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Mobile Based Classroom Management System

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ABSTRACT

This project addresses the inefficiency of traditional academic management systems, which often lack secure and reliable methods for tracking attendance, assignments, and student performance. The objective is to develop a mobile-based Digital Classroom Application that simplifies these processes while ensuring transparency and security. The application is built using Flutter (Dart) for a seamless Android user interface and Firebase as the backend for authentication, real-time database management, cloud services, and push notifications. A key feature is the smart attendance system, which allows attendance only when students are connected to the college Wi-Fi network and verified through fingerprint authentication using Android's WiFi Manager API and Biometric Authentication API. The system demonstrates improved accuracy in attendance tracking, efficient data management, and enhanced security. It also facilitates better communication between students and faculty. Overall, the application provides a secure, efficient, and user-friendly platform that automates academic activities and strengthens digital learning environments

1. INTRODUCTION

In today's digital era, education is transforming with technology to enhance accessibility, efficiency, and communication. Traditional classroom methods often cause errors in managing attendance and assignments. To address this, the Digital Classroom App simplifies academic management for students and teachers It allows assignment submission, progress tracking, and efficient attendance management through a Smart Attendance System that verifies students via fingerprint and campus Wi-Fi, preventing proxy attendance. Developed using Flutter and Firebase, the app ensures secure authentication, real-time updates, and cloud-based data storage. With

integrated Wi-Fi and biometric APIs, it enhances transparency and accuracy Overall, this app provides a secure, user-friendly, and automated platform that makes learning and administration smarter, faster, and more reliable Inaccurate and inefficient academic management due to manual processes in attendance tracking, assignment handling, and performance evaluation. This work addresses challenges in academic management such as manual attendance, poor coordination, and data inefficiency. Using Flutter and Firebase, the app provides an automated, secure, and user-friendly platform with Wi-Fi and biometric-based smart attendance for a transparent and efficient digital classroom experience

2. LITERATURE REVIEW

In recent years, the use of digital platforms for managing academic activities has gained significant attention due to the limitations of traditional classroom management systems. Many researchers have explored technology-based solutions such as mobile applications, cloud computing, and biometric authentication to improve attendance tracking, assignment management, and communication between students and faculty. Earlier systems mainly focused on web-based classroom portals where teachers could upload assignments and students could view course materials or submit work online. For instance, several studies proposed web portals that allow faculty to record attendance and share academic resources through centralized databases. These systems improved accessibility and organization of academic information but still relied heavily on manual attendance entry and lacked strong verification methods. As a result, issues like proxy attendance and inaccurate records were common.

Table 1: Comparative Analysis of Existing Mobile-Based Classroom Management and Attendance Systems

Author(s)	Title	Merits	Demerits
P. Patel et al., 2022	Smart Attendance Using RFID	Automates attendance marking; reduces manual effort; improves record accuracy	Prone to proxy attendance; requires RFID cards; additional hardware needed; higher cost
Nesma Abd El-Mawla et al. (2022) App	Smart Attendance System Using QR-Code, Finger Print and Face Recognition	Combines multiple biometric methods for enhanced accuracy; IoT-based system	May require additional hardware; potential latency in data.
K. Marimuthu (2023)	Android Based College App	Comprehensive platform integrating attendance, exams, and notifications; cross-platform compatibility	May lack advanced biometric security features; performance dependent on device specifications
RajPatil25 (2023)	Campus App using Flutter and Firebase	Modular design catering to students, teachers, and admins; supports real-time updates	Limited focus on biometric attendance; may require customization for specific institutional needs
Shrimad-Bhagwat (2023)	The Classroom: Flutter & Firebase-Based Educational App	User-friendly interface; integrates various educational tools	Absence of biometric attendance system; potential scalability issues
M. Rahaman (2025)	SmartPresence: Wi-Fi-based Online Attendance Management	Utilizes Wi-Fi signals for seamless attendance marking; real-time data synchronization	Dependent on stable Wi-Fi connectivity; potential privacy concerns

3. PROBLEM STATEMENT

The management of academic activities in many educational institutions still faces several challenges due to the lack of efficient digital systems. On one hand, colleges and universities handle a large number of tasks such as attendance tracking, assignment management, and academic record maintenance, while on the other hand, many of these processes are still carried out using traditional or semi-digital methods. The absence of a centralized application to manage attendance, assignments, and academic information makes the overall system less organized and time-consuming. In many cases, attendance is recorded manually or through simple systems that are prone to proxy attendance and misuse, which reduces the reliability and transparency of student. Another major limitation of the existing systems is the lack of secure verification mechanisms such as Wi-Fi based location validation and fingerprint authentication to ensure that the student is physically present in the classroom while marking attendance. Assignment tracking is also often managed manually, which can lead to delays, missing submissions, and difficulty in maintaining proper records. Communication between students and faculty is another challenge, as there is usually no dedicated platform for sharing announcements, updates, or academic information in real time. Furthermore, students often find it difficult to access their academic records, attendance status, and assignment updates quickly and efficiently. As a result, the overall academic management process becomes less efficient, less secure, and more dependent on manual effort.

4. OBJECTIVE

Secure digital classroom platform: The system should provide a mobile-based platform to manage attendance, assignments, and academic records in a single application, enabling easy interaction between students and teachers.

Smart attendance verification: The system should mark attendance only when the student is connected to the authorized college Wi-Fi network and verified through fingerprint authentication to prevent proxy attendance.

Real-time academic data management: The system should support real-time synchronization of academic information between the application and the server. Updates related to attendance records, assignment submissions, and performance reports should be reflected instantly for both students and faculty members.

Data security and privacy: The system should ensure strong protection of academic data and student information. Secure login authentication, encrypted cloud storage, and controlled access permissions should be used to prevent unauthorized access or tampering with academic records.

Improved student–faculty communication: The system should provide an effective communication channel between students and teachers. Important updates such as assignment deadlines, announcements, attendance reminders, and academic notifications should be delivered through real-time alerts within the application.

5. METHODOLOGY

The proposed method for the Flutter-Based Digital Classroom App with Smart Attendance System is designed as an automated system that integrates attendance management, assignment tracking, performance monitoring, and reporting. The app uses Flutter (Dart) for front-end development and Firebase for backend services, ensuring real-time data synchronization and secure cloud storage. The system operates through several main stages, as described below:

Requirement Analysis:

Identify challenges in traditional manual systems, such as repetitive data entry, inaccurate attendance, and difficulties in generating reports. Determine key features required for the app, including attendance tracking, assignment management, academic performance monitoring, and report generation.

System Design:

Design a user-friendly interface using Flutter (Dart) to ensure smooth navigation for students and teachers. Plan the backend structure with Firebase for real-time database management, cloud storage, and authentication.

Attendance Management:

Integrate Wi-Fi verification to ensure students are physically present on campus before marking attendance. Implement biometric fingerprint authentication for identity verification.

Data Management and Storage:

Use Firebase real-time database to store attendance, assignment, and academic performance data securely, ensure data is synchronized instantly across devices, allowing students and teachers to access up-to-date records anytime.

Report Generation:

Develop automated tools to generate weekly, monthly, and consolidated attendance reports. Include performance analysis and summaries to assist teachers and administrators in decision-making Ensure reports are accurate, reliable, and easily retrievable.

Assignment and Academic Tracking:

Enable teachers to upload assignments and track submissions through the app. Allow students to view deadlines, submit work digitally, and monitor their academic progress in real- time.

Testing and Validation:

Conduct multiple testing phases to ensure functionality, security, and usability. Test Wi-Fi and biometric authentication modules for accurate attendance recording. Validate report generation and database synchronization for reliability and efficiency.

Deployment:

Deploy the app on Android devices for real-world use within the institution. Monitor system performance, gather feedback from students and faculty, and implement improvements based on user experience.

6. CLASSIFICATION

System has two major components that are as listed below:

User Section: This module provides a secure login interface for users to access the Digital Classroom and manage smart attendance.



Figure 1: User and Admin login

Classroom Dashboard and Analytics: This dashboard module provides an overview of classroom analytics, including total classes, students, assignments, and overall progress in a simple and interactive interface.

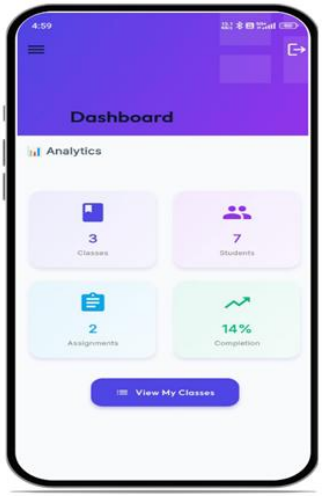

Figure 2: User Dashboard

CONCLUSION

An Attendance Management System is a modern software solution that streamlines administrative tasks in educational institutions, including attendance tracking, fee management, course updates, and communication between teachers, students, and administrators. By automating these processes, it reduces manual effort, saves time, and ensures accuracy, with digitally generated attendance records securely stored online. The system's user-friendly interface allows easy navigation even for users with minimal technical knowledge. Beyond attendance, AMS enables timely course updates, centralized messaging, and notifications, improving collaboration and reducing reliance on physical notices. It also prioritizes data security and privacy, allowing access only to authorized users. Being cloud-based, the system can be accessed from any device with an internet connection, providing flexibility and convenience for administrators, teachers, and students. Overall, implementing an AMS enhances institutional efficiency, supports better teacher productivity, promotes student engagement, and demonstrates the transformative impact of technology in education.

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