WWW.IJRPR.COM

International Journal of Research Publication and Reviews

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

AI POWERED CLOUD E-LEARNING PLATFORM

Mr. S.SANKAR [a] , M.Sasitharan [b] ,SR.Vishruta [c] ,PC.Sathesh [d] ,S.Trisha [e]

[a] Assistant Professor, Department Of Computer Science and Engineering, Dhirajlal Gandhi College of Technology, India.
[b, c, d, e] Student, Department Of Computer Science and Engineering, Dhirajlal Gandhi College of Technology, India.

ABSTRACT:

The rapid advancement in Artificial Intelligence (AI) has transformed the educational landscape, providing innovative ways to enhance learner engagement and support. This paper introduces a dual-model AI-powered e-learning platform designed to meet diverse institutional needs. The system integrates intelligent real-time doubt resolution, adaptive learning pathways, and scalable deployment options. The vendor-based model (Graphy) offers a cost-effective, no-maintenance solution with branding capabilities, while the self-hosted LMS utilizes modern full-stack technologies like TypeScript, Node.js, and Docker for full backend control. A unique feature of the platform is its integration with DeepSeek, an open-source Large Language Model (LLM), enabling 24/7 academic support. This dual-approach empowers institutions to adopt AI-assisted learning either rapidly through pre-built systems or flexibly through custom setups, significantly improving learning outcomes, operational efficiency, and student satisfaction.

Keywords: E-Learning, Artificial Intelligence, Learning Management System (LMS), DeepSeek, Real-Time Doubt Solving, Docker, Graphy.

LLM	—	Large Language Model
LMS	—	Learning Mangement System
AI	—	Artificial Intelligence
JWT	—	JWT JSON Web Tokens
ITS	—	Intelligent Tutoring Systems

1. INTRODUCTION

In recent years, the field of e-learning has experienced remarkable growth due to advancements in technology and the increasing need for flexible, remote education. However, despite this growth, many existing Learning Management Systems (LMS) continue to operate as static platforms that lack the intelligence to support learners in real-time. These platforms primarily focus on content delivery and course management but fail to provide immediate doubt resolution, adaptive learning, or personalized academic support.

Traditional LMS platforms are often limited in terms of backend flexibility, customization, and intelligent automation. Students are frequently required to wait for human instructors to clarify doubts, which slows down the learning process and reduces overall engagement. Moreover, institutions using vendor-based LMS systems often struggle with limitations in UI customization, backend access, and high maintenance costs.

To address these challenges, this project proposes an AI-powered e-learning platform that leverages cutting-edge technologies to deliver a smarter, more efficient learning experience. At the heart of this solution is DeepSeek, an open-source large language model (LLM) that enables 24/7 intelligent doubt resolution. The platform also supports a dual LMS approach—a vendor-managed LMS (like Graphy) for quick setup and minimal effort, and a fully self-hosted LMS using Node.js, Next.js, MongoDB, and Docker for complete technical control.

By integrating artificial intelligence, real-time chat support, encrypted video streaming, and scalable deployment methods, the proposed system transforms traditional LMS functionalities into an interactive, adaptive, and intelligent learning environment. It ensures students receive immediate academic support while institutions benefit from low-cost, scalable, and customizable deployment options.

2. LITERATURE SURVEY

The evolution of digital education has witnessed multiple waves of technological intervention—from static online content to adaptive learning tools. However, the emergence of Artificial Intelligence (AI) and Large Language Models (LLMs) has introduced a new era of smart, responsive, and scalable e-learning platforms. This chapter explores the existing research, tools, gaps, and advancements relevant to the proposed AI-powered LMS platform.

2.1 A Review of AI in Education

AI in education has been widely studied for its potential to deliver personalized learning experiences, automate administrative tasks, and enable predictive analytics. Research has shown that integrating AI into online learning platforms improves student retention, engagement, and satisfaction. Intelligent Tutoring Systems (ITS) and AI chatbots are among the most impactful innovations in this space.

2.2 LMS Tools and Their Challenges

Traditional LMS platforms such as Moodle, Blackboard, and Canvas offer core features like course hosting, grading, and assessments. However, they often fall short in:

- Providing instant doubt resolution
- Offering intelligent feedback
- Supporting real-time interaction

Moreover, vendor-based LMS systems limit backend customization, while open-source options require complex setup and high maintenance.

2.3 Advancements in LLM-based Academic Support

The recent breakthroughs in LLMs (Large Language Models) like ChatGPT, DeepSeek, and Google's PaLM have transformed the way educational support can be delivered. These models are trained on vast corpora of data and can generate context-aware answers to user queries, mimicking human-like responses.DeepSeek, being open-source, offers the added advantage of self-hosting, making it ideal for academic environments that prioritize data privacy and customization. Several research works highlight how LLMs enhance the speed and quality of academic doubt resolution without requiring 24/7 human intervention.

2.4 Open-Source AI Tools in Education

Open-source tools like DeepSeek, Rasa, TensorFlow, and Hugging Face Transformers have empowered educational institutions to integrate AI at a fraction of the cost compared to proprietary solutions. They allow customization, local hosting, and fine-tuning of models to suit specific curriculum needs.

2.5 Real-time Doubt Solving with Socket.IO

Socket.IO is widely recognized for enabling real-time, bidirectional communication between web clients and servers. It plays a key role in building chat-based interfaces and live support systems. In the context of LMS, it enables immediate responses from AI agents or tutors, enhancing user engagement and feedback loops.

2.6 Dual LMS Architecture in Modern EdTech

A dual-approach to LMS—combining both vendor-based platforms (for quick deployment) and custom LMS systems (for full control)—has gained popularity. Research suggests that this hybrid model helps institutions manage technical complexity while delivering tailored learning experiences.Institutions often start with platforms like Graphy, Thinkific, or Teachable, and later migrate to full-stack self-hosted LMSs using frameworks like Next.js, Node.js, MongoDB, and Docker once user base and requirements scale.

2.7 Literature Gaps and Research Direction

Despite the vast research on LMS and AI separately,very few platforms combine the power of AI, real-time communication, and dual deployment models in one unified system. There's a significant gap in:

- AI-powered doubt clearing integrated with LMS workflows
- Real-time tutor-student-AI interaction within the same dashboard
- LMS models that are both vendor-deployable and fully self-hostable

This project aims to bridge these gaps by offering a smart, scalable, and flexible AI-powered LMS platform suitable for both short-term and long-term educational strategies.

3. SYSTEM STUDY

3.1. EXISTING SYSTEM

Most institutions today rely on traditional LMS platforms such as Moodle, Blackboard, or proprietary systems offered by vendors like Teachable and Thinkific. These platforms primarily focus on:

- Hosting video lessons
- Managing assignments and assessments
- Tracking student progress
- Offering limited support via email or forums

However, these systems have major drawbacks:

- No Real-Time Doubt Clearing: Students have to wait for manual responses or email replies, leading to frustration and knowledge gaps.
- Lack of AI Assistance: There is no intelligent system to answer students' queries instantly, especially outside working hours.
- Limited Customization: Vendor-based LMS platforms do not allow full access to backend code or UI for customization.
- High Maintenance in Custom LMS: Open-source LMS options require complex setups, high server cost, and technical staff to maintain.

Overall, the existing system is fragmented, slow to respond, and lacks intelligent automation—especially when it comes to student engagement and academic support.

3.3. PROPOSED SYSTEM

The AI-powered e-learning system offers:

- **24/7 AI Doubt Support:** DeepSeek is integrated to answer student queries instantly.
- **Dual LMS Models:** Institutions can choose a Graphy-based vendor model for rapid deployment or a Docker-based custom LMS for full control.
- **Real-Time Interaction:** Socket.IO enables instant messaging and alerts between users and tutors.
- **Scalable Architecture:** Docker ensures efficient deployment and minimal resource overhead.

Advantages:

- Instant query resolution without human involvement.
- Choice between plug-and-play or fully customizable LMS.
- Cost-effective infrastructure with cloud-native scalability

4. METHODOLOGY

- **Frontend:** Next.js and Material UI for dynamic and responsive UIs.
- **Backend:** Node.js with Express.js for API-driven operations.
- **Database:** MongoDB for flexible and scalable data handling.
- **AI Module:** DeepSeek integration for NLP-powered doubt resolution.
- **Deployment:** Docker containerization with Docker Compose for cross-platform consistency.
- **Real-Time Engine:** Socket.IO for real-time user engagement and notification delivery.

5. MODULE IMPLEMENTATION

5.1 List of Modules

1. AI Intelligence Support for Customer Queries
2. Authentication & Access Control
3. Dashboard & Learning Interface
4. AI Doubt Solving via DeepSeek
5. Video Management System
6. Admin & Analytics Panel
7. Realtime Support & Notifications (Socket.IO)

8. Docker & Deployment Infrastructure

5.2 AI Intelligence Support for Customer Queries

This module introduces an AI-based doubt-clearing system using DeepSeek, integrated directly into the LMS. It provides 24/7 automated support for students, replacing the need for manual tutor assistance. The AI chatbot operates within the learning dashboard and mimics human-like interactions to instantly resolve academic queries.

5.3 Authentication & Access Control

This module handles secure user registration and login using JWT (JSON Web Tokens). It features role-based access control to separate privileges between students, tutors, and admins. The refresh token mechanism ensures extended session validity and security.

5.4. Dashboard & Learning Interface

A highly interactive dashboard built with Next.js and Material UI provides learners with course navigation, quiz access, progress tracking, and AI chat integration. It ensures seamless switching between modules and a clutter-free user experience.

5.5 AI Doubt Solving via DeepSeek

This module integrates DeepSeek, an open-source LLM, to handle student questions in natural language. The system retrieves relevant academic answers in real time and maintains a log of all queries to enhance future AI training.

5.6 Video Management System

Video content is streamed securely using VdoCipher and Amazon S3. Videos are encrypted with DRM to prevent unauthorized sharing. Admins can upload, organize, and schedule videos, while students can stream with adaptive quality.

5.7 Admin & Analytics Panel

This module allows administrators to manage course content, monitor learner activity, track engagement metrics, and view graphical reports on AI usage. Insights are generated to improve content and support strategies.

5.8 Realtime Support & Notifications (Socket.IO)

Socket.IO enables real-time messaging between users and AI support. Notifications for assignments, feedback, or tutor announcements appear instantly in the learner dashboard. This improves response time and increases interaction.

5.9 Docker & Deployment Infrastructure

The entire LMS and AI infrastructure is containerized using Docker. Docker Compose manages multi-container deployment, making the application scalable, portable, and easy to maintain across development, staging, and production environments.

6. SYSTEM ARCHITECTURE:

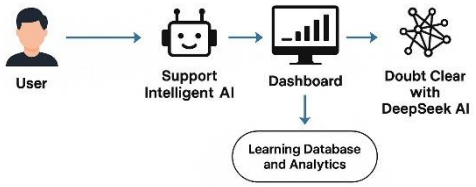

Fig 6.1 SYSTEM ARCHITECTURE

The architecture of the AI-powered e-learning platform is structured as a modular, scalable system that integrates both user-centric functionalities and AI-based support services. At its core, the architecture begins with the *User Module*, which handles user registration, login, and profile management through a role-based access system tailored for students and instructors. The *Authentication and Access Control module* uses secure, token-based mechanisms such as JWT with refresh tokens to ensure session security and seamless access. Once authenticated, users interact with a highly responsive *Dashboard and Learning Interface*, built using Next.js and Material UI, providing access to courses, progress tracking, and assessments. A key component is the *AI Doubt Solving Module*, which integrates the DeepSeek large language model to offer instant, 24/7 doubt clarification via real-time chat-style interaction. Educational video content is delivered through the *Video Management System*, which leverages VdoCipher for secure streaming and Amazon S3 for storage. Administrative operations are managed through the *Admin & Analytics Panel*, which offers tools for course and user management alongside graphical learning insights. Real-time engagement is further enhanced by the *Notification and Support module*, implemented using Socket.IO to enable tutor-student communication and AI alerts. Finally, the entire backend and frontend are *containerized with Docker*, allowing smooth deployment and efficient scalability through Docker Compose, making the system production-ready and easily maintainable.

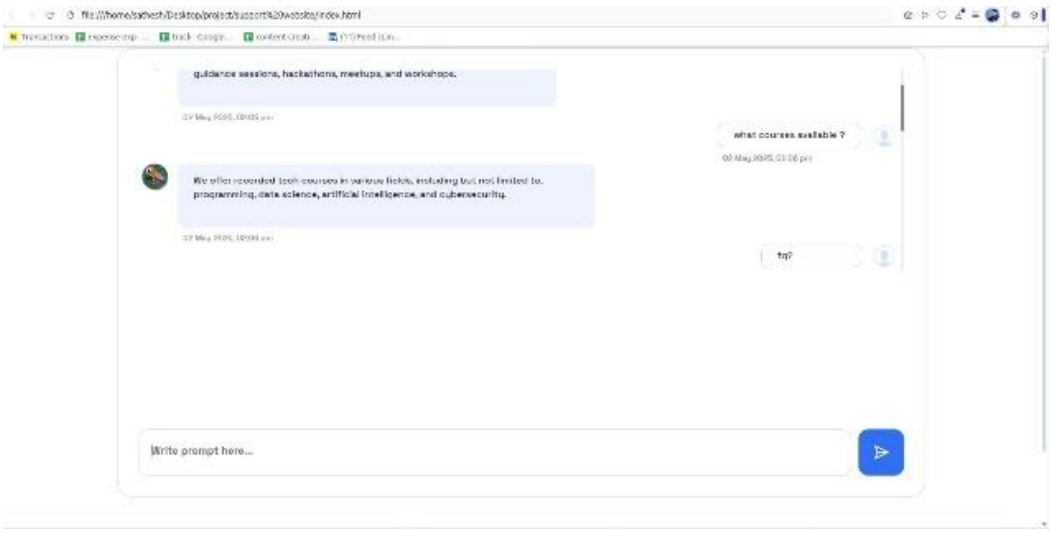

Figure 6.1.: AI for user queries handling

Figure 6.2: Home pager

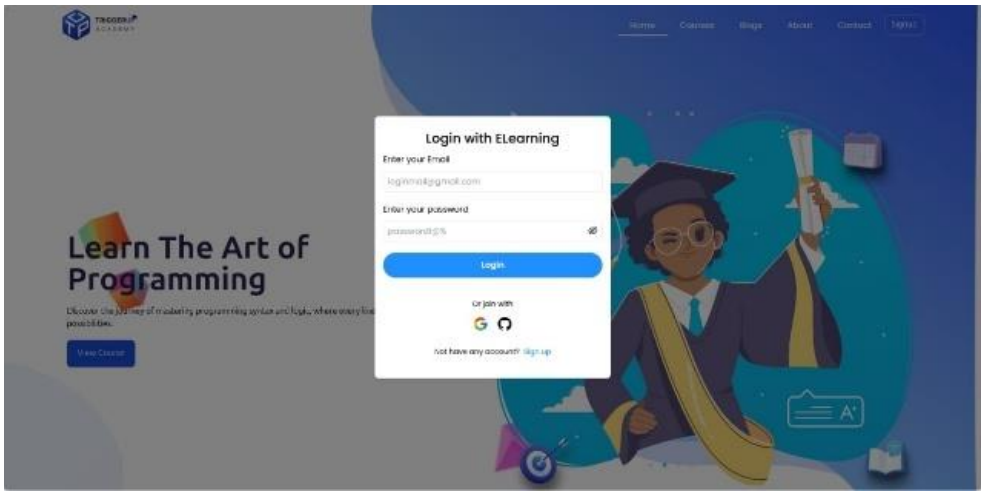

Figure 6.3: Login-Signup

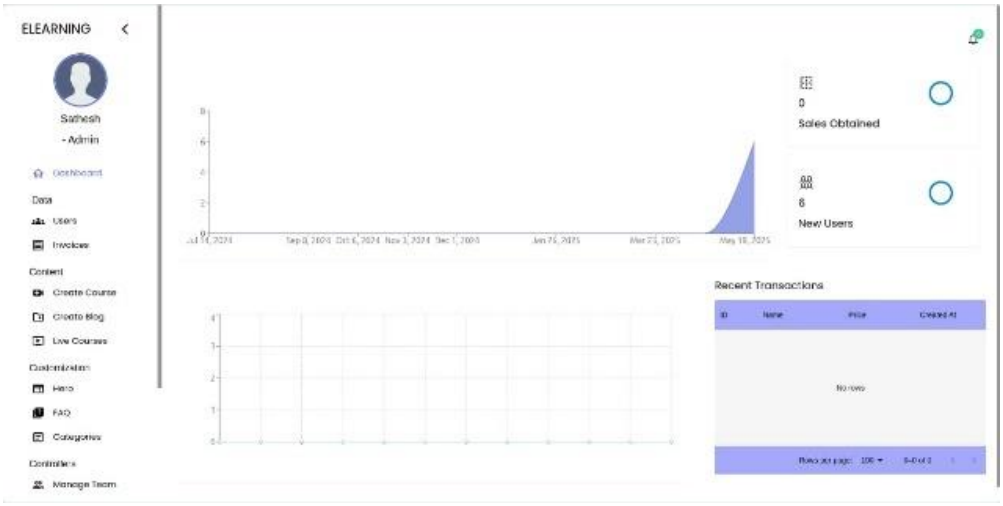

Figure 6.4: Admin Dashboard

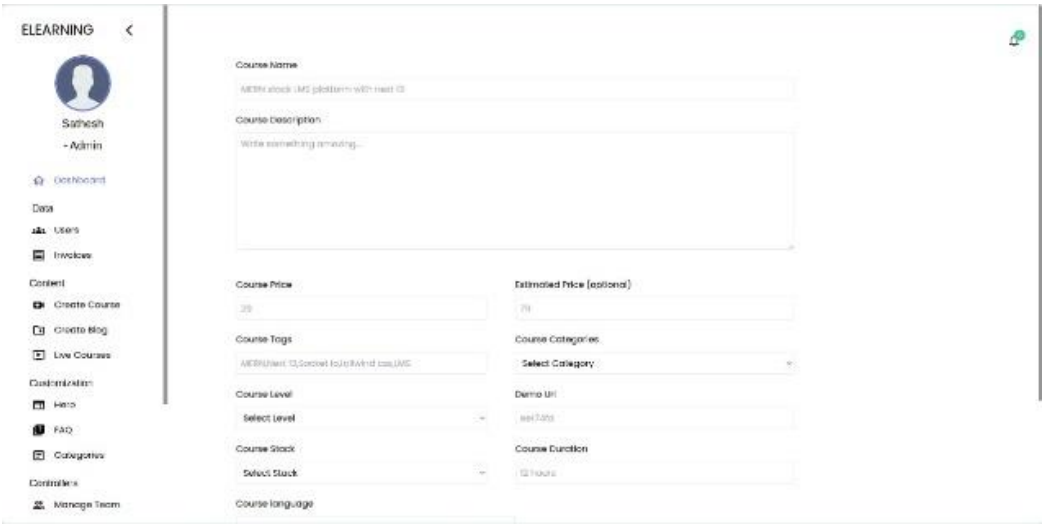

Figure 6.5 Course creation

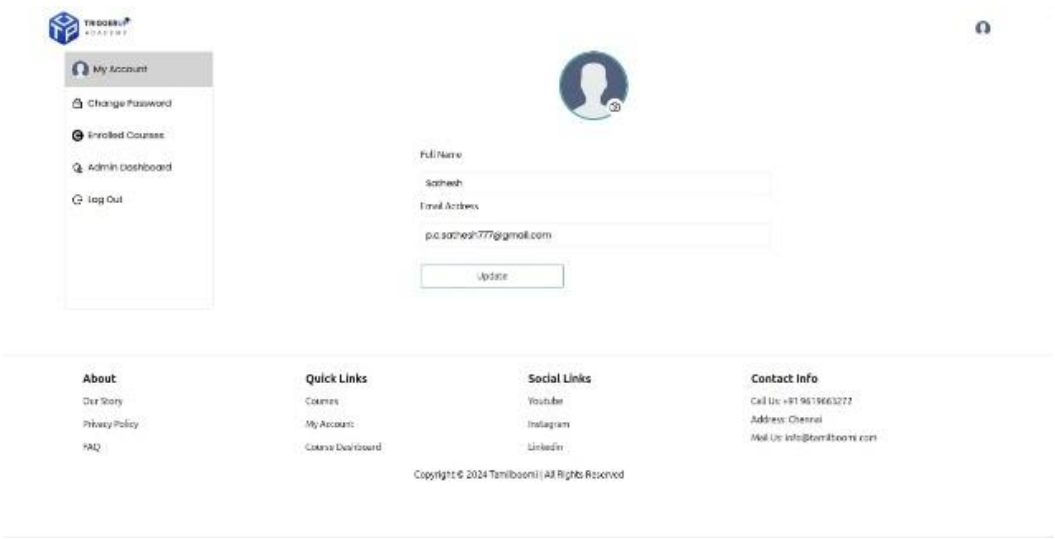

Figure 6.6User UI

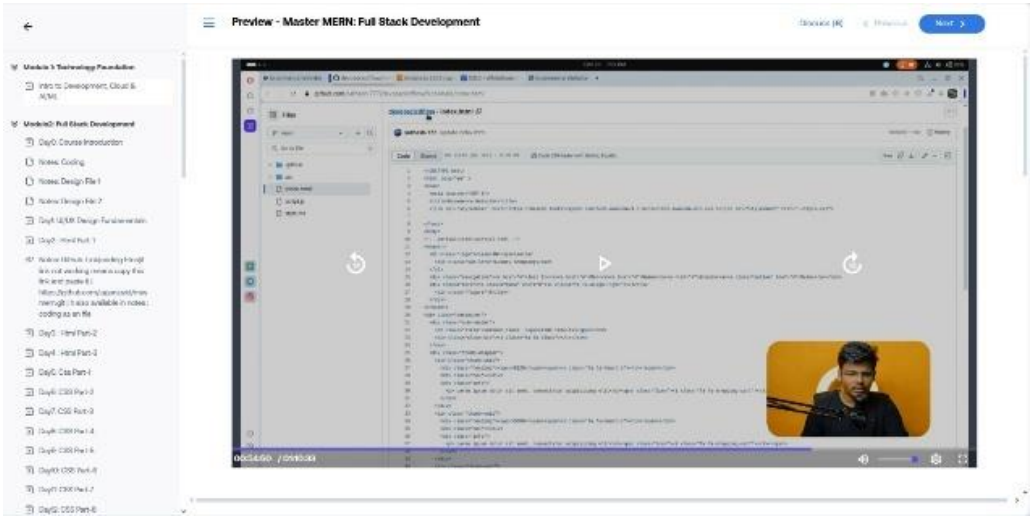

Figure 6.7 Learning Dashboard

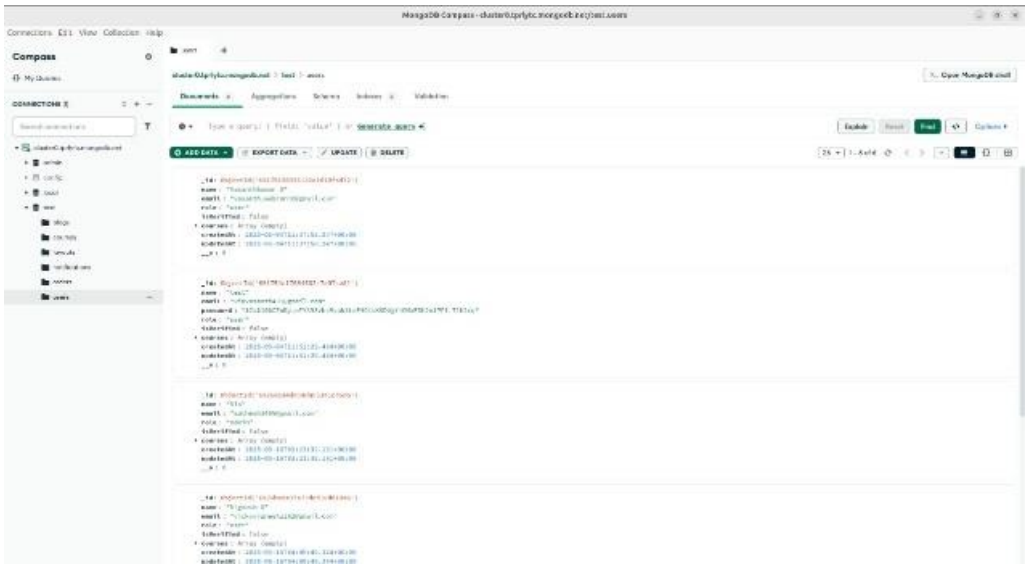

Figure 6.8Database MongoDB

Figure 6.9 Deepseek AI for doubt clearing

CONCLUSION AND FUTURE ENHANCEMENTS

CONCLUSION

This project presents a complete and scalable AI-powered e-learning platformdesigned to modernize the way educational content is delivered, accessed, andsupported. By combining a dual LMS approach—vendor-based for quick deployment and self-hosted for full control—the platform addresses the needs of both institutions and individual educators.

One of the key highlights of this platform is the integration of DeepSeek AI, an open-source language model that provides 24/7 automated doubt clarification. This drastically reduces the dependency on human tutors, enhances student satisfaction, and ensures continuity in learning. Additionally, the incorporation of real-time support via Socket.IO, secure video streaming, and admin analytics dashboards makes the platform not only user-friendly but also data-driven and highly efficient.

Extensive testing has demonstrated the platform's capability to handle concurrent users, deliver low-latency responses, and offer a seamless user experience. The architecture's modular design and Dockerized deployment model ensure that the platform can scale across use cases and user bases.

In essence, the platform serves as a future-ready solution to bridge the gap between traditional LMS limitations and the growing demand for intelligent, interactive, and scalable e-learning environments.

Future Enhancement

While the current system lays a strong foundation for smart learning, several future enhancements can further improve its capabilities and user experience:

- Voice-Based AI Doubt Solving – Enable users to ask questions via voice commands and return spoken responses.
- Multilingual Support – Add support for regional languages like Tamil and Hindi.
- Mobile App Integration – Develop a cross-platform app with offline access.
- Gamification Features – Introduce badges, leaderboards, and reward systems.
- AI Performance Optimization – Fine-tune DeepSeek and implement fallback to human support when needed.
- Automated Quiz Generator – Generate quizzes from uploaded content using AI.
- Plagiarism Detection – Ensure originality in user submissions and queries.
- LTI Integration – Enable academic institutions to adopt the platform seamlessly.

REFERENCES

[1] M. Chassignol, A. Khoroshavin, A. Klimova, and A. Bilyatdinova, "Artificial Intelligence trends in education: A narrative overview," *Procedia Computer Science*, vol. 136, pp. 16–24, 2018, doi: 10.1016/j.procs.2018.08.233.

[2] L. Chen, P. Chen, and Z. Lin, "Artificial intelligence in education: A review," *IEEE Access*, vol. 8, pp. 75264–75278, 2020, doi: 10.1109/ACCESS.2020.2988510.

[3] DeepSeek AI, “DeepSeek - Open-source LLM for doubt-solving,” GitHub Repository, 2024. [Online]. Available: https://github.com/deepseek-ai
[4] Graphy LMS, “Graphy – No-code learning management system platform,” Graphy Documentation, 2024. [Online]. Available: https://graphy.com
[5] Docker Inc., “Docker Documentation – Containerized application deployment,” Docker Docs, 2024. [Online]. Available: https://docs.docker.com
[6] MongoDB Inc., “MongoDB Atlas – Cloud database service,” MongoDB Docs, 2024. [Online]. Available: https://www.mongodb.com/docs/atlas
[7] VdoCipher, “Secure video streaming platform for educational content,” VdoCipher Developer Docs, 2024. [Online]. Available: https://www.vdocipher.com
[8] Next.js & MUI, “Modern web UI frameworks: Next.js and Material UI,” Developer Docs, 2024. [Online]. Available: https://nextjs.org and https://mui.com