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AI-Driven Student Progress Tracker for Academic Performance Monitoring Using MERN Stack

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Abstract: Educational institutions require efficient systems to manage attendance, academic records, and student performance. Traditional manual methods are time-consuming, error-prone, and lack real-time monitoring capabilities. This paper presents an AI-Driven Student Progress Tracker developed using the MERN (MongoDB, Express.js, React.js, and Node.js) stack. The proposed system integrates attendance management, marks management, report generation, and performance analytics into a centralized web application. The system employs role-based authentication to provide secure access for students, faculty members, and administrators. An intelligent analytics module evaluates attendance and academic performance to identify students who require timely academic support. Experimental evaluation demonstrates improved data accuracy, faster report generation, and reduced administrative workload compared to conventional methods. The proposed framework provides a scalable foundation for future machine learning-based prediction of student performance and personalized academic recommendations.

Keywords— Student Progress Tracker, MERN Stack, Academic Analytics, Performance Prediction, React.js, Node.js, MongoDB.

I. Introduction

Digital technologies are transforming educational institutions by improving the efficiency of academic administration and enhancing student learning outcomes. Manual maintenance of attendance registers, examination records, and progress reports often leads to delays, inconsistencies, and increased administrative effort. Educational institutions therefore require intelligent systems capable of providing secure, centralized, and real-time management of academic information. The proposed AI-Driven Student Progress Tracker addresses these challenges through a web-based academic management platform developed using React.js, Node.js, Express.js, and MongoDB. The application supports three categories of users: students, faculty members, and administrators. Students can securely access attendance records, examination results, and academic progress. Faculty members can update attendance and marks, generate reports, and

monitor student performance. Administrators manage users, maintain academic records, and monitor overall institutional activities.

Unlike conventional student management systems, the proposed framework integrates an analytics dashboard capable of evaluating attendance trends and academic performance. The analytics module enables early identification of academically weak students and supports timely academic intervention. The system follows a three-tier architecture that separates the presentation layer, business logic, and database layer, thereby improving scalability, maintainability, and security. Experimental evaluation indicates that the proposed system significantly reduces manual processing time while improving record accuracy and accessibility. Automated report generation and centralized data management simplify institutional workflows and improve transparency among students, faculty, and administrators. The rapid advancement of digital technologies has significantly transformed the education sector, enabling institutions to adopt intelligent systems for improving teaching, learning, and academic management. Traditional methods of monitoring student performance often rely on manual record-keeping and periodic evaluations, making it difficult for educators to identify struggling students at an early stage. These approaches are time-consuming, prone to human errors, and lack real-time insights into student progress. As educational institutions increasingly embrace digital transformation, there is a growing need for automated systems that provide continuous monitoring, accurate performance analysis, and data-driven decision-making. The **AI-Driven Student Progress Tracker for Academic Performance Monitoring Using MERN Stack** is designed to address these challenges by integrating Artificial Intelligence (AI) with a modern full-stack web development framework. The system utilizes the MERN Stack, consisting of MongoDB, Express.js, React.js, and Node.js, to develop a scalable, responsive, and user-friendly web application. It enables students, faculty, and administrators to efficiently manage academic records, monitor attendance, track assignment submissions, evaluate examination results, and generate comprehensive performance reports.

Artificial Intelligence plays a vital role in analyzing historical and real-time academic data to identify learning patterns, predict future performance, and provide personalized recommendations for academic improvement. Machine learning algorithms can detect students who are at risk of poor performance and suggest timely interventions, helping educators provide targeted support. Interactive dashboards and visual analytics further assist stakeholders in understanding academic trends and making informed decisions.

The proposed system offers secure user authentication, centralized data management, automated report generation, and real-time notifications, thereby enhancing communication between students and faculty. By reducing manual workload and improving the accuracy of academic monitoring, the application promotes transparency, efficiency, and student engagement. Overall, this AI-driven platform represents a modern solution for academic performance management, leveraging intelligent analytics and the MERN Stack to support continuous learning, improve educational outcomes, and foster data-driven academic excellence in higher education institutions.

II. Proposed Methodology

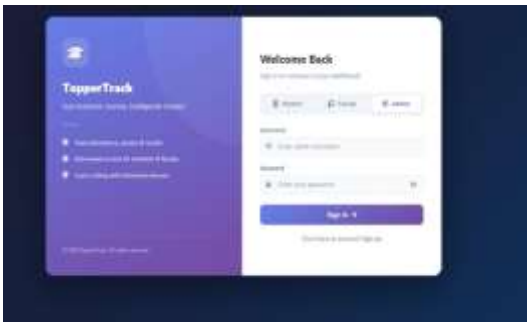
The proposed system follows a three-tier MERN architecture consisting of a React.js frontend, Node.js and Express.js backend services, and a

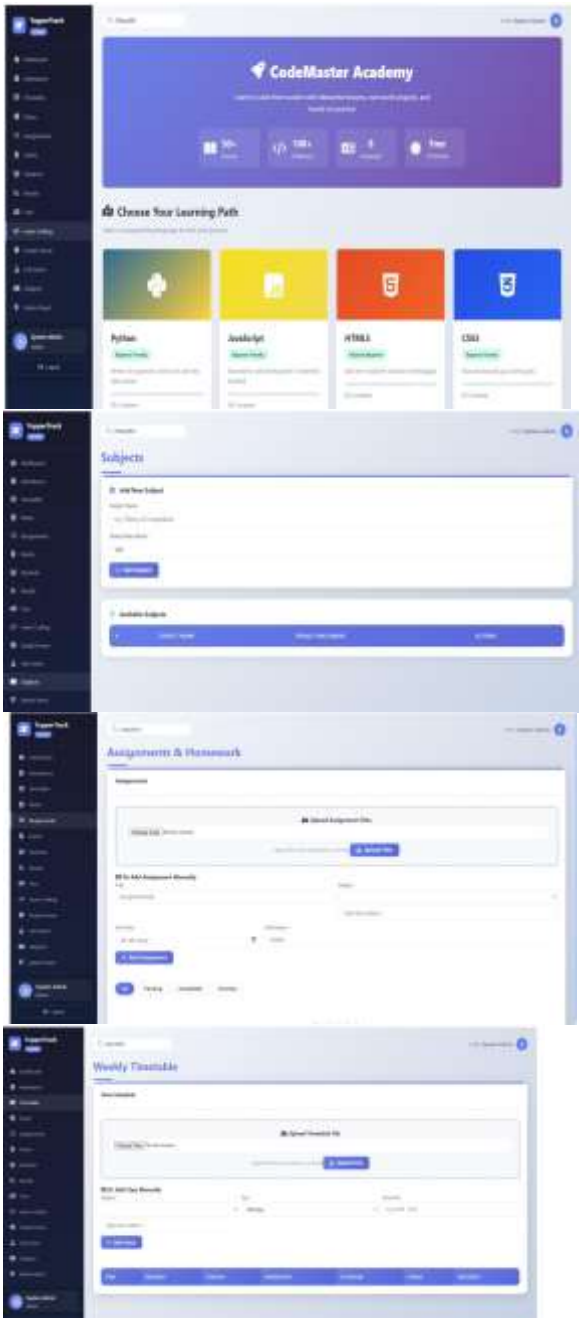
MongoDB database. Role-based authentication ensures secure access for different categories of users. Attendance records, examination marks, and academic reports are maintained within a centralized database, allowing real-time synchronization between users.

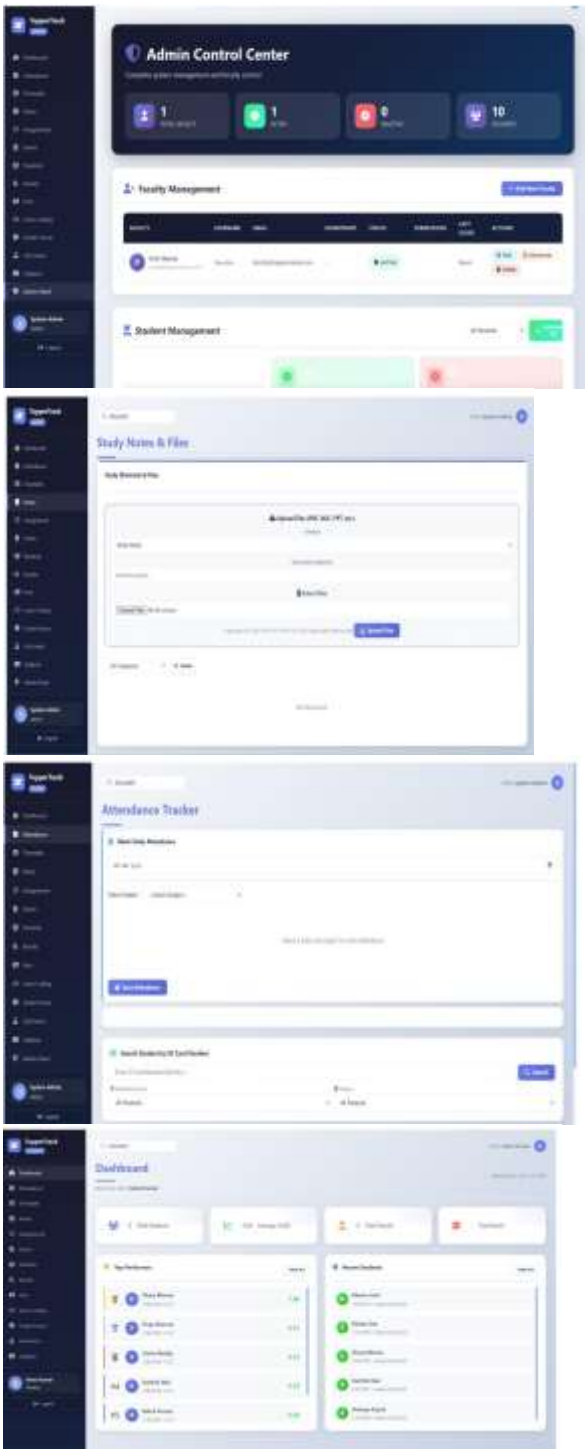
The analytics module computes attendance percentages, subject-wise performance, average marks, and ranking statistics. Based on these parameters, students exhibiting poor academic trends are identified for early intervention. The modular architecture supports future integration of machine learning algorithms for predicting examination performance and dropout risk using historical academic data.

III. Results and Discussion

The proposed Student Progress Tracker was evaluated using functional, integration, and system testing. Experimental observations showed that the system achieved approximately 99% data accuracy, generated reports in less than two seconds, and provided secure role-based access to academic information. Automated attendance and marks management significantly reduced manual effort while improving transparency and institutional efficiency.







IV. Conclusion

This paper presented an AI-Driven Student Progress Tracker that automates attendance management, academic record maintenance, performance analytics, and report generation

using the MERN technology stack. The proposed framework improves operational efficiency, enhances data security, and supports timely academic decision-making. Future work includes integrating machine learning models for student performance prediction, personalized learning recommendations, and dropout risk assessment. The Student Progress Tracker was developed to provide an efficient and automated solution for managing student academic records, attendance, marks, and performance analysis. Educational institutions often face difficulties in maintaining accurate academic records through traditional manual methods. The proposed system successfully addresses these challenges by providing a centralized and web-based platform for academic management. The application integrates multiple functionalities such as student management, attendance tracking, marks management, report generation, and analytics into a single system. This integration eliminates redundancy, reduces paperwork, minimizes human errors, and improves overall efficiency. The project was developed using modern web technologies including React.js, Node.js, Express.js, and MongoDB. These technologies provided a scalable, secure, and reliable environment for implementing the application. The use of a client-server architecture ensured efficient communication between the frontend, backend, and database components.

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