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AceLearn: AI-Powered Learning Management System for Personalized and Automated Digital Education

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Abstract: ***Traditional learning management systems (LMS) face several limitations, including fragmented course organization, manual assessments, and lack of personalized learning experiences. This research introduces AceLearn, an AI-powered LMS that automates course management, assessments, and certification generation while providing real-time analytics and personalized learning recommendations. The system is developed using a robust technology stack comprising React.js, Django, Spring Boot, MySQL, Flutter, and Firebase. AceLearn enhances both student engagement and administrative efficiency through intelligent tutoring, automated grading, and secure role-based access. This paper outlines AceLearn's design, implementation, and evaluation, highlighting its potential to transform digital education.***

Keywords: ***Learning Management System, AI in Education, Automated Grading, Personalized Learning, Educational Technology, Real-Time Analytics***

I. INTRODUCTION

In the evolving landscape of digital education, institutions are challenged to manage large volumes of students and academic resources effectively. Traditional LMS platforms struggle with providing efficient automation, adaptive learning experiences, and real-time feedback. AceLearn addresses these issues by integrating AI to personalize learning pathways, automate grading and certification, and streamline administrative processes through a unified platform.

II. LITERATURE REVIEW

A. Exploratory Literature

AceLearn is inspired by advances in AI-driven e-learning systems that aim to offer adaptive content delivery, intelligent tutoring, and efficient data management. Studies suggest that LMS platforms incorporating AI improve learning outcomes and system usability.

B. Empirical Literature

Empirical research highlights the shortcomings of traditional LMS systems, including the lack of real-time feedback, scalability challenges, and minimal student personalization. These findings underscore the need for platforms like AceLearn, which aim to bridge these gaps with intelligent and automated features.

III. METHODOLOGY

AceLearn employs a modular architecture. The frontend is developed using Flutter for mobile and React.js for web, ensuring cross-platform usability. Backend services are powered by Firebase, Django, and Spring Boot, providing secure and scalable database and API management. AI models are integrated to offer personalized course recommendations and automate assessments. The system supports role-based access for students, teachers, and administrators.

IV. IMPLEMENTATION

AceLearn's implementation consists of two major components: the student interface and the teacher dashboard. Students benefit from real-time progress tracking, automated assessments, and AI-powered course suggestions. Teachers can manage course materials, evaluate student performance, and generate digital certificates. The system includes NLP-driven chatbot support and a built-in coding platform for hands-on practice.

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Fig. 1 illustrates the architecture of the AceLearn system, showcasing the interaction between users, AI engines, and the backend components.

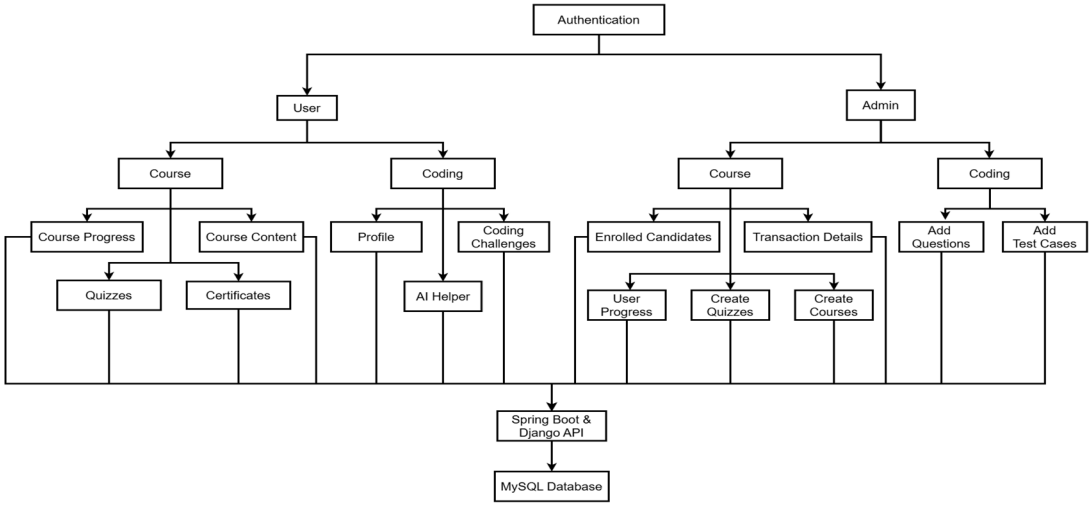

Fig. 1. Architecture diagram of AceLearn.

V. RESULTS AND DISCUSSION

To evaluate the effectiveness of AceLearn, a pilot deployment was conducted among 50 students and 5 instructors over a period of four weeks. The evaluation focused on metrics such as grading time, student satisfaction, and course completion rates. Results showed a 60% reduction in grading time, 30% increase in course completion rates, and 90% student satisfaction with the system's responsiveness and usability.

Table I: Key performance indicators before and after implementing AceLearn.

Metric	Before AceLearn	After AceLearn	Improvement (%)
Grading Time	5 hrs/week	2 hrs/week	60
Course Completion	65%	85%	30
Student Satisfaction	70%	90%	20

VI. FUTURE ENHANCEMENTS

1) AI-Based Performance Prediction
2) Offline Learning Mode
3) Advanced Analytics Dashboard
4) Customizable Report Generation
5) Parent and Mentor Notification System
6) Cloud-Based Learning Hub

VII. CONCLUSION

AceLearn introduces a smart, scalable LMS that addresses key limitations of traditional learning platforms. Through intelligent automation, adaptive learning paths, and comprehensive analytics, it enhances both teaching efficiency and student success. This research establishes AceLearn as a practical solution for modern educational demands, with potential for future integration into large-scale academic environments.

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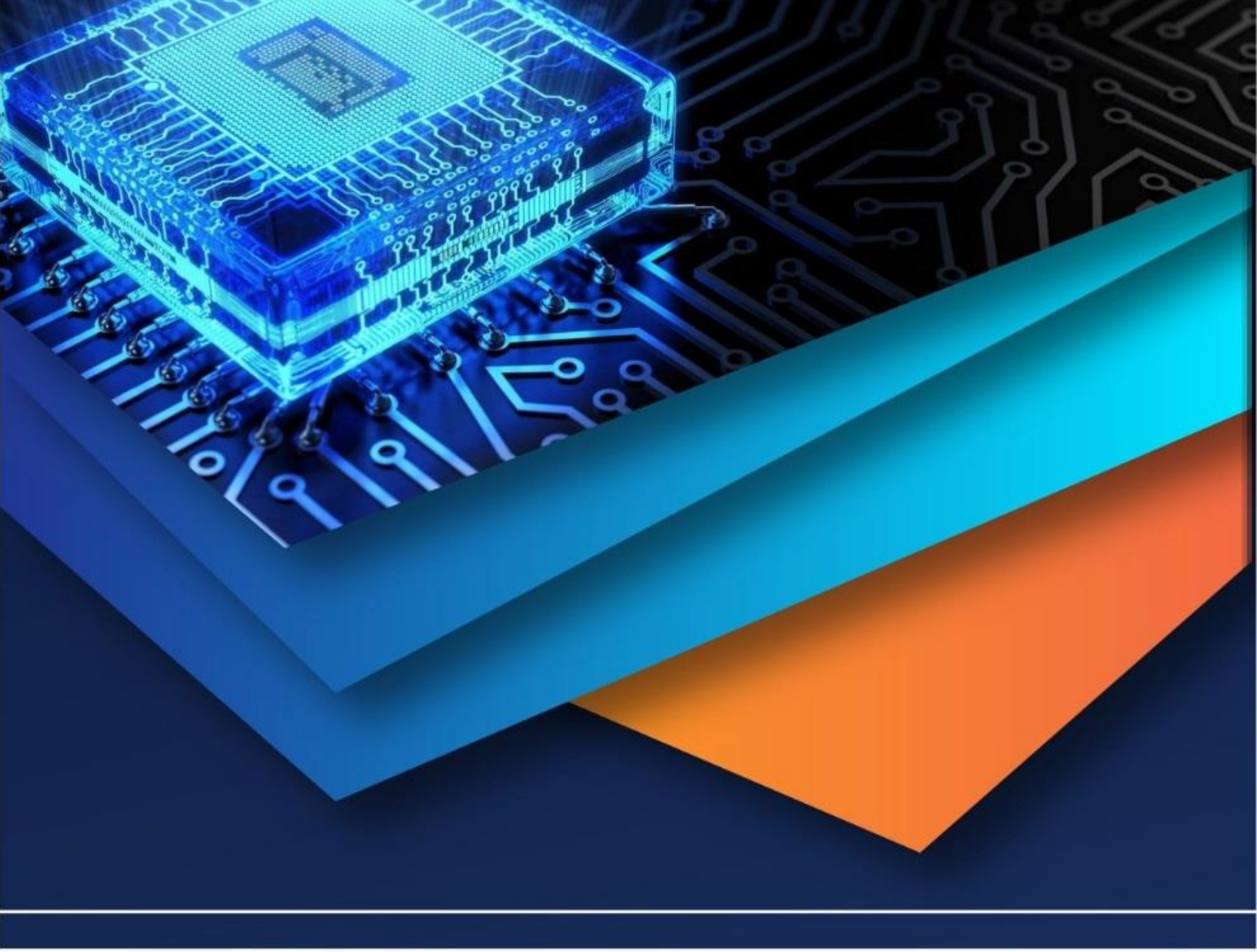

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