“FACE RECOGNITION ATTENDANCE SYSTEM”

A

Project Report

submitted

in partial fulfillment

for the award of the Degree of

Bachelor of Technology

in Department of Information Technology

Project Mentor:
Mrs. Richa Rawal
Associate Professor

Submitted By :
Ishika Agarwal, 19ESKIT032
Kritika Surana, 19ESKIT046
Kunal Bharagatiya, 19ESKIT048
Lavanya Jain, 19ESKIT051

Department of Information Technology
Swami Keshvanand Institute of Technology, M & G, Jaipur
Rajasthan Technical University, Kota
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Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Department of Information Technology

CERTIFICATE

This is to certify that Ms Ishika Agarwal a student of B.Tech(Information Technology & Engineering) 8th semester has submitted her Project Report entitled ”Face Recognition Attendance System” under my guidance.

Mentor

Mrs. Richa Rawal

Associate Professor, IT

Coordinator

Mrs Sanju Chaudhary

Associate Professor, IT

Swami Keshvanand Institute of Technology, Management & Gramothan, Jaipur

Department of Information Technology

CERTIFICATE

This is to certify that Ms Kritika Surana a student of B.Tech(Information Technology & Engineering) 8th semester has submitted her Project Report entitled ”Face Recognition Attendance System” under my guidance.

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Associate Professor, IT

Coordinator

Mrs. Sanju Chaudhary

Associate Professor,IT

Swami Keshvanand Institute of Technology,

Management & Gramothan, Jaipur

Department of Information Technology

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This is to certify that Mr Kunal Bharagatiya a student of B.Tech(Information Technology & Engineering) 8th semester has submitted his Project Report entitled ”Face Recognition Attendance System” under my guidance.

Mentor

Mrs. Richa Rawal

Associate Professor,IT

Coordinator

Mrs. Sanju Chaudhary

Associate Professor, IT

Swami Keshvanand Institute of Technology,

Management & Gramothan, Jaipur

Department of Information Technology

CERTIFICATE

This is to certify that Ms Lavanya Jain a student of B.Tech(Information Technology & Engineering) 8th semester has submitted her Project Report entitled ”Face Recognition Attendance System” under my guidance.

Mentor

Mrs. Richa Rawal

Associate Professor, IT

Coordinator

Mrs. Sanju Chaudhary

Associate Professor, IT

Acknowledgement

A project of such a vast coverage cannot be realized without help from numerous sources and people in the organization.We take this opportunity to express our gratitude to all those who have been helping us in making this project successful.

We are highly indebted to our faculty mentor Ms Richa Rawal .She has been a guide, motivator source of inspiration for us to carry out the necessary proceedings for the project to be completed successfully. We also thank our project coordinator for his co-operation, encouragement, valuable suggestions and critical remarks that galvanized our efforts in the right direction.

We would also like to convey our sincere thanks to Prof. Anil Chaudhary, HOD, Department of Information Technology, for facilitating, motivating and supporting us during each phase of development of the project.Also, we pay our sincere gratitude to all the Faculty Members of Swami Keshvanand Institute of Technology, Management and Gramothan, Jaipur and all our Colleagues for their co-operation and support.

Last but not least we would like to thank all those who have directly or indirectly helped and cooperated in accomplishing this project.

Team Members:

Ishika Agarwal, 19ESKIT032

Kritika Surana,19ESKIT046

Kunal Bhargatiya,19ESKIT048

Lavanya Jain, 19ESKIT051

Table of Content

List of Figures

Chapter 1
Introduction

1.1 Problem Statement and Objective

To develop an automated attendance system using face recognition Concept in a classroom with large number of students, it is a very tedious and time-consuming task to take the attendance manually. Therefore, we can implement an effective system which will mark the attendance of students automatically by recognizing their faces. The system will capture the images of the students and using face recognition algorithm mark the attendance in the sheet. This way the class-teacher will get their attendance marked without actually spending time in traditional attendance marking.

1.2 Literature Survey

Study of the major research has been checked and studied thoroughly and got some key points to refer Camera-based object Detection, identification and distance estimation technical paper to build our project. So basically, we focus image identification part in this project.

1.3 Introduction to Project

The main objective of this project is to develop face recognition based automated student attendance system. In order to achieve better performance, the test images and training images of this proposed approach are limited to frontal and upright facial images that consist of a single face only. In addition, the students have to register in the database to be recognized. The enrolment can be done on the spot through the user-friendly interface.

1.4 Algorithms

1. LBPH algorithm: The LBPH algorithm is a combination of Local Binary Pattern (LBPH) and Histogram Oriented Gradients (HOG), which is used to change the performance of face recognition results to be more accurate. LBPH is famous for its performance and accuracy, which can recognize a person's face from both the front and the side.
2. Haar Cascade algorithm: It is an algorithm that can detect objects in images, irrespective of their scale in image and location. This algorithm is not so complex and can run in real-time.

1.5 Scope of the Project

A face recognition system is a computer application for automatically identifying or verifying a person from a digital image or a video frame from a video source. One of the ways to do this is by comparing selected facial features from the image and a facial database. It is typically used in security systems and can be compared to other biometrics such as fingerprint or eye iris recognition systems. Some facial recognition algorithms identify facial features by extracting landmarks, or features, from an image of the subject's face. For example, an algorithm may analyze the relative position, size, and/or shape of the eyes, nose, cheekbones, and jaw. These features are then used to search for other images with matching features. Other algorithms normalize a gallery of face images and then compress the face data, only saving the data in the image that is useful for face recognition

Chapter 2
Software Requirement Specification

2.1 Overall Description

All the students of the class must register themselves by entering the required details and then their images will be captured and stored in the dataset. During each session, faces will be detected from live streaming video of classroom. The faces detected will be compared with images present in the dataset. If match found, attendance will be marked for the respective student. The task of the proposed system is to capture the face of each student and to store it in the database for their attendance. The face of the student needs to be captured in such a manner that all the feature of the students' face needs to be detected, even the seating and the posture of the student need to be recognized. There is no need for the teacher to manually take attendance in the class because the system records a video and through further processing steps the face is being recognized and the attendance database is updated

2.2 Details of Hardware and Software

2.2.1 Hardware Requirements

- Laptop with 8 GB RAM or above.
- Camera 720p or above

2.2.2 Software Requirements

- Visual Studio Code
- Tkinter

2.3 Design Details

2.3.1 System Flow

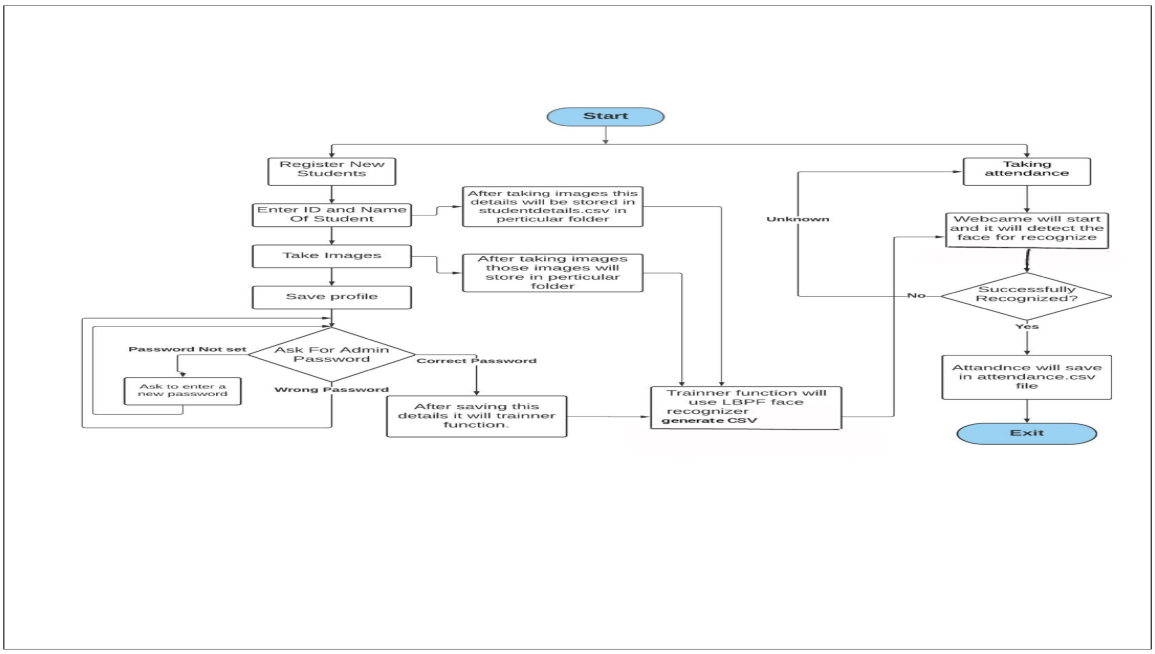


Figure 2.1: System Flow Diagram

2.4 Analysis/Framework/ Algorithm:

2.4.1 Haar Cascade Algorithm:-

It is a machine learning based approach where a cascade function is trained from a lot of positive and negative images (where positive images are those where the object to be detected is present, negative are those where it is not). It is then used to detect objects in other images. Luckily, OpenCV offers pre-trained Haar cascade algorithms, organized into categories (faces, eyes and so forth), depending on the images they have been trained on.

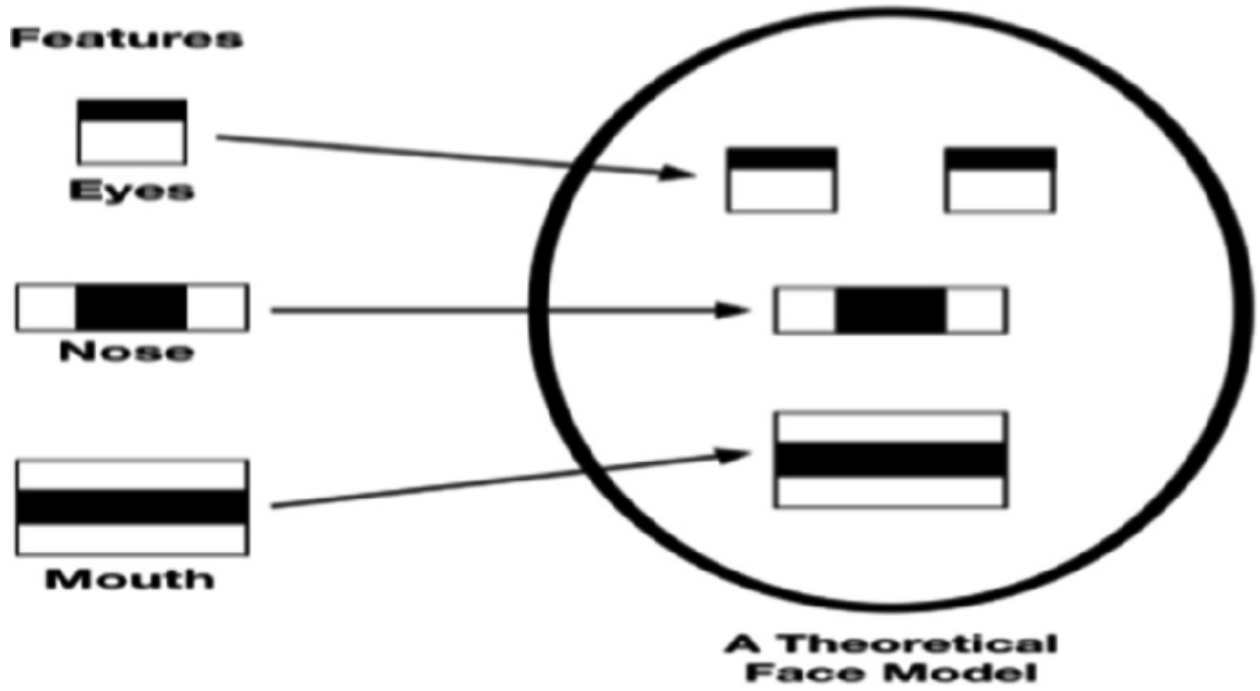


Figure 2.2: Haar Features

2.4.2 LBPH Algorithm : -

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 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.

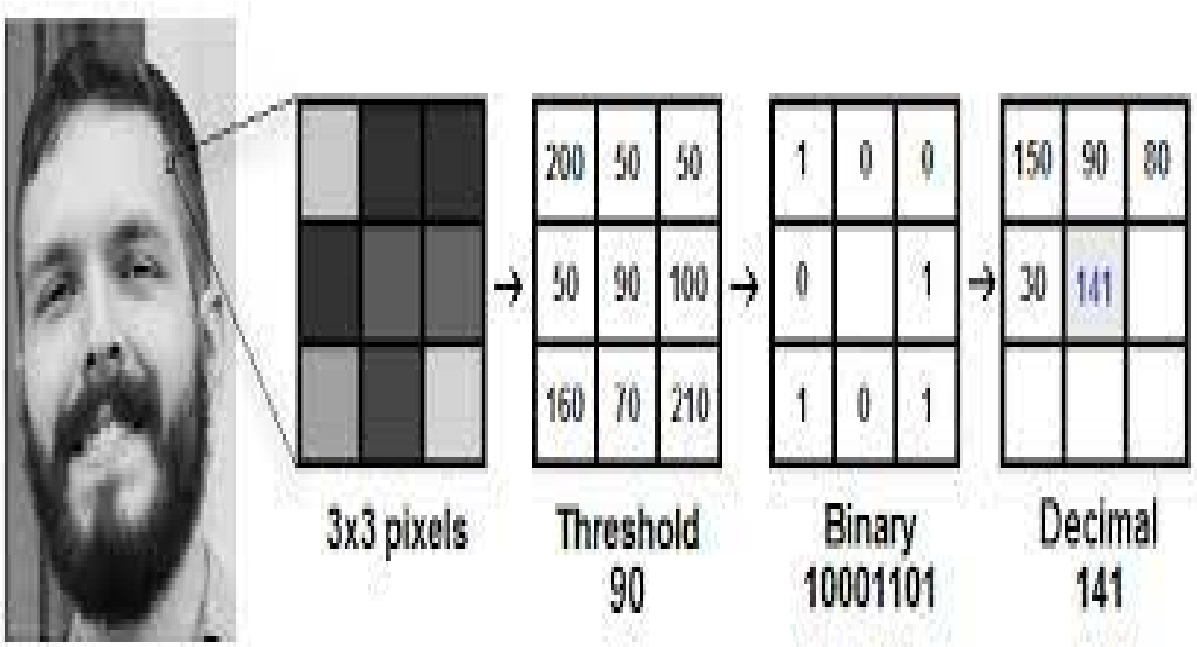


Figure 2.3: LBPH

2.4.3 OpenCV Library: -

OpenCV (Open-Source Computer Vision Library) is an open-source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in the commercial products. Being a BSD-licensed product, OpenCV makes it easy for businesses to utilize and modify the code.

2.4.4 NumPy package: -

NumPy is a Python package which stands for 'Numerical Python'. It is the core library for scientific computing, which contains a powerful n-dimensional array object, provide tools for integrating C, C++ etc. It is also useful in linear algebra, random number capability etc.

2.4.5 Pandas Library: -

Pandas is a high-level data manipulation tool developed by Wes McKinney. It is built on the NumPy package and its key data structure is called the Data Frame. Data Frames allow you to store and manipulate tabular data in rows of observations and columns of variables.

2.4.6 Tkinter Module :-

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.

2.4.7 Time Module:-

Python has a module named time to handle time related task. To use functions defined in the module, we need to import the module first.

2.4.8 Date Time Module:-

A date in python is not a date type of its own, but we can import a module named date time work with dates as a date objects.

Chapter 3
Functional And Non-Functional Requirements

Functional user requirements may be high-level statements of what the system should do but functional system requirements should also describe clearly about the system services in detail.

3.1 External Interface Requirements

3.1.1 User Interface

The user interface for the software shall be compatible to any Android version by which user can access to the system. The user interface shall be implemented using any tool or software package like Laptop,Python, MYSQL etc.

3.1.2 Hardware Interfaces

Since the application must run over the internet, the hardware shall require to connect internet to the hardware

3.1.3 Software Interfaces

This system is a Single-user, multi-tasking environment. It enables the user to interact with the server It uses Python as the front end programming tool and MySQL as the back end application tool.

3.1.4 Communication Interfaces

The Face Recognition Attendance System shall use the HTTP protocol for communication over the internet and for the intranet communication will be through TCP/IP

protocol suite.

3.2 Non Functional Requirements

3.2.1 Performance Requirements

- System can produce results faster on 2GB/4GB of RAM.
- It may take LESS time for peak loads at main node.
- The system will be available 100 percent of the time. Once there is a fatal error, the system will provide understandable feedback to the user.

3.3 Basic Flow Diagram

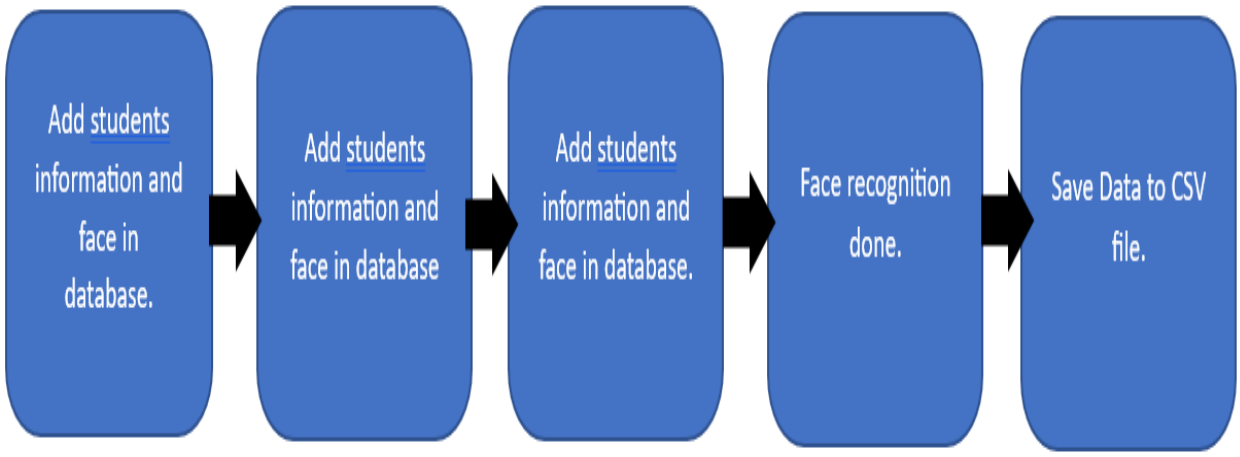


Figure 3.1: Basic Flow Diagram

3.4 Use Case Diagram

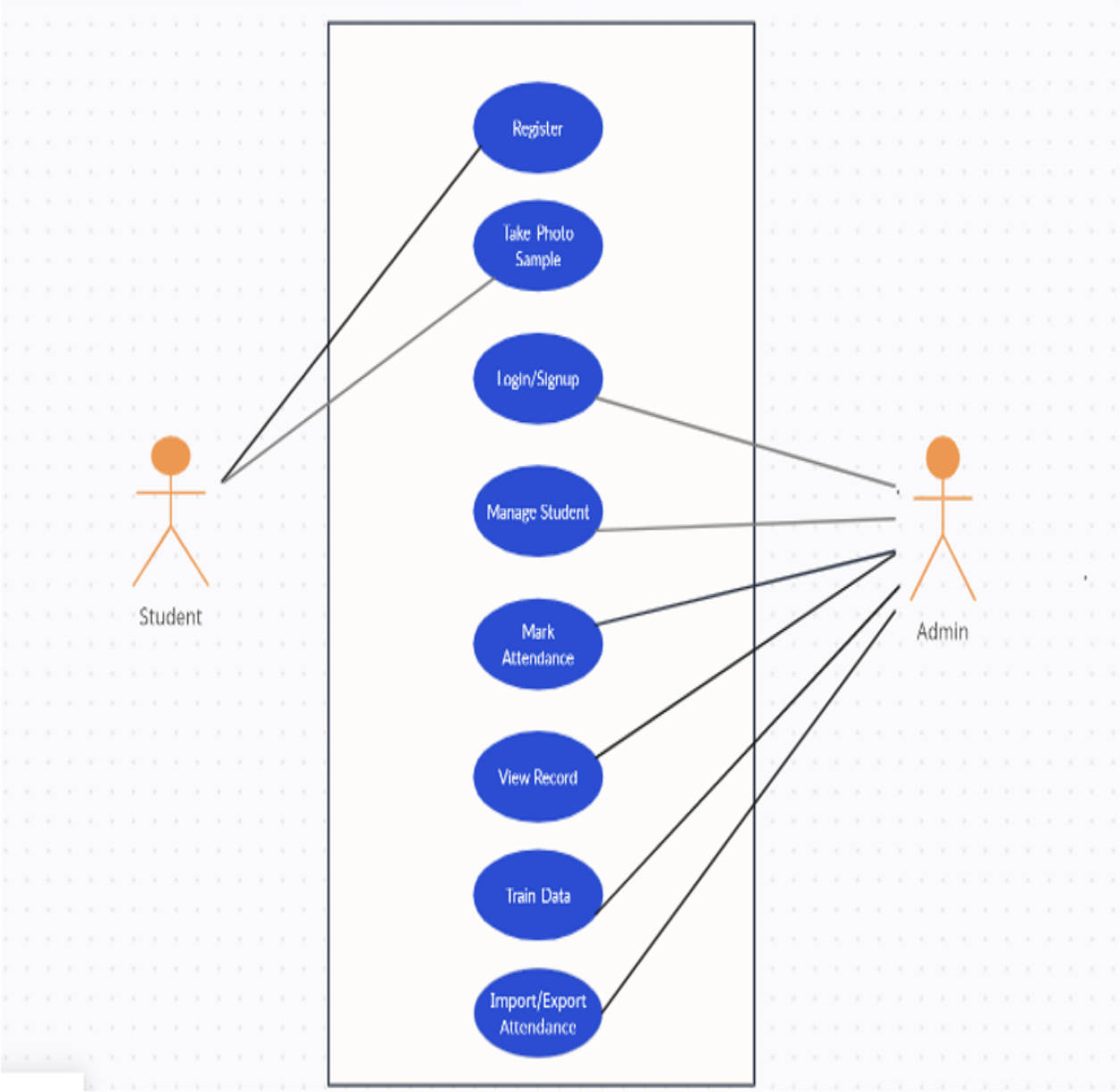
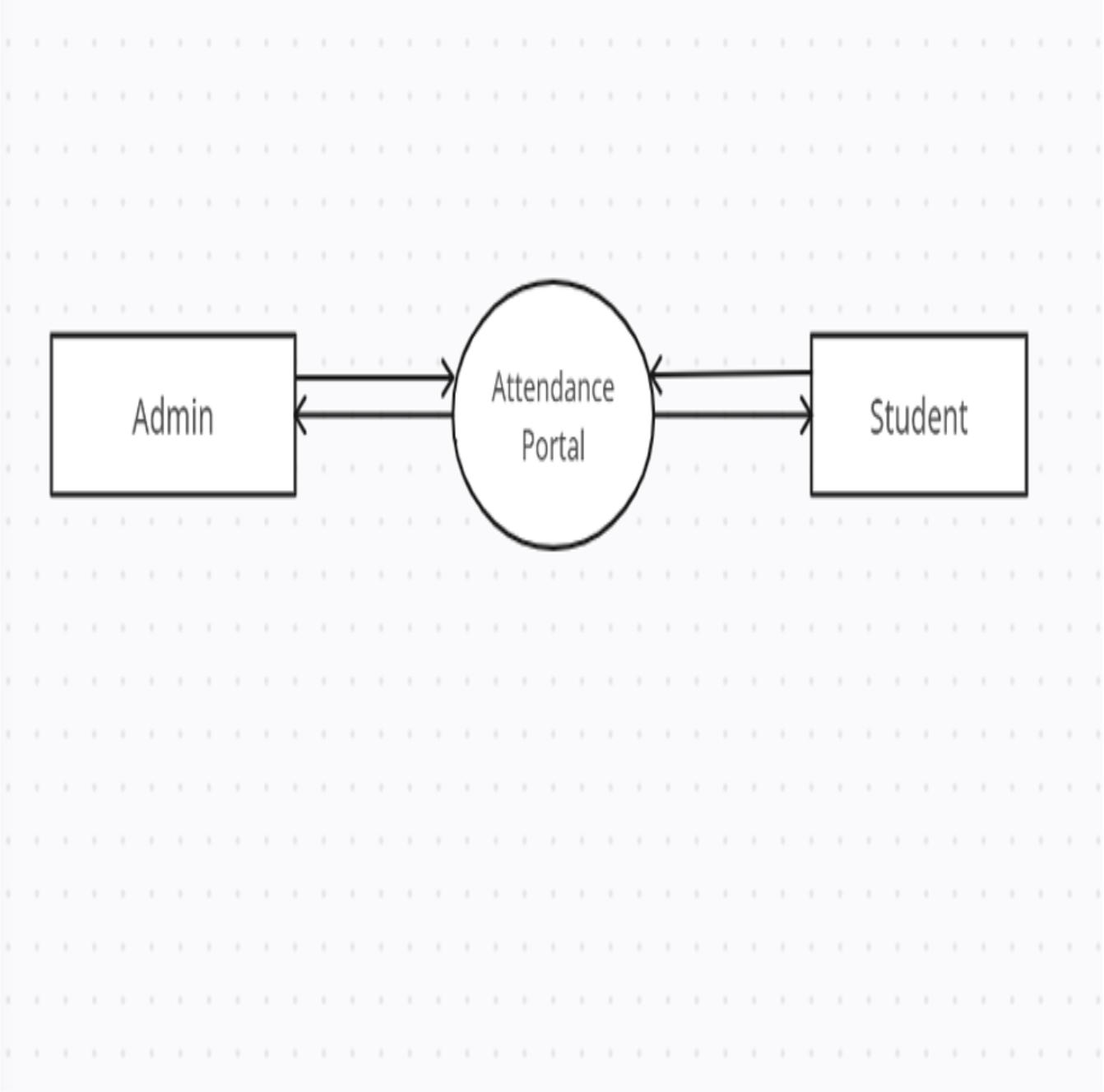


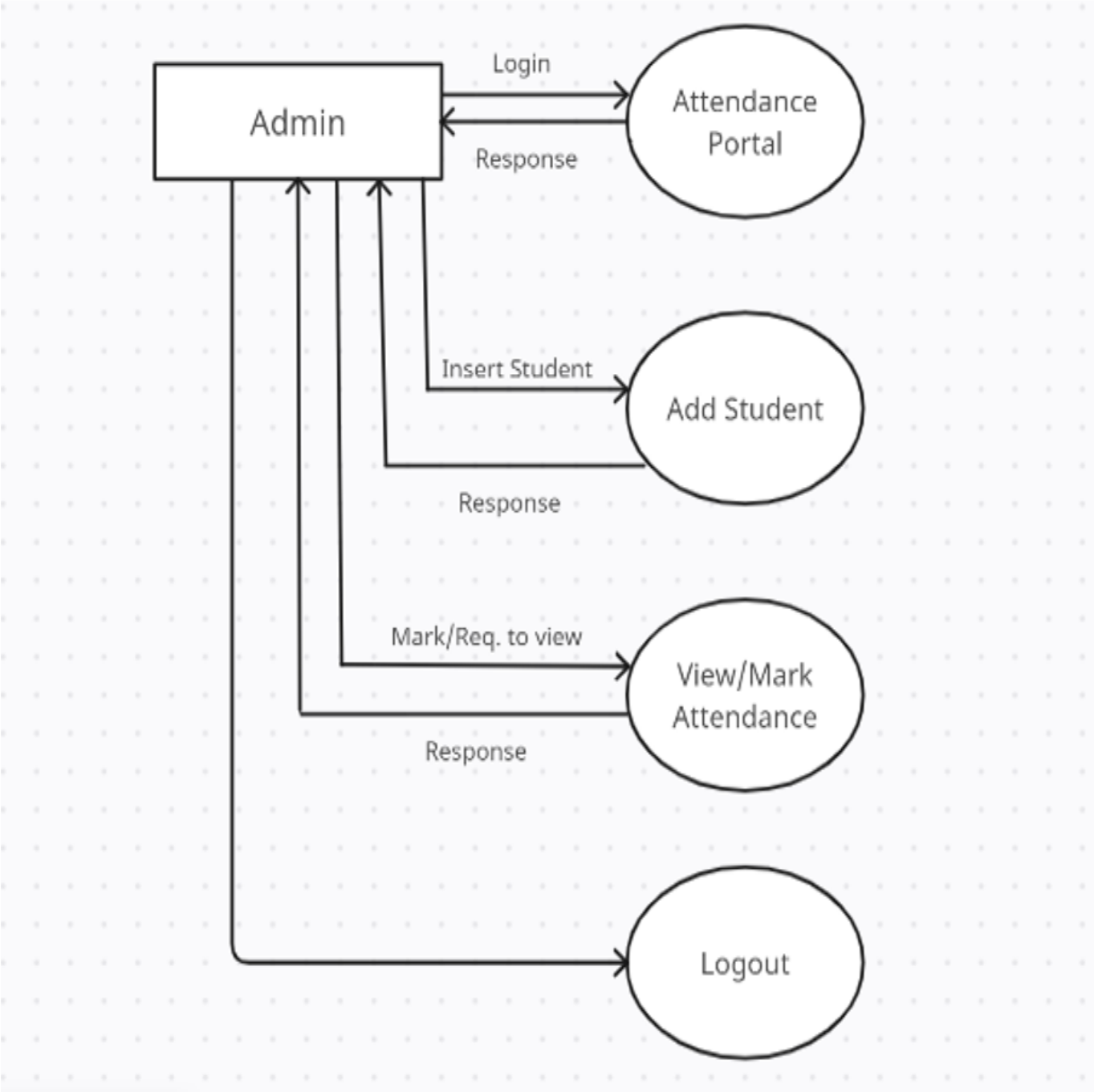
Figure 3.2: Use Case Diagram

3.5 Data Flow Diagram

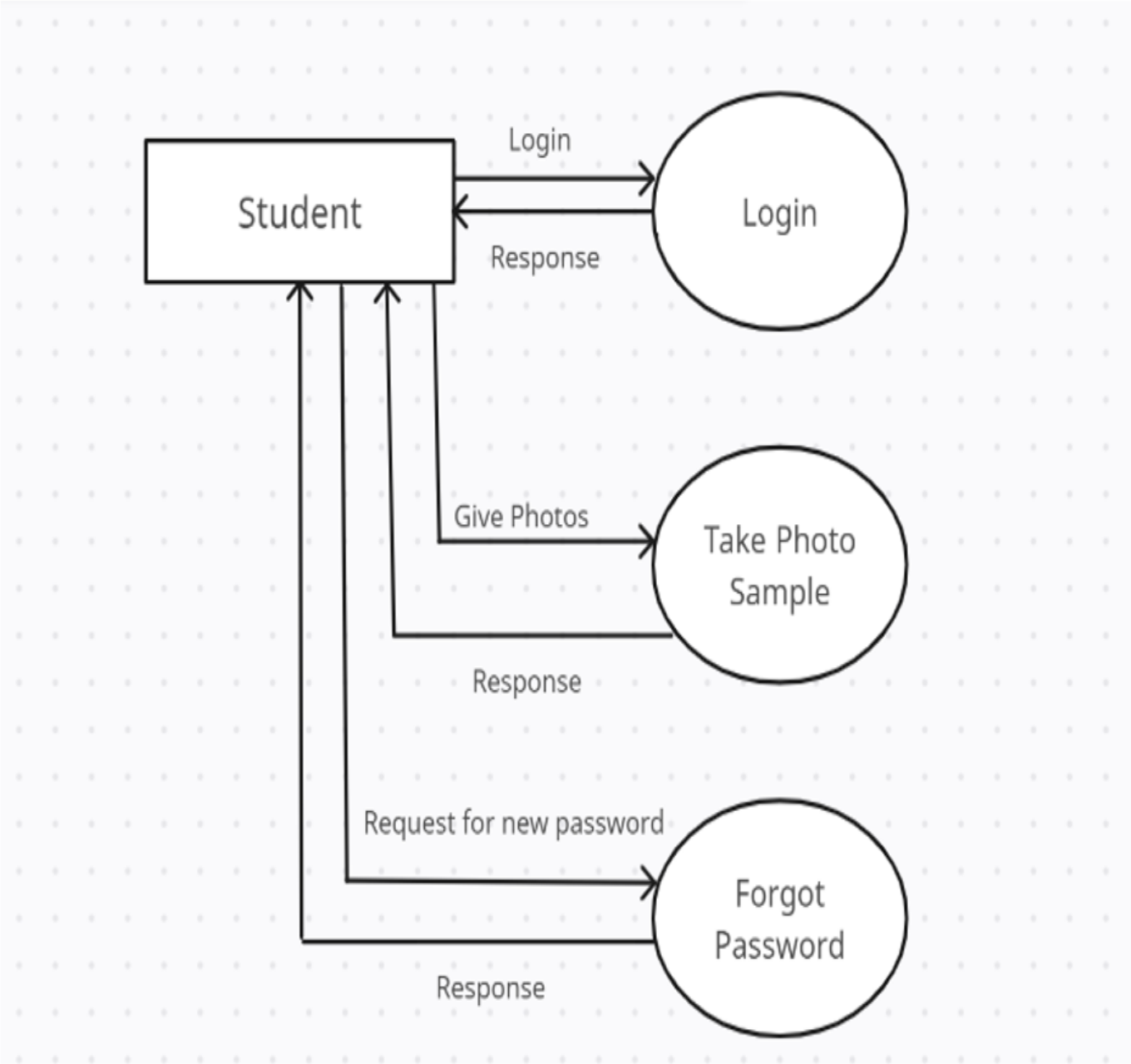
3.5.1 Level 0 Data Flow Diagram



3.5.2 Level 1 Data Flow Diagram(Admin)



3.5.3 Level 1 Data Flow Diagram(Student)



Chapter 4
System Design

4.1 Haar Cascade Algorithm

The core basis for Haar classifier object detection is the Haar-like features. These features, rather than using the intensity values of a pixel, use the change in contrast values between adjacent rectangular groups of pixels. The contrast variances between the pixel groups are used to determine relative light and dark areas. Two or three adjacent groups with a relative contrast variance form a Haar-like feature. Haar-like features as shown in figure are used to detect an image. Haar features can easily be scaled by increasing or decreasing the size of the pixel group being examined.

This allows features to be used to detect objects of various sizes. The cascading of the classifiers allows only the sub-images with the highest probability to be analyzed for all Haar-features that distinguish an object. It also allows one to vary the accuracy of a classifier. One can increase both the false alarm rate and positive hit rate by decreasing the number of stages. The inverse of this is also true. Viola and Jones were able to achieve a 90 percent accuracy rate for the detection of a human face using only 100 simple features. Detecting human facial features, such as the mouth, eyes, and nose require that Haar classifier cascades first are trained. In order to train the classifiers, this gentle AdaBoost algorithm and Haar feature algorithms must be implemented.

Fortunately, Intel developed an open source library devoted to easing the implementation of computer vision related programs called Open Computer Vision Library (OpenCV). The OpenCV library is designed to be used in conjunction with applications that pertain to the field of HCI, robotics, biometrics, image processing, and other areas where visualization is important and includes an implementation of Haar classifier detection and training. Thus with help of this algorithm system will detect

the person's face in the video. Face of the person gets Green Square as an indication of detection process. As soon as the face gets detected user can paused the video and enters the data of detected person such as person's name, address, profession, criminal record if any. If the detected person has criminal record then it can be defined as suspect. Check box option is given in the system where user can tick whether the person is suspect on not. This is the working of first module in which sample video is browsed and face is detected.

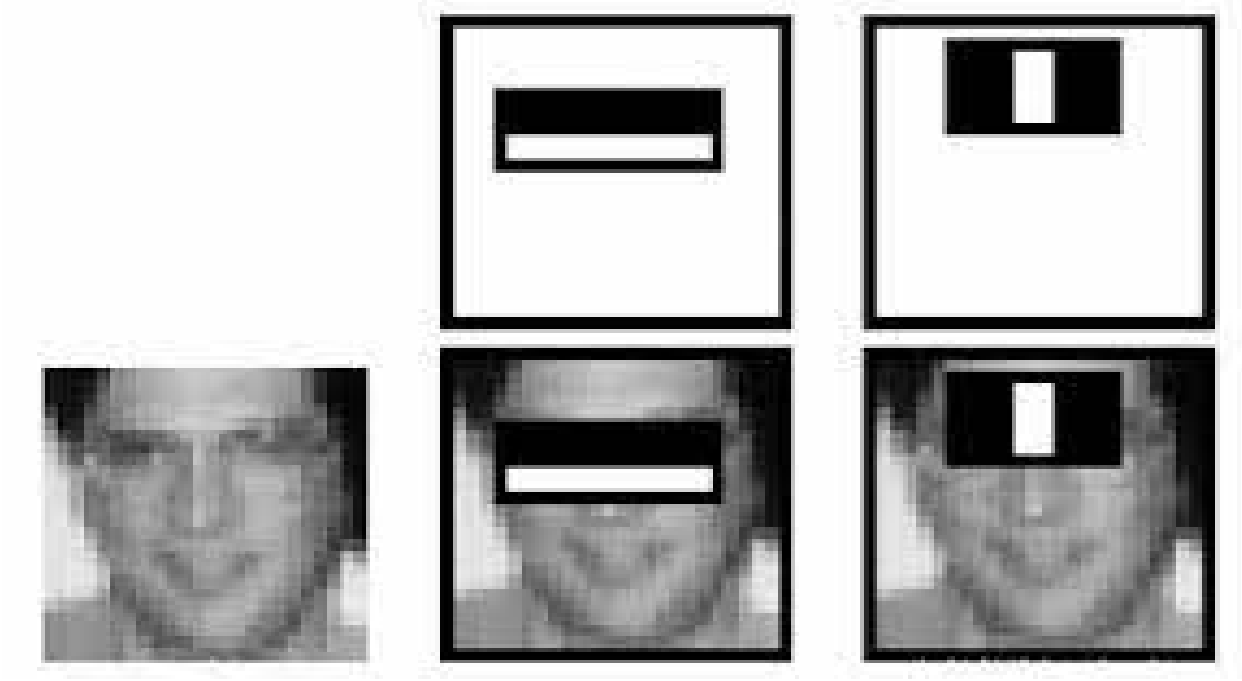


Figure 4.1: Haar Features

4.2 Local Binary Pattern Histogram(LBPH)

4.2.1 Introduction to LBPH Algorithm

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. 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.

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:

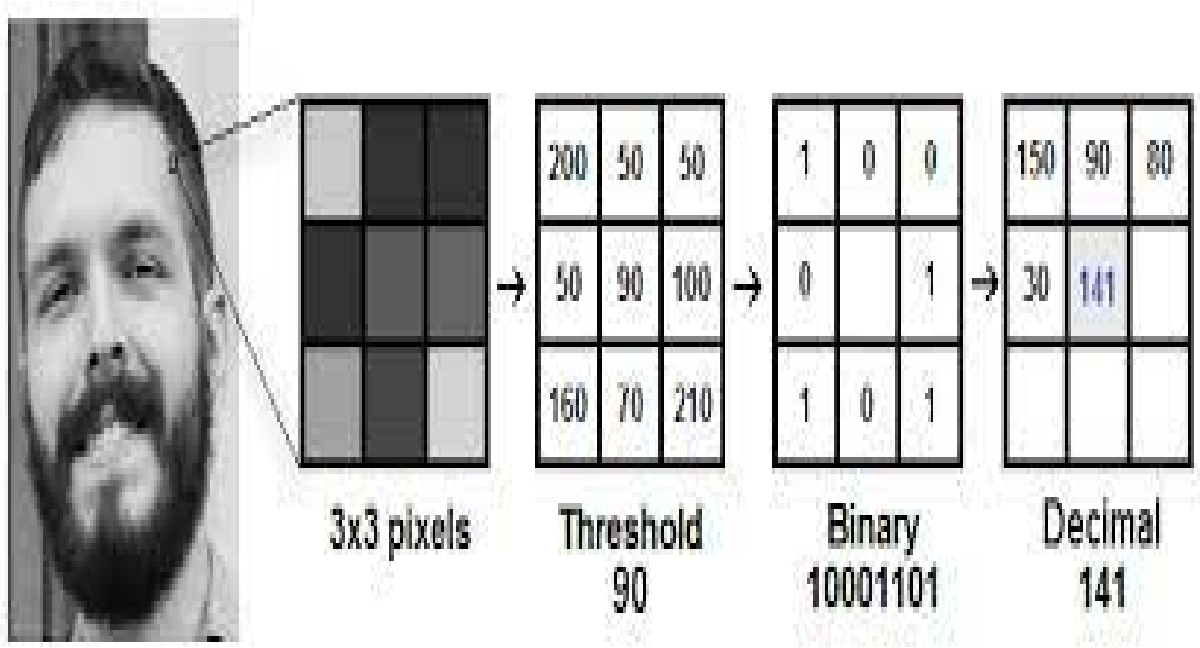


Figure 4.2: LBPH Procedure

4.3 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. Note: don't be fooled about the 'confidence' name, as lower confidences are 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.

4.4 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.

4.5 Applying LBH 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.

IMPORTANT POINTS

- 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.

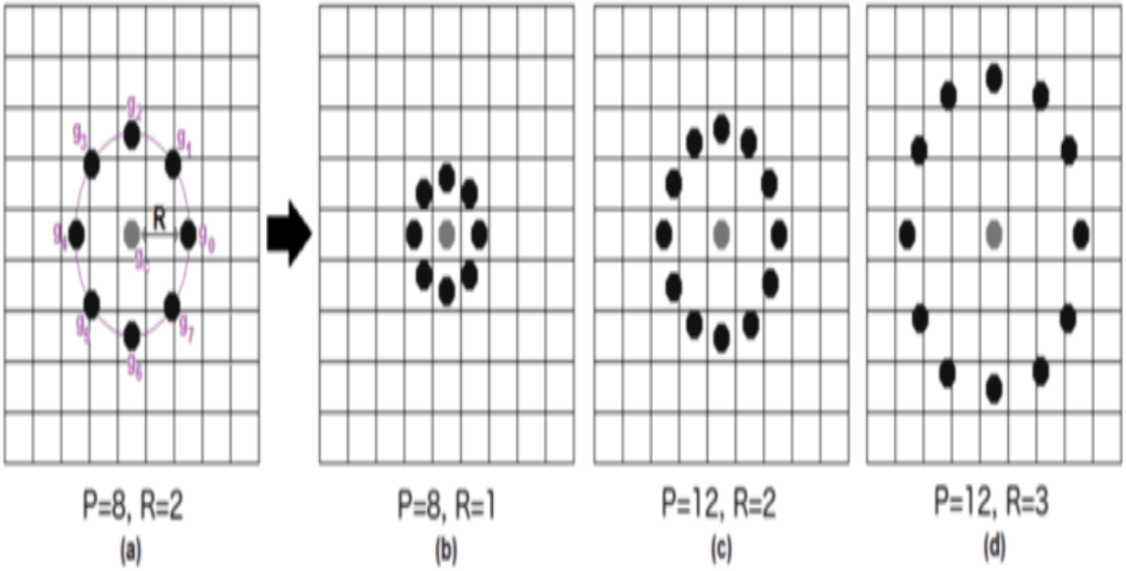


Figure 4.3: Radius of central pixel

4.6 Extracting the Histogram

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.

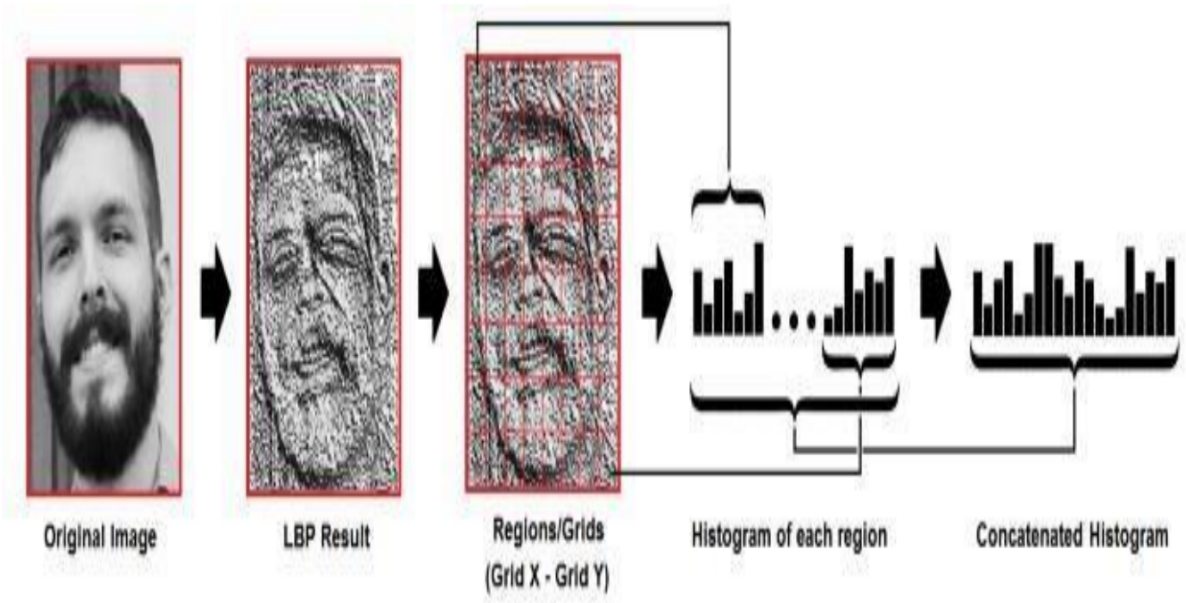


Figure 4.4: Extracting the Histogram

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

- As we have 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.

No table of figures entries found. 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,

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

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.

- 'confidence' name, as lower confidences are better because it means the distance between the two histograms is closer.
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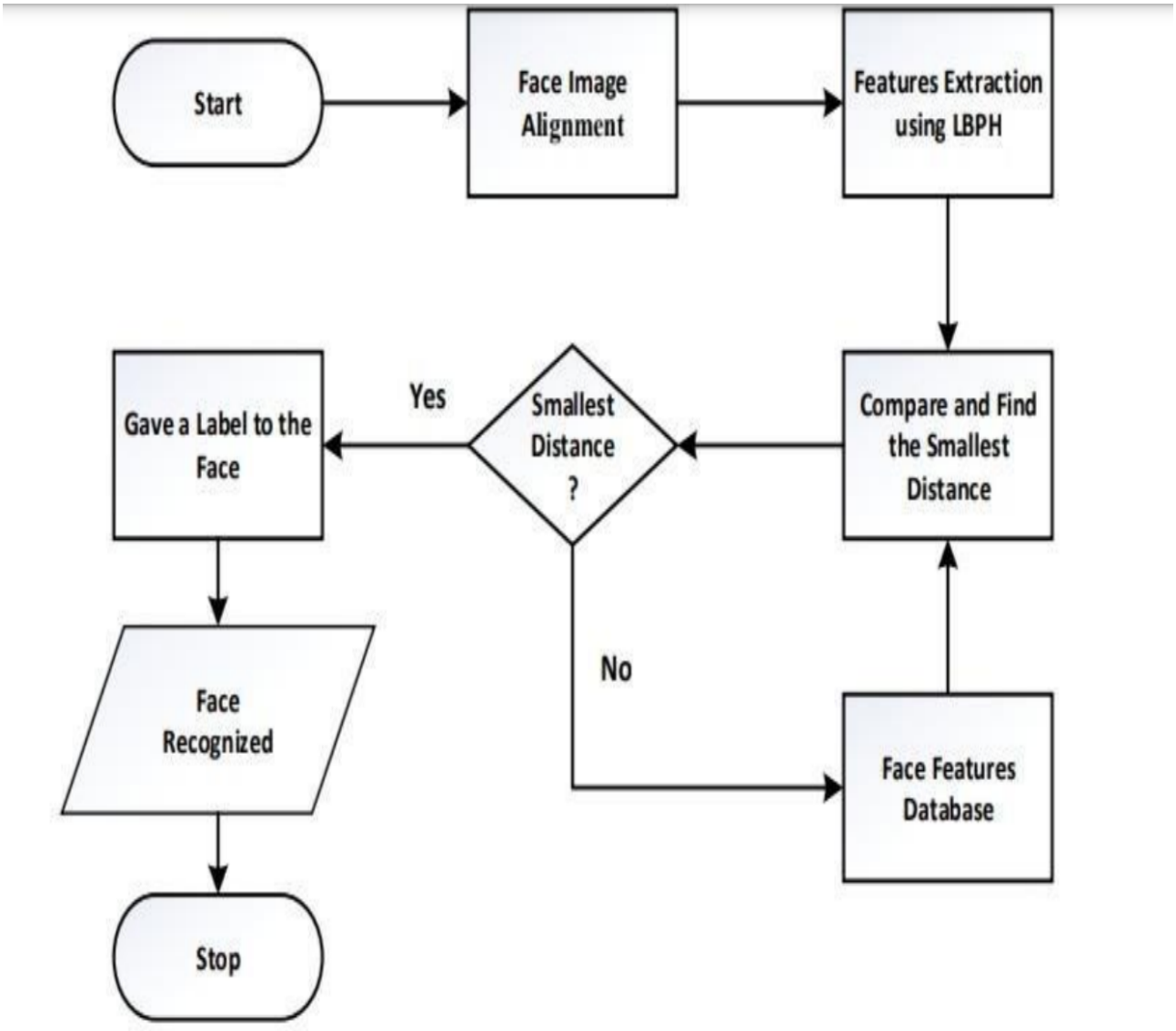


Face Alignment and feature extraction

4.7 Other Specifications

4.7.1 Advantages

- It is trouble-free to use.
- It is a relatively fast approach to enter attendance.
- Is highly reliable, approximate result from user.
- Best user Interface.
- Can obtain accuracy upto 85 percent.

4.7.2 Limitations

- While training there generates nearly 100 of copies of sample image.
- While dealing with high volume of data system required the powerful processor which is more costly.

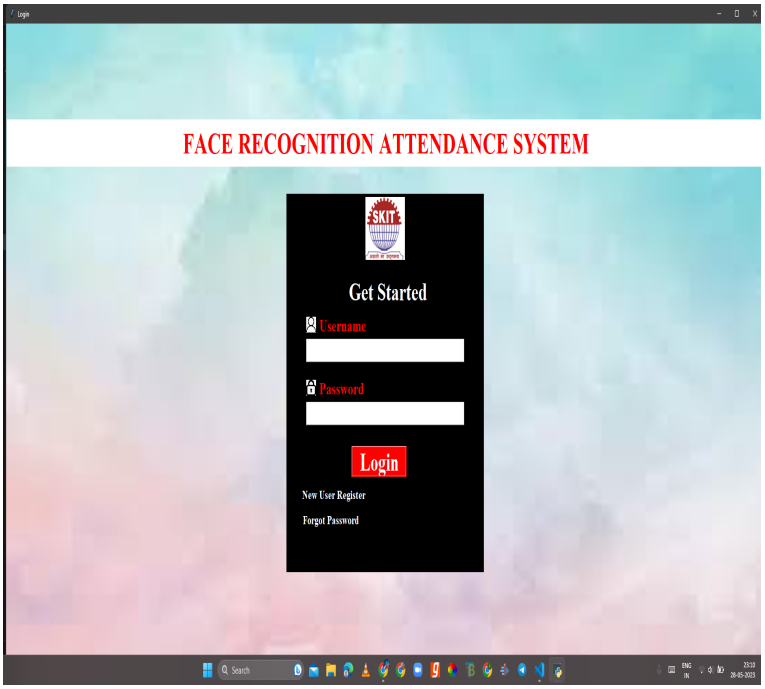
4.7.3 Applications

It is very useful for educational institutes to get attendance easily. We can get attendance of students as well as teachers without doing conventional attendance.

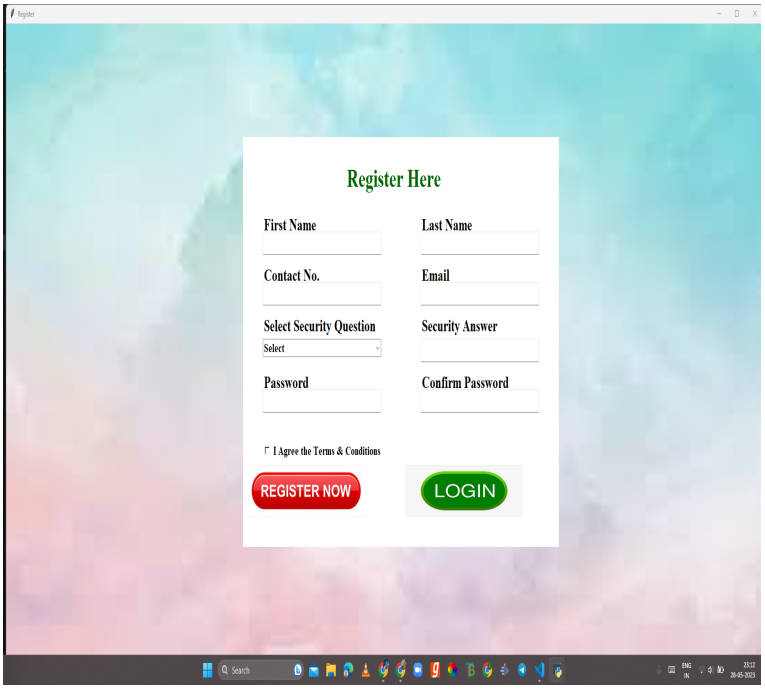
Chapter 5

Project Screenshots And Working

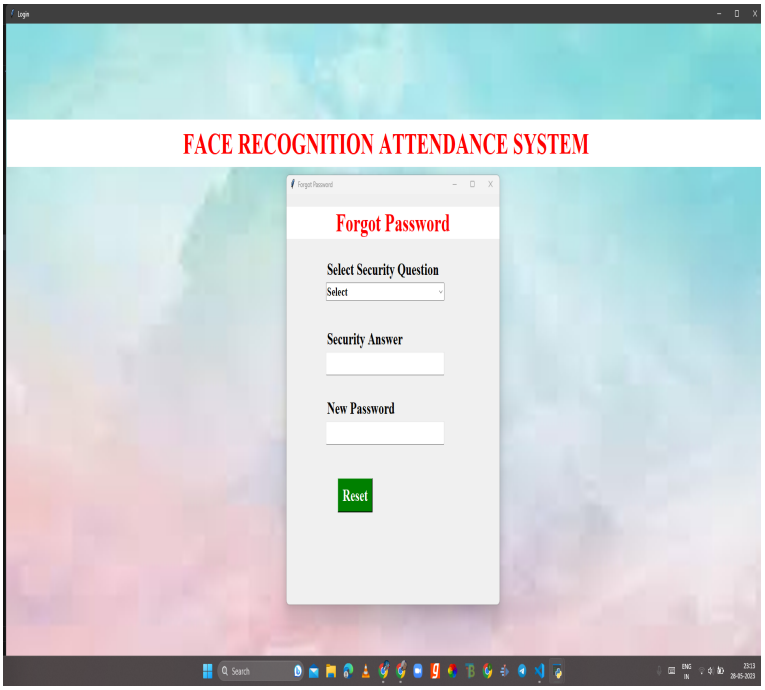
Step 1: In the very beginning, user login to the portal.



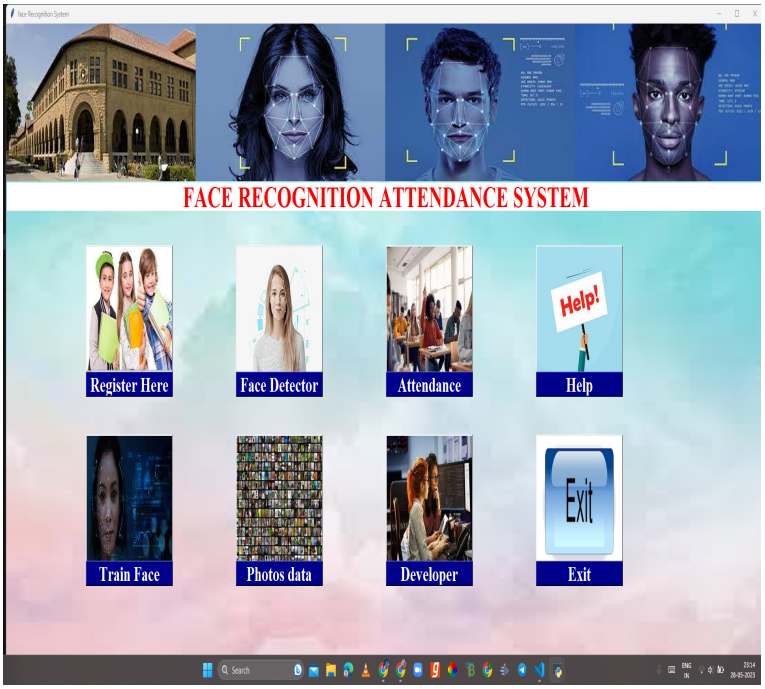
Step 2: Secondally he/she will register himself/herself.



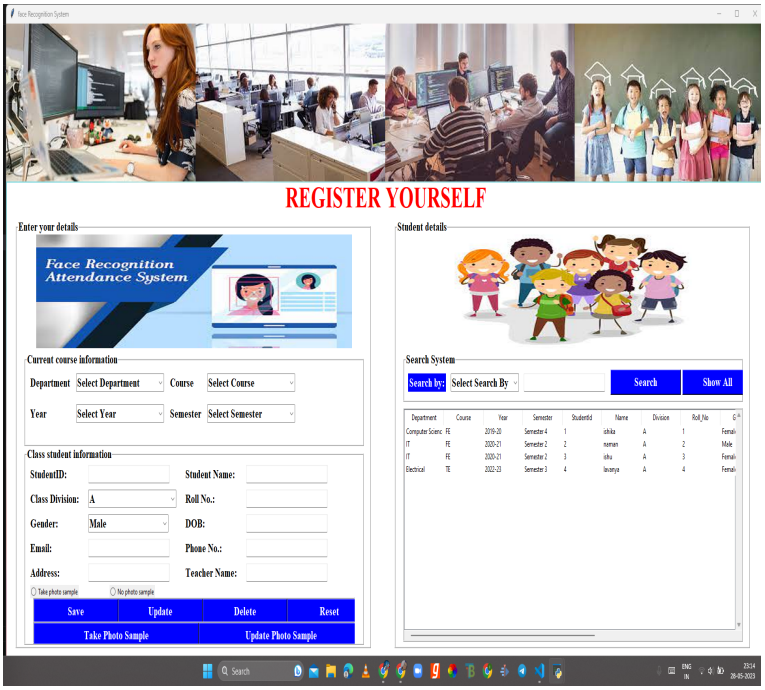
Step 3: User will be asked to enter the password to go to the home page.



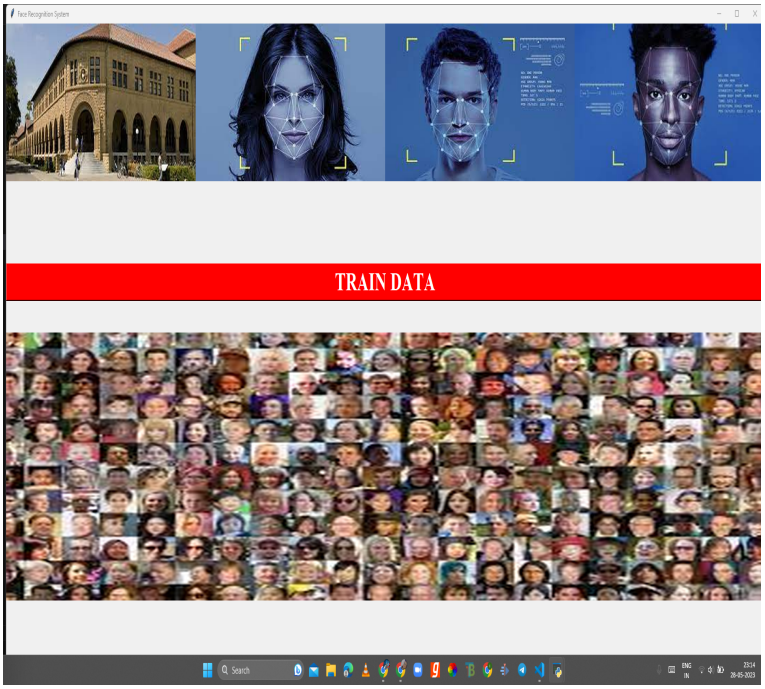
Step 4: Home Page will appear on the screen.



Step 5: Detailed Registration of the user will be done.



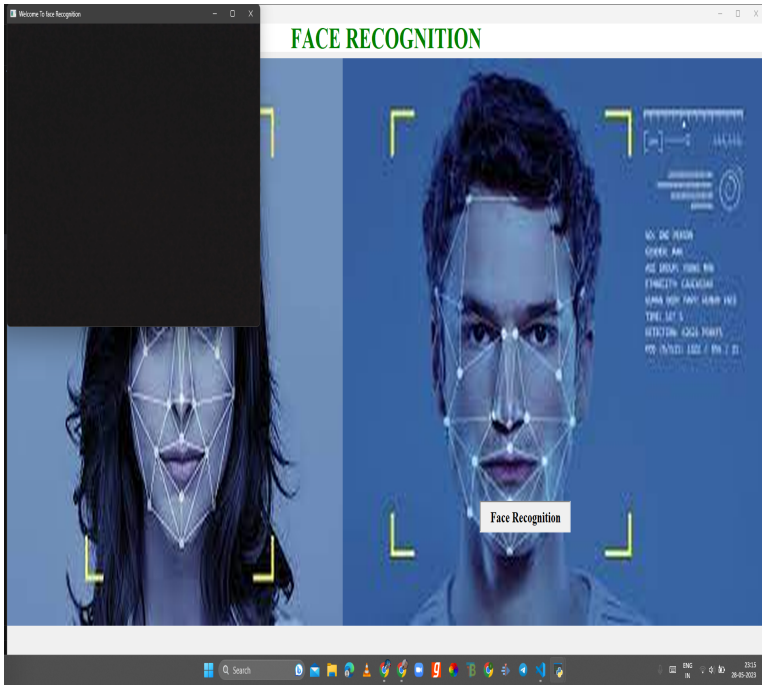
Step 6: The model will be trained by providing various samples.



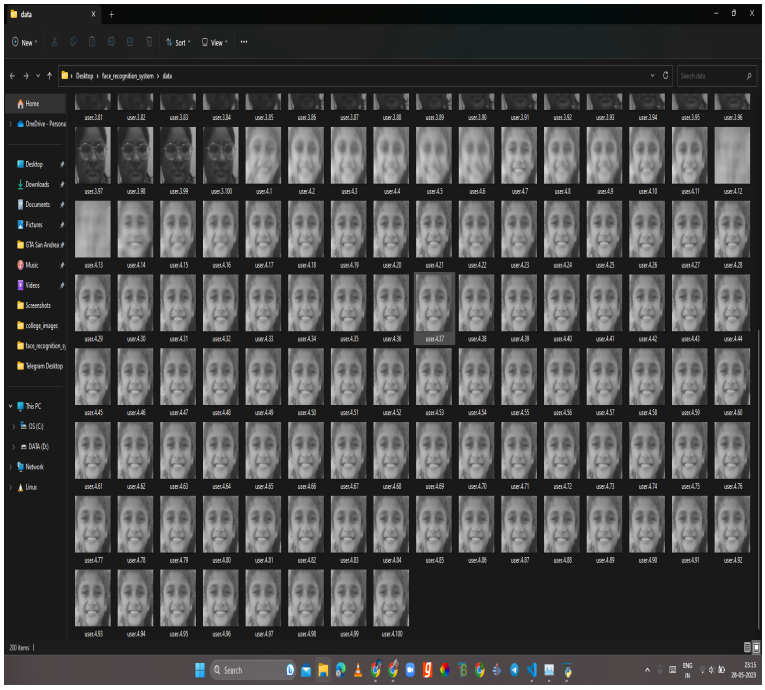
Step 7:

- Matching the data

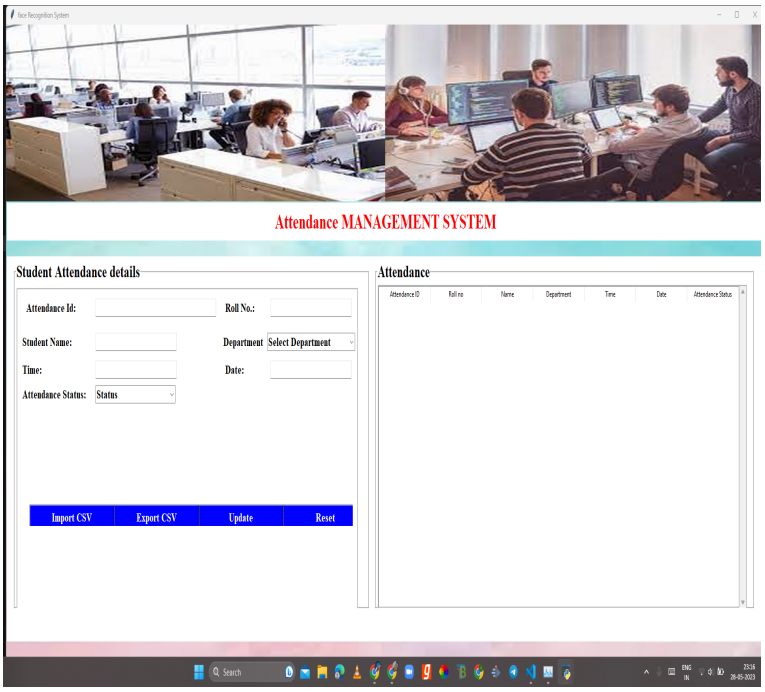
- Further matching

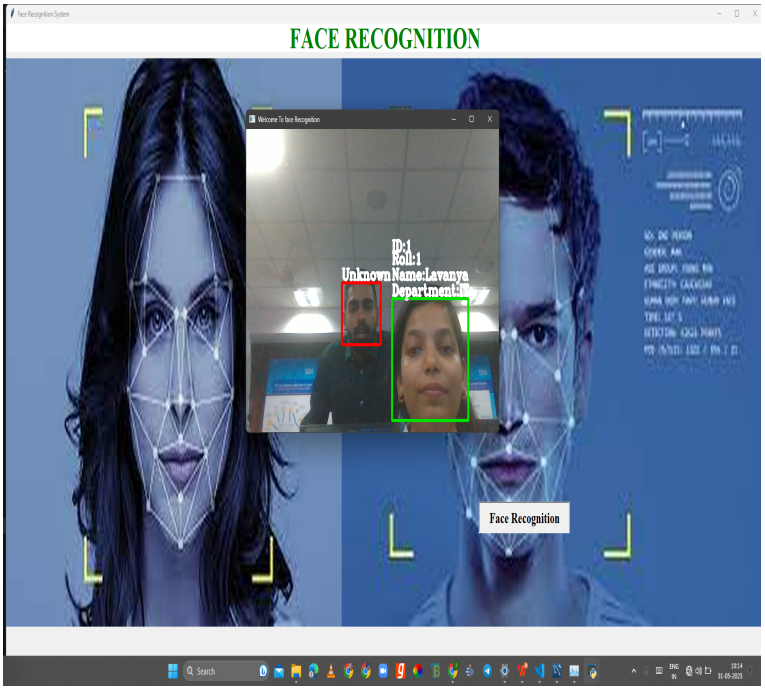


- Multiple images of user will appear.

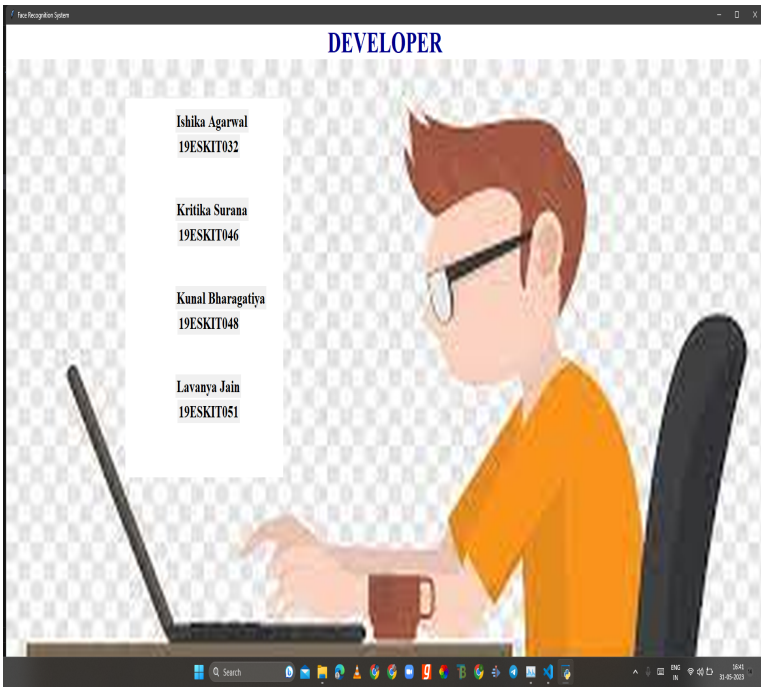


Step 8: Attendance portal will get opened.

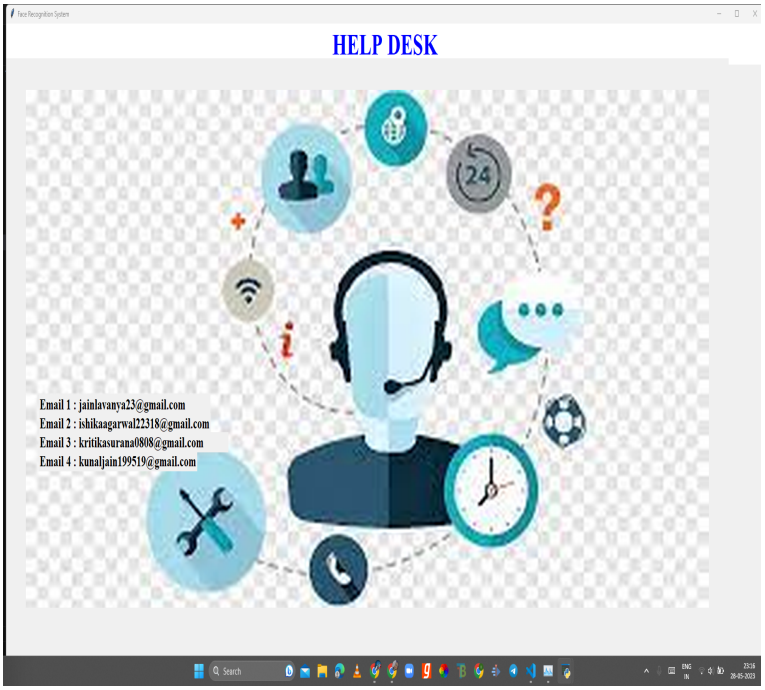




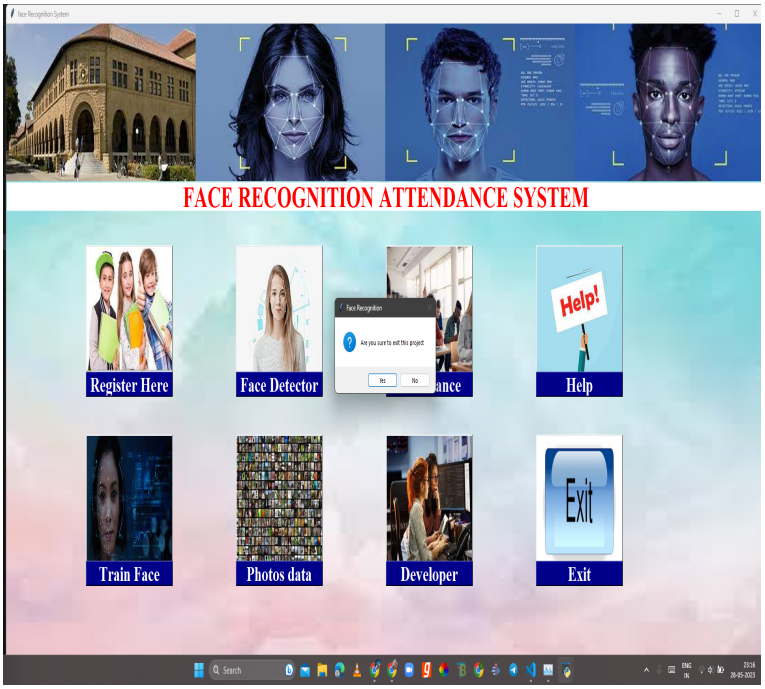
Step 9: Developer page



Step 10: Help desk for any query.



Step 11: Exit



Chapter 6
Conclusion and Future Scope

6.1 Conclusion

Automated Attendance System has been envisioned for the purpose of reducing the errors that occur in the traditional (manual) attendance taking system. The aim is to automate and make a system that is useful to the organization such as an institute. The efficient and accurate method of attendance in the office environment that can replace the old manual methods. This method is secure enough, reliable and available for use. No need for specialized hardware for installing the system in the office. It can be constructed using a camera and computer. In this system we have implemented an attendance system for a lecture, section or laboratory by which lecturer or teaching assistant can record students' attendance. It saves time and effort, especially if it is a lecture with huge number of students. Automated Attendance System has been envisioned for the purpose of reducing the drawbacks in the traditional (manual) system. This attendance system demonstrates the use of image processing techniques in classroom. This system can not only merely help in the attendance system, but also improve the goodwill of an institution.

- The Attendance Management System is developed using Machine Learning meets the objectives of the system which it has been developed. The system has reached a steady state where all bugs have been eliminated. The system is operated at a high level of efficiency. The system solves the problem. It was intended to solve as requirement specification.
- The system can recognize and identify the face well with an accuracy of 85 percent, at a face distance 40 cm from the camera with adequate lighting.
- Project Github link : https://ishika22318.github.io/Face-Recognition-Attendance-System/

6.2 Scope of Face Recognition

The world is using facial recognition technology and enjoying its benefits. Why should India be left out? There is a huge scope of this technology in India and it can help improve the country in various aspects. The technology and its applications can be applied across different segments in the country.

- Preventing the frauds at ATMs in India. A database of all customers with ATM cards in India can be created and facial recognition systems can be installed. So, whenever user will enter in ATM his photograph will be taken to permit the access after it is being matched with stored photo from the database.
- Reporting duplicate voters in India.
- Passport and visa verification can also be done using this technology.
- Also, driving license verification can be done using the same approach.
- In defence ministry, airports, and all other important places the technology can be used to ensure better surveillance and security.
- It can also be used during examinations such as Civil Services Exam, SSC, IIT, MBBS, and others to identify the candidates.
- This system can be deployed for verification and attendance tracking at various government offices and corporates. For access control verification and identification of authentic users it can also be installed in bank lockers and vaults. For identification of criminals the system can be used by police force also.

6.3 What the Future Holds?

The future of face recognition technology is bright. Forecasters opine that this technology is expected to grow at a formidable rate and will generate huge revenues in the coming years. Security and surveillances are the major segments which will be deeply influenced. Other areas that are now welcoming it with open arms are private industries,

public buildings, and schools. It is estimated that it will also be adopted by retailers and banking systems in coming years to keep fraud in debit/credit card purchases and payment especially the ones that are online. This technology would fill in the loopholes of largely prevalent inadequate password system. In the long run, robots using facial recognition technology may also come to foray. They can be helpful in completing the tasks that are impractical or difficult for human beings to complete.

Chapter 7
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