Listening Activities and Student Assistant

24-25J-103

Project Proposal Report

Dewinda A.G.T IT21196560

B.Sc. (Hons) Degree in Information Technology

Specializing in Software Engineering

Department of Computer Science and Software Engineering Sri Lanka Institute of Information Technology

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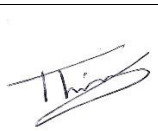
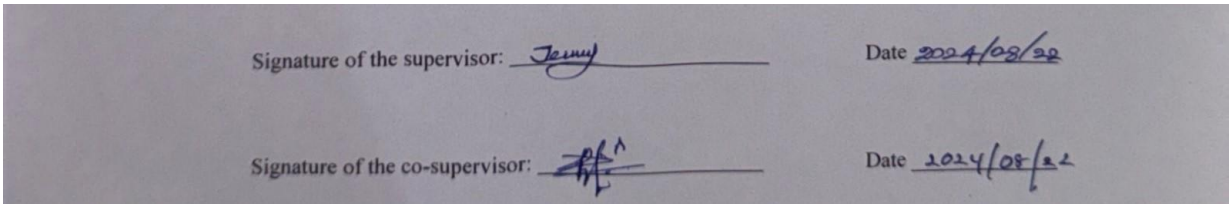
DECLARATION

I declare that this is my work. This proposal does not incorporate without acknowledgment any material previously submitted for a degree or diploma in any other university or institute of higher learning. To the best of my knowledge and belief, it does not contain any previously published material written by another person except where the acknowledgment is made in the text.

Name	Student ID	Signature
Dewinda A.G.T	IT21196560	

The above candidate is carrying out research for the undergraduate Dissertation under my supervision.



ABSTRACT

Nowadays, the need for individual educational interventions increases considerably, especially in the sphere of language learning. This project aims to fulfill this need by creating a new LMS which specifically focuses on improving the listening capabilities of students and simultaneously, offering AI chatbot functionality. The proposed project will utilize MERN stack and Machine Learning to design a system where it is tailored to the needs of an individual student to help improve learning environment.

The listening activity component may also feature multiple practice sessions and main sessions that will directly correlate with the skill level of the student. These activities will include two people conversations, four people conversations, lecturer style training and instructional dialogues. Hence, each category will have specific types of questions like multiple choice, matching, and note completion depending on the student's level. The system will also monitor the students' performance in core sessions and adapt the level of difficulty in presenting the mode, as well as give feedback on the students' performance. On the other hand, practice sessions will provide a chance to improve certain techniques without hindering the student's progress.

Machine Learning will be instrumental in this system through the determination of the students' performance data and their future learning requirements. The ML models will help to make the content and the difficulty level of the listening activities more individualized and always challenging and engaging for the learners. This approach in advance will assist in the early recognition of students who may be most at risk for falling behind and support mechanisms for modifying their behavior. The AI chatbot component will add even more value to the learning experience as it will help students individually advising when needed. Doing so, the chatbot will be equipped with NLP algorithms that will help the bot decode the queries of the student and provide the relevant study tips and advice based on previous interactions it has had. The application of the chatbot will be made in simple childlike graphic and choice of bright colors and simple fonts in the interface will add attractive touch to it.

This work is a major advancement in education technology as it provides a ML powered learning environment with the user first perspective. Ethical considerations, especially concerning data protection and information security, will remain central to this plan as student's data must always be kept secure. In this project, the long-term cell plan offers a framework for education that creates a system in which learning needs do not have to wait for poor performance to plan and cater for the learners' future learning needs.

Keywords: Individual Educational Interventions, Language Learning, Learning Management System (LMS), Listening Capabilities, AI Chatbot, MERN Stack, Machine Learning (ML), Personalized Learning, Practice Sessions, Main Sessions, Skill Level, Assessment, Two-Person Conversations, Four-Person Conversations, Lecturer Style Training, Instructional, Dialogues, Multiple Choice Questions, Matching Activities, Note Completion, Performance Monitoring, Adaptive Learning, NLP (Natural Language Processing) Algorithms, Study Tips, Student-Centric Design, Child-Friendly, Interface, Ethical Considerations, Data Protection, Information Security, Future Learning Requirements, Risk Identification, Education Technology, User-First Perspective, Dynamic Learning Environment, Student Performance Data, Feedback Mechanisms, Early Intervention, Student Engagement, Support Mechanisms, Proactive Learning, Attractive Interface, Educational Framework

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LIST OF ABBREVIATIONS

Abbreviations	Definitions
LMS	Learning Management System
ML	Machine Learning
MERN	MongoDB, Express.js, React, Node.js
NLP	Natural Language Processing
AI	Artificial Intelligence
UI	User Interface
UX	User Experience
API	Application Programming Interface
EDA	Exploratory Data Analysis
KPI	Key Performance Indicator
LKR	Sri Lankan Rupee

1. INTRODUCTION

We are thrilled to provide a brand-new feature for our Learning Management System (LMS) that skillfully combines an insightful AI Chatbot with a dynamic Listening Activity component. This feature was created with students in grades 10 through 12 in mind, with the goal of greatly improving their educational experience. Understanding conversations, obeying directions, and finishing academic lectures are just a few of the tasks that are included in the Listening Activity component, which offers a wide variety of exercises suited to each student's skill level. These carefully designed exercises guarantee that students may enhance their listening comprehension in a fun and methodical way.

Accompanying these activities is our advanced artificial intelligence AI Chatbot that will act as an informative and engaging virtual assistant. It has intelligent machine learning and natural language processing capabilities to provide students with precise and relevant responses to their queries; providing tailored study advice based on previous conversations; and, it a highly user-friendly with large font and kid-friendly colors. This kind of integration is thoughtful in a way that grants the students the needful practicing and support, making learning be more productive and fun. These parts combined give a complete conception of teaching that can be modified according to the needs of the young learners and fosters appreciation of learning as well as skill acquisition.

1.1 Background

With reference to language acquisition particularly within the scope of listening skills development, there is now much more emphasis to the use of individual learning methods in form of adaptive learning tools. Classical models of language teaching rely on the means that presuppose a uniform approach to the learning process and, therefore, are incapable of meeting individual students' demands. This leads to some student being left behind, others not being provided with adequate challenge, hence reduced interest and less than optimal learning outcomes [1].

Thus, technologies that were implemented in recent years, such as Artificial Intelligence and mechanisms of machine learning, present appropriate solutions to these challenges. Such technologies allow for differentiation of content and approach with respect to student data that can be tracked, as a result increasing interest as well as effectiveness in learning [2]. However, as it will be explained in the subsequent sections, many of today's learning systems are not capable of the dynamic adjustment to the student's requirements in real-time [3].

More importantly, language education is not very rich in terms of technologist investment compare to a number of other subject areas for instance, Mathematics and Science and it an important pillar for Guaranteed Success [4]. Additionally, there are still questions of ethical concerns regarding the collection and use of the learners' data and this is a challenge in the incorporation of AI into education [2]. This project seeks to fill these shortcomings by creating an educative tool that utilizes listening tasks together with the AI chatbot making it possible to be customized based on the student 's proficiency/ deficiency levels and most importantly respect students' data privacy and security.

1.2 Literature Survey

The integration of listening activities and AI chatbots in language learning has been extensively explored, with various approaches and outcomes identified in the literature.

1.2.1 Listening Activities

1. Listening and Skill-Level Adaptation

[2] is an analysis of the use of web-based applications for teaching listen concerned with the description of how such systems adapt activities based on their difficulty level. Many will employ form completion and multiple choice question types typical of mastery learning arrangements which inextricably feature formative data as the key to dynamic responsiveness. The idea behind this kind of approach is to help to develop listening skills by offering tasks of a level appropriate to the learner.

2. Structured Listening Activities

[4] expounds on structured listening activities which includes academic lectures and flowing conversation where the learners are expected to complete notes and form fillas. These activities are classified according to their difficulty and are intended to address particular listening skills. This particular method of organizing content guarantees that students treat content that is well-suited for their understanding levels, and therefore grasping, or memorization would be easier to accomplish in this case.

3. Engaging Listening Exercises

[5] explores the use of transcription activities with tools like LyricsTraining, which combines listening practice with interactive exercises. This approach not only makes learning more engaging but also helps in reinforcing language acquisition through repeated exposure to language in context. The integration of music and interactive content has been shown to enhance listening skills and maintain learner motivation.

1.2.2 AI Chatbots

1. Personalized Support and NLP Algorithms

[12] offers a detailed review of AI chatbots in education, highlighting their ability to provide personalized support through advanced Natural Language Processing (NLP) algorithms. These chatbots can offer tailored advice and feedback based on student interactions, thereby improving the relevance of the assistance provided and supporting better learning outcomes.

2. Contextual and Adaptive Feedback

[13] examines NLP applications in educational chatbots, focusing on how these systems use language processing techniques to deliver contextually appropriate responses. The study emphasizes the importance of adaptive feedback in maintaining engagement and addressing the specific needs of learners, which is crucial for effective language acquisition.

3. Enhancing Student Engagement

[14] assesses the impact of AI chatbots on student engagement and learning. It shows that AI chatbots can significantly enhance learner interaction and motivation by providing immediate and relevant feedback. The ability of chatbots to engage students in meaningful conversations and assist with language learning tasks has been shown to foster a more interactive and responsive educational environment.

4. Challenges and Opportunities in Chatbot Implementation

[13] also discusses the challenges and opportunities associated with implementing NLP in educational chatbots. Key challenges include ensuring the accuracy of responses and adapting to diverse learner needs. However, the opportunities lie in the potential for chatbots to provide scalable, personalized learning experiences and support language learners more effectively.

1.2 Research Gap

The research gap identifies areas where existing systems may fall short, highlighting opportunities for innovation through this project. A comparative analysis is presented in Table 1:

Functionality	**Duolingo[1]**	**ELLLO[2]**	**Proposed System**
Listening activities	**Yes**	**Yes**	**Yes**
Listening practice activities	**Yes**	**Yes**	**Yes**
Question generation based on skill level	No	No	**Yes**
student advisor	No	No	**Yes**
student quiz guider	No	No	**Yes**
FAQ on English Knowledge	No	No	**Yes**

Table 1 Research Gap Identification

1.3 Research Problem

An essential feature of educational technology, especially in a customized education environment, is to offer content and support suitable for each student. There are several flaws set with listening exercises and an AI chatbot within our learning management system (LMS). The listening activity system must work together to determine exactly what skill level the student is at and provide resources accordingly. In addition, the AI chatbot needs to deliver adaptive and personalized support for students to learn English efficiently

To address these challenges, the research must focus on the following key questions:

1. How can the system align listening assignments to individual students and optimally design practice sessions?
2. How do you contain within questions that make sure the content is aligned & personalized to individual learners?
3. In what ways can providing informal opportunities for students to practice their listening skills lead to formal activities?
4. How can the AI chatbot offer extra help when and where students need it to improve their English learning experience?

2. OBJECTIVES

2.1 Main Objective

The primary aim in this investigation is to create an AI supported chatbot and integrated LMS listening activity system for 10–12 years old students that could be conveniently used with the personalized learning approach. Our vision is to build a system which can evaluate the levels of proficiency and suggests custom listening activities as well as practice sessions, Meanwhile, it also offers appropriate supports towards improving students' English skills with more effective assists through AI chatbot, ultimately enhance their learning experience.

2.2 Specific Objectives

1. **Question Collection for Main Listening Activities and Practice Sessions (Data Sets):**
    a. Collaborate with the supervisor to curate appropriate question sets for students aged 10 to 12. These questions will be categorized into the following types:
        i. Conversations with Two People: Focus on form completion tasks
        ii. Giving Instructions: Include multiple-choice questions and matching exercises.
        iii. Conversations with Four People: Feature single-answer and multiple-answer multiple-choice questions.
        iv. Academic Lectures (One Person): Emphasize note completion tasks.
    b. Ensure that the question sets are available in varying levels of difficulty: easy, medium, and hard.

2. **Student Skill Level Assessment:**
    a. Integrate and retrieve student skill levels from the LMS system, which are calculated based on their performance in other components.
    b. Use these skill levels to tailor the main listening activities to meet individual student needs.
3. **Practice Session Development:**
    a. Design and implement practice sessions, including multiple rounds, to help students prepare for the listening activities.
    b. Provide tutorials and guidance to support students in navigating and successfully completing the listening activities.
4. **User Interface (UI) Design:**
    a. Design a clean, visually aesthetic and user-friendly interface that is easy for students to navigate.
    b. The UI must be appropriate for children, engaging and intuitive so that kids can navigate the site quickly.
5. **Machine Learning Model for Question Recommendation:**
    a. Build a question recommendation system that recommends questions to students for both practice and main topics.
    b. Stem recommendations will be determined by the skills of the student, past records as well preferences for the particular category.
    c. Leverage data from student profiles, the question database (tagged by difficulty and type and topic), & session type (practice or main) to choose questions more optimally.
6. **Get suitable educational content through the supervisor**
    a. Interview the supervisor and collect appropriate educational data with 10–12-year-old student-specific content.
    b. Make sure the content maps to learning objectives and curriculum.

7. **Create an AI to give relevant answers to the students**
    a. Building the AI model that will be trained by the educational content provided from your Supervisor.
    b. Use natural language processing techniques to determine what a student said and respond correctly.
    c. Identify trends in student questions so you can offer targeted answers that feel personal.

8. **Create an advisory system**
    a. Do interviews and forms to gather information about what challenges students typically face.
    b. Use the data you collected to spot patterns and trends in students' questions, grumbles etc.
    c. Incorporate this analysis in the AI; and assist each student by giving specific suggestions with guidance.

9. **Create a question helper system for the chatbot**
    a. Design a program that the AI system can use to correctly interpret and comprehend what students are asking.
    b. Seamless integration of educational resources that are very rich in the search for correct answers to student questions.
    c. Guide students each step of the way to work through problems and understand concepts.

10. **Create a child-friendly interface to enhance learning accessibility and interest.**
    a. Create A Simple Interface That Makes Learning Accessible To All Students
    b. Use bold colors, kind of juvenile fonts and interactive elements that attract children's attention.
    c. Make it user-friendly and easy to navigate, focused on the young learners.

3. METHODOLOGY

1. **Data Gathering and Preparation**
    a. **Educational Content Collection**
        i. Conduct interviews to create appropriate educational content for students from 10–12 ages with the supervisor. Selection question sets including those for conversations, instructions, and academic lectures in the listening activities.
        ii. Sort the collected content by categories (e.g., talk to 2 people, use instructions, etc.) and difficulties-easy-medium-hard.

2. **Development of the Listening Activity System**
    a. **System Design and UI**
        i. The listening activity system is a separate module that should communicate with the Learning Management System. Practice, First half of system Main Session An Interactive Kid- Friendly UI to navigate through various listening activities and sessions with bright colors & cartoons/fonts (easy to comprehend reasons for an engaging interface).

    b. **Practice and Main Sessions**
        i. Create a space for students to work on listening with minimal change in their level of skill. Make your own system to choose questions for practicing which provide variation. The next thing will be to implement a session where the student is asked questions according to his/her skill. A scoring mechanisms with automatic adjustments to student skill based on performance within twists.

c. **Machine Learning Model for Question Recommendation**

i. Select suitable ML models (collaborative filtering, content-based) for the question recommendation. What kind of ML models were being trained on question datasets and student interaction data? Based on student skill levels, prior performance and category preferences the model will recommend questions to students. Check the precision, recall and score to properly evaluate whether it is recommending relevant questions or not.

3. **Development of the AI Student Assistant**

a. **Natural Language Processing (NLP) Model**

i. Organize the data you collected to be teachable and make connections between things students need to know in order to answer any questions a student might ask. NLP model and Model Training, The NLP model learns from all the education content (for example monthly) + historical interaction data. The correct answers can be found, and it is modeled to five different student-asked questions. That output then goes right back into training, not to make it more random but so that your model knows when it actually should stop being a bot and offer knowledge access instead of just relevance.

b. **Advisory and Question Helper Systems**

i. Organize the data you collected to be teachable and make connections between things students need to know in order to answer any questions a student might ask. NLP model and Model Training, The NLP model learns from all the education content (for example monthly) + historical interaction data. The correct answers can be found, and it is modeled into five different student-asked questions. That output then goes right back into training, not

to make it more random but so that your model knows when it actually should stop being a bot and offer knowledge access instead of just relevance.

c. **User Interface (UI) for AI Student Assistant**

i. Create a child-friendly interface that incorporates interactive elements, vibrant colors, and simple navigation to enhance the learning experience and accessibility. Integrate the chatbot with the LMS, ensuring seamless interaction between the chatbot and other system components, such as the listening activities.

3.1. System overview

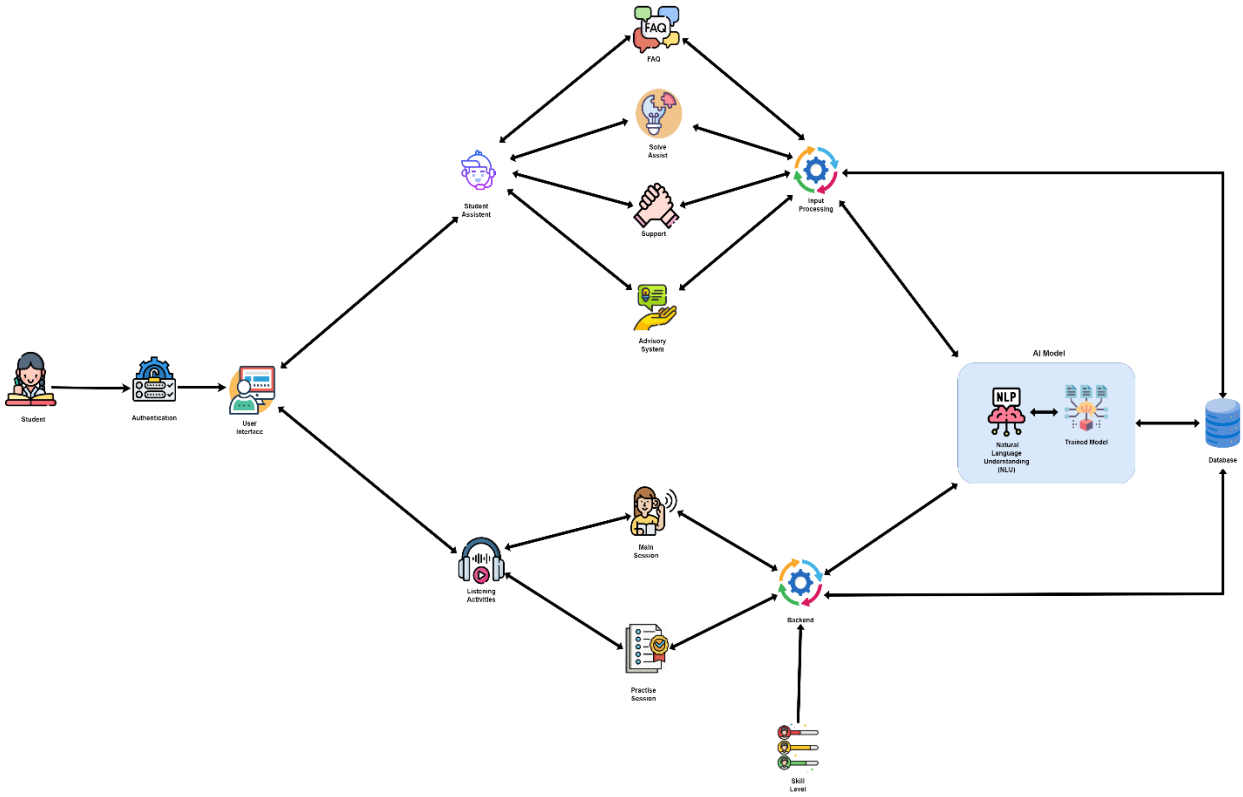

Figure 1 System Overview Diagram

- **Student Assistant**
    - Student can access the FAQ, SolveAssist, Advisory System and technical support from the Student Assistant, First when It comes to the FAQ, the question that the student gave will be tokenized in the backend and send to the AI model. In that AI model that String(question) will understand through NLP and give the relevant answers to the student. Same goes to the Advisory system, in that it will give student step that needs to be followed to keep the motivation and give answers to the ethical problems. In Solve Assist, it will capture the quiz and send that to the AI model and give relevant steps to guide the student to overcome that question. In Technical Support, it will give guidance for the how to use the system, Ex:- how to go the Listening Activities

- **Listening Activities**
    - There are two sections Main Listening Activities and Practice Sessions. In Main Listening Activities it will get the student skill level and provide relevant Listening Activities according to that skill level through the trained ML model. And also the according the how well the student perform in listening activities the skill level will changes, In practice sessions student can freely practice through given Listening activity categories to gain the skills, but this will not affect the skill level of the student that system is monitoring

4. REQUIREMENT

4.1 Functional Requirements

- Provide main and practice listening activity sessions
- Get Student skills
- Calculate the score
- Provide answers to student's questions
- Provide advice and assist on quizzes

4.2 System Requirements

Hardware Requirements

- Servers for hosting the web application and managing databases.
- Computers or tablets for users (students, educators, parents) to access the platform.
- Networking infrastructure to ensure real-time data transmission.

Software Requirements

- Backend: Node.js for server-side scripting.
- Frontend: React.js for building user interfaces.
- Database: MongoDB for data storage.
- Analytics: TensorFlow for implementing predictive models.
- Security: SSL/TLS for secure data transmission and storage encryption.

4.3 Non-Functional Requirements

- Performance
- Scalability
- Security
- Usability
- Reliability

4.5 Gantt chart

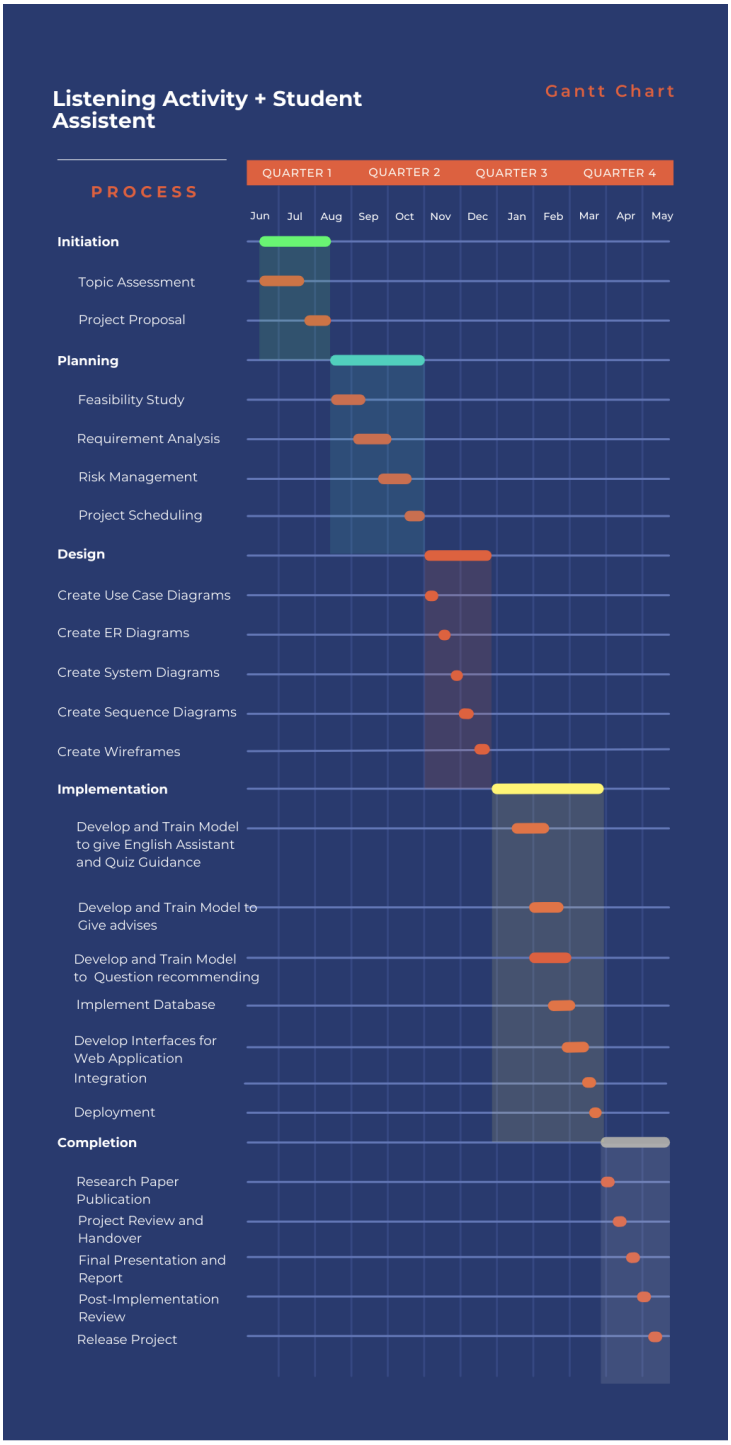

Figure 2 Gantt Chart

4.6 Use Cases

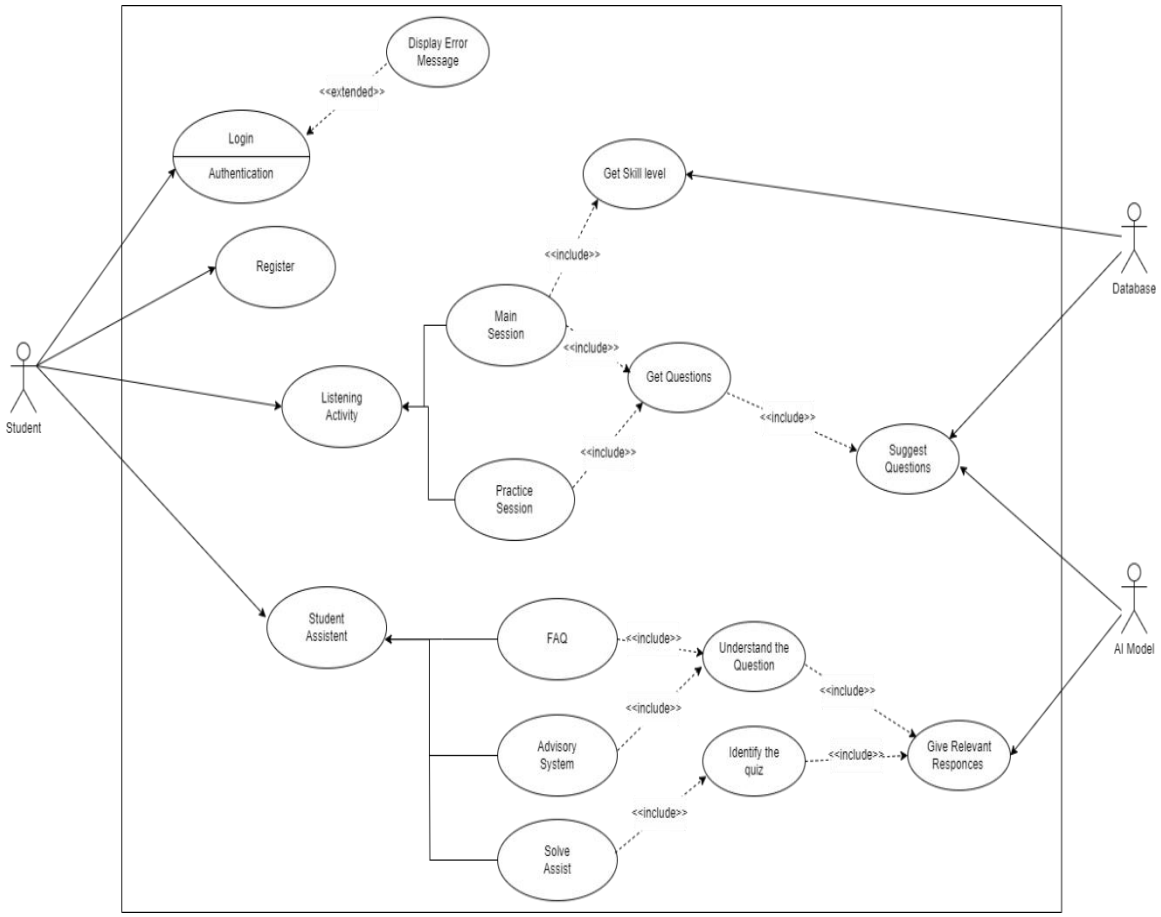

Figure 3 Use Case Diagram

4.7 Wireframes

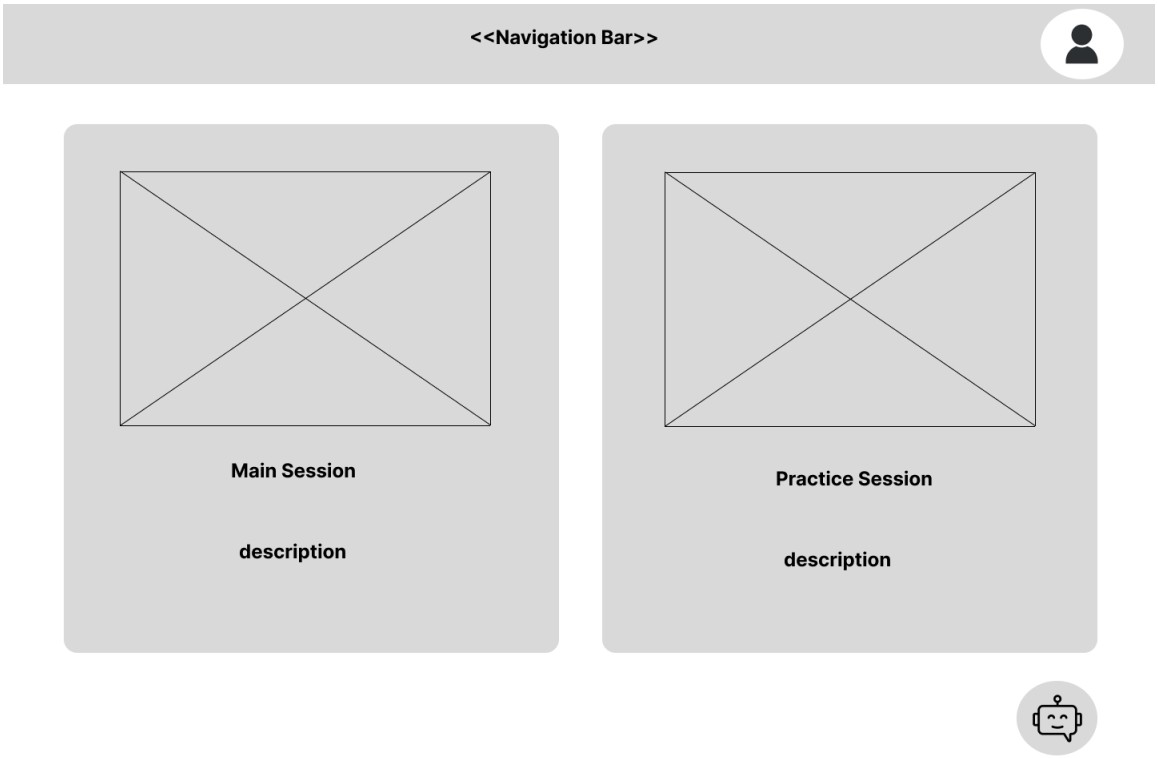

Figure 4 Wireframe – Listening Activity Menu

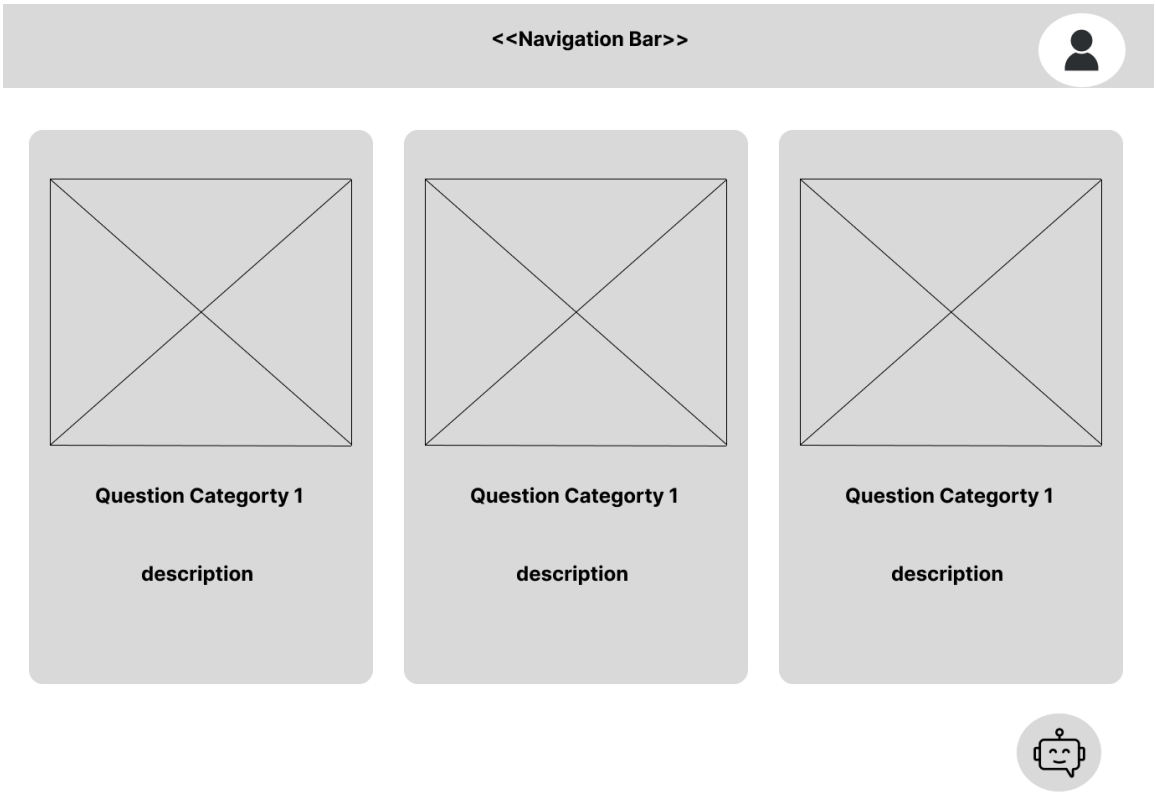

Figure 5 Wireframe – Practice Session Menu

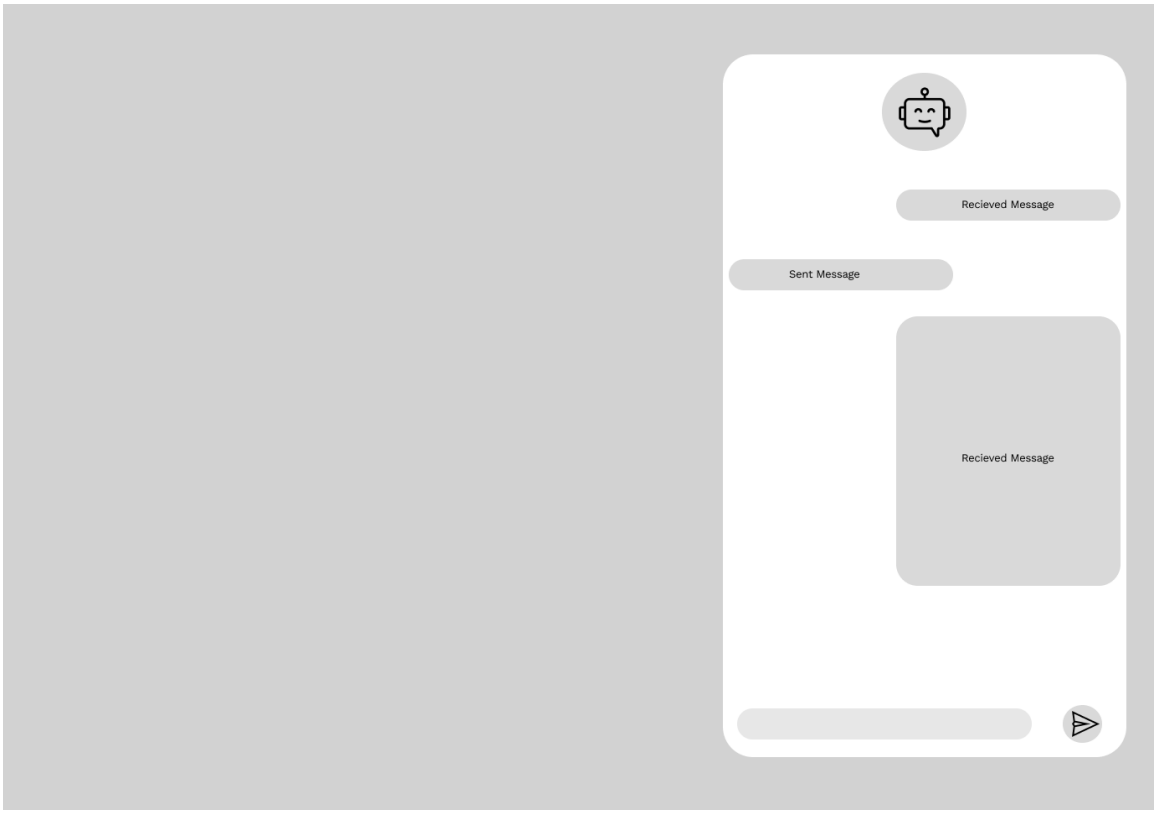

Figure 6 Wireframe - Chatbot Interface

5. BUDGET

Budget Topic	Description	Estimated Cost (LKR)
Software Development	• Frontend, Backend and AI/ML development cost • UI/UX design cost	20,000
Hardware Infrastructure	• Use existing resources or minimal hardware setup.	20,000
Licensing Fees	• Licenses for any third-party software or libraries	10,000
Data Privacy Measures	• Implement basic data protection using open-source security tools.	25,000

6. COMMERCIALIZATION

6.1 Market Research and Target Audience

- **Target Audience**
    - The main groups of clients for your Listening and AI chatbot are schools with a concentration on students' or learners aged 10-12, especially for English courses. This involves top-tier learning institutions that falls under both primary and middle school, language learning center, and perhaps home school formations.
- **Market Needs**
    - Hence, schools and educators are looking for intellectual tools with which learning can be made easier and students who have different learning pace and capability, can be taught effectively, students can be engaged more effectively and effectively evaluated and graded. The Listening activity meets the need for more differentiated listening and the AI chatbot improves the interactivity.
- **Competitive Analysis**
    - Self-organized learning tools, language learning applications, and educational chatbots available in the market should be compared and contrasted. It will assist you in presenting the product in a way that sets it apart from competitors: extra options such as skill-based activities and a child-oriented chatbot design.

6.2 Revenue Streams

- **Subscription Model**
    - Promote the idea of forced paid subscription where schools, or individual users pay monthly or annually to be on the platform. It might allow various level of access, for example simple listening activities or far more sophisticated AI-related features.

- **Licensing**
    - Provide licensing for educational entities so they can incorporate your platform into their existing Learning Management Platforms. This could be a one time per year, one time per installation / device fee or a per user fee.
- **Free Model**
    - Make the platform free with the option to pay for premium functionalities that include complex listening exercises or, for example, a chatbot with an advanced artificial intelligence.
- **Partnerships and Collaborations**
    - Collaborate with other providers or producers of educational materials, language schools or other educational technologies in order to offer your product together with other learning aids. These might be established in forms such as revenue sharing.

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