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LAB FINAL

SSDD

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BCT-7
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SECURE SOFTWARE DESIGN AND DEVELOPMENT

Contents

Secure Food Delivery System

Powered by FastAPI, Streamlit, and JWT Authentication

1. Project Overview

This project is a full-stack Food Delivery System developed with a strong focus on security, modular architecture, and role-based access control. The backend is built using FastAPI, the frontend with Streamlit, and JWT is used to ensure secure, stateless authentication.

Admin and User roles are managed distinctly, offering controlled access to sensitive resources like user data, order management, and restaurant operations. Monitoring is future-proofed using Prometheus and Grafana for container-level metrics.

2. Core Features & Functionality

2.1 Authentication & Role-Based Authorization

User Registration:
Firstly the User registers himself keeping in view the following protocols:

- Validates proper email structure.
- Password strength: min 8 characters, includes uppercase, lowercase, number, and special character.
- Username limited to 30 characters.

User Login:
Then using the username and password user registered, fills in Login form and gets successful login after passing the valid credential check.

- Secure credential check.
- Returns a JWT token with encoded user_type (admin/user).
- Token is saved in st.session_state in Streamlit.

2.2Role-Based Authorization

After successful login, in register the user registers as either admin or user i.e as a customer. This field user_type defines the role and on this basis, it is decided what operations are available for the user. Following below is the access control provided on basis of the user_type.

Access Control

- **Admin**:

❖ Manage users (view, update, delete).
❖ Full CRUD on restaurants.
❖ View and delete all orders.

- **User**:

❖ Can browse restaurants.
❖ Place and track their own orders only.

2.3Restaurant Management

Checks applied for restaurant are as follows:

- **Admin Capabilities**

❖ Create, update, and delete restaurants.
❖ Validates phone format (e.g., 03XXXXXXXXX for Pakistan).

- **User Access**

❖ Read-only access to restaurant list.

2.4Order Management

- **User Functionality**

❖ Select restaurant.
❖ Enter food item, quantity, address.
❖ Set order & payment status.
❖ Order is auto-linked with the user's id and username.

- **Admin Features**

❖ View all orders with full metadata.
❖ Delete any order.

- **Security Enhancements**

❖ JWT authentication on all endpoints.
❖ Orders protected: /orders/ GET is admin-only.
❖ ordered_by stored and retrieved from DB for clear traceability.

2.5Payments

The payment system is fully implemented and functional with clear separation of user/admin roles.

- **User Functionality:**

  ❖ A **user can create a payment** after placing an order.
  ❖ Payment form includes:
    - order_id
    - amount
    - payment_method (e.g., cash, credit card)
    - payment_status (e.g., Paid, Unpaid)
    - Optional: transaction_id

- **Admin Functionality:**

  ❖ **Admin can view all payments**, including:
    - User details (via relationship to order)
    - Payment status and metadata
  ❖ This is useful for reconciling transactions and auditing order-payment linkage.

- **Backend Enhancements:**

  ❖ Payments table is linked via ForeignKey(order_id) to the Orders table.
  ❖ All endpoints are protected with JWT authentication.
  ❖ Role-based access is enforced:
    - Users can only create payments
    - Admins can only view payments

2.6User Management

- **Admin View**

❖ View all users.
❖ Update and delete capabilities.

- **Users**

❖ Cannot view or modify other users.
❖ Can manage their own session via frontend.

2.7Access Control and Token

Endpoint	Token Required?	Access
/auth/login, /register	No	Everyone
/orders/ (POST)	Yes	User
/orders/ (GET)	Yes	Admin only
/restaurants (CRUD)	Yes	Admin only
/restaurants (GET)	Yes	All users
/users (GET/DELETE)	Yes	Admin only
/payments/ (POST)	Yes	User
/payments/ (GET)	Yes	Admin only

3. JWT Authentication: Flow & Protection

JWT (JSON Web Token) is a compact, URL-safe means of representing claims between two parties. In this project, JWT is used to secure the backend by verifying the identity of users making API requests without maintaining server-side session storage.

It ensures that only authenticated and authorized users (admins or regular users) can access protected endpoints in the system.

Why we used JWT Instead of Sessions?

The following reason make use of JWT a better choice than Sessions:

- **Stateless**: No session data is stored on the server.
- **Scalable**: Ideal for distributed systems or containerized deployments.
- **Secure**: Tokens are cryptographically signed to prevent tampering.
- **Portable**: Can be passed easily in HTTP headers, making API integration simple.

JWT Authentication Workflow

1. **User Logs In**

- The user sends a POST request to /auth/login with their username and password.
- FastAPI verifies the credentials.
- If valid, a JWT access token is created, containing:
    - username

- user_id
- user_type (admin/user)
- exp (expiry timestamp)

The token is returned to the frontend.

2. **Token Storage in Frontend (Streamlit)**

- The token is securely stored in:

  st.session_state.access_token
  st.session_state.user_type

- This state is preserved during the session and used for all API calls.

3. **Token Sent with Each Request**

- All protected endpoints in FastAPI expect a valid token in the **Authorization header**:

  Authorization: Bearer <JWT_ACCESS_TOKEN>

- In Streamlit:

```
headers = {
    "Authorization": f"Bearer {st.session_state.access_token}"
}
```

4. Token Decoding & Verification (FastAPI)

- The backend uses Depends(get_current_user) on protected routes.
- This uses a JWT middleware (custom or FastAPI dependency) to:
  - Check if the token is valid.
  - Decode the token using the server's secret key.
  - Extract the user details and permissions from the payload.

If the token is invalid, expired, or missing, a 401 Unauthorized response is returned.

5. **Role-Based Access Enforcement**

- After decoding, the backend extracts:

```
{
  "username": "ayesha",
  "user_type": "admin",
  "user_id": 1
}
```

- Based on user_type, access is conditionally allowed:
  - Admins can access routes like /users, /restaurants, and /orders (view/delete).
  - Users can only access routes like /orders/ (POST) or /payments/.

Token Security

- JWTs are signed using HS256 (HMAC + SHA-256)**.**
- Expiry (exp) is enforced to prevent token reuse or replay attacks.
- Passwords are securely hashed before JWT creation using passlib with bcrypt.

Security Benefit	How It's Achieved
Authentication	Via token payload (username, user_type)
Authorization	Role-based routing logic
Stateless Security	No server sessions; token-driven access
Reusability	Token used across requests
Protection from Tampering	JWTs are signed with a secret key

4. Monitoring & Observability

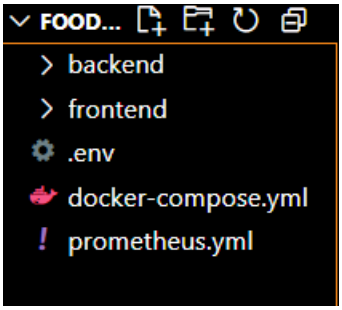
For this purpose, we shall be integrating Prometheus and Grafana along. The will:

- **Prometheus** scrapes backend /metrics endpoint every 15s.
- **Grafana** dashboards to visualize:
  - ❖ Request latency
  - ❖ Active users
  - ❖ Endpoint hit counts

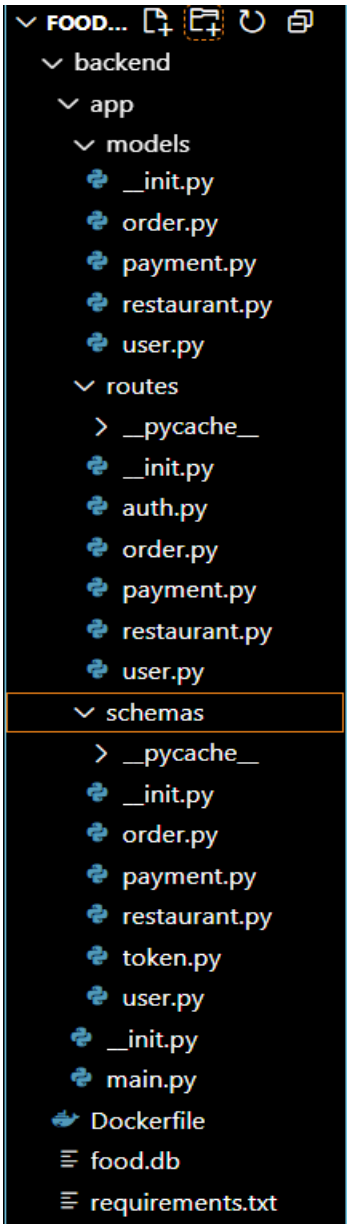
This ensures real-time health tracking and performance tuning for production readiness.

5. Project Structure

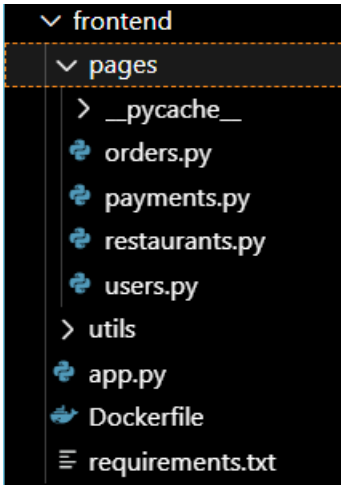
Overall Structure



Backend:



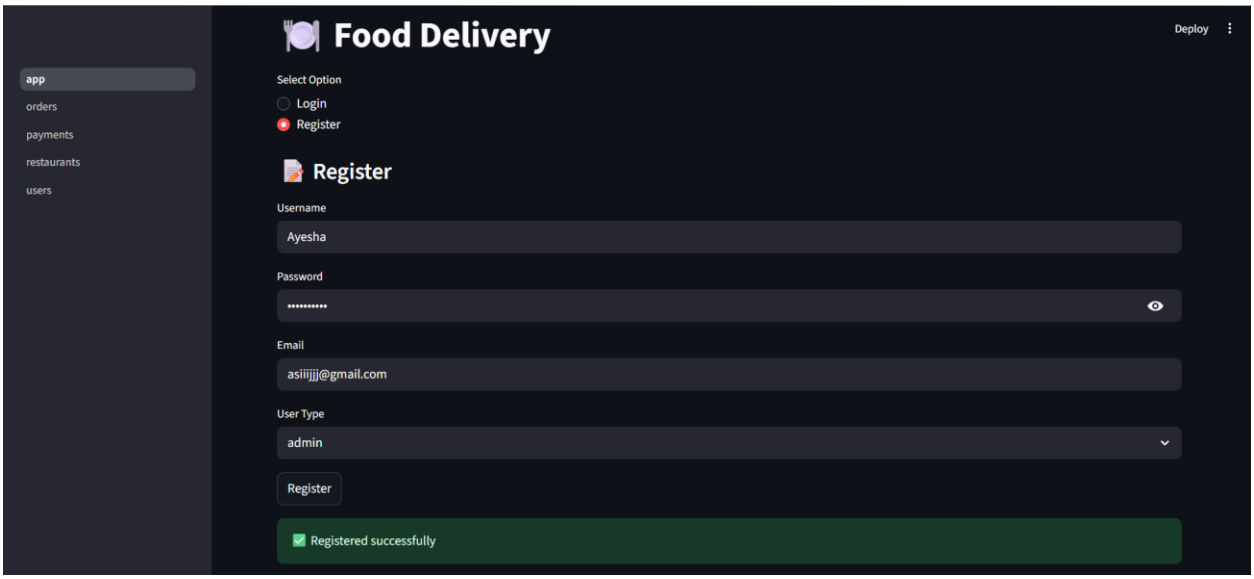
Frontend

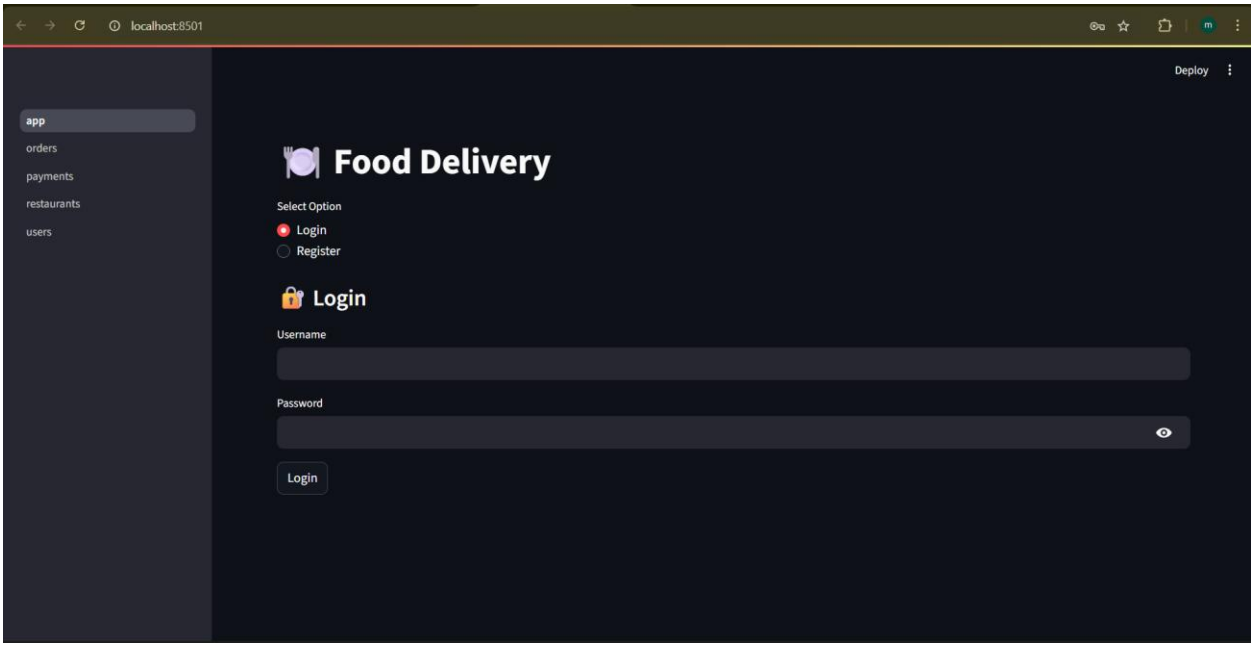


6. UI

Register:

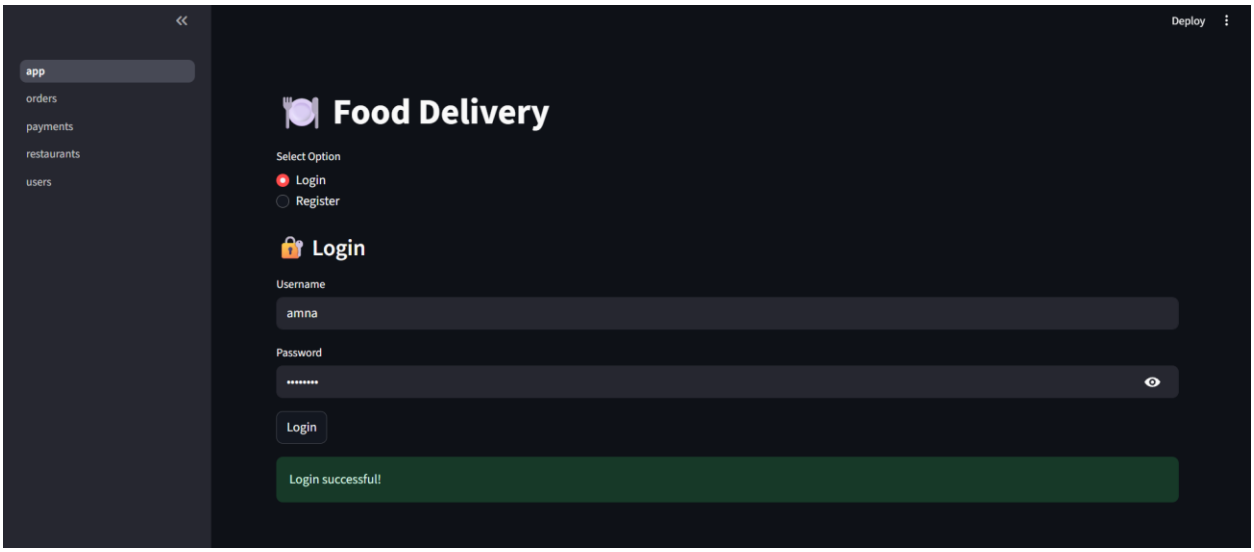
Making an admin account.



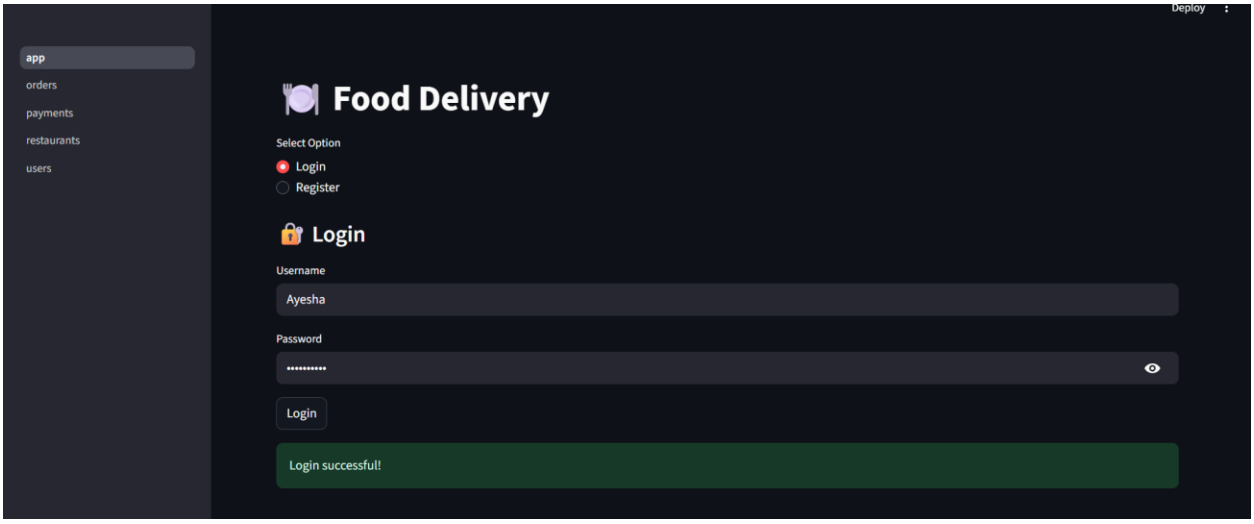


Login as User:

Amna is a registerd user. By entering valid credentials we can successfully login.



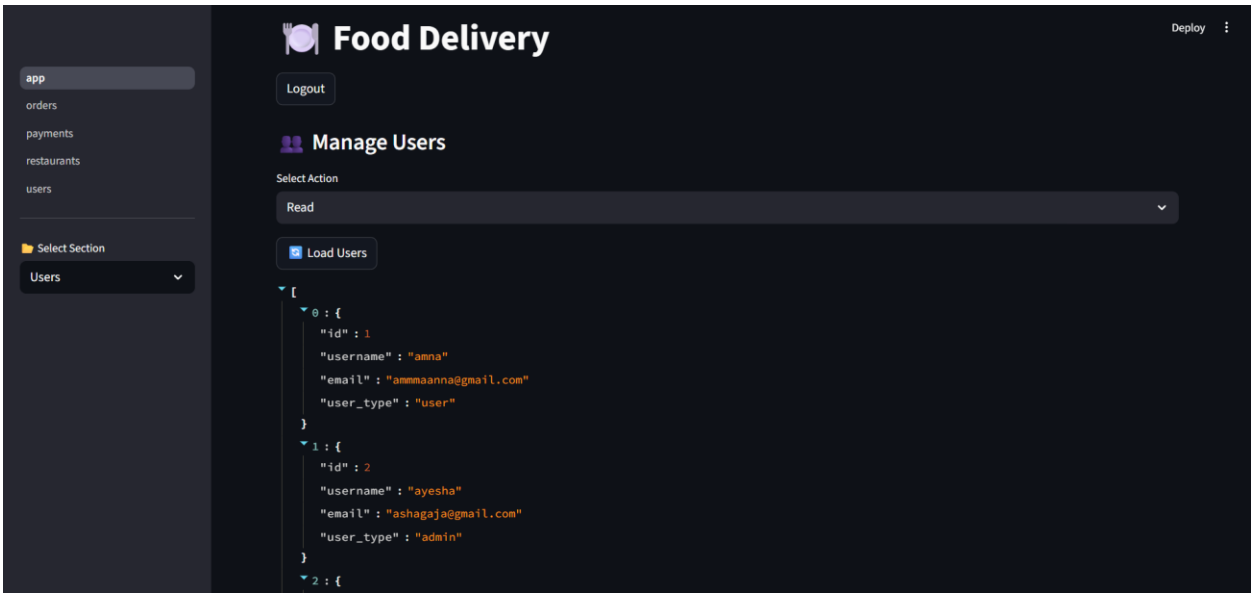
Login as Admin:



USERS:

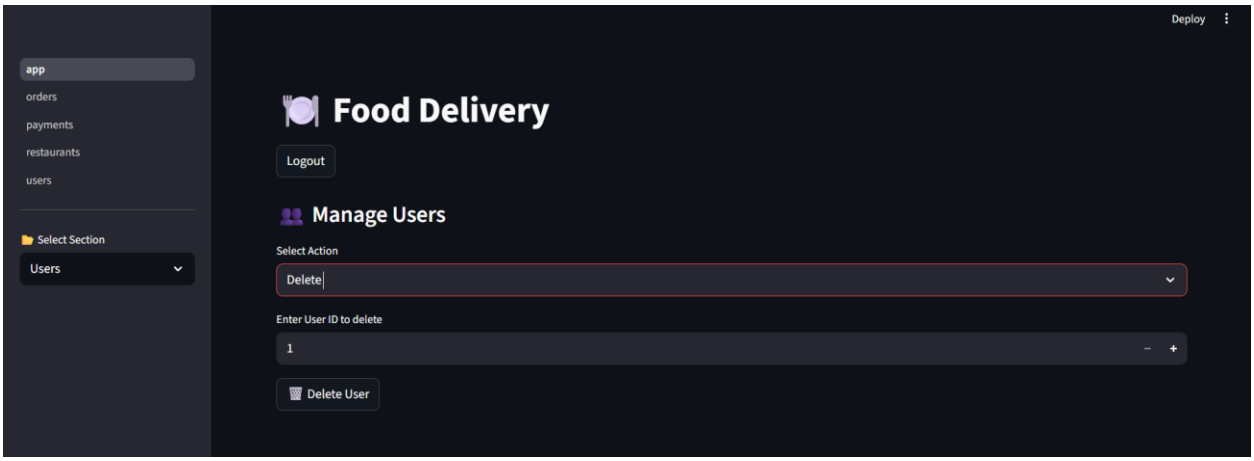
In Admin Portal:

a. **Read Users:**
By clicking on Load User we get all the users registered in database.

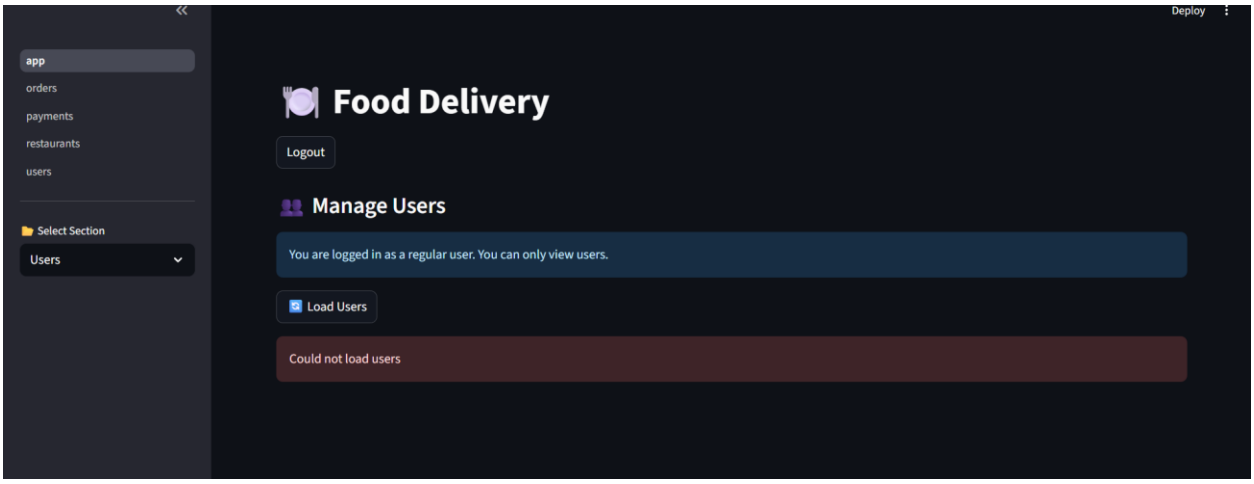


b. Update User:
Admin has right to update the registered users.

c. Delete User:
Admin can delete any user from database by entering the user id.



In User Portal:
User can not access the information of registered users.

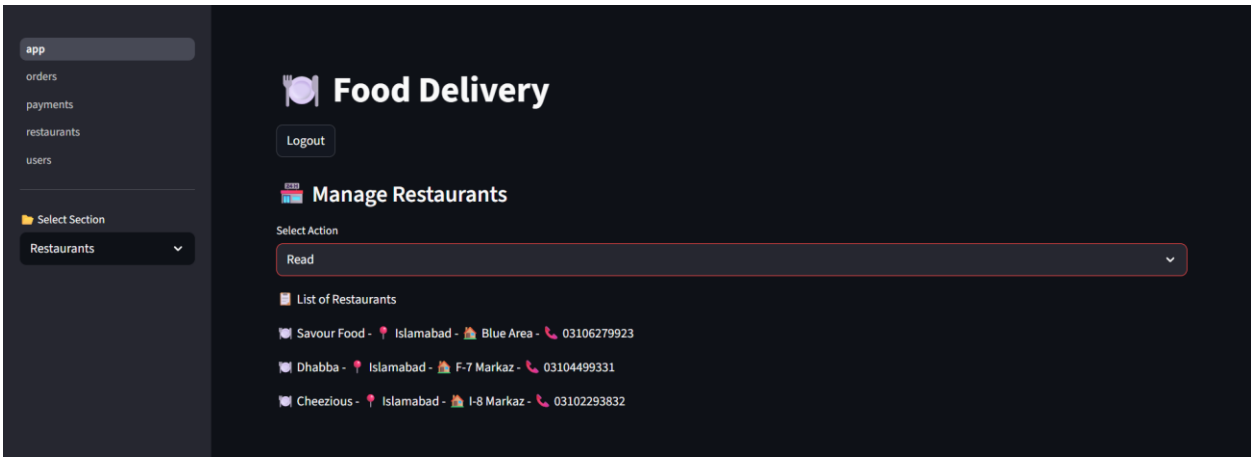


RESTAURANT:

In Admin Portal:

a. **Create:**
Registering a new restaurant.

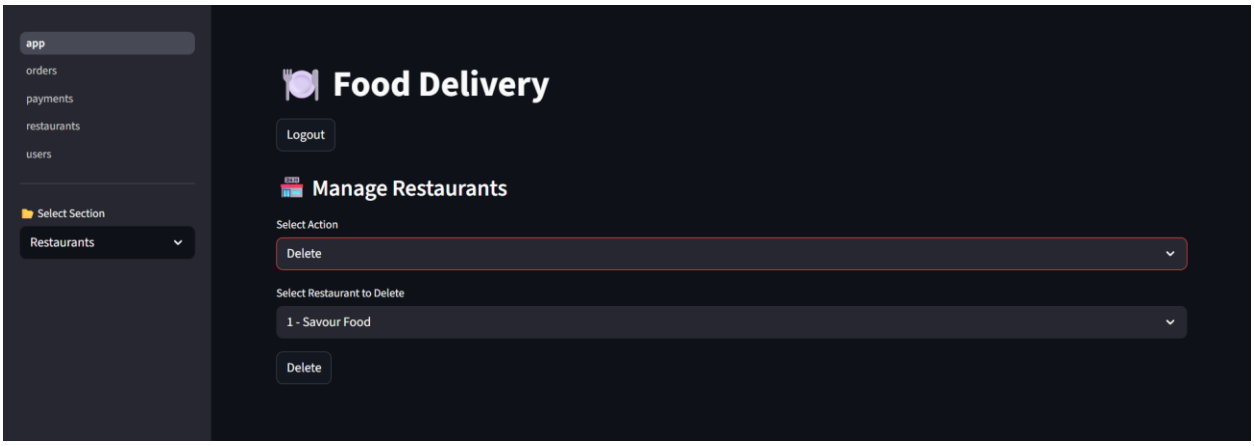
b. View:
Admin can view all registered Restaurant.



c. Update:
Admin can update the information of registered restaurants.

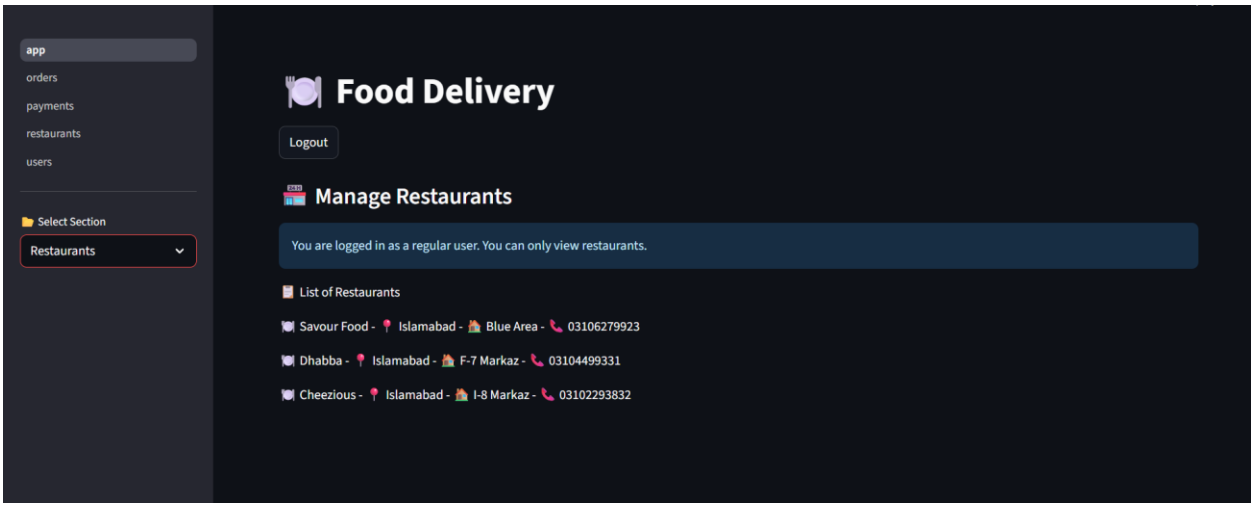
d. Delete:

Admin has right to delete.



In User Portal:

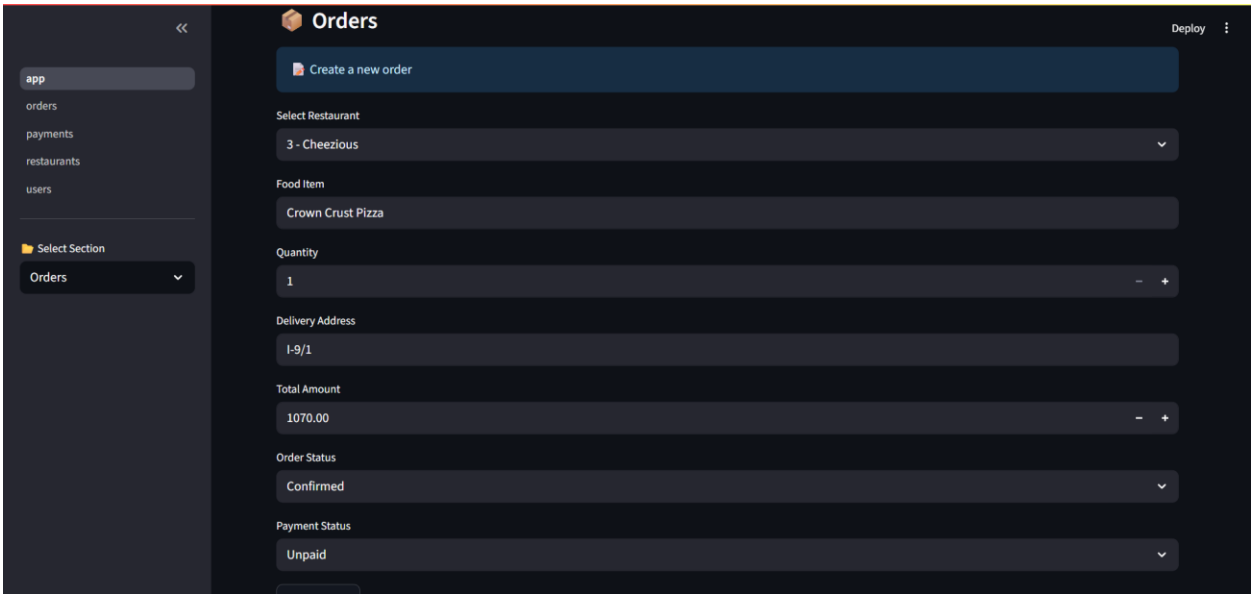
User can only view registered restaurants in the database.



ORDER:

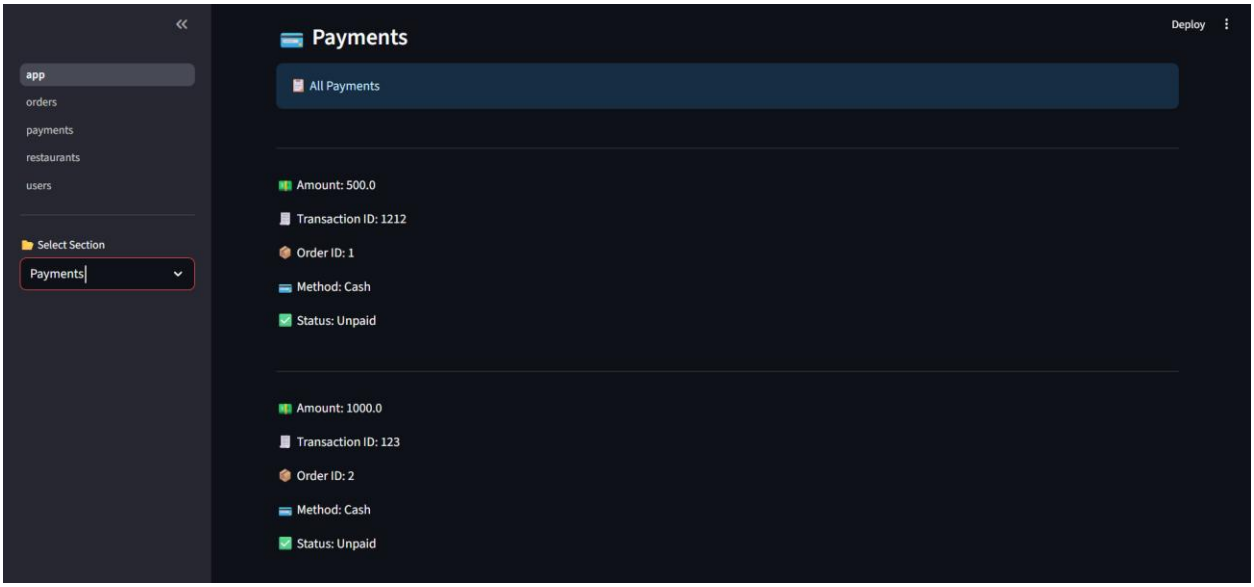
In Admin Portal:

In User Portal:



PAYMENT:

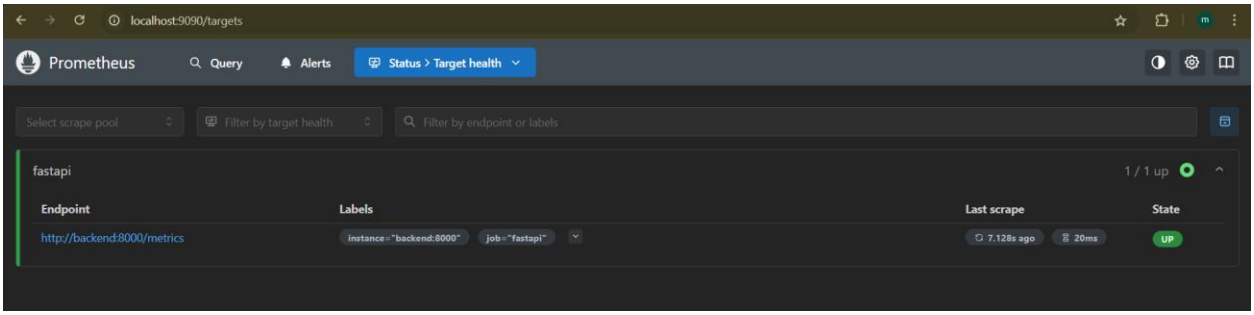
In Admin Portal:



In User Portal:

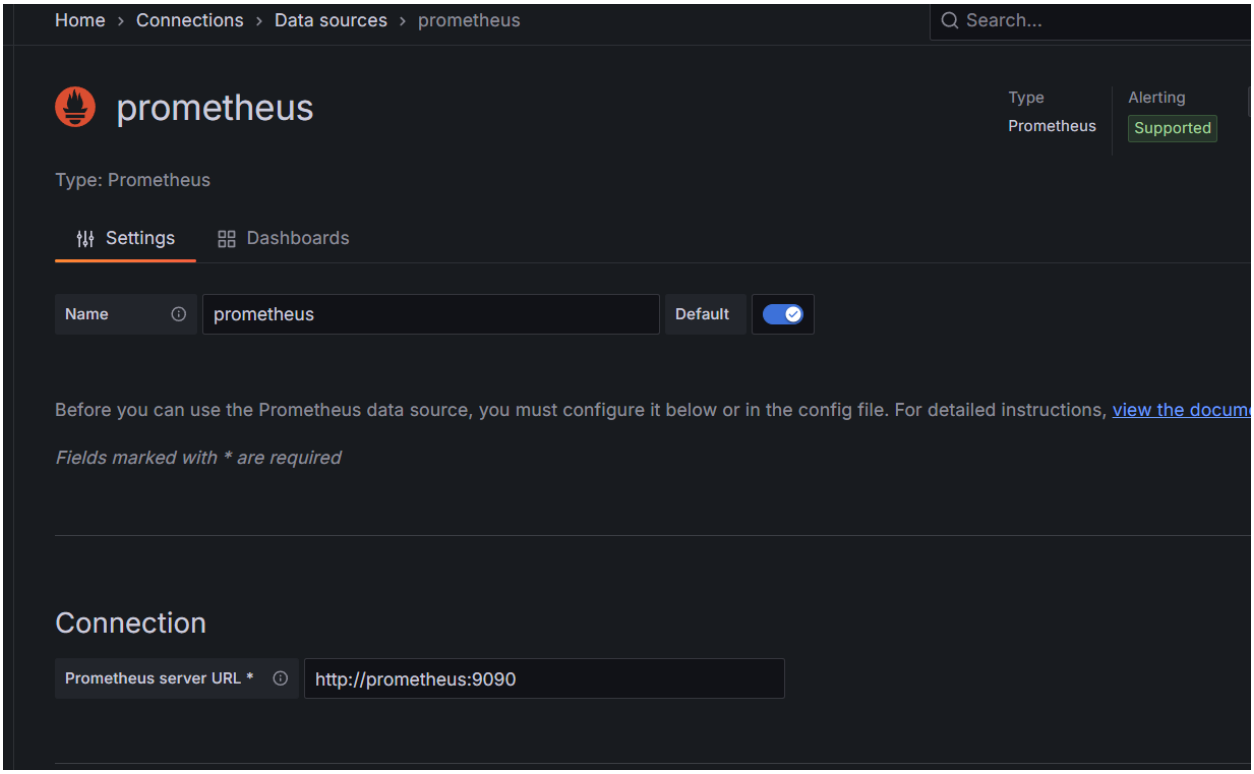
PROMETHEUS

Status Health:

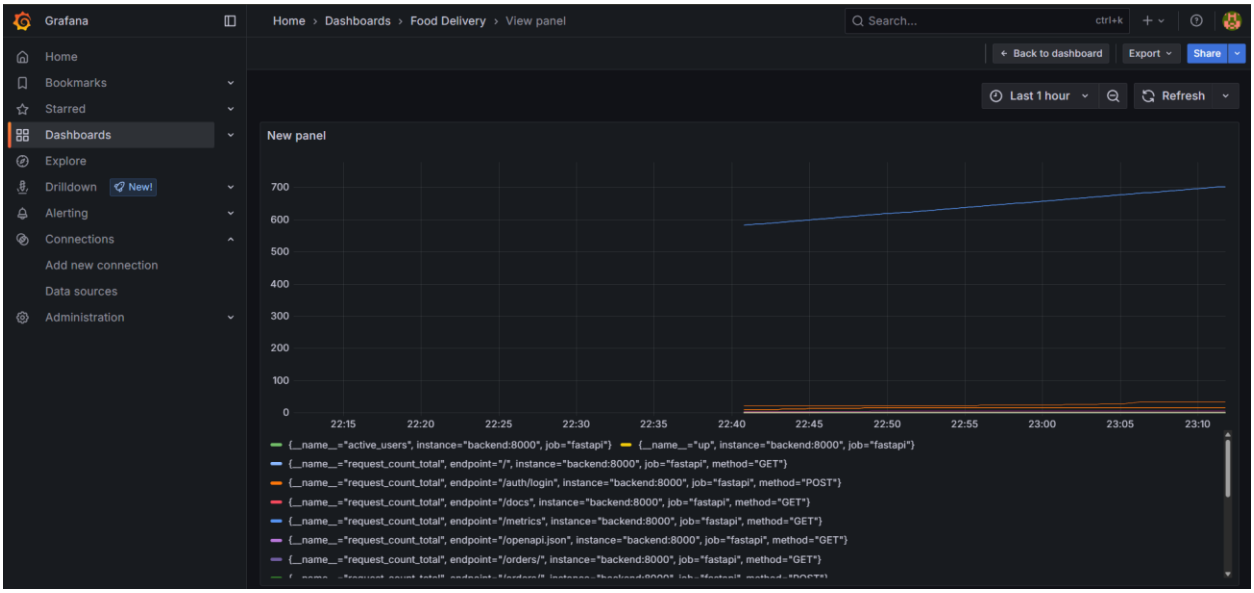


Grafana:

Setting up Prometheus in grafana.



Dashbaord:



7. Conclusion

This project presents a secure, modular, and production-ready Food Delivery System that integrates robust backend services with a clean, interactive frontend interface. The backend, developed using FastAPI**,** follows a well-structured, modular architecture that ensures a clear separation of concerns across models, schemas, routes, business logic (CRUD), and authentication utilities. By implementing JWT-based authentication and role-based authorization**,** the application enforces strict access control, ensuring that only authenticated users can interact with protected resources and that permissions are appropriately enforced based on user roles (admin/user).

The frontend, built using Streamlit**,** offers an intuitive interface for users and administrators, adapting dynamically based on the logged-in user's role. It leverages session-based JWT tokens to communicate securely with the backend, enabling real-time interactions such as order placement, restaurant management, user actions, and payment creation.

Additionally, the system is designed with scalability and observability in mind. A monitoring stack comprising Prometheus and Grafana is integrated to track backend performance metrics, including request latency, active users, and endpoint hit counts. This prepares the application for real-world deployment scenarios where reliability, security, and visibility are crucial.

Overall, this project demonstrates a complete, end-to-end implementation of a modern web application with a strong focus on security, maintainability, and user experience, making it suitable for both academic submission and professional deployment.