

E-Learning Platform with AI Tutor

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Abstract:

The current research paper introduces a smart E-Learning Platform with an Artificial Intelligence (AI) Tutor that can improve digital learning by providing personalization in the learning process, automatic content creation, and live engagement. The system allows the delivery of courses in a structured manner such as video lectures, notes, live classes, and AI-based quizzes, and facilitates free-flowing communication between students and administrators. The system combines Firebase Authentication to manage secure identity with Supabase to handle scalable database tasks and Google Gemini API to conduct tutoring and to generate quizzes with AI. These new technologies are integrated and guarantee high availability, scalability, and real-time performance of educational environments. The proposed system presents an AI Tutor that is able to comprehend student questions, produce contextual responses, and keep a conversation record. Through a quiz module powered by AI, MCQs specific to the topic are dynamically created, enhancing engagement and knowledge testing. The proposed solution is more personalized and automated, and the learning experience is more unified compared to conventional platforms, including Zoom, Google Meet, and Coursera. The platform can greatly enhance accessibility, diminish the amount of manual work, and facilitate adaptive learning based on AI-driven insights in line with current trends in AI-based education covered in recent research [1], [4].

Keywords — E-Learning, Intelligent Tutoring Systems, AI Tutor, Google Gemini, Firebase, Supabase, Personalized Learning, Adaptive Education.

I. INTRODUCTION

The education systems are changing rapidly due to the adoption of Artificial Intelligence (AI), the use of cloud computing and mobile technologies to eliminate the drawbacks of the traditional and semi-digital learning systems. Current online learning solutions tend to lean towards either communication (Zoom, Google Meet) or content delivery (Coursera, Udemy) but do not provide intelligent interaction, personalization, and automation. Such restrictions lead to the in efficiency of the knowledge delivery system and the lack of student involvement. Research indicates that AI-based systems can greatly increase the efficiency of learning by providing adaptive content delivery and real-time support [1]. The proposed AI-based E-Learning Platform with AI Tutor should offer a holistic and intelligent learning environment that combines content management, live engagement, and AI-based support. The system allows administrators to post videos, notes and live

classes and students to get access to structured learning content via a mobile interface. The AI Tutor integration brings about conversational learning in real-time, where students can pose questions and have context-aware responses created through the use of Google Gemini API. This is in line with the progress in Large Language Models (LLMs) in education [3], [11]. One of the problems of contemporary education is the absence of individual attention and immediate feedback. To solve this, the proposed system will include AI-based tutoring and quiz generation systems. The AI Tutor examines questions and creates formatted responses to the queries made by the user, whereas the AI Quiz system assesses the knowledge with dynamically created tests. This design improves the efficiency, engagement and accessibility of learning and the platform is appropriate to scalable digital learning. Other AI-based systems that are similar have demonstrated enhanced knowledge retention and student satisfaction [6].

II. PROBLEM OUTLINING

In current e-learning systems, the content is usually divided between several platforms leading to ineffective organization and lesser accessibility. Zoom and Google Meet platforms are real-time in nature but do not have content management and AI-based learning assistance. On the same note, other websites such as Coursera and Udemy offer organized courses but do not offer real-time interaction and smart help. This division of duties introduces incompetence and lowers the performance of online learning platforms [8]. The other significant concern is the lack of individualized learning. Lack of instant guidance can make students have trouble in grasping complex issues. Conventional systems involve manual work by instructors to develop quizzes, notes, and explanations, which would augment workloads and slow down the learning procedures. Also, conversational AI is not integrated to assist students in real time. Studies have shown that intelligent tutoring systems can help a great deal to eliminate these gaps through adaptive feedback [4]. To overcome these shortcomings, the proposed system incorporates AI Tutor, automatic quiz generation and centralized content management into a unified platform. It facilitates intelligent communication, real-time support, and organized learning materials, thus enhancing the effectiveness of the teaching process and the learning experience of the students. This integration aims at countering the drawbacks of current systems as found in the reference study.

III. NEED OF THE SYSTEM

As the demand on remote and hybrid learning grows, the intelligent, scalable, and user-friendly educational platforms are highly required. Conventional systems do not offer real time flexibility, personalized instructions and automated content creation, which are a necessity in the contemporary education [7]. It offers a smooth learning process, allowing students to access videos, notes, and live meetings and communicate with an AI Tutor to resolve doubts instantly. This guarantees that there is no reliance on instructors as the learning goes on which is important to massive systems of

education. With the inclusion of AI-powered technologies, like Google Gemini, the system becomes more accessible, less reliant on instructors, and self-paced. It makes sure that not only is educational content available but also interactive, adaptive, and personalized. These systems are believed to be critical to smart education systems of the future [10].

IV. TOOLS AND TECHNOLOGIES USED

The system will be developed as a mobile application that is cross-platform, based on React Native, which guarantees responsive and scalable user interface. Secure user management is provided with the help of Firebase Authentication which supports email/password and OAuth-based authentication systems. This guarantees the safety of identity verification and processing of the session with the token based authentication systems [12]. Supabase is a PostgreSQL-based database that can be used as the backend database, offering real-time data management, row-level security (RLS), and scale-able storage. Supabase Storage is applied to store files (including PDFs and user profile images) to deliver content efficiently. Relational databases increase consistency and integrity of the data throughout the platform. The core AI engine is Google Gemini API, which allows natural language understanding, generating responses in a conversation, and creating quizzes. Application flow is managed with React Navigation, and other libraries like react-native-youtube-iframe and react-native-blob-util are able to provide multimedia and file handling capabilities. These tools are well integrated to guarantee high performance and scalability of real-world applications.

V. CORE COMPONENTS

A. React Native Framework

The main framework that will be applied in the development of the mobile application is React Native as it enables the development of the app in cross-platforms, with the single-codebase. This enables the same application to be effectively utilized in both Android and iOS which saves time and cost of development. The structure is based on a component architecture, and it aids developers to

develop reusable UI components and have a modular structure. It is also capable of supporting real-time updates and rendering smooth user interface, which makes it responsive to the user. Moreover, the big developer community and extensive libraries of React Native allow it to be used to create scalable and maintainable educational applications.

B. Authentication System (Firebase)

Firebase Authentication is adopted to control user identity and provide a secure access to the platform. It offers an efficient user registration, user login and session management system, with secure token-based authentication systems. The system also allows a variety of logins, including email and password, which makes the user-onboarding easier. Firebase also encrypts passwords and provides password security automatically which minimises the chances of unauthorised access. Through Firebase Authentication, the site will only allow authenticated users to access learning functions and personal information.

C. Database System (Supabase)

Supabase is the preferred choice of a backend database solution since it offers a robust relational database with realtime functionality. It enables the platform to store user data, learning progress, quiz results and other important details in a systematic and orderly fashion. Row-Level Security (RLS) is one of its most significant attributes as it regulates the access to data on a smaller scale and makes sure that the user is able to see or manipulate only his/her data. Supabase also has RESTful and real-time APIs which enable the frontend application to easily interact with the database. This integration assists in sustaining an effective management of the data and provides a quick and dependable performance of applications.

D. AI Tutor and Quiz Engine

The AI Tutor and Quiz Engine are the main elements of the platform that will promote personalized learning. The AI Tutor relies on the Google Gemini API to create smart and context-sensitive answers to queries by students. This enables students to get instant answers, help and clarifications on a number of academic subjects. Aligned with the selection of subject or topic, the AI

Quiz module automatically creates multiple-choice questions depending on the topic or subject that is chosen by the learner. The system allows forming quizzes dynamically, making tests up-to-date and diverse. This aspect assists students to exercise regularly, test their knowledge, and enhance their knowledge effectively.

E. Backend Integration

A backend integration is the key in making sure that everything in the platform is synchronized. The system links Firebase Authentication with Supabase database with unique user identifiers of registered users. This is to prevent the data of user authentication and records of learning to be out of sync with the platform. The system can easily retrieve the stored data of a user, such as quiz results and learning progress, when the user logs in. This integration also facilitates effective management of data and effective communication between the frontend application and the backend services. Consequently, the platform offers an effective, secure, and scalable learning platform to users.

VI. LITERATURE REVIEW

The fast development of online learning platforms has drastically changed the manner in which learning is being provided and consumed. Live online classes have become popular and use video conferencing tools like Zoom, Google Meet, and Microsoft Teams. These services offer important functionalities such as video conferencing in real time, instant messaging, and recording of sessions. But they are mainly used as communication devices and do not have the ability to learn intelligently like automated content generation, adaptive tutoring, and understanding of learning content. Research suggests that these platforms do not offer customized learning and organized delivery of knowledge [8], [1]. Conversely, MOOCs like Coursera, Udemy, and edX are primarily concerned with formal and distance learning. These sites provide prerecorded video classes, homework and certification that facilitate the practice of asynchronous learning. Although they are well structured and easily accessible, they do not offer real time interaction and immediate feedback. Also, there are no AI-based

tutoring and automatic doubt resolution, which makes them less effective in dynamic learning settings. Studies indicate that the integration of formal learning with real-time communication is essential in enhancing engagement and retention of students [5], [6]. New developments in Artificial Intelligence have brought about intelligent tutoring machines that strive to individualize the learning process. AI systems are based on machine learning algorithms to process the behavior of students, suggest content, and also provide automated feedback. Digital education has become more accessible and engaging with the use of speech recognition, natural language processing as well as adaptive learning models. Nevertheless, the existing implementations are mostly stand-alone modules that are not integrated within overall learning platforms. This weakness prevents them to deliver continuous and contextual learning support [4], [7]. The development of Large Language Models (LLMs), which are implemented in generative AI systems, has greatly enhanced the power of intelligent tutoring. These types of models are able to interpret natural language queries, produce elaborate explanations and can produce educational material dynamically. In spite of these improvements, recent uses of LLMs in education tend to be in fixed chatbot interfaces or in third-party applications. They are not easily integrated with course materials, user information, and real-time learning processes. It has been proposed in the studies that the implementation of LLMs in the full-stack educational systems can greatly improve the personalization and efficiency of learning [3], [11]. According to the review of the current systems and studies, the gap in the creation of a single platform, uniting real-time communication, organized delivery of content, and learning support based on AI is evident. The E-Learning Platform with AI Tutor proposed can fill this gap by integrating Firebase-based authentication and Supabase database management with Google Gemini API to generate quizzes and implement intelligent tutoring. This integration provides real time conversational learning, automatic assessment and centralized content management in one system. This strategy is in line with new trends in intelligent education

systems and offers an extensively applicable solution to new digital learning spaces [9], [10].

VII. DESCRIPTION OF PROPOSED SOLUTION

The system suggested is a mobile based E-Learning Platform, which is intended to offer intelligent and interactive learning experiences using the modern technologies. It helps administrators to organize educational material including videos, notes, and live classes effectively. Learners are able to access organized learning materials and navigate the materials using user-friendly interface. The platform will facilitate smooth communication and centralized content delivery to enhance better learning. The system incorporates an AI Tutor that is based on the Google Gemini API that handles user queries with the help of sophisticated natural language processing. It produces context-sensitive replies that will help students to better resolve doubts in real-time and understand concepts. The flow of conversations is supported by storing the interactions in Supabase, guaranteeing continuity between the sessions. It allows customized and dynamic learning that corresponds to the personal users. The interrelation of authentication and database layers guarantees congruent user sessions and the protection of data. This architecture can improve the performance, reliability and scalability of the platform. Also, the AI Quiz module is a dynamic module that produces multiple choices based on topics via the Gemini API. It analyses the student feedback, stores the performance on the database and offers performance feedback to continuously improve. This automated evaluation system saves time and effort as well as enhances involvement and learning. AI Tutor with AI Quiz form an intelligent and holistic learning platform.

VIII. OBJECTIVES OF PROPOSED E-LEARNING PLATFORM WITH AI TUTOR

The primary goal of the suggested E-Learning Platform with Artificial Intelligence (AI) Tutor is to improve the quality,

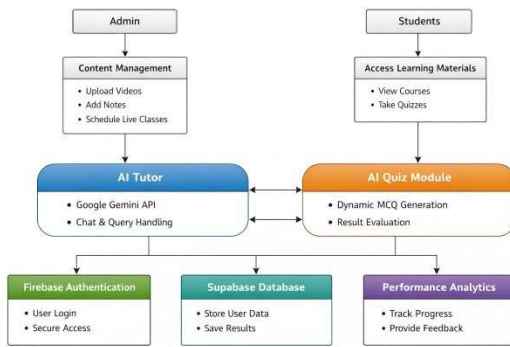


Fig. 1. Flowchart of the Working Process of the Proposed System

access, and efficiency of online learning by intelligent automation and personal learning support. The system aims to integrate structured course delivery with AI-driven tutoring to provide real-time assistance and adaptive learning experiences. The platform is built on the use of technologies like Google Gemini API, Firebase Authentication, and Supabase, which provide a smooth content management system and safe interaction with users. The application is aimed at enhancing the interaction of learners, minimizing the amount of manual work to be performed by educators, and allowing to spread the knowledge effectively among various user groups [1], [4].

Limitations of Existing Solutions (Zoom, Google Meet, Traditional E-learning Platforms): Although platforms like Zoom, Google Meet, and other old-fashioned e-learning systems have become common in education, a number of drawbacks prevent their usage in contemporary education. The main features of such platforms are communication or content delivery capabilities but do not include intelligent functions that include AI-based tutoring, automated quiz generation, and a personalized approach to learning. Also, the content can be easily divided into several tools, and students can hardly find access to organized learning materials. The lack of live AI support and responsive feedback also decreases the involvement and learning effectiveness of students [8].

Overcoming These Limitations in the Proposed System:

- 1) **AI-Powered Tutoring:** The software combines Google Gemini API to facilitate real-time conversational tutoring, where students can get real-time explanations and help.

- 2) **Automated Quiz Generation:** AI is used to dynamically create MCQs, dependent on the chosen topics, which reduces manual effort and enhances quality of assessment.
- 3) **Centralized Content Management:** The entire learning content such as videos, notes, and quizzes are handled in a single platform.
- 4) **Individualized Learning Process:** The system will personalize responses and recommendations depending on user interaction and learning history.
- 5) **Scalable Architecture and Secure:** Firebase and Supabase provide secure data handling and authentication throughout the platform. This architecture will offer efficiency in data flows, real time monitoring and increased crop productivity.

IX. SCOPE OF PROPOSED E-LEARNING PLATFORM WITH AI TUTOR

The suggested E-Learning Platform with AI Tutor has a broad range in the realm of online learning through its intelligent and conversational learning experience. The system facilitates systematic course delivery with the help of video lectures, PDF notes and live classes that allow the students to learn in a flexible manner. It combines the AI-based tutoring and quiz generation to provide the users with the opportunity to receive the real-time support and assess their knowledge. The platform makes it more accessible since students can access learning resources at any time and place. The system is scalable and flexible in the case of large user bases due to the use of cloud-based technologies and AI models. It gives one a centralized access to all learning materials enhancing ease of use and organization. The combination of Supabase database and Firebase services can guarantee effective data management and real-time synchronization. The platform also has the potential to support more intelligent capabilities like AI-driven suggestions, analytics dashboard, and adaptive learning systems, which can be used in the future smart education system [10].

X. FEASIBILITY ANALYSIS

- **Technical Feasibility:** The proposed system can technically work because it also makes use of current technologies like React Native, Firebase Authentication, Supabase, and Google Gemini API. Such technologies enable scalable architecture, real-time data processing, and AI-based capabilities. The cl is integrated into cl.
- **Operational Feasibility:** The platform has a user-friendly interface, which allows effective communication between students and administrators. The use of features, like AI Tutor, quizzes, and content access, are not complicated and need little technical expertise. This is to guarantee successful implementation in learning institutions.
- **Economic Feasibility:** The system is economical because of the application of open-source framework and cloud-based services. It saves time to educators and minimizes infrastructure expenses. Sustainability can be achieved in the form of future monetization strategies like subscription-based access.
- **User Adoption:** The system, with its customized AI tutoring system, automated quizzes, and centralized learning materials, has a high adoption potential among students and institutions. It is more interactive and effective in learning and so is appealing to the modern education system.
- **Legal Feasibility:** The platform is data privacy and data security-compliant, as it involves safe authentication and restricted access to data. It does not imply any financial risks and sensitive transactions, which guarantees the adherence to the legal requirements.

XI. REQUIRED TOOLS

- **React Native:** React Native is used for developing the mobile application, providing a responsive and interactive user interface. It provides cross-platform

development and good performance and scalability.

- **Firebase Authentication:** Authentication and identity management of users is done using firebase. It allows email/password authentication and OAuth authentication, which provides access control.
- **Supabase (PostgreSQL Storage):** Supabase is a database and storage system used to store user data, course contents, quiz scores and chat logs. It guarantees the real time synchronization and the consistency of data.
- **Google Gemini API:** Gemini API is applied in AI based tutoring and quiz generation. It allows processing natural language, contextual comprehension, and automatic content creation [3], [11].
- **React Navigation Libraries:** These tools control the flow of applications, screen navigation, and UIs components, which creates a smooth user experience.
- **Development Environment:** Coding, debugging, and version control are done with tools like Visual Studio Code, which facilitate effective development processes.

XII. FEATURES

- **AI Tutor:** Offers conversational support in real-time via the Gemini API to facilitate customized learning. It answers student questions instantly and explains concepts in a simple and understandable manner. The tutor will make suitable responses depending on the topics and the level of understanding of the learner. It also promotes self-directed learning where by, guidance is given when students require assistance.
- **AI Quiz Generation:** Creates dynamic multiple-choice questions (MCQs) by the learner-selected topics. This will assist the students to rehearse and quiz themselves at regular periods. The system automatically scores the answers and also gives an immediate performance feed-back. It also

aids in defining weak areas in order to target students on improving certain topics.

- **Video Lectures:** Allows the students to view a subject-based video lecture using an inbuilt video player in the application. These videos assist in explaining complicated issues with the use of visual and audio explanations. Students are also able to view lectures at their own convenience. This aspect promotes dynamic learning and facilitates easy revision of subjects by students.
- **PDF Notes:** Enables users to access and download study material in PDF format without leaving the site. Learners are able to read notes in various subjects and topics in a systematic way. The downloadable feature allows one to study offline without the internet. It is an aspect which enables the learners to revise the key concepts in a short time and to pass examinations.
- **Live Classes:** Assists in the scheduling and attendance of live classes in order to have an interactive learning session. Students are also able to engage in a real time chat with the instructors and ask questions in real time. Live classes are used to recreate the classroom atmosphere in an online classroom. This aspect enhances interaction and promotes learning together.
- **Low Maintenance and Reduced Manual Effort:** The system is user-friendly and simple to maintain since automation diminishes the chances of human beings having to monitor the system at all times.
- **User-Friendly Interface:** Offers a user-friendly and convenient interface that allows easy navigation through various features of the platform. The design is geared towards simplicity to ensure simplicity is achieved to enable students to access resources with ease. Well-defined menus and organized designs enhance the experience of users. This makes sure that all types of learners will be able to use the application without any apprehension.

XIII. WORKFLOW OF PROPOSED E-LEARNING PLATFORM WITH AI TUTOR

The proposed E-Learning Platform workflow starts with user authentication where students and administrators will enter the system by logging in with Firebase Authentication. Once successful, users will be redirected to their respective dashboards depending on their roles. Students are able to access learning materials and administrators can manage learning material in the form of videos and notes. This guarantees safe and role system access. In the case of the engagement of a student with the AI Tutor, the query is applied to the Google Gemini API that creates response based on the context. The system logs chat history to Supabase, which allows continuity and personalized learning experiences. This interactive session is in real time and it contributes to improved comprehension and immediate assistance to the learners. In assessment, AI Quiz module is significant in the evaluation of student knowledge based on automated dynamic generation of question. The system develops multiple-choice questions based on the topic using artificial intelligence whereby the questions will be relevant to the subject under study by the student. This module is also able to give new questions every time unlike the traditional fixed quizzes where the students go through the same set of questions. After a student has entered his/her answers, the system will automatically mark the responses and mark the score immediately. This instant feedback enables learners to easily know their performance and know what they need to improve more. The outcomes are then safely stored in the database, which enables both students and instructors to track the academic progress with time. The AI Quiz module not only enhances student engagement but also greatly decreases the manual effort of instructors who would otherwise have to create and mark quizzes by automating the assessment process. Besides creating and assessing quizzes, the platform has a detailed account of the activity and progress of every learner. All the assessment outcomes such as the scores, questions attempted, and history of the performance are systematically stored in the database. This information can be applied to study learning patterns, strengths and weaknesses and give more

individualized learning support in the future. The system will make sure that students will have the opportunity to see how they have performed in their quizzes previously and how they have been improving over time. This type of continuous assessment fosters the practice and inspires learners to improve their knowledge bit by bit. It also enables the instructors or the administrators to review the trends of the performance in general and refine the quality of the course materials where necessary. Lastly, all the necessary data in the platform, such as learning materials, quiz scores, and chat history with the AI tutor are safely saved and manipulated through Supabase. This database system will guarantee a well-organized data and fast retrieval whenever the application requires accessing user information. Supabase also has real-time functionality that enables the system to offer instant updates and notifications to users. As an example, students can be alerted about new learning material, live classes, or quizzes.

Fig. 2. Workflow of the E-Learning Platform with AI Tutor

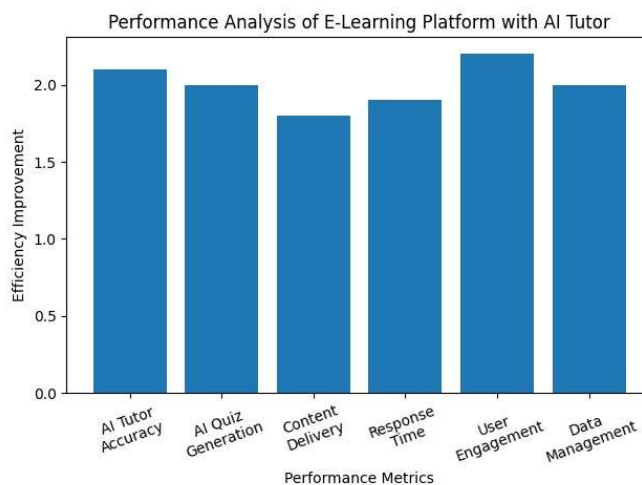
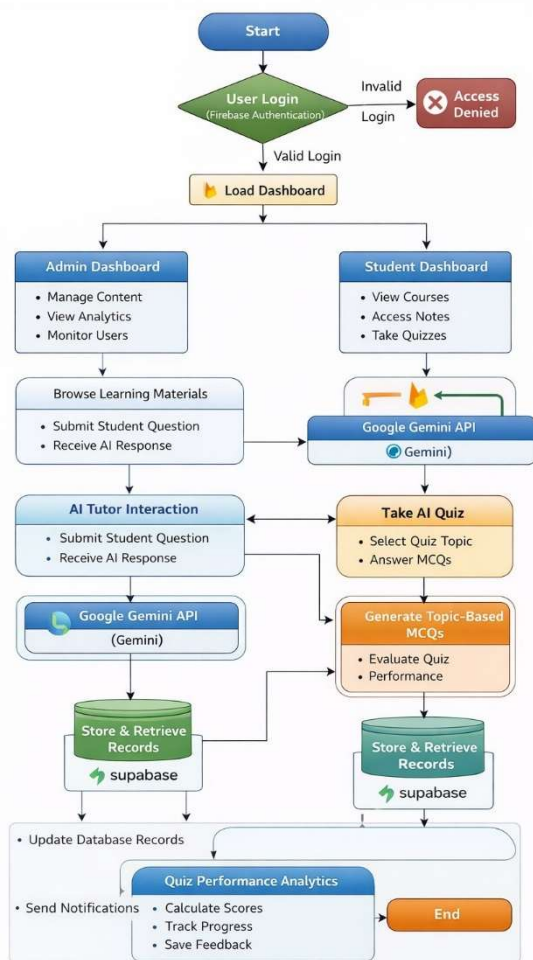


Fig. 3. E-Learning platform with AI Tutor Performance Analysis.



XIV. RESULT ANALYSIS

Performance Analysis:

The test of the proposed E-Learning Platform with AI Tutor reveals considerable advancements in essential features like AI-based tutoring, quiz generation, content management, and real-time interaction. The system offers a faster response time, better access to content, and more user engagement as compared to the traditional platforms. With the inclusion of Gemini API, there will be precise and contextual responsiveness, leading to better learning. The results show that AI-based features that include personalized tutoring and automated quizzes are more efficient than the manual approach. Scalability and reliability at different workloads is guaranteed by the use of cloud-based technologies. On the whole, the findings demonstrate that the suggested system can greatly increase the access to the learning process, minimise the workload of instructors, and make digital education systems more efficient [14].

HomePage:

The proposed E-Learning Platform featuring AI Tutor will have a centralized and easy to use interface that allows the administrator to effectively manage educational content. It shows a welcome section that is customized to welcome the administrator and give a preview of the key functionalities of the platform. Quick access

modules that are featured in the homepage include subject management, video uploading, note uploading and live class scheduling and the administrators can easily access key areas of the system. This systematic arrangement can save time needed to find features and enhance the overall efficiency of the system. The homepage is the control panel that will help control the educational resources as they have the most important tools in one place. Dashboard is made in a modern dark-themed user interface to make it usable, visual and minimize eye-strain during extended use. The features are represented in interactive cards or panels where a single click will give the administrators access to a certain feature. These cards allow a clean and orderly presentation of options making the system user friendly even by novice users. Each module has clearly displayed icons and labels to enhance easy navigation and minimize confusion. The responsive design also guarantees that the dashboard will be able to fit various sizes of the screen, and thus will be available on various devices. Moreover, the homepage shows the key features of the platform, such as managing learning videos, PDF documents, and live classes in a single platform. The administrators are able to upload learning content, manage the subjects, and schedule live sessions right on the dashboard. Automated processes and intelligent content management are further supported by the incorporation of AI-powered functionalities, which adds efficiency to the system. The homepage can also have notifications, updates, and system alerts to ensure the administrators are kept updated on what is happening at the platform. In general, due to the organized design of the homepage, the user experience is enhanced as the complicated administrative procedures are simplified. It simplifies operations, and all the necessary tools are arranged in one interface. The centralized design enables the administrators to easily manage and update learning resources without having to go through numerous pages. This makes the home page critical towards the management of the platforms, enhancing the organization of the educational content and delivery of digital learning services.

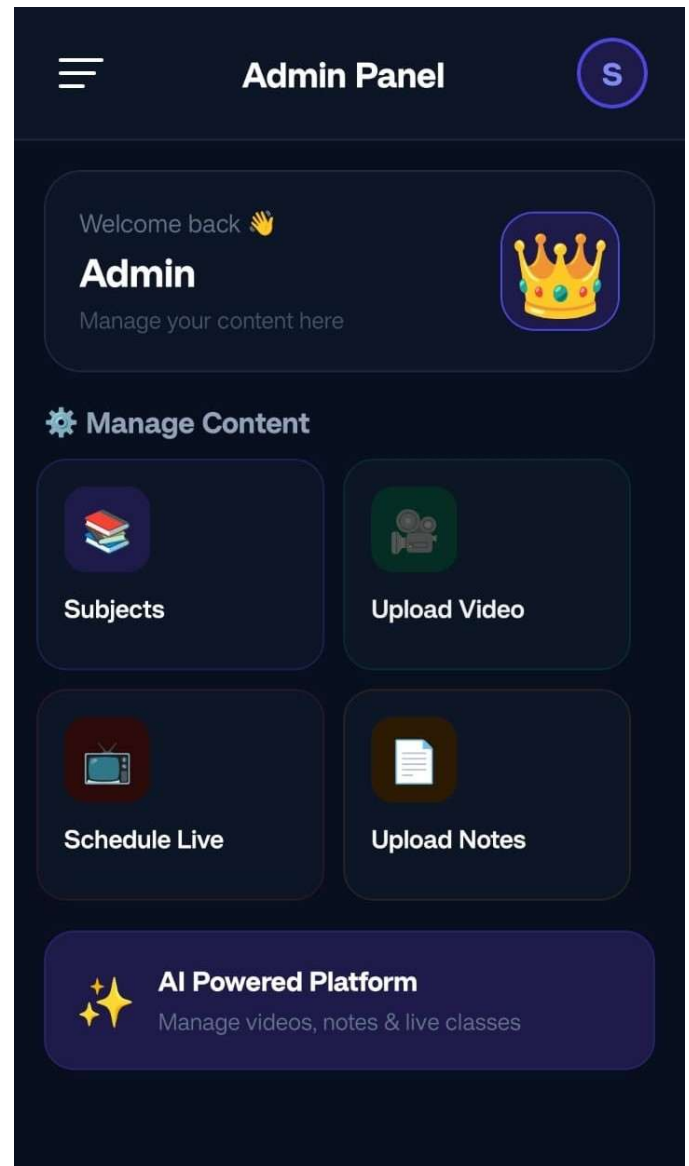


Fig. 4. Home Page of E-Learning Platform with AI Tutor

XV. CONCLUSION AND FUTURE ASPECTS

The E-Learning Platform suggested to be developed with the assistance of AI Tutor is a smart and scalable approach to modern digital education integrating AI-driven tutoring, automated evaluation, and the systematic content delivery. The system increases access and personalization and learning efficiency and minimizes manual work among educators. Firebase, Supabase and Google Gemini API are used to provide secure, scalable and high-performance system architecture. The system has

been able to overcome the shortcomings of the conventional e-learning platforms and has led to the creation of smarter learning environments. The system may be expanded in the future to include more sophisticated functionality, including AI-based learning suggestions, learning analytics, and learning trajectories. Immersive learning can be achieved with integration with Augmented Reality (AR) and Virtual Reality (VR). It is also possible to enhance the quality of AI Tutor and the accuracy of AI Tutor with advanced natural language processing models. As AI and cloud technologies keep improving, the platform has a great potential of becoming a more fully developed and globally scalable smart system of education [15].

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