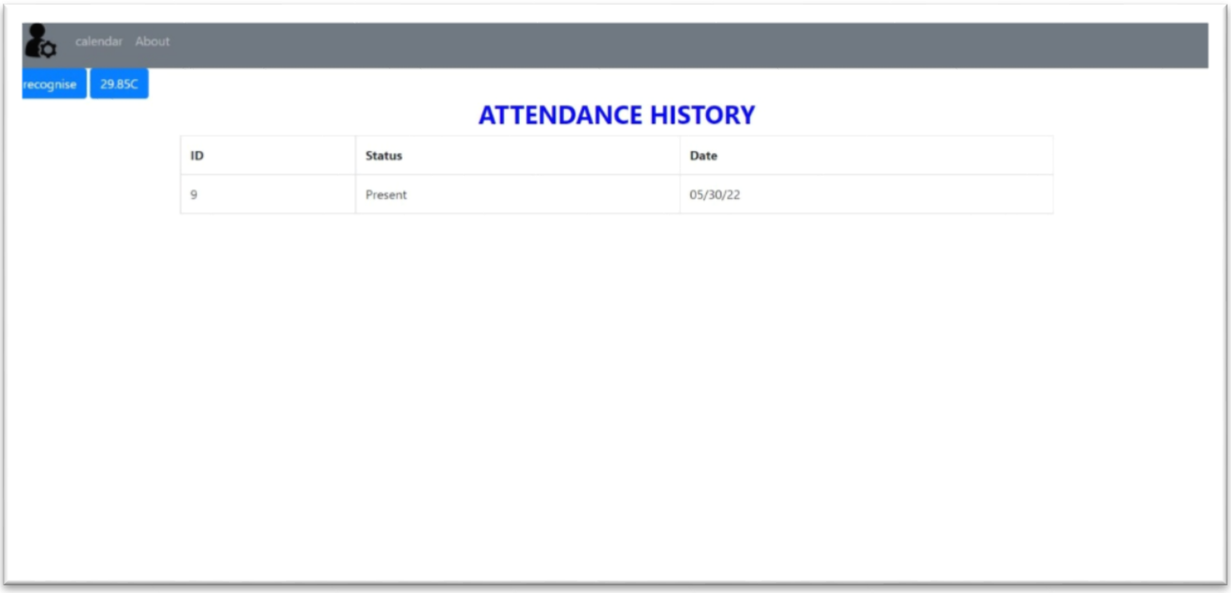
Login!

Click Here to Sign Up?

Fig 4.10 Login page for the registered candidates

The fig4.10 shows the designed webpage for the users to login which takes email and password as input. Every login is validated in the backend by comparing it with the data stored in the database. If the login credential is found to be invalid the error message is printed.

4.3.6 User page



ATTENDANCE HISTORY

ID	Status	Date
9	Present	05/30/22

Fig4.11 User page

The fig 4.11 shows the interface provided for the registered users. The Attendance history of candidate is daily updated. The temperature of a candidate is also shown at the top web page.

Chapter 5

Results and conclusion

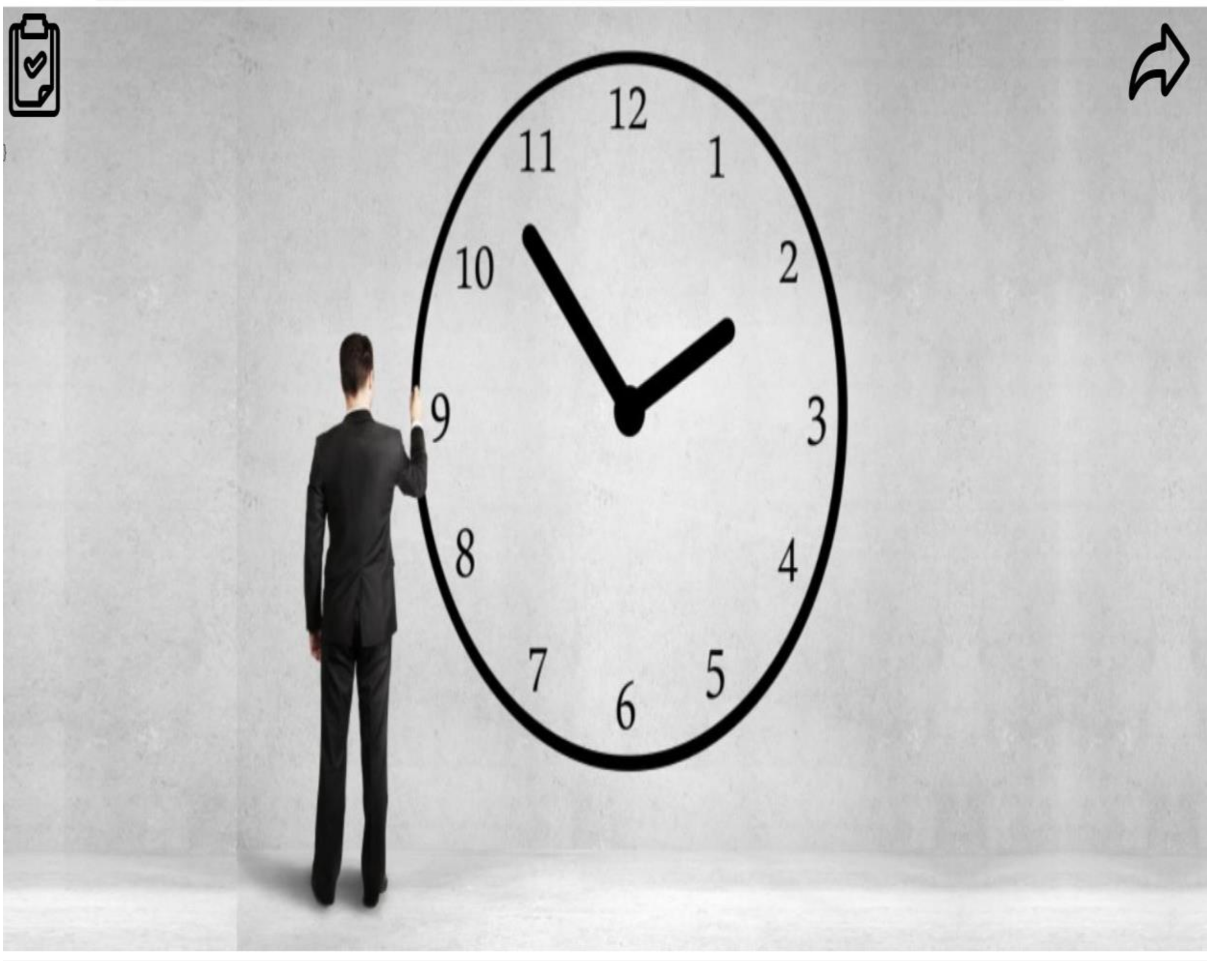


Fig 5.1 Home page of attendance management systems

The fig5.1 shows the web page of the attendance management system which is homepage of the attendance management system. The web page has two logos with different functionalities.

📋 Which is logo created to take attendance. The admin clicks the logo to take the attendance. The system runs continuously until the admin turns it off.

↪ is a redirect button which is used by admin to go to login pages.

Flowchart

When the Take attendance logo is clicked.

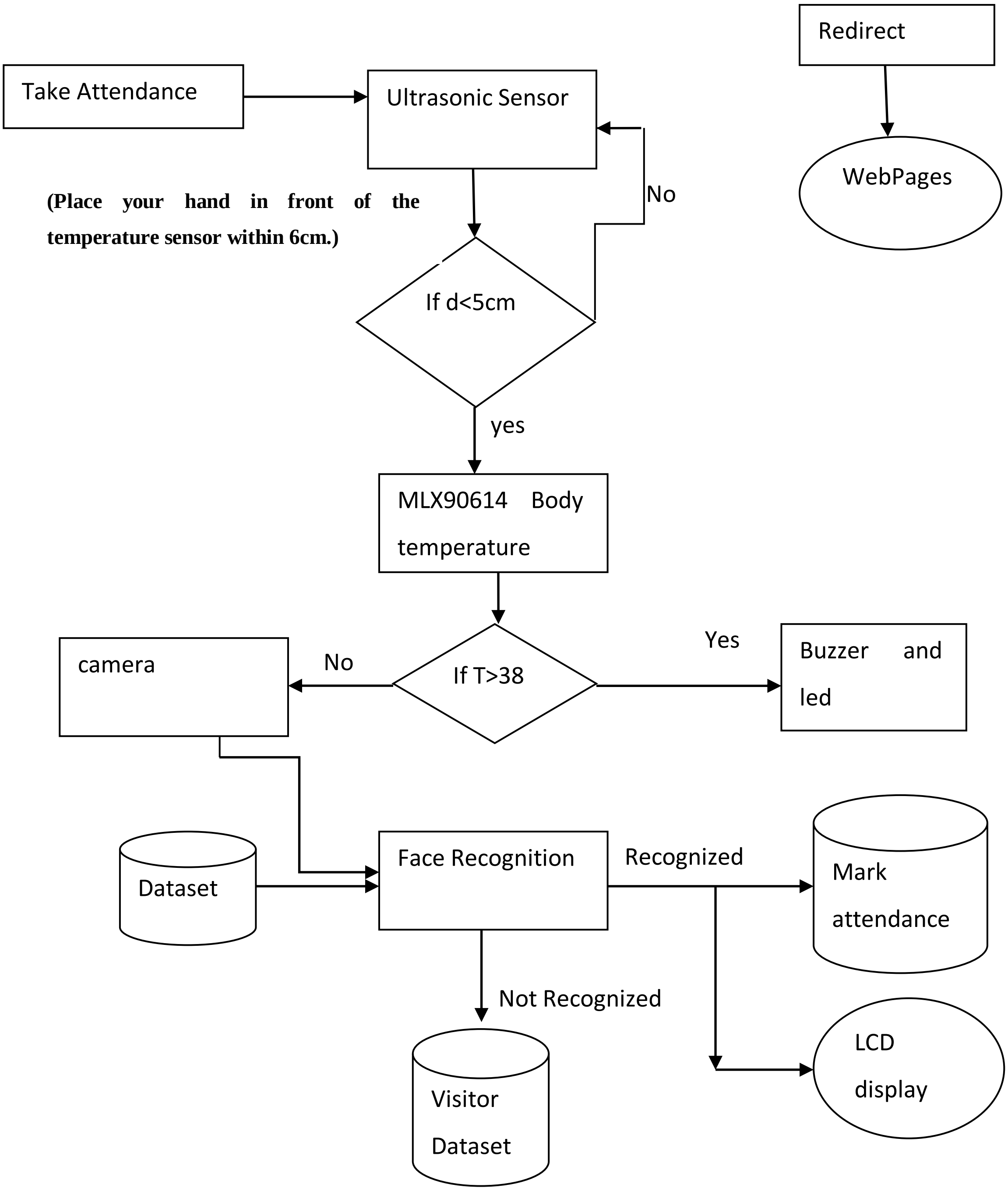


Fig5.2 Flow chart representing working of the Attendance management system.

Working of the contactless attendance management system show in fig5.2 is explained below.

- When the system is turned on the ultrasonic sensor continuously measures the distance, the candidate should place his hand in front of the temperature sensor.
- The distance needs to be below 6cm because for the proper working of the MLX90614 sensor which is used to calculate the body temperature of a candidate.
- Once the distance is found to be below 6cm the temperature of a candidate is recorded and compared with the normal human temperature(i.e.38),if the temperature is abnormal then the buzzer and red LED bulb turns on.
- Later the face recognition starts, the candidate's image is captured and preprocessed i.e. resizing, grayscale conversion, the preprocessed image is then compared with the datasets of the registered candidate.
- If the image is found in the dataset, then the attendance of the candidate is marked in the database with candidate's name, body temperature, date and time and it displays an alert message as Attendance recorded on the LCD, else the captured image is stored in the folder named visitors.
- If the same candidate whose attendance is already marked it displays alert message as Limit exceeded.

CONCLUSION:

The confidence level is a critical identification parameter and essentially measures the probability that the target parameter falls within the threshold. When confidence is weak, there is little difference between the two photos, but in order to avoid confusion in the reader's mind we take a reversal. The level of confidence now indicates the probability that the individual in a picture has the highest value of the confidence level. So, we have set our threshold on the basis of the confidence limit.

The face recognition is implemented successfully and has achieved an accuracy of 95% and detects multiple images with an accuracy of 90% as with increasing distance from the camera the faces are not detected in the dataset under ideal conditions. An acceptable amount of error is maintained under ideal conditions during testing.

Future Scope:

Further work can be done by identifying multiple faces and also sending an SMS alert to the concerned on absenteeism. Additionally, the project can be combined to detect the mood of students in the class so that the teacher can adjust the lecture accordingly in future. Moreover, we can use cloud-based services to store our dataset and also use more secure methods to send emails.

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