

Evalpro: Smart Examination Ecosystem with Real-Time Analytics and AI-Generated Assessments

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Abstract—EvalPro is a web-based Examination and Assessment Management System developed using Spring Boot for the backend and HTML, CSS, and JavaScript for the frontend. The system is designed with three core modules — Student, Staff, and Admin — to streamline assessment, performance tracking, and administrative oversight. Traditional assessment methods rely on periodic exams that fail to capture day-to-day student understanding, leading to undetected learning gaps. The proposed system addresses these challenges by integrating AI-assisted question generation, enabling staff to automatically create topic-based assessments immediately after completing a classroom session. Students can attend these assessments in real time, receive instant feedback, and track their academic progress through graphical analysis. The system promotes continuous learning, reduces manual workload for educators, and supports data-driven academic decision-making, making it a comprehensive solution for modern educational institutions.

Index Terms—Smart Examination, AI Question Generation, Spring Boot, Real-Time Analytics, Student Performance, Web-Based Assessme

I. INTRODUCTION

In the current education system, student assessment primarily depends on periodic internal or final examinations. While these methods provide a broad overview of a student's performance at specific intervals, they often fail to monitor a student's day-to-day understanding of the lessons being taught. As a result, students who struggle with particular concepts may go unidentified for extended periods, leading to significant gaps in learning and reduced overall academic performance. Moreover, traditional exam systems require considerable manual effort from teachers to design questions, evaluate answer sheets, and maintain performance records.

To address these challenges, EvalPro — a web-based Examination and Assessment Management System — has been developed using Spring Boot for the backend and HTML, CSS, and JavaScript for the frontend. The system integrates AI-assisted question generation, enabling teachers to quickly create topic-based assessments immediately after completing a classroom session. Students can then access these assessments on their portal and receive instant feedback, allowing both students and educators to monitor comprehension in real time.

The system includes three distinct modules — Student, Staff, and Admin — which collectively streamline exam management, performance tracking, and administrative oversight. By combining AI technology with real-time analytics, EvalPro aims to enhance learning outcomes, reduce manual workload for teachers, and provide a more personalized and responsive educational environment.

II. LITERATURE SURVEY

Research in the domain of educational technology and student performance prediction has grown significantly in recent years, driven by advances in data science, machine learning, and AI-based assessment tools. Several studies have explored methods to improve student evaluation, identify at-risk learners, and support evidence-based academic interventions.

Mfowabo Maphosa, Wesley Doorsamy, and Babu S. Paul (2024) conducted an exploratory data analysis of student performance patterns in engineering at the University of Johannesburg. The study extracted insights from historical data to understand the influences on student performance. Results revealed gender disparity in engineering enrollments and

highlighted that most student dropouts occurred due to incorrect qualification choices. The study demonstrated that data-driven approaches can significantly reduce dropout rates through appropriate academic advising and support interventions.

Abdullah Alshanqiti and Abdallah Namoun (2020) proposed a hybrid regression and multi-label classification model for predicting student performance and identifying its influential factors. The study combined collaborative filtering, fuzzy set rules, and Lasso linear regression to optimize prediction accuracy of student grades. An optimized self-organizing map was used for multi-label classification of influential factors. Experiments on seven datasets showed considerable improvements over single baseline models, demonstrating the practicality of identifying key factors that affect student achievement in higher education.

Hasnain Ali Shah, Sami Andberg, Anne M. Koivisto, and Roman Bednarik (2023) proposed a multi-model ensemble approach for predicting student performance in higher education. The study compared bagging, boosting, stacking, and voting ensemble methods using combinations of Naive Bayes, J48 decision trees, Adaboost, logistics, and multilayer perceptron algorithms. The results showed that the boosted tree detection method outperforms bagged trees when data size is large, while stacking performs better for smaller datasets. Behavioral analysis of students enabled data-driven academic advice for identified case studies.

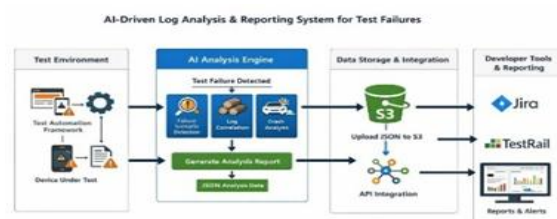
Despite these advancements, existing research primarily focuses on prediction and retrospective analysis rather than real-time continuous assessment. Most existing systems also lack integration between AI-based question generation and immediate student evaluation within a single unified platform. The proposed EvalPro system addresses these gaps by delivering an end-to-end solution that combines AI-assisted assessment creation, real-time evaluation, and comprehensive performance analytics within a user-friendly web-based interface.

2.1 EXISTING SYSTEM

Existing examination management systems largely follow traditional patterns where student assessment occurs at fixed intervals — typically mid-semester or end-of-semester examinations. These systems depend on manual question preparation by teachers, paper-based or basic digital evaluation, and periodic

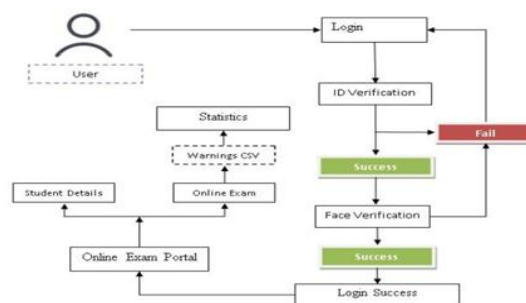
reporting. The key limitations of these existing systems are as follows:

- Efficiency is low due to manual question creation and evaluation processes.
- Low responsiveness — student performance data is only available after significant delays.
- Not user-friendly — students have no immediate access to performance feedback or progress tracking.
- No AI integration for intelligent question generation or adaptive assessment.
- Inability to identify struggling students in real time, leading to unaddressed learning gaps.



2.2 PURPOSE OF WORK

The primary purpose of this work is to develop a smart, AI-powered examination and assessment management system that enables continuous evaluation of student understanding after each classroom session. The system aims to replace periodic, manual-based assessments with instant, topic-driven AI-generated exams. By integrating AI-assisted question generation, real-time evaluation, and graphical performance analytics into a single unified platform, the proposed system significantly reduces educator workload, improves transparency, and supports personalized learning. The system also aims to provide administrators with centralized oversight and comprehensive academic insights for better institutional decision-making.



III. PROPOSED SYSTEM

The proposed system, EvalPro, is a full-stack web application built using Spring Boot for the backend and HTML, CSS, and JavaScript with Tailwind for the frontend. It follows the MVC (Model-View-Controller) architecture and incorporates JWT-based authentication for secure access. The system streamlines exam management through dedicated modules for Students, Staff, and Admin, and leverages AI-based question generation to automate assessment creation after each classroom session.

When a staff member completes a lesson, they input or describe the covered topic into the system. The AI module then automatically generates relevant questions that can be reviewed, edited, or published for students. Once published, the exam is immediately accessible to students on their portal. After completing the assessment, results are evaluated in real time and visualized through graphical dashboards for both students and staff. The key advantages of the proposed system are:

- Timed and secure AI-generated assessments reduce manual question preparation effort.
- Paperless operations improve efficiency and reduce administrative overhead.
- Real-time performance tracking and graphical visualization support data-driven teaching.
- Enhanced transparency through centralized academic data accessible to students, staff, and admin.
- User-friendly interface with role-based access ensures a smooth experience for all actors.



IV. SYSTEM MODULES

EvalPro is organized into three primary functional modules, each designed to meet the specific needs of different user roles within the educational institution.

These modules work together to ensure seamless exam management, continuous assessment, and comprehensive performance monitoring.

a) STUDENT MODULE

The Student module provides learners with a user-friendly platform to actively participate in assessments and monitor their academic progress. Students can register and log in securely to the system, apply or select their respective departments, and access exams scheduled or generated by the staff. Once a topic-based assessment is made available, students can attempt the AI-generated questions in real time. After completing the exam, the system automatically evaluates their responses and displays instant results. Students can view their scores, analyze their performance through graphical representations, and track their daily academic progress. This module encourages continuous learning by helping students identify their strengths and areas that need improvement.

b) STAFF MODULE

The Staff module enables teachers to efficiently manage assessments and monitor student performance using AI-assisted tools. Staff members can register and log in to the system, create and manage exam content, and input or describe topics after completing classroom sessions. Based on the given topic, the AI generates relevant questions that can be reviewed, edited, or updated by the staff using CRUD operations. Teachers can schedule exams, evaluate student responses, and view real-time performance analytics for individual students or entire classes. This module helps staff identify students who are struggling with specific concepts and provide targeted academic support, thereby improving teaching effectiveness and overall learning outcomes.

c) ADMIN MODULE

The Admin module provides overall administrative control and monitoring of the system. Administrators can manage student and staff records, including registration details and departmental information. This module allows access to comprehensive academic data such as exam results, overall marks, and performance trends across departments or classes. Administrators can view analytical dashboards that summarize student progress and staff activities, ensuring

transparency and accountability within the system. By offering centralized oversight and data-driven insights, the Admin module supports effective institutional decision-making and helps maintain the smooth functioning of the examination and assessment management system.

V. SYSTEM DESIGN

The system design of EvalPro follows a layered architecture that clearly separates the presentation, application, and data layers, ensuring modularity, scalability, and maintainability. The overall design is guided by several UML diagrams that together capture the structural and behavioral aspects of the system.

5.1 DATA FLOW DIAGRAM

The Data Flow Diagram (DFD) illustrates how information moves through EvalPro. Input data such as topics from staff, student registration details, and exam responses flow into the system. The AI module processes the topic input to generate questions, which are stored in the exam database. Student responses are processed by the evaluation module to calculate scores and generate performance data. The output data includes exam results, progress reports, and analytical dashboards for students, staff, and admin. This diagram clearly illustrates the transformation of data from input to output across different system components.

VI. CONCLUSION

The proposed web-based Examination and Assessment Management System — EvalPro — provides an innovative and effective solution to the limitations of traditional assessment methods by enabling continuous evaluation and real-time monitoring of student learning. By integrating AI-assisted question generation with Spring Boot and HTML, CSS, and JavaScript technologies, the system allows educators to create instant, topic-based assessments and analyze student performance efficiently.

The inclusion of Student, Staff, and Admin modules ensures seamless interaction, efficient exam management, and comprehensive administrative oversight. Real-time evaluation and graphical performance analysis help identify learning gaps early,

allowing educators to provide targeted support and improve overall academic outcomes. Overall, the system enhances digital learning by promoting personalized education, reducing manual effort for teachers, and supporting data-driven decision-making, making it a valuable and practical tool for modern educational institutions.

VII. FUTURE ENHANCEMENTS

While EvalPro successfully addresses the core limitations of traditional assessment systems, there remains significant scope for further improvement and expansion. The following enhancements are planned for future development:

- Implementing a real-world scalable database infrastructure to evaluate and support more simultaneous connections and higher user loads.
- Improving the efficiency of communication protocols used between the frontend and backend, reducing the number of messages exchanged and optimizing data transfer sizes.
- Integrating two or more advanced AI algorithms to improve question quality, difficulty calibration, and adaptive assessment capabilities based on student performance trends.
- Extending the system into a mobile application to allow students and staff to access assessments and analytics conveniently from smartphones and tablets.
- Incorporating machine learning models for early identification of at-risk students and providing automated academic counselling recommendations.

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