



Tribhuvan University
Faculty of Humanities and Social Sciences

A PROJECT REPORT
On
Face Recognition Based Attendance System

Submitted to
Department of Computer Application
NIMS College

In partial fulfillment of the requirements for the Bachelors in Computer Application

Submitted by
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Reg. No. : 6-2-756-8-2019
2023/05

Under the Supervision of
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Tribhuvan University

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Teacher's Recommendation

I hereby recommend that this project prepared under my supervision by Raj Kumar Karki entitled “**Face Recognition based Attendance System**” in partial fulfillment of the requirements for the degree of Bachelor of Computer Application is recommended for the final evaluation.

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LETTER OF APPROVAL

This is to certify that this project prepared by Raj Kumar Karki entitled “Face Recognition based Attendance System” in partial fulfillment of the requirements for the degree of Bachelor in Computer Application has been evaluated. In our opinion it is satisfactory in the scope and quality as a project for the required degree.

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Abstract

We are living in a world where everything is automated and linked online. The internet of things, image processing, and machine learning are evolving day by day. Many systems have been completely changed due to this evolve to achieve more accurate results. The attendance system is a typical example of this transition, starting from the traditional signature on a paper sheet to face recognition. This Project proposes a method of developing a comprehensive embedded class attendance system using facial recognition with showing whether the face of the person is the students for the specified class or not. The system is based on the machine learning algorithm which is to be implemented on python language and using computer/laptop camera for the input image of the students or a normal outer camera can also be used which has to be connected to the system which is programmed to handle the face recognition by implementing the Local Binary Patterns algorithm LBPHs.

Keyword: Attendance, Face, Recognize, Machine learning, LBPHs

Acknowledgement

This project was successful with the help of many people. So, I would like to thank all those who helped me to complete this project.

Firstly, I would like to express my special thanks of gratitude to TU (Tribhuvan University) and NIMS college who gave me the golden opportunity to do this project on the topic Face Recognition based Attendance system. Then I will thank Teacher (Bikash Thapa Magar and Raj Kadel) under whose guidance I have learned a lot about this project and developed an excellent project. His suggestions and directions have helped me a lot to complete this project. He motivated and corrected me while I have errors in my projects. He helped me in doing a lot of Research and i came to know about a lot of things related to this topic.

At last, I would like to thank my parents for their excellent decision, For allowing me to be part of this course. I would also like thanks my friends who have helped me with their valuable suggestions and guidance to complete the project.

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List of Abbreviations

Table 1: List of Abbreviation

Abbreviations	Full Form
CRUD	Create Read Update Delete
DBMS	Database Management System
DFD	Data Flow Diagram
ER DIAGRAM	Entity Relation Diagram
HTML	Hyper Text Markup Language
JS	JavaScript
LBPH	Local Binary Patterns Histogram
PCA	Principal Component Analysis
ROI	Region of Interest
SDLC	Software Development Life Cycle
SQL	Structured Query Language
TU	Tribhuvan University
UI	User Interface

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Chapter 1: Introduction

1.1. Introduction

Attendance system is the system which is use to shows the present of the people in a work. It is very important in every work because it help to manage and make everything in a proper system balance. In order it can be said as the record of the available of the people according to the date, time or day, months, etc.

The management of attendance in many settings has been transformed by technological improvements in recent years, along with many other parts of our life. One such invention is the face recognition-based attendance system, which accurately and effectively tracks and records attendance by using state-of-the-art facial recognition algorithms.

Historically, keeping track of attendance has been a laborious, manual procedure that is prone to manipulation. Face recognition technology, on the other hand, has given corporations, educational institutions, and organizations from many industries a more dependable and automated option. The face recognition-based attendance system functions by identifying and analyzing each person's distinctive facial traits. To identify and match facial patterns with previously collected data, it combines cameras, sensors, and sophisticated algorithms.

Using this technique, people may be accurately identified in real-time, not requiring physical cards, passwords, or signatures. To maintain the attendance record with day-to-day activities is a challenging task. The conventional method of calling name of each student is time consuming and there is always a chance of proxy attendance. The following system is based on face recognition to maintain the attendance record of students. The daily attendance of students is recorded subject wise which is stored already by the administrator. As the time for corresponding subject arrives the system automatically starts taking snaps and then apply face detection and recognition technique to the given image and the recognize students are marked as present and their attendance update with corresponding time and subject id.

We have used deep learning techniques to develop this system, histogram of oriented gradient method is used to detect faces in images and deep learning method is used to compute and compare feature facial of students to recognize them. Our system is capable

to identify multiple faces in real time. The main objective of this project is to develop face recognition based automated student attendance system. In order to achieve better performance, the test images and training images of this proposed approach are limited to frontal and upright facial images that consist of a single face only. The test images and training images have to be captured by using the same device to ensure no quality difference. In addition, the students have to register in the database to be recognized. The enrolment can be done on the spot through the user-friendly interface.

1.2. Problem Statement

Traditional student attendance marking technique is often facing a lot of trouble. The face recognition student attendance system emphasizes its simplicity by eliminating classical student attendance marking technique such as calling student names or checking respective identification cards. There are not only disturbing the teaching process but also causes distraction for students during exam sessions. Apart from calling names, attendance sheet is passed around the classroom during the lecture sessions. The lecture class especially the class with a large number of students might find it difficult to have the attendance sheet being passed around the class.

Solution

Thus, face recognition student attendance system is proposed in order to replace the manual signing of the presence of students which are burdensome and causes students get distracted in order to sign for their attendance. Furthermore, the face recognition based automated student attendance system able to overcome the problem of fraudulent approach and lecturers does not have to count the number of students several times to ensure the presence of the students.

1.3. Objectives

It provides flexibility and reduces the time loss. There will be no chance for a proxy. The objective of this project is to develop face recognition based automated student attendance system. Expected achievements in order to fulfill the objectives are:

- i. To detect the face segment from the video frame.
- ii. To classify the features in order to recognize the face detected.

- iii. To record the attendance of the identified student.
- iv. To mark the attendance automatically.
- v. To reduce the time and the efforts required for manual attendance.

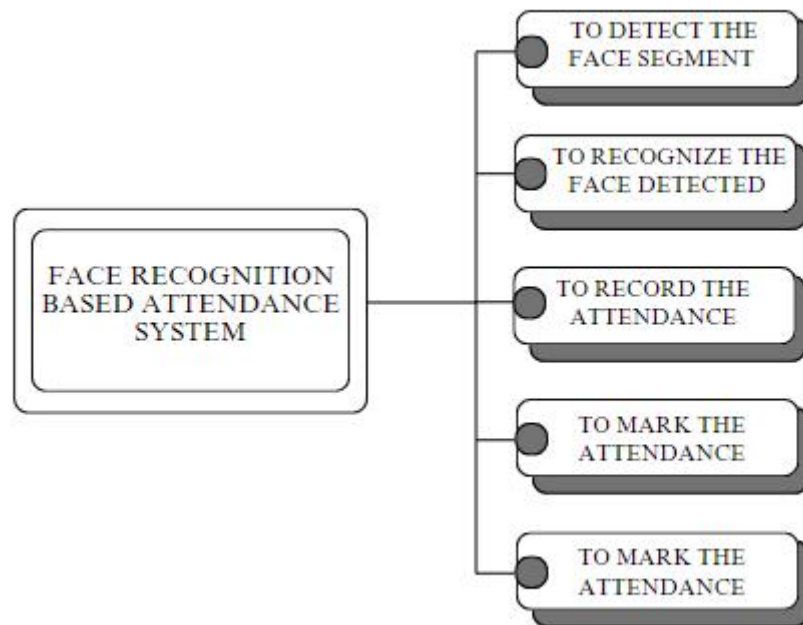


Figure 1: Chapter 1.3 Objectives

1.4. Scope and Limitation

The scope of face recognition based attendance system is that only teachers can use it as different subject teacher. They have to login to register or have to ask teachers who have the access. Once they login, they can access the system. It saves the information of the students by their name, id, mobile number, roll no, photos, email and their attendance. It has the features of taking attendance by capturing student's face and auto attendance. This features will help the teacher to take attendance. It is quite easy to use and does not required well skilled. If teachers forget the password they can simply reset password by click on forget password but have to answer the questions.

The limitation of face recognition based attendance system project is that the teachers have to take student's attendance one by one looking in front of camera. It does detect multi faces at once. faces should be clearly seen in camera otherwise it will display unknown.

1.5. Development Methodology

software engineering, a software development methodology (also known as a system development methodology, software development life cycle, software development process, software process) is a division of software development work into distinct phases (or stages) containing activities with the intent of better planning and management. It is often considered a subset of the systems development life cycle. The methodology may include the pre-definition of specific deliverable and artifacts that are created and completed by a project team to develop or maintain an application.

Common methodologies include waterfall, prototyping, iterative and incremental development, spiral development, rapid application development, extreme programming and various types of agile methodology. Some people consider a life-cycle "model" a more general term for a category of methodologies and a software development "process" a more specific term to refer to a specific process chosen by a specific organization.

In my project I have used Agile methods for the development process which is easy to used and saves many times. Every errors can be maintain at the moments.

The meaning of Agile is swift or versatile."Agile process 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. Following are the phases in the Agile model are as follows:

1. Requirements gathering:

In this phase, you must define the requirements. You should explain business opportunities and plan the time and effort needed to build the project. Based on this information, you can evaluate technical and economic feasibility.

2. Design the requirements:

When you have identified the project, work with stakeholders to define requirements. You can use the user flow diagram or the high-level UML diagram to show the work of new features and show how it will apply to your existing system.

3. Construction/ iteration:

When the team defines the requirements, the work begins. Designers and developers start working on their project, which aims to deploy a working product. The product will undergo various stages of improvement, so it includes simple, minimal functionality.

4. Testing:

In this phase, the Quality Assurance team examines the product's performance and looks for the bug.

5. Deployment:

In this phase, the team issues a product for the user's work environment.

6. Feedback:

After releasing the product, the last step is feedback. In this, the team receives feedback about the product and works through the feedback. [1]



Figure 2: Chapter 1.5 Agile Methodology

1.6. Report Organization

The font for the report is numbered in times new roman from page number 1. The page number should be inserted at the bottom, aligned is in center. The margin of paper must be set as Top = 1, Bottom = 1, Right = 1, Left =1.25. The paper size corresponds to A4. All paragraphs must be justified and have a spacing of 1.5 and the content of the document should be in Times New Roman Font. The font size for the heading is 16 where section heading, sub-section heading and paragraph have 14, 12 and 12 respectively. All the headings are bold faced. The position of figures and tables should be aligned center. The figure caption should be centered below the figure and table captions should be centered above the table. All the captions should be of bold face with 12 font size.

There's Five chapters which have different steps of developing the main projects(Face Recognition based Attendance System). We have introduction with background related to face detection and recognize along with it's problem statements, objective, scope and limitation,development methodology and report organization in chapter 1. where as in chapter 2, we have background study and literature review of the project. Similarly in chapter 3, We have system analysis and Architectural Design. In System analysis, it includes requirement analysis, feasibility analysis, Data modeling (ER-DIAGRAM) and Process modeling. Where requirements analysis includes functional requirements and non-functional requirements. in Feasibility analysis, it includes Technical, operational economic and schedule. And Architectural Design includes Database Schema design, interface design and physical DFD. In chapter 4, We have implementation and Testing. Where implementation includes Tools used and Implementation details of modules. And Testing which includes unit testing and system testing.As chapter 5 is the final chapter which consist of lesson learn(outcome), conclusion and future recommendations of the project.

Chapter 2: Background Study and Literature Review

2.1. Background Study

Attendance management has come a long way from traditional paper-based methods to advanced digital solutions that streamline and automate the process. Over the years, technological advancements have revolutionized how organizations track and manage employee attendance. In this blog, we'll explore the three generations of attendance management, leading up to the cutting-edge Tempus Central—and automated attendance management software that has taken the industry by storm.

1st Generation:

Paper-Based Attendance Management In the early days, attendance management relied heavily on manual processes involving pen and paper. Employees would sign in on a physical attendance sheet, and HR personnel would painstakingly record and tally the data. This method was not only time-consuming but also prone to errors. Organizations faced challenges in maintaining the accuracy of records, especially as the workforce grew. Additionally, managing attendance data in physical files made it difficult to access and analyze the information efficiently.

2nd Generation:

Biometric Devices and Excel-Based Attendance Management With technological progress, the second generation saw the introduction of biometric devices like fingerprint scanners and facial recognition systems. These biometric solutions provided a more reliable way to record employee attendance and reduced the possibility of time theft and buddy punching. However, despite the improvement, the data was still managed using Excel spreadsheets or basic software. While this digitized the process to some extent, HR departments still struggled to handle different sheets for various departments, leading to potential discrepancies.

3rd Generation:

Attendance Software-Based Attendance Management As businesses recognized the need for more sophisticated solutions, the third generation of attendance management arrived with specialized attendance software. These software solutions allowed organizations to

centralize attendance data, making it easily accessible and manageable. Employees could punch in and out using biometric devices, swipe cards, or even mobile apps, ensuring accurate attendance records. HR teams benefited from real-time insights into attendance patterns, enabling them to address attendance-related issues promptly.

Later on Tempus Central was introduced for the attendance. The Automated Attendance Management Software Revolution Tempus Central marks the most revolutionary generation of attendance management. This all-in-one automated software offers seamless attendance tracking and management, integrated with a comprehensive payroll system. With Tempus Central, there's no need to manage multiple Excel sheets or shuffle between various platforms for attendance and payroll. The software streamlines the entire process, ensuring accuracy, efficiency, and significant time savings for HR teams. [2]

2.2. Literature Review

A literature review is a compilation, classification, and evaluation of what other researchers have written on a particular topic. A literature review normally forms part of a research thesis but it can also stand alone as a self-contained review of writings on a subject.

Case 1

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 student's 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 could not 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 biometric 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. [3]

Case 2

The second research journals “Face Recognition Based Attendance Marking System” (Senthamil Selvi, 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 this issue, the whole attendance management system can be developed on an portable module so that it can be work just by executing the python program. [4]

Case 3

The third 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. Other than that, the database information cannot be accessible easily. Meaning that, for the parents whom are interested in knowing their child's attendance cannot easily or conveniently access the information. Therefore, to provide accessibility of the student's information to the legitimate concerned party, the information can be uploaded to a web server for easy access. While the authentication for the appropriate access can be enforced through a login screen. [5]

Case 4

According to the fourth research journal "RFID based Student Attendance System" (Hussain, Dugar, Deka, Hannan, 2014), the proposed solution is almost similar to the first research journal where RFID technology is used to improve the older attendance system. In this system, a tag and a reader is again used as a method of tracking the attendance of the students. The difference between the first journals with this is where attendance's information can be accessed through a web portal. It provides more convenient for information retrieval. Again, this system is imperfect in the sense that, firstly, it is not portable, as the RFID reader can only work when it is connected to a PC. Secondly, the RFID tag is not a guanine information that can uniquely identify a student, thus, resulting in the inaccuracy of the collected attendance information. [6]

In conclusion, a better attendance monitoring system should be developed based on its portability, accessibility and the accuracy of the collected attendance information.

Chapter 3: System Analysis and Design

All the students of the class must be registered by administrator by entering the required details and then their images will be captured and stored in the datasets. During each session, faces will be detected from live streaming video of classroom. The faces detected will be compared with images present in the datasets. If match found, attendance will be marked for the respective student.

3.1. System Analysis

The process of gathering information on certain topic through interviews, surveys, etc is called Requirement identification. It is the first stage of collecting data. It includes the study of existing system and literature reviews which shows how the system works and why it is needed.

3.1.1. Requirement Analysis

The process of identifying and categorizing the requirements for a system is called requirement analysis. The purpose of this step in the software development life cycle (SDLC) is to ensure that all stakeholders have clear, shared understanding about what the system should do or achieve. This includes defining functional and non-functional requirements as well as prioritizing them based on their importance and urgency.

i. Functional Requirements

- i. Faces on an image must be detected.
- ii. Compute the total attendance based on detected faces.
- iii. Store the cropped faces in a folder.
- iv. Train faces for recognition.
- v. Display the name and ID of the output image down the image in the plot area.

Use Case Diagram

The Use Case Model describes the proposed functionality of the new system. A Use Case represents a discrete unit of interaction between a user (human or machine) and the system. A Use Case is a single unit of meaningful work. For example login to system,

register with system and create order are all Use Cases. Each Use Case has a description which describes the functionality that will be built in the proposed system. A Use Case may 'includes' another Use Case's functionality or 'extends' another Use Case with its own behavior.

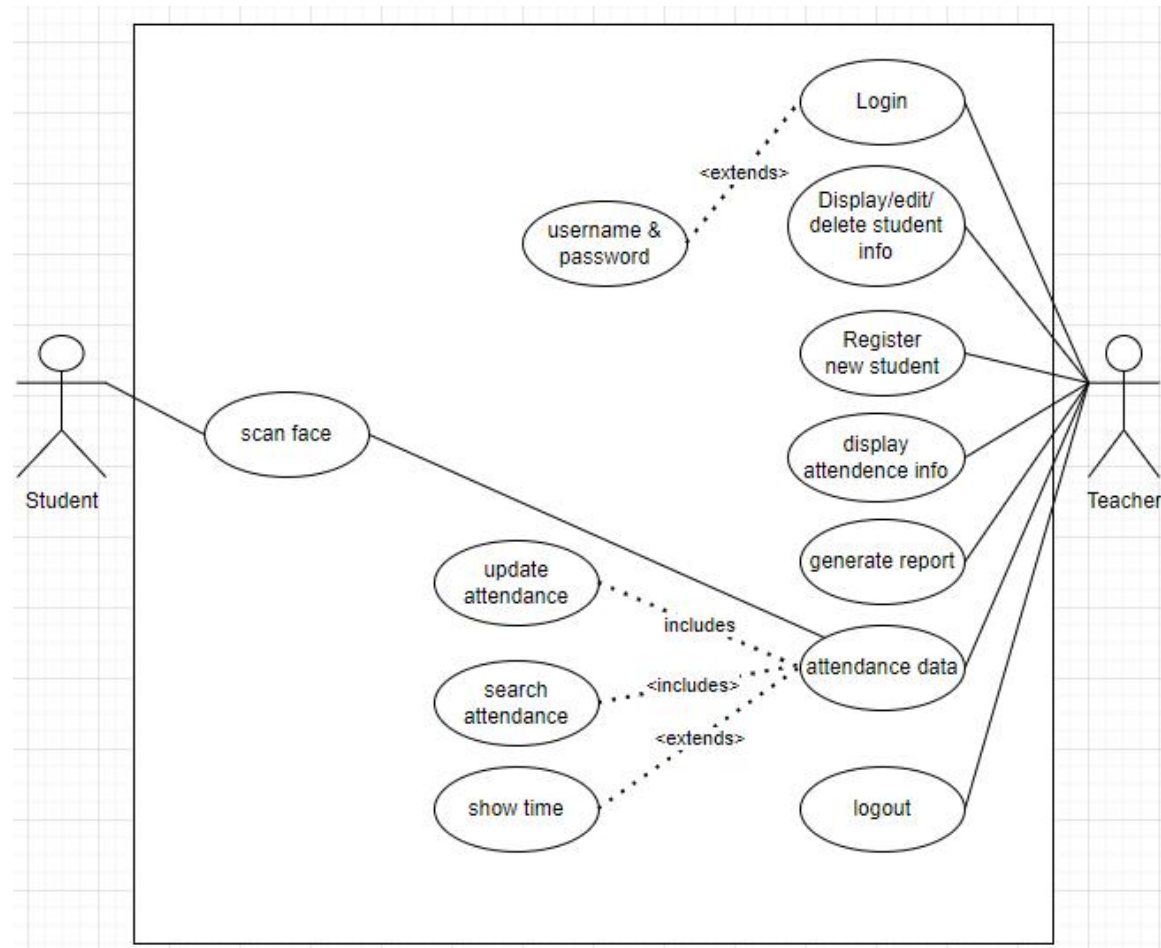


Figure 3: Chapter 3.1.1 Use case

As above Use Case Diagram show the roles of the two persons as an student and Teacher. Teacher have the authorities to manipulate in the system where student doesn't have authorities. There are many features like display, updating, deleting, login, logout, registration new student, generate report, attendance data, display attendance information and can access the system online. These are mostly required to complete the system.

- i. Teacher can add or delete the student from the system as students by their id, name and class section.

- ii. When Teacher registered the students name as student, student's face can be use to take attendance in the system.
- iii. Whenever the teacher have any problems regards update, they can change in the system communicate with teacher about it.
- iv. If the teacher would like to leave the system from the connect device they would simply need to logout.

ii. Non-Functional Requirements

- i. The user will inform the students when taking a photo with clear instructions on how to position their faces.
- ii. The system can detect the face from a live-stream video.
- iii. The system is reliable because of the advanced technology that is used to develop the system, the system can achieve a face detection accuracy of up to 90%.
- iv. The system will have a response time of many seconds.

3.1.2. Feasibility Analysis

A feasibility study evaluates the project's potential for success. Therefore, perceived objectivity is an important factor in the credibility of the study for potential investors and lending institutions. . It must therefore, be conducted with an objective, unbiased approach to provide information upon which decisions can be based. Here, we discuss 3 major feasibility studies required for our project.

i. Technical

Technical feasibility is carried out to determine whether the project is feasible in terms of software, hardware, personnel, and expertise, to handle the completion of the project. It considers determining resources for the proposed system. As the system is developed using python, it is platform independent. Therefore, the users of the system can have average processing capabilities, running on any platform. The technology is one of the latest hence the system is also technically feasible.

ii. Operational

Operational feasibility is the measure of how well a proposed system solves the problems with the users. Operational feasibility is dependent on human resources available for the project and involves projecting whether the system will be used if it is developed and implemented. The project is operationally feasible for the users as nowadays almost all the teachers/staffs are familiar with digital technology.

iii. Economic

Economic feasibility defines whether the expected benefit equals or exceeds the expected costs. It is also commonly referred to as cost/benefit analysis. The procedure is to determine the benefits and the savings expected from the system and compare them with the costs. A proposed system is expected to outweigh the costs. This is a small project with no cost for development. The system is easy to understand and use. Therefore, there is no need to spend on training to use the system. This system has the potential to grow by adding functionalities for students as well as teachers. This can Hence, the project could have economic benefits in the future.

iv. Schedule

Through this, timeline is develop for the project. It makes quite easier to see the tasks along with time required and how long should be taken to complete it. It also shows the who should be working on it and what order work should be done in. The following Gantt Chart shows the timeline and completion of project along with the starting and ending dates of the project. Gantt chart is a project management tool that illustrates work completed over a period of time in relation to the time planned for the work. A Gantt chart can include the start and end dates of tasks, milestones, dependencies between tasks, assignee, and more.

Table 2: Chapter 3.1.2 Gantt Chart

S. N	Task	Start Date	End Date	Duration
1	Project Management	27-Feb-2023	18-Mar-23	20 days
2	Feasibility Study	27-Feb-2023	3-Mar-23	5 days
3	Study of Existing System	4-Mar-2023	8-Mar-23	5 days
4	Gantt Chart and Flow Chart	9-Mar-2023	13-Mar-23	5 days
5	Proposal Submission	14-Mar-2023	18-Mar-23	5 days
6	Introduction	19-Mar-2023	12-Apr-23	25 days
7	Introduction and Problem Statement	19-Mar-2023	28-Mar-23	10 days
8	Aim & Objectives	29-Mar-2023	2-Apr-23	5 days
9	Scope & Limitation	3-Apr-2023	7-Apr-23	5 days
10	Development Methodology	8-Apr-2023	8-Apr-2023	1 day
11	Report Organization	9-Apr-2023	12-Apr-23	5 days
12	Background Study and Literature Review	13-Apr-2023	2-May-23	20 days
13	Background Study	13-Apr-2023	22-Apr-23	10 days
14	Literature Review	23-Apr-2023	2-May-23	10 days
15	System Analysis and Design	3-May-2023	8-Jun-23	37 days
16	System Analysis	3-May-2023	3-May-23	1 day
17	Requirement Analysis	4-May-2023	4-May-23	1 day
18	i. Functional Requirement	5-May-2023	9-May-23	5 days
19	ii. Non functional Requirement	10-May-2023	14-May-23	5 days
20	Feasibility Analysis	15-May-2023	19-May-23	5 days
21	Data Modeling (ER-Diagram)	20-May-2023	21-May-23	2 days
22	Process Modeling (DFD)	22-May-2023	24-May-23	3 days
23	System Design	25-May-2023	27-May-23	3 days
24	Architecture Design	28-May-2023	30-May-23	3 days
25	Database Schema Design	31-May-2023	2-Jun-23	3 days
26	Interface Design (UI Interface)	3-Jun-2023	4-Jun-23	2 days

27	Physical DFD	5-Jun-2023	8-Jun-23	4 days
28	Implementation and Testing	9-Jun-2023	2-Aug-23	55 days
29	Implementation	9-Jun-2023	8-Jul-23	30 days
30	Tools Used(CASE tools)	9-Jun-2023	23-Jun-23	20 days
31	Implementation Details of Modules	24-Jun-2023	8-Jul-23	5 days
32	Testing	8-Jul-2023	1-Aug-23	5 days
33	Test Cases for Unit Testing	8-Jul-2023	17-Jul-23	5 days
34	Test Cases for System Testing	18-Jul-2023	1-Aug-23	5 days
35	Conclusion and Future Recommendations	2-Aug-2023	15-Aug-23	25 days
36	Lesson Learn/ Outcome	2-Aug-2023	6-Aug-23	10 days
37	Conclusion	7-Aug-2023	11-Aug-23	5 days
38	Future Recommendations	12-Aug-2023	15-Aug-23	5 days

Above table shows the time period of the tasks. It took 8 days for introduction of the project. Similarly, for background study and literature review, it took 13 days, 13 days for system analysis and design, 21 days for implementation and testing and 22 days for conclusion and future recommendation.

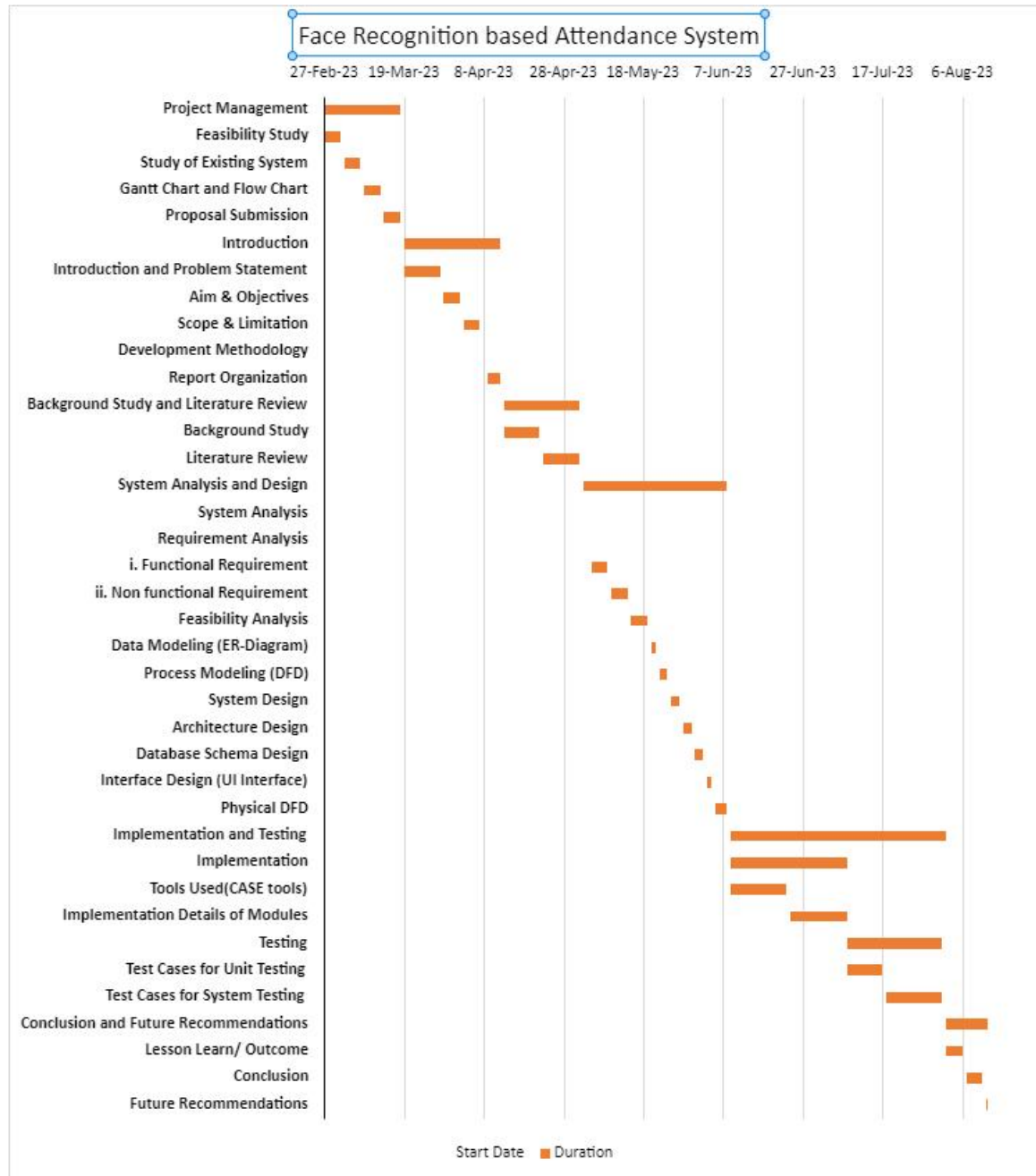


Figure 4: Chapter 3.1.2 Schedule_Gantt chart

On the left of the chart is a list of the activities and along the top is a suitable time scale. Each activity is represented by a bar; the position and length of the bar reflects the start date, duration and end date of the activity.

3.1.3. Data Modeling (ER-Diagram)

This ER diagram for a face recognition based attendance system depicts the various steps taken to develop a face recognition based attendance system. Below E-R Diagram shows the one to many relationship between the different entity table in the system. There are

three entities which includes Registration teacher as regteach, student attendance as stattendance and students. Even we have three entity in the E-R diagram, all are required to complete the system. regteach entity contains seven attributes i.e, first name, last name, mobile number, email, select security questions, security answers and password. Teacher is the admin in the system. This entity help teacher to login in the system if teacher name is match in registration teacher otherwise cannot access the system. Students entity contains thirteen attributes i.e, student id, name, department, course, year, semester, division, gender, birth of date, mobile no,address, roll no, and email. This entity help to keep the information of student in the system. Student attendance entity contains five attributes i.e, student id, roll no, name, date and attendance status. Teacher have authorities to add, delete and manipulate in student information.

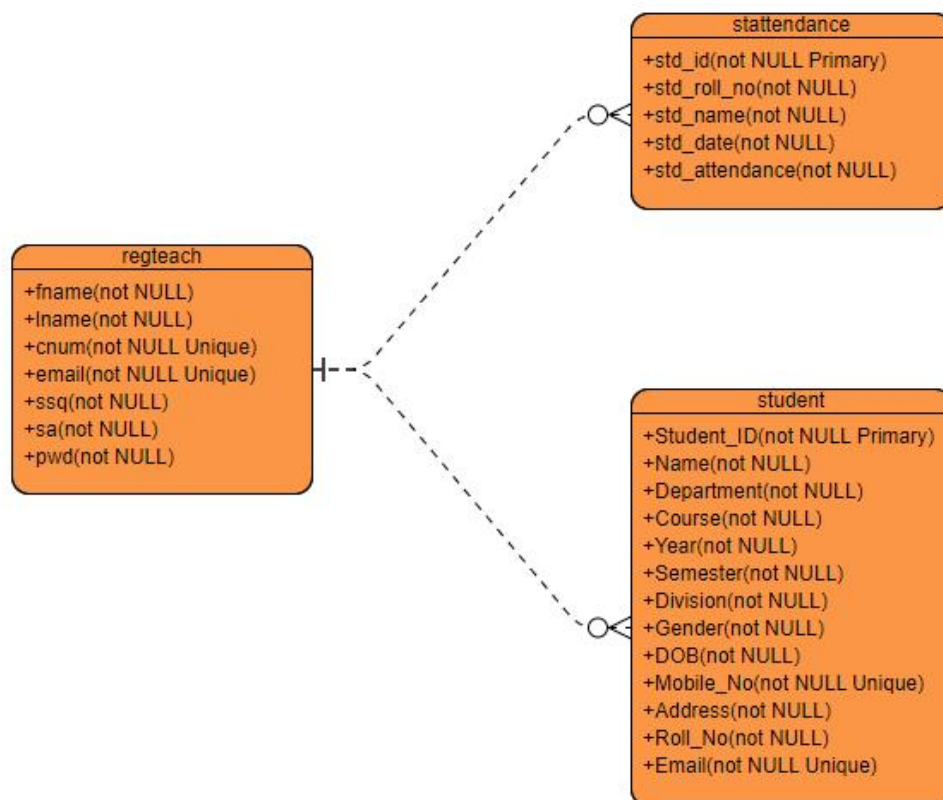


Figure 5: Chapter 3.1.3 E-R Diagram

3.1.4. Process Modeling (DFD)

It represent the system of different levels of abstraction. It have 3 levels. Started from level 0 to level 2. level 0 represent the system as a single process with its relationship to external entities. It shows entire system as a single bubble with inputs and outputs data

indicated by arrows. level 1 represent the main functions of the system and breakdown the high-level of level 0 into sub process. Level 2 represent the one step deeper into parts of level 1 with functional and database storage. The following figures shows the level 0, level 1 and level 2 of DFD.

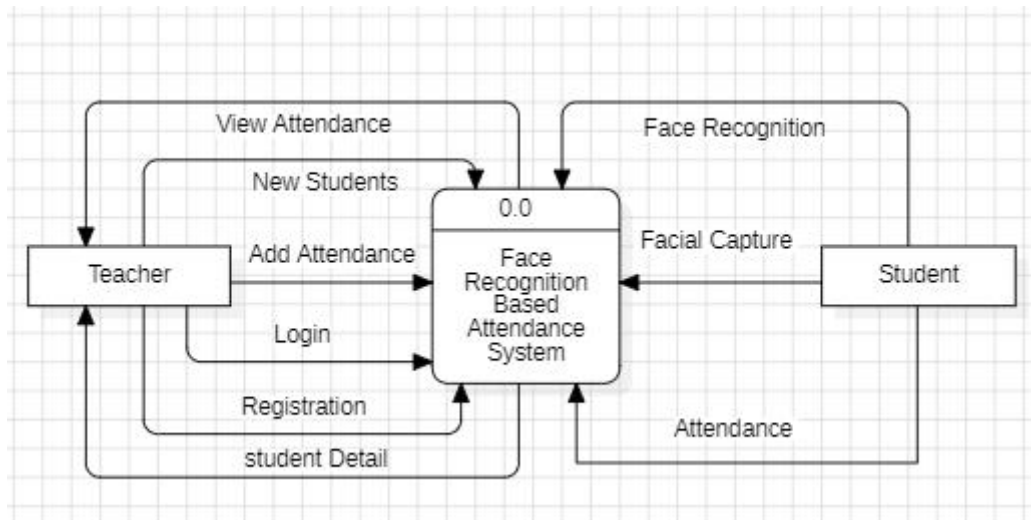


Figure 6: Chapter 3.1.4 level 0 DFD

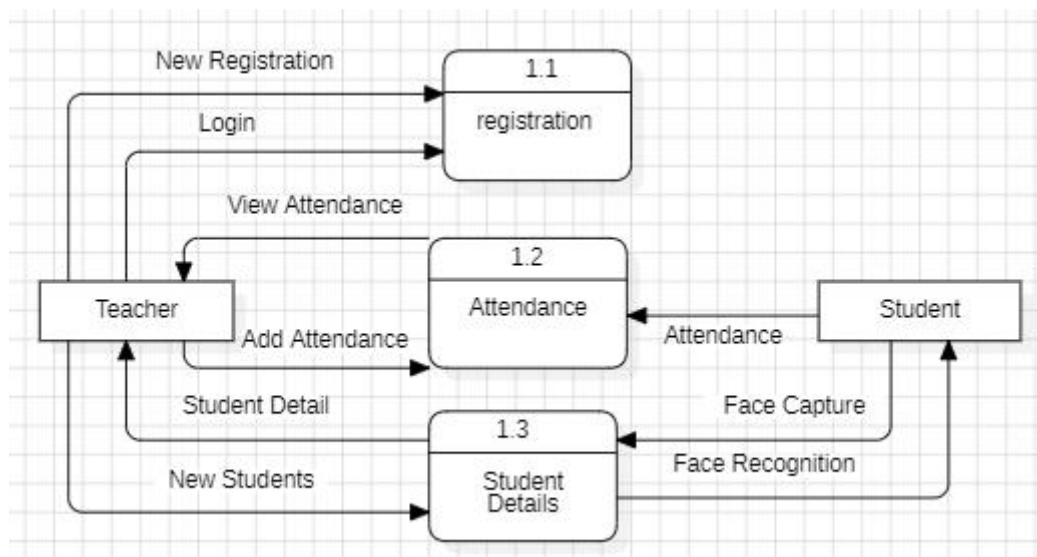


Figure 7: Chapter 3.1.4 level 1 DFD

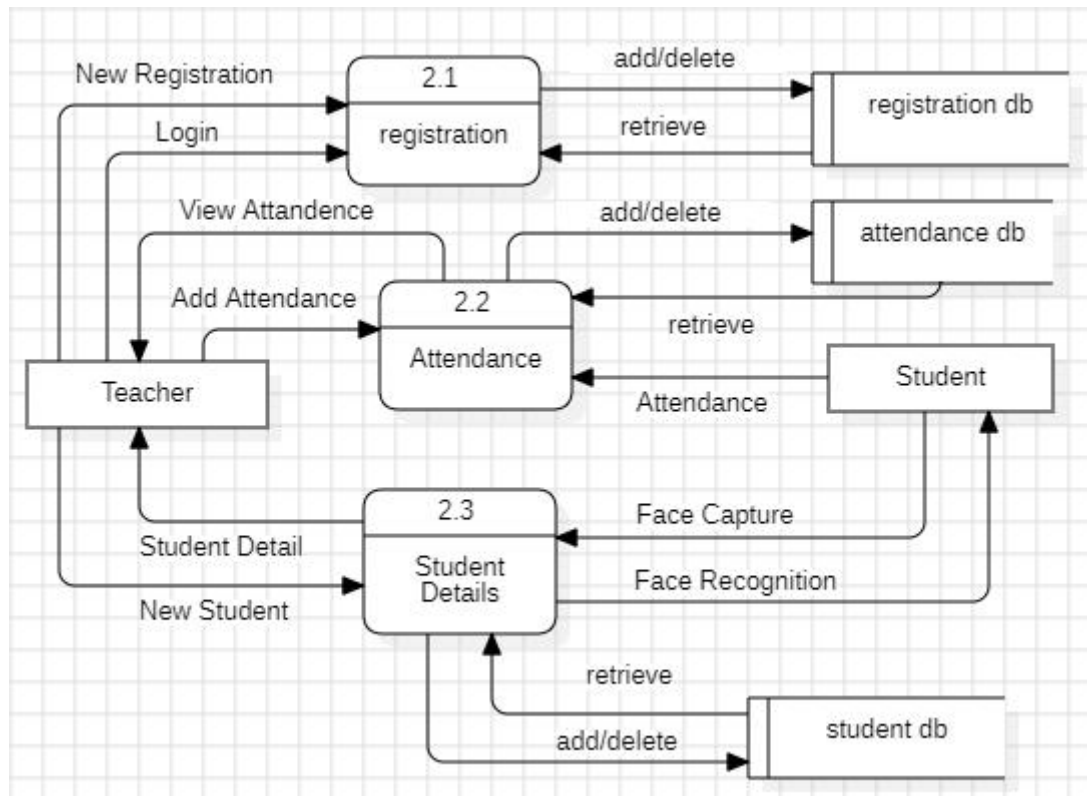


Figure 8: Chapter 3.1.4 level 2 DFD

3.2. System Design

3.2.1. Architectural Design

A flowchart is a picture of the separate steps of a process in sequential order. It is a generic tool that can be adapted for a wide variety of purposes, and can be used to describe various processes, such as a manufacturing process, an administrative or service process, or a project plan.

- To develop understanding of how a process is done
- To study a process for improvement
- To communicate to others how a process is done
- When better communication is needed between people involved with the same process
- To document a process
- When planning a project

Admin

Teachers are admin in my project, where they have many authorities. First of all teacher have to login into the system to access all features. As they get into the system, teacher can view the system. Some of them are given below:

- i. Teachers have the authorities to add new students in the system
- ii. Teacher have to save their student's face in the datasets for the auto attendance system by camera.
- iii. Teachers can view students information along with edit, delete and add features.
- iv. Teachers can view the attendance information of students and can delete it, if needed.

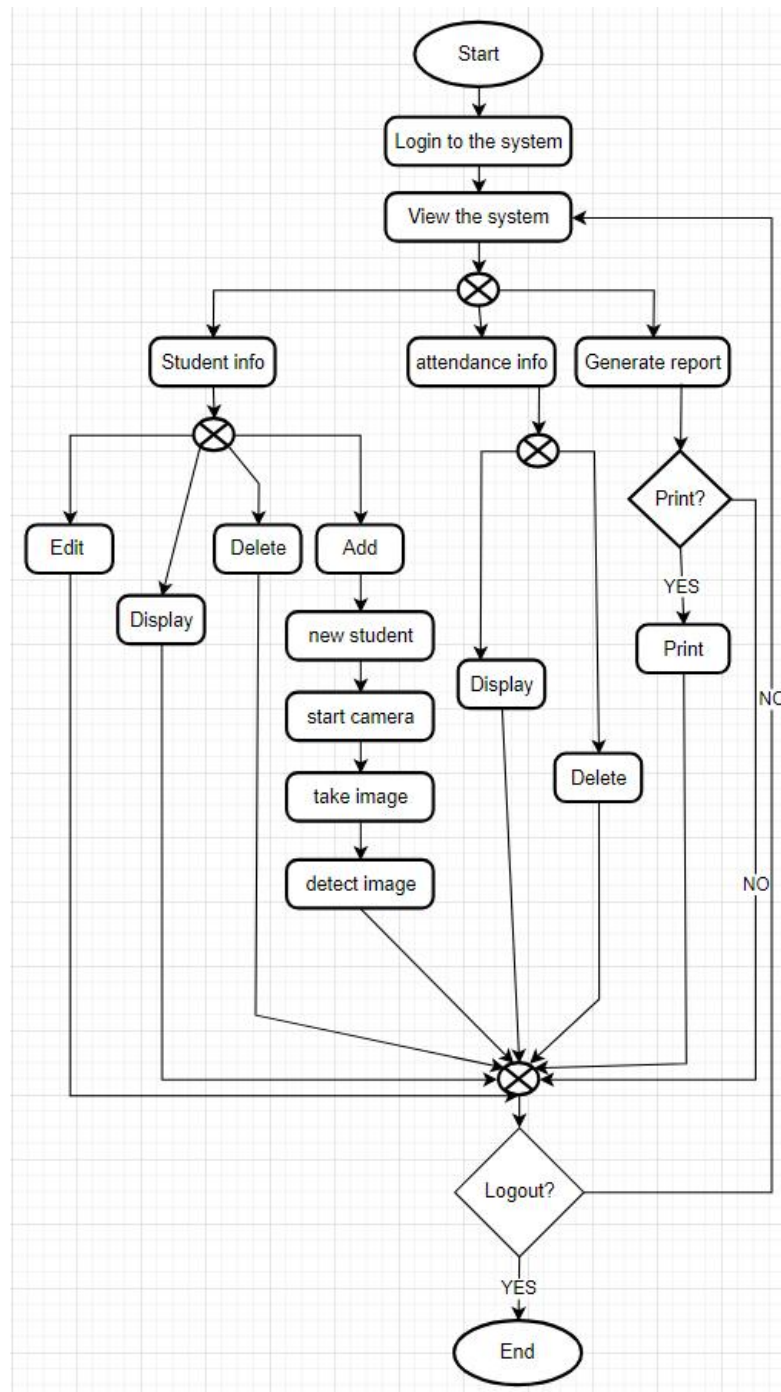


Figure 9: Chapter 3.2.1 Admin Flow Chart

User

Students are user in my project. They don't have any authorities as teachers have. They simply has to face towards the camera as to present their attendance in the college/school. Some of the things students have to do are:

- i. Students have to enter the class and look at the camera then camera will take image.
- ii. Try to match the face saved in the datasets, If not match then display as absent.
- iii. If face is matched then it will check time and present their name in attendance if time is matched otherwise present as late.

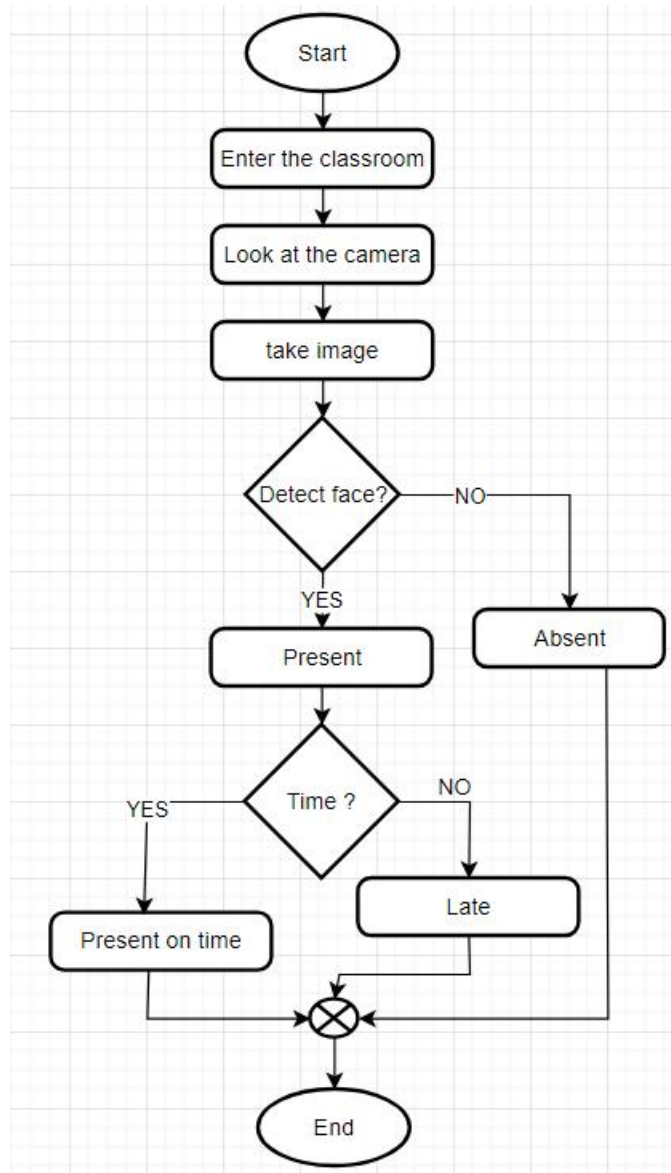


Figure 10: Chapter 3.2.1 User Flow Chart

3.2.2. Database Schema Design

In this project, the Database is created through the help of Workbench with MySQL.

The main database is named as face recognition based attendance system and it has three table names which have their own attributes which are shown in the figure below.

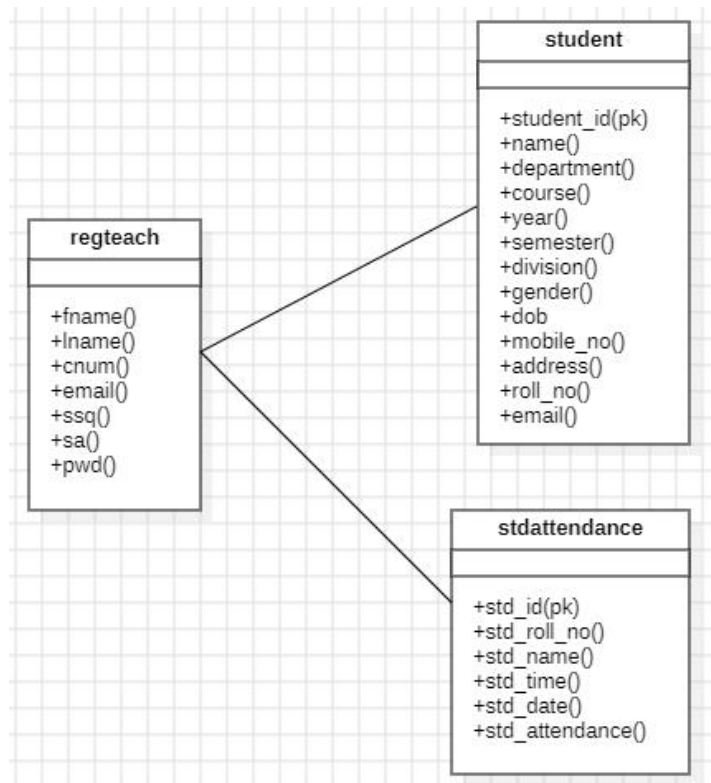


Figure 11: Chapter 3.2.2 Database schema

3.2.3. Interface Design (UI Interface / Interface Structure Diagrams)

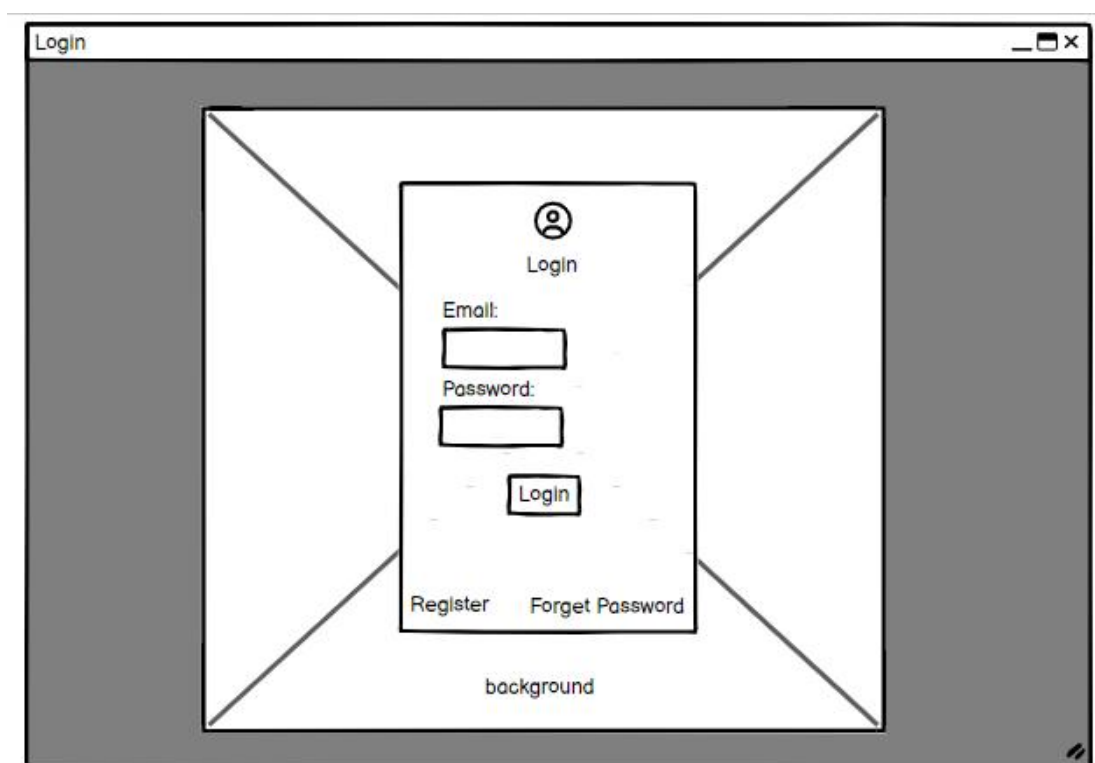


Figure 12: Chapter 3.2.3 login UI

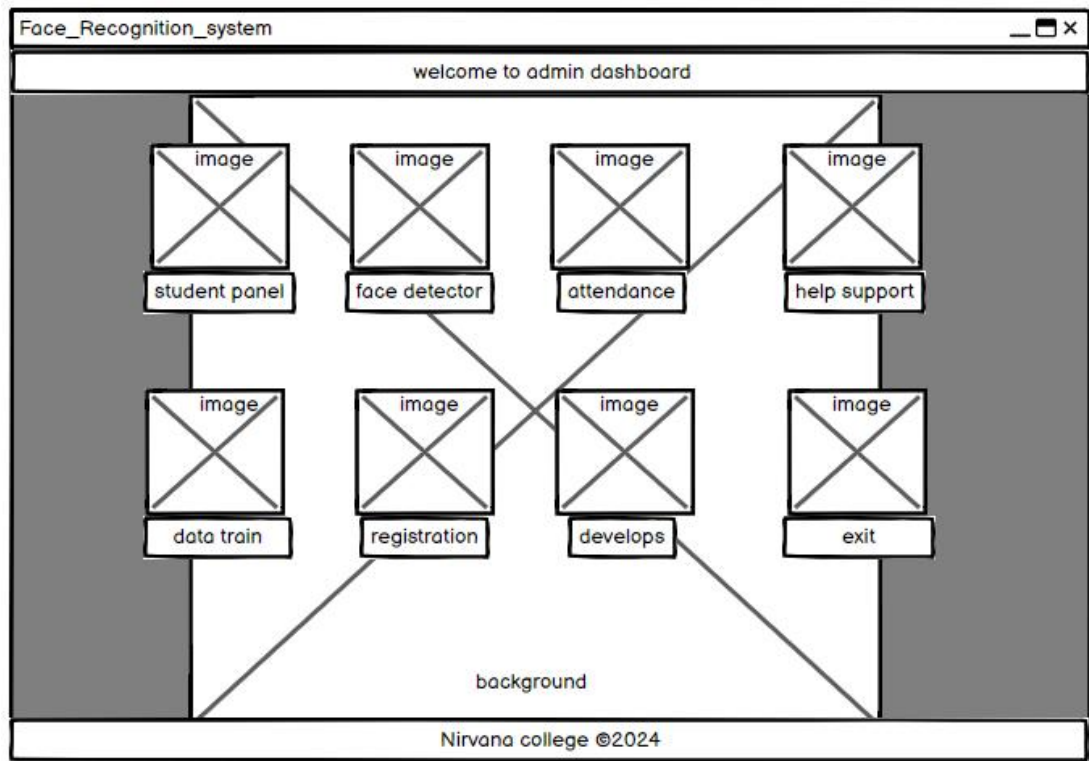


Figure 13: Chapter 3.2.3 admin UI

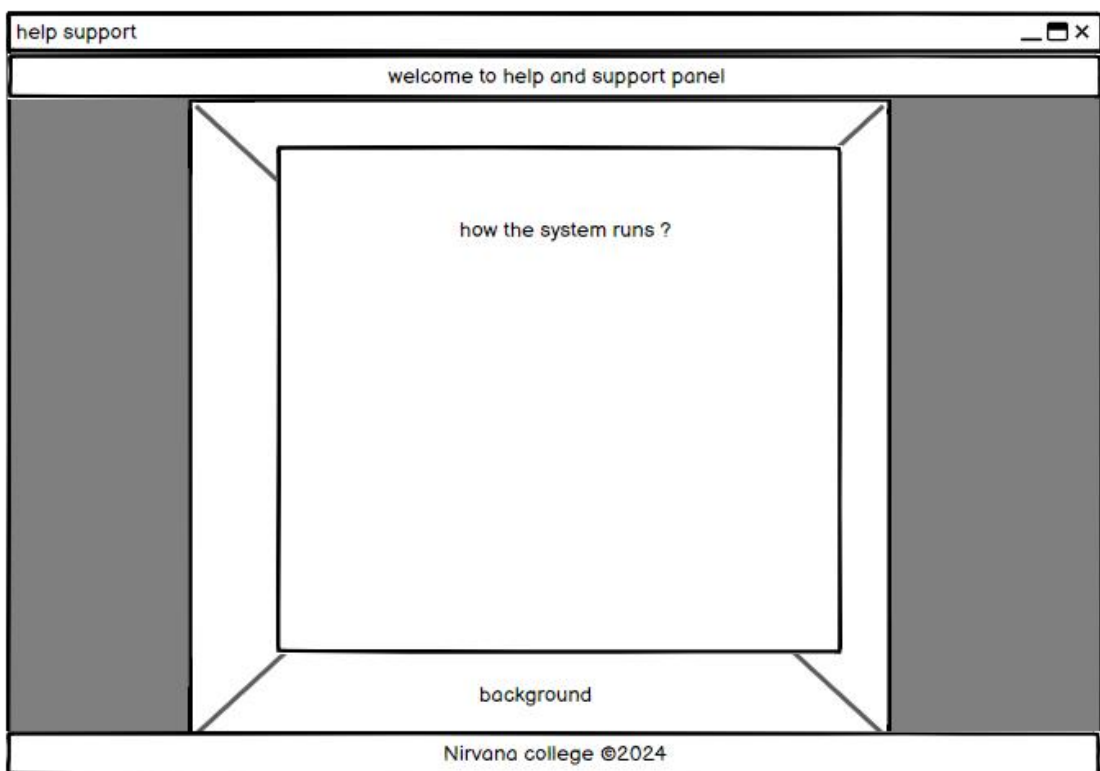


Figure 14: Chapter 3.2.3 support UI

student panel

welcome to student panel

current course

department

year

st-id

class division

gender

email

address

☐ photo sam
☐ no photo sam

save

update

delete

reset

student detail

course

semester

std-name

roll-no

dob

mob-no

teacher

take pic

updatepic

search system

search

student id

name

dept

course

yr

sem

background

Nirvana college ©2024

register

registration

first name:

last name:

select security question:

select

security answer:

contact no:

email:

password:

confirm password:

☐ i agree the terms and conditions

register

background

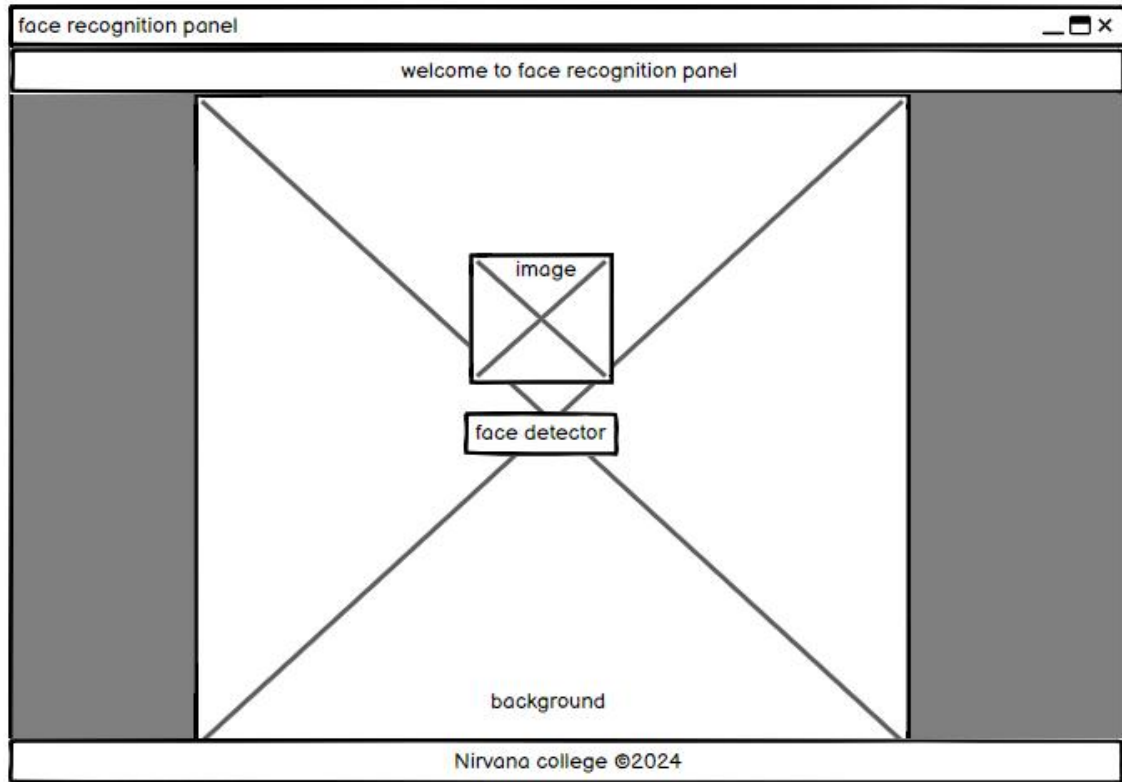


Figure 17: Chapter 3.2.3 face detector UI

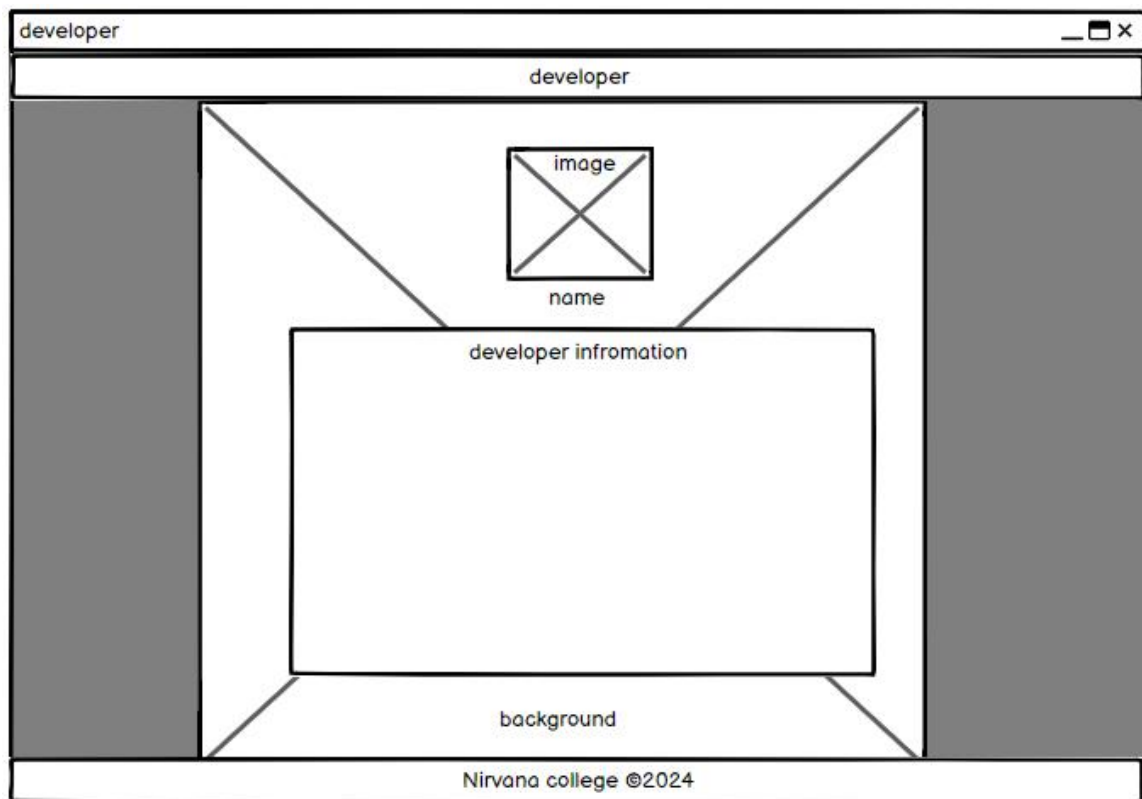


Figure 18: Chapter 3.2.3 developer UI

attendance panel

welcome to attendance panel

student detail

st-id

roll-no

std-name

time

date

attendance-status

status

update

delete

studentid roll name time date atten-st

studentid roll name time date atten-st

import csv

export csv

update

reset

background

Nirvana college ©2024

Figure 19: Chapter 3.2.3 attendance UI

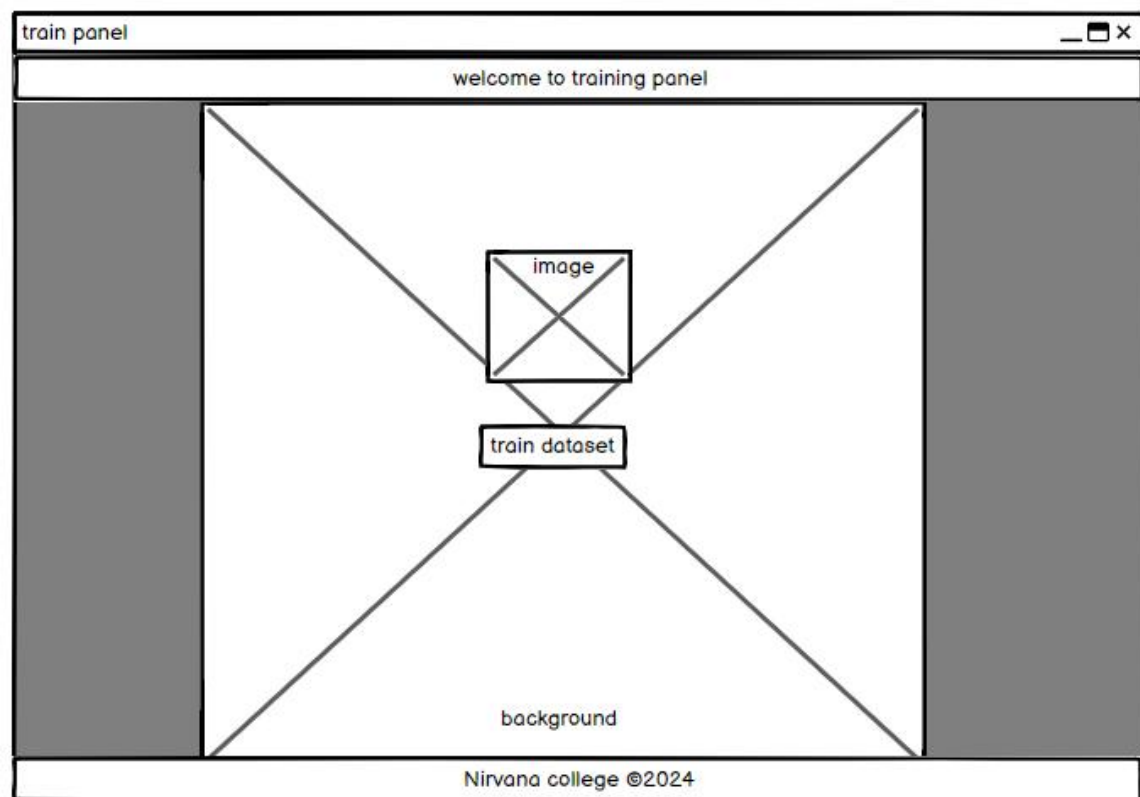


Figure 20: Chapter 3.2.3 training UI

3.2.4. Physical DFD

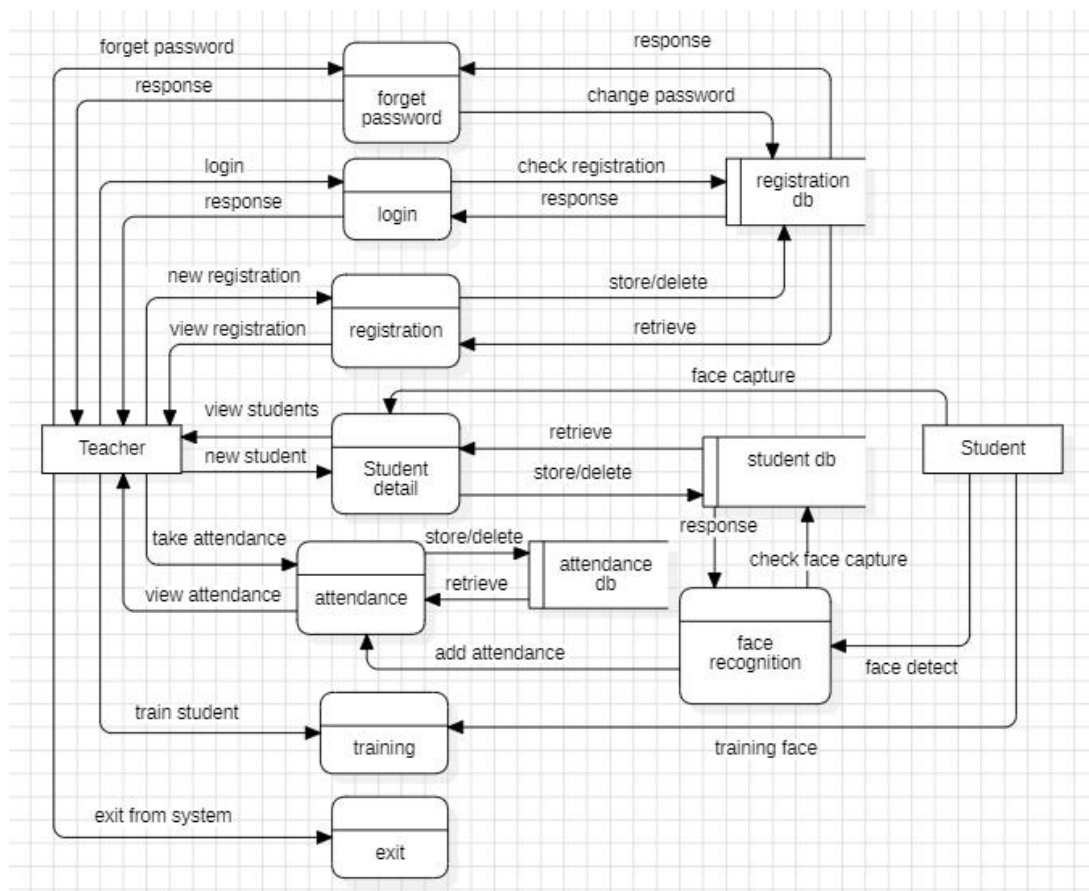


Figure 21: Chapter:3.2.4 Physical DFD

3.3. Algorithm Details

Face recognition algorithms are made to recognize and verify people based on the characteristics of their faces. I'll give a broad overview of a common face recognition algorithm even though there are many different techniques and algorithms utilized in face recognition systems.

Proposed Algorithm

Capture the student's image through camera.

Detect each and every individual face by apply face detection algorithm.

Extract the ROI(Region Of Interest) in rectangular bounding box.

Converting to gray scale, apply histogram equalization and resize to 100x 100 i.e. apply pre-processing.

If image captured then Store in database Else Apply LBPH (for feature extraction) Apply SVM(for classification) End if

Post-processing

Local Binary Patterns Histogram(LBPH) Step- by -step algorithm:

Parameters: the LBPH uses 4 parameters:

Radius:

the radius is used to build the circular local binary pattern and represents the radius around the central pixel. It is usually set to 1.

Neighbour:

the number of sample points to build the circular local binary pattern. Keep in mind: the more sample points you include, the higher the computational cost. It is usually set to 8.

Grid X:

the number of cells in the horizontal direction. The additional cells, the finer the grid, the higher the dimensional of the resulting feature vector. It is usually set to 8.

Grid Y:

the number of cells in the vertical direction. The more cells, the finer the grid, the higher the dimensional of the resulting feature vector.

Training the Algorithm:

First, we need to train the algorithm. To do so, we need to use a datasets with the facial images of the people we want to recognize. We need to also set an ID (it may be a number or the name of the person) for each image, so the algorithm will use this information to recognize an input image and give you an output. Images of the same person must have the same ID.

Applying the LBP operation:

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

Extracting the Histograms:

Now, using the image generated in the last step, we can use the Grid X and Grid Y parameters to divide the image into multiple grids. [7]

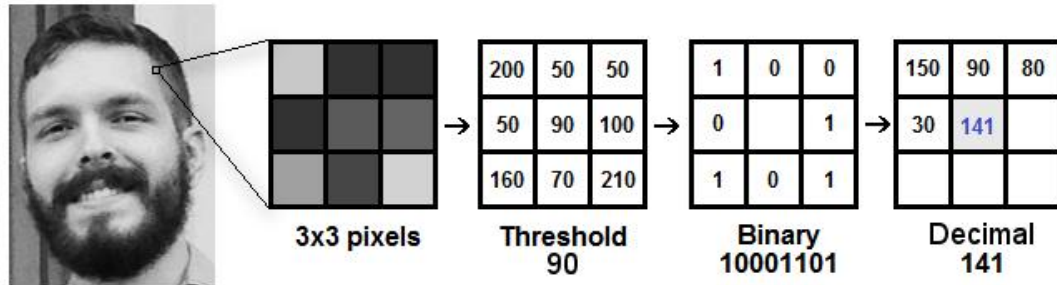


Figure 22: Chapter 3.3 LBPH Algorithm


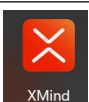
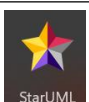


















Chapter 4: Implementation and Testing

4.1. Implementation

4.1.1. Tools Used (CASE tools, Programming languages, Database platforms)

CASE Tools

Table 3: Chapter 4.1.1 CASE tools

Used for	Tools and technologies
Analysis Tools	  
Design Tools	   
Programming Tools	  
Prototyping Tools	
Maintenance Tools	
Diagram Tools	   
Process Modeling Tools	  
Project Management Tools	
Documentation Tools	

Configuration Management Tools	 
Change Control Tools	
Web Development Tools	    
Quality Assurance Tools	

Visual Paradigm



Visual Paradigm is an application software which is used by the software development teams to model business information systems and manage development processes. Along with modeling support, it also provides facilities of report generation and code engineering capabilities including code generation. [8]

XMind



XMind is a software developed by XMind Ltd. It is a mind mapping and brainstorming software which is used to capture ideas, clarify thinking, manage complex information and promote team collaboration. It supports mind maps, fishbone diagrams, tree diagrams, organization charts, spreadsheets etc and is used for knowledge management, meeting minutes and task management. [9]

StarUML



StarUML is a modular and open tool which provides frameworks for extending the functionality of the tools. It allows to access to all functions of the model/ meta- model and tool through COM Automation and provides extension of menu and option items. It allows Teachers to create to their own approaches and frameworks according to their methodologies. Any external tools can be integrated with this tool. [10]

Vs Code



Visual Studio Code is a free, lightweight but powerful source code editor that runs on your desktop and on the web and is available for Windows, macOS, Linux, and Raspberry Pi OS. It comes with built-in support for JavaScript, TypeScript, and Node.js and has a rich ecosystem of extensions for other programming languages (such as C++, C#, Java, Python, PHP, and Go), runtimes (such as .NET and Unity), environments (such as Docker and Kubernetes), and clouds (such as Amazon Web Services, Microsoft Azure, and Google Cloud Platform).[11]

Balasamiq cloud



Balsamiq Cloud is a web-based Teacher interface design tool mostly used for creating wireframes. It is used to generate digital sketches of an idea or concept for an application or website, to facilitate discussion and understanding before writing any code. The completed wireframes are used for Teacher testing, clarifying vision, and getting feedback from stakeholder as well as for getting approval to start development. [12]

WPS Office



WPS Office is a free office software which involve Writes, Spreadsheet, Presentation and PDF. It provides ideal working experience for devices like PC, pad and phone. It allows to achieve high work efficiency anytime and anywhere. [13]

YouTube



YouTube is a video sharing social media platform where any Teacher s can watch, like, share, comment and upload their own videos. YouTube can be accessed through PC, laptops, tablets and mobile phones. [14]

Google Chrome



Google Chrome is a web browser developed by Google. It is used for displaying the contents of the web pages available on the internet. It was development to replace the Internet Explorer. It contains a new rendering engine, provides annotation features, easy to use icons and allows the Teacher to draw on Web pages. This browser also provides the features of betters security and better organization. It can also integrate with Cortana, Microsoft's virtual personal assistant. [15]

Microsoft Edge



Originally, it is the replacement of Internet Explorer. Since 1995, it was default browser in that time of windows system. It requires 1 GB of memory. It has a new rendering engine along with annotation features. it's allows Teacher s to draw on Web pages with easy to use icons features. As comparing with internet explorer, it has better security. [16]

MySQL Workbench



MySQL Workbench is a unified visual database designing or graphical user interface tool used for working with database architects, developers, and Database Administrators. It is developed and maintained by Oracle. It provides SQL development, data modeling, data migration, and comprehensive administration tools for server configuration, user administration, backup, and many more. We can use this Server Administration for creating new physical data models, E-R diagrams, and for SQL development (run queries, etc.). It is available for all major operating systems like Mac OS, Windows, and Linux. MySQL Workbench fully supports MySQL Server version v5.6 and higher. [17]

Microsoft Excel



Excel is a spreadsheet program from Microsoft and a component of its Office product group for business applications. Microsoft Excel enables users to format, organize and calculate data in a spreadsheet. By organizing data using software like Excel, data analysts and other users can make information easier to view as data is added or changed. Excel contains a large number of boxes called cells that are ordered in rows and columns. Data is placed in these cells. Excel is a part of the Microsoft Office and Office 365 suites and is compatible with other applications in the Office suite. The spreadsheet software is available for Windows, macOS, Android and iOS platforms. [18]


OpenCV



OpenCV is the huge open-source library for the computer vision, machine learning, and image processing and now it plays a major role in real-time operation which is very important in today's systems. By using it, one can

process images and videos to identify objects, faces, or even handwriting of a human. When it integrated with various libraries, such as NumPy, python is capable of processing the OpenCV array structure for analysis. To Identify image pattern and its various features we use vector space and perform mathematical operations on these features.[19]

Table 4: Chapter: 4.1.1 Programming tools

Used for	Tools and technologies
Programming languages	

Python



Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its high-level built in data structures, combined with dynamic typing and dynamic binding, make it very attractive for Rapid Application Development, as well as for use as a scripting or glue language to connect existing components together. Python's simple, easy to learn syntax emphasizes readability and therefore reduces the cost of program maintenance. Python supports modules and packages, which encourages program modularity and code reuse. The Python interpreter and the extensive standard library are available in source or binary form without charge for all major platforms, and can be freely distributed.[20]

4.1.2. Implementation Details of Modules (Description of procedures/functions)

Teacher s module

Teacher are the member of the system. For the registration their name, id and their password as the key to login in the system. Teacher also have some features like login into the system with their email and password, view the students information, attendance, add delete the attendance and as well as students information and register new teacher as member.

Login

Login feature allow teachers to authenticate person who would have the power of controlling the system. Login features allows teachers to enter into the system if he/she is the registered in the system.

Register

Register feature allow teachers to register the new teacher by their name along with email. Register feature, registered teacher can enter into the system which allows teachers to be part of the system.

Addition

Addition features allows teachers to add anything in the system. teachers can add new teacher as the member of the system, adding new students information, attendance of time, attendance report and student 's image.

Remove

This features allows the teacher to delete anything from the system if it is not needed anymore. This allows to remove teacher who is no long member of system, deleting the student information and attendance report.

Update

This features allows teacher to change in the teacher's registration, attendance and student's information,etc if it is needed. Sometimes data entry in the system might occurs mistake. At that time edit is must needed to correct it.

View

This features allows teachers to view the whole system but students doesn't have any authorities in the system. teacher can view the register list of the teachers, student's information and attendance.

4.2. Testing

4.2.1. Test cases for Unit Testing

Table 5: Chapter 4.2.1 Unit testing

S.No	Action	Inputs	Expected Output	Actual Output	Test Result
1.	Add Button	On click Add Button	Inserted data in the database	Inserted data in the database	Pass
2.	Update Button	On click update Button	Update data in the database	Update data in the database	Pass
3.	Delete Button	On Click Delete Button	Delete data from the database	Delete data from the database	Pass
4.	Search Button	On click search Button	Display data from the database	Display data from the database	Pass
5.	Import Button	On Click import Button	Importing data in the system	Importing data in the system	Pass
6.	Export Button	On Click export Button	Exporting data from the system	Exporting data from the system	Pass
7.	Reset Button	On Click reset Button	Reset data in the database	Reset data in the database	Pass
8.	Exit Button	On click exit Button	Close whole system	Close whole system	Pass

4.2.2. Test cases for System Testing

Table 6: Chapter 4.2.2 System testing

S.No	Action	Inputs	Expected Output	Actual Output	Test Result
1.	Launch FRAS	Login.py	FRAS system	FRAS system	Pass
2.	Login (valid email & password)	:raj123@gmail.com Password: ***	Login Successful	Login Success	Pass
3.	Login (invalid email & valid password)	:raj456@gmail Password: ***	Incorrect password & email	Incorrect password & email	Pass
4.	Login (valid email & invalid password)	raj123@gmail.com Password: *****	Incorrect password & email	Incorrect password & email	Pass
5.	Login (invalid email & password)	raj456@gmail Password: *****	Incorrect password & email	Incorrect password & email	Pass
6.	Capture Images	Student's face	Images are captured and stored	Images are captured and stored	Pass
7.	Train the Image Datasets	Stored images of a face	Create histograms and store values	Histograms are created and values are stored	Pass
8.	Face recognition	A live streams of a student's face	Name of detected student is displayed in the screen	Name of detected student is displayed in the screen	Pass

Chapter 5: Conclusion and Future Recommendations

5.1. Lesson Learn / Outcome

This is my first project using python, so I didn't have knowledge and idea to develop the website. Even I was confuse in which topic I should develop the website. My Teacher gave me some idea to select the topic. So, I chose face recognition based attendance system. Although I got the topic I was still unknown from where to start and where to end the project. So I started searching what kind of face recognition will be good for the college. I thought about the Teacher and students to generate good relationship and time table schedule between them through digital attendance based system. Where there will be students information, datasets of image and attendance along with report. And I started coding and documentation where again I faced many problems with it too. I had only little knowledge about the programming language with the help of my subject Teacher (scripting languages). I have learned PHP, JavaScript, Ajax, MySQL and WordPress but to run them combining the code is so difficult and I didn't have idea. But with the help of Bikash and Raj sir, he guided me to learn python. So, I started searching it and I got knowledge and idea from w3school where the code is explained properly. And even through YouTube channel like Mr.web designer and Cyber warriors who explained more clearly. In the same way I also tried to execute the code in my own laptop and in the first time I was successful to develop first home page with python. But as I started coding for login and registration, it required the database to store the registered data. So I have to download MySQL workbench. I have to create database with connection to website as to retrieve the data from database as for login. For three times I was fail to develop the websites because I couldn't find out the main error. But at the 4th time, my Teacher guided me to find out the error, why errors occurs and how to solve it. When I developed website and wanted to change in it, I got one great idea in the Microsoft edge with the help of copilot. It gives us what problems I'm facing and it teaches to do that and I did it. It worked. I started running the code by comment and running the code one by one without disturbing the real code. This was best step for me to learn as a beginner. This is how I completed my project. Through this project I have gain many idea and knowledge about the coding and documentation. I learned about Python, OpenCV, Tkinter GUI and MYSQL with combining execution and dealing with errors and solving it. What I have

learn was only in theoretical but this project really help me to achieve real time experiences and to develop executable system.

This system aims to build an effective class attendance system using face recognition techniques. The proposed system will be able to mark the attendance via face Id. It will detect faces via webcam and then recognize the faces. After recognition, it will mark the attendance of the recognized student and update the attendance record.

5.2. Conclusion

Finally, I have completed my project meeting all the guidance and requirements of TU. My project was on face recognition based attendance system which have many features are includes like Student's information, attendance, attendance report, registration, training and datasets of image. And it the demo type website system which manages the attendance within the academic fields. But as looking around in Nepal, everyone is not properly using the facial attendance and somehow in Nepal, every attendance is not taken by asking name of students which consumes time and having habituate of physical noting attendance system. So I want to develop this system with many features which can be useful in academic field and can bring well systematic change in Nepal and Nepali Societies. So it is the first step for me to learn that I'm able to develop the demo type websites.

5.3. Future Recommendations

My project is completed with sweet and simple concept. But I want to develop it totally online server based system in the upcoming future which will be require host account like domain. I will develop it fully functional web server along with having several features like accurate time table, calenders feature, meeting scheduling, minuting features, managing time table for students and students can only have the login id. The system will be not only for Teacher but it will be for students too. My system would be easy to use in any fields like education, business, etc. The system would be compatible with any electronic devices like android mobiles, tablets, computers, etc.

Appendices

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator: stdattendance student regteach x

SCHEMAS

Filter objects

face_recognition

- Tables
 - regteach
 - stdattendance
 - student
- Views
- Stored Procedures
- Functions

sys

1 • `SELECT * FROM face_recognition.regteach;`

Result Grid

	fname	lname	cnum	email	ssq	sa	pwd
▶	rajkumar	karki	9856232341	raj123@gmail.com	Your Nick Name	raj	123456
	ram	karki	9856243107	ram@gmail.com	Your Nick Name	ramu	123
	susan	karki	2154876923	susan@gmail.com	Your Nick Name	susn	2424
	123	123	123	123@gmail.com	Your Date of Birth	123	123
	123	123	123	123	Your Date of Birth	123	123
	12345	123	83	raj	Your Date of Birth	123	123
	123	123	1234	123	Your Date of Birth	123	123
	123	123	12345	raj@gmail.com	Your Date of Birth	123	123
	raj	raj	1325649784	raji@gmail.com	Your Date of Birth	123	abc123
	raju	bk	7789456321	raju@gmail.com	Your Date of Birth	123	abc123

regteach 1 x

Output

Action Output

#	Time	Action
✓ 1	21:28:22	SELECT * FROM face_recognition.regteach LIMIT 0, 1000

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator: stdattendance student regteach stdattendance student x

SCHEMAS

Filter objects

face_recognition

- Tables
 - regteach
 - stdattendance
 - student
- Views
- Stored Procedures
- Functions

sys

1 • `SELECT * FROM face_recognition.student;`

Result Grid

	Student_ID	Name	Department	Course	Year	Semester	Division	Gender	DOB	Mobile_No	Address	Roll_No	Email
▶	100	susan	BCA	Com.Graphic	2021-25	Semester-4	Morning	Male	1999/01/24	2154876923	imadol	2	susan
	101	asmita	BCA	Com.Graphic	2021-25	Semester-7	Morning	Female	1010/10/10	1254879623	gwarko	10	asmita
*	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL	NULL

Output

Action Output

#	Time	Action	Message
✓ 1	21:28:22	SELECT * FROM face_recognition.regteach LIMIT 0, 1000	10 row(s) returned
✓ 2	22:37:29	SELECT * FROM face_recognition.stdattendance LIMIT 0, 1000	0 row(s) returned
✓ 3	22:37:34	SELECT * FROM face_recognition.student LIMIT 0, 1000	2 row(s) returned

MySQL Workbench

Local instance MySQL80 x

File Edit View Query Database Server Tools Scripting Help

Navigator: stdattendance - Table stdattendance regteach student stdattendance

SCHEMAS

Filter objects

face_recognition

- Tables
 - regteach
 - stdattendance
 - student
- Views
- Stored Procedures
- Functions
- sys

1 • **SELECT * FROM face_recognition.stdattendance;**

Limit to 1000 rows

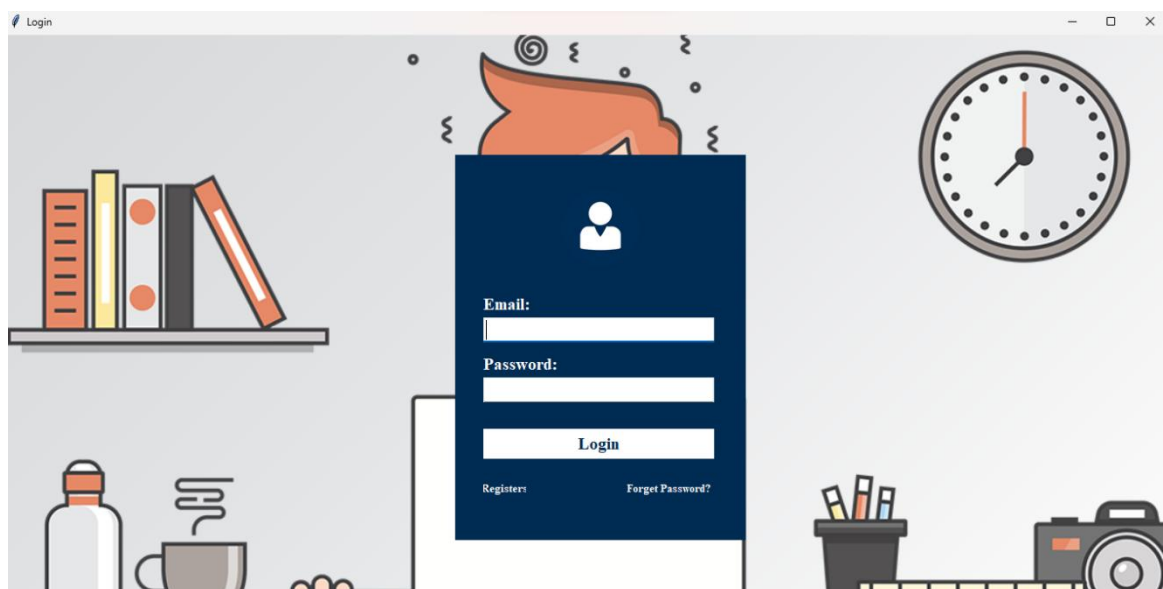
Result Grid

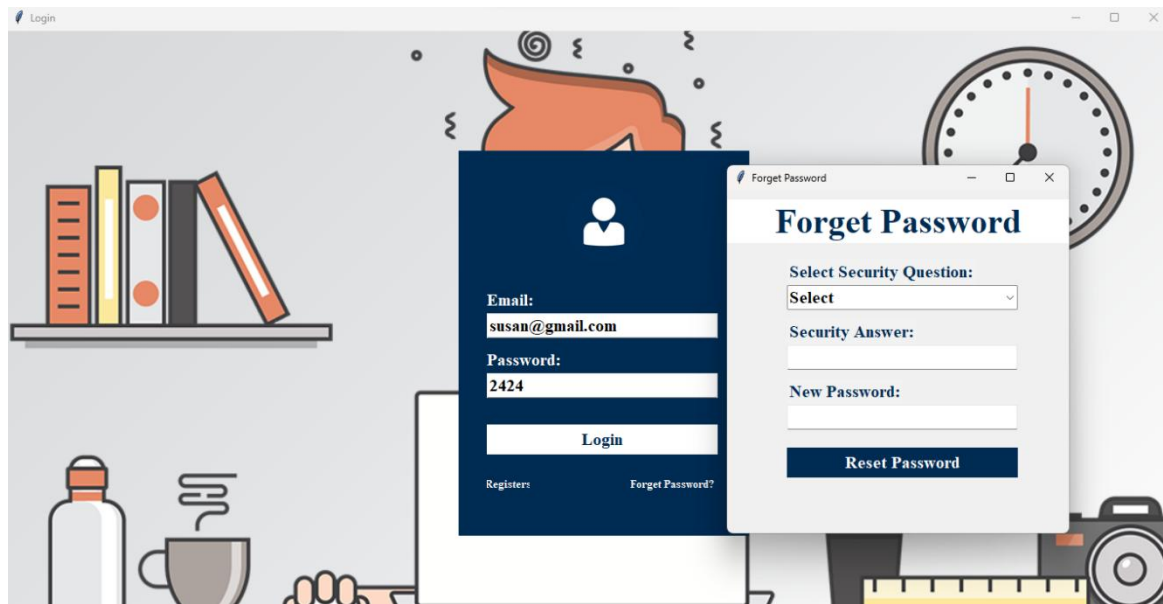
std_id	std_roll_no	std_name	std_time	std_date	std_attendance
100	2	susan	10:00	2024/3/3	present
101	5	asmita	11:00	2024/3/3	present
NULL	NULL	NULL	NULL	NULL	NULL

Output

Action Output

#	Time	Action
4	22:39:16	SELECT * FROM face_recognition.stdattendance LIMIT 0, 1000





Student Pannel

Welcome To Student Panel

Student Details

Current Course

Department
Select Department
Course
Select Course

Year
Select Year
Semester
Select Semester

Class Student Information

Std-ID:
Std-Name:

Class Division:
Morning
Roll-No:

Gender:
Male
DOB:

Email:
Mob-No:

Address:
Teacher Name:

☐ Take Photo Sample
☐ No Photo Sample

Save
Update
Delete
Reset
Take Pic
Update Pic

Student Details


Search System

Search:
Select
Search
Show All

StudentID	Name	Department	Course	Year	Semester	
100	susan	BCA	Com.Graphic	2021-25	Semester-4	N
101	asmita	BCA	Com.Graphic	2021-25	Semester-7	N

Face Recognition Panel

Welcome To Face Recognition Panel



Attendance Panel

Welcome To Attendance Panel

Student Details

Std-ID:

Roll.No:

Std-Name:

Time:

Date:

2/28/24

Attend-status:

Status

Update

Delete

Std-ID	Roll.No	Std-Name	Time	Date	Attend-status
100	2	susan	10:00	2024/3/3	present
101	5	asmita	11:00	2024/3/3	present

Import CSV

Export CSV

Update

Reset

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Register

Registration

First Name:

Contact No:

Last Name:

Email:

Select Security Question:

Select

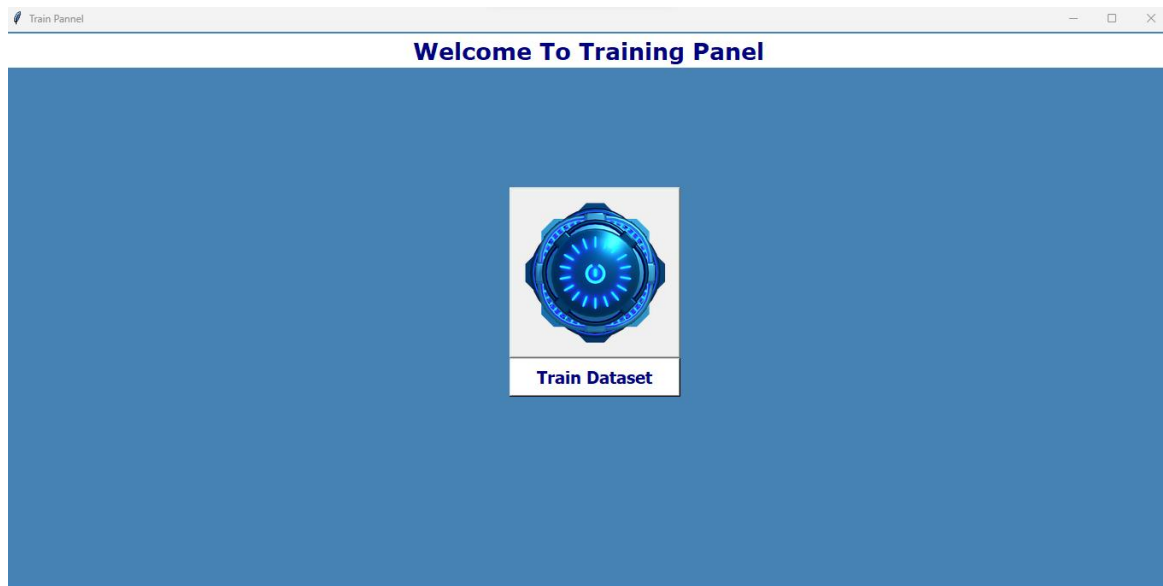
Password:

Security Answer:

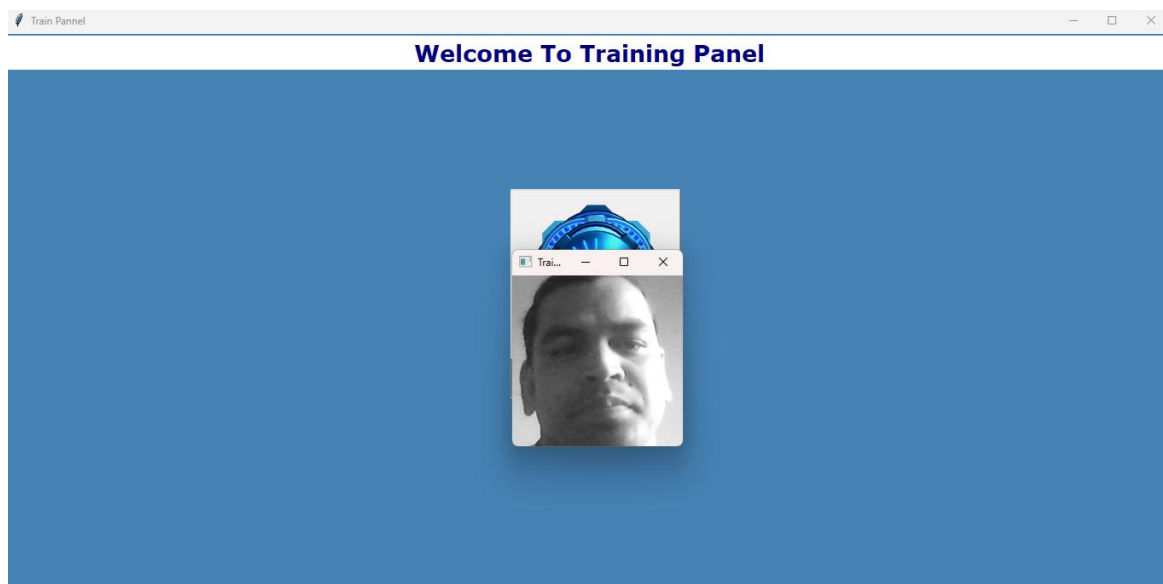
Confirm Password:

I Agree the Terms & Conditions

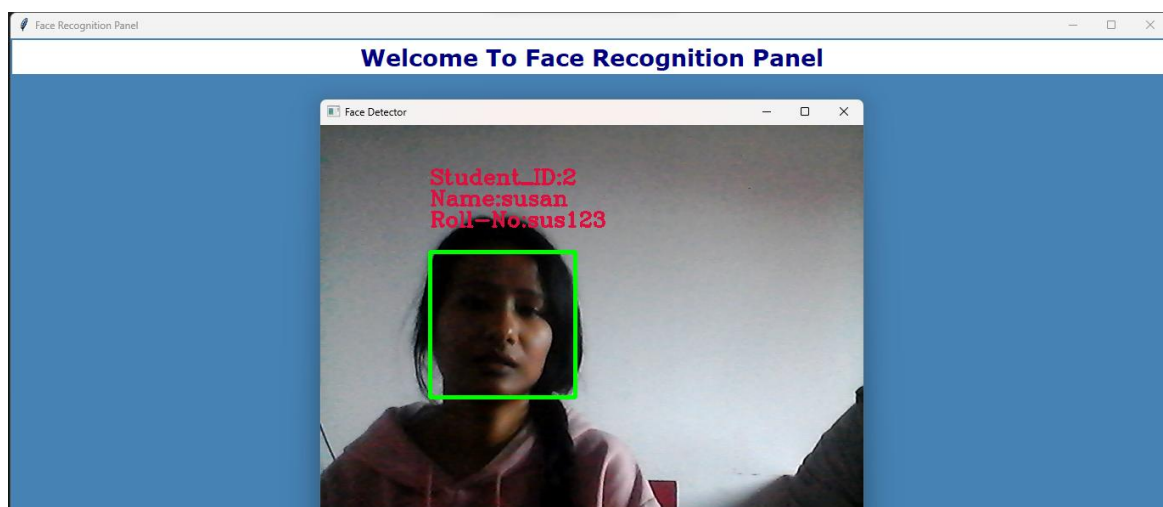
Register



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Help Support

— □ ×

Welcome To Help & Support Panel

!Click As you want to Know!

1. How to Run Program ?
2. Troubleshooting ?
3. Frequently Asked Questions ?
4. Conclusion:

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File Edit Selection View Go Run ... Python_Test_Projects

EXPLORER

PYTHON_TEST_PROJECTS

> __pycache__

> .vscode

> data_img

> Images_GUI

attendance.csv

attendance.py

face_recognition.py login.py attendance.csv ×

attendance.csv > data

```
1
2
3 2, susan, sus123, 13:40:32, 15/03/2024, Present
4 1, raj, abc123, 13:40:35, 15/03/2024, Present
```

Home attendance.csv +

Menu

Home Insert Page Layout Formulas Data Review View Tools Smart Toolbox

Format Painter Paste

Calibri 11

B I U

Wrap Text Merge and Center

General

A1 fx

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1														
2														
3		2	susan	sus123	13:40:32	15/03/2024	Present							
4		1	raj	abc123	13:40:35	15/03/2024	Present							
5														
6														

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