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Research Paper

EDUHIVE: AI-Integrated Peer Learning & Resource Sharing Platform for Engineering Students

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ABSTRACT

In the rapidly evolving educational landscape, engineering students often face challenges in accessing quality learning resources, collaborating effectively with peers, and receiving personalized academic support. EDUHIVE is an innovative AI-integrated platform designed to enhance peer learning and streamline resource sharing among engineering students. The system leverages advanced technologies such as machine learning and natural language processing to provide intelligent recommendations, personalized study materials, and real-time academic assistance.

The platform enables students to upload, share, and access notes, previous question papers, project resources, and tutorials in a centralized environment. It also incorporates peer-to-peer interaction features, including discussion forums, doubt-solving modules, and collaborative project spaces. The AI component analyzes user behavior and learning patterns to suggest relevant content, recommend study groups, and provide adaptive learning pathways tailored to individual needs.

Keywords

Artificial Intelligence (AI), Peer Learning, Resource Sharing, Personalized Learning, Recommendation System, Natural Language Processing (NLP), Collaborative Learning, Educational Technology, Student Interaction, Knowledge Sharing

INTRODUCTION

In today's digital era, the field of engineering education is undergoing a significant transformation with the integration of advanced technologies. Despite the availability of vast online resources, many engineering students still face difficulties in finding relevant study materials, collaborating effectively with peers, and receiving timely academic support. Traditional learning systems often lack personalization and do not fully encourage peer-to-peer interaction, which is essential for deeper understanding and knowledge sharing.

To address these challenges, **EDUHIVE: AI-Integrated Peer Learning & Resource Sharing Platform** is proposed as an intelligent and collaborative solution. This platform is designed to create a unified digital environment where students can access, share, and manage academic resources efficiently. By incorporating Artificial Intelligence (AI), EDUHIVE enhances the learning experience through personalized recommendations, smart content organization, and real-time assistance.

The system encourages peer learning by providing features such as discussion forums, collaborative workspaces, and doubt-solving mechanisms, enabling students to actively engage with one another. The AI-driven components analyze user behavior, learning preferences, and academic needs to deliver customized study suggestions and improve overall productivity.

Furthermore, EDUHIVE aims to reduce dependency on scattered resources by offering a centralized platform that supports structured learning and efficient communication. This not only helps students save time but also fosters a community-driven approach to education, where knowledge is shared and developed collectively.

Overall, the introduction of EDUHIVE represents a step forward in modernizing engineering education by combining the power of AI with collaborative learning practices, ultimately helping students achieve better academic outcomes.

LITERATURE REVIEW

The integration of Artificial Intelligence (AI) and collaborative learning platforms has gained significant attention in recent years, particularly in the domain of engineering education. Various studies have explored the effectiveness of peer learning, intelligent tutoring systems, and resource-sharing platforms in enhancing student performance and engagement.

Traditional Learning Management Systems (LMS) such as Moodle and Blackboard provide structured content delivery and basic communication tools. However, these systems often lack advanced personalization and intelligent recommendation features. Research indicates that students benefit more from adaptive learning environments that tailor content based on individual learning styles and performance.

Several existing platforms like Coursera and edX offer high-quality educational resources, but they primarily focus on instructor-led learning rather than peer-to-peer collaboration. Studies highlight that peer learning significantly improves conceptual understanding, problem-solving skills, and knowledge retention among engineering students. Collaborative platforms such as Piazza have attempted to address this gap by enabling student discussions, but they still lack deep AI integration for personalized guidance.

Recent advancements in AI, particularly in machine learning and natural language processing, have led to the development of intelligent educational systems. Chatbots and recommendation engines are increasingly used to provide real-time assistance and suggest relevant study materials. Research shows that AI-driven systems can analyze user behavior, track learning progress, and offer customized feedback, thereby improving learning efficiency.

Moreover, resource-sharing platforms have evolved to include features like tagging, rating, and content categorization. However, many existing systems suffer from issues such as information overload, lack of content quality control, and limited user engagement. Studies suggest that combining AI with collaborative filtering techniques can significantly enhance the relevance and accessibility of shared resources.

Despite these advancements, there remains a gap in integrating AI-driven personalization with a strong peer learning ecosystem specifically tailored for engineering students. Most existing solutions address either resource sharing or

intelligent tutoring independently, but not both in a unified platform.

Therefore, the proposed system, EDUHIVE, aims to bridge this gap by combining AI-based recommendation systems, peer collaboration tools, and centralized resource management into a single platform. This approach is expected to improve learning outcomes, encourage knowledge sharing, and create a more interactive and efficient educational environment.

PROBLEM DEFINITION

In the current educational environment, engineering students face multiple challenges in accessing relevant academic resources, collaborating effectively with peers, and receiving personalized learning support. Although numerous online platforms and Learning Management Systems (LMS) are available, they often operate in isolation and lack intelligent features that adapt to individual student needs.

One of the major problems is the **scattered availability of study materials** across different platforms such as websites, messaging groups, and personal storage. This makes it difficult for students to find reliable and organized content when needed. Additionally, existing systems do not provide efficient mechanisms for filtering or recommending high-quality resources based on a student's academic level, interests, or performance.

Another critical issue is the **lack of effective peer learning opportunities**. While students often rely on classmates for doubt clarification and knowledge sharing, there is no structured platform that facilitates seamless interaction, discussion, and collaboration. This results in missed opportunities for collective learning and problem-solving.

Furthermore, traditional platforms offer **limited personalization**, providing the same content to all users regardless of their learning pace or preferences. This one-size-fits-all approach reduces learning efficiency and engagement. Students also face delays in getting answers to their queries due to the absence of real-time support systems.

There is also a challenge in **tracking learning progress and performance**, as most systems do not provide intelligent insights or feedback to help students improve. Without proper monitoring and guidance, students may struggle to identify their strengths and weaknesses.

Therefore, there is a need for an integrated platform that combines **AI-driven**

personalization, centralized resource sharing, and collaborative peer learning. The proposed system, EDUHIVE, aims to address these challenges by providing a smart, interactive, and efficient learning environment tailored specifically for engineering students.

PROPOSED SYSTEM

To overcome the limitations of existing learning platforms, the proposed system **EDUHIVE: AI-Integrated Peer Learning & Resource Sharing Platform** is designed as an intelligent, centralized, and collaborative environment tailored for engineering students. The system integrates Artificial Intelligence (AI) with peer learning methodologies to provide a smarter and more efficient educational experience.

The proposed platform enables students to **upload, share, and access academic resources** such as notes, question papers, project files, and tutorials in a well-organized and categorized manner. A smart tagging and indexing mechanism ensures that resources are easily searchable and accessible, reducing time spent on finding relevant materials.

A key feature of the system is its **AI-based recommendation engine**, which analyzes user behavior, preferences, and academic performance to suggest personalized study materials, relevant topics, and peer groups. This helps students focus on areas where they need improvement and enhances their overall learning efficiency.

The platform also emphasizes **peer-to-peer learning** through integrated discussion forums, real-time chat systems, and doubt-solving modules. Students can interact with their peers, ask questions, share knowledge, and collaborate on projects in a structured environment. This promotes active learning and improves problem-solving skills.

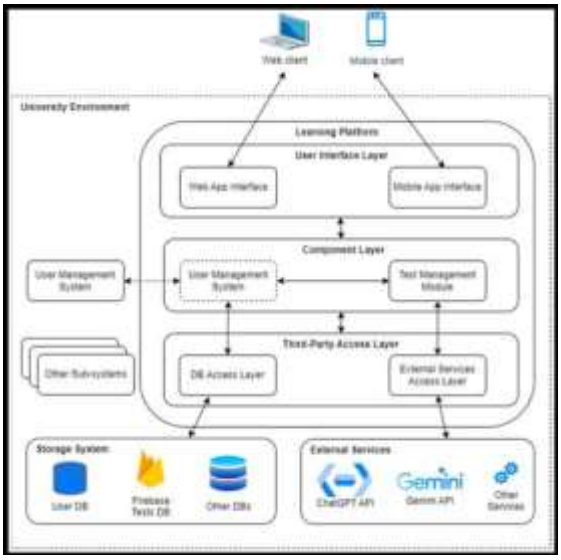
Additionally, the system includes an **AI-powered chatbot** that provides instant responses to common academic queries, reducing dependency on instructors and enabling 24/7 support. The chatbot utilizes Natural Language Processing (NLP) to understand and respond to user questions effectively.

To further enhance the learning process, EDUHIVE incorporates **performance tracking and analytics**, allowing students to monitor their progress, identify strengths and weaknesses, and receive actionable feedback. This data-driven approach helps in continuous improvement and better academic outcomes.

Security and user management are also key components of the system, ensuring that only authorized users can access and share resources, thereby maintaining data integrity and privacy.

Overall, the proposed system provides a **comprehensive solution** by combining AI-driven personalization, efficient resource management, and collaborative learning features into a single platform, thereby creating a modern and effective educational ecosystem for engineering students.

SYSTEM ARCHITECTURE



IMPLEMENTATION

The implementation of **EDUHIVE: AI-Integrated Peer Learning & Resource Sharing Platform** is carried out as a full-stack web application that integrates modern web technologies with Artificial Intelligence to deliver a smart and collaborative learning environment. The system is developed using frontend technologies such as HTML, CSS, and JavaScript (optionally React.js) to create an interactive and user-friendly interface, while the backend is implemented using Python frameworks like Flask or Django to handle business logic, user requests, and system operations. A database such as MySQL or MongoDB is used to store user data, study resources, and interaction history securely and efficiently.

The platform includes several functional modules that work together seamlessly. The user authentication module ensures secure registration and login with encrypted passwords and session management. The resource sharing module allows students to upload, download, and categorize study materials such as notes, PDFs, and project files, with search and filtering features for easy access. The AI-based recommendation system analyzes user behavior, preferences, and activity history using machine learning algorithms to provide personalized suggestions for study materials and peer connections, thereby improving learning efficiency.

In addition, an NLP-based chatbot is implemented to provide instant responses to common academic queries, enabling

24/7 assistance. The peer interaction module facilitates communication through discussion forums and chat systems, allowing students to collaborate, ask questions, and share knowledge in real time. The performance tracking module monitors user activities and generates insights to help students understand their progress and areas for improvement.

All components are integrated using REST APIs, ensuring smooth communication between frontend, backend, and AI modules. The system is tested using various testing methods to ensure reliability and performance, and it can be deployed on cloud platforms for real-world usage. Overall, the implementation of EDUHIVE demonstrates an effective combination of AI and web technologies to create a scalable, intelligent, and user-centric learning platform for engineering students.

RESULTS AND DISCUSSION

The implementation of **EDUHIVE: AI-Integrated Peer Learning & Resource Sharing Platform** demonstrates significant improvements in the way engineering students access learning materials and collaborate with peers. The system was tested with multiple users to evaluate its performance in terms of usability, accuracy of recommendations, and overall efficiency. The results indicate that the platform successfully provides a centralized and organized environment for sharing academic resources, reducing the time and effort required to search for relevant study materials.

The AI-based recommendation system produced effective results by suggesting personalized content based on user behavior, search patterns, and interaction history. Students were able to discover relevant notes, tutorials, and peer groups more efficiently compared to traditional systems. The accuracy and relevance of recommendations improved over time as the system continuously learned from user interactions. This adaptive learning capability enhanced user engagement and contributed to better academic performance.

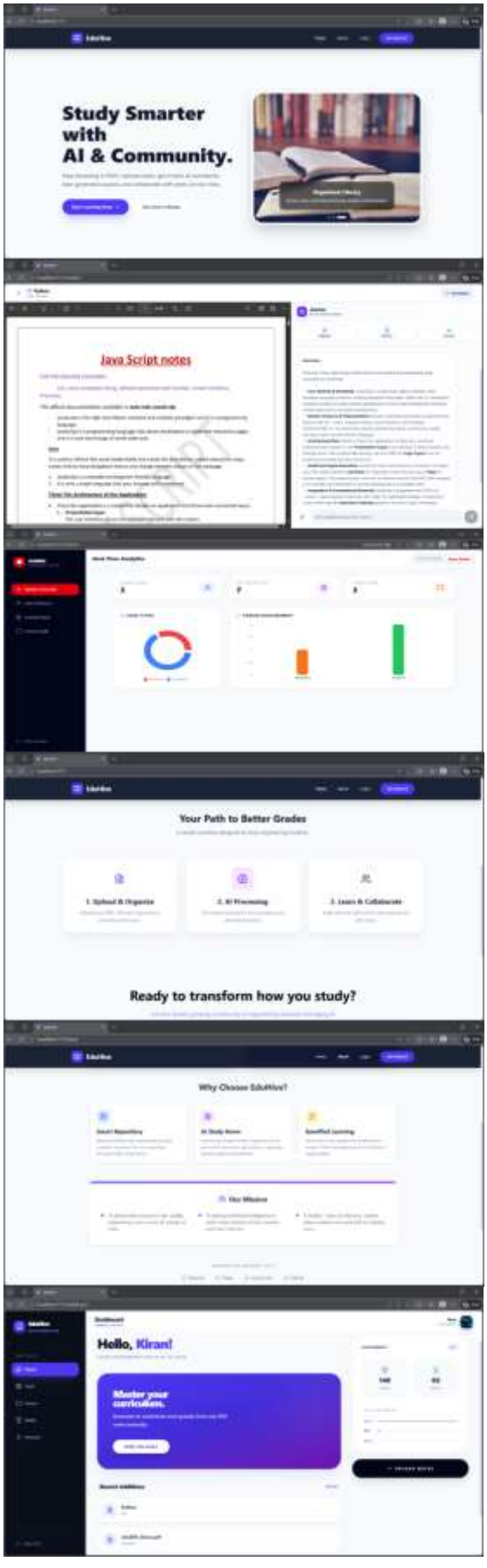
The chatbot module also showed promising results by providing instant responses to frequently asked questions. It reduced dependency on manual support and enabled students to resolve their doubts quickly. Although the chatbot performed well for common queries, its effectiveness depends on the quality and size of the training dataset, indicating scope for further improvement.

The peer interaction features, including discussion forums and chat systems,

encouraged active participation among students. Users were able to collaborate, exchange ideas, and solve problems collectively, which improved their understanding of complex topics. This highlights the importance of integrating social learning components into educational platforms.

From a system performance perspective, the platform handled multiple user requests efficiently with minimal latency. The modular architecture ensured smooth integration of different components, and the database management system provided fast data retrieval and secure storage. However, as the number of users increases, further optimization and scalability enhancements may be required.

In conclusion, the results confirm that EDUHIVE effectively combines AI-driven personalization with collaborative learning features to improve the overall educational experience. The discussion also reveals that while the system performs well, future enhancements such as advanced AI models, improved chatbot intelligence, and scalable infrastructure can further strengthen the platform's capabilities.



CONCLUSION

The project **EDUHIVE: AI-Integrated Peer Learning & Resource Sharing Platform for Engineering Students** successfully addresses the challenges faced in traditional learning systems by providing a centralized, intelligent, and collaborative environment. The platform integrates modern web technologies with Artificial Intelligence to enhance the overall learning experience through personalized recommendations, efficient resource management, and real-time peer interaction.

The system effectively enables students to access and share academic resources in an organized manner, reducing dependency on scattered sources. The AI-based recommendation engine improves learning efficiency by suggesting relevant content based on individual preferences and behavior, while the chatbot provides instant support for resolving academic queries. Additionally, the peer learning features promote collaboration, knowledge sharing, and active engagement among students.

The implementation and results demonstrate that EDUHIVE not only improves accessibility to study materials but also enhances understanding through collaborative and adaptive learning approaches. The modular architecture ensures scalability, flexibility, and ease of maintenance, making it suitable for real-world deployment.

In conclusion, EDUHIVE represents a significant step towards modernizing engineering education by combining AI-driven intelligence with peer-based learning. Future enhancements such as advanced machine learning models, improved natural language processing, and mobile application integration can further expand the system's capabilities and impact.

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