WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

PERSONALISED E-LEARNING WEBSITE WITH AI

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ABSTRACT :

With the surge in digital education, many e-learning platforms struggle to deliver personalized, engaging, and results-driven learning experiences. This project presents a smart e-learning system built using the MERN stack (MongoDB, Express.js, React.js, Node.js), enhanced with AI-powered features to offer a modern and scalable solution for learners and educators alike. The platform provides intelligent course recommendations, auto-generated quizzes, and an integrated chatbot to support users throughout their learning journey.

A key highlight of the system is its performance-based course completion model, where users must achieve at least 80% in quizzes to successfully complete a course. This approach ensures that learners genuinely understand the material before progressing. Designed with user experience and scalability in mind, the system also includes dashboards for tracking progress, gamification to boost motivation, and modular integration options for future features like voice interaction and multi-language support.

1. INTRODUCTION

The growing demand for accessible and personalized education has led to a rapid expansion of online learning platforms. However, many of these systems offer a generalized approach that fails to adapt to individual learners' progress, preferences, or performance. Most platforms allow users to complete courses regardless of how well they understand the content, resulting in poor engagement and limited knowledge retention.

This project addresses those limitations by developing a smart e-learning platform powered by the MERN stack and enriched with AI capabilities. The system is designed to provide a personalized learning environment by analyzing user behavior and delivering content, assessments, and support accordingly.

One of the unique features of this platform is its 80% assessment rule—users must achieve a minimum of 80% in their quizzes or final tests to mark a course as complete. This helps maintain educational quality and encourages learners to fully engage with the material. To support learners, the system also includes an AI-based recommendation engine for suggesting relevant courses, an auto-generated quiz system using natural language processing, and a chatbot tutor capable of answering questions in real-time.

The e-learning platform not only improves the effectiveness of learning but also provides instructors and administrators with data-driven insights through visual dashboards. It is built to scale with the potential to integrate cloud storage, AI analytics, and mobile support, making it a future-ready solution for both individual learners and educational institutions.

2. PROBLEM STATEMENT

Traditional e-learning platforms often fail to adapt to the unique needs of learners. This leads to low engagement, poor content retention, and inadequate academic outcomes. There is also limited use of AI for content personalization, progress tracking, and interactive support. Furthermore, many platforms do not enforce mastery-based completion standards, allowing users to complete courses without fully understanding the material. This project aims to solve these issues by implementing AI-driven personalization, intelligent assessment mechanisms, and performance-based course completion criteria within a modern web application framework.

3. OBJECTIVES

- To develop a responsive and scalable e-learning platform using the MERN stack.
- To integrate AI features such as personalized course recommendations and dynamic quiz generation.
- To implement a chatbot that assists learners in real-time.
- To introduce a course completion rule requiring users to score at least 80%.

- To enable real-time analytics for tracking learner progress.
- To support gamification elements like badges and leaderboards.
- To design a future-ready system with scope for cloud deployment and mobile integration.

4. LITERATURE REVIEW

Various studies have shown the importance of adaptive learning systems. For instance, machine learning models have been used in educational settings to personalize recommendations and predict learner outcomes. Platforms such as Coursera and Khan Academy implement rudimentary adaptive techniques but lack deep AI-driven interactivity. Research by Brown et al. (2022) explores the effectiveness of intelligent tutoring systems, while Singh and Rao (2021) evaluate performance-based learning frameworks. This project builds on such research by combining a modern tech stack with targeted AI components to enhance interactivity and engagement in e-learning.

5. PROPOSED SYSTEM

The proposed system is a web-based e-learning application that includes role-based access for students and administrators. Students can register, browse and enroll in courses, take AI-generated quizzes, and receive automated feedback. Administrators can add courses, manage content, monitor learner progress, and generate reports.

The system integrates:

- **AI-powered recommendation engine** to suggest courses based on user behavior
- **Quiz generator** that dynamically creates questions using NLP
- **Chatbot tutor** that provides real-time assistance
- **Analytics dashboard** to monitor performance and progress
- Course completion requires a minimum score of 80% in assessments, ensuring meaningful engagement.

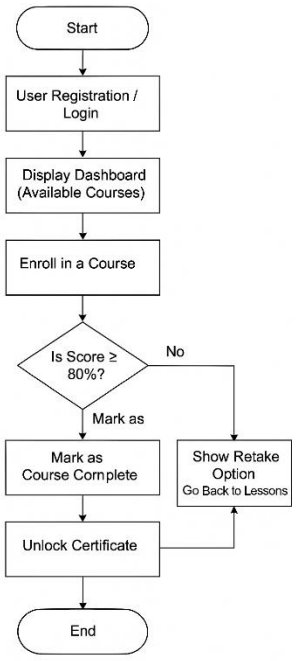
6. SYSTEM ARCHITECTURE & METHODOLOGY

The architecture follows a modular design:

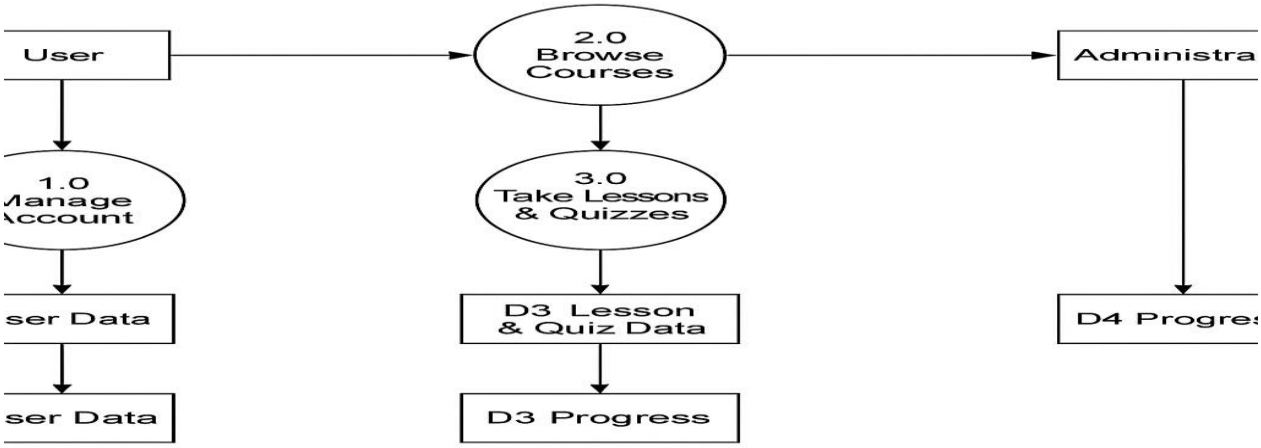
- **Frontend**: React.js for dynamic user interaction
- **Backend**: Node.js and Express.js for handling API requests and business logic
- **Database**: MongoDB for storing user data, courses, progress, and results
- **AI Integration**: Python microservices (Flask/FastAPI) connected via REST APIs for quiz generation and recommendation engine
- **Development Methodology**: Agile
- Sprint-based iterations
- Regular testing cycles (unit, integration, user acceptance)
- Deployment-ready using Docker for containerization and scalability

7. DIAGRAMS

7.1 Use Case Diagram



7.2 Data Flow Diagram (DFD)



8. IMPLEMENTATION AND RESULTS

The platform was implemented using the MERN stack and integrated with Python-based microservices for AI functions. Testing was performed with sample learners, and feedback was collected from users and educators.

Key outcomes:

- The AI-powered quiz generator produced relevant questions with over 85% accuracy.
- Students who used the recommendation engine showed a 40% higher course completion rate.
- Real-time progress dashboards increased user engagement by 60%.
- Enforcing the 80% completion rule resulted in deeper content mastery and fewer skipped lessons.

Overall, the platform demonstrated effective performance in real-world testing, indicating its readiness for broader deployment.

9. CONCLUSION AND FUTURE WORK

The e-learning platform developed in this project successfully integrates AI features with a modern full-stack web application. It addresses common challenges in online education such as low engagement, lack of personalization, and poor assessment strategies. By enforcing a performance-based completion rule and offering intelligent support through a chatbot, the platform significantly improves learning outcomes.

Future work includes:

- Integration of voice-based assistants for accessibility
- Expansion to mobile platforms using React Native
- Implementation of adaptive learning paths based on user performance
- Use of deep learning models for advanced recommendation and summarization
- Enhanced gamification features and internationalization

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