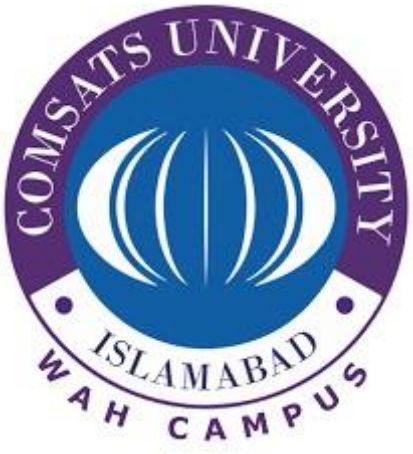

PlagProbe: The Plagiarism Schield

Software Requirement and Design Specification (SRDS)

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Contents

1 Introduction

1.1 System Introduction

PlagProbe project is a plagiarism detection system that helps students and teachers detect plagiarism in different types of assignments such as text, handwritten work, programming code and presentations. Students can login, upload their assignments and check for plagiarism. The system will provide detailed report showing any copied content and give suggestions to improve their work. Teachers can create online classes, share a link for students to join and can upload multiple assignments to check for plagiarism, even they can compare student assignments for similarity. Additionally, the system clusters students into groups based on similar content, helping teachers identify potential group plagiarism. The system also includes AI tone detection to detect tone of content whether it is harsh, formal or informal etc. An admin manages the entire platform, ensuring smooth operations and user management.

1.2 Background of the System

In recent years, the increasing access to vast digital information has made plagiarism a growing concern in both academic and professional fields. Students, researchers, and content creators have access to a wide range of resources, which has inadvertently made it easier for plagiarism—both intentional and unintentional—to proliferate. Existing plagiarism detection tools are often limited by their database size, functionality, and adaptability to emerging languages and content types. This calls for a more robust and versatile solution that not only identifies copied content but also detects paraphrasing, synonym substitution, and other advanced plagiarism techniques.

PlagProbe aims to bridge this gap by leveraging advanced Natural Language Processing (NLP) technologies and machine learning to provide a comprehensive, user-friendly, and adaptable plagiarism detection solution. By incorporating libraries such as Hugging Face's transformers, TD-IDF, Gensim, BERT, and SpaCy. **PlagProbe** is designed to deliver more accurate, efficient, and contextually aware results compared to traditional keyword-based plagiarism detectors. This system will be particularly useful in academic settings for instructors and students, as well as in corporate environments where original content creation is critical.

1.3 Objectives of the System

- **Detect and Prevent Plagiarism**: PlagProbe identifies copied content in various assignment types, supporting **academic** integrity. It provides a reliable way for students and teachers to detect Plagiarism.
- **Support Multiple Assignment Formats**: The system accommodates text, handwritten, code, and presentation formats, ensuring versatility across diverse submission types.
- **Provide AI Tone Detection**: AI tone detection identifies tone of content whether its harsh, formal or informal etc.
- **Generate Detailed Plagiarism Reports**: The system produces comprehensive reports with feedback and improvement suggestions, assisting both students and teachers.
- **Efficient User and Class Management by Admin**: Admins can manage user accounts, class enrolments, and generate insights, ensuring smooth platform operations and user satisfaction.

1.4 Significance of the System

PlagProbe addresses a growing challenge in academia and professional fields by providing a multi-format plagiarism detection system that supports educational integrity. With increased accessibility to information, plagiarism has become a persistent issue. PlagProbe empowers students and teachers with tools to identify and prevent plagiarism. PlagProbe support (text, handwritten work, code, and presentations) ensures a versatile approach to plagiarism detection, making it highly relevant for diverse educational and professional needs. By incorporating AI-driven tone detection and similarity clustering, PlagProbe helps maintain the authenticity of submissions and identifies group-based similarities, which are critical for fair evaluations. Additionally, the system's comprehensive reports, feedback features, and classroom management tools aid educators in evaluating student work effectively and efficiently.

2 Overall Description

2.1 Product Perspective

This system design consists of key actors: **Student**, **Teacher**, and **Admin**, interacting with core modules. The **User Authentication Module** manages login and registration for all users. Students can use the **Assignment Upload Module** to submit assignments, which are stored in the **Database**. Teachers and admins can access the **Plagiarism Detection Module** to analyse assignments for plagiarism. The results are generated in the **Report Generation Module**, allowing students to view their plagiarism reports and teachers to monitor submissions. The **Admin Management Module** enables admins to manage user accounts and system roles, while the **Class Management Module** supports teachers in organizing and managing classes. All modules interact with the **Database** to store and retrieve data efficiently.

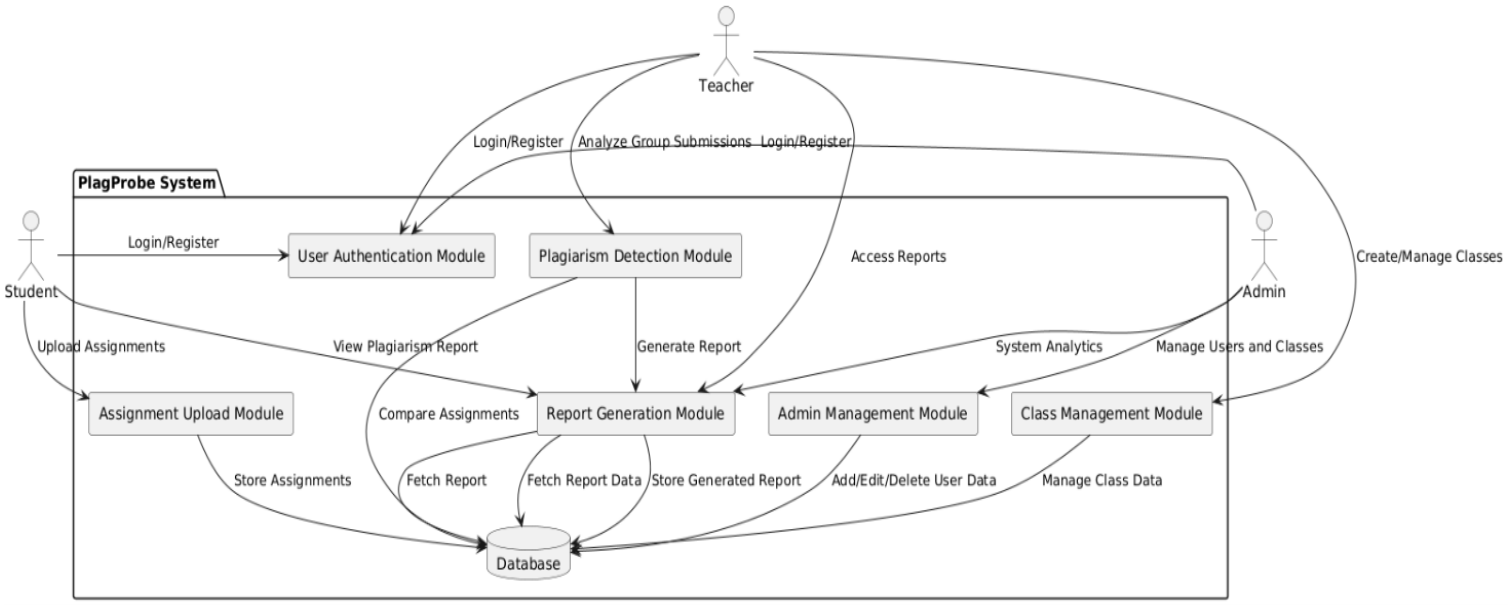


Figure 2.1: System Design

2.2 Product Scope

The scope of PlagProbe includes developing a comprehensive plagiarism detection platform tailored to meet the needs of students, teachers, and administrators in academic and professional environments. The system will support multiple formats—text, handwritten content, programming code, and presentations—providing extensive coverage across different types of assignments.
Key functionalities of PlagProbe will include user authentication, multi-format assignment uploads, and a plagiarism detection module capable of performing text-based and code-based plagiarism checks, Optical Character Recognition (OCR) for handwritten content, and AI tone detection to identify AI-generated content. Additionally, the system will support classroom management, enabling teachers to create classes, manage assignments, and group students based on content similarity to detect group plagiarism.

The system will generate detailed plagiarism reports with actionable feedback, helping students learn and improve their skills. Administrative capabilities, such as user management, analytics, and platform monitoring, will ensure smooth operations and scalability.

2.3 Product Functionality

2.3.1 User Authentication: Students and teachers can create accounts, log in, and access personalized dashboards to upload assignments and view plagiarism reports.

2.3.2 Multi-format Assignment Upload: Students can upload various types of assignments, including text documents, handwritten work (via OCR), programming code, and presentations, ensuring flexibility for diverse content formats.

2.3.3 Plagiarism Detection

- **Text Detection:** Identifies copied content in text-based assignments.
- **Code Comparison:** Compares programming code submissions for similarities.
- **Handwritten OCR**: Uses OCR technology to convert handwritten work into text for plagiarism checks.
- **Presentation Scanning**: Scans presentations to detect copied slides or content.
- **AI Tone Detection**: Detects tone of content whether it is formal, informal harsh etc.

2.3.4 Classroom Management: Teachers can create virtual classes, invite students, manage assignments, and view plagiarism reports, simplifying oversight of student submissions.

2.3.5 Plagiarism Report Generation: The system generates detailed plagiarism reports with similarity percentages, matched sources, and feedback to help students improve their work.

2.3.6 Group Clustering: Automatically groups students with similar submissions, aiding teachers in identifying potential group plagiarism.

2.3.7 Admin Management

- **User Management**: Admins can manage user accounts, including creating, editing, or deleting accounts.
- **Class Management**: Admins oversee class creation and enrolment, ensuring efficient platform use.
- **Analytics and Insights**: Provides platform trends and performance data to monitor user activity and system effectiveness.

2.4 Users and Characteristics

There are three types of users in our system.

- Students
- Teachers
- Admin

Students:

Students have the primary role of submitting their assignments and receiving insights on originality. Each student can create an account, log in, and access a personalized dashboard that allows them to upload various types of assignments—whether text-based documents, handwritten submissions, programming code, or presentations. After submission, the system processes their work and generates detailed plagiarism reports. These reports not only highlight instances of copied content but also provide feedback and suggestions for improvement, helping students refine their skills and understand academic integrity standards. The student experience in PlagProbe is cantered on fostering originality and supporting skill development by providing clear, constructive insights into their work.

Teachers:

Teachers in PlagProbe have a structured role that supports the management of classes, assignments, and students. Teachers can register and log in to a dashboard where they can create virtual classes and manage enrolments by sharing links with students. This class-based organization simplifies tracking and managing multiple student submissions. Teachers can review assignments to detect plagiarism and even compare submissions to identify similarities within a group. Additionally, the system includes a feature that automatically groups students with similar submissions, which helps teachers detect potential group-based plagiarism.

Admin:

Admins oversee the platform's overall operations, providing support for both students and teachers while ensuring the system runs smoothly. Admins manage user accounts, handling student and teacher access to the platform, and oversee class creation and enrolment, which supports teachers in organizing their virtual classrooms. The admin role in PlagProbe ensures that the platform remains secure, user-friendly, and aligned with its goal of promoting academic integrity.

2.5 Operating Environment

The PlagProbe application is a web-based platform accessible via modern web browsers. It utilizes a cloud-hosted backend, providing real-time data processing, user authentication, and scalable storage for assignment submissions. Currently, the project uses PhpMyAdmin for database management, but it is planned to shift to MySQL later for enhanced scalability and performance. This ensures fast, secure, and reliable data handling for students, teachers, and admin users.

Hardware Platform:

The PlagProbe platform is accessible on devices including desktops, laptops, tablets, and smartphones.

Minimum Requirements:

- **Processor**: Dual-core processor or equivalent.
- **RAM**: At least 2 GB for efficient operation, especially when handling multimedia files.
- **Storage**: Minimum of 50 MB of free storage space for browser cache; additional space is not required as data is stored on the cloud.

Desktop Platforms:

- **Windows:** Compatible with Windows 7 and higher.
- **macOS:** Supports macOS 10.12 (Sierra) and higher.
- **Linux:** Compatible with most distributions with recent versions of Chrome, Firefox, or Edge browsers.

Mobile Platforms:

- **Android:** Accessible via Chrome (Android 5.0 and higher).
- **iOS:** Accessible via Safari (iOS 10.0 and higher).

Browser Requirements:

- Google Chrome: Version 80 and higher.
- Mozilla Firefox: Version 78 and higher.
- Microsoft Edge: Version 80 and higher.
- Safari: Version 10.1 and higher.

Other Requirements:

- **Internet Connection:** A stable internet connection is required for real-time data processing, report generation, and accessing resources from the cloud.
- **Permissions:** The application may request permission for local storage and network connectivity for optimal functionality, enabling temporary caching of resources for faster access.

3 Specific Requirements

3.1 Functional Requirements

3.1.1 User Account Management

Requirement Number	Requirement	Description
PFR-001	User Registration	Users must be able to create a new account using email or institutional login for secure access to the PlagProbe platform.
PFR-002	User Login	Users shall log in with their registered credentials or through institution-based Single Sign-On (SSO) methods.
PFR-003	Account Recovery	Users should be able to recover their accounts through email verification or other secure methods in case of forgotten credentials.
PFR-004	Profile Management	Users should be able to update their profile information, including profile picture, bio, and role (e.g., student, teacher).

3.1.2 Assignment Submission and Processing

Requirement Number	Requirement	Description
PFR-005	Assignment Submission	Users (students and teachers) must be able to submit assignments by uploading scanned documents or images to the platform.
PFR-006	Submission Confirmation	The system should provide confirmation to users after a successful assignment submission.

3.1.3 Plagiarism Detection

Requirement Number	Requirement	Description
PFR-007	Plagiarism Detection	The system should analyse submitted assignments to detect plagiarism by comparing with a database of previous submissions.
PFR-008	Similarity Analysis	The system should highlight sections with high similarity scores and provide detailed comparison insights.

3.1.4 Student Specific Requirements

Requirement Number	Requirement	Description
PFR-009	Multi-File Upload	Students must be able to upload a minimum and maximum of two files only to compare them for similarity.

3.1.5 Teacher Specific Requirements

Requirement Number	Requirement	Description
PFR-010	Online Class Management	Teachers should create online classes and share a join link with students.
PFR-011	Bulk Assignment Upload	Teachers should upload multiple student assignments at once for batch plagiarism checks.
PFR-012	Student Comparison	Teachers must compare assignments submitted by students within a class to identify similarities.
PFR-013	Tone Analysis Insights	Teachers should view tone detection results for student assignments to assess communication quality.
PFR-014	Content Clustering	The system should group similar assignments based on content for teachers to review clustered submissions more efficiently.

3.1.6 Admin Specific Requirements

Requirement Number	Requirement	Description
PFR-015	System Monitoring	Admins must monitor platform activity, such as user registrations, assignment submissions, and plagiarism reports.
PFR-016	Database Management	Admins must oversee the database, ensuring all data is securely stored and available for analysis.
PFR-017	Class Management Oversight	Admins should oversee all teacher-created classes and manage potential conflicts or issues.
PFR-018	System Analytics	Admins should view analytics such as platform usage statistics, plagiarism trends, and student performance metrics.
PFR-019	User Support	Admins should assist users with account recovery, technical support, or other issues.
PFR-020	User Role Management	Admins should assign roles (e.g., student, teacher, admin) and permissions to users based on their responsibilities.

3.1.7 User Activity Tracking

Requirement Number	Requirement	Description
PFR-021	User Activity Logs	The platform should maintain activity logs for all user actions, such as submissions, profile updates.
PFR-022	Assignment History	Users should be able to view a history of their submitted assignments along with plagiarism report links.

3.1.8 Reporting and Feedback

Requirement Number	Requirement	Description
PFR-023	Report Generation	After analysis, the system should generate a detailed plagiarism report for each submission, highlighting potentially copied sections.
PFR-024	Feedback to Users	Users should receive feedback on the plagiarism analysis, including suggestions for reducing similarity if applicable.

3.1.9 Data and Database Management

Requirement Number	Requirement	Description
PFR-025	Database Management	The system should securely store all user submissions, reports, and user data for future analysis and reference.
PFR-026	Data Backup	The system should perform regular backups of all data to prevent loss due to technical failures.

3.1.10 Notification System

Requirement Number	Requirement	Description
PFR-027	Notification System	Users should receive notifications regarding submission status, plagiarism reports, and account-related updates.
PFR-028	Email Notifications	The system should send email notifications for important updates, such as completed reports and account recovery requests.

3.2 Behavior Requirements

3.2.1 Use Case Diagram for PlagProbe

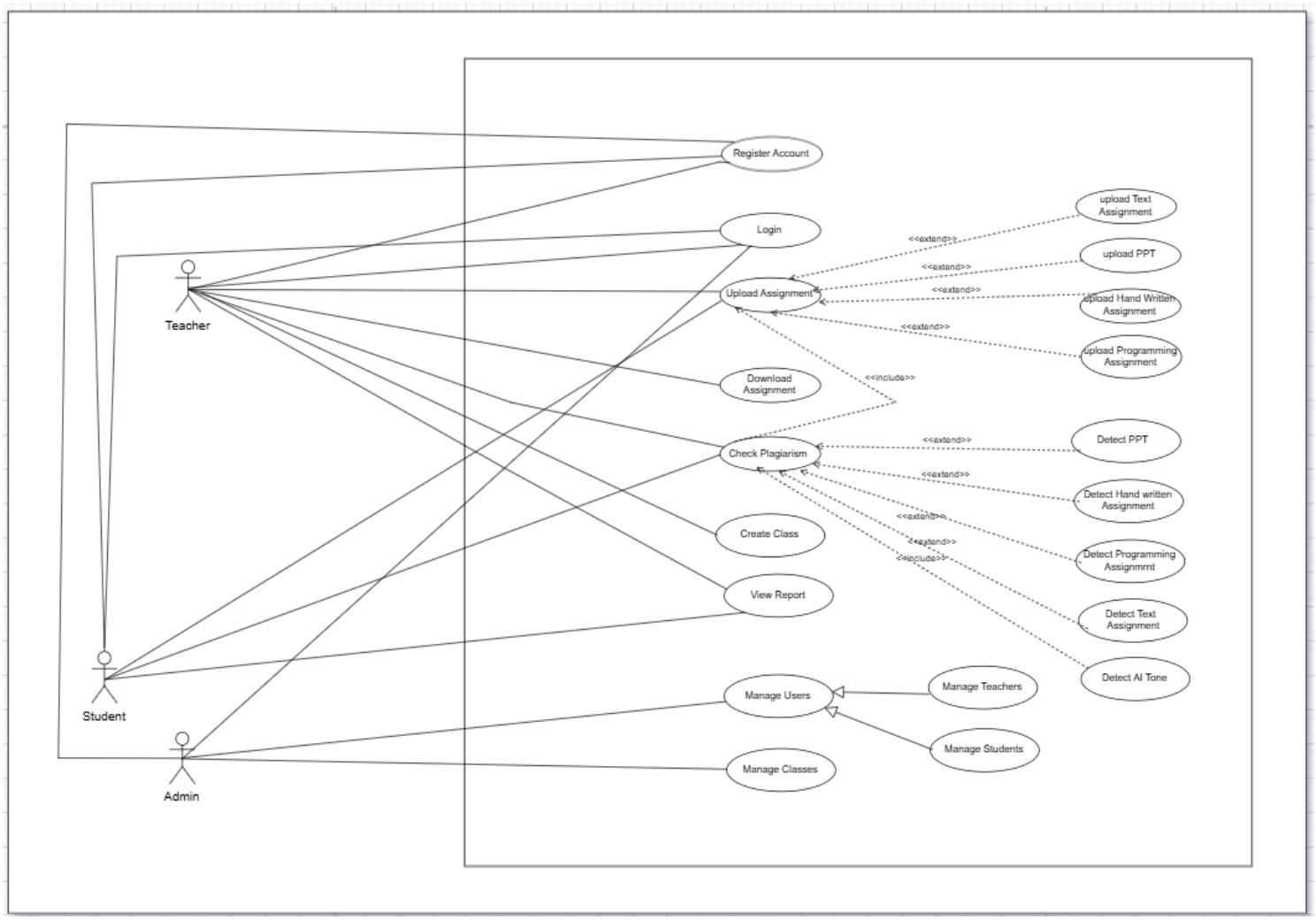


Figure 3.1: Use Case Diagram for PlagProbe

3.2.2 Use Case #1: Signup

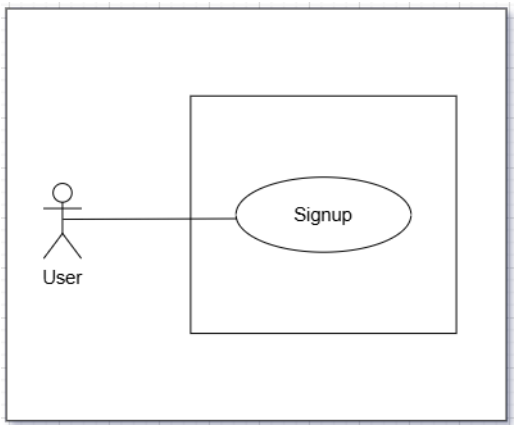


Figure 3.2: Use Case Diagram for Signup

Table 1: For Signup

Actors	User
Description	User needs to signup if they don't already have an account.
Pre-Condition	User must have an Email account.
Steps	1. Enter Name, Email and other required information. 2. Press "Signup" after filling relevant details.
Post-Condition	User will be successfully registered.

3.2.3 Use Case #2: Login

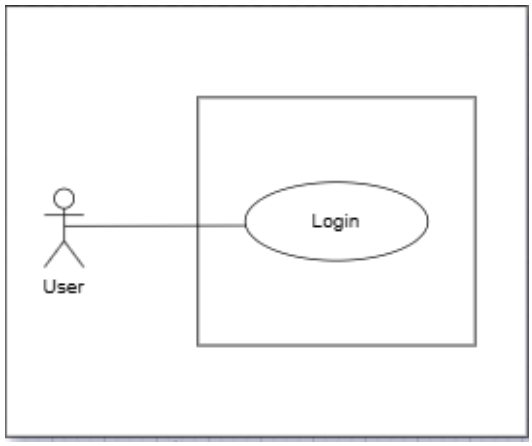


Figure 3.3: Use Case Diagram for Login

Table 2: For Login

Actors	User
Description	User needs to Login to access the features of the system to the fullest.
Pre-Condition	User wants to login his account
Steps	1. Enter Email and Password. 2. Press "Login" after filling relevant credentials.
Post-Condition	Successfully logged in.

3.2.4 Use Case #3: Logout

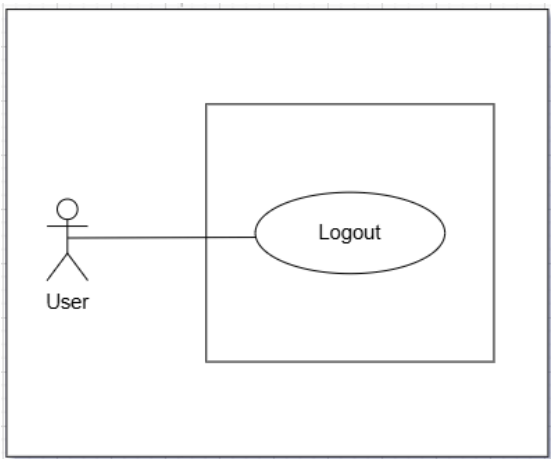


Figure 3.4: Use Case Diagram for Logout

Table 3: For Logout

Actors	User
Description	User wants to logout.
Pre-Condition	User must be logged in.
Steps	1. Navigate to profile section. 2. Press the "Logout" button.
Post-Condition	Successfully logged out.

3.2.5 Use Case #4: Manage Users

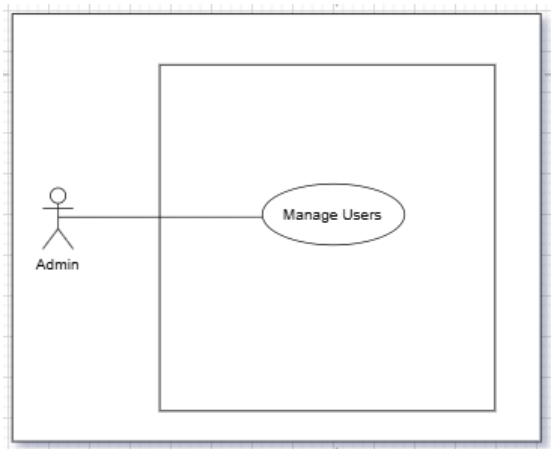


Figure 3.5: Use Case Diagram for Manage Users

Table 4: For Manage Users

Actors	Admin
Description	Admin needs to manage user accounts, including adding new users, updating roles, and deactivating accounts.
Pre-Condition	Admin is logged into the system and navigates to the "Manage Users" module..
Steps	1. Navigate to the "User Management" section from the admin dashboard. 2. Select "Add User" to create a new user account by entering details such as name, email, role (student/teacher/admin), and password. 3. For existing users, click "Edit" to update their role or other details. 4. Click "Deactivate" for users who should no longer have access. 5. Confirm actions (e.g., adding, updating, or deactivating users) in a confirmation dialog.
Post-Condition	User accounts are successfully created, updated, or deactivated, and changes are reflected in the system.

3.2.6 Use Case #5: Upload Assignment

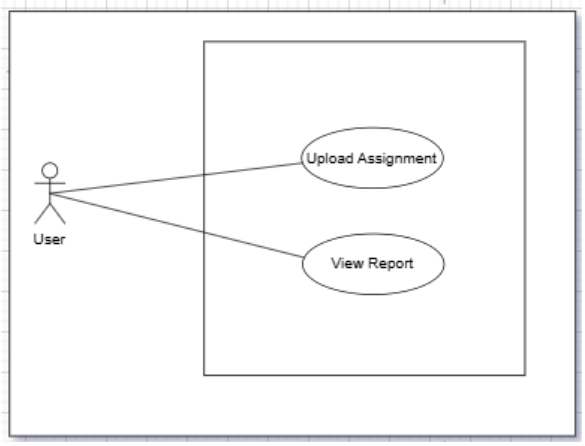


Figure 3.6: Use Case Diagram for Upload Assignment

Table 5: For Upload Assignment

Actors	User
Description	Users need to upload assignments for plagiarism detection and download plagiarism reports.
Pre-Condition	User must be logged in to the system.
Steps	1.Navigate to the "Assignment Upload" page. 2. Select "Upload Assignment" to choose the file to upload (PDF, Word, Code, etc.). 3. Click "Submit" to upload the assignment. 4. For downloading, click "Download Report".
Post-Condition	Assignment is uploaded successfully for plagiarism analysis. Plagiarism report is generated.

3.2.7 Use Case #5: Check Plagiarism

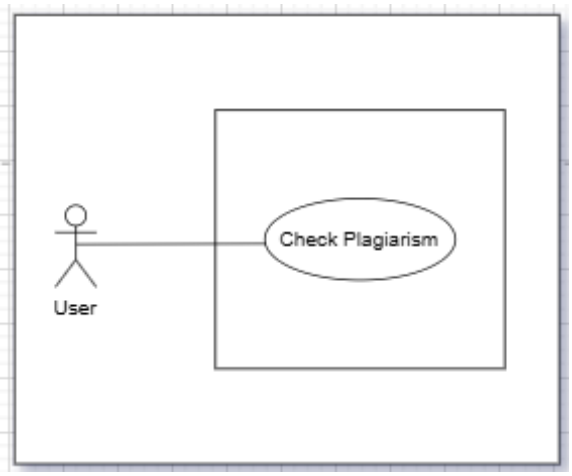


Figure 3.7: Use Case Diagram for Check Plagiarism

Table 6: For Check Plagiarism

Actors	User
Description	The system processes uploaded assignments to detect plagiarism by analysing text similarities and generating a detailed report.
Pre-Condition	Assignment has been successfully uploaded.
Steps	1. User uploads the assignment file in the "Assignment Upload" section. 2. System automatically begins the plagiarism detection process. 3. The system compares the uploaded content against internal databases and external sources. 4. Once the analysis is complete, the system generates a plagiarism report and notifies the user.
Post-Condition	A plagiarism report is successfully generated, highlighting similarities, sources, and providing a similarity score.

3.3 External Interface Requirements

3.3.1 User Interfaces

The PlagProbe web application provides an intuitive, accessible user interface designed for ease of navigation across different user roles (students, teachers, and administrators). The UI consists of several key screens, buttons, and controls that allow users to submit assignments, view reports, and manage classes. This section describes the logical characteristics of each interface, common elements, and design standards for consistency and usability.

3.3.1.1 Homepage

Features:

- Introduces PlagProbe with a clear focus on plagiarism detection for various assignment formats.
- Includes Login and Register buttons for both students and teachers for role-based access.
- Features a hero section with a headline, brief description, and a "Read More" button to explore platform features.
- Navigation bar for easy access to: Home, About Us, Products, Our Team, and Contact Us.
- Highlights platform capabilities for Text, Handwritten, Code, and Presentation Assignments through a segmented feature section.
- Contact Us section includes a contact form, email, phone number, and address for inquiries.

Standard Buttons and Functions:

- Login/Register (Students & Teachers): Allows users to sign in or create accounts.
- Read More: Redirects users to additional platform details.
- Contact Us Form: Enables users to send messages or requests for support.
- Navigation buttons for seamless access to different sections of the site.

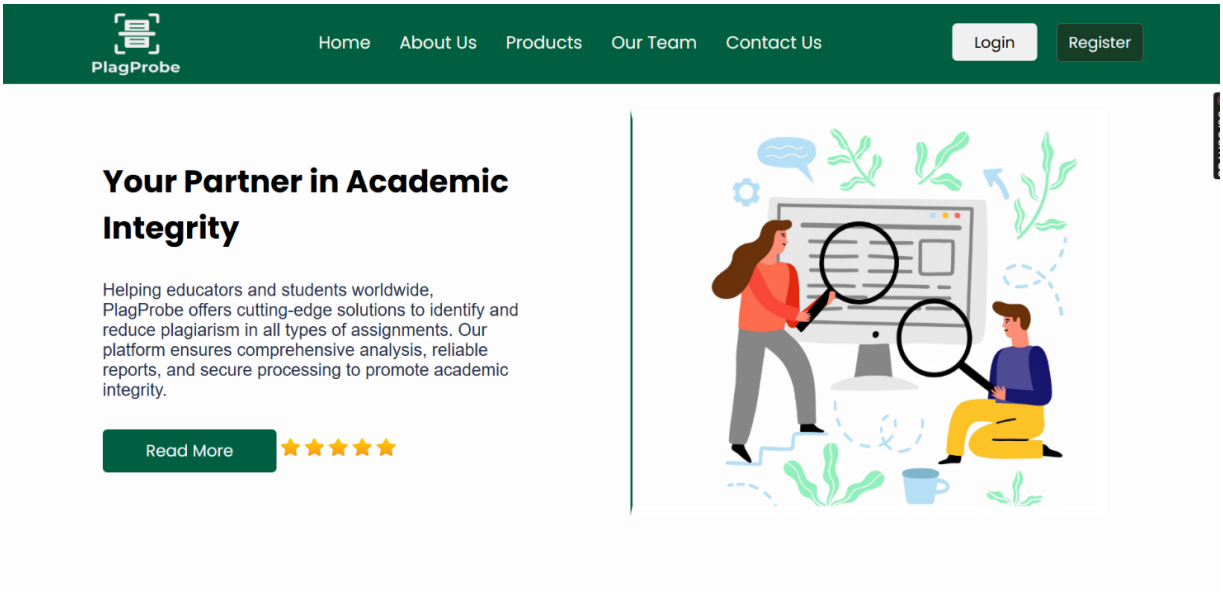


Figure 3.8: Homepage of PlagProbe

Figure 3.9: Homepage of PlagProbe

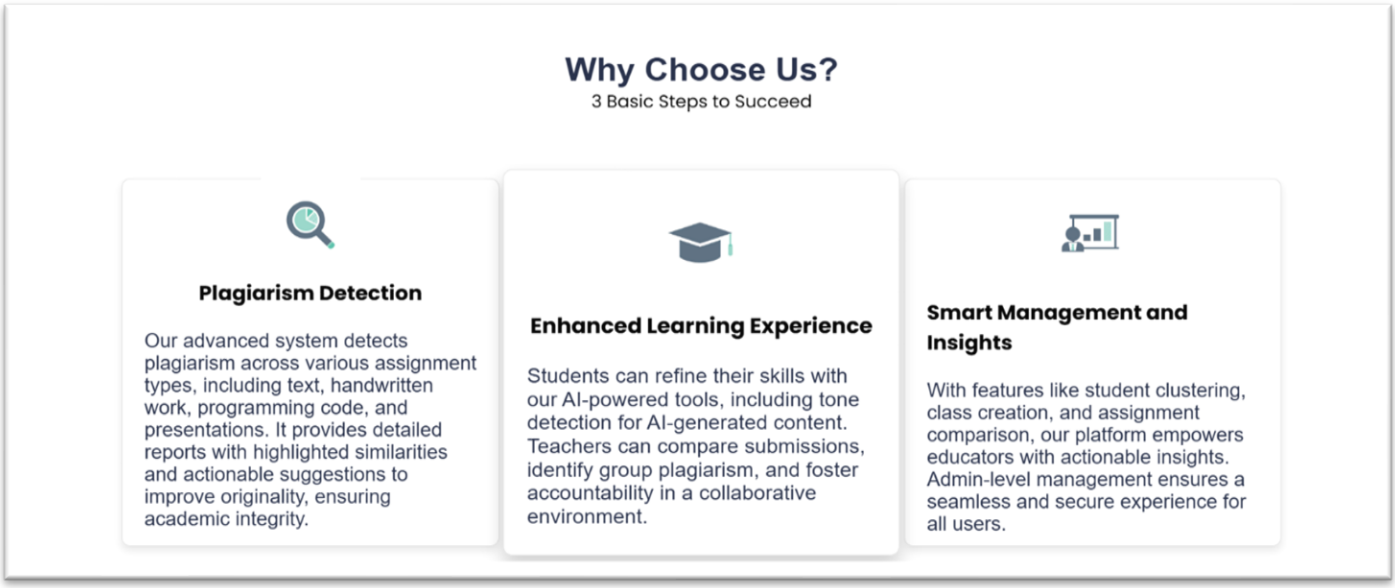


Figure 3.10: Homepage of PlagProbe

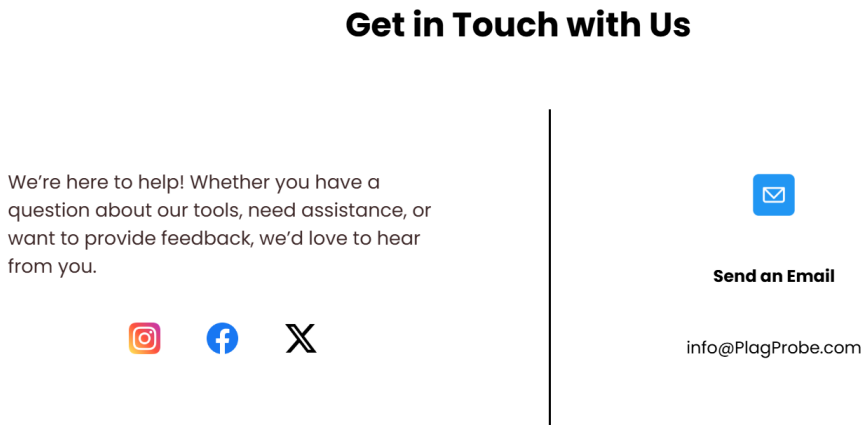


Figure 3.11: Homepage of PlagProbe

3.3.1.3 Student Login Page

Features:

- Allows students to securely log in to their accounts using their credentials.
- Contains fields for **Email** and **Password** for authentication.
- Ensures data security with encryption during the login process.
- User-friendly interface with clear labels and input validations for errors like empty fields or invalid email formats.

Standard Buttons and Functions:

- **Login Button:** Submits the entered credentials for verification.
- **Register Link:** Provides a quick option for students who do not have an account to create one.

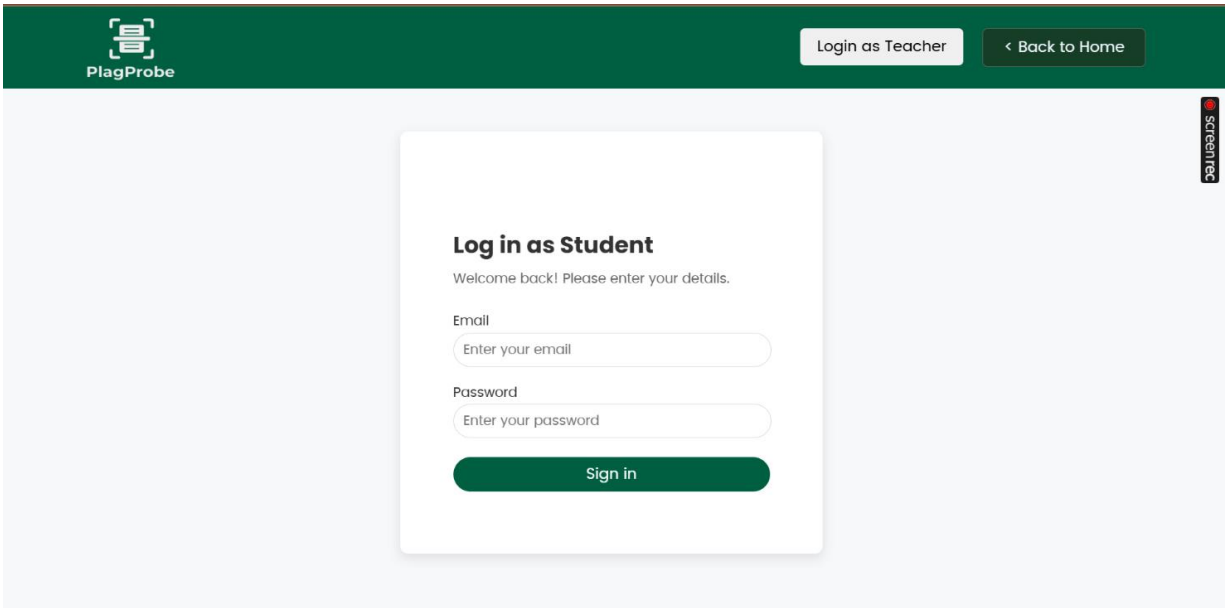


Figure 3.12: Login page as a student

3.3.1.4 Student Signup Page

Features:

- Allows new students to create an account on the platform.
- Includes input fields for **Username**, **Email**, **Password**, and **Confirm Password**.
- Ensures password validation (e.g., minimum length, special characters).
- Provides visual feedback for input errors such as invalid email format or mismatched passwords.
- Secure data submission with encryption.

Standard Buttons and Functions:

- **Signup Button:** Submits the form to create a new account.
- **Already have an account. Login:** Redirects users to the login page if they already have an account.
- Password strength indicator for user guidance.

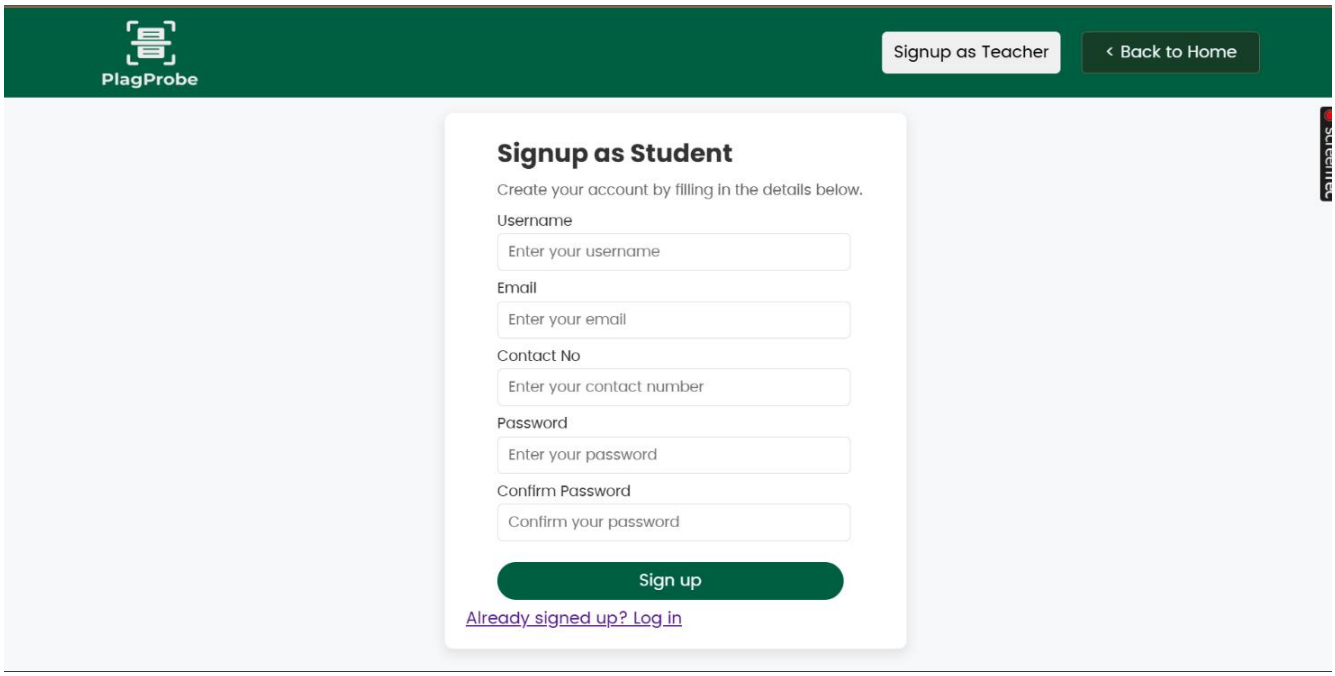


Figure 3.12: Signup page as a student

3.3.1.2 Student Panel:

- **Features:**
  - Students use this screen to upload assignments in various formats, such as text documents, scanned handwritten pages, code files, and presentations.
  - Features a drag-and-drop area and "Browse" button for selecting files to upload.
  - Displays file size and format restrictions for guidance, with a summary of uploaded files and an option to confirm submission.

Standard Buttons and Functions:

- The “Upload" button initiates the assignment submission process.
- The “Cancel" button allows users to exit the upload screen without submitting.
- A progress indicator appears during the upload to show the user’s upload status.

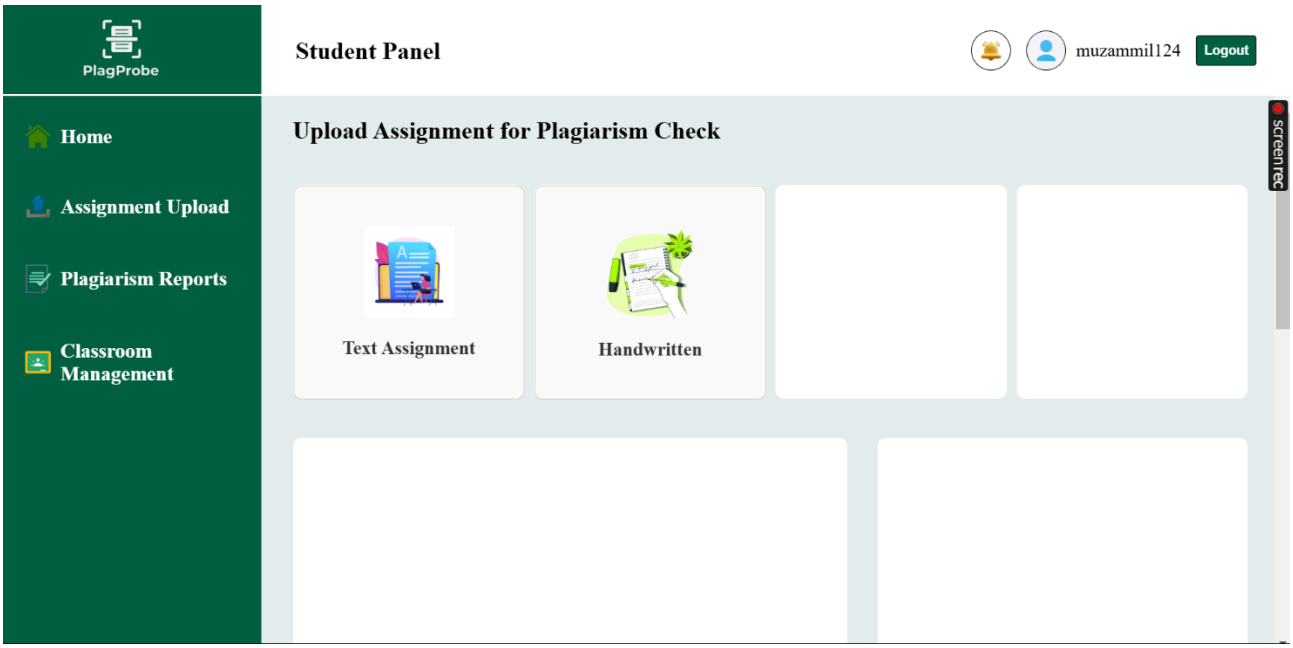


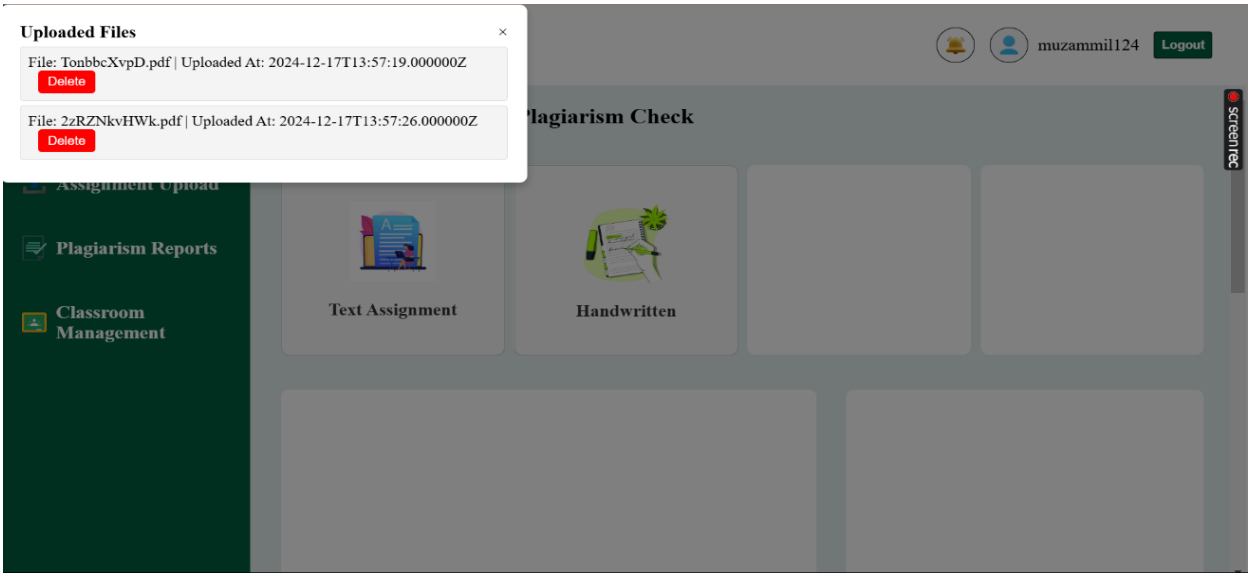
Figure 3.12: Student Panel

3.3.1.4 Plagiarism Report Screen

- **Features:**
  - After plagiarism analysis, students and teachers can access detailed plagiarism reports on this screen.
  - The report includes highlighted sections for detected similarities, similarity percentage, and suggestions for improvement.
  - Teachers can view class-specific reports and compare student submissions to identify group plagiarism.

Standard Buttons and Functions:

- The “Back" button allows users to return to the previous page.
- "Download Report" button provides an option to save the plagiarism report as a PDF.
- "Feedback" button shows suggestions for reducing similarity or improving assignment originality.



3.3.2 Hardware Interfaces

- **No extra hardware interfaces are needed**.
- The PlagProbe web application will utilize standard hardware and data communication resources.
- This includes, but is not limited to, a general network connection at the server/hosting site, network server, and network management tools for handling user requests and managing data storage securely on cloud servers. Management tools

3.3.3 Software Interfaces

The PlagProbe web application connects with several software components to function properly. This section describes the interfaces between the application and other software elements, including operating systems, databases, libraries, tools, and APIs. It also identifies key data exchanges and the purpose of each interaction.

Operating Systems

The PlagProbe application is a web-based system that supports all major operating systems capable of running modern browsers, including:

- Windows
- macOS

Browser Requirements:

- Google Chrome: Version 80 or higher.
- Mozilla Firefox: Version 78 or higher.
- Microsoft Edge: Version 80 or higher.

Communication with OS:

- The application relies on the operating system's networking stack and web browser for tasks like file uploads, data caching, and secure communication.

Database and Backend Services

- **MySQL Database:** Used for storing and managing user data, assignment submissions, plagiarism reports, and system configurations. The database ensures structured and secure data storage with relational schema.
- **Data Tables:**
  - **Users Table**: Stores information about students, teachers, and admins, including authentication credentials.
  - **Assignments Table:** Manages uploaded assignments with metadata such as file type, submission time, and related user ID.
  - **Reports Table:** Holds detailed plagiarism analysis results for each assignment.
  - **Classes Table:** Tracks virtual classes created by teachers and their associated students.

- **Database Operations**:
  - **CRUD operations (Create, Read, Update, Delete) for managing data.**
  - **Relational queries for generating** plagiarism reports and cross-referencing submissions.

- **Data Sharing:**
  - Data exchanged between the application and the MySQL database occurs over secure communication protocols (e.g., SSL/TLS).

Libraries and Plugins:

- **OCR and Text Processing Libraries:**
  - Tesseract.js: Used for Optical Character Recognition to process handwritten submissions.
  - NLP Libraries (Natural Language Toolkit or SpaCy): For text similarity detection and content analysis.

- **External Libraries:**
  - Chart.js: For visualizing data in reports and dashboards.
  - bcrypt: For secure password hashing and authentication processes.
  - jsonwebtoken (JWT): For managing user sessions securely.

3.3.4 Communications Interfaces

The PlagProbe web application requires robust communication interfaces to support various functions, including user interactions, assignment uploads, plagiarism report generation, and real-time notifications. This section outlines the major communication standards used by the application, along with security and encryption considerations.

Communication Functions

- **Assignment Uploads:** Students upload various file types (text, images, code, presentations) to the server for plagiarism detection.
- **Report Generation and Viewing:** Teachers and students can access detailed plagiarism reports, which are dynamically generated and securely delivered.
- **User Account Management:** Includes user authentication, role-based access control, and profile updates.
- **Administrative Operations:** Admins manage users, classes, and monitor platform usage through secure interface.

Communication Standards:

- **HTTP/HTTPS:** The application uses HTTPS for all communication between the user's browser and the server.
- **HTTPS** ensures data encryption during transmission, protecting sensitive user information such as assignment files, reports, and credentials.
- **WebSocket Communication:** WebSocket is used for real-time updates, such as notifying users when plagiarism reports are ready or when system updates occur.
- **Email Communication:** The system sends email notifications for account-related activities, such as password recovery, assignment submission confirmations, and plagiarism report availability.
-

Security and Encryption:

- **Data Encryption:** All data transmitted between users and the server is encrypted using SSL/TLS protocols to ensure the confidentiality and integrity of sensitive information.
- Sensitive files, such as assignments and reports, are further encrypted before storage in the database.
- **Secure Communication**: The application follows best practices for secure communication, using role-based access controls to ensure that only authorized users can access specific data or features.
- API keys and tokens (JWT) are used for secure session management and user authentication.

Data Transfer and Synchronization

- The application ensures real-time updates for plagiarism analysis status and report availability, allowing users to access their results without delays.
- Teachers can see updates in class submissions and student activity immediately.

- **Data Transfer Rates:** The system is optimized to handle typical data transfer rates efficiently, ensuring smooth uploads of assignments and downloads of reports, even for large files.
- Performance testing ensures minimal latency during high-traffic periods, such as exam submission deadlines.

The communication interfaces in the **PlagProbe** web application are designed to ensure secure, reliable, and efficient data exchange, enabling seamless user interaction while maintaining high security and performance standards.

4 Other Non-functional Requirements

4.1 Performance Requirements

Performance requirements define the expected responsiveness, reliability, and resource utilization for the PlagProbe Web Application. These requirements ensure that the app provides a smooth user experience and meets the performance expectations of users under various circumstances. The following outlines key performance metrics and specific requirements.

4.1.1 General Performance

- **Response Time**: Most user interactions, such as navigating between screens or uploading assignments, should complete within **2 seconds** under normal conditions.
- **Startup Time**: The application should fully load and be ready for use within **5 seconds** on supported devices, assuming a stable network connection.
- **Network Latency**: Data requests to and from the backend (currently PhpMyAdmin, planned MySQL) should be processed within **300ms** on average in normal conditions.

4.1.2 Data Synchronization

- **Real-time Data Updates**: user profiles, and reviews should synchronize across devices presently.
- **Offline Capability**: The application should support basic functionality in offline mode, with data synchronization occurring when a network connection is re-established.

4.1.3 Server Performance

- **Backend Response Time**: Requests to the Firebase backend, such as user authentication or assignment upload, should complete within few seconds.
- **Scalability**: The system should be capable of handling increased loads, such as a sudden influx of users or a huge assignment upload, without significant performance degradation.

4.1.4 Resource Utilization

- **Memory Usage:** The application should use system resources efficiently, with memory usage remaining within reasonable limits to prevent slowdowns or crashes.

4.1.5 Error Handling and Recovery

- **Error Recovery:** The application should be able to recover from errors or unexpected conditions quickly, with minimal disruption to the user experience.
- **Error Response Time:** Errors, such as network outages or server issues, should be detected and reported to users instantaneously.

4.2 Safety and Security Requirements

Safety and security requirements address potential risks, threats, and harms that could result from using the PlagProbe application. These requirements ensure user data protection, privacy, and compliance with relevant safety and security standards A key safety concern involves the possibility of authors uploading assignments with incorrect titles or misleading information, which can affect user trust and content quality. This section outlines the necessary actions to mitigate such risks.

4.2.1 Safety Requirements:

- **Data Protection**: All user data, including personal information and communication content, must be protected against unauthorized access, loss, or damage.

- **Error Handling and Recovery**: The application should have mechanisms in place to recover from errors or unexpected conditions without causing harm to users or data loss.

4.2.2 Security Requirements:

- **User Authentication**: The application must implement secure user authentication mechanisms, such as email verification, password protection, or single sign-on (SSO), to prevent unauthorized access.

- **Access Control**: The application should have robust access control measures, ensuring that users have access only to authorized functions and data.

4.2.3 Safeguard of content accuracy:

- **Content Verification:** Implement mechanisms to verify the accuracy of assignment titles and associated content before it is checking plagiarism. This can include automated checks or manual review by moderators to ensure that the assignments title matches its content.
- **Author Guidelines:** Provide clear guidelines for authors on proper content submission, specifying the importance of accurate titles, genre categorization, and relevant information.
- **Reporting Mechanism:** Allow users to report content that appears to be mislabelled or inaccurate, providing a process for review and correction

These safety and security requirements help ensure that the PlagProbe application provides a safe and secure environment for users. By implementing these measures, the application can mitigate risks and comply with relevant safety and security standards.

5 Design Description

5.1 Composite Viewpoint

5.1.1 Package Diagram (Logical)

The package diagram for **PlagProbe** illustrates the modular architecture of the system, showcasing the interaction and responsibilities of its key components. Users (students, teachers, and admins) interact with the **User Authentication** package for logging in or registering. Assignments are uploaded through the **Assignment Upload** package, which handles various types of submissions like text, handwritten, programming, and presentations. These assignments are processed by the **Plagiarism Detection Module**, which includes specialized detection tools (text, code, AI tone, and OCR analysis).

The system also incorporates **Classroom Management** for organizing students and assignments, **Admin Management** for managing users and system analytics, and **Detailed Plagiarism Reports** for providing users with feedback and improvement suggestions. The **Group Clustering** feature groups assignments by similarity for easier analysis. All modules are connected through a central database, ensuring smooth data storage and retrieval across the application. This package-level overview highlights the clear separation of concerns and modular design for scalability and efficiency.

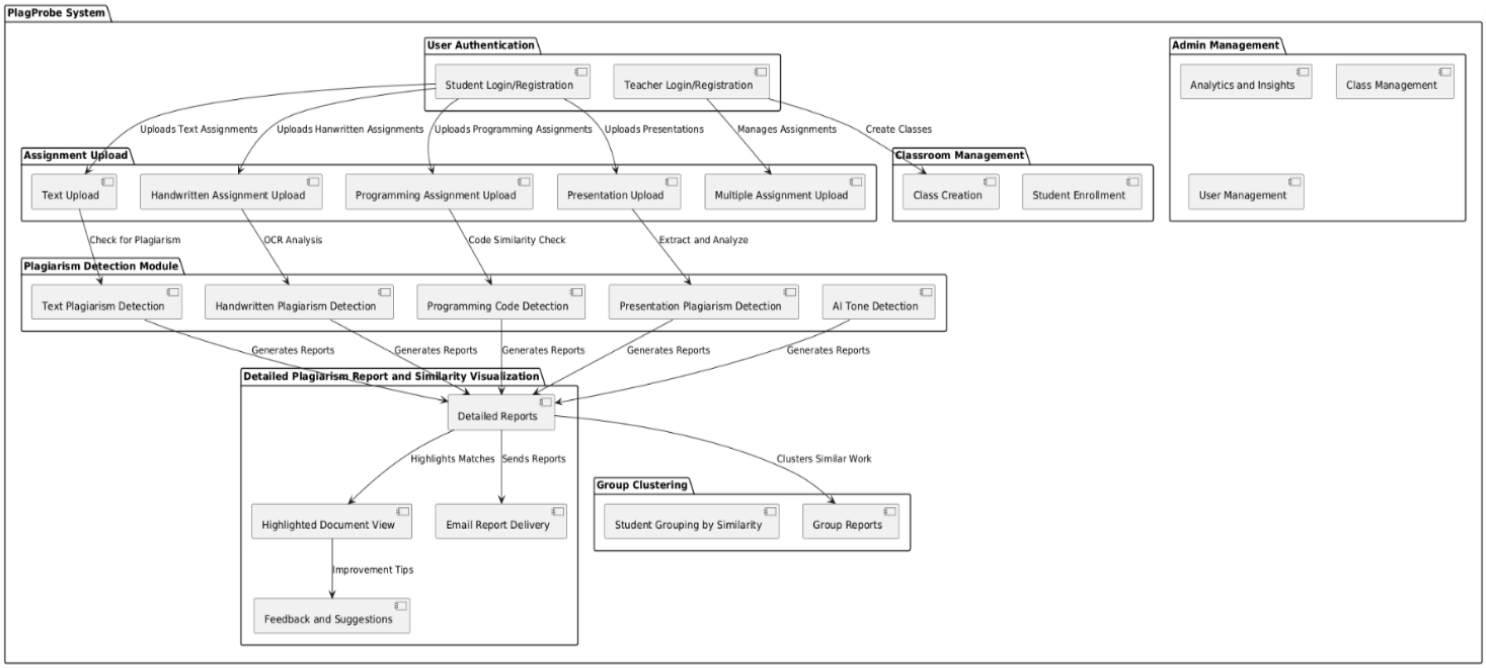


Figure 5.1: Package Diagram of the system

5.1.2 Deployment Diagram (Physical)

The deployment diagram of **PlagProbe** illustrates the structure of the web application, showcasing how its modules, such as the user interface, server-side processing, and database, are deployed and interact with each other.

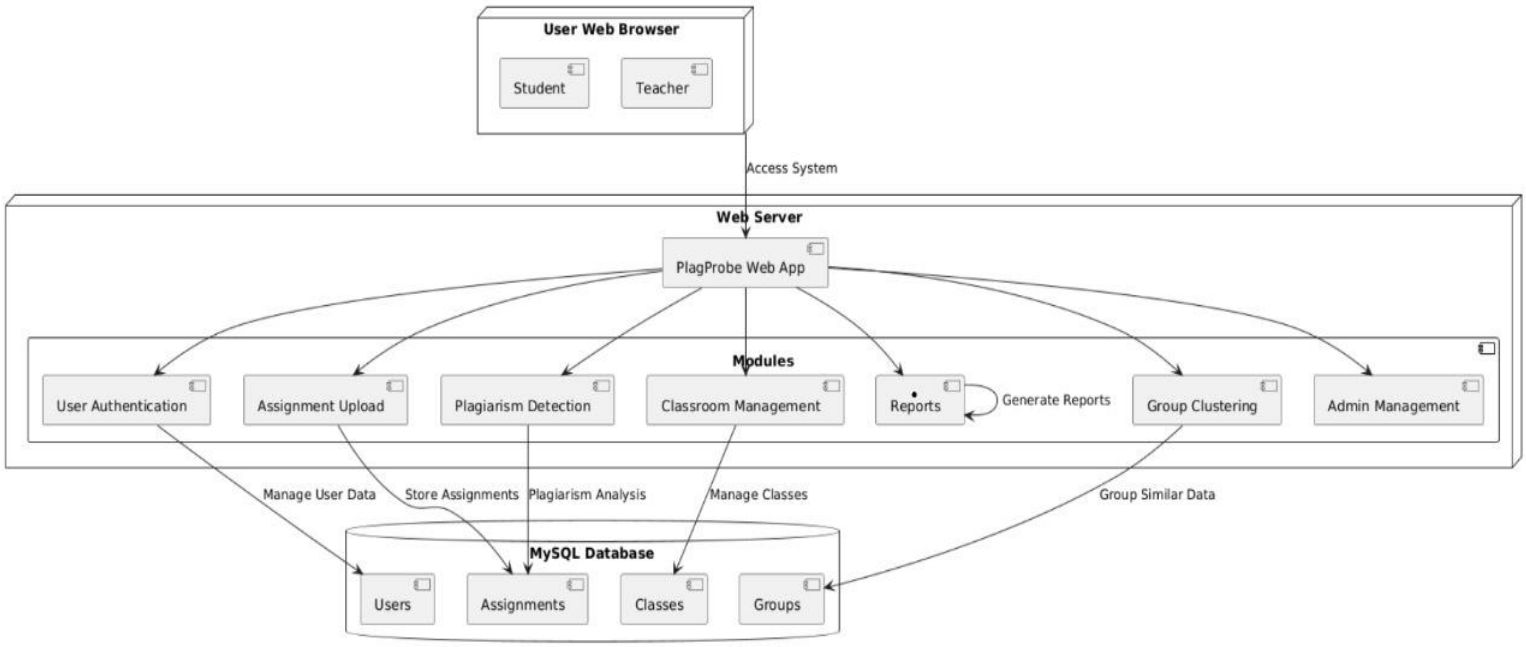


Figure 5.2: Deployment Diagram of the system

5.2 Logical Viewpoint

The logical viewpoint offers a structural look of the system. The Class diagram is used here to showcase the classes and their interaction with each other representing the structure of the system.

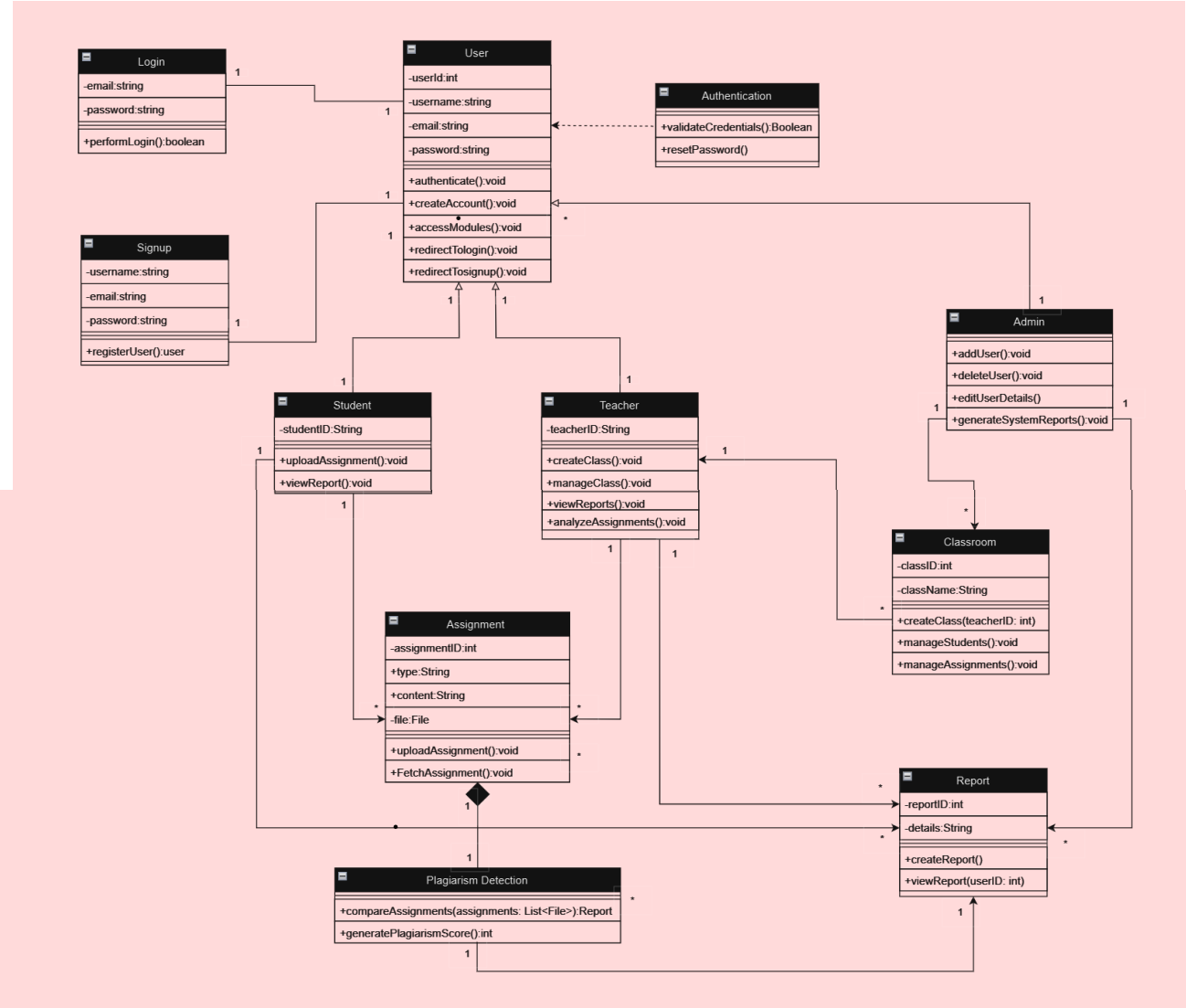


Figure 5.3: Class Diagram of the system

5.3 Information Viewpoint

Informational viewpoint of the system is represented using Entity Relation Diagram. Here the ERD showcases different entities of PlagProbe, their main attributes and relations with each other.

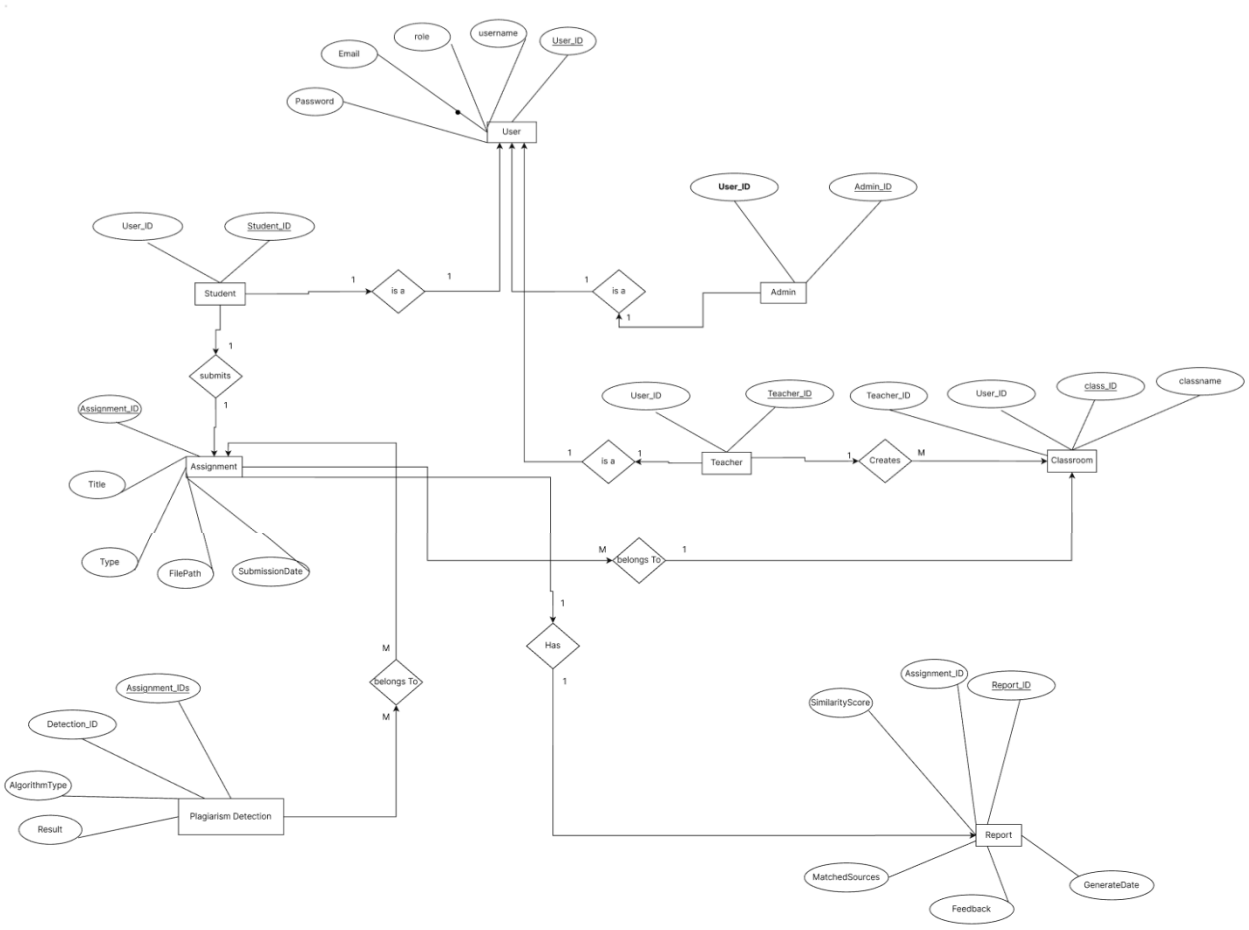


Figure 5.4: ERD Diagram of the system

5.4 Interaction Viewpoint

Interaction viewpoint displays a dynamic aspect of the system. It shows how entities interact with each other leading to step-by-step action. Following are the Sequence diagrams for the implemented modules, encapsulating interactions between different entities.

5.4.1 Sequence Diagram for Signup Module

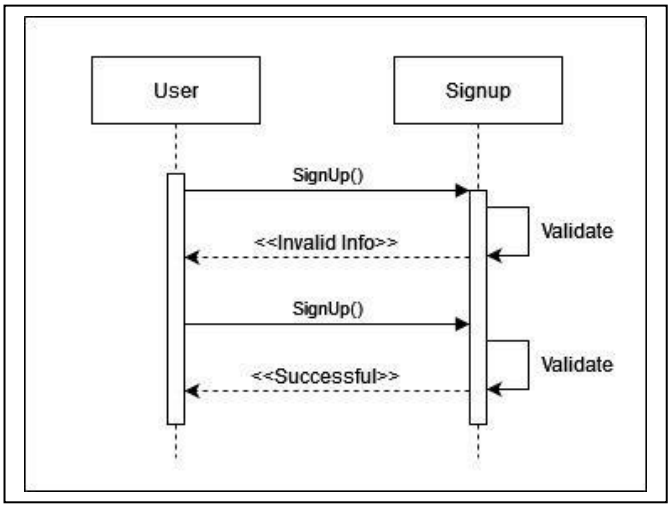


Figure 5.5.1: Sequence Diagram of Signup Module

5.4.2 Sequence Diagram for Login Module

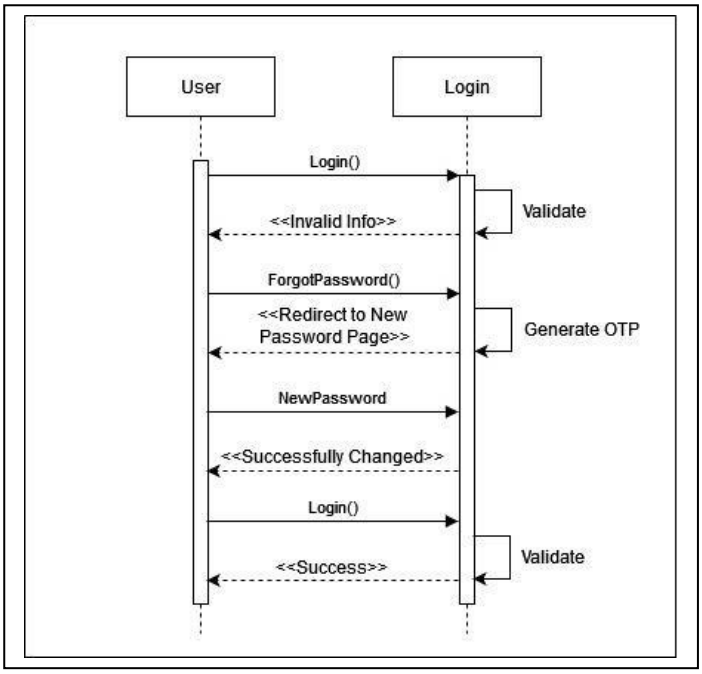


Figure 5.5.2: Sequence Diagram of Login Module

5.4.3 Sequence Diagram for Manage Users

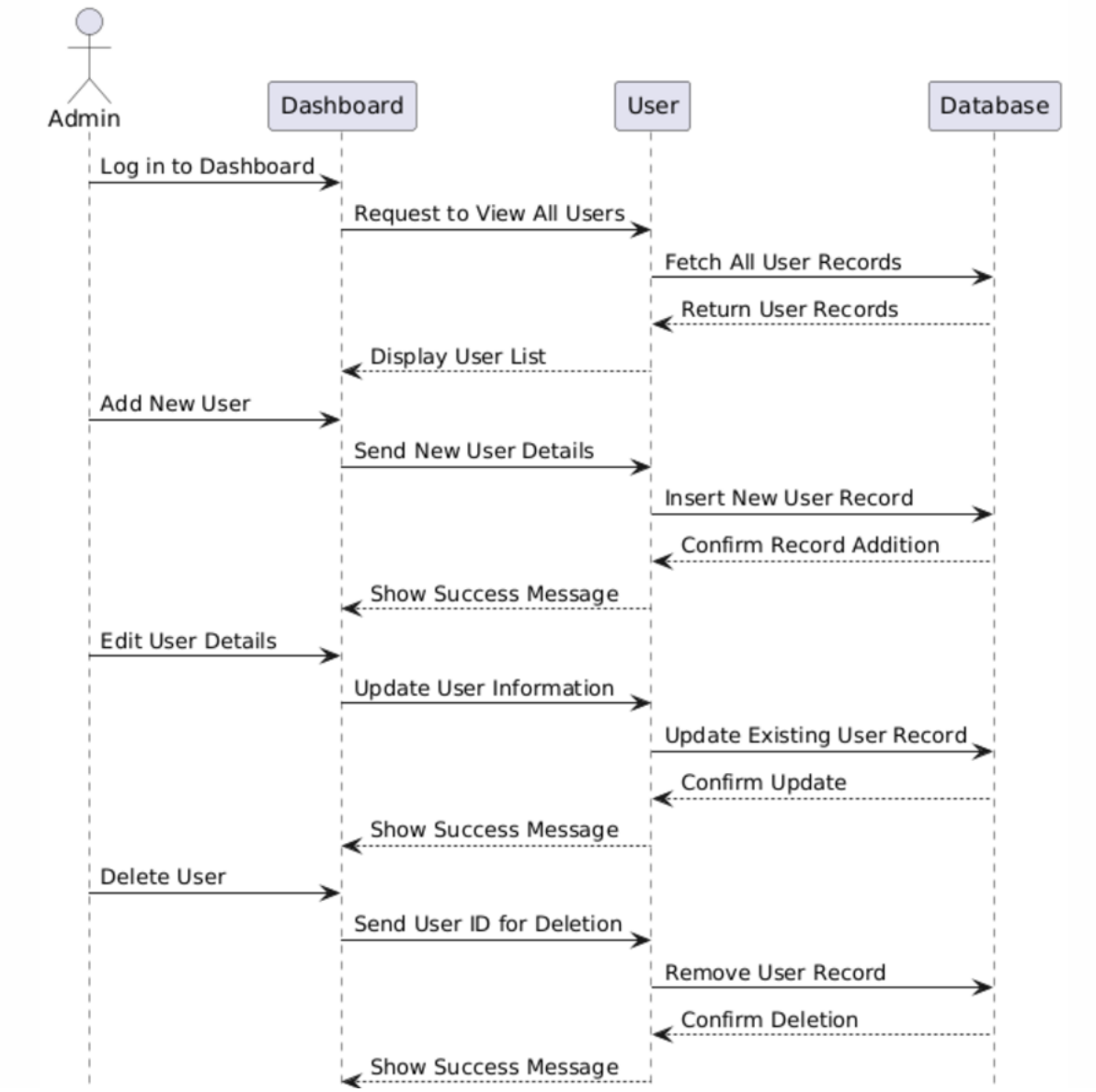


Figure 5.5.3: Sequence Diagram of Manage Users

5.4.4 Sequence Diagram for Upload Assignments

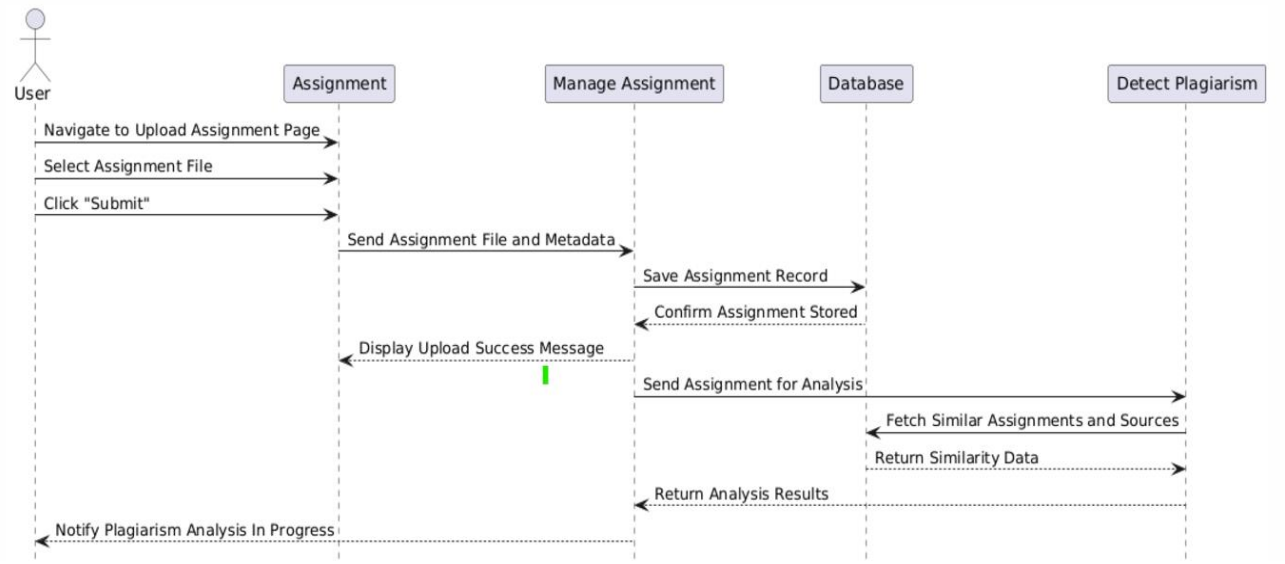


Figure 5.5.4: Sequence Diagram of Upload Assignments

5.4.5 Sequence Diagram for Check Plagiarism

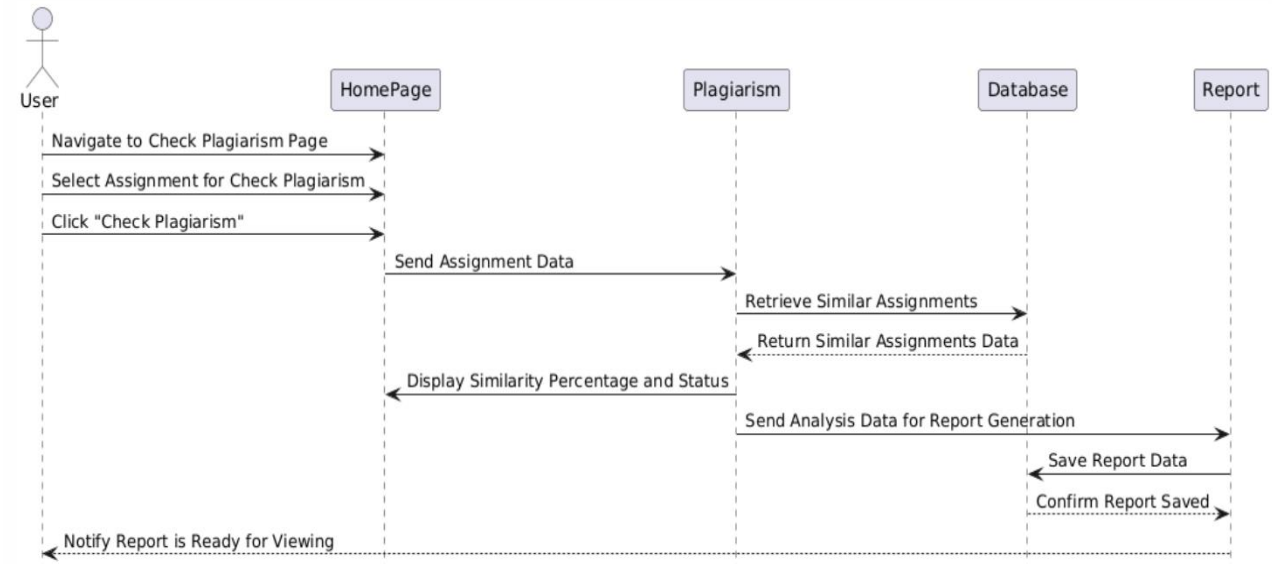


Figure 5.5.5: Sequence Diagram of Check Plagiarism

5.5 State Dynamics Viewpoint

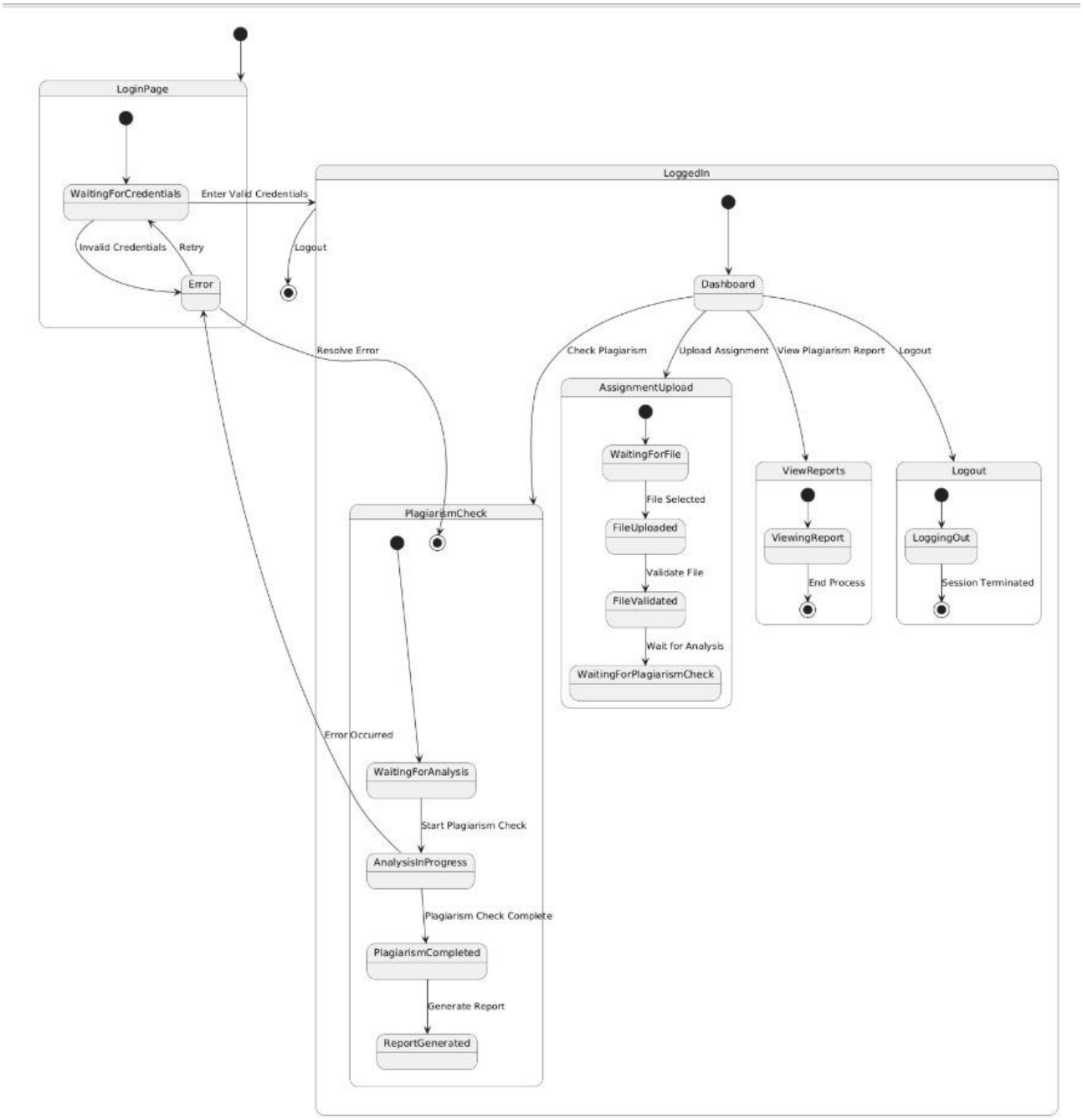


Figure 5.6: State Machine Diagram of the System

5.6 Algorithm Viewpoint

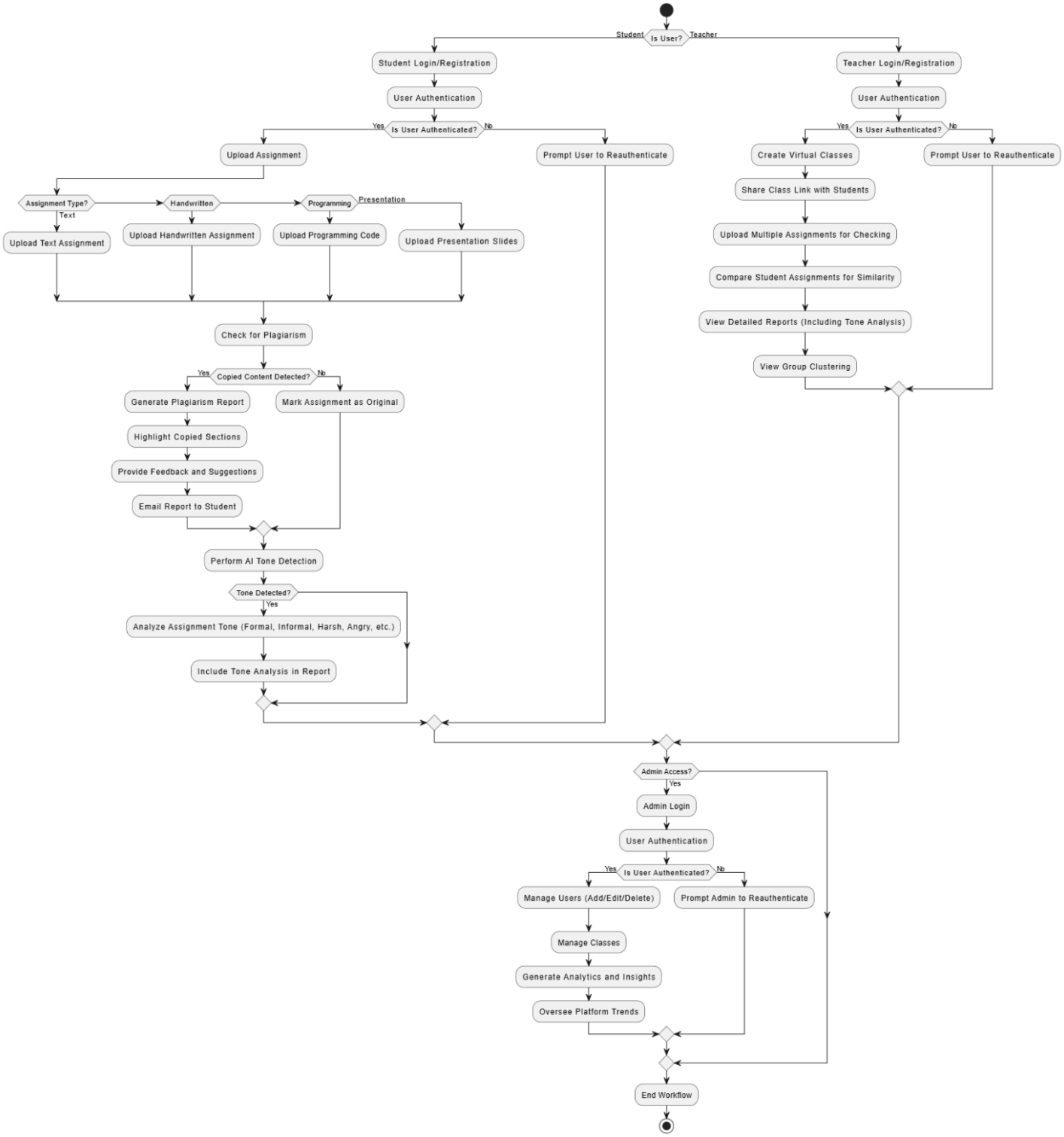


Figure 5.7: Activity Diagram of the System