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An Intelligent Platform for Real-Time Academic Progress Evaluation and Data-Driven Learning Enhancement

[1]Kanjariya Jay, [2]Vaghashiya Harekrushn, [3]Patel Niyati, [4]Parmar Devangini, [5]Dr.Shailendra Kumar Mishra, Associate Professor

[1,2,3,4]Student Department of Computer Science Engineering Parul Institute of Engineering and Technology, Parul University,Vadodara, Gujarat

[5]Department of Computer Science Engineering, Parul Institute of Engineering and Technology, Parul University, Vadodara, Gujarat,India

Abstract- The project, presents the design and implementation of an intelligent online academic progress evaluation system that combines state-of-the-art web technologies with advanced artificial intelligence to provide holistic insights into students' academic performance. Unlike conventional platforms that pri- marily display static grades and scores, it leverages modern data processing and AI-driven analytics to convert raw educational data into actionable and personalized feedback. The system architecture integrates Next.js for building a responsive and dynamic frontend, supported by a Node.js backend that manages the core business logic. For persistent and scalable data storage, the platform employs NeonDB (PostgreSQL) in conjunction with Prisma ORM, ensuring efficient querying, data integrity, and seamless integration with modern development workflows. Authentication and authorization mechanisms emphasize security and ease of access through a hybrid model involving JWT (JSON Web Tokens), Passport.js, and federated identity via Google OAuth, thereby enhancing both reliability and user convenience. The AI capability of the system is realized through the GROQ API, integrated with the LLaMA-3.3-70b-versatile large language model. These models enable natural language understanding and generation, empowering the system to conduct tasks such as gen- erating personalized learning feedback, performing performance trend forecasting, and producing automated evaluation reports for educators and institutions. By interpreting performance records, assignment results, and behavioral data, the system provides tailored recommendations that support learner improvement, reduce educator workload, and aid institutions in achieving data- driven educational decisions. In essence, the platform bridges the gap between raw academic data and meaningful educational insights. It transforms academic evaluation from a traditional grade-centric process into a comprehensive, adaptive, and pre- dictive learning support system. This work demonstrates the potential of integrating modern web frameworks with advanced AI methodologies to enrich educational analytics, optimize stu- dent outcomes, and promote personalized learning experiences at scale

Keywords - Academic progress evaluation, online assessment, student performance analytics, machine learning, AI-assisted education.

I. INTRODUCTION

The digital era has transformed the way education is deliv- ered and managed. With the growth of online learning plat- forms, there is a strong need for tools that can not only record students' academic results but also provide meaningful insights into their learning patterns and overall progress[1]. Traditional methods of evaluating performance are often limited to test scores, manual grading, and simple record-keeping. These approaches are not only time-consuming but also offer very little personalized guidance to students, leaving teachers and institutions with an incomplete picture of academic growth. To address these challenges, we propose, an intelligent and fully web-based platform designed to simplify and improve the pro- cess of academic evaluation. The platform goes beyond

simply recording grades by analyzing patterns in student performance, identifying strengths and weaknesses, and generating useful feedback[6]. This reduces the burden on teachers and gives students clearer directions on how they can improve. From a technological perspective, is built using modern web frame- works to ensure speed, reliability, and scalability. The frontend is developed with Next.js, providing a smooth, responsive user interface, while the backend is powered by Node.js, which manages the system's core operations[3].

To store and orga- nize student data efficiently, the system uses NeonDB (Post- greSQL) with the help of Prisma ORM, ensuring reliable data management and flexibility as the platform grows[4]. Security and ease of use are also central concerns. Authentication is managed through JWT, Passport.js, and Google OAuth, allowing users to log in safely and conveniently, without compromising on data protection[2]. This makes the platform accessible to both students and educators without adding extra complexity to the login process. The most innovative compo- nent of lies in its integration of advanced artificial intelligence. By using the GROQ API and the LLaMA-3.3-70b-versatile model, the system is capable of understanding natural language and generating intelligent insights[5]. These AI features allow to provide personalized feedback to students, forecast future performance trends based on existing data, and automatically generate reports for educators and institutions.

In this way, the platform transforms raw academic data into clear, actionable insights that improve decision-making and learning outcomes. Overall, the proposed system represents a modern, practical solution to one of the key challenges in education: how to evaluate academic progress in a way that is accurate, efficient, and meaningful for all stakeholders. It combines cutting-edge web technologies with the power of artificial intelligence to create a system that supports personalized learning, reduces educator workload, and drives better educational results.

Background and Motivation

In education, timely and accurate feedback is one of the most important factors for improving student learning. When students and teachers can clearly see strengths, weaknesses, and learning trends, they can make better decisions about where to focus effort[7]. However, in many schools and institu- tions, the process of tracking progress is still manual—teachers often have to calculate averages, compare results, and prepare reports on their own. This not only takes time but also delays the feedback that students need to improve. As a result, oppor- tunities for early intervention are often missed, and learners may continue struggling without realizing exactly where help is needed. With the growth of digital learning environments, the amount of data available about student behavior and perfor- mance is increasing. Every test score, assignment submission, and classroom interaction generates valuable information.

Un- fortunately, most of this data is underutilized because existing systems only present the numbers without deeper analysis. There is a clear need for platforms that can transform this raw data into useful insights in real time[8]. Recent advances in cloud computing, artificial intelligence, and modern web frameworks provide an opportunity to meet this need. Cloud platforms allow academic systems to scale easily and handle data for thousands of learners[8]. AI models, especially large language models, can interpret data and provide personalized recommendations in natural language[9].

At the same time, frameworks like Next.js and backend tools like Node.js make it possible to build fast, reliable, and user-friendly platforms at low cost[3]. The motivation behind developing is to combine these technologies in a practical system that makes academic evaluation smarter and more accessible. By bridging AI-driven analytics with secure and scalable web architecture, allows every student to receive tailored feedback, enables teachers to save time by automating reports, and helps institutions gain a broader understanding of student performance trends. In essence, the project aims to democratize academic progress evaluation—making intelligent academic insights available not just to elite institutions, but to a wide

range of learners and educators, regardless of scale or resources.

Problem Statement

Academic progress tracking still faces several key chal- lenges:

- Traditional academic evaluations are usually done manu- ally, which makes the process slow, sometimes inconsis- tent, and not suitable for giving students continuous or real-time feedback.
- While many digital tools exist, most of them only store grades and display results. They rarely combine advanced features like detailed data analysis, AI-driven insights, and secure yet easy-to-use interfaces in a single platform.
- Since academic data is sensitive, strong security is es- sential. However, many current systems do not provide reliable solutions for authentication, privacy, and safe data handling[12].
- There is a growing need for an affordable, scalable, and AI-powered online platform that can automate academic evaluation and provide personalized feedback tailored to each student's learning journey.

Scope of the System

The scope of the system defines the main features and functionalities that the system will provide. It focuses on combining advanced web technologies with AI-driven ana- lytics to improve how academic performance is monitored, analyzed, and reported. The system will include the following core features:

- **Data Collection:** The platform will gather student infor- mation from multiple sources such as test scores, written assignments, class participation, and attendance records. This ensures that academic evaluation is not limited to grades alone but considers different aspects of student learning.
- **Secure Authentication and Access Control:** Users (stu- dents, teachers, or administrators) will have to log in through a secure system. The platform will use JWT, Passport.js, and Google OAuth for authentication and authorization, which provides both strong security and easy access through existing Google accounts. Role-based access control ensures that teachers, students, and admins see only the information relevant to them.
- **AI-Powered Analysis:** Using the GROQ API integrated with the LLaMA-3.3-70b-versatile model, the system will analyze student performance patterns. This includes identifying strengths and weaknesses, predicting possible outcomes, and suggesting areas where improvement is needed[5].
- **Personalized Reports and Feedback:** The system will automatically generate customized reports for individual students. These reports will provide not just grades, but clear explanations, actionable feedback, and future learning suggestions for both students and teachers[17].
- **User-Friendly Interface:** The frontend will be built with Next.js to deliver a modern, responsive, and easy-to- navigate interface. Students and teachers will be able to interact with dashboards, graphs, and reports seamlessly without needing advanced technical skills[3].
- **Reliable Data Management:** Academic data will be stored in NeonDB (PostgreSQL) with the help of Prisma ORM. This ensures fast and efficient querying, accurate data handling, and the ability to scale as the system grows to support more users and institutions[4].

Overall, is designed not just as a simple gradebook system but as a comprehensive platform that makes academic evaluation smarter, more secure, and more personalized. It benefits stu- dents by providing actionable insights, supports teachers by reducing workload in reporting, and helps institutions monitor academic performance at scale.

Contribution of the Research

This research makes several important contributions to the field of educational technology by combining modern web frameworks, database management, and advanced AI models into a single platform for academic progress evaluation. The main contributions are:

- **A Full-Stack Academic Evaluation Platform:** The project develops a complete web-based system built with Next.js for the frontend and Node.js for the backend. This ensures that the platform is not only visually friendly and

responsive for students and teachers but also robust and efficient in handling requests and data processing[3].

- **Secure and Flexible Authentication:** The research inte- grates multiple authentication mechanisms such as JWT, Passport.js, and Google OAuth. This makes the system both highly secure (to protect sensitive academic data) and convenient (allowing users to log in with familiar tools like Google without the hassle of creating new accounts)[2].
- **AI-Driven Learning Analytics:** By applying advanced AI technology through the GROQ API and the LLaMA- 3.3-70b-versatile model, the platform can analyze student data in depth. Unlike typical grading systems, this allows the system to provide individualized insights, predict learning trends, and automatically generate natural lan- guage explanations and feedback—making the evaluation more meaningful and personal[5].
- **Scalable and Reliable Database Design:** The project uses NeonDB (PostgreSQL) in combination with Prisma ORM to manage academic data. This ensures data accu- racy, easy query handling, and scalability, meaning the system can grow to support large numbers of students and institutions without performance loss[4].
- **AI-Powered Feedback and Decision Support:** A key contribution is the ability to automatically generate progress reports for students and educators. These reports not only summarize academic performance but also pro- vide clear suggestions for improvement, helping students know exactly where to focus and enabling teachers to save time on repetitive reporting tasks. Institutions can also use these reports for data-driven decision-making at a larger scale[6].
- In summary, this research does not only create a functional academic monitoring tool but also demonstrates how cutting- edge web technologies and AI can be combined to make education more personalized, efficient, and accessible.

II. LITERATURE REVIEW

The integration of Artificial Intelligence (AI) into education has been a significant area of research over the past decade. As machine learning and web technologies have advanced, many researchers have focused on how these tools can im- prove academic evaluation and support personalized learning experiences. Unlike traditional performance tracking, which mainly relies on test scores, recent approaches aim to provide deeper insights into learning progress, student behavior, and future outcomes[1]. One area widely studied is the use of AI-driven performance prediction and feedback systems. Several works propose machine learning models that can predict how well students might perform in future exams by analyzing past grades, participation, and assignment results. These systems also generate personalized feedback that helps learners identify their weaknesses and improve proactively[7].

Such studies form the foundation for it's AI-powered analysis and forecasting features. Another body of work emphasizes scalable database solutions for education. As digital learning expands, educational platforms must handle large amounts of data from thousands of students simultaneously. Research highlights the value of using relational databases such as PostgreSQL along with Object-Relational Mappers (ORMs) like Prisma for efficient data storage, fast querying, and reliability[4].

These findings support it's choice of NeonDB and Prisma ORM for scalable academic data management. Data privacy and protection is also a core concern in ed- ucation research. Studies show that secure authentication frameworks such as JWT and OAuth are among the most effective standards for protecting sensitive student information. By providing encrypted access and role-based control, these mechanisms ensure that only authorized users (students, teach- ers, or admins) can access relevant data[9]. This motivates it's implementation of JWT, Passport.js, and Google OAuth. In parallel, recent advancements in natural language processing (NLP) have introduced powerful models like transformers. Models such as GPT and LLaMA are increasingly explored in educational contexts because they can process large amounts of text, understand context, and generate human-like feed- back[10]. Research

shows that such models can summarize performance, provide learning advice, and assist in creating automated reports[11]. It draws directly from these advances by employing the LLaMA-3.3-70b model via the GROQ API to transform raw student data into meaningful insights. In sum- mary, existing literature highlights four main directions—AI- based prediction and feedback, scalable data handling, secure authentication, and transformer-based NLP models—all of which collectively inspire the design of it. This research builds upon these contributions to create a unified, AI-powered platform that not only evaluates academic performance but also makes the evaluation process smarter, faster, and more personalized.

III. SYSTEM ARCHITECTURE DESIGN

The system architecture follows a modular, layered design with the following components:

- **Frontend Module:** Developed in Next.js to provide responsive, dynamic interfaces for students, teachers, and administrators[3].
- **Backend Module:** Built on Node.js, this server manages API requests, processes business logic, and coordinates with the AI module for data analysis. It ensures se- cure communication between frontend, database, and AI services while handling user actions and data valida-tion[14].
- **Database Module:** Utilizes NeonDB, a cloud-hosted PostgreSQL database, for reliable and scalable storage of academic records, user profiles, attendance, and assess- ment data. Prisma ORM simplifies data operations, en-forces schema consistency, and supports efficient query generation[4].
    - **Authentication Module:** Implements secure user au- thentication and authorization by combining JWT for token-based sessions, z

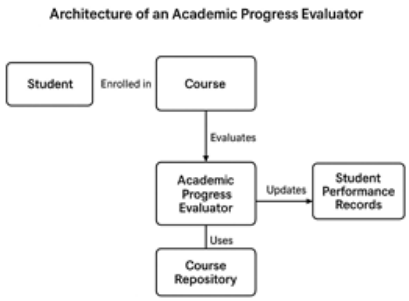

Fig. 1. Block diagram of system architecture for online academic progress evaluation.

IV. IMPLEMENTATION METHODOLOGY

Development followed Agile methodologies with iterative prototyping and continuous integration[14].

Development Framework and Architecture

System Architecture Overview: The architecture of it is designed as a multi-layered framework to ensure scala- bility, performance, and intelligent academic analytics. The frontend layer is implemented using a Next.js application with server-side rendering, which improves both SEO and load performance[3]. The backend layer is built on Node.js using the Express framework and is responsible for handling RESTful API requests, business logic, user authentication, and integration with the AI module for fetching and processing analytics[14].

At the database layer, PostgreSQL is hosted on NeonDB, providing secure storage for academic data, while Prisma ORM serves as an abstraction layer to simplify queries, migrations, and ensure type safety[4]. Authentication is managed through JWT tokens that allow stateless, token- based session management, with Passport.js enabling multiple authentication strategies including Google OAuth for secure single sign-on[2]. Finally, the AI processing layer integrates with the GROQ API and leverages the LLaMA-3.3-70b lan- guage model to deliver natural language processing tasks such as personalized feedback, predictive performance forecasting, and automatic academic report generation[5].

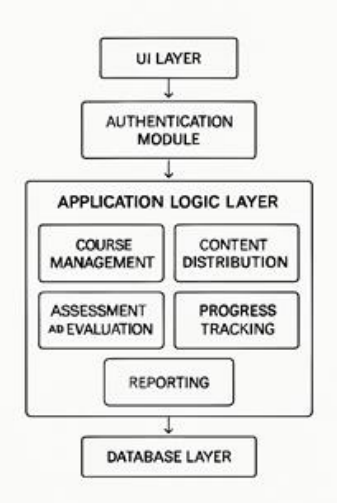

Fig. 2. Development framework and architecture for project, showcasing frontend, backend, database, authentication, and AI layers.

Frontend Implementation

- **Technologies Used:** The frontend of the application is developed using Next.js, which enables fast server-rendered React interfaces that enhance SEO and load speed[3]. Type- Script provides type safety, catching potential errors early in the development process and improving code quality. Tailwind CSS allows for the creation of responsive, modern, and visu- ally appealing user experiences, ensuring consistency across devices. Real-time features are supported through WebSockets, which allow instant updates and notifications without requiring page reloads.
- **User Interface Features:** The user interface is designed to provide a seamless experience to both students and teachers. A central dashboard displays academic metrics at both the individual and classroom levels, serving as a hub for per- formance tracking[13]. An upload interface facilitates secure submission of assignments, records, and academic documents. Interactive charts present data visually, making academic trends and performance easier to interpret. Additionally, the

- system leverages AI-driven personalized feedback modules that provide students with targeted insights into their strengths and weaknesses[17].

Backend Development

- **Node.js and Express Framework:** The backend is pow- ered by Node.js and Express, exposing RESTful APIs that sup- port CRUD operations for user data and academic records[14]. Middleware components are employed to validate requests, enforce authentication rules, and ensure that data handling is both secure and consistent. Integration with the GROQ API extends backend functionality by enabling AI-based analysis and personalized reporting[5].

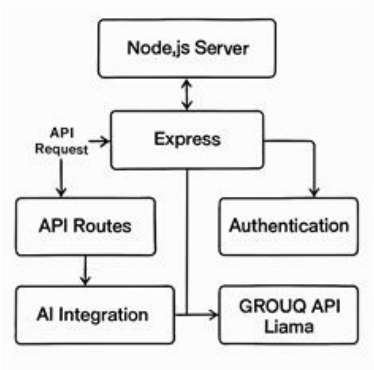

Fig. 3. Backend components using Node.js and Express for API handling, authentication, and AI integration.

- **Authentication:** Authentication is managed using JWT tokens, which provide secure, stateless session handling. These tokens are issued and verified for each request, ensuring that sessions remain lightweight without requiring storage on the server [?]. Passport.js further enables multiple strategies for authentication, including both local username- password logins and Google OAuth 2.0 integration for convenient single sign- on[9]. Advanced security practices such as password hashing and session expiration are also incorporated to strengthen user protection.

Database Management

- **NeonDB and Prisma ORM:** The database layer lever- ages NeonDB to host PostgreSQL, ensuring data persistence, security, and scalability. The schema is carefully structured to organize models for users, courses, grades, assessments, and AI-generated feedback so that

academic records remain easily accessible[4]. Prisma ORM further enhances devel- oper productivity by providing type-safe database queries and streamlined migrations, reducing errors during development. Automated backups and proper indexing strategies are also incorporated to guarantee both reliability and optimized per- formance[19].

AI Module Integration

- **GROQ API with LLaMA:** The AI component integrates with the GROQ API to harness the LLaMA-3.3-70b language model[5]. This enables academic data analysis by identifying trends, strengths, and weaknesses in student performance. Natural language generation capabilities produce detailed and personalized feedback reports, while predictive modeling helps forecast future academic outcomes, supporting timely inter- ventions by educators.
- **API Processing Pipeline:** The API processing pipeline begins with data ingestion and preprocessing, cleaning and formatting the inputs to ensure that analysis is accurate and relevant. AI-generated responses are then parsed for meaning- ful insights, which are seamlessly integrated into the frontend for end-user display. To improve scalability, the system also supports batch processing, enabling group-level or class-wide analytics to be performed efficiently.

V. TESTING AND RESULTS

Security and Authentication Testing

The authentication mechanisms were rigorously tested to confirm both functionality and security. JWT tokens were verified to be securely generated with proper expiration poli- cies[9]. Google OAuth was successfully integrated, allowing for a reliable single sign-on experience. Penetration testing confirmed that no unauthorized access or breaches were present, validating the overall security model used for pro- tecting sensitive academic data.

Performance Testing

Performance was evaluated by testing API response times and database operations. The system consistently responded in under 1.5 seconds during normal usage, ensuring smooth user experience[13]. Database queries optimized with Prisma demonstrated efficient data access even as the dataset grew. AI modules also handled batch analyses without performance degradation, demonstrating the system's robustness for large-scale operation.

Functional Testing

Functional testing validated that academic data such as attendance and scores were processed correctly and reports generated accurately. The user interface was thoroughly exam- ined on various devices and browsers, maintaining consistency across different platforms. Real-time updates and notifications also functioned smoothly, providing instant feedback without requiring manual page refreshes.

VI. CONCLUSION

The proposed system successfully shows how a modern and secure online system can be built to evaluate academic progress using advanced technology. By combining powerful web tools like Next.js for the user interface and Node.js for the server, along with NeonDB PostgreSQL and Prisma ORM for managing and storing student data, the platform ensures smooth, reliable, and scalable performance. Security is a top priority, and by using JWT, Passport.js, and Google OAuth, the platform protects users' privacy while providing easy and secure login options. Using cutting-edge AI technology through the GROQ API and the LLaMA-3.3-70b language model, It offers personalized feedback to students, predicts future academic performance, and automatically generates use- ful reports for educators and institutions. This helps improve learning outcomes by giving clear, data-driven guidance. The project establishes a strong base for future improvements such as mobile apps for learning on the go, more advanced analytics for deeper insights, and adaptive learning tools tailored to each student's needs. Overall, it aims to make academic evaluation smarter, faster, and more accessible for everyone involved in education.

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