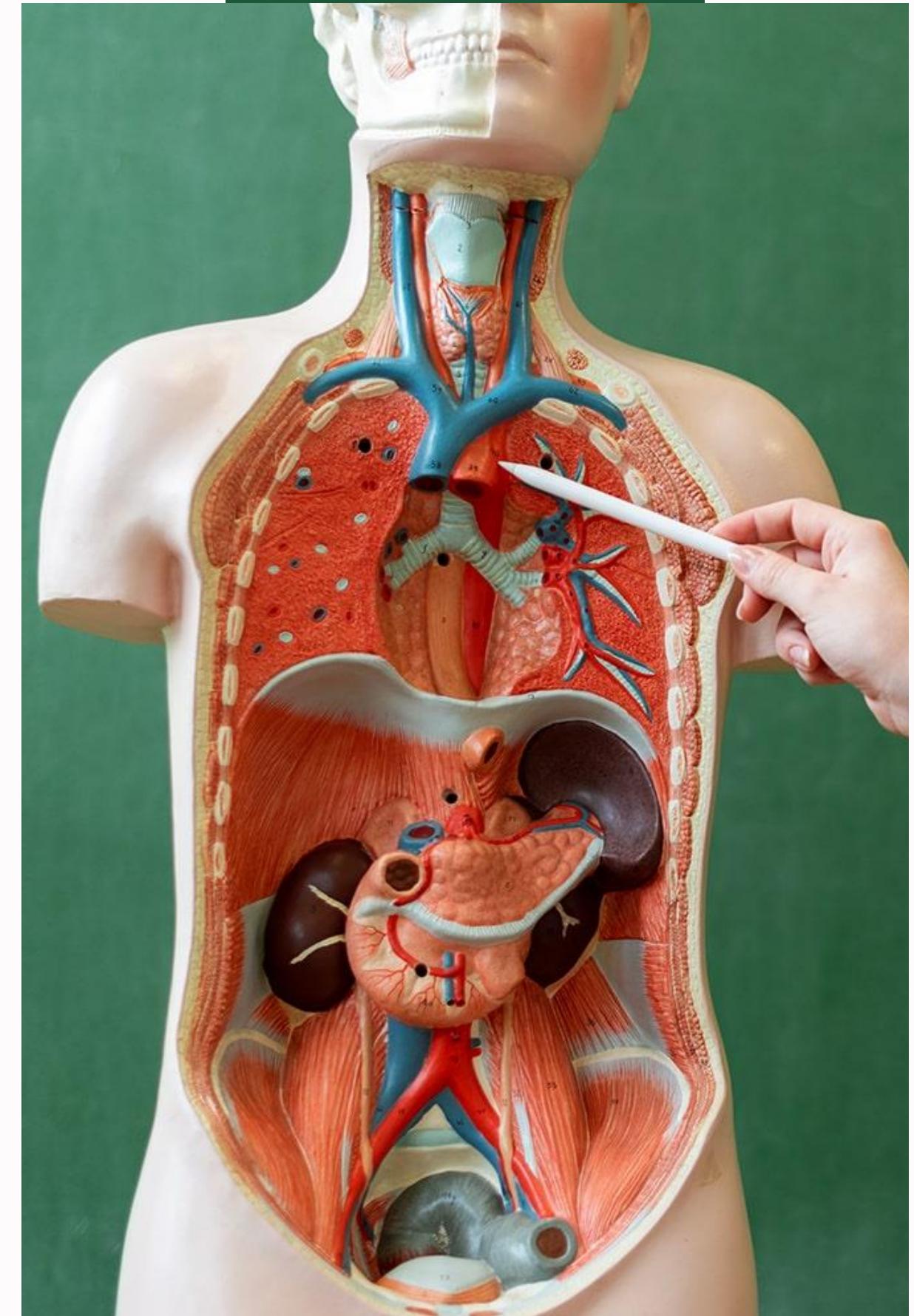


# **BIOMENTOR - PERSONALIZED E- LEARNING PLATFORM FOR ENGLISH MEDIUM A/L BIOLOGY SUBJECT STUDENTS IN SRI LANKA**

24-25J-257



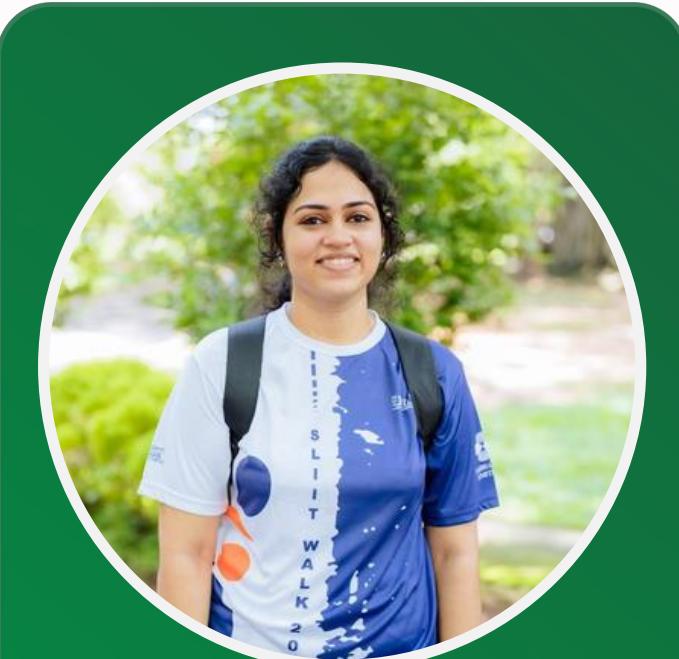
# Our Team



Srirajan G. A  
IT21375132



Dharane.S  
IT21068478



Sujitha.S  
IT21264634



Sajeevan.S  
IT21204302

# Introduction

01

Background

02

Research Problem

03

Research Objectives

04

Overall System Diagram



# Background

This project aims to create an engaging and effective learning environment that caters to individual learning styles and promotes continuous improvement through detailed feedback and performance tracking.

We're focusing on this project to provide personalized learning in A-Level Biology using approved government resources. Our advanced technologies aim to offer tailored, engaging experiences that enhance retention and readiness.



# Research Problem

01



A/L biology students in Sri Lanka struggle with memorizing complex biological terms and their pronunciation. There is a need for an interactive tool that combines spaced repetition with detailed feedback to enhance vocabulary retention and accuracy.

02

Students struggle with extensive biology texts, and existing tools don't effectively extract key concepts or support auditory learners. There is also a lack of tools that provide targeted summaries for exam preparation. A solution is needed to offer concise, accurate content that supports diverse learning styles and aligns with educational standards.

03



Static MCQ platforms do not adapt to students' abilities, leading to ineffective practice and poor identification of knowledge gaps. The objective is to develop an adaptive quiz system that adjusts question difficulty, offers detailed performance analytics, and provides targeted feedback.

04

Existing evaluation systems for biology responses often lack comprehensive feedback and actionable recommendations. The problem is to design a platform that provides accurate answers, detailed feedback, and additional study resources to support student improvement.

# Objectives

## Objective 01

Biology vocabulary memorization tool using digital flashcards and spaced repetition, providing personalized feedback and adaptive learning paths.

## Objective 02

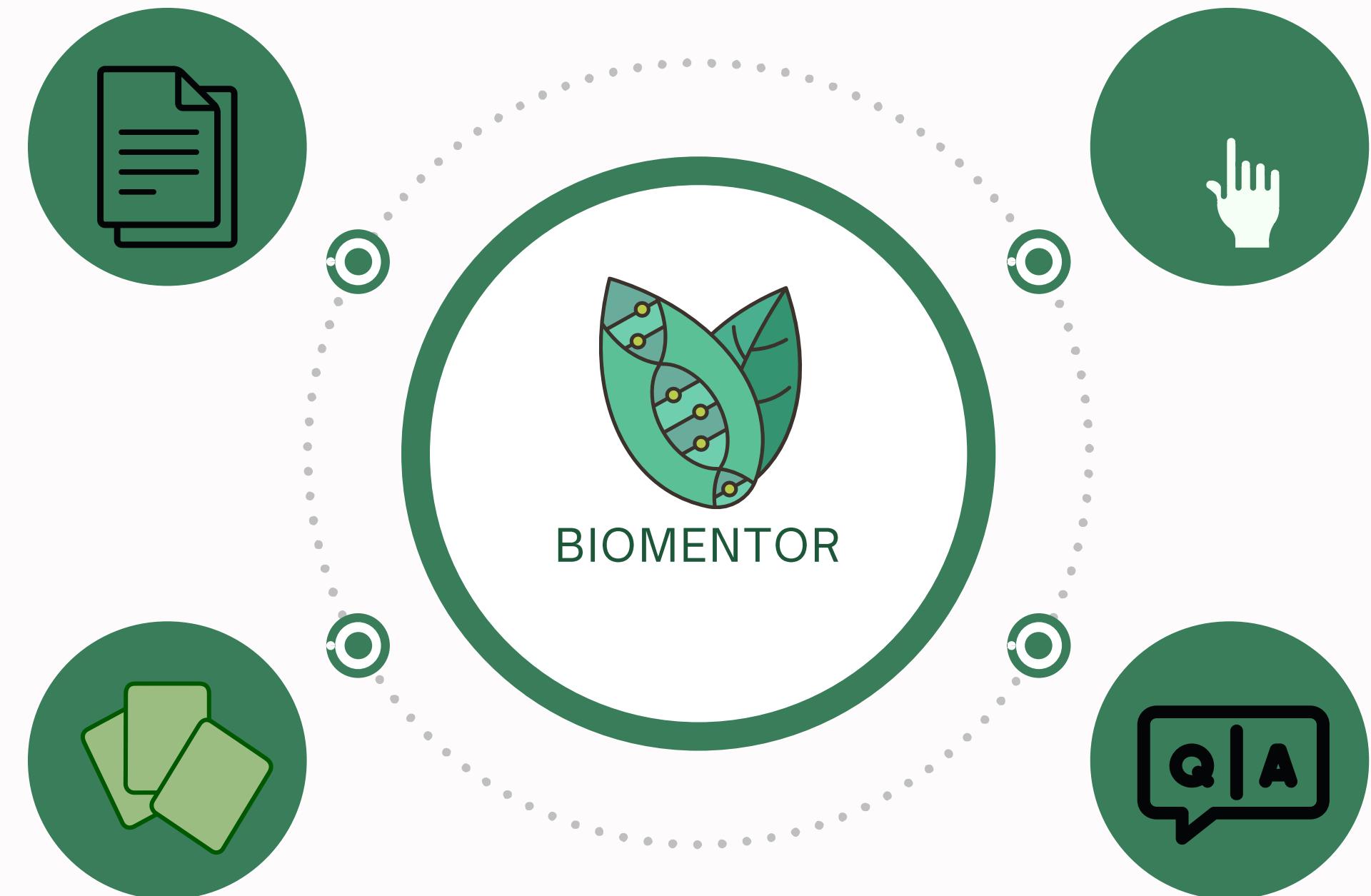
Summarization tool that generates concise, topic-based summaries from uploaded documents and searches through resources to produce summaries on specific topics, with customizable word counts and voice output for diverse learning styles.

## Objective 03

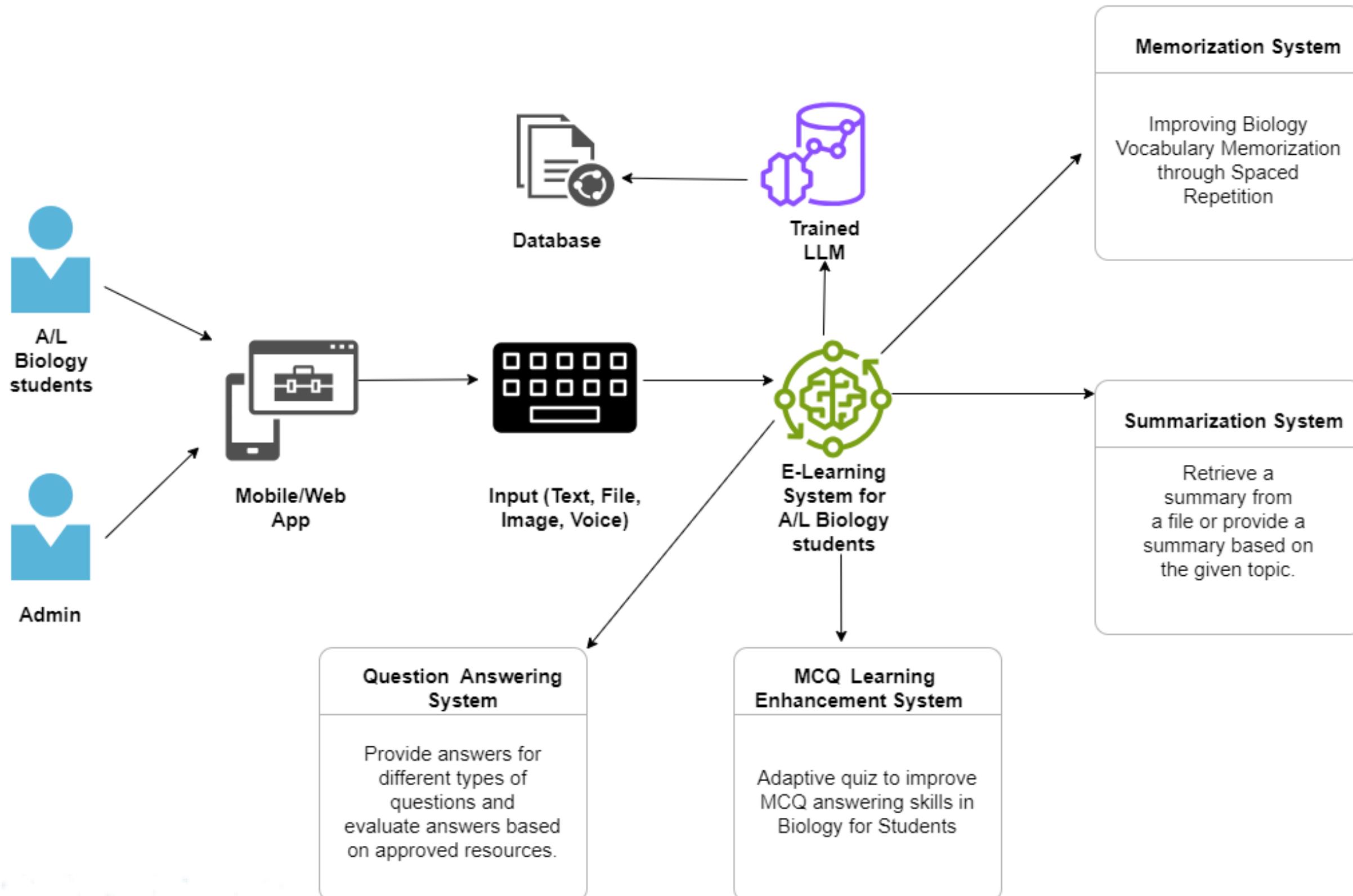
An adaptive quiz platform that dynamically adjusts question difficulty based on student performance, offering targeted practice and detailed performance analysis to enhance learning outcomes.

## Objective 04

Q & A platform to generate answers for provided questions and evaluate responses, offering feedback and personalized study resources to improve student understanding and performance.



# Overall System Diagram



# IT21375132

Srirajan G.A

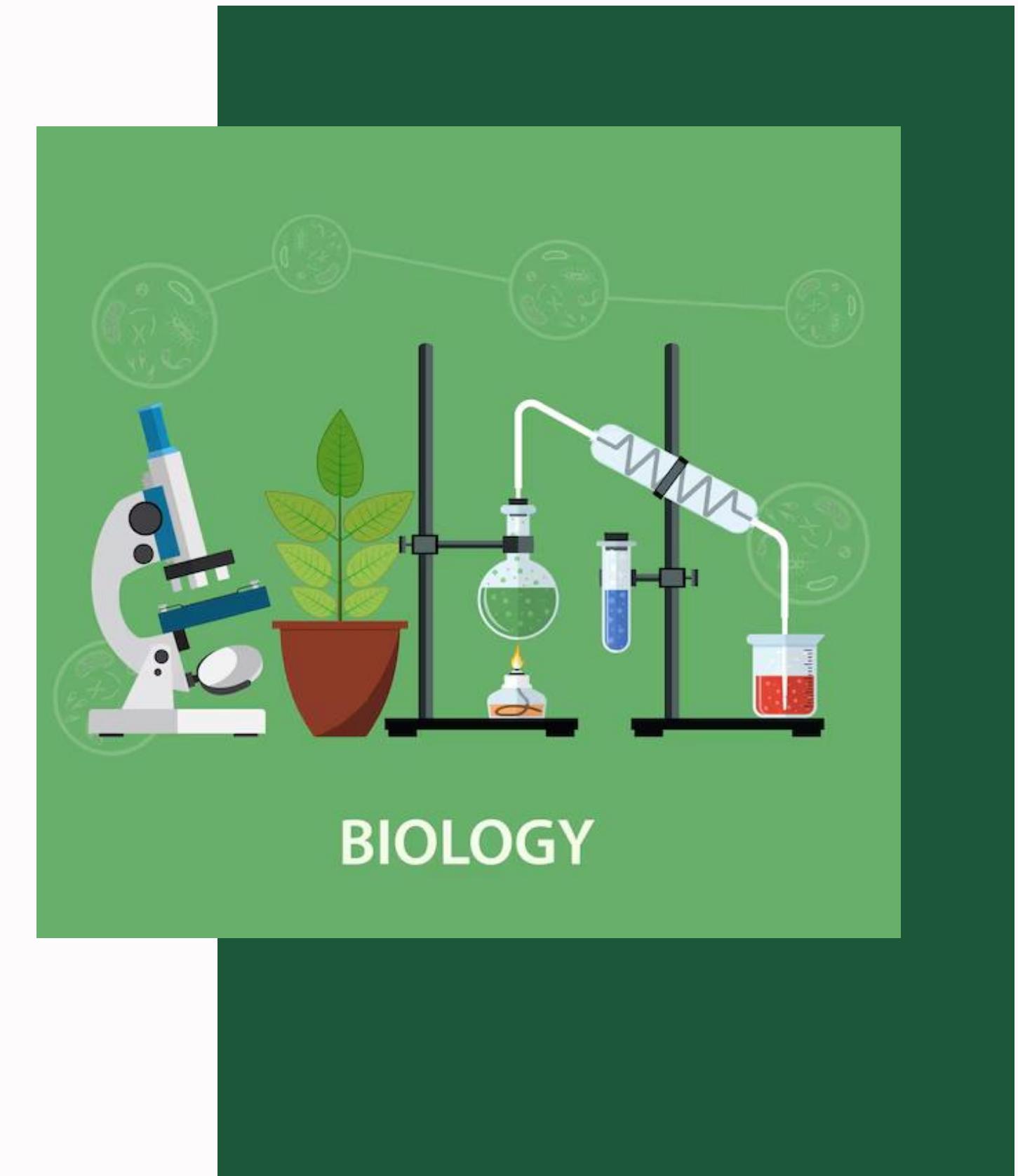
Software Engineering

IMPROVE BIOLOGY VOCABULARY  
MEMORIZATION THROUGH  
SPACED REPETITION



# Introduction

- 01 Background
- 02 Research Question
- 03 Research Gap
- 04 Main and Sub Objectives
- 05 Methodology



# BACKGROUND



Students struggle with retaining large amounts of biology vocabulary due to the natural forgetting curve, where newly learned information is quickly forgotten if not reviewed.



An innovative system is needed to leverage cognitive science principles, such as spaced repetition, to counteract the forgetting curve.

# BACKGROUND

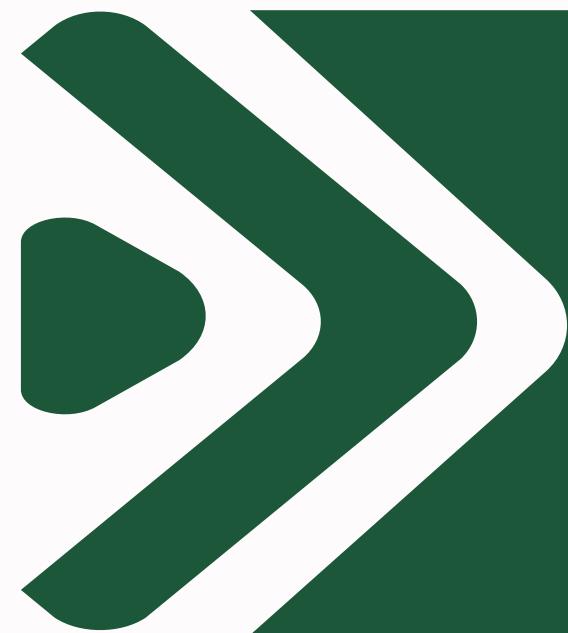


## Schistosomiasis

*Schistosomiasis is an acute  
and chronic disease caused  
by parasitic worms*

# RESEARCH PROBLEM

01



How can we customize the spaced intervals based on the performance of the user and the difficulty of the vocabulary to maximize memory retention among Advanced Level Biology students?

02



How can we incorporate multi-sensory spaced repetition techniques on the memorization of biology vocabulary to maximize the memory retention among Advanced Level Biology students?

# Research Gap

*Personalized Spaced Repetition*



*Customized for A/L Biology Students*



*Flash Cards*



*Multi-Sensory Techniques*



**duolingo**



**BIOMENTOR**



# OBJECTIVES

## Objective 1

Create a spaced repetition model that adapts to individual user performance and adjusts review intervals based on the difficulty level of the vocabulary.

## Main Objective

To create an interactive application with flashcards that enhances biology vocabulary memorization through a custom spaced repetition model, which analyzes user performance and the difficulty of the questions and will repeat accordingly.

## Objective 2

Incorporating multi-sensory elements to cater to different learning styles and enhance the memorization process.

## Objective 3

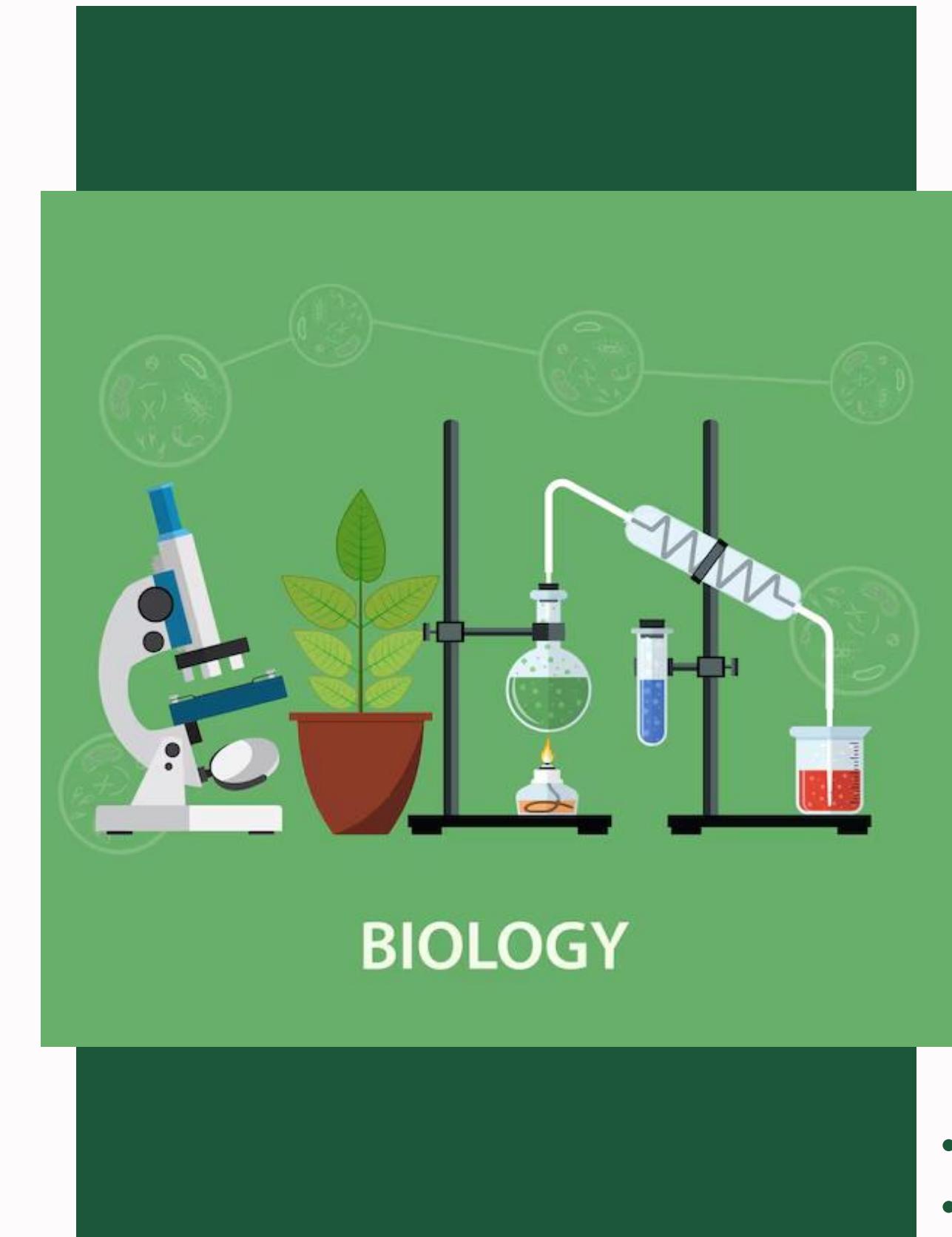
Incorporate gamification elements to maintain user motivation and engagement throughout the learning process

## Objective 4

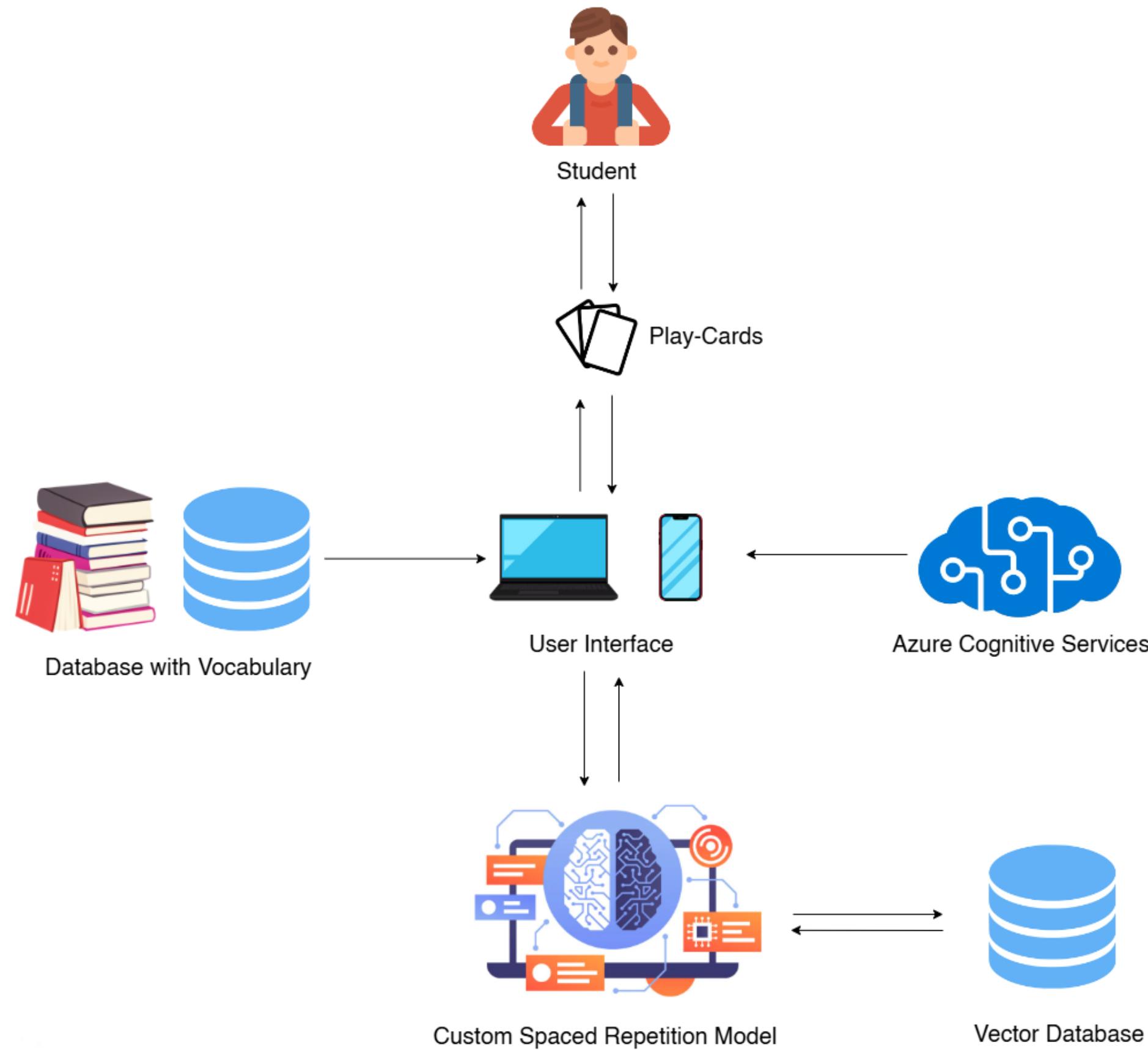
Implement a model to check the accuracy of the word that was entered.

# Methodology

- 01 System Diagram
- 02 Tools and Technologies
- 03 Requirements
- 04 Work Breakdown Structure



# System Diagram



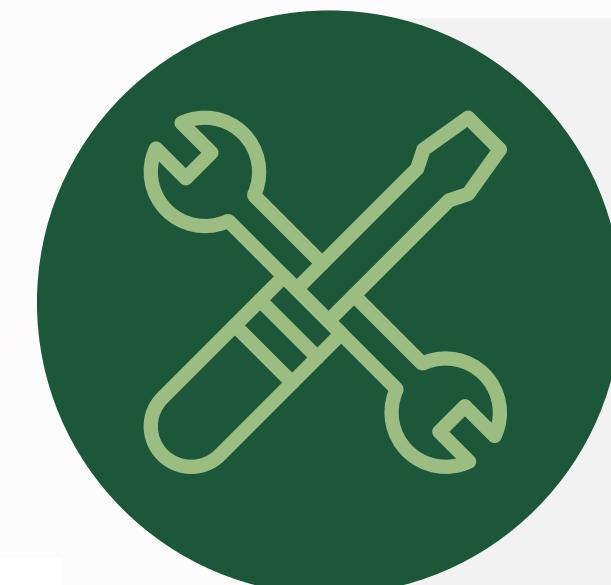
# Tools & Technologies



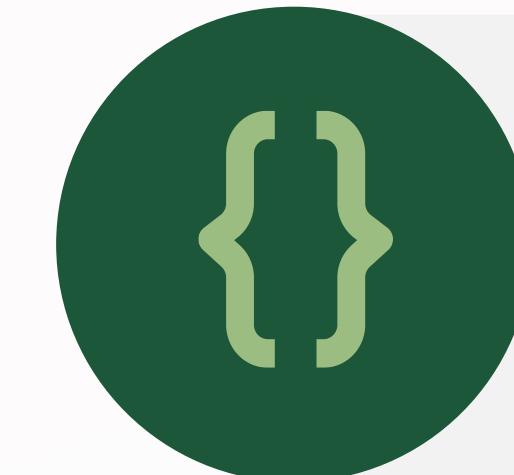
**Project Management**  
Jira



**Database**  
Faiss  
Mongo DB



**Other tools**  
Git  
Figma  
Postman  
Azure Cognitive Services



**Programming Languages**  
Python  
Javascript



**Frameworks**  
Flask  
React  
Tensorflow

# Requirements

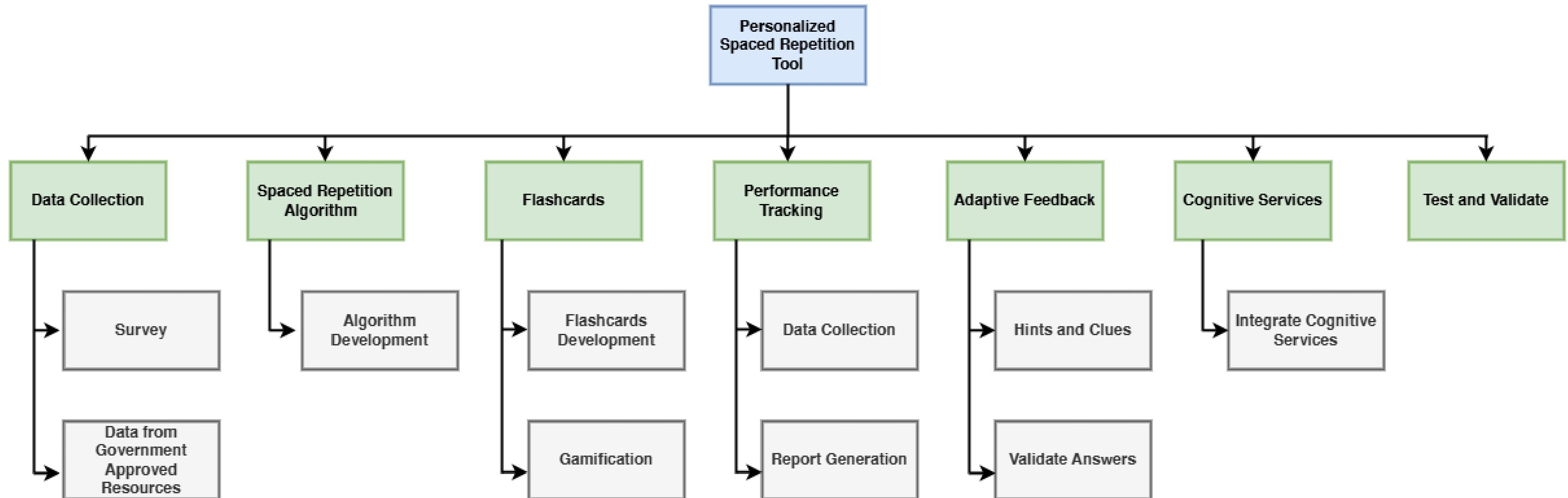
## Functional

1. The tool should allow users to customize flashcard sets with multimedia elements, including images, audio, and text.
2. The spaced repetition model should adjust review intervals based on user performance and vocabulary difficulty.
3. The tool should track user performance, generate detailed reports, and provide instant, adaptive feedback.

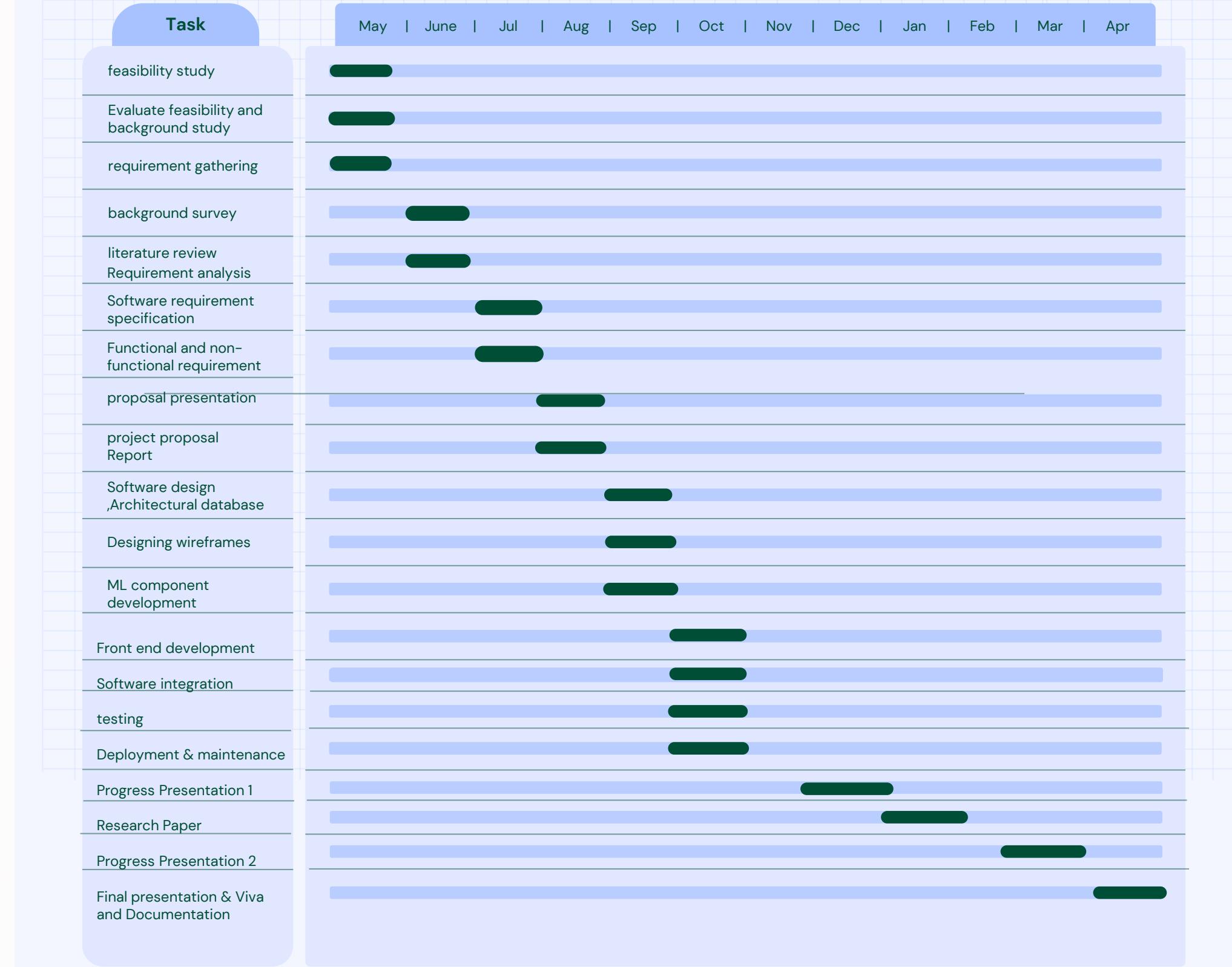
## Non-Functional

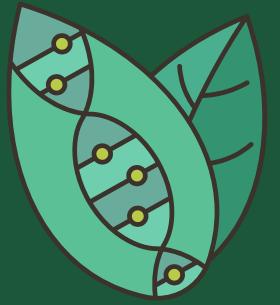
1. Compatibility
2. Accuracy
3. Performance
4. Usability
5. Availability

# Work Breakdown Structure



# Gantt Chart



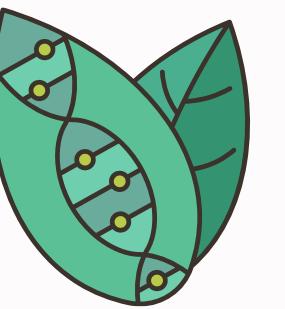


BIOMENTOR

# Cost Management Plan

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





BIOMENTOR

# Commercialization



Advertising

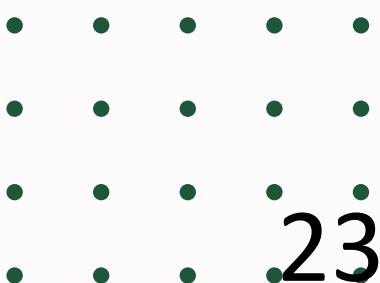


Subscription



# References

- [1] J. Su, J. Ye, L. Nie, Y. Cao and Y. Chen, "Optimizing Spaced Repetition Schedule by Capturing the Dynamics of Memory," in IEEE Transactions on Knowledge and Data Engineering, vol. 35, no. 10, pp. 10085-10097, 1 Oct. 2023, doi: 10.1109/TKDE.2023.3251721.
- [2] F. Schimanke, R. Mertens and B. S. Huck, "Retrieval of Relevant Data for Measuring the Impact of Spaced-Repetition Algorithms on the Learning Success in Mobile Learning Games," 2019 IEEE International Symposium on Multimedia (ISM), San Diego, CA, USA, 2019, pp. 279-2795, doi: 10.1109/ISM46123.2019.00063.
- [3] D. P. Shah, N. M. Jagtap, S. S. Shah and A. V. Nimkar, "Spaced Repetition for Slow Learners," 2020 IEEE Bombay Section Signature Conference (IBSSC), Mumbai, India, 2020, pp. 146-151, doi: 10.1109/IBSSC51096.2020.9332189.
- [4] F. Schimanke, "The Impact of Spaced Repetition Learning on the Learning Success in Mobile Learning Games," 2021 IEEE International Symposium on Multimedia (ISM), Naple, Italy, 2021, pp. 275-280, doi: 10.1109/ISM52913.2021.00054.



# IT21068478

Dharane.S

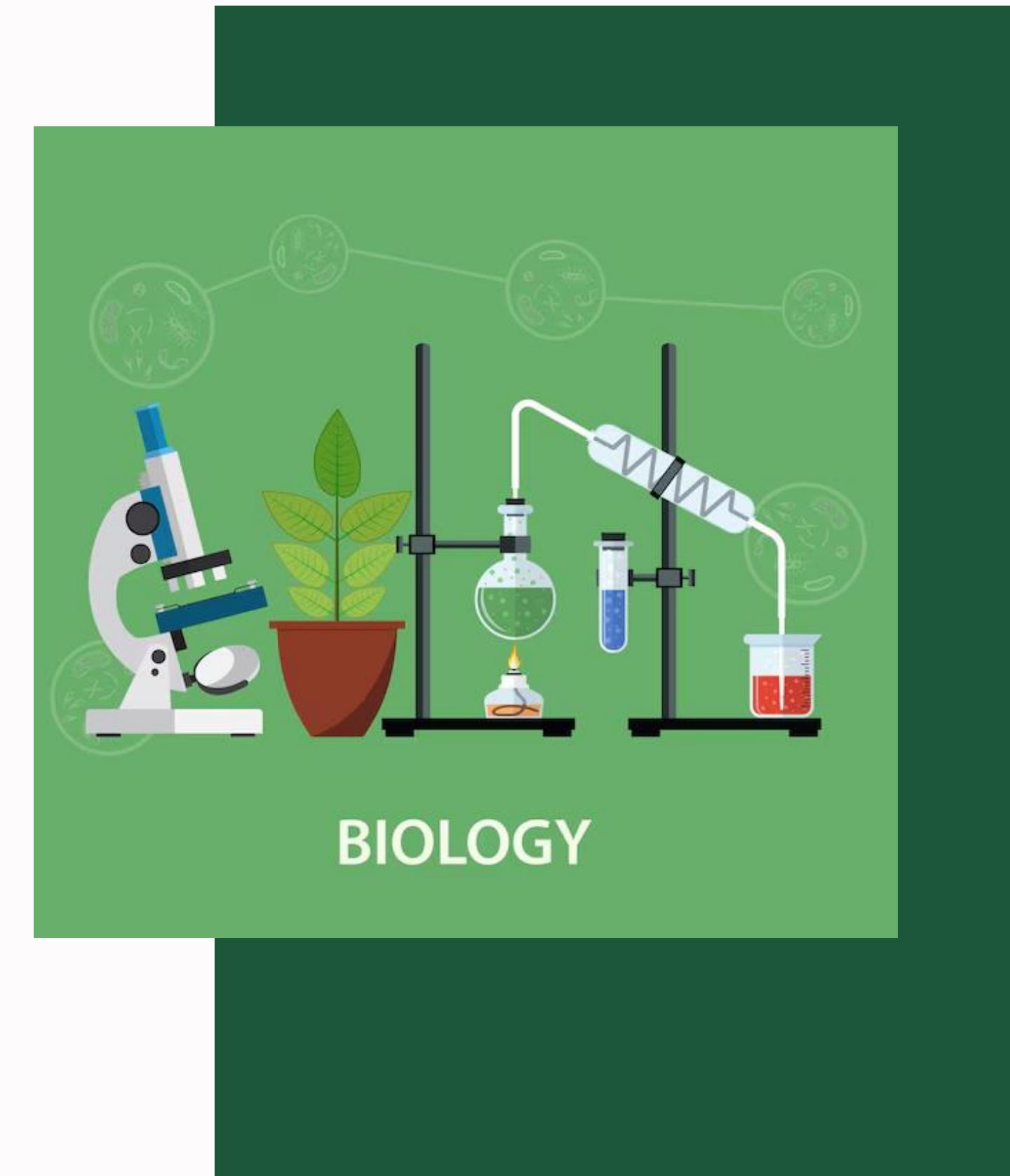
Software Engineering

LLM BASED ABSTRACTIVE TEXT  
SUMMARIZATION TOOL WITH  
VOICE OUTPUT IMPLEMENTED IN  
DIFFERENT SOFTWARE  
ARCHITECTURES

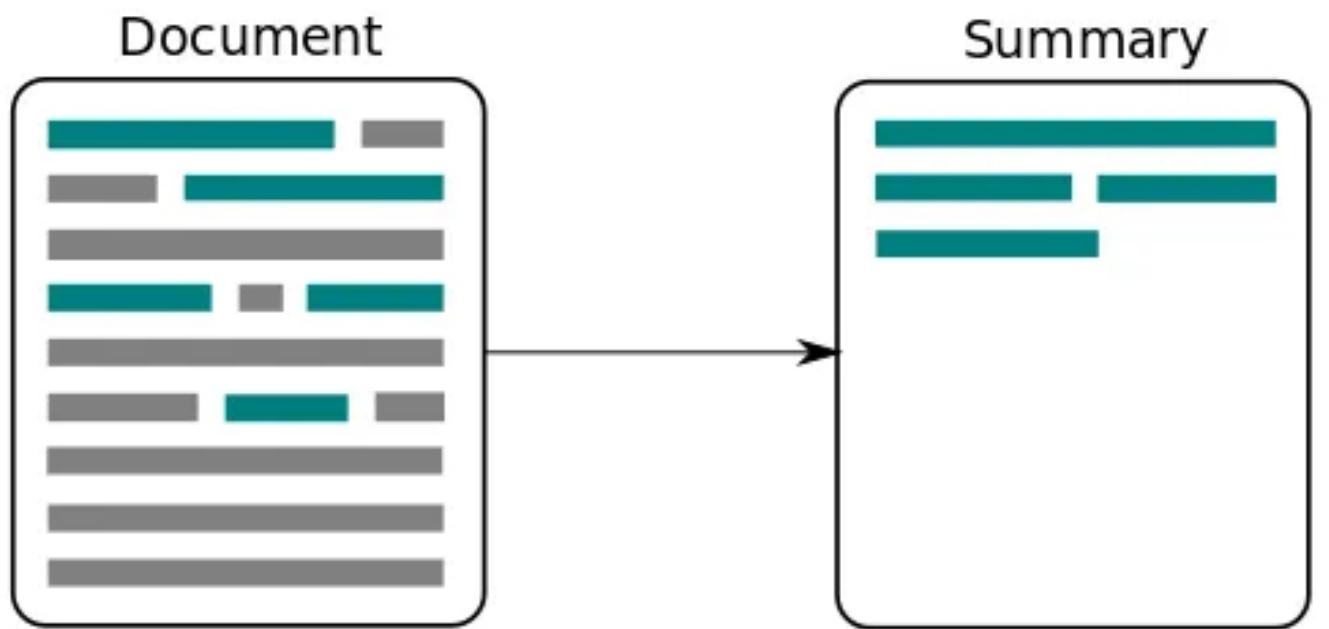


# Introduction

- 01 Background
- 02 Research Problem
- 03 Research Gap
- 04 Main and Sub Objectives
- 05 Methodology



# BACKGROUND



What is summarization?



What is NLP?

# RESEARCH PROBLEM

01



How can text summarization algorithms be optimized to provide concise, exam-focused summaries for A/L biology students?

02



How can the integration of voice output features with customizable word counts in an e-learning summarization tool enhance accessibility, catering to different learning preferences and needs?

# Research Gap

Document upload

Customizable word count

Audible summary

Extract data from approved resources



# OBJECTIVES

## Objective 1

Ensure Accuracy: Use government-approved resources to maintain content accuracy and educational standards.

## Objective 3

User customization: Implement customizable word count settings for summaries.

## Main Objective

Create a tool that extracts and summarizes key concepts from A/L biology resources based on a given topic, and generates concise summaries from uploaded text documents, specifically to aid students preparing for A/L exams.

## Objective 2

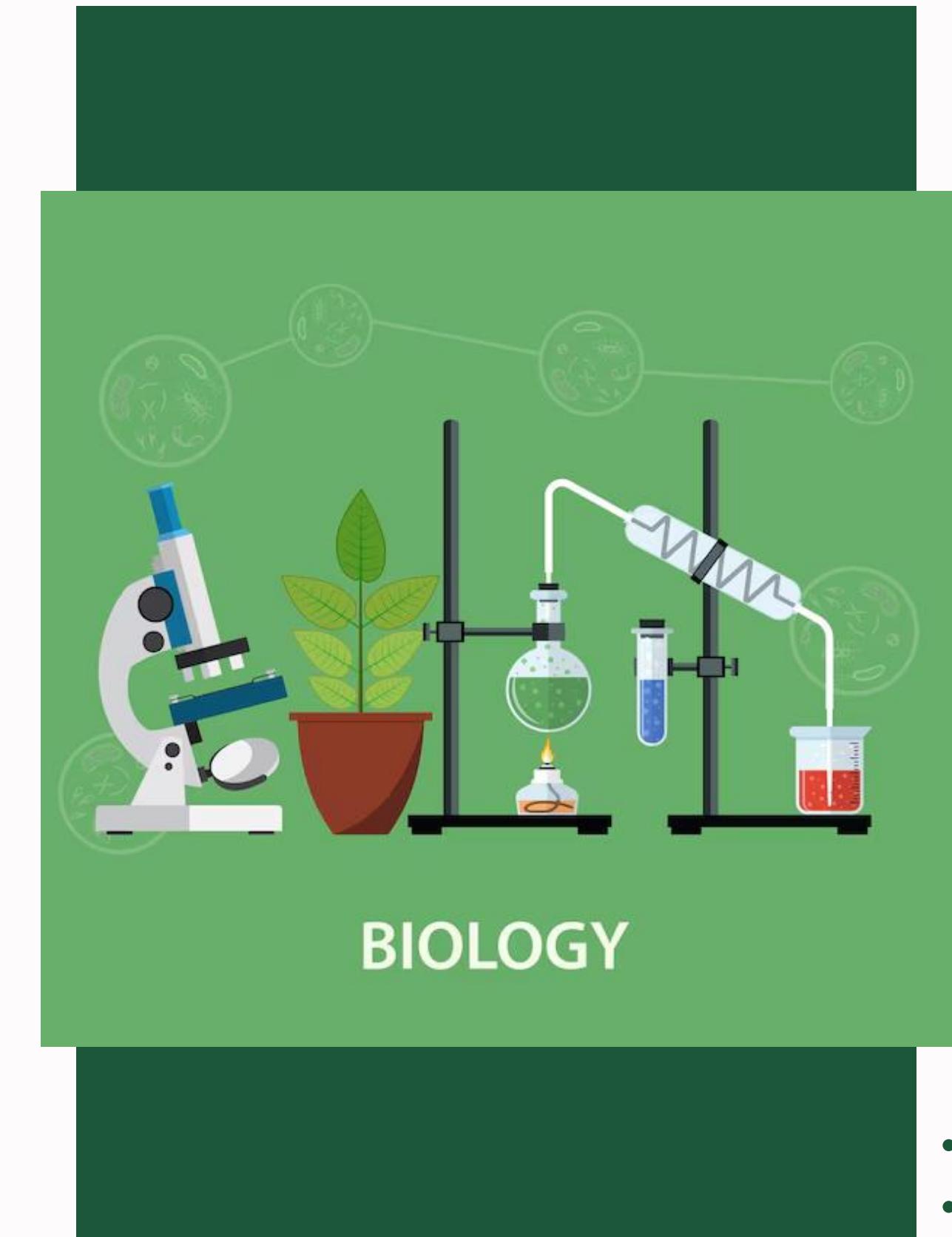
Enhance Accessibility: Integrate a voice output feature to provide audible summaries.

## Objective 4

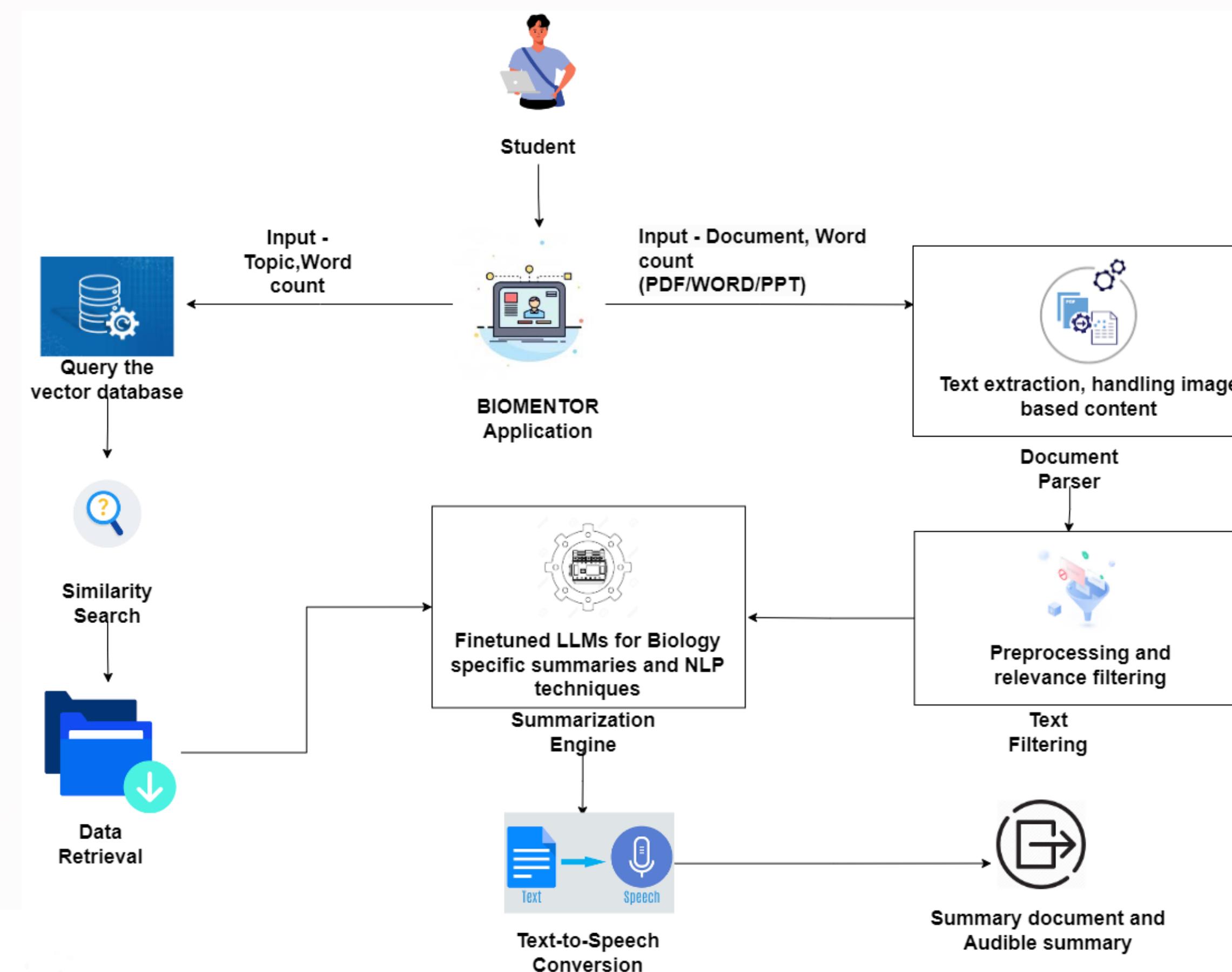
Various implementation: Implement the component in various architectures, compare, and analyze their strengths and weaknesses.

# Methodology

- 01 System Diagram
- 02 Tools and Technologies
- 03 Requirements
- 04 Work Breakdown Structure



# System Diagram



# Tools & Technologies



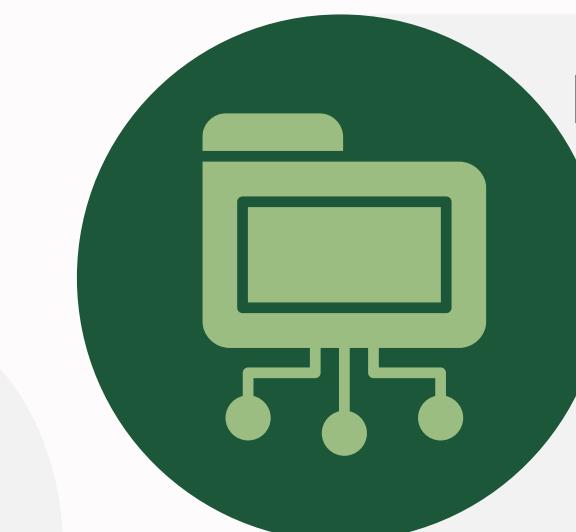
**Project Management**  
Jira



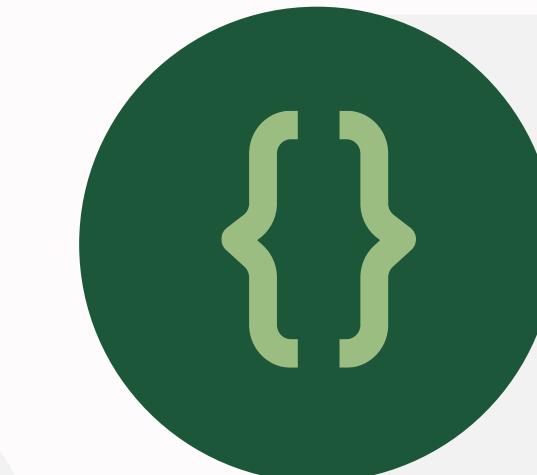
**Other tools**  
Git  
Draw.io  
Postman



**Database**  
Faiss  
Mongo DB



**Frameworks**  
Transformer model  
Pytorch  
pyttsx3  
OCR  
Flask



**Programming Languages**  
Python  
React Js

# Requirements

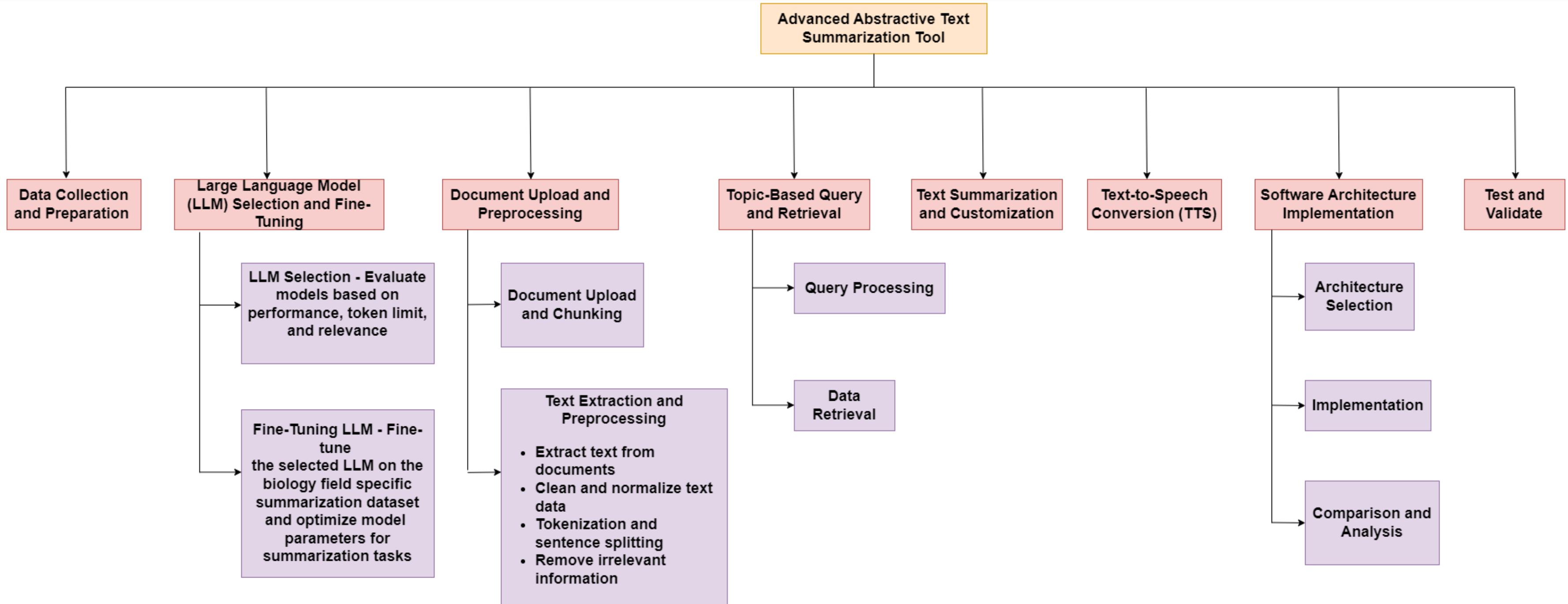
## Functional

1. The tool should accept any type of text documents, and extract text from image-based documents using OCR.
2. Collect data from government-approved A/L Biology resources.
3. The tool should extract relevant text from documents.
4. The tool generates concise summaries based on user-defined word counts.
5. The tool should convert summarized text into voice output.

## Non-Functional

1. Accuracy
2. Performance
3. Availability
4. Compliance
5. Usability

# Work Breakdown Structure



# References

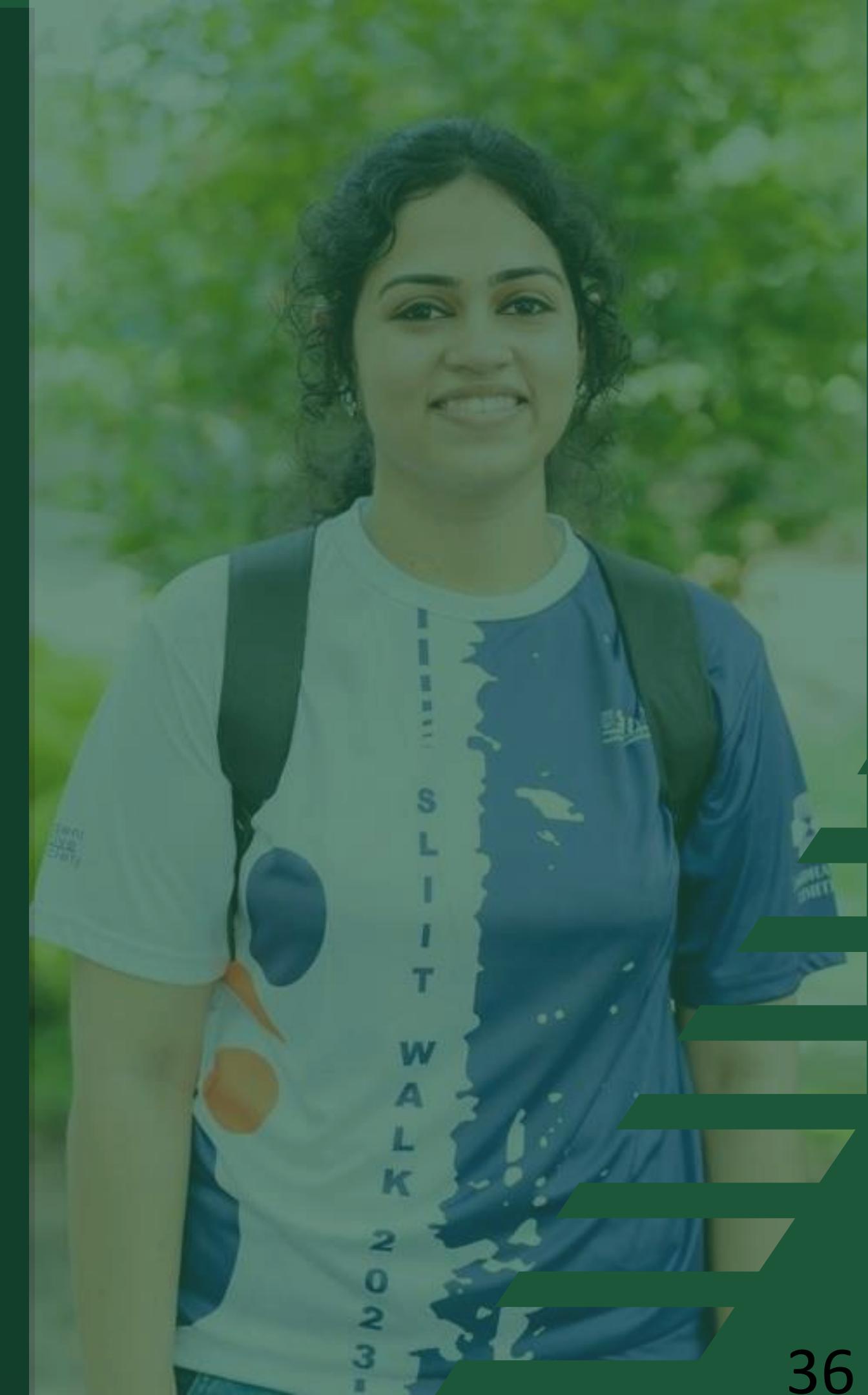
- [1] Abstractive Text Summarization Using BART. [ONLINE] <https://ieeexplore.ieee.org/document/9972639> [Accessed 15 May 2024]
- [2] NLP-Enhanced Long Document Summarization: A Comprehensive Approach for Information Condensation. [ONLINE] <https://ieeexplore.ieee.org/document/10551101> [Accessed 20 May 2024]
- [3] Topic level summary generation using BERTinduced Abstractive Summarization Model. [ONLINE] <https://ieeexplore.ieee.org/document/9972639> [Accessed 01 June 2024]
- [4] Speech-to-Text and Text-to-Speech Recognition using Deep Learning. [ONLINE] <https://ieeexplore.ieee.org/document/9972639> [Accessed 05 June 2024]
- [5] A Novel Text To Speech Conversion Using Hierarchical Neural Network. [ONLINE] <https://ieeexplore.ieee.org/document/10533516> [Accessed 05 June 2024]

# **IT21264634**

**Sujitha.S**

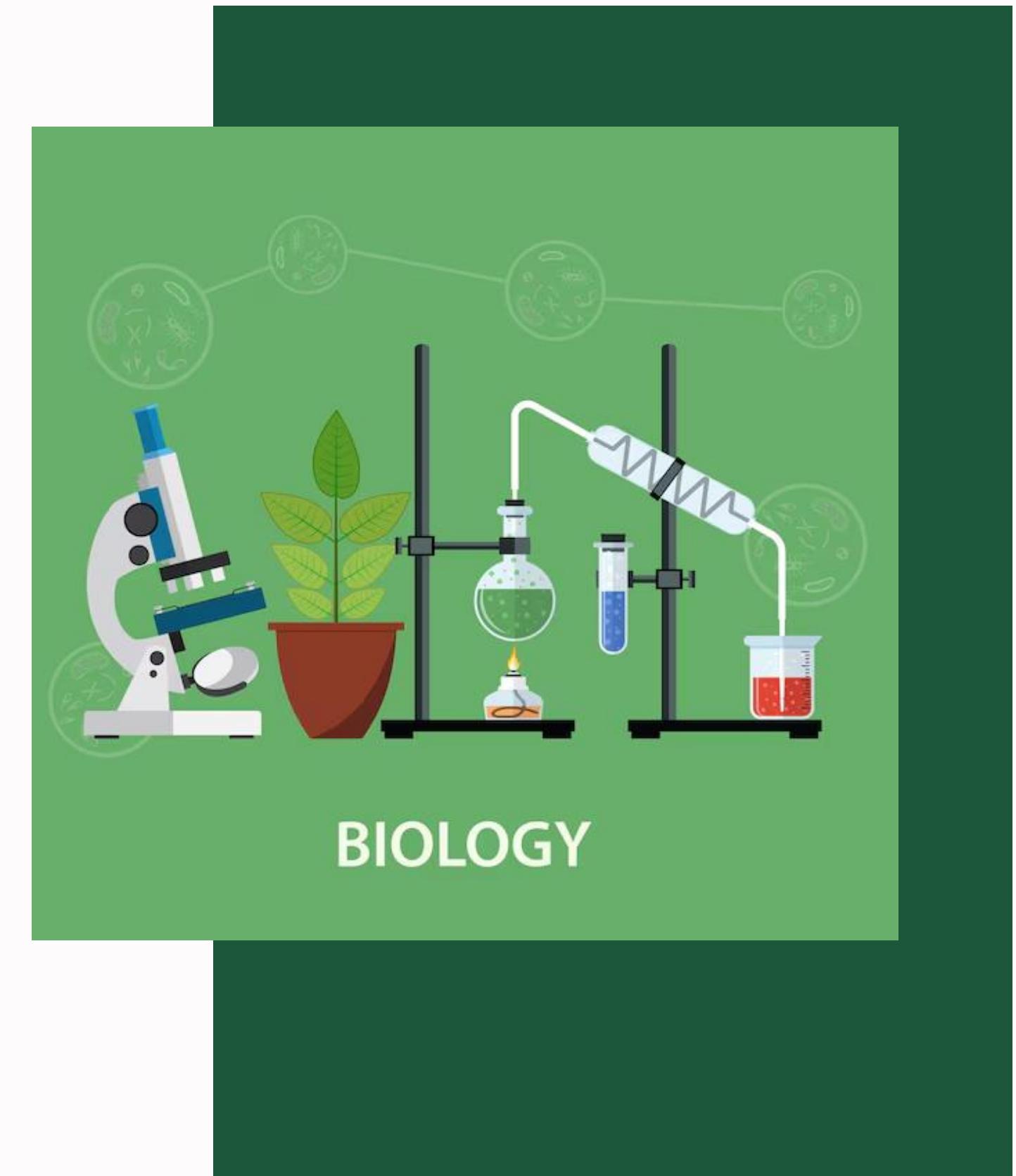
**Software Engineering**

**LLM BASED ADAPTIVE QUIZ TO  
IMPROVE MCQ ANSWERING  
SKILLS IN BIOLOGY FOR  
STUDENTS**



# Introduction

- 01 Background
- 02 Research Question
- 03 Research Gap
- 04 Main and Sub Objectives
- 05 Methodology



# BACKGROUND



Increasing demand  
for personalized  
learning experiences  
in education.



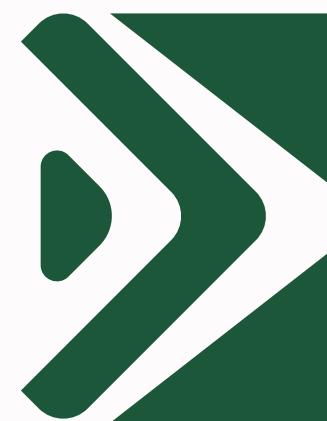
Need for adaptive  
assessment tools that  
cater to individual  
learning paces and  
capabilities.



Technological  
advancements  
enabling real-time data  
analysis and dynamic  
content adjustment.

# RESEARCH PROBLEM

01



Traditional quiz platforms fail to provide real-time adaptability based on individual student performance.

02



There is a need for a system that can offer varied levels of difficulty and content tailored to each learner.

03



Ensuring comprehensive assessment and detailed performance tracking is challenging in existing systems.

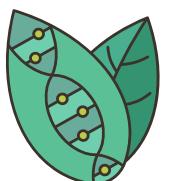
# Research Gap

*Adaptive MCQ  
Generation*

*Personalized*

*Specialized for Sri  
Lankan a/l syllabus*

*MCQ Generation*



BIOMENTOR



# OBJECTIVES

## Objective 1

Create a variety of MCQs categorized by difficulty to stimulate different cognitive skills.

## Main Objective

Develop an intelligent adaptive quiz system that personalizes MCQs based on student performance, integrates government-approved educational resources, and dynamically adjusts difficulty to cater to varying proficiency levels.

## Objective 2

Enhance the platform's ability to identify knowledge gaps and provide targeted practice recommendations.

## Objective 3

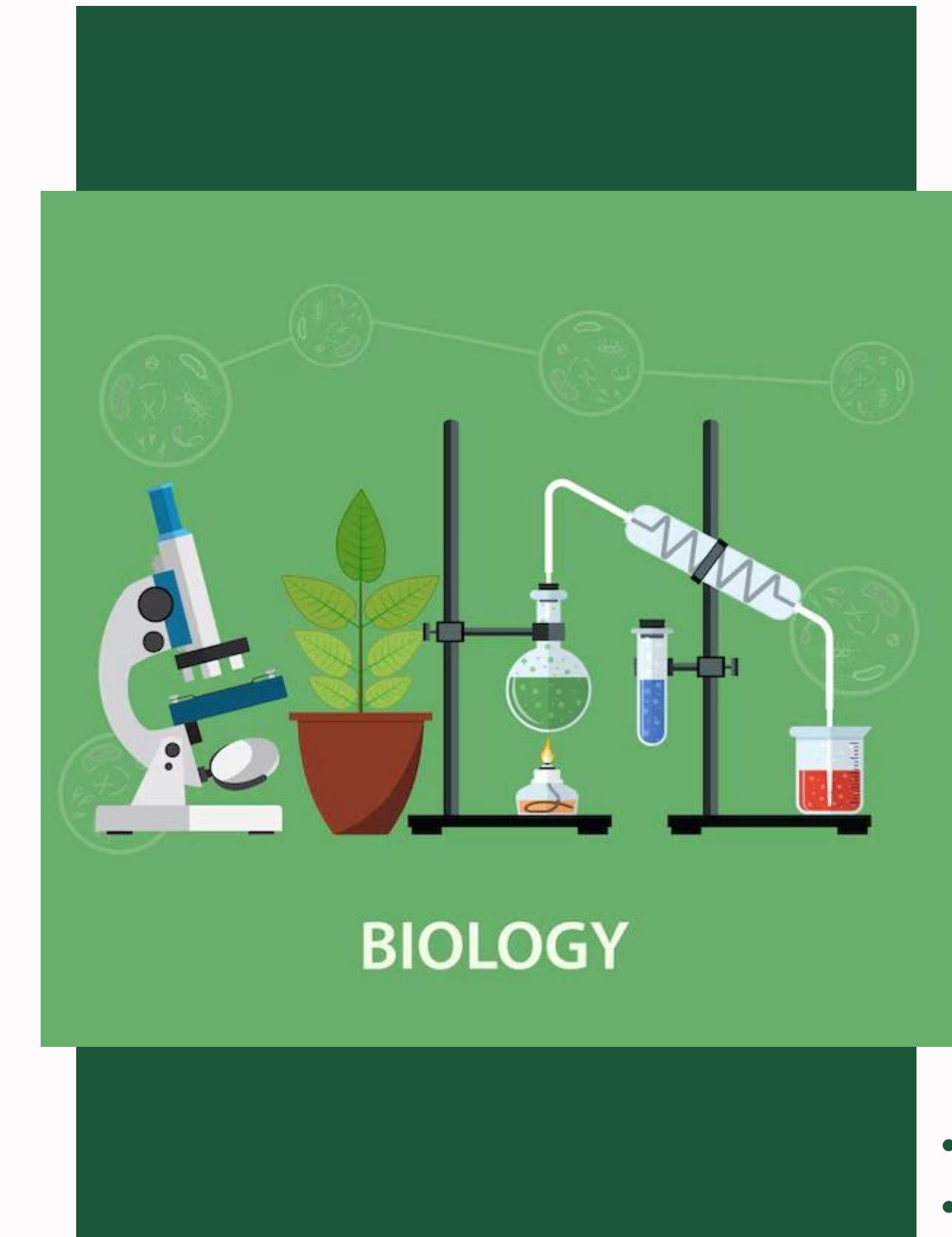
Design a system for continuous performance tracking and detailed analysis report generation.

## Objective 4

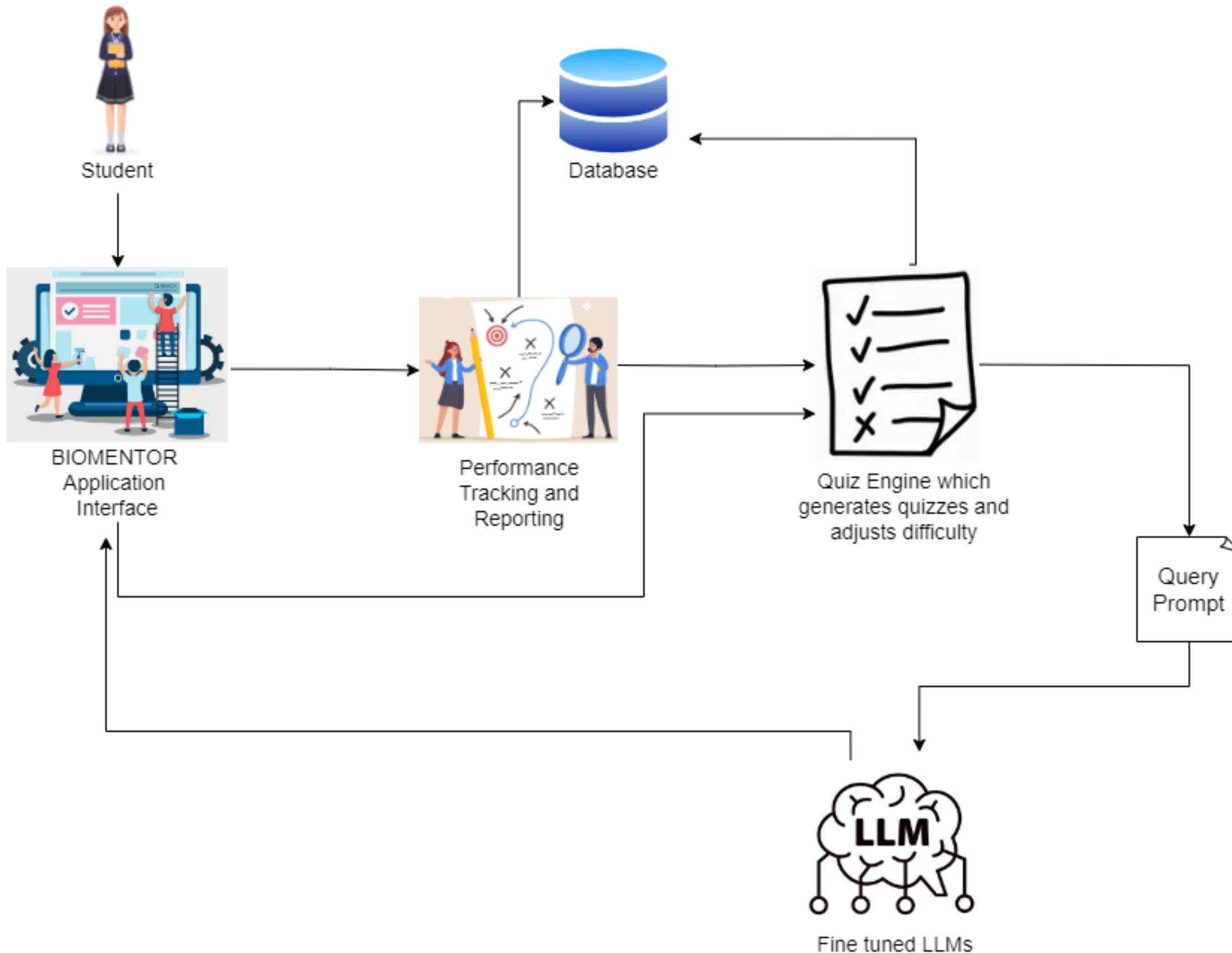
Ensure user-friendly interface and accessibility for diverse learner groups.

# Methodology

- 01 System Diagram
- 02 Tools and Technologies
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- 04 Work Breakdown Structure



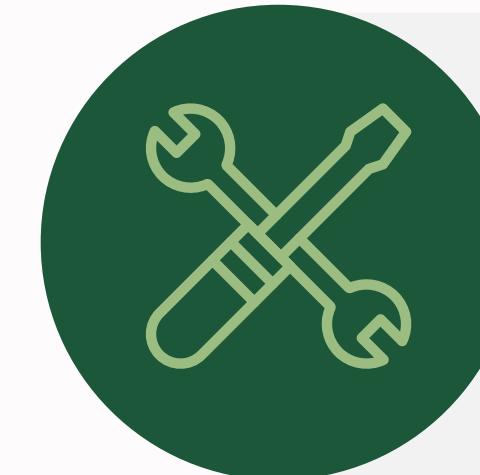
# System Diagram



# Tools & Technologies



**Project Management**  
Jira



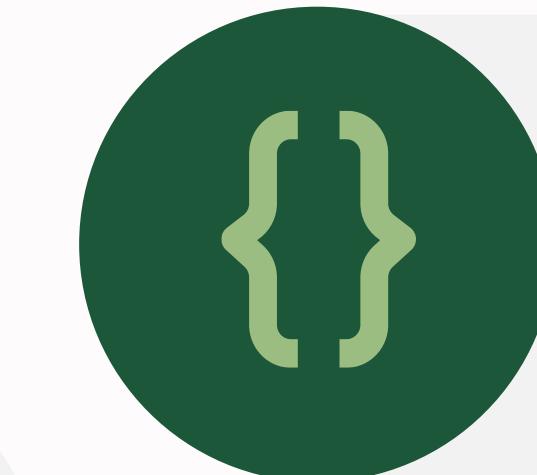
**Other tools**  
Git  
Draw.io  
Postman



**Database**  
RDBMS  
Faiss  
Mongo DB



**Frameworks**  
Transformers  
Scikit-learn  
NLTK  
Flask



**Programming Languages**  
Python  
React Js

# Requirements

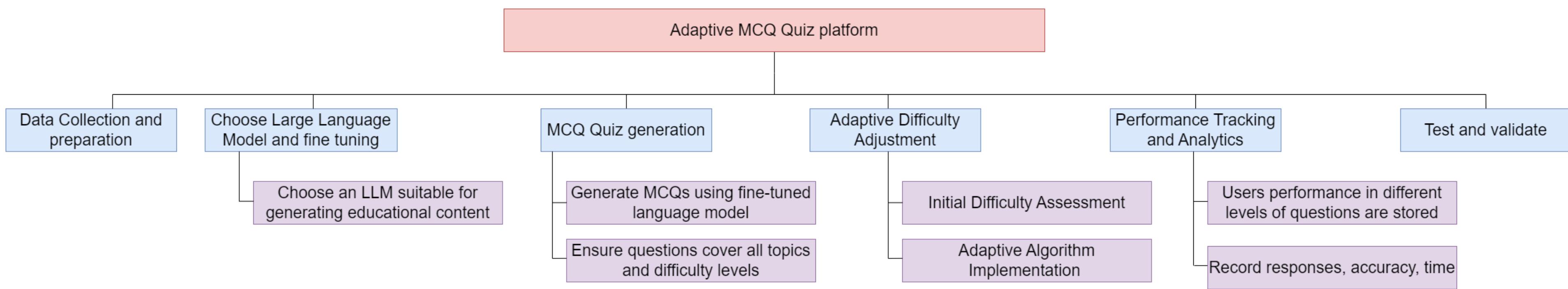
## Functional

1. Collect Dataset from Advanced Level Biology Past Papers
2. Update Database with Government Biology Resources for Advanced Level
3. Implement real-time adjustment of question difficulty based on student performance.
4. Track and store individual performance data over time to analyze trends and areas for improvement.
5. Generate detailed performance analysis reports with metrics on accuracy, time taken, and progress.

## Non-Functional

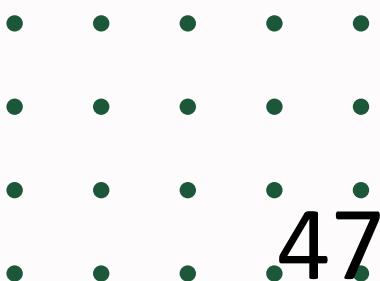
1. Compliance
2. Maintainability
3. Usability
4. Scalability
5. Performance

# Work Breakdown Structure



# References

- [1] Automatic Question Answer Generation using T5 and NLP. [ONLINE] <https://ieeexplore.ieee.org/document/9972639> [Accessed 13 May 2024]
- [2] Generation of Multiple-Choice Questions From Textbook Contents of School-Level Subjects. [ONLINE] <https://ieeexplore.ieee.org/document/9964056> [Accessed 20 May 2024]
- [3] Automatic question generation for intelligent tutoring systems. [ONLINE] <https://ieeexplore.ieee.org/document/9972639> [Accessed 06 June 2024]
- [4] MCQGen: A Large Language Model-Driven MCQ Generator for Personalized Learning. [ONLINE] <https://ieeexplore.ieee.org/document/9972639> [Accessed 05 June 2024]
- [5] Generation of Multiple Choice Questions from Indian Educational Text. [ONLINE] <https://ieeexplore.ieee.org/document/10270551> [Accessed 16 June 2024]



# **IT21204302**

Sajeevan S

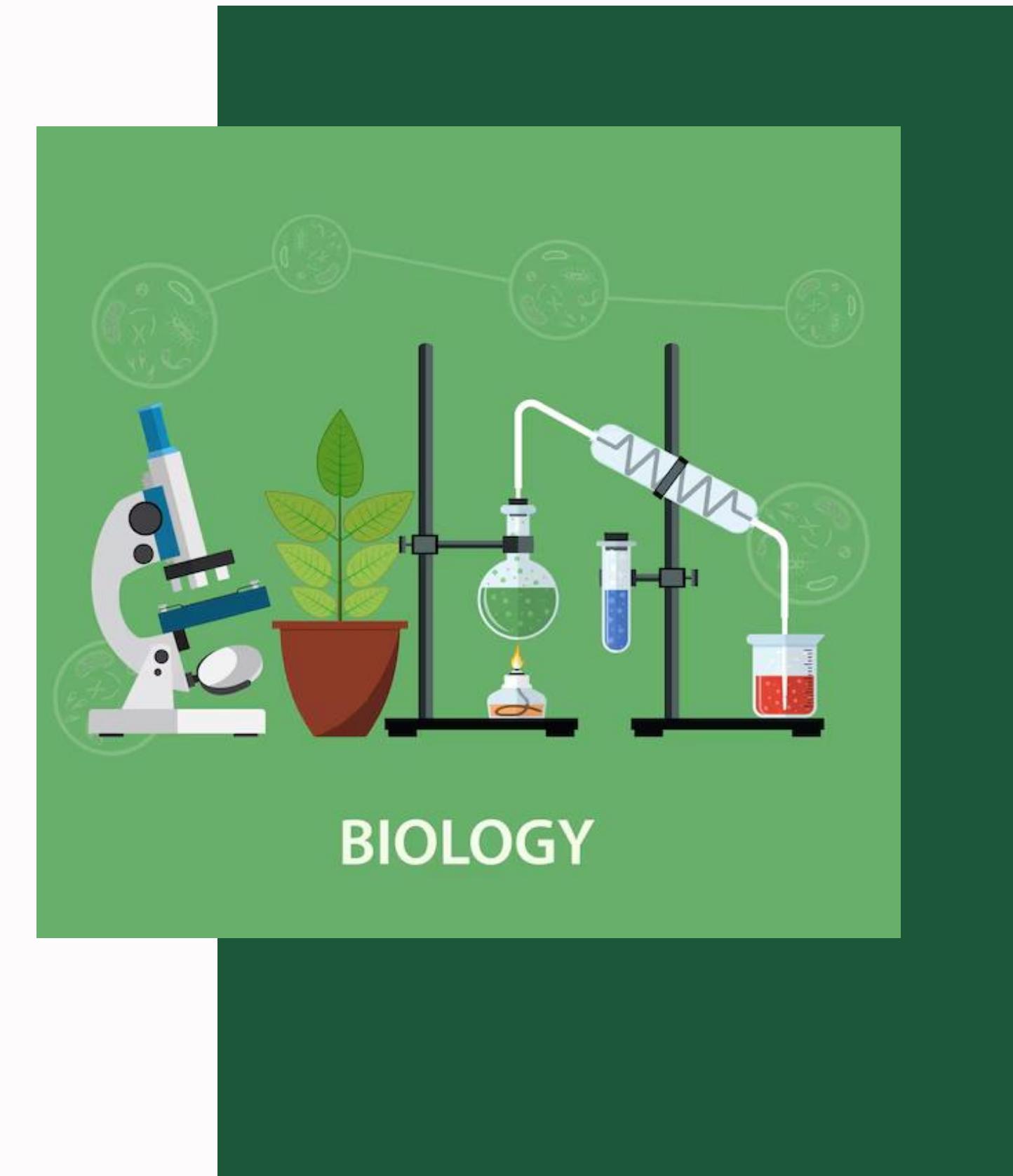
Software Engineering

**LLM BASED PROVIDE ANSWERS  
FOR STRUCTURED AND ESSAY  
TYPE OF QUESTIONS AND  
EVALUATE ANSWERS BASED ON  
APPROVED RESOURCES.**



# Introduction

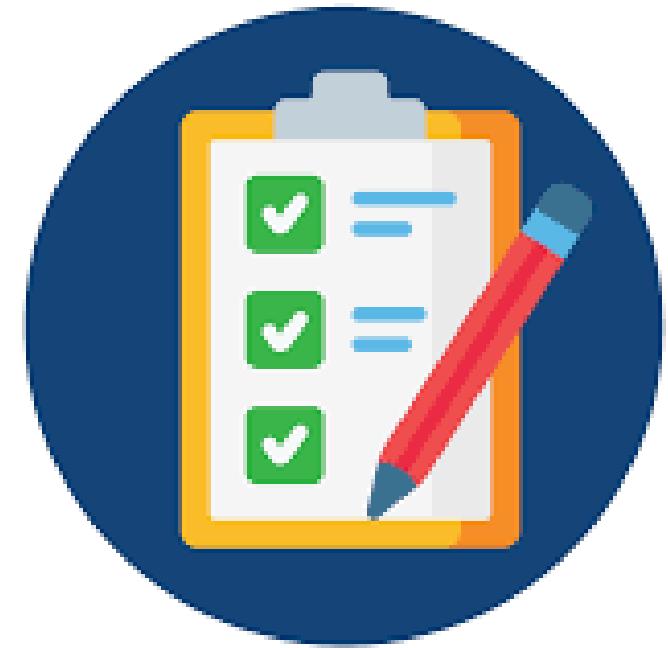
- 01 Background
- 02 Research Question
- 03 Research Gap
- 04 Main and Sub Objectives
- 05 Methodology



# BACKGROUND



The Importance of  
Independent Learning  
in Modern Education



## Self Assessment

The Challenges of Self-Evaluation in structured essay-type answering

# RESEARCH PROBLEM

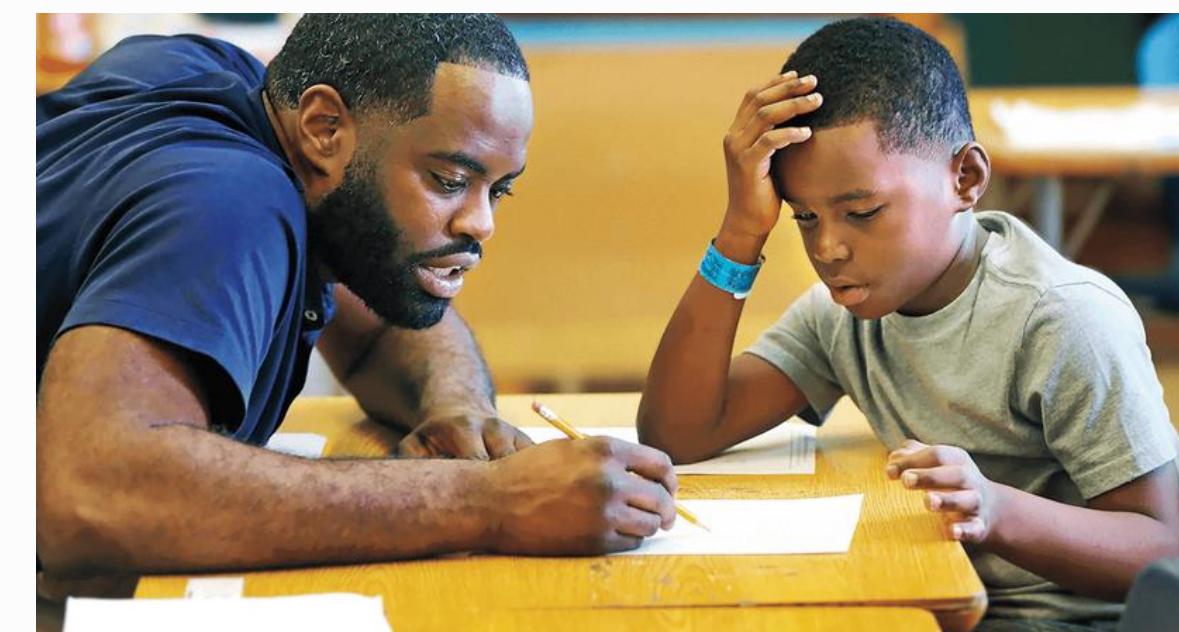
01



How can technology-based tools be developed and utilized to assist students in improving their essay-writing skills independently, without relying on mentor support?

What strategies can students employ to self-evaluate and improve their structured essay-type answers in the absence of mentor guidance?

02



# Research Gap

*For Srilankan A/L Bio syllabus*

*Answer based on the Srilankan A/L system*

*Answer Evaluation and suggestion*



BIOMENTOR



# OBJECTIVES

Objective 1

Answer Generation for a Question

Objective 3

Provide Suggestions for Improvement

Objective 2

Enhance Self-Directed Learning in Advanced-Level Biology

Objective 4

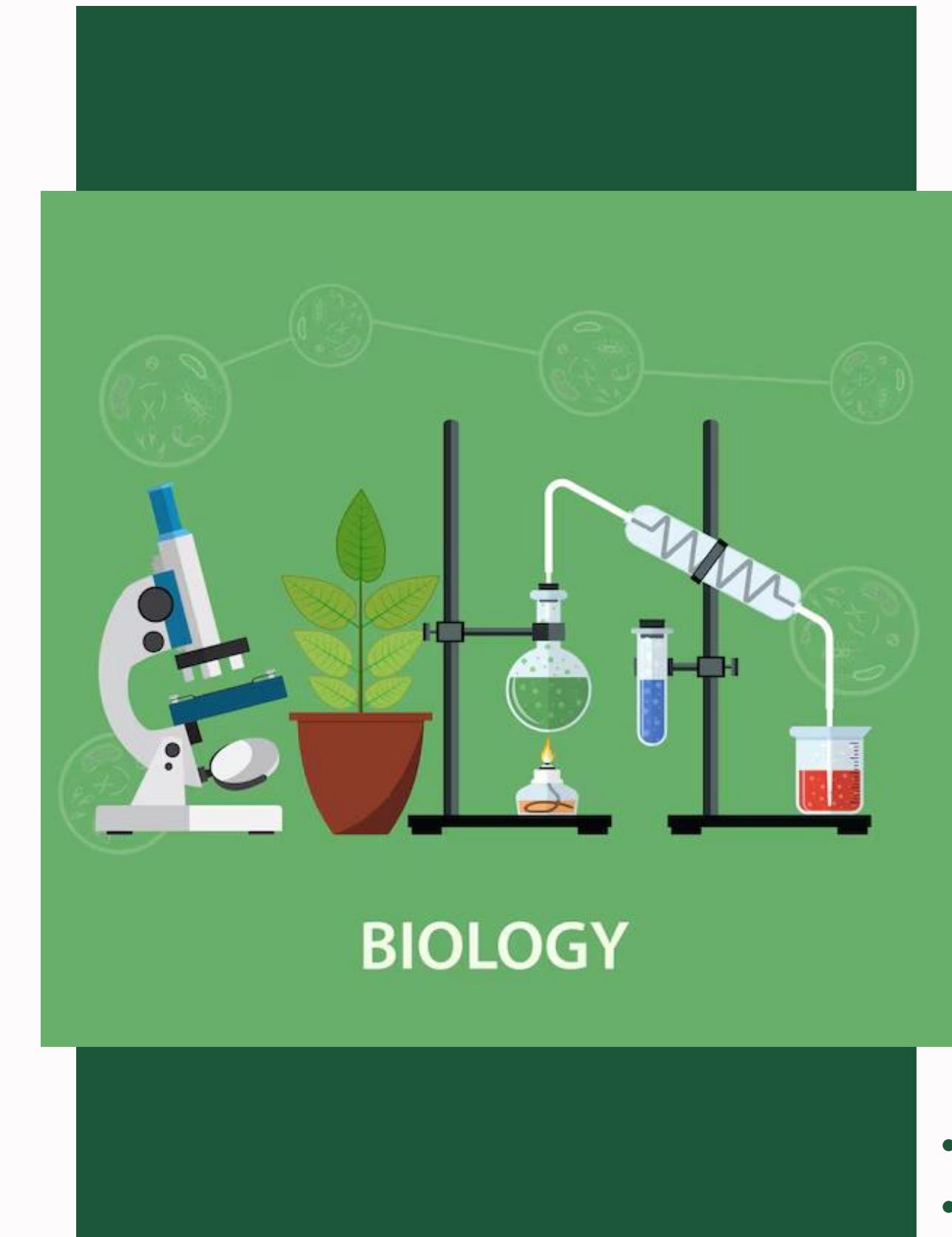
Provide Feedback for Answers

## Main Objective

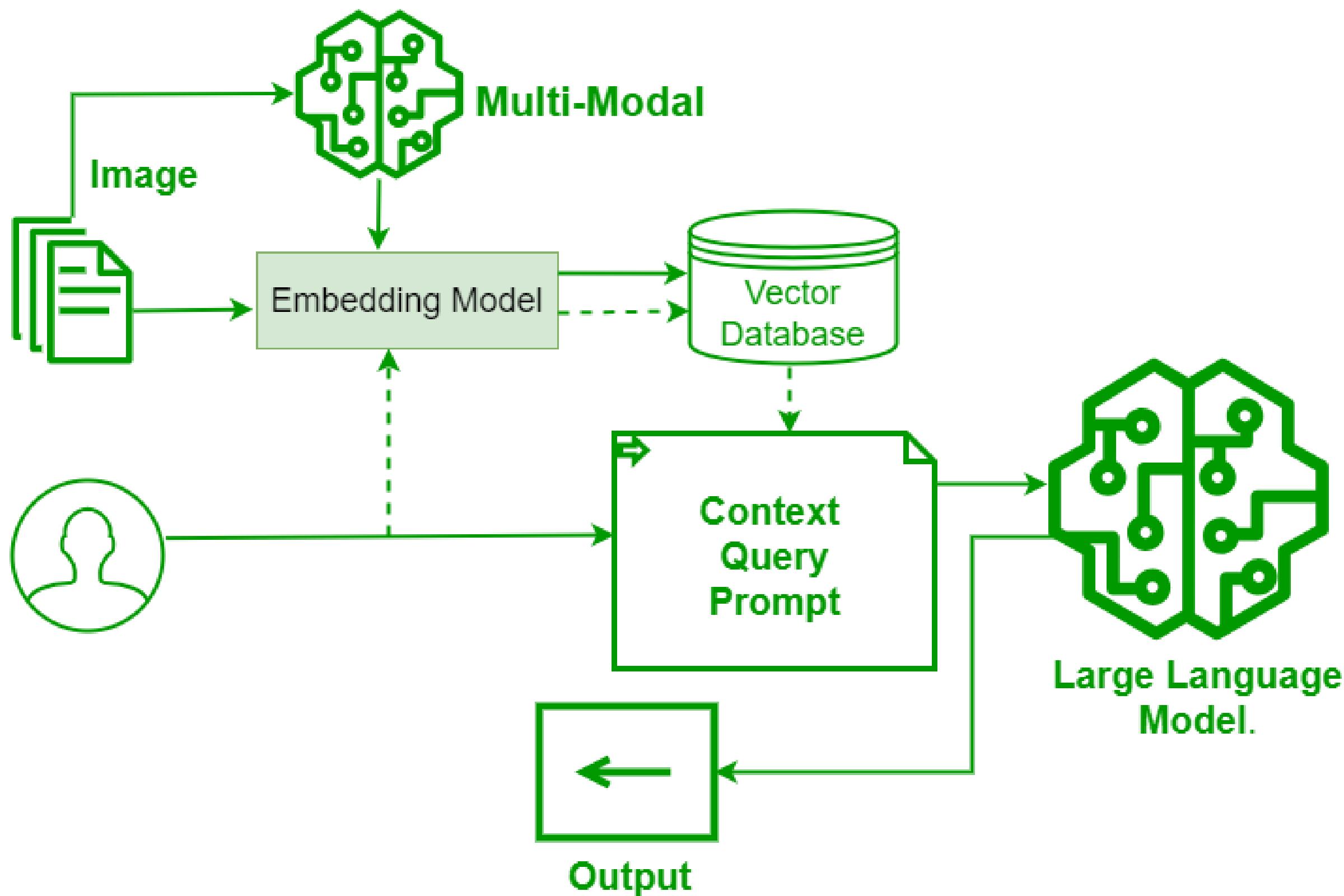
If students provide a question, the system will generate an answer, and if students also provide their corresponding answer, the system will evaluate their response and offer suggestions to improve the answer.

# Methodology

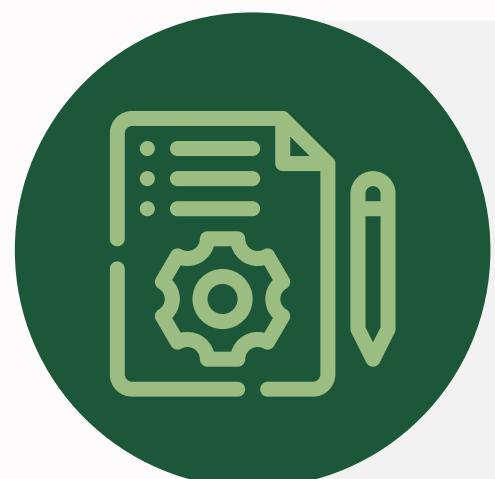
- 01 System Diagram
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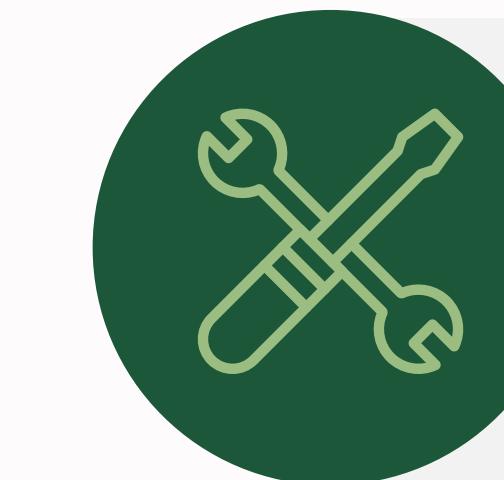
# System Diagram



# Tools & Technologies



**Project Management**  
Jira



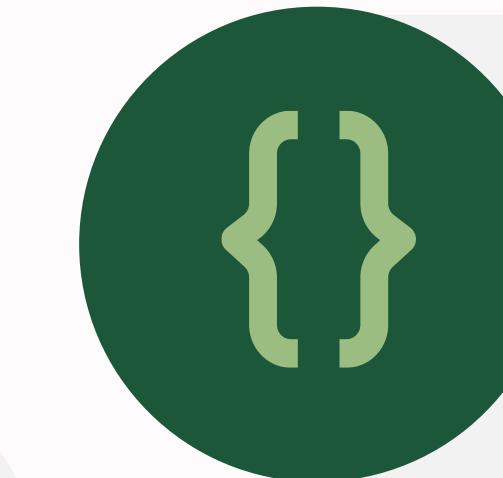
**Other tools**  
Git  
Draw.io  
Postman



**Database**  
Faiss  
Mongo DB



**Frameworks**  
Transformer model  
Flask  
Pytorch  
OCR



**Programming Languages**  
Python  
React JS

# Requirements

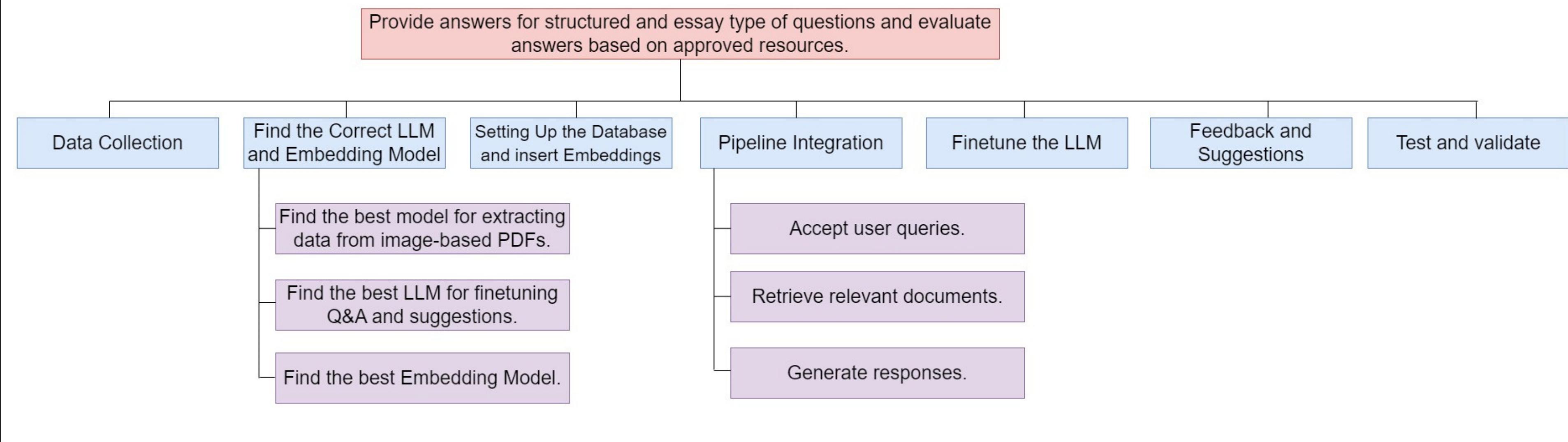
## Functional

1. Collect Dataset from Advanced Level Biology Past Papers
2. Update Database with Government Biology Resources for Advanced Level
3. Evaluate Answers and Provide Improvement Suggestions
4. Answer Generation for Structured and Essay Questions

## Non-Functional

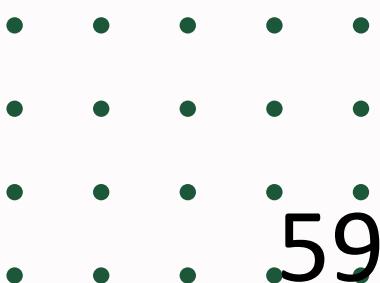
1. Accuracy
2. Performance
3. Availability
4. Usability

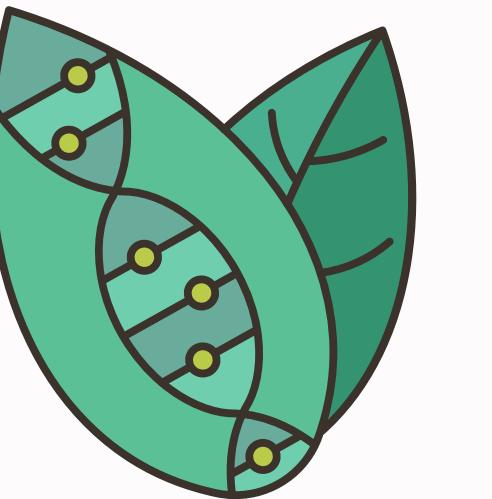
# Work Breakdown Structure



# References

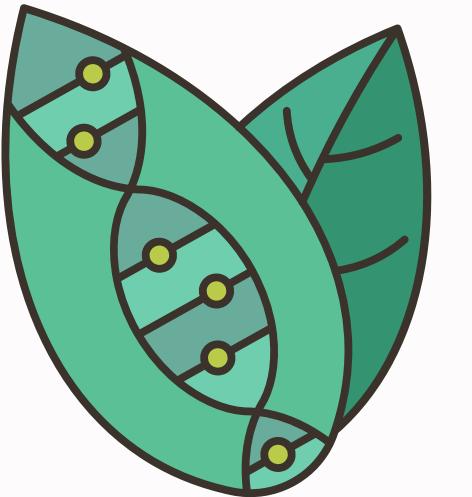
- [1] BERT-Based Model for Reading Comprehension Question Answering. [ONLINE] <https://ieeexplore.ieee.org/document/9972639> [Accessed 12 May 2024]
- [2] Question Answering System using NLP and BERT. [ONLINE] <https://ieeexplore.ieee.org/document/10551101> [Accessed 22 May 2024]
- [3] Question Answering Model Based Conversational Chatbot using BERT Model and Google Dialogflow. . [ONLINE] <https://ieeexplore.ieee.org/document/9972639> [Accessed 03 June 2024]
- [4] BERT-Based Mixed Question Answering Matching Model. [ONLINE] <https://ieeexplore.ieee.org/document/9972639> [Accessed 05 June 2024]
- [5] Semantic Similarity Detection and Analysis For Text Documents. [ONLINE] <https://ieeexplore.ieee.org/document/10533516> [Accessed 15 June 2024]





BIOMENTOR





BIOMENTOR

**THANK  
YOU**

A photograph showing a hand placing the final wooden block in a vertical stack of five blocks. The blocks are light-colored wood with black text. The text on the blocks reads:  
BLOCK 1: THANK  
BLOCK 2: YOU  
BLOCK 3: FOR  
BLOCK 4: YOUR  
BLOCK 5: ATTENTION (in red capital letters)  
The background is a dark blue surface with a faint watermark of the word "PRESENTATION" visible.