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AI-Powered School ERP System: A Comprehensive Digital Platform For Modern Education Management

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Abstract

The digitization of educational systems has become critical in today's technology-driven world. This paper presents the architecture, design, and development of an AI-powered School ERP (Enterprise Resource Planning) system—a unified platform aimed at enhancing operational efficiency, decision-making, and user engagement in educational institutions [1]. The system integrates a centralized web-based admin panel, mobile applications for parents and students, and bus-attendee modules, supported by AI-powered tools like ChatGPT-based assistants [2] and video analytics for student attendance [6]. This comprehensive solution ensures better communication, transparency, and intelligent automation, making it suitable for schools seeking modernization and smart administration.

Keywords

School ERP, Artificial Intelligence, EdTech, School Management System, ChatGPT Assistant, Education Technology, Video Analytics, Web & Mobile Apps.

1. Introduction

Traditional methods of managing school activities like attendance, fee collection, admissions, and communication are often time-consuming and error-prone. The proposed system addresses these challenges by offering a centralized School ERP that digitally manages academic and administrative tasks through intelligent automation and data-driven processes

[3]. The aim is to empower school management with advanced tools that facilitate smarter decision-making, real-time tracking, and effective stakeholder communication [4].

2. Literature Review

Modern School ERP systems have gradually evolved from basic data entry software into intelligent platforms that incorporate automation, analytics, and mobile access. These developments aim to address the increasing complexity of educational management and enhance operational efficiency in institutions. Owoc et al. [1] outline the growing role of artificial intelligence (AI) in educational technologies, emphasizing its impact on improving student engagement and institutional efficiency.

Sajja et al. [2] highlight how AI-enabled intelligent assistants—specifically those based on large language models like ChatGPT—can facilitate personalized and adaptive learning, as well as administrative support. These assistants serve as a bridge between users and data by offering contextual help, reducing manual overhead for school staff, and improving accessibility. Johnson et al. [11] further support the integration of chatbots in education, noting their potential in automating routine communication and improving student satisfaction.

Kamalov et al. [15] discuss the multifaceted revolution AI is bringing to the education sector. Their study identifies a need for scalable, AI-powered systems that can be adapted to various educational levels and institutional sizes. The proposed ERP system directly aligns with this vision by offering modular components and smart integration of AI tools.

Dong et al. [4] provide a comprehensive review of intelligent and adaptive educational systems, underlining how AI can dynamically respond to changing user needs. They argue that most legacy ERP platforms lack adaptability, a limitation this project aims to address. Meanwhile, Almeman et al. [5] explore the combined potential of AI and metaverse technologies, which although futuristic, point toward the direction modern educational systems are headed.

Gillani et al. [7] critically analyze the lack of transparency in AI-powered education systems and emphasize the importance of designing explainable and ethical AI. This is relevant to the project's use of AI assistants and video analytics, which must operate transparently and securely, especially in environments involving minors.

Practical ERP implementations like the one detailed by Johnson et al. [8] show that most institution-based systems focus narrowly on data management without AI integration. In contrast, this project attempts to build a unified platform that incorporates real-time video analytics for attendance using OpenCV [6], enhancing both automation and accuracy.

As supported by the foundational work on SRS standards (IEEE 830-1998) [1] and
technologies like OpenAI's ChatGPT [13], MongoDB [14], React.js, and Node.js [15], this project integrates modern tools to deliver a robust, scalable, and intelligent school ERP solution. The system bridges critical gaps in traditional ERP systems through AI-based interaction and predictive features, aligning with global trends in educational innovation [3][10].

3. System Design and Architecture

The system follows a microservice-based modular architecture with RESTful APIs connecting the frontend (React/React Native) with the backend (Node.js/Express and MongoDB) [4]. The solution is divided into multiple modules:

- **Admin Panel**: Access to all system functionalities with dashboards, reports, user management, and control over configurations.
- **Mobile Applications**: Separate apps for students, parents, and transport staff for easy interaction and information sharing [7].
- **Marketing Website**: A public-facing portal for admission inquiries and showcasing school features.
- **AI Assistant**: Integrated chatbot using OpenAI's GPT model for admin help and student queries [2].
- **Video Analytics**: Automated attendance using camera feeds and facial recognition models [6].

4. Key Modules

- Admission & Enrollment
- Student & Staff Attendance
- Fees Management
- Time Table Scheduling
- Grade Management
- Events and Announcements
- Push Notifications
- Library and Asset Management
- Subscription Plan (if SaaS)

5. Technologies Used

Component	Technology
Frontend (Web)	React.js
Frontend (Mobile)	Flutter / React Native
Backend	Node.js, Express
Database	MongoDB / Mongoose
AI Assistant	OpenAI API (ChatGPT)
Video Analytics	OpenCV, Python
Hosting	AWS / Firebase
Notifications	Firebase Cloud Messaging

6. AI Integration

6.1 ChatGPT-Based Assistant

A private ChatGPT assistant is embedded in the admin dashboard to answer frequently asked queries, provide quick documentation help, and suggest actions based on usage patterns [2][11].

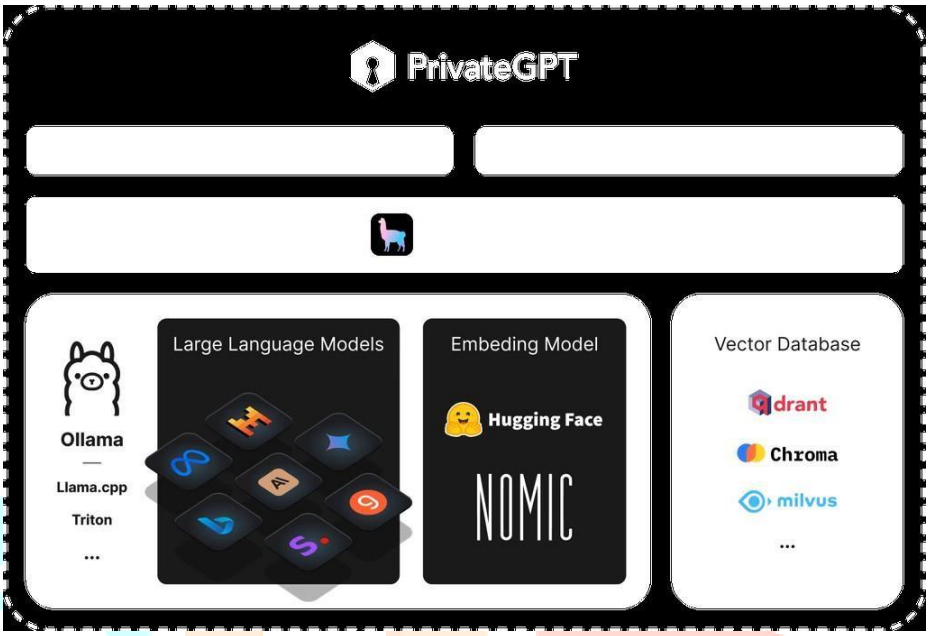

Figure 6.1.1: ChatGPT- Based Assistant

6.2 Video Analytics for Attendance

A computer vision module captures student faces at entry points and matches them against a database for real-time attendance logging. This reduces manual work and increases accuracy [6][13].

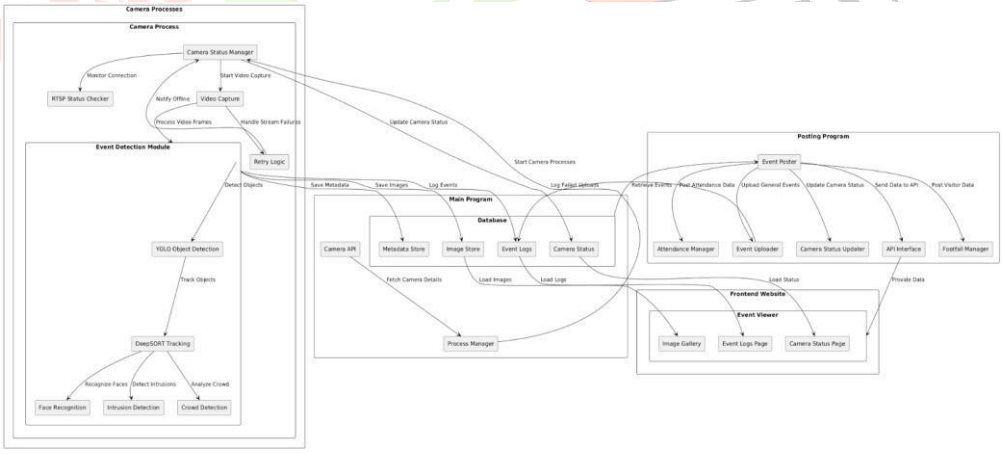

Figure 6.1.2: Video Analytics for Attendance

7. Security Considerations

- JWT-based authentication for all users
- Role-based access control
- Encrypted database fields for sensitive data
- Secure HTTPS communication across services [9].

8. Testing and Validation

- **Unit Testing**: Conducted for backend APIs using Mocha & Chai
- **UI Testing**: Manual testing across devices (desktop/tablet/mobile)
- **Performance Testing**: API stress testing using Postman
- **AI Validation**: Face recognition module tested with 90%+ accuracy rate in various lighting conditions [6].

9. Results

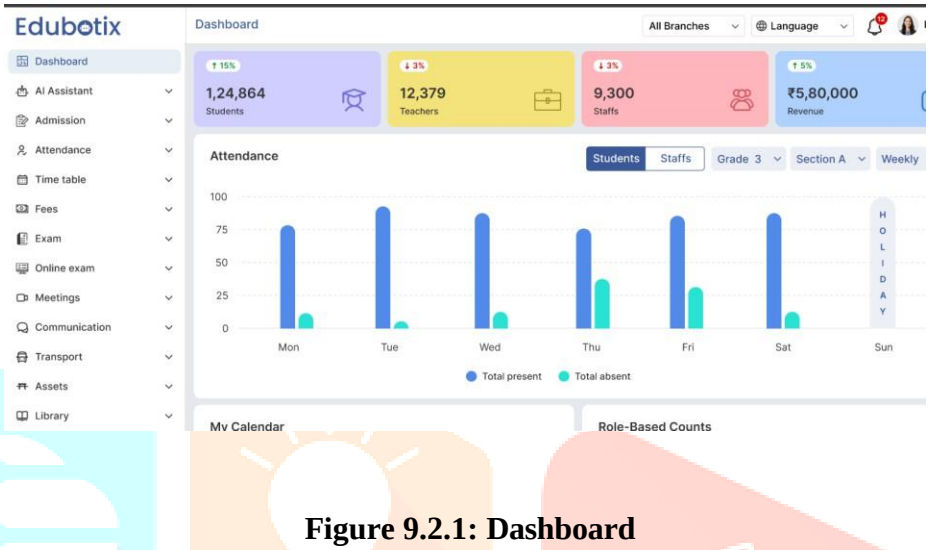

Figure 9.2.1: Dashboard

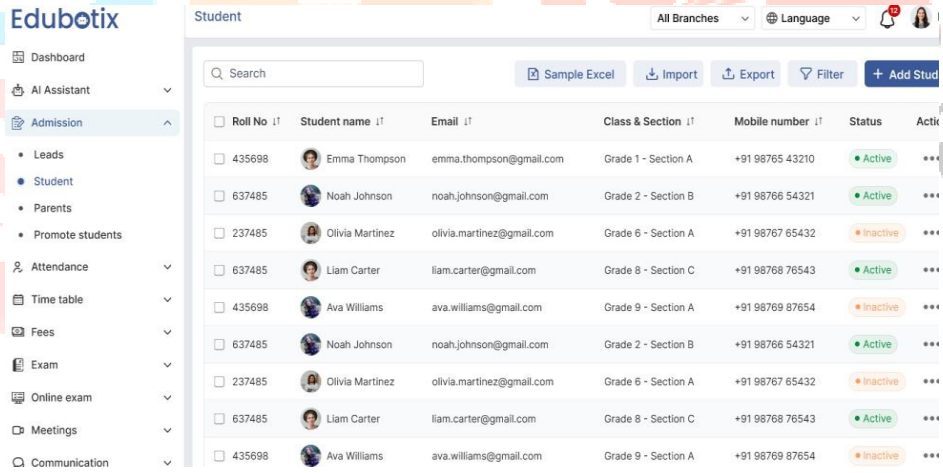

Figure 9.2.2: Addmission Page

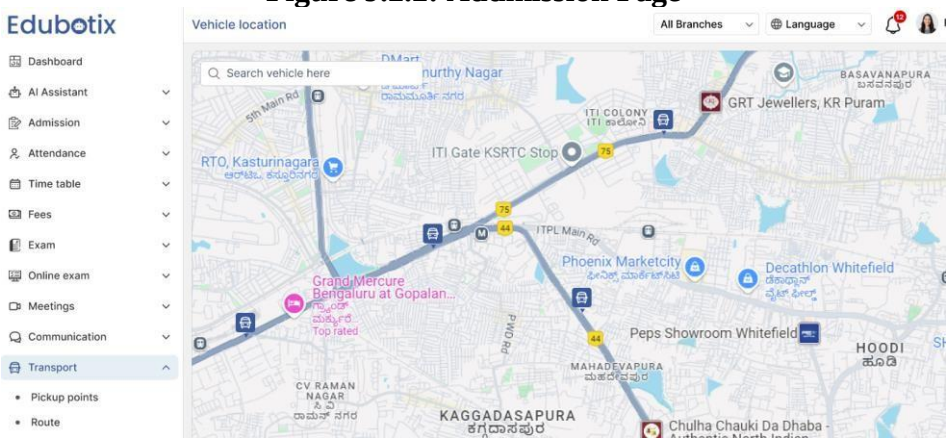

Figure 9.2.3: Transport GPS

10. Conclusion

The AI-powered School ERP System presented in this study demonstrates how integrating artificial intelligence into educational administration can modernize and streamline key operations such as attendance, fee tracking, timetable management, and communication. The system's modular architecture, combining a web-based admin panel, mobile applications, and AI-enhanced features like a ChatGPT assistant and video analytics, enables real-time decision-making and fosters engagement among stakeholders [1][2][6]. AI tools like
intelligent assistants offer scalable support for administrative tasks, while video analytics help automate attendance with high accuracy and minimal human intervention [3][6]. Future enhancements to the system include the implementation of AI-driven academic performance prediction models that can proactively support students based on behavioral and academic data [10]. Additionally, integrating voice-based interactions within the assistant can further enhance user experience and accessibility, especially for younger users or individuals with disabilities [2][11]. Compatibility with national education platforms such as DigiLocker and CBSE APIs will not only ensure compliance with government standards but also broaden the system's reach and acceptance [12]. With its scalable backend and flexible front-end design, the ERP system holds strong potential to evolve into a multi-institutional solution adaptable to colleges and universities, incorporating features like research tracking and alumni engagement. Overall, the system paves the way for a data-driven, intelligent, and inclusive school ecosystem that aligns with global EdTech innovations and the long-term goals of digital education transformation [1][3][10].

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