



# **AI-enabled Intelligent Assistant to Improve Reading and Comprehension Skills in English Language**

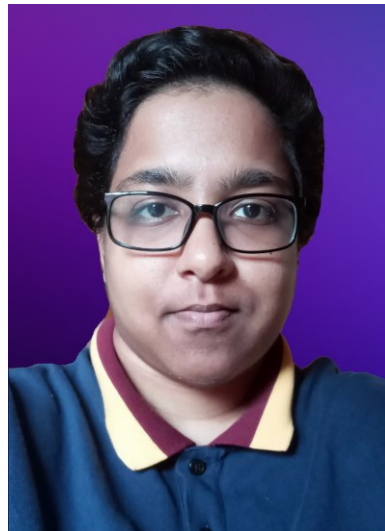
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**24-25J-027**

# Our Team



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# Introduction

AI-enabled system which can offer personalized content and activities based on skill level & interests of the user to enhance English reading and comprehension skills.



# Research Problem

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- Proficiency in English required for higher education & professionalism.
- Reading & comprehension skills vital for academic success & critical thinking.
- Current educational tools do not adequately address the needs of English learners in terms of comprehension.
- Challenges:
  - Lack of dynamic content tailored to user's skill level and interest
  - Inability to provide feedback
  - Lack of tools that can evaluate essay-type questions without human involvement.

# Research Objectives

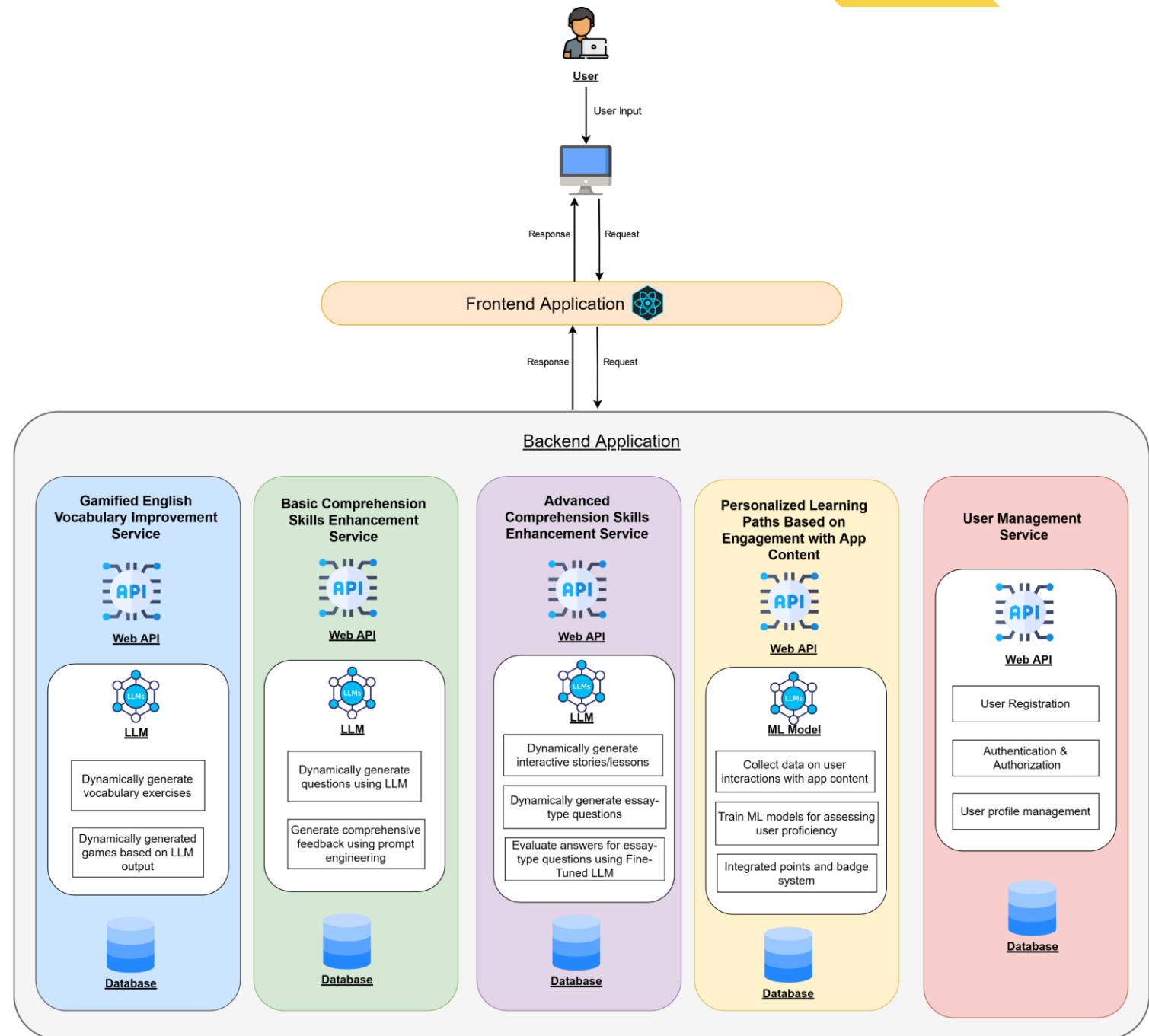
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**Main Objective:** Provide a AI-enabled platform to improve reading and comprehension skills in English language among Sri Lankan Students

**Sub Objectives:**

1. Provide a gamified platform to improve English vocabulary.
2. Provide a platform to improve basic comprehension skills such as Keywording, Skim reading, Scanning
3. Provide a platform to improve advances comprehension skills such as Sequencing, Summarizing, Self-questioning
4. Provide a feature to create personalized learning paths based on engagement with app content and identify student interest.

# Overall System Diagram



# AI-Powered Gamified English Vocabulary Improvement Module



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IT21173790 – Sooriyaarachchi M.D.A

# Background

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Vocabulary is essential for effective communication and comprehension, especially in learning a second language like English.



Many educational tools rely on static vocabulary lists and traditional methods, such as memorization and repetitive exercises, which may not engage students effectively.



The module uses AI to create personalized exercises as a games based on students' vocabulary lists, catering to their specific learning levels and interests.



By providing dynamic and interactive content, the system offers a tailored and engaging learning experience, making vocabulary learning more enjoyable and effective.



# Research Problem?

- The challenge is to create a system that dynamically generates educational exercises as games and based on a student's inputted vocabulary list, enhancing the learning experience.
- Solving this issue will lead to a more engaging and personalized learning experience, ultimately improving vocabulary acquisition in language learning.



# Research Gap

Application Reference	Focus Area	Dynamic Content	User-Generated Content	Engagement Mechanism	Gamification	Sinhala Definitions
Duolingo	General language learning	✗	✗	Points, Streaks	✓	✗
Quizlet	General memorization	✗	✗	Flashcards, Games	✓	✗
Mindsnacks	Language learning	✗	✗	Mini-games	✓	✗
Proposed System	Vocabulary Improvement	✓	No, AI-generated based on input	dynamic exercises as A Games	✓	✓

# Specific and Sub Objectives

## Specific Objective

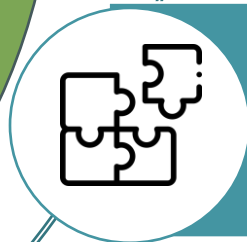
To help high school students improve their English vocabulary and comprehension, we will create a module that generates interactive games and exercises based on the vocabulary words they provide



Fine-Tune a Large Language Model (LLM) to generate contextually relevant vocabulary exercises.

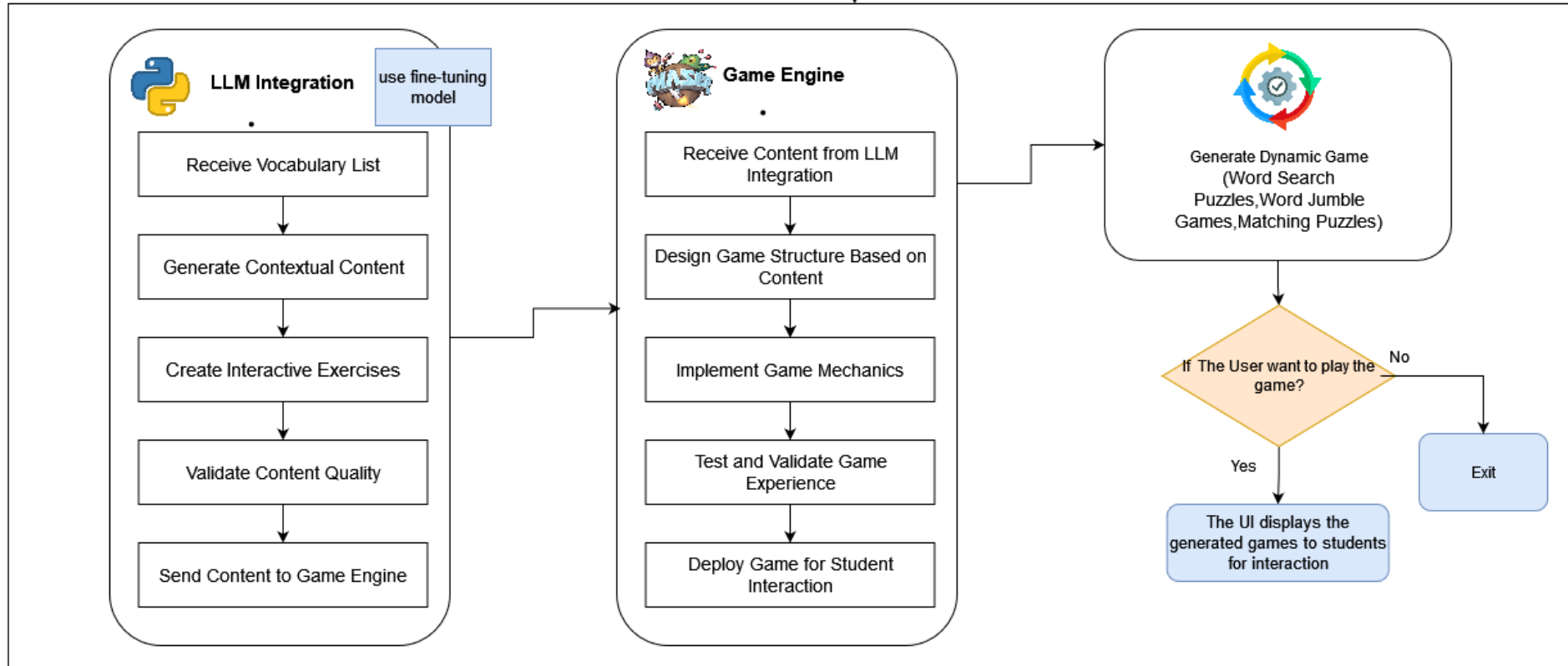
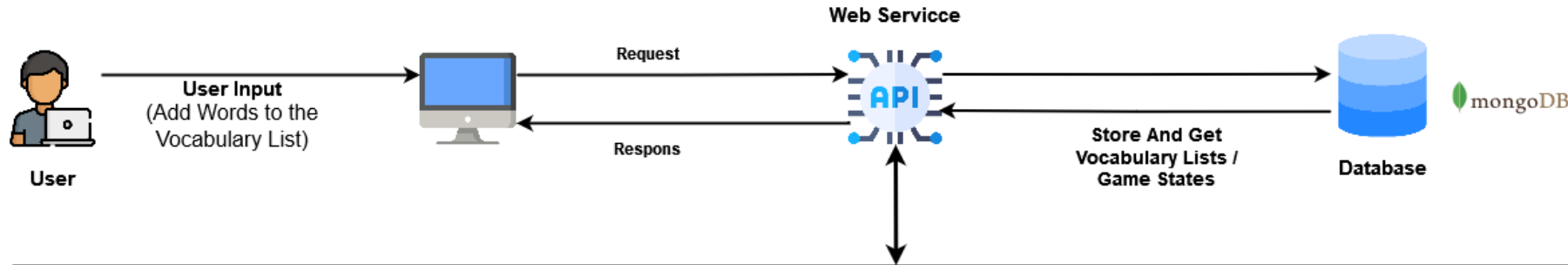


Develop a dynamically generated glossary that provides definitions, example sentences, and pronunciation guides for user-inputted vocabulary words.



Develop dynamically generated games based on LLM output

# System Diagram

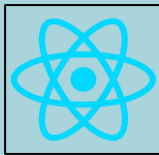


# Technologies, Techniques, Algorithms



## Technologies

- React Js
- Node JS and Express JS
- Python and Django
- Phaser.js/HTML5 game framework
- MongoDB
- Docker
- Kubernetes



mongoDB®



## Techniques

- Large Language Models (LLMs)
- Machine Learning



## Algorithms

- Game Mechanics

# System, Personnel, and Software Specification Requirements

## Software Requirements

- React Js
- Node JS and Express JS
- Python and Django
- Unity and JS
- MongoDB
- Docker
- Kubernetes

## Personnel Requirements

- Help Of English Teachers

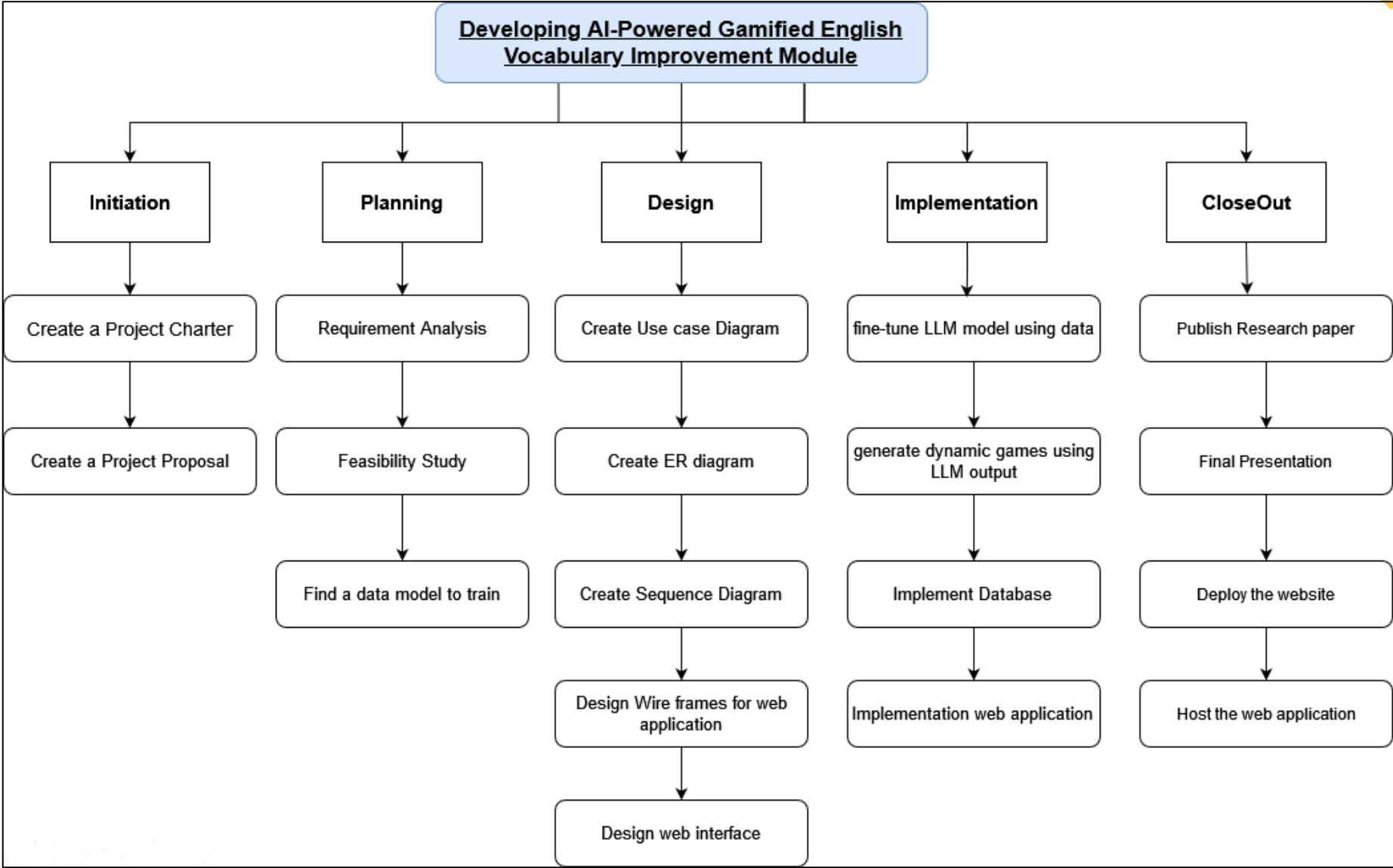
## Functional Requirements

- The system should allow students to input and manage their vocabulary lists effortlessly
- Students should be able to add, edit, and remove words from their vocabulary lists.
- The system should create gamified learning activities
- The system should provide a user-friendly interface that allows easy navigation and access to features.

## Non-Functional Requirements

- The user interfaces should be user friendly to the user.
- Users can trust the application's reliability and consistent performance.
- The application is expected to produce highly accurate results.
- The generated results should be more efficient and effective.

# Work Breakdown Structure



# Gnatt Chart

Task	Duration														
	2023								2024						
	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL
<b>1. Initial Stage</b>															
Research topic selection	■														
Requirement gathering	■	■													
Study on research area		■	■												
Topic approval			■												
<b>2. Proposal Stage</b>															
Project proposal draft submission			■	■											
Proposal presentation				■											
<b>3. Implementation Stage 1</b>															
System planning and design				■	■										
Implementation of function					■	■	■								
Integration and testing level 1						■	■								
Progress presentation – 50%							■								
Prepare research paper				■	■	■	■	■	■	■	■	■			
<b>4. Implementation Stage 2</b>															
Implementation of remaining function							■	■	■	■	■	■	■		
Integration and testing level 2											■	■	■		
Progress presentation – 90%													■		
<b>5. Final Stage</b>															
Final thesis with proof reader sign off													■	■	
Deploy the website														■	
Final presentation															■



# References

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- [1] P. Dillenbourg, M. Jermann, and S. Gurtner, "Introduction to dual and interactive learning," *New Learning Models*, vol. 5, no. 3, pp. 45-55, 2006.
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- [4] N. G. Nagy, P. W. Herman, and R. C. Anderson, "Learning Words From Context," *Reading Research Quarterly*, vol. 20, no. 2, pp. 233-253, 1985.

# Basic Comprehension Skills Enhancement Module

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IT21158322 – W. G. B. Senanayake

# Background

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1. Traditional educational tools for reading comprehension often lack the capability to dynamically generate quizzes and reading materials tailored to individual student needs.
2. Existing systems provide generic feedback, which may not address specific areas where a student needs improvement.
3. Leveraging AI technologies, particularly Large Language Models (LLMs) and prompt engineering, offers the potential to create personalized and dynamic educational experiences

# Research Problem?

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1. How can we leverage AI technologies, Large Language Models (LLMs) to dynamically generate quizzes and reading paragraphs
2. How can we use prompt engineering to provide effective, personalized feedback to improve students reading comprehension skills?

# Research Gap

Feature/Tool	Khan Academy	Quizlet	Duolingo	AceReader Pro	Proposed System (Basic Comprehension Enhancement Module)
Dynamic Quiz Generation	No	No	Yes	No	Yes
Personalized Feedback	Yes	No	Limited	No	Yes
Dynamic Paragraph Generation	No	No	No	No	Yes
Prompt Engineering for Feedback	No	No	No	No	Yes
Comprehensive Feedback for Each Answer	Limited	No	Limited	No	Yes

# Research Objectives

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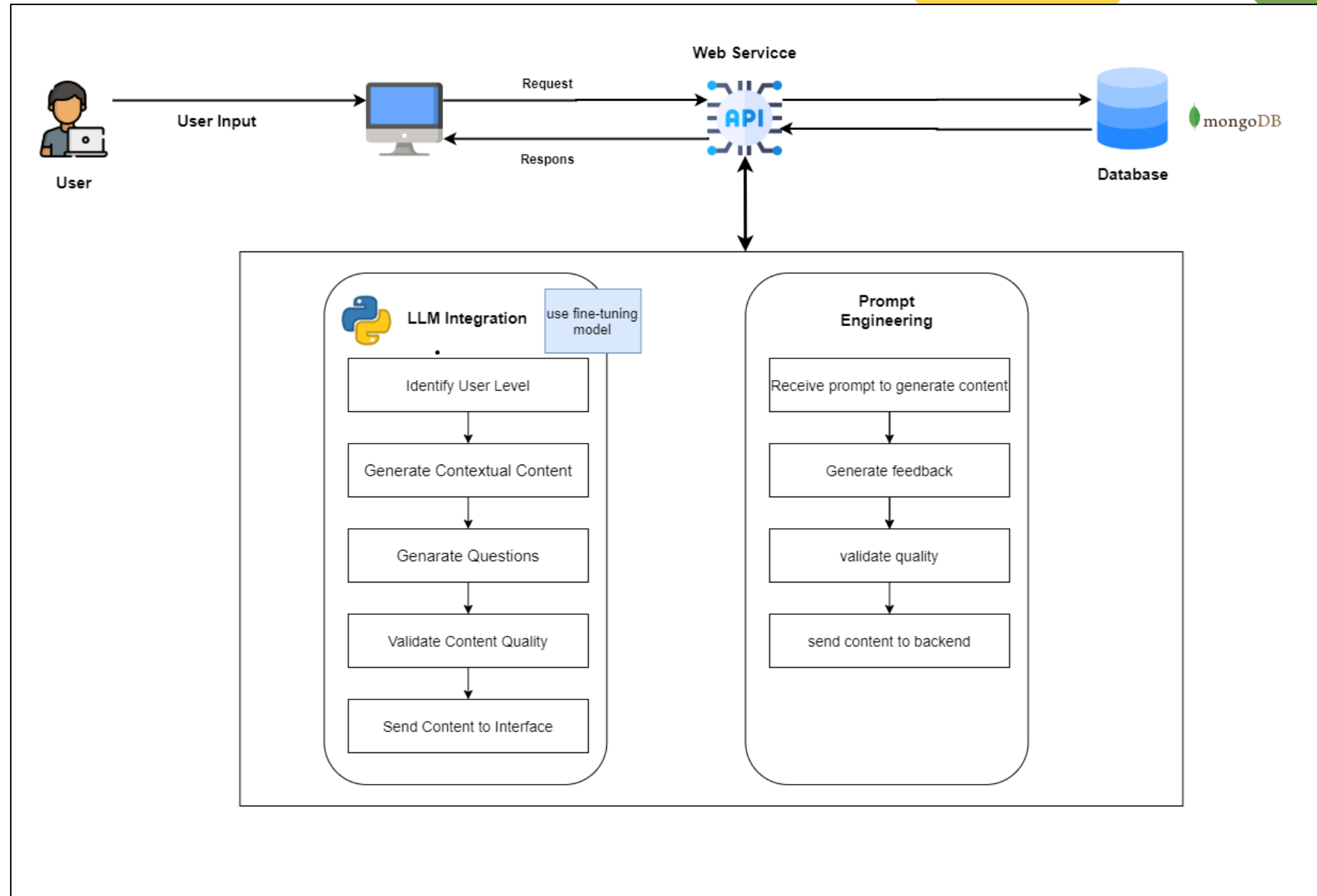
## Main Objective:

- Integrate AI-based technologies to generate dynamic quizzes
- Integrate Prompt Engineering to provide comprehensive feedback for students' answers.

## Sub Objectives:

1. Develop a system that generates basic level quizzes (MCQ, Drag & Drop, Fill in the blanks, True/False).
2. Use prompt engineering to create comprehensive feedback for each student answer.
3. Dynamically generate reading paragraphs tailored to different comprehension levels.

# System Design



# Tools & Technologies



- Frontend - JavaScript & React
- Backend - Python & Django
- Database - PostgreSQL
- Hosting – Azure
- CI/CD – GitHub, Docker, Kubernetes
- Large Language Models (LLMs) for generating quizzes and generating paragraphs
- Prompt Engineering for refining AI-generated content.



# Software Specification Requirements

## Functional:

1. The system should be able to generate multiple types of quizzes (MCQ, Drag & Drop, Fill in the blanks, True/False) based on student proficiency levels.
2. The system should generate reading paragraphs tailored to different comprehension levels of students.
3. The system should provide detailed, personalized feedback for each student answer using prompt engineering techniques.
4. Feedback should highlight correct answers, explain mistakes, and offer suggestions for improvement.

**Non Functional:** Scalability , Performance, Security, Usability

# Other Requirements

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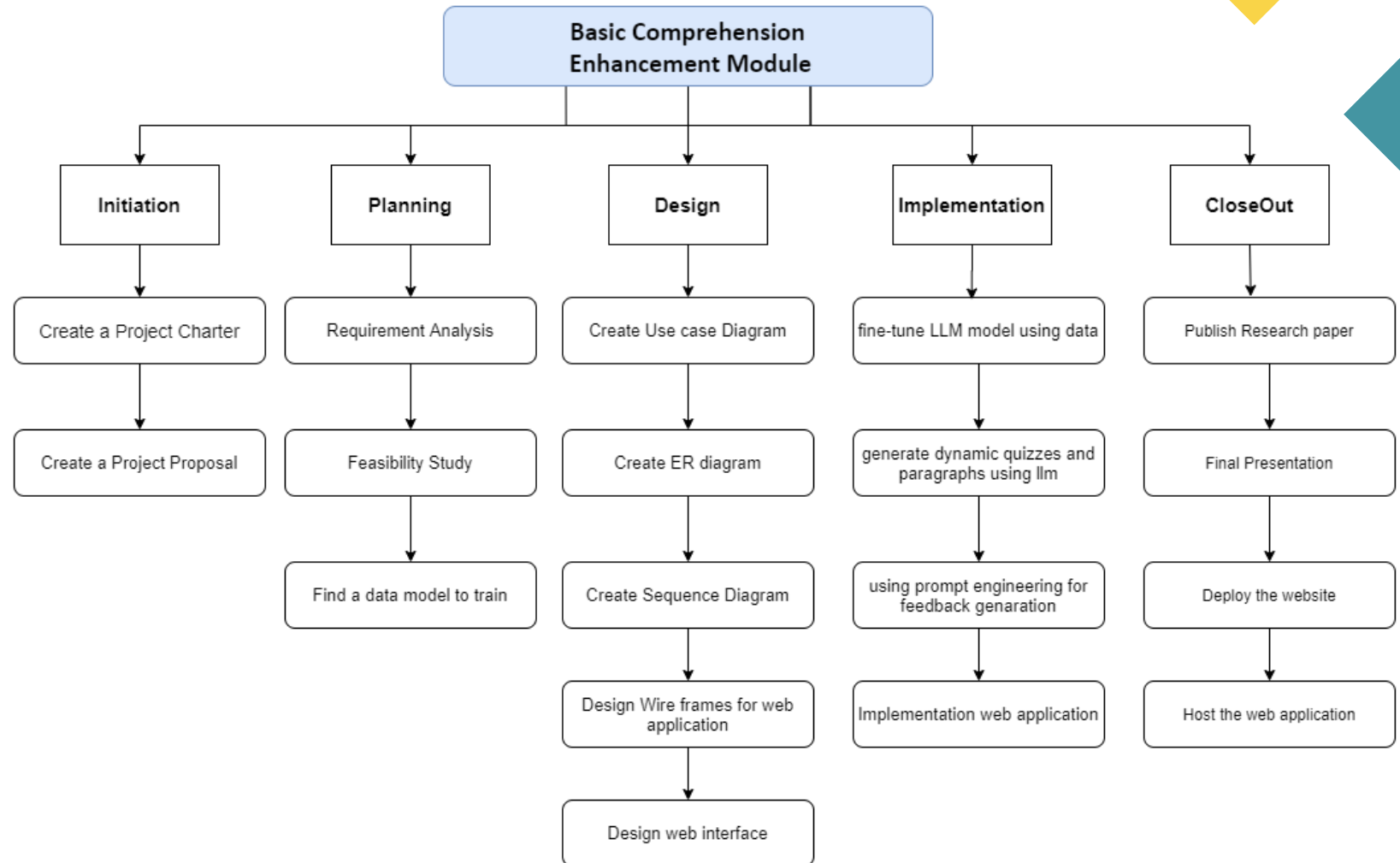
## System:

- High-performance servers to handle AI computations.
- Secure databases for storing user data and quizzes.

## Personal:

- Expertise in AI/ML, backend development, and data security

# Work Breakdown Structure



# Gnatt Chart

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4. Implementation Stage 2															
Implementation of remaining function															
Integration and testing level 2															
Progress presentation – 90%															
5. Final Stage															
Final thesis with proof reader <a href="#">sign</a> off															
Deploy the website															
Final presentation															

# References

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[1] AI-Driven Feedback Mechanisms in E-Learning

Yang, S. J., Chen, I. Y., Kinshuk, & Chen, N. S. (2007). Enhancing learning performance with personalized feedback in web-based learning environments. *Interactive Learning Environments*, 15(3), 327-341.

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Brown, T. B., Mann, B., Ryder, N., Subbiah, M., Kaplan, J., Dhariwal, P., ... & Amodei, D. (2020). Language models are few-shot learners. *arXiv preprint arXiv:2005.14165*.

[3] Large Language Models: Radford, A., Wu, J., Child, R., Luan, D., Amodei, D., & Sutskever, I. (2019). Language models are unsupervised multitask learners. *OpenAI Blog*, 1(8), 9.

[4] Quizlet: Quizlet. (n.d.). Retrieved from <https://quizlet.com/>

# Advanced Comprehension Skills Enhancement Module



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IT21118340 – S. A. D. S. Kumarathunga

# Background

## What are Advanced Comprehension Skills?

- Understanding the implied meaning of the text.
- Ability to evaluate and analyze given text.
- Skills:
  - Making inferences and deductions,
  - Connecting different parts of the text
  - Applying background knowledge
  - Finding the main idea, important facts, and supporting details
  - Summarizing
  - Generating and Asking Questions



# Research Problem?

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1. Lack of dynamically adaptable content.
2. Lack tools to provide assessments for essay-type questions that typically require human evaluation.





# Research Gap

Apps	Dynamic Content	Evaluate answers without human involvement	Provide feedback without human involvement
Generic Reading Apps	✗	✗	✗
Duolingo	✓	Only offer MCQ based questions	Limited feedback
AceReader Pro	✗	✗	✗
ReadyRead	✗	✗	✗
Smart AI Reading Assistant for Reading Comprehension	✗	✗	✗
Proposed System	✓	✓	✓

# Research Objectives

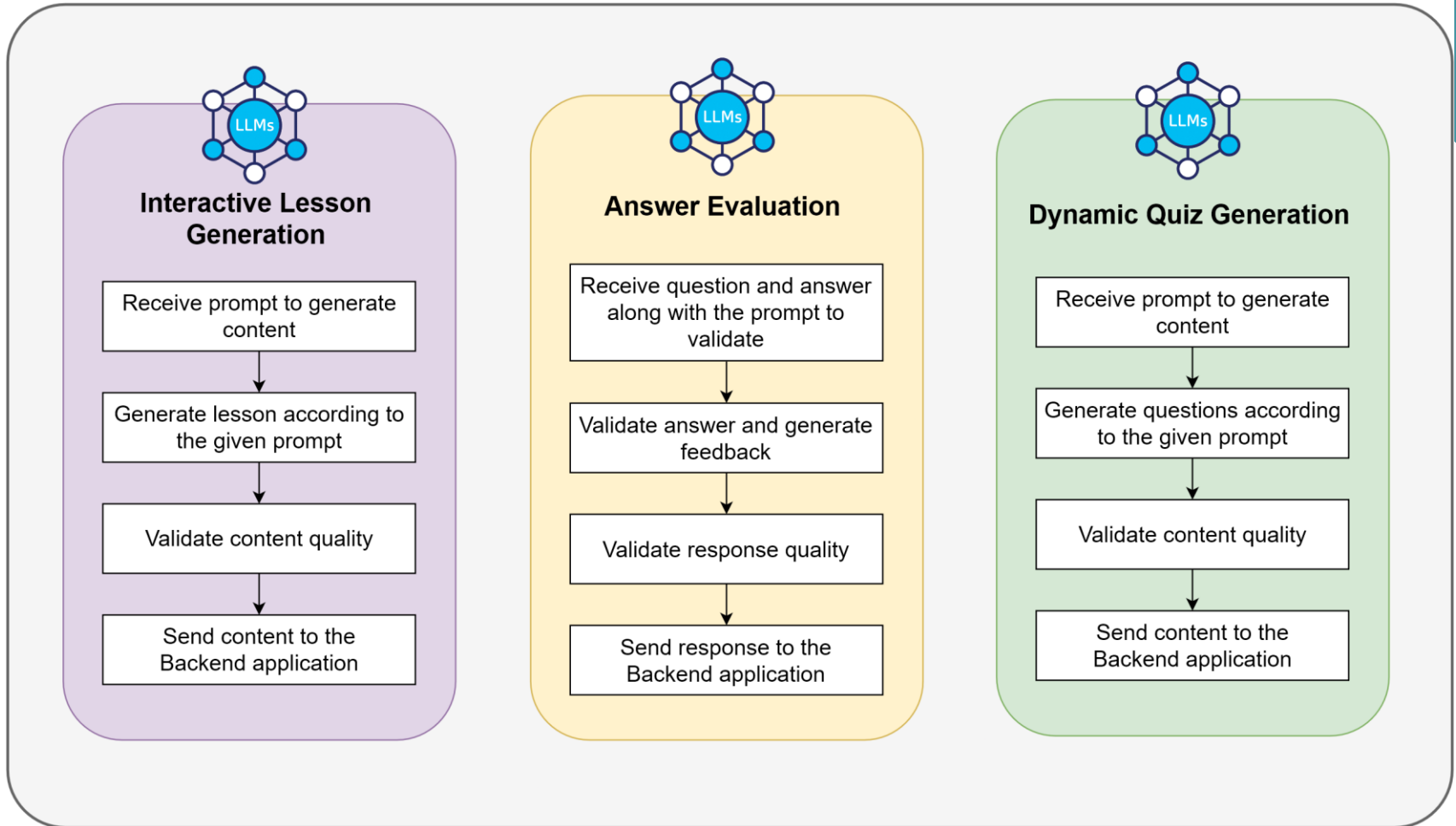
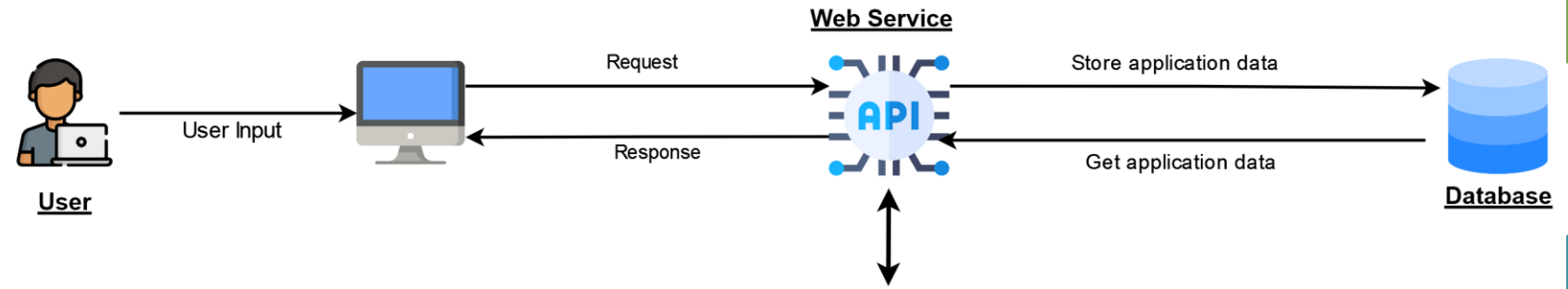
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**Main Objective:** Provide a platform to improve advanced comprehension skills such as Sequencing, Summarizing, Self-questioning

## **Sub Objectives:**

1. Fine-Tune LLM model to generate dynamic content
2. Fine-Tune LLM model to accurately evaluate answers without human involvement
3. Develop the most suitable prompts to generate dynamic content and evaluate answers

# System Diagram



# Tools & Technologies

- Frontend - JavaScript & React
- Backend - Python & Django
- Database – Postgres SQL
- LLM Model – Llama
- Fine-Tuning – Vertex AI
- Prompt Engineering Techniques
  - Zero-Shot Prompting, Few-Shot Prompting
- Hosting – Azure, Hugging Face
- CI/CD – GitHub, Docker, Kubernetes



# Software Specification Requirements

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## Functional:

1. The system should be able to dynamically generate content given on user's interest and skill level
2. The system should be able to accurately evaluate user answer without human intervention
3. The system should be able to give extensive feedback about user's answer

**Non Functional:** Accuracy, Performance, Availability, Usability

# Other Requirements

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## Software:

- Languages: JavaScript & Python
- Web Frameworks: React & Django
- Database: PostgreSQL
- AI/ML: Llama, Vertex AI, LangChain
- CI/CD – GitHub, Docker, Kubernetes

## Personal:

- Expertise in
  - Web frameworks
  - LLM related tools
  - Database Design
  - System Design & Deployment

# Work Breakdown Structure



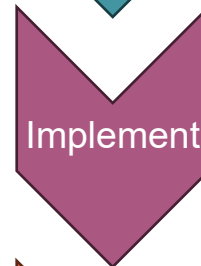
- Topic Assessment
- Project Charter
- Project Proposal



- Requirement Analysis
- Feasibility Study
- Collect data



- Create Use Case Diagram
- Create ER Diagram
- Design Wire Frames for UI
- Design User Interface



- Develop prompt for generating content, assessment and feedback
- Fine Tune LLM model using data
- Implement Backend application
- Implement Frontend application



- Publish research paper
- Final presentation
- Deploy web application

# Gnatt Chart

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# References

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- [1] K. Moholkar, M. Chaturvedi, A. Jain, A. Parkhe and K. Singh, "Machine Learning Techniques for Descriptive Answer Evaluation: A Comprehensive Survey," 2024 International Conference on Inventive Computation Technologies (ICICT), Lalitpur, Nepal, 2024, pp. 1412-1419, doi: 10.1109/ICICT60155.2024.10544714.
- [2] P. Mirabal, M. Castillo-Sanhueza, R. Curín-Zarate and O. O. Calzadilla-Pérez, "Use of Language Models based on Deep Learning to improve reading comprehension," 2023 42nd IEEE International Conference of the Chilean Computer Science Society (SCCC), Concepcion, Chile, 2023, pp. 1-6, doi: 10.1109/SCCC59417.2023.10315757.
- [3] Laban, P., Wu, C., Murakhovs'ka, L., Liu, W., & Xiong, C. (2022). Quiz Design Task: Helping Teachers Create Quizzes with Automated Question Generation. NAACL-HLT.
- [4] Xia, W., Mao, S., & Zheng, C. (2024). Empirical Study of Large Language Models as Automated Essay Scoring Tools in English Composition Taking TOEFL Independent Writing Task for Example. ArXiv, abs/2401.03401.
- [5] Hussein, M.A., Hassan, H.A., & Nassef, M. (2019). Automated language essay scoring systems: a literature review. PeerJ Computer Science, 5.

# Personalized Learning Paths Based on Engagement with App Content

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IT21182396 – A. P. Ranaweera

# Background

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1. The personalized learning platform aims to enhance English reading and comprehension using adaptive learning methods.
2. It measures student performance through metrics such as response times and error patterns etc.
3. Machine learning algorithms analyze these metrics to accurately assess each user's proficiency and determine the appropriate level of content to present next.

# Research Problem?

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How can machine learning algorithms effectively measure a learner's current proficiency level in reading comprehension and accurately determine the appropriate next level of difficulty for personalized learning paths?

# Research Gap

Feature / System	Proposed System	Duolingo	AceReader Pro	Quizlet	ReadyRead
Personalized Learning Path	✓	Limited	✗	✗	✗
Dynamic Difficulty Adjustment	✓	Limited	✗	✗	✗
Real-Time Performance Tracking	✓	✗	Limited	✗	Limited
Pre-trained Model for Difficulty	✓	✗	✗	✗	✗
Behavioral Analytics	✓	✗	✗	✗	✗

# Research Objectives

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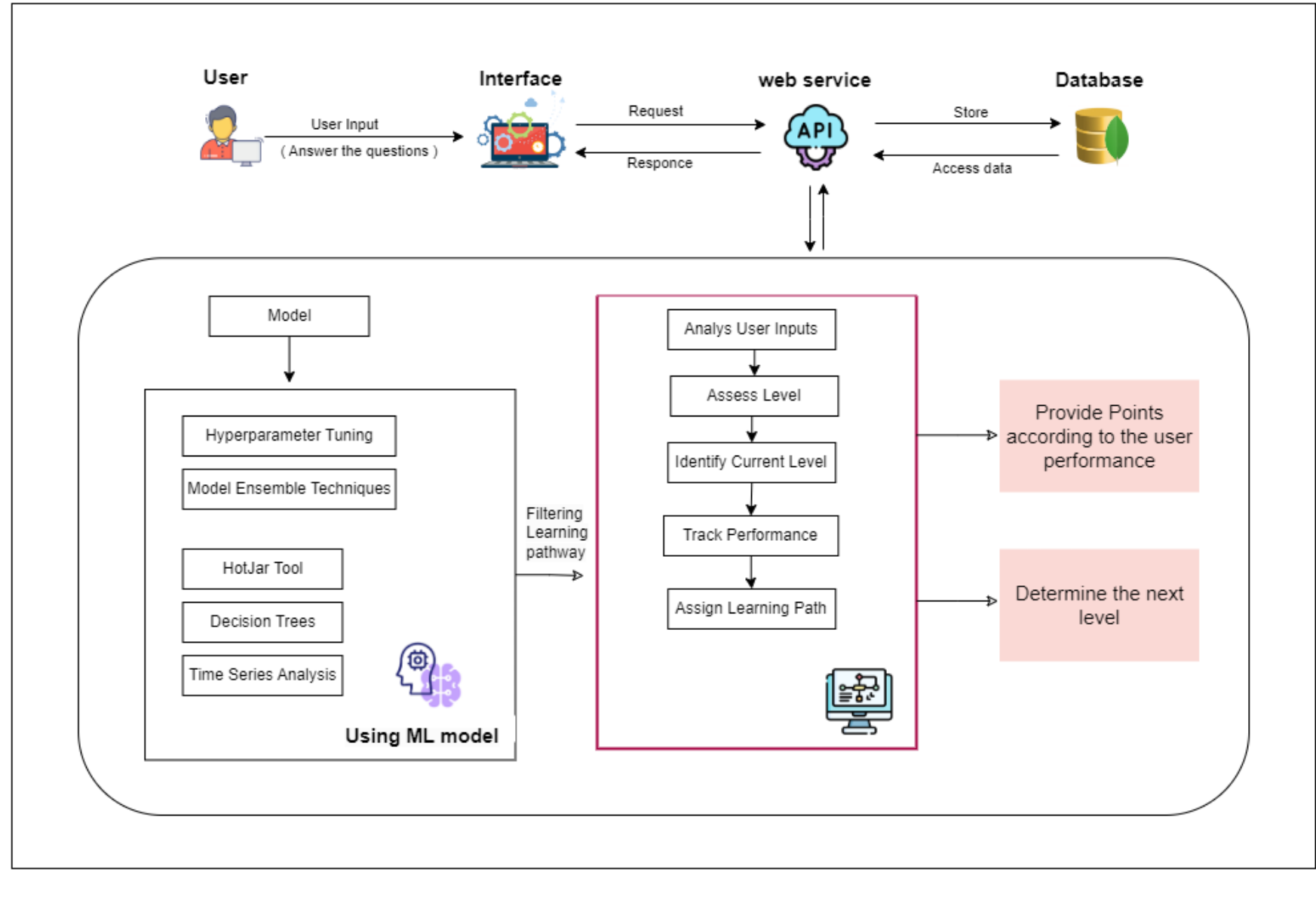
## Main Objective:

- Identify and analyze learner personalized learning paths based on engagement with app content and identify student interests.

## Sub Objectives:

1. Collect data on user interactions with app content, including time spent, frequency of access, and types of content engaged with.
2. Use machine learning techniques to train models for assessing user proficiency and identifying interests.
3. Integrate a points and badge system to enhance user engagement and motivation. Track and analyze the impact of these elements on user performance and satisfaction.

# System Design



# Tools & Technologies



- Frontend - JavaScript & React
- Backend - Python & Django
- Database - PostgreSQL
- Hosting – Azure
- CI/CD – GitHub, Docker, Kubernetes
- Machine learning - Hyperparameter Tuning / Model Ensemble Techniques
  - Scikit-learn
  - MLflow



# Software Specification Requirements

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## Functional:

1. The system should Identify Student Current Performance Level and Interest Fields
2. The system should recommend learning paths based on user interests, performance, and engagement.
3. The system must adapt learning paths based on user progress
4. The system should award points and badges to users based on their engagement and achievements.

**Non Functional:** Accuracy , Performance, Availability, Usability

# Other Requirements

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## Software:

- Languages: JavaScript & Python
- Web Frameworks: React & Django
- Database: mongo DB
- ML: Auto-sklearn , MLflow
- CI/CD – GitHub, Docker, Kubernetes

## Personal:

- Expertise in Web frameworks
- Expertise in ML related tools
- Expertise in Database Design
- Expertise in System Design & Deployment

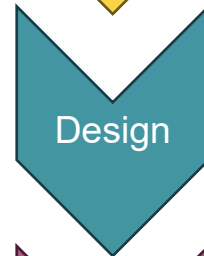
# Work Breakdown Structure



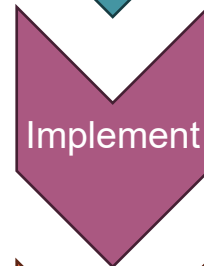
- Project Charter
- Project Proposal



- Requirement Analysis
- Feasibility Study
- Collect data



- Create Use Case Diagram
- Create ER Diagram
- Design Wire Frames for UI
- Design User Interface



- Develop Dataset
- Develop Algorithm
- Implement Backend
- Implement Frontend



- Publish research paper
- Final presentation
- Deploy web application

# Gnatt Chart

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Final thesis with proof reader <a href="#">sign</a> off															
Deploy the website															
Final presentation															

# References

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- [1] B. Bouihi and M. Bahaj, "Ontology and rule-based recommender system for e-learning applications", International Journal of Emerging Technologies in Learning (Online), vol. 14, no.
- [2] D. Shi, T. Wang, H. Xing and H. X., "A learning path recommendation model based on a multidimensional knowledge graph framework for e-learning", Knowledge Based Systems, vol. 195, no. 105618, 2020.
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- [5] <https://www.analyticsvidhya.com/blog/2022/02/a-comprehensive-guide-on-hyperparameter-tuning-and-its-techniques/>

# Supportive Information Commercialization

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- **Target Audience:** High school students, English language learners, Educators
- **Business Model:** Software as a Service
  - Free tier: Ad Supported ( Advertisements from education institutions)
  - Premium version: Subscription based
- **Marketing:**
  - Establish partnerships with educational institutions to pilot and scale the product
  - Explore collaborations with government agencies and non-profit organizations focused on literacy and education

# Supportive Information Budget

Resource	Cost Per Month	Cost (LKR)
<b>Direct Costs</b>		
Deployment cost	\$28	LKR 15000.00
Domain	\$15	LKR 5000.00
<b>Indirect Costs</b>		
Wi-Fi / mobile data	\$5	LKR 3000.00

# Thank You

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Any questions??