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Automated Learning and Assessment Platform using Gen AI

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ABSTRACT: Traditional academic systems are hindered by manual evaluation, inconsistent feedback, and fragmented data management. To address these limitations, we propose an Automated Learning and Assessment Platform that leverages Gen AI for intelligent academic operations. To highlight the system's effectiveness in enhancing educational workflows, this paper outlines its architecture, implementation, and performance. Using tools like the Gemini API techniques, the system performs semantic matching, mistake analysis, and generates personalized performance insights. This paper outlines the system's architecture, implementation, and performance to demonstrate its effectiveness in enhancing educational workflows.

KEYWORDS: Gen AI, Learning Automation, Educational Technology, Gemini API, Subjective Answer Evaluation, Question Generation

I. INTRODUCTION

A rapid transformation is occurring in the education sector during this digital era. Traditional academic systems, while effective in the past, are increasingly proving to be inadequate in managing the scale, complexity, and personalization required by modern educational institutions. Manual teaching and evaluation processes are time-consuming, prone to human error, and lack the agility required to meet the dynamic needs of students and educators. Faculty members spend a significant amount of time on repetitive administrative tasks such as preparing question papers, evaluating answer scripts, and generating performance reports—time that could otherwise be spent on improving the quality of instruction. On the other hand, students frequently receive feedback that is both generic and delayed, which hampers their motivation to understand and effectively learn from their mistakes.

The need for automation and intelligent digital infrastructure in academia has grown due to the COVID-19 pandemic. Institutions are now seeking solutions that not only digitize learning materials and assessments but also embed intelligence to support personalized learning, automate evaluations, and enable real-time performance analytics. By enabling data-driven insights and automating educational work, Gen AI offers powerful capabilities in this context.

This paper introduces the Automated Learning and Assessment Platform, a comprehensive academic management system that integrates AI and ML to modernize and automate key components of the educational process. The platform's role-based modules have been modified to meet the demands of various stakeholders, comprising university authorities, college administrators, faculties, and students. By leveraging technologies such as Gemini API, semantic similarity detection, and data visualization, the system automates tasks such as question paper generation, subjective answer evaluation, and feedback delivery.

One of the distinctive features of the platform is its use of the Google Gemini API for intelligent question and answer generation. This allows the system to create context-aware and syllabus-aligned assessments with minimal manual intervention. The platform also utilizes API semantic matching techniques to compare student answers with model solutions, offering a fair and consistent evaluation process. Furthermore, the integration of Plotly enables the generation of interactive performance dashboards, helping both students and educators gain deeper insights into academic progress and problem areas.

In addition to reducing the administrative burden on educators, this initiative aims to foster an environment fortinuous, personalized, and analytically driven learning. Through this platform, institutions can achieve standardization in assessment procedures, enhance transparency in evaluations, and make informed academic decisions backed by real-time data.

II. PROPOSED SYSTEM

Within the point to changing customary scholastic workflows into a shrewdly, computerized, and adaptable framework, the Robotized Learning and Assessment Stage may be a measured, role-based advanced plan. This segment diagrams the architecture, components, and useful capabilities of the proposed framework, which bolsters the whole lifecycle of scholastic activities—from substance conveyance and address paper era to reply assessment and criticism announcing Learners can get to the syllabus, address notes, previous, and exam comes about within the Student Module's centralized interface. One of its standout features is the provision of personalized feedback through mistake analysis and performance tracking. This not only encourages self-paced learning but also helps students identify and address their academic weaknesses efficiently.

The Faculty Module is intended to minimize the manual workload associated with teaching and evaluation. Using the Google Gemini API, allows educators to generate AI-based internal and external question papers, upload course materials, and evaluate student responses. The system employs API-based semantic comparison to assess subjective answers, ensuring fair and consistent grading. Additionally, it generates subject-wise performance analytics and identifies common learning gaps to aid in instructional planning.

The College Module serves administrative purposes by enabling internal exam management. Administrators can generate standardized internal question papers based on the uploaded syllabus, monitor academic performance across departments, and produce consolidated internal assessment reports. The module enhances coordination among faculty members and supports institution-wide performance tracking.

The University Module serves as an administrator with an accent on high-level academic administration. It offers resources for creating primary test questions, evaluating academic performance amongst associated schools, and examining vast amounts of student data. By integrating automated analytics, this module supports evidence-based policy-making and helps ensure standardization in assessments across the university.

At the core of the system are several intelligent features, including AI-driven question and key answer generation, automated result processing, mistake tracking, and performance visualization using Plotly. The platform is backed by a SQLite database for efficient data storage and retrieval. Information security and framework intelligence are ensured through the use of secure verification techniques and role-based consents. By automating critical academic functions, the proposed system reduces errors, saves time, and enhances the overall learning and evaluation experience, aligning with the modern demands of digital education.

III. METHODOLOGY

The proposed Automated Learning and Assessment Platform's methodology is structured as a layered structure integrating database operations, backend processing, on the web interaction, user role management, and AI-based external services. This architecture ensures seamless automation of academic workflows while maintaining scalability, security, and efficiency.

The process gets started by assigning roles to a variety of teams, which include students, teachers, college administrators, and university authorities. Each user type is granted controlled access to the system based on their responsibilities. It has secure authentication and authorization. The system allows those with authorization to engage with their related modules.

Clients get to the stage utilizing an select web interface created on Flask and HTML/CSS on confirming. The interface supports essential academic functionalities, including resource sharing (such as lecture notes, syllabi, and model answers), exam management (internal/external paper generation), and performance tracking. It also enables

result analysis and mistake detection, helping students receive personalized feedback. Further, Plotly's graphical data representations enhance understanding of academic performance trends.

User interactions are processed by backend layer, deployed by Python -based flask -based applications. This layer handles logic execution, API calls, file parsing, result calculation, and report generation. It acts as the core computational engine, coordinating between the frontend interface, AI APIs, and database.

The database layer is managed by SQLITE, the database of relations based on important information storage files, including user records, downloaded content, recorded, evaluation results and error analysis. This centralized storage ensures the consistency of data and allows effectively recovery between the tissues.

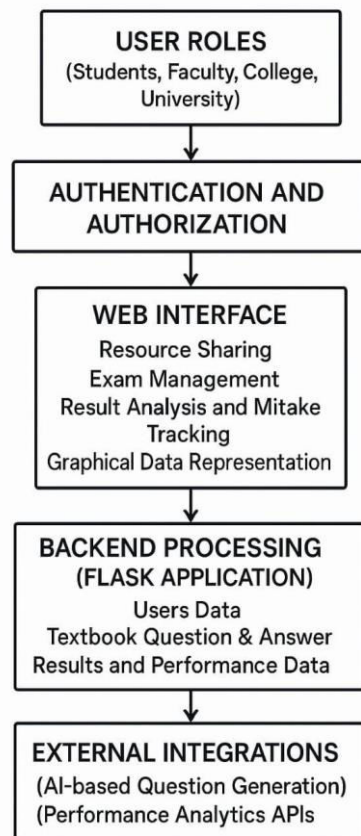


FIG 2 WORKFLOW DIAGRAM

Finally, the platform is equipped with external AI integrations, particularly through APIs like the Google Gemini API, which are used for intelligent question generation, key answer synthesis, and feedback automation. In addition, API analysis external contributes to visualization of performance and comparative relationships between organizations.

This method supports a comprehensive academic ecosystem by automating repetitive processes, improving the accuracy of evaluation and providing real -time data information to all stakeholders.

IV. SYSTEM ARCHITECTURE

The architecture of the Automated Learning and Assessment Platform is designed as a layered and modular framework that integrates Gen AI technologies to automate the academic lifecycle. For university administrators, colleges, faculty, and students, it ensures secure, role-based access. Each of them uses the platform for certain purposes. The system is implemented using Python, Flask for the web interface, and SQLite as the primary database, with AI capabilities

powered by the Google Gemini API and data visualizations handled using Plotly.

At the core of the system lies the Application Layer, which manages all user-facing operations. This platform can be accessed by administrators, university staff and faculty and students on a flask -based web interface. Administrators and members of the lecturer can load the study materials in this layer, such as notes and course programs in PDF format. These documents are parsed using the PyMuPDF (fitz) library to extract meaningful text data. It acts as a basis for the process of creating questions, using the requests invited to API Gemini to create internal and external tests corresponding to the uploaded syllabus.

The application layer also combines control and authentication to ensure that users only access functions related to their tasks Faculty can evaluate student submissions, while students are limited to viewing their results and feedback. Answer sheets submitted by students are evaluated through the Answer Script Comparison module, which applies API techniques—such as keyword extraction, semantic similarity analysis, and length-based scoring—to compare student responses with AI-generated model answers.

After evaluation, the Result and Feedback Generator compiles the scores and generates personalized feedback reports. This is done using data processing libraries such as pandas and xlsx Writer and reports provided in Excel and HTML / PDF formats. Software combines conspiracy to display students' performance and subject performance through graphics and interactive control panels to better understand understanding.

Beneath the Application Layer lies the AI/ML Layer, which acts as a bridge between the front-end logic and the core AI functionalities. To perform activities such as questions and key answer creation, context identification and semantic words, this layer manages communication with AI services like API Gemini. These processes help generate accurate and fair assessments while offering actionable feedback.

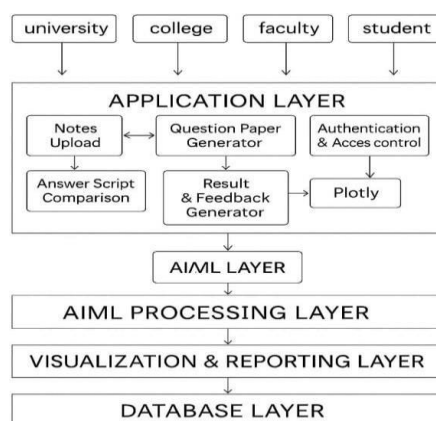


FIG 2: SYSTEM ARCHITECTURE

The evaluation results and the plotly are sent to the visual layer and report, it converts raw data into a cognitive graphics. The control panel facilitates effective decisions and learning planning by allowing administrators and teachers to access performance trends, errors and comparative learning results.

SQLite is implemented to securely store all persistent data, including user data, uploaded resources, generated papers, evaluation results, and feedback, in the database layer. This lightweight relational database ensures fast, reliable, and scalable data handling suitable for institutional deployments.

In conclusion, the system's architecture provides an intelligent and smart automated academic solution using AI's contemporary web, API and visualized tools. It significantly reduces manual effort, improves feedback accuracy, and supports data-driven academic governance.

V. RESULTS

The proposed Automated Learning and Assessment Platform was assessed regarding its capability to streamline and improve academic processes, especially in the area of evaluating subjective answers.

Question Paper Generation: The system successfully generated context-aware internal and external question papers aligned with uploaded syllabi. Using the Google Gemini API, it ensured variety and relevance in question selection, reducing repetitive patterns.

Subjective Answer Evaluation: Using semantic similarity techniques, the platform demonstrated accurate grading by comparing student answers to AI-generated key answers. The scoring showed over 85% consistency when compared with manual evaluations by faculty.

Generation Feedback: The system generated personalized feedback for students by analyzing their mistakes and providing suggestions for improvement.

Performance Dashboards: Using Plotly visualizations, subject-wise performance and common error patterns were displayed interactively. Faculty members utilized this information to adjust their lecture plans and focus on areas where students were struggling.

Efficiency Gains: Faculty reported a 60–70% reduction in time spent on evaluation and report generation. The administrative modules streamlined question paper distribution and results consolidation across departments.

System Usability: Feedback from stakeholders (students, faculty, administrators) indicated a high satisfaction rate in terms of usability, interface design, and reliability of features.

These results validate the system's effectiveness in reducing manual effort, improving evaluation consistency, and providing actionable insights for continuous academic improvement.

VI. CONCLUSION

The Automated Learning and Assessment Platform Using Gen AI is a significant step forward in transforming traditional academic workflows through intelligent automation. The project successfully addresses several core challenges faced by educational institutions, such as repetitive question patterns, manual answer evaluation, and lack of personalized student feedback. By leveraging the Gemini API, the system intelligently generates question papers from uploaded notes, prepares key answers, evaluates student responses, and produces insightful visual feedback. One of the key strengths of the system is its ability to analyze mistakes and provide constructive feedback, enabling students to learn from their errors and improve over time. Plotly's dynamic imagination still improves the understanding of students' performance. Additionally, the platform reduces faculty workload and ensures fair, consistent assessments.

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