BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI

SECOND SEMESTER 2024-25

DSECS ZG628T DISSERTATION (DSE)

Mid Semester Project Report on

CI/CD Pipeline with DevSecOps Integration for a Microservices-Based Application

Submitted By

Yash Hoshing
BITS ID: 2021MT70136

Name of supervisor : Nomitha Angadi

Designation: Associate Principal – Software Engineering

Name of Examiner: Praveenkumar Gopagoni

Designation: Professor

Project Overview

This project is centered on the combined design, development, and deployment of an advanced Task Management Application and the creation of a robust Continuous Integration/Continuous Deployment (CI/CD) pipeline. Both components play equally critical roles in the automation, reliability, scalability, and productivity delivered through the final solution. The dual focus ensures that not only is a functional application created, but it is also built, tested, secured, and deployed through industry-standard pipelines.

Project Goal and Objectives

Goal :

Design, develop, and deploy a robust Task Management Application that streamlines organizing, tracking, and completing tasks for individuals and teams, ensuring productivity and collaboration.

Objectives :

- Implement secure user authentication and authorization systems.
- Enable creation, updating, deletion, and retrieval of tasks with features like status, progress tracking, priority, dependencies, and labels.
- Provide real-time dashboards and reporting features for monitoring progress and productivity.
- Lay the groundwork for integrating CI/CD pipelines to automate testing, building, and deployment in future stages.

System Requirements

Hardware Requirements :

- Processor: Quad-core 2.4GHz or greater.
- RAM: Minimum 8GB (16GB recommended for production).
- Storage: At least 20GB of available disk space.

Software Requirements :

- **Backend:** Python 3.9+, FastAPI, SQLAlchemy, PostgreSQL.
- **Frontend:** React.js
- **Containerization:** Docker (for future deployment).
- **Optional (Future plans):** monitoring tools (Grafana, Prometheus).

Progress to Date :

- **Requirements Analysis:** Defined use cases and main features around secure task operations and user roles.
- **System Design:** Designed the application architecture and database schemas to support advanced task features (status, dependencies, priorities, progress, labels).
- **Backend Implementation:** Developed API endpoints for:
  - Secure user registration/authentication.
  - CRUD operations for tasks, including support for dependencies, priorities, and labels.
  - Dashboard endpoints supplying real-time data.

API Endpoints Used in the Project :

- **User Service Endpoints:**
  These endpoints allow users to register a new account, authenticate (log in) and obtain a JWT token, and retrieve their own profile information.

Endpoint	Method	Description
/register	POST	Register a new user account with required credentials.
/login	POST	Authenticate user and return a JWT token for secure access.
/users/me	GET	Retrieve profile information of the currently authenticated user.

- **Task Service Endpoints:**

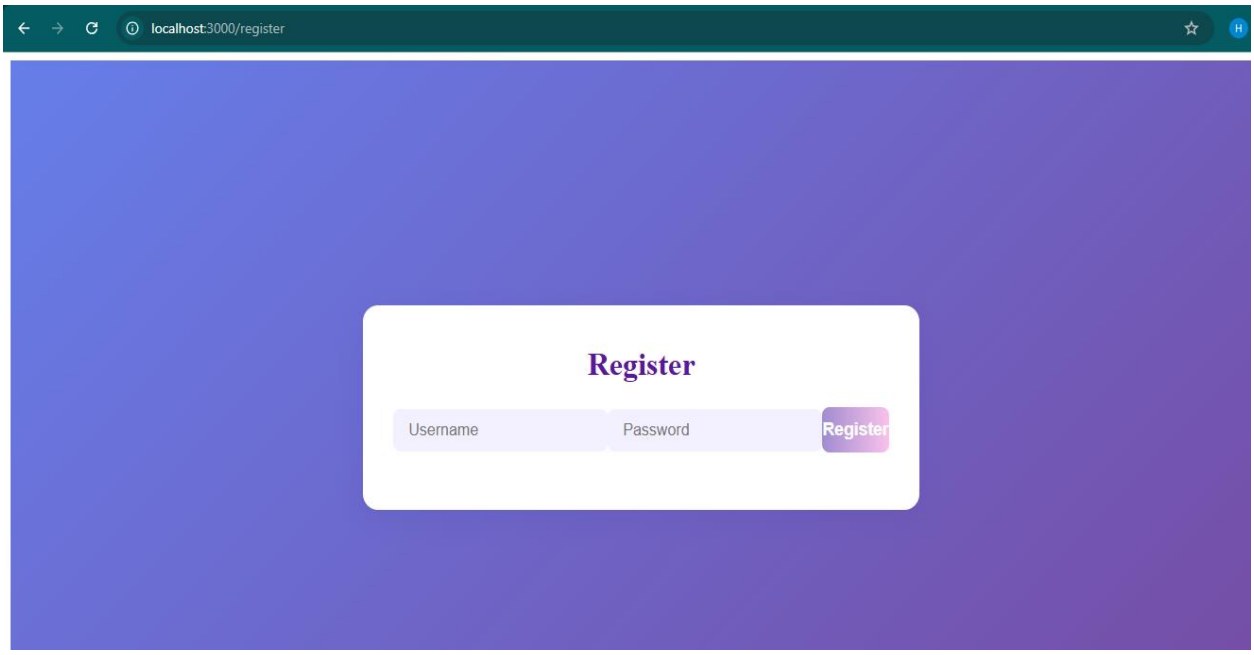
  These endpoints let authenticated users create, read, update, and delete tasks—supporting features such as filtering by priority , reporting, and dashboard analytics. They provide all functionality required for users to manage their workflow and monitor their progress.

Endpoint	Method	Description
/tasks	POST	Create a new task for the authenticated user.
/tasks	GET	Retrieve the list of tasks for the authenticated user.

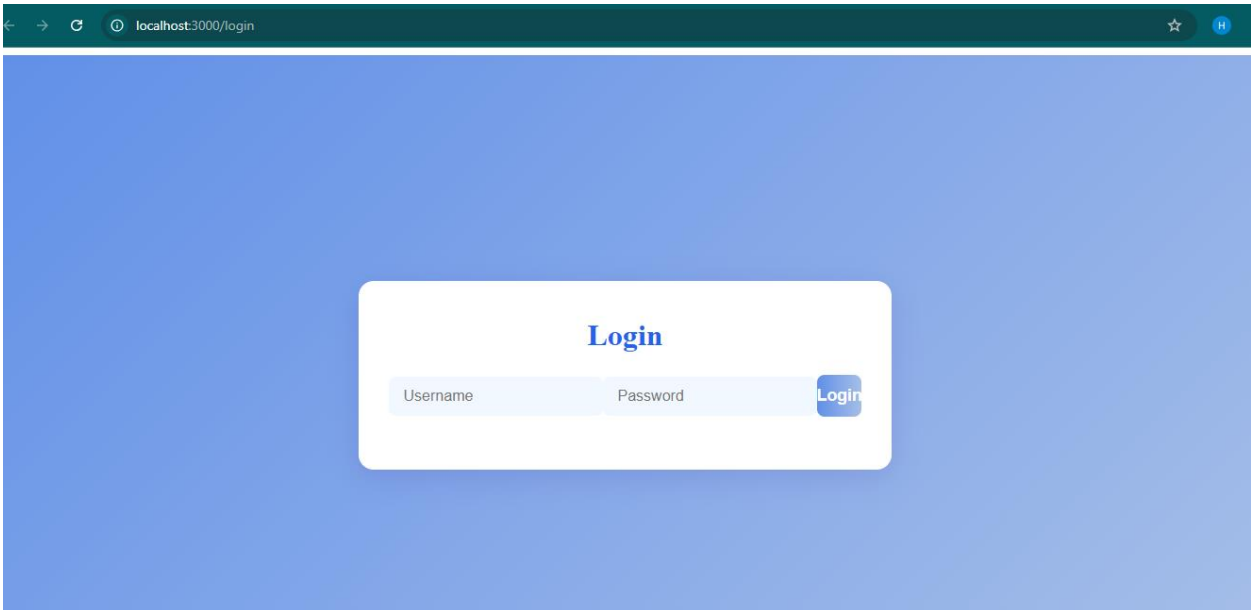
/tasks/{task_id}	GET	Get detailed information on a specific task owned by the authenticated user.
/tasks/{task_id}	PUT	Update an existing task's data, including status, priority, dependencies, and labels.
/tasks/{task_id}	DELETE	Delete a specific task.
/dashboard/summary	GET	Get real-time analytics including counts of completed, in-progress, blocked, and overdue tasks, plus averages.

UI Overview:

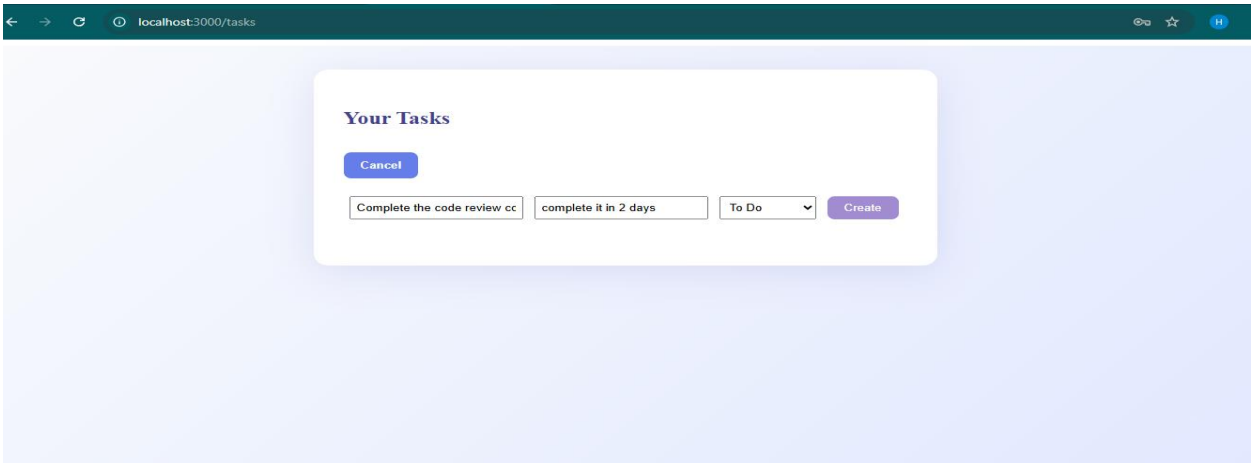
- **Register User**



- **User login Page**



- **Add Task Page**



Challenges Encountered

- Managing and validating complex task dependencies, ensuring data integrity.

- Designing extensible schemas to accommodate future collaborative and reporting features.
- Planning for future CI/CD integration while maintaining clean separation of concerns.

Future Work and Next Steps

Immediate Next Steps

- **Frontend Development:** Build a user-friendly interface for interacting with the backend APIs, supporting dashboards .
- **Documentation Expansion:** Complete end-user and deployment manuals.

Planned CI/CD Integration

- **CI/CD Pipeline Implementation:**
    - Automate code building, testing, and packaging using tools such as Jenkins.
    - Integrate static (SonarQube) and dynamic (OWASP ZAP) security scanning into the pipeline.
    - Enable automated Docker image creation and publishing for backend services.
    - Develop and test deployment scripts for Kubernetes.
    - Configure continuous deployment with automatic rollback, monitoring, and reporting.
- **Testing and Security:**
    - Expand unit and integration test coverage.
    - Harden the system against vulnerabilities through automated scans.
- **Deployment:**
    - Roll out production deployments using the new pipeline.
    - Establish centralized logging and monitoring.