BIOMENTOR - PERSONALIZED E-LEARNING PLATFORM FOR ENGLISH MEDIUM A/L BIOLOGY SUBJECT STUDENTS IN SRILANKA

LLM BASED ADAPTIVE QUIZ PLATFORM TO IMPROVE MCQ ANSWERING SKILLS IN BIOLOGY FOR A/L STUDENTS

24-25J-257

Project Proposal Report

Sujitha.S – IT21264634

B.Sc. (Hons) in Information Technology Specializing in Software Engineering

Department of Computer Science & Software Engineering

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Declaration

I declare that this is my own work, and this proposal does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or Institute of higher learning and to the best of our knowledge and belief it does not contain any material previously publish or written by another person expect where the acknowledgement is made in the text.

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Abstract

This project focuses on the development of an innovative Adaptive MCQ Quiz Platform designed to improve learning outcomes for Advanced Level (A/L) Biology students in Sri Lanka. With 50% of the A/L Biology exam grade based on multiple-choice questions (MCQs), many students struggle to achieve high scores due to inadequate practice and unaddressed knowledge gaps. This platform aims to enhance students' MCQ skills by offering personalized quizzes that adapt to their individual performance. Through an initial assessment featuring a mix of easy, medium, and hard questions, the platform identifies each student's strengths and areas for improvement. Subsequent quizzes are tailored to challenge the student at an appropriate level, helping them to progressively build their knowledge and confidence. Additionally, the platform provides detailed feedback and analysis, allowing students to focus on specific areas that need improvement. By offering a structured, engaging, and personalized approach to MCQ practice, this platform is designed to help students maximize their scores and achieve academic success in their A/L exams.

Keywords: E-Learning, Adaptive Learning, A/L Biology, MCQ Quiz Platform, English Medium Education, Dynamic Quiz Generation, Performance Analysis

List Of Abbreviations

A/L	Advanced Level
MCQ	Multiple Choice Question
LLM	Large Language Model
NLP	Natural Language Processing
NLP	Natural Language Processing
ML	Machine Learning
DB	Database
API	Application Framework Interface
VS CODE	Visual Studio Code

Table 1: List of Abbreviations

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1.0 Introduction

1.1 Background and Literature

Adaptive learning has become a significant focus in modern education due to its ability to tailor learning experiences to each student's unique needs. This is especially crucial for high-stakes exams, such as the A/L Biology exam in Sri Lanka, where proficiency in multiple-choice questions (MCQs) is vital for academic success. Traditional quiz platforms often fall short as they do not adjust question difficulty based on individual performance, which can lead to either frustration from overly challenging content or disengagement due to insufficient challenge [1].

Adaptive learning systems are designed to enhance student engagement and improve academic outcomes by aligning content delivery with each learner’s needs. These systems adjust in real-time, providing questions that match a student's current knowledge and skill level. This dynamic approach helps maintain an optimal level of challenge and promotes deeper learning and retention of material. Large language models (LLMs) have demonstrated the effectiveness of personalized MCQ generation, adapting to learner performance and ensuring a balanced and engaging educational experience [1], [2].

Personalized question generation plays a crucial role in improving learning outcomes by ensuring that students are continually challenged at the appropriate level. Advanced models, such as T5, have highlighted the benefits of tailored learning paths in enhancing educational success [2]. These adaptive systems support students in mastering complex subjects, like biology, by addressing areas where they need the most improvement.

Additionally, continuous performance tracking and timely feedback are essential for effective learning platforms. Feedback mechanisms are vital for helping students identify their strengths and weaknesses, enabling focused improvement efforts. Research underscores that personalized feedback not only enhances understanding and retention but also fosters a self-directed learning approach [9]. Comprehensive performance tracking provides detailed insights into student progress, which is crucial for sustained academic improvement.

The development of an Adaptive MCQ Quiz Platform for A/L Biology students is based on these principles. By utilizing advanced adaptive learning techniques and incorporating sophisticated algorithms, such as those demonstrated in studies on fuzzy genetic algorithms [8], this platform aims to dynamically adjust quiz difficulty and content based on real-time student performance. The goal is to deliver a personalized, engaging, and effective learning experience that prepares students thoroughly for their A/L Biology exams [1], [2], [8].

1.2 Research Gap

Many existing educational platforms offer adaptive MCQ generation but fail to meet the specific needs of students preparing for Sri Lankan A/L Biology exams. Platforms like ToolsaDay, while adaptive, aren't specialized for the A/L Biology syllabus, limiting their effectiveness for Sri Lankan students. Eklavvya.AI lacks adaptive MCQ features altogether, relying on static question banks. In contrast, BioMentor, currently in development, addresses this gap by tailoring its adaptive MCQ system specifically to the Sri Lankan A/L Biology curriculum, dynamically adjusting difficulty based on real-time student performance.

Personalization is another area where existing platforms fall short. ToolsaDay and Eklavvya.AI offer limited or no personalization, leading to a one-size-fits-all approach that doesn't cater to individual student needs. BioMentor, however, is designed to provide a deeply personalized learning experience, analyzing student performance to create customized learning paths that target areas needing improvement.

Additionally, current platforms are often too generalized or aligned with different educational systems, making them less effective for Sri Lankan students, especially those studying in the English medium. BioMentor addresses this by aligning its content strictly with the Sri Lankan A/L Biology syllabus, ensuring relevance to the exams.

While other platforms offer basic MCQ generation, they often lack the depth and adaptability required for thorough exam preparation. BioMentor stands out by providing a robust and adaptive MCQ system that adjusts to student performance and covers a wide range of question difficulties, ensuring comprehensive exam readiness.

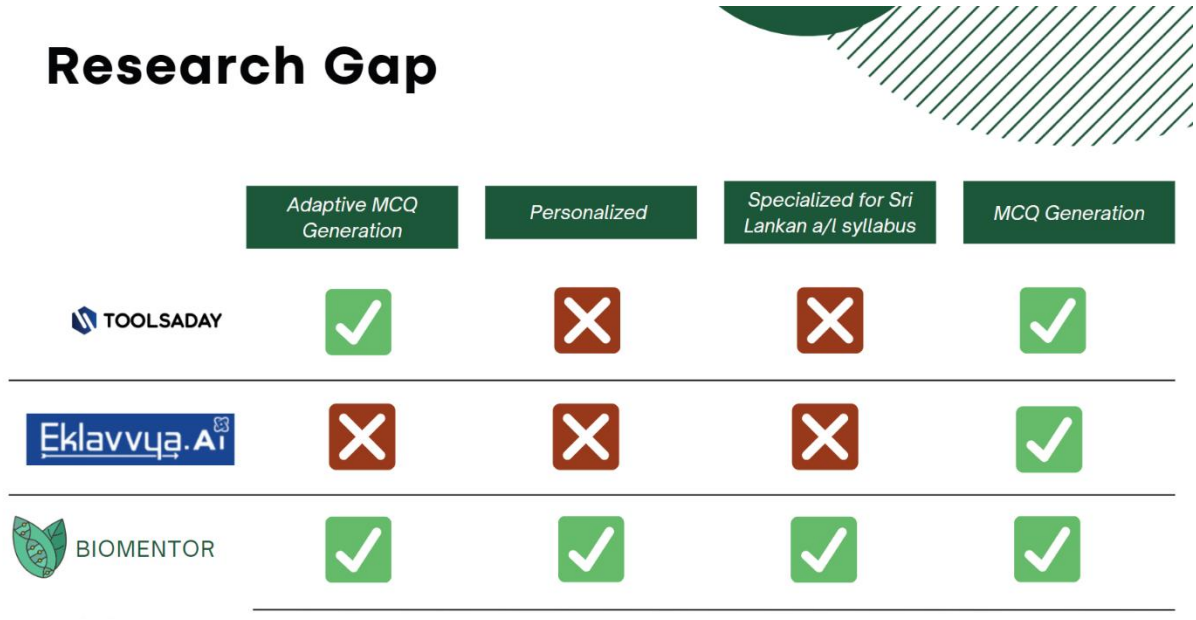

Figure 1 : Competitive Analysis

1.3 Research Problem

In the current educational landscape, particularly within the context of A/L Biology in Sri Lanka, students encounter significant challenges that hinder their ability to achieve optimal academic performance. Traditional quiz platforms often lack real-time adaptability based on individual student performance, resulting in a one-size-fits-all approach that fails to meet the unique learning needs of each student. This lack of adaptability limits students' engagement with appropriately challenging content, thereby impeding effective learning and retention [1], [2].

There is a pressing need for a system that can dynamically adjust the difficulty and content of quizzes in response to each learner's performance. Research into adaptive quizzes, such as those utilizing advanced algorithms, has shown promise in providing a more responsive and effective learning environment [8]. The absence of such tailored educational tools leaves many students without the necessary practice in areas where they are weakest, which is crucial for mastering complex biological concepts.

Additionally, ensuring comprehensive assessment and detailed performance tracking remains a significant challenge in existing systems. Many current platforms lack the ability to provide in-depth analysis of student performance, which is essential for identifying knowledge gaps and offering targeted interventions [9]. This deficiency impacts students' preparedness for final exams, where a nuanced understanding and precise knowledge are critical.

This research seeks to address these challenges by developing an advanced digital learning platform that incorporates real-time adaptability, varying levels of difficulty, and thorough performance tracking. Through the use of innovative algorithms and adaptive learning strategies, the platform aims to enhance the effectiveness of biology education, ensuring that students are better prepared and more confident as they approach their A/L Biology exams [1], [2], [8], [9].

2.0 Objectives

2.1 Main Objective

The main objective of this research is to develop an advanced adaptive MCQ quiz platform specifically designed for A/L Biology students that dynamically adjusts the difficulty and content of quizzes based on individual student performance, thereby enhancing learning outcomes and exam preparedness.

2.2 Specific Objectives

- Implement a system that dynamically adjusts the difficulty level and content of MCQs in real-time based on student performance.
- Ensure that all generated MCQs align with approved educational resources and past papers, maintaining accuracy and relevance to the A/L Biology syllabus.
- Integrate tools for detailed performance tracking and analysis to provide insights into individual strengths and weaknesses.
- Utilize fine-tuned language models (LLMs) and ML algorithms to tailor the quiz experience, increasing student engagement and learning retention.
- Develop an intuitive and accessible interface specifically designed for A/L Biology students in the English medium.
- Formulate a commercialization plan that includes subscription models and advertising to ensure the platform's accessibility and sustainability.

3.0 Methodology

3.1 Requirement Gathering

Requirement gathering is a crucial step in completing this study. It involves analyzing recent research to identify current systems and solutions for the issues discussed. Datasets will be collected from government-approved educational resources and past exam papers to ensure content accuracy. Student performance data from these exams will be analyzed to pinpoint biology topics where students commonly struggle with MCQs. Surveys will be conducted with biology students to identify areas they find difficult to study and remember. An external supervisor, an English-medium biology teacher, will be engaged to ensure that the syllabus is correctly followed and that the generated questions align with the A/L final exam standards. This comprehensive approach will ensure that the platform meets educational needs and technical standards, leading to effective refinement of its requirements.

3.1.1 Past Research Analysis

Past research on adaptive quiz platforms has primarily focused on enhancing personalized learning through real-time adaptability and detailed feedback mechanisms. Studies have often involved the development and testing of algorithms that adjust quiz difficulty based on individual performance. Research on adaptive learning systems has demonstrated the effectiveness of algorithms that dynamically tailor content to the learner's needs, thereby improving engagement and learning outcomes [7], [8].

Comparative studies typically evaluate the impact of these adaptive systems against traditional methods, using machine learning techniques to analyze how adaptability influences educational outcomes, such as learner engagement, retention, and performance [9]. It has been shown that adaptive platforms outperform traditional static quiz systems by offering a more personalized assessment experience, leading to better academic performance [7].

Data analytics has also been widely utilized to assess the effectiveness of these systems, particularly in tracking performance and providing feedback. Feedback plays a crucial role in adaptive learning environments by helping learners identify their strengths and weaknesses, enabling them to focus on areas that need improvement [9]. Studies have highlighted the importance of detailed performance tracking in creating a responsive learning environment that adapts to the learner’s progress [10].

This research will build on these findings by incorporating a more detailed performance analysis tool, offering in-depth insights into student strengths and weaknesses. By using fine-tuned language models specifically tailored to A/L Biology content, the platform aims to achieve greater accuracy and relevance, enhancing the overall learning experience beyond what has been typically explored in past research [2], [4].

3.1.2 Identifying Existing Systems

Existing adaptive quiz platforms utilize algorithms and real-time data to create personalized learning experiences. These platforms, which cater to various subjects such as math, science, and language learning, typically offer features like adaptive content delivery, performance tracking, and personalized feedback.

However, most of these systems do not fully leverage the potential of large language models (LLMs) and advanced algorithms tailored to specific subject areas like A/L Biology. By fine-tuning LLMs with subject-specific data and integrating sophisticated algorithms, this research aims to develop a platform that offers a more customized and responsive educational experience. This approach will not only enhance the adaptability of the quizzes but also improve the accuracy and relevance of the content provided to students.

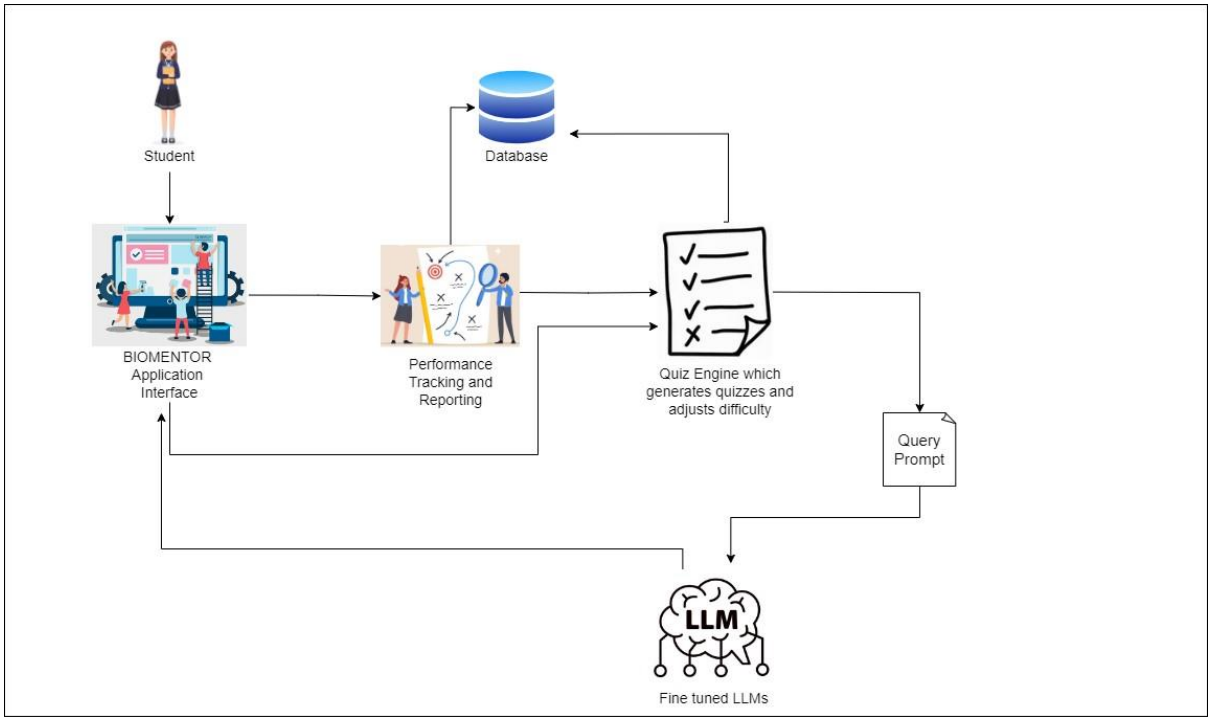

Figure 2 : System Diagram

3.2 Development Methodology

To effectively manage the development of the adaptive quiz platform, time, scope, and cost must be carefully considered. The project should accommodate changes in requirements while also allowing for adjustments throughout its lifecycle. After thorough evaluation of these factors, the Agile methodology was chosen to guide the development process. This approach allows for the creation of a functional prototype that can be iteratively refined based on regular feedback from the mentor. By incorporating feedback in brief sprints, there will be sufficient time to make necessary improvements, ultimately resulting in a product that meets the highest satisfaction of both the author and the mentor. Presenting a functional prototype facilitates easier and more precise mentor feedback.

3.3 Project Management Methodology

Research requires effective project management, where scope, time, and cost must be carefully aligned through a structured system or procedure. For the adaptive quiz platform project, a process-oriented methodology will be employed, dividing the project into distinct stages with meticulously planned inputs and outputs. This approach is designed to accommodate changes, identify risks, and manage the project effectively. JIRA will be used to support this methodology, providing a robust platform for tracking progress, managing tasks, and ensuring that project requirements and timelines are met efficiently.

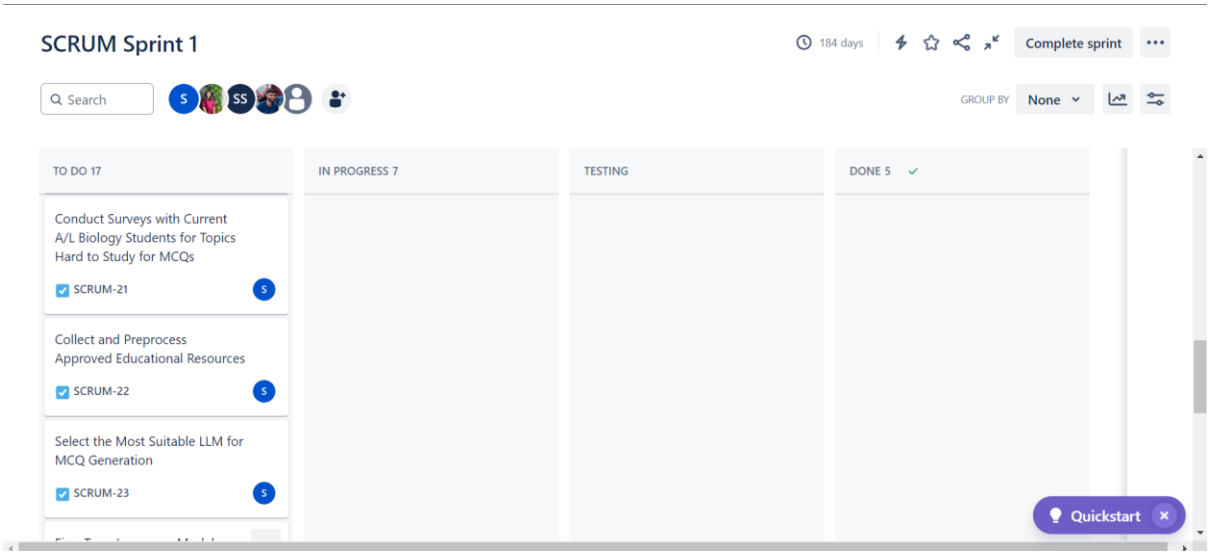

Figure 3 : Jira - Project Management Tool

3.4 Feasibility study

3.4.1 Technical Feasibility

3.4.1.1 Knowledge on Technologies

To develop the proposed solution, the knowledge in below mentioned technologies should be wanted.

- **Data Preprocessing:** Skills in cleaning, transforming, and preparing data to ensure high-quality and effective quiz content and analysis.
- **Large Language Models (LLMs):** Understanding and implementation of advanced models for generating and adapting MCQ questions based on student performance and educational content.
- **Machine Learning Frameworks:** Experience with frameworks such as TensorFlow for building, training, and fine-tuning models used in the quiz platform.
- **Adaptive Algorithms:** Familiarity with algorithms such as Item Response Theory (IRT) for dynamically adjusting the difficulty of quiz questions according to individual student performance.
- **Performance Analysis Tools:** Experience with analysis tools for generating detailed reports and visualizations of student performance data.

3.4.1.2 Knowledge on Tools

To develop the proposed optimization model, all members should have quite an in-depth understanding of the development tools and project management, as well as other supportive tools. We will be using Jira to facilitate project tracking and management throughout the development process.

3.4.1.3 Data Collection Knowledge

Data collection and preprocessing are essential steps in any data analysis task.

1. **Data Collection:** For this project, data will be collected from A/L biology syllabuses, approved government resources, and past papers. This approach ensures the data is comprehensive and aligned with the educational standards and requirements.
2. **Data Preprocessing:** The collected data will be meticulously cleaned and formatted to ensure consistency and relevance, including steps such as removing any irrelevant or redundant information, standardizing formats, and addressing any missing values to prepare the data for effective analysis and modeling.

3.4.2 Schedule Feasibility

Another important consideration during this investigation was the feasibility of the project schedule. To ensure that the timeline is realistic and manageable, tasks are created and tracked using Jira. This approach allows for detailed planning and scheduling, with a major emphasis placed on setting up the necessary tools and resources for effective project management and assessment. By utilizing Jira, we can closely monitor progress, address potential delays, and adjust as needed to maintain a feasible and resilient project timeline.

3.4.3 Economic Feasibility

Economic feasibility involves assessing the potential costs of development and the use of tools and technologies. This includes estimating expenses for software licenses, development tools, infrastructure, and ongoing operational costs. By carefully evaluating these factors, we aim to ensure the project remains within budget and delivers a cost-effective solution.

3.5 System Analysis

3.5.1 Software Solution Approach

1. Project Planning

- **Define Objectives**: Establish clear goals for the adaptive quiz platform, focusing on real-time adaptability, detailed performance analysis, and personalized learning.
- **Gather Requirements:** Collect requirements from stakeholders, including students and educators.
- **Create a Project Timeline:** Develop a timeline with milestones for each phase of development.

2. Data Collection

- **Educational Resources:** Gather approved A/L Biology educational resources, past papers, and syllabuses.
- **User Data:** Collect initial user data for model training, such as performance metrics and quiz responses.

3. Pre-Processing

- **Data Cleaning:** Remove irrelevant or erroneous data from educational resources.
- **Data Structuring:** Organize data into a structured format suitable for model training and quiz generation.
- **Annotation:** Label data with key concepts and difficulty levels.

4. Model Selection and Fine-Tuning

- **Select a Language Model (LLM):** Choose a pre-trained LLM that suits the quiz generation needs.
- **Fine-Tuning:** Adapt the LLM using the gathered educational resources and past papers to generate relevant and accurate quiz questions.

5. Algorithm Implementation

- **Dynamic Difficulty Adjustment:** Develop algorithms that adjust the difficulty of questions based on student performance.
- **Personalized Question Generation:** Implement algorithms that generate questions tailored to individual learning paths and performance.

6. Performance Analysis

- **Real-Time Analytics:** Implement real-time analytics to monitor student performance during quizzes, including accuracy, response time, and question difficulty.
- **Performance Metrics:** Track metrics such as average scores, question difficulty levels, and improvement rates.
- **Report Generation:** Generate detailed performance reports that provide insights into individual strengths, weaknesses, and overall progress.

7. User Interface (UI) Design

- **Design:** Develop a user-friendly interface for students to interact with the quiz platform, ensuring ease of navigation and accessibility.
- **Prototyping:** Create mockups and prototypes for the quiz interface and review them with stakeholders for feedback.

8. System Integration

- **Integrate Components:** Combine the LLM, algorithms, and UI components into a cohesive system.
- **API Development:** Develop APIs for interaction between the frontend and backend components.

9. Testing and Quality Assurance

- **Unit Testing:** Test individual components for functionality and accuracy.
- **Integration Testing:** Verify that integrated components work together correctly.
- **User Testing:** Conduct usability testing with actual users to gather feedback and identify areas for improvement.
- **Performance Testing:** Assess system performance under various loads to ensure reliability and responsiveness.

3.5.2 Tools and Technologies

Programming Languages:

- **Python**: For implementing machine learning models and NLP tasks required for adaptive question generation and performance analysis.

Frameworks and Libraries:

- **Hugging Face Transformers**: Provides pre-trained models for NLP tasks such as question generation and understanding, which can be fine-tuned for your domain.
- **TensorFlow**: For building and training complex models related to adaptive question generation and performance prediction.
- **NLTK**: Useful for foundational NLP tasks like tokenization and part-of-speech tagging, aiding in the preprocessing of text data for question generation.
- **Scikit-learn**: Useful for implementing traditional machine learning algorithms for performance analysis and adaptive learning.

Data Storage and Management:

- **Faiss**: For efficient similarity search and clustering of dense vectors, useful for retrieving relevant questions and managing content dynamically.
- **MongoDB**: A NoSQL database for storing user data, quiz content, and performance metrics. It handles unstructured data well and scales effectively.
- **PostgreSQL**: For handling structured data with complex queries, useful for storing detailed performance metrics and structured content.

Development and Project Management Tools:

- **Google Colab or VS Code**: For development and testing of models and code. Google Colab is suitable for collaborative work and leveraging cloud resources.
- **Jira**: For project management, tracking progress, and managing tasks.

UI Design and Development:

- **Figma**: For designing user interfaces and user experience elements.
- **React JS**: For front-end development, creating dynamic and responsive user interfaces.
- **Tailwind CSS**: For designing and developing UI components with a utility-first approach.

Diagramming and Design Tools:

- **Draw.io**: For creating system diagrams and visualizing architectural designs.

Version Control System:

- **Git**: For version control and collaborative development. Use GitHub or GitLab for repository hosting and collaboration.

Collaboration Tools:

- **Microsoft Teams or WhatsApp**: For team communication and collaboration.

Testing Tools:

- **pytest**: For writing and running test cases in Python, ensuring code quality and reliability.
- **Postman**: For testing and debugging APIs.

Deployment Tools:

- **Docker**: For containerizing the application, ensuring consistency across different environments.
- **Kubernetes**: For orchestrating containerized applications, managing scaling, and deployment efficiently.

Project Management:

JIRA: Tracks and manages project tasks, issues, and progress, facilitating effective project management and team collaboration.

3.6 Project Requirements

3.6.1 Functional Requirements

The following are the main functional requirements that this research's implementation approach aims to meet.

- Gather a comprehensive dataset specific to A/L Biology, including multiple-choice questions (MCQs) and answers from past papers.
- Select and configure a pre-trained language model (LLM) suitable for generating and adapting MCQs for A/L Biology.
- Fine-tune the selected LLM using the collected dataset to enhance its performance in generating A/L Biology MCQs.
- Develop and integrate an adaptive algorithm to dynamically adjust question difficulty based on student performance.
- Implement real-time question generation and adjustment functionalities to provide a dynamic quiz experience.
- Track and analyse user performance in real-time, including question correctness, time taken, and accuracy.

3.6.2 Non-functional Requirements

Non-functional requirements refer to the qualities or characteristics of a system that describe how it operates or performs. In the context of this project, some examples of non-functional requirements are:

- Performance - The system must respond to user interactions with minimal latency.
- Scalability - The system must be scalable to handle varying numbers of concurrent users.
- Reliability - The system must be reliable and have high availability.
- Security - User data should be encrypted both in transit and at rest to protect against unauthorized access and breaches.
- Maintainability - The codebase should follow best practices and be well-documented to facilitate maintenance and future development.
- Usability - The platform should have an intuitive and user-friendly interface that is easy to navigate for students of varying tech proficiency.

3.7 Project Scope

3.7.1 In-Scope

Dynamic Quiz Generation: The system will dynamically generate MCQs based on approved educational resources, past papers, and real-time student performance.

Adaptive Difficulty Adjustment: The quiz platform will adapt the difficulty of questions in real-time based on student responses.

User Interface: Development of a user-friendly web interface for quiz-taking, which includes features for displaying questions, submitting answers, and receiving feedback.

Performance Analysis: The system will track and analyze user performance, generating detailed reports highlighting strengths, weaknesses, and progress.

Personalized Learning: Adaptive learning paths will be created based on individual student performance to provide a tailored quiz experience.

3.7.2 Out of Scope

Content Beyond A/L Biology: The platform will not support quiz generation or adaptation for subjects other than A/L Biology.

Offline Functionality: The platform will not support offline access; it is designed exclusively for online use.

Extensive Customization: Customization of the quiz interface by individual users beyond basic settings is not included.

Gamification: Advanced gamification elements such as leaderboards or achievements are not part of the initial scope.

3.8 Testing

Testing is a crucial stage in validating the Adaptive MCQ Quiz Platform. The process will begin with unit and system testing conducted by the development team to ensure all functionalities operate correctly and to identify any potential issues. This phase will focus on testing key features, such as the generation of adaptive quizzes, dynamic adjustment of question difficulty, and the accuracy of performance tracking.

Following this, the platform will be tested with a select group of A/L biology students in both controlled and live environments. This phase will include acceptance testing, with alpha and beta testing to evaluate how the platform performs in real-world scenarios and to collect user feedback.

The testing process will primarily be manual, but it will be supported by internal checks and assertions to validate specific functionalities of the platform. This strategy will ensure that the platform not only meets the intended functional requirements but also consistently delivers a reliable and personalized learning experience for the students.

3.9 Timeline

For the timeline, the project will follow a structured development process. Initially, the team will focus on finalizing the platform's design, including the detailed system diagram and selection of key technologies. This will be followed by the implementation phase, where the LLMs will be fine-tuned, and algorithms for dynamic quiz adjustment will be developed. Integration of the performance analysis tools, and other components will be done concurrently. The final stages will involve rigorous testing, performance evaluation, and the development of commercialization strategies. The project is expected to move through these phases ensuring thorough development and testing before the platform is launched.

Figure 4 : Gantt Chart

3.10 Risk management Plan

Identified Risk	Risk level	Probability for occurrence of risk	Mitigation plan
Technical Failures or Bugs	High	High	Seek expert advice or consult with the supervisor and co-supervisor to address and resolve technical issues quickly.
Limited Knowledge in the field	High	Medium	Close knowledge gaps by participating in relevant online courses, workshops, and expert consultations.
Insufficient Technical Skills	High	Medium	Explore existing technologies and projects to build the necessary skills, especially in implementing algorithms and adaptive systems.
Changes in Project Scope	High	Medium	Examine the scope thoroughly and make feasible modifications with input from the supervisor and co-supervisor to ensure alignment with objectives.
Difficulty in Defining Requirements	High	Low	Employ effective requirement-gathering techniques and consult with experts to ensure clear and accurate project specifications.
Data Loss from System Failures	High	Medium	Implement regular data backups, utilize cloud storage solutions, and adopt strong cybersecurity practices to prevent data loss.
Modifications Requested by Review Panel	High	Medium	Evaluate requested changes promptly and adjust the project timeline as needed, with guidance from the supervisor and co-supervisor.
Risk of Data Breaches or Security Vulnerabilities	High	Low	Apply stringent security measures, perform regular security audits, and use encryption to safeguard user data and maintain confidentiality.

Table 2 : Risk Management Plan

3.11 Communication Management Plan

The Communications Management Plan is designed to ensure that all team members, as well as the supervisor and co-supervisor, receive the necessary information to effectively perform their roles throughout the project. Successful project execution relies on strategic planning and effective communication. This plan outlines how to communicate with various stakeholders efficiently, detailing the audience, content, format, frequency, and expected outcomes of communications. It also specifies each stakeholder's role, task assignment, and communication strategy based on their influence, interests, and expectations.

3.11.1 Communication Objectives

Proactive communication is essential for project success. Communication should be:

- **Adequate**: Providing information in the right format and content.
- **Specific**: Tailored to the targeted audience.
- **Sufficient**: Including all necessary details.
- **Concise**: Clear and to the point, avoiding unnecessary repetition.
- **Timely**: Addressing relevant points at appropriate times.

3.11.2 Communication Media

The following media will be utilized for communication throughout the project:

1. **Email**: For formal updates, documentation, and detailed communications.
2. **Documents (MS Word and PowerPoint)**: For reports, presentations, and detailed project documentation.
3. **Phone Calls**: For quick discussions and urgent matters.
4. **Meetings**: Conducted via meeting rooms, conference phones, or Microsoft Teams for in-depth discussions, planning, and progress reviews.
5. **Chats (WhatsApp)**: For informal, quick exchanges and real-time updates.

4.0 Work Breakdown

The work breakdown structure (WBS) for the Adaptive MCQ Quiz Platform is an essential component of the project management process. It involves systematically breaking down the overall project into smaller, manageable tasks or work packages. This structured approach ensures that each aspect of the platform, from data collection to final validation, is meticulously planned and executed. The WBS facilitates clear delegation, monitoring, and control of the project's progress, enabling the team to efficiently manage resources, timelines, and deliverables. It also aids in identifying dependencies and critical paths, ensuring that all project goals are met within the specified constraints.

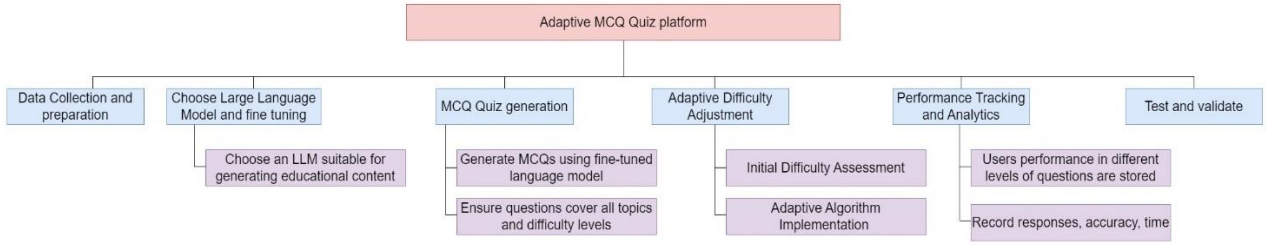

Figure 5 : Work Breakdown Structure

5.0 COMMERCIALIZATION

Subscription Model: The web application, designed specifically for English-medium biology students, will offer both free and premium subscription plans. The free version will provide limited access to the adaptive quiz platform and other integrated components. Premium subscribers will gain full access to all features across the application, including advanced performance analytics, personalized learning paths, and exclusive study resources. Subscription plans will be available on a flexible basis, catering to different user needs.

Advertising Strategy: To increase the visibility and adoption of our web application, a targeted advertising campaign will be launched. This campaign will focus on reaching school students, parents, and educators through various digital channels, including social media, educational forums, and online communities. Advertisements will highlight the unique benefits of our application, such as the adaptive quiz platform and its integration with other educational tools, aiming to establish it as a go-to resource for biology students.

6.0 BUDGET

To ensure the successful development and deployment of the adaptive quiz platform, a comprehensive budget has been outlined to cover essential expenses. This budget includes costs associated with internet use and web hosting, which are crucial for maintaining the platform's online presence and functionality. Training costs are allocated to equip team members and users with the necessary skills and knowledge. Publication costs cover the expenses for disseminating information and promoting the platform. Additionally, a small amount is set aside for stationery needs. The total budget required for these components is outlined below.

Type	Cost
Internet use and web hosting	LKR.10,000.00
Training Cost	LKR.30,000.00
Publication Cost	LKR.70,000.00
Stationery	LKR.1,000.00
Total	LKR.111,000.00

Table 3 : Cost Management Plan

7.0 SUMMARY

The research for the Adaptive MCQ Quiz Platform aims to support A/L Biology students, particularly those in the English medium. The platform is designed to dynamically adjust quiz difficulty based on student performance, using approved educational resources and past papers. The plan is to categorize quizzes into easy, medium, and hard levels initially, with subsequent adjustments made through fine-tuned LLMs and specific algorithms. The platform will include detailed performance analysis to improve knowledge, timing, and confidence, offering insights into individual strengths and weaknesses to support personalized learning pathways.

This platform is part of a broader proposed web application, which will include three other components developed by team members. The commercialization strategy includes potential subscription and advertising models. The proposal outlines the development of a detailed system diagram covering components like LLM, algorithms, and architecture, using technologies such as Python, the Transformers Library, TensorFlow, and MongoDB. Project management and development tools like Jira, Figma, and Docker will be utilized, with communication facilitated through platforms like Microsoft Teams and WhatsApp. The focus on adaptive learning is intended to enhance the educational experience for school students studying biology.

Additionally, the proposal includes strategies for monetization and reaching the target audience effectively, ensuring the platform's sustainability and scalability in the educational technology market.

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