

Individual Project Report

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This individual project aims to create a robust distributed web application designed for online learning. The application facilitates a dual-role system where users can register as teachers to create and manage courses and as students to search, purchase, and study various courses. Below, the project's comprehensive structure and functionality are elaborated.

1. Prototypes from Coursera and EdX

The design and functionality of this online learning platform takes inspiration from established e-learning platforms like Coursera and EdX. These platforms have set a benchmark for delivering high-quality educational content online, offering features such as course creation by educators, secure user authentication, diverse course catalogues, and robust analytics.

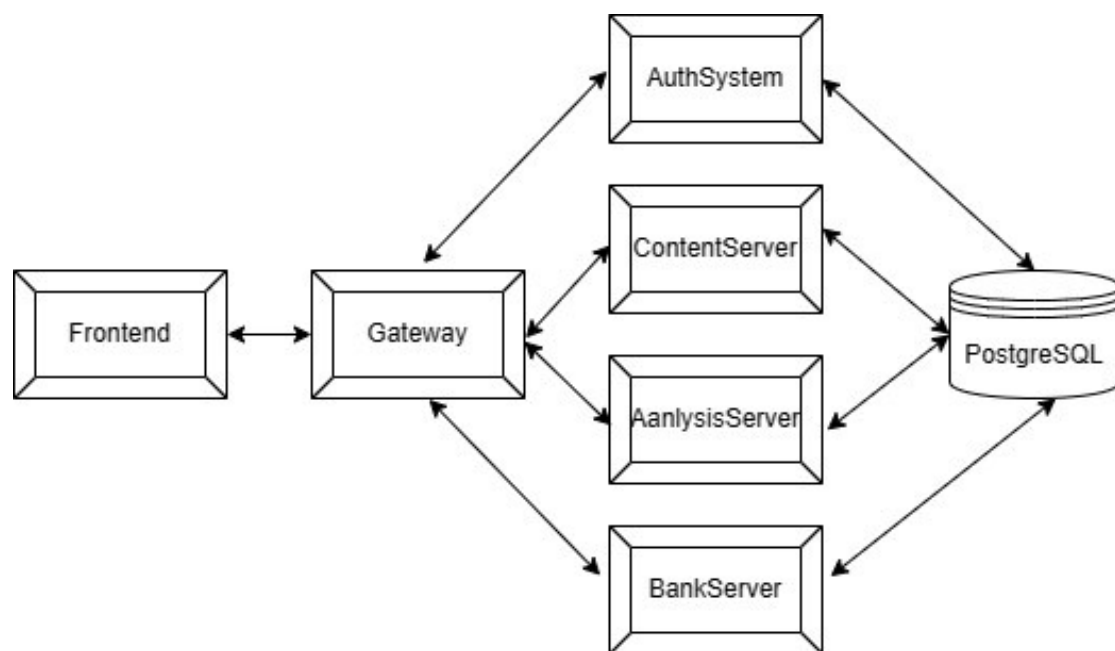
Coursera is a widely recognized online learning platform that collaborates with universities and organizations to offer courses, specializations, and degrees in various fields. Coursera's system allows instructors to create detailed courses with videos, quizzes, and assignments, while students can enroll, participate in discussions, and receive certifications upon completion.

EdX is another leading online learning platform founded by Harvard University and MIT. It provides a similar set of features, including course creation tools for instructors, various course formats (self-paced, instructor-led), and a robust system for managing user enrollments and course progress. Both platforms emphasize high-

quality content delivery, user engagement, and comprehensive analytics, serving as prototypes for this project.

2. Project Structure

The project is divided into several key components, each serving a specific function within the system. This modular structure ensures that the application is scalable, maintainable, and efficient.



2.1 Frontend (on port 3000)

Framework: Next.js

Programing language: JavaScript

Next.js is employed for building the frontend of the application. It is a powerful React framework that supports server-side rendering, static site generation, and client-side rendering. These capabilities make it an ideal choice for developing dynamic and performant web applications, enhancing the user experience through fast load times and smooth navigation.

2.2 Gateway (8080)

Framework: Spring Cloud

Programing language: Java

Spring Cloud is utilized for the gateway layer, which acts as an entry point to the backend services. It provides essential features such as service discovery, routing, load balancing, and security. These features ensure that requests are appropriately directed and managed across the distributed system, enhancing the reliability and scalability of the application.

2.3 Backend

The backend is divided into several distinct servers, each handling specific functionalities. This separation of concerns allows for specialized management of different aspects of the application, ensuring optimal performance and maintainability.

2.3.1 Auth Server (on port 8000)

Framework: Django

Programing language: Python

Authentication Method: JWT (JSON Web Tokens)

The Auth Server is responsible for managing user authentication and authorization. Django, a high-level Python web framework, is used for its scalability and robust security features. JWT is implemented for secure token-based authentication, providing a stateless and efficient method for user verification and session management.

2.3.2 Content Server (on port 4000)

Framework: Express.js

Programing language: JavaScript

The Content Server handles course-related content, including storage, retrieval, and

management of course materials. Express.js, a minimalist web framework for Node.js, is chosen for its flexibility and performance. This server ensures that all content-related requests are processed efficiently, providing a seamless experience for both teachers and students.

2.3.3 Analysis Server (on port 2345)

Framework: Django

Programing language: Python

The Analysis Server provides analytical functionalities, such as tracking user progress, course performance, and generating insightful reports. Django is utilized again for its powerful database interaction and ease of creating analytical models. This server helps in providing valuable insights to teachers about their course's performance and students' progress.

2.3.4 Bank Server (on port 8888)

Framework: Express.js

Programing language: JavaScript

The Bank Server manages financial transactions, including course purchases and payments. Express.js is used to handle these operations efficiently, ensuring secure and reliable financial processing. This server plays a crucial role in managing the monetary aspects of the platform, facilitating smooth and secure transactions.

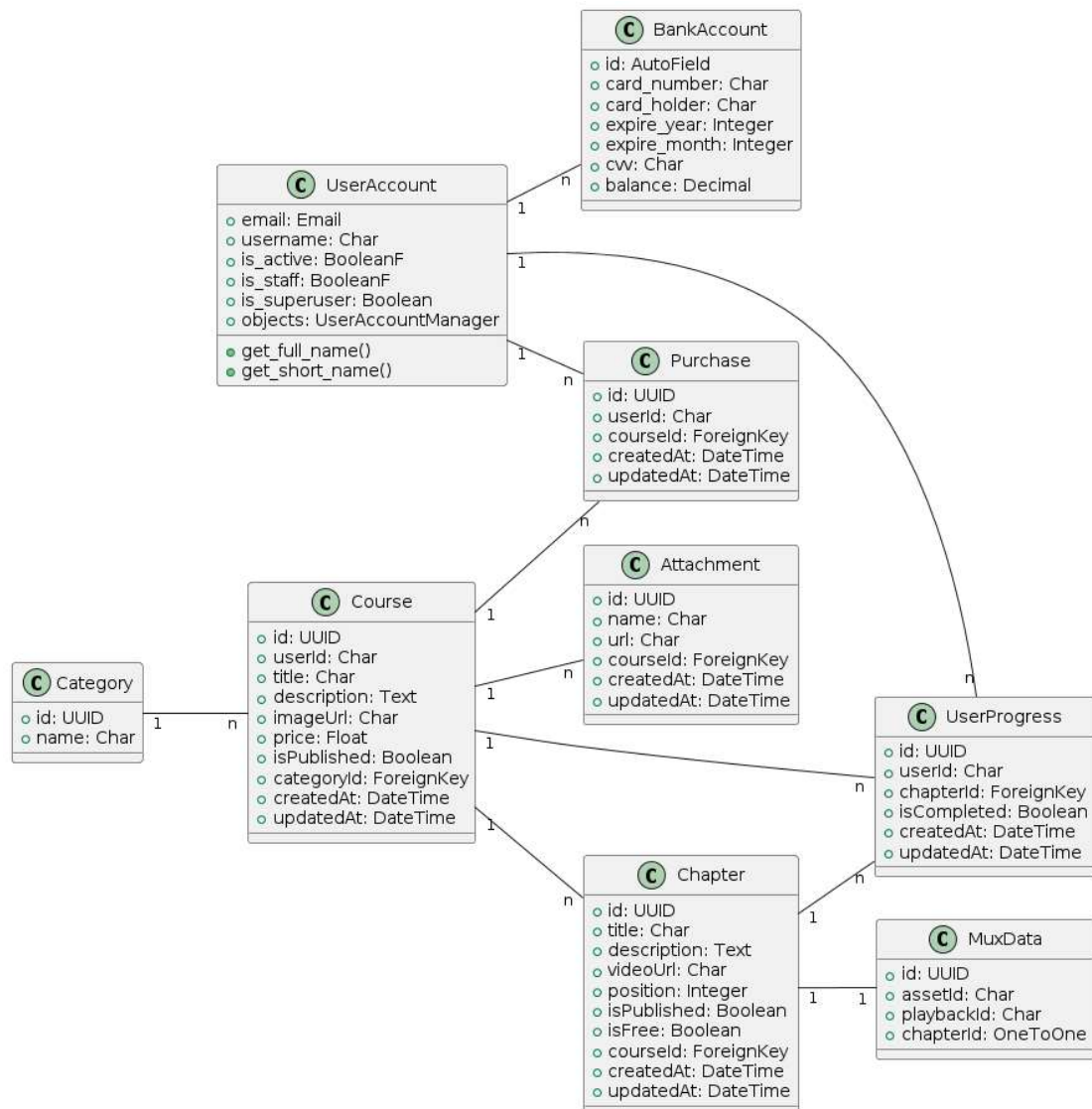
2.3.5 Database (on port 5432)

Technology Used: PostgreSQL

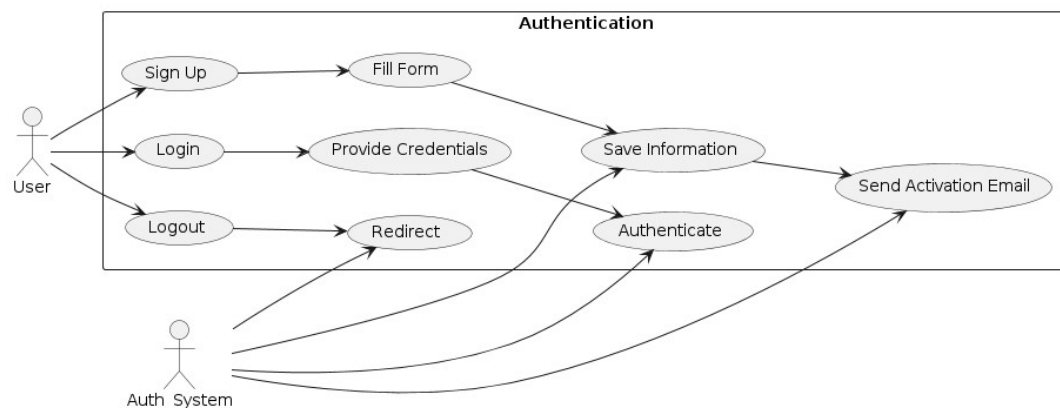
PostgreSQL is the chosen database management system due to its advanced features, reliability, and performance. It is well-suited for handling complex queries and large datasets, which are essential for an online learning platform. PostgreSQL's robustness ensures data integrity and availability, supporting the various data operations required by the application.

3. UML Diagrams

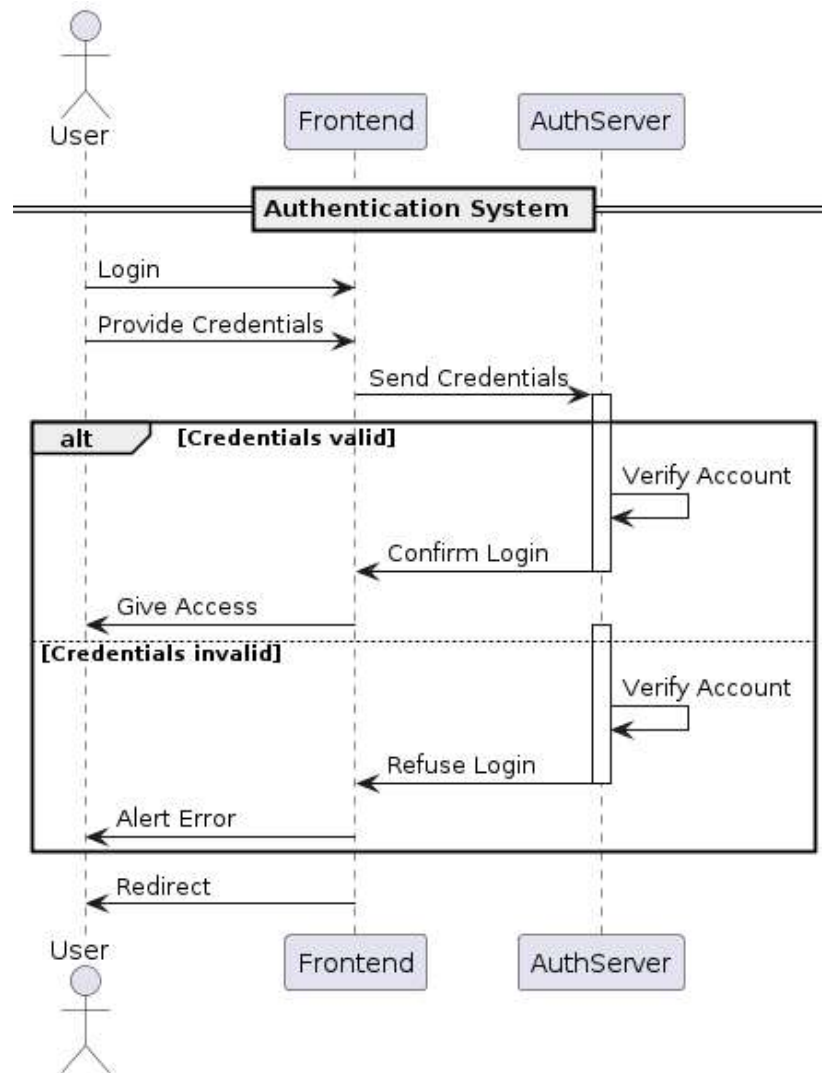
3.1 Class Diagram



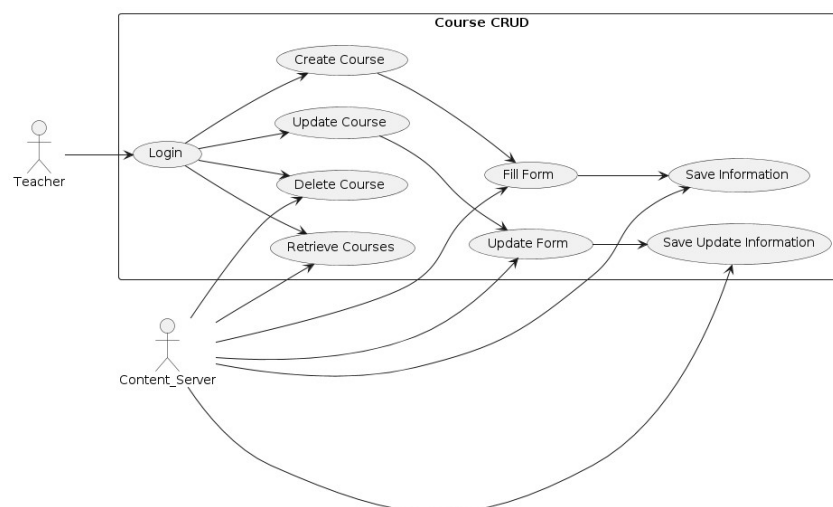
3.2 Authentication Use Case Diagram



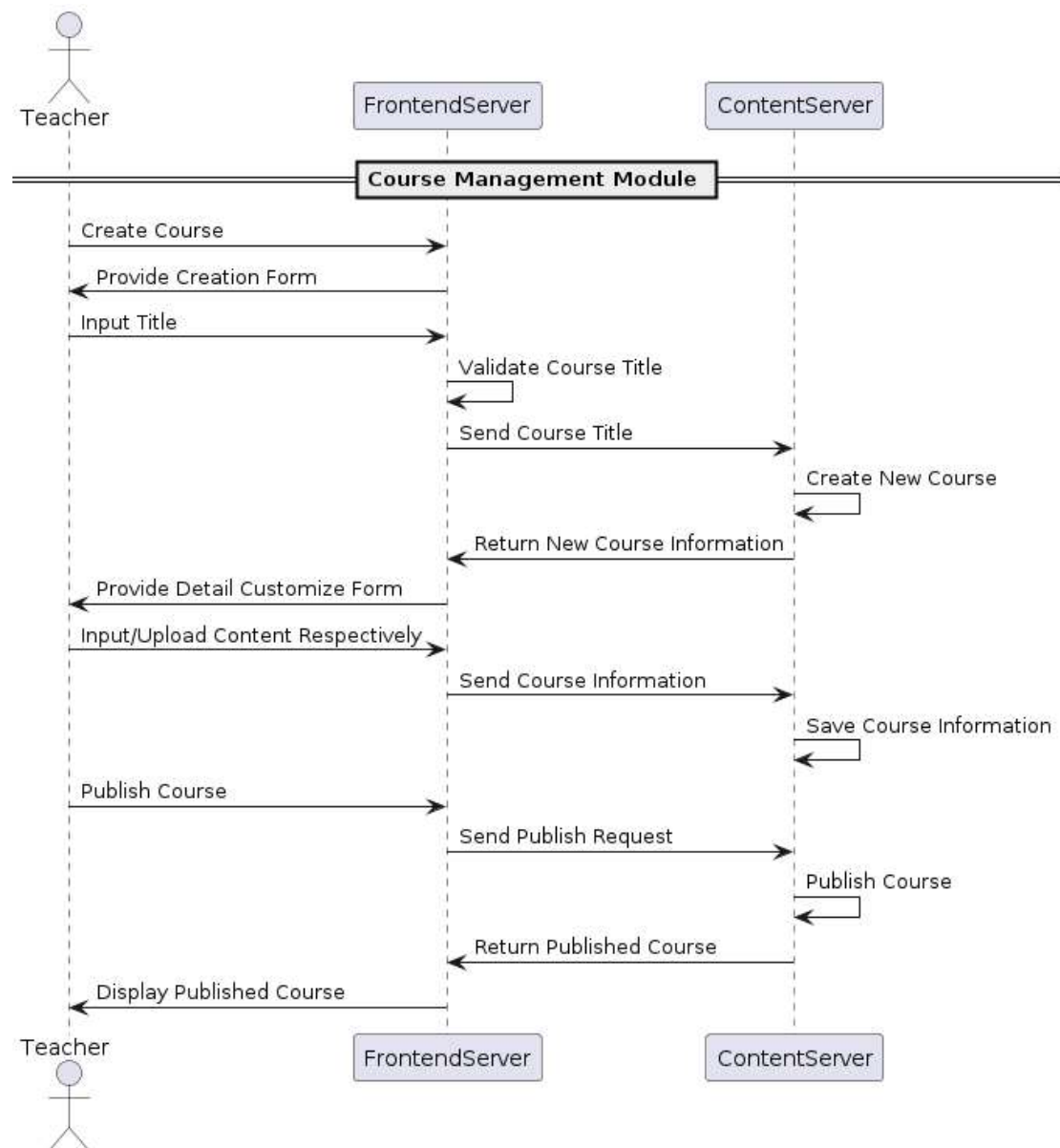
3.3 Authentication Sequence Diagram



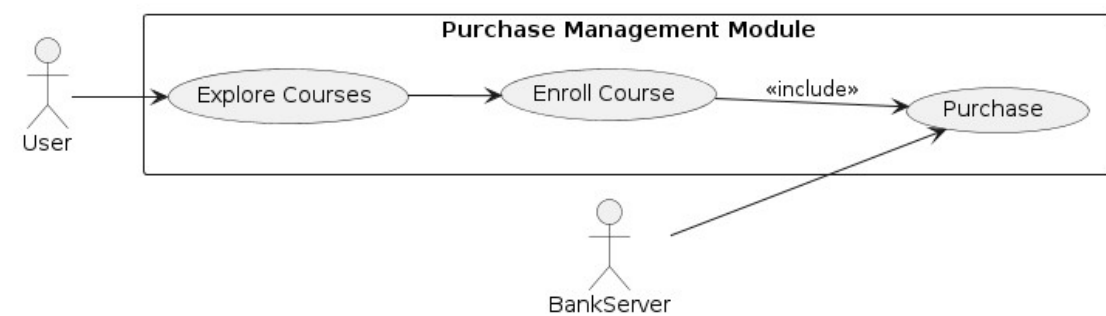
3.4 Course CRUD Use Case Diagram



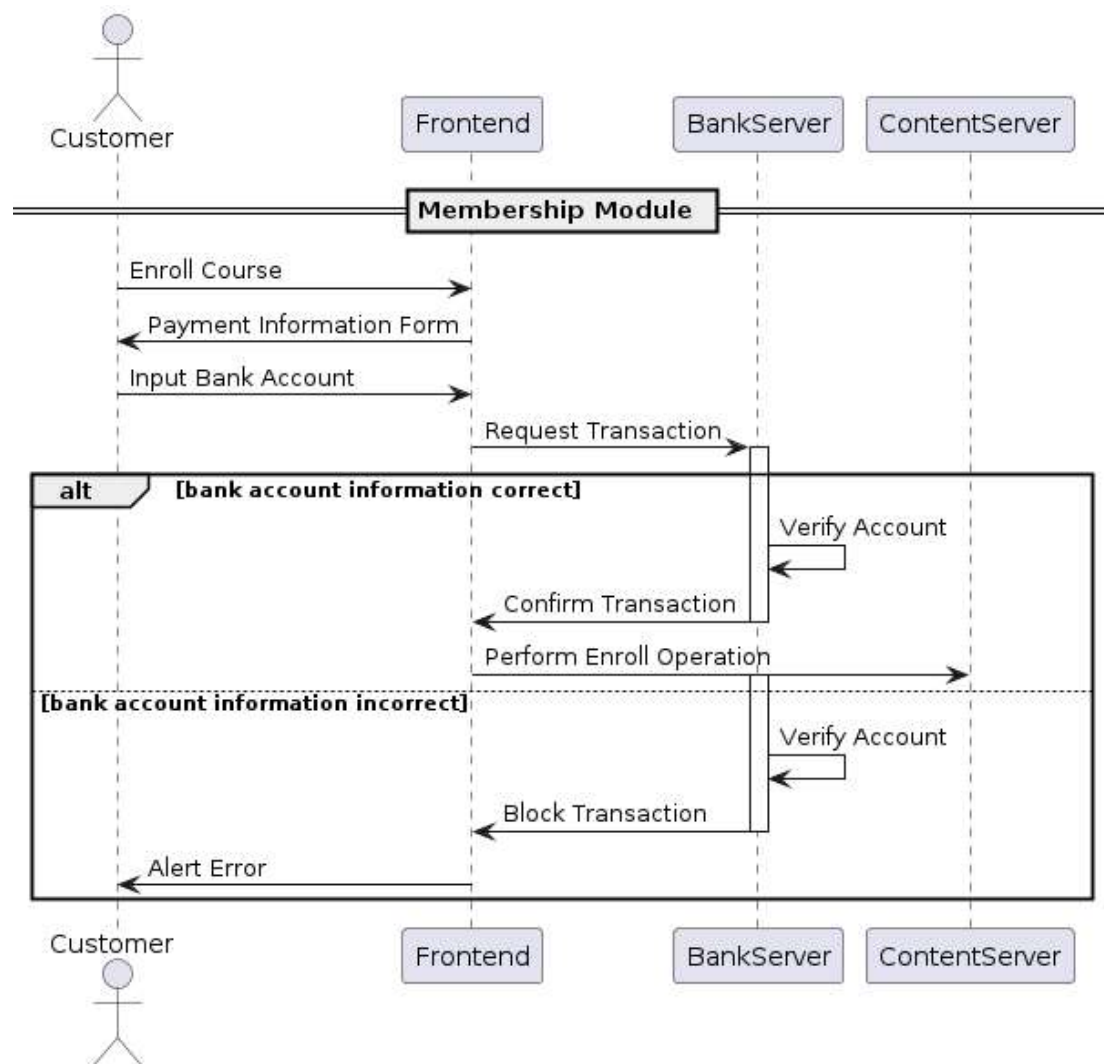
3.5 Course CRUD Sequence Diagram



3.6 Purchase Use Case Diagram



3.7 Purchase Sequence Diagram



4. Implemented Features

The application offers a wide range of features designed to enhance the online learning experience for both teachers and students.

4.1 Auth System

The authentication system ensures secure access and user management.

4.1.1 Register

Users can create an account, which involves email verification to activate the account.

4.1.2 Login

Users can log in using standard credentials or via OAuth providers such as Google and GitHub.

4.1.3 Logout

Users can securely log out of their accounts.

4.1.4 Reset Password

Users can reset their passwords via email verification.

4.2 Course Creation (CRUD)

Teachers can create and manage their courses with ease.

4.2.1 Switch to Teacher Mode

Users can switch to teacher mode after logging in to create courses.

4.2.2 Course Creation

Teachers can name their course, customize it with descriptions, videos, and attachments, and complete required fields.

4.2.3 Publish Course

Teachers can publish their courses, making them available for students.

4.3 Browse Courses

Students can explore and discover new courses.

4.3.1 Explore Section

Students can explore available courses after logging in.

4.3.2 Search and Filter

Courses can be searched by title and filtered by categories for easy discovery.

4.4 Purchase Courses

The purchasing system ensures secure and efficient enrollment.

4.4.1 Course Details:

Students can view detailed information about courses, including chapters and contents.

4.4.2 Enrollment and Payment

Students can enroll in courses and complete payments securely.

4.5 Study Courses

Students can engage with course content effectively.

4.5.1 Access Purchased Courses

Students can find their purchased courses in the Dashboard or Explore page.

4.5.2 Course Details Page

Students can watch course videos and access attachments directly from the course details page.

4.6 Check Sales

Teachers can monitor their course sales and performance.

4.6.1 Analytics

Teachers can switch to teacher mode and access the Analytics section to view their course sales and other metrics.