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GYALPOZHING COLLEGE OF INFORMATION TECHNOLOGY

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Project Report

Smart Attendance System

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CERTIFICATE

This is to certify that the BSc.IT project report titled “Smart Attendance System”, which is being submitted by Nar Bdr Kharka(12190065), Phuntsho Dorji(12190070), Samten Wangmo(12190073) and Sonam Dendup (12190083), the students of Bachelor of Science in Information Technology, prepared during the academic year 2022 in partial fulfilment of the requirement for the award of the degree of Bachelor of Science in Information Technology is a record of the students’ work carried out at the Gyalpozhing College of Information Technology, Royal University of Bhutan, Gyalpozhing under my supervision and guidance.

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ACKNOWLEDGEMENT

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ABSTRACT

The aim of Smart Attendance System (SAS) is to provide a system that simplifies and automates the process of recording and tracking students' attendance through face recognition. Our goal is to build a face recognition-based attendance system for educational institution to enhance and upgrade the current attendance system to become more efficient and effective as compared to before.

In current situation, most of the universities and college still follow the traditional way of taking attendance which basically involves roll call or student signing on attendance sheet. This is both time consuming and not secure. In Most of the universities, the ones who takes the attendance especially the lecturers face challenges such as calling the students name, letting them sign the attendance sheet where the students might do proxy (signing on behalf of others) and also, there is a high possibility of missing out some students while calling student names. As a result, some students could be marked absent while they are actually present in class. Moreover, it becomes tedious to keeps records of every student and referring it.

Smart Attendance System, therefore addresses aforementioned problems and aims to aid both the one who take the attendance and students to not only by saving time but also by reducing their strain and providing secure, fast and efficient way of taking attendance and storing those attendance records. Our main motive is to digitize the traditional approach of taking attendance.

Smart Attendance System is web-app based system that will allow user to take attendance of the student through facial recognition and manage attendance records where it offers various options like editing, updating, downloading and storing attendance records without time consuming and making it more effective, convenient and easy to manage and use.

TERMINOLOGY

Term	Definition
Smart Attendance System	An web based application that enable users to take attendance and manage attendance records.
OpenCV (open computer vision)	Open source library for computer vision, machine learning and image processing.
Face Recognition	Technology capable of matching a human face from a digital image or a video frame against a database of faces.
AI (Artificial Intelligence)	Ability of a computer to do tasks that are usually done by humans.
Django	High-level Python web framework that encourages rapid framework development and clean design.
Visual Studio	Code editor to help build applications.
Heroku	Platform to deploy, manage and scale applications entirely in cloud.

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CHAPTER 1 INTRODUCTION

1.1 AIM

To provide a system that simplifies and automates the process of recording and tracking students' attendance through face recognition.

1.2 MOTIVATION

Motivation and Needs:

All organizations need an attendance management system to maintain a record of their staff attendance. Especially in the universities and schools, student's daily attendance in class is essential to maintain discipline and success in academics. By attending the class regularly, the students can keep up with daily lessons and assignments. Roll call or student signing on attendance sheet is the traditional methods that has long been adopted by most of the organizations especially universities and schools. This is both time consuming and not secure. In Most of the universities, the ones who takes the attendance especially the lecturers face challenges such as calling the students name, letting them sign the attendance sheet where the students might do proxy (signing on behalf of others) and also, there is a high possibility of missing out some students while calling student names. As a result, some students could be marked absent while they are actually present in class. Moreover, it becomes tedious to keeps records of every student and referring it. Thus, to overcome all those constraints, the most suitable method to ensure full security and to save history records digitally is through smart attendance system using face recognition.

All these observations and experiences leads to the idea of creating this web-application.

1.3 OBJECTIVES

The specific objectives of this project are:

- Eliminate the paperwork where attendance marking will no longer involve any manual recordings.
- Reduce the total time needed to do attendance recording.
- Maintaining the accuracy and security of data collected by avoiding the chances of proxy attendance.

1.4 SCOPE

The targeted groups of the attendance monitoring system are the students and teaching staff of the schools and universities.

The facial recognition process can only be done for 1 person at a time.

The system needs internet connection to update the database of the attendance system constantly.

1.5 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 type of input method used, the types of data processing employed and the controllers used to implement the systems.

1. Attendance System Using NFC Technology with Embedded Camera on Mobile Device

According to research journal “Attendance System Using NFC (Near Field Communication) Technology with Embedded Camera on Mobile Device” (Bhise, Khichi, Korde, Lokare, 2015). The attendance system is improved by using NFC technology and mobile application.

According to the research paper, each student is given a NFC tag that has a unique ID during their enrolment into the college. Attendance of each class will then be taken by touching or moving these tags on the lecturer mobile phone. The embedded camera on the phone will then capture the students face to send all the data to the college server to do validation and verification.

The advantages of this method is where the NFC is simple to use, and the speed of connection establishment is very high. It indeed speeds up the attendance taking process a lot. However, this system couldn't automatically spot the violation when the NFC tag is not personally tagged by the original owner. Apart from that, the convenience of the system which uses the mobile phone as the NFC reader was actually an inconvenience to the lecturer.

Imagine if the lecturer had forgotten to bring their mobile phones to work, what would be the backup procedure for the attendance to be recorded? Moreover, most of the lecturer will not likely to prefer their personal smart phones to be used in this way due to privacy matter. Hence, unique information about the student like biometrics or face recognition, which is genuine for a student should be used in replacement of the NFC tag. This will ensure attendance to be taken originally by the actual student.

2. Fingerprint Based Attendance System Using Microcontroller and LabView

The second research journal “Fingerprint Based Attendance System Using Microcontroller and LabView” (Kumar Yadav, Singh, Pujari, Mishra, 2015) proposed a solution of using fingerprint to mark the attendance. This system is using 2 microcontrollers to deal with the fingerprint recognition process. Firstly, the fingerprint pattern will be obtained through a fingerprint sensor, then the information will be transmitted to microcontroller 1. Next microcontroller 1 will pass the information to microcontroller 2 to do the checking with the database that resides in it. After finding a student’s match, the details are sent to the PC through serial communication to be displayed.

This design is good as it accelerates development while maintaining design flexibility and simplifies testing. But again, this system is attached to a PC which make it not portable.

3. Face Recognition Based Attendance Marking System

The third research journals “Face Recognition Based Attendance Marking System” (SenthamilSelvi, Chitrakala, Antony Jenitha, 2014) is based on the identification of face recognition to solve the previous attendance system’s issues.

This system uses camera to capture the images of the employee to do face detection and recognition. The captured image is compared one by one with the face database to search for the worker’s face where attendance will be marked when a result is found in the face database. The main advantage of this system is where attendance is marked on the server which is highly secure where no one can mark the attendance of other. Moreover, in this proposed system, the face detection algorithm is improved by using the skin classification technique to increase the accuracy of the detection process.

Although more efforts are invested in the accuracy of the face detection algorithm, the system is yet not portable. This system requires a standalone computer which will need a constant power supply that makes it not portable. This type of system is only suitable for marking staff’s attendance as they only need to report their presence once a day, unlike students which require to report their attendance at every class on a particular day, it will be inconvenient if the attendance marking system is not portable.

Thus, to solve the issues related to the above mentioned problems from the reviewed literature, we have smart attendance system to systematically record student’s attendance from anywhere at any time without any vulnerable to forgery and inaccurate attendance records.

CHAPTER 2 BACKGROUND OF THE PROJECT

2.1 CURRENT STATE OF ART

Every organization needs an attendance management system to record employee attendance. Especially in colleges and schools, the daily presence of students in class is essential to maintaining discipline and success in their research. By attending classes on a regular basis, students can keep up with their daily classes and assignments. Roll calls or student signatures on attendance sheets are the traditional methods that have long been adopted by most organizations, especially universities and schools. This is time consuming and unsafe. At most universities, attendance handlers, especially faculty members, face challenges such as the likelihood of missing some students when naming students. As a result, some students may be marked as absent while actually in class. In addition, keeping and referencing each student's records can be tedious. To overcome all these limitations, the most appropriate way to ensure full security and digitally store history records is with an intelligent attendance system with facial recognition.

2.2 TECHNOLOGIES USED DEVELOPMENT

The technology to be used for developing this application is

1. Laptop and Desktop
2. Visual Studio
3. Django.
4. Face Recognition

CHAPTER 3 METHODOLOGY

3.1 METHODOLOGY OF THE STUDY

Problem Statement

All organizations need an attendance management system to maintain a record of their staff attendance. Especially in the universities and schools, student's daily attendance in class is essential to maintain discipline and success in academics. By attending the class regularly, the students can keep up with daily lessons and assignments. Roll call or student signing on attendance sheet is the traditional methods that has long been adopted by most of the organizations especially universities and schools. This is both time consuming and not secure. In Most of the universities, the ones who takes the attendance especially the lecturers face challenges such as calling the students name, letting them sign the attendance sheet where the students might do proxy (signing on behalf of others) and also, there is a high possibility of missing out some students while calling student names. As a result, some students could be marked absent while they are actually present in class. Moreover, it becomes tedious to keeps records of every student and referring it. Thus, to overcome all those constraints, the most suitable method to ensure full security and to save history records digitally is through smart attendance system using face recognition.

Software Development Process:

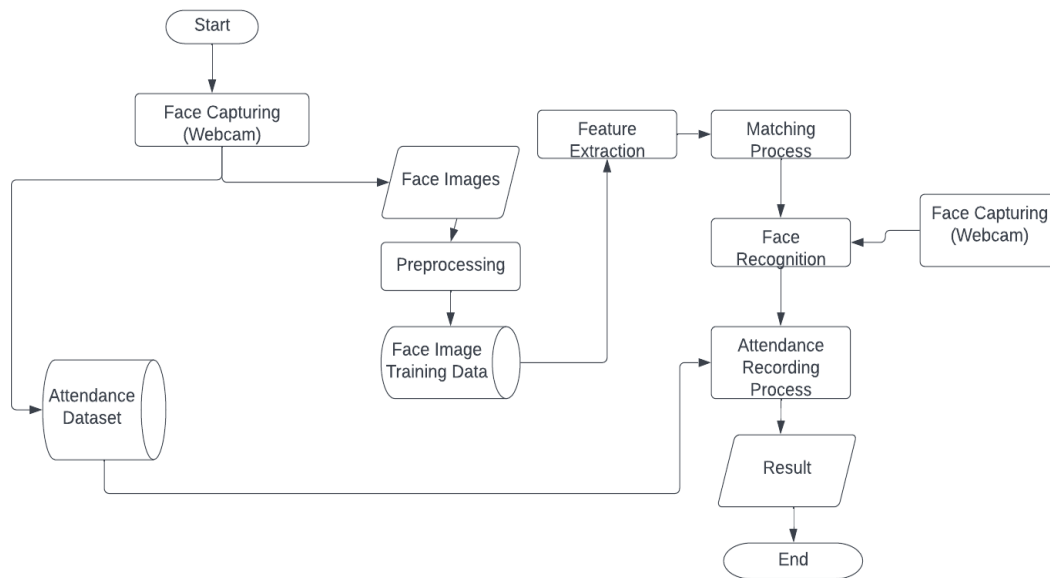


Figure 1.1 Overall workflow of Smart Attendance System

Detailed System Workflow

There are two major system flows in the software development section as shown below:

- **The creation of the face database**
- **The process of attendance taking**

Both processes mentioned above are essential because they made up the backbone of the attendance management system. In this section, the process of both flows will be briefly described.

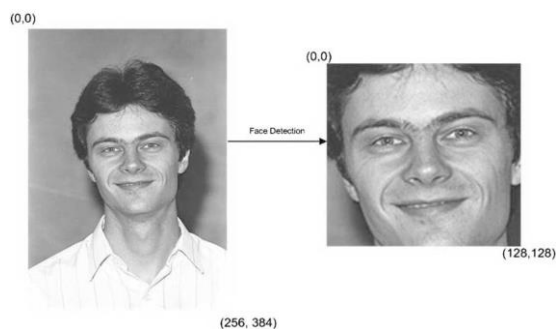
THE CREATION OF FACE DATABASE:

The face database is an important step to be done before any further process can be initiated. This is because the face database acts as a comparison factor during the recognition process.



1. Portrait Acquisition

The image of the student's face will be captured for a specific amount to be stored into the files.



2. Face Detection

The captured image will first undergo a face detection algorithm to ensure the system can identify a face in every portrait.



3. Portrait Pre-processing

Captured image with a confirmed face detected in it will then undergo cropping, color conversion before actually being stored into the files.

```

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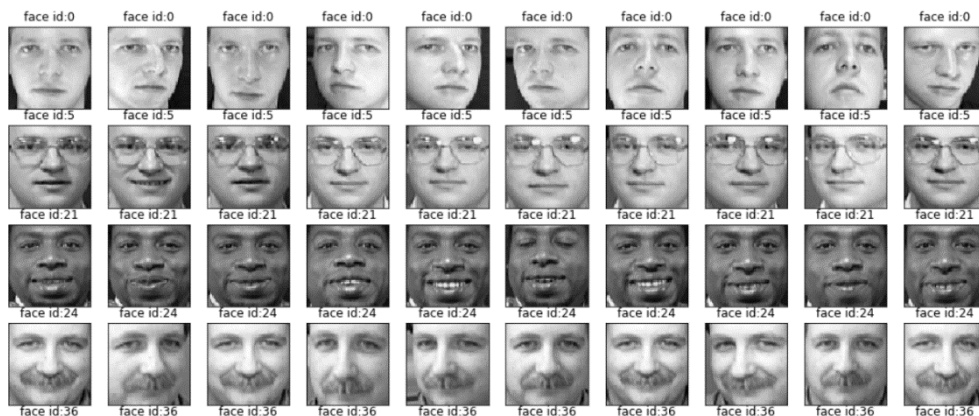
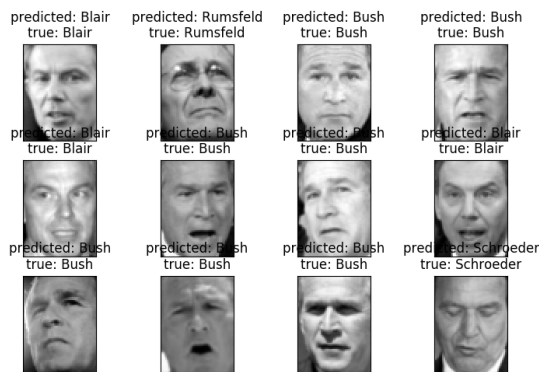
4. Creation of CSV file

With the face database data, we need to read it in the program, here we need to use csv file to read the image data in the face database.

By using the path of the stored image, a csv file will be created.

5. Training the Recognizer

The images in the created list retrieved from the csv will then be pumped into a recognizer (a library provided by openCV for face recognition) to do the training.



6. Save the Trained Data

After the training process is done, the trained sets of data will be stored into a file which will be retrieved during the recognition process.

THE PROCESS OF TAKING ATTENDANCE:

Access the attendance management system website

The attendance taking system can be started after the lecturer login to the website with username and password.



1.Acquire Portrait

The system will then start to capture student's portraits and then undergo the same pre-processing routine and face detection process.



2.Recognize the face

Valid portraits will then be compared against the loaded gallery from the recognizer to identify the captured faces.

Enroll no	Name	Date	Time	Status
12190065	Nar	12-Mar	11:15-12:15	p
12190070	Phuntsho	12-Mar	11:15-12:15	p
12190073	Samten	12-Mar	11:15-12:15	P
12190082	Sonam	12-Mar	11:15-12:15	P

3.Mark the attendance

After identifying the appropriate student from the capturing process, a record of the current attendance will be added into the attendance table managed by a database.

DEPLOYMENT

The model and the web application will be deployed in Heroku platform.

Requirement Gathering

We will be gathering requirements through series of meeting within team members and further discussing with the project guide.

Requirement Analysis

In this stage, we will be further analyzing the gathered requirements and will eliminate some unnecessary requirements and take in new requirements if any.

Design

Taking into account of requirements from the requirement analysis, we will start with the designing of prototype as well as Use case and Sequence diagram for our project.

Coding

After requirement gathering and designing is completed designing the prototype, we will start with implementation where we will be developing the web-application in visual studio using Django framework.

Testing

Each functionality will be tested right after it is developed. The process of testing each functionality separately is called unit testing. Unit testing will be carried out thoroughly for each module followed by integration testing, system testing and acceptance testing. If any functionality doesn't work as expected, it can always go back and verify from the previous phases.

Agile model

Agile model refers to a software development approach based on iterative development. Agile methods break tasks into smaller iterations, or parts do not directly involve long term planning. The project scope and requirements are laid down at the beginning of the development process. Plans regarding the number of iterations, the duration and the scope of each iteration are clearly defined in advance. The division of the entire project into smaller parts helps to minimize the project risk and to reduce the overall project delivery time requirements.

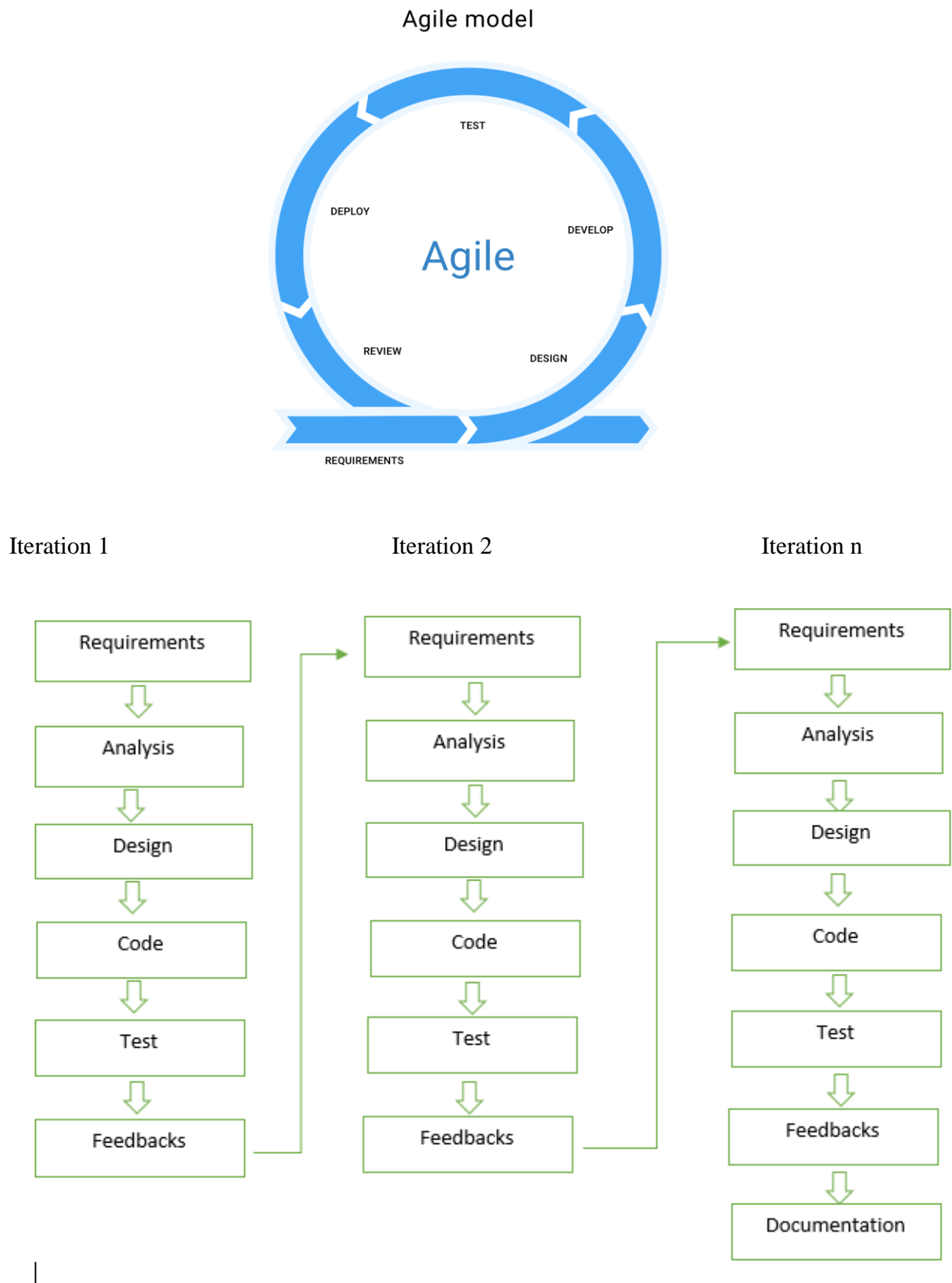


Fig 1: Agile Development Model

Documentation

To provide evidence of progress in the development process and to monitor the process as well as to record information that can help support the proper treatment plan and the reasoning for such services, documentation is must. Also, without proper document, it will be difficult for future progress.

Finally, after completing the coding and fulfilling all the required features for the application, project document is made.

CHAPTER 4 REQUIREMENT SPECIFICATION

4.1 FUNCTIONAL REQUIREMENT

Specify what the system must do in response to different inputs and what it must output

Features:

User:

- 1. Attendance: Display a select class option**
- 2. Take Attendance: Will display a web camera to capture face**
- 3. Attendance Record: Will display a present, absent and history records of attendance**
- 4. Reset: Will clear the pre listed attendance records**
- 5. Refresh: Will display the updated attendance records**
- 6. Download: Will download the attendance record in a CSV file format**
- 7. Edit Profile: Allow user to edit students detail**
- 8. Delete profile: Allow user to delete students detail**
- 9. Add Profile: Allow user to register new students**
- 10. About: Will display the developers detail.**

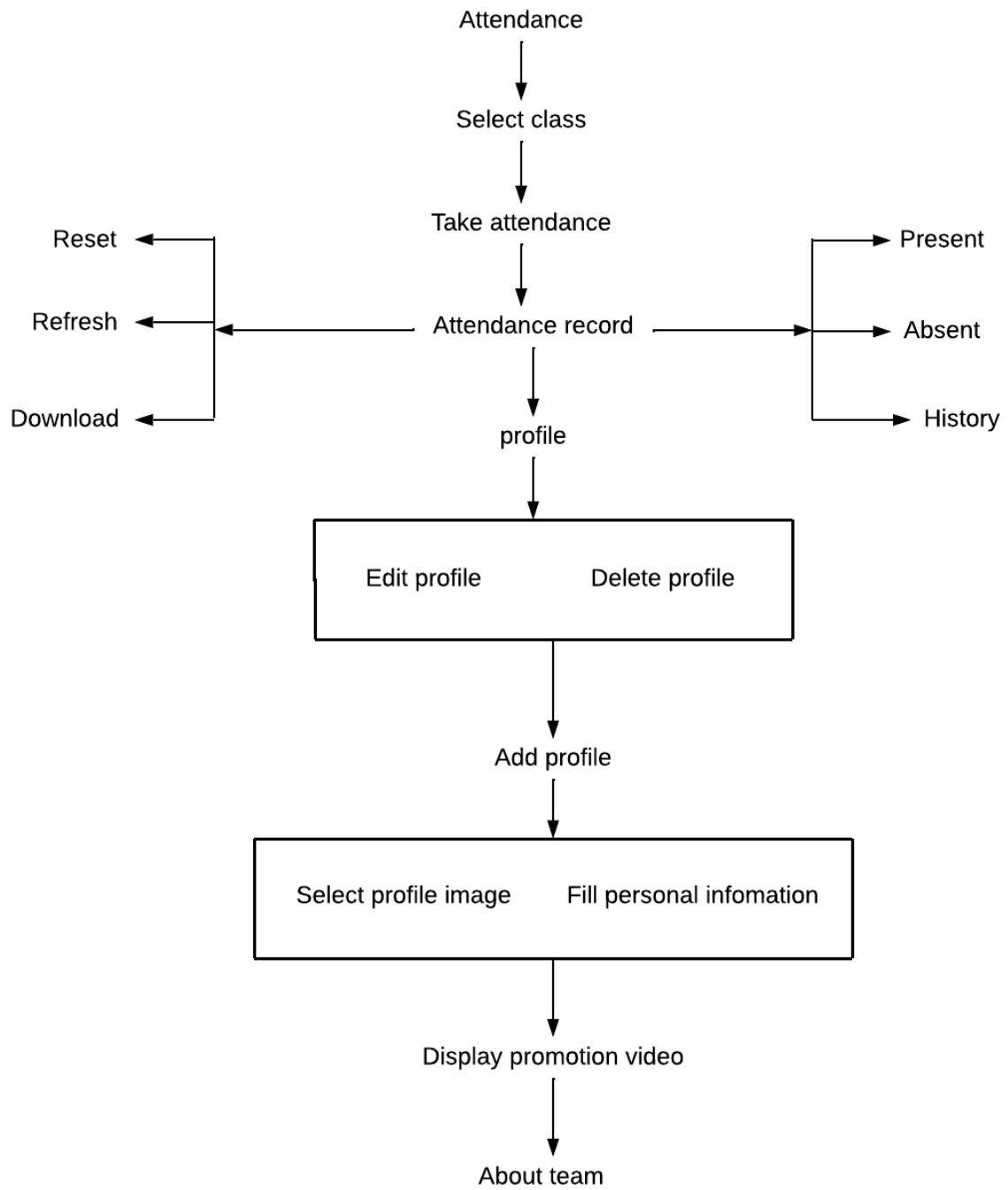


Figure 0: Functional Requirement

4.2 NON-FUNCTIONAL REQUIREMENT

Non-functional Requirements

Requirements that describe how the system works. Non-functional requirements are all about system usability and meeting at least some non-functional requirements are important in a well performing system.

Some of the non-functional requirements of our application are:

1. Security

Those with faces recognized in the video camera will be marked present only when the machine matches their faces with the dataset collected.

2. Portability

The system is highly portable as it can easily be deployed in various platforms such as computer laptop, computer desktop, or a mobile device (mobile phone, tablet).

3. Usability: It is effortless for the user to use the Smart Attendance System due to the following reasons:

- a. Learnability: The user will be able to use our application very easily since the system instructions will be properly written in a simple language that can be understood by anyone.
- b. Errors: There is no option of any mistakes from user's side as they cannot make any changes to the system.
- c. Memorability: Since our application is not complex as the user does not require to learn anything to use our application, the users will not face trouble when using our application after long time also.

4.3 SOFTWARE REQUIREMENT

Software Requirements:

The technology and version to be used for developing this application is

Face Recognition: technology capable of identifying a subject through an image or video element of his face.

OpenCV (open computer vision): Open source library for computer vision, machine learning and image processing.

Advantages of openCV over other deep learning frameworks:

1. OpenCV has everything you need for image manipulation or computer vision applications.
2. All other frameworks for machine learning/neural network models can be imported and used in openCV.
3. Unlike openCV, classical computer vision techniques cannot be achieved by deep learning tools.
4. It has high performance as running deep learning models in openCV is faster compared to other frameworks.

Visual Studio: Code editor to help build applications.

Heroku: Platform to deploy, manage and scale applications entirely in cloud.

Algorithm:

Haar Cascade algorithm in openCV will be used for face detection from the camera.

Object detection using Haar feature based cascade classifiers is an effective object detection method proposed by Paul Viola and Michael Jones.

It is a machine learning based approach where a cascade function is trained from a lot of positive images (images of face) and negative images (images without faces) to train the classifier. Then we need to extract features from it.

Features are nothing but numerical information extracted from the images that can be used to distinguish one image from another.

LBPH (Local Binary Pattern Histogram) will be used for face recognition.

LBPH is widely used in facial recognition due to its computational simplicity and discriminative power. It 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.

LBPH extracts local features in the face and matches it with the most similar face image in the database. LBPH is a method that works by dividing the face image into several blocks. Histograms will be calculated for each block and in the matrix we compare the pixels with the center pixel. At the end we will get a binary number which will be converted to decimal format. It will be combined together under one vector which will help to recognize the face in the database.

4.4 HARDWARE REQUIRMENT

Hardware Requirements:

Developer requirements:

1. Laptop/Desktop (Microsoft Windows 7/8/10 (64 bits)/Linux/mac)
2. 4 GB RAM minimum, 8 GB RAM recommended
3. 1280 * 800 minimum screen resolution
4. Processor 2.00GHz * 4

User requirements:

Smart phone / Laptop / Desktop

CHAPTER 5 SOLUTION AND IMPLEMENTATION

5.1 INTERFACE DESIGN

We designed the interface of our app making it look as user friendly as possible

1. Home Page

On clicking the website link, it will display a home page which consist of:

- 1.Small description about the website
- 2.On click button/icon to display the promotional video of out website
- 3.Navigation bar consisting of Attendance and Team option

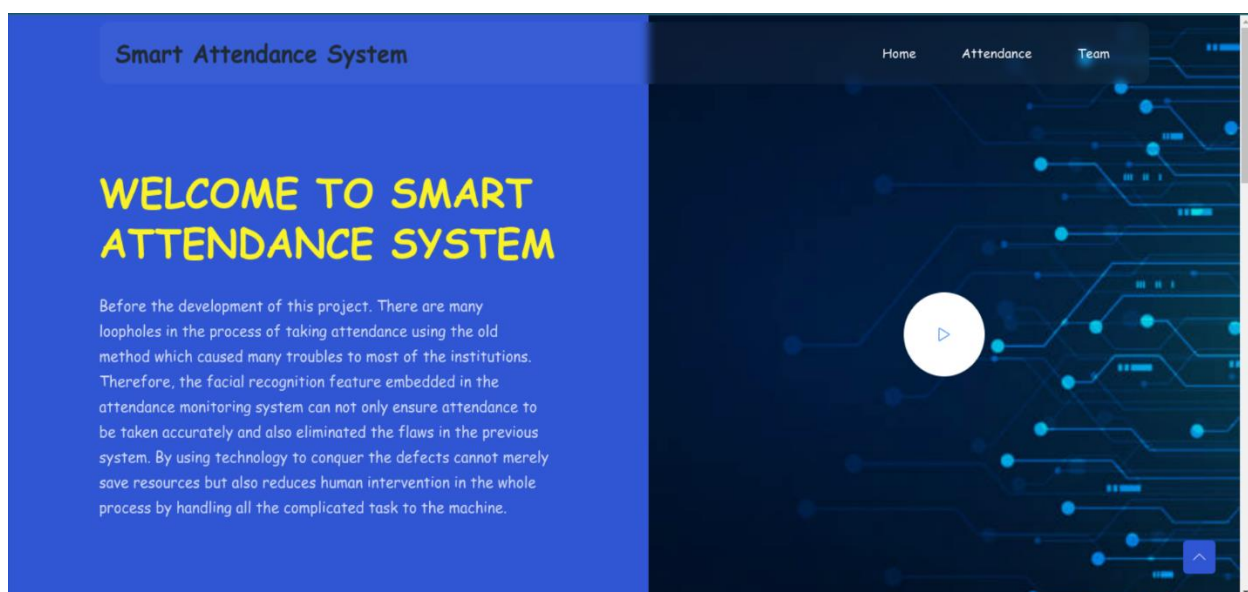


Figure 2: Home Page

2. Select Class Option

On clicking the attendance button, it will display a page where we have to click on one of the class to take attendance

ATTENDANCE

Select Class For Attendance

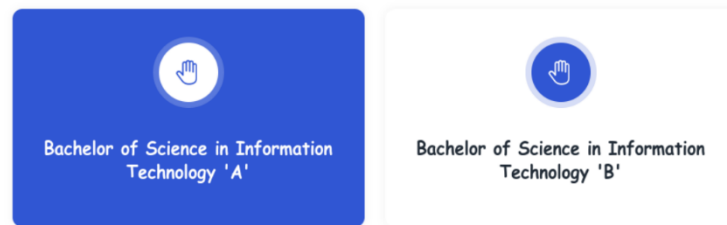


Figure 3: Select Class

3. Student and attendance details

On clicking one of the class, it will display the following which consist of:

1. Present Detail, 2. Absent Detail, 3. History Records

And an option to Reset, Refresh and Download the attendance records of the students

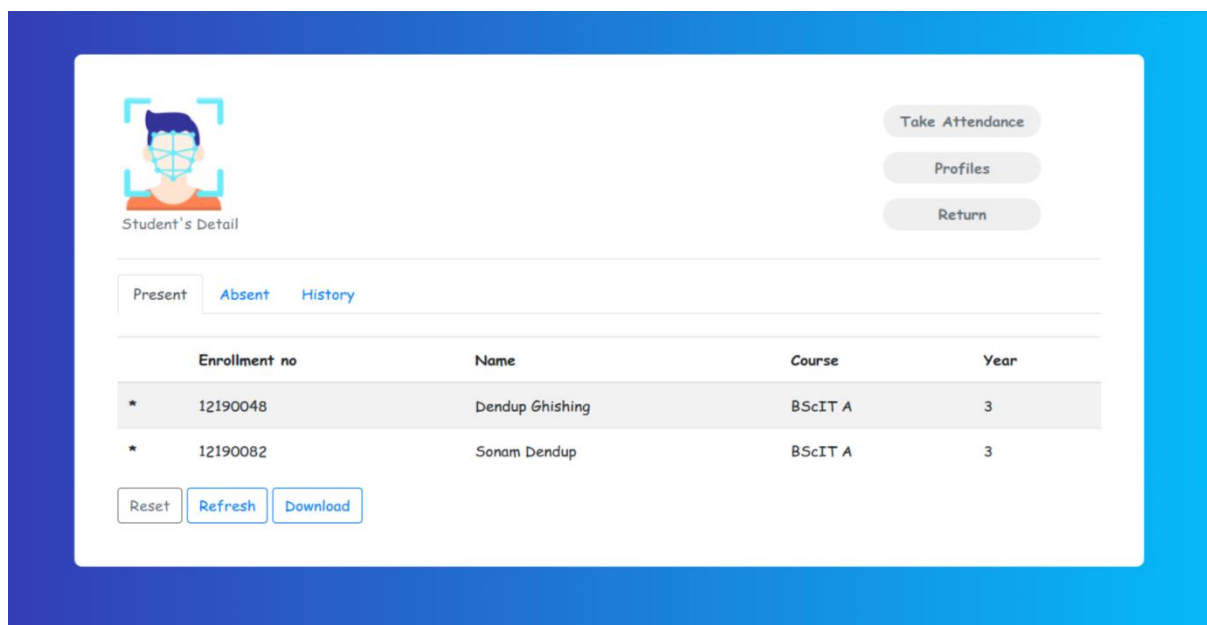


Figure 4: Student and attendance details

4. Take Attendance

Display a web camera and if face gets recognised, it will display the name of that person below the face box drawn around the face with red line

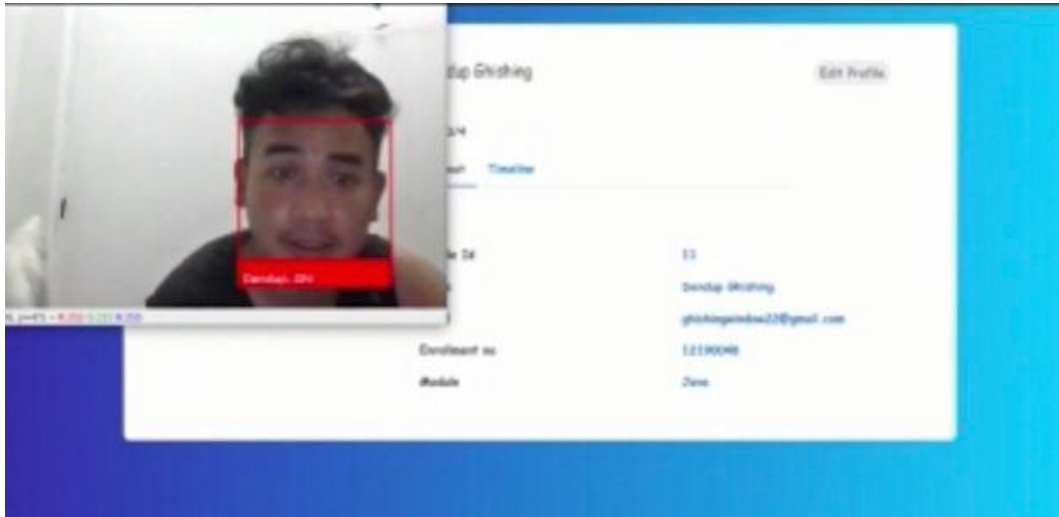


Figure 5: Face Recognised

At the back of the web camera, it will display the details of the recognised face



Figure 6: .Details of Recognised Face

5. Profile

On clicking the profile option, it displays the students detail. It also has the option to delete or edit students profile

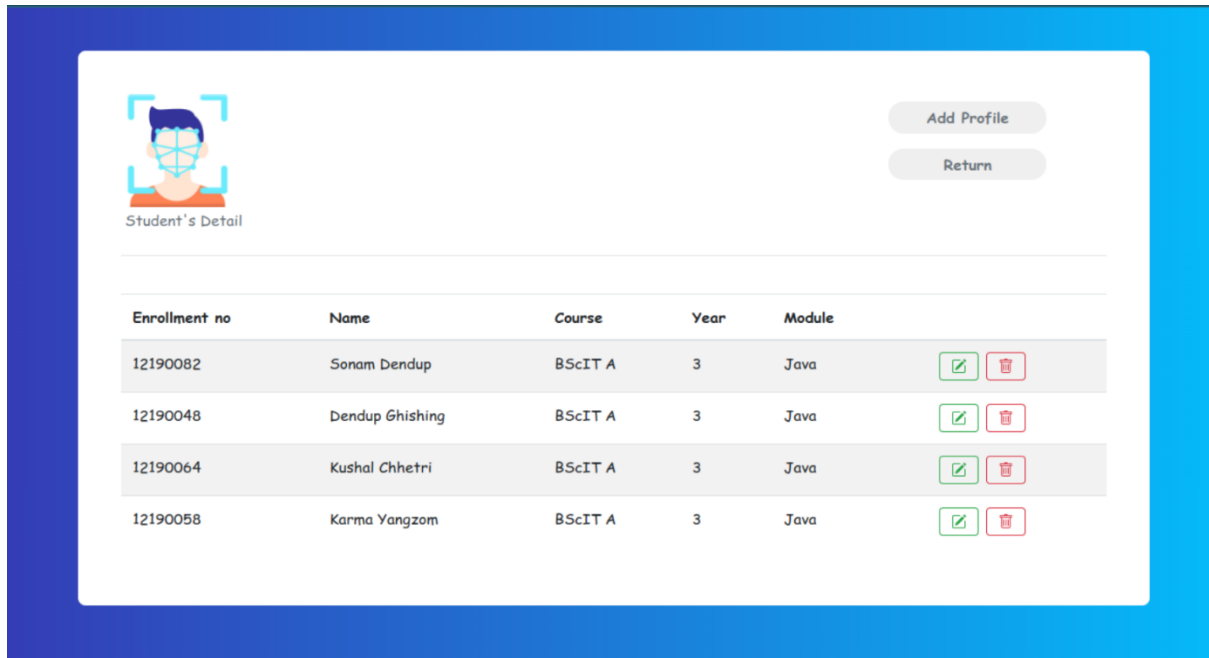


Figure 7: Profile

6. Add Profile

On clicking the add profile button, it will allow user to add new students detail along with an option to upload his/her picture

The screenshot shows a form titled "Add Profile". It is divided into two main sections: "Personal Informations" and "Biometric Photo:". The "Personal Informations" section contains fields for First Name, Last Name, Enrollment Number, Email, Birth date, Module, Course, Time, and Year/4. The "Biometric Photo:" section includes a warning "use only biometric pictures with .jpg format", a placeholder image showing two faces with biometric markers, and a "Choose File" button with the text "No file chosen". At the bottom left are "Save" and "Cancel" buttons.

Figure 8: Add Profile

7. About

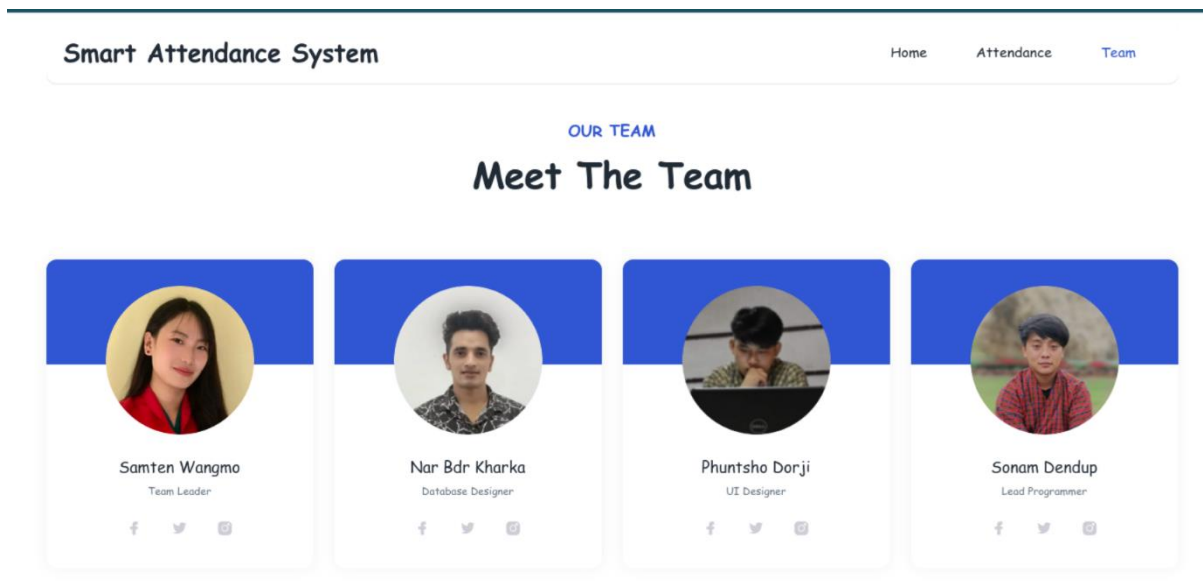


Figure 9: About Us

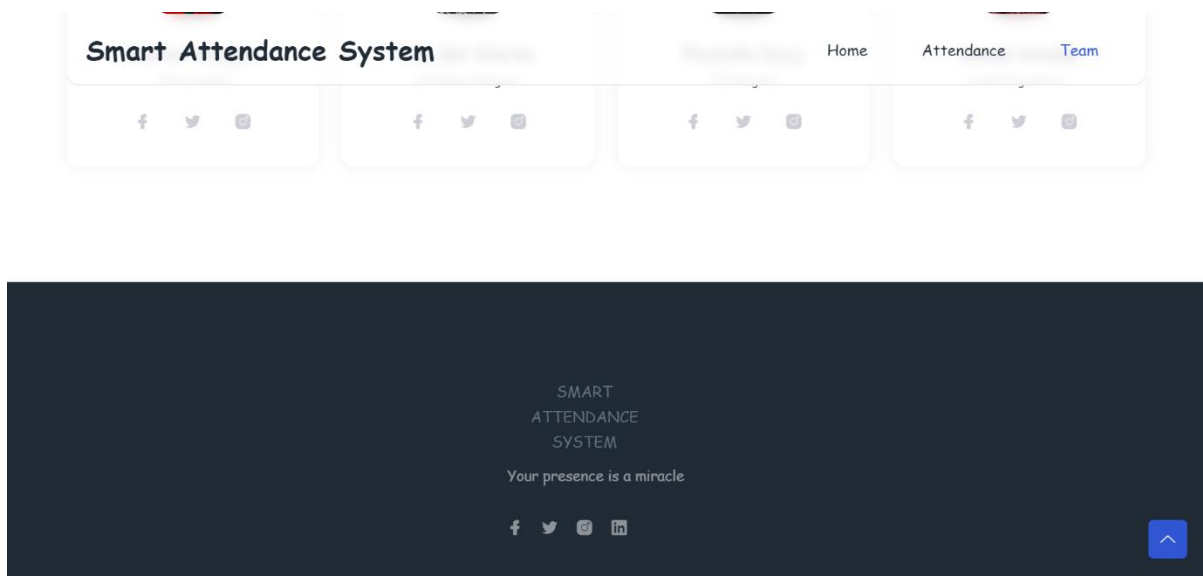


Figure 10: Contact Information

5.2 USE CASE DIAGRAM

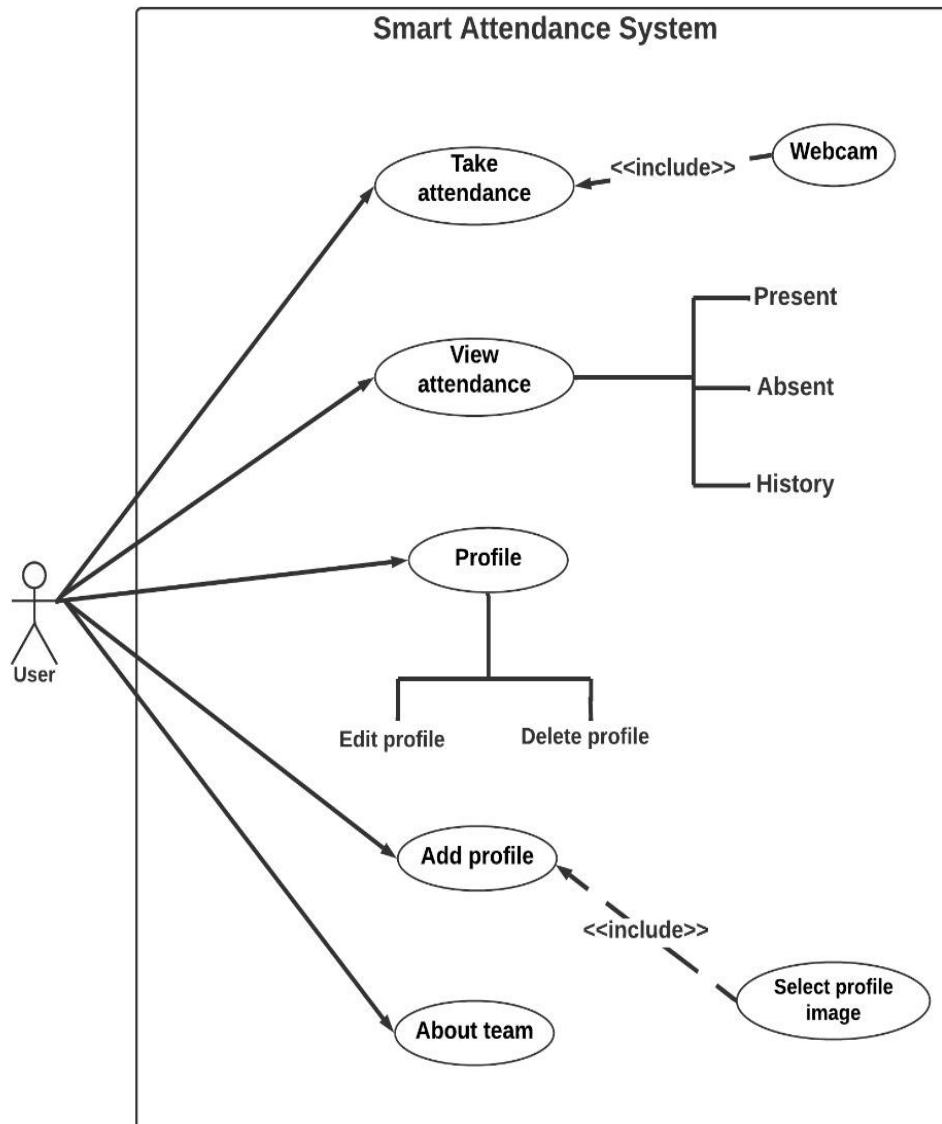


Fig 22: Use case

5.5 SEQUENCE DIAGRAM

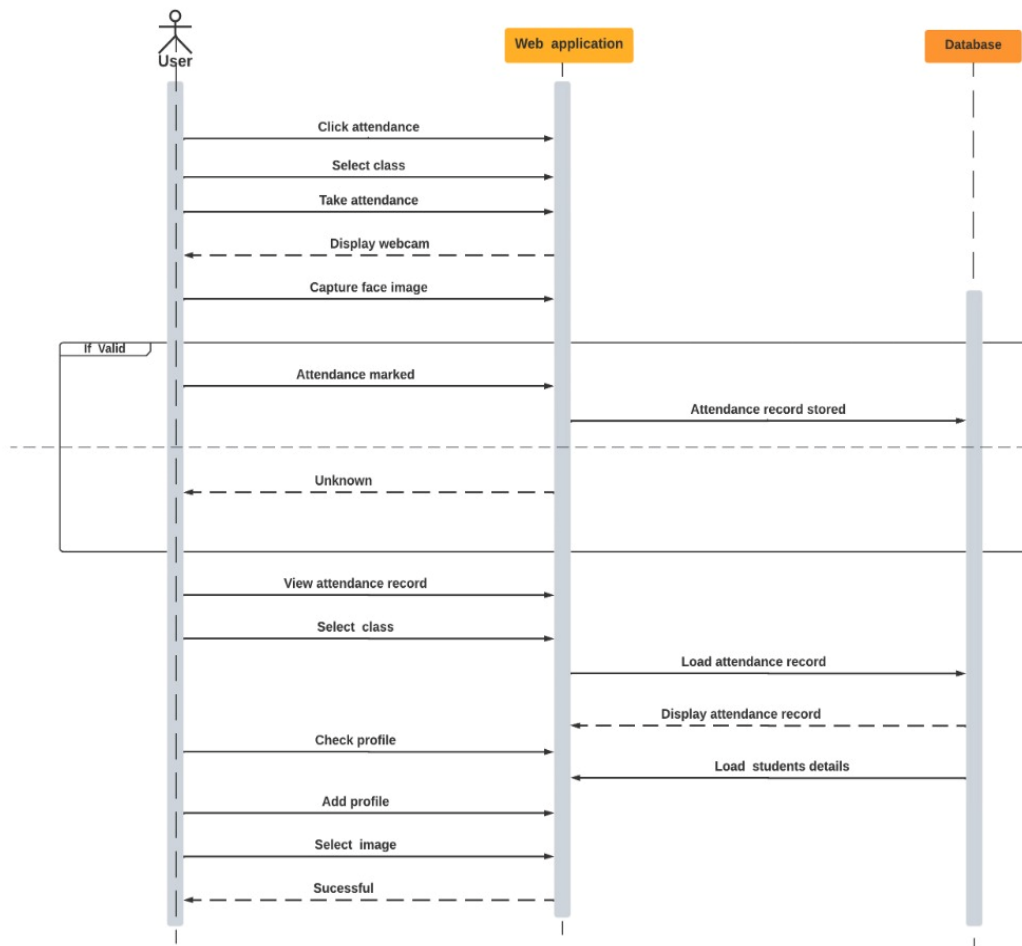


Fig 25: Sequence Diagram

DEPLOYMENT

After successful testing of development of Smart Attendance System, we have deployed our application in Heroku platform. Additionally, all the system functionalities are thoroughly tested.

CONCLUSION

Every organization needs an attendance management system to record employee attendance. Especially in colleges and schools, the daily presence of students in class is essential to maintaining discipline and success in their research. By attending classes on a regular basis, students can keep up with their daily classes and assignments. Roll calls or student signatures on attendance sheets are the traditional methods that have long been adopted by most organizations, especially universities and schools. This is time consuming and unsafe. At most universities, attendance handlers, especially faculty members, face challenges such as the likelihood of missing some students when naming students. As a result, some students may be marked as absent while actually in class. In addition, keeping and referencing each student's records can be tedious. To overcome all these limitations, the most appropriate way to ensure full security and digitally store history records is with an intelligent attendance system with facial recognition. Smart attendance system will take the attendance of the students through facial recognition and store it where user can view it, delete it, update and share it to others.

FUTURE WORK

The future work of this system is to improve the time taken to open the web camera for face capturing and make it more dynamic so that any of the user can use the system any time, form anywhere. And also to integrate with other IOT devices and make it in a such a way that it can take attendance of many students by recognising many faces at a time.

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