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# Design and Development of Attendance Management and Analysis System using LLM

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## Abstract

This research addresses the present issues in attendance management system, including poor faculty user interface when handling large volume of student data and the time-consuming process of analysing and visualizing attendance and other student related information from the database using SQL queries. To resolve these challenges, a user friendly, web-based attendance management system is developed. This system can be deployed on both desktop and standalone devices. This system incorporates an SQL chatbot powered by a Large Language Model (LLM) to analyse and retrieve information from the database. The server side of this application is built with PHP scripting language, with MySQL as the database for managing students, faculties, subjects, timetable, and attendance data. The frontend of this software is developed using HTML 5.0, Sassy CSS (SCSS), and JavaScript to ensure a responsive and user-friendly user interface. A key feature of this system is the integrated MySQL chatbot, built with Python using the streamlit (U/I) framework, LangChain NLP library and OpenAI API. This chatbot interface directly connects with attendance database, allowing administrators to analyse and visualize data through natural language commands, eliminating the need for simple/complex


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SQL queries. Through natural language interaction, the chatbot can perform various database operations such as updating, modifying, and deleting records, thus significantly enhancing data management efficiency and usability.

**Keywords:** PHP, MySQL DB, HTML 5.0, SCSS. JavaScript, Python, Langchain (NLP Library), Streamlit (Chatbot UI), OpenAI API.

## 1. Introduction

Attendance management software reduces manual work, but efficiency remains low when handling large amounts of student data. Additionally, there is no effective method for analyzing the attendance database. To address these issues, we have developed a fully responsive, user-friendly, web-based system that can be used on both desktop and standalone devices. Faculty can easily mark attendance by entering the last three digits of student roll numbers to mark them absent, with the remaining students automatically set to present, and vice versa. On the administrative side, an SQL chatbot that allows information to be easily retrieved from the database using natural language has been developed, bypassing SQL queries, and facilitates the easy analysis of statistical measures on student data.

### 1.1 Purpose

Faculty Side: The primary goal of this system is to provide a responsive and user-friendly interface for faculty, minimizing time consumption by offering search and marking functionalities to quickly mark students as absent or present. This feature enables faculty to mark attendance quickly and efficiently. Additionally, the software provides faculty members with their timetable information in the schedule section, helping them keep track of their departments and classes.

Administrative Side: For administrators, a MySQL chatbot has been introduced to directly connected to the student information database. This chatbot allows administrators to retrieve statistical information about students, such as overall attendance percentages, daily attendance, and department-wise analysis. These operations can be performed efficiently by entering natural language prompts into the chatbot, which eliminates the need to use SQL queries for communication.

### 1.2 Objective

- Simplifies and accelerates attendance marking.
- Enhance administrative capabilities.
- Natural language driven MySQL chatbot.
- Responsive and user friendly

## 2. Software Tools and Technologies

### 2.1 XAMPP 8.2.12

XAMPP stands for X – Cross-Platform, A – Apache, M – MySQL, P – PHP, P – Perl. It provides an Apache server environment to run, develop and test this attendance web application. XAMPP is a platform independent software that can run on various operating systems, for this attendance application, it runs on windows OS. XAMPP interface shown in Figure 1.

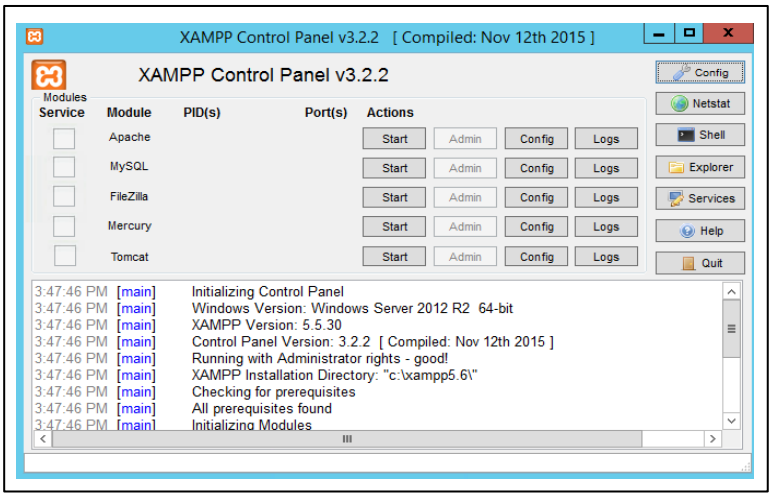


**Figure 1.** XAMPP Server Management Console

### 2.2 Apache Server 2.4.47

The Apache server is used to execute the backend part of this attendance system, enabling the server (Database) and frontend to share and manipulate data related to student details, subject details, faculty details, timetable details, and attendance records.

### 2.3 MySQL DB

MySQL is the central database of this attendance management system, which stores and manages all the data related to handling attendance. This database fetches real-time attendance data for each student and displays it on the frontend application.

### 2.4 PHP

PHP stand for Hypertext Preprocessor. In the attendance application, it is used to build the entire backend, including connecting to the MySQL database. It is also used to create pop-up messages on the frontend of both the administrator and faculty interfaces using embedded HTML.

### 2.5 phpMyAdmin

phpMyAdmin is an administrative tool for managing databases, here, it is used for administrating the MySQL database, including the tasks such as defining database size, security, root name, host name and password.

### 2.6 HTML 5.0

HTML stands for Hypertext Markup Language, it is used to build complete frontend for both the administrator and faculty interfaces of this attendance system. HTML5 supports the <marquee> tag, which is used in this attendance application for displaying the floating message on the faculty interface regarding guidelines for marking attendance.

### 2.7 CSS

CSS stands for Cascading Style Sheet, Complete design of the web application for both the faculty and administrator interface is done using CSS.

### 2.8 JavaScript

JavaScript is a lightweight, cross-platform, dynamically typed, single-threaded, and interpreted programming language. It is commonly known as a scripting language for webpages. JavaScript is utilized for both client-side and server-side development. It enables the creation of interactive events on webpages, such as onclick, onhover, onload, and more.

jQuery is a fast, small, cross-platform, and feature-rich JavaScript library. It simplifies tasks like HTML document traversal and manipulation, animation, event handling, and AJAX operations with an easy-to-use API. jQuery's API is designed to work efficiently across various web browsers.

### 2.9 Visual Studio Code Editor

Visual Studio Code is a code editor used to write entire code for this application in HTML, CSS, JavaScript and PHP. It provides additional support for third party extensions to enhance application scalability. In this case, the Sassy CSS (SCSS) extension is used to improve CSS performance with additional features such as design inheritance of HTML tags (styling a child tag within a parent tag).

### 2.10 Python 3.2.4

Python is a high-level programming language. In the attendance management application, it is used to build the chatbot. The libraries and frameworks used are:

**Streamlit:** Streamlit allows to incorporate widgets, charts, maps, and display tables, among other features. It offers an intuitive API that supports creative vision by installing the pip command [pip install streamlit].

**LangChain:** It is a python library used to build LLM based chatbots. Every LLM chatbot requires a specific chat model to process user queries, in this application it uses gpt-3.5-turbo-16k, which is integrated using an API key provided by OpenAI. The OpenAI API key activates the chat model to run the user query. Once activated, the chatbot is integrated with this attendance MySQL database and starts performing query tasks related to students' attendance details, as well as other details related to subjects, timetables, administrators, and faculty. The LangChain is installed using the pip command [pip install langchain].

**LangSmith:** LangSmith is a platform for building production grade applications. It allows developer to closely monitor and evaluate the LLM applications. pip command is used to install LangSmith [pip install -U langsmith]. LangSmith interface is shown in Figure 2.

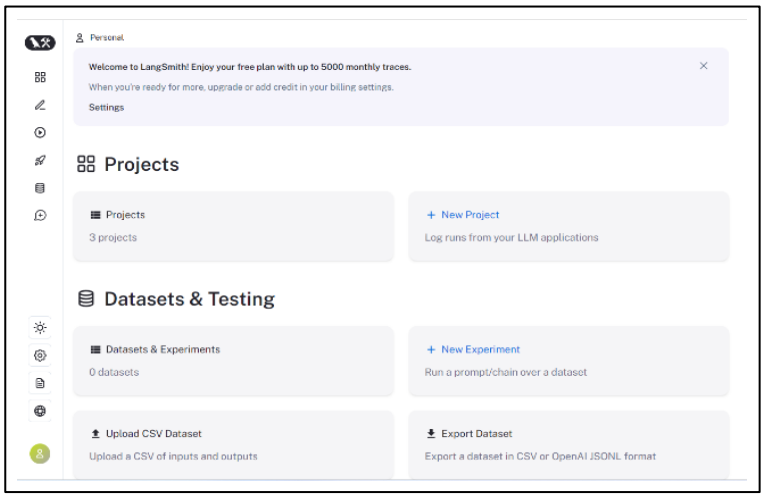


**Figure 2.** LangSmith Developer Console Panel [15]

## 3. Related Works

S. Kotresh et al [1] have developed an attendance management system based on RFID – Radio Frequency Identification. RFID systems enable seamless communication between RFID readers and tags, eliminating the need for direct contact and manual data entry. Yash Ghorpade, et al [2] introduced a Facial Recognition Monitoring System, that uses a real-time facial recognition to offer improved security and data insights for better resource management. N Mohammed Nowsath et al [3] developed a biometric attendance system using fingerprint recognition to automate attendance tracking in educational institutions, reducing manual effort and increasing efficiency. Amelia et al [4] developed web-based attendance system implemented in CV to significantly improve the accuracy in employee attendance management. Hasan et al [5] developed a system to manage the attendance based on the web server. The application was designed and developed using MySQL, PHP, HTML, CSS and JavaScript. Rahman et al [6] proposed an system for attendance management and found that when evaluated on a class of student fingerprint databases, the suggested automated attendance system utilizing fingerprint recognition produced noteworthy outcomes for recording attendance for Department of Computer Science and Engineering students.Singh et al [7] suggests an automatic facial recognition system for student attendance that uses a user-friendly interface to access the camera and authenticate images in videos or real time, marking the name and time of the individual on the attendance sheet upon a successful match. Utkarsh et al [8] developed attendance system using face recognition technology, capturing students' images

through a high-resolution camera. R. K. Kodali and team developed a web-based system using a deep supervised network for face recognition [9]. Yashi Porwal et al [10] proposed a mobile-based attendance system using QR codes. Preeti et al [11] developed a system where absent student information is sent to guardians through automatic messages, and staff receive email reports on student attendance, streamlining the process and saving time. Mohamad et al [12] proposed a biometric-based attendance management system using fingerprint recognition to electronically track and store attendance records. The system integrates artificial intelligence to reduce errors and enhance the efficiency of attendance compilation. Selvia et al [13] proposed a web-based attendance information system for Malang City Polytechnic using fingerprint recognition, replacing the manual system. Mool Raj et al [14] proposed a study that evaluates the effectiveness of a fingerprint-based attendance system in improving teacher punctuality.

## 4. Proposed Work

The proposed application currently has three interfaces: Administrator, Faculty, and Chatbot, with MySQL used as the backend storage. Each interface manages distinct functionalities: The administrator interface controls data, the faculty interface is used to mark attendance, and the Chatbot interface analyses data.

### 4.1 System Architecture

Here is an overview of the attendance system's working process. The Figure.3 indicates that all three interfaces administrator, faculty, and chatbot are connected to a single database.

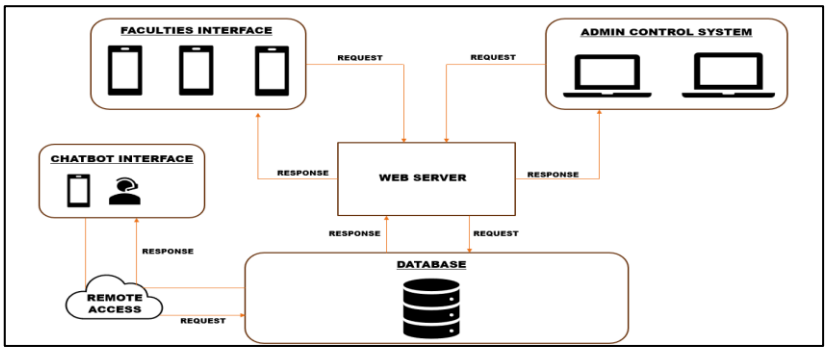


**Figure 3.** System Architecture

As mentioned above, data related to student records, faculty records, subjects, and administrator's information are entered into the database through the administrator interface.

This interface also allows modification of all entities, including adding, updating, and deleting records. In the faculty interface, student records are fetched and displayed based on the administrator's entries of students, subjects, faculty, and timetable details in the database. Faculty members can mark attendance using either the traditional mode or search mode; however, both processes involve manually marking attendance.

On the other hand, the chatbot, which is connected to the database, is explicitly designed for administrator for analysis purposes. Administrators can use the chatbot to query overall student attendance percentages, specific department or section attendance percentages, or details related to subjects, faculty, or timetables. The chatbot processes these queries using the GPT-3.5-turbo-16k model, provided by the OpenAI API, to analyse the database and retrieve and display the relevant data.

### 4.2 MySQL Database

It is used as backend technology to store, update, modify, delete, and insert all data for both the administrator and faculty interfaces. The schema is shown in Figure.4

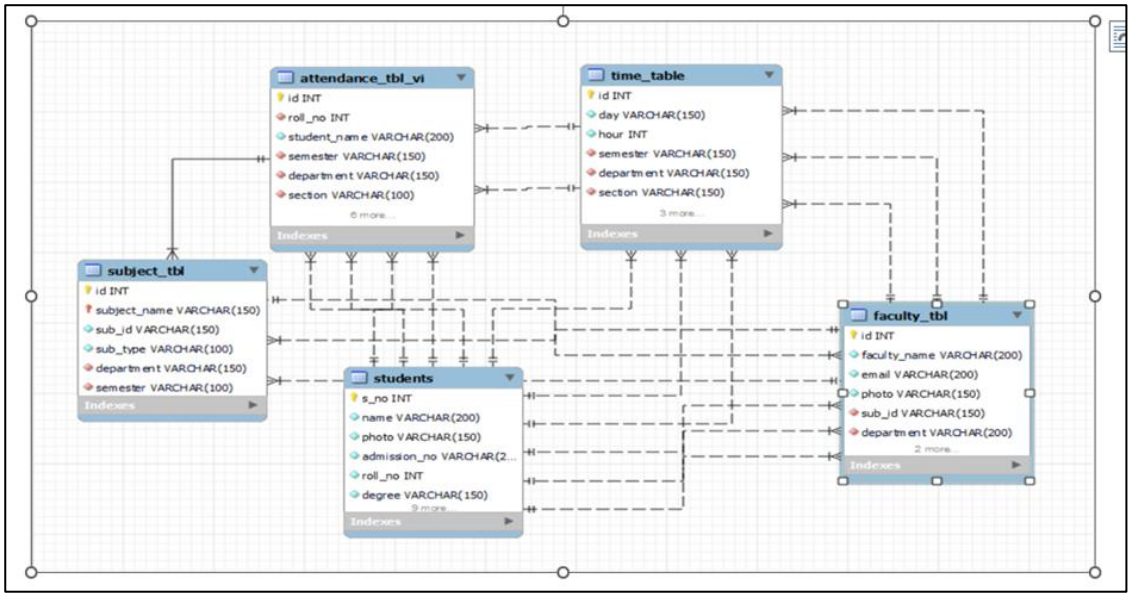


**Figure 4.** MySQL Database Schema

## 5. Results and Discussion

### 5.1 Administrator Interface

The Administrator interface is designed to manage all data entries manually, including the details of the administrator, subjects, students, faculty, class timetables, and attendance

records. Adding, updating, and deleting all data is completely controlled by the Administrator interface. The Administrator page consists of eight sections, such as:

**Administrator Login Page:** It is used to ensure authentication and entry access for administrator, its interface is shown in the Figure 5.

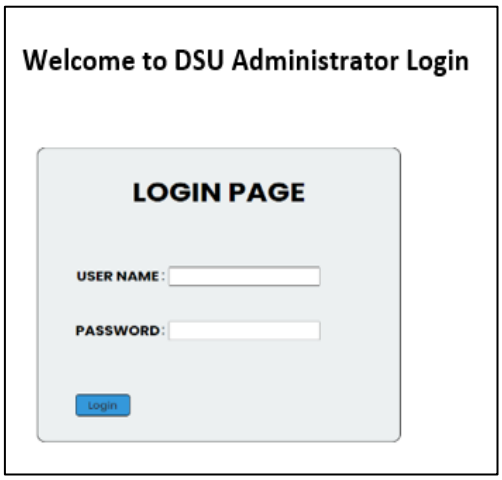


**Figure 5.** Administrator Login Page

**Home Page:** It is a dashboard for visualizing entire data of attendance system. The interface is shown in Figure 6.

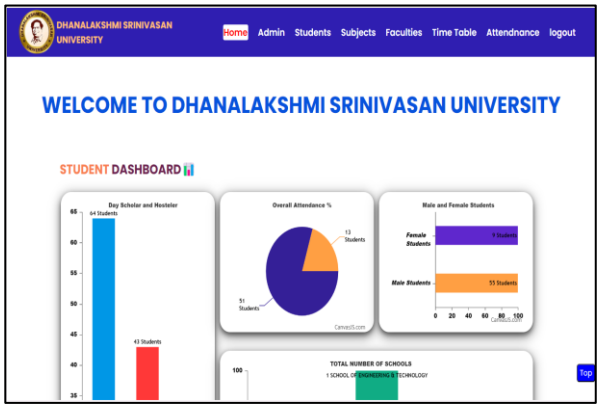


**Figure 6.** Admin Home Page

**Administrator Page:** It is used to add, update, and delete administrator, student, and the faculty information as shown in Figure 7, 8 and 9

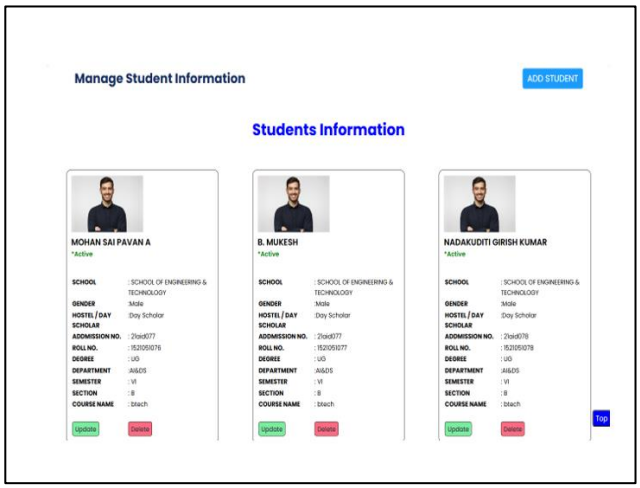


**Figure 7.** Administrator User Page

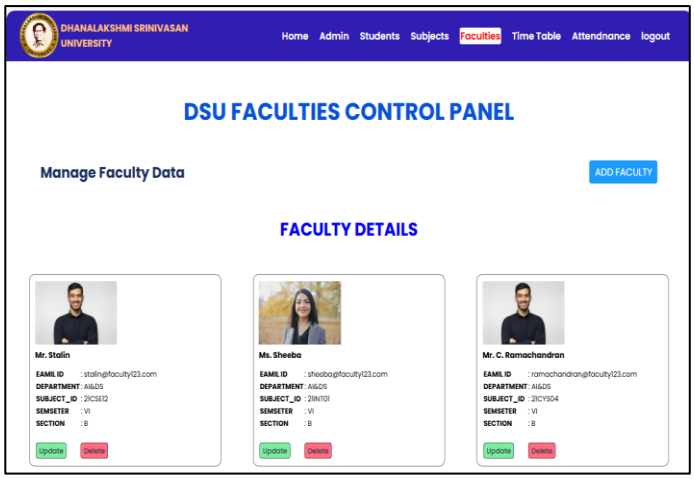


**Figure 8.** Faculty Page

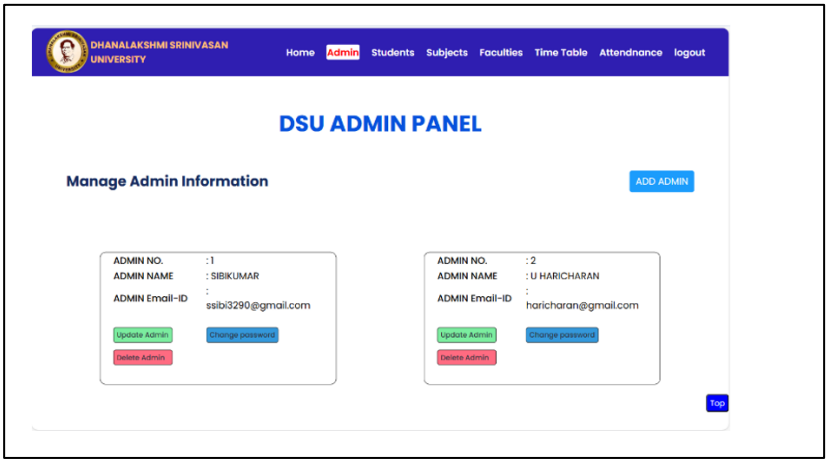


**Figure 9.** Administrator Page

**Subjects Page:** It is used to add, update and delete subjects' details as shown in Figure 10

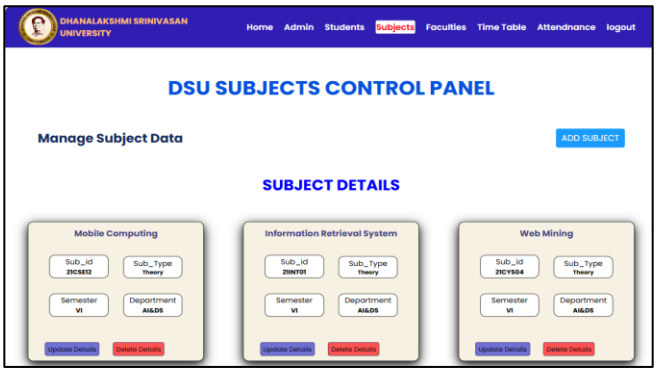


**Figure 10.** Subjects Page

The Figure.11 shows the Timetable page that is used to add, update and delete the timetable.

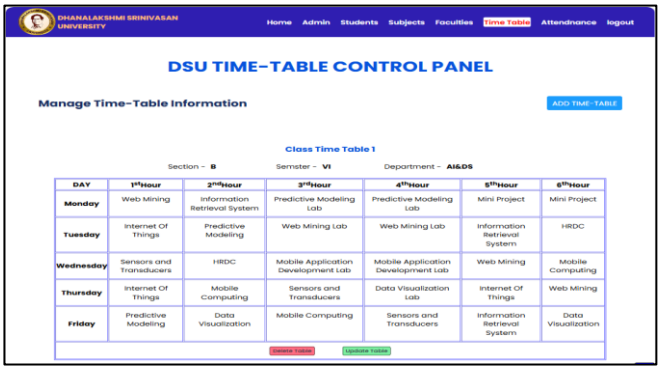


**Figure 11.** Timetable Page

The Figure 12 shows the students attendance page that displays the student attendance status in form of a pie chart.

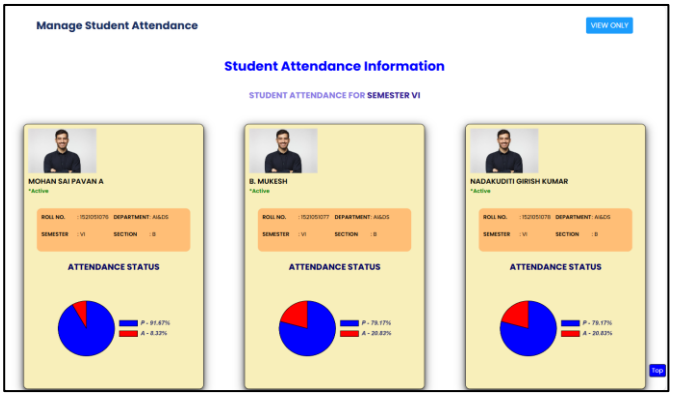


**Figure 12.** Students Attendance Page

## 5.2 Faculty Interface

It is mainly designed to efficiently mark attendance for students. Each faculty member can access the system using their unique credentials (User ID and Password). This interface currently contains three different sections of web pages, namely:

**Faculty Login Page:** Provides access to the faculty interface by validating entries with valid credentials**,** interface shown in the Figure 13.

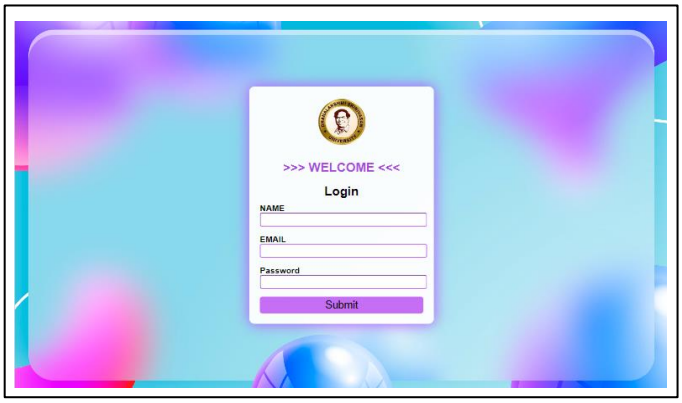


**Figure 13.** Faculty Login Page

Attendance section allows faculty to mark the attendance in two different ways: Traditional method as well as Search and Mark method. In Traditional method faculty can mark attendance by navigating through each student's record and marking them as either absent or present, as shown in the Figure.14

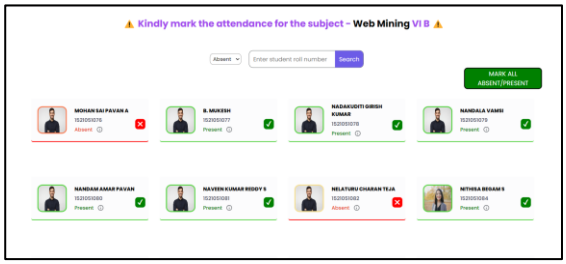


**Figure 14.** Faculty Attendance Marking Page – Traditional Method

In Search and Mark method faculty can enter the last three digits of student's registration number to mark attendance for that student. After clicking the search button, the attendance status for the specified hour is automatically updated, as illustrated in the Figure.15

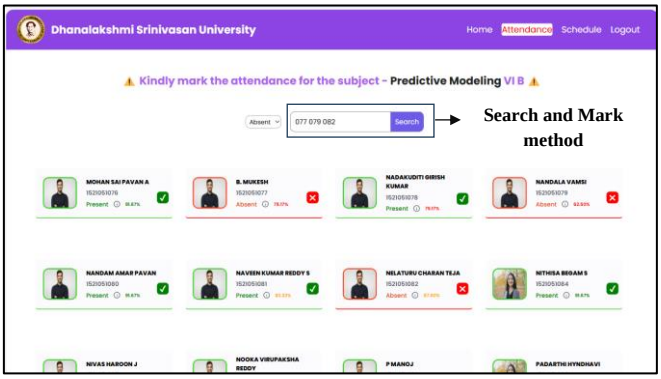


**Figure 15.** Faculty Attendance Marking Page – Search Method

By default, the search functionality is set to “Absent mode”. Faculty can switch between “Absent” and “Present” by selecting desired option from the dropdown menu, as shown in the Figure.16

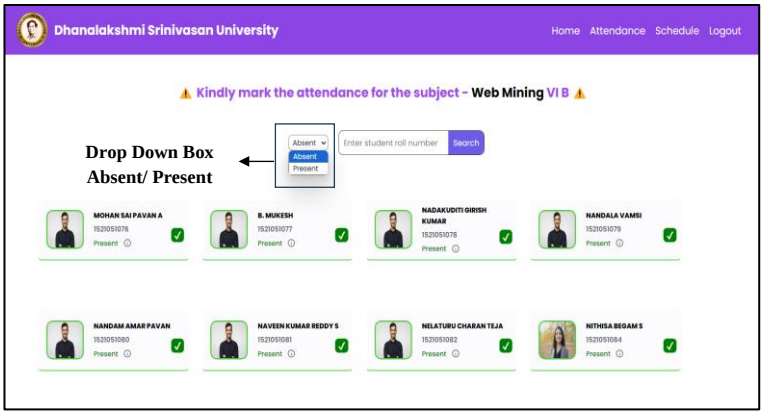


**Figure 16.** Faculty Attendance Marking Page – Drop Down for Absent / Present

**Schedule Section:** It is used to display information regarding the faculty timetable. It provides details of the current day's timetable, weekly timetable, and information on the faculty members handling each semester, section, and department as shown in Figure.17

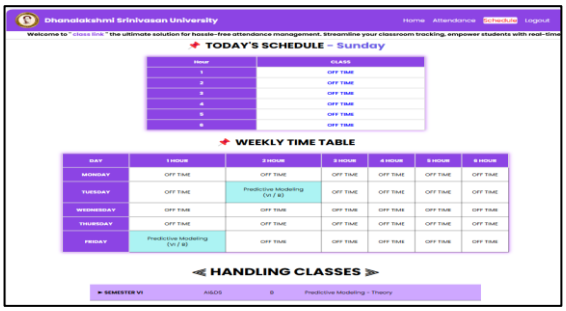


**Figure 17.** Faculty Schedule Page

## 5.3 Chatbot Interface

The MySQL chatbot application is used to communicate directly with the attendance database, allowing the administrator to retrieve and analyse statistical information about student data. The interface is shown in Figure.18

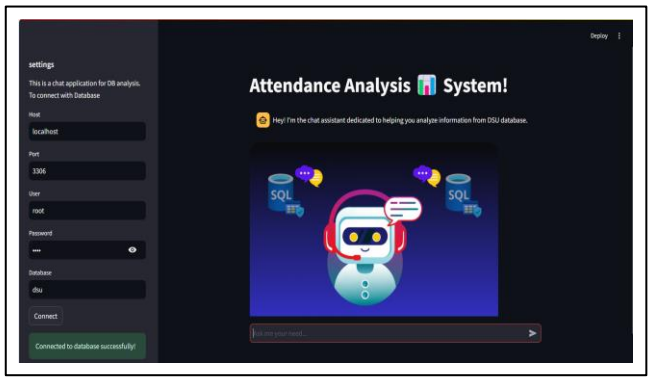


**Figure 18.** Chatbot Interface

## 6. Conclusion and Future Work

This web-based attendance management system is designed for efficient attendance marking. It overcomes various limitations of existing systems, especially reducing time consumption, providing a user-friendly interface, and allowing easy analysis of student attendance information from the database. An additional feature, the schedule section on the faculty interface, helps faculty track their respective classes, departments, and sections.

In the future, additional components will be added to the faculty interface, including an announcement module, a student mark entry module, and a news module. The student interface will also be implemented with multiple components, such as a schedule module, a fees module, a result module, and an announcement module.

## 7. Acknowledgment

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