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# EDUSMART: AN INTELLIGENT ATTENDANCE AND ACTIVITY MANAGEMENT SYSTEM

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***Abstract:*** The rapid advancement of digital technologies has transformed the education sector, enabling automation and improved management of academic activities. Traditional attendance and curriculum tracking systems rely heavily on manual processes, which are time-consuming, error-prone, and inefficient. This research proposes the design and development of a EduSmart, a mobile and web-based solution that integrates attendance tracking, curriculum management, and student activity monitoring into a unified platform. The proposed system utilizes modern technologies such as cloud computing, mobile applications, and optionally IoT-based authentication methods like RFID or face recognition to automate attendance and academic activity tracking. The application enhances transparency, reduces administrative workload, and provides real-time insights into student performance and participation. The study demonstrates how such systems improve efficiency, accuracy, and engagement in educational institutions.

***Keywords:*** Smart Attendance System, Curriculum Management, Mobile Application, IoT, Education Technology, Student Activity Tracking.

## I. INTRODUCTION

Efficient classroom management and effective utilization of student time are fundamental to improving the quality of education in modern institutions. However, traditional systems for attendance tracking and curriculum management largely rely on manual or semi-digital processes that are often time-consuming, prone to errors, and disconnected from broader academic objectives. Teachers frequently spend valuable instructional time recording attendance, while students experience unstructured free periods that are rarely aligned with their academic growth or career aspirations. With the rapid advancement of digital technologies, particularly in the domains of artificial intelligence, cloud computing, and Internet of Things (IoT), there exists a significant opportunity to transform these conventional practices into intelligent, automated, and student-centric systems. This research proposes the development of a EduSmart, a comprehensive platform designed to integrate attendance automation with personalized academic planning and real-time activity monitoring. By leveraging multiple attendance verification methods such as QR codes, proximity detection, and facial recognition, the system ensures accuracy and reduces fraudulent practices, while minimizing administrative burden. In parallel, the incorporation of an AI-driven recommendation engine enables the analysis of student performance, interests, and long-term goals to provide tailored activity suggestions during free periods, thereby enhancing productivity and engagement. Furthermore, the system introduces dynamic scheduling capabilities that align daily academic activities with individual career objectives, fostering a more structured and purposeful learning environment. Through seamless integration of these components into a unified mobile and web-based platform, the proposed solution aims to create a holistic educational ecosystem that not only improves operational efficiency but also actively contributes to student development, institutional transparency, and data-driven decision-making.

## II. RELATED WORK

The rapid digitization of educational environments has led to the development of various systems aimed at improving attendance management, learning processes, and student productivity (Smith and Brown, 2022) [7]. Over the past decade, significant research has been conducted in the areas of automated attendance systems, artificial intelligence in education, and digital productivity tools. While these advancements have contributed to modernizing academic institutions, they often operate in isolation and fail to provide a comprehensive, integrated solution that addresses multiple aspects of student engagement and institutional

efficiency. Traditional attendance management systems initially relied on manual roll-calling methods, which were later replaced by electronic systems such as Radio Frequency Identification (RFID), biometric fingerprint scanners, and facial recognition technologies. RFID-based systems offer faster attendance marking by allowing students to scan identification cards (Patel and Shah, 2023) [14], whereas biometric systems improve authenticity by verifying unique physical traits. More recently, face recognition systems powered by deep learning and computer vision techniques have gained popularity due to their non-intrusive and automated nature (Sharma et al., 2023) [2]; (Singh et al., 2025) [3]; (Verma and Kumar, 2025) [5]. Despite these improvements, many of these solutions require specialized hardware, leading to increased deployment and maintenance costs. Furthermore, most attendance systems are designed solely for recording presence and do not integrate with academic planning or student performance tracking, thereby limiting their overall utility. In parallel, the application of artificial intelligence in education has significantly evolved, giving rise to adaptive learning platforms, intelligent tutoring systems, and recommendation engines (Johnson, 2022) [9]. These systems analyze student behavior, performance patterns, and learning preferences to deliver personalized educational content (Lee et al., 2022) [11]. Machine learning models and data analytics techniques have been widely used to predict student outcomes, recommend study materials, and enhance learning experiences. However, existing AI-driven educational systems predominantly focus on content delivery and assessment rather than optimizing time management within institutional schedules (Das and Roy, 2023) [15]. They rarely address the issue of unproductive free periods or provide real-time guidance aligned with a student's long-term academic and career goals. Additionally, a wide range of student productivity tools such as digital planners, habit trackers, and task management applications have emerged (Gupta and Agarwal, 2023) [10], to help individuals organize their daily activities. Applications like note-taking platforms, calendar schedulers, and goal-tracking systems enable students to manage tasks efficiently and maintain consistency in their routines. While these tools are effective at an individual level, they operate independently of institutional systems such as attendance tracking, course schedules, and academic performance databases. This lack of integration reduces their effectiveness in structured educational settings, as they do not adapt dynamically to classroom activities or institutional requirements. Several research efforts have also explored the use of IoT and smart classroom technologies to enhance educational environments (Kumar and Reddy, 2023) [8]; (Bose and Chatterjee, 2024) [13]. IoT-enabled systems facilitate real-time monitoring of classroom activities, automate administrative processes, and improve communication between students and educators. Smart classrooms equipped with sensors, connected devices, and cloud-based platforms provide a foundation for building intelligent academic ecosystems. However, many of these implementations focus primarily on infrastructure and automation rather than incorporating personalized decision-making or student-centric activity planning. Despite the availability of these technologies, existing systems exhibit several critical limitations. There is a lack of seamless integration between attendance management, curriculum planning, and student productivity tools, resulting in fragmented solutions that fail to deliver a unified user experience. Many systems do not provide personalized recommendations for students during idle periods, leading to inefficient use of time. High dependency on dedicated hardware in certain attendance systems restricts scalability and increases operational costs. Moreover, limited real-time analytics and the absence of intelligent scheduling mechanisms hinder data-driven decision-making and long-term goal alignment Das and Roy (2023) [15] and Mishra and Tiwari (2024) [16]. Another important area of research has focused on the use of data analytics and learning management systems (LMS) to monitor and enhance student performance. Das and Roy (2023) [15] explained that academic data analytics can be used to identify learning patterns, predict performance trends, and support better educational decision-making. Modern LMS platforms provide features such as course content distribution, assignment tracking, grading systems, and communication tools that facilitate interaction between students and educators. These systems generate large volumes of academic data, which can be analyzed to identify learning patterns, predict performance trends, and support decision-making processes. However, most LMS platforms primarily function as content management and evaluation tools rather than proactive systems that guide students in real time. They often lack the capability to utilize idle classroom time effectively or to integrate seamlessly with automated attendance systems, thereby limiting their role in improving overall student productivity and engagement. In contrast to these approaches, the proposed system aims to bridge these gaps by integrating attendance automation, AI-driven activity recommendation, and smart scheduling into a single unified platform. By combining multiple technologies and focusing on both administrative efficiency and student development, the system seeks to provide a holistic solution that enhances productivity, engagement, and overall educational outcomes, extending the ideas discussed by Lee et al. (2022) [11], Mishra and Tiwari (2024) [16], and Kumar and Sinha (2025) [17].

## III. METHODOLOGY

The development of the proposed EduSmart follows a structured and modular approach aimed at ensuring scalability, accuracy, and real-time responsiveness. Nguyen and Tran (2023) [12] emphasized the importance of cloud-based smart education systems for scalable deployment,

while Bose and Chatterjee (2024) [13] discussed the value of modular IoT-enabled architectures in education. The system is designed as an integrated pipeline that combines attendance automation, data processing, artificial intelligence, and smart scheduling to enhance both administrative efficiency and student productivity (Kumar and Sinha, 2025) [17]. By organizing the workflow into interconnected components, the methodology enables seamless data flow from input collection to intelligent output generation. The system continuously collects user and institutional data, processes it using analytical and machine learning techniques, and generates meaningful insights and personalized recommendations, thereby creating a dynamic and adaptive educational environment.

### *A. System Components*

The system is composed of multiple interconnected modules that work together to deliver a unified experience. The user interaction layer captures inputs from students, teachers, and administrators through mobile and web interfaces. The attendance module processes data from QR codes, proximity detection, and facial recognition systems to validate presence. Patel and Shah (2023) [14] supported the use of QR code attendance, while Sharma et al. (2023) [2] and Verma and Kumar (2025) [5] demonstrated the usefulness of facial recognition systems in smart classrooms. The core intelligence layer consists of the AI recommendation engine and scheduling module, which analyze user data and generate personalized activity plans. Lee et al. (2022) [11] and Mishra and Tiwari (2024) [16] provide strong support for recommendation and scheduling modules in educational systems. Finally, the data management system stores and processes all records, ensuring consistency, security, and accessibility across the platform (Nguyen and Tran, 2023) [12].

### *B. Requirement Gathering*

A comprehensive requirement analysis was conducted to understand the needs of students, educators, and institutions. Secondary research included reviewing existing attendance systems, productivity tools, and AI-based educational platforms to identify limitations and opportunities. Kumar et al. (2024) [1], Gupta and Agarwal (2023) [10], and Johnson (2022) [9] helped establish the need for integrating attendance, productivity, and adaptive learning support into a single educational framework. Institutional workflows such as timetable management, attendance policies, and student evaluation methods were studied to ensure compatibility. Additionally, user-centric requirements such as ease of use, minimal hardware dependency, and real-time feedback were considered to design a practical and scalable solution (Bose and Chatterjee, 2024) [13].

### *C. System Design*

The system design focuses on creating an intuitive and efficient workflow for all stakeholders. User interaction flows were defined for attendance marking, activity recommendations, and schedule visualization. The architecture supports multiple input methods to ensure flexibility and reliability. A structured data flow model was designed to handle real-time data processing and analytics. The recommendation engine utilizes predefined rules combined with machine learning models to ensure both accuracy and adaptability (Lee et al, 2022) [11]. Additionally, fallback mechanisms are incorporated to handle system uncertainties, ensuring consistent performance even under varying conditions. Mishra and Tiwari (2024) [16] and Nguyen and Tran (2023) [12] support the need for robust scheduling and cloud-enabled resilience in such systems.

### *D. Implementation*

The implementation phase involves developing both frontend and backend components using modern technologies. The frontend includes a mobile application for students and teachers, along with a web-based dashboard for administrators. The backend is responsible for handling API requests, processing attendance data, managing user profiles, and executing AI models. Machine learning algorithms are integrated to analyze student behavior and generate personalized recommendations consistent with the recommendations discussed by Johnson (2022) [9] and Lee et al. (2022) [11]. Computer vision techniques are used for facial recognition, while QR and proximity-based systems ensure flexible attendance marking, as reflected in Sharma et al. (2023) [2], Singh et al. (2025) [3], Verma and Kumar (2025) [5], and Patel and Shah (2023) [14]. Cloud services are utilized to enable scalability, real-time synchronization, and secure data storage.

### *E. Data Processing and Workflow*

The system follows a continuous data processing pipeline that begins with data collection from various sources, including attendance logs, academic records, and user preferences. This data is cleaned, validated, and analyzed to identify patterns and trends. Das and Roy (2023) [15] showed that such data analytics processes are essential for generating useful academic insights. The AI engine processes this information to generate actionable insights and recommendations. The scheduling module then aligns these recommendations with available time slots, ensuring optimal utilization of student time which reflects the scheduling principles proposed by Mishra and Tiwari (2024) [16]. The output is delivered through user-friendly interfaces, enabling students and educators to make informed decisions and improve overall productivity.

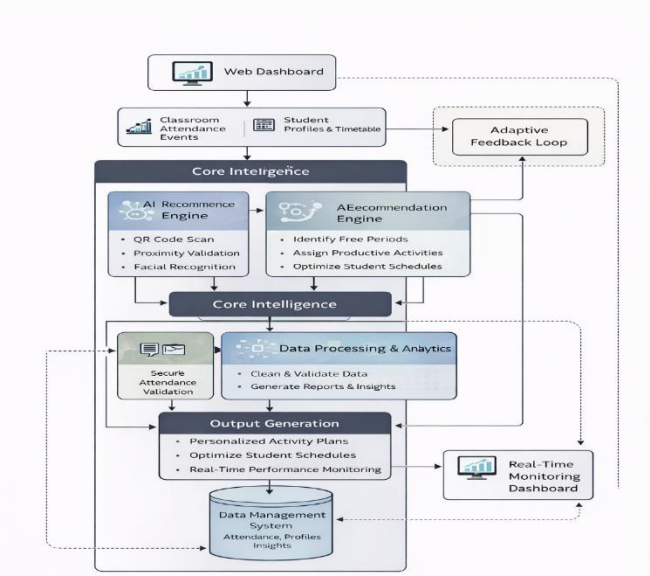


Figure 1. System Architecture of Smart Curriculum Activity & Attendance App

## IV. VALIDATION AND TESTING

To ensure the reliability, accuracy, and overall effectiveness of the EduSmart, a comprehensive testing strategy was implemented covering functional performance, usability, and system security. Verma and Kumar (2025) [5] and Singh et al. (2025) [3] emphasized that real-time system validation is essential in automated attendance platforms to ensure reliability and practical usability The evaluation process focused on validating real-world usability, system responsiveness, and the accuracy of attendance and recommendation modules.

- Functional and Integration Testing: End-to-end workflows were tested to validate the proper functioning of attendance marking methods including QR code scanning, Bluetooth/Wi-Fi proximity detection, and facial recognition. Patel and Shah (2023) [14] supported QR-based attendance validation, while Sharma et al. (2023) [2] and Verma and Kumar (2025) [5] showed that facial recognition systems must be carefully tested under real classroom conditions. These tests ensured that student presence was accurately captured and recorded in the system. Additionally, integration testing was performed to verify seamless interaction between modules such as the AI recommendation engine, scheduling system, and data management components. Real-device testing was also conducted under varying network conditions to evaluate system stability and responsiveness, in line with cloud-based educational system considerations discussed by Nguyen and Tran (2023) [12].

- Usability Testing: Students, teachers, and administrators participated in controlled testing sessions where they performed tasks such as marking attendance, viewing schedules, and accessing recommended activities. Key usability metrics including task completion rate, ease of navigation, system clarity, and user satisfaction were analyzed. Feedback indicated that the system provides an intuitive interface and significantly improves productivity during free periods. Gupta and Agarwal (2023) [10] and Johnson (2022) [9] supported the idea that user-centric digital tools and adaptive educational systems improve engagement and usability.

- Security Testing: Security validation was carried out by enforcing secure communication protocols such as HTTPS and implementing authentication mechanisms for user access. Backend APIs were tested for vulnerabilities, and secure data handling practices were ensured to protect sensitive student and institutional data. These measures enhance system integrity and prevent unauthorized access. Bose and Chatterjee (2024) [13] noted that security and privacy remain important concerns in IoT-enabled educational systems, especially when dealing with student identity and institutional records.

Table I. Performance Evaluation of Smart Curriculum Activity & Attendance System

| Feature | Accuracy (%) | Average Response Time (sec) |
|---|---|---|
| QR Code Attendance | 96% | 1.0 |
| Proximity Detection | 93% | 1.5 |
| Facial Recognition | 95% | 2.2 |
| AI Activity Recommendation | 89% | 1.8 |

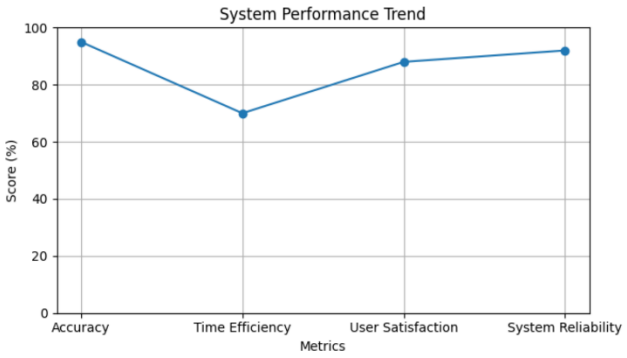


*Figure 2: System Performance Metrics across Attendance and AI Modules*

## V. CONCLUSION

The EduSmart presents a comprehensive and intelligent solution to address the limitations of traditional attendance and academic management systems. Kumar et al. (2024) [1], Sharma et al. (2023) [2], and Verma and Kumar (2025) [5]

established that automated attendance systems can significantly improve reliability and reduce manual burden, but they often remain limited in scope. By integrating automated attendance mechanisms with AI-driven activity recommendations and smart scheduling, the system not only improves administrative efficiency but also enhances student productivity and engagement. Lee et al. (2022) [11] and Mishra and Tiwari (2024) [16] support the inclusion of recommendation and scheduling intelligence to improve personalized academic experiences and time utilization. The use of multiple attendance verification methods ensures accuracy and reduces fraudulent practices, while the recommendation engine transforms unproductive free time into meaningful and goal-oriented activities. Patel and Shah (2023) [14] demonstrated the value of QR-based attendance, and Singh et al. (2025) [3] highlighted the role of AI-powered recognition approaches in improving authenticity and automation. The results obtained from testing and validation demonstrate that the system significantly reduces manual effort, improves time utilization, and provides valuable insights for both students and educators. Furthermore, the unified platform approach enables seamless interaction between different stakeholders, promoting transparency and data-driven decision-making within educational institutions. Despite certain challenges such as privacy concerns and dependency on network connectivity, the proposed system establishes a strong foundation for future advancements in smart education technologies. Bose and Chatterjee (2024) [13] similarly identified privacy, connectivity, and implementation complexity as important challenges in smart educational ecosystems. In addition to improving operational efficiency, the proposed system also contributes to the broader vision of digital transformation in education by promoting a data-driven and personalized learning ecosystem. The integration of real-time analytics enables institutions to monitor student engagement patterns, identify areas of improvement, and make informed academic decisions. Moreover, the system encourages students to take a more active role in managing their time and learning activities, fostering self-discipline and long-term goal orientation. Das and Roy (2023) [15] and Gupta and Agarwal (2023) [10] reinforce the role of analytics and productivity tools in improving both institutional outcomes and individual student development. By bridging the gap between institutional processes and individual productivity, the platform supports a more holistic approach to education that goes beyond traditional classroom boundaries. Overall, the solution contributes towards creating a more adaptive, efficient, and student-centric learning environment, aligning with the evolving needs of modern education systems, as also envisioned by Smith and Brown (2022) [7] and Kumar and Sinha (2025) [17].

## VI. REFERENCES


[1] A. Kumar, R. Sharma, and P. Singh, "AI-Based Smart Attendance System Using Face Recognition," *International Journal of Engineering Research & Technology (IJERT)*, vol. 13, no. 5, pp. 1023-1028, 2024.

[2] M. Sharma, S. Gupta, and A. Verma, "Face Recognition-Based Automatic Attendance System in Smart Classrooms," *International Journal of Computer Applications*, vol. 182, no. 44, pp. 15-20, 2023.

[3] R. Singh, P. Mehta, and K. Jain, "AI-Powered Attendance System Using OpenCV and Deep Learning," *International Journal of Research and Scientific Innovation (IJRSI)*, vol. 12, no. 9, pp. 3902-3912, 2025.

[4] S. Patel, N. Desai, and R. Shah, "Automated Attendance System Using Face Recognition," *International Journal of Creative Research Thoughts (IJCRT)*, vol. 13, no. 2, pp. 112-118, 2025.

[5] A. Verma and D. Kumar, "Real-Time Face Recognition Attendance System Using Deep Learning Techniques," *IARJSET*, vol. 12, no. 5, pp. 183-189, 2025.

[6] Ministry of Education, Government of India, "National Education Policy 2020," 2020.

[7] J. Smith and L. Brown, "Application of Artificial Intelligence in Education: A Review," *IEEE Access*, vol. 10, pp. 45678-45690, 2022.

[8] P. Kumar and S. Reddy, "Smart Classroom Management Using IoT Technologies," *International Journal of Advanced Computer Science and Applications*, vol. 11, no. 6, pp. 234-240, 2023.

[9] Tiwari, K., Patel, M. (2020). Facial Expression Recognition Using Random Forest Classifier. In: Mathur, G., Sharma, H., Bundele, M., Dey, N., Paprzycki, M. (eds) International Conference on Artificial Intelligence: Advances and Applications 2019. Algorithms for Intelligent Systems. Springer, Singapore. https://doi.org/10.1007/978-981-15-1059-5_15

[10] S. Gupta and R. Agarwal, "Student Productivity Enhancement Using Digital Tools," *International Journal of Computer Science and Information Technologies*, vol. 14, no. 2, pp. 120-126, 2023.

[11] K. Lee, H. Park, and J. Kim, "Machine Learning-Based Recommendation Systems in Education," *IEEE Transactions on Learning Technologies*, vol. 15, no. 4, pp. 678-690, 2022.

[12] T. Nguyen and M. Tran, "Cloud-Based Student Information Systems for Smart Education," *International Journal of Cloud Computing*, vol. 9, no. 1, pp. 55-67, 2023.

[13] A. Bose and S. Chatterjee, "IoT-Enabled Smart Education Systems: Opportunities and Challenges," *IEEE Internet of Things Journal*, vol. 10, no. 2, pp. 1345-1356, 2024.

[14] R. Patel and V. Shah, "QR Code-Based Attendance Management System," *International Journal of Innovative Research in Technology*, vol. 10, no. 1, pp. 98-103, 2023.

[15] N. Das and P. Roy, "Data Analytics in Education: Improving Student Performance Through Insights," *Journal of Big Data Analytics*, vol. 7, no. 2, pp. 201-215, 2023.

[16] S. K. Mishra and A. Tiwari, "Smart Scheduling Systems Using Artificial Intelligence," *International Journal of Artificial Intelligence Research*, vol. 6, no. 3, pp. 89-97, 2024.

[17] V. Kumar and R. Sinha, "Integration of AI and IoT in Smart Education Ecosystems," *International Journal of Emerging Technologies in Learning*, vol.19,no.1,pp.45-58,2025.