Optimizing Student Attendance Tracking Through Network-Based Presence Detection

Introduction:

Attendance tracking remains an essential process in higher education, serving as a measure of student engagement and participation. However, the traditional methods commonly used today—such as manual sign-in sheets or QR-code-based systems—are increasingly inefficient and unreliable. Pen-and-paper attendance wastes valuable class time, introduces opportunities for human error, and is easily manipulated. Meanwhile, QR code systems, while intended to modernize the process, often create new challenges: students must interrupt lectures to scan codes or deal with broken codes. These interruptions not only consume class time but also create unnecessary inconvenience for both students and instructors.

At our university, students are required to maintain a **minimum of 75% attendance** to pass their courses. Yet, without a consistent and reliable system in place to verify attendance accurately, this requirement can become very unfair due to how It's very easy to manipulate with methods like letting other students write down your name or taking a picture of the qr code and sending it to your friends

With the rapid advancement of campus networking infrastructure, particularly Wi-Fi systems that already authenticate students across university networks, there exists a more seamless and automated solution. By leveraging existing Wi-Fi connectivity data, attendance can be tracked accurately and passively, eliminating the need for physical sign-ins or device-based scanning. This approach not only saves time but also enhances reliability and integrity, ensuring attendance data is collected efficiently and fairly without disrupting the learning environment.

This project proposes the design and evaluation of a **Wi-Fi-based attendance tracking system** that utilizes the university's existing network infrastructure to detect student presence in classrooms. The goal is to demonstrate that attendance can be automated, reducing classroom disruptions, administrative workload, and errors associated with current methods.

Proposed Solution

The proposed system will utilize the university's existing Wi-Fi infrastructure to automate attendance tracking. Each access point (AP) already deployed across campus can act as a detection node, identifying when a student's registered device connects to it. By linking AP connection logs with the university's learning management system, attendance can be automatically marked once a student's device connects to the classroom's designated AP during lecture hours.

This solution removes the need for QR codes, manual signing, or additional hardware installation. Since every student already connects to Wi-Fi during class, the process becomes seamless and passive. A backend system will periodically collect connection data from the

APs, verify student identities based on login credentials, and update attendance records in real time.

By leveraging the existing Wi-Fi network, this approach ensures accuracy, scalability, and minimal cost while requiring no change in student behavior or classroom infrastructure.

Implementation Methodology

The prototype was developed to demonstrate how attendance can be automatically recorded through students' Wi-Fi connections without requiring manual input or QR code scanning. The system operates by identifying the connection between a student's registered device and the access point (AP) corresponding to their classroom.

The implementation consisted of three main stages:

1. **System Design and Setup**
   The prototype was designed using a networking simulation software to interface Wi-Fi networks, utilizing access point connection logs or API data to detect when a registered device connects to the network during a scheduled class period. A small backend server was built to collect, process, and store this connection data in real time.

2. **Device Registration and Authentication**
   Each student's device was registered in the system using its unique login credentials which include the id of each student. This ensured that attendance detection remained accurate and associated with the correct student identity.

3. **Attendance Processing and Visualization**
   Once the backend server received connection data, it automatically verified whether the student was connected to the correct classroom AP within the scheduled time window. Attendance records were then updated and displayed on a simple dashboard for instructors to review.

Conclusion

The current attendance process relies on outdated and inefficient methods such as manual signing or volatile QR code scanning, both of which are time-consuming and susceptible to error or tampering. The proposed Wi-Fi-based attendance system offers an open, automated alternative that leverages the university's existing network infrastructure to record attendance accurately and conveniently.

By leveraging students' connection data from classroom access points, the system eliminates additional hardware, minimizes classroom disruption, and offers a more inclusive process —

especially in consideration of the university's policy requiring a minimum attendance percentage to pass a course. Implementing such a system not only simplifies administrative tasks but also resonates with the university's and the country’s broader goals of digital transformation and smart campus development.

This proof of concept demonstrates the feasibility of the solution and can serve as a foundation for additional development and integration with existing learning management systems. With minimal adjustments and institutional support, this project has the potential to evolve into a full-fledged working attendance solution that saves time, is more accurate, and promotes transparency in all classes.