

Dockerized Entertainment React Service

Course Name: DevOps Foundation

Institution Name: Medicaps University – Datagami Skill Based Course

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Problem Statement & Objectives

1. Problem Statement

Modern web applications often suffer from inconsistent development environments, deployment challenges, and integration issues between frontend, backend, and database components. Manual deployments lead to configuration mismatches, downtime, and scaling difficulties.

The objective of this project is to containerize an Entertainment Service application built using React and FastAPI using Docker best practices. The project also aims to automate deployment using CI/CD pipelines and ensure portability across development and production environments.

2. Project Objectives

1. Containerize React frontend using multi-stage Docker build.
 2. Containerize FastAPI backend with optimized Python image.
 3. Integrate MySQL database container.
 4. Create Docker Compose configuration for service orchestration.
 5. Implement CI/CD pipeline using GitHub Actions.
 6. Deploy the application on AWS EC2.
 7. Ensure consistent, portable, and scalable deployment architecture.
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3. Scope of the Project

The project focuses on:

- Containerization of frontend, backend, and database services.
- Image optimization using multi-stage builds.
- Service orchestration using Docker Compose.
- Automated deployment pipeline using GitHub Actions.
- Cloud deployment on AWS EC2.

Proposed Solution

The solution involves creating isolated Docker containers for each service:

- React frontend (served via Nginx)
- FastAPI backend (served via Uvicorn)
- MySQL database

A Docker Compose file orchestrates these services and handles networking and dependencies.

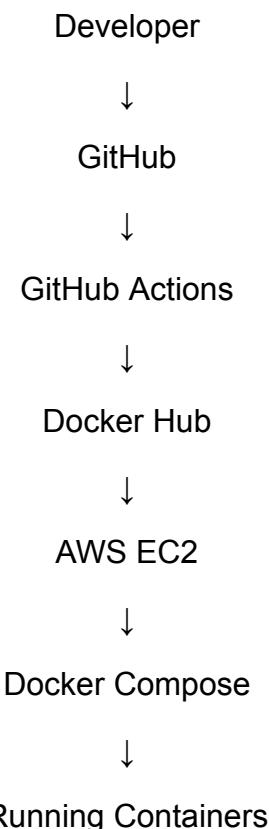
CI/CD automation is implemented using GitHub Actions. On every push to the main branch, Docker images are built and pushed to Docker Hub. The pipeline then connects to an EC2 instance and redeploys the updated containers automatically.

1. Key Features

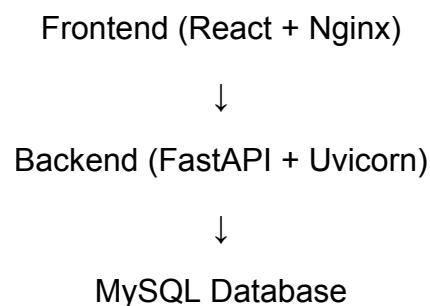
- Multi-stage Dockerfile for frontend optimization
 - Lightweight Python backend container
 - MySQL container with persistent volume
 - Docker Compose orchestration
 - REST API with authentication
 - CI/CD pipeline using GitHub Actions
 - Automated cloud deployment on AWS EC2
 - Secure environment variable configuration
 - Service-to-service communication using Docker networking
-

2. Overall Architecture / Workflow

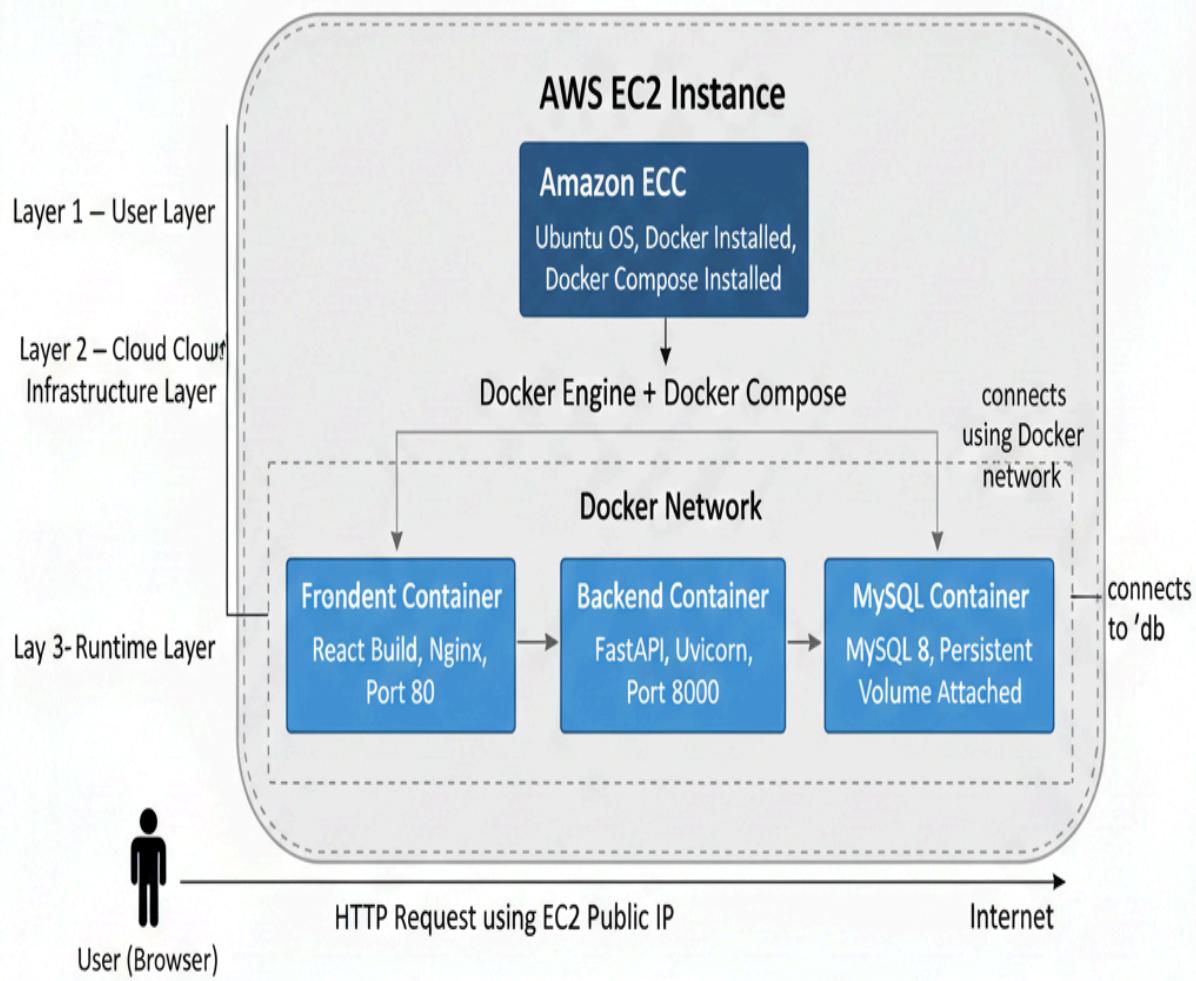
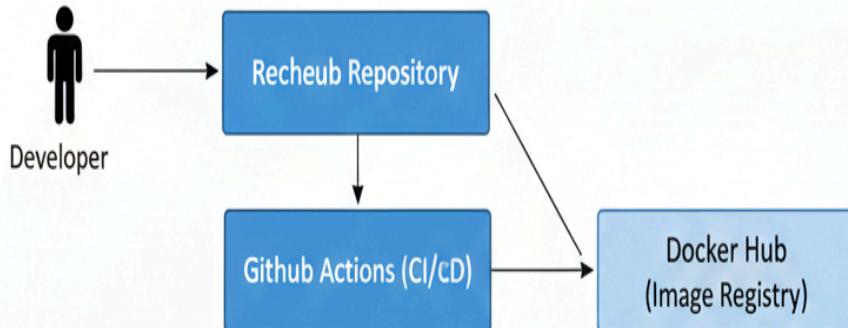
2.1 Development Workflow



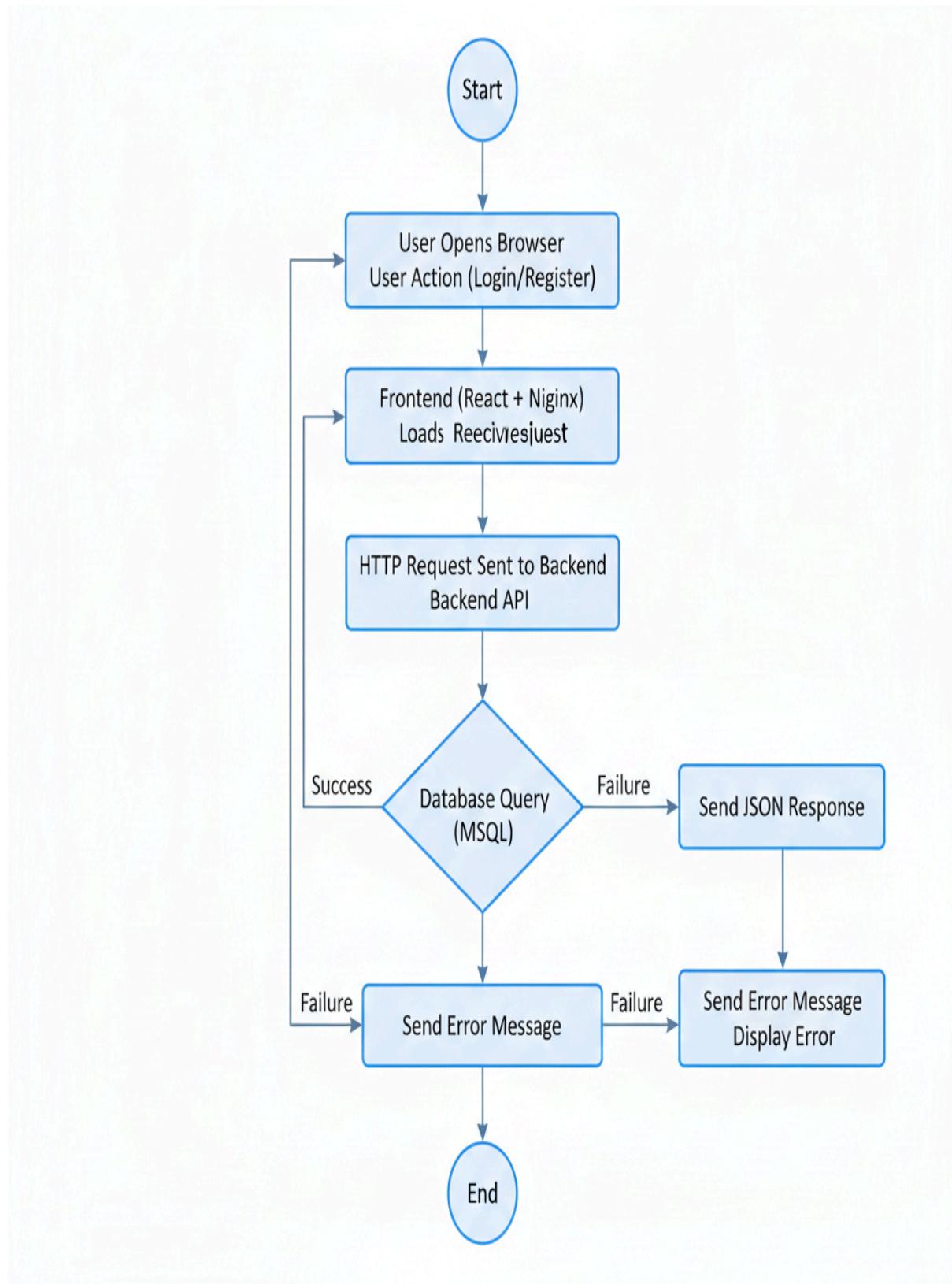
2.2 Application Architecture



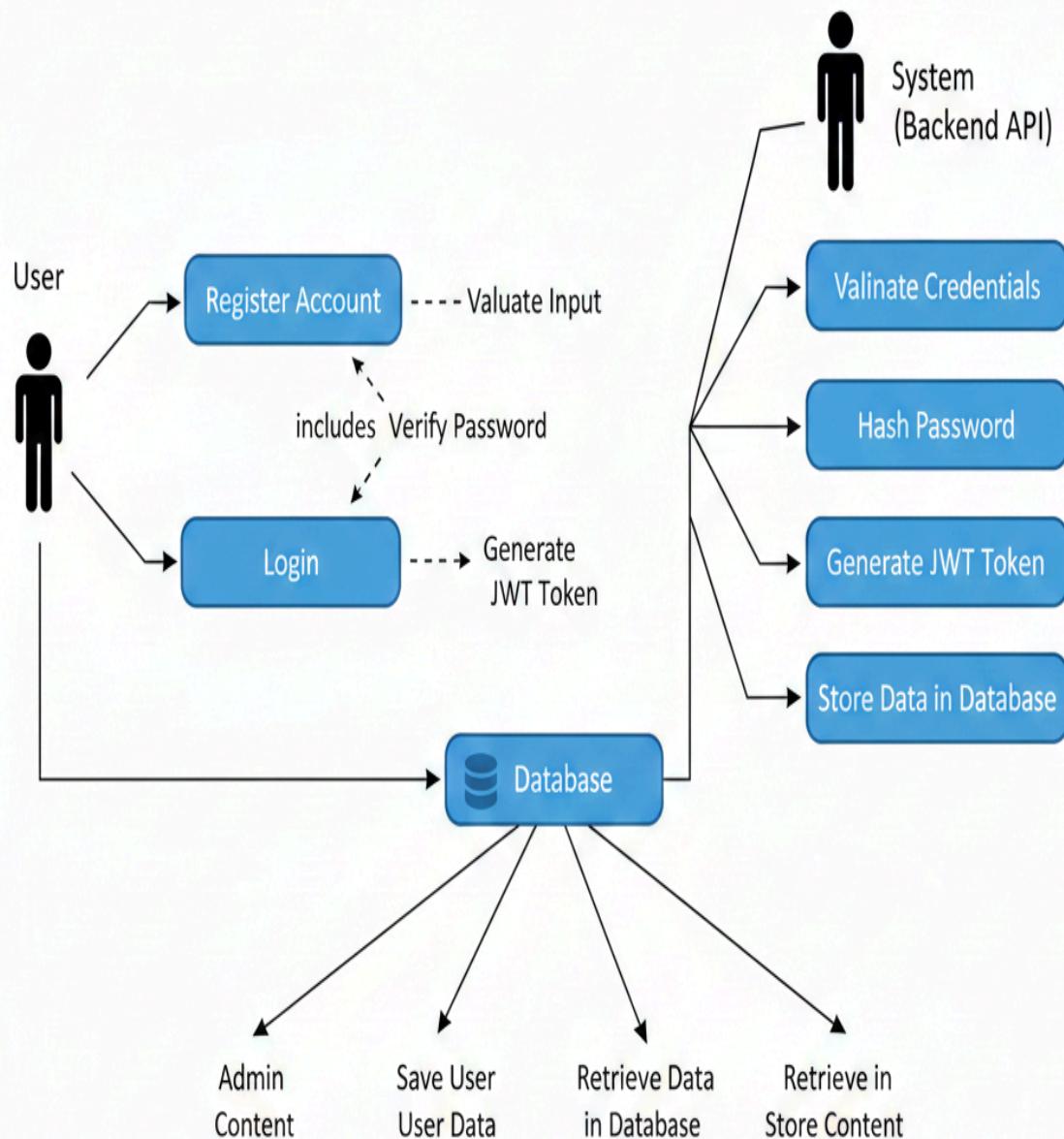
2.3 System Architecture



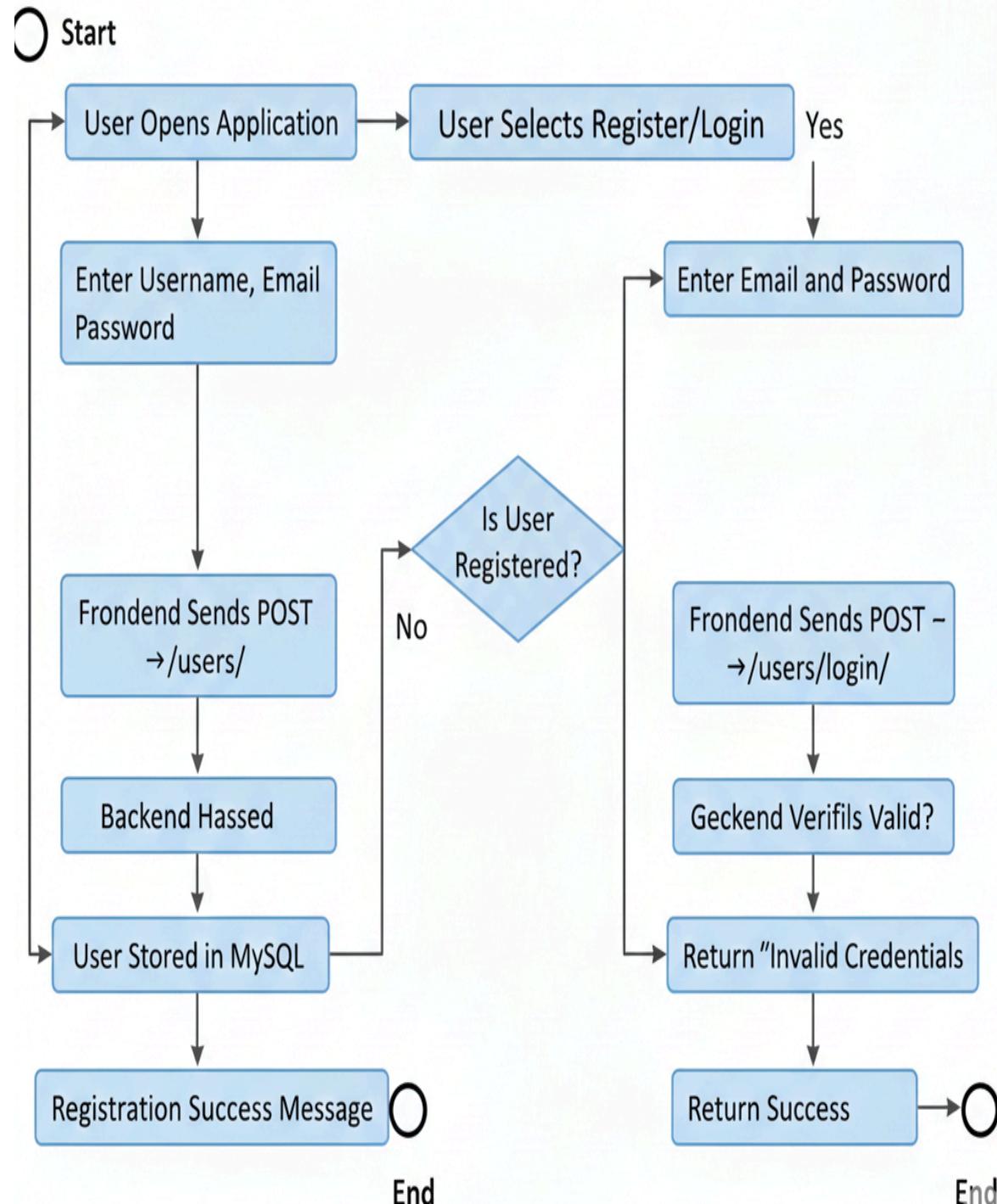
2.4 Flow chart



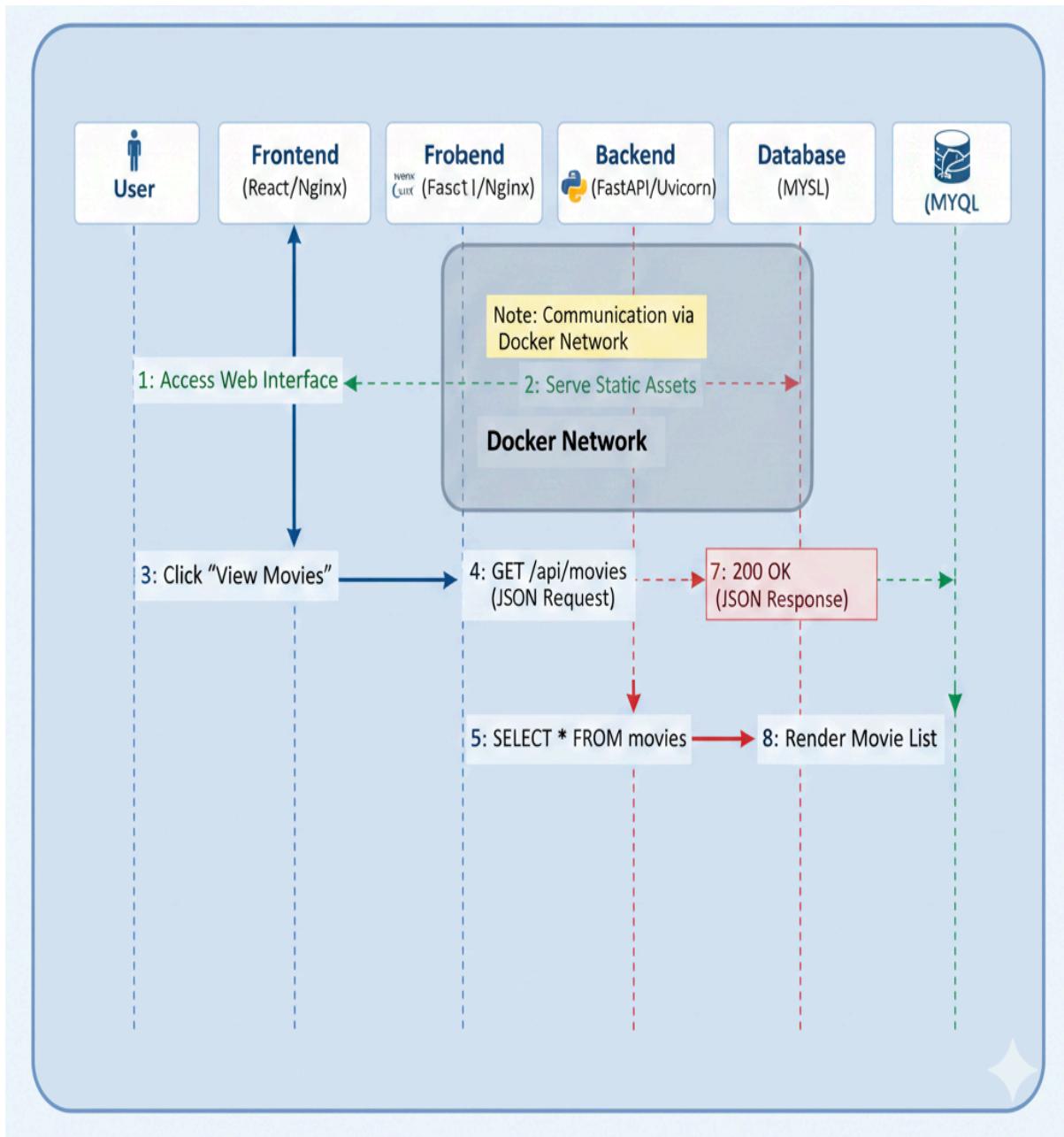
2.5 Use case diagram



2.6 Activity Diagram



2.7 Sequence diagram



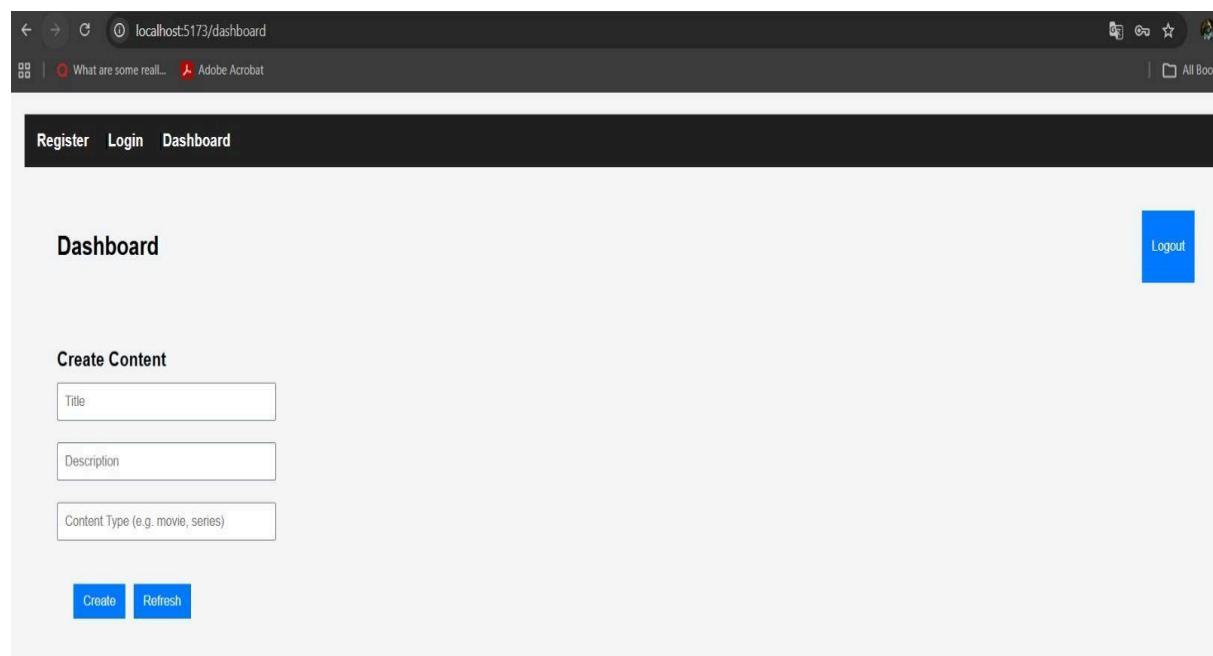
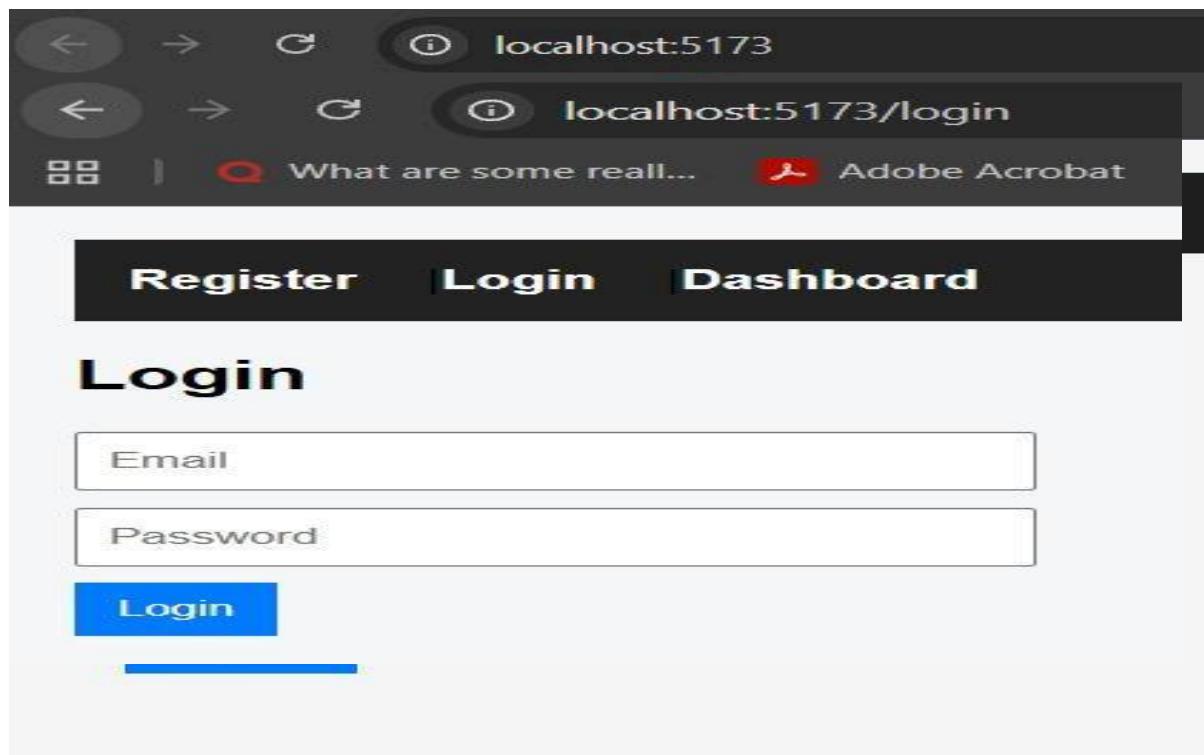
2. Tools & Technologies Used

- Git (Version Control)
- Docker (Containerization)
- Docker Compose (Service Orchestration)
- GitHub Actions (CI/CD)
- AWS EC2 (Cloud Deployment)
- React (Frontend)
- FastAPI (Backend)
- MySQL (Database)
- Nginx (Frontend Serving)
- Uvicorn (ASGI Server)

Results & Output

1. Screenshots / Outputs

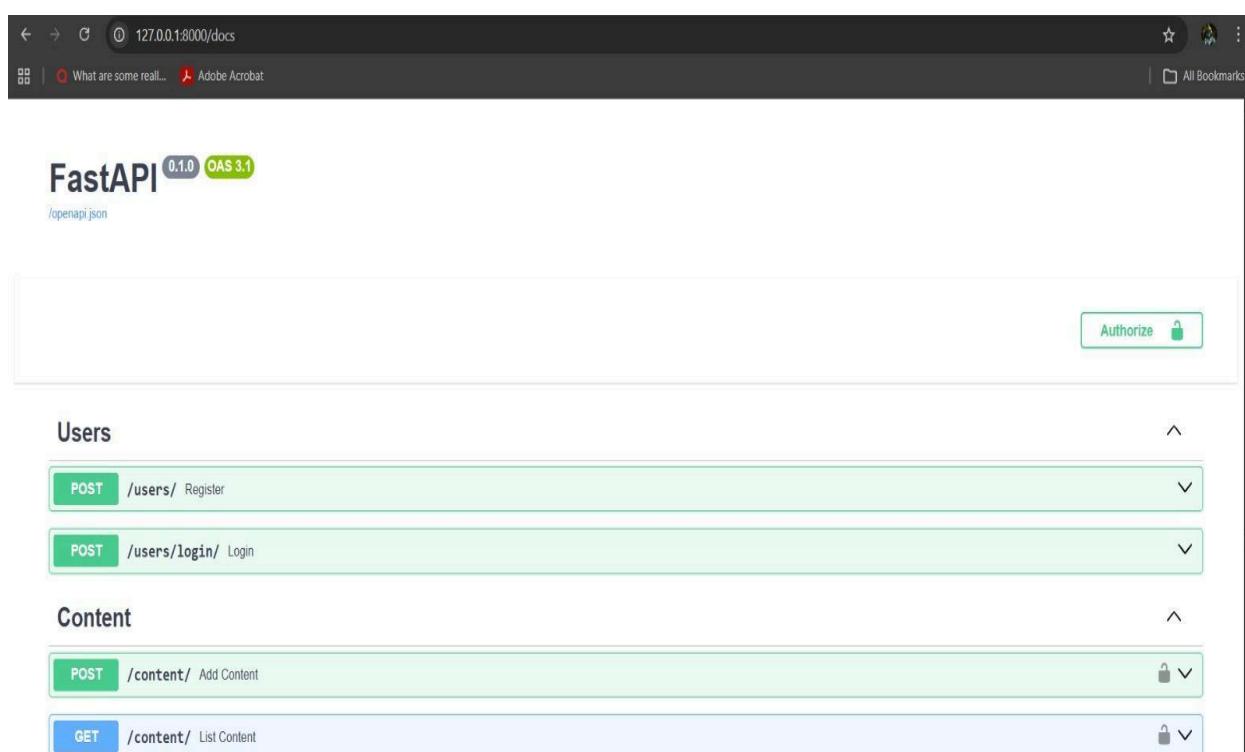
- Login/Register UI



Search / Filter

SearchClear

- Swagger API documentation



The screenshot shows the FastAPI Swagger UI documentation at `127.0.0.1:8000/docs`. The interface includes a header with the FastAPI logo (0.1.0), OAS 3.1, and an Authorize button. Below the header, there are two main sections: "Users" and "Content".

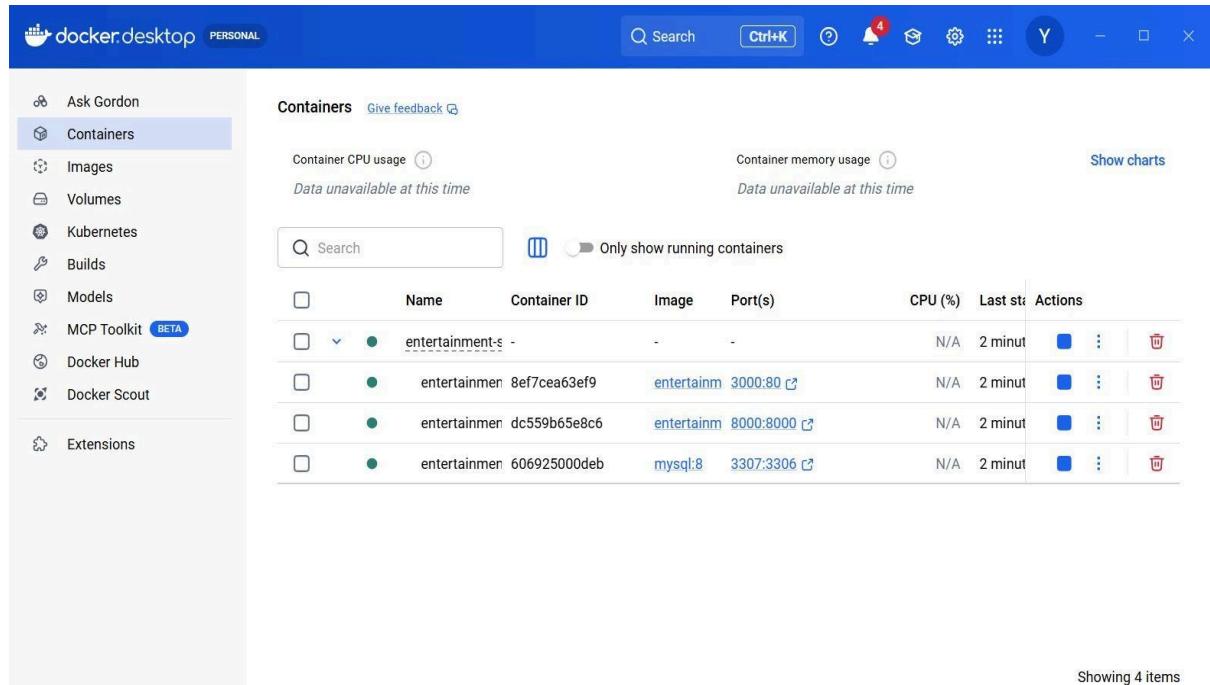
Users

- `POST /users/` Register
- `POST /users/login/` Login

Content

- `POST /content/` Add Content
- `GET /content/` List Content

- Running containers (docker ps)

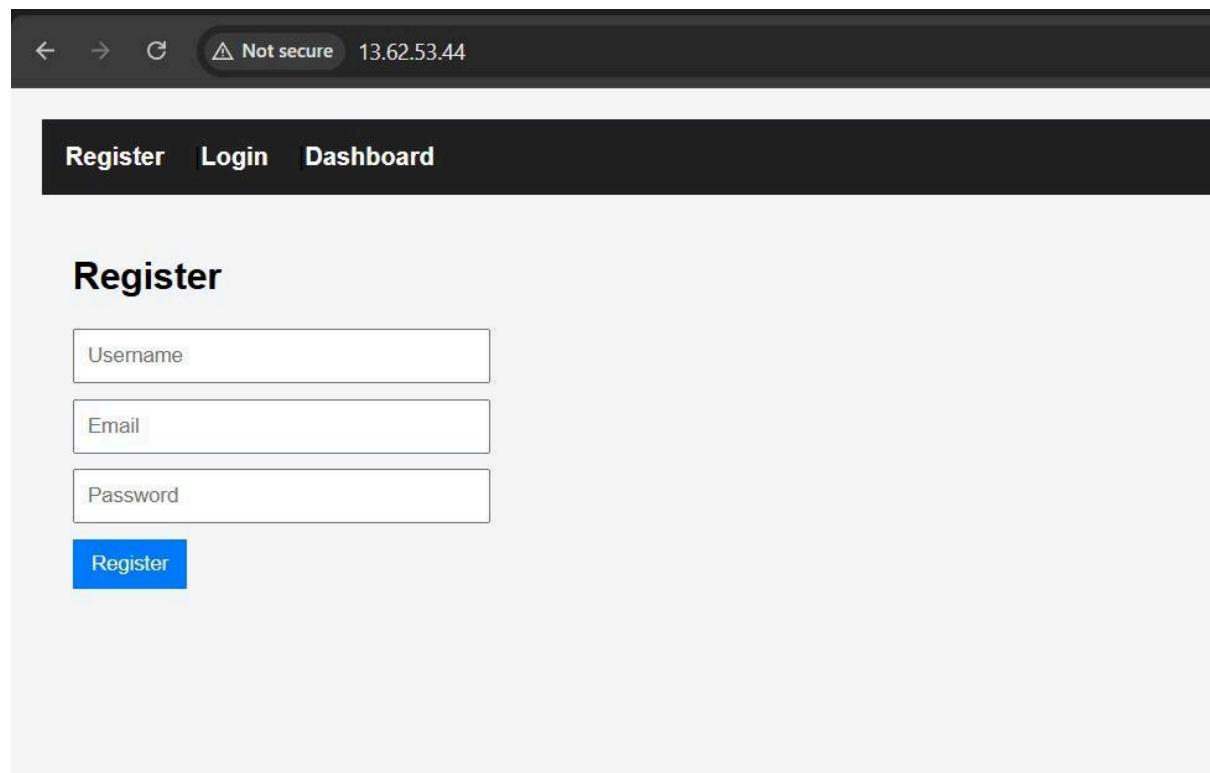


The screenshot shows the Docker Desktop interface. The left sidebar has 'Containers' selected. The main area displays a table of running containers:

	Name	Container ID	Image	Port(s)	CPU (%)	Last st:	Actions
<input type="checkbox"/>	entertainment-s -	-	-	-	N/A	2 minut	... Stop
<input type="checkbox"/>	entertainmen 8ef7cea63ef9	entertainm	3000:80 ↗		N/A	2 minut	... Stop
<input type="checkbox"/>	entertainmen dc559b65e8c6	entertainm	8000:8000 ↗		N/A	2 minut	... Stop
<input type="checkbox"/>	entertainmen 606925000deb	mysql:8	3307:3306 ↗		N/A	2 minut	... Stop

Showing 4 items

- EC2 deployment



The screenshot shows a web browser window with the URL `13.62.53.44`. The page title is "Register". The form fields are:

- Username
- Email
- Password
- Register button

- GitHub Actions successful run

2. Reports / Dashboards / Models

- CI/CD execution logs

- Docker image build logs

✓ Image mysql:8	Pulled
✓ Image entertainment-service-webapp-devops-backend	Built
✓ Image entertainment-service-webapp-devops-frontend	Built
✓ Network entertainment-service-webapp-devops_default	Created
✓ Volume entertainment-service-webapp-devops_mysql_data	Created
✓ Container entertainment-mysql	Healthy
✓ Container entertainment-backend	Created
✓ Container entertainment-frontend	Created

- Container health status

```
ubuntu@ip-172-31-24-149:~/Entertainment-Service-WebApp-DevOps$ docker compose ps
      NAME           IMAGE             COMMAND       SERVICE   CREATED        STATUS          PORTS
entertainment-backend  entertainment-service-webapp-devops-backend  "uvicorn app.main:ap..."  backend  5 minutes ago  Up 4 minutes  0.0.0.0:8000->8000/tcp
entertainment-frontend  entertainment-service-webapp-devops-frontend  "/docker-entrypoint.s..."  frontend  5 minutes ago  Up 4 minutes  0.0.0.0:80->80/tcp,
[::]:80->80/tcp
entertainment-mysql    mysql:8            "docker-entrypoint.s..."  db        5 minutes ago  Up 5 minutes (healthy)  3306/tcp, 33060/tcp
ubuntu@ip-172-31-24-149:~/Entertainment-Service-WebApp-DevOps$
```

3. Key Outcomes

- Successfully containerized multi-service application.
- Reduced environment dependency conflicts.
- Automated build and deployment pipeline.
- Achieved consistent production-ready deployment.
- Improved scalability and maintainability.

Conclusion

The Dockerized Entertainment React Service project successfully demonstrates the practical implementation of containerization and CI/CD automation using modern DevOps practices. By leveraging Docker and GitHub Actions, the application ensures consistent development and deployment environments. Cloud deployment on AWS EC2 further enhances portability and real-world applicability.

The project provided hands-on experience in container orchestration, image optimization, backend integration, and automated deployment strategies aligned with industry standards.

Future Scope & Enhancements

1. Deployment using Kubernetes for orchestration.
2. Implementation of HTTPS using SSL certificates.
3. Integration of monitoring tools (Prometheus & Grafana).
4. Add centralized logging (ELK Stack).
5. Implement role-based authentication.
6. Use Docker Secrets for enhanced security.
7. Auto-scaling using Kubernetes or AWS ECS.
8. Infrastructure as Code using Terraform.