

FULL STACK DEVELOPMENT WITH MERN (NM1042)
ON ONLINE LEARNING PLATFORM

A NAAN MUDHALVAN PROJECT REPORT

Submitted By:

AAKASH D (412721104001)

JAYASHRI A (412721104016)

MONICA G (412721104028)

SOURAV ANAND N (412721104048)



TAGORE ENGINEERING COLLEGE, RATHINAMANGALAM – 600 127

ANNA UNIVERSITY::CHENNAI

ABSTRACT

The **LearnHub Online Learning Platform** is a scalable, feature-rich application designed to revolutionize digital education by making it flexible, accessible, and engaging. This platform caters to three distinct user roles—students, teachers, and administrators—each with tailored functionalities. Students can browse, enroll in courses, access multimedia content (video, audio, PDF, Word documents), and earn completion certificates. Teachers are empowered to create, manage, and update courses with ease, while administrators oversee platform-wide operations, including user and content management.

LearnHub leverages the MERN stack for a dynamic and robust architecture. The frontend, built with **React** and styled with **Bootstrap**, offers an intuitive user experience, while the backend, powered by **Node.js** and **Express.js**, ensures secure, efficient data handling. **MongoDB Atlas** serves as the scalable database solution. Integrated payment processing ensures secure transactions for premium courses.

With additional features like **JWT-based authentication**, role-based access control, and future-ready provisions for real-time interactions and AI-driven personalization, LearnHub aspires to bridge the gap between traditional and digital education, delivering high-quality online learning experiences tailored to diverse needs.

1. Introduction

- **Project Title:** Online Learning Platform
- **Team ID:** NM2024TMIB0214
- **Team leader and members:**

S.No	Name	Role	Register Number	Program ID
1.	Monica G	Team Leader	412721104028	1C1EFBBA6904C668C8C4FED80E1D85A7
2.	Jayashri A	Team Member	412721104016	1514D2A08C56DD0A7EF49A01FDE5242A
3.	Aakash D	Team Member	412721104001	2642B0426B4DBEDBA0C418C7F7261DFB
4.	Sourav Anand N	Team Member	412721104048	1A9C4E316076016B4744B98C284D15BC

2. Project Overview

Purpose:

LearnHub is an Online Learning Platform designed to make education flexible and accessible. It bridges the gap between traditional and digital learning by providing a user-friendly platform where students can enroll in courses, track their progress, and earn completion certificates. Teachers can efficiently manage their courses, and administrators can maintain the platform's standards through robust management tools.

Key Features:**1. User Roles and Access Control:**

- Students: Enroll in courses, access multimedia content, and download certificates.
- Teachers: Create, edit, and manage courses, including content uploads.
- Admin: Oversee platform management, including user and course moderation.

2. Comprehensive Course Management:

- Add courses with prerequisites, banners, and multimedia content (video, audio, documents).
- Update or remove outdated content to ensure relevance.

3. Admin Control:

- Access to all courses and user data.
- Tools for content moderation and user management.

4. Advanced Technical Integration:

- Cloudinary for secure media storage.
- Stripe/PayPal for seamless payment processing.

LearnHub ensures a collaborative and scalable platform for students, teachers, and administrators, making online education more engaging and efficient.

3. Architecture

Frontend:

The frontend of LearnHub is built using React, ensuring a dynamic and responsive user interface. Key elements include:

- **Framework:** React, Vite for component-based development.
- **Styling:** Bootstrap and custom CSS for a clean and responsive design.
- **Routing:** Protected routes using JWT tokens to restrict access to authenticated users.
- **State Management:** React Context API or Redux for managing global state across the application.

Backend:

The backend is powered by Node.js and Express, providing a scalable server-side environment. Key components include:

- **Framework:** Express.js, for handling RESTful API requests.
- **Authentication:** Secure authentication and session management using JWT tokens.
- **Media Handling:** Integration with Cloudinary for uploading and serving multimedia course content (videos, audio, documents).

Database:

The database uses MongoDB Atlas, a cloud-based NoSQL database, for scalable and flexible data storage. Key details:

- **Schema Design:**
 - **User Schema:** Separate models for students, teachers, and administrators, including role-based access control.
 - **Course Schema:** Detailed information about courses, sections, media files, and enrolled students.
 - **Payment Schema:** Tracks premium course transactions.
- **Interactions:** The backend uses Mongoose as the ORM for defining and interacting with database schemas.

4.Setup Instructions

Prerequisites:

- Install Node.js (v14+).
- Install MongoDB (local or cloud-based like MongoDB Atlas).
- Have npm or yarn installed for managing dependencies.
- Configure environment variables for:
 - MongoDB connection (MONGO_URI).
 - JWT secret (JWT_SECRET).

Installation:

1. Clone the repository: `git clone “https://github.com/Mon82sj/online-learning-platform.git”`.
2. Navigate to project folders: `cd frontend` and `cd backend`.
3. Install dependencies: `npm install`.
4. Configure environment variables:
 - a. For the backend: MONGO_URI, JWT_SECRET, etc.
 - b. For the frontend: API endpoints for backend communication.

5. Run the application

- Start the backend server:

```
>> cd backend  
  
>> node index.js
```
- Start the frontend server:

```
>> cd frontend  
  
>> npm create vite@latest  
  
>>select react framework, javascript and enter to continue  
  
>>npm run dev
```

6. Folder Structure

Frontend:

```
frontend/
├── src/
│   ├── components/  # Reusable UI components
│   ├── pages/       # Page-specific components
│   ├── services/    # API calls and service functions
│   ├── App.js       # Main application component
│   └── index.js      # Entry point of the React app
└── public/
    ├── index.html    # Main HTML file
    └── assets/       # Static assets like images
```

Backend:

```
backend/
├── routes/           # Route definitions for APIs
├── controllers/      # Business logic for routes
├── schemas/          # Mongoose models and schemas
├── middleware/       # Authentication and validation middleware
├── config/           # Configuration files (e.g., database connection)
├── utils/            # Utility functions
├── server.js         # Entry point of the backend server
└── .env              # Environment variables
```

This structured approach ensures maintainability and scalability for both the frontend and backend components.

6. Running the Application

- **Frontend:**

To start in the /frontend directory.

```
>> cd frontend
```

```
>> npm create vite@latest
```

```
>>select react framework, JavaScript and enter to continue
```

```
>>npm run dev
```

- **Backend:**

To start the /backend directory.

```
>> cd backend
```

```
>> node index.js
```

7. API Documentation

- **Endpoints:**

- /auth: Handles login, registration, and authentication.
- /courses: Manages course creation, editing, deletion, and enrollment.
- /payments: Handles premium course payments.
- /Dashboards: Handles all the dashboards (admin / user / teacher)

- **Example:**

- **POST api/auth/login**

Request Body: {email, password}

Response: {token, user}

8. Authentication

Authentication in LearnHub is handled securely using JWT (JSON Web Tokens). Below is a detailed explanation:

1. Registration:

- A new user registers by providing their name, email, password, and role.
- Passwords are hashed using bcrypt before being stored in the database.

2. Login:

- A user logs in with their email and password.
- Upon successful authentication, a JWT token is generated and returned.

3. Token Verification:

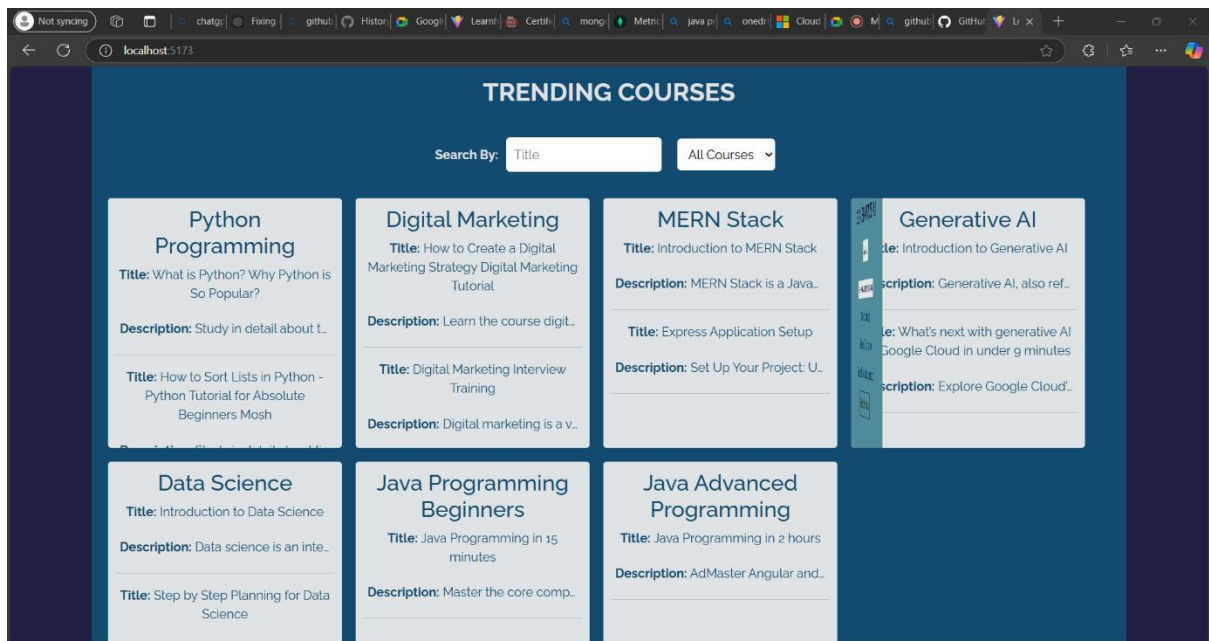
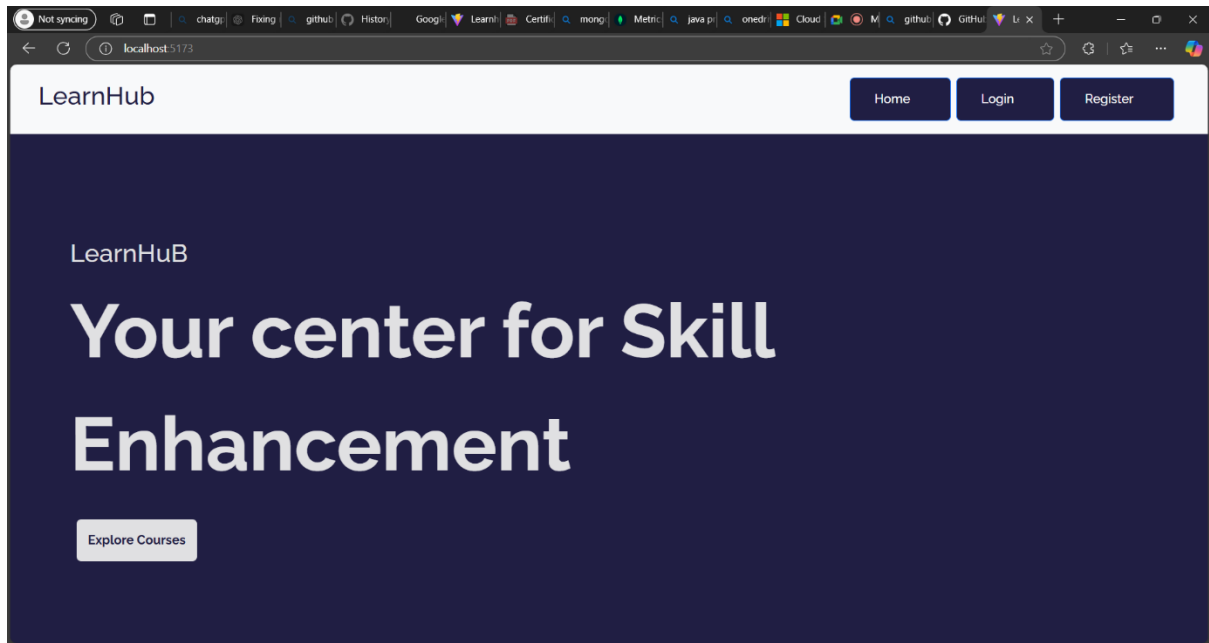
- The JWT token is included in the Authorization header (Bearer <token>) for all protected routes.
- Middleware on the backend verifies the token's validity and extracts the user's role and ID.

4. Role-Based Access Control:

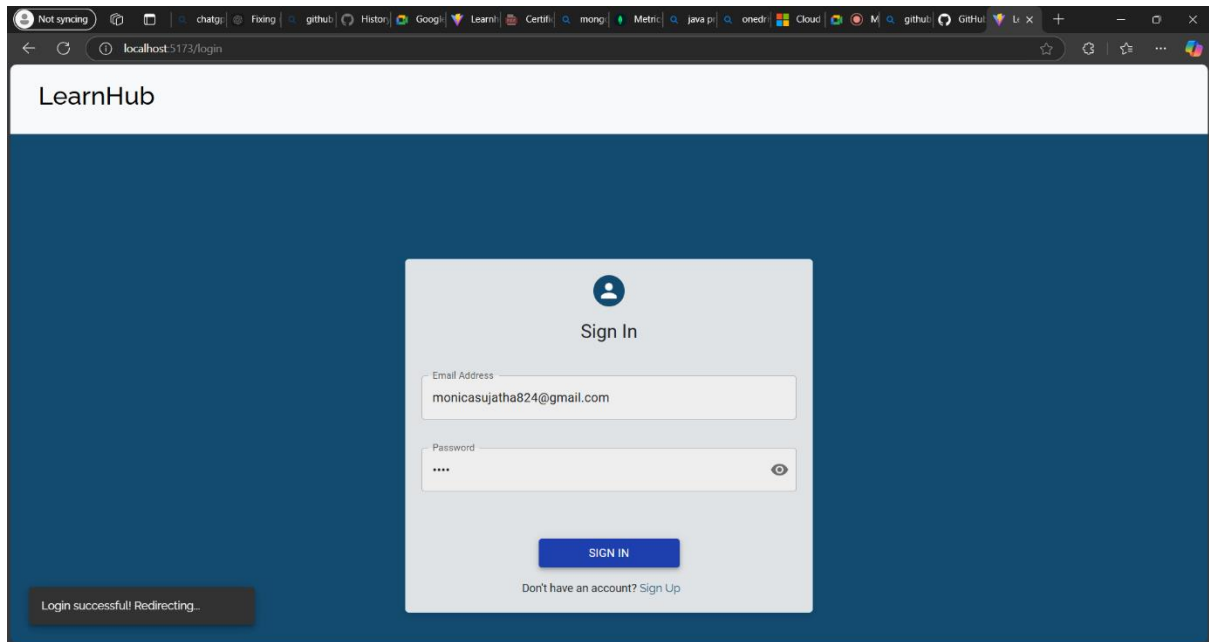
- Depending on the user's role (student, teacher, admin), they are granted specific permissions:
 - Students: Can access their enrolled courses and content.
 - Teachers: Can create, edit, and delete courses.
 - Admins: Can manage all users and content.

This approach ensures secure session management and fine-grained access control across the platform.

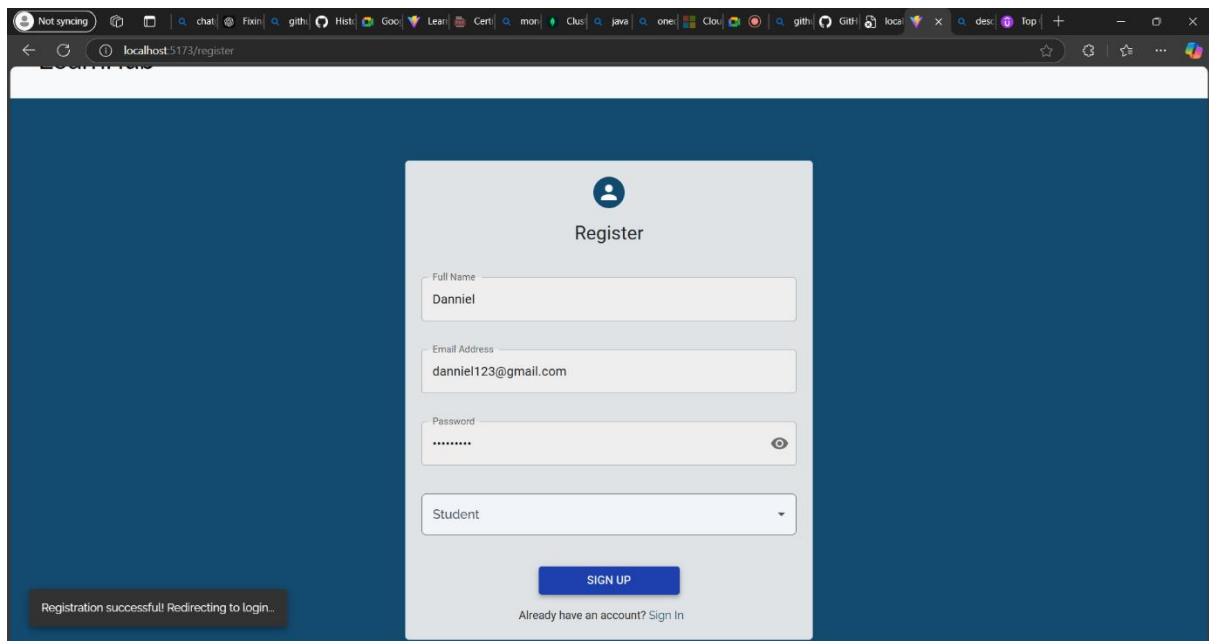
9. User Interfaces:



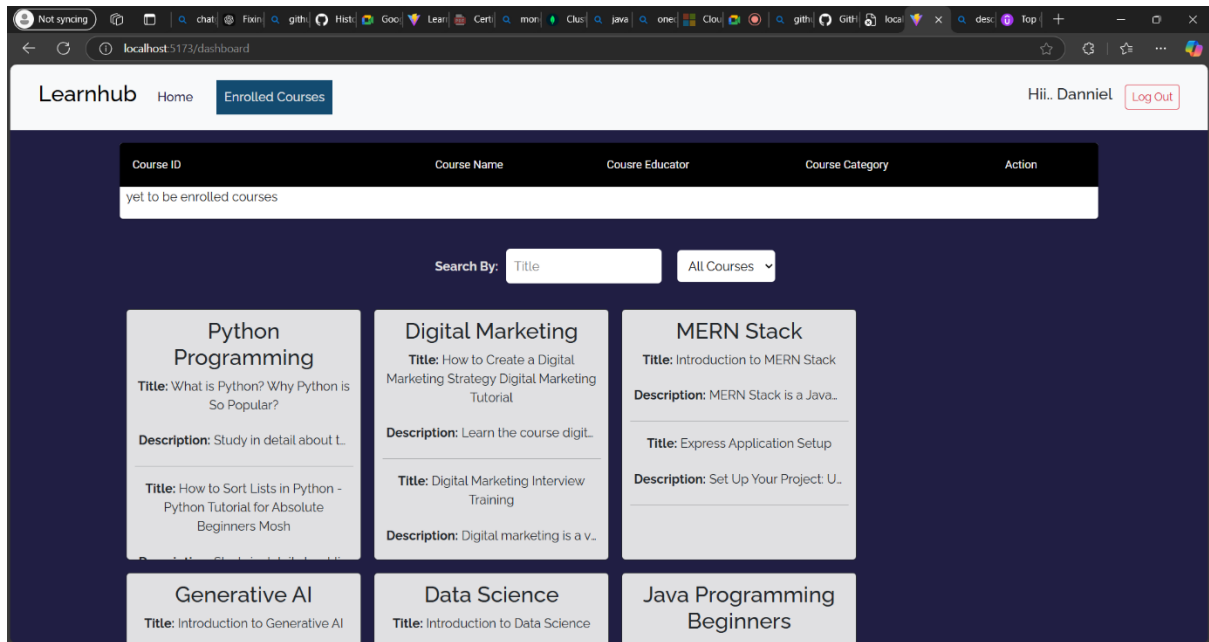
Landing Page



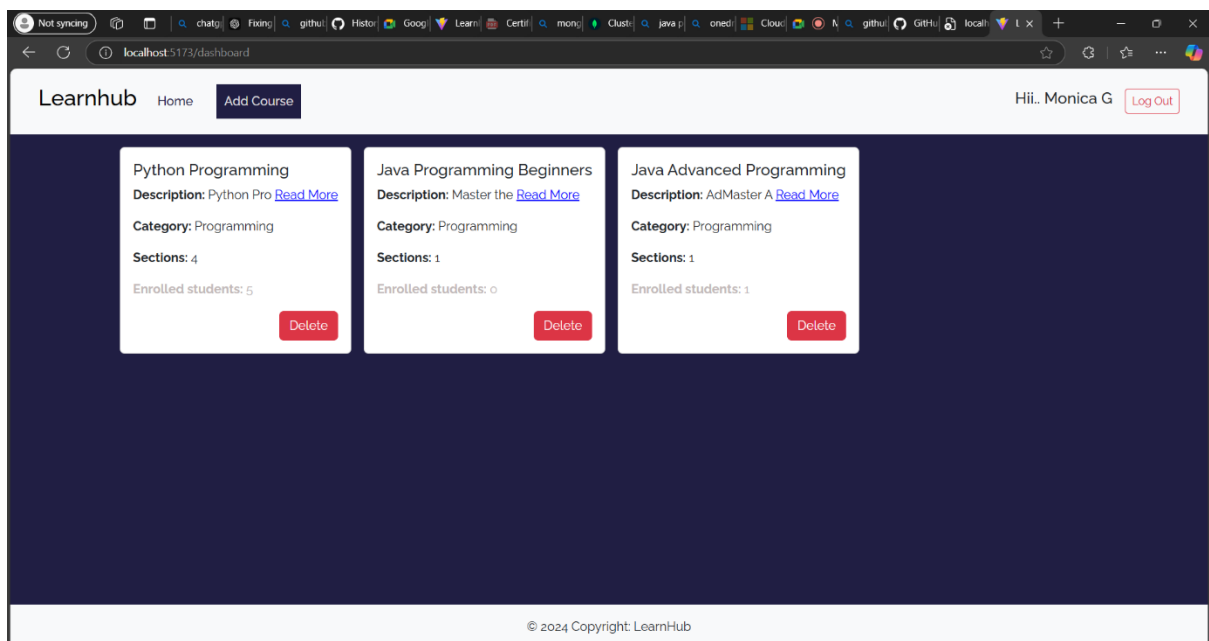
Login page



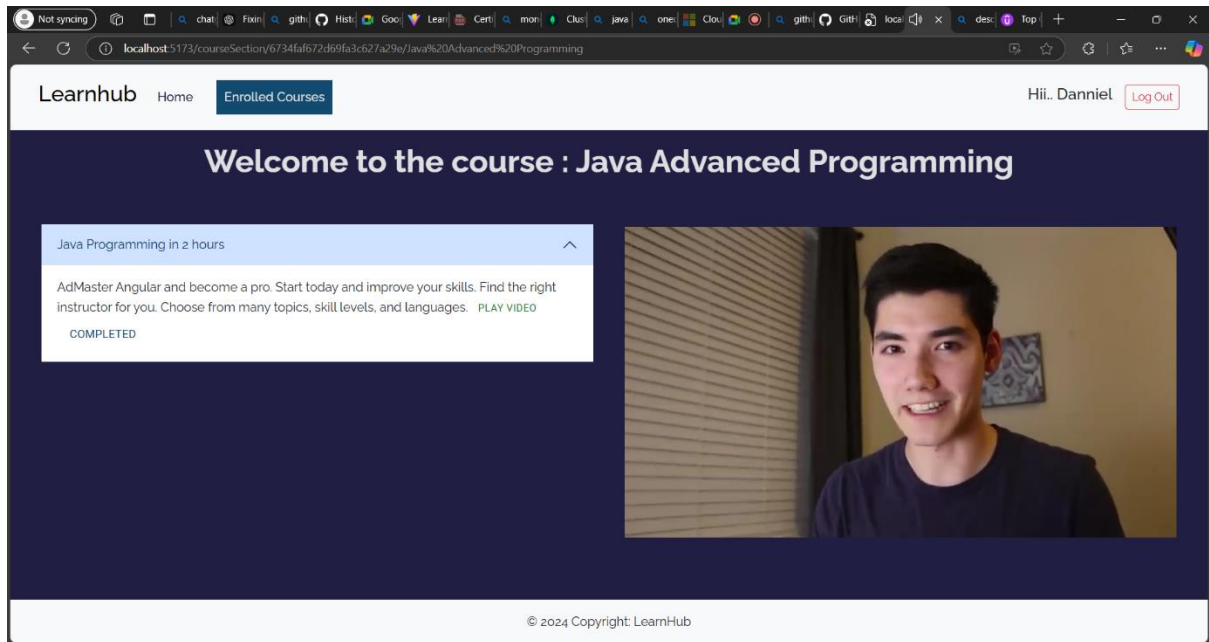
Registration page



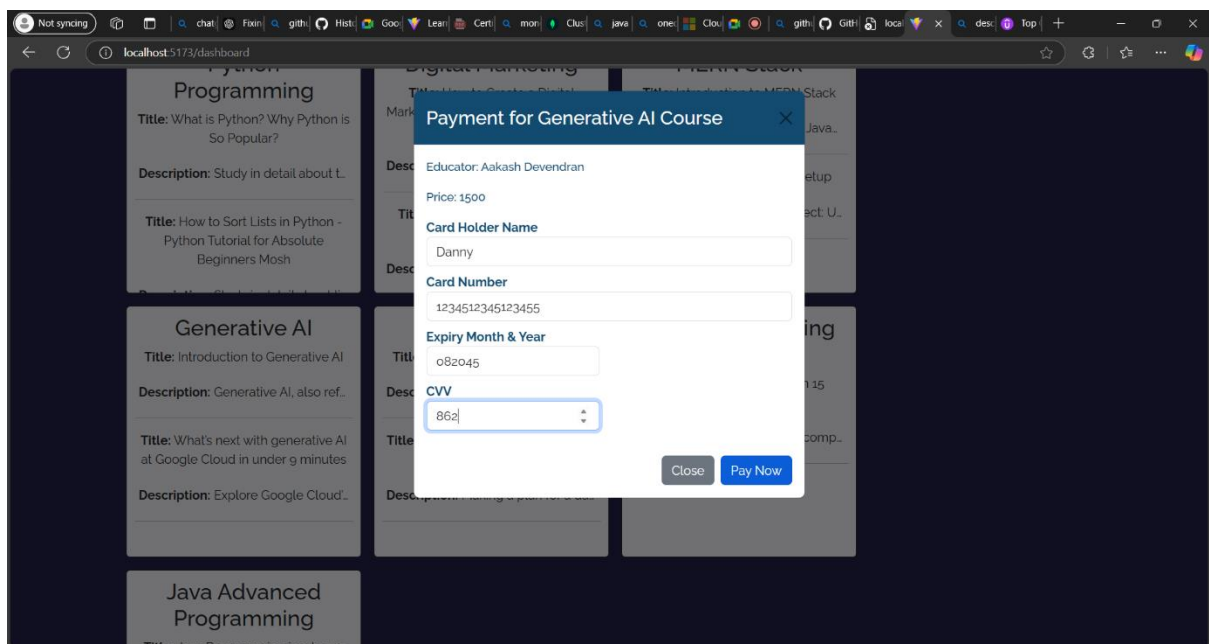
Student Dashboard



Teacher Dashboard



Course access page



Payment page

10. Testing of the Application

Testing ensures the functionality, performance, and security of LearnHub. Here's an overview of the testing process:

Unit Testing

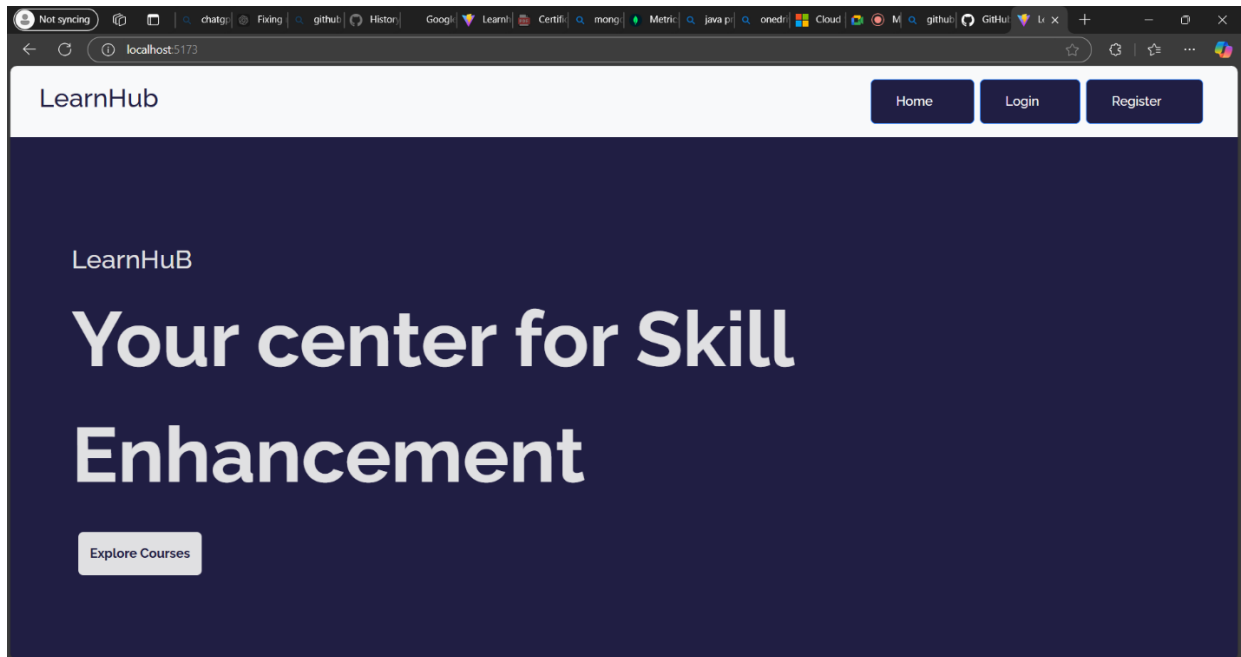
- **Focus:** Tests individual components and functions.
- **Tools:**
 - Jest for backend logic, such as API controllers and utility functions.
 - React Testing Library for testing React components.
- **Examples:**
 - Verifying correct rendering of the login form.
 - Testing backend functions like user registration or JWT generation.

Bug Tracking and Reporting

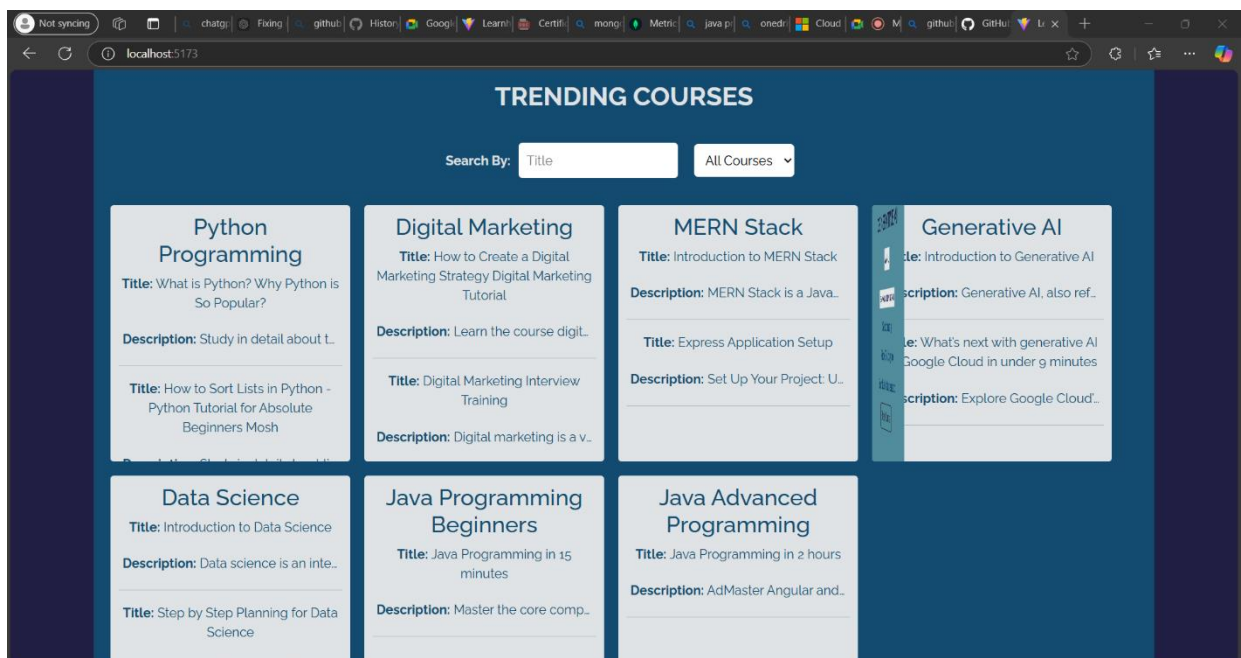
- Bugs and issues are documented using tools like JIRA or GitHub Issues, categorized, and prioritized for resolution.

Testing is an iterative process that ensures LearnHub delivers a seamless, secure, and efficient user experience.

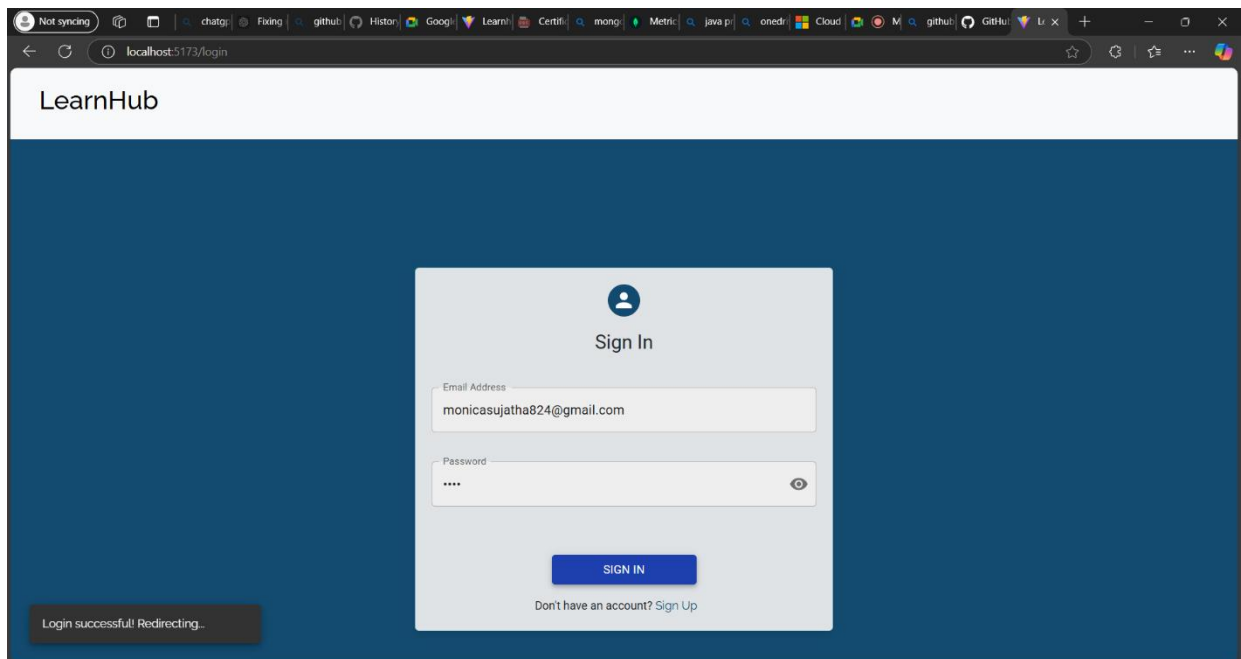
11. Screenshots / Demo



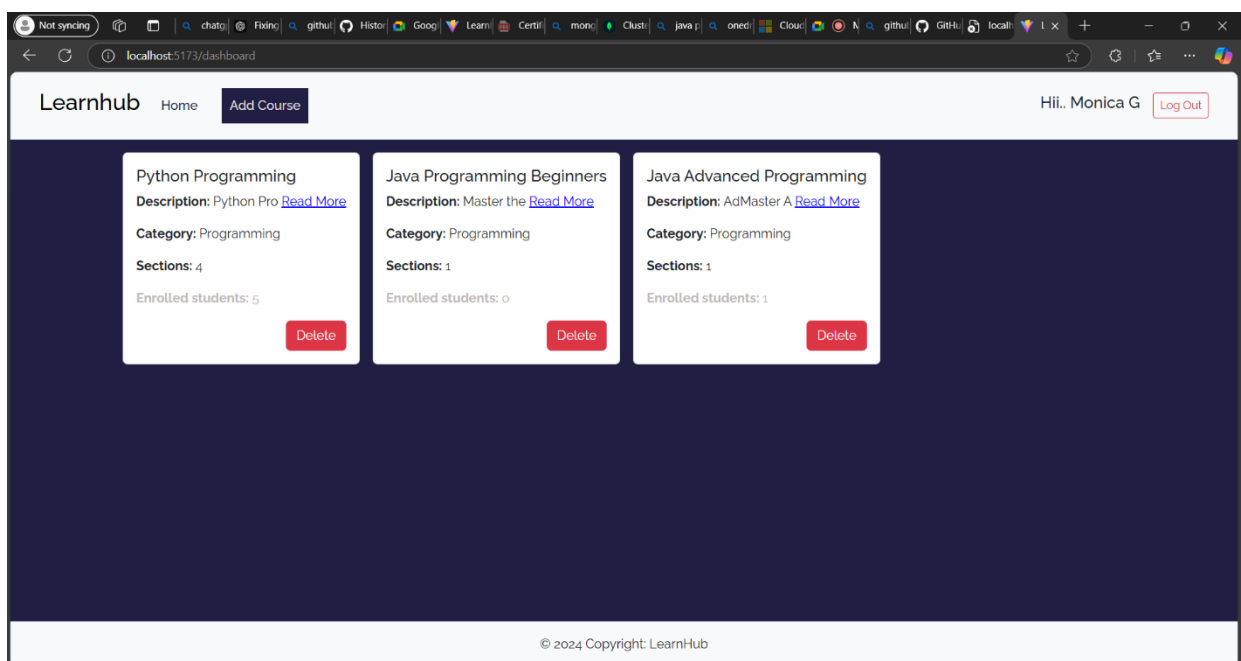
1.HomePage



2.Home Page



3. Login Page



4. Teacher's Home Page

Learnhub Home Add Course Hii.. Monica G Log Out

Educator Name
Aakash D

Course Title
MERN stack

Category
Programming

Price
799

Description
The MERN stack is an acronym for MongoDB, Express.js, React, and Node.js1. It is a comprehensive course that teaches full-stack development skills from scratch2. The MERN stack allows developers to build robust and scalable applications using JavaScript1.

Section Title
MERN Stack

Section Description

5.Add Course Page

Price
799

Description
The MERN stack is an acronym for MongoDB, Express.js, React, and Node.js1. It is a comprehensive course that teaches full-stack development skills from scratch2. The MERN stack allows developers to build robust and scalable applications using JavaScript1.

Section Title
MERN Stack

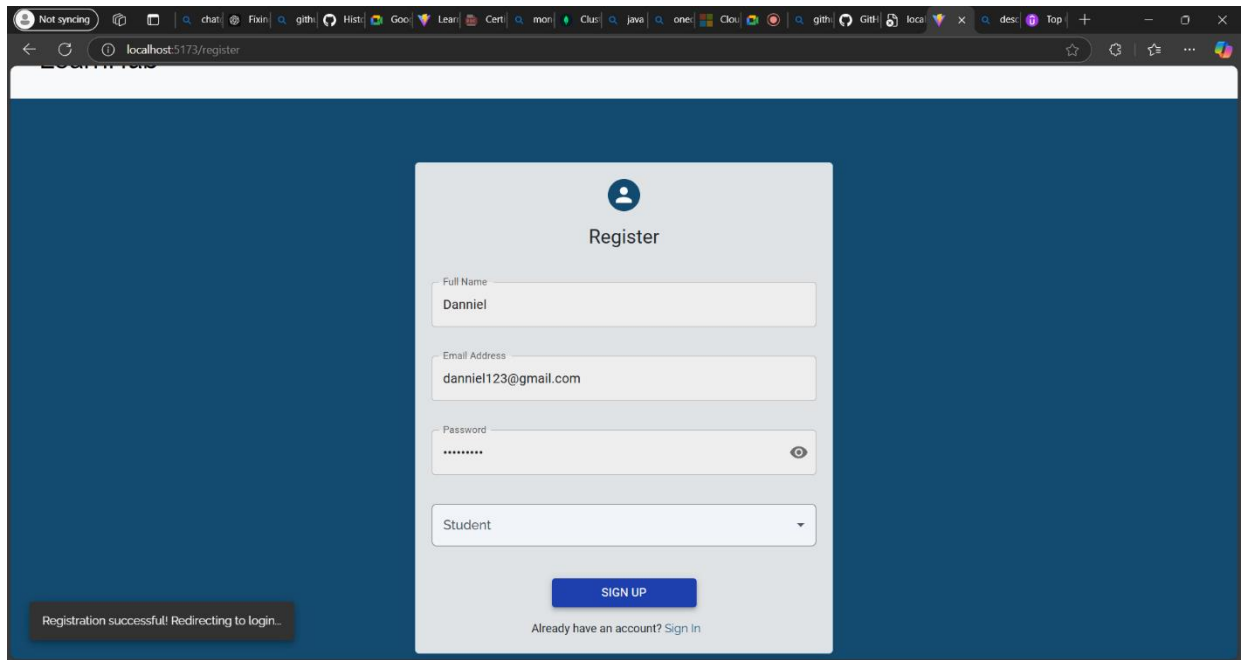
Section Description
The MERN stack is an acronym for MongoDB, Express.js, React, and Node.js1. It is a comprehensive course that teaches full-stack development skills from scratch2. The MER

Upload Content
Choose File MERN Stack Tutorial 1 - What is the MERN Stack.mp4

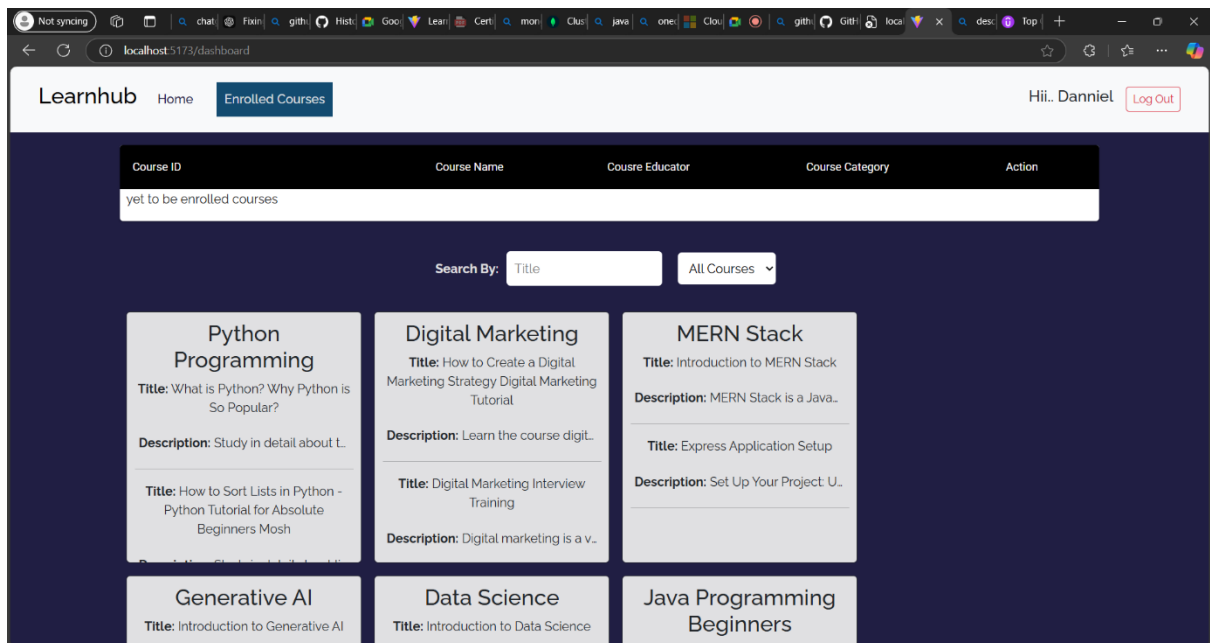
Add Section Submit

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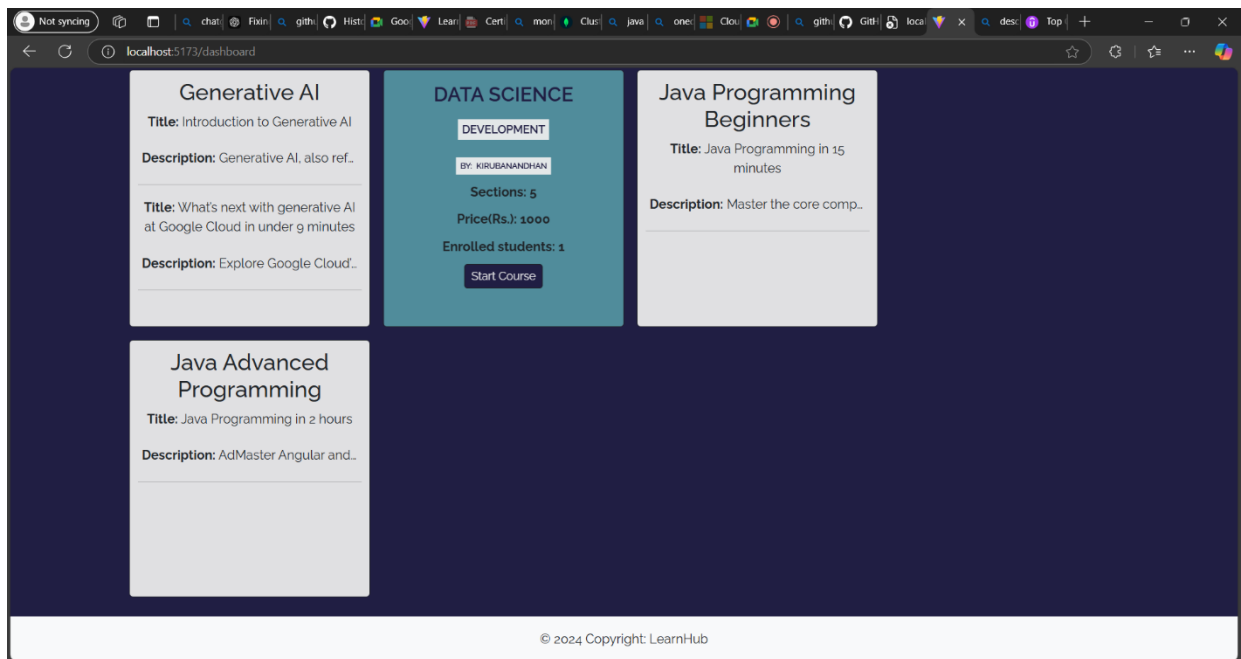
6.Add Course Page



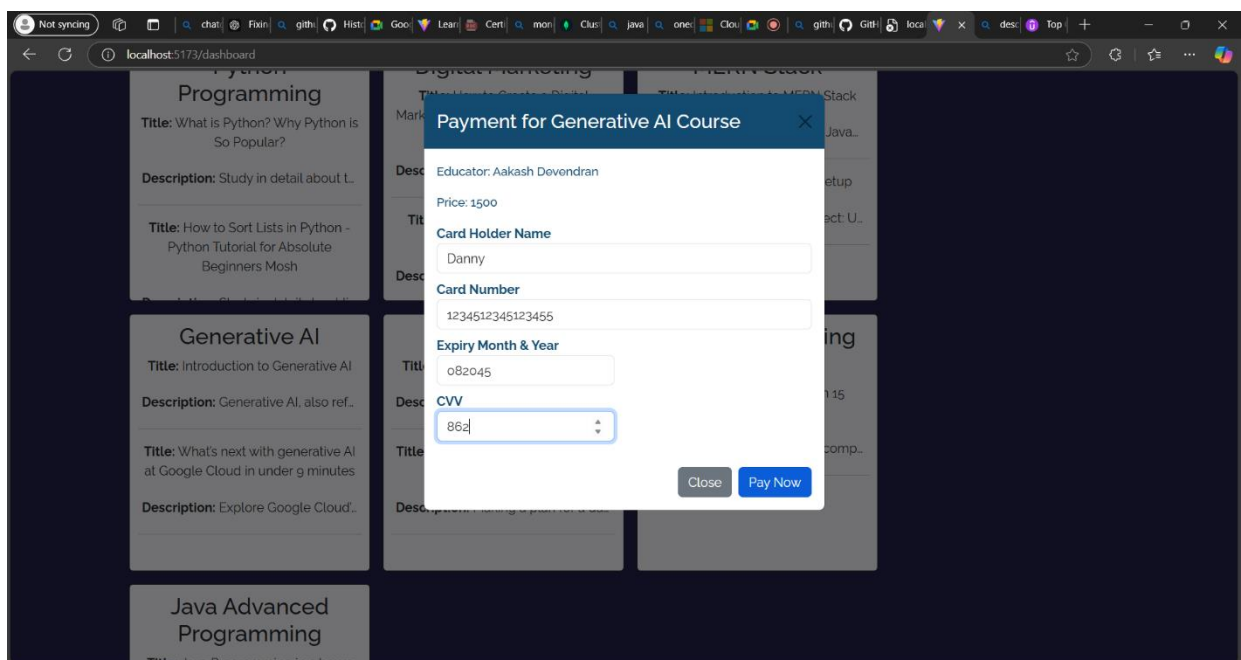
7.Register Page



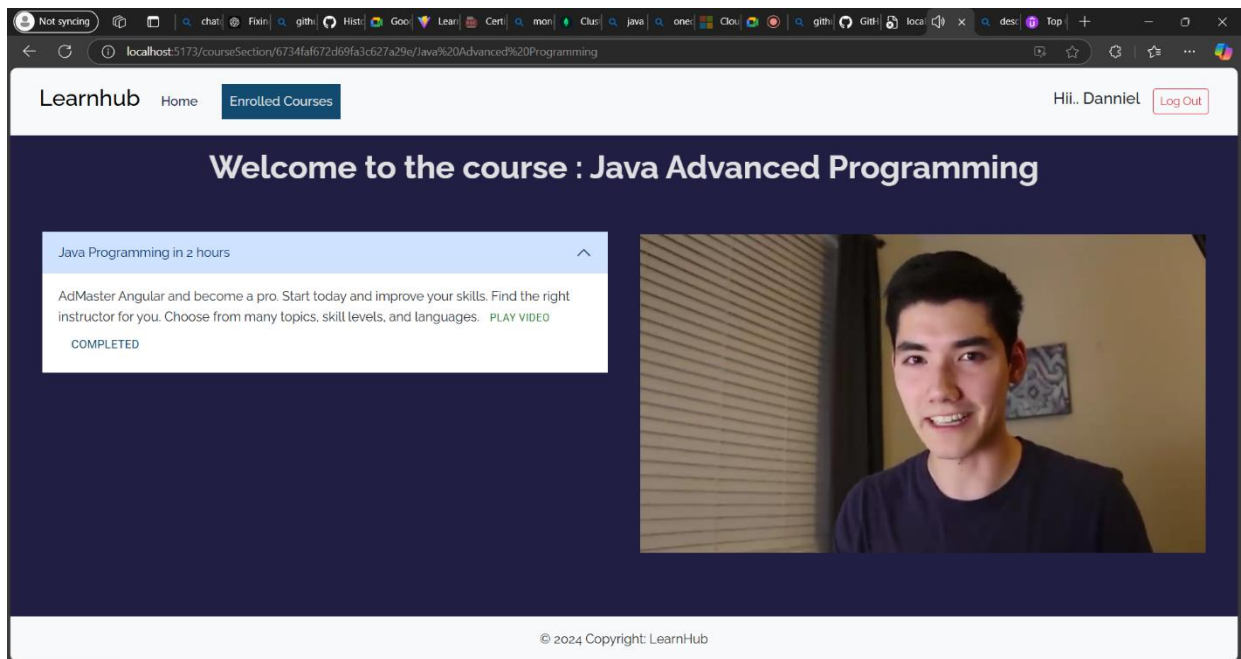
8.Student Home Page



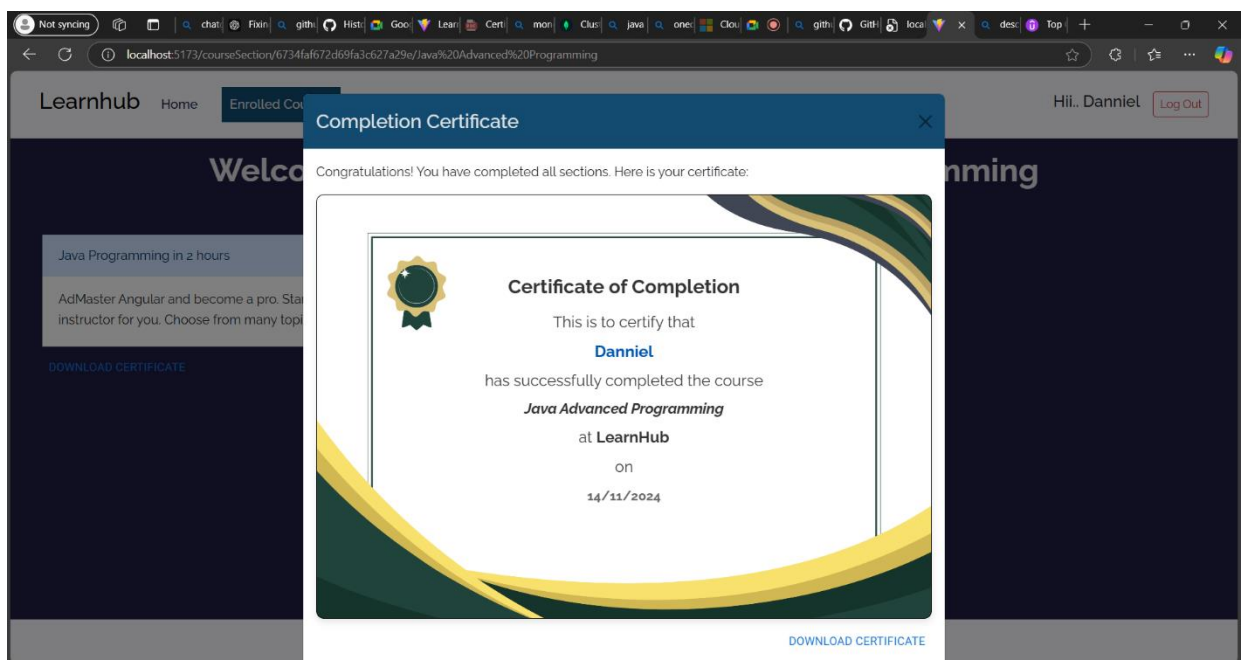
9.Enrolling Course



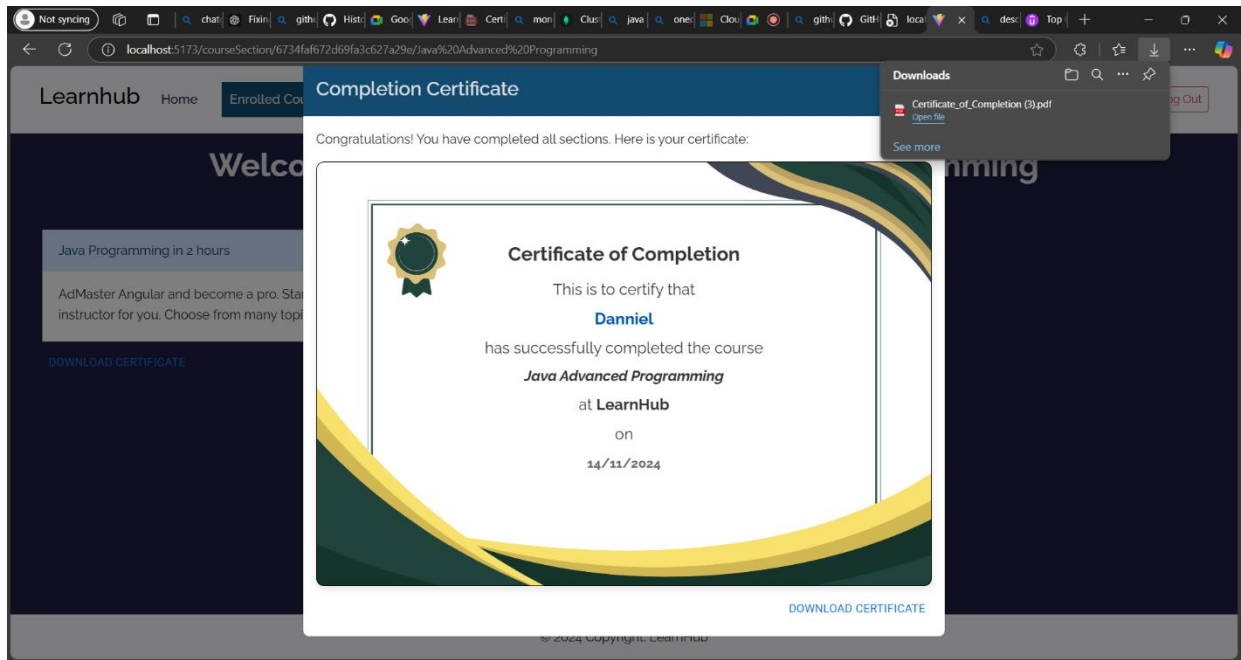
10.Course Payment



11.Course Content



12.Course Completion Certificate



13.Downloaded Certificate

User ID	User Name	Email	Type	Action
672b85779592f417718ec109	Monica G	monicasujatha824@gmail.com	Teacher	DELETE
672b88f6ca99978b3bed08d1	Aakash D	aakashdev2503@gmail.com	Student	DELETE
672c4454d891f3eaa4ca24d9	Jayashri A	jayashriashokkumar@gmail.com	Teacher	DELETE
672c55d1a3f55682eb2c8873	Sourav	souravanandn700@gmail.com	Teacher	DELETE
672c60e1ff66df80d93ad3cf	Jayashri A	miss.jayashriashokkumar@gmail.com	Student	DELETE
672c61b2e2d2376105021cfb	Aakash	aakashdev0825@gmail.com	Teacher	DELETE
672c627a79e2ace1ceb9acea	DK	souravanandn123@gmail.com	Student	DELETE
672cd6fe16788c15ab78a105	Moni	sujamoni824@gmail.com	Student	DELETE
673447e8ffceb118be358ec5	Monica G	monicasujatha@gmail.com	Admin	DELETE
67344c0cfcfeb118be358ed8	Moni	moni@gmail.com	Admin	DELETE
6734ed1272d69fa3c627a1a9	Mon	monicag@gmail.com	Student	DELETE

14.Admin User Management

Course ID	Course Name	Course Educator	Course Category	Course Price	Course Sections	Enrolled Students	Action
672c83d034557d088ebad6a5	Python Programming	Monica G	Programming	0	4	5	DELETE
672d8f8a52b337019dc865b9	Digital Marketing	Sourav Anand	Programming	700	2	1	DELETE
672d92c652b337019dc865bc	MERN Stack	Jayashri A	Development	699	4	1	DELETE
672d969252b337019dc865be	Generative AI	Aakash Devendran	AIML	1500	3	1	DELETE
672d9ad252b337019dc865c0	Data Science	Kirubanandhan	Development	1000	5	1	DELETE
6734f63f72d69fa3c627a279	Java Programming Beginners	Monica G	Programming	299	1	0	DELETE
6734faf672d69fa3c627a29e	Java Advanced Programming	Monica G	Programming	999	1	2	DELETE

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15.Admin Course Management

12. Known Issues

Current Known Bugs and Limitations in LearnHub:

1. Page Refresh Requirement:

- Some pages may require a manual refresh to reflect the latest data or changes (e.g., after enrolling in a course or completing a payment). This is due to caching and state management updates that need refinement.

2. Content Loading Delays:

- Occasionally, media files like videos or PDFs might take longer to load depending on the network and server load.

3. Limited Mobile Optimization:

- While the platform is functional on mobile devices, certain UI components may not be fully optimized for smaller screens.

4. Error Message Clarity:

- Some error messages (e.g., failed login or invalid input) may not provide detailed or user-friendly feedback.

13. Future Enhancements

Potential Improvements and New Features for LearnHub:

1. Real-Time Features:

- Integrate live class functionality using **WebRTC** for real-time teacher-student interactions.

2. Multi-Language Support:

- Enable content and UI localization to make the platform accessible to a global audience.

3. Enhanced Analytics:

- Add advanced analytics dashboards for students, teachers, and admins to monitor progress, engagement, and performance metrics.

4. AI-Driven Recommendations:

- Implement AI-powered personalized course suggestions based on user behavior and preferences.

5. Gamification:

- Introduce badges, leaderboards, and rewards to encourage engagement and motivation among users.

6. Improved Mobile Experience:

- Enhance the UI/UX for mobile users to ensure seamless functionality across all devices.

7. Automated Testing Integration:

- Add robust CI/CD pipelines with automated tests to ensure consistent quality during development and deployment.