Full Stack Development with MERN

Introduction:

- *Project Title:*
  - Online Learning Platform
- *Team Members:*
  - Syed Sahil A (2021503053): Team Leader, Documentation, Version Control.
  - Praveen P (2021503035): Frontend developer.
  - Shanthosh Kumar E (2021503049): Backend developer.
  - Rupesh A (2021503549): Frontend and backend integration.
  - Hemnath S (2021503513): Frontend and backend integration.

Project Overview:

- *Purpose:*
  - To provide a flexible, accessible, and user-friendly platform for online learning, enabling learners and instructors to connect, share knowledge, and achieve educational goals through interactive and self-paced courses.
- *Features:*
  - User-Friendly Interface: Simplified navigation for learners and instructors.
  - Course Management: Upload, organize, and track course materials and progress.
  - Interactivity: Discussion forums, live webinars, and real-time chat support.
  - Certification: Digital certificates upon course completion.
  - Accessibility: Multi-device compatibility for learning anytime, anywhere.
  - Self-paced learning: Freedom to progress through content based on individual schedules.
  - Payment Options: Free and premium courses with secure payment systems.

Architecture:

- *Frontend:* The frontend is built using React.js, employing a component-based architecture to ensure modularity and reusability. Key elements include:
  - Routing: React Router for navigating between pages such as course browsing, user profile, and course details.
  - UI Libraries: Bootstrap and Material-UI for responsive and user-friendly design.

    - State Management: Context API or Redux (optional for scalability) to manage application-wide states like user authentication and course enrollment.
    - API Integration: Axios is used for communication with backend RESTful APIs to fetch and send data in real time.
- *Backend:* The backend is developed using Node.js and Express.js, designed with a layered architecture:
    - Route Layer: Handles API endpoints for user actions (e.g., registration, course enrollment).
    - Controller Layer: Manages the business logic for processing requests and responses.
    - Service Layer: Handles data manipulation and interaction with the database.
    - Middleware: Implements features like authentication (JWT) and error handling.
- *Database*: The database uses MongoDB to store and retrieve structured data. The schema includes:
    - User Collection: Stores user details (e.g., name, email, password, role [student/instructor], enrolled courses).
    - Course Collection: Contains course information (e.g., title, description, instructor, modules, pricing).
    - Progress Collection: Tracks individual learner progress (e.g., completed modules, scores).
    - Payments Collection: Manages payment records and subscriptions for premium courses.
    - Database interactions use Mongoose, providing a clear schema definition and efficient query handling. The relationships are designed to ensure flexibility and scalability, allowing seamless addition of new features.

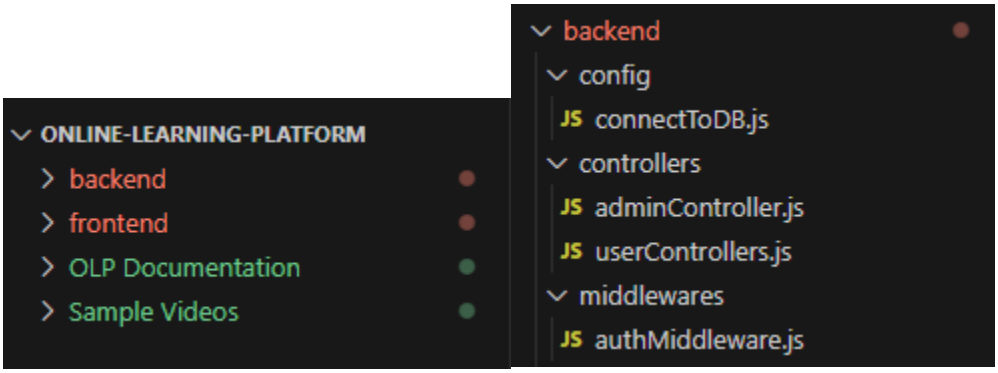
Setup Instructions:

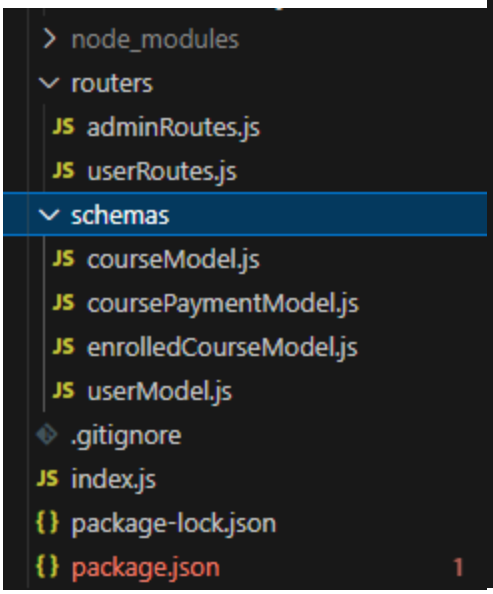
- *Prerequisites:*
    - Node.js (v16.x or later) - For running the backend and managing dependencies.
    - MongoDB (v5.x or later) - For database storage.
    - Git - For cloning the project repository.
    - Web Browsers - Two installed browsers for testing (e.g., Chrome and Firefox).
    - Code Editor - Recommended: Visual Studio Code (VS Code).
    - Internet - Minimum bandwidth of 30 Mbps.
- *Installation:*
    - Clone the Repository:

```
git clone <repository-url>
cd <project-directory>
```

- Install Dependencies:
  - For Frontend:
    ```
    cd frontend
    npm install
    ```
  - For Backend:
    ```
    cd backend
    npm install
    ```
- Set Up Environment Variables:
  - Create a .env file in the root of the backend directory with the following values:
    ```
    PORT=8000
    MONGO_URI=<your-mongodb-connection-string>
    ```
- Start the Application:
  - Run Backend:
    ```
    cd backend
    npm start
    ```
  - Run Frontend:
    ```
    cd client
    npm start
    ```
- Access the Application:
  - Open a browser and navigate to http://localhost:5173.
- Testing and Usage:
  - Register as a user or instructor to explore features.
  - Upload courses, enroll, and simulate interactions.

Folder Structure:

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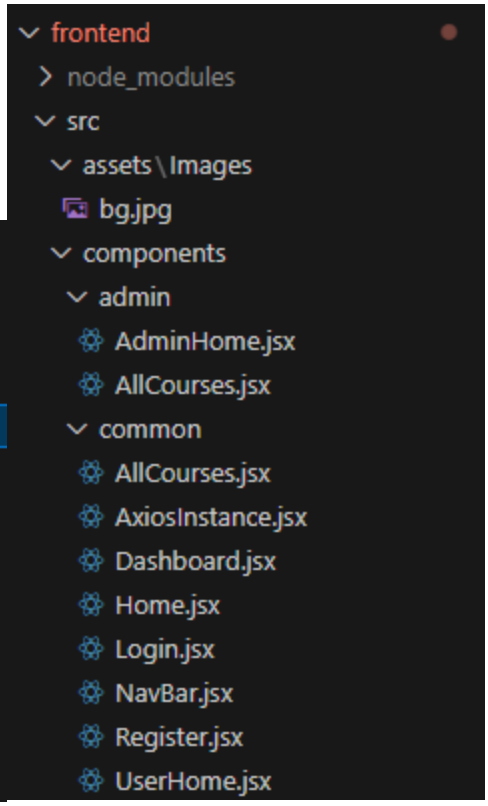
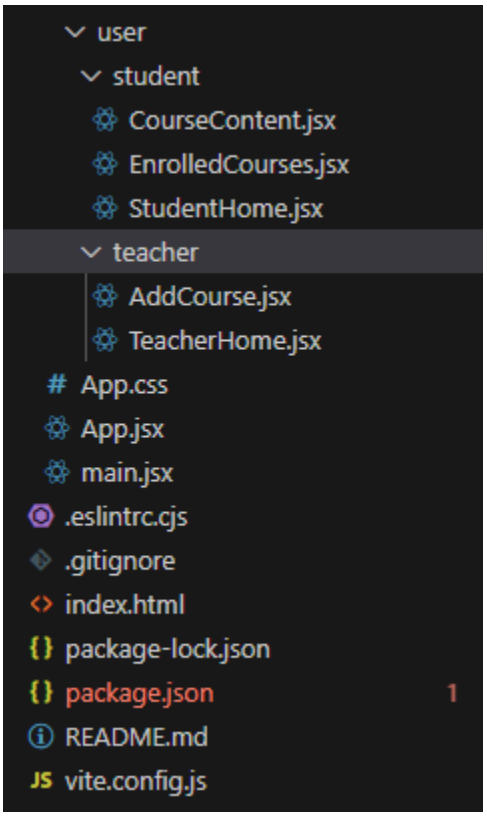
routers
adminRoutes.js
userRoutes.js
schemas
courseModel.js
coursePaymentModel.js
enrolledCourseModel.js
userModel.js
.gitignore
index.js
package-lock.json
package.json
1


frontend
node_modules
src
assets\Images
bg.jpg
components
admin
AdminHome.jsx
AllCourses.jsx
common
AllCourses.jsx
AxiosInstance.jsx
Dashboard.jsx
Home.jsx
Login.jsx
NavBar.jsx
Register.jsx
UserHome.jsx


user
student
CourseContent.jsx
EnrolledCourses.jsx
StudentHome.jsx
teacher
AddCourse.jsx
TeacherHome.jsx
App.css
App.jsx
main.jsx
.eslintrc.cjs
.gitignore
index.html
package-lock.json
package.json
1
README.md
vite.config.js

Running the Application:

- To run the application locally, use the following commands:
  - Frontend:
    - Navigate to the client directory and start the frontend server:

      cd frontend

      npm run dev
    - This will launch the React application at http://localhost:5173.
  - Backend:
    - Navigate to the server directory and start the backend server:

      cd backend

      npm start
    - The backend server will run on http://localhost:8000 (or the port specified in the .env file).
  - Ensure both servers are running simultaneously for full functionality.

API Documentation:

- *User Registration:*
  - Endpoint: /register
  - Method: POST
  - Description: Registers a new user by providing name, email, and password.
- *User Login:*
  - Endpoint: /login
  - Method: POST
  - Description: Authenticates a user and returns a JWT token for access.
- *Add Course:*
  - Endpoint: /addcourse
  - Method: POST
  - Description: Adds a new course with uploaded content (requires authentication).
- *Get All Courses:*
  - Endpoint: /getallcourses
  - Method: GET
  - Description: Retrieves a list of all available courses.
- *Get All Teacher's Courses:*
  - Endpoint: /getallcoursesteacher
  - Method: GET
  - Description: Retrieves all courses uploaded by the authenticated teacher.

- *Delete Course:*
    - Endpoint: /deletecourse/:courseid
    - Method: DELETE
    - Description: Deletes a specific course by its ID (requires authentication).
- *Enroll in a Course:*
    - Endpoint: /enrolledcourse/:courseid
    - Method: POST
    - Description: Enrolls the authenticated user in the specified course.
- *Get Course Content:*
    - Endpoint: /coursecontent/:courseid
    - Method: GET
    - Description: Retrieves the content of a specific course (requires authentication).
- *Complete Module:*
    - Endpoint: /completemodule
    - Method: POST
    - Description: Marks a course section as complete for the authenticated user.
- *Get User's Enrolled Courses:*
    - Endpoint: /getallcoursesuser
    - Method: GET
    - Description: Retrieves all courses the authenticated user is enrolled in.
- *Get All Users:*
    - Endpoint: /getallusers
    - Method: GET
    - Description: Fetches details of all users (admin access required).
- *Delete User:*
    - Endpoint: /deleteuser/:cuserid
    - Method: DELETE
    - Description: Deletes a user by their ID (admin access required).

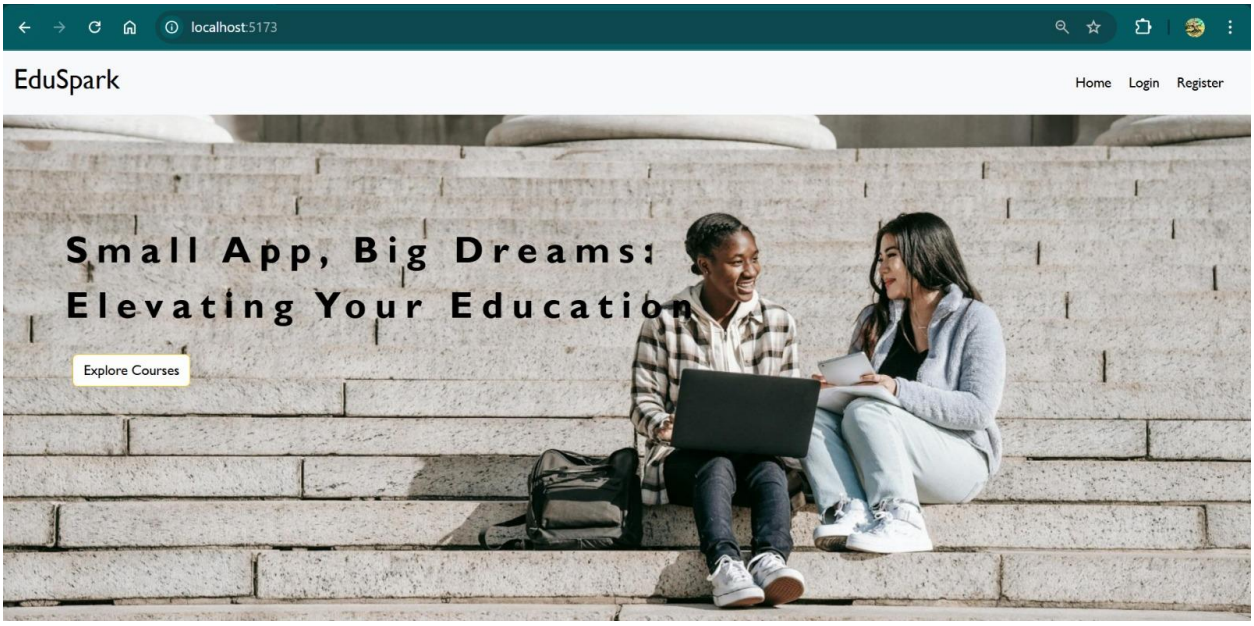
Authentication:

- *Authentication:* The project uses JWT (JSON Web Tokens) for secure authentication. A token is generated and sent back to the client when a user logs in. The token is included in the Authorization header for all protected routes.
- *Authorization:* Middleware (authMiddleware) verifies the token and grants access to protected resources based on the user's role (student, instructor, admin).

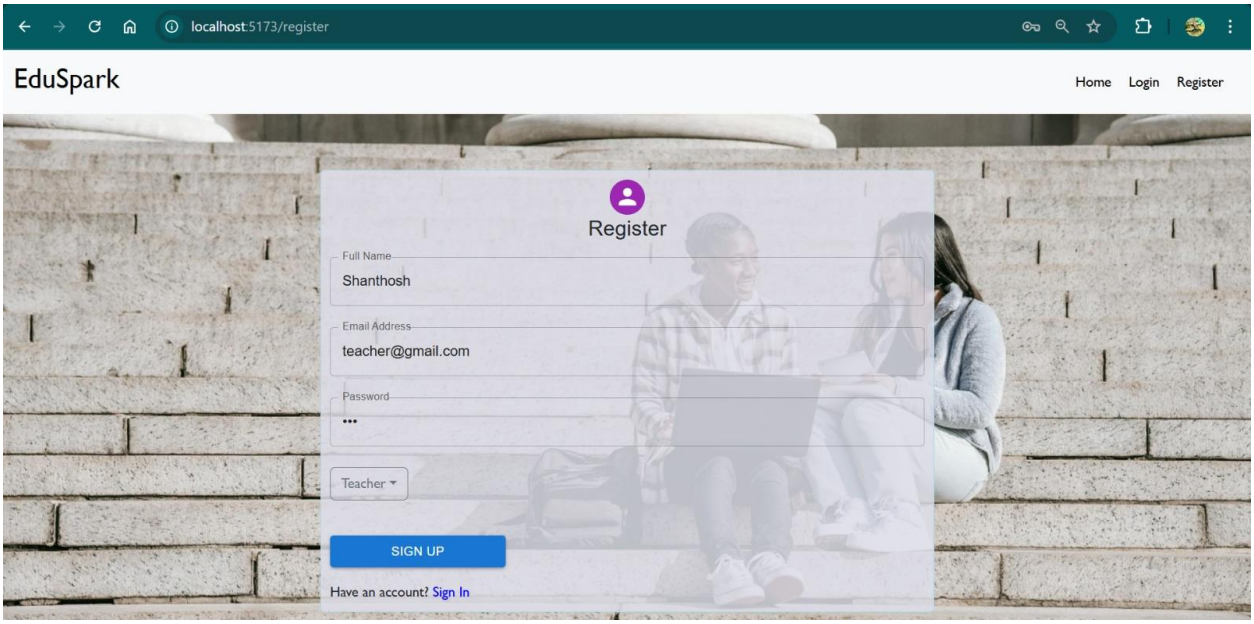
- *Token Handling:* Tokens are generated using jsonwebtoken with a secret key (JWT_SECRET from the .env file). Expired or invalid tokens result in a 401 Unauthorized error.
- *Session Management:* Sessions are stateless, relying on the client to store and send tokens. To add security, tokens can be stored in HTTP-only cookies to prevent XSS attacks.

User Interface:

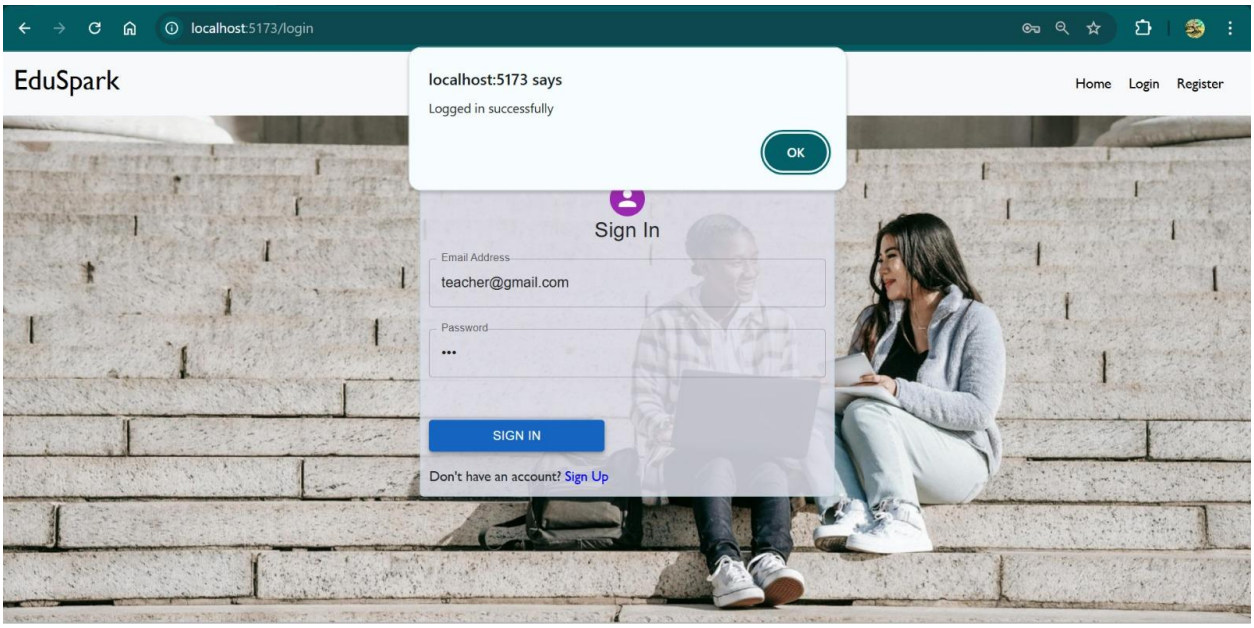
- *Home Page:*



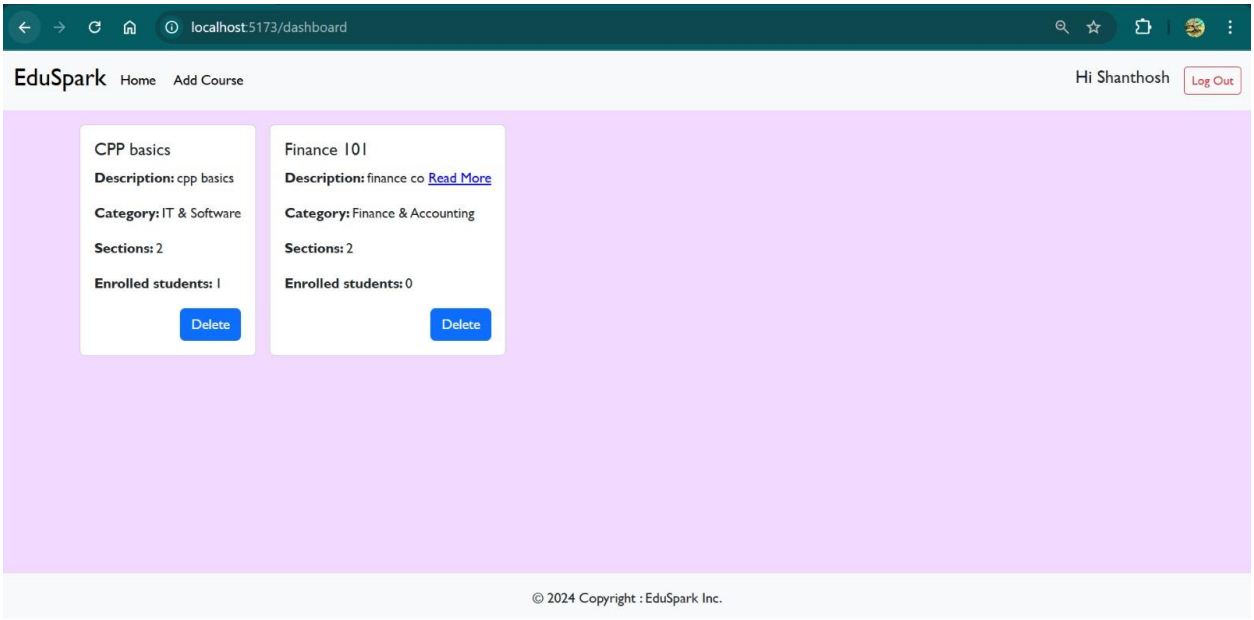
- *Signup Page:*



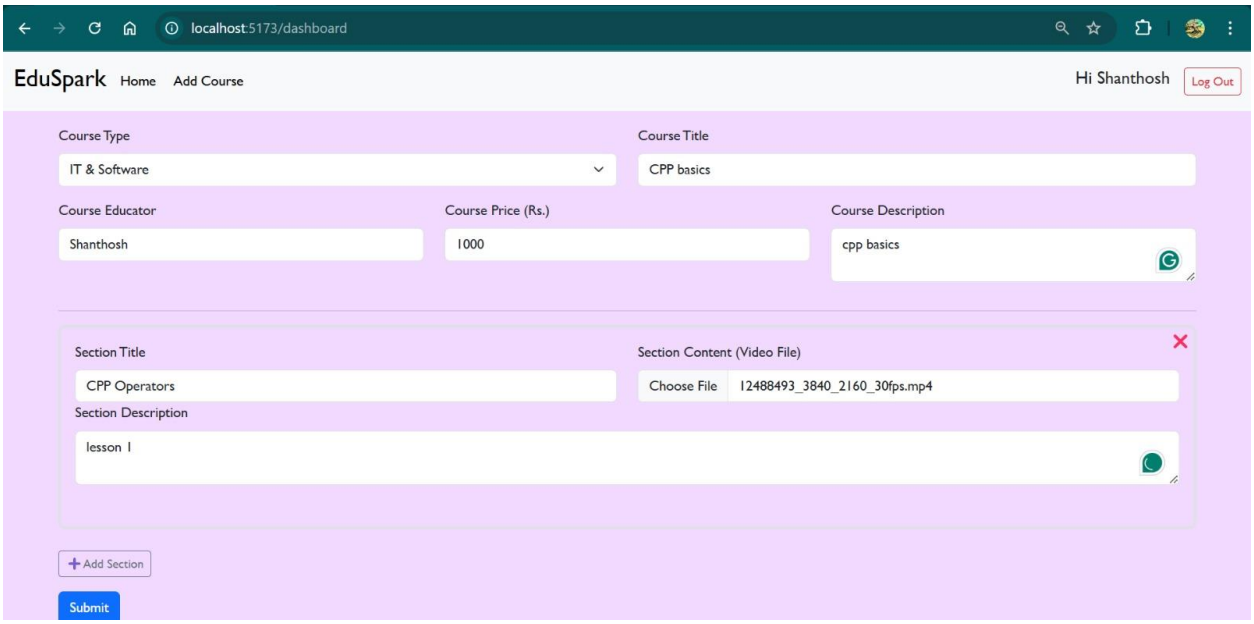
- *Login Page:*



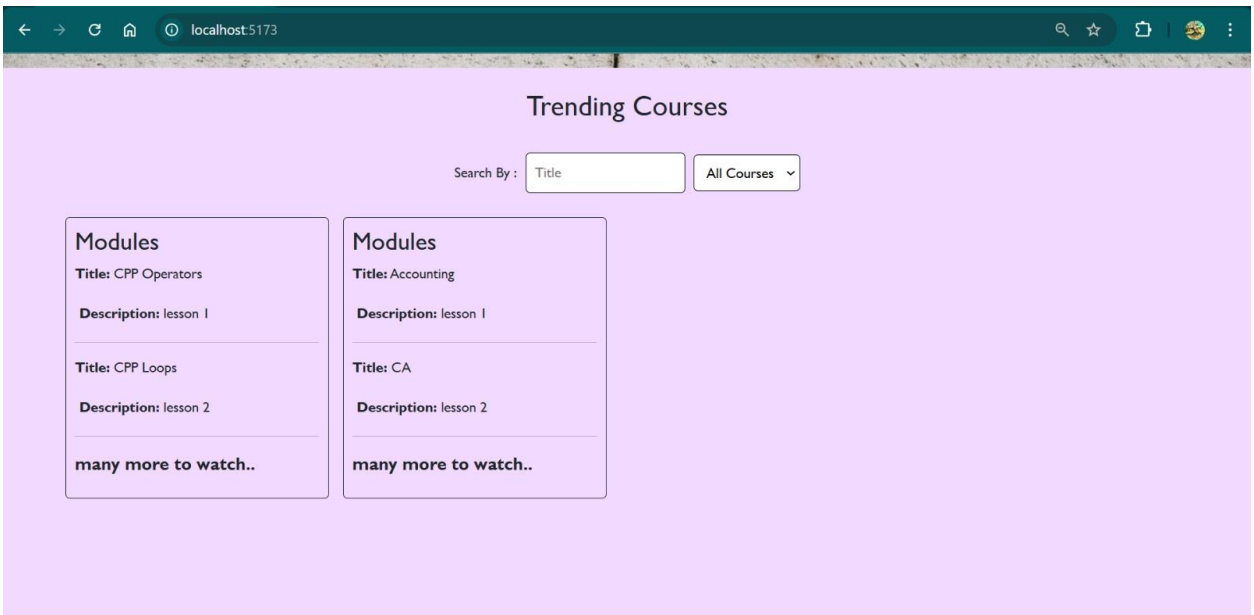
- *Teacher Home Page:*



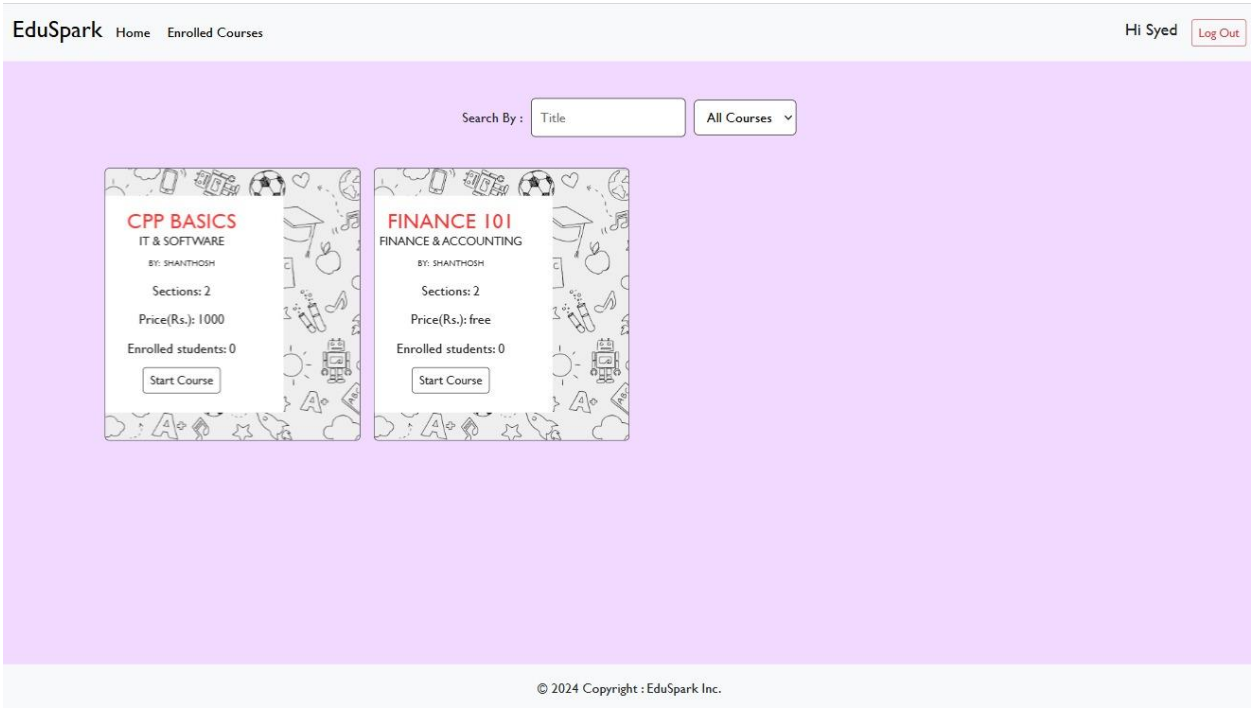
- *Course Creation:*



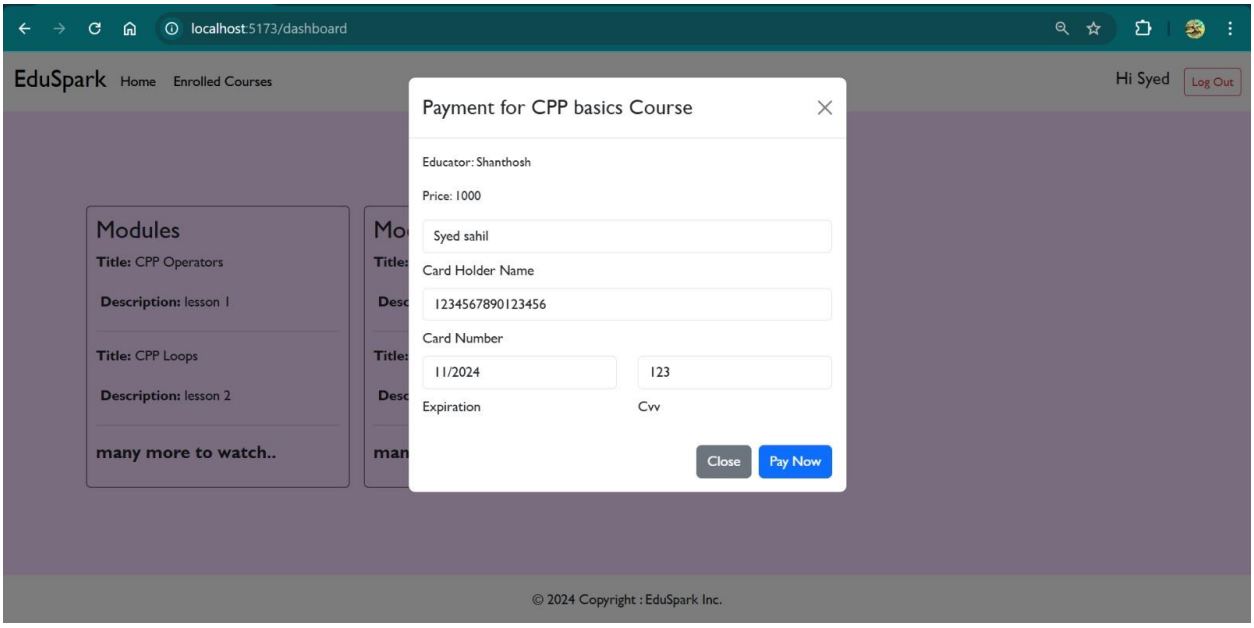
- *Trending Courses:*



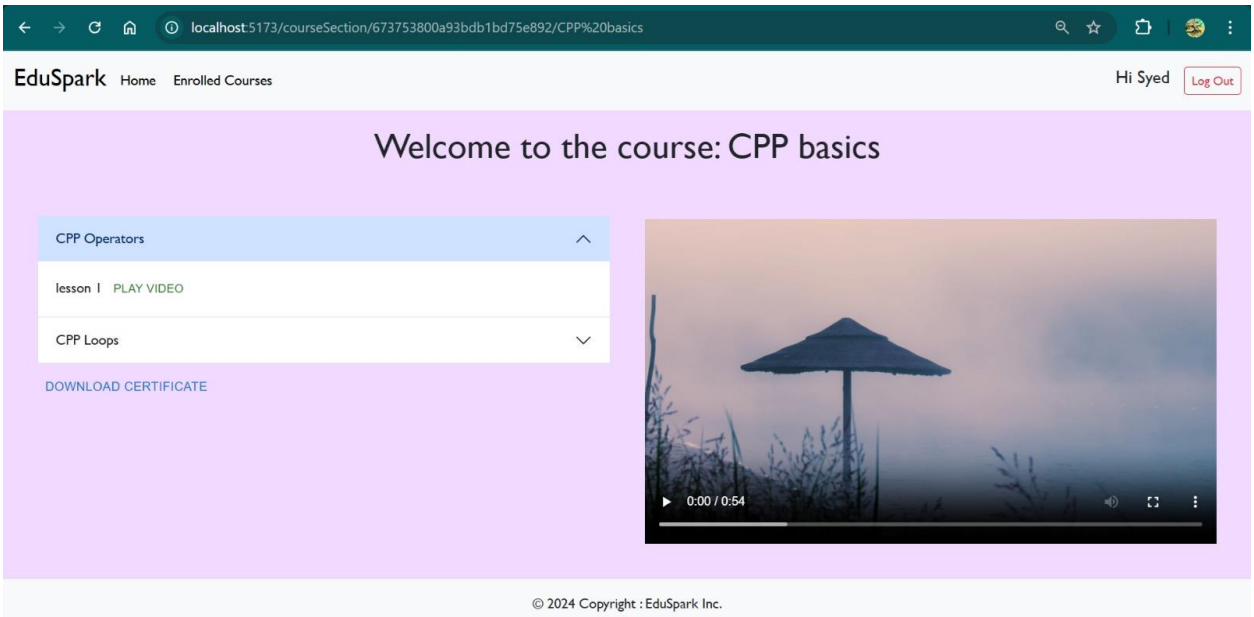
- *Student Home Page:*



- *Course Enrollment:*

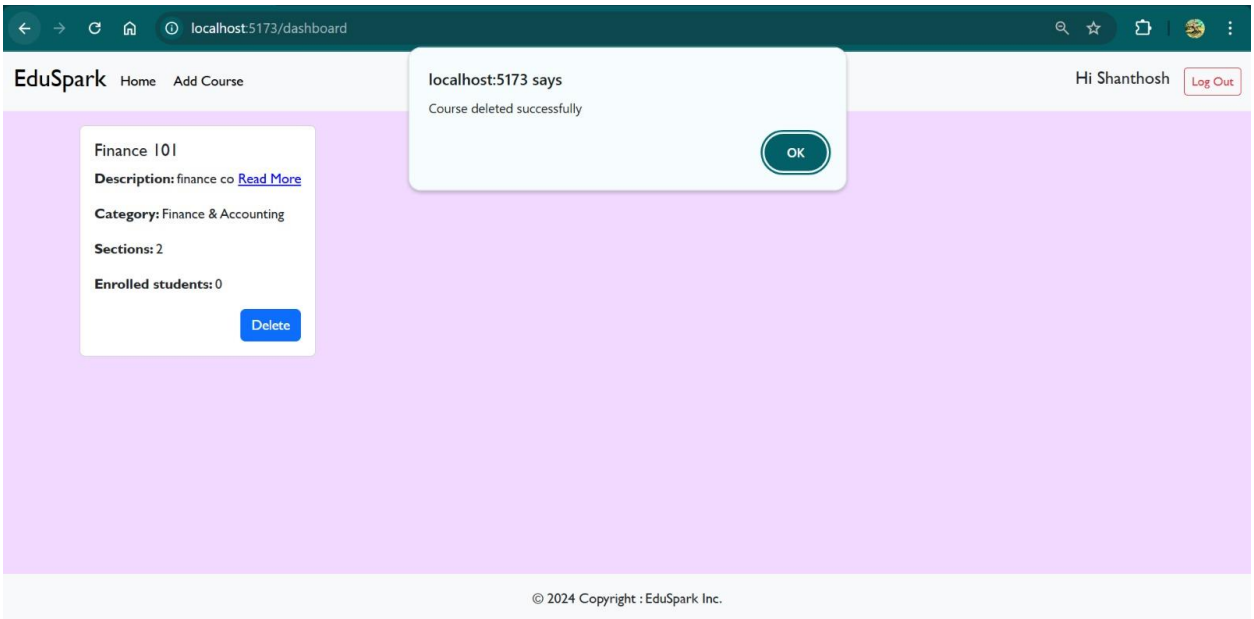


- *Course Progression:*



- *Completion Certificate:*

- *Course Deletion:*



Testing:

- The project follows a comprehensive testing strategy to ensure the application's functionality, performance, and reliability. Testing is divided into the following stages:
- *Unit Testing:*
  - Focuses on testing individual components or modules in isolation.
  - Examples: Testing backend APIs (e.g., user registration, course creation).
- *Integration Testing:*
  - Verifies that different modules work together as expected.
  - Examples: Ensuring the frontend properly integrates with backend APIs.
- *Manual Testing:*
  - Performed for exploratory and UI/UX testing to ensure the user interface meets expectations.

Screenshots or Demo:

- *Demo Video:* olp_demo_video.mp4

Known Issues:

- *File Upload Limitations:*
  - Large files may take longer to upload or could fail due to server limitations.
  - Potential Fix: Optimize file upload configurations and enable cloud-based storage like AWS S3 or Google Cloud Storage.
- *Error Handling:*
  - Some API responses might not provide detailed error messages, making debugging difficult.
  - Potential Fix: Improve error handling middleware for descriptive error responses.
- *Token Expiration:*
  - Users need to log in again when their JWT token expires, which might disrupt the learning experience.
  - Potential Fix: Implement token refresh functionality.

Future Enhancements:

- *AI-Powered Recommendations:* Use machine learning to recommend courses based on user interests, progress, and feedback.
- *Localization:* Add multi-language support to cater to a global audience.
- *Live Class Integration:* Allow instructors to schedule and conduct live classes or webinars directly on the platform using tools like Zoom or WebRTC.
- *Course Reviews and Ratings:* Enable students to leave feedback and ratings for courses, helping others make informed choices.
- *Third-Party Integration:* Integrate with platforms like LinkedIn for certification sharing and professional networking.