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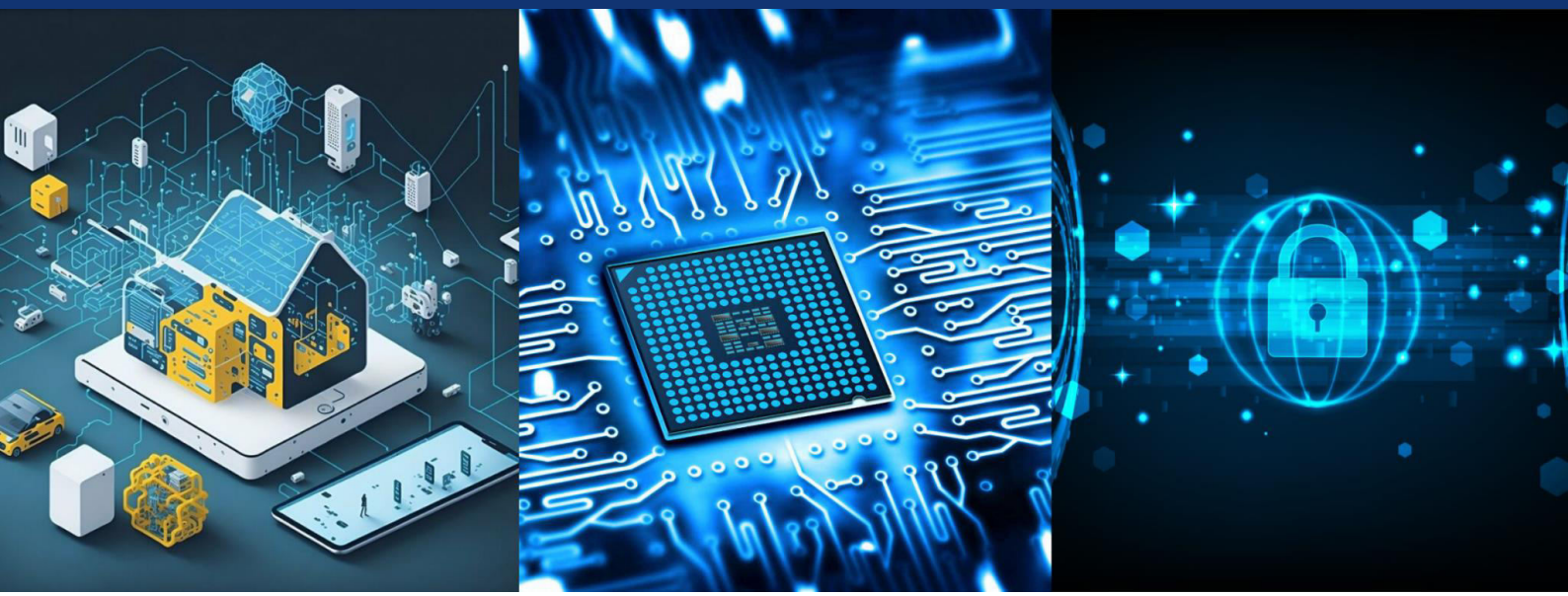

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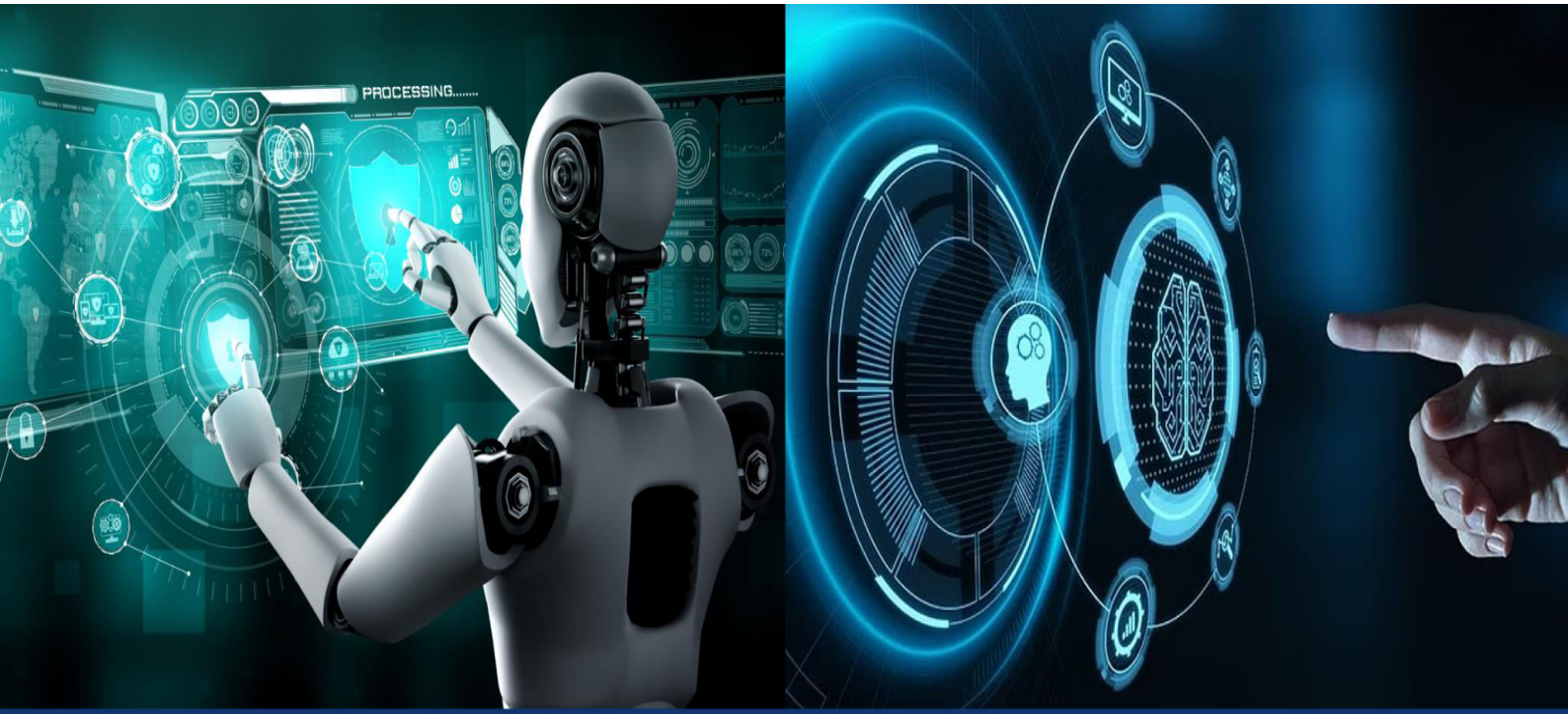

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DPCOE Studion – Student Management System

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ABSTRACT: The rapid digital transformation in educational institutions has created a need for intelligent systems that improve efficiency, security, and transparency. This paper presents the DPCOE Studion, an AI-based Student Management System that integrates face recognition and GPS-based geofencing for accurate and automated attendance tracking. Traditional attendance systems suffer from issues such as proxy attendance, manual errors, and lack of real-time monitoring. The proposed system eliminates these limitations by using computer vision and deep learning algorithms to identify students in real time. Additionally, the system provides a centralized platform for managing student services such as document requests, fee details, and gate pass approvals. The integration of personalized dashboards for students, faculty, and administrators enhances usability and communication. Experimental results show that the system achieves high accuracy and reduces administrative workload significantly. This system contributes to the development of a smart campus by combining automation, security, and real-time analytics.

KEYWORDS: Face Recognition, Student Management System, AI Attendance, GPS Geofencing, Smart Campus, Automation.

I. INTRODUCTION

In recent years, the rapid advancement of digital technologies has significantly transformed the educational sector, leading to the adoption of smart and automated systems for academic and administrative processes. Traditional student management systems, which rely on manual record-keeping and attendance marking, are often inefficient, time-consuming, and prone to human errors. One of the major challenges faced by educational institutions is proxy attendance, where students manipulate attendance records, thereby reducing the reliability and integrity of academic monitoring systems.

To overcome these limitations, biometric-based systems such as fingerprint and RFID have been introduced. While these systems improve accuracy to some extent, they still have several drawbacks, including high installation costs, physical contact requirements, and vulnerability to misuse [3]. Moreover, such systems fail to provide real-time analytics and centralized access to student-related services, limiting their overall effectiveness in modern academic environments

This paper presents the DPCOE Studion – Student Management System, an AI-based platform designed to automate attendance tracking and student service management. The proposed system integrates real-time face recognition with GPS-based geofencing to ensure accurate and secure attendance marking. It also provides a centralized dashboard for students, faculty, and administrators to access and manage academic services efficiently. By addressing the limitations of existing systems, the proposed solution aims to contribute to the development of a smart, secure, and scalable campus environment.

II. RELATED WORK

The development of automated attendance systems and student management platforms has gained significant attention in recent years due to the increasing need for efficiency, accuracy, and security in educational institutions. Traditional attendance systems, which rely on manual entry or paper-based records, are often inefficient, error-prone, and susceptible to proxy attendance [1]. These limitations have motivated researchers to explore automated solutions using biometric and intelligent technologies. Early approaches to attendance management utilized biometric systems such as

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fingerprint and RFID-based identification. These systems improved accuracy compared to manual methods but introduced challenges such as high implementation cost, maintenance issues, and hygiene concerns due to physical contact [2][3]. Additionally, RFID-based systems can be misused if cards are shared among students, leading to inaccurate attendance records [4]. With advancements in computer vision, face recognition has emerged as a reliable alternative for attendance systems. The Haar Cascade classifier, proposed by Viola and Jones, is widely used for real-time face detection due to its efficiency and speed [5]. For face recognition, algorithms such as Local Binary Pattern Histogram (LBPH) have been used extensively because of their robustness to lighting variations and low computational requirements [6]. These techniques laid the foundation for real-time face recognition-based attendance systems. Recent studies have focused on deep learning approaches for improving the accuracy of face recognition. Convolutional Neural Networks (CNNs) have demonstrated superior performance in extracting complex facial features and handling variations in pose, lighting, and expressions [7][8]. The introduction of FaceNet further enhanced recognition accuracy by mapping facial images into a high-dimensional embedding space, enabling precise comparison using distance metrics [9]. These advancements have significantly improved the reliability of face recognition systems in real-world applications. Several researchers have proposed AI-based attendance systems that integrate face recognition with real-time monitoring. For instance, systems using OpenCV and deep learning frameworks have achieved high accuracy in detecting and recognizing student faces in classroom environments [10][11]. These systems reduce manual effort and eliminate proxy attendance, making them suitable for modern educational institutions.In addition to face recognition, the integration of Internet of Things (IoT) technologies has further enhanced attendance systems. IoT-based solutions use smart devices and sensors to automate data collection and monitoring, enabling real-time attendance tracking and remote access [12]. However, these systems often require additional hardware infrastructure, increasing complexity and cost.

III. PROPOSED ALGORITHM

A. User Layer

The user layer consists of three main types of users: students, teachers, and administrators. These users interact with the system through a web-based interface. Students use the system to mark attendance, view attendance records, and apply for services such as gate passes and certificates. Teachers monitor attendance and approve requests, while administrators manage the overall system, including user data, reports, and system configuration.

B. Frontend Layer

The frontend layer is developed using modern web technologies such as React or Next.js. It provides a user-friendly interface that allows users to interact with the system efficiently. The frontend includes modules such as the dashboard, attendance interface (camera-based), and service request forms. It communicates with the backend through REST APIs to send and receive data in real time.

C. Backend Layer

The backend layer is implemented using FastAPI or Node.js and acts as the central processing unit of the system. It handles authentication, role-based access control, attendance processing, service request handling, and notification management. The backend also manages communication between the frontend, AI module, GPS module, and database. It ensures secure and efficient data processing through APIs.

D. AI Module (Face Recognition)

The AI module is responsible for face detection and recognition. It uses computer vision and deep learning techniques such as Haar Cascade for face detection and LBPH, CNN, or FaceNet for face recognition. Once a face is detected, the system extracts features and compares them with stored data using similarity measures. This ensures accurate identification of students and prevents proxy attendance.

E. Database Layer

The database stores all essential system data, including student profiles, attendance records, service requests, authentication details, and system logs. Technologies such as MongoDB or MySQL are used to manage structured and unstructured data. This centralized storage allows efficient data retrieval, updates, and reporting.

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F. GPS Module (Geofencing)

The GPS module ensures that attendance is marked only when the student is physically present within the campus. It uses geofencing techniques and calculates the distance between the student's location and the campus location using the Haversine formula. If the student is within the allowed range, attendance is permitted; otherwise, it is rejected.

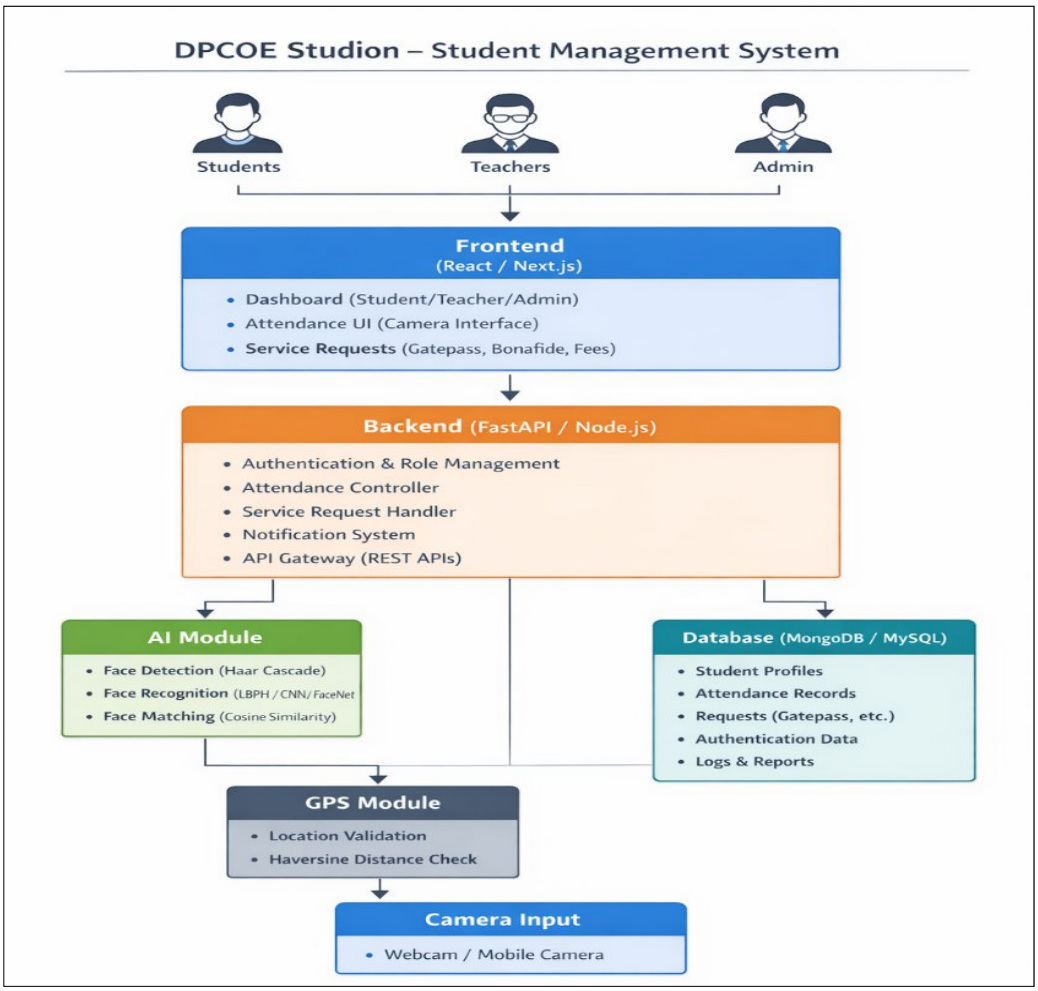

Fig. 1. System Architecture

G. Camera Input Module

The camera input module captures real-time images using a webcam or mobile camera. These images are passed to the AI module for face detection and recognition. This module is essential for enabling contactless and automated attendance marking.

H. Dashboard and Analytics

The dashboard provides a centralized interface for monitoring and analysis. Students can view their attendance and request status, while teachers and administrators can access reports, approve requests, and monitor system activity. It also supports analytics and reporting features for better decision-making.

IV. PSEUDO CODE

Step 1: Capture real-time image of the student using camera.
Step 2: Detect face from the image using Haar Cascade algorithm.

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Step 3: Extract facial features and generate embedding using CNN/LBPH/FaceNet.
Step 4: Compare extracted features with database.
If similarity is greater than threshold, verify student.
Else reject attendance.
Step 5: Capture current GPS location of the student.
Step 6: Calculate distance using Haversine formula.
If distance is within allowed range, verify location.
Else reject attendance.
Step 7: If both face and location are verified, mark attendance and store in database.
Else do not mark attendance.
Step 8: End.

V. SIMULATION RESULTS

The proposed DPCOE Studion – Student Management System was implemented and tested under various real-time conditions to evaluate its performance, accuracy, and reliability. The face recognition module demonstrated an accuracy ranging between 92% to 98%, depending on lighting conditions and facial variations. The system was able to detect and recognize faces within 1–2 seconds, ensuring a fast and seamless attendance process. The integration of GPS-based geofencing successfully validated the physical presence of students within the campus boundary, effectively eliminating cases of proxy attendance. Compared to traditional manual and biometric systems, the proposed system significantly reduced human errors and improved efficiency in attendance tracking.

Furthermore, the system provided a centralized and user-friendly platform for managing student services such as attendance records, document requests, and administrative approvals. The dashboard enabled real-time monitoring and improved transparency among students, teachers, and administrators. The automated workflow reduced paperwork and administrative workload, enhancing overall productivity. However, minor challenges were observed in low-light environments and with changes in facial appearance, which slightly affected recognition accuracy. Despite these limitations, the system proved to be a reliable and scalable solution for smart campus environments, offering improved accuracy, security, and operational efficiency compared to existing systems.

VI. CONCLUSION AND FUTURE WORK

The proposed DPCOE Studion – Student Management System presents an efficient and intelligent solution for modernizing academic and administrative processes in educational institutions. By integrating Artificial Intelligence-based face recognition with GPS-enabled geofencing, the system ensures accurate and secure attendance marking while effectively eliminating proxy attendance and manual errors. The centralized platform provides seamless access to student services such as attendance records, document requests, and administrative approvals, thereby improving transparency and communication among students, teachers, and administrators. The implementation of real-time dashboards and automated workflows significantly reduces administrative workload and enhances overall productivity. Experimental results demonstrate high accuracy and fast processing, making the system suitable for real-time applications in smart campus environments. Although certain challenges such as lighting conditions, facial variations, and privacy concerns exist, they can be addressed through advanced deep learning techniques and improved security mechanisms. The system is scalable, user-friendly, and adaptable to future enhancements such as cloud integration, mobile applications, and advanced analytics. Overall, the proposed solution contributes to the development of a secure, automated, and intelligent student management system that aligns with the vision of digital and smart education.

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