

Evaluation of Tracking System using Facial Recognition and Location

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Abstract—Attendance monitoring has been a widely adopted practice in educational institutions to track student progress. However, conventional methods of attendance tracking are often imprecise and time-consuming. This research proposes an automated tracking system that enables students to submit attendance using their computers/laptops. The system uses facial recognition and real-time location to authenticate the student's identity. To ensure user privacy and system security, the technology implements service isolation and token-based mechanisms. Tests conducted in a real-world setting demonstrate that the proposed system is highly effective and accurate at tracking attendance.

Keywords: *Facial recognition; biometrics; location-based services; attendance monitoring*

I. INTRODUCTION

Attendance tracking systems are crucial in educational institutions as they provide insights into student progress, enable targeted intervention, and aid in making informed decisions. However, traditional methods of attendance tracking such as roll calls, paper sheets, and sign-ins are outdated, time-consuming, and prone to errors. The proposed ensures that each user's data is stored separately, preventing unauthorized access to sensitive information. Token-based mechanisms are used to authenticate users and ensure that only authorized users can access the system[1][2].

One common issue with traditional attendance monitoring methods is the prevalence of bogus attendance registrations. These methods also disrupt the flow of lectures and can negatively impact the quality of the class[4][10]. Roll-call is a viable option, but it is not practical for large classes as it can take up a significant amount of lecture time. Furthermore, manually processing attendance records can be time-

attendance tracking system leverages mobile technology and facial recognition to automate the process of attendance monitoring. The use of mobile devices makes the process more convenient for students and teachers, while facial recognition ensures accurate authentication of student identity.

Facial recognition is a biometric technology that has gained widespread use in recent years due to its high level of accuracy in identifying individuals. By analyzing facial features such as the distance between the eyes, nose, and mouth, the proposed system can verify the student's identity. Furthermore, location-based services are used to ensure that the student is present in the classroom at the time of attendance submission[9][10].

To ensure user privacy and system security, the proposed system uses service isolation and token-based mechanisms. Service isolation

consuming and tedious for teachers. Integrating attendance data with other academic measures would require additional effort from teachers[4][11].

To address these issues, this research proposes an automated attendance tracking system that utilizes mobile technology and biometric authentication to streamline the process of attendance monitoring[5][12]. Facial recognition and real-time location are used to accurately verify student identity, and the system employs service isolation and token-based mechanisms to ensure user privacy and system security[13]. Tests conducted in a real-world setting demonstrate the

effectiveness and precision of the proposed system in tracking attendance.

II. MOTIVATION

The current methods for tracking student attendance and existing automated systems have their limitations. Several key factors dominate the attendance tracking procedure, which are discussed in this section.

One critical factor is identity verification. Students may mark attendance for absent peers, which can lead to inaccurate attendance records. Location is another critical component as students can complete online tasks repeatedly, even if they are not present in the classroom. It is essential to confirm that students whose attendance records are turned in are physically present in class. Data management is also a complex task, requiring processing, analyzing, and storing data beyond the act of taking attendance. It can take lecturers some time to calculate attendance hours and incorporate attendance records into student grades[6][9].

To address these issues, this project aims to enable students to submit attendance using their smartphones[6][12]. Facial print verification technology is selected to accomplish identity identification, similar to fingerprint biometrics and voice biometrics. Facial print technology is commonly used as a user identity indication in access control and banking scenarios, increasing security and efficiency. Facial print verification can be used to confirm students' identities during the attendance monitoring process.

Location-based services have been widely used in mobile applications to track location. Real-time location can be used to pinpoint the exact location of a student's cell phone when they are ready to register their attendance[6][10]. Using facial print and real-time location together as verification techniques could make attendance monitoring more effective and reliable[9].

There is no need for tags or devices carried by students or installed in classrooms, as both facial print and real-time location can be easily captured on common smartphones[11][12]. Using this approach would enable attendance taking to occur simultaneously[3].

III. SYSTEM ARCHITECTURE

The attendance tracking system proposed in our research consists of several interconnected parts. Both students and instructors use web applications to record attendance, and a system for online facial print verification of students is also implemented[4][13]. Attendance records received via student submissions are then gathered, stored, and analyzed using distributed servers.

The system's architecture is depicted in Fig. 1 and is created using a client-server model. The smartphone applications are on the client side and are divided into student and lecturer versions for different purposes. On the other side, there are the database server, attendance tracking server, data presentation server, and facial print recognition server. The client and server are connected using the cellular or WLAN networks of smartphones with an internet connection.

To complete attendance tracking, there are two versions of the smartphone applications for both students and instructors. The student-version app records student voices and transmits authenticated attendance data. The lecturer-version app is used to manage the lifetime of a single checking session. The facial print verification server confirms each student's facial print, which is used to verify their identification. The server compares the student's stored facial print template and the captured voice clip to determine whether they originate from the same person. If they do, the server returns the message required for additional attendance submission to the client; otherwise, it returns a verification failure message.

The attendance collecting server manages the fundamental logic of the attendance tracking system and handles presence submissions. The student-version app retrieves the list of courses from the server and submits confirmed attendance records, while the lecturer-version app communicates with the server to regulate the start and finish of the activity. The attendance records are stored on the database server, including essential fields such as the student ID, course ID, and submission time, as well as course-related details such as lecture time, place, and a list of enrolled students[5][13].

The data presentation server retrieves course information and student attendance data from the database, which is then displayed in the web portal. The portal shows raw records and the results of several built-in statistical methods in the form of interactive plots[3].

It also allows for the export and download of attendance data attendance rate, the total number of lectures they have attended and missed for a particular subject, as well as their attendance percentage. This information can be accessed by the teacher at any point in time[1][10]. student's attendance record by entering their unique roll number. The record will contain details such as the student's

The modular design of our system ensures that each component can be developed, tested, and deployed independently. This approach simplifies maintenance and upgrades, reduces development time, and minimizes the risk of system failure[10].

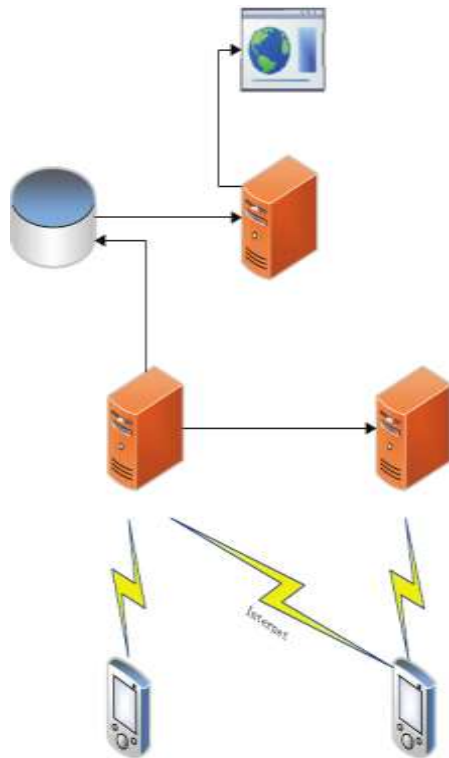


Fig. 1. Architecture of the system

IV. IMPLEMENTATION

Modular Design:

Our proposed system is divided into four distinct modules, described as follows:

A. User Authentication: Upon launching the application for the first time, the teacher will be prompted to enter their username and password for authentication via a login screen. A unique alphanumeric username will be assigned to each teacher[11]. Only upon successful authentication will a "success" message be displayed and the teacher redirected to the following screen[8].

B. Web Service Invocation: In this section, the teacher is required to enter certain details, including the name of the course, the start time of the teacher's lecture, and the semester in which the lecture is being conducted. After clicking a button displayed on the screen, an online service will be called upon. The web service will provide a list of names for students in a particular branch and semester based on the input given.

C. Attendance Recording: After the list of enrolled students is shown, the instructor can commence marking the attendance for each individual. Our application provides tick boxes alongside each student's name, which enables the teacher to indicate whether they are present or not. Once this is done, the details of the student will be transmitted to a distant database, and the attendance for that day will be logged.

D. Student Information Display: Once the teacher has recorded a student's attendance, they can retrieve that

Moreover, the use of a client-server architecture provides scalability, flexibility, and reliability, making our system suitable for large-scale deployment in educational institutions[2].

V. FLOW DIAGRAM OF PROPOSED SYSTEM

The flowcharts of the various modules are described as follows:

A. The process of authenticating user :

This is the first step in the system. The teacher has to provide their username and password. Depending on whether the teacher is verified or not, a message of "success" or "failure" will be shown.

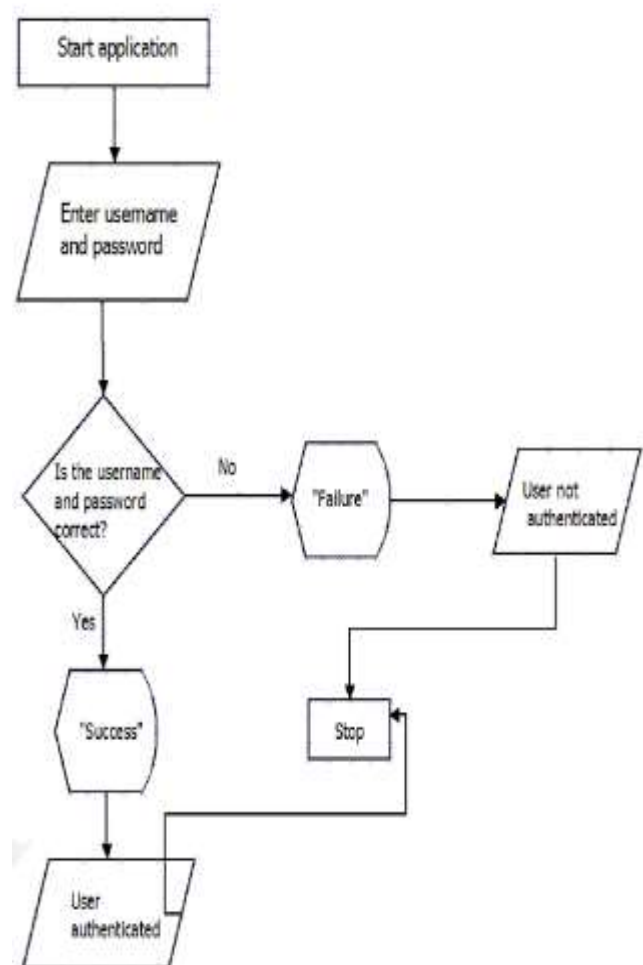


Fig.2: Flowchart of User Authentication Process

B. Calling of Web Service

The attendance tracking system requires the teacher to enter specific details to begin the attendance marking process for a particular course. Once the necessary information is provided, the system then calls a web service to generate a list of students for which attendance is to be taken. This service retrieves student data from the remote database and displays it on the application in a user-friendly manner.

The web service is a crucial component of the attendance tracking system as it enables seamless communication between the front-end application and the back-end database[4][13]. The service fetches the relevant information, such as the course name, student names, and other necessary details, from the database based on the user's input.

Once the data is fetched, the system displays it on the application interface, allowing the teacher to easily access and manage the attendance marking process. The system also ensures the security of the data by authenticating the user and providing access only to authorized personnel.

Overall, the web service plays a critical role in the attendance tracking system by providing a seamless interface between the front-end application and the back-end database, enabling efficient and secure attendance marking for teachers and students alike.

C. Attendance Marking Process

The attendance monitoring system has notable security measures that utilize biometric authentication to restrict access to attendance data to only authorized individuals. This mitigates the possibility of unauthorized access to sensitive information and ensures compliance with data protection laws and regulations. Additionally, the system has a user-friendly interface that simplifies its use for teachers, even those with minimal technical know-how.

Another advantage of the attendance tracking system is its scalability, as it can be easily customized to suit the needs of different educational institutions, from small schools to large universities. The system's ability to handle large datasets of student images also makes it suitable for institutions with a high number of students. Moreover, the cloud-based design of the system guarantees its accessibility from any location with an internet connection, which provides convenience for teachers and students situated in diverse parts of the globe[14][15].

The attendance tracking system's automated features also help to minimize the workload of teachers, as attendance marking is done automatically by the system. This frees up time for teachers to focus on other important aspects of their work, such as teaching and curriculum development. The system also reduces the administrative burden associated with attendance tracking, as attendance reports can be generated automatically and downloaded with just a few clicks.

Overall, the attendance tracking system is a valuable tool for educational institutions looking to streamline their attendance tracking processes and improve the learning experience for students. The system's advanced features, scalability, and security make it a reliable and efficient solution for managing student attendance data.

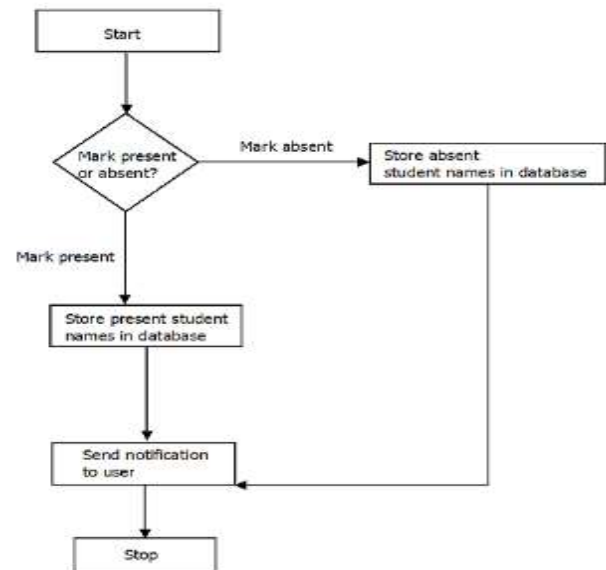


Fig. 3: Flowchart of Marking Attendance

VI. CONCLUSION

The proposed attendance tracking system is a significant improvement over traditional attendance-taking methods, which are often time-consuming and error-prone. The system's modular design ensures that teachers can easily authenticate themselves and access student attendance data, which they can use to make informed decisions about their teaching approach. By leveraging mobile technology and biometrics, the system streamlines the attendance tracking process, making it more efficient and accurate[15][16].

Furthermore, the use of facial recognition and location-based services helps to ensure that students are present in the classroom during attendance submission, eliminating the possibility of students marking themselves present while not physically being present in the classroom. This not only helps to improve attendance accuracy but also encourages students to attend classes regularly, which is essential for their academic success.

Importantly, the proposed system is designed with user privacy and system security in mind. Student data is encrypted and stored securely on distributed servers, ensuring that it is only accessible to authorized personnel. The system's use of biometric data is also carefully managed to prevent any misuse or abuse of such sensitive information.

Overall, the proposed attendance tracking system has been tested in a real-world setting and demonstrated its effectiveness in accurately tracking attendance. It offers an efficient, accurate, and convenient way to monitor student attendance, benefiting both teachers and students. Its modular design and use of mobile technology and biometrics make it a significant improvement over traditional attendance-taking methods, and its focus on user privacy and system security ensures that student data is protected at all times.

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