AI-Based Student Monitoring

Submitted in partial fulfillment of the requirements of the degree of

BACHELOR OF COMPUTER ENGINEERING

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(2022-2023)

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CERTIFICATE

This is to certify that the Mini Project 2B entitled "**AI-Based Student Monitoring**" is a bonafide work of **"Namrata Narkhede (20102106), Anupama Menon (20102036), Itisha Mathane (20102001), Sayali Nikam (20102203)"** submitted to the University of Mumbai in partial fulfillment of the requirement for the award of the degree of **Bachelor of Engineering** in **Computer Engineering.**

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Project Report Approval for Mini Project-2B

This project report entitled "**AI-Based Student Monitoring"** by **Namrata Narkhede, Anupama Menon, Itisha Mathane , Sayali Nikam** is approved for the partial fulfillment of the degree of ***Bachelor of Engineering*** in ***Computer Engineering***, ***2022-23***.

Examiner Name Signature

1._____ _____

2._____ _____

Date:

Place:

Declaration

We declare that this written submission represents my ideas in my own words and where others' ideas or words have been included, I have adequately cited and referenced the sources. I also declare that I have adhered to all principles of academic honesty and integrity and have not misrepresented or fabricated or falsified any idea/data/fact/source in my submission. I understand that any violation of the above will be cause for disciplinary action by the Institute and can also evoke penal action from the sources which have thus not been properly cited or from whom proper permission has not been taken when needed.

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Abstract

An innovative approach that enables schools and institutions to monitor student performance and behavior is the AI-based student monitoring system. By utilizing cutting-edge technologies like face recognition, the system makes it easier for teachers to keep track of students' attendance while also giving administrators useful information. The technology automatically logs student attendance, doing away with the necessity for human attendance taking and allowing teachers to concentrate on their instruction. Each student's attendance rate is determined, and subject-specific attendance records are created for additional examination.

Administrators can more easily identify students with strong or poor attendance records thanks to the visualisation module of the system, which presents attendance data as a graphical representation.

Administrators can use this function to ensure that students attend classes on a regular basis. Additionally, the system notifies students and their parents through email when a particular level of attendance is not met, encouraging students to improve their attendance by taking appropriate action and fostering accountability.

The AI-based student monitoring system is a useful tool for teachers and students alike overall. By encouraging an accountability and attendance culture in businesses and institutions, it aids in the improvement of academic achievement. Additionally, the system lessens instructors' workloads and gives administrators useful information. Contact us right away to learn more about how AI-based student monitoring might help your college or university.

Keywords: AI-based student monitoring system, face recognition, student performance, visualisation module, email notification.

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Chapter 1

Introduction

Attendance monitoring is an essential task in educational institutions, and it plays a crucial role in student management. Manual attendance taking can be a tedious and time-consuming task for teachers, which can hinder their focus on teaching. Our AI-based student monitoring system is designed to simplify this task and provide valuable insights to school administrators.

With the help of face recognition technology, our system automatically records student attendance, eliminating the need for manual attendance taking. The system calculates the attendance percentage of each student and generates subject-wise attendance reports, providing administrators and teachers with a quick and easy overview of attendance patterns in their institution. The attendance reports can be used for further analysis, enabling teachers to identify students who may be at risk of falling behind academically due to poor attendance.

The visualization module provides a graphical representation of attendance data, making it easier for administrators to identify students who have good or poor attendance records. By analyzing the attendance patterns, school administrators can take corrective actions to promote a culture of attendance and accountability among students.

The system sends alerts to students and their parents via email when their attendance falls below a certain threshold, promoting responsibility and accountability among students. The alerts ensure that students are aware of their attendance records and take corrective actions to improve their attendance. The system not only helps to improve academic performance but also promotes a culture of attendance and accountability in organizations and schools.

Furthermore, our AI-based student monitoring system goes beyond just monitoring attendance. The system can also track student behaviour patterns, such as tardiness or leaving class early, providing teachers with valuable insights into student behaviour. By analysing behaviour patterns, teachers can identify students who may be struggling with the course material or facing other challenges and provide them with appropriate support. This helps to ensure that students receive the help they need, improving their academic performance and overall well-being.

Chapter 2

Literature Survey

[1] This research paper presents a face recognition based attendance system for academic institutions. The system records the attendance of the student by marking his/her presence in the database. The system also generates the report of the student's attendance for a particular period, and the report can be viewed by the respective faculty or the student itself.

[2] The purpose of this study is to create a face recognition and Raspberry Pi-based attendance management system. Two primary subsystems make up the proposed system. Each class will receive a Raspberry Pi as the first component, and a web application will receive data from the Raspberry Pi as the second component.

[3] This paper exactly focused on producing a secure attendance marking system which is based upon one of the human gesture as Face. There are two stages to implement the approach. One is face detection using Haar classifier. Second one is face recognition using LHBP classifiers which is generated from trained faces. The proposed system is going to record the attendance of the people who are present in a classroom environment autonomously and this is an easiest way to produce the analysis and proof oriented approach makes as reliable applications.

Research Paper	ANALYSIS
1. "Face Recognition based Attendance System with Analysis" by N. Jaiswal and V. R. Singh ,International Journal of Computer Applications, Vol. 136, No. 2, February 2016	This research paper presents a face recognition based attendance system for academic institutions. The system uses a webcam to capture the facial image of the student, and then the image is processed to recognize the face using Principal Component Analysis (PCA) technique.
2. "Facial Recognition Based Attendance System Using Raspberry Pi" by S. P. Gaware and A. S. Mane, 2018 International Conference on Advances in Computing, Communications and Informatics (ICACCI), 2018	This study aims to develop a machine-learning-based attendance management system using face recognition and Raspberry Pi. The proposed system is composed of two main subsystems. The first is a Raspberry Pi, to be installed in each class, and the second is a web application fed by data from the Raspberry Pi. To take attendance, an instructor commands a Raspberry Pi camera through a web-based subsystem. Then, the camera takes a picture of the whole class and detects faces using trained Haar Cascades. It sends back a file with the class picture and Cartesian coordinates of the detected faces.
3."Smart Attendance Monitoring System Using Face Recognition and E-mail Notifications" by R. K. Saini and R. K. Aggarwal, IEEE International Conference on Computing, Communication and Automation (ICCCA), 2016	Till today attendance marking is manual event for many educational bodies. It is a mandatory, common and important activity in day to day life of a faculty member. Manual attendances maintaining is bit difficult process, time consuming effort while doing analysis or report generations on it. Few automated systems are developed to overcome those complexities. To overcome these initiations, there is a need of innovative a smart and automated attendance system.

Chapter 3

Problem Statement, Objective & Scope

Problem Statement: -

To solve the problem of inefficient and inaccurate student attendance tracking and monitoring of academic progress, an AI-based student monitoring system is proposed.

Traditional methods of attendance taking are often manual, time-consuming, and prone to errors, which can lead to inaccurate records and difficulty in identifying absenteeism trends. Furthermore, it can be challenging for teachers and administrators to monitor the academic progress of individual students and provide timely feedback and support. This can result in low academic performance and disengagement from school.

Objective: -

- To automate the process of tracking student attendance, reducing the workload for teachers and administrators.
- To provide a more accurate and up-to-date record of student attendance, reducing the risk of errors.
- To improve parent engagement and keep them informed about their child's attendance.
- To provide data-driven insights into student attendance, allowing colleges and universities to identify areas for improvement.
- To analyses student attendance data that will assist faculty in keeping student records.

Scope: -

- The scope of this system is to track subject-wise attendance of students, analyze attendance data to identify trends and patterns, visualize attendance data for easy interpretation, and send notifications to students and parents about low attendance.
- Traditional student monitoring systems rely on manual attendance taking, which can be time-

consuming, prone to errors, and ineffective in tracking subject-wise attendance. The AI-based student monitoring system aims to solve these problems by using facial recognition technology to accurately and automatically track attendance.

- The system also provides analysis and visualization of attendance data, which can help teachers and administrators identify trends and patterns and make data-driven decisions.
- Additionally, the system sends notifications to students and parents about low attendance, which can help improve attendance rates and reduce absenteeism.

Chapter 4

Proposed System Architecture

Proposed System : -

The proposed system of our project includes a series of modules in which the project work is breakdown and implementation of each module is done by using various software engineering skills required during the process. The project will require a wide range of software engineering skills, and the successful implementation of each module will contribute to the development of a robust and efficient system.

I. Modules:

a. **Face Recognition Module:** This module would be responsible for capturing images of students as they enter the classroom and comparing them with the pre-existing database of student images to mark attendance.

b. **Attendance Management Module :** This module would store attendance data for each student for each subject, along with the corresponding date and time stamp.

c. **Analysis Module :** This module would perform analysis on the attendance data collected for each subject, such as calculating the percentage of attendance for each student, identifying students who are frequently absent, and generating reports on subject-wise attendance.

d. **Overall Attendance Analysis Module:** This module would provide an overview of the attendance data collected across all subjects, such as the overall attendance percentage of the attendance.

e. **Visualization Module :** This module would provide visual representations of the attendance data, such as graphs and charts, to help teachers and administrators quickly identify patterns and trends in student attendance.

f. **Email Functionality Module :** This module would enable teachers and administrators to send automated emails to students and their parents notifications about poor attendance.

II. Architecture Diagram :-

An architecture diagram is a visual representation of the components, relationships, and interactions of a system. Architecture diagrams are useful for communicating the design and functionality of a system to stakeholders, developers, and other interested parties.

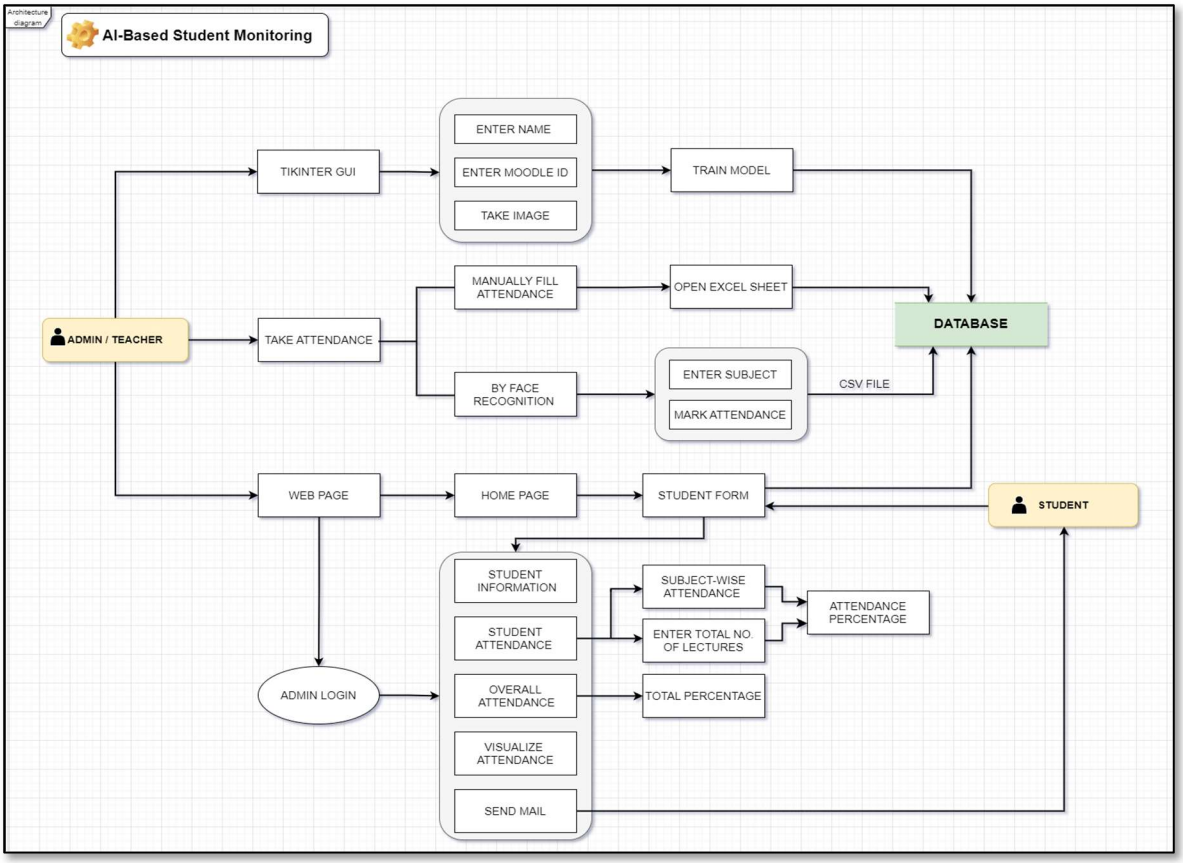

Figure 1 : Architecture Diagram

The above architecture diagram illustrates the various components of the student monitoring system. The system is primarily managed by the admin who has access to the dashboard. The admin can perform various tasks such as registering students, taking attendance, and viewing student attendance analysis.The face recognition component is responsible for training and recognizing student faces. The admin provides the student's name, Moodle ID, and image for training the model, which is stored in the database. When taking attendance, the face recognition system is used to verify the student's identity. The database component stores all the data related to student registration, attendance, and analysis. The admin can fetch the data from the database

to view student attendance analysis such as subject-wise attendance, overall attendance, and visualized attendance. The admin can also send mail to students and parents, and their data is fetched from the database.

III. UML Diagrams :-

A UML diagram is a diagram based on the UML (Unified Modelling Language) to visually represent a system along with its main actors, roles, actions, artifacts, or classes, to better understand, alter, maintain, or document information about the system

a. Data Flow Diagram

A Data Flow Diagram (DFD) is a graphical representation of how data flows through a system, illustrating the input, output, and processing of data. It is a modelling technique used to analyze and design information systems, which helps to identify the data sources, data destinations, data flows, and processes of a system.

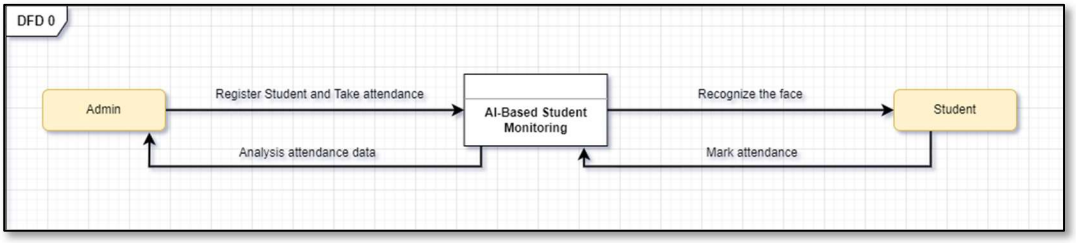

Figure 2 : Data Flow Diagram (LEVEL 0)

The Level 0 diagram of our AI-based student monitoring system outlines the fundamental operations that an admin can carry out. These include registering students and marking attendance, with the aid of face recognition technology that enables the system to recognize students and record their presence. Additionally, our system enables the admin to analyze attendance data and extract valuable insights that can be used to identify trends and patterns in attendance records.

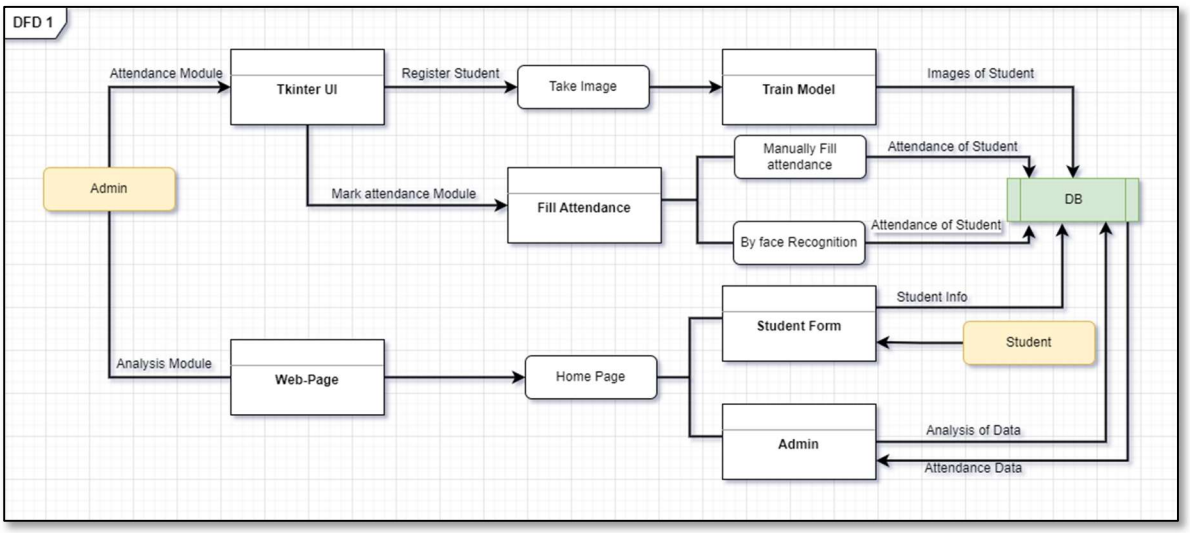

Figure 2 : Data Flow Diagram (LEVEL 1)

The Level 1 data flow diagram of our AI-based student monitoring system outlines the processes involved in more detail, including the attendance and analysis modules, and the database component that stores all related data. The attendance module allows admins to mark attendance subject-wise using the face recognition system, and the attendance data is stored in the database. The analysis module enables admins to fetch and analyze attendance data, including subject-wise attendance, overall attendance, and visualized attendance, to identify areas for improvement

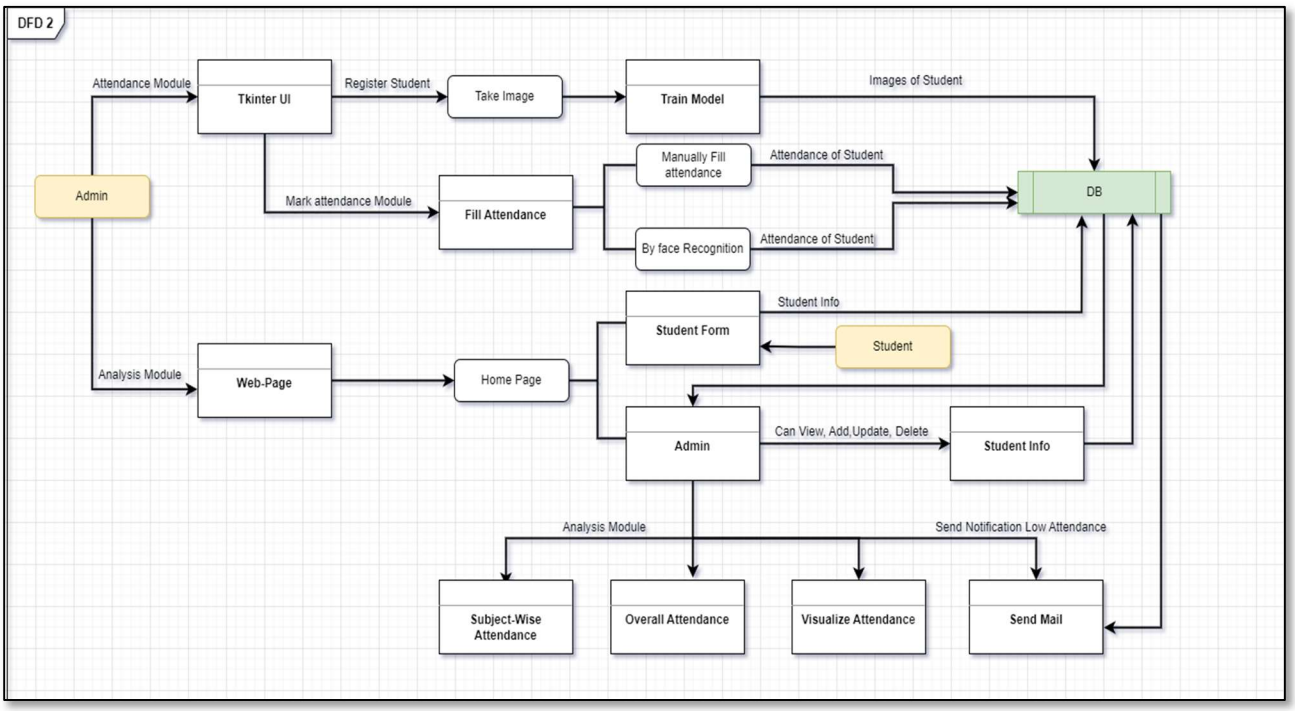

Figure 2 : Data Flow Diagram (LEVEL 2)

DFD level 2 diagram basically shows decomposed structure of level 1 diagram. It deplicts the modules in AI based student monitoring into more detailed manner for better understanding

b. Use Case Diagram:

A use case diagram is a graphical depiction of a user's possible interactions with a system. A use case diagram shows various use cases and different types of users the system has and will often be accompanied by other types of diagrams as well. The use cases are represented by either circles or ellipses.

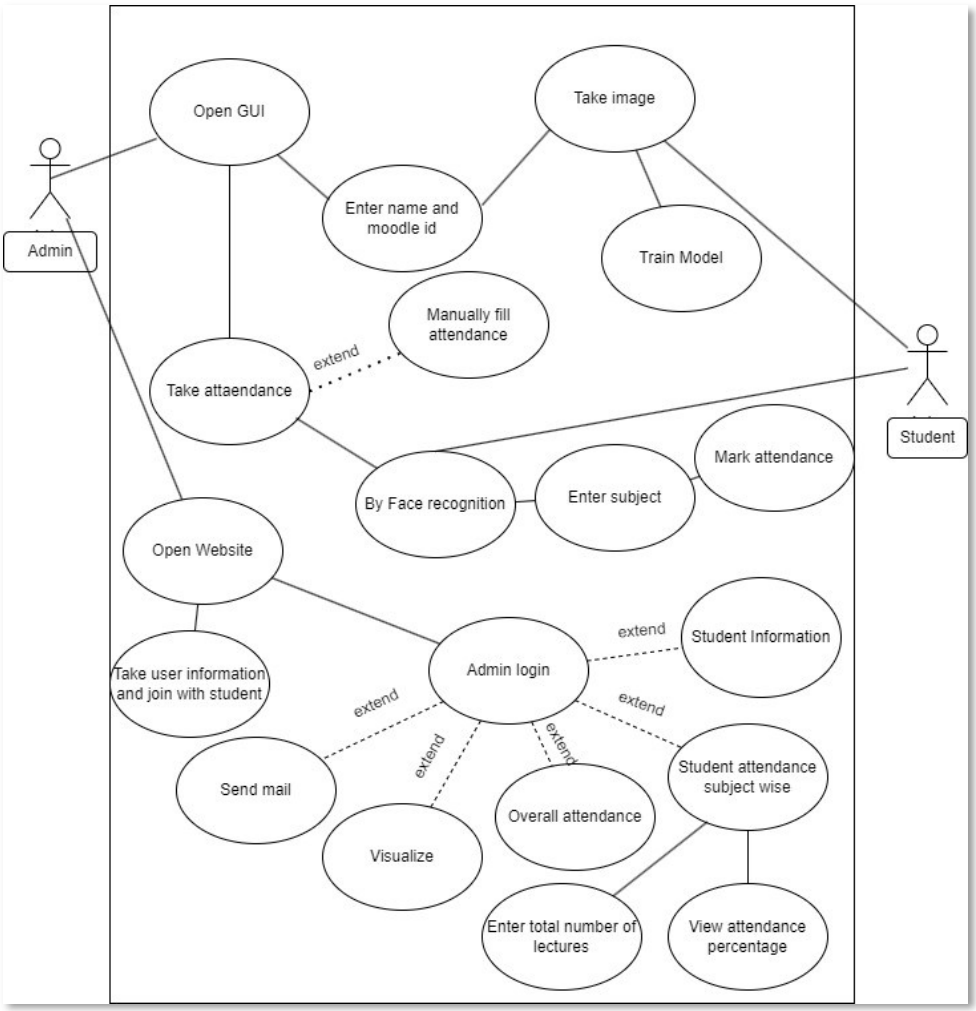

Figure 3 : Use Case Diagram

c. Sequence Diagram:

A sequence diagram simply depicts the interaction between objects in sequential order i.e., the order in which these interactions take place. We can also use the terms event diagrams or event scenarios to refer to a sequence diagram. Sequence diagrams describe how and in what order the objects in a system function. These diagrams are widely used by businessmen and software developers to document and understand requirements for new and existing systems.

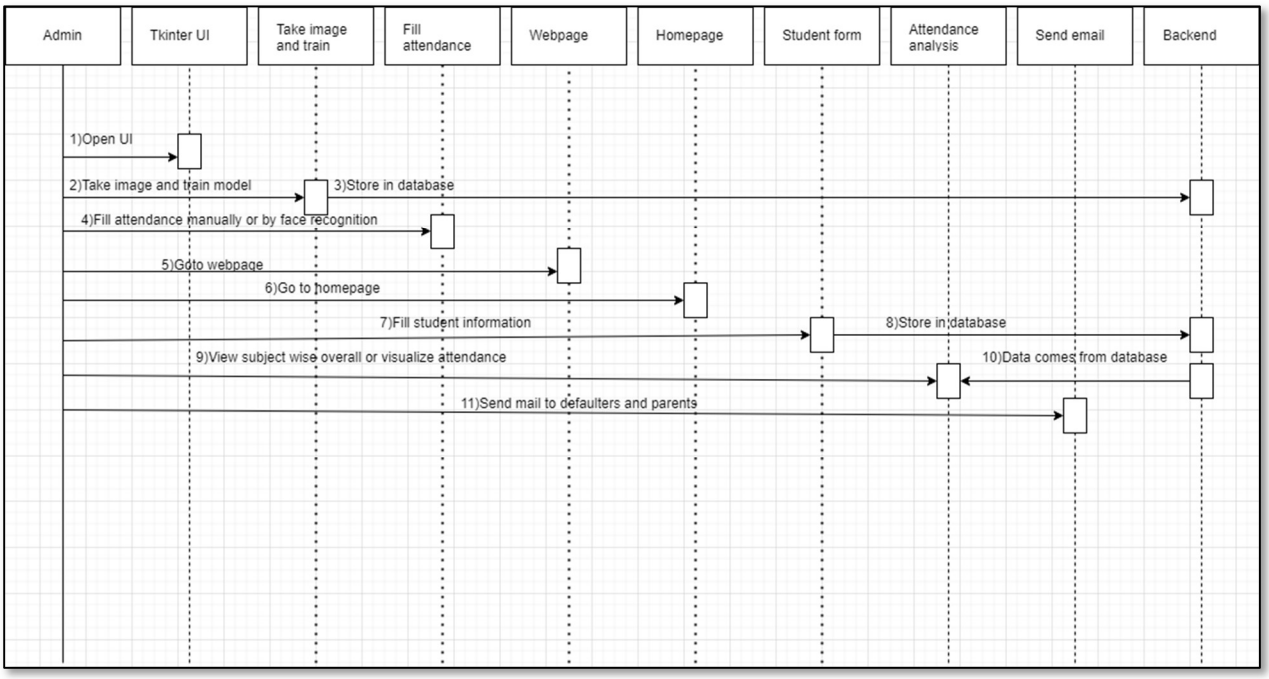

Figure 4 : Sequence Diagram

d. Activity Diagram:

The activity diagram is another important diagram in UML to describe the dynamic aspects of the system. An activity diagram is a flowchart to represent the flow from one activity to another activity. The activity can be described as an operation of the system. The control flow is drawn from one operation to another. This flow can be sequential, branched, or concurrent. Activity diagrams deal with all types of flow control by using different elements such as fork, join, etc.

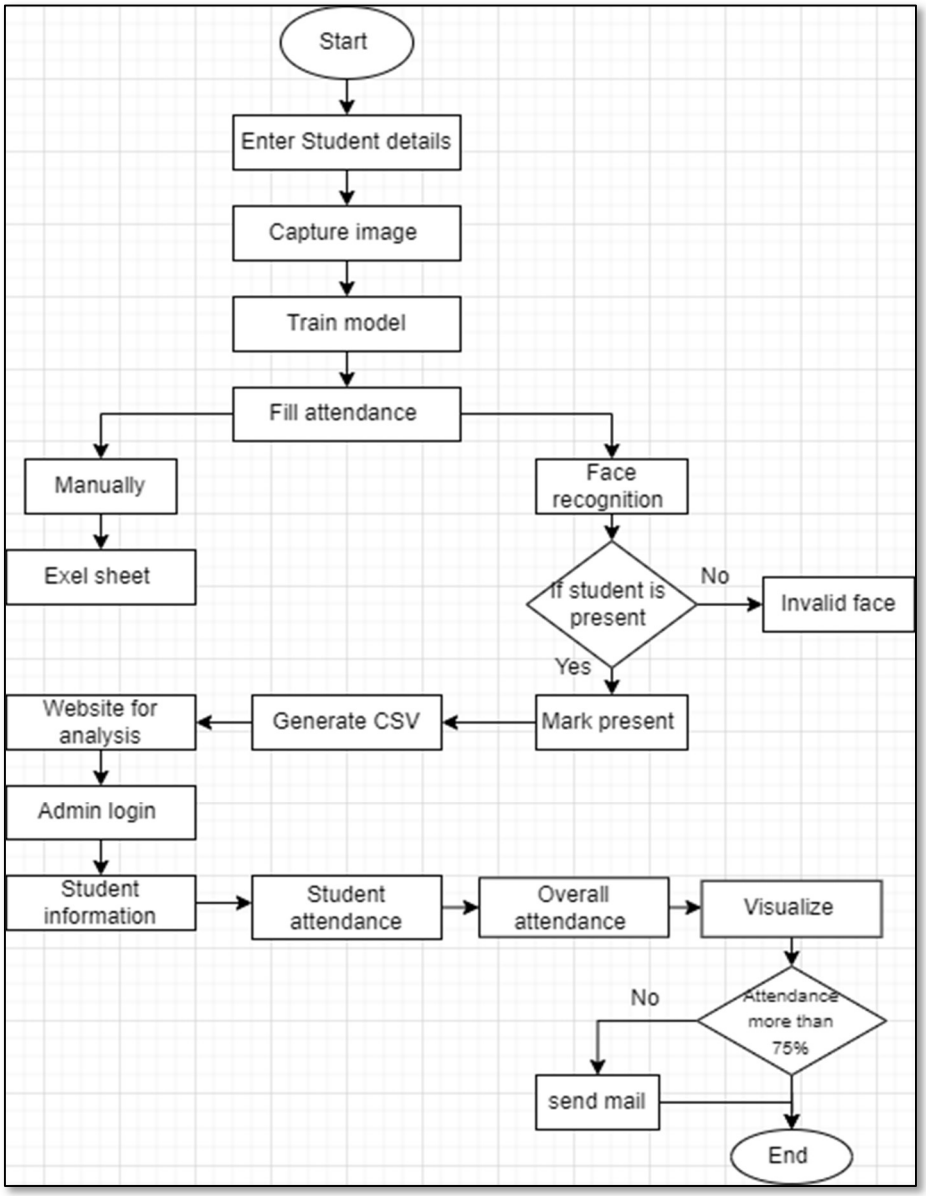

Figure 5 : Activity Diagram

Chapter 5

Project Planning

My Team | AI-Based Student Monitoring

	Task name	Start date	End date
		25/01/2...	**13/04/2...**
1	Project Selection	25/01/2...	31/01/2...
2	Requirement Gathering	03/02/2...	08/02/2...
3	System Design and Pl...	08/02/2...	13/02/2...
4	Identify data sources f...	13/02/2...	15/02/2...
5	Develop Data Pre-Pro...	15/02/2...	20/02/2...
6	GUI Designing and Te...	20/02/2...	22/02/2...
7	Developing the AI mo...	22/02/2...	28/02/2...
8	Testing and Bug Fixes	28/02/2...	03/03/2...
9	Integration with Stude...	03/03/2...	09/03/2...
10	Develop Front End Us...	09/03/2...	15/03/2...
11	Develop Attendance ...	15/03/2...	22/03/2...
12	Testing and Debugging	22/03/2...	24/03/2...
13	Develop Email genera...	24/03/2...	31/03/2...
14	Final Revisions and Te...	31/03/2...	06/04/2...
15	Report Generation	06/04/2...	12/04/2...
16	Final Internal Mini-Pro...	13/04/2...	13/04/2...

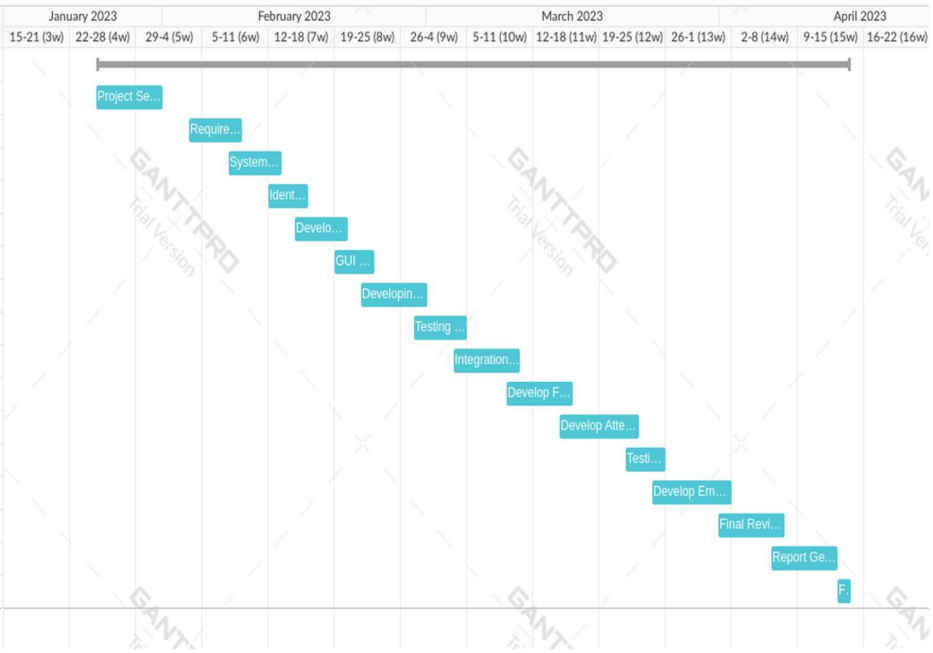

Figure 6 : Gantt Chart

Chapter 6

Experimental Setup

- **Software Requirements: -**

  Programing language : Python , Flask web framework

  Platform : VScode /PyCharm

  Supporting libraries : Tkinter GUI library, OpenCV Computer Vision library, Numpy and Pandas Analysis libraries

  Databases : PyMySQL database connector

  API : Gmail API for email notifications

- **Hardware Requirements : -**

  CPU: Intel Core i5 or higher

  GPU: Nvidia GeForce GTX 1060 or higher (if using GPU for face recognition)

  RAM: 8 GB or higher

  STORAGE: 500 GB HDD or higher

  OS: Windows 10 or Linux-based OS

Chapter 7

Implementation Details

Implementation Technology :

I. Frontend :

Frontend refers to the part of a software system that users interact with directly. It includes the graphical user interface (GUI) and other visual elements that allow users to access and use the system's features. In the context of a student attendance system, the frontend would be the part of the system that students and teachers use to perform actions such as marking attendance and viewing reports. It is typically developed using technologies such as HTML, CSS, and JavaScript, which are used to create the visual and interactive components of the system.

II. Backend :

Back-end refers to the part of a software system that handles data processing and storage. In the context of a student attendance system, the back-end would be responsible for storing and processing attendance data, generating reports, and performing other data-related tasks. This component of the system is typically built using programming languages such as Python and frameworks such as Flask, which provide tools and libraries for working with data.

III. AI/ML Models :

AI/ML models refer to advanced machine learning algorithms and models that can be used to perform facial recognition and attendance analysis. In the context of a student attendance system, these models would be used to analyze images of students and determine whether they are present or absent. The OpenCV library is often used for this, as it provides tools and algorithms for computer vision and image processing.

IV. Data Science :

Data Science is a field that involves using various tools and techniques to analyze and derive insights from data. In the context of attendance analysis, Data Science can be used to extract

valuable information from attendance records, such as patterns, trends, and correlations. This can be achieved through statistical analysis, which involves using statistical methods to identify patterns and trends in data, and data visualization, which involves creating visual representations of data to help understand and communicate complex information. By applying Data Science techniques to attendance data, schools and educators can gain insights that can help improve attendance rates and make data-driven decisions.

V. Email Service :

Email services refer to the tools and technologies used to send notifications to parents, such as when their child is absent from school. SMTP is a commonly used email service that provides a protocol for sending and receiving email messages. In the context of a student attendance system, an email service would be integrated with the system to automatically send notifications to parents when their child is absent.

Chapter 8

Result

Result and Discussion

- **Face Recognition Module:**

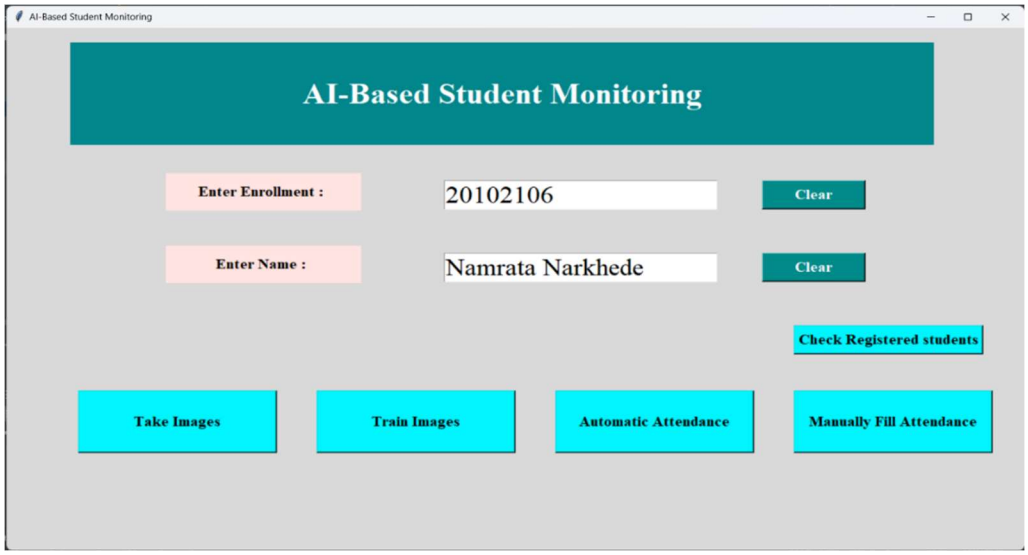

Figure 7 : Register Student

Here, we are registering the students by adding their name and enrollment no.

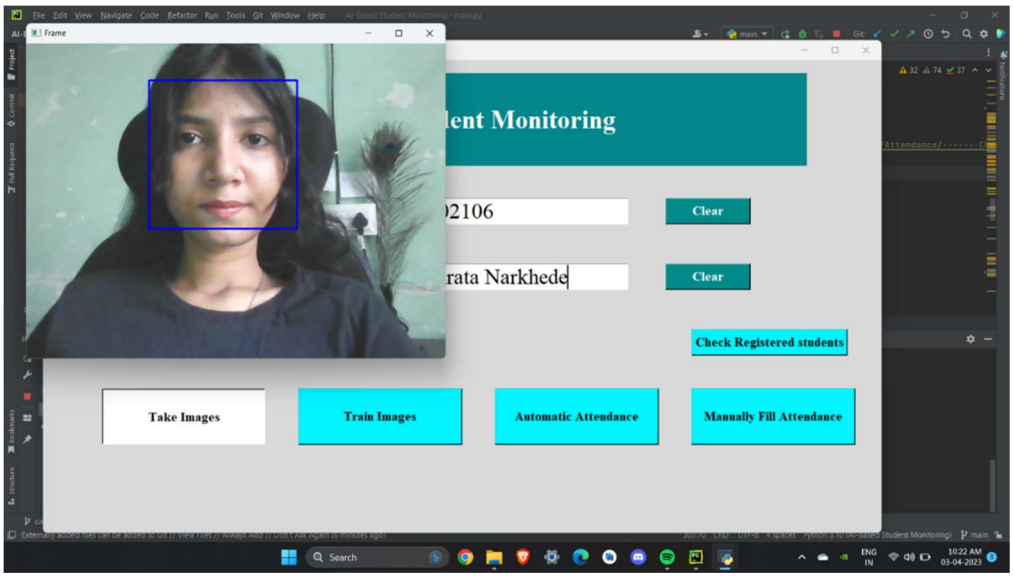

Figure 8 : Take Image

Here we are taking the image of the student and then training the model.

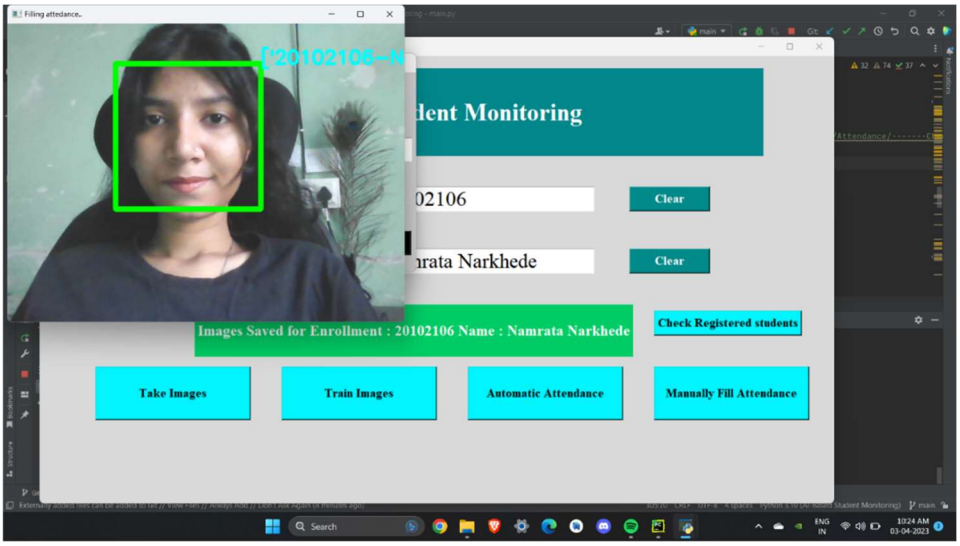

Figure 9 : Face Recognition Module

Then the image is stored in the database. Now by clicking automatic attendance, the students face is detected, and their attendance is marked for particular subject entered. Attendance can also be marked manually.

- **Attendance Management Module :**

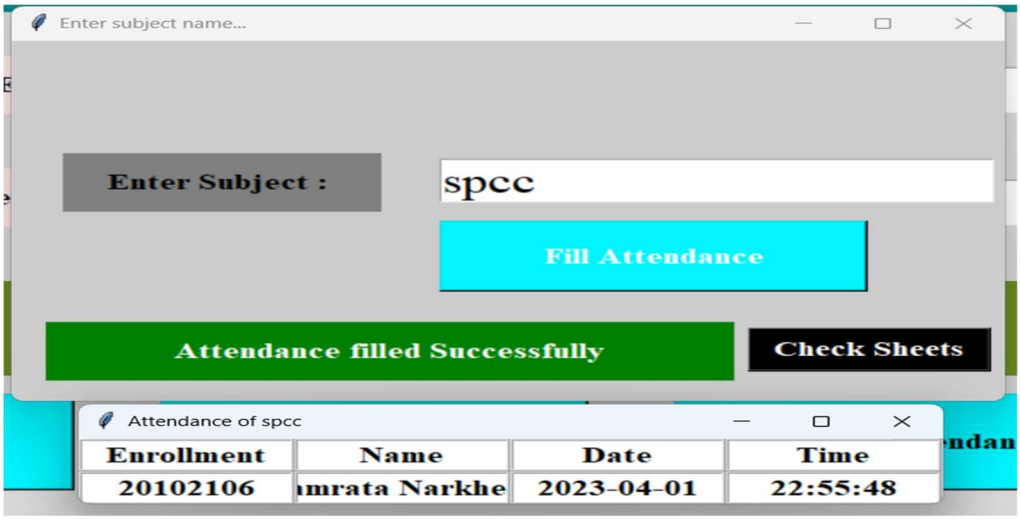

Figure 10 : Attendance Management Module

Teacher enters subject name and take the attendance by clicking on Fill Attendance then the window will be pop up for face recognition for detecting the face of student and mark their attendance

- **Analysis Module :**

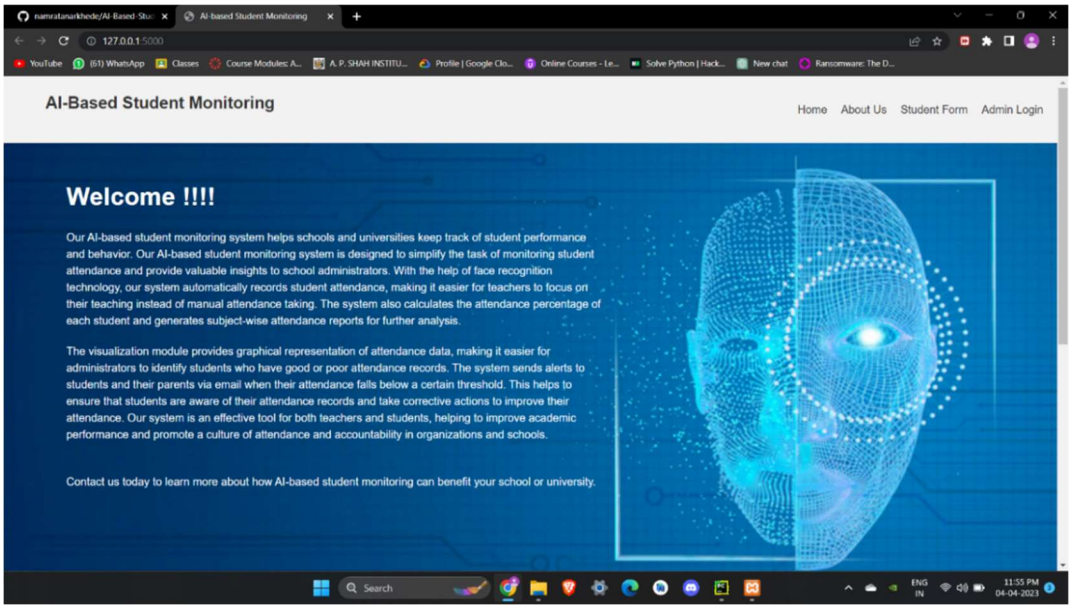

Figure 11 : Homepage

This is our website to show students attendance analysis.

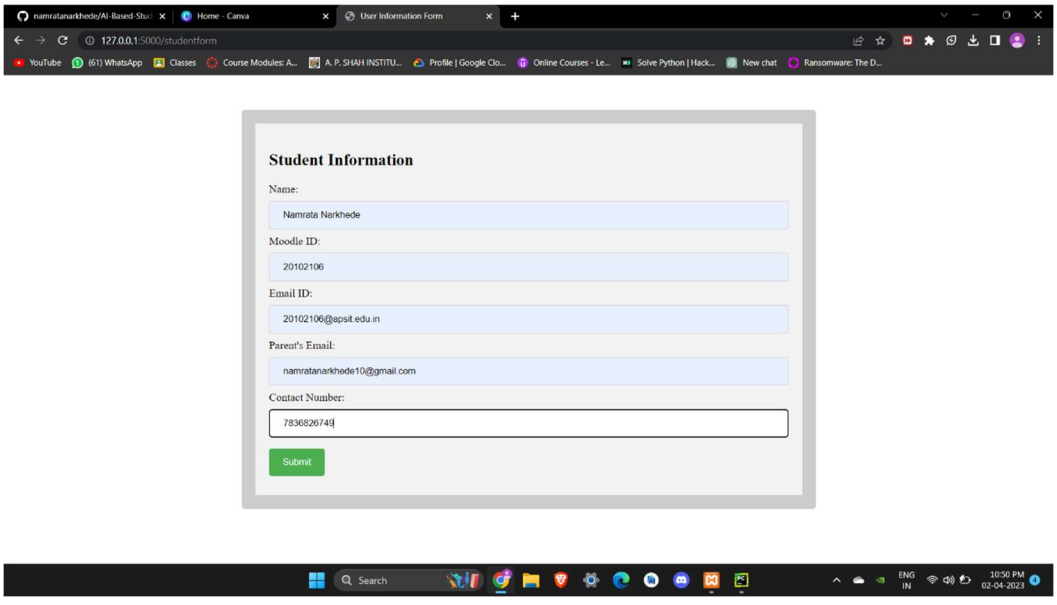

Figure 12 : Student Information Form

Here the information of students is to be submitted by admin.

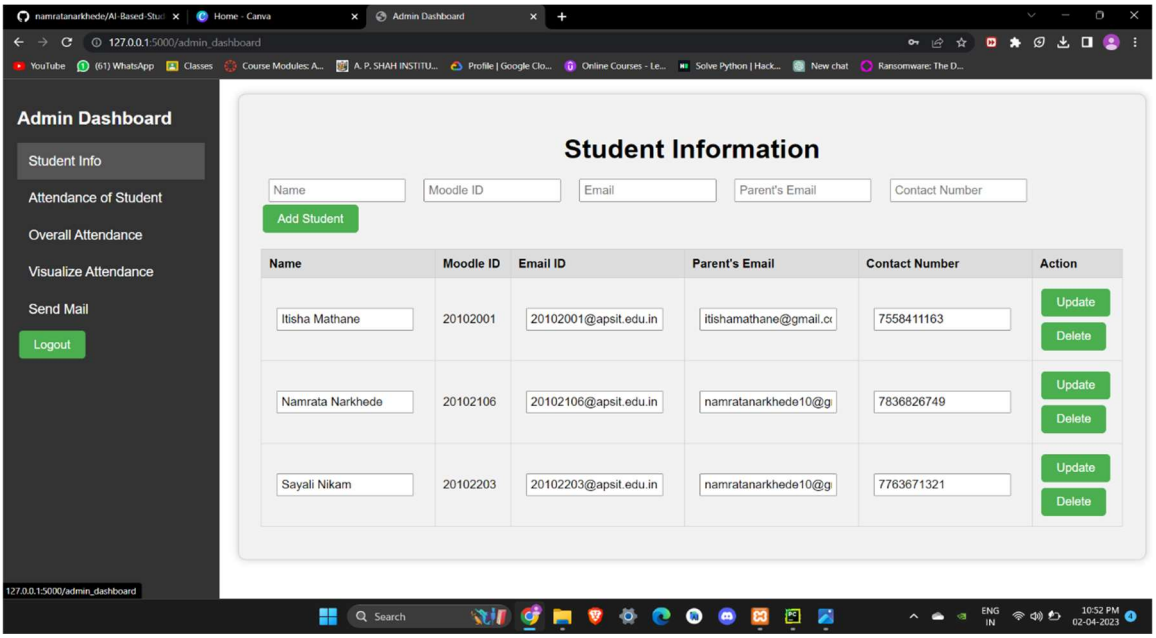

Figure 13 : Student Information

The student information will be visible in the student info section in tabular format.

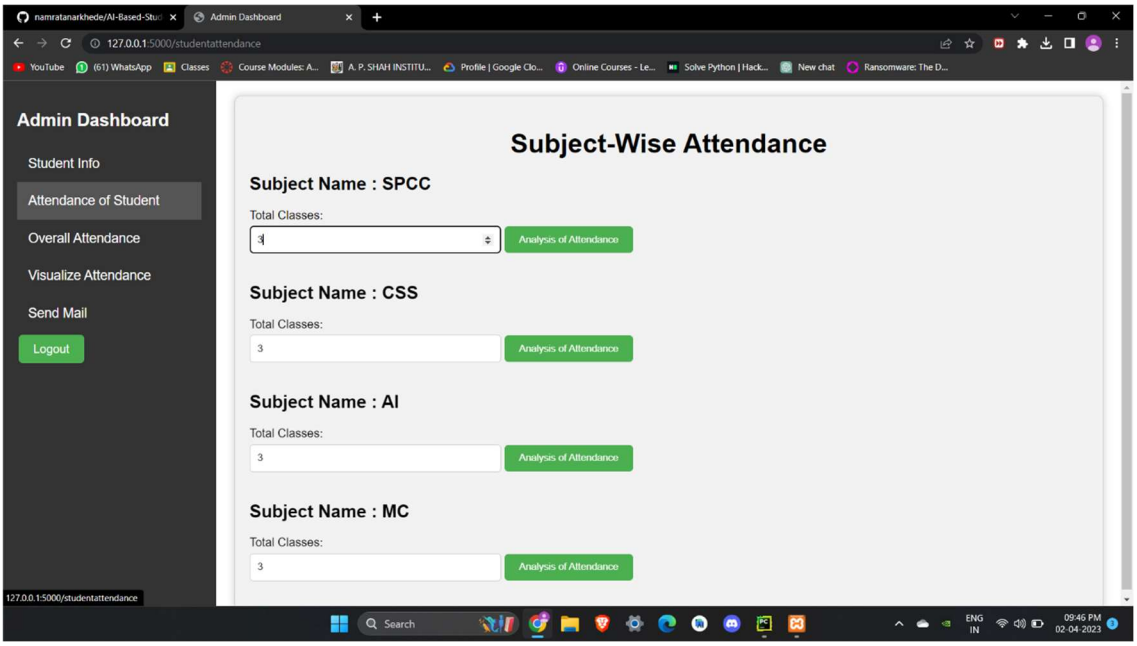

Figure 14 : Subject-Wise Attendance

Here in attendance of Student after entering total number of classes of any subject we can see the attendance count and percentage of each student individually

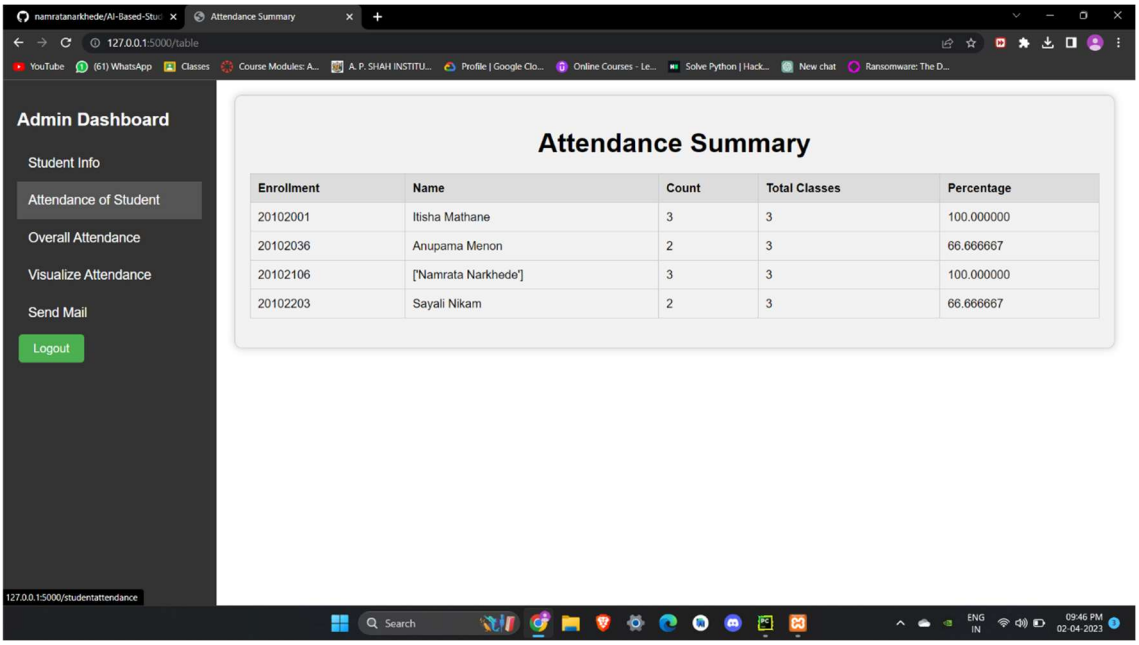

Figure 15 : Attendance Summary

Here for the particular subject the attendance and analysis is displayed.

- **Overall Attendance Analysis Module :**

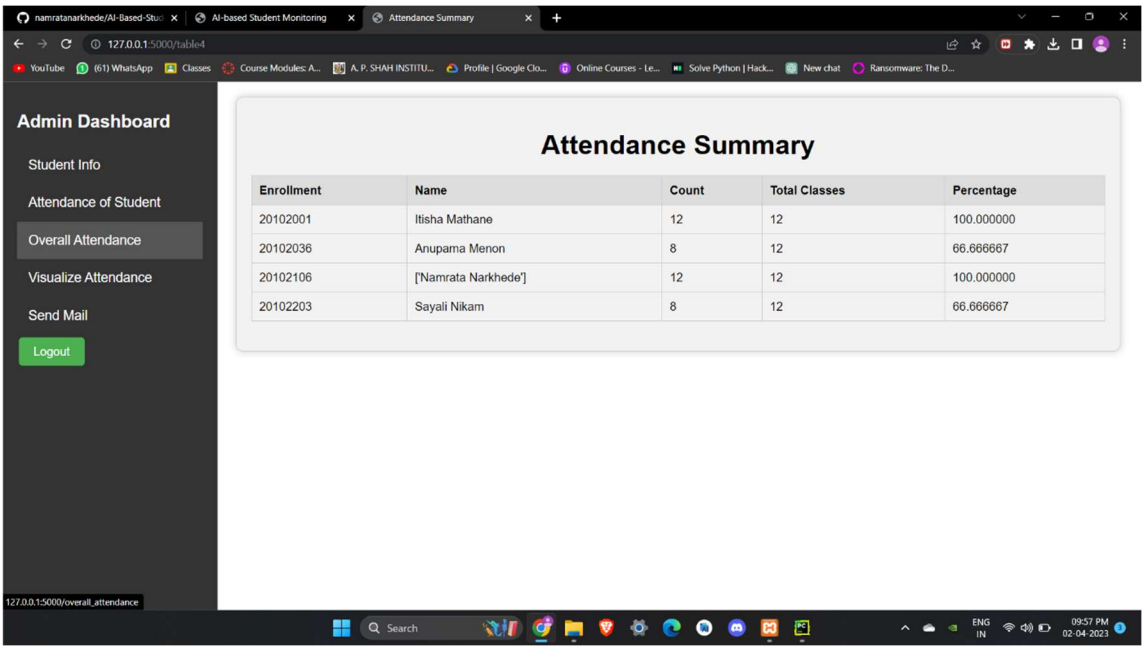

Figure 16 : Overall Attendance Summary

We can also check overall attendance for all subjects combined.

- **Visualization Module :**

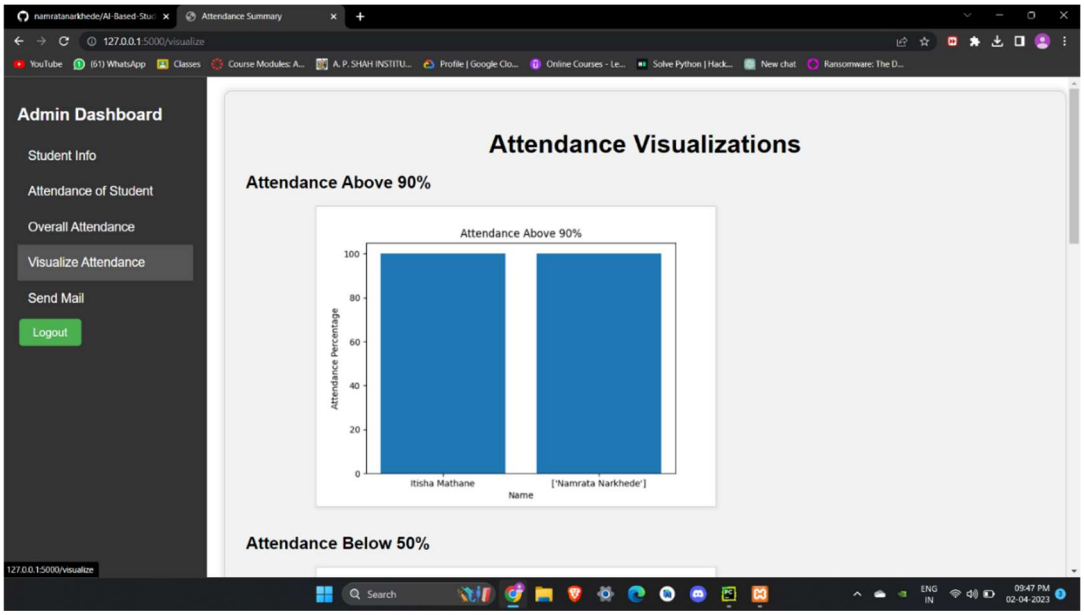

Figure 17 : Attendance Visualization

In the visualize attendance section we can see a visual representation of percentage of classes attended by each student

- **Email Functionality Module :**

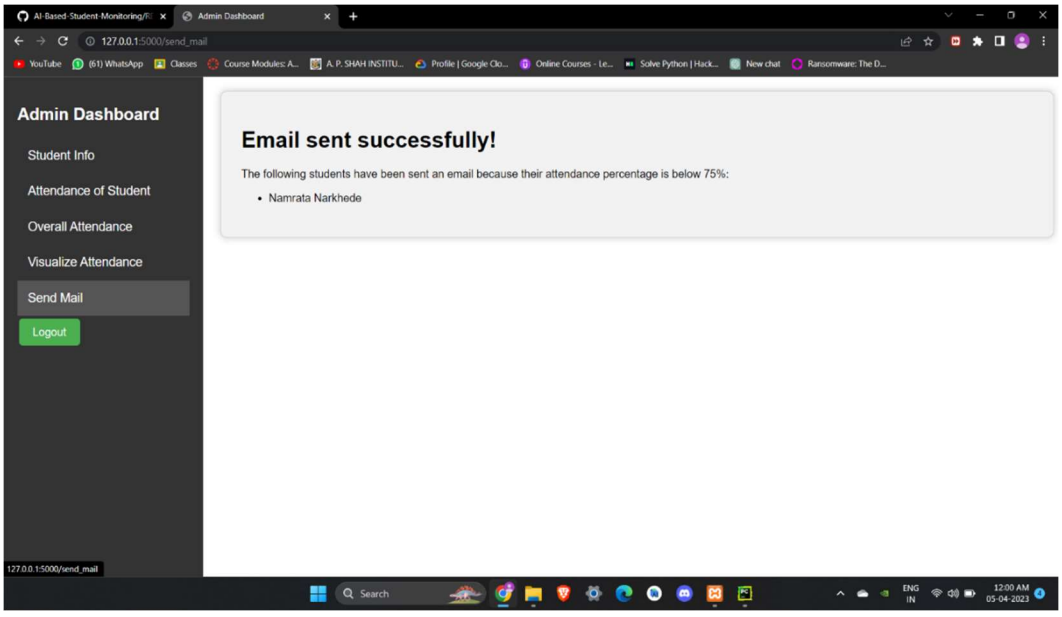

Figure 18 : Send Email Notification

In the send email section we send email to defaulter

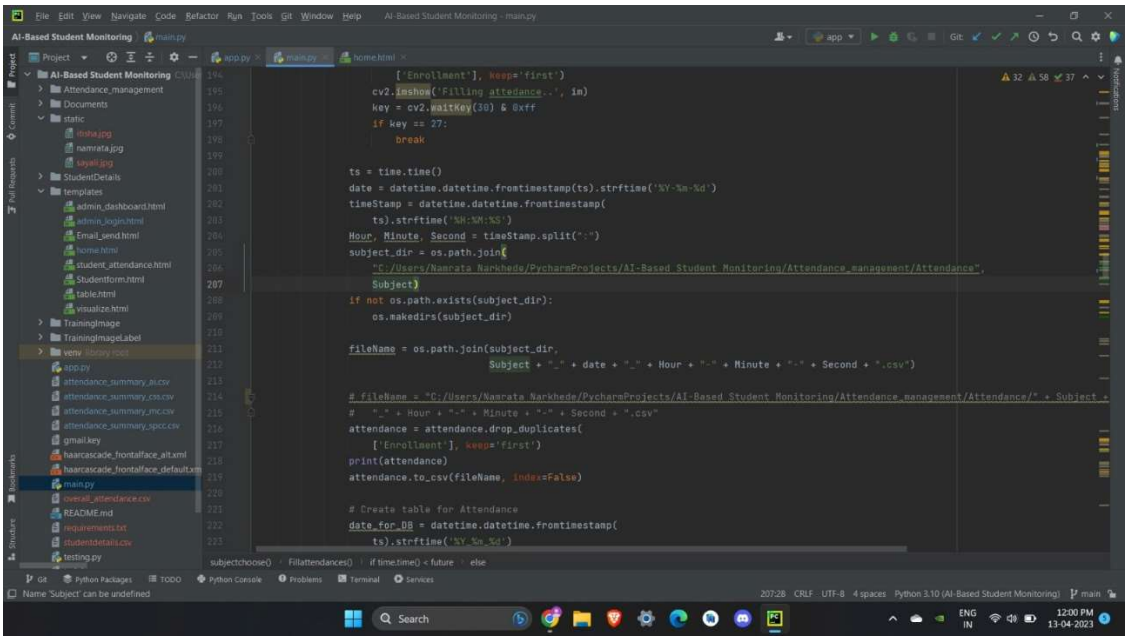

Figure 19 : Subject-Wise Attendance CSV

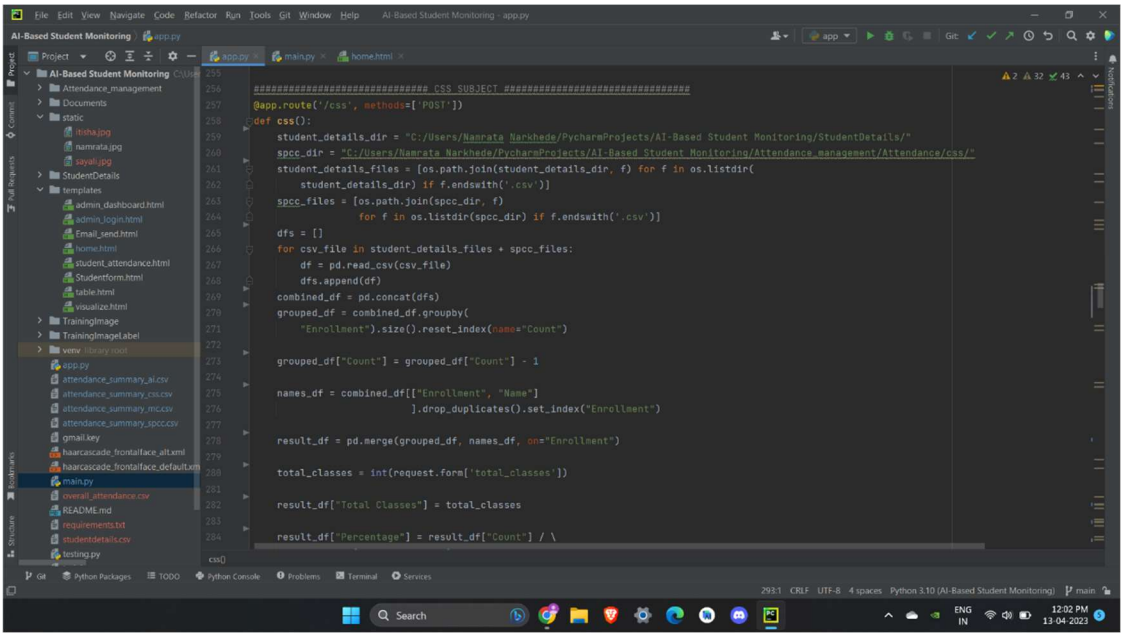

Figure 20 : Student Information in Database

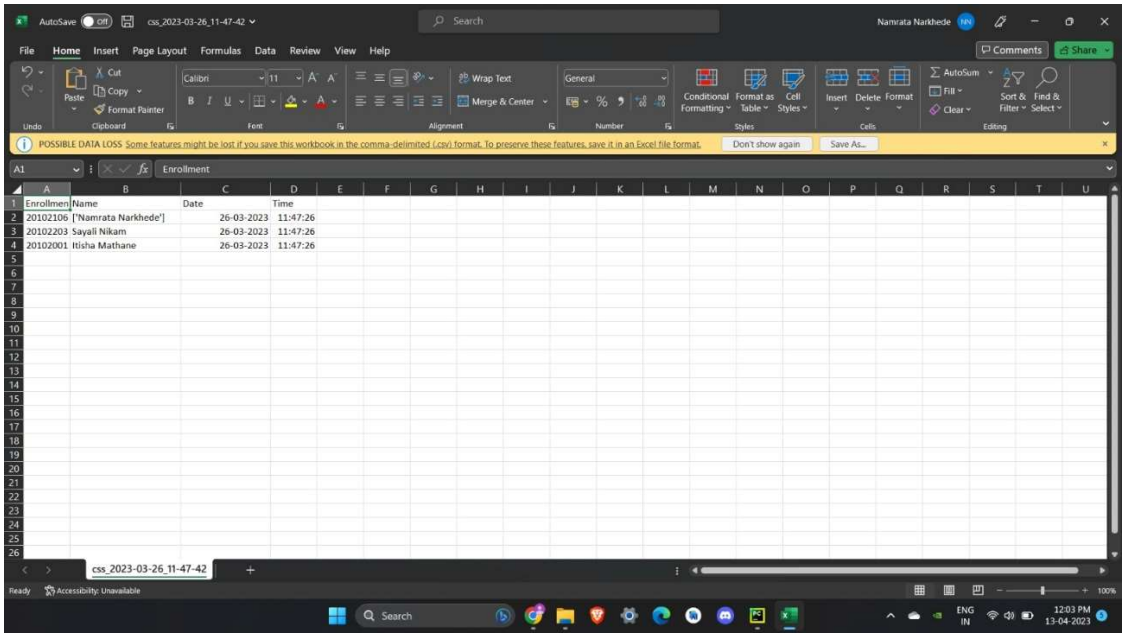

Figure 21 : Mark Attendance CSV

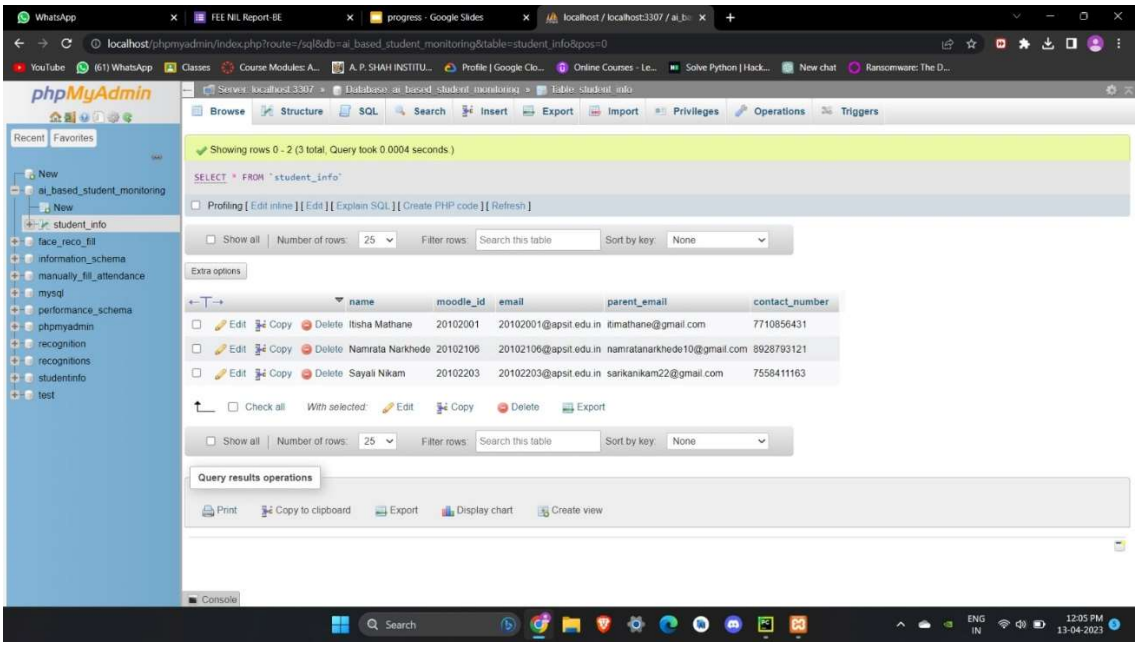

Figure 22 : Student Database

Chapter 9

Conclusion and Future Scope

In conclusion, an AI-Based student monitoring system can significantly improve the accuracy and efficiency of attendance tracking and academic monitoring. By using facial recognition technology and machine learning algorithms, the system can accurately track student attendance and analyze attendance and academic data to identify trends and patterns. The system also provides a user-friendly interface for teachers and administrators to view attendance and academic data in real-time and make data-driven decisions about student support and interventions. Additionally, the system can send timely notifications to students and parents about low attendance and academic progress, which can help improve engagement and performance.

In terms of future scope, the system can be further enhanced to incorporate additional features and functionalities. For example, the system can be integrated with learning management systems to provide a more comprehensive view of student progress and engagement. The system can also be enhanced with natural language processing capabilities to provide personalized feedback and support to students. Additionally, the system can be integrated with other school systems such as student information systems, transportation systems, and security systems to provide a more holistic view of student activities and behavior. Overall, an AI-Based student monitoring system has significant potential to improve the efficiency and effectiveness of student attendance tracking and academic monitoring, ultimately leading to improved student engagement and academic performance

Chapter 10

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