



Attendance System using Geolocation & Browser Fingerprint

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ABSTRACT:

The increasing adoption of digital solutions in education has highlighted the need for efficient and secure attendance management systems. Traditional methods, such as manual registers and RFID cards, are prone to errors, manipulation, and inefficiencies. To address these challenges, this project presents a Flask-based attendance system that leverages geo location and browser fingerprinting for authentication. The system ensures that students can only mark attendance from authorized locations, preventing fraudulent entries. It also employs browser fingerprinting techniques to identify unique user devices, adding an extra layer of security. Attendance records are stored in an SQLite database, and administrators can generate customized attendance reports based on subject and date. Additional features include announcement posting, feedback collection, and timetable management. The proposed system enhances accuracy, security, and accessibility, offering a scalable and automated solution for modern educational institutions.

Keywords: Attendance System, Flask, Geolocation, Browser Fingerprinting, Authentication, SQLite, Report Generation, Web Security.

INTRODUCTION:

Traditional attendance management systems in educational institutions rely on manual roll calls or RFID-based systems, which are often inefficient, time-consuming, and susceptible to manipulation. Ensuring accurate attendance tracking is crucial for academic integrity, resource allocation, and institutional management. However, conventional methods lack robust security measures, allowing students to mark attendance on behalf of others or from unauthorized locations.

To address these challenges, this project presents a Flask-based attendance system that integrates geolocation tracking and browser fingerprinting to enhance authentication and prevent fraudulent attendance marking. Geolocation ensures that students can only mark attendance from predefined locations, while browser fingerprinting uniquely identifies user devices, preventing multiple logins from different devices.

The system is designed with SQLite as the database, storing attendance records, user details, and timetable information. Administrators can generate attendance reports, manage student records, and post important announcements, while teachers can mark attendance and prevent time-slot conflicts.

This paper explores the implementation of geolocation-based authentication, browser fingerprinting techniques, and attendance tracking automation. By leveraging modern web technologies, the system enhances security, accuracy, and accessibility, offering an efficient and scalable solution for attendance management in educational institutions.

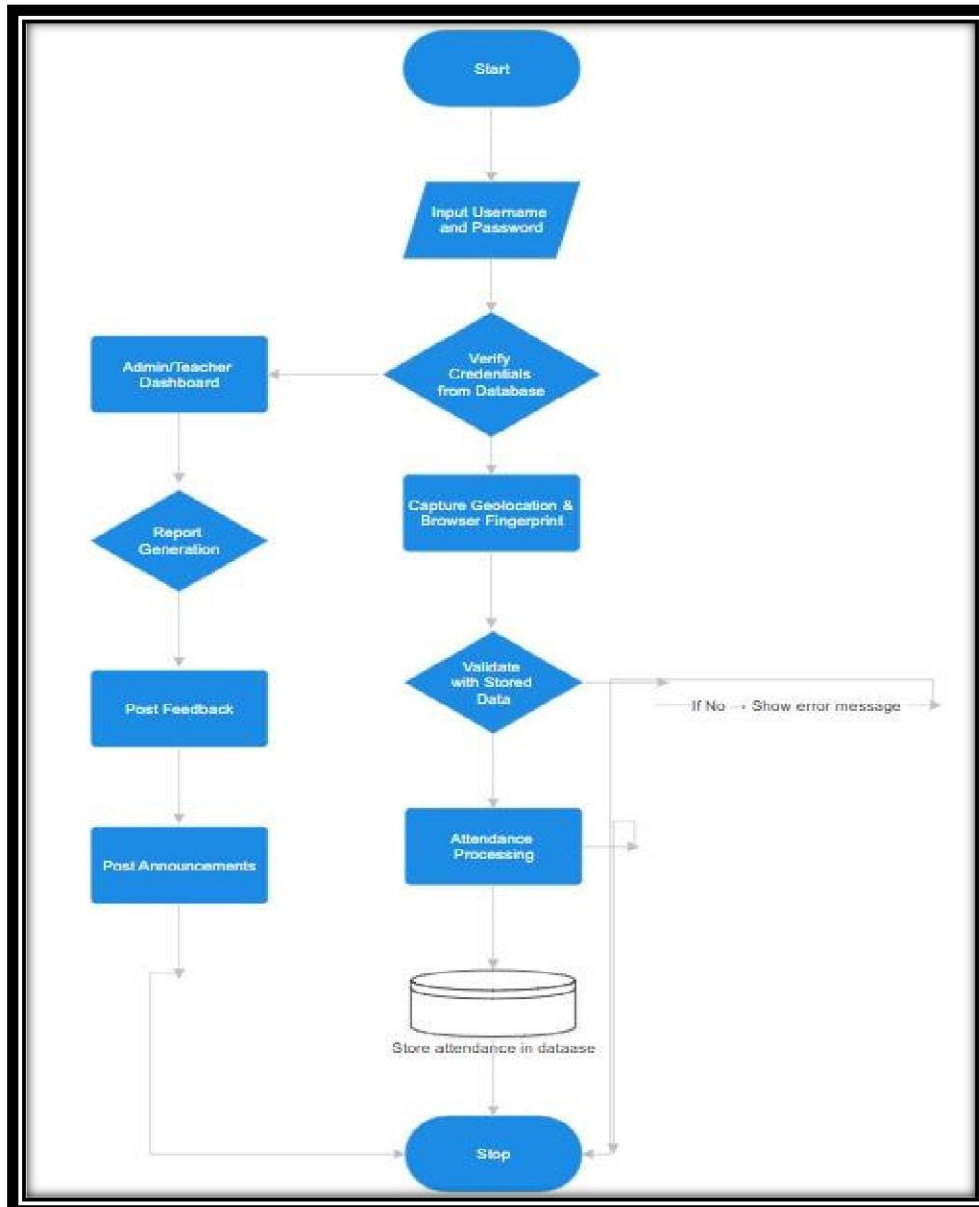
Problem Statement:

Traditional attendance management systems in educational institutions are prone to inefficiencies, inaccuracies, and security vulnerabilities. Manual roll calls are time-consuming and susceptible to proxy attendance, where students mark attendance on behalf of others. RFID-based systems, while offering some automation, can still be misused by sharing ID cards. Additionally, remote or hybrid learning models require secure and location-based authentication to ensure genuine participation.

This project aims to develop a Flask-based attendance system that addresses these challenges by integrating geolocation tracking and browser fingerprinting. Geolocation ensures that students can only mark attendance from authorized locations, preventing remote or unauthorized check-ins. Browser fingerprinting adds an extra layer of security by uniquely identifying devices, preventing attendance fraud through multiple logins on different devices. By implementing these technologies, the system enhances the accuracy, security, and efficiency of attendance management, making it a scalable and automated solution for modern educational institutions.

Working:**Technologies Used:**

1. **Flask:** Handles backend processing, authentication, and attendance management.
2. **SQLite:** Stores user credentials, attendance records, and announcements.
3. **Geolocation API:** Verifies student location before allowing attendance marking.
4. **Browser Fingerprinting:** Prevents fraudulent logins by identifying unique devices.
5. **Pandas & OpenPyXL:** Generates attendance reports in Excel format.
6. **HTML, CSS, JavaScript:** Builds an interactive front-end with real-time location tracking.

System Architecture:**Attendance System Flowchart Explanation****1. User Authentication**

Input Username and Password: Users (admins, teachers, or students) enter their login credentials.

Verify Credentials from Database: The system checks the entered credentials against stored records in the SQLite database.

2. Access Control

Admin/Teacher Dashboard: Upon successful authentication, users access their respective dashboards. Report Generation: Admins/teachers can generate attendance reports based on selected dates.

Post Feedback: Teachers can provide feedback regarding student performance or attendance.

Post Announcements: Admins can post important announcements that students can view and download.

3. Attendance Verification

Capture Geolocation & Browser Fingerprint: Before marking attendance, the system records the user's geolocation and browser fingerprint for security. Validate with Stored Data: The system checks if the user's location and device match pre-approved records.

If Validation Fails: An error message is displayed, preventing fraudulent attendance marking.

4. Attendance Processing

Attendance Marking: If validation is successful, the system processes attendance for the student.

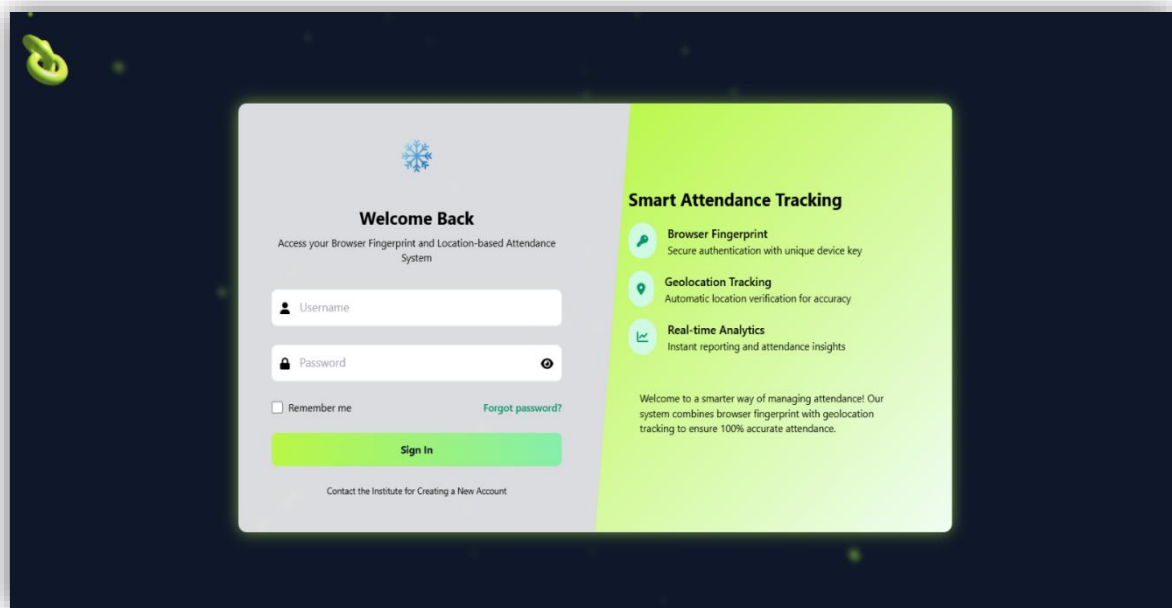
Store Attendance in Database: The attendance record is saved in the SQLite database for future reference.

5. System Completion

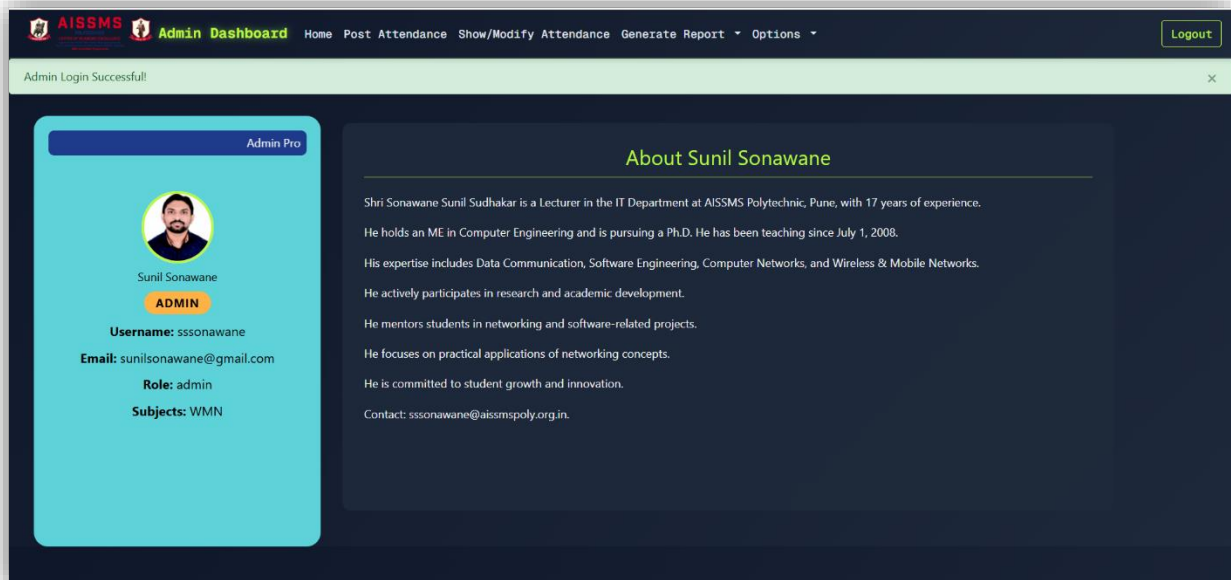
Stop: The process ends after attendance is successfully recorded or an error message is displayed.

Outputs:

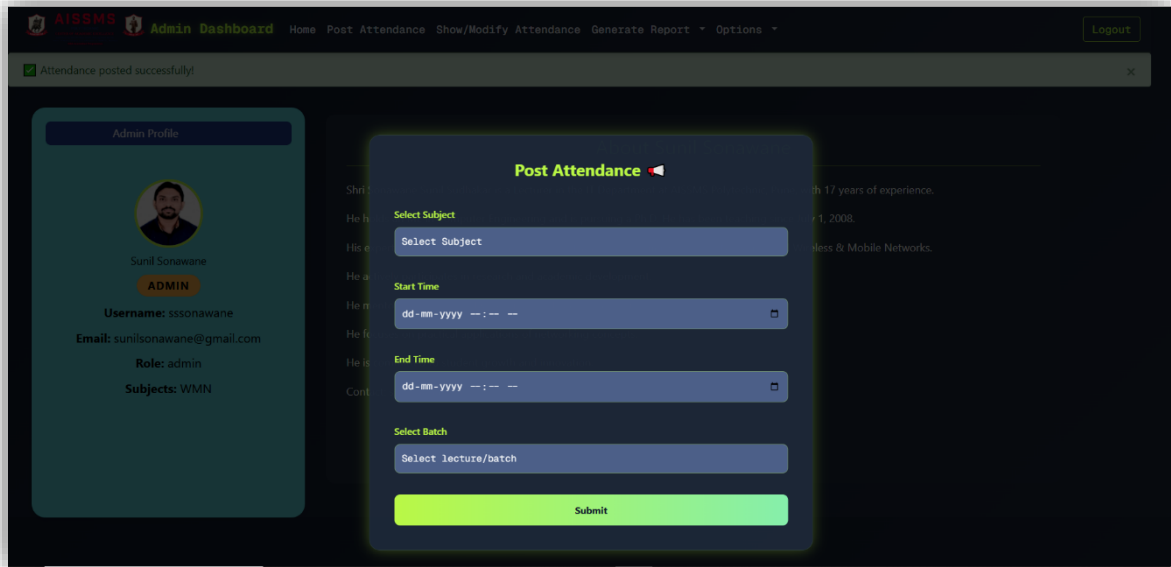
Login Page (Same for admin and students)



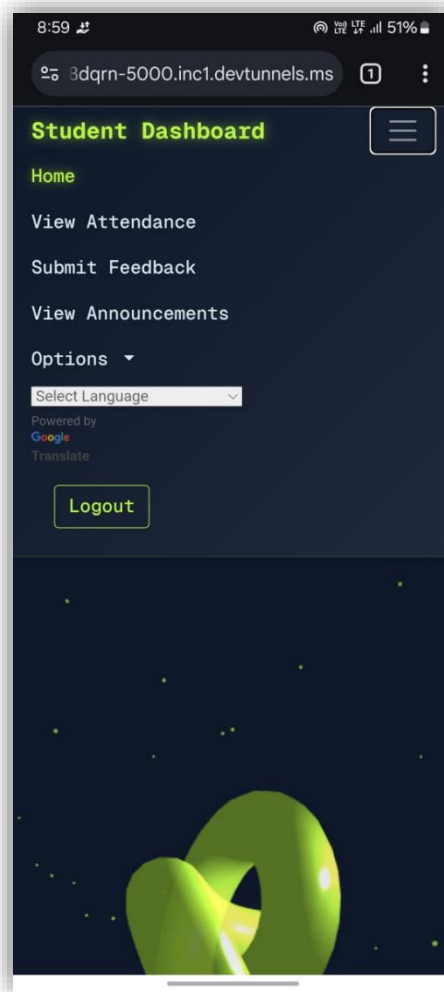
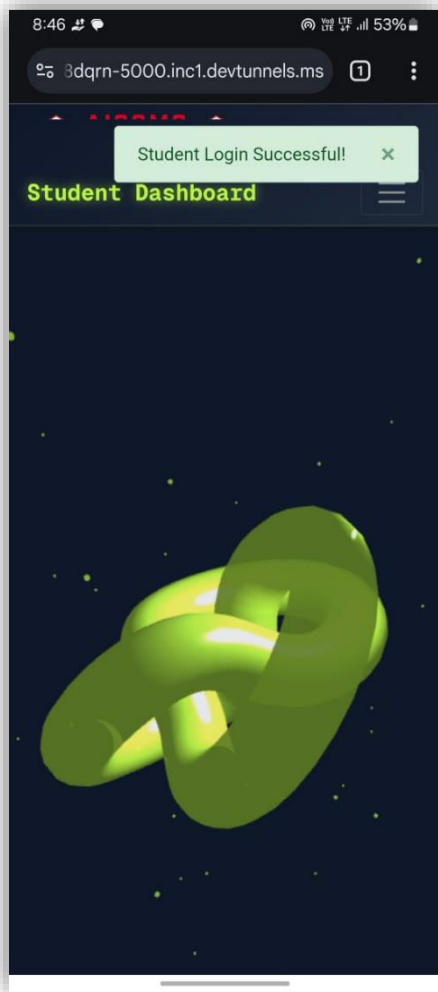
Admin log's in through his credentials and the Home page will be displayed



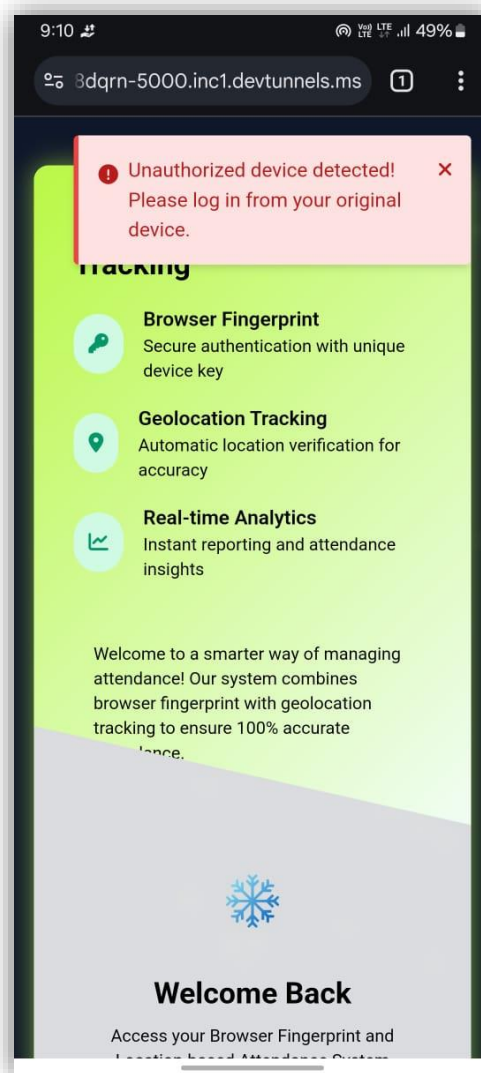
Post Attendance page for posting the Attendance for students where you have to enter the subject, start time, end time and the batch (lecture or practical) and click “Submit “



Student logs in through his credentials and if the Browser Fingerprint matches with the one stored in the DB, then Home page will be displayed



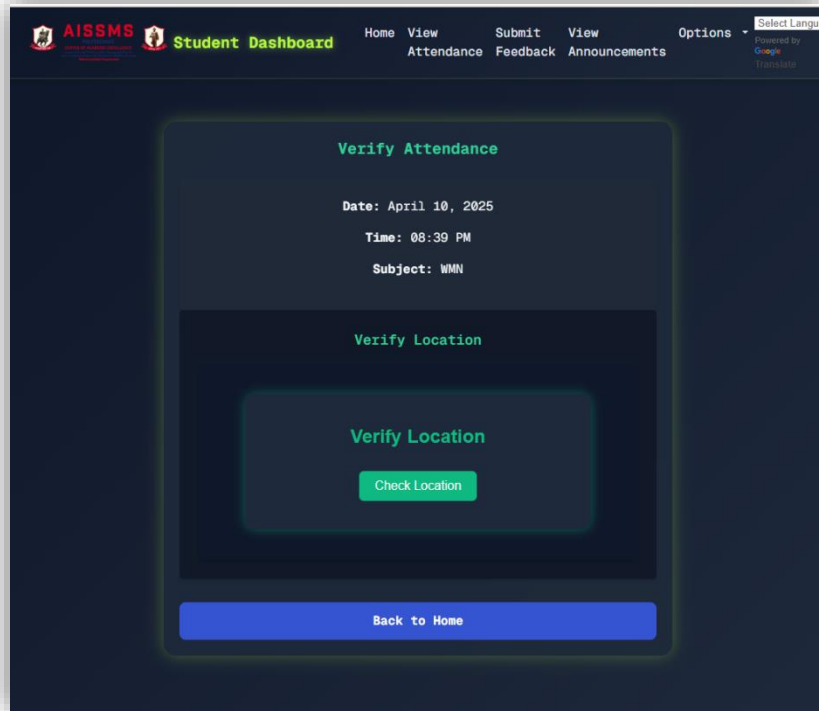
If the Fingerprint does not match and if a student tries to log in through other student's account using his credentials (username and password), then he would not be able to log in as his Fingerprint won't match with the one stored in the DB, thus proxy attendance is not Possible in this case



At the Terminal ,message is displayed

```
[DEBUG] Stored Fingerprint: 9f5b8f9d4aa215a7841e8a34ded632a6
[ALERT] Unauthorized device detected! Login blocked.
127.0.0.1 - - [10/Apr/2025 21:10:37] "POST / HTTP/1.1" 302 -
127.0.0.1 - - [10/Apr/2025 21:10:38] "GET / HTTP/1.1" 200 -
```

When the student clicks on the “View attendance “, Page the live Attendance as well as the Expired attendance will be Displayed and on clicking on the mark Attendance the “Mark Attendance” page will be displayed



Student click on the verify Location Button and if the student is in the College Classroom, then his attendance will be marked and will be navigated to the Home Page and at the admin side the particular student attendance will be shown (absent/present)

Roll No	Name	Subject	Batch	Date	Attendance	Action
2300	ADMIN	Not Marked	4	N/A	✘ Absent	Mark
2301	AVALE AJAY MAHADEV	Not Marked	4	N/A	✘ Absent	Mark
2302	BAGUL SNEHAL SANJAY	Not Marked	1	N/A	✘ Absent	Mark
2303	BHOIR SIMRAN MILIND	Not Marked	1	N/A	✘ Absent	Mark
2304	BHOSALE SAHIL SANJAY	Not Marked	1	N/A	✘ Absent	Mark
2305	DENGAL ADITYA UDAY	WMN	1	2025-04-10	✔ Present	Unmark
2306	DHAS SHWETA NITIN	Not Marked	1	N/A	✘ Absent	Mark
2307	GAYKAR SHRUTI POPAT	Not Marked	1	N/A	✘ Absent	Mark
2308	GHULE ARNAV SACHIN	Not Marked	4	N/A	✘ Absent	Mark
2309	GODASE ARNAV BIBHISHAN	Not Marked	4	N/A	✘ Absent	Mark
2311	JADHAV MANSI ANKUSH	Not Marked	1	N/A	✘ Absent	Mark

If a student has no Mobile phone, then the admin can also Explicitly mark his attendance using the mark/unmark feature Similarly, if Admin wants to unmark a student, then he can do so by clicking the “unmark” button next to the student’s name

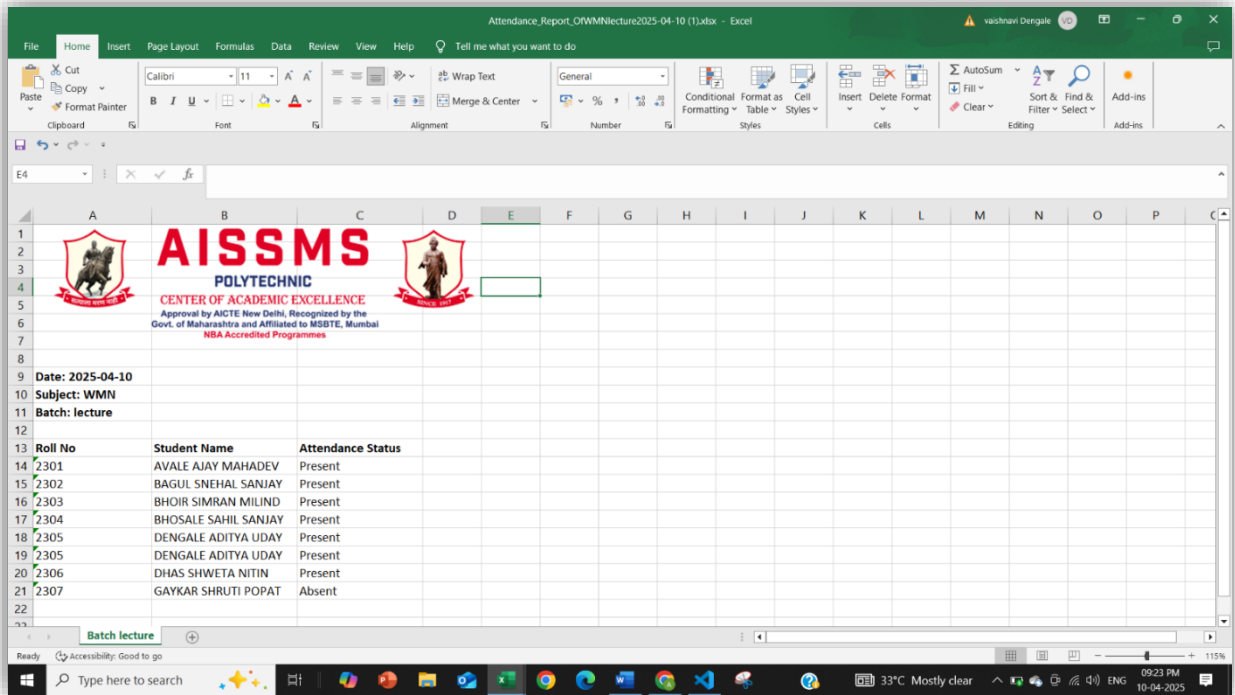
The screenshot shows the 'Admin Dashboard' with a navigation menu including Home, Post Attendance, Show/Modify Attendance, Generate Report, and Options. The main content area is titled 'Modify Attendance' and features a 'View Attendance Chart' button. Below this is a table with the following data:

Roll No	Name	Subject	Batch	Date	Attendance	Action
2300	ADMIN	Not Marked	4	N/A	✘ Absent	Mark
2301	AVALE AJAY MAHADEV	WMN	4	2025-04-10	✔ Present	Unmark
2302	BAGUL SNEHAL SANJAY	WMN	1	2025-04-10	✔ Present	Unmark
2303	BHOIR SIMRAN MILIND	WMN	1	2025-04-10	✔ Present	Unmark
2304	BHOSALE SAHIL SANJAY	WMN	1	2025-04-10	✔ Present	Unmark
2305	DENGALE ADITYA UDAY	WMN	1	2025-04-10	✔ Present	Unmark
2306	DHAS SHWETA NITIN	WMN	1	2025-04-10	✔ Present	Unmark
2307	GAYKAR SHRUTI POPAT	WMN	1	2025-04-10	✔ Present	Unmark
2308	GHULE ARNAV SACHIN	Not Marked	4	N/A	✘ Absent	Mark
2309	GODASE ARNAV BIBHISHAN	Not Marked	4	N/A	✘ Absent	Mark
2311	JADHAV MANSI ANKUSH	Not Marked	1	N/A	✘ Absent	Mark

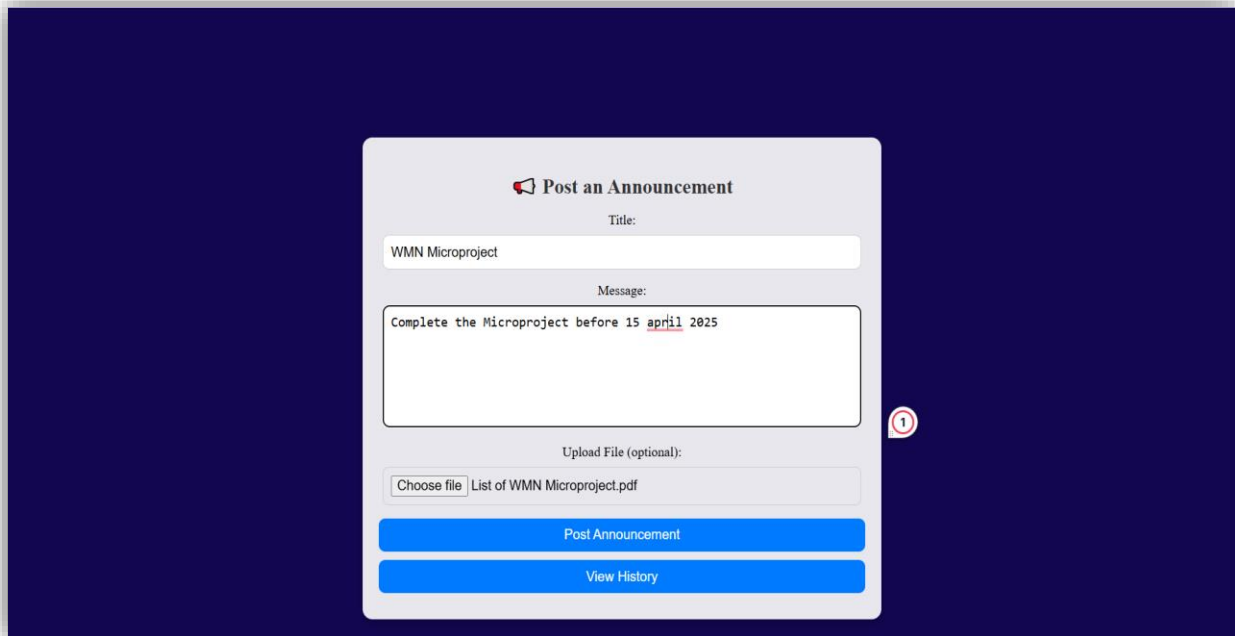
Admin can generate the report of the attendance by using the Generate report feature and by selecting lecture/batch

The screenshot shows a form titled 'Select Date for Batch lecture'. It includes a 'Choose Date:' label, a date input field with the value '10-04-2025', and two buttons: 'Generate Report' and 'Back'.

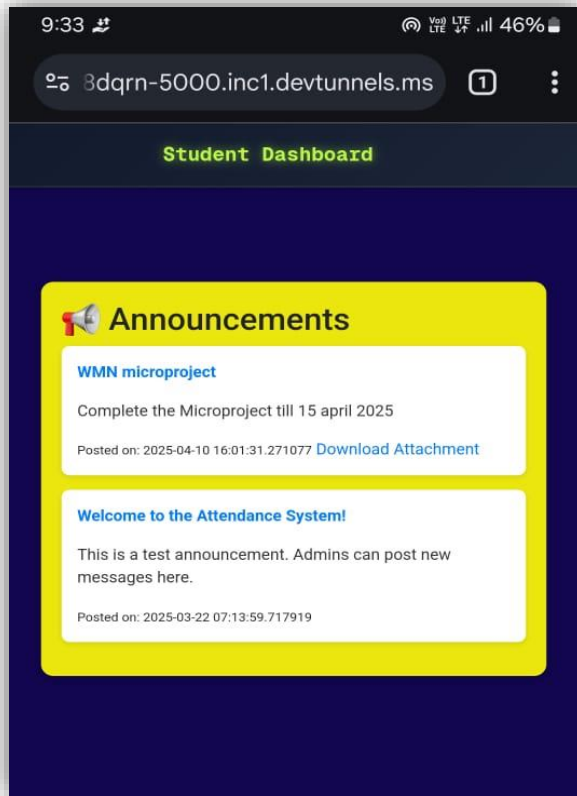
The Excel sheet will be downloaded containing the attendance report with the student’s name, rollno and present/absent status



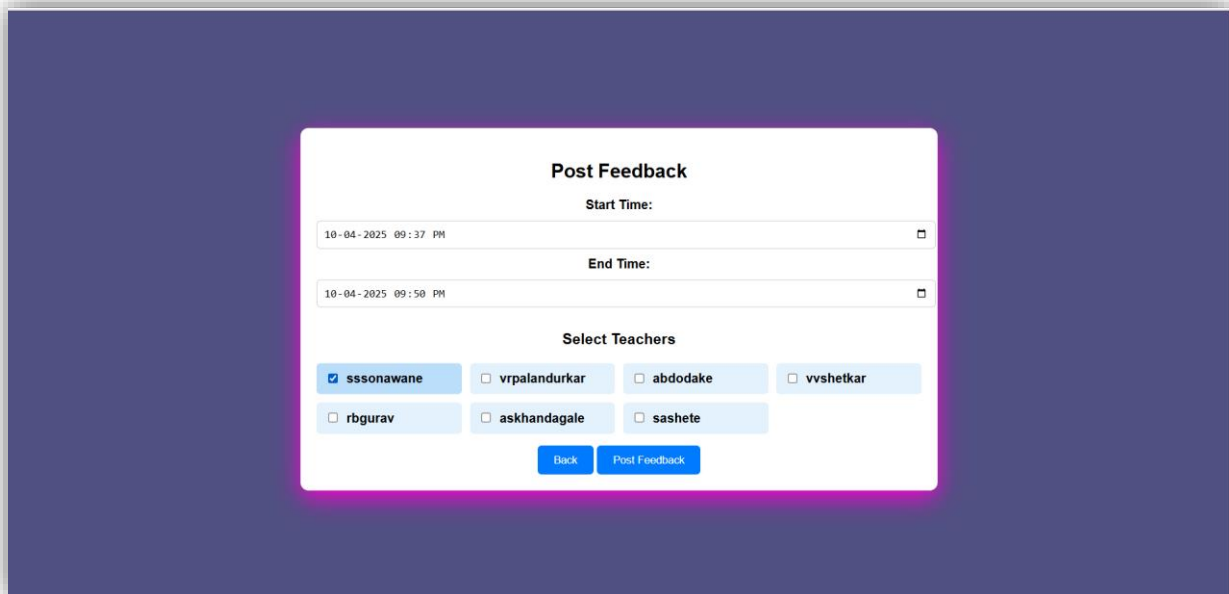
If the Admin wants to post and Announcement to the Class regarding the assignment completion or any other announcement then there is a feature as “Post Announcement” where you can also add the Attenchemnt as file



Student can view announcement and download the Attachment on their side



There is a special feature for the Head of the Department (HOD) to create feedback for teacher's

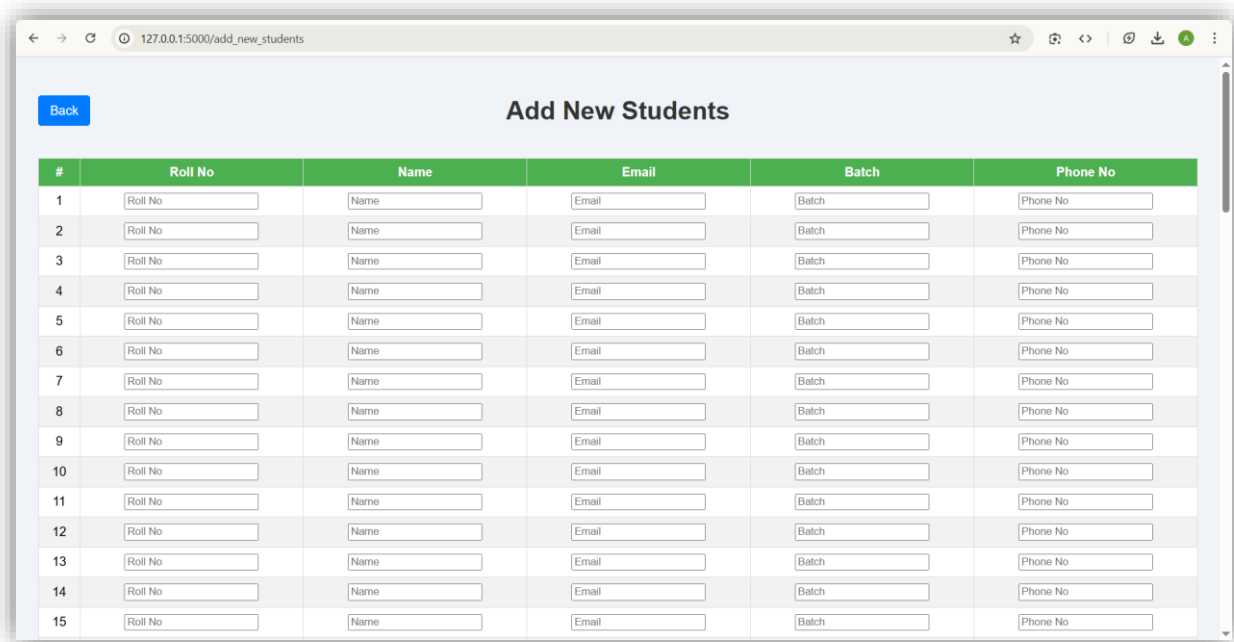


On the Student side the feedback will be visible and the student can give the feedback as per his choice

Upon submitting , it would be visible to the HOD on the view Feedback page

ID	Roll No	Name	Teacher ID	Status	Timestamp
1	2301	AVALE AJAY MAHADEV	3	Submitted	2025-03-22 11:31:10
2	2302	BAGUL SNEHAL SANJAY	3	Submitted	2025-03-22 12:22:27
3	2309	GODASE ARNAV BIBHISHAN	1	Submitted	2025-03-22 13:22:32
4	2309	GODASE ARNAV BIBHISHAN	3	Submitted	2025-03-22 13:29:18
5	2309	GODASE ARNAV BIBHISHAN	4	Submitted	2025-03-22 13:29:25
6	2305	DENGALE ADITYA UDAY	1	Submitted	2025-03-23 17:17:33
7	2301	AVALE AJAY MAHADEV	1	Submitted	2025-04-10 16:12:22

In case of a new Admission or to add an entire new Batch, the HOD has a feature to add the student's in the System



The screenshot shows a web browser window with the URL `127.0.0.1:5000/add_new_students`. The page title is "Add New Students". There is a blue "Back" button in the top left corner. Below the title is a table with 15 rows and 6 columns. The columns are labeled "#", "Roll No", "Name", "Email", "Batch", and "Phone No". Each cell in the table contains an input field for data entry.

#	Roll No	Name	Email	Batch	Phone No
1	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
2	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
3	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
4	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
5	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
6	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
7	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
8	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
9	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
10	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
11	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
12	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
13	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
14	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>
15	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

Outcome:

A Flask-based attendance system using geolocation and browser fingerprinting ensures high accuracy in attendance tracking by preventing fraudulent check-ins. By verifying a student's physical location and unique device characteristics, the system significantly reduces proxy attendance cases. The accuracy of geolocation-based verification depends on factors like GPS precision and network availability, while browser fingerprinting ensures consistent user identification across sessions. While these technologies provide robust security, minor inaccuracies may occur due to VPN usage, dynamic IPs, or GPS errors. However, by integrating these advanced authentication methods, the system enhances institutional integrity, prevents attendance manipulation, and ensures reliable and efficient attendance management.

CONCLUSION:

The implementation of a Flask-based attendance system with geolocation tracking and browser fingerprinting provides a secure, accurate, and scalable solution for modern educational institutions. By ensuring that students can only mark attendance from authorized locations and registered devices, the system eliminates proxy attendance and enhances institutional integrity. The automated report generation feature further streamlines attendance management for administrators. While minor challenges such as GPS inaccuracies or device spoofing may exist, integrating these advanced technologies significantly improves accuracy, security, and efficiency. Overall, this system offers a modern, reliable, and technology-driven approach to attendance tracking, fostering a more disciplined and transparent academic environment.

Acknowledgments

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