*A Mini Project Report on*

# Smart Attendance System

**T.E. - I.T Engineering**


**Submitted By**

**Vaishnavi Shinde 20104002**

**Gandharvi Walavekar 20104045**

**Gulshan Yadav 20104085**

**Under The Guidance Of**

**Prof. Manasi Choche**




**DEPARTMENT OF INFORMATION TECHNOLOGY**

A. P. SHAH INSTITUTE OF TECHNOLOGY

G.B. Road, Kasarvadavali, Thane (W), Mumbai-400615

UNIVERSITY OF MUMBAI


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# CERTIFICATE

This to certify that the Mini Project report on **Smart Attendance System** has been submitted by **Vaishnavi Shinde**(*20104002*), **Gandharvi Walavekar** (*20104045*) and **Gulshan Yadav(*20104085*)** who are a Bonafede students of A. P. Shah Institute of Technology, Thane, Mumbai, as a partial fulfilment of the requirement for the degree in **Information Technology**, during the academic year **2022-2023** in the satisfactory manner as per the curriculum laid down by University of Mumbai.

**Prof. Manasi Choche**
Guide

**Dr. Kiran Deshpande** **Dr. Uttam D. Kolekar**
Head Department of Information Technology
Principal

External Examiner(s)
1.
2.

Place: A. P. Shah Institute of Technology, Thane
Date:

## ACKNOWLEDGEMENT

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## ABSTRACT

A smart attendance monitoring system is a technological advancement that automates and streamlines the attendance tracking process. This system is designed to provide real-time monitoring of attendance and accurate reporting of attendance records, enabling organizations to efficiently manage their workforce or student population. The smart attendance monitoring system makes use of advanced technology of facial recognition to identify and record attendance. The use of these technologies offers a high level of accuracy, reliability, and security in the attendance tracking process.

One of the key features of the smart attendance monitoring system is its user-friendly interface. The interface allows for easy configuration and customization of the attendance tracking process, enabling organizations to adapt the system to their unique needs. This feature ensures that the system can be used in various environments, including schools, universities, offices, and other organizations.

Another advantage of the smart attendance monitoring system is its ability to generate reports in real-time. With this system, organizations can access accurate and timely attendance records, which can be used for various purposes, such as payroll processing and performance evaluation. The system also helps to minimize the risk of errors and delays, reducing the workload and costs associated with manual attendance tracking.

In summary, a smart attendance monitoring system is a highly efficient and reliable solution for attendance tracking in organizations. It offers various benefits, including real-time monitoring and reporting, accuracy, reliability, and security. The system's user-friendly interface and customization options make it an ideal solution for various environments, and its ability to generate reports in real-time is a significant advantage for organizations looking to optimize their attendance tracking process.

## TABLE OF CONTENTS

# Chapter 1

## Introduction

Attendance is an indivisible element of any institute or an organization. In today's fast-paced world, the importance of efficient attendance management cannot be overstated. Whether in a school, college, or workplace, keeping track of attendance is essential for maintaining accountability, compliance, and productivity. However, traditional attendance systems can be time-consuming, error-prone, and often ineffective in ensuring accurate attendance tracking.

Enter the smart attendance system – a cutting-edge solution that leverages the power of technology to streamline attendance management. Using advanced feature like facial recognition a smart attendance system offers a more efficient and accurate way to monitor attendance. With real-time data, automated reporting, and analytic, this system not only saves time and reduces errors but also helps organizations make informed decisions based on attendance patterns.

Overall, a smart attendance system offers a seamless and modern approach to attendance management, making it an indispensable tool for institutions and organizations looking to improve their efficiency and productivity.

### 1.1. Purpose

The purpose of a smart attendance system is to revolutionize attendance management by leveraging the power of technology to improve efficiency, accuracy, and productivity. The system aims to automate the process of taking attendance and eliminate the need for manual record-keeping, reducing errors and saving time for both administrators and attendees. By providing real-time data and analytic, a smart attendance system also allows organizations to make informed decisions based on attendance patterns and identify areas for improvement.

Moreover, a smart attendance system offers enhanced security features, such as facial recognition and fingerprint scanning, to ensure the integrity of attendance data and prevent fraudulent attendance. It also eliminates the need for physical contact, reducing the risk of the spread of infectious diseases, especially in high-density environments like schools and workplaces.

Overall, the purpose of a smart attendance system is to provide a modern and seamless attendance management solution that benefits both organizations and attendees by increasing efficiency, accuracy, and security while reducing manual workload and promoting a safer environment.

## 1.2. Problem Statement

The traditional methods of attendance management, such as manual registers and paper-based systems, are often inefficient, time-consuming, and prone to errors. These methods require a significant amount of administrative effort to maintain, which can result in wasted time and resources, leading to decreased productivity.

Moreover, traditional attendance systems are susceptible to fraudulent attendance practices, such as buddy punching and falsifying records, which can undermine the integrity of attendance data and compromise the accountability of the system. The reliance on physical contact also poses a risk of spreading infectious diseases, especially in high-density environments.

Additionally, traditional attendance systems offer limited insights into attendance patterns and do not provide real-time data and analytics, making it difficult for organizations to make informed decisions based on attendance patterns.

Thus, the problem that a smart attendance system seeks to solve is the inefficiency, inaccuracy, and lack of insights of traditional attendance management methods. It aims to provide a modern and seamless solution that automates attendance tracking, improves accuracy, and reduces the administrative burden. By leveraging advanced features like facial recognition, fingerprint scanning, and geolocation tracking, a smart attendance system also aims to enhance security and prevent fraudulent attendance practices, while promoting a safer environment by reducing physical contact.

## 1.3. Objectives

- The main objective of this project is to develop an automated face recognition based on student attendance system.

- To detect the face segment from the video frame.

- To extract the useful features from the face detected.

- To classify the features in order to recognize the face detected.

- To record the attendance of the identified student.

## 1.4. Scope

The scope of a smart attendance system includes the following:

- The system is able to track attendance automatically using advanced features such as facial recognition.
- The system is able to store attendance data securely and provide tools to manage attendance data, including real-time reporting and analytics.
- The system provides a user-friendly and seamless attendance management experience for both administrators and attendees, with a clear and intuitive interface.

Overall, the scope of a smart attendance system is to provide a comprehensive and modern attendance management solution that is secure, accurate, efficient, and user-friendly, while allowing for customization and integration with existing systems and support for future growth.

# Chapter 2

## Literature Review

| Sr.no | Title | Author(s) | Year | Algorithms | Limitations | Result |
|---|---|---|---|---|---|---|
| 1 | Face Recognition Based Smart Attendance System | Arjun Raj,Mahammed Shoheb,K Arvind,KS Chethan | 2020 | LBPH & DNN | Limited data sources.<br>Lack of comparative analysis of different machine learning techniques.<br>Does not cover areas such as sensor placement, data preprocessing, and feature extraction techniques.<br>Outdated information. | The system uses LBPH to identify students in real-time, eliminates proxy attendance,auto updates attendance data in an Excel sheet, and sends absent notifications to parents via SMS. Additionally, an Android application developed by MIT app Inventor allows students to check their attendance. |
| 2 | Student Attendance System using Face Recognition | Samridhi Dev,Tushar Patnaik | 2020 | Haar classifiers along with SVM, KNN & CNN | Sensitivity to image quality<br>Limited training data<br>Evaluation on a single dataset | The system replaces the traditional method of taking attendance by using Haar classifiers, KNN, CNN, SVM & generating attendance reports in excel format. After testing, the system is found to be accurate, and cost-effective. |

# Chapter 3

## Proposed System

Following are the main components of the proposed system:

**1. Student Registration :**

a. marks student's attendance via face

b. admin registers students' details

**2. Face Detection :**

a. detects face via inbuilt camera\webcam

**3. Face Recognition-**

a. Feature Classification :

I. categorize students after recognizing their faces

b. Feature Extraction :

I. withdraws details by cross-checking the details associated with the

faces

c. Trainer Part :

I. clubs different images of the same person, to help in identification

**4. Attendance management system**

a. Automated Attendance marking

b. Attendance details of users


**Fig 3.1. Block Diagram Of General Framework**

## 3.1. Features and Functionality

A smart attendance system is a modern technological solution for keeping track of attendance records. The system typically utilizes advanced technologies like facial recognition in our case to accurately and efficiently track attendance.

Here are some common features of a smart attendance system:

- **It reduces the number of touch points :**

a. Facial recognition requires fewer human resources than other types of

security measures, such as fingerprinting.

b. It also doesn't require physical contact or direct human interaction.

c. Without making changes in excel or manual checking in the notebook it

generates attendance lists.

- **Time efficient :**

a. This system is effective and saves time and efforts of users.

b. It saves the user's time in manually calculating attendance.

c. Automatic data validation

- **Easy performance check.**

a. It saves attendance automatically by recognizing the face.

- **User friendly environment**

- **Data security and reliability :**

a. Facial recognition also helps improve safety and security too.

## 3.2. Algorithm

### 1. Local Binary Pattern Histogram (LBPH) algorithm:

LBPH is based on a local binary operator.

It is widely used in facial recognition due to its computational simplicity and discriminatory power. It's a part of OpenCV.

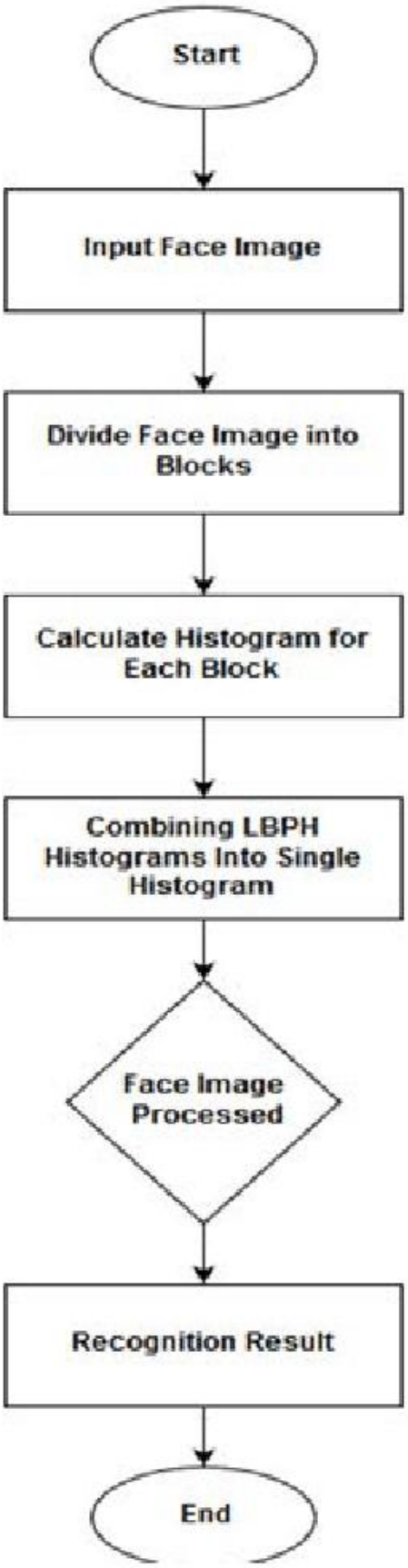



**Fig 3.2a Flowchart Of LBPH**

**The steps of the LBPH algorithm:**

**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. Keep in mind: the more sample points you include, the higher the computational cost. It is usually set at 8.

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

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

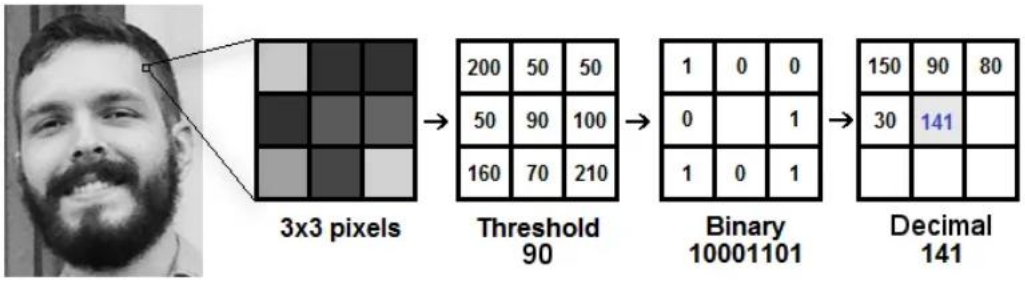
2) **Training the Algorithm:**

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. With the training set already constructed, let's see the LBPH computational steps.

**3) Applying the LBP operation:**

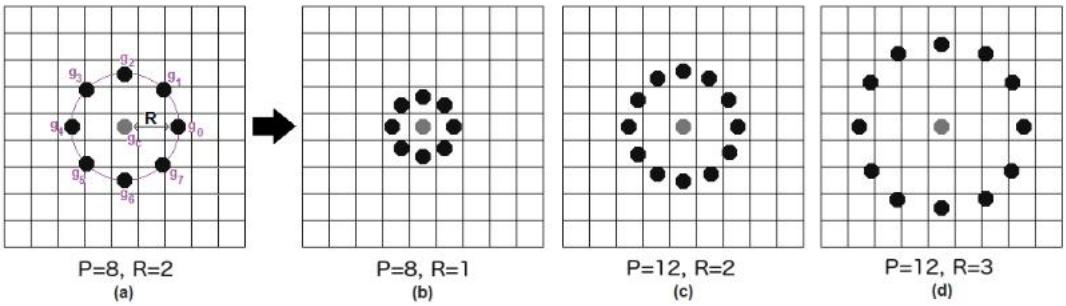
The first computational step of the LBPH is to create an intermediate image that describes the original image in a better way, by highlighting the facial characteristics. To do so, the algorithm uses a concept of a sliding window, based on the parameters radius and neighbors.

The image below shows this procedure:




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

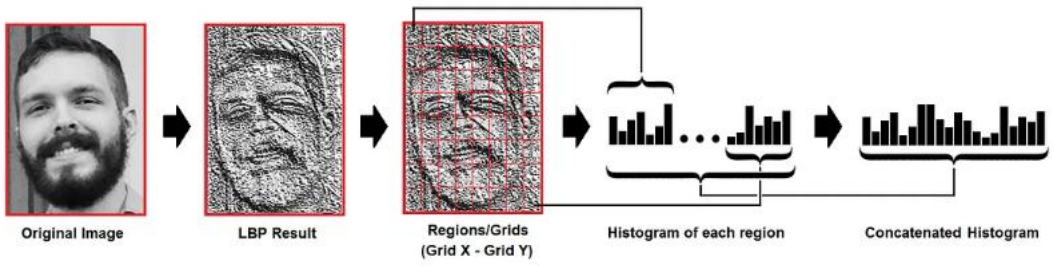
- Suppose we have a facial image on gray scale.
- We can get part of this image as a window of 3x3 pixels.
- It can also be represented as a 3x3 matrix containing the intensity of each pixel (0~255).
- Then, we need to take the central value of the matrix to be used as the threshold.
- This value will 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). Note: some authors use other approaches to concatenate the binary values (e.g. clockwise direction), but the final result will be the same.
- 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.
- Note: The LBP procedure was expanded to use a different number of radius and neighbors, it is called Circular LBP.




It can be done by using bi-linear interpolation. If some data point is between the pixels, it uses the values from the 4 nearest pixels (2x2) to estimate the value of the new data point.

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:




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

- As we have an image in gray scale, 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.The LBPH algorithm is pretty much it.

**5) Performing 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 create 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 (calculating 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.
- Note: don’t be fooled by the ‘confidence’ name, as lower confidence is better because it means the distance between the two histograms is closer.
- 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.

**Conclusions:**

- LBPH is one of the easiest face recognition algorithms.
- It can represent local features in the images.
- It is possible to get great results (mainly in a controlled environment).
- It is robust against monotonic gray scale transformations.
- It is provided by the OpenCV library (Open Source Computer Vision Library).

## 2. Haar Cascade Classifier:

Haar Cascade is a popular object detection algorithm that is often used in computer vision applications. It is based on the Viola-Jones algorithm and is used to detect objects in an image or video stream.

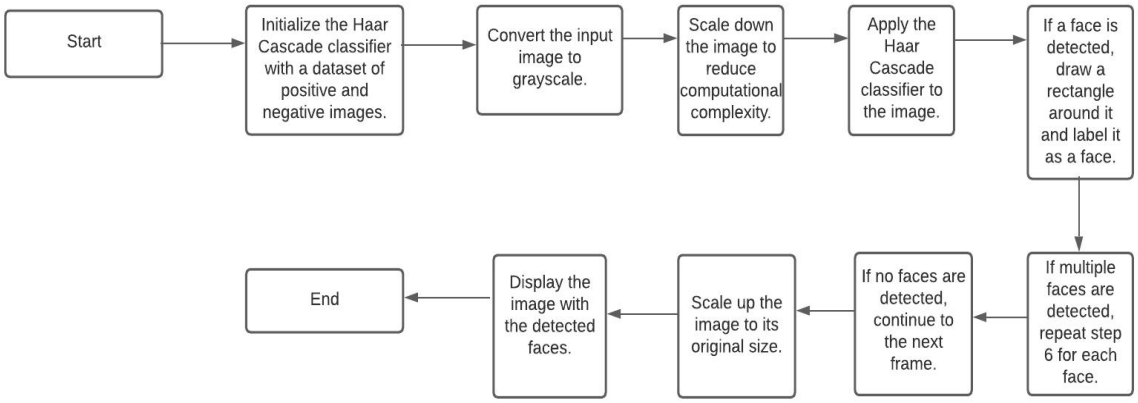



**Fig 3.2b Flowchart Of Haar Cascade**

**The steps of the Haar Cascade algorithm:**

The above flowchart illustrates the basic steps involved in using the Haar Cascade algorithm to detect faces in an image or video stream. The algorithm starts by initializing the classifier with a dataset of positive and negative images. It then converts the input image to gray scale and scales it down to reduce computational complexity. The classifier is then applied to the image, and if a face is detected, a rectangle is drawn around it and labeled as a face. This process is repeated for each face in the image, and the final image is displayed with the detected faces.

# Chapter 4

## Requirement Analysis

### 1. Functional Requirements

- The system should be able to capture attendance data automatically and accurately.
- The system should be able to recognize individual students and track their attendance records over time.The system should be able to capture attendance data automatically and accurately.
- The system should be able to recognize individual students and track their attendance records over time.

### 2. Non-Functional Requirements

- The system should be secure and protect personal data.
- The system should be user-friendly and easy to use for teachers, students, and administrators.
- The system should be compatible with a range of devices and operating systems.

# Chapter 5

# Project Design

## 5.1. Use Case Diagram

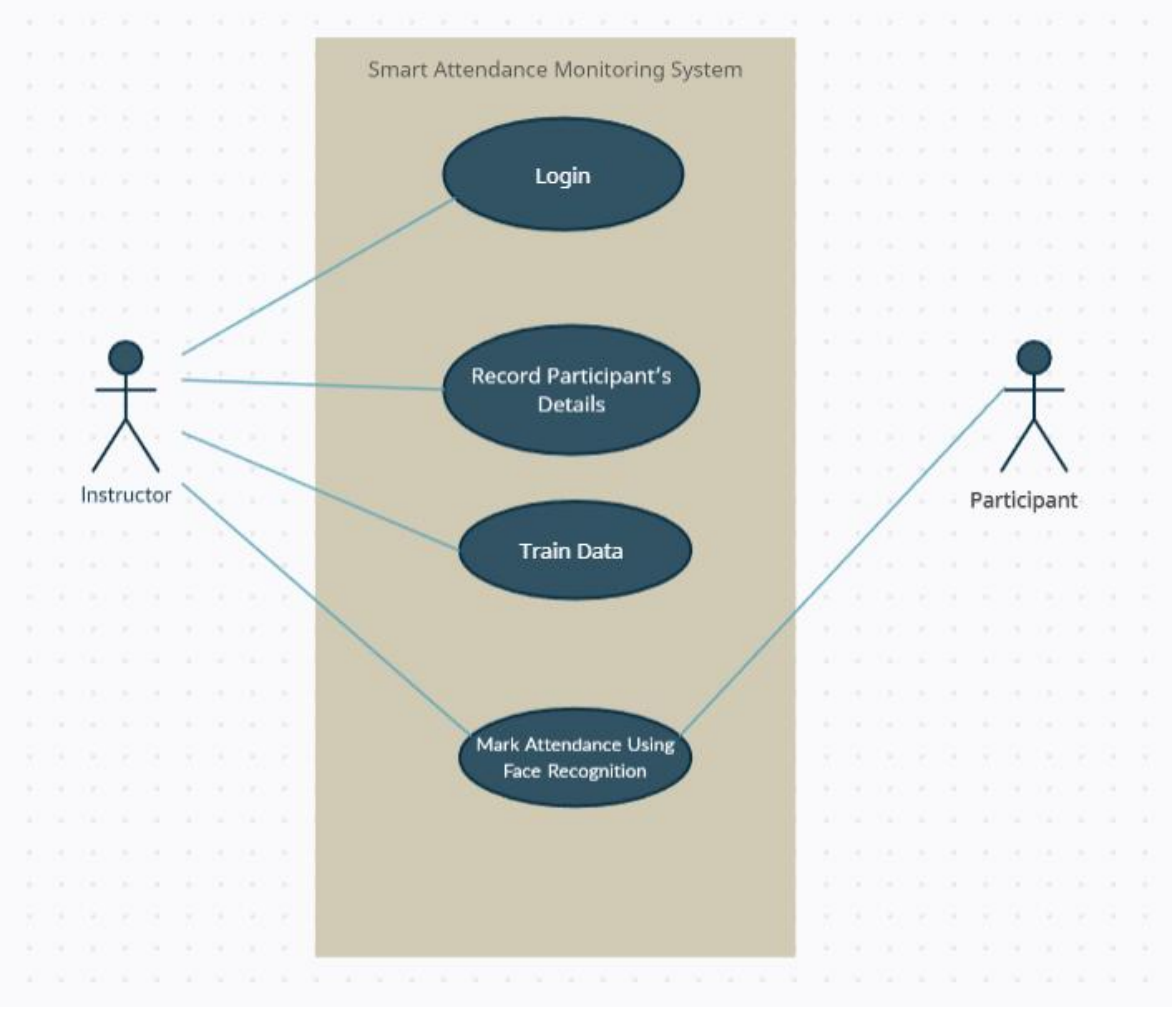



**Fig 5.1. Use Case Diagram**

## 5.2. DFD (Data Flow Diagram)

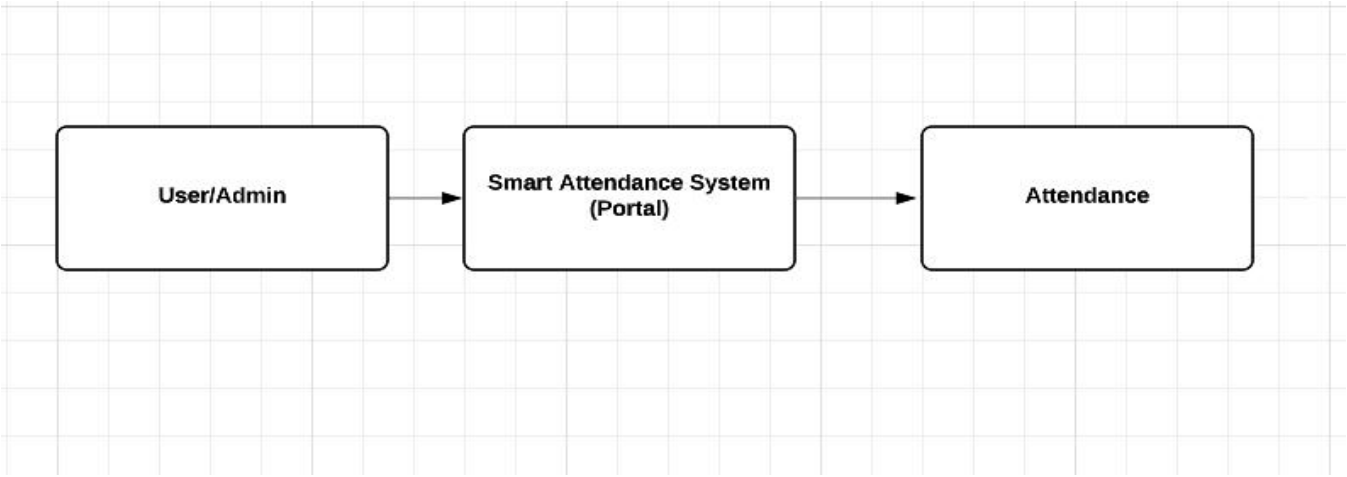



**Fig 5.2a.DFD (Level 0)**

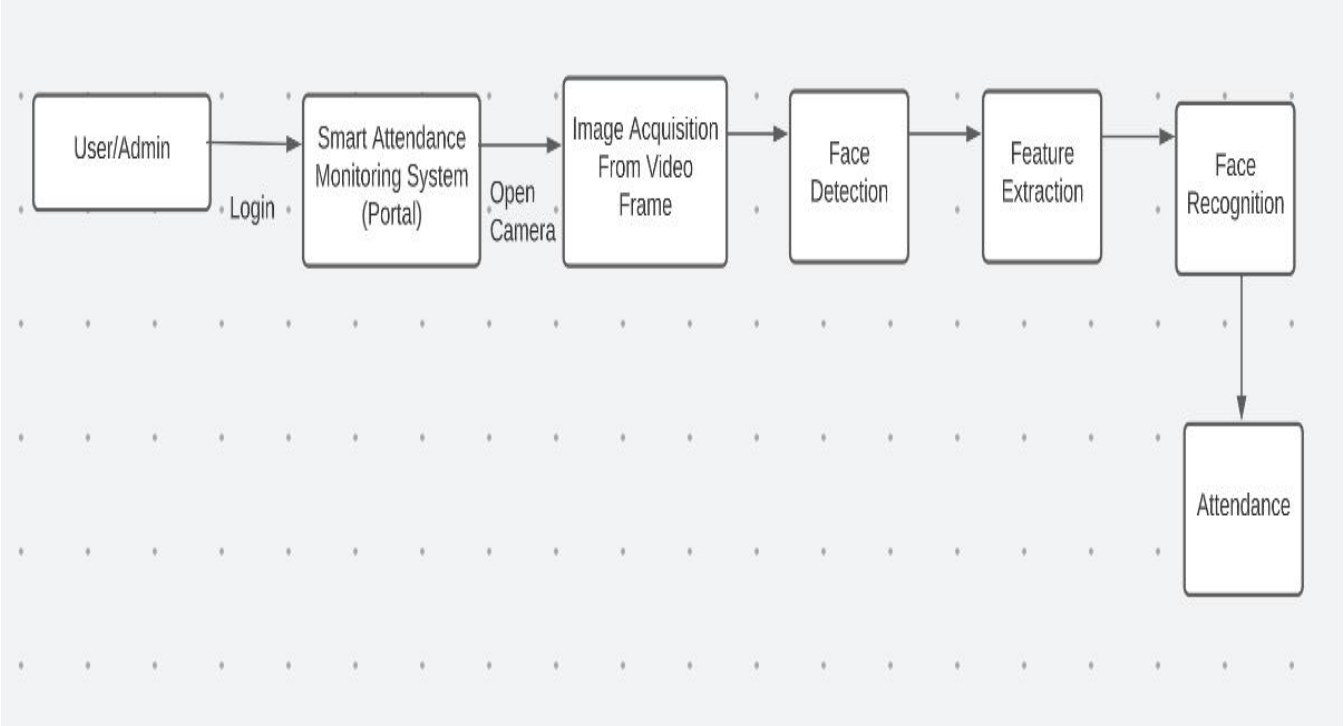



**Fig 5.2b. DFD (Level 1)**

## 5.3. System Architecture:

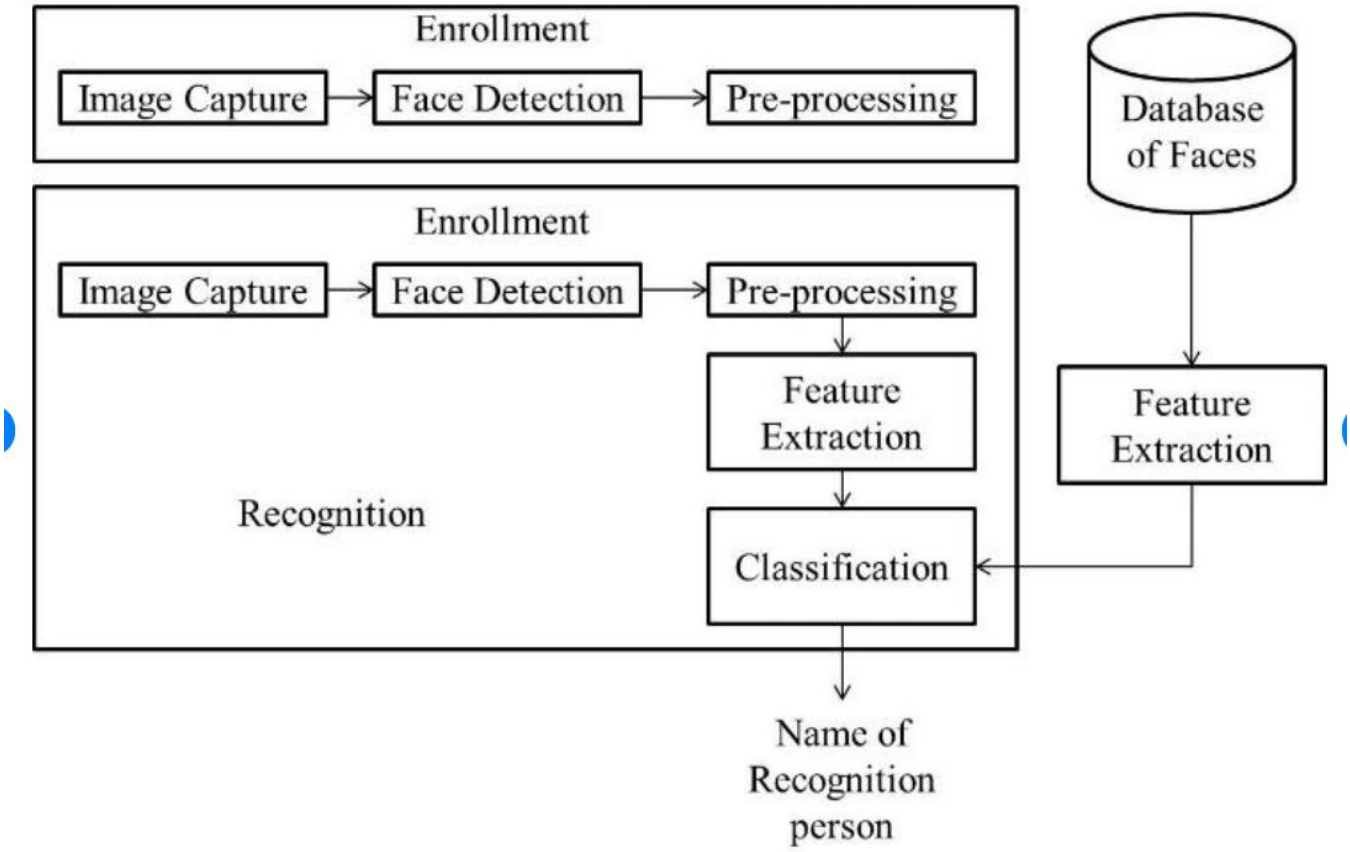



**Fig 5.3 System Architecture**

# Chapter 6

## Technical Specifications

**Frontend:**

**Python - Idle:**

IDLE (Integrated Development and Learning Environment) is an integrated development environment (IDE) for Python. The Python installer for Windows contains the IDLE module by default. IDLE can be used to execute a single statement just like Python Shell and also to create, modify, and execute Python scripts. IDLE provides a fully-featured text editor to create Python scripts that includes features like syntax highlighting, auto completion, and smart indent. It also has a debugger with stepping and break-point features.

● **OpenCV** is a huge open-source library for computer vision, machine learning, and image processing. OpenCV supports a wide variety of programming languages, like Python, C++, Java, etc. It can process images and videos to identify objects, faces, or even the handwriting of a human. When it is integrated with various libraries, whatever operations one can do in Numpy can be combined with OpenCV.

● The **Graphical User Interface (GUI)** is a form of user interface that allows users to interact with electronic devices through graphical icons and audio indicators such as primary notation, instead of text-based user interfaces, typed command labels or text navigation. GUIs were introduced in reaction to the perceived steep learning curve of command-line interfaces (CLIs), which require commands to be typed on a computer keyboard.

● **Tkinter - Python GUI**

Tkinter is the standard GUI library for Python. Python when combined with Tkinter provides a fast and easy way to create GUI applications. Tkinter provides a powerful object-oriented interface to the Tk GUI toolkit.

**BackEnd :**

**MySQL Workbench:**

MySQL Workbench is a visual database design tool that integrates SQL development, administration, database design, creation and maintenance into a single integrated development environment for the MySQL database system. It is the successor to DBDesigner 4 from fabFORCE.net, and replaces the previous package of software, MySQL GUI Tools Bundle. More features: SQL Editor, Performance monitoring, Data modeling, Database migration.

● **Database - MySQL** MySQL is an open-source relational database management system (RDBMS). Its

The name is a combination of "My", the name of co-founder Michael Widenius's daughter, and "SQL", the abbreviation for Structured Query Language. A relational database organizes data into one or more data tables in which data types may be related to each other; these relations help structure the data. SQL is a language programmers use to create, modify and extract data from the relational database, as well as control user access to the database. In addition to relational databases and SQL, an RDBMS like MySQL works with an operating system to implement a relational database in a computer's storage system, manages users, allows for network access and facilitates testing database integrity and creation of backups. MySQL is free and open-source software under the terms of the GNU General Public License, and is also available under a variety of proprietary licenses.

● **Laptop Camera**

# Chapter 7

## Project Scheduling

| Sr. No | Group Member | Time duration | Work to be done |
|---|---|---|---|
| 1 | Vaishnavi Shinde,Gandharvi Walavekar | 3rd week of January | Implementation of TKINTER package i.e base of application starting with the main page of our application. |
| | | 4th week of January | Implementation of classes and objects i.e creation of classes required for building our application. |
| 2 | Vaishnavi Shinde,Gandharvi Walavekar, Gulshan Yadav | 2nd week of February | Implementation of client-side GUI , for connecting users with our application. |
| | | | Implementation of trainer module using LBPH algorithm. |
| 3 | Vaishnavi Shinde,Gandharvi Walavekar, Gulshan Yadav | By the end of march month | Implementation of the complete application along with testing conditions. |

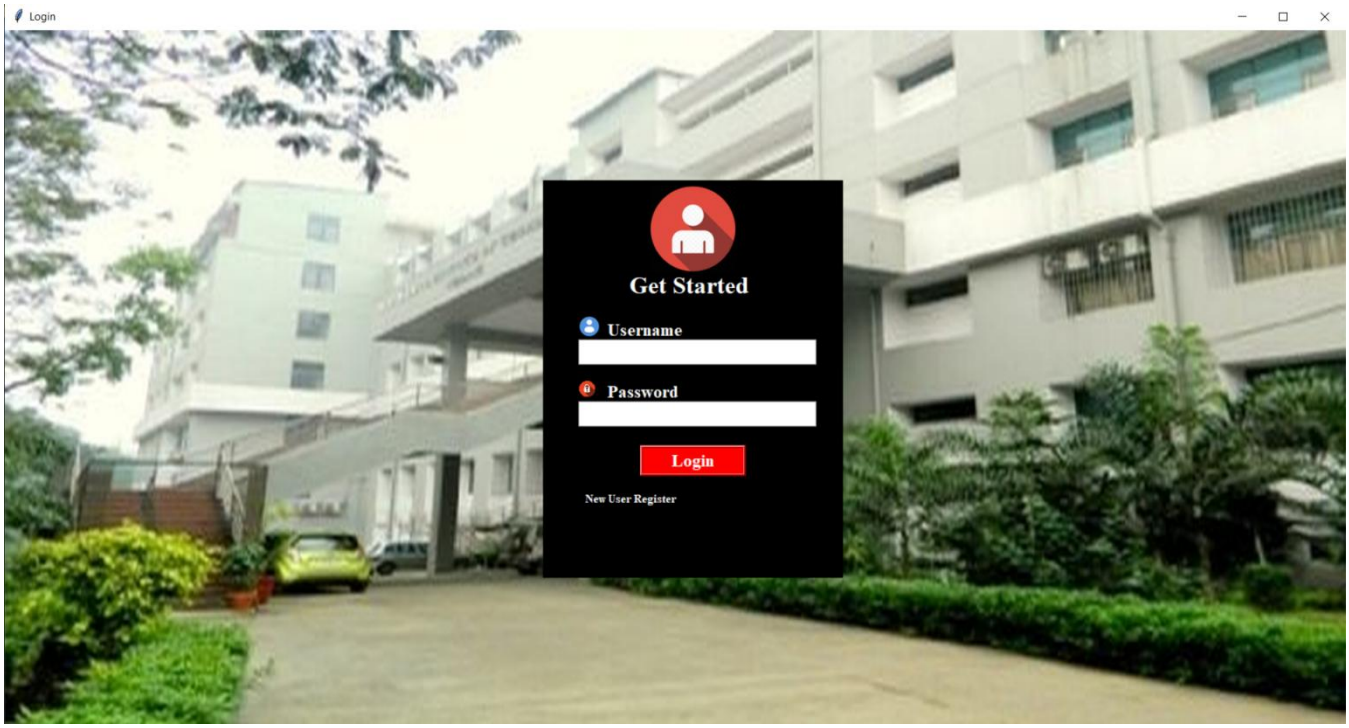
# Chapter 8

## Implementation

- **User side :**

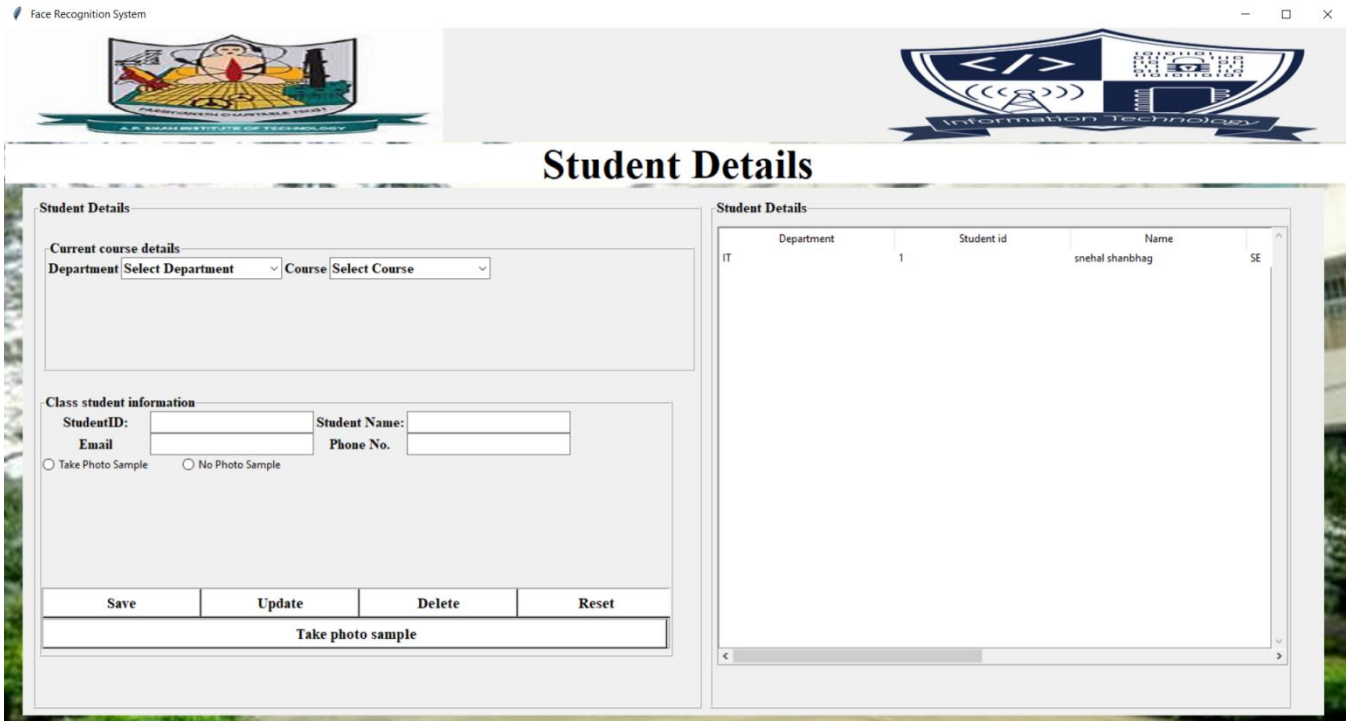

By clicking on the face recognition button, user/student can mark their attendance.

**● Admin side:**

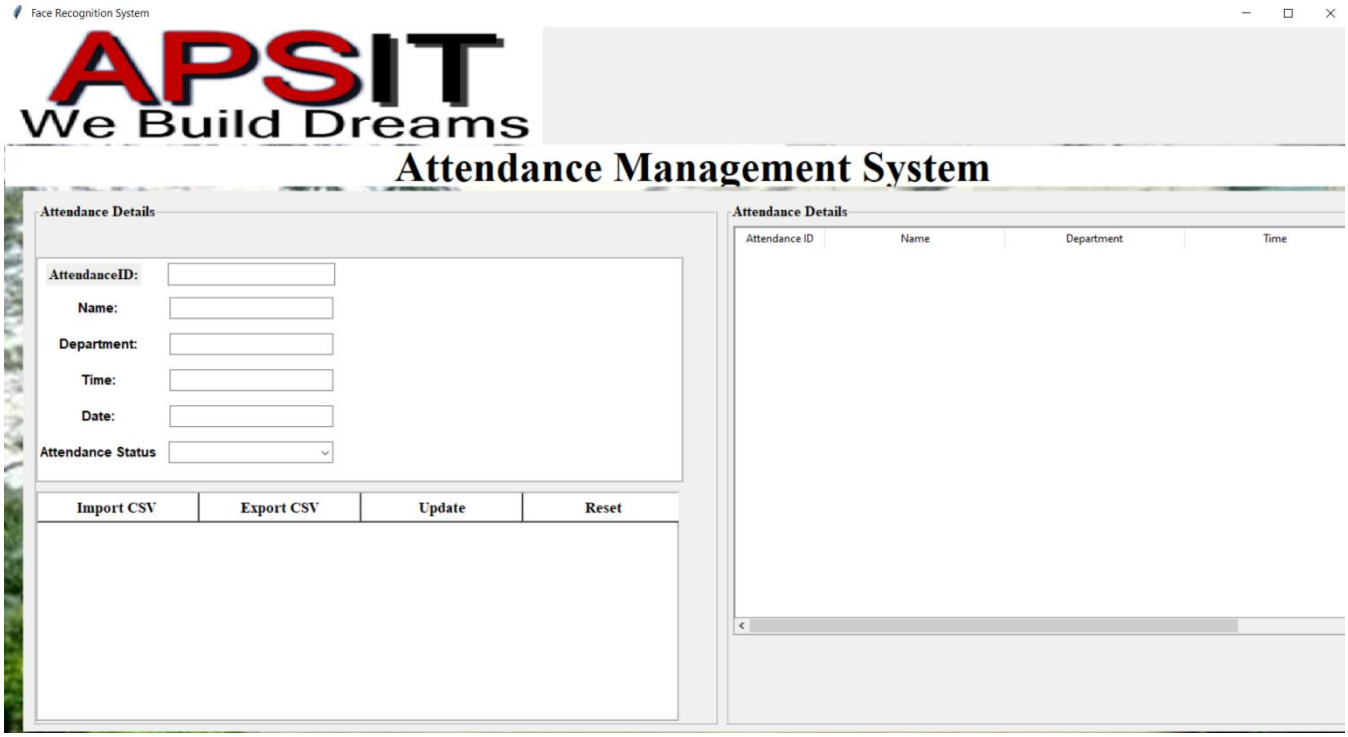



Once the admin is successfully logged in, they can see the main page.

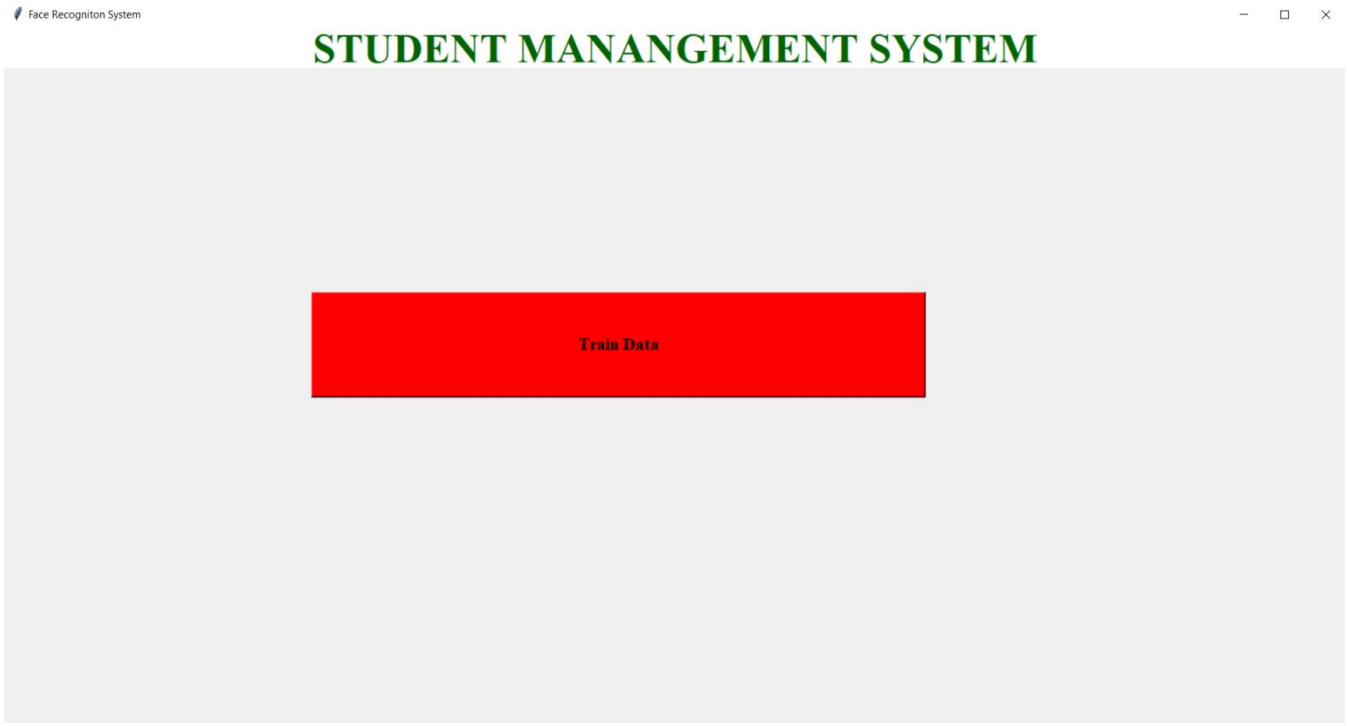

● **Student details :**



● **Attendance :**


Face Recognition System
APSIT
We Build Dreams
Attendance Management System
Attendance Details
AttendanceID:
Name:
Department:
Time:
Date:
Attendance Status
Import CSV
Export CSV
Update
Reset
Attendance Details
Attendance ID
Name
Department
Time

● For training the machine with a data set:



# Chapter 9

## Result and Discussion

A smart attendance monitoring system can provide several benefits, including improved accuracy and efficiency in tracking attendance, reduced administrative burden for teachers and staff, and enhanced security for campuses. By utilizing technology of facial recognition, the system can quickly and accurately identify students and staff as they enter and mark their attendance. This can also help to prevent proxies. Additionally, the data collected by the system can be used to generate reports and insights that can inform decision-making and help to identify patterns or issues related to attendance. Overall, a smart attendance monitoring system can offer a valuable tool for schools and other organizations seeking to streamline attendance tracking and enhance security.

In this approach, a face recognition based automated student attendance system is thoroughly described. The proposed approach provides a method to identify the individuals by comparing their input image obtained from image frame with respect to the train image. This proposed approach is able to detect and localize faces from an input facial image, which is obtained from the recording image frame. Besides, it provides a method in the pre-processing stage to enhance the image contrast and reduce the illumination effect. The accuracy of this proposed approach is 100 % for high-quality images, 92.31 % for low-quality images

# Chapter 10

## Conclusion and Future Scope

In conclusion, a smart attendance monitoring system offers numerous advantages for schools and organizations seeking to improve their attendance tracking processes. By utilizing advanced technology of facial recognition, the system can accurately and efficiently identify students and manage attendance. With the ability to generate reports and insights based on the data collected, the system can help administrators identify patterns or issues related to attendance and make informed decisions. Ultimately, a smart attendance monitoring system can offer a valuable tool for enhancing efficiency, reducing administrative burden, and promoting safety and security on campus.

The future scope of smart attendance monitoring systems is vast, as technology continues to advance and new innovations emerge. Some potential areas for development and expansion include:

- **Integration with other systems:** Smart attendance monitoring systems can be integrated with other school systems, such as student information systems or learning management systems, to provide a more comprehensive view of student performance and engagement.
- **Personalized attendance tracking**: With the use of wearable technology or mobile apps, attendance tracking can be customized to individual student needs, such as tracking attendance for remote or hybrid learners.
- **AI-powered analysis:** Artificial intelligence and machine learning can be used to analyze attendance data and identify patterns or trends that can inform school policies and interventions.
- **Predictive analytics:** By analyzing historical attendance data, smart attendance monitoring systems can predict future attendance patterns and alert administrators to potential issues or trends.
- **Enhanced security features:** Smart attendance monitoring systems can be further developed to include features such as facial recognition or voice recognition to enhance security measures and prevent unauthorized access.

Overall, the future scope of smart attendance monitoring systems is promising, and their potential to enhance attendance tracking, inform decision-making, and promote safety and security on school campuses is significant.

# Chapter 11

## References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https://docs.python.org/3/library/idle.html

[8] Mysql Documentation

https://dev.mysql.com/doc/