CourseMate: An AI-Enabled Learning Management System with Integrated Real-Time Interview Platform Using the MERN Stack

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Abstract - The rapid expansion of digital education has created a strong demand for intelligent, scalable, and interactive platforms capable of supporting both learning and evaluation processes. This paper presents *CourseMate*, an AI-enabled Learning Management System (LMS) integrated with a real-time interview assessment platform, implemented using the MERN stack consisting of MongoDB, Express.js, React.js, and Node.js. The proposed system provides a unified framework for course administration, digital content delivery, learner progress analysis, and AI-assisted interview evaluation. Core functionalities include secure authentication, role-based access control, interactive learning modules, and automated feedback generation during interview sessions. The MERN architecture ensures high performance, responsiveness, and scalability, making the system suitable for academic institutions and training organizations. Experimental observations indicate that CourseMate improves assessment efficiency, reduces manual evaluation effort, and delivers reliable real-time feedback to users.

Key Words: Learning Management System, MERN Stack, Artificial Intelligence, Real-Time Interview Platform, Scalable Web Application

1.INTRODUCTION

Digital education has undergone a significant transformation with the advancement of web technologies and the integration of artificial intelligence. Modern Learning Management Systems are no longer limited to static content delivery; instead, they aim to provide adaptive learning, automated assessments, and personalized feedback mechanisms that enhance learner engagement and academic performance.

Simultaneously, real-time online interview platforms have become essential tools for academic evaluations, technical assessments, and recruitment processes. These platforms enable institutions to assess candidates instantly without geographical limitations. However, many existing systems operate independently and rely heavily on manual evaluation, resulting in delayed feedback, limited personalization, and inefficient assessment workflows.

The MERN stack offers a complete JavaScript-based development environment that supports real-time communication, scalability, and seamless integration between front-end and back-end components. This makes it an ideal technology stack for developing AI-powered educational platforms that combine learning management and interview evaluation within a single system.

2. Body of Paper

2.1 Existing Learning Management Systems and Their Limitations

Popular LMS platforms such as Moodle, Blackboard, Canvas, and Google Classroom provide essential academic functionalities, including course content management, assignment submission, grading systems, and communication tools like discussion forums and announcements.

Despite their widespread adoption, these systems face several limitations:

- Lack of real-time analytics for continuous learner performance monitoring
- Limited adaptability to individual learning styles
- Heavy dependence on manual assessment and feedback processes
- Scalability and security issues when handling large user bases
- Minimal integration of artificial intelligence for personalized learning

These challenges highlight the need for an intelligent LMS that integrates AI-based evaluation and real-time interview capabilities within a unified platform.

2.2 Role of Artificial Intelligence in Modern LMS

Artificial intelligence plays a crucial role in enhancing the effectiveness of modern LMS platforms. AI-driven adaptive learning algorithms dynamically adjust content delivery based on learner behavior and performance. Recommendation systems suggest relevant courses, modules, and learning resources tailored to individual needs.

Machine learning and natural language processing techniques enable automated grading, answer evaluation, and instant feedback generation. AI-powered analytics dashboards provide instructors and learners with insights into engagement levels, progress trends, and skill gaps. Additionally, chatbots and virtual assistants offer continuous academic support, improving overall user experience and accessibility.

2.3 Real-Time Interview Platforms: State of the Art

Contemporary interview platforms such as HackerRank, InterviewBit, Codility, and video-based assessment tools support live coding environments, audio-video communication, automated scoring, and performance analytics.

Advanced AI techniques enhance candidate evaluation through speech analysis, facial expression recognition, behavioral assessment, and code quality analysis. Real-time proctoring mechanisms help detect suspicious activities during interviews. However, these platforms face challenges related to data privacy, ethical fairness, scalability, and latency during AI-based real-time evaluation.

2.4 MERN Stack for LMS and Interview Platforms

The MERN stack consists of:

- **MongoDB:** A schema-less NoSQL database enabling flexible and scalable data storage
- **Express.js:** A lightweight backend framework for building secure and efficient APIs
- **React.js:** A front-end library for creating responsive and interactive user interfaces
- **Node.js:** A server-side runtime that supports asynchronous operations and real-time communication

This full-stack JavaScript ecosystem enables seamless integration between application layers, efficient real-time data handling, and simplified deployment of scalable web applications.

2.5 Integration of AI with MERN Stack

AI modules are integrated into the MERN architecture using RESTful APIs or microservices, often developed with Python-based frameworks such as Flask or FastAPI. Lightweight models can be deployed using TensorFlow.js to execute AI logic directly in the browser for faster response times.

WebSockets enable real-time data exchange during live interviews and adaptive learning sessions. Structured data pipelines store learner activity, interview metrics, and training datasets. Separating AI computation from user interface components enhances system scalability, maintainability, and performance.

2.6 Research Gaps Identified

The literature review identifies several research gaps:

- Lack of unified platforms combining LMS and real-time interview evaluation
- Limited research on real-time AI feedback in MERN-based applications
- Insufficient studies on scalability and performance optimization of AI models
- Absence of standardized metrics for adaptive learning and interview evaluation
- Limited focus on privacy, fairness, and security in AI-driven educational systems

2.7 Summary of Reviewed Literature

- Piyumantha et al. (2022):
  Developed an LMS using adaptive learning and NLP techniques. Integrated system components through RESTful APIs. Achieved improved learner engagement .Limited by the absence of real-time feedback capabilities

- Rajasekar (2024):
  Designed an AI-based interview evaluation Platform. Utilized facial recognition and automated code evaluation. Implemented using a microservices architecture. Provided accurate assessment results. Faced privacy and ethical concerns related to biometric data

- Sharma et al. (2025):
  Proposed an AI-enabled LMS with a recommendation engine. Implemented using the MERN stack. Offered personalized learning paths.Encountered scalability issues under high user load.

2.8 Research Directions and Opportunities

Future research may focus on developing hybrid AI-MERN frameworks that combine LMS and interview evaluation systems. Deploying edge AI or lightweight models can further improve real-time feedback. Additional opportunities include AI-based skill gap analysis, personalized learning roadmaps, intelligent recruiter dashboards, and blockchain-enabled security mechanisms for trusted assessments.

3. CONCLUSIONS

This paper presented *CourseMate*, an AI-enabled Learning Management System integrated with a real-time interview evaluation platform using the MERN stack. The proposed system enhances digital education by automating course management, enabling AI-assisted assessments, and supporting interactive learning experiences. Addressing challenges related to scalability, real-time AI integration, and data security can further strengthen such platforms, making them reliable and adaptable for global academic and organizational use.

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