COMP7705 Project

Detailed Project Proposal

Project Title: Smart Learning Platform

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Aim

The online learning field is developing rapidly, but it still faces numerous challenges, particularly in meeting learners' needs, improving learning efficiency, and fostering interaction. Although traditional platforms like LeetCode and MOOC occupy a certain market share in their respective domains, they have significant shortcomings.

Taking MOOC as an example, while it offers a wealth of course content, it mainly relies on recorded videos and predefined exercises, lacking real-time interaction and limiting opportunities for self-directed learning. Additionally, the absence of personalized recommendations and in-depth error analysis leaves learners without motivation and feedback, making it difficult to enhance learning outcomes. In contrast, while LeetCode provides a degree of interactivity, it lacks AI-assisted features, failing to provide learners with real-time guidance and detailed feedback, which negatively impacts the learning experience.

To address these issues, constructing intelligent learning platforms is essential. By integrating AI-driven Q&A systems, personalized recommendations, real-time feedback, and data analytics, these platforms can significantly enhance the learning experience. Data-driven strategies will help learners optimize their learning methods, while community interaction features will boost motivation. This project aims to leverage AI technology to create a more intelligent online learning model that meets the needs of modern learners.

Brief Literature Review

As educational demands diversify, traditional educational models face increasing challenges. Personalized learning, as an emerging educational approach, can better meet the unique needs and learning styles of students. Traditional educational models primarily rely on standardized curricula and uniform teaching methods, which struggle to accommodate the increasingly diverse needs of students. For instance, Khan Academy

(n.d.) provides widely accessible video explanations but lacks personalized recommendations that may not cater to all learners' individual needs. Additionally, the value of Coursera's (n.d.) course certificates may be limited for some users, and the quality of community interaction varies. LeetCode (n.d.) focuses on enhancing programming skills, but its personalized recommendations may not be accurate enough for beginners, making it difficult to find suitable challenges. These issues highlight the importance of personalized learning approaches. Murtaza et al. (2022) emphasize that personalized e-learning systems can intelligently match appropriate learning content and assessment methods based on learners' comprehension levels, learning habits, and preferred learning styles. This approach not only improves learning efficiency but also fosters learners' autonomy and interest.

The implementation of personalized learning platforms significantly relies on artificial intelligence (AI) technology. In recent years, AI has made remarkable progress in the education sector, providing strong technical support for customized learning (Guan, Zhang, & Gu, 2025). Chen et al. (2020) highlight that generative AI, combined with recommendation algorithms and data analytics, is increasingly being applied in education to provide personalized learning support and optimize learning outcomes. Research by Park et al. (2025) shows that using ChatGPT in programming education has significant advantages. Compared to students relying on Stack Overflow or receiving no assistance, learners using ChatGPT perform better in understanding programming concepts and solving problems. Furthermore, Chen et al. (2014) highlights the growing use of collaborative filtering (CF) in e-learning, where hybrid approaches like CF and social network analysis enhance personalized learning recommendations for better student outcomes. Thus, the CF algorithm shows significant potential in the education sector. Additionally, Yu et al. (2024) emphasize that the use of data visualization techniques in personalized learning significantly enhances learning outcomes. Experimental results show that combining routing algorithms and data visualization enhances user experience in e-learning by providing real-time analysis of learning behaviors, helping students track progress and identify weaknesses.

Despite the immense potential of AI technology in personalized learning, these platforms still face significant gaps in AI integration. Specific challenges include the complexity of technological integration, the protection of user data privacy, and the lack of real-time feedback and adaptive learning experiences (Yousuf & Wahid, 2021). These challenges must be addressed to create a more efficient learning environment.

This project aims to develop a highly integrated AI-driven personalized learning platform to bridge the existing gaps in AI integration, real-time feedback, and adaptive learning experiences. Through this comprehensive approach, the project hopes to construct a more interactive, intelligent, and personalized learning environment, ultimately enhancing students' learning efficiency and engagement. Future research can further explore how to optimize user experience and enhance the platform's adaptability and flexibility.

References:

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Proposed Methodology

1. AI-Driven Q&A System
Model Selection: GPT-3 will be chosen as the core model due to its excellent performance in natural language understanding and generation. The Hugging Face Transformers library will be used to load and utilize this model.
Data Preparation: Relevant Q&A datasets, such as those from Quora or Stack Overflow, will be collected. Data cleaning will be performed using Python to remove noise, irrelevant content, and duplicate entries. The data will be labeled to ensure each question has the correct answer.
Training Process: The model will be trained using PyTorch, with appropriate settings for learning rate and batch size. Multiple rounds of iterative training will be conducted, utilizing a validation set to monitor model performance and avoid overfitting.

2. Personalized Recommendation System
Algorithm Selection: A user-item collaborative filtering algorithm will be adopted, implemented using the Surprise library.
Data Processing: A user-question matrix will be constructed to record user responses to each question (correct or incorrect). Data cleaning will be performed with Pandas to ensure matrix integrity and consistency.
Evaluation Metrics: Precision, recall, and F1 score will be used to evaluate recommendation effectiveness. Online A/B testing will be conducted to compare the performance of different recommendation algorithms and select the best option.

3. Data Analysis and Reporting
Data Storage: MySQL will be chosen as the database, designing user data tables, question data tables, and error record tables for efficient access.
Data Cleaning and Feature Extraction: Pandas will be used for data cleaning to remove invalid records and fill in missing values. User learning behavior features will be extracted,

such as study duration and question accuracy.
Error Analysis and Time Expenditure: User error types will be analyzed to identify common mistakes and develop targeted review plans. Time reports will be generated based on user study time to help with effective learning scheduling.
Visualization Tools: Chart.js will be used to create learning progress charts and error analysis graphs, showcasing user performance over different time periods. Automated learning reports will be generated, including review suggestions and areas for error improvement.

4. Front-End Development
UI Components: The React framework will be used to create components such as question display, answer submission, and progress tracking components. An intuitive user interface will be designed to ensure users can quickly find the features they need.
Responsive Design: CSS Flexbox and Grid layouts will be employed to ensure good display performance on mobile, tablet, and desktop devices. Media Queries will be used to adjust styles for different screen sizes.

5. Back-End Development
API Design: Spring Boot will be used to create a RESTful API, providing functionalities such as user registration, login, fetching questions, and submitting answers. Clear API documentation will be designed, with Swagger used to generate interface documentation for front-end and back-end collaboration.
Database Architecture: Database table structures will be designed, including user tables, question tables, answer tables, and error record tables to ensure clear data relationships. MyBatis will be employed for database operations to facilitate complex queries and data management.

6. Evaluation Plan
Functional Testing: Unit tests will be written for each module to ensure functionalities operate correctly.
Performance Testing: JMeter will be used for stress testing the system, simulating high concurrent user access to evaluate system response time and stability.

Milestones

	Tasks	***Estimated completion time***	***Estimated number of learning hours***
1	Clarify the platform goals, background, and motivation, and formulate technical solutions.	3.10	20
2	Conduct market product research, technology selection, core function planning, architecture design, and preliminary development preparation.	4.7	40
3	Establish the overall technical framework and begin preliminary development of the online Q&A module's functionality.	5.5	40

4	Implement multiple functions of the online Q&A module.	6.1	60
5	Establish basic functionality for the data analysis module and recommendation feature.	6.16	80
6	Confirm that the core functions of the platform are complete, conduct comprehensive system function testing, and make final adjustments.	7.7	20
7	Submit the complete web version, ensuring the platform is online and accessible.	7.15	15
8	Submit the complete project report, summarizing project goals, methods, test results, challenges, and solutions, and provide technical documentation and future development suggestions.	7.18	15
9	Conduct a project presentation, demonstrating the project functions, summarizing the project content, and preparing to answer questions from the review committee.	End of July	10
10			
			Total: 300

Deliverables

Items	
1	Submit a complete detailed proposal that clarifies the platform goals, background, and technical solutions.
2	Submit the first progress report, including market research, technology selection, core function planning, and screenshots of preliminary development.
3	Submit the second progress report, describing the establishment of the technical framework and initial development progress of the online Q&A module's functionality.
4	Submit the mid-term report and presentation materials, showcasing multiple functions of the online Q&A module and basic functionality of the data analysis module.
5	Submit the third progress report, covering the development of the recommendation feature and enhancements to other module functionalities.
6	Submit the fourth progress report, confirming the completion of core functions and documenting comprehensive system testing and final adjustments.
7	Submit the complete web version, ensuring the platform is online and accessible with cross-platform compatibility.
8	Submit the complete project report, summarizing project goals, methods, test results, and future development suggestions.
9	Prepare the project presentation, demonstrating project functions and summarizing project content to answer questions from the review committee.
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