Project on

# Attendance System Using Facial Recognition


Submitted to

**Department of Computer Science and Engineering**

**Nepal Engineering College**

in Partial Fulfillment of the

requirements for the Degree of B.E. in Computer

By:

Lakim Dahal (018-315)

Shankar Dangaura (018-334)

Sunil Kumar Mandal (018-338)

Supervised By: Asst. Prof. Ishwor Pokharel

Date: 18/07/2023

# Abstract

An attendance system using facial recognition involves using a camera or other visual input device to capture images of individuals as they enter a building or location. These images are then processed using facial recognition software, which compares the captured images to a database of known individuals to identify and confirm the identity of the person. Once the individual has been identified, their attendance is recorded and logged in the system. This system can be used to automatically track attendance for meetings, events, or classes, eliminating the need for manual sign-in sheets or other manual processes. It can also be used to enhance security by only allowing access to authorized individuals. Overall, an attendance system using facial recognition can provide a convenient and efficient way to track attendance and ensure the security of a location.

***Keywords:*** Web application, Face Detection System, Face Recognition, Image Processing, Database of known individuals.

# Acknowledgement

We would like to take this opportunity to express our sincere appreciation and gratitude to all those who have contributed to the successful completion of our group project report on the attendance system using facial recognition.

First and foremost, we would like to extend our heartfelt thanks to Nepal Engineering College for providing us with the necessary platform and resources to carry out this project. The college's commitment to excellence in education and its support for research and innovation have been crucial in our endeavor.

We are extremely grateful to our supervisor, Assistant Professor Ishwor Pokharel, for his invaluable guidance and unwavering support throughout the duration of this project. His expertise, encouragement, and constructive feedback have been instrumental in shaping the direction of our work and ensuring its quality. We are deeply appreciative of his mentorship.

We would also like to express our gratitude to our supportive friends and colleagues who have been an integral part of this project. Their collaboration, dedication, and contribution have played a significant role in the success of our endeavor. Their diverse perspectives, insightful discussions, and continuous motivation have enriched our project and made it a truly collaborative effort.

Lastly, we would like to extend our heartfelt thanks to all the individuals who have directly or indirectly contributed to the completion of this group project report. Their support, encouragement, and belief in our abilities have been pivotal in our journey. We deeply appreciate their presence and contributions.

# List of Figures

# Abbreviations

**AI:** Artificial Intelligent

**ASUFR:** Attendance System Using Facial Recognition

**MySQL:** My Structured Query Language

**OpenCV:** Open Computer Vision

**SQL:** Structured Query Language

**SVM:** Support Vector Machine

**UI:** User Interface

# Chapter 1: Introduction

Attendance system using facial recognition (ASUFR) is a web application that allows an organization to track and monitor employee attendance using facial recognition technology. This system utilizes a webcam or other camera device to capture an employee's image, which is then compared to a database of images to verify their identity. Once the employee's identity is confirmed, the system records their attendance in real-time. This attendance system offers a convenient and efficient way to track employee attendance, as it eliminates the need for manual tracking methods such as sign-in sheets or card swipes. It also adds an extra layer of security, as it ensures that only authorized employees are able to mark their attendance. This attendance system is particularly useful for organizations with a large number of employees, as it can save time and resources that would otherwise be spent on manual attendance tracking.

## 1.1 Problem Statement

The current attendance system at XYZ company relies on employees manually signing in and out of the office using a physical attendance sheet or a centralized computer system. This process is time-consuming and prone to errors, as employees may forget to sign in or out, or may sign in for a colleague who is absent.

To improve the attendance system, the company would like to implement a facial recognition system that automatically tracks employee attendance by detecting their face as they enter and exit the office. The system should be able to accurately identify individual employees and record their attendance in real-time.

## 1.2 Objective

The main objectives of the facial recognition attendance system are as follows:

- To accurately identify individual employees and record their attendance in real-time. Employees will become more diligent about attending office. This is because employee’s attendance can only be taken personally, and

any absentees will be detected by the system. This not only trains employees to be punctual but also avoids immoral ethics such as signing attendance for their friends.

- To reduce the time and effort required for employees to sign in and out of the office.
- To eliminate errors and discrepancies in the attendance records.
- To provide an efficient and secure attendance tracking system.

## 1.3 Aim

The aim of an attendance system using face recognition is to accurately and efficiently track employee attendance by using facial recognition technology to confirm the identity of an individual. This system can be used to streamline the process of taking attendance, reduce errors and manual effort, and ensure that attendance records are accurate and up-to-date.

Some potential benefits of using a face recognition attendance system include:

- Increased accuracy: By using facial recognition technology, the attendance system can accurately confirm the identity of an individual, reducing the risk of errors or fraudulent attendance.
- Enhanced security: The system can be configured to only allow access to authorized individuals, providing an additional layer of security and preventing unauthorized access to the workplace.
- Increased efficiency: The system can automate the process of taking attendance, reducing the time and effort required to manually track employee attendance.
- Better record-keeping: The system can automatically record attendance data in real-time, providing an accurate and up-to-date record of employee attendance.

Overall, the aim of an attendance system using face recognition is to provide a reliable and efficient way to track employee attendance and improve the accuracy and security of attendance records.

## 1.4 Motivation

There are several potential motivations for using a face recognition system for attendance tracking:

- Accuracy: Face recognition systems can be highly accurate, especially when combined with other biometric data such as a fingerprint or iris scan. This can be particularly useful in situations where it is important to accurately track attendance, such as in a school or at a conference.
- Convenience: Face recognition systems can be quick and easy to use, as they do not require individuals to manually sign in or out. This can save time and make the attendance tracking process more efficient.
- Security: Face recognition systems can provide an additional layer of security, as they can help to ensure that only authorized individuals are able to access certain areas or events. This can be particularly useful in settings where security is a concern, such as at a government facility or a secure conference.
- Data collection and analysis: Using a face recognition system for attendance tracking can also allow for the collection and analysis of attendance data, which can be useful for understanding patterns of attendance and identifying trends. This information can be used to improve the efficiency and effectiveness of attendance tracking processes.
- Cost-effectiveness: In addition to the benefits outlined above, an attendance system using a face recognition system may also be cost-effective, as it can reduce the need for manual attendance tracking processes and eliminate the need for physical sign-in sheets or badges.

## 1.5 Scope

The scope of an attendance system using a face recognition system may include the following elements:

- Hardware: This may include the hardware required to capture and process face recognition data, such as cameras, scanners, and servers.

- Software: This may include the software required to operate the face recognition system, such as the face recognition software itself, as well as any additional software required to manage and analyze the attendance data.
- Integration: The attendance system may need to be integrated with other systems, such as a payroll system or an employee management system, in order to accurately track and record attendance data.
- Training: Users of the attendance system, such as employees or students, may need to be trained on how to use the system in order to ensure accurate and efficient attendance tracking.
- Maintenance: The attendance system will likely require ongoing maintenance in order to ensure that it is functioning correctly and accurately tracking attendance.
- Data management: The attendance system will generate a large amount of data, which will need to be managed and stored securely.
- Reporting: The attendance system may need to generate reports on attendance data, such as attendance rates or patterns of attendance, in order to provide useful insights and inform decision-making.

## 1.6 Application

There are many potential applications for an attendance system using a face recognition system, including:

- Schools: An attendance system using a face recognition system can be used in schools to track the attendance of students and staff. This can help administrators to monitor attendance rates and identify patterns of absenteeism.
- Conferences: An attendance system using a face recognition system can be used at conferences to track the attendance of attendees. This can help organizers to ensure that only authorized individuals are able to access the conference and to track attendance data for analysis.
- Government agencies: An attendance system using a face recognition system can be used in government agencies to track the attendance of employees and contractors. This can help to ensure that only authorized

individuals are able to access certain areas and to accurately track attendance data.

- Corporate offices: An attendance system using a face recognition system can be used in corporate offices to track the attendance of employees. This can help to streamline attendance tracking processes and improve efficiency.
- Event venues: An attendance system using a face recognition system can be used at event venues, such as concert halls or sports arenas, to track the attendance of attendees. This can help organizers to ensure that only authorized individuals are able to access the event and to track attendance data for analysis.

# Chapter 2: Literature Review

Plenty of research has been conducted so far on the various available methods for implementation of an effective attendance monitoring system. These methods vary in terms of the types of input method used, the types of data processing employed and the controllers used to implement the systems. In this section we will be looking for the various available solution with the advantages and disadvantages of each system. First system, “Attendance System Using NFC Technology with Embedded Camera on Mobile Device”. Near field communication is a type of short distance wireless communication that takes place between two devices, one active and the other passive. The two devices are basically inductor coils which can respond to an electromagnetic induction. The active device is utilized to produce an electromagnetic field of a given radius and strength. Which used to implement an attendance system. In a school setting for example, students can be given NFC tags that are uniquely programmed with their unique identification numbers. Upon attending the classes, the lecturers bring the NFC readers and a student is required to swipe their NFC tags near the reader, say the lecturers’ phone. This information is then transmitted to the school database to mark the attendance of the student. However, this system is vulnerable to impersonation where one person can sign in for someone else. The other related systems that use biometrics (Fingerprint recognition RFID, etc.) to identify end user are time management systems used in many colleges, institutions and schools. However, these systems introduce further privacy concerns. These systems are also subject to physical damage from their users. Therefore, they need additional maintenance costs. The idea proposed by us, Removes physical access from anyone to the automated system. the camera will take an image and starts the process of face detection using the techniques and methods. After this the program will automatically make a folder in the database having the employees to be recognized. The already placed images of each employee is taken and used from database for image recognition. The images will be fetched and compared with each of the entry in the database and hence will be checked whether the employee is present in the organization or not. If there is no match the program will move on to the next picture [1].

Aadhaar Based Biometric Attendance System Using Wireless Fingerprint Terminals. Narra Dhanalakshmi; Saketi Goutham Kumar; Y Padma Sai. Published in: 2017 IEEE 7th International Advance Computing Conference (IACC) In this paper, two different approaches are proposed to authenticate the captured fingerprint in the process of verification. The first approach uses data base which is created by the organization itself and the second approach uses the Aadhaar Central Identification Repository (CIDR). Wireless fingerprint terminals are used to capture and store the attendance records of the students in the device data base and updating them to the server data base. SMS Alerts are sent to students and their parents in case of their irregularity, absence or shortage of attendance. Limitation: Aadhar Data may not be available and also fingerprint bases system has its own drawbacks [2].

A web enabled secured system for attendance monitoring and real time location tracking using Biometric and Radio Frequency Identification (RFID) technology. Srinidhi MB ; Romil Roy Published in: 2015 International Conference on Computer Communication and Informatics (ICCCI) The main idea of this paper is to built a safe and secure web based attendance monitoring system using Biometrics and Radio Frequency Identification (RFID) Technology based on multi-tier architecture, for both computers and smartphones. Limitation: Students can exchange their RFID cards [3].

Real-Time Online Attendance System Based on Fingerprint and GPS in the Smartphone. Lia Kamelia; Eki Ahmad Dzaki Hamidi; Wahvudin Darmalaksana; Afit Nugraha Published in: 2018 4th International Conference on Wireless and Telematics (ICWT) The purpose of the research is to develop an online presence system which is a combination of fingerprint modules and GPS. The ZFM-20 fingerprint module is used as the system's main input as well as a security tool as an entrance to get access to the entire system. To determine the user's location and sends it to the smartphone, GPS Module is used. Arduino module present in the system will send a text message to the parties concerned about the user's location data automatically. Limitation: It is a fingerprint-based system and has its own disadvantages [4].

# Chapter 3: System Design

System design is concerned with the computer-oriented design of the system. System design (sometimes also called Top-Level Design) is the process of defining the architecture, components, modules, interfaces, and data for a system to satisfy specified requirements. The Attendance System Using Facial Recognition (ASUFR) is designed to automate the attendance process in an organization using facial recognition technology. The system has two types of users: employees and admins. Employees can have their attendance marked by the system, while admins have additional privileges such as managing employees, registering new employees, and training the facial recognition model.

## 3.1 Methods

In the context of ASUFR various methods are employed to accomplish different objectives.

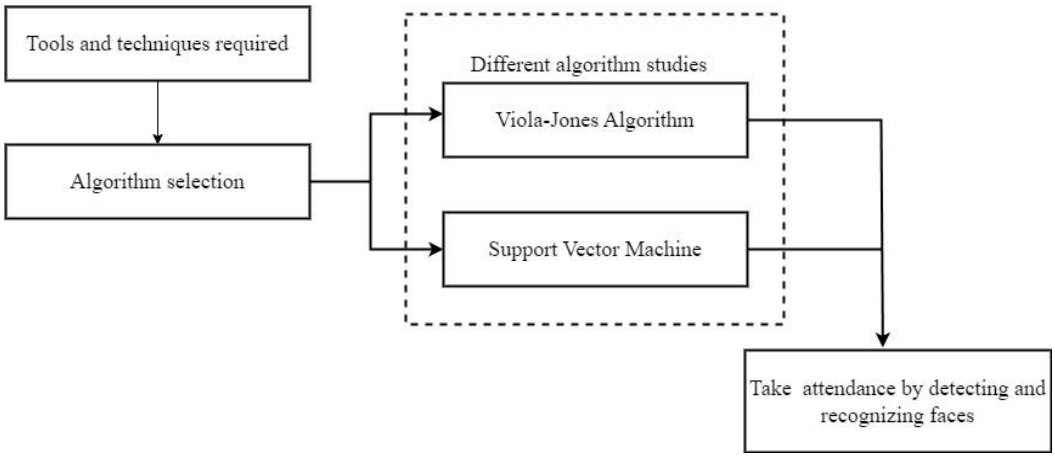



*Figure 3.1: Research Methodology*

### 3.1.1 Tools and Techniques Used

Our whole project suggests that the research of machine learning approaches along with practical implementation. We started with the explanatory technique to define problem statements and objectives for better understanding of the project.

Face detection and recognition rely on a variety of tools and techniques to accurately identify and analyze facial features. Tools and techniques that are used in our projects are:

- Machine learning: In machine learning, models are trained on a dataset that contains examples or instances with known outcomes or labels. Through an iterative process, the model learns from the data, discovers underlying patterns or relationships, and generalizes that knowledge to make predictions or decisions on new, unseen data.
- Viola-Jones Algorithm: The Viola-Jones algorithm is a popular face detection algorithm that combines Haar-like features and a cascading framework for efficient face detection. It is known for its real-time performance.
- OpenCV Method: To perform the face recognition function, face detection is first performed to determine the position of the face in the picture. The OpenCV method is a common method in face detection. It firstly extracts the feature images into a large sample set by extracting the face Haar features in the image and then uses the AdaBoost algorithm as the face detector. In face detection, the algorithm can effectively adapt to complex environments such as insufficient illumination and background blur, which greatly improves the accuracy of detection. For a set of training sets, different training sets are obtained for subsequent work by changing the distribution probabilities of each of the samples, and each training set is trained to obtain a weak classifier, and then these several classifiers are weighted.
- Dlib: Dlib is a popular open-source library that offers various machine learning algorithms, including face detection and recognition. It provides pre-trained models and APIs for face-related tasks.
- Facial Landmark Detection: Facial landmark detection algorithms locate and track key facial landmarks such as eyes, nose, mouth, and eyebrows. These landmarks serve as reference points for accurate face alignment and feature extraction.
- Support Vector Machine: Support Vector Machine or SVM is one of the most popular Supervised Learning algorithms, which is used for Classification as well as Regression problems. However, primarily, it is used for Classification problems in Machine Learning.

### 3.1.2 Method Selection

Model selection is a crucial step in developing an attendance system based on facial recognition. It involves choosing the most appropriate algorithms that can effectively detect and recognize faces to accurately record attendance. The overview of the model selection process employed in our project, focusing on the Viola-Jones algorithm and Support Vector Machines (SVM) algorithm.

- Viola-Jones Algorithm: The Viola-Jones algorithm is a popular and widely-used algorithm for object detection, particularly in face detection tasks. It operates by dividing an image into multiple sub-regions, known as Haar features, and employs an integral image representation for efficient computation. These features are then passed through a cascade of weak classifiers, which together form a strong classifier capable of detecting faces with high accuracy. In our attendance system, we utilized the Viola-Jones algorithm for face detection. By employing this algorithm, we were able to accurately identify faces within the input images, allowing us to extract facial features required for recognition.
- Support Vector Machines (SVM) Algorithm: Support Vector Machines (SVM) is a powerful machine learning algorithm commonly used for classification tasks, including facial recognition. SVM works by mapping data into a high-dimensional feature space, where it identifies an optimal hyperplane that separates different classes with maximum margin. SVMs have been extensively used in face recognition systems due to their ability to handle complex data distributions and handle high-dimensional feature spaces effectively. For our attendance system, we employed SVM algorithm for face recognition. Once the faces were detected using the Viola-Jones algorithm, we utilized SVMs to classify and recognize these faces based on their extracted features. SVMs allowed us to train a model that could accurately match and identify individuals, enabling us to record attendance reliably.

### 3.1.3 Take Attendance of Employee

Finally, once the employee is recognized by the algorithms, the server updates the attendance of that employee in the database.

## 3.2. Requirement Analysis

### 3.2.1 Functional Requirements

- Authentication of a user when he/she tries to log into the system.
- Employees have the access to change their password while they forgotten.
- Capture image to upload in the server.
- Return employee's name and attendance successful when image capturing device captures the employees and it is recognized.

### 3.2.2 Non-Functional Requirements

- Image capturing device should start during taking attendance.
- Printing device should start when admin or employees prints their report.

## 3.3 Modules

### 3.3.1 User Module

This module is used by users (employees and admins) to monitor the camera for attendance based on in or out times. The user module is also responsible for managing user authentication and all the interface components for interacting with the system.

### 3.3.2 Face Detection and Recognition module

The Face Detection and Recognition Module is a vital component of computer vision systems that enables the identification and authentication of individuals based on their facial features. This module utilizes advanced algorithms and techniques to detect and recognize faces from images or real-time video streams. The process can be broken down into two main steps: face detection and face recognition.

Face Detection Steps:

- Face Detect: In this step, the module uses shape predictor 68 face landmark to locate human faces within an image or video frame. The algorithm scans the input data, identifies facial features like eyes, nose, and mouth, and accurately determines the boundaries of each detected face.
- Pre-processing: Once the faces are detected, pre-processing techniques are applied to normalize and enhance the facial region. These methods help in removing noise, adjusting lighting conditions, and improving the overall quality of the facial data for subsequent steps.
- Feature Extraction: After pre-processing, relevant facial features are extracted from the face region. These features are crucial landmarks or distinctive patterns that aid in distinguishing one face from another. These features are encoded and stored in database.

Face Recognition Steps:

- Feature Matching: In this stage, the module compares the extracted features of the detected face with the features of faces stored in its database. These stored features belong to known individuals, such as employees in an organization. The matching process involves calculating the similarity between the detected face's features and the stored features of each individual.
- Recognized Employee: The module then determines the best match by evaluating the similarity scores. If the similarity score surpasses a predefined threshold, the system recognizes the individual and associates them with the corresponding identity in the database. Thus, the recognized employee's identity is revealed, enabling various applications such as attendance tracking, access control, or personalized services.

### 3.3.3 Attendance Module

The Attendance Module is a crucial component of workforce management systems used to efficiently track and manage the attendance of employees within an organization. It operates in conjunction with the Face Detection and Recognition Module, which provides the necessary data for employee identification. The

Attendance Module plays a significant role in automating attendance processes, minimizing paperwork, and ensuring accurate records.

Functionality:

- Employee Identification: The Attendance Module relies on the Face Detection and Recognition Module to identify employees based on their facial features. Once an employee's face is detected and recognized, the module associates the face with the corresponding employee profile in the system.
- Attendance Tracking: After successful identification, the module records the timestamp and updates the attendance status of the recognized employee. It notes whether the employee is present, absent, or tardy at that specific time.
- Real-time Updates: The module operates in real-time, allowing employees' attendance to be marked immediately as they are recognized by the system. This ensures that attendance records are up-to-date and accurate at all times.
- Reporting and Analytics: The module can generate comprehensive attendance reports and analytics. These reports provide valuable insights into employee attendance patterns, trends, and compliance. Admin can use this data to identify attendance-related issues and make informed decisions to improve workforce efficiency.

## 3.4 Use Case Diagram

The Use Case Diagram provides an overview of the functionalities and interactions between different actors in the Attendance System Using Facial Recognition (ASUFR). The diagram shows two main actors: "Admin" and "Employee."

The "Admin" actor has several use cases:

- Register New Employees: The admin can register new employees into the system by providing their details.
- Manage Attendance: The admin can manage the attendance of employees, which includes monitoring and maintaining attendance records.
- Generate Attendance Report: The admin can generate attendance reports, providing an overview of employee attendance data.

- Train Dataset: The admin can train the facial recognition system by capturing employee images using image capturing devices.

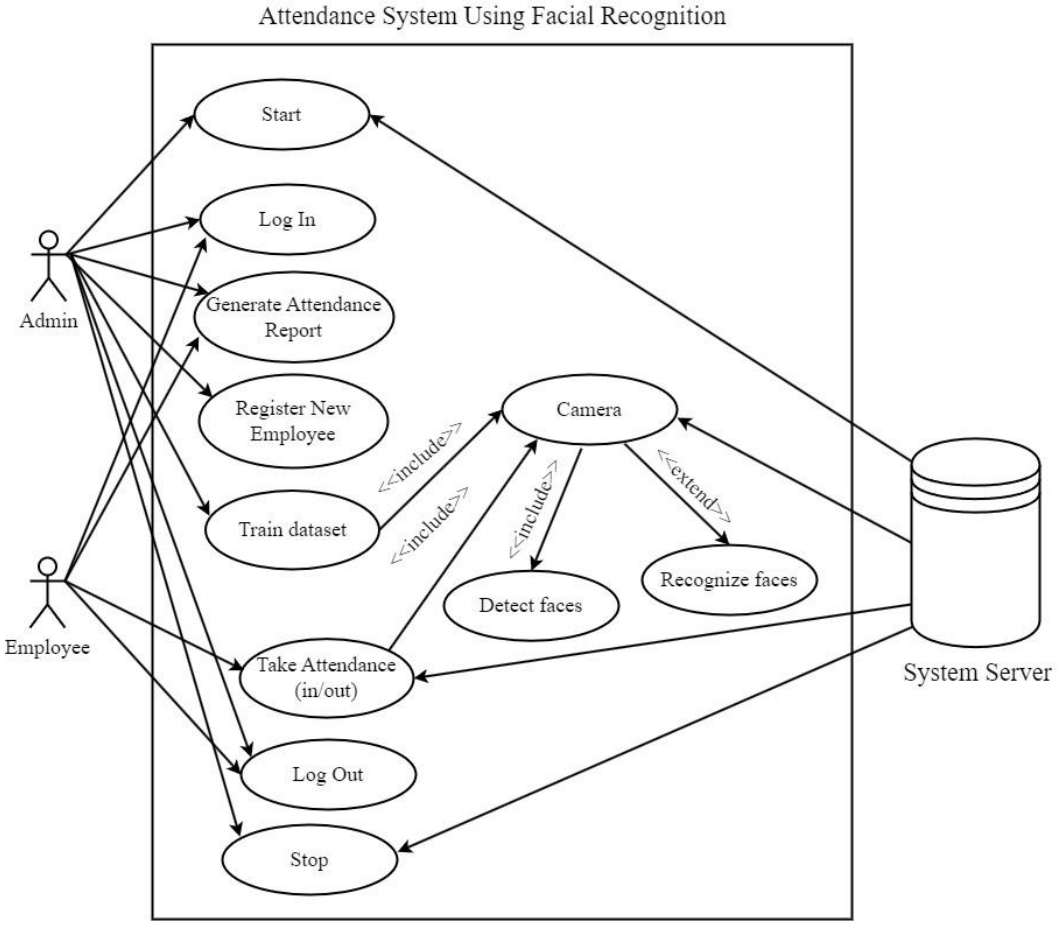



*Figure 3.2: Use Case Diagram of ASUFR*

The "Employee" actor has two use cases:

- Take Attendance: Employees can take attendance based on their entry or exit time using the image capturing device and facial recognition system.
- Generate Employee Attendance Report: Employees can generate their attendance reports by logging into the system, providing them with their attendance history.

The "System Server" oversees the monitoring of the image capturing device and handles the face detection and recognition process. Once the Employees are recognized the attendance in database is updated.

## 3.5 Class Diagram

We have 8 database tables. Among them users_present and users_time are used for the controlling and managing the information related to the attendance. Django_admin_log and auth_user is used for controlling and managing information related to the user's details. Auth_user_user_permission, auth_user_groups, auth_group_permissions, auth_group and auth_permission are co-related with other table which are used for various function.

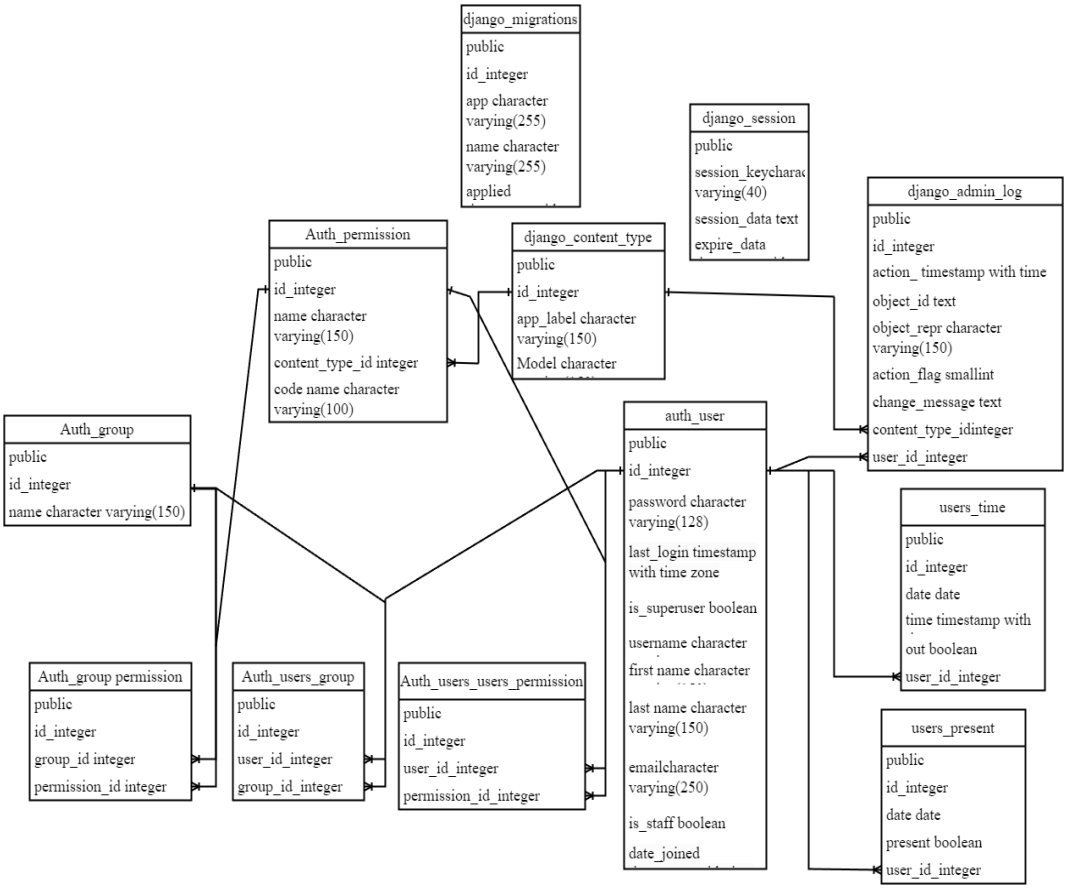



*Figure 3.3: Class Diagram of ASUFR*

## 3.6 Flow Diagram

The process begins when the ASUFR is activated. The system presents a web interface where users can interact and initiate the attendance process. The system activates the camera to capture the input frame. The camera captures a live frame from the video feed. The system utilizes facial detection algorithms to identify and locate a frontal face in the captured frame. Once the frontal face is detected, the

system extracts facial features and key-points, such as eyes, nose, and mouth positions. The facial features and key-points are used to create a unique face encoding, which represents the distinctive characteristics of the detected face. The system compares the generated face encoding with the pre-stored encodings of known employees in the database. If the face encoding does not match any stored encoding in the database, the system identifies the person as an unknown individual, and the attendance process terminates. If the face encoding matches an entry in the database, the system retrieves the employee's name associated with that encoding. The system displays a message indicating that the attendance is successful, along with the employee's name. The attendance process concludes.

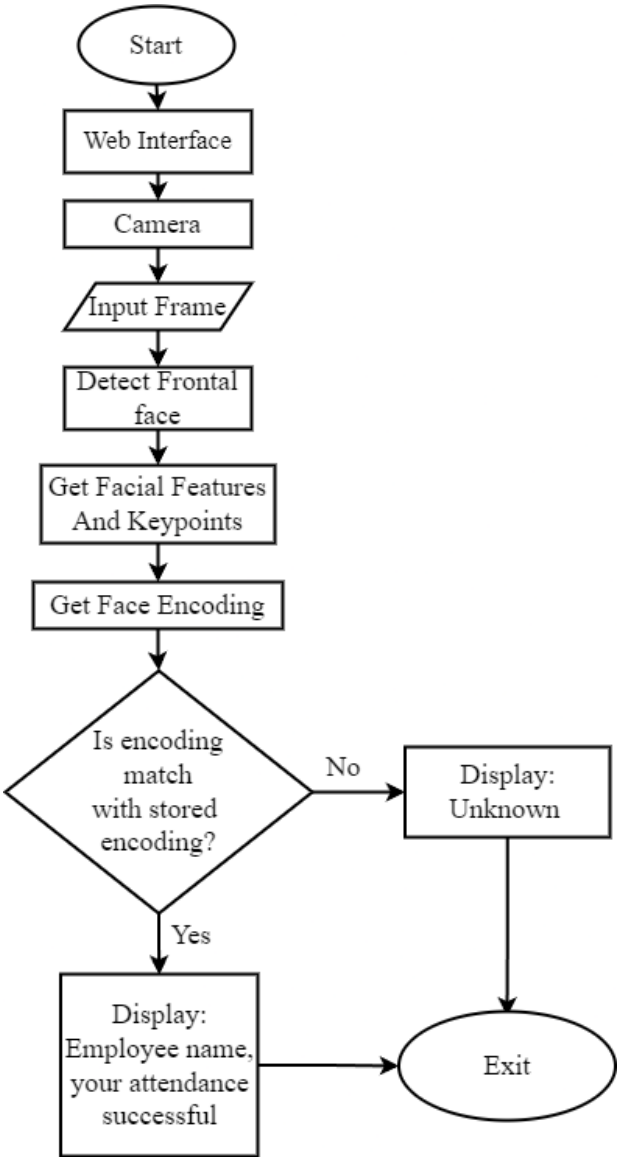



*Figure 3.4: Flow Diagram of ASUFR*

## 3.7 System Architectural Diagram

The ASUFR system can be designed using a client-server architecture. The server-side handles the core functionalities, while the client-side provides user interfaces for both employees and admins. Admin is responsible for adding new employee to the ASUFR and training the model. Once new employees are added, employees can log in and see their report and print. Admin can manage the employees and their attendance.

The system architecture of the Attendance System Using Facial Recognition (ASUFR) involves the following components and workflow:

- Users: The ASUFR is designed for two types of users: employees and the admin. Employees use the system to record their attendance by providing their images and time of entry or exit. The admin manages the system and has access to the attendance records.
- Image Capturing Device: An image capturing device, such as a camera or webcam, is used to capture the images of employees as they enter or exit the premises. These images serve as input for the facial recognition process.
- Web Server: The web server acts as the central processing unit for the ASUFR. It receives the images from the capturing device and handles the recognition process.
- Facial Detection and Recognition: The web server employs facial detection and identify human faces in the captured images by using shape predictor landmark. It is based on Viola Jones algorithm. Jones Viola algorithm extracts the haar features from the detected faces and creates integral images (binary encoded). These binary encoded images then stored into classes during training dataset by using SVM algorithm. For recognition process SVM compares the captured integral image with existing integral images in its database to find a match.
- Database: The ASUFR maintains a PostgreSQL database that stores employee information, including their names and other relevant details. The recognized employee's name is searched within this database to verify their identity.

- Attendance Taken: Once the recognized employee's name is matched with the local database, the attendance system updates the attendance record for that particular employee. The system logs the entry or exit time and marks the attendance accordingly.

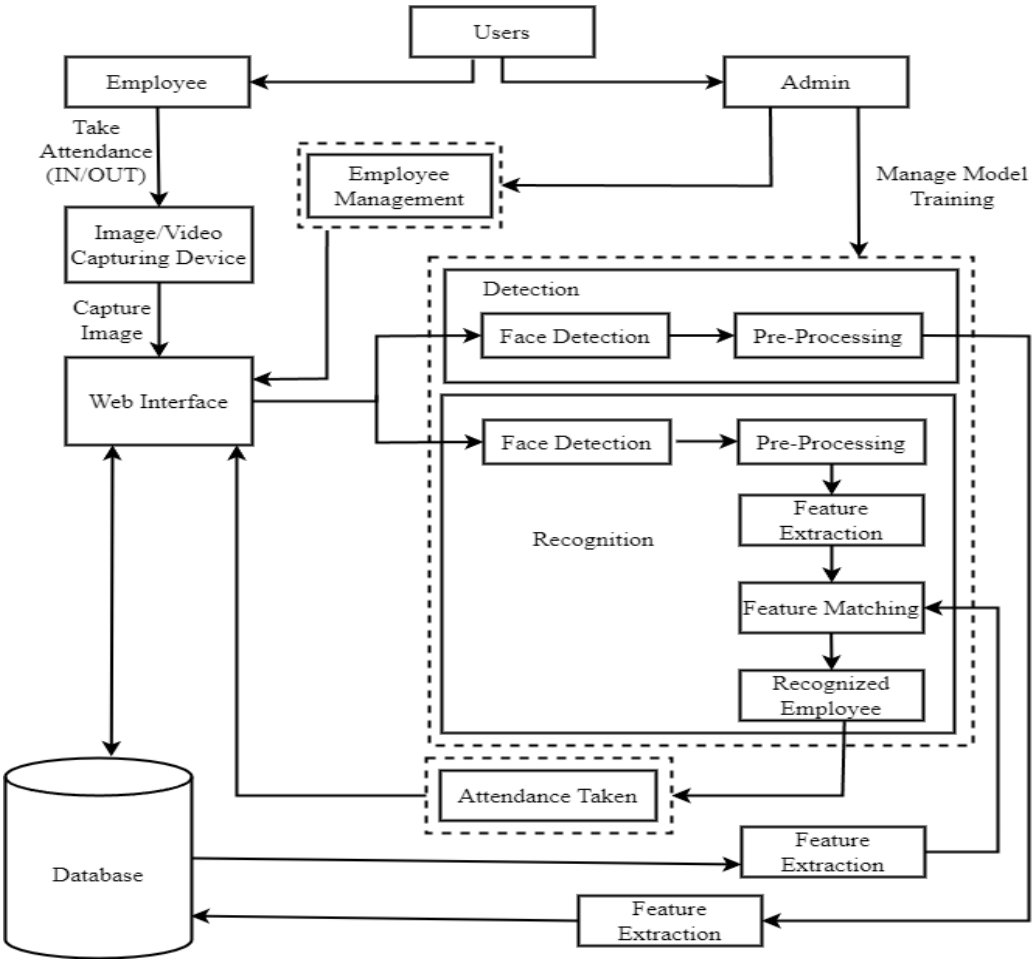



*Figure 3.5: System Architecture of ASUFR*

## 3.8 Software Requirements

A major element in building a system is the section of compatible software. This document gives a detailed description of the software requirement specification. The study of requirement specification is focused specially on the functioning of the system. These are the main software requirements for our project.

### 3.8.1 Django

Django is a comprehensive Python web framework known for its rapid development capabilities and elegant, practical design. In this project, we will utilize Django to build APIs for interacting with our database as well as both mobile and web applications.

### 3.8.2 OpenCV

OpenCV (Open Source Computer Vision Library) is an open-source computer vision and machine learning software library. It provides a wide range of tools and functions for various image and video processing tasks, making it highly popular in the fields of computer vision, image and video analysis, and robotics.

### 3.8.3 PostgreSQL

PostgreSQL, also referred to as Postgres, is a free and open-source relational database management system that prioritizes extensibility and adherence to SQL standards. In this project, we will be using PostgreSQL as the database for our system to manage information related to plant species' profiles, feedback from the users and other geospatial data.

# Chapter 4: Implementation and Discussion

## 4.1 Tasks Implemented

This section attempts to provide a concise summary of the development process and developed system highlighting the most salient points. The following tasks are implemented for the project:

- The basic design layout (web front-end part) and functionality of the project have been completed.
- The web front-end can now communicate with the back-end and model server, enabling features such as signing in, register new employees, train data model.
- Most of the back-end features, such as creating new employees, logging in, using authentication features, detection and recognition of the employees, updating the attendance.
- The admin portal for managing the database and its information, including employee's information, and attendance report.
- Attendance report printing portal for both employees and admin.

## 4.2 Output Obtained

The following output is obtained as the result of the above-mentioned task:

- Registered employee and admin can login via login UI.
- Admin can register new employees and train the datasets.
- Both Admin and Employees can generate the attendance report and print.
- Employees can take attendance (IN/OUT) via UI.
- Report printing portal working accurately.

## 4.3 Discussion

The Attendance System using Facial Recognition represents an innovative application of machine learning and computer vision in employee management. It utilizes algorithms such as Viola-Jones for face detection, SVM for classification, OpenCV for image processing, and shape predictors with 68 face landmarks for precise feature extraction. By implementing these techniques, the system efficiently

automates attendance tracking, reducing manual efforts and errors while ensuring accurate identification of employees. The project's machine learning approach highlights the value of data-driven solutions, while security, privacy, and scalability considerations are crucial for successful real-world deployment. Overall, the system showcases the potential of facial recognition technology in revolutionizing employee management processes.

## 4.4 Testing

Testing is the process of evaluating a system or its components to see if they meet specified requirements. Simply put, testing is running a system to identify gaps, bugs, or missing requirements in contrast to the actual requirements. There are various types of testing (Unit Testing, Integration Testing, Black Box Testing, White Box Testing, System Testing etc.). Each test type addresses a specific testing requirement.

### 4.4.1 Black Box Testing

Black box testing involves testing a system with no prior knowledge of its internal workings. A tester provides an input, and observes the output generated by the system under test. This makes it possible to identify how the system responds to expected and unexpected user actions, its response time, usability issues and reliability issues. We performed various testing in following modules and are error free.

- Login
- Register
- Forget password

#### 4.4.1.1 Test Case for Unit Testing

Various modules were tested individually to find any possible errors.

**I. Login:**

For the wrong username and password this login module must return alert message.

| **Test Case** | **Test Data** | **Expected output** | **Status** |
|---|---|---|---|
| Test for invalid Username and Password | → Username: Shankar<br>→ Password: shankar@123 | Please enter a correct username and password. Note that both fields may be case-sensitive | Pass |

*Table 4.1: Login Test of ASUFR*

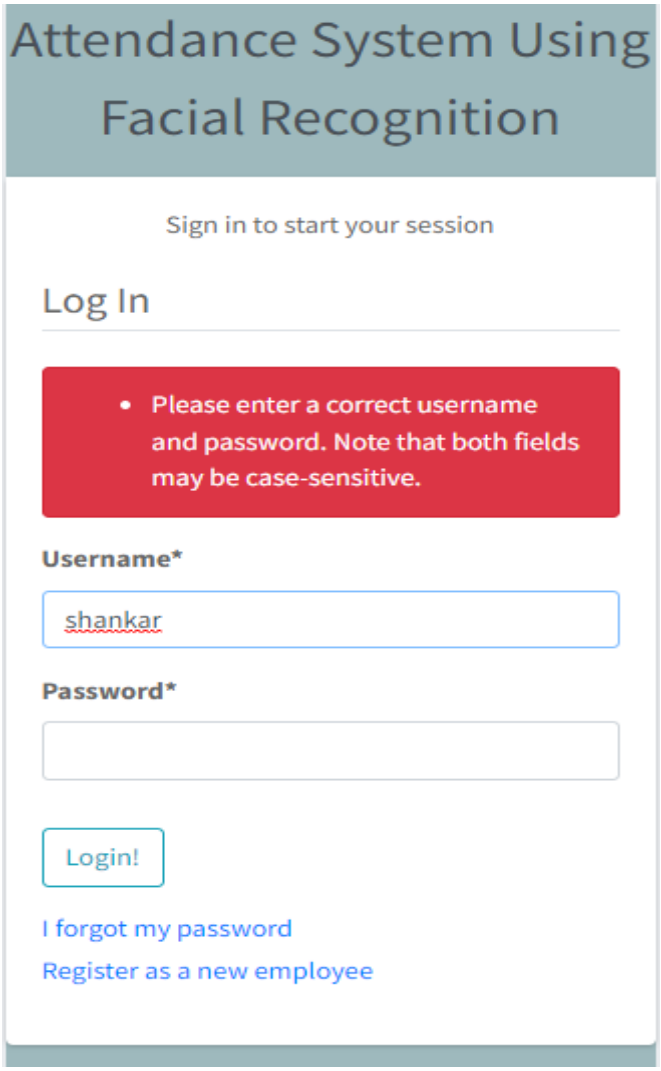



*Figure 4.1: Login Test of ASUFR*

## II. Register

| Test Case | Test Data | Expected output | Status |
|---|---|---|---|
| Test for wrong Password Format | → Name: Shankar<br>→ Password: sha123 | This password is too short. It must contain at least 8 characters. | pass |

*Table 4.2: Wrong Password for Registration of New Employee*

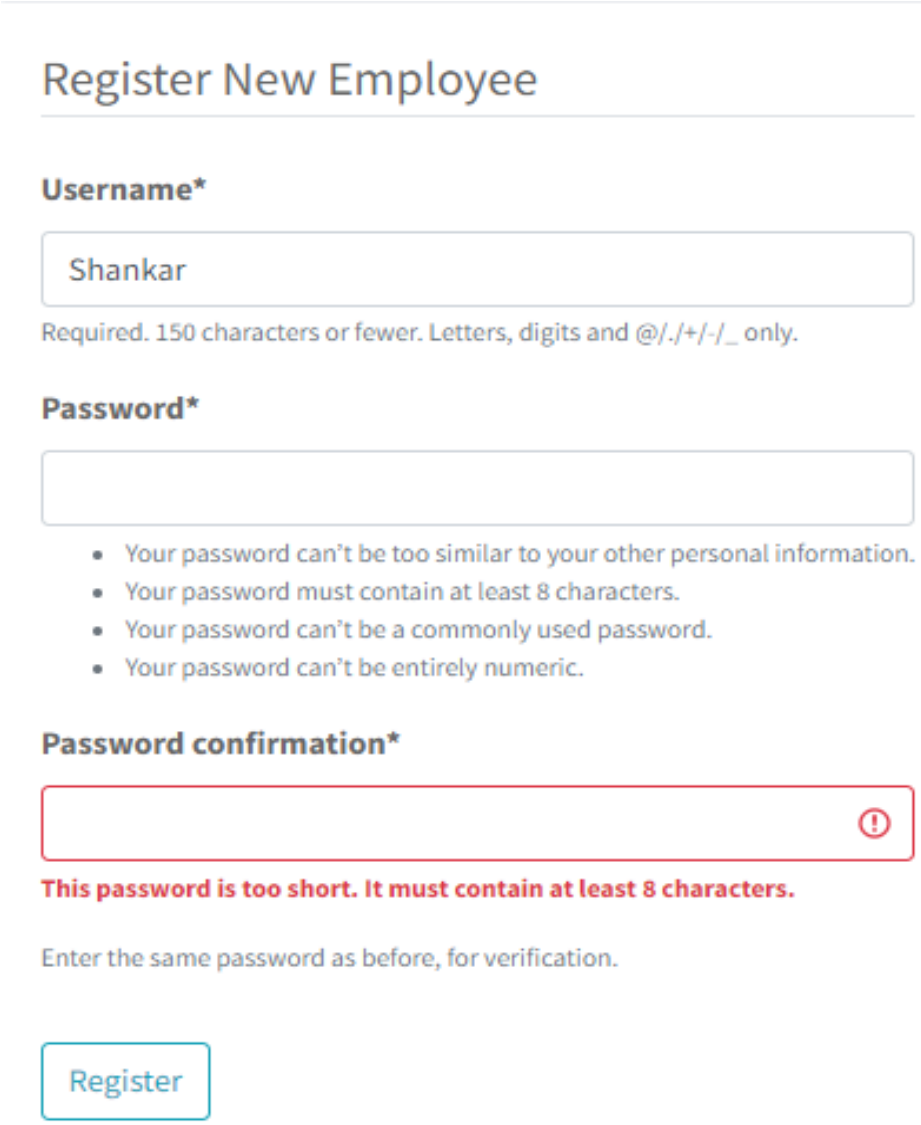



*Figure 4.2: Wrong Password for Registration of New Employee*

### III. Forget Password

In case the users of ASUFR forget their password, they can simply reset their login password by clicking on the 'I forgot my password' button in the login panel. This process requires their authorized Gmail ID. For the wrong Gmail format this module must return (pop-up) alert message.

| Test Case | Test Data | Expected output | Status |
|---|---|---|---|
| Test for invalid Gmail format | Email: Shankar143gmail.com | please include an '@' in the email address. 'shankar143gmail.com' is missing an '@'. | pass |

*Table 4.3: Forgot Password Test*

## 4.4.2 White Box Testing

White-box testing, also known as structural testing or code-based testing, is a

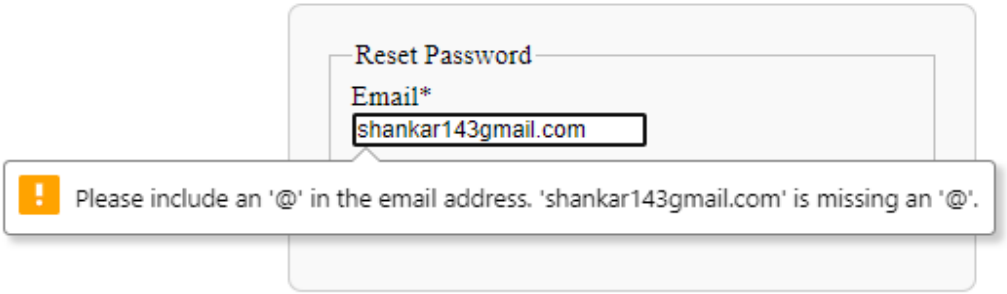



*Figure 4.3: Forgot Password Test*

software testing technique that focuses on examining the internal logic and code structure of a system. In the context of an attendance system using facial recognition, white-box testing plays a crucial role in ensuring the system's reliability, security, and functionality.

In this project, we conducted white-box testing in various ways to thoroughly assess the internal components and logic of the attendance system. Some of the key aspects of white-box testing in this context include:

- Code Coverage: We analyzed the system's code to achieve high code coverage. This involves identifying and testing all possible paths, branches, and statements in the code, aiming to uncover any potential bugs or errors.
- Path Testing: We systematically tested different execution paths within the facial recognition algorithm and attendance system logic. This approach helps identify critical areas that could be prone to errors or unexpected behavior.
- Security Testing: With white-box testing, we assessed the security measures and access controls in place to ensure the system is safeguarded against unauthorized access and potential vulnerabilities.
- Boundary Value Analysis: We tested boundary conditions, where input values are at the edge of the acceptable range, to identify any issues related to data validation or boundary handling.
- Performance Optimization: By examining the code, we identified areas where performance improvements could be made to enhance the overall efficiency of the facial recognition and attendance processing.
- Error Handling: White-box testing allowed us to evaluate how well the system handles exceptions and errors, ensuring that it gracefully handles unexpected situations without crashing or causing data integrity issues.

## 4.5 Gantt Chart

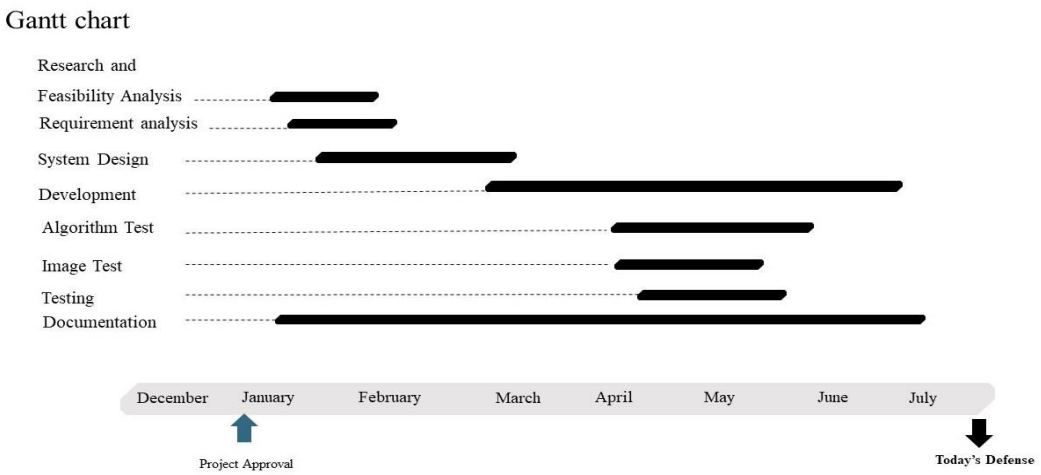



*Figure 4.4: Gantt Chart of ASUFR*

# Chapter 5: Analysis and Evaluation

Before developing the system, it is crucial for requirement collection and analysis. This phase was used to determine the requirements such as: who are the target group for the system? How will they use the system? How will they be benefited by using this system? These were the types of questions that were answered during the requirement gathering. After requirement gathering was completed, requirements were analyzed to determine whether or not these requirements can be measured and tested. Once, requirements analysis was completed, the designing of the system was initiated.

## 5.1. Analysis of Output Obtained

The test results show that our system runs smoothly. This indicates that we were able to achieve all the major objectives we intended to fulfill after the completion of this project. We are able to take employees attendance fluently. We have used various algorithms such as Viola-Jones Algorithm, Support Vector Machines (SVM), OpenCV, etc. Our model can recognize images and match the respective employee.

The output of the task includes several key functionalities: registered employees and admins can access the login user interface, enabling secure access to the system. Admins have the privilege to register new employees and train the datasets for facial recognition. Both admins and employees can generate reports based on specific dates and employee names, facilitating convenient data retrieval. Employees can easily mark their attendance (IN/OUT) through the user interface. Lastly, the report printing portal functions accurately, ensuring reliable and efficient report generation and distribution. Overall, the output demonstrates a well-developed attendance system with comprehensive features for smooth operation and management.

# Chapter 6: Conclusion

In conclusion, the Attendance System using Facial Recognition presents a robust and efficient solution for automating employee management processes. By harnessing the power of machine learning and computer vision, the system showcases the potential of data-driven technologies in transforming traditional attendance tracking systems. The successful integration of algorithms such as Viola-Jones for face detection, SVM for classification, OpenCV for image processing, and shape predictors with 68 face landmarks for feature extraction ensures accurate and reliable identification of employees.

The project's implementation highlights the significance of facial recognition technology in optimizing workforce management by reducing manual efforts and human errors. The seamless web interface, coupled with real-time facial recognition capabilities, streamlines the attendance process and enhances overall organizational efficiency. Moreover, the utilization of machine learning algorithms demonstrates the adaptability of the system to handle varying scenarios and achieve high levels of accuracy.

However, it is essential to acknowledge the security and privacy implications associated with facial recognition systems. Safeguarding employee data and ensuring compliance with data protection regulations are critical factors in the system's successful deployment and acceptance within the organization.

Looking ahead, further research and development can explore ways to enhance the system's scalability to accommodate larger employee populations and diverse environmental conditions. Continuous improvement and optimization will ensure the system's reliability and performance, making it a valuable asset for organizations seeking advanced and modernized attendance tracking solutions.

## 6.1 Limitations

Some of the limitations of our projects are as follow:

- The employee's time shifts, spanning from today to tomorrow, are not suitable for the situation.
- While the system performs well with a moderate-sized employee database, scalability to handle larger databases with thousands of employees may pose challenges. Further optimization and resource allocation might be required to ensure efficient processing and real-time performance.
- It needs regular training of datasets to ensure the system works correctly
- Not able to distinguish live or stationary object..

## 6.2 Future Enhancement

The system can be improved by adding a large number of data sets. Besides employees, our system can be implemented with other institution as well, such as for students in schools. More advanced the system, the more it could assist the administration to handle processes in multiple departments simultaneously.

Some of the future enhancement for our projects that we have identified are as follow:

- Improve algorithm accuracy for image recognition.
- Implement a leave management system within the attendance system.
- Develop a desktop application for added accessibility.
- Explore hardware implementation using Raspberry Pi or Arduino boards.

# References

[1] Bhise, "Attendance System Using NFC Technology with Embedded Camera on Mobile Device," *JOUR*, pp. 350-353, 28 February 2015.

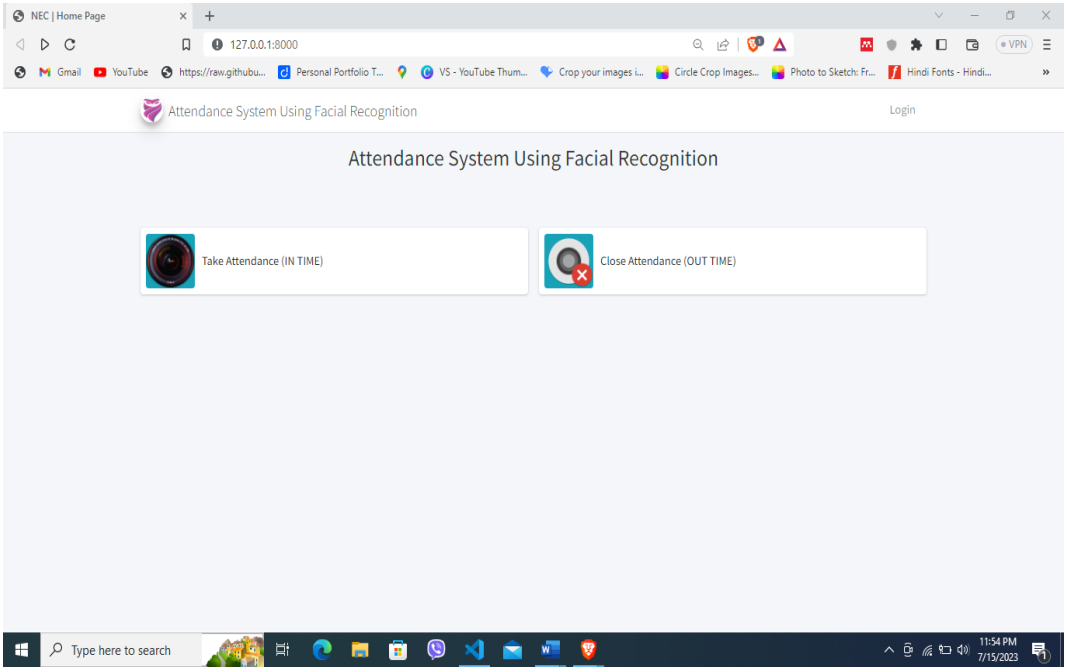
[2] Sai, "Aadhaar Based Biometric Attendance System Using Wireless Fingerprint Terminals," *2017 IEEE 7th International Advance Computing Conference (IACC)*, pp. 651-655, 2017.

[3] Roy, "A web enabled secured system for attendance monitoring and real time location tracking using Biometric and Radio Frequency Identification (RFID) technology," *A web enabled secured system for attendance monitoring and real time location tracking using Biometric and Radio Frequency Identification (RFID) technology*, pp. 1-5, 20015.

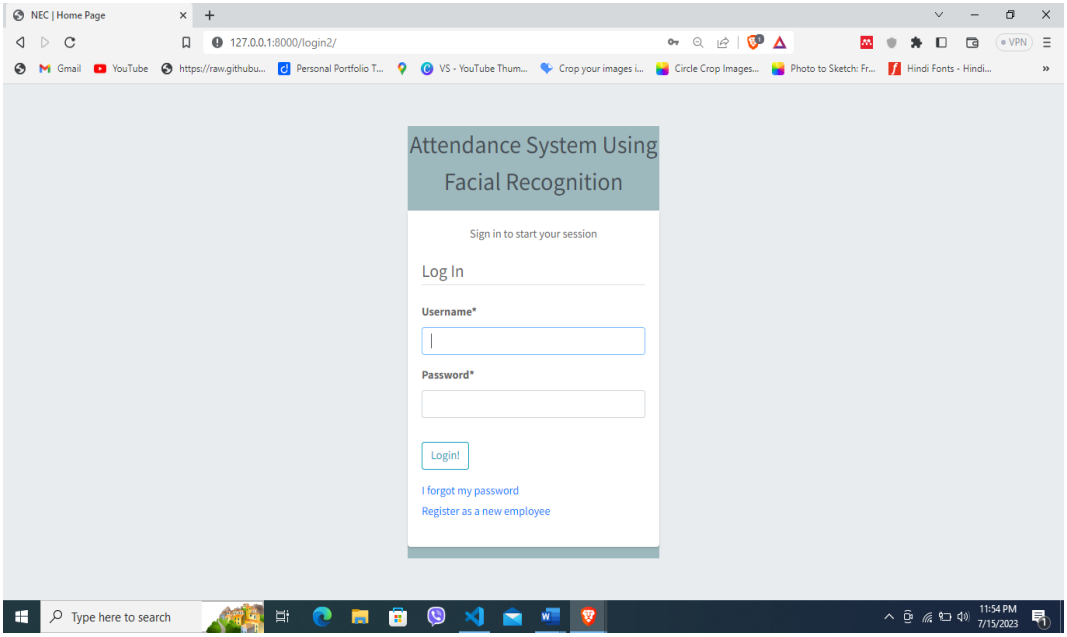
[4] Nugraha, "Real-Time Online Attendance System Based on Fingerprint and GPS in the Smartphone," *2018 4th International Conference on Wireless and Telematics (ICWT)*, pp. 1-4, 2018.

# Appendix

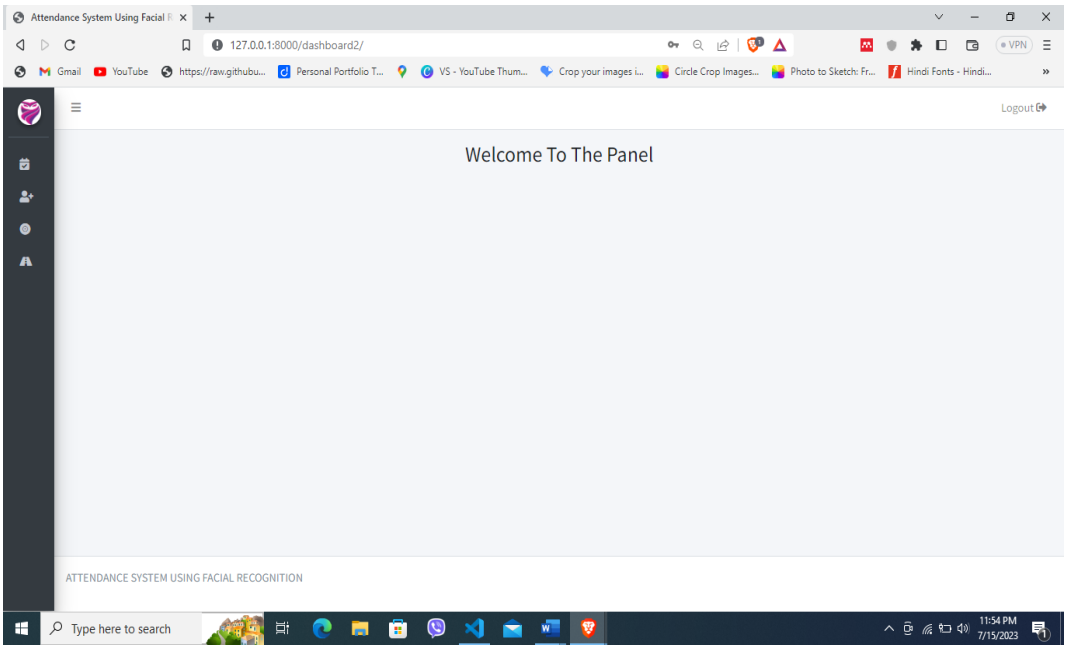
## 1. Home Page:



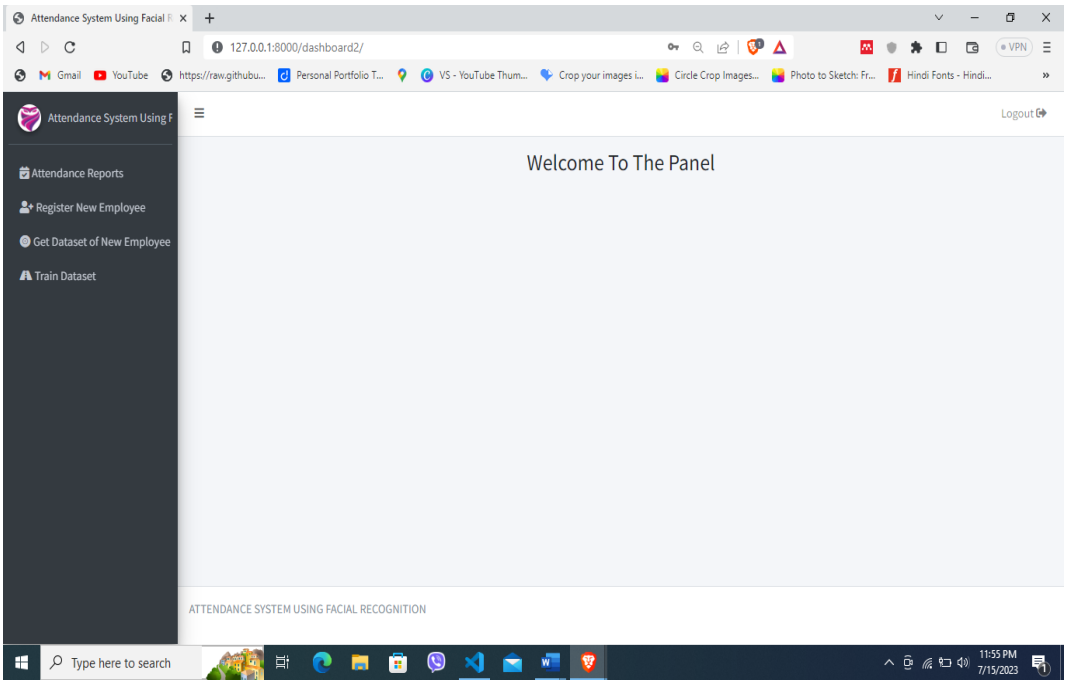

## 2. Login page:



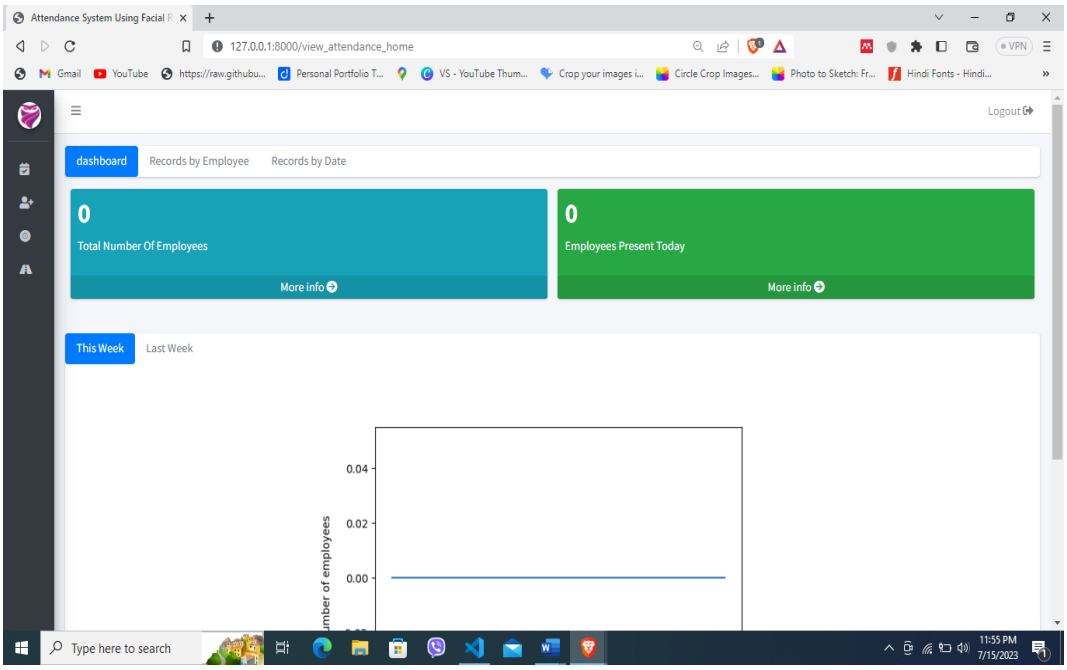
## 3. Admin Page:



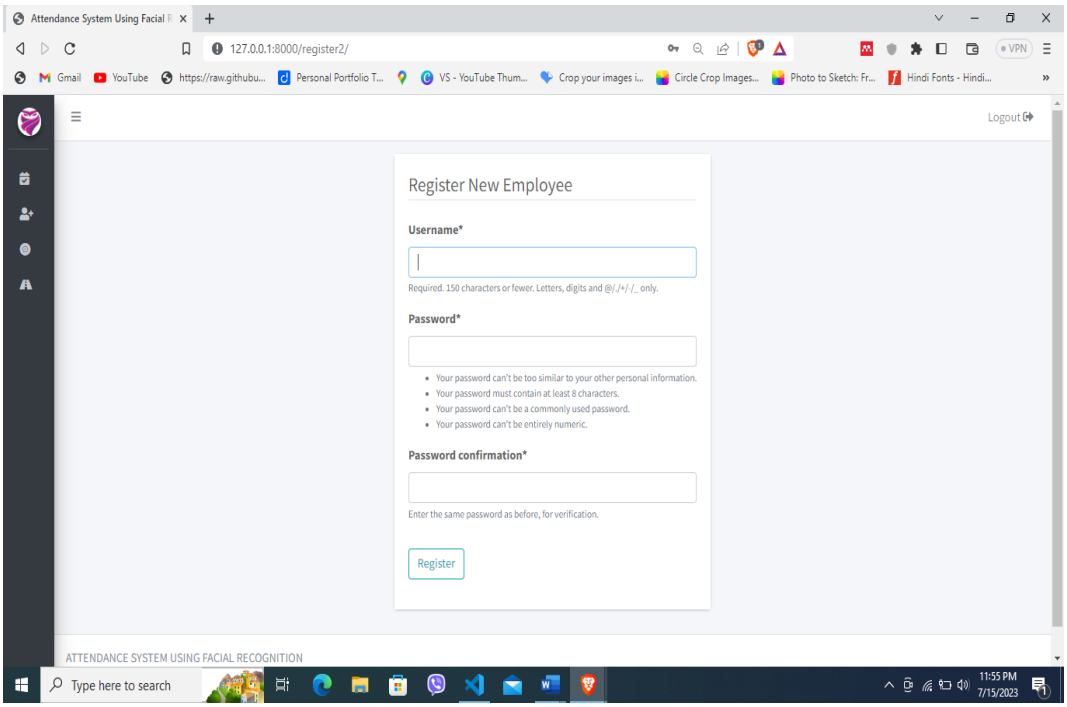

## 4. Admin Dashboard:



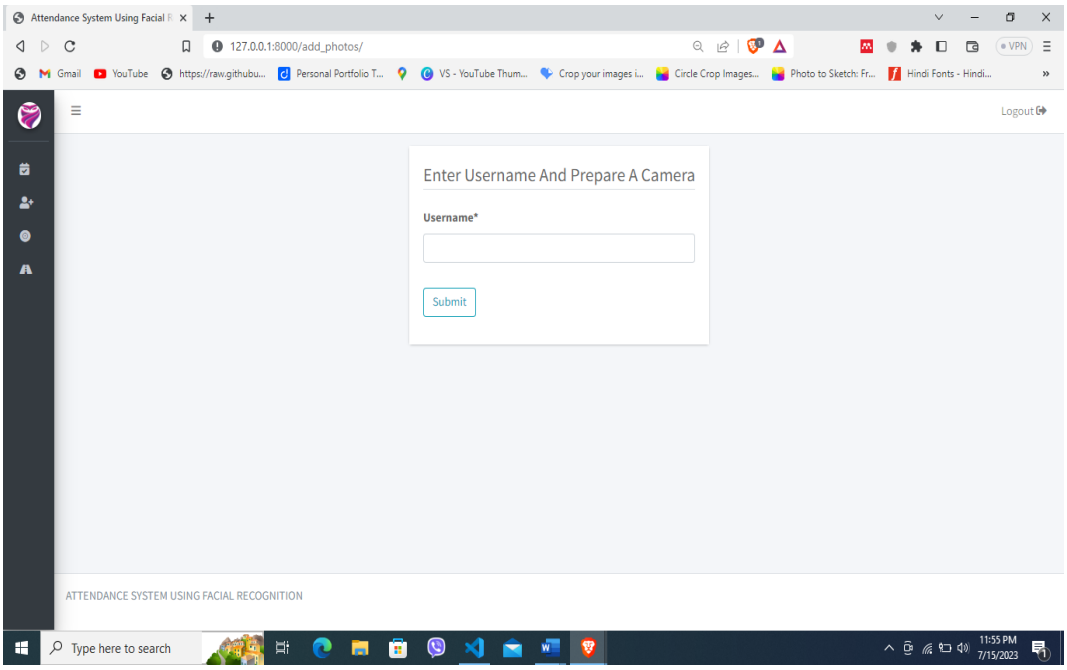
## 5. Attendance Reports (Admin Page):



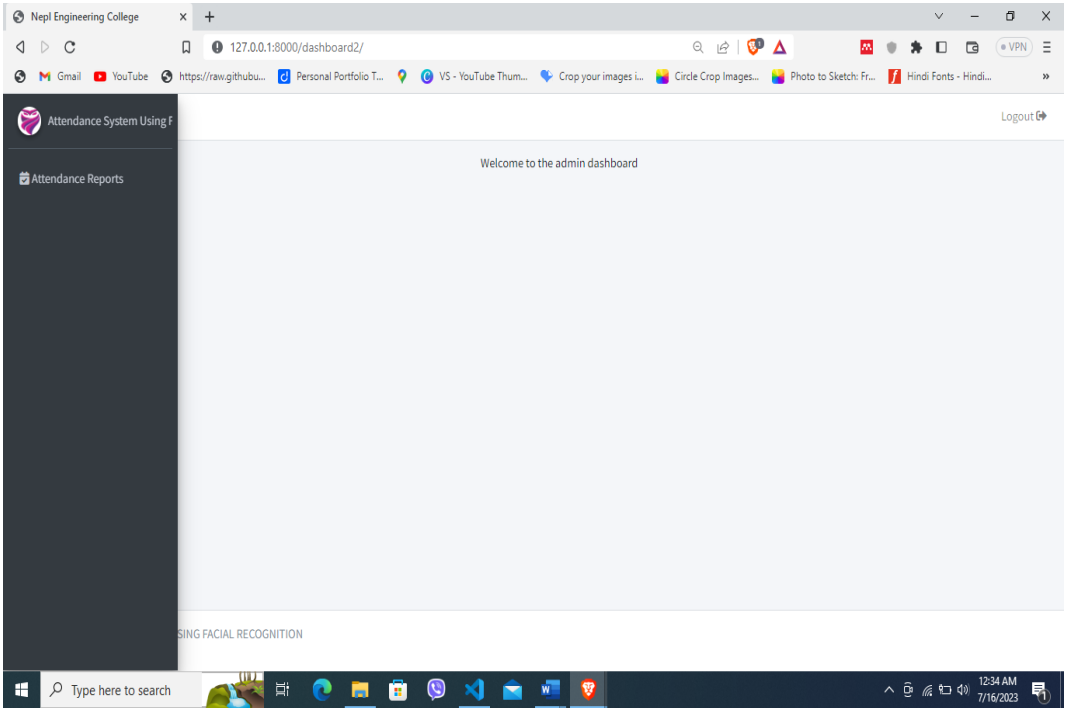

## 6. Register New Employee:



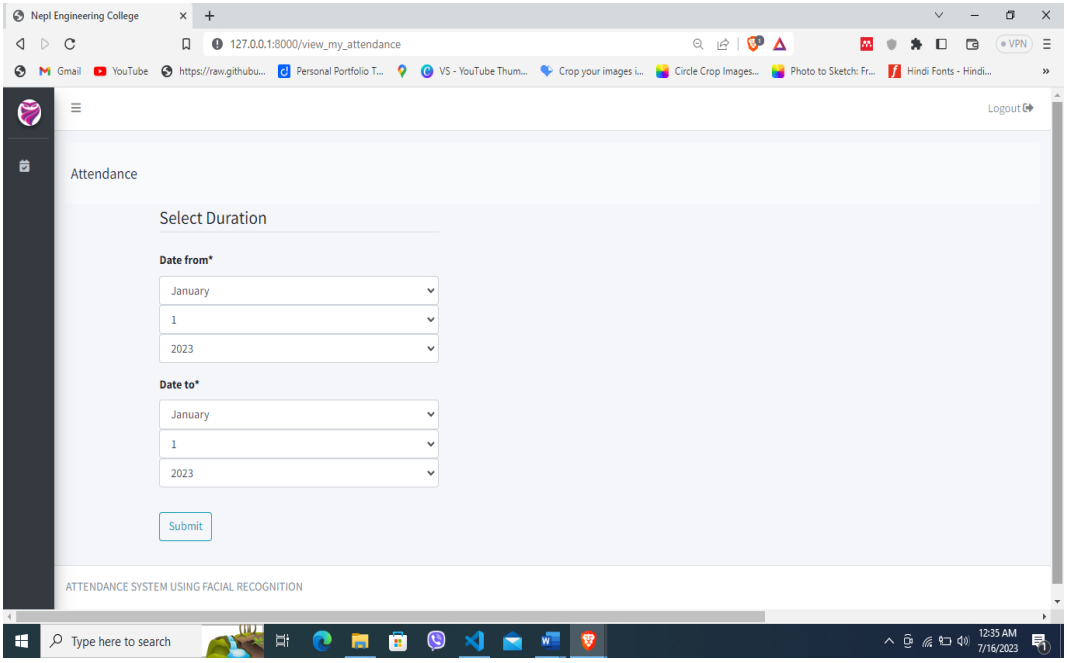
## 7. Get Dataset of New Employee:



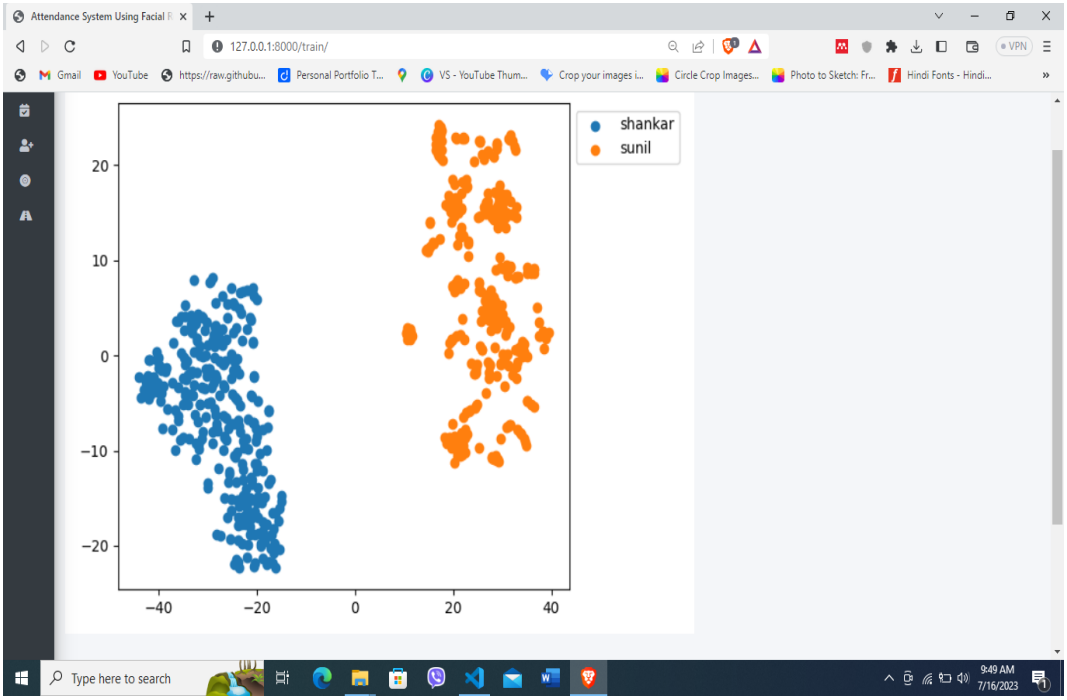

## 8. Employee Page:



## 9. Attendance Reports (Employee Page):




## 10. Train Dataset



# 11. Forgot password