FOSSEE Summer Fellowship Report

On

UI/UX Enhancement, Testing, and Safe Browser Integration in Yaksh Learning Platform

Submitted by

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Chapter 1

Introduction

The **National Mission on Education through Information and Communication Technology (NMEICT)**, an initiative of the Ministry of Education (MoE), Government of India, promotes the use of Information and Communication Technology (ICT) to improve the quality of education across the country. Under this initiative, several open-source educational projects have been developed to make learning resources and software freely accessible to students, educators, and institutions.

One of the major initiatives under NMEICT is the **Free/Libre and Open Source Software for Education (FOSSEE)** project at the Indian Institute of Technology (IIT) Bombay. FOSSEE encourages the adoption of Free and Open Source Software (FOSS) in academia by developing educational tools, creating learning resources, and providing internship opportunities for students to contribute to real-world software projects.

During my Summer Internship at FOSSEE, I worked on **Yaksh**, an open-source Learning Management System (LMS) and online assessment platform. My work involved enhancing the user interface, fixing reported issues, writing unit test cases using Vitest, implementing the Safe Browser feature, and integrating it with the existing Yaksh platform. This internship provided practical exposure to modern web development, testing methodologies, collaborative software development, and open-source contribution.

1.1 FOSSEE Project

The **Free/Libre and Open Source Software for Education (FOSSEE)** project is funded through the **National Mission on Education through Information and Communication Technology (NMEICT)**, Ministry of Education, Government of India, and is hosted at the **Indian Institute of Technology (IIT) Bombay**.

The primary objective of FOSSEE is to promote the adoption of Free and Open Source Software (FOSS) in educational institutions by developing open-source tools, creating educational resources, organizing workshops, and providing internship opportunities for students. Through these initiatives, FOSSEE helps students and educators gain practical experience with industry-relevant technologies while contributing to open-source software development.

1.2 Yaksh Learning Platform

Yaksh is an open-source Learning Management System (LMS) and online assessment platform developed by FOSSEE, IIT Bombay. It enables teachers to create and manage courses, organize learning modules, upload study materials, design quizzes and programming assignments, and evaluate student performance efficiently.

Students can enrol in courses, access learning resources, complete lessons, submit assignments, attempt quizzes, and track their academic progress through the platform. Yaksh supports both learning and assessment in a single integrated environment, making it suitable for educational institutions, workshops, and online training programs.

During my internship, I contributed to the Yaksh Learning Platform by improving its user interface, resolving reported issues, writing unit tests using Vitest, implementing the Safe Browser feature, and integrating secure examination functionalities into the existing system. These contributions enhanced the platform's usability, reliability, and security for both instructors and students.

Chapter 2

Internship Overview

2.1 Objectives

The primary objective of this internship was to contribute to the development and enhancement of the **Yaksh Learning Platform**, an open-source Learning Management System (LMS) developed by FOSSEE, IIT Bombay. The internship focused on improving the platform's functionality, usability, and reliability through frontend development, testing, and feature enhancement.

The main objectives of the internship were:

- To understand the architecture and workflow of the Yaksh Learning Platform.
- To enhance the user interface by improving existing components and user experience.
- To identify and resolve reported bugs in the frontend application.
- To write and maintain unit test cases using **Vitest** to improve code coverage and software quality.
- To assist in integrating the Safe Browser functionality with the existing Yaksh system.
- To gain practical experience in collaborative open-source software development using Git and GitHub.

2.2 Technologies Used

The following technologies and tools were used during the internship:

- **React.js** – Frontend development
- **Django** – Backend framework
- **JavaScript (ES6+)** – Application logic
- **HTML5** – Web page structure
- **CSS3** – Styling and responsive design
- **Vite** – Frontend build tool
- **Vitest** – Unit testing framework
- **Git** – Version control
- **GitHub** – Source code management and collaboration
- **REST APIs** – Communication between frontend and backend
- **Visual Studio Code** – Development environment

2.3 Development Environment

The Yaksh project follows a client-server architecture, where the frontend is developed using React and the backend is built using Django. The development environment was configured locally to facilitate implementation, testing, and debugging of new features.

The development workflow included:

- Cloning the Yaksh repository from GitHub.
- Setting up the frontend and backend environments.
- Running the React application using Vite.
- Running the Django development server.
- Managing source code using Git and GitHub.
- Writing and executing unit tests using Vitest.
- Testing newly implemented features and bug fixes before submitting changes for review.

This environment enabled efficient development, debugging, testing, and collaboration throughout the internship while ensuring that all implemented features met the project's quality standards.

Chapter 3

Project Work

During my Summer Internship at FOSSEE, IIT Bombay, I worked on the **Yaksh Learning Platform**, contributing to its frontend development, testing, and enhancement. My work primarily involved improving the user interface, fixing reported issues, increasing unit test coverage, enhancing the Safe Browser, and preparing it for integration with the existing Yaksh system. The following sections describe the major tasks completed during the internship.

3.1 UI Enhancement

The initial phase of the internship involved understanding the existing Yaksh interface and identifying areas that required improvement. Several user interface components were enhanced to provide a cleaner, more intuitive, and responsive experience.

The improvements included:

- Enhancing the layout and overall user experience of different pages.
- Improving the responsiveness of components across different screen sizes.
- Refining the styling of buttons, forms, and navigation elements.
- Ensuring consistency in the appearance and behavior of UI components.
- Improving accessibility and usability for both teachers and students.

These enhancements resulted in a more modern and user-friendly interface while maintaining compatibility with the existing application.

3.2 Unit Testing with Vitest

To improve the reliability of the application, unit tests were written and maintained using Vitest.

The tasks performed included:

- Setting up and configuring the Vitest testing environment.
- Writing unit tests for React components and application stores.
- Updating existing test cases to match recent code changes.
- Improving code coverage by testing different execution paths.
- Debugging and fixing failing test cases.

Testing Environment: Unit tests were executed and verified on **Windows 11** and **Ubuntu (WSL)** using **Node.js**, **npm**, and **Vitest** to ensure consistent application behavior across the development environment.

The implementation of comprehensive unit tests helped ensure that new features and bug fixes did not introduce regressions, thereby improving the overall reliability and maintainability of the application.

3.3 Bug Fixes

A significant part of the internship involved identifying, reproducing, and resolving bugs reported in the Yaksh platform.

The work included:

- Fixing UI rendering issues.
- Resolving component state management problems.
- Correcting form validation and user interaction issues.
- Debugging API-related frontend errors.
- Improving application stability through code optimization.

Each bug was thoroughly tested before submitting the changes to ensure that existing functionality remained unaffected.

3.4 Safe Browser Feature Development

The Safe Browser feature was developed and integrated into the Yaksh Learning Platform to improve the security and integrity of online examinations. The feature provides configurable proctoring settings that help instructors conduct secure online assessments while monitoring student activities during the examination.

The implemented features include:

- Camera permission verification before starting the examination.
- Microphone permission verification.
- Live webcam preview for identity verification.
- Fullscreen mode enforcement during examinations.
- Tab switching detection.
- Fullscreen exit detection.
- Multiple browser tab detection.
- Right-click restriction.
- Copy, cut, and paste restriction.

- Keyboard shortcut blocking (Developer Tools, View Source, etc.).
- Violation counter and warning mechanism.
- Face detection using Face API.
- Multiple face detection.
- Screenshot shortcut detection.

The Safe Browser feature provides a secure examination environment by restricting unauthorized browser activities and continuously monitoring student behavior throughout the examination.

3.5 Safe Browser Integration

After developing the Safe Browser feature, it was integrated into the Yaksh Learning Platform to work seamlessly with the existing quiz workflow.

The Safe Browser feature was integrated into the **Django-based Yaksh** using **Python, Django, HTML5, CSS3, JavaScript (ES6), Django Template Language (DTL), and Browser Web APIs**. The same functionality was extended to the **React-based Yaksh** using **React.js, JavaScript (ES6), Tailwind CSS, Vite, Axios, and Django REST Framework (DRF)** for seamless frontend-backend integration.

The integration involved:

- Adding configurable Safe Browser settings to the quiz configuration page for teachers.
- Extending the database schema to store quiz-specific proctoring settings.
- Updating Django APIs to save and retrieve Safe Browser configurations.
- Integrating the frontend with backend APIs to apply quiz-specific security settings.
- Implementing dynamic violation handling based on teacher-defined limits.
- Testing the complete Safe Browser workflow, including database integration, API communication, and frontend functionality.

The integration enables instructors to configure proctoring settings for each quiz while ensuring that the selected security features are automatically enforced when students attempt the examination. This provides a flexible and secure online examination environment within the Yaksh Learning Platform.

Chapter 4

Conclusion

The Summer Internship at **FOSSEE, IIT Bombay** provided me with an excellent opportunity to contribute to the development of the **Yaksh Learning Platform** while gaining practical experience in open-source software development. Throughout the internship, I worked on frontend development, testing, debugging, and enhancing secure examination features. The internship strengthened my understanding of modern web development practices and collaborative software engineering.

4.1 Work Accomplished

During the internship, the following tasks were successfully completed:

- Enhanced the user interface of the Yaksh Learning Platform.
- Fixed several reported bugs and improved application stability.
- Wrote and maintained unit test cases using **Vitest** to improve code coverage.
- Implemented the Safe Browser feature by adding camera and microphone verification, fullscreen mode, and examination security mechanisms.
- Assisted in the integration of the Safe Browser with the existing Yaksh platform.
- Collaborated with mentors and team members using Git and GitHub for version control and code reviews.

4.2 Skills Developed

The internship helped me strengthen both my technical and professional skills, including:

- Frontend development using **React.js**.
- Backend understanding with **Django**.
- JavaScript programming and debugging.
- Writing unit tests using **Vitest**.
- REST API integration.
- Version control using **Git** and **GitHub**.
- Debugging and problem-solving.
- Working in a collaborative open-source development environment.
- Effective communication and teamwork.

4.3 Future Improvements

The Yaksh Learning Platform can be further enhanced by implementing the following improvements:

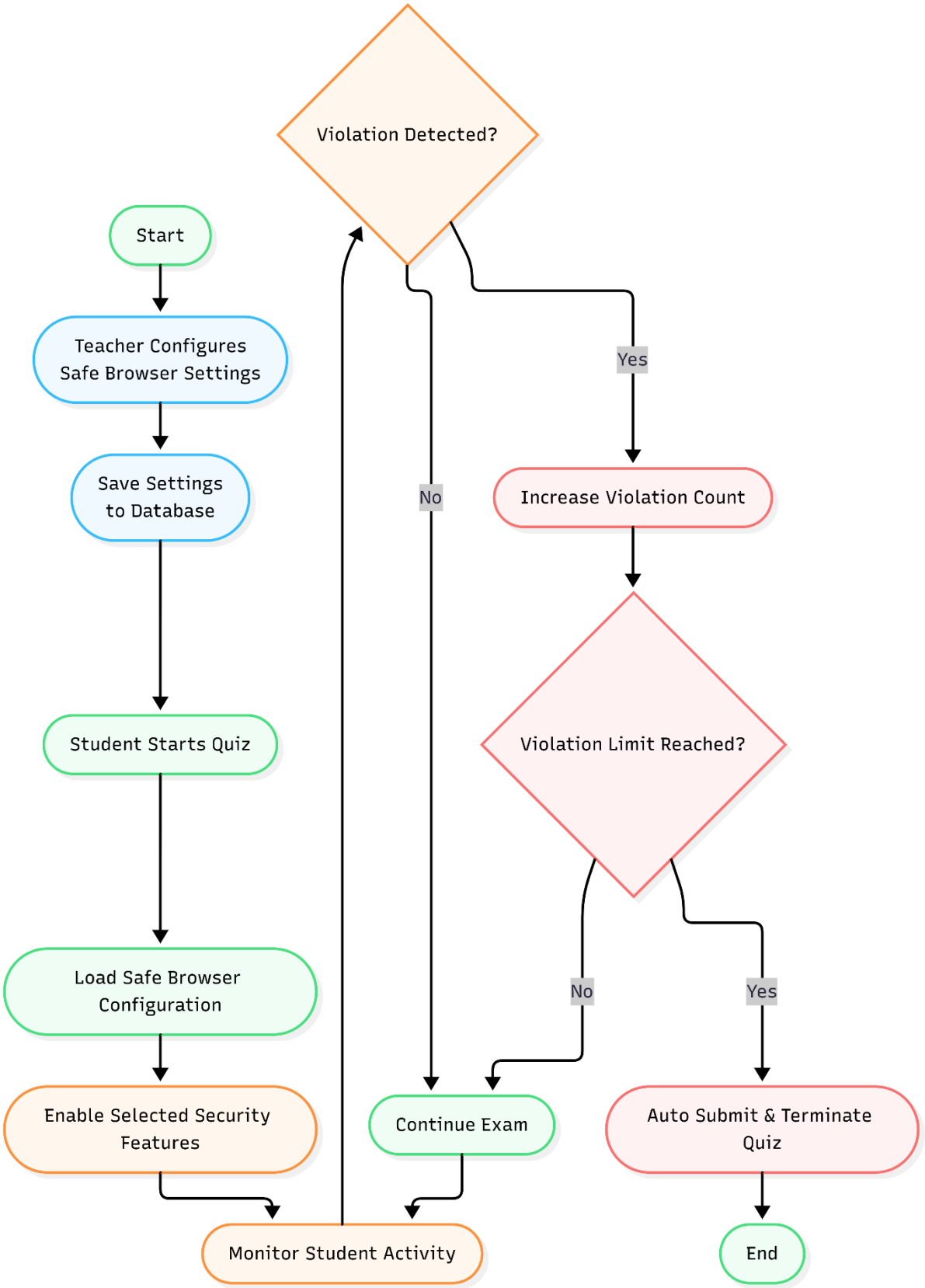
- Complete integration of the Safe Browser with all examination modules.
- Increase unit test coverage for remaining frontend components.
- Improve the user interface with additional accessibility and responsive design features.
- Enhance examination security by adding advanced proctoring capabilities.
- Optimize application performance for better scalability and user experience.
- Continue improving code quality through automated testing and continuous integration.

Appendix

A.1 Bug Fixes and Enhancements Completed

Sr. No.	Bug / Enhancement	Type	Status
1	Edit Quiz page updated to correctly display **Start Date** and **End Date**	Bug	Done
2	Upload option added for **Upload Question** type	Bug	Done
3	Module description rendered as formatted HTML during lesson creation	Missing Feature	Done
4	Module order starts from **1** and order selection improved while adding modules	Issue	Done
5	Module description rendered instead of displaying raw HTML	Missing Feature	Done
6	Course module order hidden from students	Enhancement	Done
7	Exercise name displayed as the page heading instead of the generic **"Quiz"** title	Enhancement	Done
8	Displayed a warning message and restricted submission when a quiz contains no questions	Enhancement	Done
9	Quiz score hidden from students after submission	Enhancement	Done
10	Improved continuity between course modules for a better learning experience	Missing Feature	Done

A.2 Safe Browser Implementation



The Safe Browser workflow begins when the teacher configures the required proctoring settings for a quiz, such as camera access, microphone access, fullscreen mode, tab-switch detection, and other security options. These settings are stored in the database and are loaded automatically when a student starts the quiz.

During the examination, the system continuously monitors the student's activity based on the enabled security features. If a prohibited action or security violation is detected, the system increments the violation counter. As long as the number of violations remains below the configured violation limit, the student is allowed to continue the examination. Once the violation count reaches the specified limit, the quiz is automatically terminated and submitted to maintain the integrity and fairness of the online assessment process.

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