E-PROCEEDINGS

INTERNATIONAL TINKER INNOVATION & ENTREPRENEURSHIP CHALLENGE (i-TIEC 2025)

"Fostering a Culture of Innovation and Entrepreneurial Excellence"

23 January 2025
PTDI, UiTM Cawangan Johor
Kampus Pasir Gudang

ORGANIZED BY:

Electrical Engineering Studies, College of Engineering
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PREFACE

It is with great pleasure that we present the e-proceedings of International Tinker Innovation & Entrepreneurship Challenge (i-TIEC 2025), which compiles the extended abstracts submitted to the International Tinker Innovation & Entrepreneurship Challenge (i-TIEC 2025), held on 23 January 2025 at **PTDI, Universiti Teknologi MARA (UiTM) Cawangan Johor, Kampus Pasir Gudang.** This publication serves as a valuable resource, showcasing the intellectual contributions on the invention and innovation among students, academics, researchers, and professionals.

The International Tinker Innovation & Entrepreneurship Challenge (i-TIEC 2025), organized under the theme "Fostering a Culture of Innovation and Entrepreneurial Excellence," is designed to inspire participants at various academic levels, from secondary students to higher education students and professionals. The competition emphasizes both innovation and entrepreneurship, encouraging the development of product prototypes that address real-world problems and have clear commercialization potential. By focusing on technological and social innovations, i-TIEC 2025 highlights the importance of turning creative ideas into viable, market-ready solutions that can benefit users and society. The extended abstracts in this e-proceedings book showcase the diverse perspectives and depth of research presented during the event, reflecting the strong entrepreneurial element at its core.

We extend our sincere gratitude to the contributors for their dedication in sharing their innovation and the organizing committee for their hard work in ensuring the success of the event and this publication. We also appreciate the support of our collaborators; Mass Rapid Transit Corporation Sdn. Bhd. (MRT Corp), Universitas Labuhanbatu, Indonesia (ULB), Universitas Riau Kepulauan, Indonesia (UNRIKA) and IEEE Young Professionals Malaysia, whose contributions have been instrumental in making this event and publication possible.

We hope that this e-proceedings book will serve as a valuable reference for researchers, educators, and practitioners, inspiring further studies and collaborations in both innovation and entrepreneurship. May the knowledge shared here continue to spark new ideas and market-ready solutions, advancing our collective expertise and fostering the growth of entrepreneurial ventures.

B-ST143: WEB AI IN EDUCATION INTERACTIVE WEB-BASED TUTOR FOR SELF-DIRECTED LEARNING

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ABSTRACT

Web AI in Education: Interactive Web-Based Tutor for Self-Directed Learning is an innovative educational platform that leverages artificial intelligence to provide personalized learning experiences. This AI-driven tutor is designed to assist students in learning at their own pace, adapting to different learning styles, and offering real-time feedback. The platform bridges the gap between traditional classroom settings and self-directed learning, allowing students to take control of their educational journey. By utilizing advanced natural language processing models, the tutor can offer tailored explanations, answer questions, and provide constructive feedback. The platform's accessibility anytime, anywhere, makes it a flexible learning resource suitable for various educational levels. Additionally, it eliminates geographical and financial barriers, promoting equal access to quality education. With its potential for commercialization, the platform offers scalable solutions for educational institutions, tutoring centers, and corporate training programs. This project contributes to the development of personalized learning tools and encourages a culture of entrepreneurship in the education sector.

Keywords : AI in Education, Interactive Tutor, Self-Directed Learning, Personalized Learning, Web-Based Learning Platform

1. Product Description

Interactive Web-Based Tutor for Self-Directed Learning is an innovative platform designed to enhance the learning experience by providing students with an AI-driven tutor accessible via the web. This tool uses advanced natural language processing models to offer personalized guidance and explanations in real-time, helping students to learn at their own pace. The tutor can adapt to different learning styles, providing explanations, answering questions, and offering feedback on assignments or quizzes. It aims to bridge the gap between traditional classroom learning and self-directed study, allowing students to take control of their learning journey. With an intuitive interface and user-friendly features, this platform is suitable for various educational levels and disciplines. The use of AI ensures that the tutor evolves based on student interactions, making it a dynamic and engaging learning resource. Additionally, it promotes independent learning by enabling students to receive immediate support and solutions without needing constant supervision. This tool is a valuable resource for students seeking to enhance their knowledge and skills outside the classroom setting.

2. Workflow and System Design

a) Flowchart

This flowchart illustrates the workflow of the Web AI in Education : Interactive Web-Based Tutor for Self-Directed Learning system, from the initial step of user access to the various features available. The diagram is designed to depict the structured and logical interaction process between users and the system, including stages such as registration, login, feature navigation, and action completion. This workflow aims to ensure an intuitive and efficient user experience while supporting flexibility in independent learning through the AI-based platform.

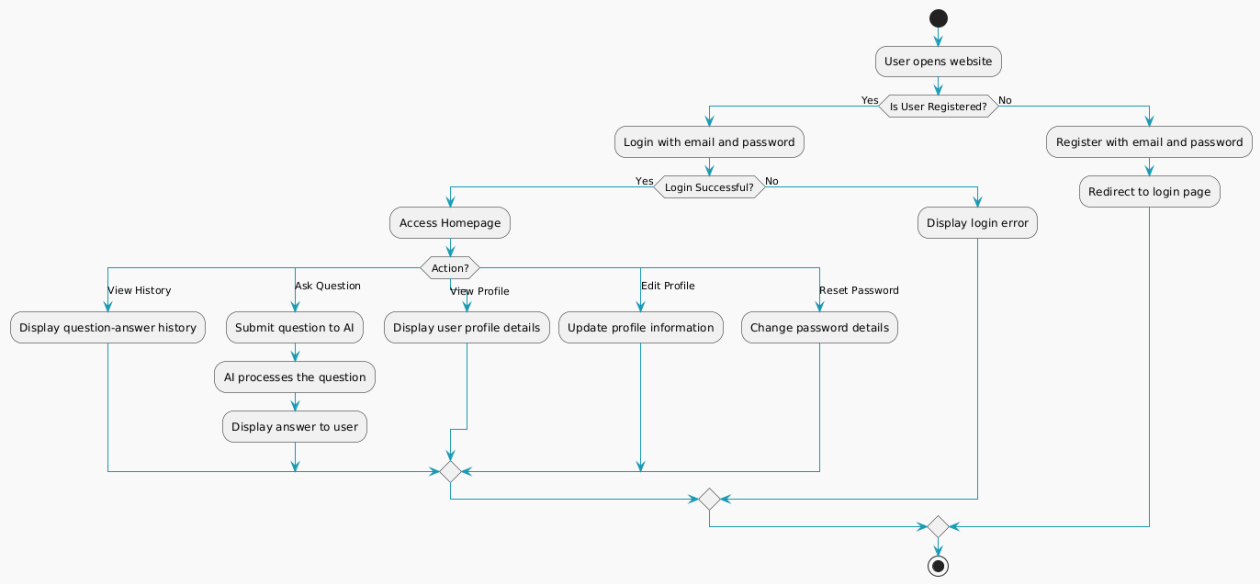


Figure 1. Workflow of the Web AI in Education System

This flowchart in **Figure 1** illustrates the main workflow of the Web AI in Education: Interactive Web-Based Tutor for Self-Directed Learning system. The process begins when a user opens the website through a browser. If the user is already registered, they will be directed to the login page to input their email and password. If not registered, the user is prompted to complete the registration process by providing their email and password, after which they are redirected to the login page. Upon successful login, the user is taken to the main page (homepage), where various features are available for selection. On the homepage, users have the option to view their interaction history (View History), which contains previous questions and answers to help them review their discussions with the AI. Users can also type a new question (Ask Question), which will then be processed by the AI system to provide a response. Additionally, users can view their profile (View Profile), update their profile information (Edit Profile), or change their password if needed (Reset Password). After completing the desired actions, users can continue using the website or log out of their account. This flowchart illustrates a simple and structured interaction process, ensuring an optimal user experience while effectively supporting self-directed learning.

b) System Architecture Diagram Translation

This is a comprehensive explanation of the system architecture diagram designed to support Web AI in Education: Interactive Web-Based Tutor for Self-Directed Learning. This system integrates various modern technologies, including React for the frontend, Node.js with Express for the backend, MongoDB as the database, and the Google Generative AI API as the core for processing user questions. Each element in this architecture is designed to provide users with an intelligent, flexible, and personalized learning experience while ensuring scalability and security in its operations. The diagram illustrates the relationships between the system's main components and the workflow from user interaction to AI-based response delivery.

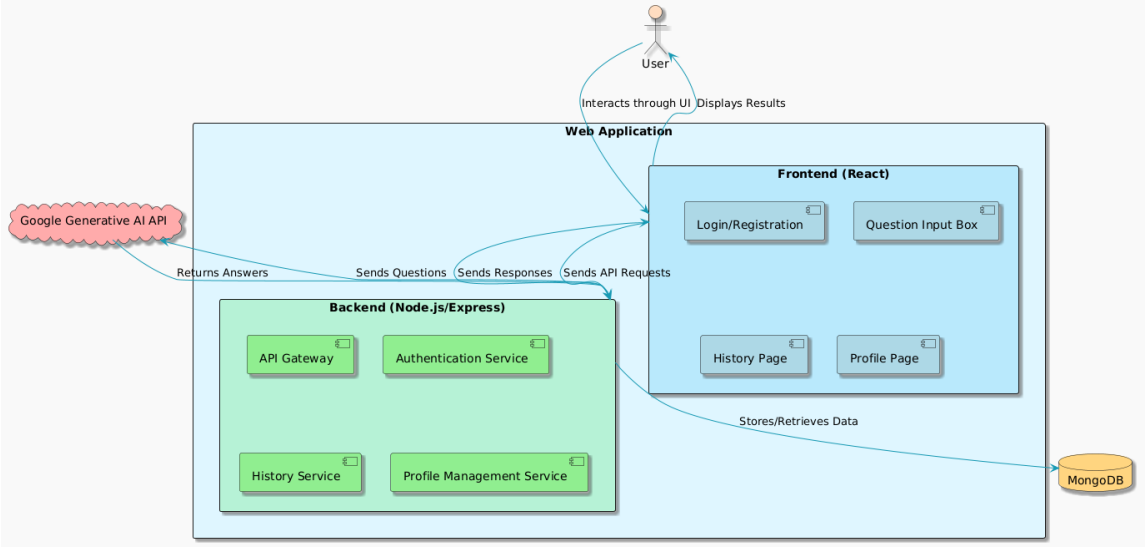


***Figure 2**. System Architecture of the Web AI in Education System*

The system architecture in **Figure 2** provides a detailed explanation of the Web AI in Education, designed as a web-based application. The system leverages React for the frontend, Node.js with Express for the backend, MongoDB as the database, and the Google Generative AI API as the core component to handle user queries. Users interact with the system through a web interface, performing actions such as logging in, registering, asking questions, viewing discussion history, and accessing or editing their profiles. The frontend, built with React, includes components such as login and registration pages, a question input box for submitting queries, a history page for reviewing past questions and answers, and a profile page for viewing or updating user information. As shown in **Figure 2**, all frontend interactions are directed to the backend, developed with Node.js and Express, which serves as the hub for business logic. The backend consists of several key services, including an API Gateway as the main entry point, an authentication service for managing login and token validation, a history service for processing question-and-answer data, and a profile management service for handling user information. The system stores critical data such as user information, question history, and answers in MongoDB. When a user submits a query, the backend forwards the request to the Google Generative AI API using an HTTP/HTTPS connection. The API processes the query and returns a response to the backend, which then

delivers it to the user through the frontend. All question-and-answer data is stored in MongoDB, allowing users to access their history later through the history page.

This system architecture, as depicted in **Figure 2**, offers several benefits. Its modular design separates the frontend, backend, database, and API components, making the system easy to develop and maintain. Integration with the Google Generative AI API ensures intelligent and relevant responses, while MongoDB provides scalability for managing large data volumes. Additionally, the authentication service guarantees the security of user data. Overall, this architecture, illustrated in **Figure 2**, is designed to deliver a flexible, secure, and efficient learning experience for users.

3. Novelty and uniqueness

Web AI in Education: Interactive Web-Based Tutor for Self-Directed Learning introduces innovation in how students learn independently by utilizing artificial intelligence to provide a fully personalized learning experience. The key uniqueness of this platform lies in its ability to adapt to each student's learning style, offering in-depth explanations and providing instant feedback tailored to their level of understanding. Furthermore, the AI used in this tutor continuously evolves and learns based on student interactions, making it a smarter tool over time. This platform also offers easy access and full flexibility, enabling students to learn anytime and anywhere without relying on face-to-face instruction. This makes the tutor not only a learning tool but also a personal mentor that can provide guidance and support automatically, maximizing each student's potential. The combination of artificial intelligence and interactive self-directed learning makes it an innovative solution that transforms the way education is accessed and received by students.

4. Benefit to mankind

Web AI in Education: Interactive Web-Based Tutor for Self-Directed Learning provides significant benefits by offering accessible educational opportunities. This platform allows students to learn independently at their own pace, promoting autonomy in the learning process. With AI technology, the learning experience is tailored to individual needs, supporting students with diverse learning styles. It reduces geographical and financial barriers, providing equal opportunities for anyone to access quality education. Additionally, the platform supports lifelong learning, enabling students to continuously develop skills without time or location constraints. By offering more flexible and personalized learning support, this platform contributes to a more educated, skilled society, ready to face the challenges of a rapidly changing world. This technology creates opportunities for everyone to reach their full potential, accelerating both individual and collective development.

5. Innovation and Entrepreneurial Impact

Web AI in Education: Interactive Web-Based Tutor for Self-Directed Learning fosters innovation by leveraging artificial intelligence to create personalized learning experiences. By using AI-driven technology, the platform not only enhances traditional education but also introduces a new model for self-directed learning that can be accessed anytime, anywhere. This project promotes entrepreneurial thinking by encouraging individuals to explore and

develop their learning path, empowering students to take ownership of their educational journey. Moreover, it provides an opportunity for entrepreneurs to integrate AI in education, leading to new business ventures focused on personalized learning tools. The platform also contributes to the education industry by showcasing the potential of AI as an essential tool in shaping future learning environments. By encouraging creativity and flexibility, this project creates opportunities for innovation and drives a culture of entrepreneurship within both educational institutions and the wider community.

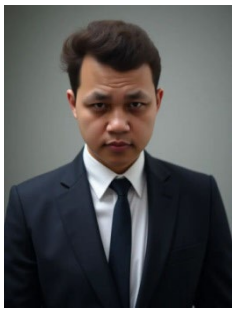
6. Potential commercialization

Web AI in Education: Interactive Web-Based Tutor for Self-Directed Learning holds strong commercialization potential by addressing the growing demand for personalized and accessible education solutions. As more institutions and learners seek flexible, self-paced learning tools, this AI-powered platform can be marketed to educational institutions, tutoring centers, and corporate training programs. It offers a scalable solution that can be customized for various educational levels and subjects, providing significant market opportunities. Subscription-based models or licensing to schools and businesses could generate steady revenue, while offering individual access through affordable pricing plans could attract a wider audience. Additionally, partnerships with edtech companies or educational content providers could further expand its reach. The platform's ability to adapt and evolve through AI also presents an opportunity for continuous product improvement, ensuring long-term competitiveness in the growing online learning market. Thus, this project has substantial potential for commercialization, offering both scalability and flexibility for diverse markets.

7. Acknowledgment

We would like to express our sincere gratitude to all those who have supported and contributed to the development of the Web AI in Education: Interactive Web-Based Tutor for Self-Directed Learning project. Our heartfelt thanks go to our academic advisors and faculty members at Labuhanbatu University for their guidance, expertise, and encouragement throughout this project. We also appreciate the support and feedback from fellow students, which has been invaluable in refining our ideas and improving the platform. Additionally, we would like to acknowledge the contributions of the developers and technologists whose work on AI, machine learning, and web development has provided the foundation for our project. Finally, we extend our thanks to our families for their constant support and belief in our vision. Without their encouragement, this project would not have been possible.

8. Authors' Biography



Febri Ananda Lubis is a student at Labuhanbatu University, specializing in website technology, application development, and system architecture. With over two years of experience, he has pioneered the development of AI-based websites in education, focusing on creating an interactive web-based tutor for self-directed learning. His work aims to enhance personalized learning experiences and bridge the gap between traditional education and modern technological advancements. Passionate about innovation, Febri strives to contribute to the future of digital education by leveraging AI to support autonomous student learning.

Rizky Rahman Rambe is a student at Labuhanbatu University, specializing in frontend development with over two years of experience. He is the pioneer behind the Web AI in Education platform, an interactive web-based tutor designed to enhance students' learning experiences through AI technology. Rizky is passionate about leveraging modern technologies to create innovative educational solutions that foster independent learning and support personalized student growth. His work aims to bridge the gap between traditional learning methods and the digital age, making education more accessible and engaging for students worldwide.