

FACE RECOGNITION ATTENDANCE SYSTEM

CIS 634 - OBJECT ORIENTED SOFTWARE ENGINEERING

FINAL PROJECT REPORT

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Abstract:

Face detection and face recognition are very important technologies these days. We decided to make a device that detects and recognize the face as a student attendance system and can be a substitute for the regular paper attendance system and fingerprint attendance system. Open cv python is a very helpful programming tool in regards of facial uses and very helpful in other uses. This tool detects and recognize the faces of students which is already registered in the database. And then it records the attendance of student when their face image matches with the image in the database.

1.Introduction

1.1 Project Definition:

When a student's face is displayed from the folder containing the database of all the pupils in the class, attendance is registered if the face matches one of the faces in the saved image; otherwise, the face is disregarded, and attendance is not marked. The model has an accuracy of 99.38% on the Labelled Faces in the Wild benchmark. Any organization, including businesses and educational institutions, places a high value on attendance. Therefore, keeping a record of attendance is crucial. The issue arises when one must manually take attendance, which takes a lot of time and is also exhausting.

1.2 Project Objectives:

- Reducing time wastage during conventional class attendance.
- Produce monthly report
- Flexibility and liability
- Encouraging the use of technology in daily lives.
- Preventing fake roll calls as one to one attendance marking is possible only.

1.3 Project Specifications:

- Metric: Camera Resolution
- Requires good lighting condition for better camera capture capability.

1.4 Architecture and components:

1.4.1 Functional Diagram:

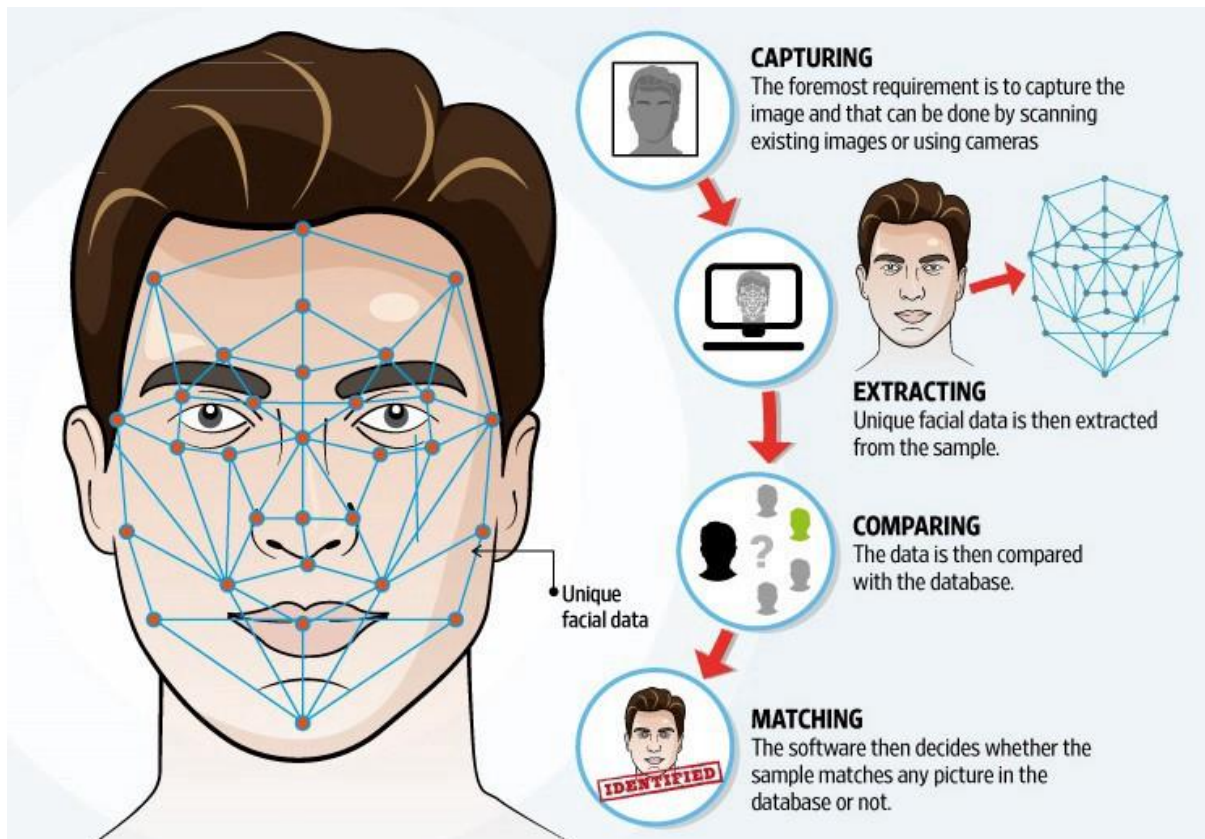


Fig 1.1: Working of this project in detail

The description is as follows:

Camera: The camera is the only hardware component required to capture images of the students.

Image Capturing: This module allows camera to capture the images of students and compare it with images that already registered in the student database which contains student details. Open cv is the programming tool helps to compare the captured images with the student database.

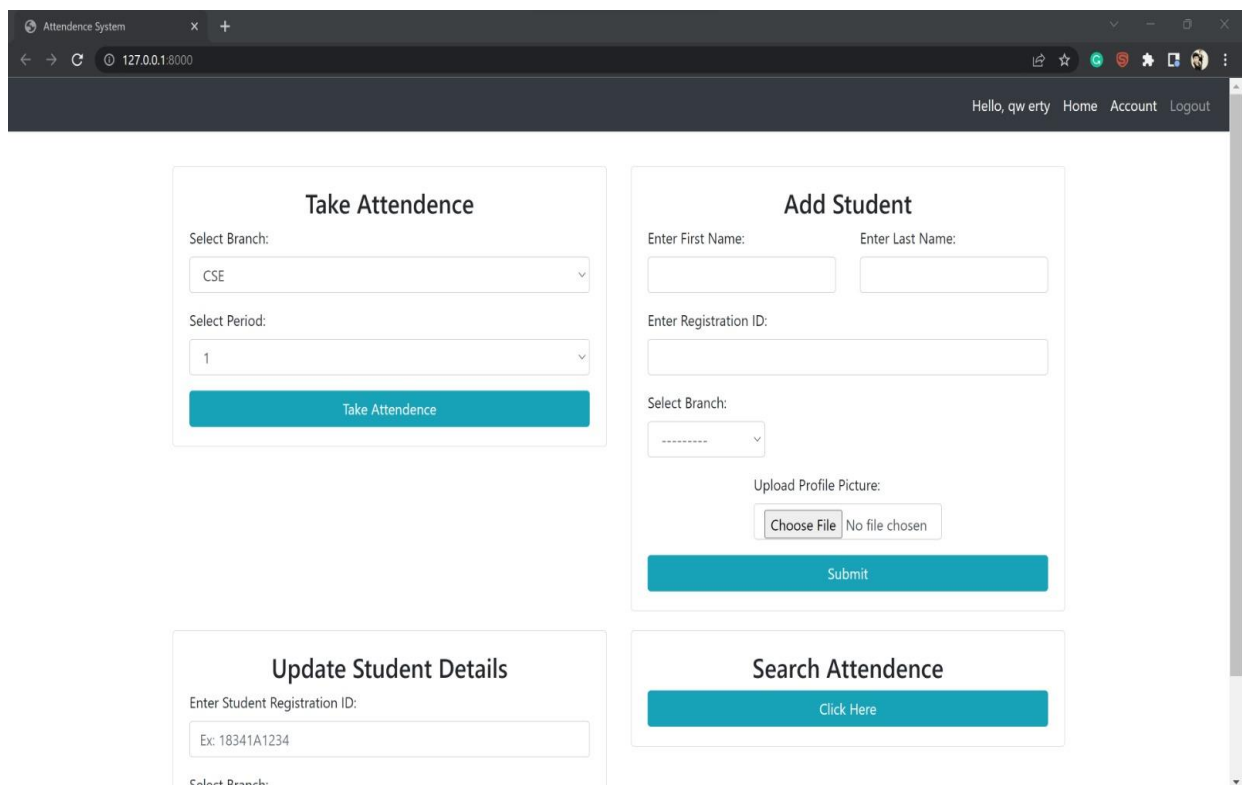
Feature Extraction: This module is used to extract important features out of image. It compares them with registered face images, saves in database and provides a result of comparison.

Comparisson and Matching: Our database has preserved images of students which we aim to recognize and mark attendance. The comparison involves matching the facial data with the stored database images and if matched, it marks attendance for that class.

Update Attendance: If the student face image is matched to the database image, it will mark attendance and update in the database. If the image is not matched to the database, it will give result as the student is not in the registered database and gives access to register as a new student to the class.

1.4.2 User Interface:

Image of HomePage:



The screenshot displays the front panel of the Student user Interface. It features a dark header bar with the text "Attendance System" and a navigation menu with links: "Hello, qwerty", "Home", "Account", and "Logout". The main content area is divided into four sections:

- Take Attendance:** Includes a "Select Branch:" dropdown menu with "CSE" selected, a "Select Period:" dropdown menu with "1" selected, and a blue "Take Attendance" button.
- Add Student:** Includes fields for "Enter First Name:", "Enter Last Name:", and "Enter Registration ID:". Below these is a "Select Branch:" dropdown menu and an "Upload Profile Picture:" section with a "Choose File" button and "No file chosen" text. A blue "Submit" button is at the bottom.
- Update Student Details:** Includes a field for "Enter Student Registration ID:" with an example "Ex: 18341A1234" and a "Select Branch:" dropdown menu.
- Search Attendance:** Includes a blue button labeled "Click Here".

Fig 1.2: Front panel of Student user Interface

As we can see, the home page contains four different sections, and it will work as per the wish of the student. The students can record his/her daily attendance in the section 'Take Attendance'. Students have access to register as a New Student in the section 'Add Student' and also students can check their recorded reports of their daily attendance on the website by clicking section 'Search Attendance'.

1.5 Applications:

- Large application in institute attendance system where multiple attendances are carried out for different classes. The attendance will be short timed and reduce manual errors.
- Large application of computer vision in field of Communication, Biomedical, Automatic Product Inspection.

2. Literature Review

2.1: Project background:

In the face detection and recognition system, the process flow is initiated by being able to detect the facial features from a image taken by camera. The algorithm processes the image captured and identifies the features from image to compare it with the registered known database images. The main motive behind this project is to simplify how attendance is taken during lectures and how much time it takes. Manually calling out attendance and writing it down on sheets is not productive and efficient. With this 'Face recognition Attendance system', it will be easy to tell if a student is present in the classroom or not.

2.2 Previous Work:

Project#1

This is a project done by students as a final year project at Kingston University London in 2018.

The system will be presented an image either via camera or from memory and it must detect the number of faces on it automatically. After identifying faces, the system should crop the faces from the image and store them in memory for image recognition which will be done in the second step. The system should be able to automatically count the number of faces detected on the image.

The second step will be the recognition part where the system will be able to match faces from the stored dataset and compare it to the input data from the first step. A software will be used for this system which automatically sorts out the faces. The software will be inter-active so to facilitate interaction between multiple tasks as required. Because the system has two steps, the second phase of the system will involve the training of images on a dataset that are to be used for recognition.

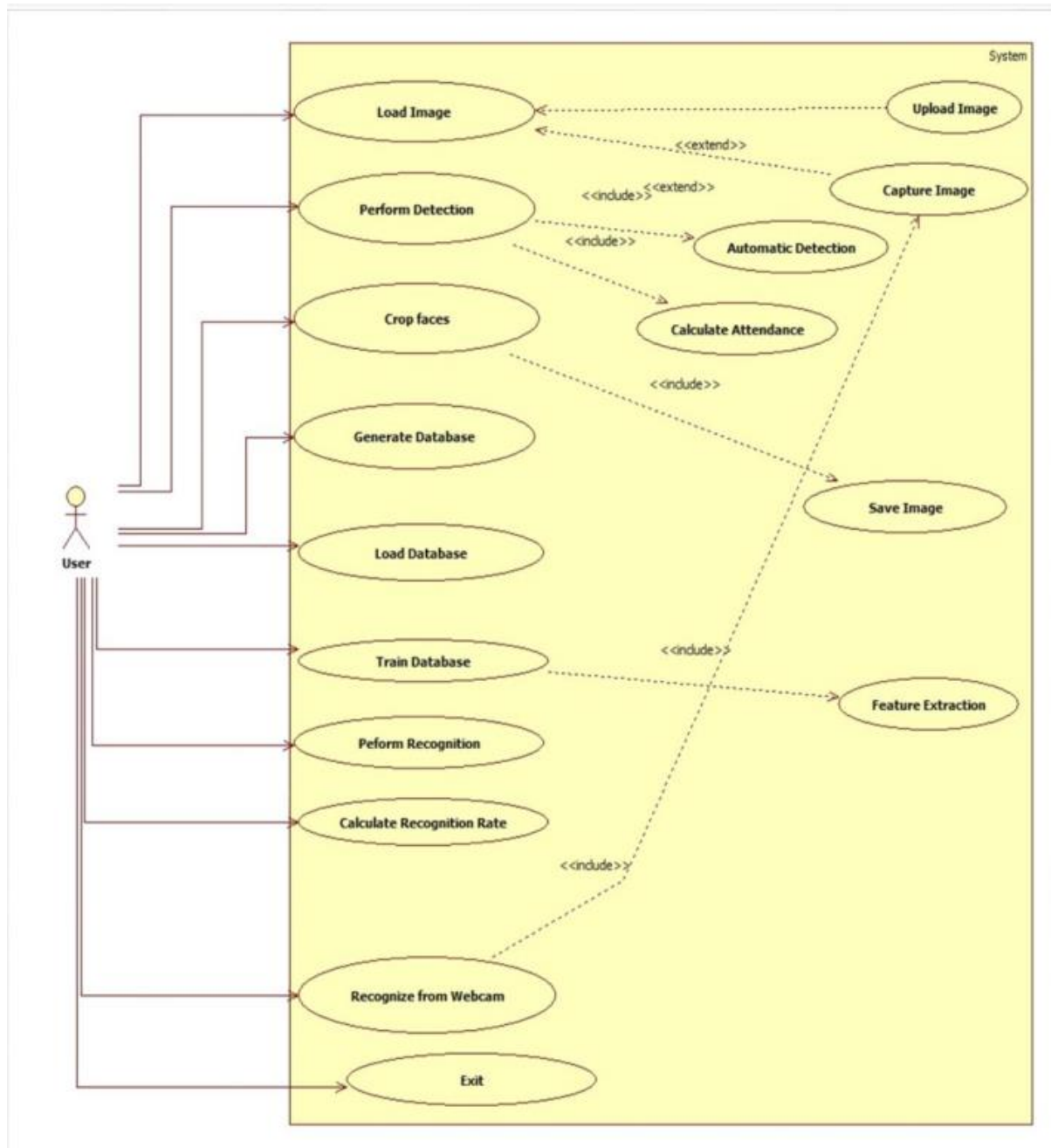


Fig 2.1: Block Diagram of previous project#1

Project#2:

This is a project done by students as a final year project at Universiti Tunku in 2018.

The approach performs face recognition-based student attendance system. This method is also similar to others and begins with the input of an image either loaded from memory or from camera. Then it pre-processes the facial features and extracts it followed by subjective selecting and then the recognition of the facial images from known database. Both LBP and PCA feature extraction methods are studied in detail and computed in this approach in order to make comparisons. LBP is enhanced in this approach to reduce the illumination effect. An

algorithm to combine enhanced LBP and PCA is also designed for subjective selection in order to increase the accuracy.

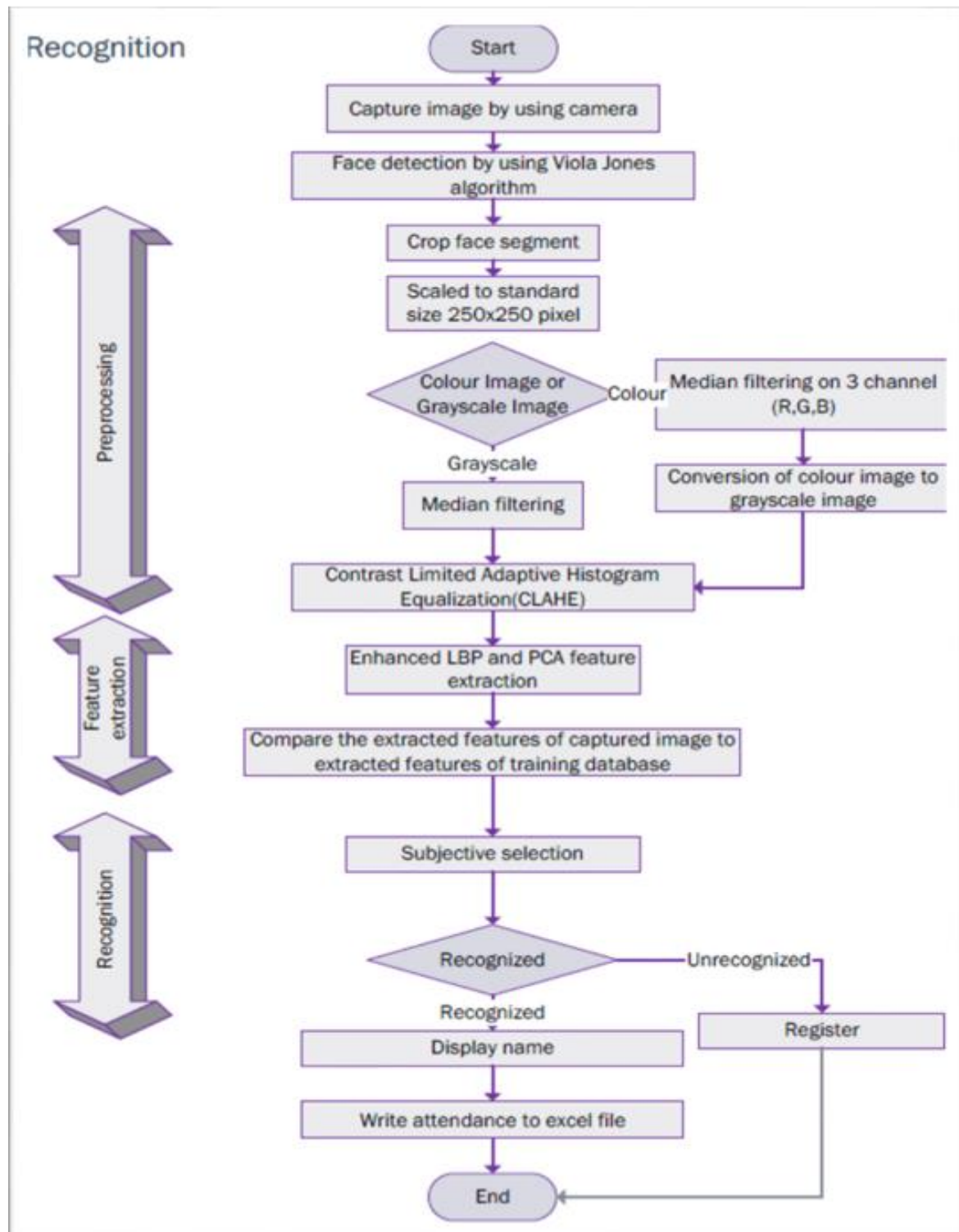


Fig 2.2: Block diagram of Previous Project#2

2.3 Comparative Study:

Our project is different than all the previous projects made and mentioned above. Though the general mechanism and flow of events is similar in above projects and our current project however, the mechanism of face detection is completely unique and different.

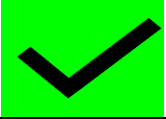
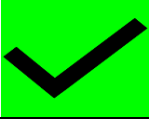
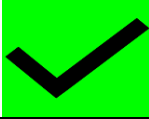
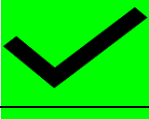
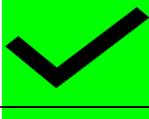
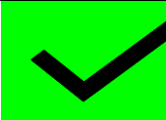
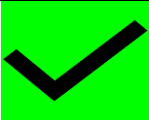
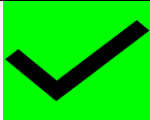
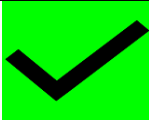
PROJECTS	Time Saving	Demand in Market	Data Saving in Records	Face recognition & detection
Previous project#1				
Previous project#2				
Our Project				

Fig 2.3: Comparison between projects

3.1 System Design:

3.1.1 Design Constraints:

Camera needs to be in active state all the time during class hours. Continuous internet access is required to store the attendance records of students on the website. And we can observe one limitation which is, if a student who is already registered in student database changes his/her looks might result in face image features mismatch and difficult to record the attendance. Biometric detection technology will be used to record attendees with a high-definition camera that detects individual faces, so the machine compares known faces with student faces stored within the website. When the face of the code is matched to a saved image, attendees are marked with the current website for further calculation. During this process, there is a chance that the camera will not take the correct picture or will miss the number of individuals in the picture.

3.2 Design Methodology:

As we mentioned before,

- A camera will need to be installed in each lecture room.
- All the students must register with their details individually, it will capture their images and store them in the database.
- So that when the students appear in front of this systems camera, it will match some features with image features already stored in the database. If the features are matched, attendance will be counted for each class.
- After login into the account, student can see their individual report of their attendance.

3.3 Tools and Technology:

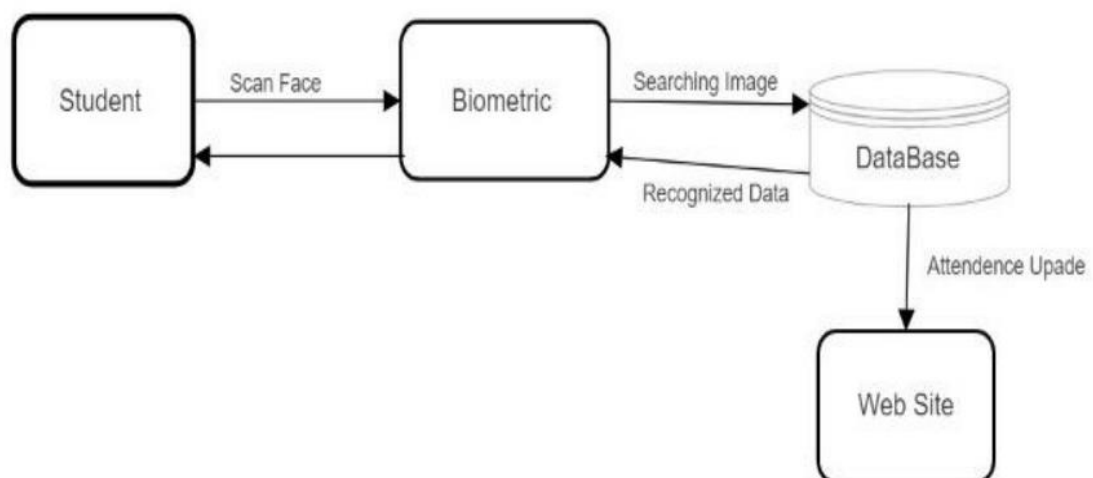
- Open cv python: it is used to access the web camera.
- VS Code: It's a platform to develop code(IDE)
- Python: It is a programming language
- Django: It is a fame work. It has built-in database.

3.4 Database Design:

- The related data stored on this system uses sqlite3, which is a relational database
- The information in the database mainly contains the basic personal information of students, as well as the facial feature pictures selected by students, punch card records, overtime, leave records and student logs, etc.
- The personal information table is stored separately from the facial feature table for more efficient reading and search performance.
- Facial features are an important part of face recognition. The background will take all the face data in the table at one time, package it into a byte number, and provide it to the face module for comparison.

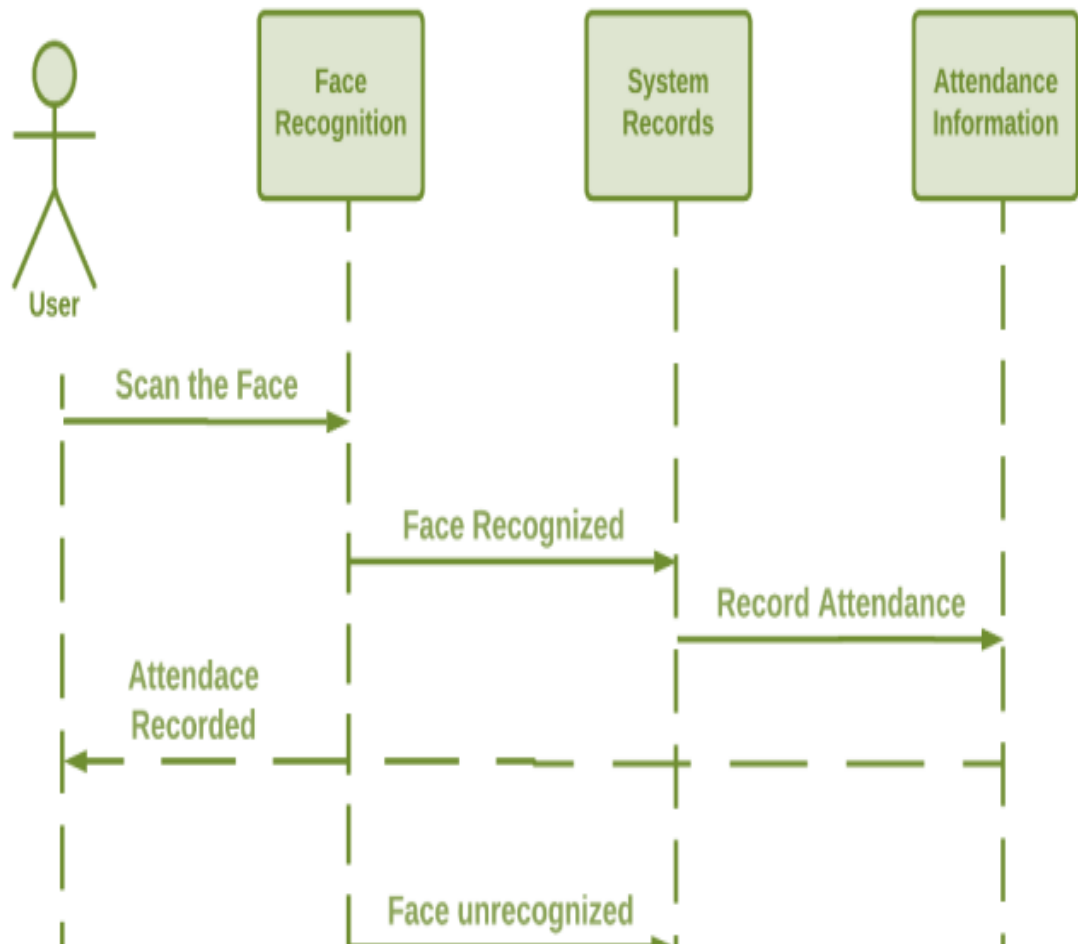
3.5 Static model:

This static model is a thought of providing the complete detail of system's implementation view.



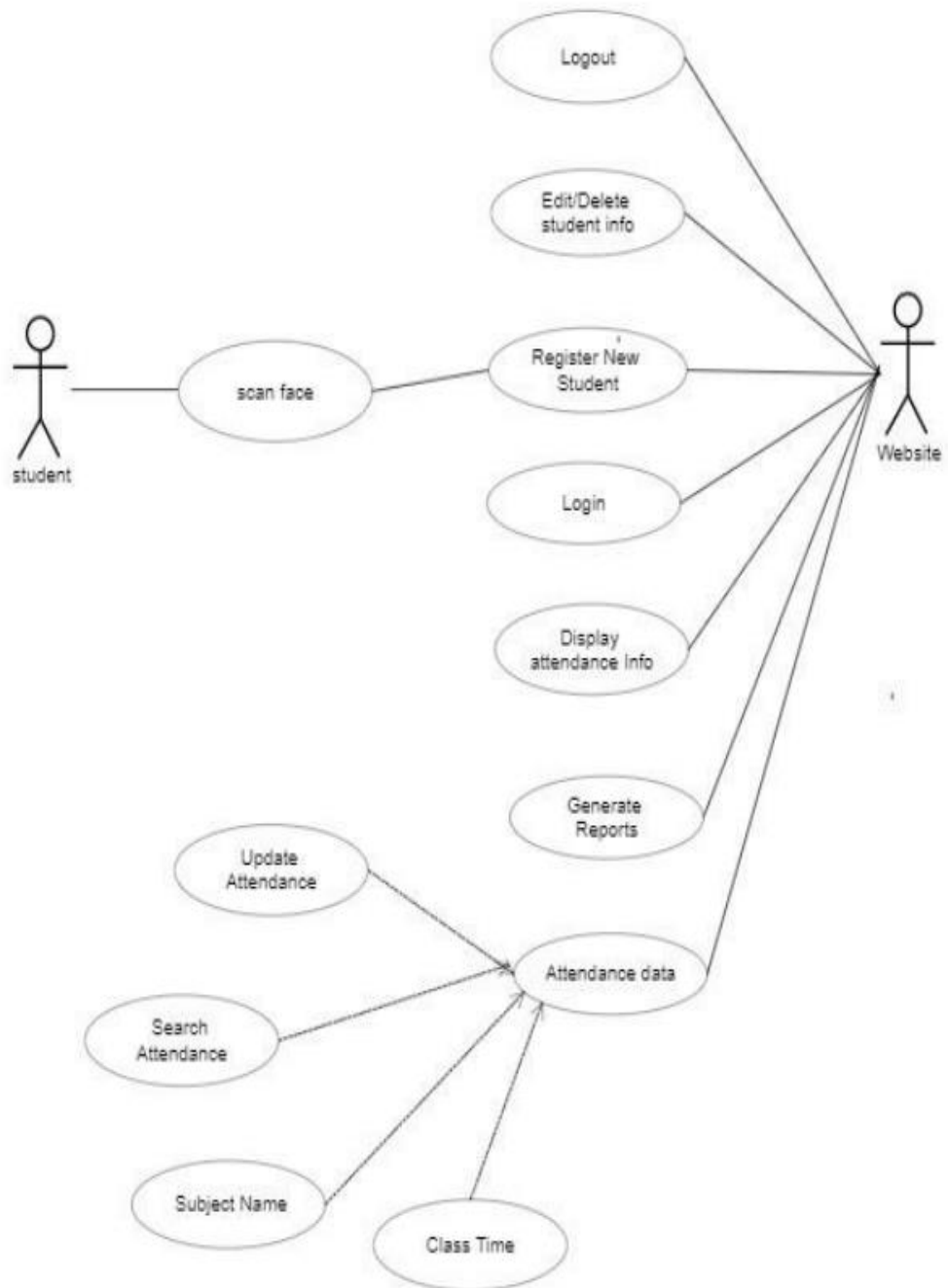
3.6 Dynamic model:

Dynamic modelling describes those aspects of the system that are concerned with time and sequencing of the operations. It is used to specify and implement the control aspects of the system.



3.6 Use Case Model:

This describes the complete functionalities involves in the system. A use case represents a discrete unit of interaction between student and a website which stores attendance records.



4. System Testing and Analysis

4.1 Test Plan:

The software here to be evaluated simply comprises of what and where in the facial recognition attendance system to be examined. The testing exclusivities include tests that have not yet been fully developed and hence require extra time to implement and merge modifications.

- Authentication of the student will be managed.
- Authentication of the admin will be managed.
- Registering new student data in database.
- facial recognition algorithm will be tested.
- compare the capture data with the database will be tested.
- marking attendance will be managed.
- result in mobile will be tested.
- API gateway will be tested.

4.2 Testing tools and environment:

Simply said, testing tools are the equipment required to evaluate a system. Because the system is internet-based, we can test it from any location. PyTest and salenium are the package tool in python to run the test and manual testing for API using python condition and package. As this project is not a very complex data, manual testing is better option.

4.3 Test Cases:

ID	1
Test Input	Authorization of the user
Expected Output	login successful
Description	This is a login module, which has two tabs as username and password. Username as admin or student detail. password as per the condition

ID	2
Test Input	Register module
Expected Output	Success on registration
Description	In this module, the data of the students are added in the admin user. Each student data is classified by the name and image of the student. A conformation mail will be sent to the student of the registration

ID	3
Test Input	Database module
Expected Output	Loading and saving data successful
Description	This module stores the data of each student. this work as backend storing data where you can store the new student and retrieve the stored data to compare

ID	4
Test Input	Face recognition model
Expected Output	Successful running
Description	This module is to run the algorithm to compare the image data and find the correct object. This takes two inputs, one from camera and another from database. The captured image is compared with the already stored student image from the database. the output is transferred

ID	5
Test Input	API module
Expected Output	Pathway is successful
Description	This module is to transfer the output data to the desired platform. In this project, we used to google spread sheet API from google cloud. This marked the data in spread sheet

4.4 Use Cases:

We have 2 types of users of the system.

- Student profile
- Admin profile

➤ Following functionalities can be performed by the admin:

- Login page:
 - Enter the username and password as admin
 - In username, no special character in the beginning of the name
 - Password should contain,
 1. at least one Alphabets
 2. at least one Numbers
 3. minimum of 8 characters

- Register new student to the system
 - Takes the photo and get the details of the student
 - Add student photos to the training data set
 - This stores the data in the data base and starts to compare and get the detail in specific number
 - Train the model
 - This starts to train itself by comparing with other data stored in the data base and using the web camera it gets more detailed face data from the student
 - View attendance report of all students. Attendance can be filtered by date or employee.
 - This store all the data in csv file
 - This result in a report of specific class attendance.
- Following functionalities can be performed by the students:
- Login page
 - Enter the username and password
 - Each student has their own username and password
 - Password should contain,
 1. at least one Alphabets
 2. at least one Numbers
 3. minimum of 8 characters
 - Mark his/her present or absent by scanning their face
 - Student face are shown in front of the camera
 - Once the camera detects the face, it starts to compare the image with the database
 - Once the face is confirmed from the data base, it marks the student as present
 - If face shown is not in the class database, it will send a message as “no student detail”.
 - View attendance report of self
 - After login into the account, student can see their individual report of their attendance.

4.5 Special usage considerations:

This device is not portable and always require internet to access data from the database. With this we can add new student or delete the existing student data from the database.

5 Overall Outputs:

We were successfully able to register the student details by logging into our account.

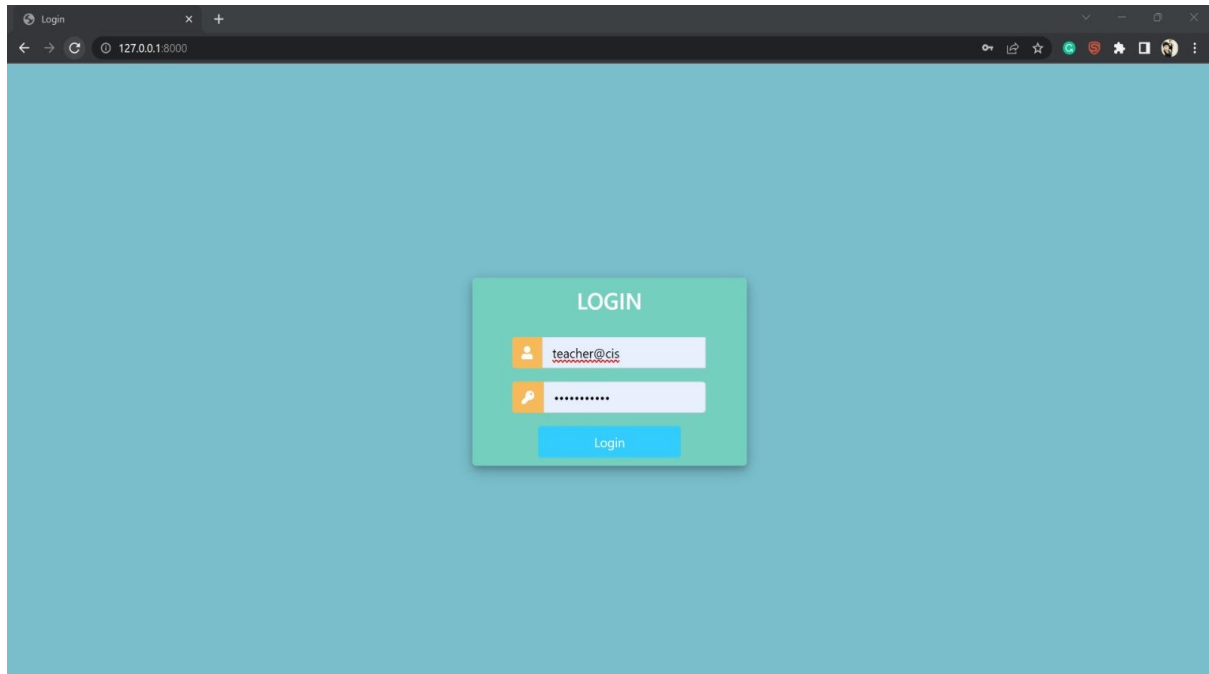


Fig 5.1 Login Page

After Logging in, it will direct you to the Home Page.

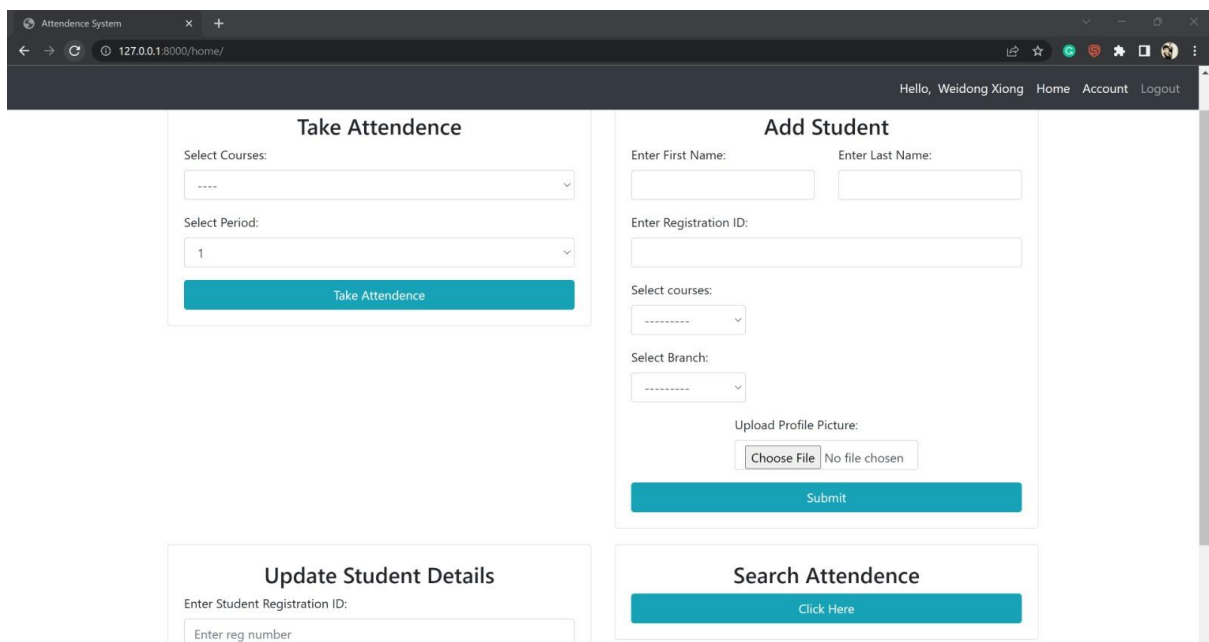
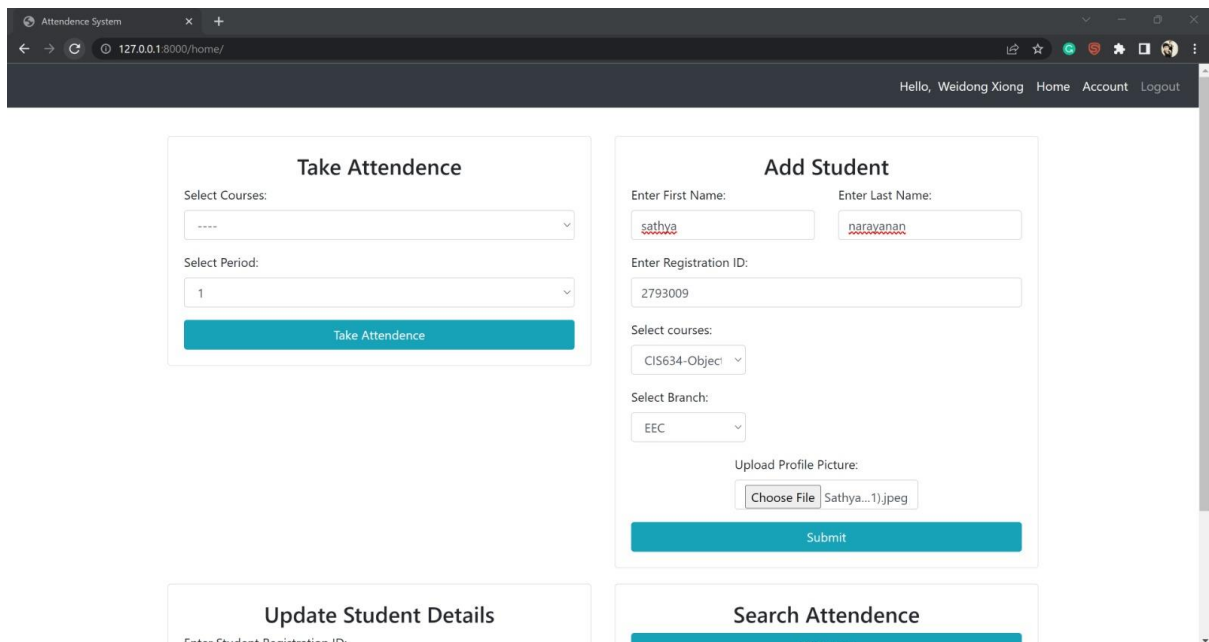


Fig 5.2 Home Page

We can see four sections here,

Firstly, we need to register as a student by submitting our details in the section ‘Add Student’.

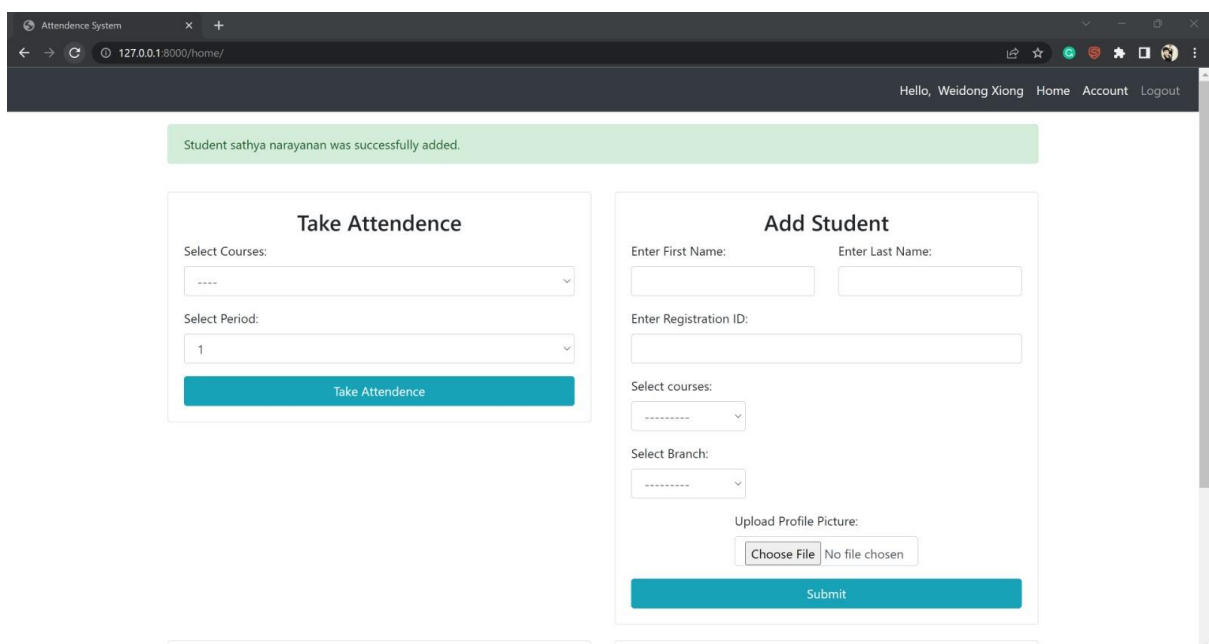


The screenshot shows a web browser window titled "Attendance System" with the URL "127.0.0.1:8000/home/". The user is logged in as "Weidong Xiong". The page displays four main sections: "Take Attendance", "Add Student", "Update Student Details", and "Search Attendance". The "Add Student" form is the primary focus, containing the following fields and options:

- Enter First Name:** sathya
- Enter Last Name:** narayanan
- Enter Registration ID:** 2793009
- Select courses:** CIS634-Object
- Select Branch:** EEC
- Upload Profile Picture:** Choose File (Sathya...1).jpeg
- Submit** button

The "Take Attendance" section includes a "Select Courses" dropdown (empty) and a "Select Period" dropdown (1), with a "Take Attendance" button below them. The "Update Student Details" section has an "Enter Student Registration ID:" field. The "Search Attendance" section has a "Search" button.

Fig 5.3 Registering as a student.



This screenshot shows the same "Attendance System" web application after a successful registration. A green notification banner at the top states: "Student sathya narayanan was successfully added." The "Add Student" form is now empty, with the following fields and options:

- Enter First Name:** (empty)
- Enter Last Name:** (empty)
- Enter Registration ID:** (empty)
- Select courses:** (empty dropdown)
- Select Branch:** (empty dropdown)
- Upload Profile Picture:** Choose File (No file chosen)
- Submit** button

The "Take Attendance" section remains unchanged, showing the "Select Courses" dropdown (empty), "Select Period" dropdown (1), and "Take Attendance" button. The "Update Student Details" and "Search Attendance" sections are also visible at the bottom of the page.

Fig 5.4 Student successfully registered.

We can also update the student details in the section ‘Update Student Details’

The screenshot shows a web browser window titled 'Attendance System' with the URL '127.0.0.1:8000/home/'. The user is logged in as 'Weidong Xiong'. The main content area is divided into two columns. The left column contains a dropdown menu with the value '1' and a 'Take Attendance' button. The right column contains a 'Select courses:' dropdown, a 'Select Branch:' dropdown, an 'Upload Profile Picture:' section with a 'Choose File' button and 'No file chosen' text, and a 'Submit' button. Below these columns, there is a section titled 'Update Student Details' with a text input for 'Enter Student Registration ID:' containing '2793009', a 'Select Branch:' dropdown with 'EEC' selected, and a 'Submit' button. To the right of this section is a 'Search Attendance' section with a 'Click Here' button.

Fig 5.5 Checking the student details.

In this fig 5.6, we took attendance without registering first as a student in that particular course. So, it will notify that ‘student not found’

The screenshot shows the same web browser window as Fig 5.5, but with a red error message banner at the top that reads 'Student Not Found'. The main content area is divided into two columns. The left column contains a 'Take Attendance' section with a 'Select Courses:' dropdown, a 'Select Period:' dropdown with '1' selected, and a 'Take Attendance' button. The right column contains an 'Add Student' section with text inputs for 'Enter First Name:' and 'Enter Last Name:', a text input for 'Enter Registration ID:', a 'Select courses:' dropdown, a 'Select Branch:' dropdown, an 'Upload Profile Picture:' section with a 'Choose File' button and 'No file chosen' text, and a 'Submit' button.

Fig 5.6 Student is not in the list.

Finally, the camera detects the students face by recognizing some face image features and record attendance.

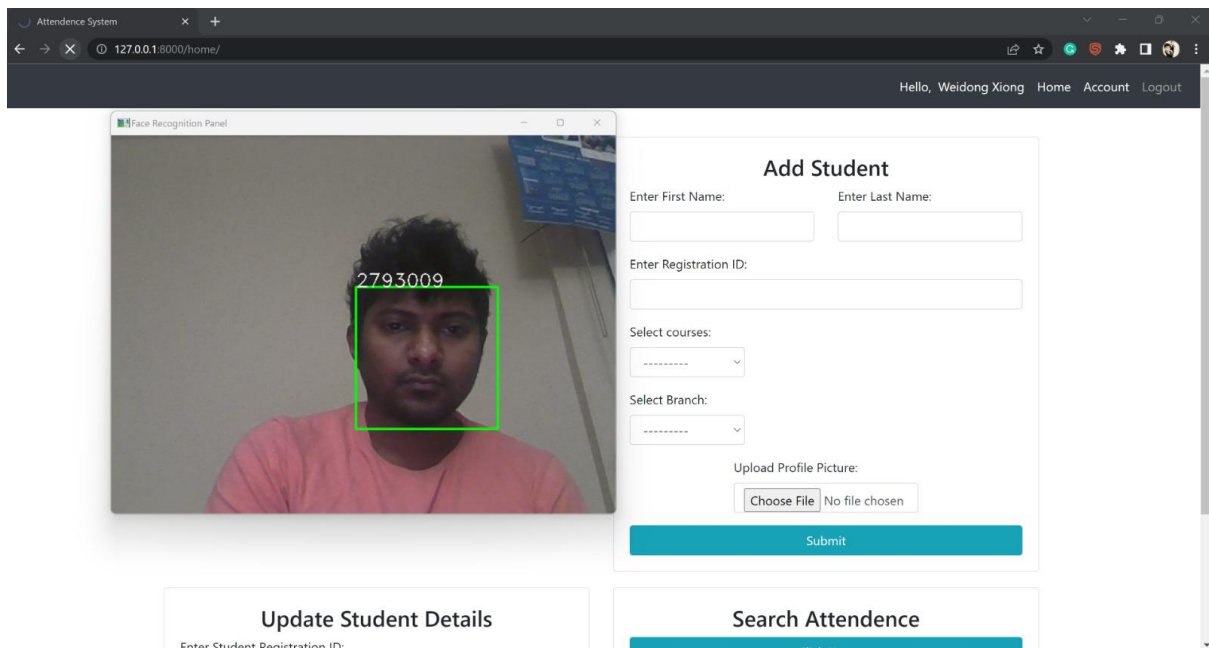


Fig 5.7 Camera detects student and record attendance

In **fig 5.8** we can see that, the attendance recorded in a particular course. The students who shown in front of the systems camera marks as present and students who doesn't shown up in that course but registered marks with absent.

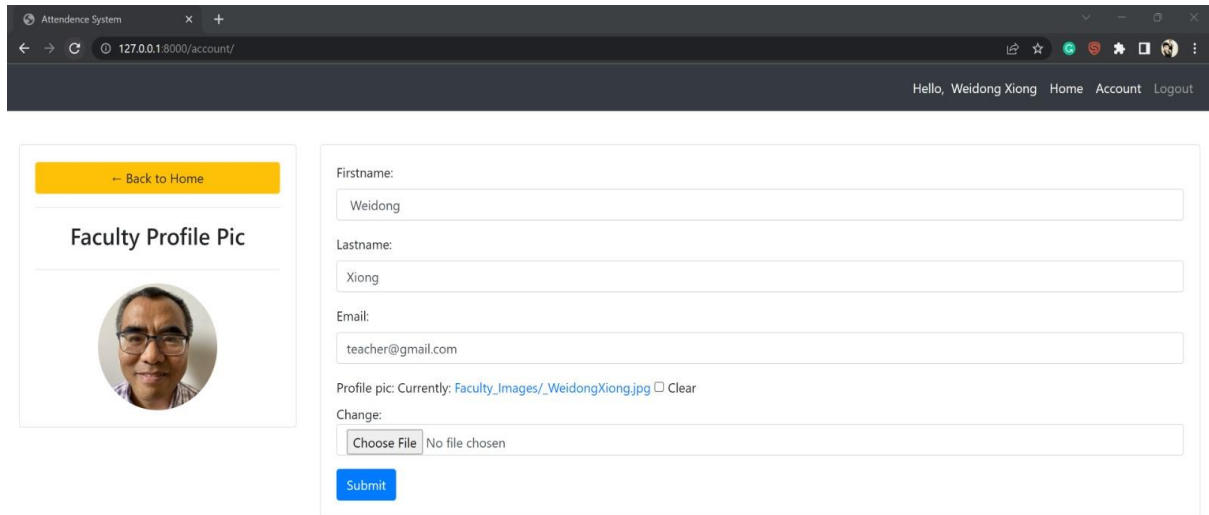
Attendance taking Success

Present Period Attendance

Student ID	Branch	courses	Status
2793009	None	CIS634	Present
2792970	None	CIS634	Absent
2819758	None	CIS634	Absent
2824635	None	CIS634	Absent
2793009	None	CIS634	Present

Fig 5.8 Records of attendance

In this **fig 5.9** we can see the faculty details of this particular course. Only respected professor will have the access to modify or update faculty profile as well as student attendance records and this helps professor to generate monthly reports of all students who registered in that course.



Attendance System

127.0.0.1:8000/account/

Hello, Weidong Xiong Home Account Logout

Back to Home

Faculty Profile Pic

Firstname: Weidong

Lastname: Xiong

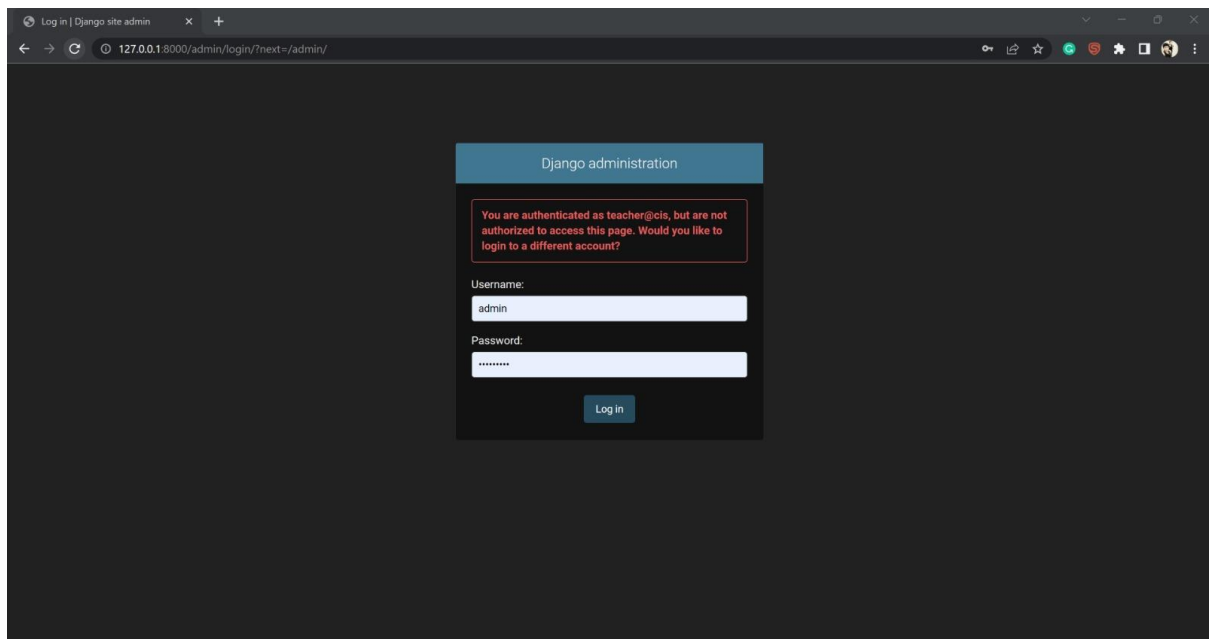
Email: teacher@gmail.com

Profile pic: Currently: [Faculty_Images/_WeidongXiong.jpg](#) ☐ Clear

Change: No file chosen

Fig 5.9 Faculty Profile

The following figures will show the all the features which can accessed by only Admin's. Admins are either Faculty or Student.



Log in | Django site admin

127.0.0.1:8000/admin/login/?next=/admin/

Django administration

You are authenticated as teacher@cis, but are not authorized to access this page. Would you like to login to a different account?

Username: admin

Password: *****

Fig 5.10 Admin login Page

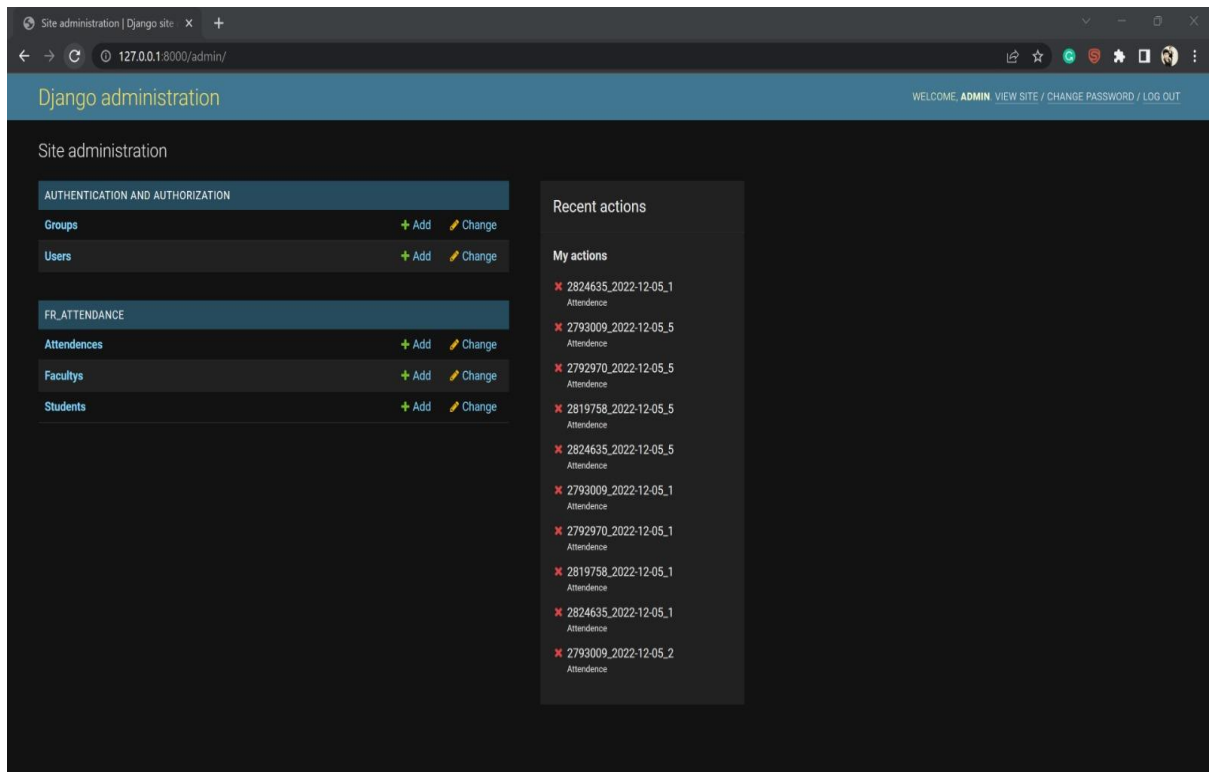


Fig 5.11 Admin Home Page

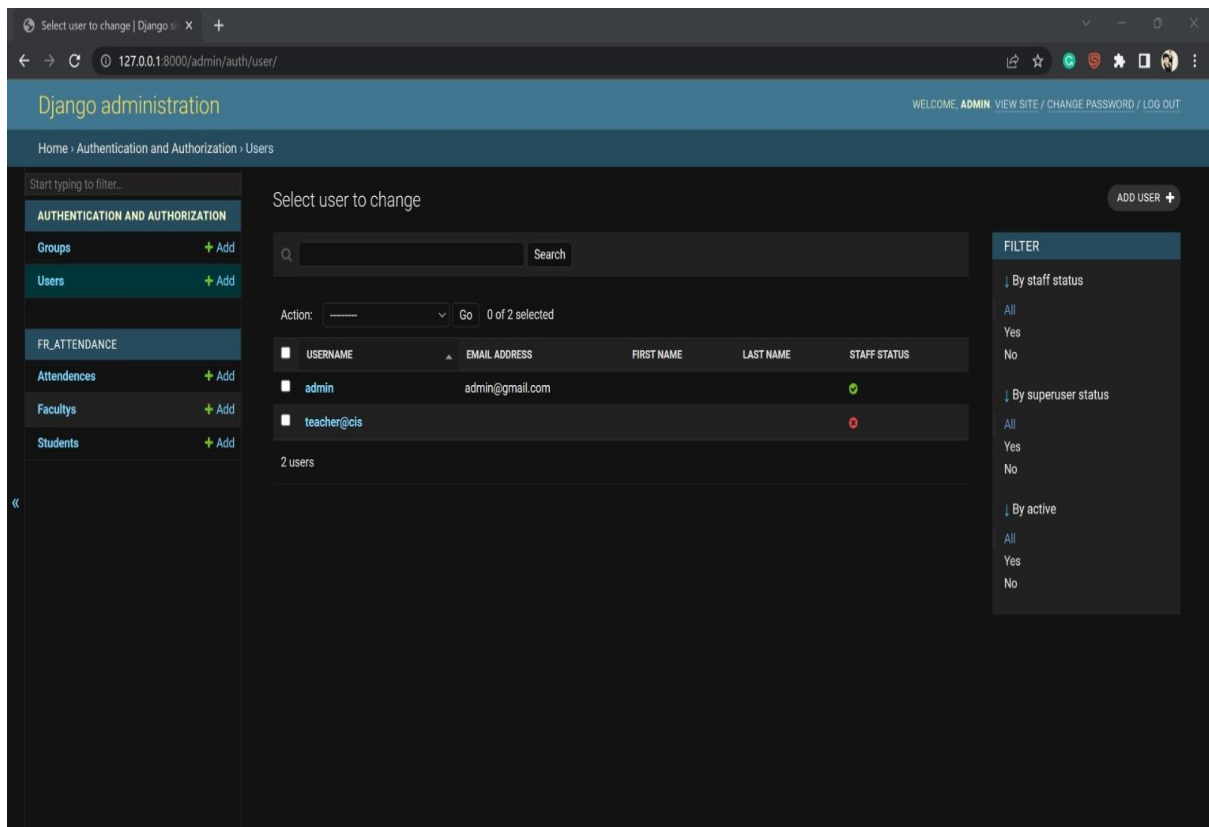


Fig 5.12 Admin user list page

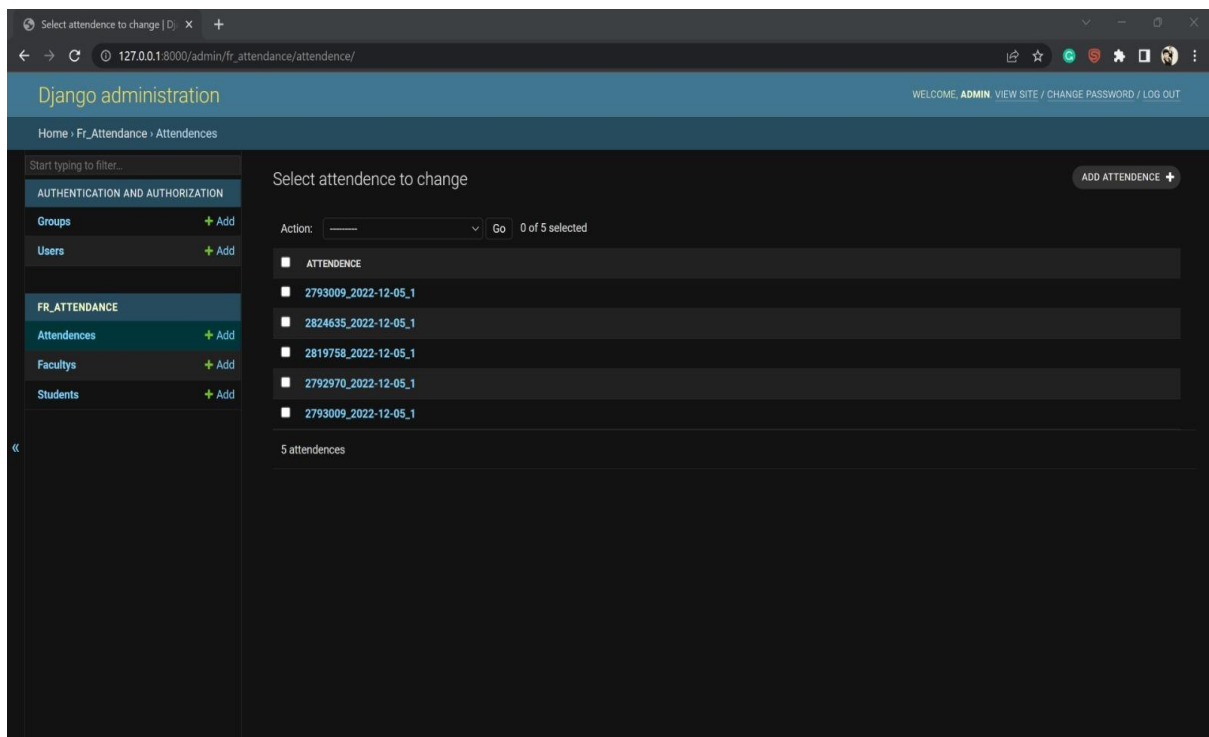


Fig 5.13 Attendance taken by Admin

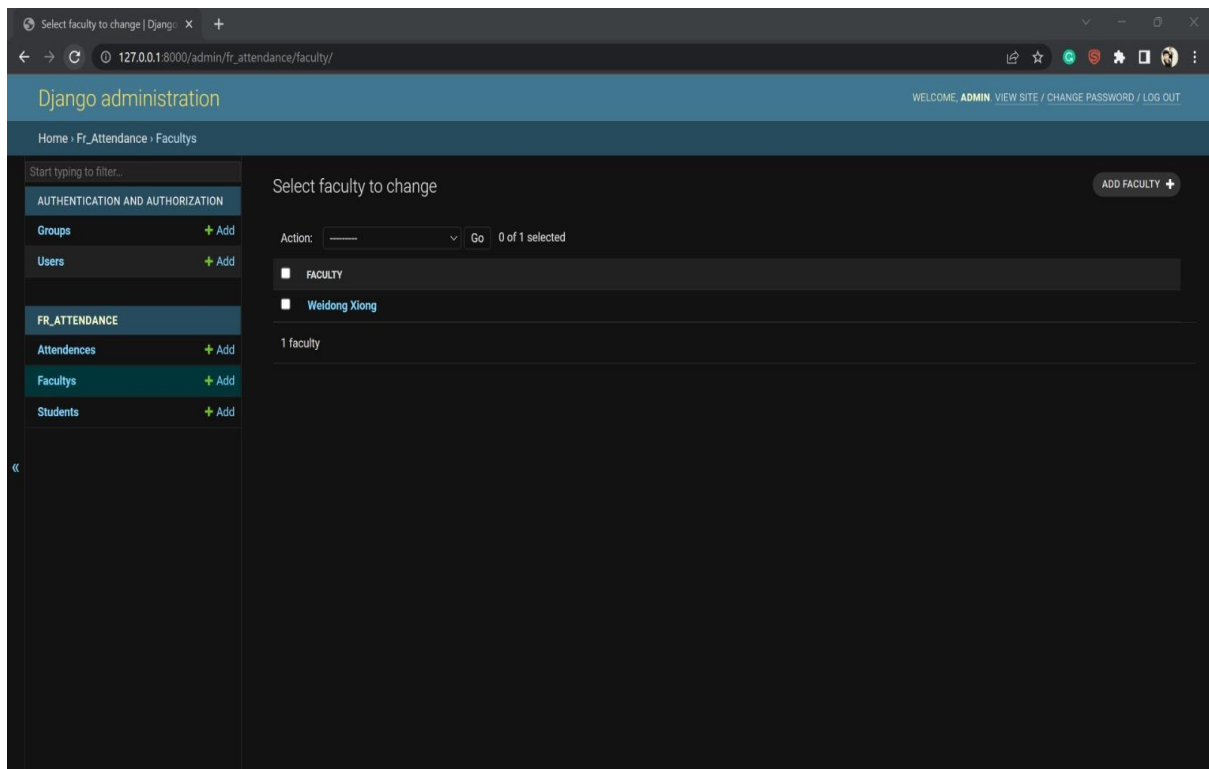


Fig 5.14 Faculty User page

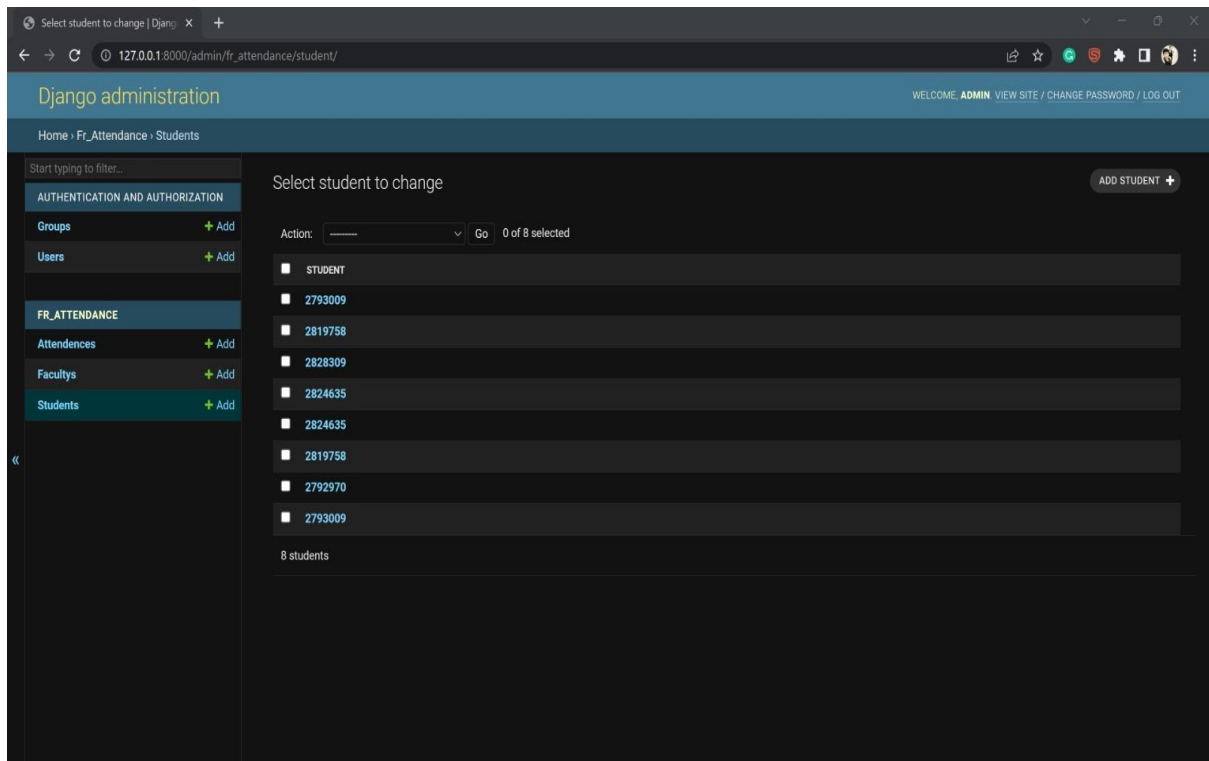


Fig 5.15 Student User page

6. Conclusion and Future Recommendations:

6.1 Conclusion:

From our experiment, we noticed the face recognition was sensitive to face background, light and head orientations. An automatic attendance has many advantages, most of the existing systems are time consuming and require semi manual interference from lecturers, our system seeks to solve these issues by using face recognition in the process to save time. And for this, no need to install any complex hardware for taking the attendance in classroom, all we need is camera and laptop. This technique is the most effective and accurate for taking automatic attendance in classroom which replace the traditional method.

6.2 Future Recommendations:

Automatic attendance system can be improved by implementing new techniques and algorithms which will generate results with more accuracy than we developed. Although introducing new techniques is cost effective but will be helpful to develop an mobile application which can serve for whole institution or university. So each and every student or faculty member can register at once.

7. References:

- https://www.luxand.com/facesdk/?utm_source=google&utm_medium=cpc&utm_campaign=face-recognition-python&gclid=Cj0KCQiA7bucBhCeARIsAIOwr-hW4Dq1KZPuieUqCEVngp10mm1srO53bj065yIDd7c05_uFwhqVS4aAhyiEALw_wcB
- <https://techvidvan.com/tutorials/face-recognition-project-python-opencv/>
- <https://www.analyticsvidhya.com/blog/2022/04/face-recognition-system-using-python/>