University of Sri Jayewardenepura

Faculty of Technology

Department of Information and Communications Technology

ExamLabs LK

An AI-Assisted Platform for Mastering Past Paper Questions

Project Report

Group 04

Project Title

Empowering Sri Lankan O-Level Students: An AI-Assisted Platform for Mastering Past Paper Questions

Project Personnel

1. Details of Academic Supervisor

Name : Ms. Nirasha Kulasooriya

Institution : University of Sri Jayewardenepura

Contact details : 071-7102240

2. Details of Team Members

Name	Specialized Area	Faculty	Index Number	email	Mobile Number
Dasanayaka D.A.N.I.	Software Technology	Faculty of Technology	ICT/21/821	ict21821@fot.sjp.ac.lk	0786512658
Dasanayaka D.MP.D.	Network Technology	Faculty of Technology	ICT/21/822	ict21822@fot.sjp.ac.lk	0714707197
De Silva G.H.S.	Software Technology	Faculty of Technology	ICT/21/823	ict21823@fot.sjp.ac.lk	0725435407
Dewmini K.K.H	Software Technology	Faculty of Technology	ICT/21/825	ict21825@fot.sjp.ac.lk	0767317696
Bandara D.M.K.S	Multimedia Technology	Faculty of Technology	ICT/21/812	ict21812@fot.sjp.ac.lk	0785068756

Declaration

We certify that this report does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any university, and to the best of our knowledge and belief, it does not contain any material previously developed, published or written by another person except where due reference is made in the text.

Acknowledgement

With great appreciation, we would like to thank all of the individuals and organizations who assisted us to implement the “ExamLabs LK”, An AI-Assisted Platform for Mastering Past Paper Questions Project. This endeavor would not have been accomplished without their invaluable assistance.

First and foremost, we would like to thank our academic supervisor, Ms. Nirasha Kulasooriya, for her unwavering support and insightful critiques throughout our project journey. Her expertise and dedication have been instrumental in shaping the project's direction and ensuring its success.

We also wish to acknowledge the hard work and dedication of each member of our project team. This project is a product of collective effort, and every member’s commitment, collaboration, and resilience were essential to achieving our objectives.

Finally, we extend our heartfelt thanks to the focus group and usability participants who took the time to share their valuable insights and feedback. Their responses provided us with a better understanding of the needs and expectations surrounding this project, and their input has greatly enriched our work. Thank you to everyone who has contributed to the success of the ExamLabs LK project.

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List of Abbreviations

- AI - Artificial Intelligence
- NLP - Natural Language Processing
- MCQ - Multiple-Choice Questions
- UI - User Interface
- UX - User Experience
- QA - Quality Assurance
- UAT - User Acceptance Testing
- API - Application Programming Interface
- MERN - MongoDB, Express.js, React.js, Node.js (technology stack)
- RBAC - Role-Based Access Control
- PDF - Portable Document Format
- ID - Identification

1. Introduction and Background

1.1 Introduction

Ordinary Level (O-Level) examinations in Sri Lanka are a pivotal milestone in a student’s academic journey. These exams significantly impact students' future educational and career opportunities. Despite their importance, many students struggle to find comprehensive and accessible resources to prepare effectively for these examinations. The traditional methods of studying, which often involve rote learning and lack of personalized feedback, fall short in helping students master exam techniques and subject matter.

This project aims to address these challenges by developing a web application titled "ExamLabs LK" The platform is designed to provide students with easy access to past examination papers, marking schemes, and personalized learning experiences through advanced AI technologies. By leveraging modern web technologies and natural language processing (NLP) models, the platform aims to enhance students' preparation and performance in O-Level exams.

1.2 Background

The Ordinary Level (O-Level) examinations in Sri Lanka are a pivotal milestone in the academic journey of students. These exams significantly influence their future educational and career opportunities. However, many students face challenges in accessing comprehensive and reliable study resources, which hampers their exam preparation. Traditional study methods, such as textbooks and classroom notes, often do not provide the targeted practice and timely feedback necessary for mastering exam techniques.

The existing problems include:

1. **Limited Access to Resources:** Many students struggle to find and access past papers and marking schemes, which are essential for understanding exam patterns and practicing effectively.
2. **Lack of Targeted Practice:** Traditional methods do not offer the tailored practice needed to address individual weaknesses and improve specific skills.

3. **Insufficient Feedback:** Students often do not receive timely or detailed feedback on their practice papers, making it difficult for them to gauge their progress and identify areas for improvement.

To address these issues, the proposed web application will provide:

Easy Access to Resources: Students will be able to download past papers and marking schemes without creating an account, ensuring that essential resources are readily available to everyone.

Personalized Learning Experience: By creating an account, students can access additional services, including online multiple-choice questions (MCQs) and structured essay papers. These services will be enhanced by AI-driven feedback mechanisms.

AI-Powered Feedback: The platform will utilize advanced NLP models, such as GPT-3, to provide automated marking and detailed feedback on essay responses. This feature aims to mimic the personalized feedback that students might receive from a tutor, helping them understand their mistakes and learn how to improve.

This project, rooted in academic research and technological innovation, seeks to empower Sri Lankan O-Level students by providing them with the tools and resources they need to succeed. By addressing the gaps in the current education system and leveraging the power of AI, we aim to create a transformative learning experience that can significantly improve students' academic outcomes.

1.3 Innovation and Competitiveness

1.3.1 Innovation

The proposed platform introduced several innovative features that distinguished it from traditional educational resources. By integrating advanced AI technology, the platform offered personalized, automated feedback on student submissions, enhancing the learning experience. This approach ensured consistent, high-quality evaluations, helping students identify and address their strengths and weaknesses more effectively. Additionally, the platform's design emphasized accessibility and usability, ensuring that resources were readily available to all students, while the interactive practice features provided a comprehensive, adaptive learning environment.

1. **AI-Powered Feedback:**
    - Utilizing advanced Natural Language Processing (NLP) models like GPT-3, the platform provided personalized, automated feedback on structured essay answers. This innovation ensured high-quality, consistent evaluations and helped students understand their strengths and areas for improvement more effectively than traditional methods.
2. **Integrated Learning Environment:**
    - The platform combined the convenience of accessing past papers and marking schemes with interactive practice features such as online MCQs and essay question practice. This integrated approach offered a comprehensive learning experience that adapted to the individual needs of each student.
3. **Accessibility and Usability:**
    - The application design prioritized accessibility, ensuring that resources were available without requiring account creation. This reduced barriers to entry and encouraged more students to utilize the platform. For registered users, the personalized learning features enhanced engagement and learning outcomes.
4. **User-Centric Design:**
    - The platform's user interface was designed with students and administrators in mind, ensuring intuitive navigation, ease of use, and a positive user experience. Features like the admin dashboard allowed for efficient content management, ensuring the platform remained up-to-date and relevant.

1.3.2 Competitiveness

The platform's competitive edge lies in its unique integration of advanced AI capabilities, tailored content, and user-friendly design. By focusing specifically on the needs of Sri Lankan O-Level students, the platform provides a highly relevant and effective learning tool that stands out in the educational technology market. Unlike generic educational resources, this platform offers detailed, personalized feedback that helps students improve their academic performance more effectively.

One of the key advantages of this platform is that there is no specific web or mobile application currently providing this kind of specialized service for O-Level students in Sri Lanka. The

closest competitor is "E-Thaksalawa" by the Ministry of Education, Sri Lanka. However, "E-Thaksalawa" serves a broad scope of all grades and does not focus solely on O-Level students. Additionally, it lacks the comprehensive online quiz functionality for all subjects, which limits its effectiveness in providing targeted exam preparation.

1. **Differentiation from Competitors:**
    - While other platforms may offer access to past papers or AI-powered tools, our application uniquely integrates these features into a single, cohesive platform. The combination of easy access to resources, AI-driven feedback, and interactive practice makes this platform stand out in the educational technology market.
2. **Tailored to Sri Lankan O-Level Curriculum:**
    - The platform is specifically designed to cater to the Sri Lankan O-Level curriculum, addressing the unique needs and challenges faced by students in this education system. This localized focus ensures that the content is highly relevant and effective.
3. **Enhanced Learning Outcomes:**
    - The platform's ability to provide detailed, personalized feedback helps students improve their academic performance more effectively than generic study methods. This focus on targeted improvement is a key competitive advantage, as it directly contributes to better exam results.

2. Business Analysis Process

2.1 Project Objectives and scope

2.1.1 Project Objectives

The primary objective of this project is to develop a web application that empowers Sri Lankan Ordinary Level (O-Level) students by providing an AI-assisted platform for mastering past paper questions. This will be achieved through:

1. **Enhanced Access to Resources:** Ensuring students can easily access past papers and marking schemes without any barriers.

2. **Personalized Learning Experience:** Offering tailored feedback through AI-powered evaluation to help students identify and improve their weaknesses.
3. **Interactive Practice:** Providing an engaging and interactive environment for students to practice multiple-choice questions (MCQs) and structured essay questions online.
4. **Efficient Administrative Tools:** Enabling admins to manage content and user accounts seamlessly, ensuring the platform remains up-to-date and relevant.

2.1.2 Project Scope

The scope of this project includes the design, development, testing, and deployment of the web application. The project encompasses the following key areas:

1. **User Registration and Authentication:**
    - Implement a user-friendly registration and login system using Google OAuth for authentication.
2. **Access to Past Papers and Marking Schemes:**
    - Provide a repository where students can download past papers and marking schemes without creating an account.
3. **Online MCQ and Essay Practice:**
    - Allow registered users to access and complete online MCQ papers.
    - Enable students to submit structured essay answers and receive AI-generated feedback.
4. **AI-Powered Feedback System:**
    - Integrate advanced NLP models (such as GPT-3) to evaluate essay responses and provide detailed feedback.
5. **Admin Dashboard:**
    - Develop an admin dashboard where administrators can upload new papers, create MCQ sets, and manage user accounts.
6. **User Interface and Experience:**
    - Design a responsive and intuitive user interface that provides a seamless user experience for both students and administrators.

2.2 Competitor Analysis

To understand the landscape of educational platforms in Sri Lanka, we conducted a competitive analysis focusing on "E-Thaksalawa." While E-Thaksalawa provides a broad range of resources for various grades, it lacks specialized features tailored to O-Level exam preparation. The platform's **content depth** is limited in interactivity, with no AI-driven feedback or personalized support, which "ExamLabs LK" aims to provide.

In terms of **User Experience (UX)**, E-Thaksalawa's interface is functional but lacks the intuitive, engaging design needed for sustained user engagement, particularly for young students. This finding led us to prioritize a more user-friendly interface in "ExamLabs LK." Finally, **technological insights** revealed that E-Thaksalawa's static content delivery could benefit from the dynamic, interactive features that "ExamLabs LK" will introduce, such as real-time AI feedback on essays.

These insights guided our **feature prioritization** and **design choices**, positioning "ExamLabs LK" as a more interactive, personalized, and accessible platform that directly addresses the needs of O-Level students in Sri Lanka.

2.3 Functional Requirements

1. Authentication and User Management:

- Google OAuth integration for user authentication.
- User registration and profile management functionalities.

2. Content Management:

- Ability to upload, view, and delete past papers, MCQs, and structured essays.
- Categorization and tagging of resources for easy navigation.

3. AI-Powered Feedback System:

- Integration of Natural Language Processing (NLP) models for automated evaluation of structured essays.
- AI-driven insights and feedback for MCQ answers to enhance learning outcomes.

4. User Interface and Experience:

- Responsive web design ensuring usability across devices (desktop, tablet, mobile).

- Intuitive navigation and user-friendly interfaces for seamless interaction.

5. Admin Dashboard:

- Secure login for administrators with roles and permissions management.
- Tools for content moderation, analytics (e.g., user activity, resource usage), and user support.

2.4 Non-functional Requirements

- **Performance:**
  - System should handle concurrent user requests without performance degradation.
- **Security:**
  - User data encryption and secure API endpoints for data transmission.
- **Scalability:**
  - Architecture should support future expansion and an increased user base.

3. System Design

3.1 System Architecture Design

- **Architecture Pattern:** The system will follow a client-server architecture with a monolithic design for simplicity and ease of management.
- **Main Components:** The main components of the system include the user interface (UI) built with React.js, the backend server developed using Node.js and Express.js, the MongoDB database for data storage, and the AI-powered feedback system utilizing GPT-3.
- **Interactions:** The UI interacts with the backend server through RESTful APIs, which handle user authentication, data retrieval, and submission of MCQ and essay responses. The backend processes these interactions and communicates with the MongoDB database and the AI model for storing data and generating feedback.

3.2 Database Design

The database design for the "ExamLabs LK" project leverages MongoDB, a NoSQL database, to ensure flexibility, scalability, and efficient data management. The design focuses on storing various types of data, including user information, exam papers, marking schemes, MCQs, and essay submissions. Below is a detailed description of the key collections and their schemas.

Database Collections

1. **Admin Collection**
2. **Users Collection**
3. **Items Collection**
4. **Favorites Collection**

3.3 Use Case Diagram

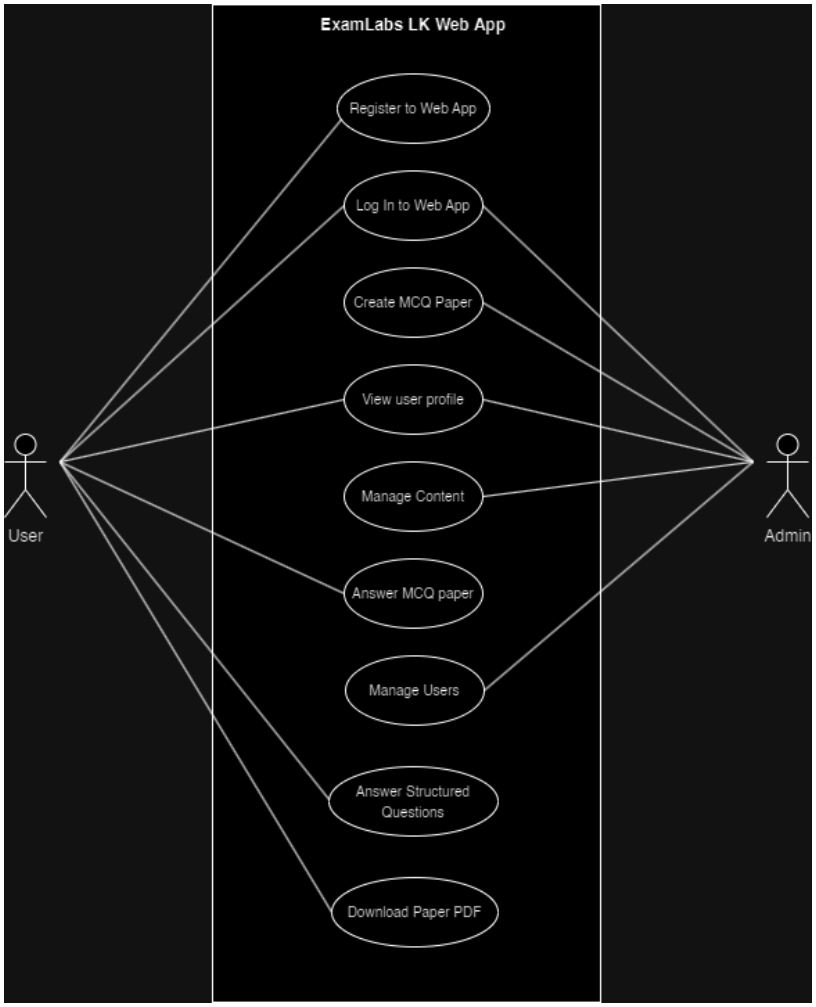


Figure 1: Use Case Diagram

3.4 NLP Model Architecture

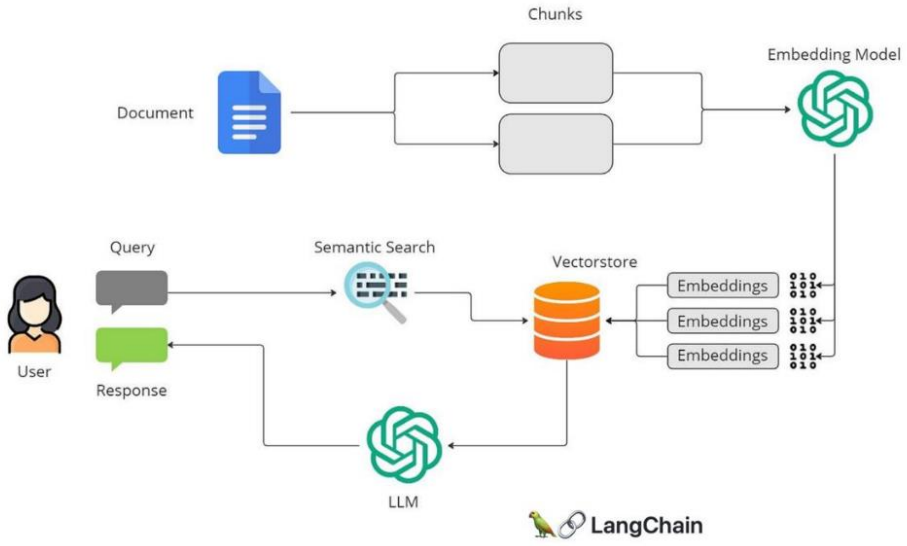


Figure 2: NLP Model Architecture

3.5 Security Plan

The security plan outlines detailed security measures to ensure the integrity, confidentiality, and availability of the system. This includes authentication, authorization, and encryption strategies.

1. **Authentication:**
    - Utilized Google OAuth for user authentication, ensuring secure and reliable login processes.
2. **Authorization:**
    - Implemented role-based access control (RBAC) to restrict access to specific features and data based on user roles (e.g., admin, student).
3. **Encryption:**
    - Used HTTPS for secure communication between the client and server.
    - Encrypted sensitive data stored in the database to protect it from unauthorized access.

3.6 Performance Optimization and Scalability

To ensure the system performed efficiently and could handle increasing numbers of users, the following strategies for performance optimization and scalability were implemented:

1. **Performance Optimization:**
    - Implemented caching mechanisms to reduce the load on the database and speed up data retrieval.
    - Optimized database queries and indexing to enhance data access speeds.
    - Used asynchronous processing for time-consuming tasks to improve responsiveness.
2. **Scalability:**
    - Implemented load balancing to distribute incoming traffic evenly across multiple servers.

3.7 Technology Stack

Frontend:

- **React.js**: For building a responsive and dynamic user interface.
- **HTML5**: Markup language for structuring content.
- **CSS3**: Styling the web application.
- **Bootstrap**: For responsive design and layout.

Backend:

- **Node.js**: JavaScript runtime for server-side development.
- **Express.js**: Web framework for creating RESTful APIs.
- **Google OAuth**: For user authentication and authorization.

Database:

- **MongoDB**: NoSQL database for flexible and scalable data storage.

AI and NLP:

- **GPT-3 (OpenAI)**: Pre-trained language model for natural language processing tasks.

Version Control:

- **Git**: For source code management.
- **GitHub**: Hosting the repository and facilitating collaboration.

4. Software Development Process

4.1 User Research

For the "ExamLabs LK" project, conducting thorough user research helped us understand the needs, pain points, and preferences of Sri Lankan O-Level students, parents, and educators. This research guided feature development, improved user experience, and ensured the platform effectively supported students in their exam preparation.

Research Objectives

- Understand the main challenges students face when preparing for O-Level exams.
- Identify the specific needs for accessible resources, personalized learning, and feedback mechanisms.
- Discover preferred study methods, frequency of practice, and expectations from an online exam preparation platform.
- Assess the demand for AI-driven features, such as automated marking and feedback.

Target Audience

We have identified the target audience of our project “ExamLabs LK” follows:

- Primary Users: O-Level students in Sri Lanka (ages 14-16)
- Secondary Users: Parents and Educators

Research Method

We used focus groups as our research method. It helped us to explore collaborative perspectives on exam preparation, preferred study tools, and feedback requirements. We used 2 groups of 5 to 6 students for this research. Following are the points we discussed with them.

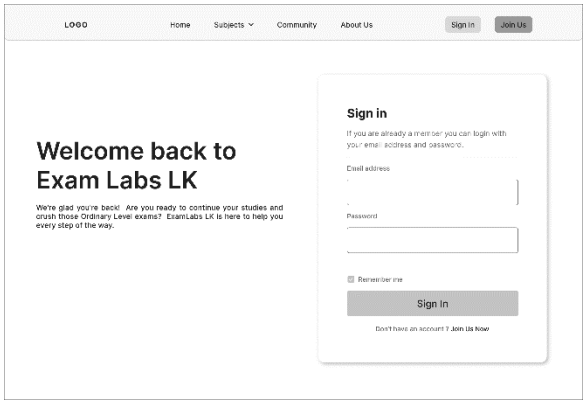
- Effective study practices and tools currently used.
- Desired features in a digital learning tool.
- Perceived benefits and drawbacks of AI-assisted feedback.

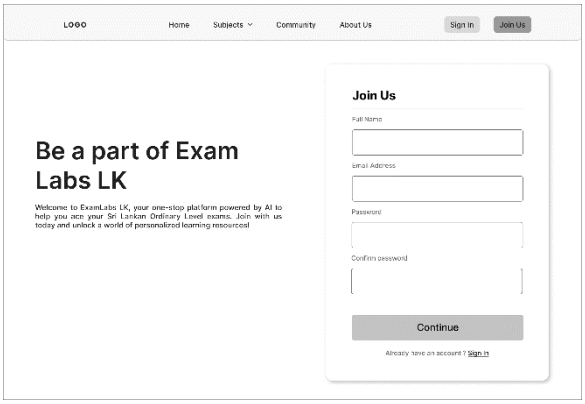
Insights from User Research

- High Demand for Accessible Resources
    - Students consistently reported difficulty in finding reliable past papers and marking schemes, especially online. Many rely on teachers or classmates to share these resources.
- Preference for Targeted Practice
    - Students expressed a desire for more personalized practice, as traditional resources often do not address individual weaknesses or specific exam techniques.
- Positive Reception of AI-Driven Feedback
    - While students were initially cautious about AI-driven feedback, most were open to it after understanding its benefits, especially in providing timely feedback they cannot always get from teachers.
- Usability Concerns
    - Students highlighted the need for an intuitive interface with clear navigation, especially when submitting essays or accessing results.

4.2 Wireframes

From the insights we gathered from the user research we created the initial wireframes as follows:





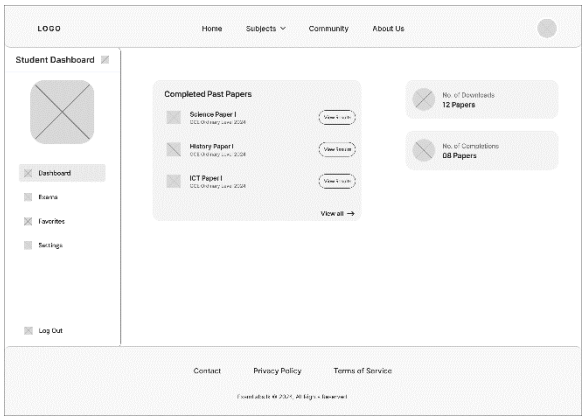


Figure 3: Sing In, Join Us and Dashboard Wireframes

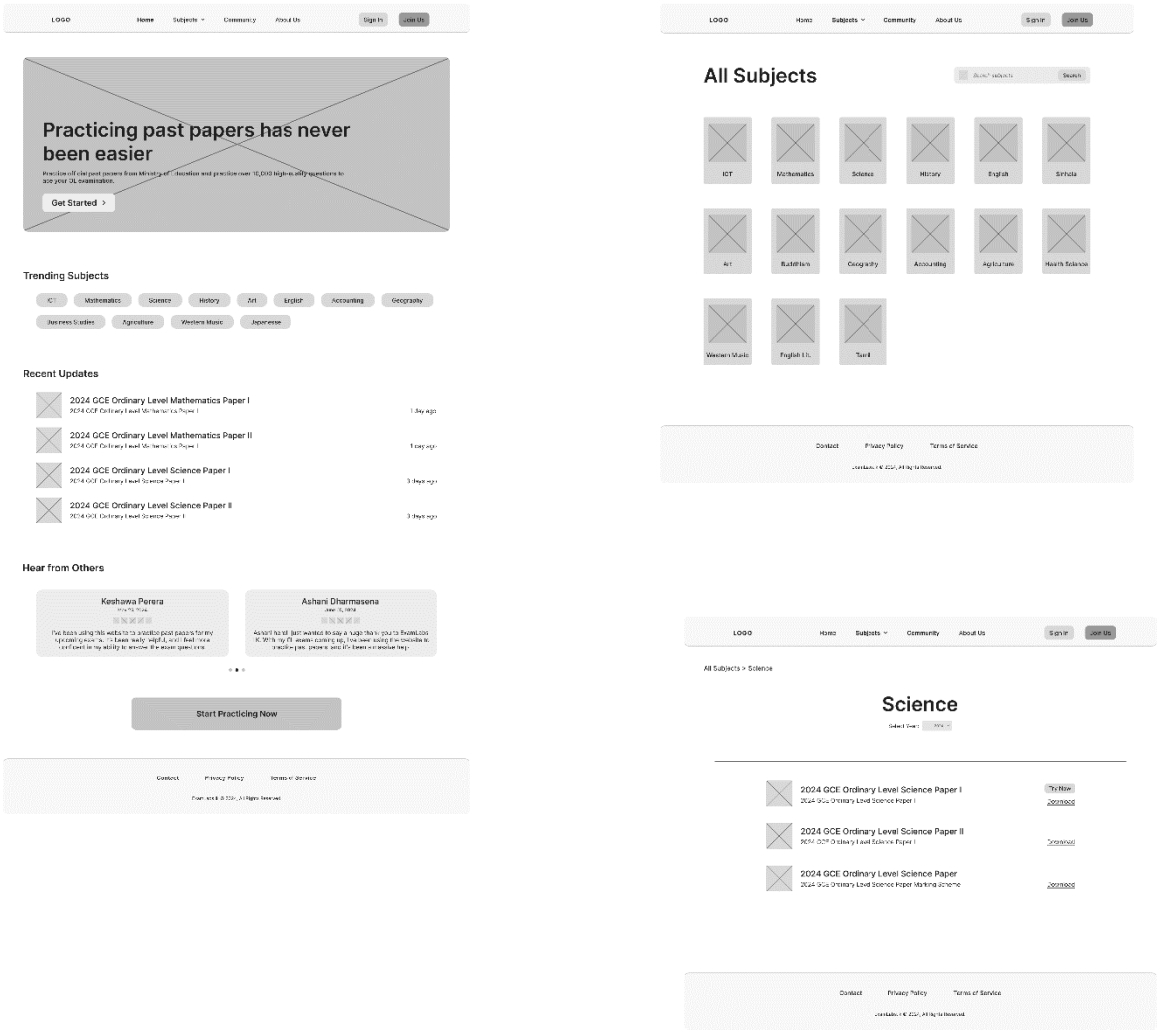


Figure 4: Home page and Subject Pages

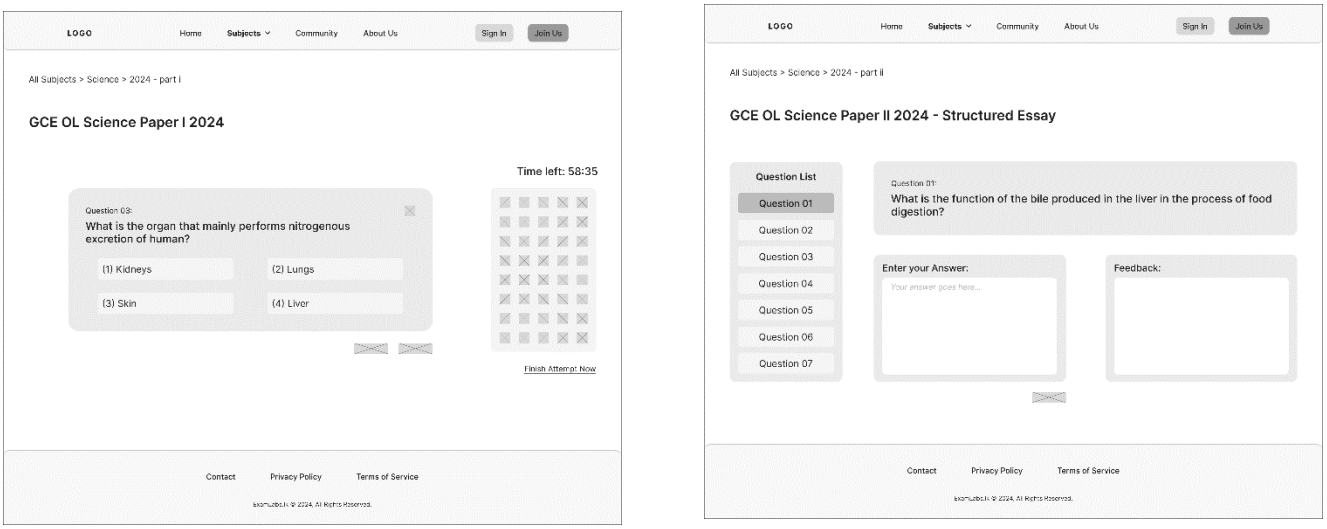


Figure 5: MCQ and Structured Question Pages

4.3 User Interface Design

After creating the wireframes, we used them as the base for our Ui design and developed the necessary Ui screens for our project.

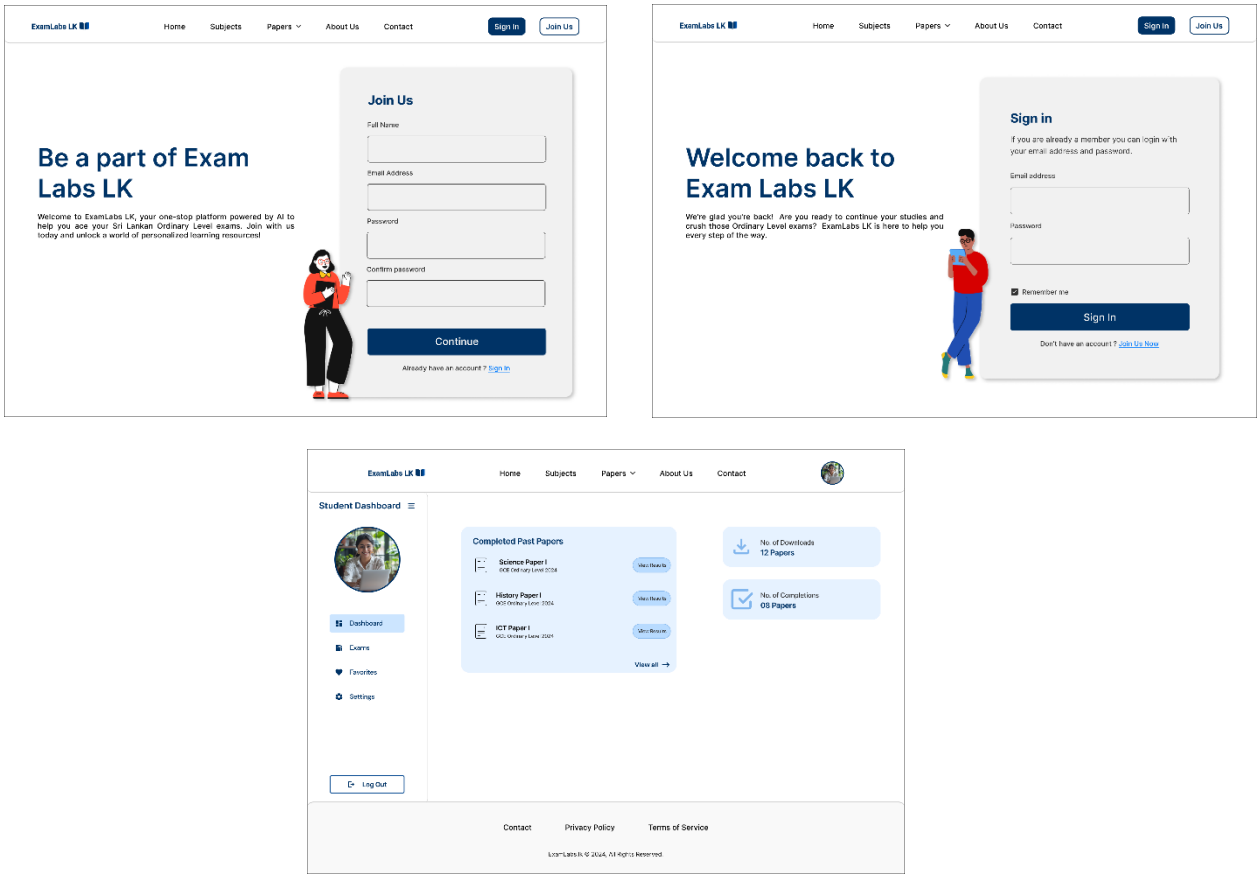
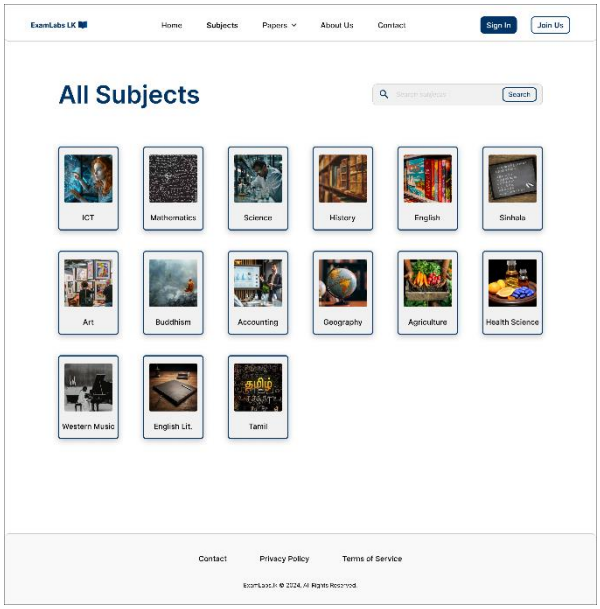


Figure 6: Sign In, Join Us and Dashboard UI Design



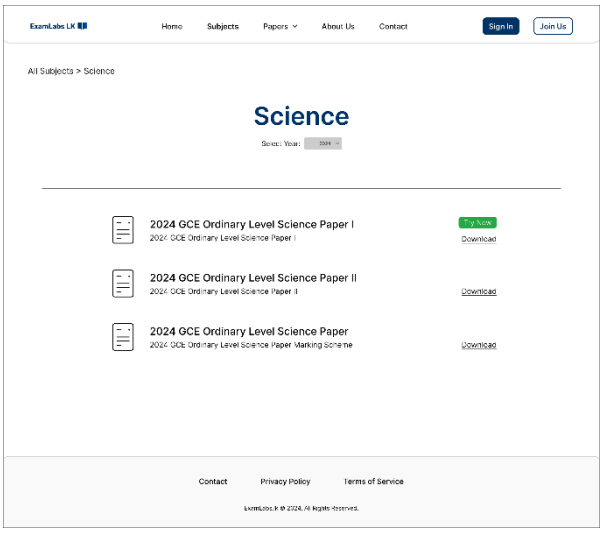
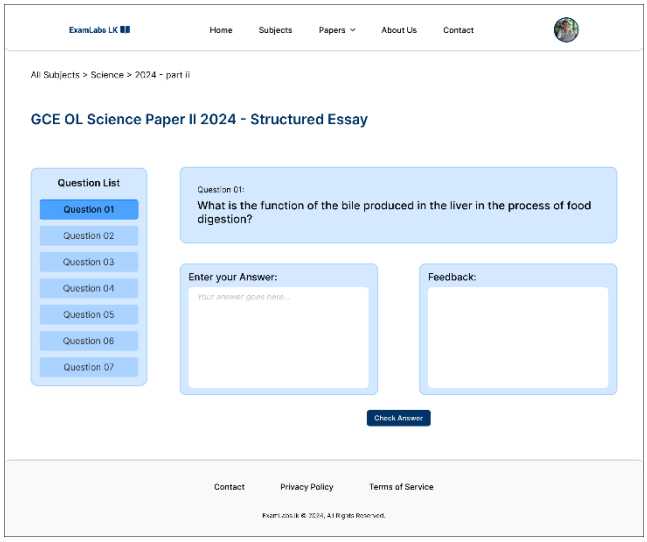


Figure 7: Subject Pages UI Design



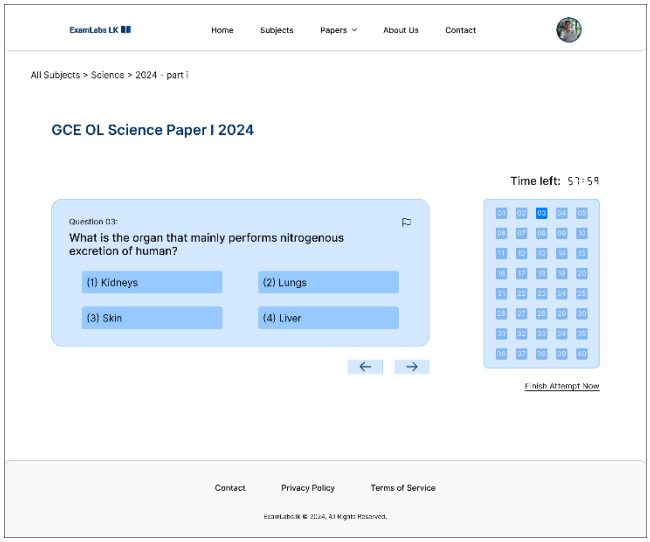


Figure 8: MCQ and Structured Question Pages UI Design

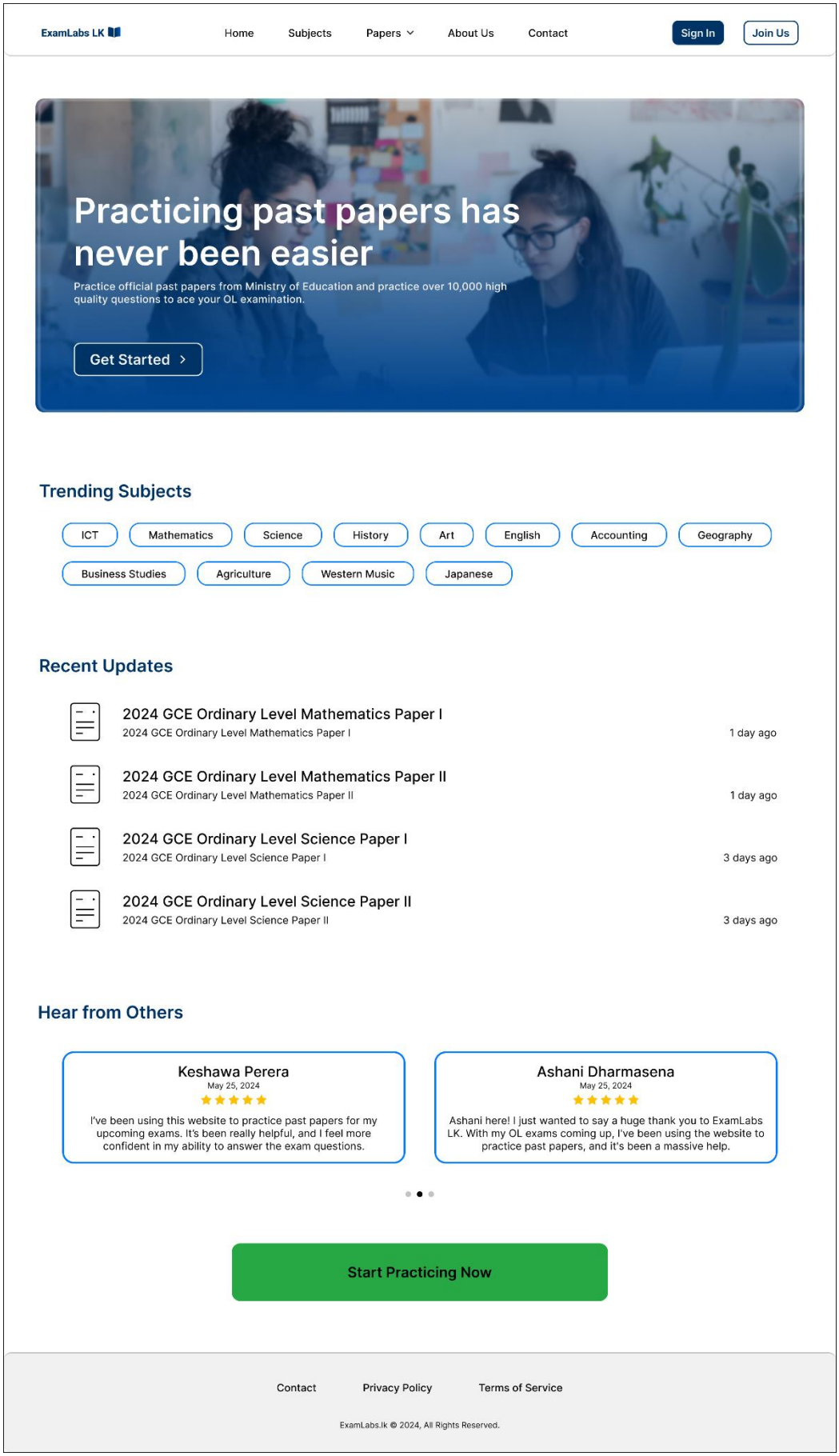


Figure 9: Home Page UI Design

4.4 Prototype

Click here to view the high-fidelity prototype.

4.5 Usability Testing

After creating the prototype, we conducted usability testing to observe user interactions with the platform's prototype to identify usability issues and areas for improvement. For the usability testing we used 5 participants who represented our target audience. The following are the tasks we assigned them to do.

- Navigate the platform.
- Download resources.
- Complete an MCQ test.

We used the following metrics to evaluate progress.

- Time on task
- Completion rate
- User satisfactory rate

From the usability testing we produced the following insights.

- Task completion rate: 80%
- Average time on task: 45 seconds
- User satisfaction rating: 4.2/5.0

Insights from Usability Testing

- High Accessibility for Downloading Resources
    - Students quickly navigated to download past papers and marking schemes, with high satisfaction in ease of access.
- Positive User Experience with MCQ Tests
    - Users found the online MCQ tests easy to navigate and complete, though some suggested clearer navigation back to the main dashboard.
- Improvement Needed in Essay Submission Flow
    - Several users struggled with submitting essays for AI feedback.

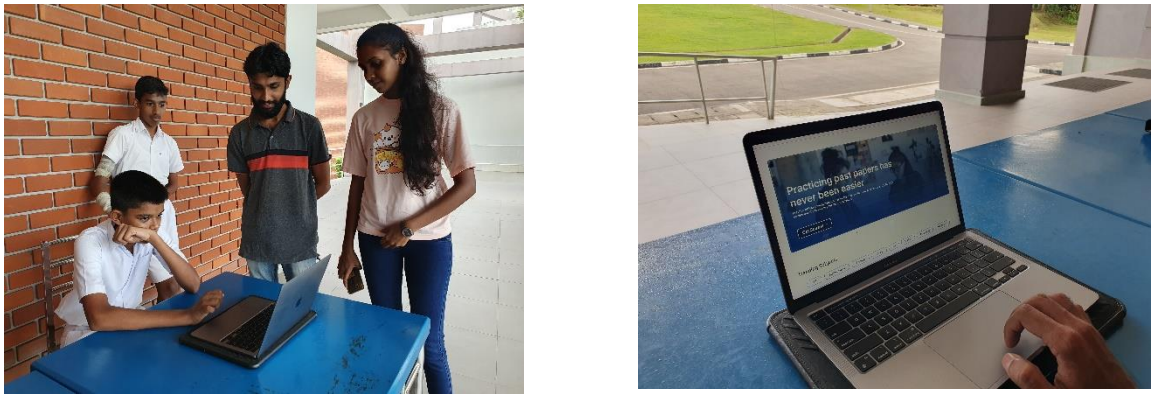


Figure 10: Conducting Usability Testing

4.6 Implementation

- Developed the user interface using React.js, HTML5, CSS3, and Bootstrap.
- Implemented the server-side logic using Node.js and Express.js.
- Integrated MongoDB for data storage.
- Implemented user authentication using Google OAuth.

5. Software Testing Process

5.1 Developer Testing

Developer testing was conducted to verify that individual components of "ExamLabs LK" functioned correctly before moving to more extensive testing stages. This phase allowed developers to address any immediate issues in real-time and ensure the initial quality of code and component interactions.

Developers performed informal tests during coding to identify and fix issues as components were being developed. Key areas of focus included:

- **Functionality**: Ensuring that each feature behaved as expected, such as the login mechanism, MCQ interactions, and resource downloads.
- **Error Handling**: Validating that the application could handle invalid inputs gracefully, with appropriate error messages.

- **Code Quality**: Ensuring clean, maintainable code to facilitate easier debugging and future updates.

Developer testing identified and resolved common issues related to user input validation, interface responsiveness, and minor bugs in the MCQ and essay submission components. This initial testing phase provided a stable foundation for unit and integration testing.

5.2 Unit Testing

By testing each component independently, the team ensured that the core functionality of each module met specified requirements before integration with other components.

Scope of Testing:

- **Frontend Components**: Tested form inputs, button functionalities, and UI components (e.g., login fields, MCQ question displays) for expected behavior.
- **Backend Logic**: Tested individual API endpoints, ensuring data retrieval (e.g., past papers and marking schemes) and user authentication processes operated correctly.

Unit testing validated that core functionalities worked independently and met the specified requirements. Any detected issues were resolved immediately, strengthening each component before integration.

5.3 Integration Testing

Integration testing ensured that modules functioned correctly when combined, verifying smooth data flow and interaction between frontend, backend, and AI components. This step was essential for identifying issues in module interactions that might not be evident in isolated unit tests. Postman was used for API testing.

Scope of Testing:

- **Frontend and Backend Integration**: Ensured that frontend components could successfully call backend APIs, such as retrieving past papers, submitting MCQ answers, and handling user authentication.

- **Backend and Database**: Verified that backend processes correctly accessed, stored, and retrieved data from MongoDB, including user data, test results, and past paper records.

Integration testing verified that modules functioned seamlessly together, with successful data exchange between components. Minor adjustments were made to ensure consistent data formatting and to optimize the speed of API responses. This testing phase confirmed that the entire system operated as intended when fully integrated.

5.4 Software Quality Assurance

The primary goal of QA testing for "ExamLabs LK" was to ensure the platform's functionalities, performance, and security met project requirements, providing a reliable and user-friendly experience for O-Level students. Comprehensive tests were conducted on key features, user interactions, and system performance to verify expected behavior under various conditions.

Key Test Cases and Results

Name	ID	Test Step	Description	Test Data	Expected Result	Actual Result
Launch Platform & Log In	EL_01	1	Go to URL (platform homepage)	URL: [localhost:5174]	Platform homepage displays successfully	Pass
		2	Enter valid user credentials	Email: student40@gmail.com	Login fields accept input	Pass
		3	Click on the "Log In" button	Password: student40	User is logged in and redirected to dashboard	Pass

View Past Paper Repository	EL_02	1	Navigate to Past Paper section	None	List of available past papers displays	Pass
Attempt MCQ Practice	EL_03	1	Select an MCQ practice paper	Subject: Geography	Selected paper loads with multiple-choice questions	Pass
		2	Submit answer for a question	Answer: Choice A	Feedback on answer (correct/incorrect) is displayed	Pass
Resource Download	EL_04	1	Download a marking scheme	File: Geography _2023.pdf	File downloads successfully	Pass
			Download a past paper	File: Geography _2023.pdf	File downloads successfully	Pass

Table 1:Test Cases and Results

QA Checklist Overview

A structured checklist guided the QA process, covering essential domains such as user accounts, exam practice, AI feedback, resource accessibility, performance, and security. Each domain was evaluated for functionality and reliability.

Domain	**Description**	**Expected Results**	**Result**
User Accounts	Login with existing user account	User can log in and access the main dashboard	Pass

	Sign up for a new account	New account is created successfully with valid email	Pass
	Logout	User successfully logs out of the session	Pass
Exam Practice	Access MCQ practice section	MCQ questions display correctly	Pass
	Submit answer in MCQ section	Feedback on answer (correct/incorrect) is displayed	Pass
Resources	View past paper pdf	List of past papers is displayed and accessible	Pass
	Download marking scheme	Selected marking scheme downloads successfully	Pass
Performance	Load dashboard after login	Dashboard loads within 3 seconds	Pass
Security	Validate data encryption	User data is encrypted during transmission and storage	Pass

Table 2: QA Checklist

Summary of Results

QA testing confirmed that all major functionalities of "ExamLabs LK" met the expected standards. User actions (e.g., logins, resource access, exam practice) were processed smoothly, Minor adjustments were recommended for improving response times and enhancing user experience.

6. Project Management

6.1 Development Methodology

- **Agile Development:** We followed the Agile methodology, allowing us to develop the system in iterative cycles. This approach provided flexibility, continuous improvement, and allowed for adaptive planning and evolutionary development.

6.2 Iterations

1st Iteration - Requirements Gathering & User Research

- Focused on collecting detailed requirements and conducting initial user research.
- Outputs: User personas, pain points, prioritized requirements.

2nd Iteration - Wireframe & Initial UI Design

- Created low-fidelity wireframes and initial UI designs.
- Conducted preliminary usability testing with early design concepts to gather feedback.
- Outputs: Wireframes, early UI elements, initial user feedback.

3rd Iteration - Frontend Development (Basic)

- Started frontend development with core screens and navigation.
- Developed the structure and layout without full functionality.
- Outputs: Clickable frontend.

4th Iteration - Backend and Database Setup

- Developed backend structure and initial database setup.
- Created APIs for core features, such as accessing past papers and user management.
- Outputs: Basic backend connected to frontend, initial data handling.

5th Iteration - AI Model Development

- Started development and testing of the AI model with a focus on the feedback system.
- Performed preliminary integration with backend for data flow.
- Outputs: Prototype of AI model, feedback loop from early testing data.

6th Iteration - Full Integration & Feature Refinement

- Integrated the AI model fully into the platform.
- Refined frontend and backend interactions based on testing feedback.
- Outputs: Fully functional, tested platform with end-to-end user interactions.

6.3 Project Management Tool and Documentation

For effective project management and thorough documentation, we used ClickUp as our primary tool. ClickUp allowed us to organize tasks, set deadlines, and track progress efficiently. We used it to manage sprints, visualize project timelines, and facilitate team collaboration through real-time updates and integrated communication features. Comprehensive documentation was maintained within ClickUp, covering requirement specifications, design documents, development notes, testing plans, and deployment guides. This structured approach ensured that our project stayed on track and all team members remained aligned, contributing to the successful delivery of our AI-assisted platform for Sri Lankan O-Level students.

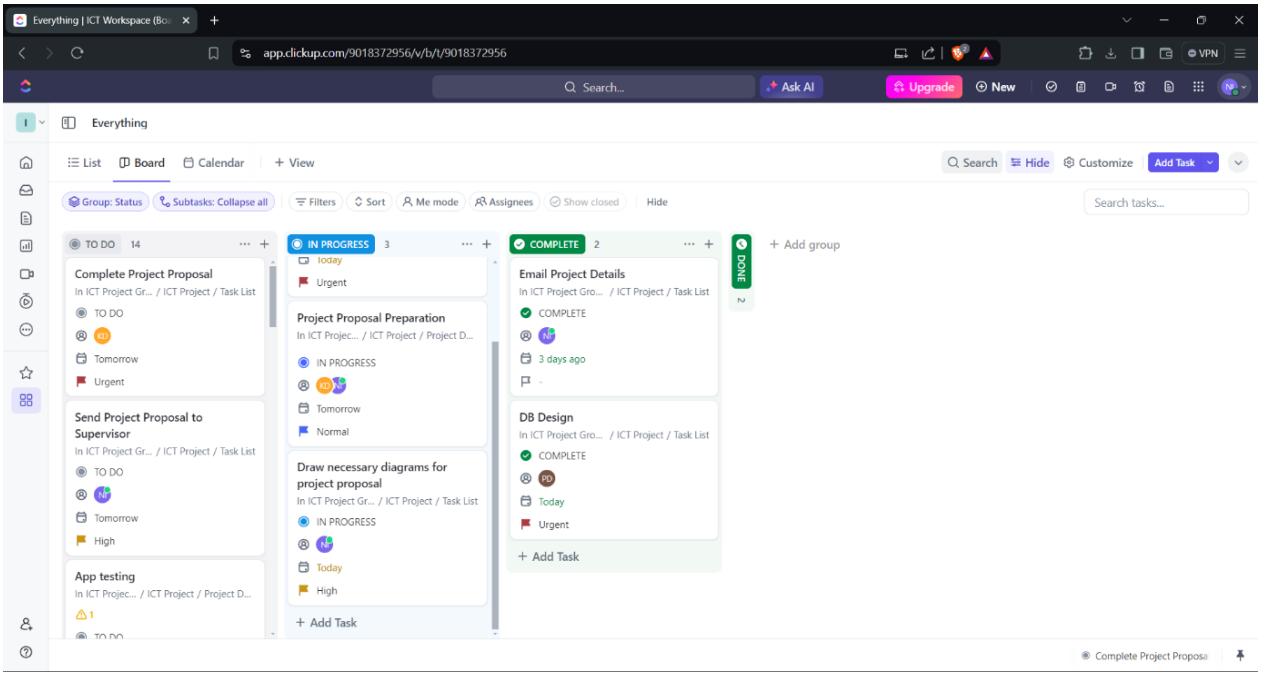


Figure 11: ClickUp Interface

7. Discussion

The development and implementation of "ExamLabs LK" highlight the transformative potential of AI-driven, accessible learning platforms in addressing critical gaps in exam preparation for Sri Lankan O-Level students. By focusing on the specific challenges that students face—such as limited access to past papers, lack of targeted feedback, and inadequate interactive learning options—this platform demonstrates how technology can bridge educational disparities and support students in achieving better academic outcomes.

One of the core strengths of "ExamLabs LK" lies in its AI-powered feedback system, which provides personalized insights and guidance on essay submissions. This feature not only simulates the benefits of one-on-one tutoring but also offers students continuous, self-paced support that adapts to their individual learning needs. The competitive analysis of existing platforms, particularly E-Thaksalawa, was instrumental in identifying key differentiators, such as the need for real-time feedback and a more engaging user interface. These insights guided our design decisions, resulting in a platform tailored specifically to the requirements of O-Level students.

7.1 Challenges Faced

The development of "ExamLabs LK" presented various challenges that required strategic solutions and collaborative problem-solving to deliver a reliable, user-centered platform.

Technical Challenges

- **AI Model Integration**
  Integrating the NLP model for AI-powered essay feedback required extensive configuration and testing to ensure feedback was both relevant and constructive. Aligning the AI model with educational standards posed a significant challenge, requiring fine-tuning to provide consistent, high-quality responses.

- **Ensuring Data Security**
  With a platform designed for young users, data privacy and security were top priorities. Implementing robust data encryption, secure API endpoints, and role-based access controls (RBAC) involved meticulous planning and testing. Balancing security with user experience was essential, especially for handling sensitive data like student information and essay submissions.

Usability Testing Challenges

- **Prototype Familiarity**
  Many student users had little to no prior experience with prototypes, making it challenging for them to navigate early versions of the platform. This unfamiliarity initially impacted their feedback quality and usability testing accuracy. The team responded by providing brief orientation sessions, allowing students to understand the prototype's purpose and features better, which ultimately helped gather more reliable feedback.

7.2 Future Work and Improvements

"ExamLabs LK" has laid a strong foundation for O-Level exam preparation, but there are opportunities for enhancement and feature expansion:

- **Mobile Application Development**
  Developing dedicated mobile applications for Android and iOS will further improve accessibility, allowing students to use "ExamLabs LK" anytime, anywhere. Mobile access will enhance engagement, especially for students who rely primarily on smartphones for learning resources.

- **Subscription-Based Model for Premium Features**
  Introducing a subscription model could help sustain platform operations while providing users with premium features, such as additional resources, more in-depth feedback, and priority support. This commercial approach could fund ongoing improvements and maintain the platform’s quality.

- **Teacher and Parent Accounts**
  Incorporating accounts for teachers and parents would expand the platform’s reach and utility. Teachers could track student progress, assign specific tasks, and provide additional support, while parents could monitor their child’s engagement and improvement over time.

7.3 Lessons Learned

The "ExamLabs LK" project offered valuable insights into balancing technical innovation with user-centered design:

- **Importance of Iterative Feedback**
  User feedback was crucial in refining features and enhancing usability. Regular feedback cycles helped the team address students' real needs, ensuring that the final platform delivered both functionality and accessibility.
- **Agile Development Benefits**
  Adopting Agile methodology allowed for flexibility and continuous improvement. Dividing development into sprints enabled rapid problem-solving and integration of user feedback, which ultimately led to a more polished, effective product.

The "ExamLabs LK" platform has established itself as a valuable educational resource for Sri Lankan O-Level students, with a foundation that supports future expansion and enhancement. By continuing to innovate and adapt based on emerging needs and technologies, the platform can further empower students in their academic journeys.

8. Appendix

In this section, we provide supplementary material that complements the main content of our project report. These appendices contain additional technical details, code snippets, and graphs to offer a comprehensive understanding of our project.

Appendix A

This appendix contains the user manual for users.

Appendix B

This appendix contains the user manual for admins.