TARA: THE ENGLISH LANGUAGE LEARNING RESOURCES ON A WEBSITE PLATFORM THAT HELP TEACHERS AND STUDENTS TEACH AND LEARN ENGLISH READING SKILLS.

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RATCHANON TRAITIPRAT

PASSAPOL PHUKHANG

A PROJECT SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR

THE DEGREE OF BACHELOR OF SCIENCE (COMPUTER SCIENCE)

SCHOOL OF INFORMATION TECHNOLOGY

KING MONGKUT'S UNIVERSITY OF TECHNOLOGY THONBURI

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A Project Submitted in Partial Fulfillment of the Requirements for

The Degree of Bachelor of Science (Computer Science)

School of Information Technology

King Mongkut's University of Technology Thonburi

Academic Year 2024

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Project Title	Tara: The English language learning resources on a website platform that help teachers and students teach and learn English reading skills.
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Program	Bachelor of Science
Field of Study	Computer Science
Faculty	School of Information Technology
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Abstract

Tara is an EdTech project that aims to provide teachers with tools and resources that boost their teaching and creativity to develop fun English learning experiences for students in grades 4 to 6. Our focus is on enhancing the current English language (Reading skills) learning setup in classrooms rather than replacing it entirely. Tara provides learning contents and exercises that work as useful tools and resources for teachers and provides edu-gamification for students. Besides these features, it provides tools to assist teachers and students in their teaching and learning journey, making it more dynamic, creative, and engaging. Initially, we are partnering with Sathya Sai School in Lopburi, Thailand, as our primary customer (user). However, our platform is flexible and can be adapted for broader usage. Our primary target audience is primary school students who are learning English.

Keywords : EdTech / gamification / English

Acknowledgement

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Vocabularies and Abbreviations

KMUTT   King Mongkut's University of Technology Thonburi

Chapter 1

Introduction

The global demand for English proficiency has grown significantly, particularly in non-native English-speaking regions like Thailand, where English is a crucial skill for academic and professional success. Despite this, traditional classroom methods often struggle to meet the dynamic needs of young learners, leading to disengagement and suboptimal language acquisition. Studies suggest that gamification and interactive learning tools can significantly enhance students' motivation, engagement, and retention of language skills. Moreover, primary school teachers often face challenges such as limited resources, lack of tailored content, and the need for innovative teaching methods to cater to diverse learning styles. Initiatives like Tara aim to address these gaps by combining technology, pedagogy, and creativity, offering teachers the support they need while creating an immersive, enjoyable learning experience for students. With its initial rollout at Sathya Sai School in Lopburi, Thailand, Tara aligns with the growing push for EdTech solutions that empower educators and enrich English learning environments.

1.1 Background

1.2 Objectives

The objectives of this project can be summarized as follows:

1. Facilitate Reading Instruction: Offer practical guidance and instructional approaches to assist teachers in effectively teaching reading skills to students in grades 4 to 6, focusing on the A1 CEFR proficiency level.

2. Promote Reading Habits: Encourage the cultivation of reading habits among students by providing engaging and diverse texts that cater to their interests and cognitive development.

3. Develop Reading Skills: Provide strategies and activities to help students develop essential reading skills, including attention to detail, comparison of ideas, recognition of figurative language, understanding of narrative perspectives, and improvement in reading comprehension.

4. Expand Textual Access: Offer a wide range of texts, including limericks, persona poems, poems, fables, short stories, songs, and haiku, to enrich students' reading experiences and broaden their literary horizons.

5. Reinforce Vocabulary: Integrate vocabulary-building activities and context-rich texts to strengthen students' lingual knowledge and comprehension abilities within the context of their reading practice.

1.3 Scope

1.3.1 Initial Scope

This project aims to provide educators with effective strategies and resources to enhance reading skills among students in grades 4 to 6, aligned with the A1 level curriculum of the Common European Framework of Reference (CEFR). It encompasses a range of learning outcomes and resources designed to foster a love for reading, develop comprehension abilities, and reinforce vocabulary acquisition.

1.4 Expected Benefits

1. The staff will have a tool to store and retrieve data and information they require to perform their jobs.

2. The software system should lead to more efficient services to students and teachers, resulting in increased performance.

3. Enhancing English reading skills ensures that students establish a solid foundation for their educational growth and achieve better engagement and learning outcomes in English reading skills .

Chapter 2

Feasibility Study

Tara leverages gamification and adaptive learning to address the key challenges in teaching English reading skills to primary school students. It focuses on integrating gamified elements, personalized learning, and teacher-oriented tools into a cohesive system. The project emphasizes working closely with teachers to develop resources tailored to their needs.
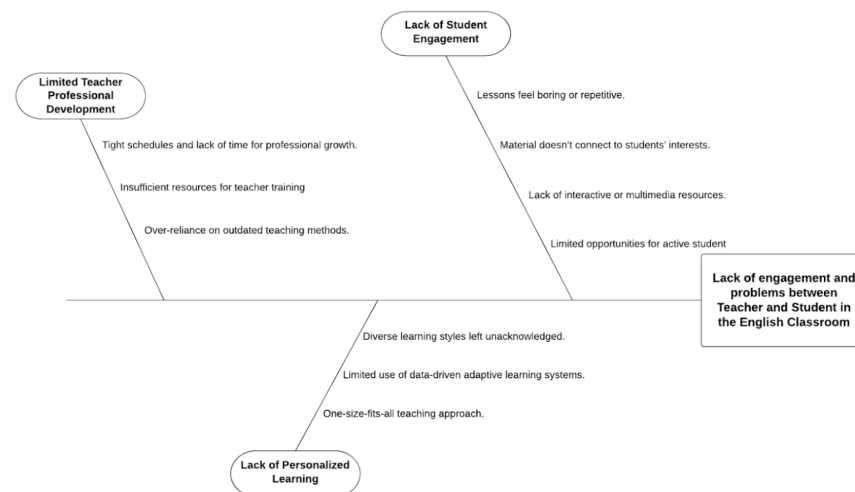
2.1 Problem Statement

Figure 2.1: Fishbone Diagram

From figure 2.1 shows the breakdown of problems. Lack of Student Engagement: Many students struggle to stay interested and motivated in traditional classrooms. They might zone out during lectures, struggle to connect the material to their lives, or simply not feel motivated to participate. This can be because the lessons feel boring or repetitive, or they don't connect to the students' interests. Additionally, the lessons might not be presented in a way that caters to different learning styles, making it harder for some students to grasp the concepts. The end result? Frustration, boredom, and ultimately, a disconnect from the learning process. Solution: Integrate gamification elements, interactive content, and multimedia resources into the learning experience to enhance student engagement. Limited Teacher Professional Development: Stagnant learning plagues classrooms due to inadequate resources and opportunities for teacher training and professional development. With demanding schedules and tight budgets, schools often struggle to provide teachers with the resources and time needed for ongoing training. Solution: Develop an EdTech platform offering online courses, exercises, and learning content to support ongoing teacher training and development. Lack of Personalized Learning: The traditional one-size-fits-all approach in classrooms fails to consider that students learn at different paces and have distinct

learning styles. This can lead to frustration and disengagement for some students who race ahead or fall behind. Solution: Implement adaptive learning systems that tailor educational content to individual student needs, allowing personalized learning experiences.

2.2 Related Research and Projects

2.2.1 The use of literature

In recent years, schools have been making efforts to preserve and develop the interest on literature of the students, a discipline that is getting lost with the rise of technology and social media. Although our project cannot include literature fragments due to possible copyright issues, we make use of a wide variety of unique texts and poetic forms that can be dynamically used inside the classrooms.

Literature is not only used as a way of reinforcing the students' reading skills, but also a tool to develop their intercultural awareness, nurturing empathy, tolerance, and emotional intelligence [2]. It provides us a way to embrace pupils' creativity, curiosity and caring of the world around them. Tara, our EdTech platform, focuses on storytelling through short texts, poems such as limericks, haiku and persona poems, as well as visual tools like flashcards.

Storytelling, as many have proven, is one of the most impactful tools for young learners to acquire a language since they pay special attention to visual aids, in this case drawings (images), and the repetition of specific vocabulary and grammar structures through short stories.

In consequence, short stories that teach vocabulary and are catchy are key for learning how to read and listen, especially when learning a foreign language (EFL). Short texts of any kind allow the teacher to repeat words many times and give students a deeper level of understanding of the meaning. Moreover, short texts such as poems and limericks are ideal for introducing the concept of rhythm and work transversally with other subjects such as music. Also, students get hardly distracted given that the texts are shorter than their attention span.

2.2.2 EdTech

Personal learning tailors the content and/or pace of individual student learning by adapting digital tools to meet the needs and questions of a single student. It can facilitate engagement, and there is evidence of its support for learning outcomes-particularly around math and reading, where growth can be measured over time. Personalized learning technologies, such as adaptive learning platforms, have taken the forefront to permit students to progress at an individualized pace towards great command of the specific subject. Research by RAND shows that personalized learning models can achieve significant gains when teachers use adaptive tools to align students' progression through a course with their learning pathways for comprehension and retention [7].

EdTech use increases the flexibility and accessibility of learning, especially in reading. Through digital means, instructors can implement interactive reading activities, allow students access to large digital libraries, and utilize tools that track their reading patterns for detecting areas of difficulty. According to studies, the most effective integration of technology into classrooms takes

place by supplementing the use of technology with immediate adjustments provided by a teacher and offering activities or other resources that enhance reading abilities. The EdTech Hub brings out that technology, especially, has the potential to provide scalable solutions for bridging learning gaps in low-resource settings if it is implemented along with robust instructional support and teacher training.

Furthermore, according to the Research Institute of America, those students who make use of technology often outperform traditional learners. The U.S. The Department of Education also took part in researching whether this new phenomenon is as effective as it has been portrayed in some educational media just to find out that online instruction had better results than face-to-face courses [8]. Nonetheless, it is important to mention that when blending both teaching modalities we are able to create a learning environment that is more personalized, dynamic and engaging for the students, being this reason why Tara is a resource for teachers to teach, and not a replacement of in-class education.

2.2.3 Gamification

Gamification is a process by which game-like elements, such as points, levels, badges, and so on, are put into educational tasks, which drastically increases the chances of raising student motivation and interest in education.

Challenges, rewards, and progress tracking on gamified platforms might provide the most dynamic way of developing one's reading skills and making learning fun. Gamification applied to reading can take exercises into more playful, interactive stories or games that build continuous practice and also encourage vocabulary. Studies within the realm of educational gamification have shown that once the learning environment is gamelike and fun, students will engage much better with the learning materials-especially in fundamental skills such as reading [4].

Gamification has emerged as a significant pedagogical approach aimed at enhancing learning outcomes, performance, and engagement among learners. A meta-analysis by Sailer and Homner highlights the effectiveness of gamified learning environments, suggesting that specific game design elements can fulfill psychological needs as outlined in self-determination theory, thereby improving educational outcomes [10]. This is corroborated by Setyaedhi, who found that students exposed to gamification in 2D and 3D animation subjects exhibited significantly better learning outcomes compared to their non-gamified counterparts [11]. Furthermore, Khatoon emphasizes that gamification not only enhances engagement but also acts as a predictor of improved language learning performance, indicating that the integration of game-like elements fosters a more invested learning experience [5].

The enjoyment derived from gamification stems from its ability to create a more interactive and motivating learning environment. Polat notes that gamification can enhance problem-solving, participation, and motivation, making educational activities more engaging and enjoyable [9]. This sentiment is echoed by Nurtanto et al., who report that challenge-based games can lead to substantial improvements in student performance, thereby increasing enthusiasm and satisfaction with

the learning process [**?**]. Additionally, Wang and Sari highlight the importance of task-technology fit in gamification, suggesting that when learners find the gamified elements relevant and adaptable to their needs, their overall learning experience improves [12].

In the context of Asian educational settings, the effectiveness of gamification may be particularly pronounced. Research indicates that cultural factors can influence how gamification is perceived and implemented. For instance, Jang et al. suggest that gamification can enhance student engagement and motivation, which may resonate well within collectivist cultures that emphasize group participation and achievement [3]. Moreover, studies have shown that gamification can effectively reduce anxiety and increase motivation among English as a Foreign Language (EFL) learners in Asian contexts, further supporting its applicability [13].

The role of leaderboards in gamification is another critical aspect influencing learner engagement. Leaderboards can create a competitive atmosphere that motivates students to improve their performance. However, it is essential to balance this competitive element with intrinsic motivation to avoid potential negative effects, such as anxiety or disengagement. Mamekova et al. caution that excessive reliance on extrinsic rewards, such as points and leaderboards, may undermine intrinsic motivation, suggesting that a thoughtful integration of these elements is crucial for sustaining engagement [6]. Alenezi supports this view, indicating that while gamification can enhance motivation and learning outcomes, it must be carefully designed to align with educational goals [1].

2.2.4 Competitor Comparison

FEATURES COMPARISON				
	Personalized Education	**Gamification**	**Exercises Provided**	**Recommendation Algorithm**
TARA	✓	✓	✓	✓
nearpod	✓	✓	✗	✗
Quizizz	✓	✓	✗	✓
ellii	✓	✗	✓	✗

Figure 2.2: Feature Comparison

Nearpod: Nearpod is a popular interactive learning platform that enables educators to deliver engaging lessons through multimedia content, interactive quizzes, polls, and real-time feedback. It emphasizes Personalized Education by allowing teachers to customize lessons to suit student needs and monitor progress. Nearpod also includes Gamification features like interactive activities to maintain student engagement and participation. However, it lacks dedicated Exercises

Provided for practice and a Recommendation Algorithm to suggest tailored content, making it more suitable for live, teacher-driven instruction rather than independent learning.

Quizizz is a gamified learning platform that focuses on creating engaging educational experiences through interactive quizzes, assignments, and live challenges. It offers Personalized Education by allowing educators to tailor quizzes to student needs and track individual progress. The platform's strong emphasis on Gamification encourages motivation and active participation with competitive elements like points, leaderboards, and instant feedback. Quizizz also incorporates a Recommendation Algorithm that analyzes student performance and suggests relevant content to improve learning outcomes. However, it does not provide dedicated Exercises, limiting its use for structured, practice-based learning.

Ellii is an educational resource platform primarily designed for teachers and learners seeking structured learning materials. It focuses on Personalized Education by offering customizable lesson plans, worksheets, and teaching resources. The platform provides Exercises to help learners practice and reinforce skills, making it ideal for a content-driven learning experience. However, Ellii does not include Gamification, which may reduce engagement for some learners, and it lacks a Recommendation Algorithm, meaning content suggestions are not tailored to individual progress. This makes Ellii a strong option for traditional teaching and practice-based learning environments.

2.3 Requirement Specifications

2.3.1 System Requirements

1. The system includes interactive English reading content, organized into units, lessons, and exercises.

2. Students use a dedicated portal to view lessons, track their learning progress, and interact with classroom content.

3. Teachers manage classrooms through a teacher portal, enabling class creation, student monitoring, announcements, feedback, and lesson selection.

4. Gamified elements integrate with learning, allowing students to earn points and use them in a core gameplay loop with leveling, battling, and shop systems.

5. A smart recommendation algorithm personalizes learning by suggesting lessons, tracking progress, and adapting exercises to preferences.

6. A generative AI chatbot supports students by answering questions and guiding their studies.

7. User authentication and account management ensure secure access for both students and teachers.

8. Additional features include dashboards, help centers, announcements, and game access management for an enhanced user experience.

2.3.2 Web App Requirements

1. Computer or Laptop with Windows, mac or linux OS

2. Devices must include an internet connection and a web browser capable of supporting the application.

2.4 Implementation Techniques

2.4.1 Front-end Development

- React.ts

- Vite: Build Tool

- Zustand: State Management

- HonoRPC: Type Safe API Calls

- Swr: React Hooks Library (Caching and performance)

- Framer-motion: Animations

2.4.2 Back-end Development

- Bun: JS Runtime

- Hono.js: Web Framework

- Zod: Validation

- cron: Job Scheduler

- mongoose: ODM

- scalar: API Documentation

2.4.3 Database

- MongoDB Atlas

2.4.4 Infrastructure

- Firebase Cloud Storage: Images and Data

- Google Cloud Run: Deployment

- Docker

2.4.5 AI

- OpenRouter: LLM Provider

- Nouresearch/Hermes-3 (405B): LLM Model

2.4.6 Game Development

- Gadot

2.4.7 Other Tools

- Postman

- Figma

- VS Code

- Github and Gitlab

- Discord

- MS Teams

- Canva

- Google Docs

2.5 Implementation Plan
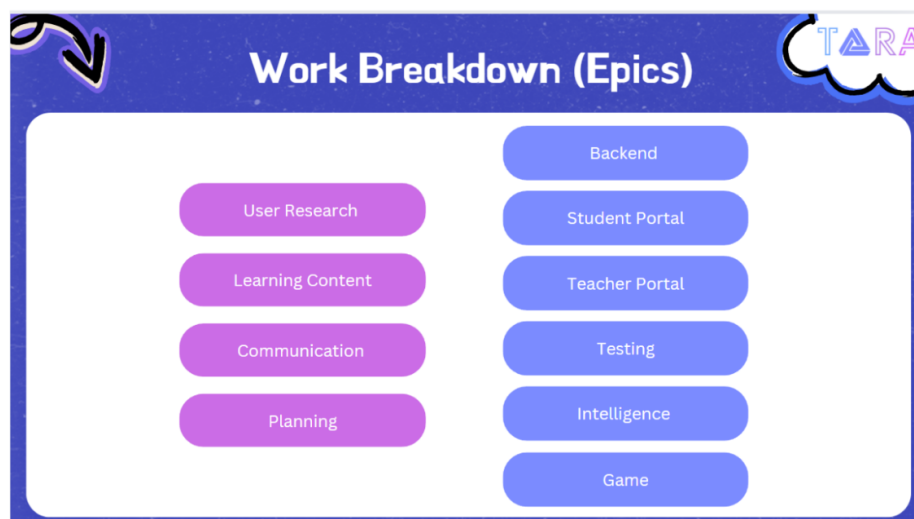
2.5.1 Work Breakdown Structure (WBS)

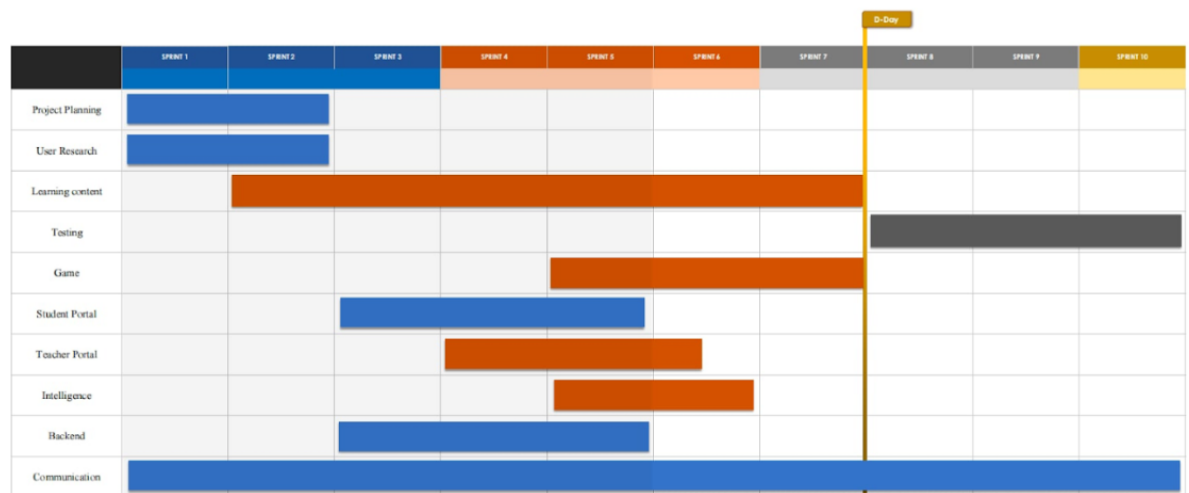Figure 2.3: Work Breakdown Structure

2.5.2 Project Timeline

Figure 2.4: Project Timeline

2.5.3 Time Estimation

Time Estimation Epic 1: User Research (27) Epic 2: Learning Content (264) Epic 3: Communication (17) Epic 4: Testing (70) Epic 5: Game (87) Epic 6: Student Portal (56) Epic 7: Teacher Portal (41) Epic 8: Intelligence (32) Epic 9: Backend (44) Epic 10: Planning (76)

Total: 714 hours

Total hours/sprint: 71.4

No. of people in team: 3 (Extra Help from Education Expert Veronica for Learning Content) Total hours/sprint/person (3 person assuming): 23.8

Man hours: 2.38 (Actual man hours may be lower than 2.38 due to help from veronica in creating learning content)

Chapter 3

System Analysis and Design

This chapters covers the user requirements and new systems design. The user requirement part discusses the market segmentation, target market, user personas and justification for targeting the users. The new systems design consists of the teaching flow, database design and recommendation algorithm design.

3.1 User Requirement Analysis

3.1.1 Market Segmentation

- Demographic:

  - Age: Primary focus on students aged 9-12 years old. Teachers are typically 21+ years old.

  - Gender: Male and female

  - Education: Students in primary school (A1 CEFR), teachers with bachelor's degrees in education.

  - Occupation: Students and Teachers

- Geographic:

  - Country: Thailand

  - Language: Thai (primary), English (learning objective)

- Behavioral:

  - Willingness to pay: Free and subscription models are considered.

  - Internet usage: Primarily for learning and gaming aspects.

- Psychographic:

  - Student Personality: Engaging, curious, competitive, and open to new learning methods.

  - Teacher Personality: Idealistic, open to innovative teaching tools, forward-thinking, and ambitious in improving student outcomes.

  - English knowledge: Spectrum from unfamiliar to familiar, with a strong desire to improve.

  - Motivators: Students seek knowledge and engaging ways to learn English. Teachers seek effective tools to improve student learning experiences and outcomes.

- Need Segmentation:

  - Access to a device (phone, tablet, laptop) with a reliable internet connection.

3.1.2 Target Market

The demographic segmentation for our target audience includes students aged 9-12 years old (A1 CEFR) and teachers aged 21 years old and above, encompassing both genders. They are primarily affiliated with primary education and hold bachelor's degrees in education fields. Therefore, in terms of occupation, they are either students or teachers. Our geographic focus is on Thailand, where our users primarily speak Thai but also want to achieve proficiency in English. Behaviorally, our audience exhibits a range of willingness to pay preferences, from seeking free access to being open to subscription models. They engage with the internet predominantly for educational purposes.

Initial Target Customer: Sathya Sai School in Lopburi, Thailand (4th Grade)

3.1.3 User Personas

Somchai

Gender: M
Age: 9
Occupation: Student
Location: Thailand

Somchai is a 4th grade student who wants to improve his English reading skills to be able to understand the foundation of the language.

Goals
-He wants to learn English more fun.
-He wants to play game.

Frustrations
-He found the traditional way of learning so boring.
-He got distracted easily.

Figure 3.1: User Persona 1

Pim

Gender: F
Age: 24
Occupation: Teacher
Location: Thailand

Pim is a primary school English teacher. Who wants to develop the way she teaches English more fun and creative.

Goals
-She wants to improve how she teaches English reading skills.
-She wants students to pay attention to her class.
-She wants students to have fun while learning English.

Frustrations
-Her students find her class boring.
-She runs out of idea how to design her way of teaching.
-She doesn't know where to find an accessible resource to teach English.

Figure 3.2: User Persona 2

3.1.4 Justification for Targeting

Why Primary School Teachers and Students?

Primary school education presents a unique opportunity for impactful intervention. It is during this critical period that students begin their journey with the English language, emphasizing the importance of making their initial exposure enjoyable. Thus, our focus on primary school students aims to establish a solid foundation in English, ensuring their learning experience is both effective and enjoyable.

Why Hybrid and not Purely Online?

The decision to adopt a hybrid approach, combining online resources with in-classroom learning, stems from practical considerations and the diverse needs of students and teachers. Recognizing the scarcity of resources for teachers, our platform equips educators with valuable tools to enhance their teaching effectiveness. Additionally, the hybrid model addresses disparities in access to technology, ensuring that all students have the opportunity to engage with the material, especially those who may lack access at home. Importantly, classrooms provide a controlled environment conducive to learning, particularly in the context of English language acquisition.

Why English?

English holds unparalleled global significance as the lingua franca, offering myriad opportunities for communication, education, and career advancement. By focusing on English language learning, we aim to equip students with a vital skill set that opens doors to diverse opportunities worldwide. Moreover, the demand for English proficiency is pervasive, making it a strategic focus area for educational interventions.

3.1.5 Methodology

Design Thinking

Empathy: Researching Users' Needs

In the initial phase, a team member conducted interviews with primary school teachers, revealing insights that prompted a shift in focus from grades 1-3 to grades 4-6. Additionally, it was highlighted that teachers require tools that not only assist in teaching but also captivate students' attention in the classroom.

Define: Identifying Users' Needs and Challenges

The interviews identified three primary challenges faced by teachers:

- Student Engagement: Increasing student engagement and attention in the classroom emerged as a significant concern for teachers.

- Teacher Professional Development: Teachers expressed a desire for resources and support to improve their teaching skills in the classroom. To assist in teaching, managing, and saving time.

- Personalized Learning: There is a need to tailor learning experiences to meet the individual needs of students as much as possible, enhancing their understanding and engagement.

Ideation: Generating Innovative Solutions

We brainstormed potential features for an EdTech platform to address the identified challenges:

- Learning Contents: Offering students to study with our developed English reading lessons. Providing various learning modalities to accommodate different learning styles.

- Exercises with Rewards: Introducing exercises within the platform where students can earn rewards upon completion, fostering motivation and reinforcement of learning.

- Gamification: Incorporating gamified elements utilizing rewards earned through exercises as in-game currency. Impact in students enjoy learning and playing at the same time.

- Smart Algorithm and AI Q&A Chatbot: Integrating a smart rule-based algorithm to personalize learning experiences and an AI-powered chatbot to provide students with 24/7 support for their queries.

3.2 New System Design

3.2.1 Work Flow Diagram
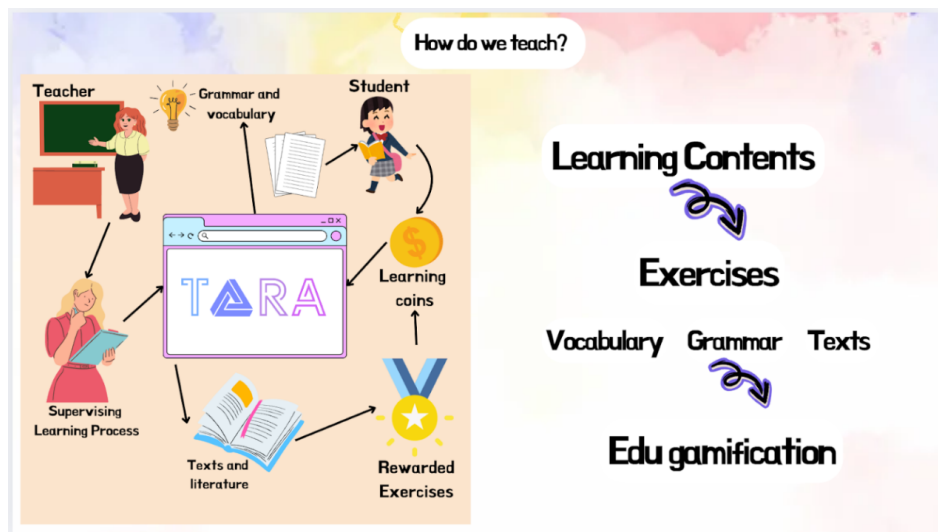
Figure 3.3: Workflow Diagram

Within the class the teacher can utilise the tara application and use it's provided content: learning units which include Lessons and exercises, in order to teach students in the class. The students each have their student portal open on their desktops which shows the interactive learning content including flashcards, images, passages and more. After the lesson is complete (being taught by the teacher), the students can complete the provided exercises which award students rewards in the form of coins or points which they can accumulate and use in a separate game

within the application. The students can then spend the coins to upgrade the stats of their characters and battle other player until their coins run out which they would then need to collect again by learning through the lessons and exercises provided in the student portal.

3.2.2 BPNM Diagram
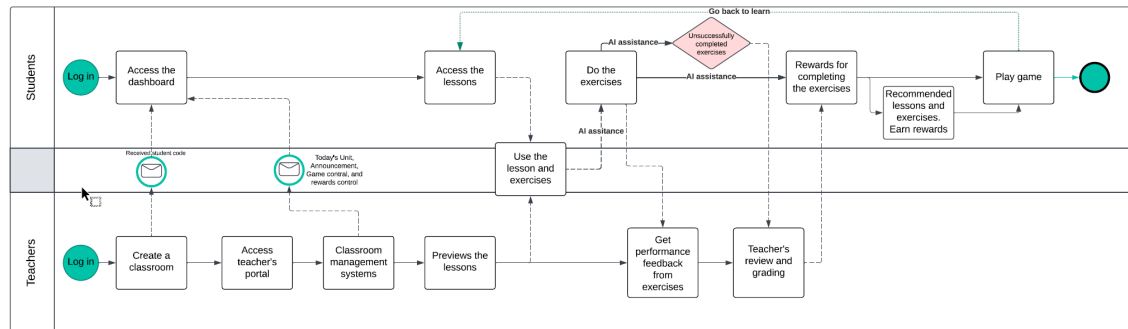
Figure 3.4: BPNM Diagram

The process begins with students and teachers logging into their respective systems. Teachers first create a classroom, which generates a student code. They then access the teacher's portal to manage classroom systems, preview lessons, and provide updates, such as the unit of the day, announcements, game controls, and rewards management. Students use the provided code to access their dashboard, where they can navigate to the lessons and exercises. Students do the exercises in the student portal. Upon successfully completing exercises, students earn rewards and receive suggestions for further lessons or tasks. AI chatbot is available to the students to assist them with learning anlong with personalized recommendations. Rewards and recommended activities enable students to play games, creating an engaging learning cycle. Teachers monitor progress through performance feedback from exercises, review students' work, and grade their efforts. This feedback loop ensures that students are continually supported, motivated, and directed to improve their learning outcomes.

3.2.3 Database Diagram
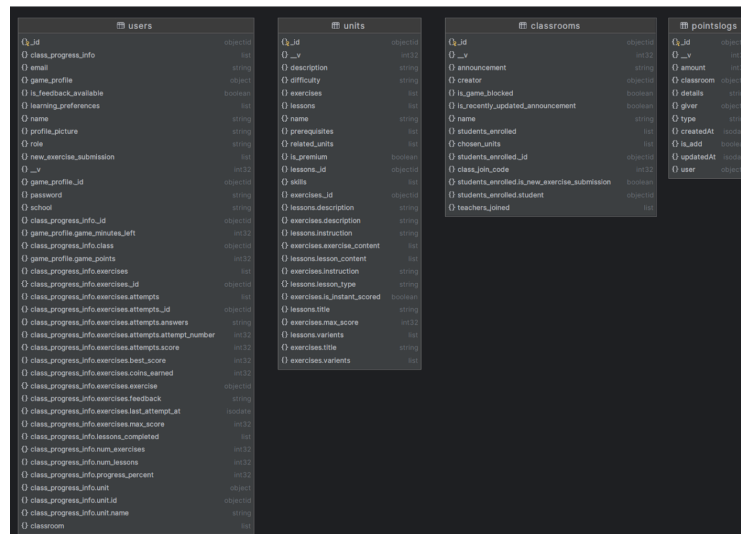
Figure 3.5: Database Diagram

The application uses MongoDB, a no-sql database to store the user information, game information, class information and learning content. The database has following collections:

- Users: Stores users personal information, their game information, their progress information, their role (student, teacher or admin) and what classroom they have joined.

- Units: Stores all learning content including unit information, exercises and lessons

- Classrooms: Stores Classroom information, students enrolled, creator of classroom.

- PointsLog: Stores a log of information on when points are awarded or spent and for what reason.

3.2.4 Recommendation Algorithm Diagram
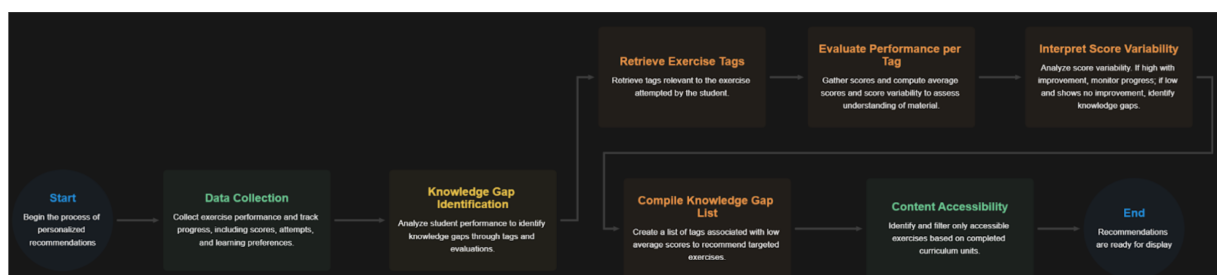
Figure 3.6: Recommendation Algorithm Diagram

A rule based recommendation algorithm. To generate a list of recommended lessons and exercises for users, their data such as progress information is collected, then a list of knowledge gaps is compiled through analysing students performance for each knowledge tag. Their average

score across various attempts and the rate of improvement is then compared with a threshold to finalze the list which is then filtered to recommend only accessible lessons and exercises to the students.

Chapter 4

System Functionality

This chapter outlines the functionality of the system,providing a comprehensive overview of its architecture,modular design and specific roles of each components.it highlights how the system has been structured to achieve its objective,focusing on the smooth integration of various components to ensure efficiency.

4.1 System Architecture
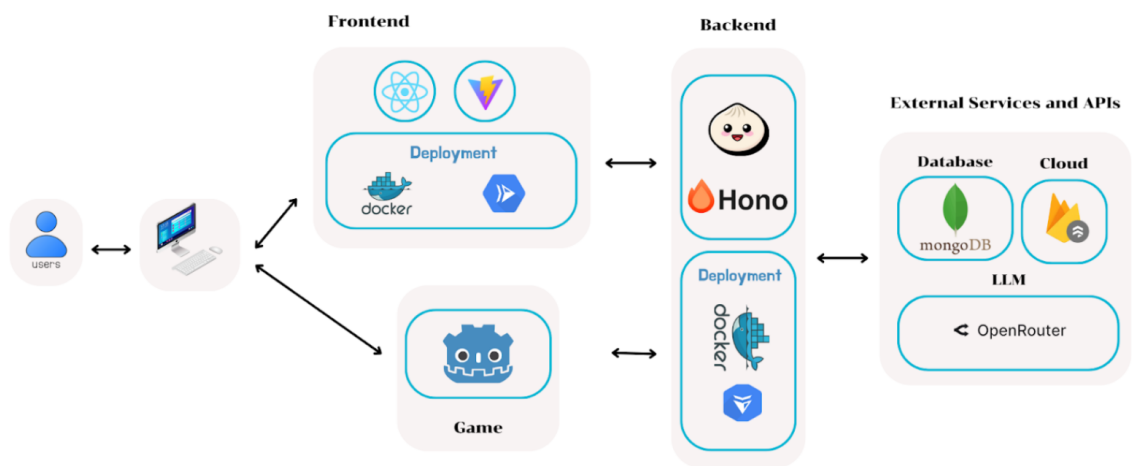
Figure 4.1: System Architecture Diagram

The system will consist of three main components. The first component is the frontend, which is the user-interaction layer built using React and Vite. It handles functionalities such as displaying the user interface and sending requests to the backend. The frontend is containerized using Docker and deployed on Google Cloud Run, ensuring scalability and reliability. It communicates with the backend via REST APIs and integrates with the game engine to provide interactive and dynamic content for users.

The second component is the backend, which handles data processing and business logic. It is built using Hono, a lightweight web framework, and runs on the Bun JavaScript runtime for fast and efficient operations. The backend processes requests received from the frontend, retrieves or stores data in the MongoDB database, and connects to external APIs and services. This component is also deployed in Docker containers on Google Cloud Run, ensuring flexible and containerized operations.

The third component is the external services and APIs, which include the game engine,

storage, and AI integrations. The game is powered by the Godot engine, which manages game logic and rendering. The system uses MongoDB to store application data and Firebase Cloud Storage to manage image uploads securely and efficiently. For advanced AI features, the system integrates with OpenRouter, providing access to large language models to enhance interactivity and intelligence within the application.

All components are connected seamlessly to ensure a modular, scalable, and user-friendly system capable of handling dynamic application requirements and high-performance demands.

4.1.1 Groups of System Functions
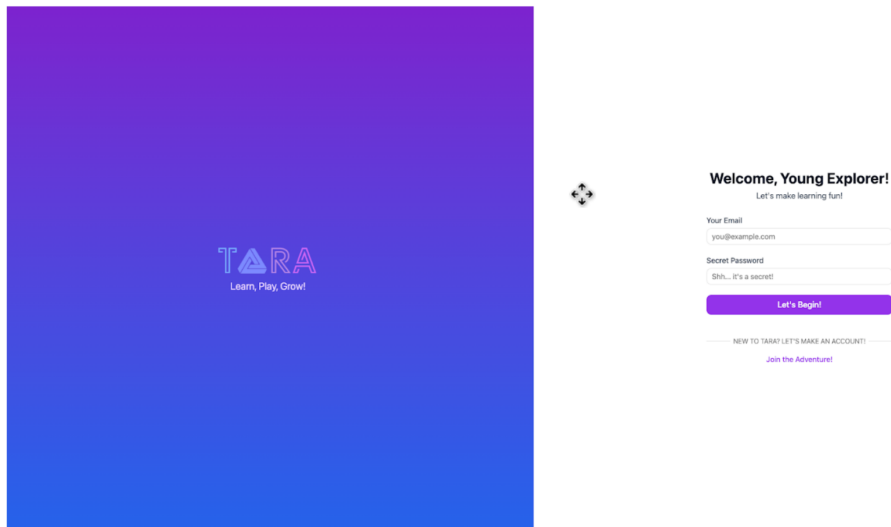
Figure 4.2: Login Page

The login page of the student portal of "TARA" app allows registered students to securely access their accounts by entering their email or username and password.
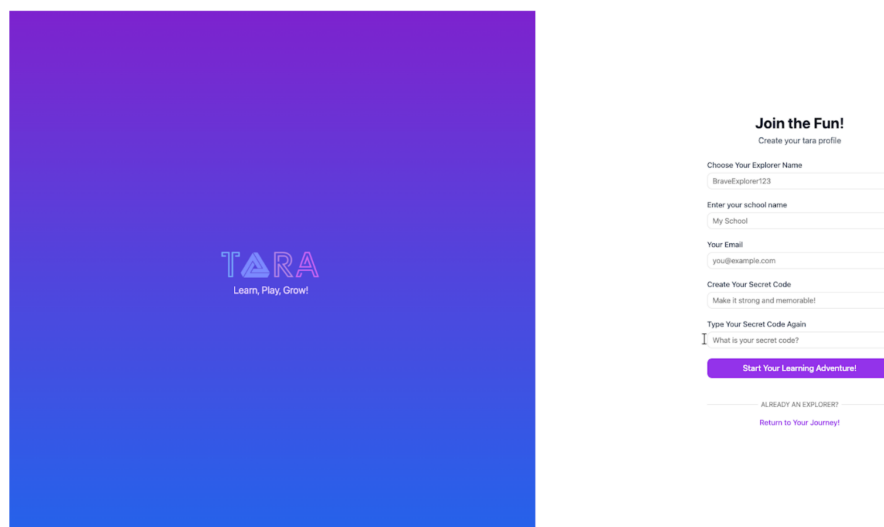
Figure 4.3: Register Page

The register page of the student portal of "TARA" app. It collects user information, including

name, email, and password, through input fields on the registration page. Upon submission, the function validates the input data, ensuring all required fields are completed and the email is unique.
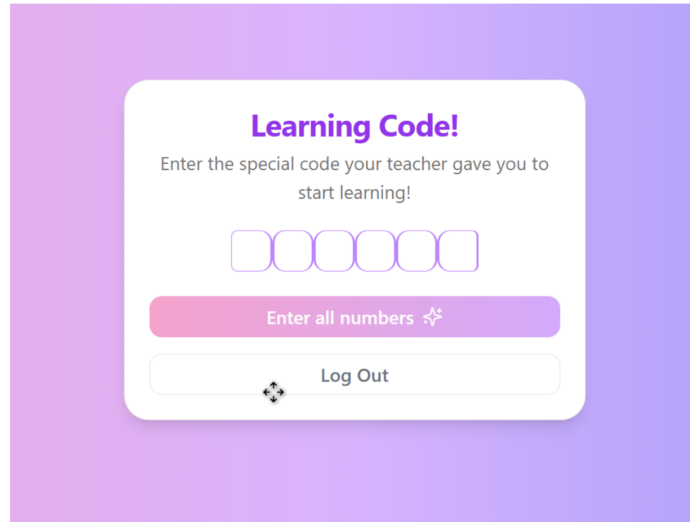
Figure 4.4: Classroom Code

Students can input the classroom code provided by the teachers in order to join the classroom created by the teacher and access the learning content of the classroom.
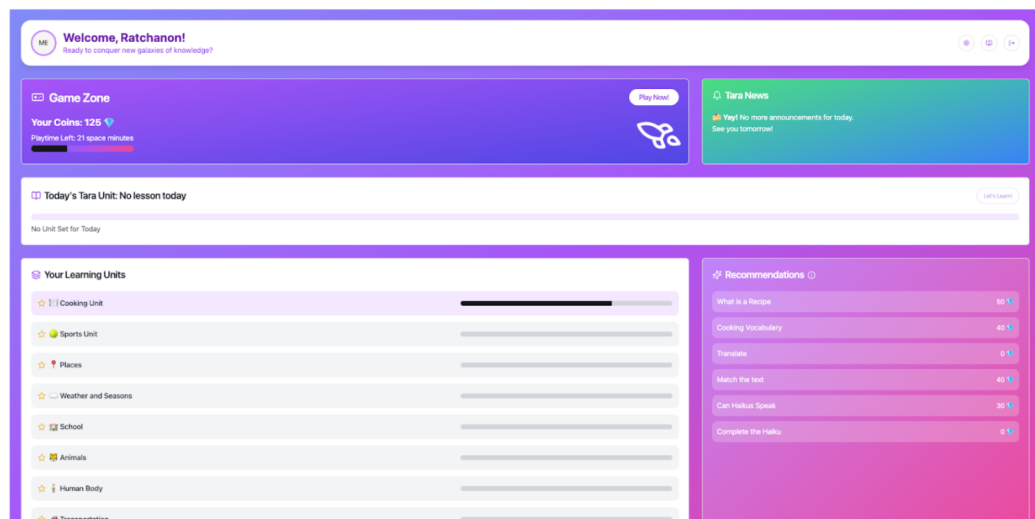
Figure 4.5: Student Portal

The figure shows the student portal dashboard, where students can access the learning units, see their game points and time left, announcements, today's unit and recommendations. It also includes links to the settings page, help page and logout modal.

The figure shows a list of recommended lessons and exercises along with the points the students can earn by completing them.
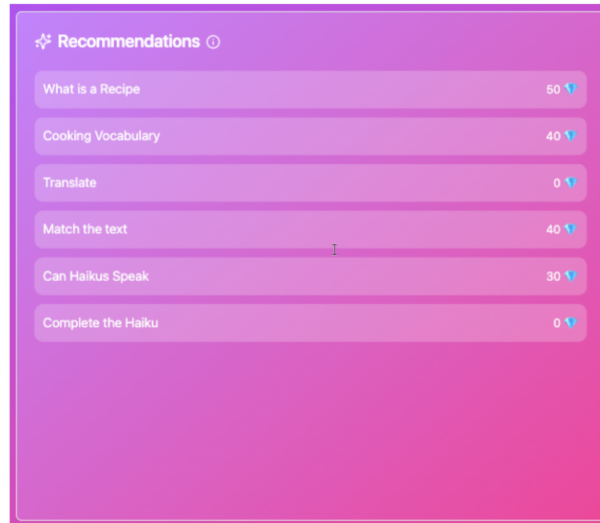
Figure 4.6: Recommendations
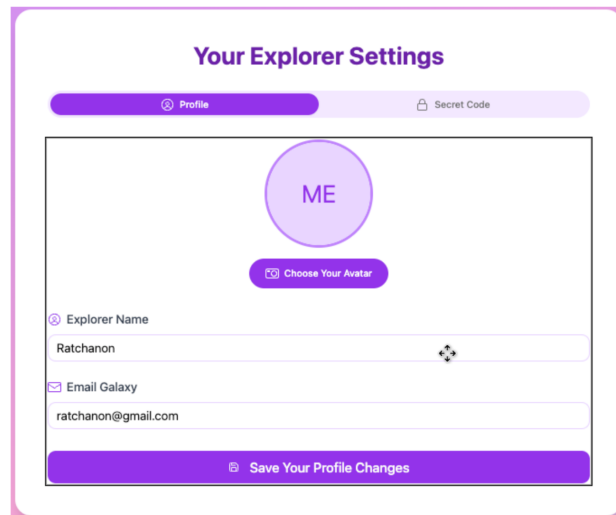
Figure 4.7: Settings Page

This figure shows the settings page where the students can change their profile picture, name, email and password.
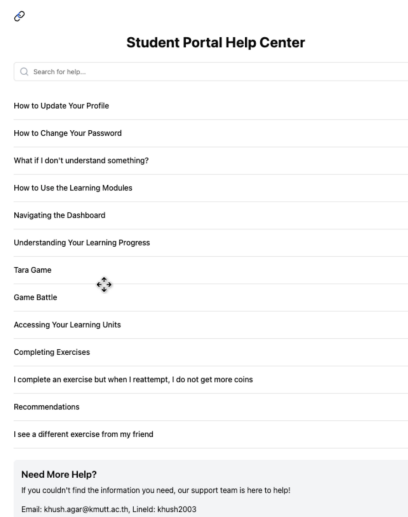
Figure 4.8: Help Page

The Help page offers users support and guidance, providing solutions to common issues and assistance with app features to ensure a smooth experience.
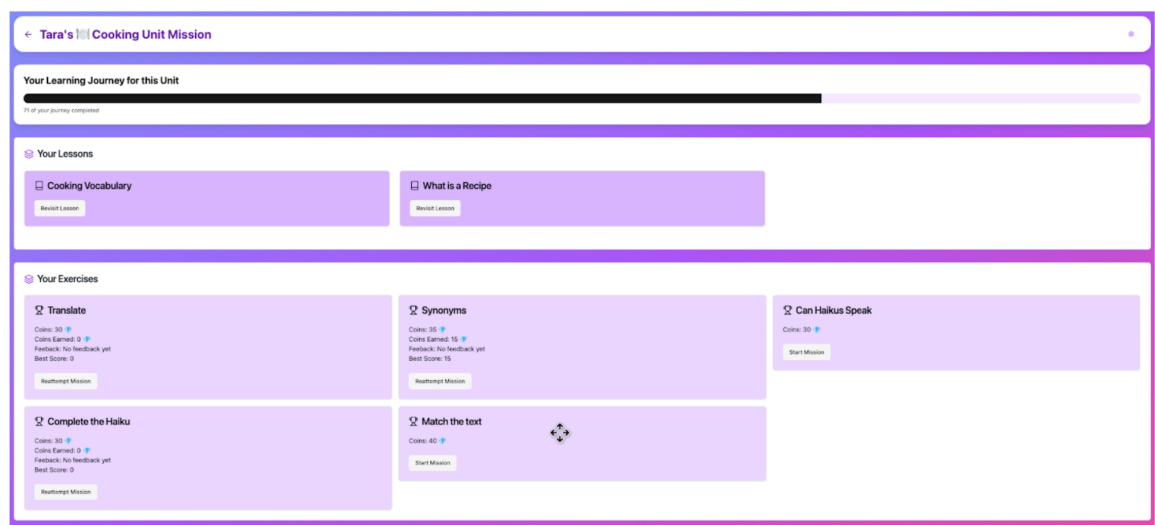
Figure 4.9: Unit overview

The Unit overview page shows the learning progress, the lessons and exercises in the unit along with the points earn-able from a exercise and attempt information.
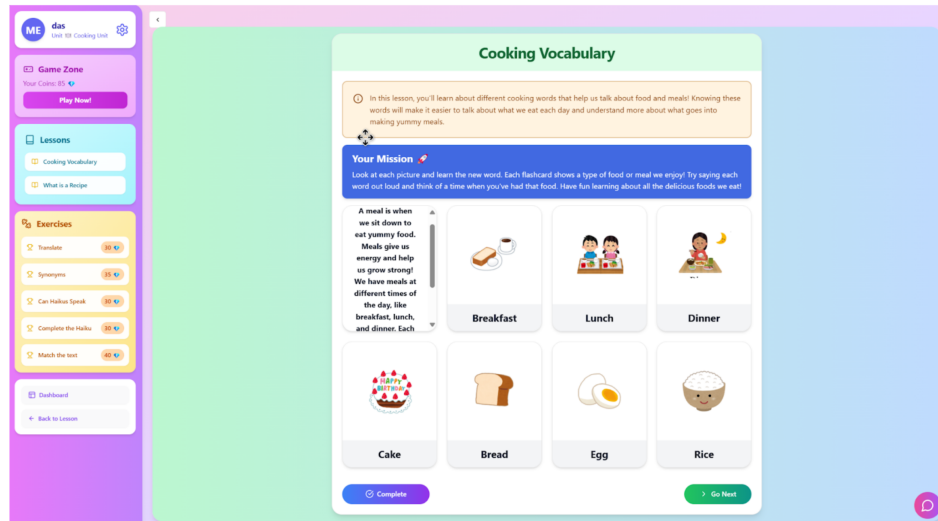
Figure 4.10: Learning Page
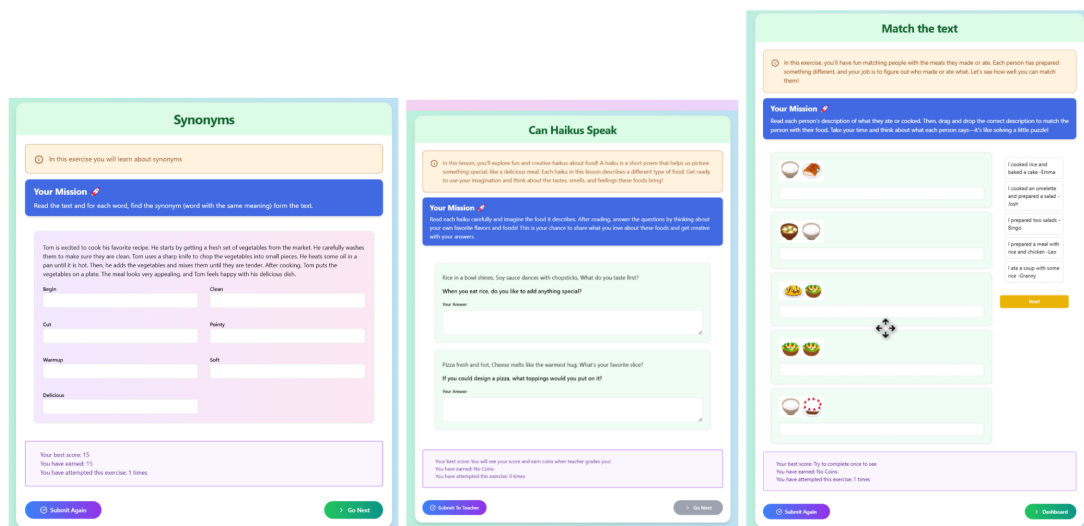
Figure 4.11: Exercises from Learning Page

The learning page presents the interactive learning content (lessons or exercises) to the student.
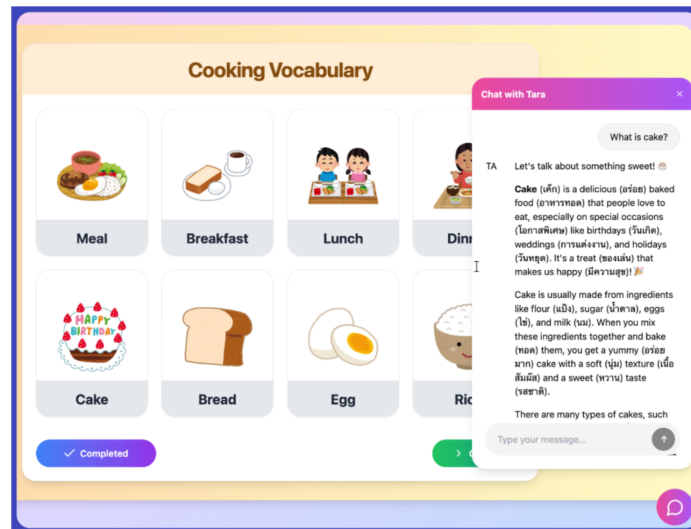
Figure 4.12: AI Chatbot

AI chatbot acts as a helpful assistant, offering instant support during their language learning journey. It can answer questions, provide practice exercises, and offer personalized tips based on the user's progress.

Figure 4.13: Leaderboard Page

The figure shows the leaderboard which displays the level, score and ranking of each student in the class.

Figure 4.14: Game

The left panel displays the player's stats: health, food, and attributes like Attack, Defense, and Speed, which can be modified by using earned stat points. The center highlights the main character in a battle arena with a "Fight" button for progression. The right side houses a shop where players can buy items such as potions, popcorn, and protein with in-game currency that can help improve gameplay strategy and survival.
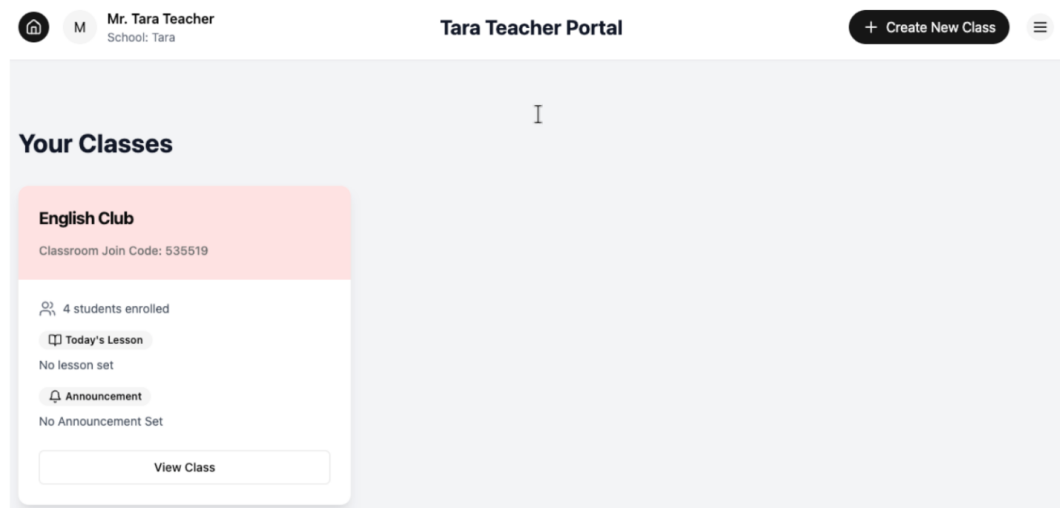
Figure 4.15: Teacher Portal

The teacher portal offers tools for efficient classroom management, displaying all of the classes they created and details such as name, join code, enrollment numbers, and quick links to content.

Figure 4.16: Class Creation page

The figure shows the class creation page where teachers can pick the from the provided learning content, what to include in the class. The teacher receives a learning code upon creating a classroom which they can share with students to allow them to join the classroom.

Figure 4.17: Class Management Page

The figure shows the class management page which shows the details of the classroom such as students enrolled, their progress in each unit and allows to set today's lesson, announcements, restrictions on game, update the units in classroom and award extra points to students for any reason.
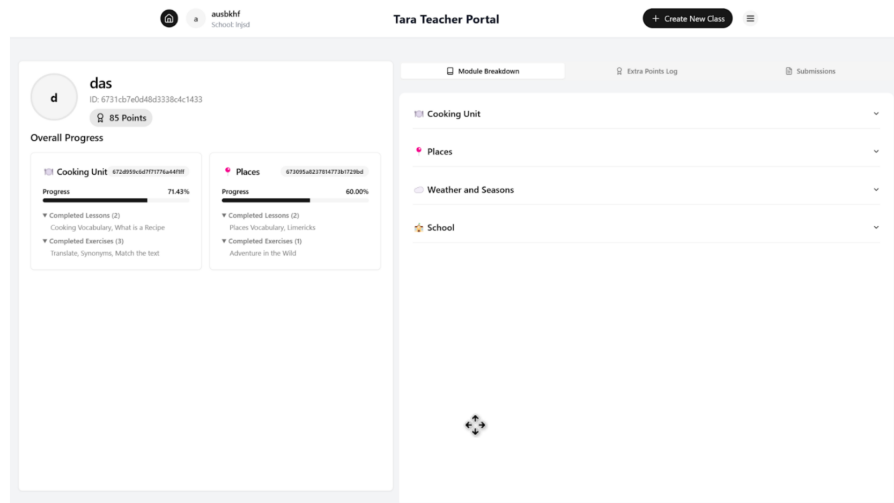
Figure 4.18: Student Details Page
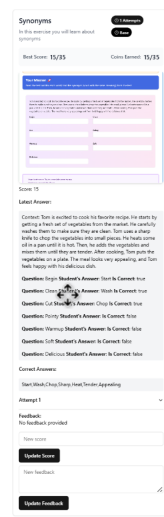
Figure 4.19: Expanded Student Submission and Grading Module

The figure shows the student details page where teachers can see which lessons and exercise the student has completed along with what points they received and see and grade student's exercise submissions.

Figure 4.20: Teacher Settings Page

Teachers can update settings such as personal information and passwords.

4.2 Test Plan

The test plan is to go to Sathya Sai school and conduct testing at site, where we teach the students using deployed platform along with the presence of their English teacher.

4.3 Test Results

The results of the tests show that overall students like using Tara to study, they love being able to learn interactively, in a non-traditional way and play the game, However, younger students tend to struggle with typing and using application initially which requires supervision of the teachers and may take a full class to get the students up and running. When students sometimes struggled with learning content, they used the help of the AI assistant to ask questions with some students using it very often and some students not using it at all. We saw that students were paying more attention to the learning process as they wanted to earn more points in the exercises to spend in the game and a competitive environment was formed in the class. According to the teacher, the students showed better attention during class along with more enthusiasm to learn.

Chapter 5

Summary and Suggestions

This chapter provides a summary of the project, which comprises three parts: project summary, problems encountered and solutions, and suggestions for further development. Project summary summarizes and provides the overall results of the project. problems encountered and solutions outlines the problems encountered and proposes solutions to the limitations of the project. Finally, suggestions are provided for the future improvement of the project.

5.1 Project Summary

The Tara project is an EdTech platform designed to enhance English language learning (focused on reading skills) for students in grades 4 to 6 while equipping teachers with creative tools to foster dynamic and engaging classroom experiences. Built to complement existing teaching methods, Tara offers a suite of features tailored to support educators and students. Key features include the Teacher Portal, which enables educators to manage classrooms and track student progress, and the Student Portal, offering students access to educational resources and personalized learning experiences. The Game Feature motivates students through immersive, interactive gameplay, where they can upgrade characters and batlle others, fostering engagement. Tara also incorporates a Recommendation Algorithm to deliver personalized learning suggestions and an AI Chatbot, to assist students in resolving queries when teachers are unavailable.

The project's performance goals were largely achieved, with successful deployment and usability testing, though further refinement is needed to improve scalability and address minor performance issues. The partnership with Sathya Sai School in Lopburi, Thailand, marks the project's initial implementation, with potential for broader adoption in the future.

5.2 Problems Encountered and Solutions

Several challenges arose during the project, requiring innovative solutions and significant effort to overcome.

One major issue was related to the initial implementation of learning content, which involved creating full pages for each lesson or exercise through code. While this approach offered flexibility for diverse lesson designs, it created significant duplication of work. Each lesson or exercise required the creation of both its content and its accompanying code. Furthermore, this setup lacked dynamic update capabilities; any addition of new lessons or exercises necessitated redeploying the application. To address this, we developed a custom parsing system that allowed lessons and exercises to be represented as JSON. This solution streamlined the process: lesson creators could now input content into a JSON format, which was uploaded to the database, while the lesson/exercise code only needed to be written once for each type. This significantly improved efficiency and scalability.

Another obstacle was our limited knowledge of Godot and game development. As we were new to using Godot, we needed to invest time in learning how to develop games and integrate them with our backend. A significant hurdle arose when we discovered that Godot does not support query parameters, making it impossible to pass user data directly. To solve this, we wrote custom JavaScript code inside the .gd file, which was then converted to JavaScript. This enabled us to extract query parameters and make backend calls to retrieve user information. Although the process was challenging, the solution ensured smooth integration.

Finally, time constraints proved to be a recurring issue. Exams and other responsibilities occasionally hindered our ability to make consistent progress, leading to periods of reduced productivity. However, we managed to catch up by dedicating extra hours afterward, demonstrating adaptability and commitment to meeting project deadlines.

These challenges highlighted areas for improvement. To prevent similar issues, future projects should prioritize scalable content management systems from the start, allocate time for learning new tools early in the development process, and establish more flexible schedules that account for external commitments.

5.3 Suggestions for Further Development

Several enhancements could improve the system's functionality, user experience, and overall impact in future iterations. Administrative tools such as the ability to export and import student lists, as well as the functionality to stop or resume enrollment in classes, would streamline management for teachers. Supporting more device types, including touch-enabled devices, would broaden accessibility and inclusivity.

In terms of personalization and advanced features, building an AI-based recommendation system could provide tailored learning experiences once sufficient data is available. Adding translation functionality would further enhance accessibility, especially for non-native speakers. Expanding the types of learning content to include formats like word searches and video-based lessons would cater to diverse learning preferences. Teachers could also benefit from tools to create their own content, alongside access to outsourced, high-quality content libraries. Features to search, sort, filter, and recommend content would make lesson planning more efficient.

Integrating generative speech APIs, such as ChatGPT's real-time speech API, could support speaking evaluations and enhance language-learning exercises. The game itself could be further developed with new content, additional mini-games, character customizations, and expanded character options, enriching the learning experience.

Implementing a chatting system and a parent monitoring system would foster communication and engagement, while also ensuring accountability. Updating the UX/UI—especially for the teacher portal—would enhance usability and accessibility, making the platform more intuitive. Comprehensive guides for teachers on effective ways to use the platform would support successful adoption and utilization.

Lastly, the chatbot could be upgraded to have full awareness of on-screen information, en-

abling it to provide context-specific guidance to students. These improvements would significantly elevate the application's capability to engage students, support teachers, and deliver high-quality educational experiences.

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Appendix

Appendix A

Interview Appendix

A.1 Interview script for an English Teacher

Interviewer: What is the problem you as a teacher are facing in the classroom? Teacher: I don't get much attention and engagement from the students in the classroom. Interviewer: What is the current solution you are using to fix that? Teacher: I use online media such as Youtube or educational websites to help get engagement from students! Interviewer: Great! What do you think about implementing technology into the classroom to get students engaged and to save your time as a teacher? Teacher: That would be a great tool to have!! Interviewer: **Show Tara prototype to the teacher** Teacher: That is amazing! It will help both teachers and students in this situation. However, which grade are you targeting for? Interviewer: We are thinking of implementing it for G.1-G.3. Teacher: With the Thai students from that age, I think they are too young to be using such a technology like that. Why don't you try with students from G.4-G.6. Interviewer: That works! We are already developing the contents to match with A1 CEFR level of English. (According to the Design Thinking method, due Empathize step, we come back to improve and adjust our scope.)