INSTITUTE FOR ADVANCED COMPUTING AND SOFTWARE DEVELOPMENT, Akurdi, PUNE

“DutyMatrix”

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Submitted By:

Group No.: 73

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Project Guide	**Center Coordinator**

ABSTRACT

DutyMatrix is a comprehensive Police Duty and Leave Management System designed to automate and streamline administrative and operational workflows within police departments. It enables efficient management of duty schedules, leave approvals, shift assignments, and operational coordination while ensuring strict adherence to hierarchical authority. The system utilizes modern technologies such as React for a responsive front-end and Spring Boot for a robust backend API. Security is enforced through Spring Security with JWT-based authentication and authorization, while a dedicated Node.js notification microservice provides real-time alerts for critical operational events.

DutyMatrix is a secure and scalable application developed to address the challenges faced by police departments in managing duties, leave processes, and operational oversight through manual or fragmented systems. The project aims to improve transparency, accountability, and efficiency by providing an integrated platform built with React on the frontend, Spring Boot on the backend, and a microservice-based notification mechanism that supports reliable and uninterrupted police operations.

ACKNOWLEDGEMENT

I take this opportunity to thank God Almighty for blessing us with His grace and guiding our efforts toward the successful completion of this project. I express my sincere gratitude to our esteemed project guide, Mr. Harshad Sinha, for his valuable guidance, continuous support, and insightful suggestions throughout the development of the project. His encouragement and technical expertise played a crucial role at every stage of the project.

I am also thankful to our respected Centre Coordinator, Mr. Narendra Pawar, for providing the necessary facilities and a supportive learning environment that made this project possible. I extend my appreciation to all faculty members of the institute for their cooperation and guidance during the course of this project.

Last but not least, I would like to express my heartfelt thanks to my friends and family for their constant support, encouragement, and motivation, which helped us overcome challenges and complete the project successfully.

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1. INTRODUCTION

In modern law enforcement agencies, effective duty allocation, leave management, and operational coordination are critical to maintaining public safety and organizational efficiency. Police departments operate in a highly structured hierarchy where responsibilities, approvals, and accountability must be clearly defined. However, in many police stations, these processes are still handled manually through registers, paper forms, phone calls, or informal messaging. Such manual systems often lead to delays, miscommunication, lack of transparency, and difficulties in maintaining accurate records.

DutyMatrix is a centralized, role-based web application designed to automate and manage police duty allocation, leave approvals, shift assignments, and operational notifications within a police department. The system aims to replace traditional manual and paper-based administrative processes with a secure, efficient, and transparent digital platform. It enables police personnel at different hierarchy levels to coordinate duties and administrative tasks seamlessly while ensuring strict adherence to authority and accountability.

DutyMatrix is developed using modern full-stack technologies such as **React** for a responsive and user-friendly frontend, **Spring Boot** for a robust and scalable backend, and **MySQL** for reliable data persistence. Security is enforced using **Spring Security with JWT-based authentication and authorization**, ensuring that only authenticated users can access the system based on their assigned roles. A dedicated **Node.js notification microservice** is integrated to provide real-time alerts for leave requests, approvals, shift assignments, and shift swaps without affecting core system functionality in case of service downtime.

The DutyMatrix system is specifically tailored to meet the operational needs of police departments, where duty continuity, approval hierarchy, and real-time communication are critical. By automating leave workflows, shift management, and approval chains, the system minimizes delays, reduces human errors, and enhances operational efficiency.

This digital transformation enables police departments to maintain accurate records, improve transparency, and ensure uninterrupted public service.

In the DutyMatrix system, three primary roles—**Police Officer**, **Station Incharge**, and **Commissioner**—play crucial roles in the management and operation of the platform. Each role is assigned specific responsibilities, permissions, and access levels to ensure that the system functions securely and in accordance with the organizational hierarchy.

1. Police Officer Role

The Police Officer role represents the operational staff responsible for day-to-day field duties. This role has limited but essential access to the system, allowing officers to manage their personal duties and administrative requests without interfering with higher-level controls.

❖ **Responsibilities:**

- **Leave Management:**
  - Apply for leave and view leave status.
  - Receive notifications for leave approval or rejection.
- **Shift Management:**
  - View assigned shifts and duty schedules.
  - Receive notifications for new or updated shift assignments.
- **Shift Swap Requests:**
  - Request shift swaps with other officers belonging to the same station.
  - Track the approval or rejection status of swap requests.
- **Profile Management:**
  - View personal profile details.

    - Maintain basic account-related information.

Access Level:

- Limited access restricted to personal duties and requests.
- No authority to approve or assign duties.
- Cannot access sensitive administrative or global system data.

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2. Station Incharge Role

The Station Incharge role holds supervisory authority at the station level. This role is responsible for managing police personnel, approving requests, and ensuring smooth station operations.

❖ **Responsibilities:**

- **Leave Approval:**
    - Approve or reject leave requests submitted by Police Officers.
    - Monitor leave availability to maintain adequate staffing.
- **Shift Management:**
    - Create duty shifts for the station.
    - Assign Police Officers to shifts.
- **Shift Swap Management:**
    - Approve or reject shift swap requests between officers.
- **FIR Management:**
    - Assign investigating officers to FIRs within the station.

- **Notifications:**
  - Receive alerts for leave requests and shift swap requests.
  - Ensure timely decision-making for operational continuity.

Access Level:

- Full control over station-level operations.
- Cannot modify system-wide configurations.
- Cannot access data belonging to other stations.

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3. Commissioner Role

The Commissioner role represents the highest authority in the DutyMatrix system, providing oversight across all police stations. This role focuses on governance, monitoring, and high-level approvals.

❖ **Responsibilities:**

- **Leave Approval:**
  - Approve or reject leave requests submitted by Station Incharges.
  - Commissioner leave requests are auto-approved.
- **Operational Oversight:**
  - View duty and shift details across all stations.
  - Monitor FIR assignments and station activities.
- **System Monitoring:**
  - Ensure compliance with departmental policies.
  - Maintain high-level visibility into police operations.

Access Level:

- Read-only access to global operational data.
- Approval authority for higher-level leave requests.
- No involvement in station-level shift creation.

Role-Based Access Control (RBAC)

DutyMatrix implements **Role-Based Access Control (RBAC)** using **Spring Security**. This ensures that users can only access features explicitly permitted by their assigned role.

- **Police Officers** can manage personal duties and requests.
- **Station Incharges** can manage station-level approvals and assignments.
- **Commissioners** have global visibility and approval authority.

RBAC ensures strict enforcement of hierarchy, prevents unauthorized access, and protects sensitive operational data.

Security Considerations

DutyMatrix incorporates robust security mechanisms to safeguard system integrity and user data:

- **Authentication:** Secure login using JWT tokens.
- **Authorization:** Role-based endpoint protection.

- **Session Management:** Stateless authentication using tokens to prevent unauthorized access.
- **Fail-Safe Notifications:** Core operations remain unaffected even if the notification service is unavailable.

DutyMatrix's structured role-based design ensures that responsibilities are clearly defined and operational workflows are efficiently managed. Higher authorities can focus on oversight and governance, while operational staff can perform their duties without administrative friction—resulting in a secure, transparent, and efficient police management system.

1.1 Purpose

The purpose of the **DutyMatrix – Police Duty and Leave Management System** is to provide a centralized, secure, and efficient platform for managing administrative and operational workflows within a police department. The system is designed to streamline critical processes such as duty allocation, leave approvals, shift management, and operational notifications, ensuring uninterrupted police services and effective workforce utilization.

DutyMatrix aims to reduce the dependency on manual processes, paperwork, and informal communication channels by introducing a structured digital workflow aligned with the hierarchical nature of law enforcement organizations. By automating approvals and maintaining digital records, the system enhances transparency, accountability, and decision-making efficiency at all levels of authority. Ultimately, DutyMatrix supports police personnel in focusing more on law enforcement duties while minimizing administrative overhead.

1.2 Scope

The scope of the DutyMatrix project includes the design, development, deployment, and maintenance of a full-stack web-based application tailored specifically for police department operations. The system covers essential administrative modules such as leave management, shift management, shift swapping, FIR management, and real-time notifications, all governed by a strict role hierarchy.

DutyMatrix supports three core user roles—Police Officer, Station Incharge, and Commissioner—each with clearly defined access levels and responsibilities. The system enforces role-based access control on both frontend and backend layers to ensure secure data access and workflow integrity. While the system is focused on internal departmental operations, its modular architecture allows for future enhancements such as analytics dashboards, historical reporting, and integration with other government or law enforcement systems.

1.3 Objectives of DutyMatrix

The objectives of the DutyMatrix project define the key goals that guide the system's design, implementation, and operational focus. These objectives ensure that the system meets real-world policing requirements while improving efficiency and governance.

1. To automate police duty scheduling and leave management processes.
2. To enforce strict hierarchical approval workflows.
3. To reduce manual errors and administrative delays.
4. To provide real-time notifications for operational events.
5. To ensure secure authentication and role-based authorization.
6. To improve transparency and accountability in administrative decisions.
7. To enable command-level oversight across multiple stations.
8. To ensure duty continuity and effective workforce utilization.
9. To design a scalable and maintainable system for future expansion.
10. To enhance overall operational efficiency within police departments.

1.4 Functionalities Provided by DutyMatrix

1. User Management

- **User Authentication and Login:**
  - Users can securely log in using valid credentials.
  - JWT-based authentication ensures secure session handling.
- **Role-Based Access Control:**
  - The system supports multiple user roles with predefined permissions.
  - Access to features is strictly controlled based on role hierarchy.
- **Profile Management:**
  - Users can view their personal details.
  - Basic account information is securely maintained.

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2. Leave Management

- **Leave Application:**
  - Police Officers can apply for leave through the system.
  - Station Incharges and Commissioners can apply for leave at their respective levels.
- **Approval Workflow:**
  - Leave requests from Police Officers are approved or rejected by Station Incharges.
  - Leave requests from Station Incharges are approved or rejected by Commissioners.
  - Commissioner leave requests are automatically approved.

- **Leave Status Tracking:**
    - Users can view the real-time status of their leave applications.
    - Notifications are sent for approval or rejection decisions.

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3. Shift Management

- **Shift Creation:**
    - Station Incharges can create duty shifts for their respective stations.
- **Shift Assignment:**
    - Police Officers can be assigned to shifts by Station Incharges.
    - Assigned officers receive notifications regarding duty schedules.
- **Shift Monitoring:**
    - Commissioners have read-only access to shift details across all stations.

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4. Shift Swap Management

- **Swap Requests:**
    - Police Officers can request shift swaps with other officers from the same station.
- **Approval Process:**
    - Station Incharges approve or reject swap requests.
- **Notifications:**
    - Both officers involved are notified of the decision.

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5. FIR Management

- **FIR Assignment:**
    - FIRs are maintained at the station level.
    - Station Incharges assign investigating officers to FIRs.
- **Oversight:**
    - Commissioners have global visibility of FIR records.

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6. Notification System

- **Event-Based Notifications:**
    - Notifications are generated for leave events, shift assignments, and shift swaps.
- **Fail-Safe Design:**
    - Notification failures do not interrupt core system operations.

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7. Security and Compliance

- **Data Security:**
    - All APIs are secured using Spring Security and JWT.
- **Audit and Traceability:**
    - Approval actions and operational changes are digitally recorded for accountability.

2. SOFTWARE REQUIREMENT SPECIFICATION

The Software Requirement Specification (SRS) for **DutyMatrix – Police Duty and Leave Management System** defines the functional and non-functional requirements of the system. These requirements describe the specific features, capabilities, and constraints that DutyMatrix must fulfill to meet the operational needs of police departments. The SRS serves as a reference for system design, development, testing, and validation, ensuring that the final system aligns with organizational objectives and real-world policing workflows.

2.1 Functional Requirements for DutyMatrix

1. User Management

- **User Authentication:** The system shall allow registered users to log in using secure credentials. The system shall authenticate users using JWT-based authentication.
- **Role-Based Access Control:** The system shall support role-based access control where different users (Police Officer, Station Incharge, Commissioner) have different permissions.
- **Profile Management:** Users shall be able to view their profile information securely. Personal details shall be protected from unauthorized access.

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2. Leave Management

- **Leave Application:** Police Officers shall be able to apply for leave through the system. Station Incharges and Commissioners shall be able to apply for leave at their respective levels.
- **Leave Approval Workflow:** Leave requests from Police Officers shall be approved or rejected by Station Incharges. Leave requests from Station Incharges shall be approved or rejected by Commissioners. Leave requests from Commissioners shall be automatically approved.

- **Leave Status Tracking:** The system shall update and display the real-time status of leave requests. Users shall receive notifications regarding approval or rejection.

3. Shift Management

- **Shift Creation:** The system shall allow Station Incharges to create duty shifts for their stations.
- **Shift Assignment:** Station Incharges shall assign Police Officers to shifts. Assigned officers shall be notified of their duty schedules.
- **Shift Monitoring:** Commissioners shall have read-only access to all shift details across stations.

4. Shift Swap Management

- **Shift Swap Requests:** Police Officers shall be able to request shift swaps with other officers. Shift swaps shall be allowed only between officers of the same station.
- **Approval of Shift Swaps:** Station Incharges shall approve or reject shift swap requests.
- **Notifications:** Both officers involved shall receive notifications regarding swap decisions.

5. FIR Management

- **FIR Records:** The system shall maintain FIR records at the station level.
- **Assignment of Investigating Officers:** Station Incharges shall assign investigating officers to FIRs.
- **Global Oversight:** Commissioners shall have visibility of FIR records across all stations.

6. Notification Management

- **Event-Based Notifications:** The system shall send notifications for leave applications, approvals, rejections, shift assignments, and shift swap decisions.
- **Fail-Safe Operation:** Notification service failures shall not interrupt core business functionality.

7. Security

- **Authentication and Authorization:** The system shall enforce secure authentication and role-based authorization using Spring Security and JWT.
- **Data Protection:** Sensitive user and operational data shall be protected from unauthorized access.

2.2 Non-Functional Requirements for DutyMatrix

1. Performance

- **Response Time:** The system shall respond to user actions within acceptable time limits under normal conditions.
- **Scalability:** The system shall support multiple police stations and concurrent users without performance degradation.
- **Throughput:** The system shall handle multiple simultaneous requests efficiently.

2. Reliability

- **Availability:** The system shall ensure high availability for continuous police operations.

- **Fault Tolerance:** The system shall continue to function even if the notification service becomes unavailable.
- **Error Handling:** The system shall handle errors gracefully and provide meaningful feedback to users.

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3. Usability

- **User Interface:** The system shall provide a simple, intuitive, and user-friendly interface suitable for users with varying technical skills.

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4. Maintainability

- **Modular Architecture:** The system shall follow a layered and modular architecture to allow easy maintenance and future enhancements.
- **Code Quality:** The system shall follow coding best practices with clean, well-documented code.
- **Testing:** The system shall undergo unit testing, integration testing, and user acceptance testing to ensure reliability and correctness.

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5. Other Requirements

Hardware and Network Interfaces

- **Back-end Server Configuration:**
    - Intel Pentium-IV Processor
    - 8 GB RAM

- **Front-end Client Configuration:**
  - AMD RYZEN 5 Processor
  - 128 MB SDRAM
  - 10 GB Hard Disk Drive

Software Interfaces

- **Software Configuration for Back-end Services:**
  - Java 21
  - Spring Boot
  - Spring Security (JWT)
  - Hibernate / JPA
  - MySQL
  - STS 4.30
  - Nodejs / Expressjs
- **Software Configuration for Front-end Services:**
  - ReactJS
  - React Router
  - Redux
  - Context API
  - HTML, CSS, JavaScript
  - Bootstrap
  - VS Code

3. DIAGRAM

3.1 Entity Relationship Diagram:

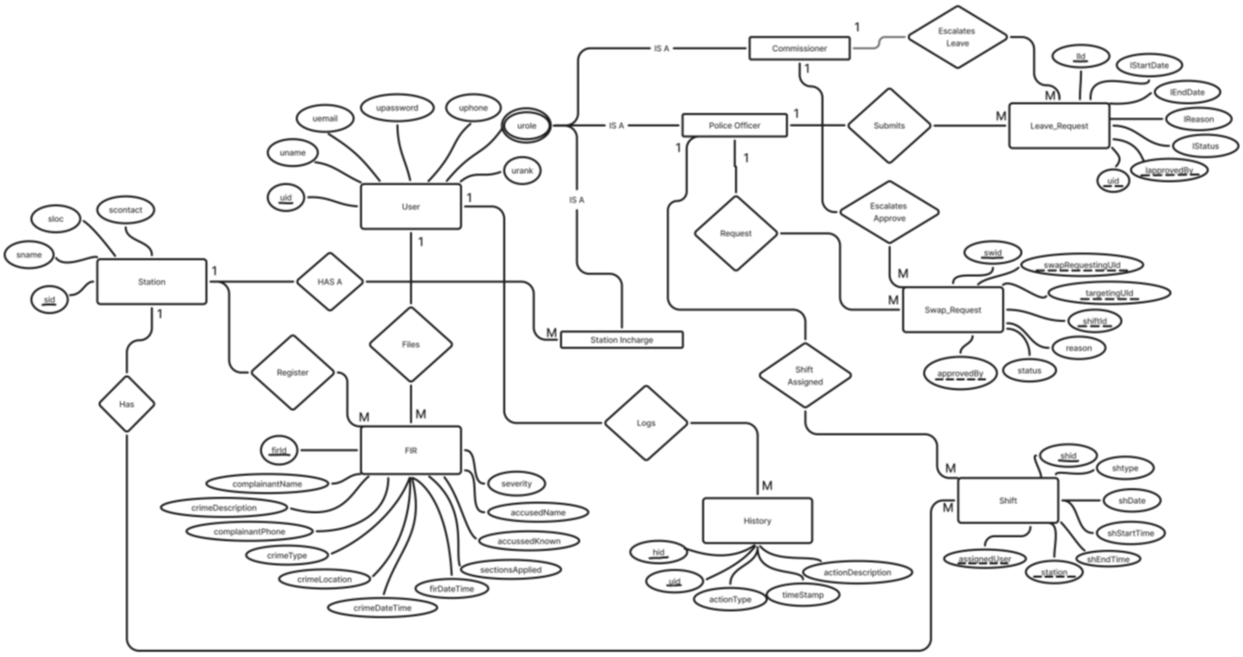
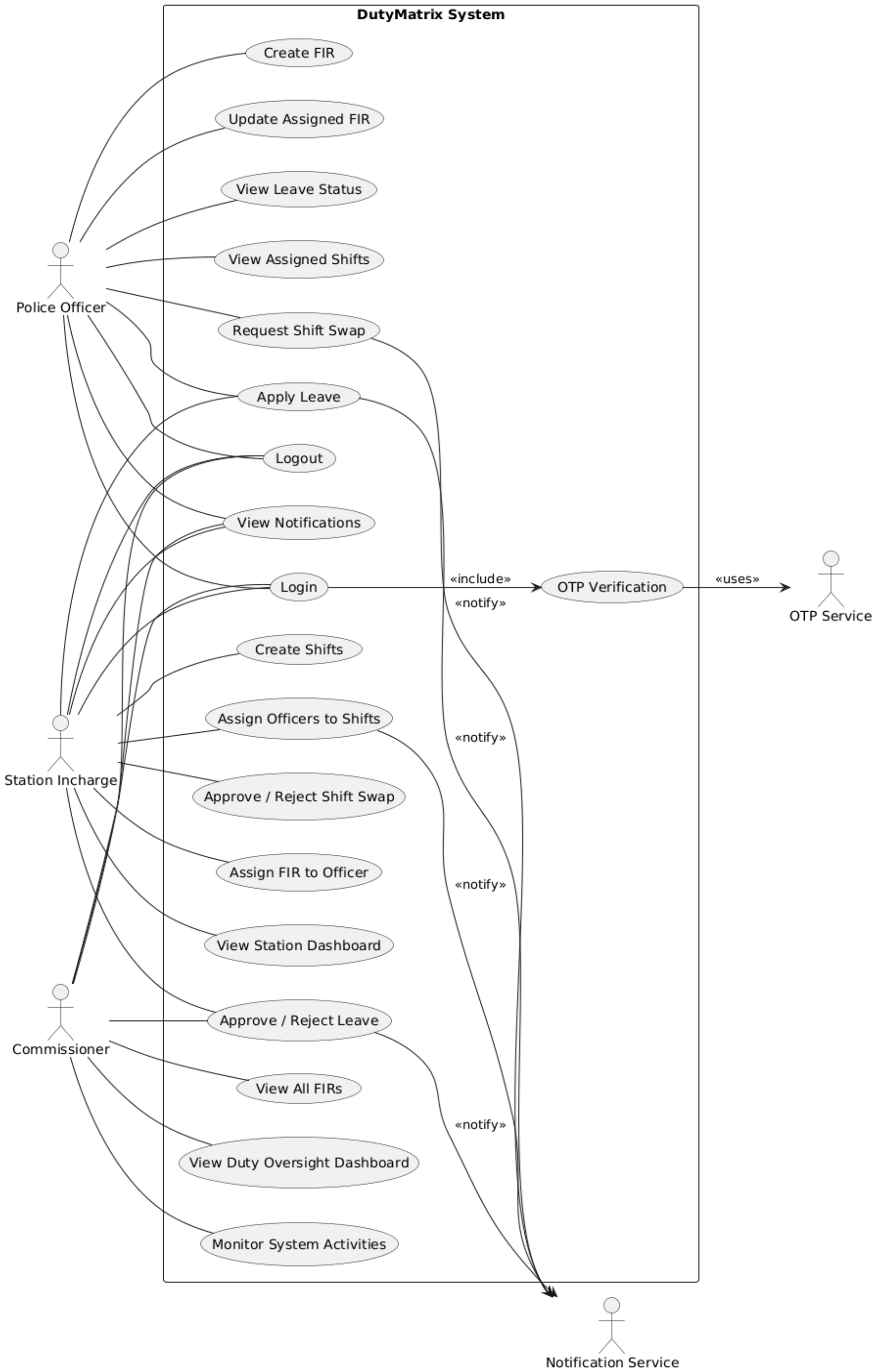


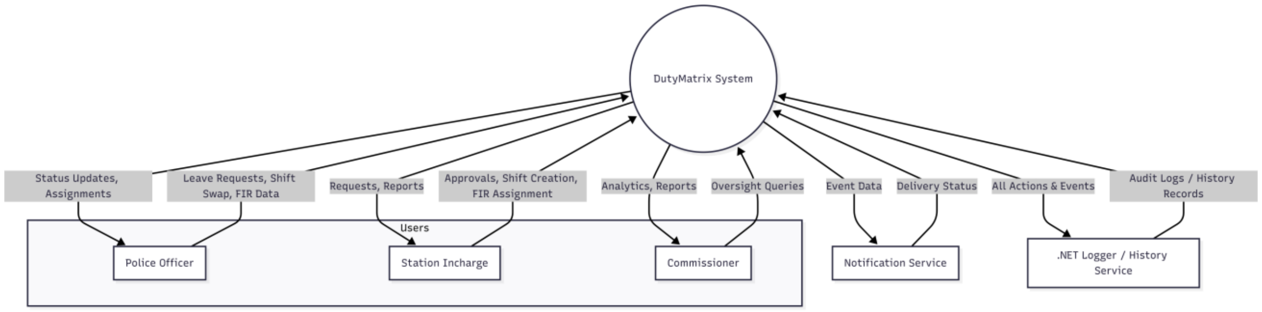
Fig. ER Diagram for DutyMatrix

3.2 Use Case Diagram:

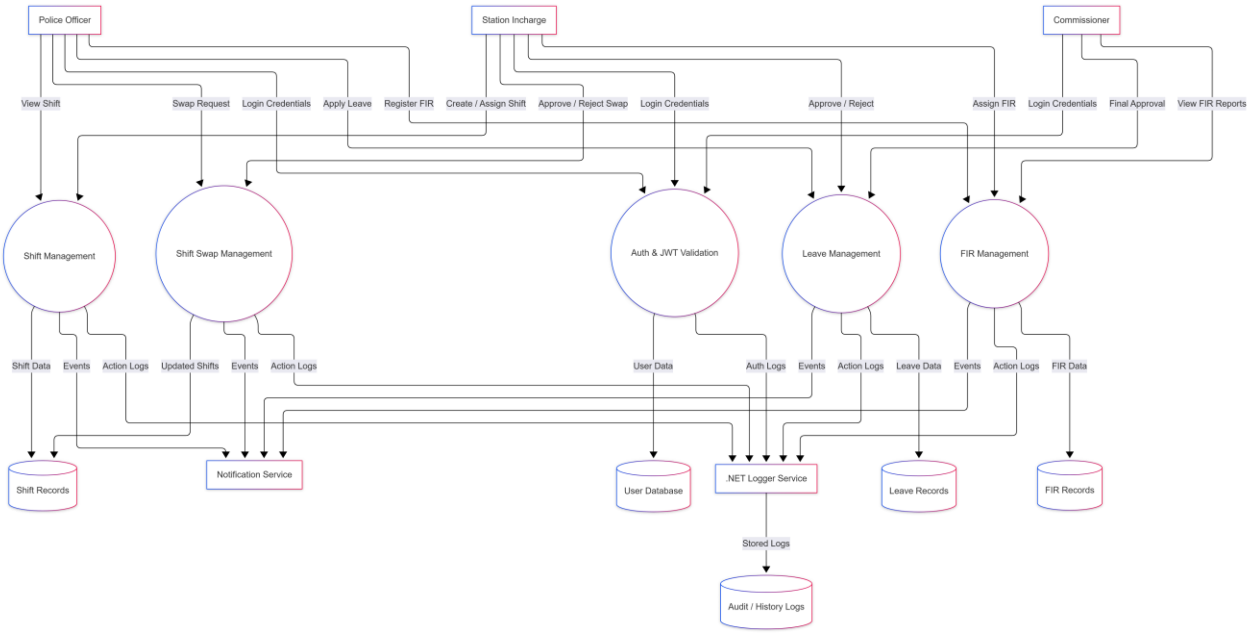


3.3 Data Flow Diagram:

DFD Level 0:

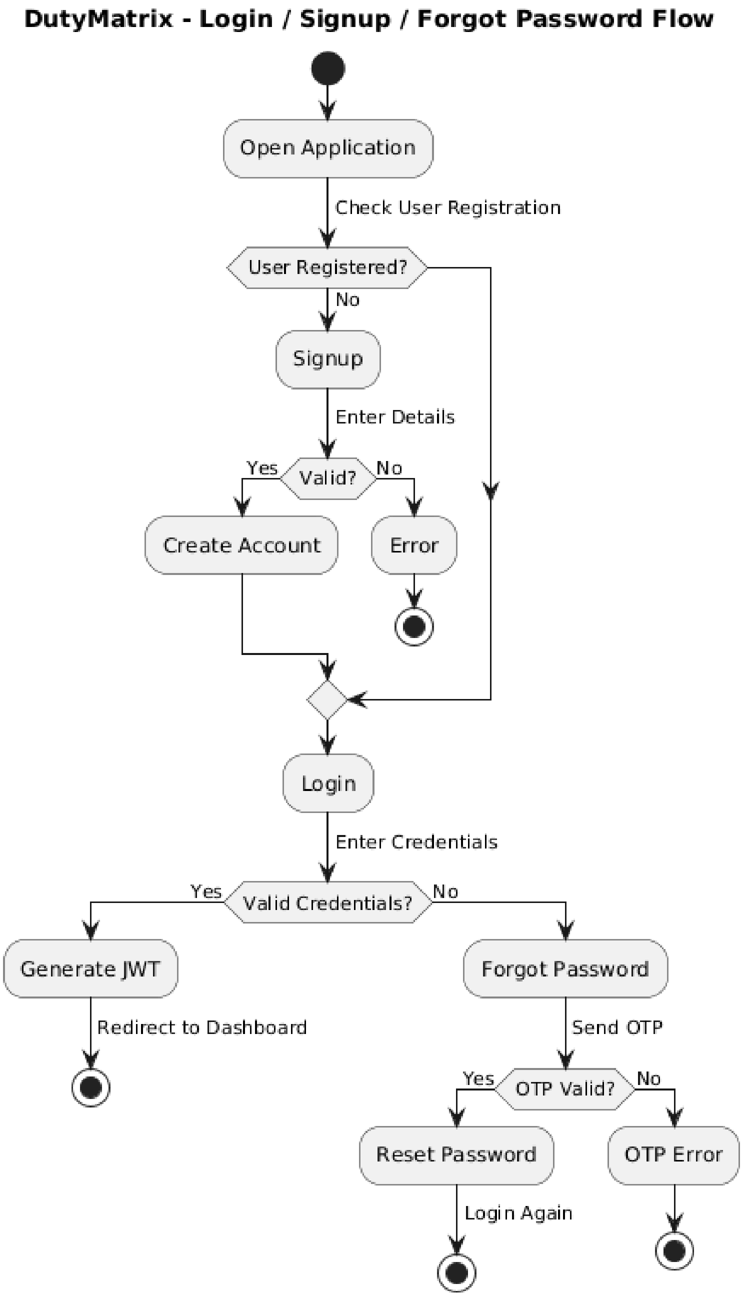


DFD level 1 :

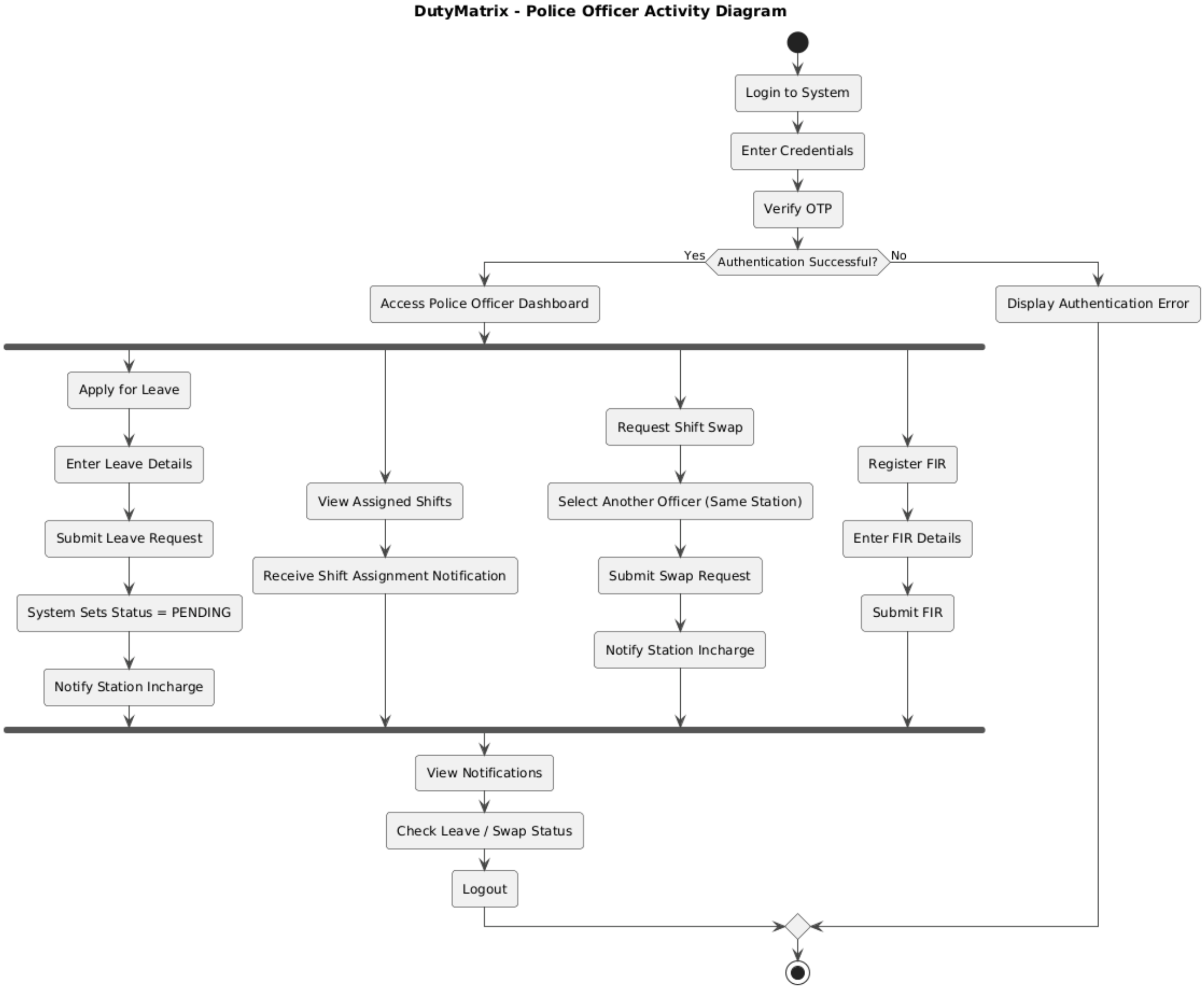


3.4 Activity Diagram :

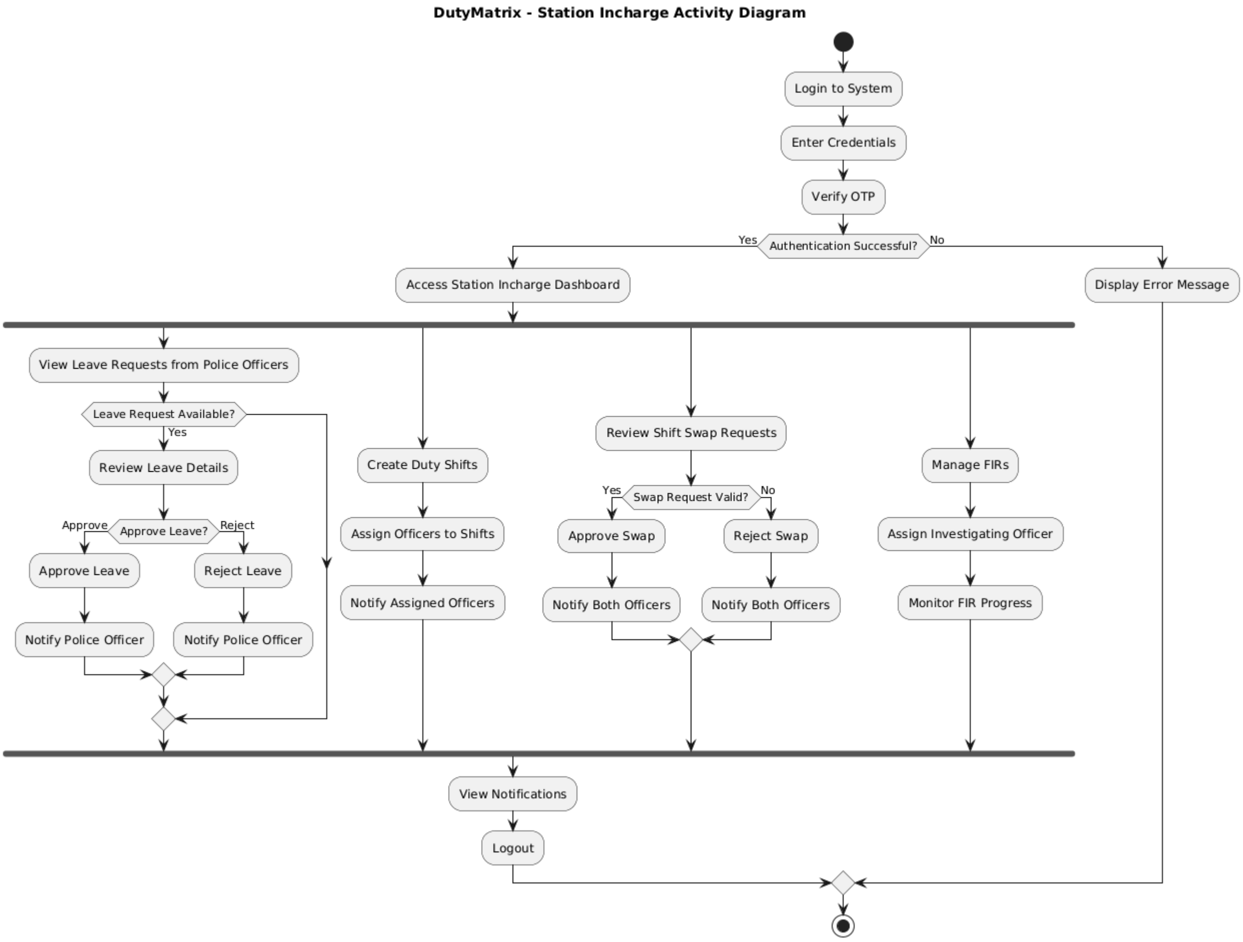
1. Login Activity Diagram



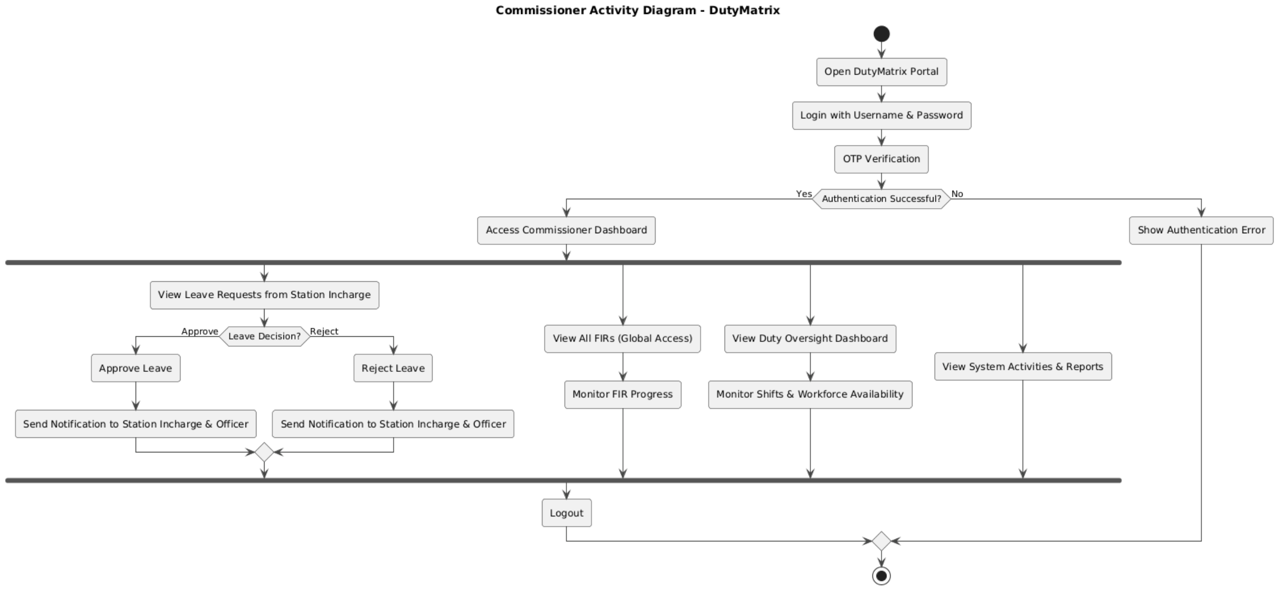
2. Police Officer Activity Diagram:



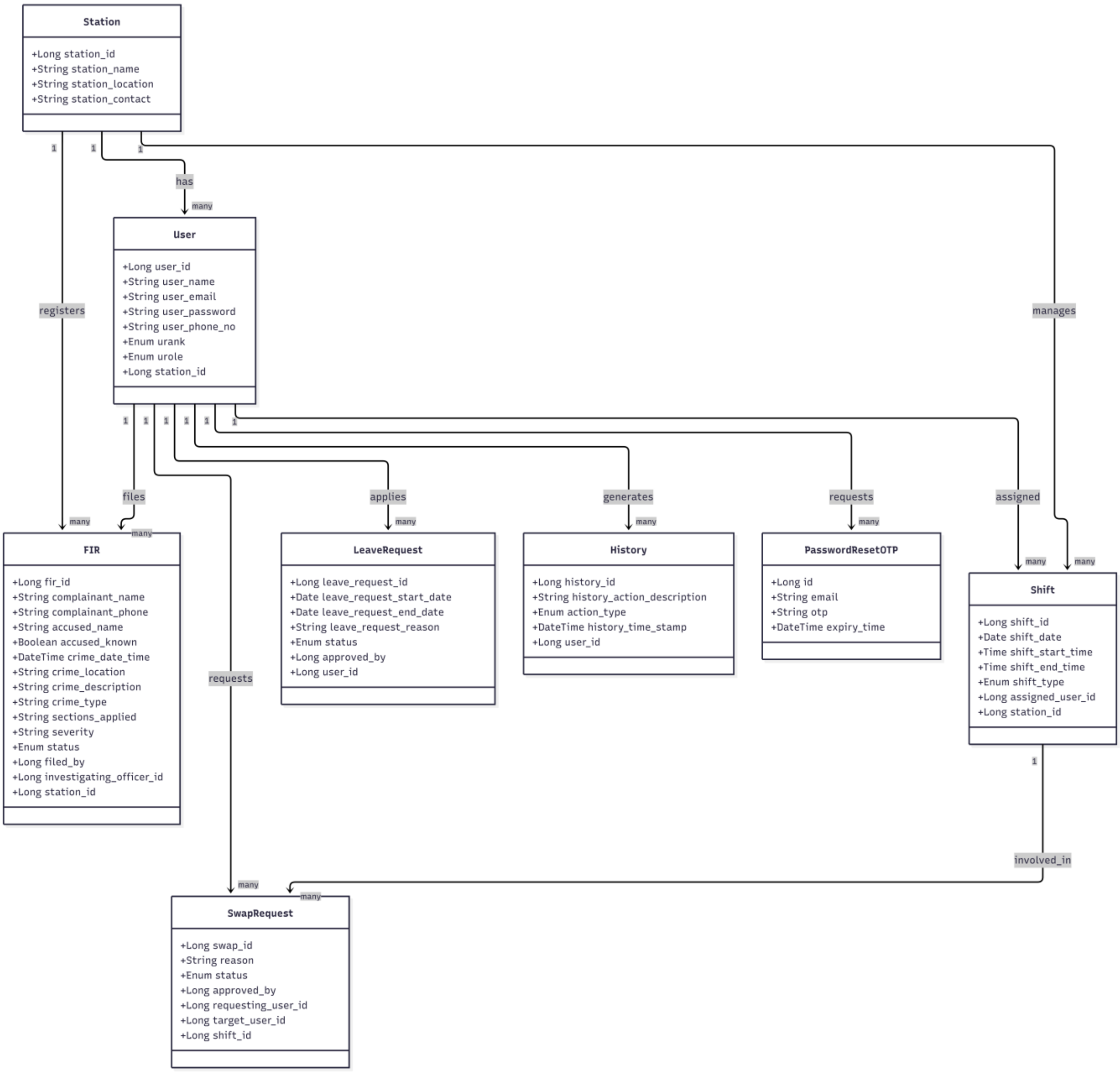
3. Station Incharge Activity Diagram:



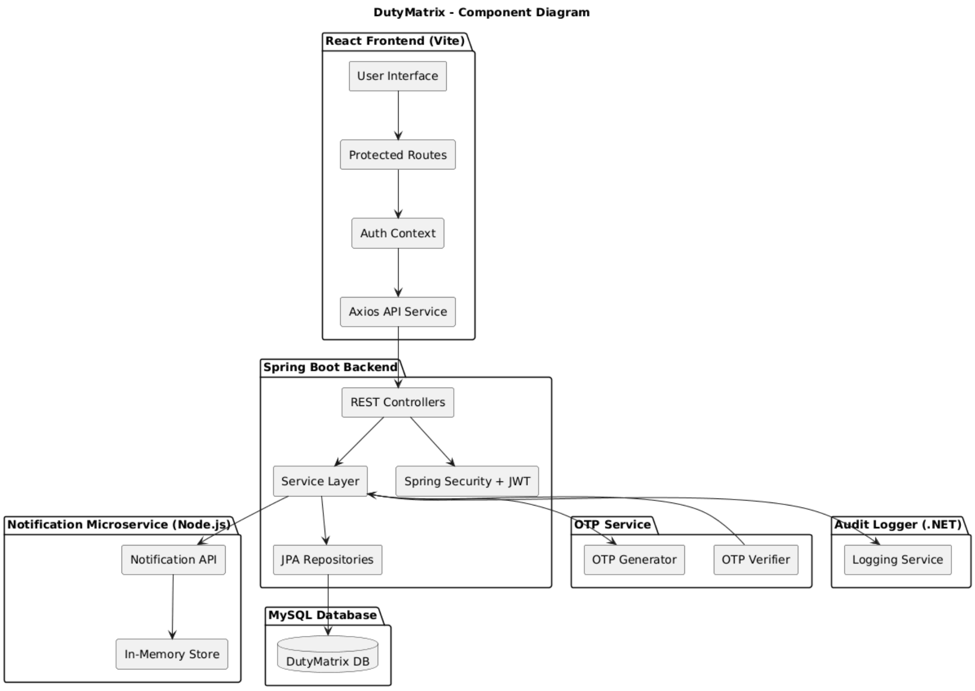
4. Commissioner Activity Diagram:


Commissioner Activity Diagram - DutyMatrix
Open DutyMatrix Portal
Login with Username & Password
OTP Verification
Yes
Authentication Successful?
No
Access Commissioner Dashboard
Show Authentication Error
View Leave Requests from Station Incharge
Approve
Leave Decision?
Reject
Approve Leave
Reject Leave
Send Notification to Station Incharge & Officer
Send Notification to Station Incharge & Officer
View All FIRs (Global Access)
Monitor FIR Progress
View Duty Oversight Dashboard
Monitor Shifts & Workforce Availability
View System Activities & Reports
Logout

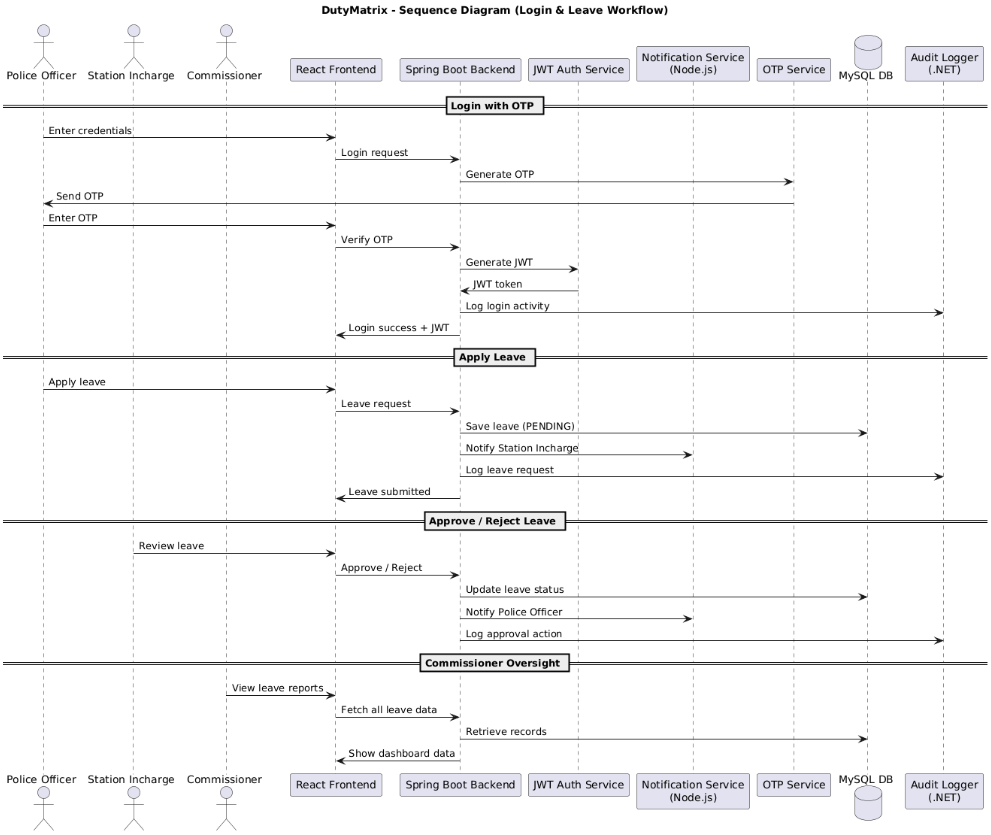
3.5 Class Diagram



3.6 Component Diagram

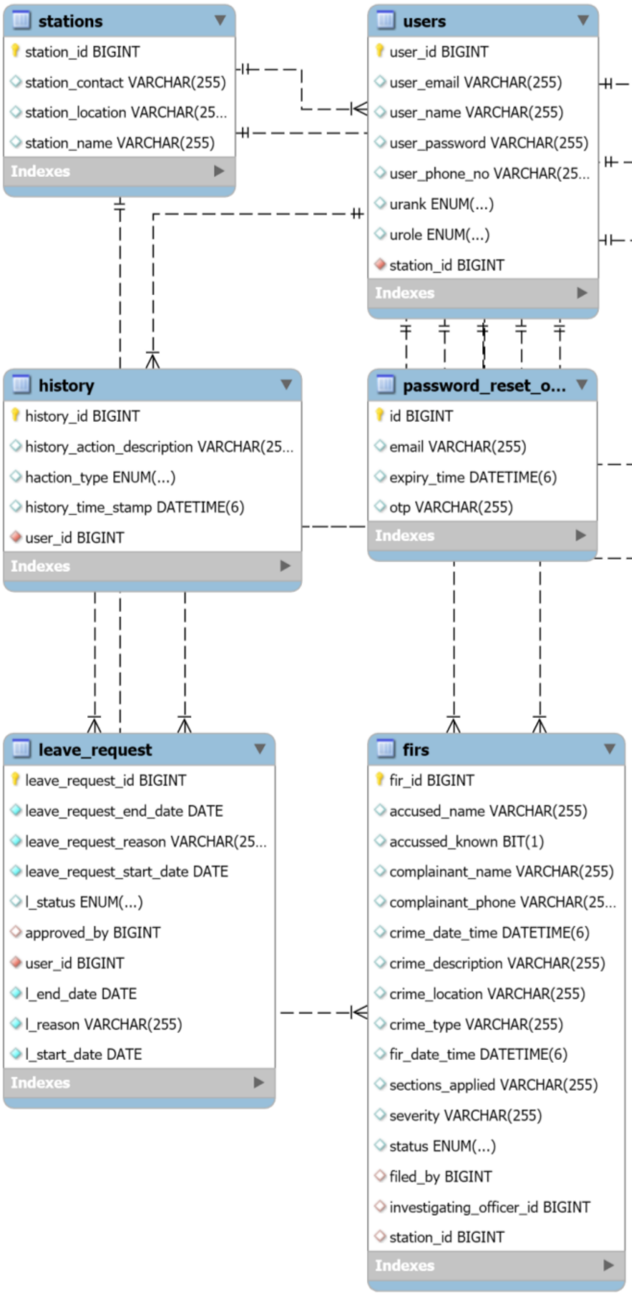


3.7 Sequence Diagram



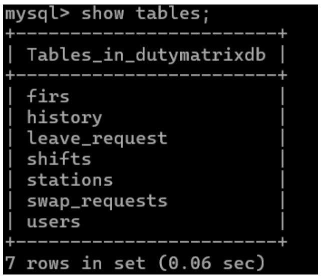
4. DATABASE DESIGN

4.1 Design



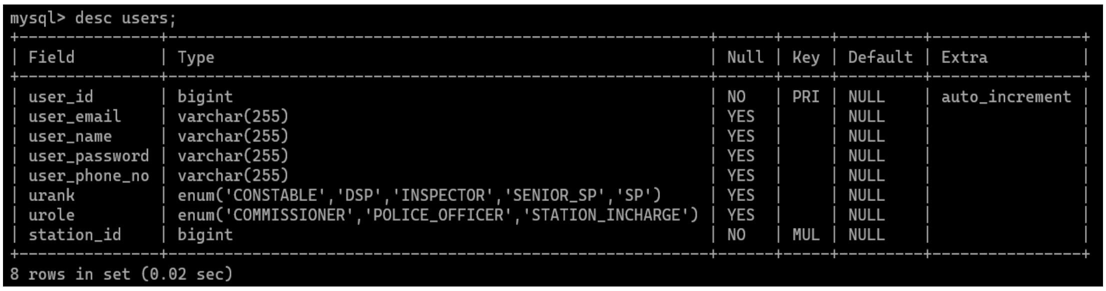
4.2 Tables

These are the tables exists in the database “dutymatrixdb”



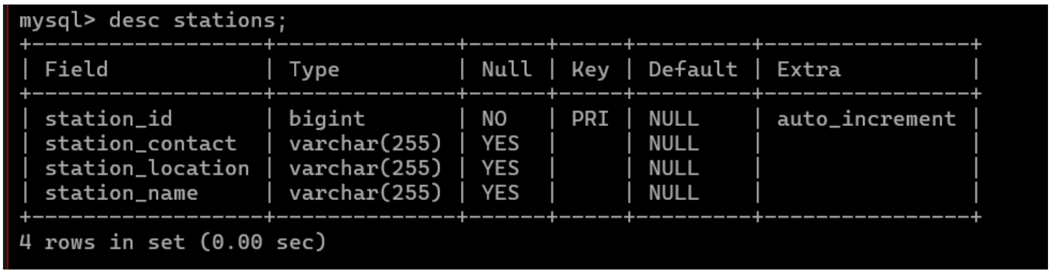
```
mysql> show tables;
+------------------------+
| Tables_in_dutymatrixdb |
+------------------------+
| firs                   |
| history                |
| leave_request          |
| shifts                 |
| stations               |
| swap_requests          |
| users                  |
+------------------------+
7 rows in set (0.06 sec)
```

The following table structures depict the database design.



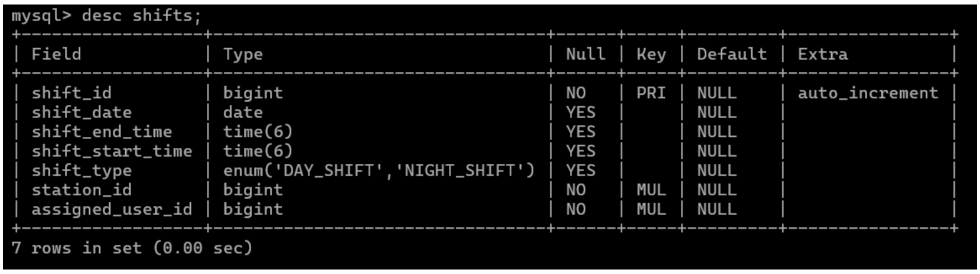
```
mysql> desc users;
+---------------+----------------------------------------------------------+------+-----+---------+----------------+
| Field         | Type                                                     | Null | Key | Default | Extra          |
+---------------+----------------------------------------------------------+------+-----+---------+----------------+
| user_id       | bigint                                                   | NO   | PRI | NULL    | auto_increment |
| user_email    | varchar(255)                                             | YES  |     | NULL    |                |
| user_name     | varchar(255)                                             | YES  |     | NULL    |                |
| user_password | varchar(255)                                             | YES  |     | NULL    |                |
| user_phone_no | varchar(255)                                             | YES  |     | NULL    |                |
| urank         | enum('CONSTABLE','DSP','INSPECTOR','SENIOR_SP','SP')     | YES  |     | NULL    |                |
| urole         | enum('COMMISSIONER','POLICE_OFFICER','STATION_INCHARGE') | YES  |     | NULL    |                |
| station_id    | bigint                                                   | NO   | MUL | NULL    |                |
+---------------+----------------------------------------------------------+------+-----+---------+----------------+
8 rows in set (0.02 sec)
```

Table 1: users



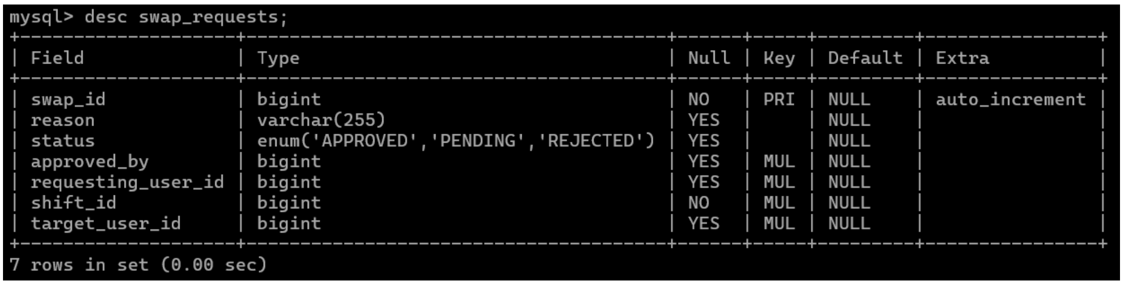
```
mysql> desc stations;
+------------------+--------------+------+-----+---------+----------------+
| Field            | Type         | Null | Key | Default | Extra          |
+------------------+--------------+------+-----+---------+----------------+
| station_id       | bigint       | NO   | PRI | NULL    | auto_increment |
| station_contact  | varchar(255) | YES  |     | NULL    |                |
| station_location | varchar(255) | YES  |     | NULL    |                |
| station_name     | varchar(255) | YES  |     | NULL    |                |
+------------------+--------------+------+-----+---------+----------------+
4 rows in set (0.00 sec)
```

Table 2: stations



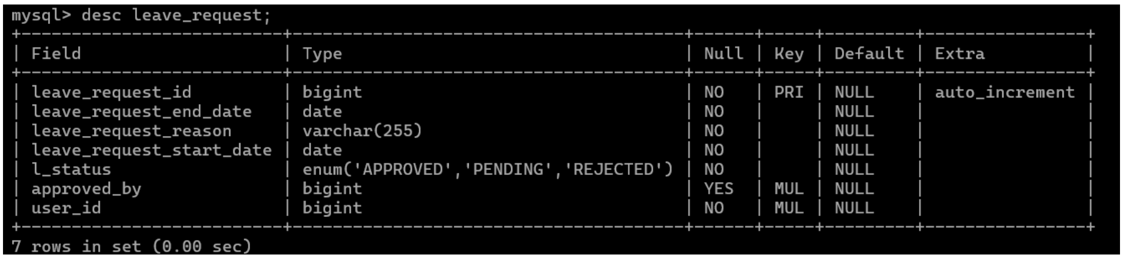
```
mysql> desc shifts;
+------------------+---------------------------------+------+-----+---------+----------------+
| Field            | Type                            | Null | Key | Default | Extra          |
+------------------+---------------------------------+------+-----+---------+----------------+
| shift_id         | bigint                          | NO   | PRI | NULL    | auto_increment |
| shift_date       | date                            | YES  |     | NULL    |                |
| shift_end_time   | time(6)                         | YES  |     | NULL    |                |
| shift_start_time | time(6)                         | YES  |     | NULL    |                |
| shift_type       | enum('DAY_SHIFT','NIGHT_SHIFT') | YES  |     | NULL    |                |
| station_id       | bigint                          | NO   | MUL | NULL    |                |
| assigned_user_id | bigint                          | NO   | MUL | NULL    |                |
+------------------+---------------------------------+------+-----+---------+----------------+
7 rows in set (0.00 sec)
```

Table 3: shifts



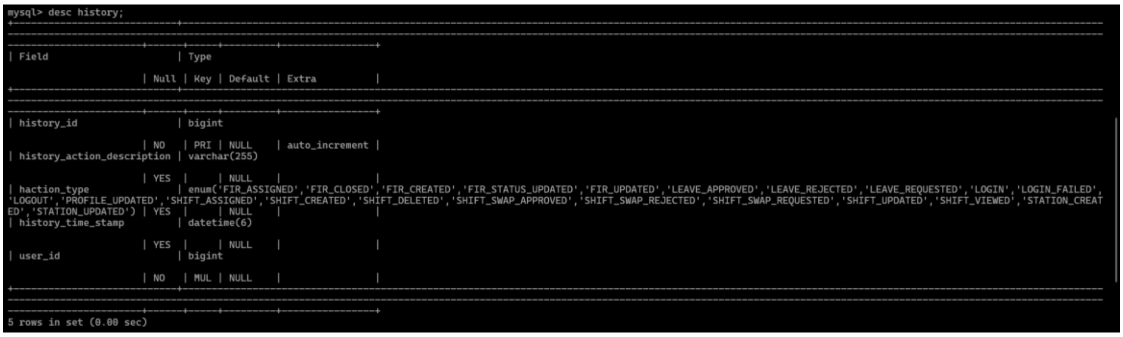
```
mysql> desc swap_requests;
+--------------------+---------------------------------------+------+-----+---------+----------------+
| Field              | Type                                  | Null | Key | Default | Extra          |
+--------------------+---------------------------------------+------+-----+---------+----------------+
| swap_id            | bigint                                | NO   | PRI | NULL    | auto_increment |
| reason             | varchar(255)                          | YES  |     | NULL    |                |
| status             | enum('APPROVED','PENDING','REJECTED') | YES  |     | NULL    |                |
| approved_by        | bigint                                | YES  | MUL | NULL    |                |
| requesting_user_id | bigint                                | YES  | MUL | NULL    |                |
| shift_id           | bigint                                | NO   | MUL | NULL    |                |
| target_user_id     | bigint                                | YES  | MUL | NULL    |                |
+--------------------+---------------------------------------+------+-----+---------+----------------+
7 rows in set (0.00 sec)
```

Table 4: swap requests



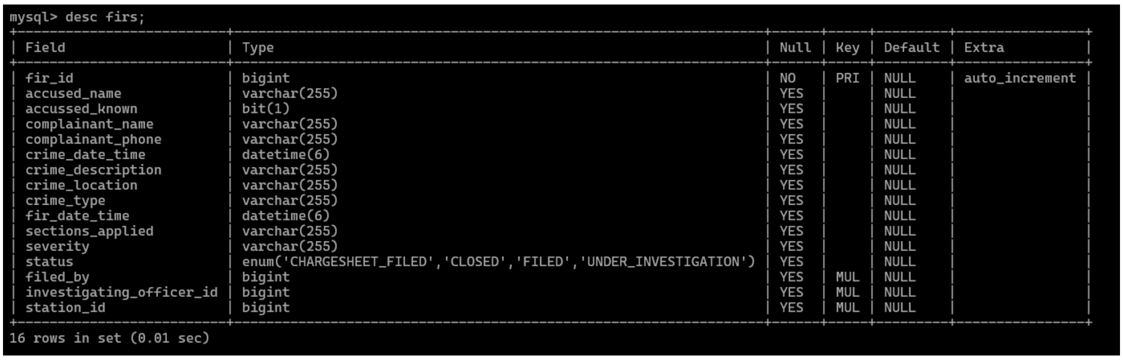
```
mysql> desc leave_request;
+--------------------------+---------------------------------------+------+-----+---------+----------------+
| Field                    | Type                                  | Null | Key | Default | Extra          |
+--------------------------+---------------------------------------+------+-----+---------+----------------+
| leave_request_id         | bigint                                | NO   | PRI | NULL    | auto_increment |
| leave_request_end_date   | date                                  | NO   |     | NULL    |                |
| leave_request_reason     | varchar(255)                          | NO   |     | NULL    |                |
| leave_request_start_date | date                                  | NO   |     | NULL    |                |
| l_status                 | enum('APPROVED','PENDING','REJECTED') | NO   |     | NULL    |                |
| approved_by              | bigint                                | YES  | MUL | NULL    |                |
| user_id                  | bigint                                | NO   | MUL | NULL    |                |
+--------------------------+---------------------------------------+------+-----+---------+----------------+
7 rows in set (0.00 sec)
```

Table 5: leave requests



```
mysql> desc history;
+----------------------------+--------------------------------------------------------------------------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
----------------------------+------+-----+---------+----------------+
| Field                      | Type

                           | Null | Key | Default | Extra          |
+----------------------------+--------------------------------------------------------------------------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
----------------------------+------+-----+---------+----------------+
| history_id                 | bigint

                           | NO   | PRI | NULL    | auto_increment |
| history_action_description | varchar(255)

                           | YES  |     | NULL    |                |
| haction_type               | enum('FIR_ASSIGNED','FIR_CLOSED','FIR_CREATED','FIR_STATUS_UPDATED','FIR_UPDATED','LEAVE_APPROVED','LEAVE_REJECTED','LEAVE_REQUESTED','LOGIN','LOGIN_FAILED',
'LOGOUT','PROFILE_UPDATED','SHIFT_ASSIGNED','SHIFT_CREATED','SHIFT_DELETED','SHIFT_SWAP_APPROVED','SHIFT_SWAP_REJECTED','SHIFT_SWAP_REQUESTED','SHIFT_UPDATED','SHIFT_VIEWED','STATION_CREAT
ED','STATION_UPDATED') | YES  |     | NULL    |                |
| history_time_stamp         | datetime(6)

                           | YES  |     | NULL    |                |
| user_id                    | bigint

                           | NO   | MUL | NULL    |                |
+----------------------------+--------------------------------------------------------------------------------------------------------------------------------------------------------------------
--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------
----------------------------+------+-----+---------+----------------+
5 rows in set (0.00 sec)
```

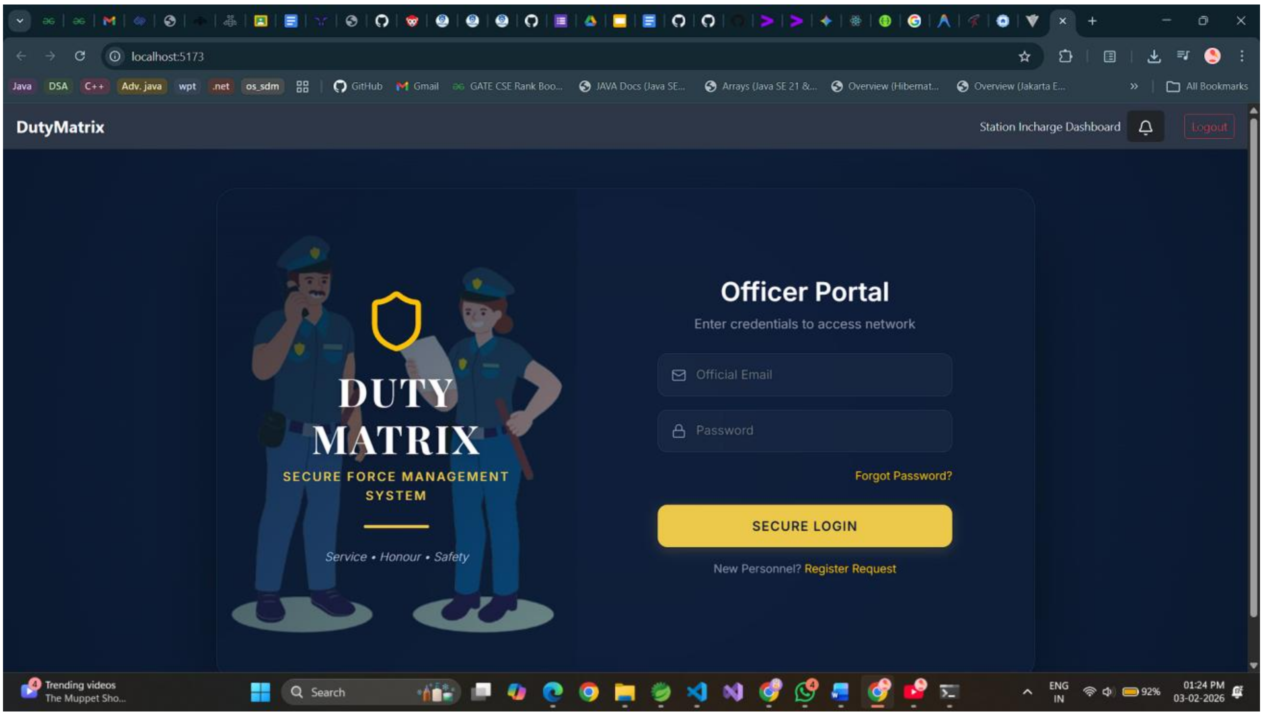
Table 6: history



```
mysql> desc firs;
+-------------------------+-------------------------------------------------------------------+------+-----+---------+----------------+
| Field                   | Type                                                              | Null | Key | Default | Extra          |
+-------------------------+-------------------------------------------------------------------+------+-----+---------+----------------+
| fir_id                  | bigint                                                            | NO   | PRI | NULL    | auto_increment |
| accused_name            | varchar(255)                                                      | YES  |     | NULL    |                |
| accused_known           | bit(1)                                                            | YES  |     | NULL    |                |
| complainant_name        | varchar(255)                                                      | YES  |     | NULL    |                |
| complainant_phone       | varchar(255)                                                      | YES  |     | NULL    |                |
| crime_date_time         | datetime(6)                                                       | YES  |     | NULL    |                |
| crime_description       | varchar(255)                                                      | YES  |     | NULL    |                |
| crime_location          | varchar(255)                                                      | YES  |     | NULL    |                |
| crime_type              | varchar(255)                                                      | YES  |     | NULL    |                |
| fir_date_time           | datetime(6)                                                       | YES  |     | NULL    |                |
| sections_applied        | varchar(255)                                                      | YES  |     | NULL    |                |
| severity                | varchar(255)                                                      | YES  |     | NULL    |                |
| status                  | enum('CHARGESHEET_FILED','CLOSED','FILED','UNDER_INVESTIGATION') | YES  |     | NULL    |                |
| filed_by                | bigint                                                            | YES  | MUL | NULL    |                |
| investigating_officer_id | bigint                                                           | YES  | MUL | NULL    |                |
| station_id              | bigint                                                            | YES  | MUL | NULL    |                |
+-------------------------+-------------------------------------------------------------------+------+-----+---------+----------------+
16 rows in set (0.01 sec)
```

Table 7: firs

5. SNAPSHOTS



localhost:5173

DutyMatrix

Station Incharge Dashboard

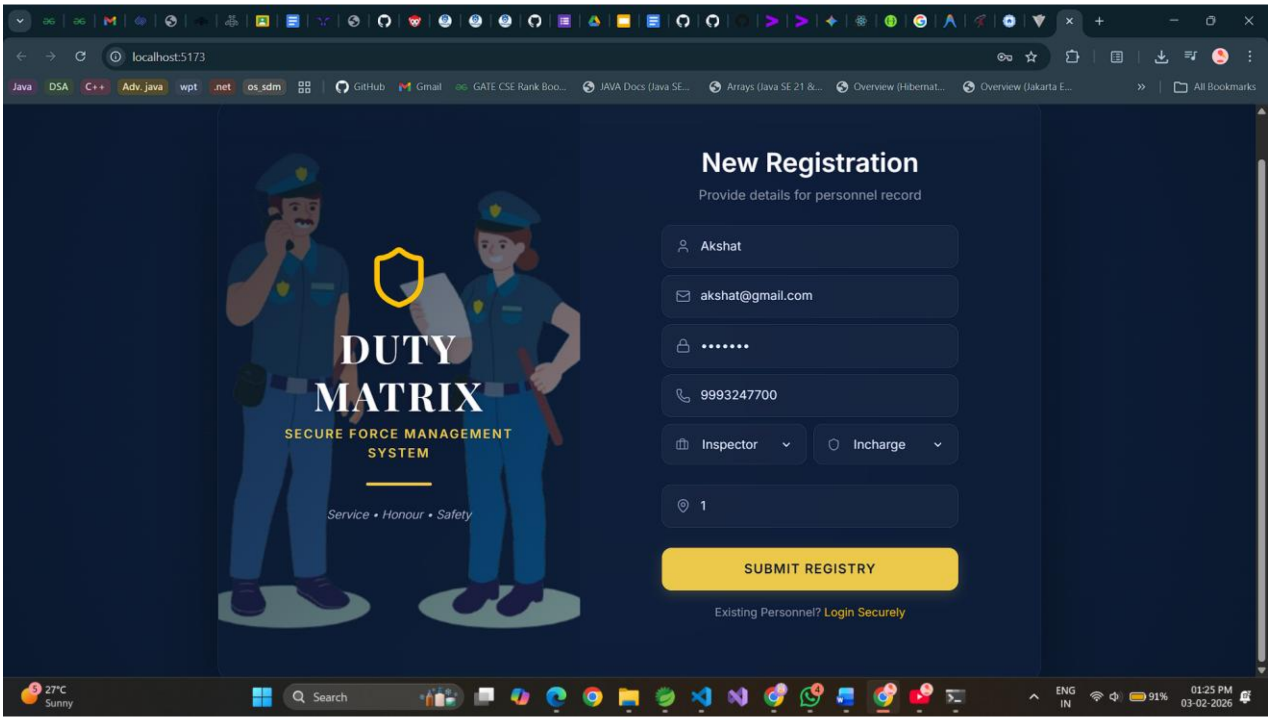
Officer Portal

Enter credentials to access network

Official Email

Password

Logout
DUTY MATRIX
SECURE FORCE MANAGEMENT SYSTEM
Service • Honour • Safety
Forgot Password?
SECURE LOGIN
New Personnel? Register Request



localhost:5173

New Registration

Provide details for personnel record

Akshat

akshat@gmail.com

•••••••

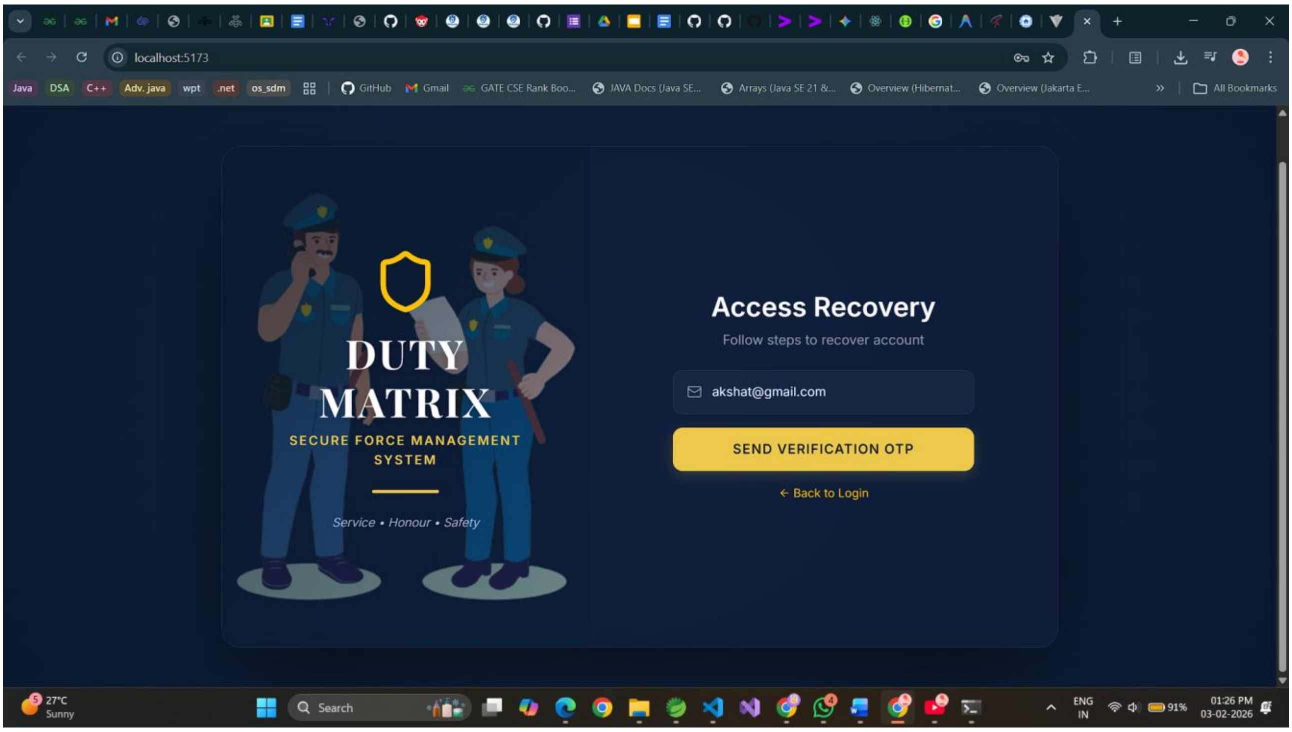
9993247700

Inspector

Incharge

1

DUTY MATRIX
SECURE FORCE MANAGEMENT SYSTEM
Service • Honour • Safety
SUBMIT REGISTRY
Existing Personnel? Login Securely



localhost:5173

DUTY MATRIX

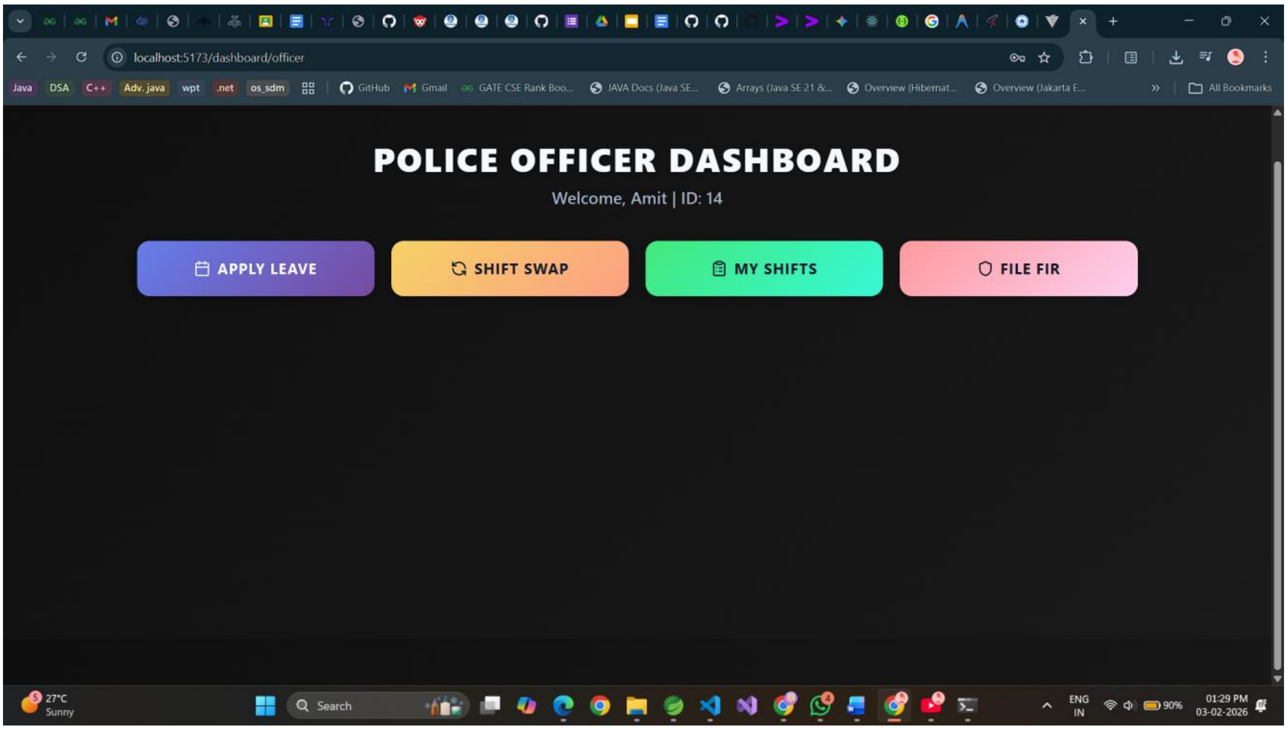
SECURE FORCE MANAGEMENT SYSTEM

Service • Honour • Safety

Access Recovery

Follow steps to recover account

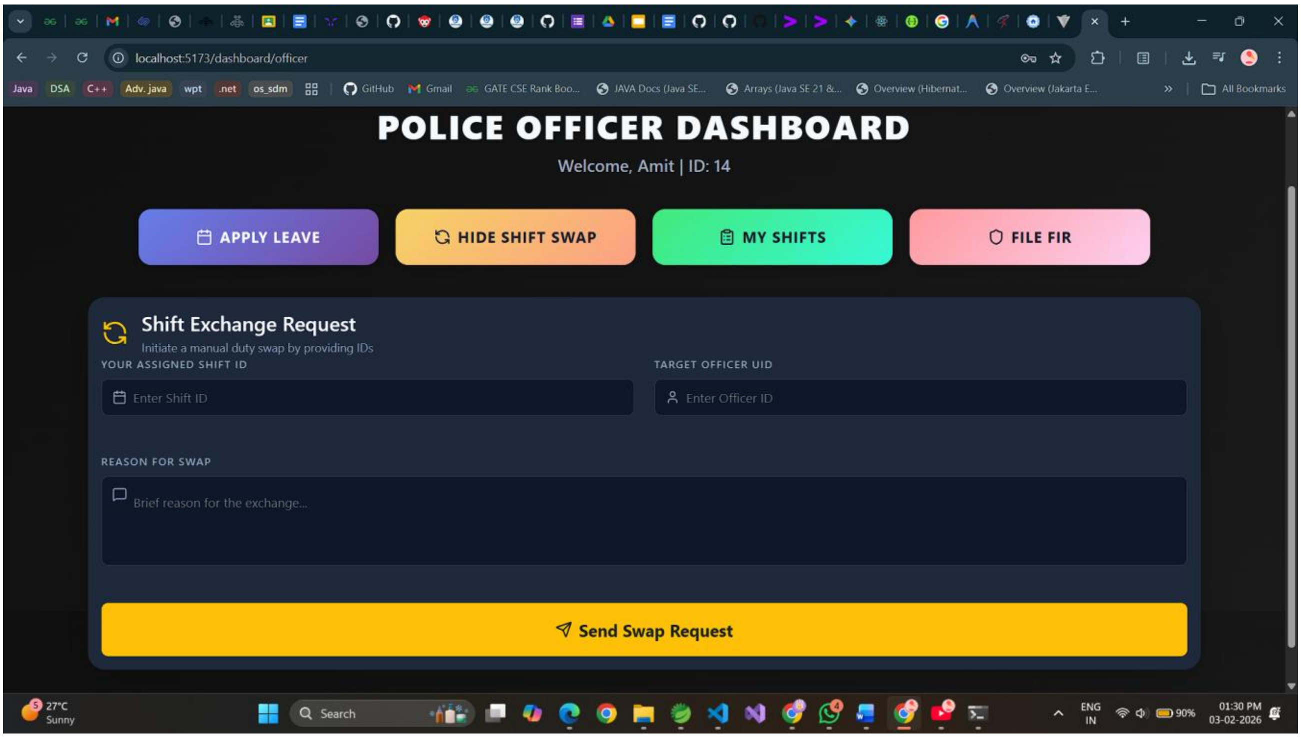
akshat@gmail.com



localhost:5173/dashboard/officer

POLICE OFFICER DASHBOARD

Welcome, Amit | ID: 14



POLICE OFFICER DASHBOARD

Welcome, Amit | ID: 14

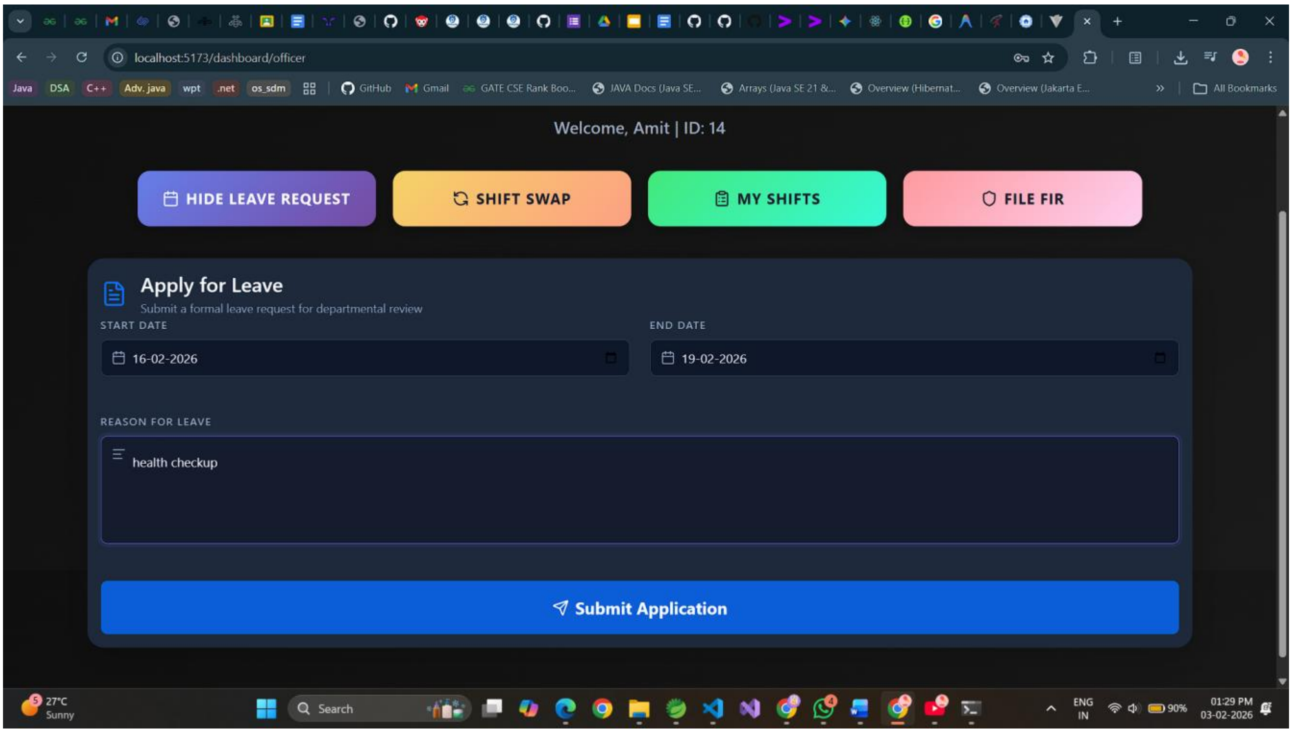
Shift Exchange Request

Initiate a manual duty swap by providing IDs

YOUR ASSIGNED SHIFT ID: Enter Shift ID

TARGET OFFICER UID: Enter Officer ID

REASON FOR SWAP: Brief reason for the exchange...



Welcome, Amit | ID: 14

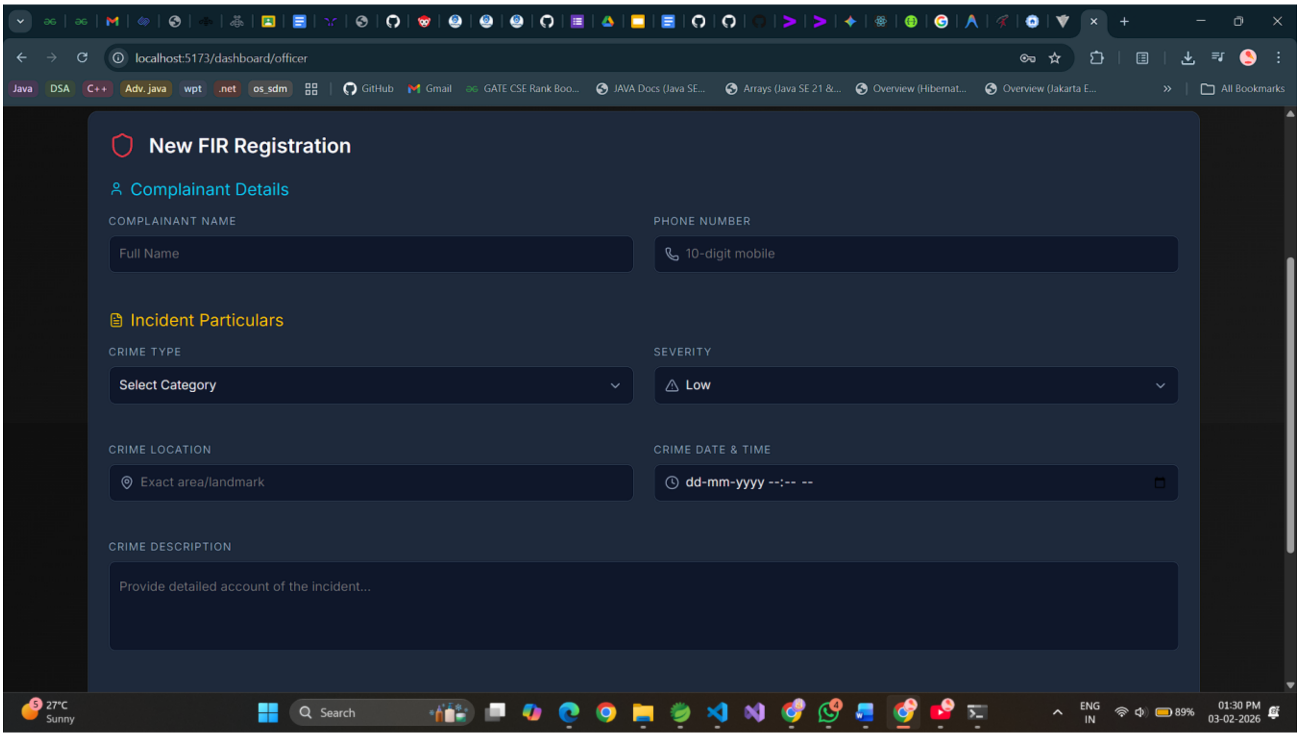
Apply for Leave

Submit a formal leave request for departmental review

START DATE: 16-02-2026

END DATE: 19-02-2026

REASON FOR LEAVE: health checkup



New FIR Registration

Complainant Details

COMPLAINANT NAME

Full Name

PHONE NUMBER

10-digit mobile

Incident Particulars

CRIME TYPE

Select Category

SEVERITY

Low

CRIME LOCATION

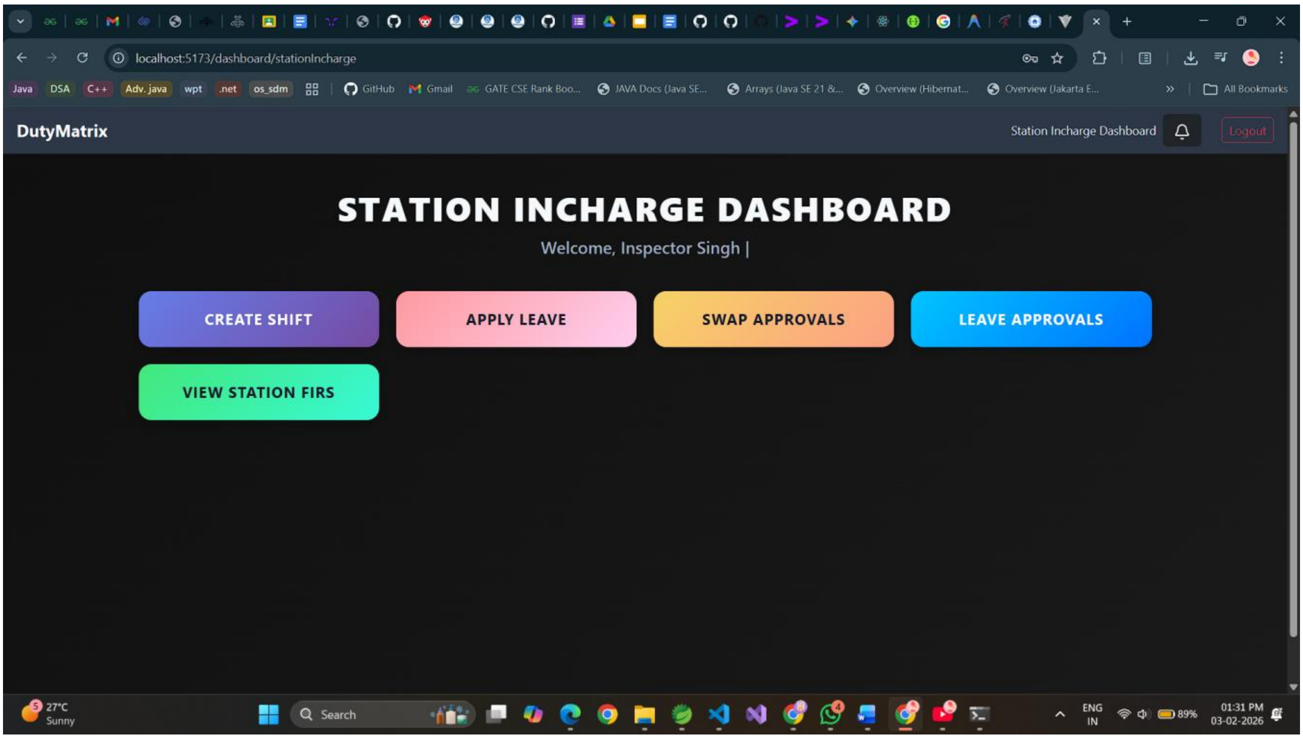
Exact area/landmark

CRIME DATE & TIME

dd-mm-yyyy --:-- --

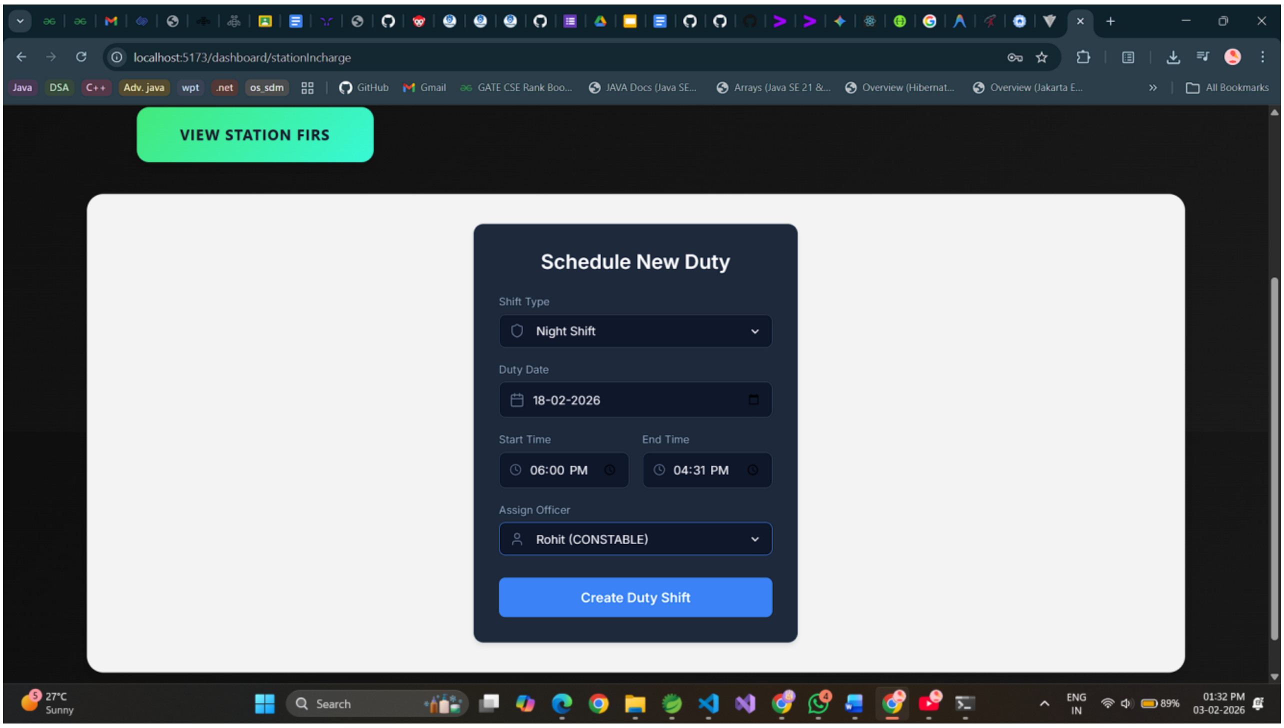
CRIME DESCRIPTION

Provide detailed account of the incident...



STATION INCHARGE DASHBOARD

Welcome, Inspector Singh |



Schedule New Duty

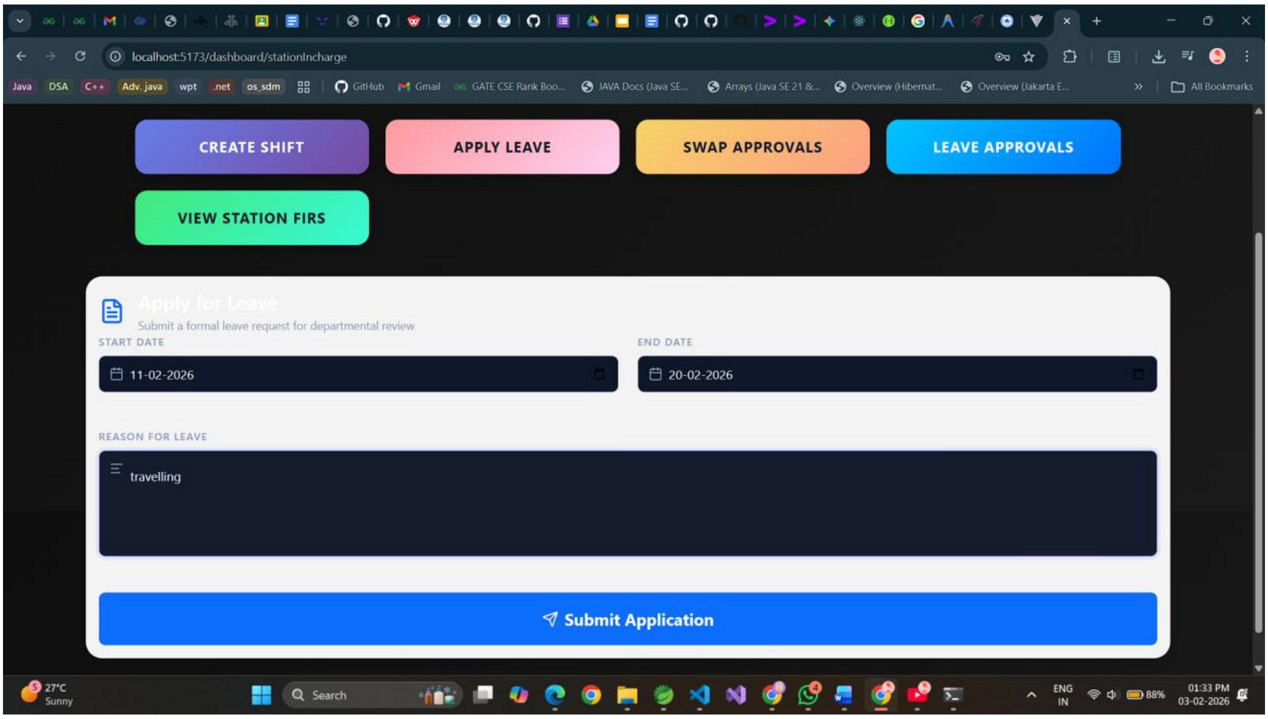
Shift Type: Night Shift

Duty Date: 18-02-2026

Start Time: 06:00 PM

End Time: 04:31 PM

Assign Officer: Rohit (CONSTABLE)



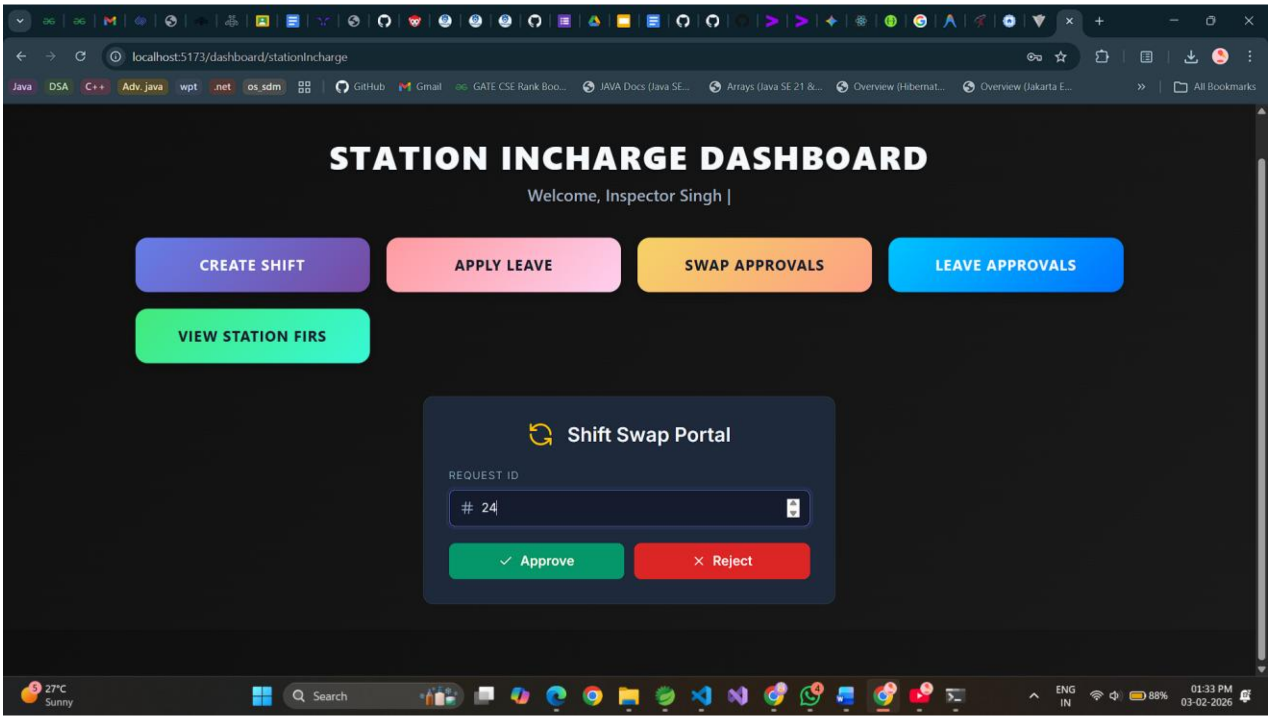
Apply for Leave

Submit a formal leave request for departmental review

START DATE: 11-02-2026

END DATE: 20-02-2026

REASON FOR LEAVE: travelling

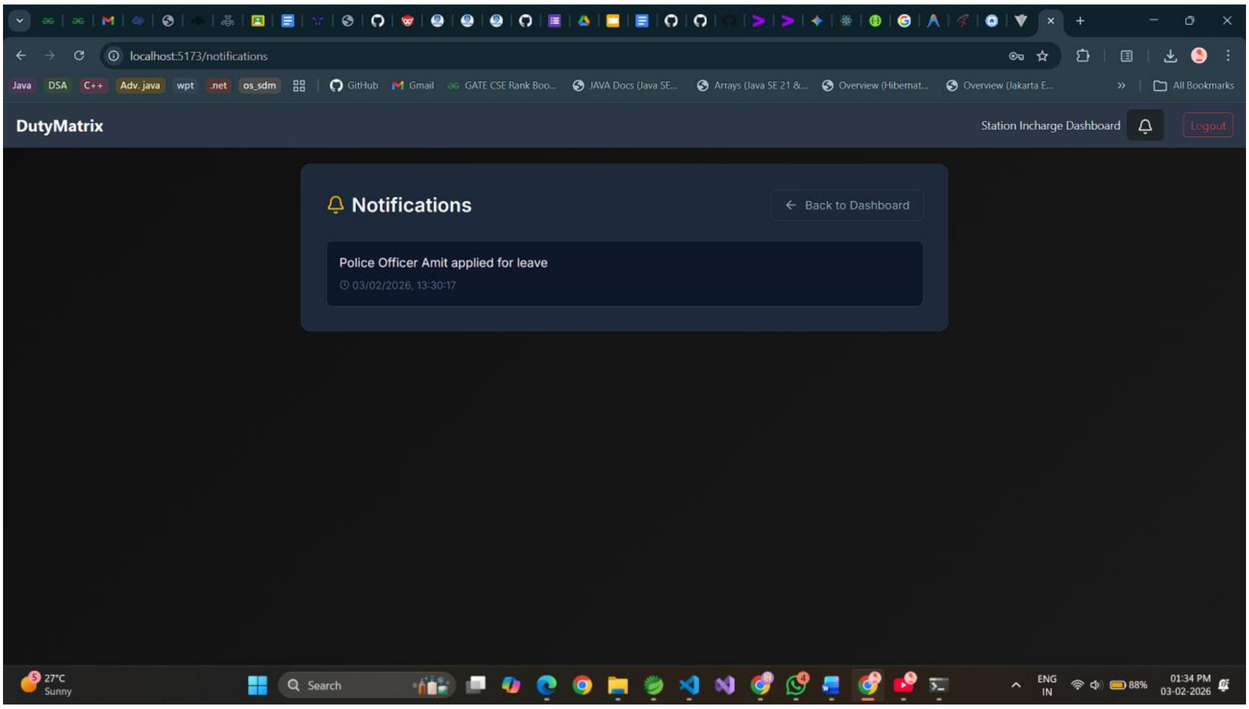


STATION INCHARGE DASHBOARD

Welcome, Inspector Singh |

Shift Swap Portal

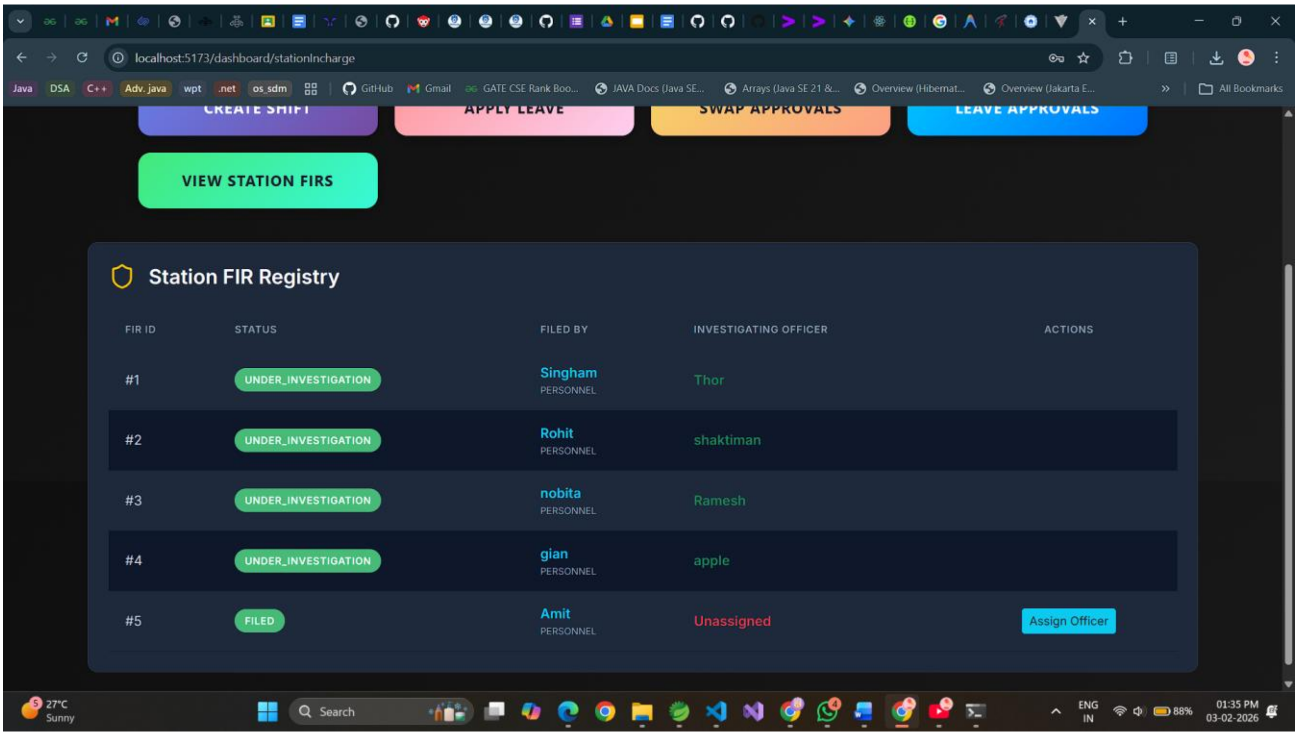
REQUEST ID: # 24



Notifications

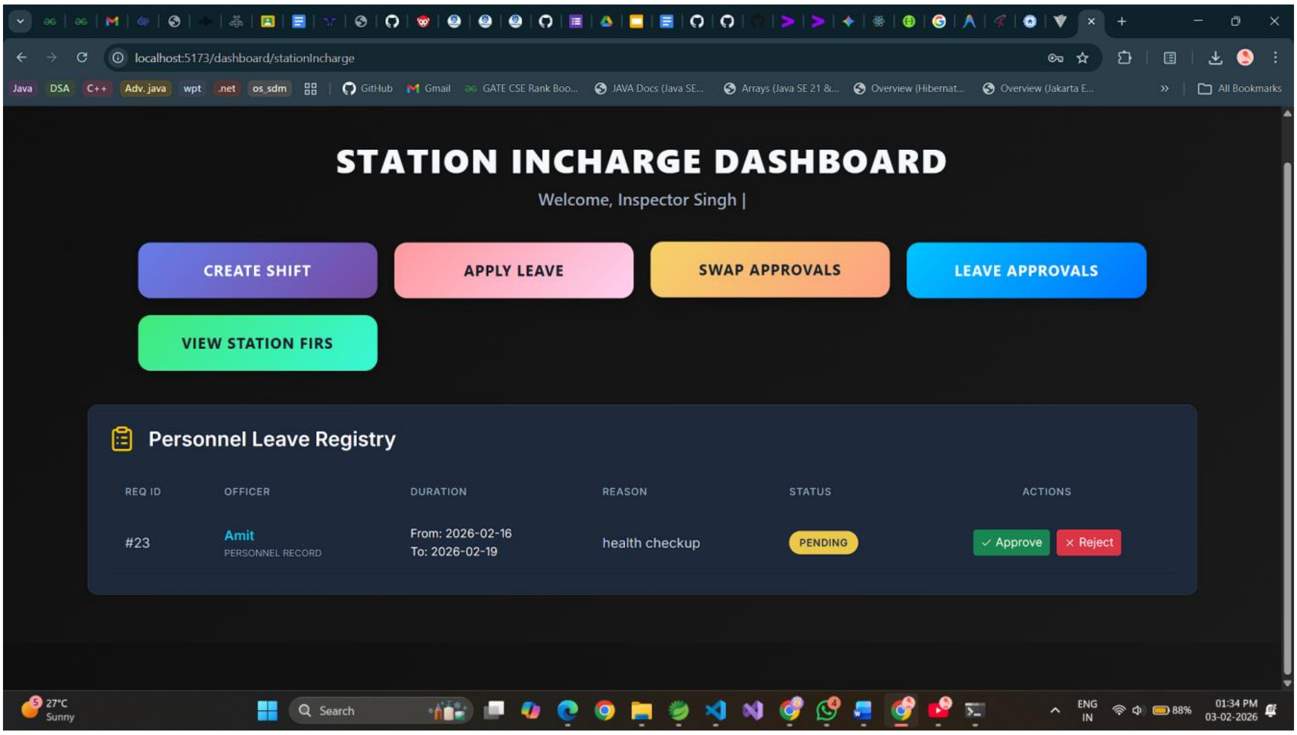
Police Officer Amit applied for leave

03/02/2026, 13:30:17



Station FIR Registry

FIR ID	STATUS	FILED BY	INVESTIGATING OFFICER	ACTIONS
#1	UNDER_INVESTIGATION	Singham PERSONNEL	Thor	
#2	UNDER_INVESTIGATION	Rohit PERSONNEL	shaktiman	
#3	UNDER_INVESTIGATION	nobita PERSONNEL	Ramesh	
#4	UNDER_INVESTIGATION	gian PERSONNEL	apple	
#5	FILED	Amit PERSONNEL	Unassigned	Assign Officer

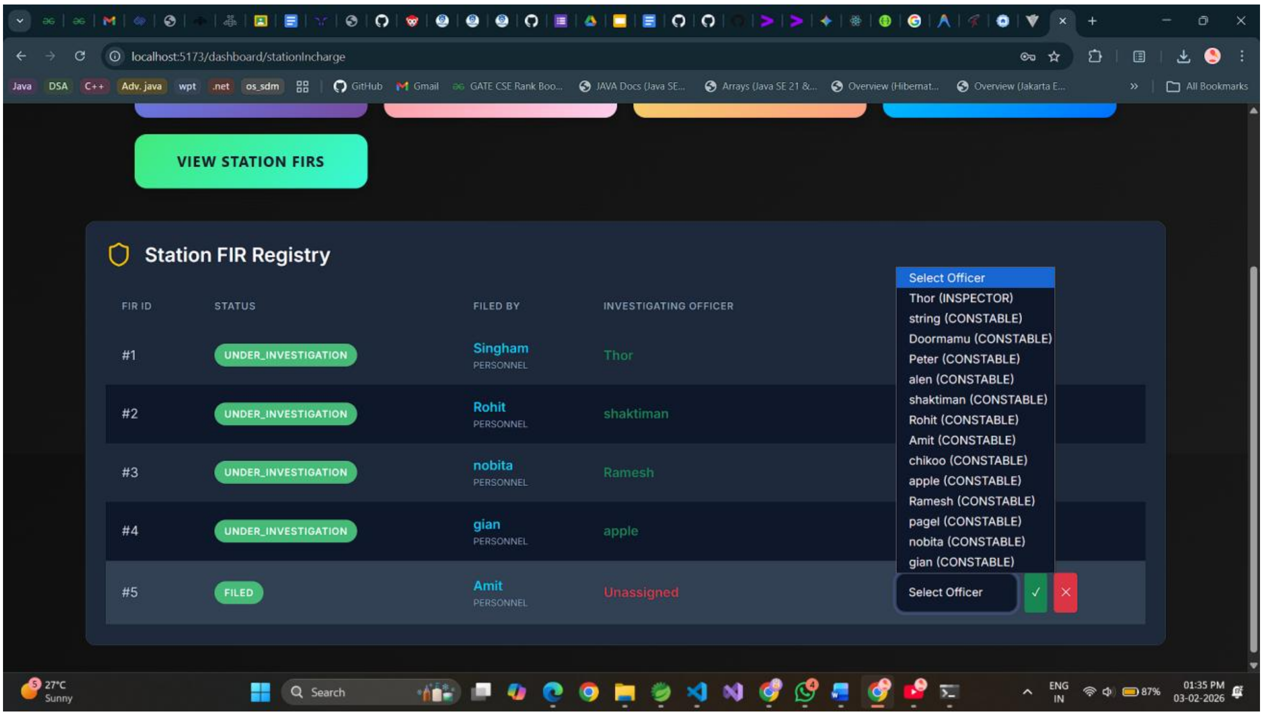


STATION INCHARGE DASHBOARD

Welcome, Inspector Singh |

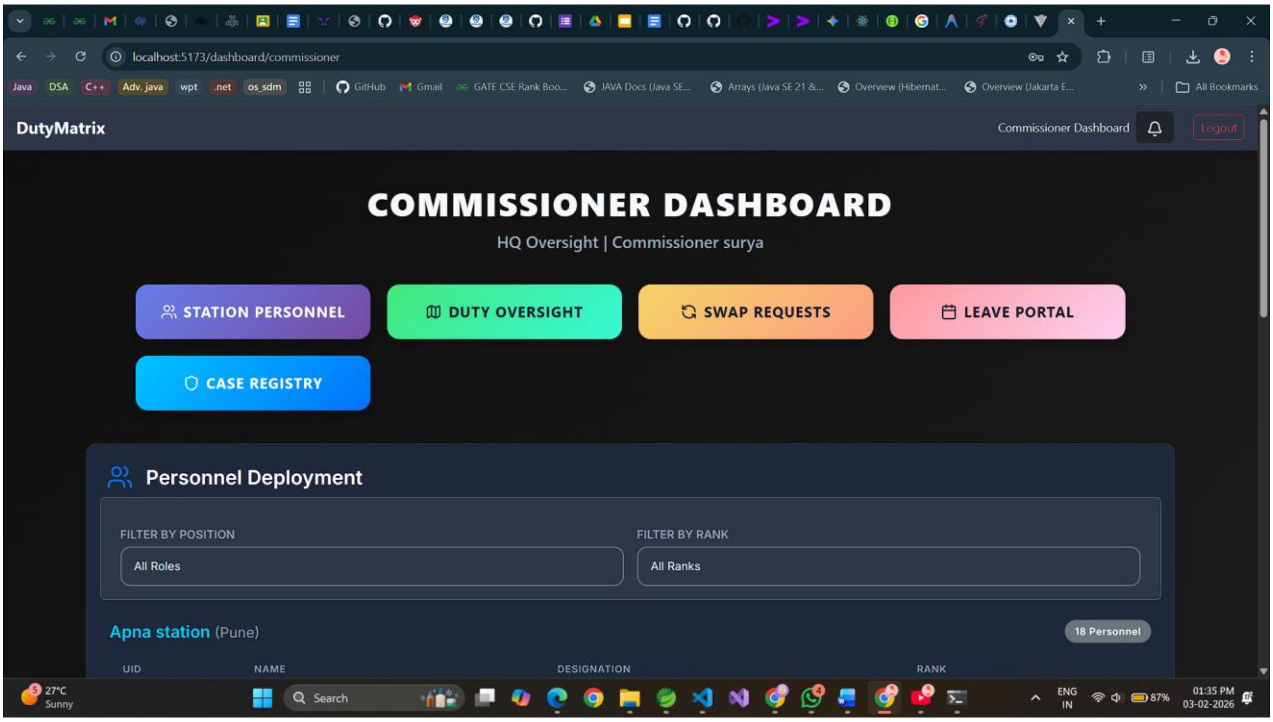
Personnel Leave Registry

REQ ID	OFFICER	DURATION	REASON	STATUS	ACTIONS
#23	Amit PERSONNEL RECORD	From: 2026-02-16 To: 2026-02-19	health checkup	PENDING	✓ Approve ✕ Reject



Station FIR Registry

FIR ID	STATUS	FILED BY	INVESTIGATING OFFICER
#1	UNDER_INVESTIGATION	Singham PERSONNEL	Thor
#2	UNDER_INVESTIGATION	Rohit PERSONNEL	shaktiman
#3	UNDER_INVESTIGATION	nobita PERSONNEL	Ramesh
#4	UNDER_INVESTIGATION	gian PERSONNEL	apple
#5	FILED	Amit PERSONNEL	Unassigned



COMMISSIONER DASHBOARD

HQ Oversight | Commissioner surya

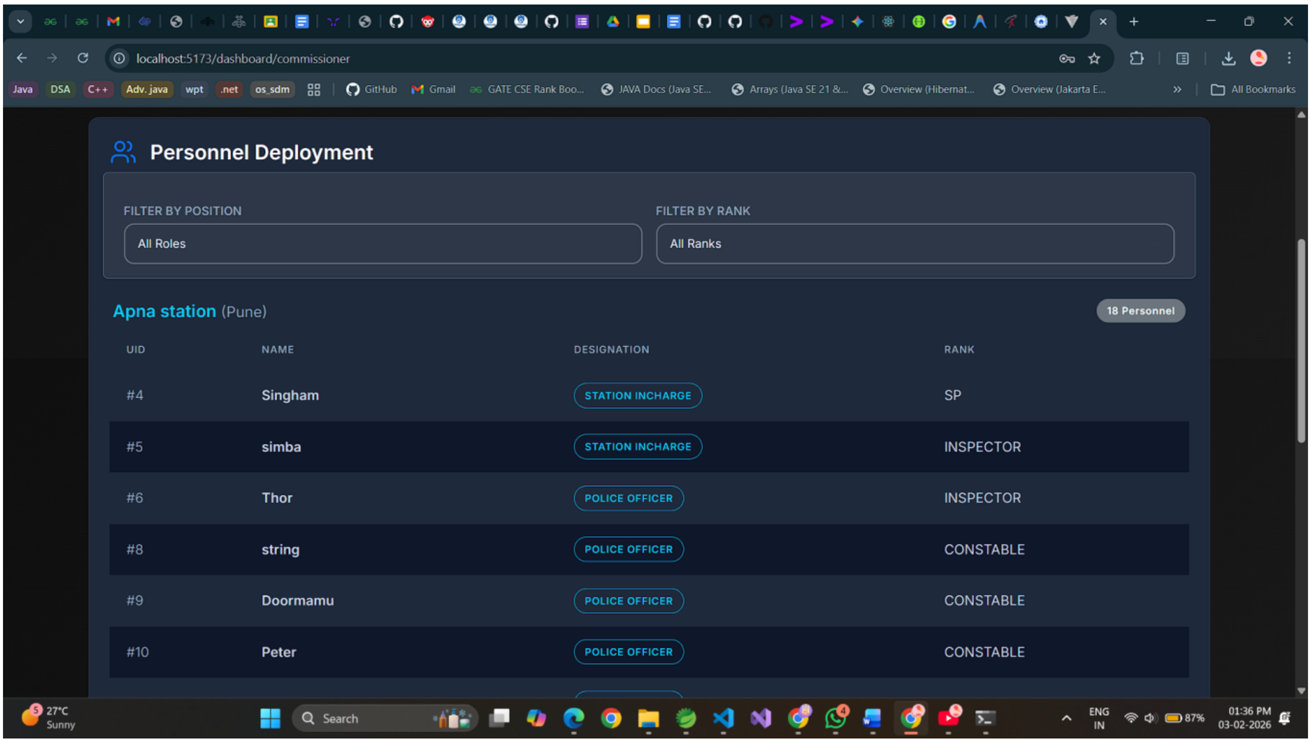
Personnel Deployment

FILTER BY POSITION: All Roles

FILTER BY RANK: All Ranks

Apna station (Pune) — 18 Personnel

UID	NAME	DESIGNATION	RANK



Personnel Deployment

FILTER BY POSITION

All Roles

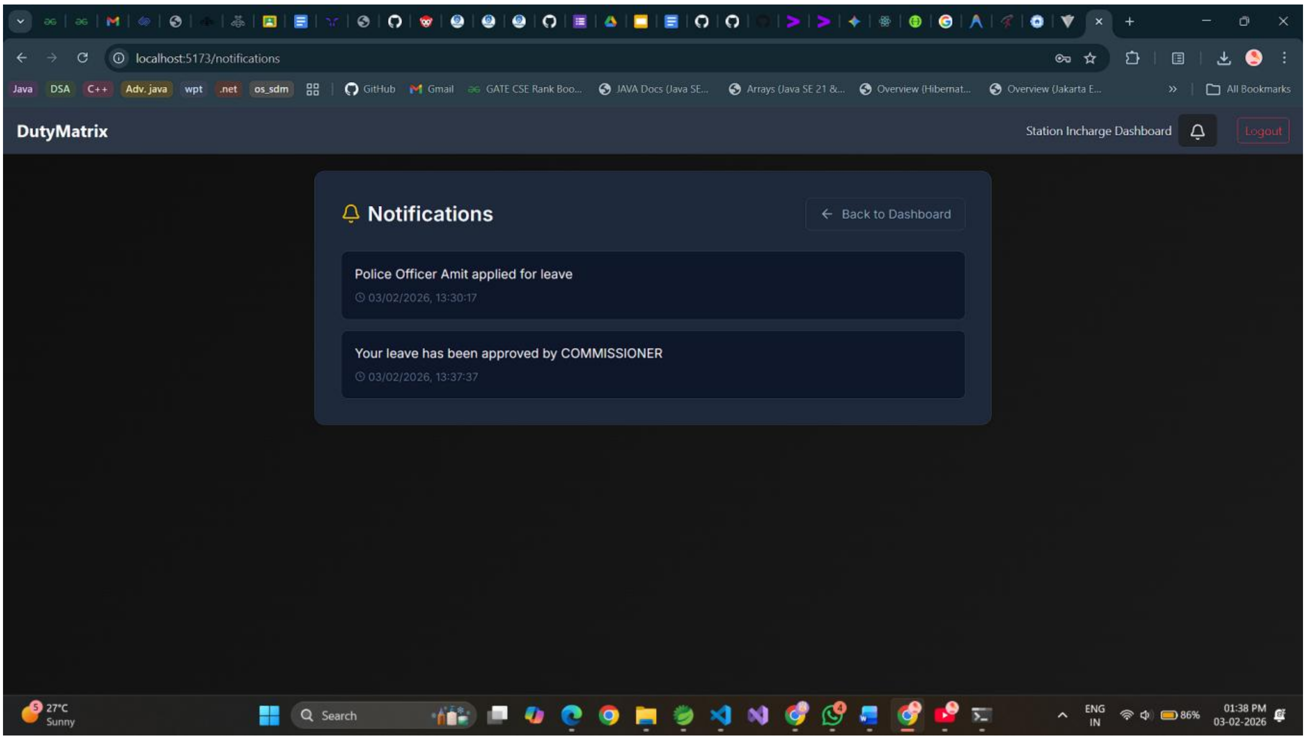
FILTER BY RANK

All Ranks

Apna station (Pune)

18 Personnel

UID	NAME	DESIGNATION	RANK
#4	Singham	STATION INCHARGE	SP
#5	simba	STATION INCHARGE	INSPECTOR
#6	Thor	POLICE OFFICER	INSPECTOR
#8	string	POLICE OFFICER	CONSTABLE
#9	Doormamu	POLICE OFFICER	CONSTABLE
#10	Peter	POLICE OFFICER	CONSTABLE

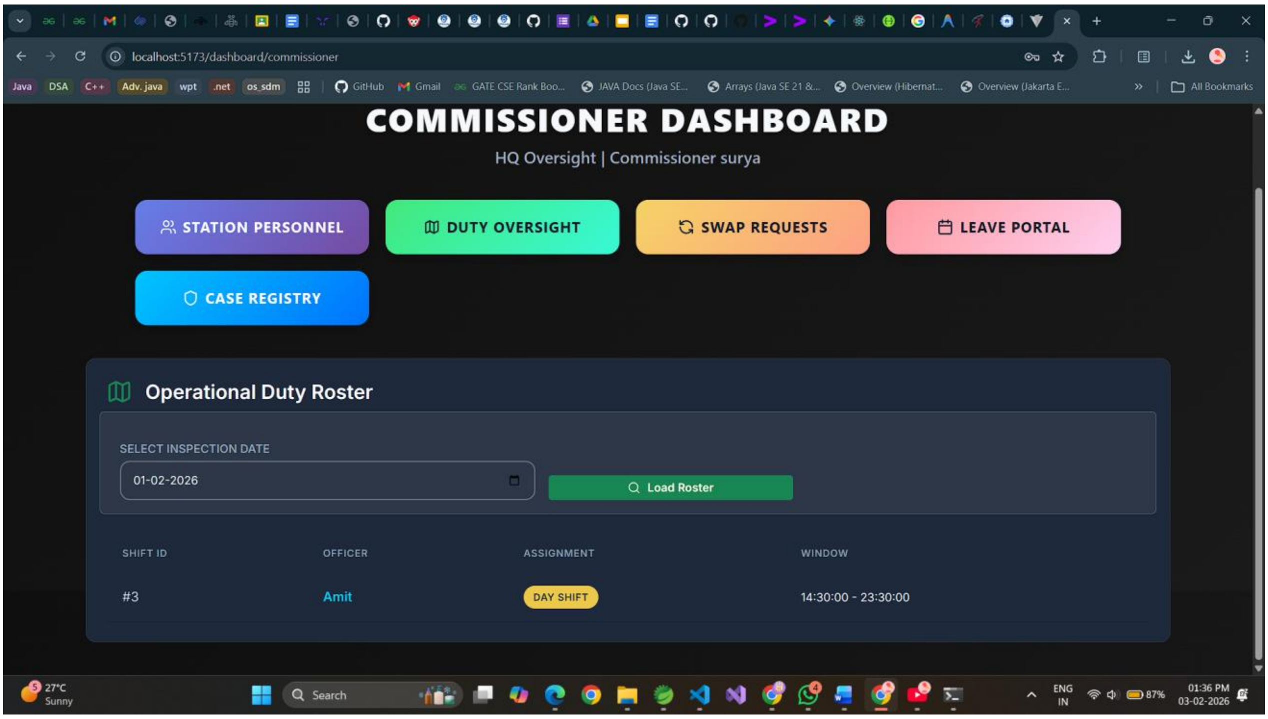


Notifications

← Back to Dashboard

Police Officer Amit applied for leave
03/02/2026, 13:30:17

Your leave has been approved by COMMISSIONER
03/02/2026, 13:37:37



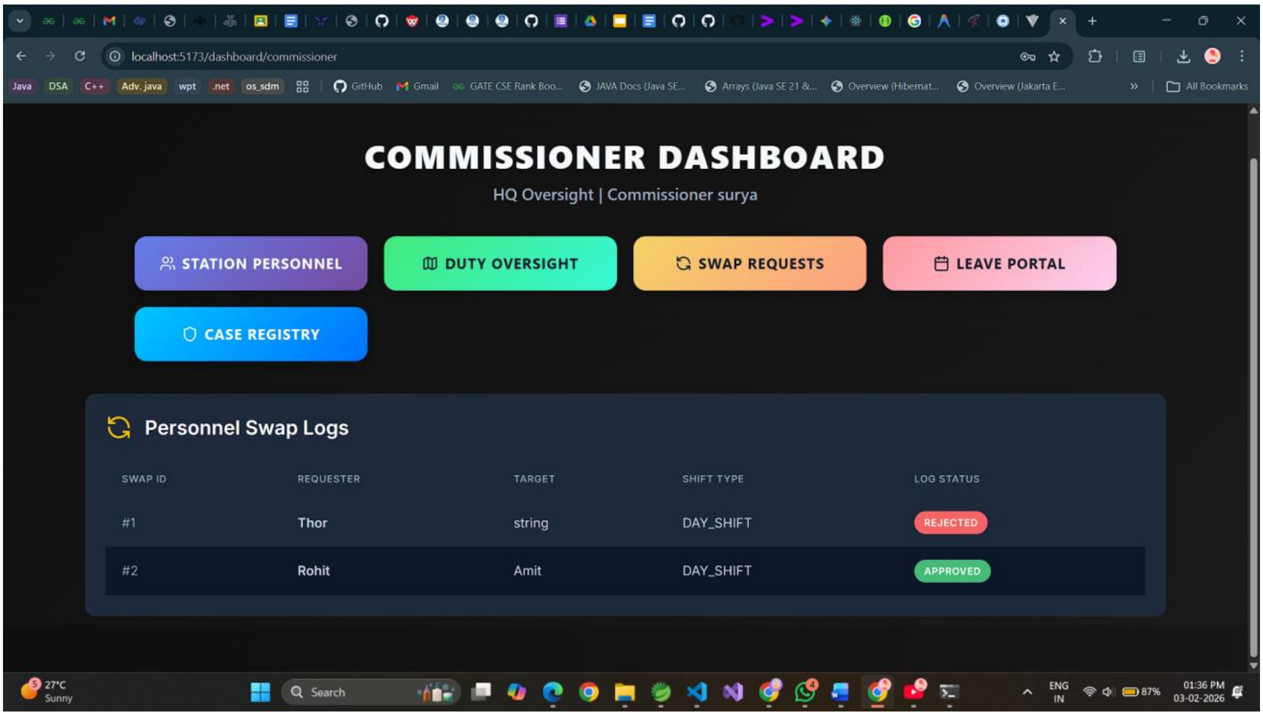
COMMISSIONER DASHBOARD

HQ Oversight | Commissioner surya

Operational Duty Roster

SELECT INSPECTION DATE: 01-02-2026

SHIFT ID	OFFICER	ASSIGNMENT	WINDOW
#3	Amit	DAY SHIFT	14:30:00 - 23:30:00

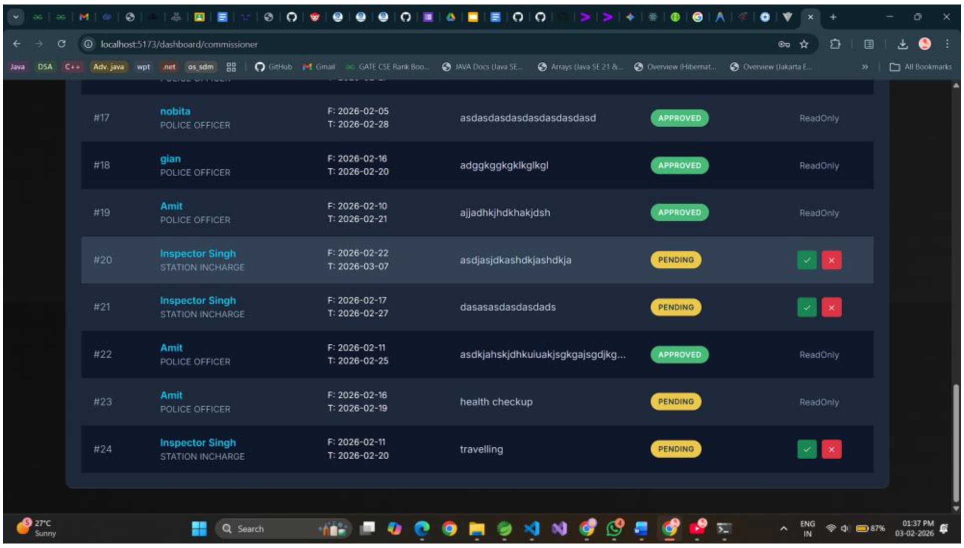


COMMISSIONER DASHBOARD

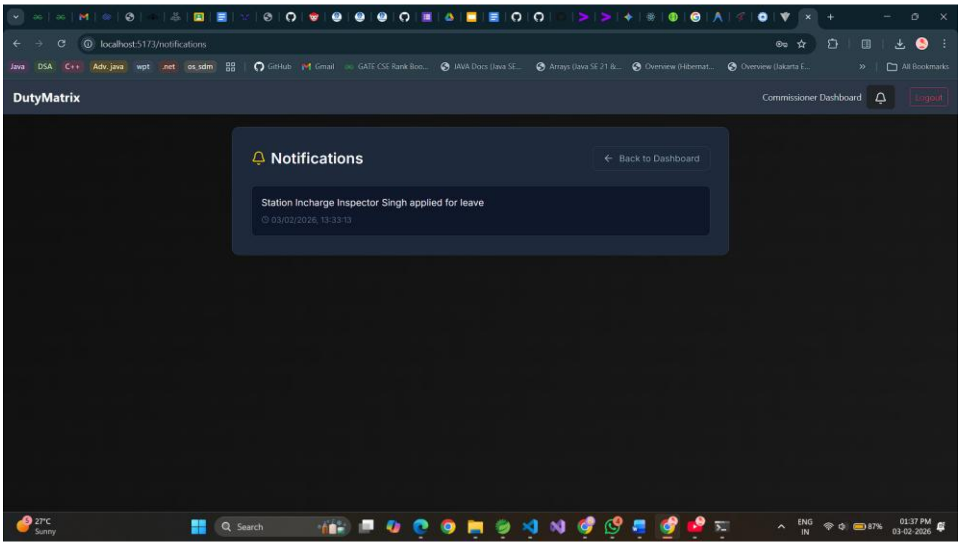
HQ Oversight | Commissioner surya

Personnel Swap Logs

SWAP ID	REQUESTER	TARGET	SHIFT TYPE	LOG STATUS
#1	Thor	string	DAY_SHIFT	REJECTED
#2	Rohit	Amit	DAY_SHIFT	APPROVED



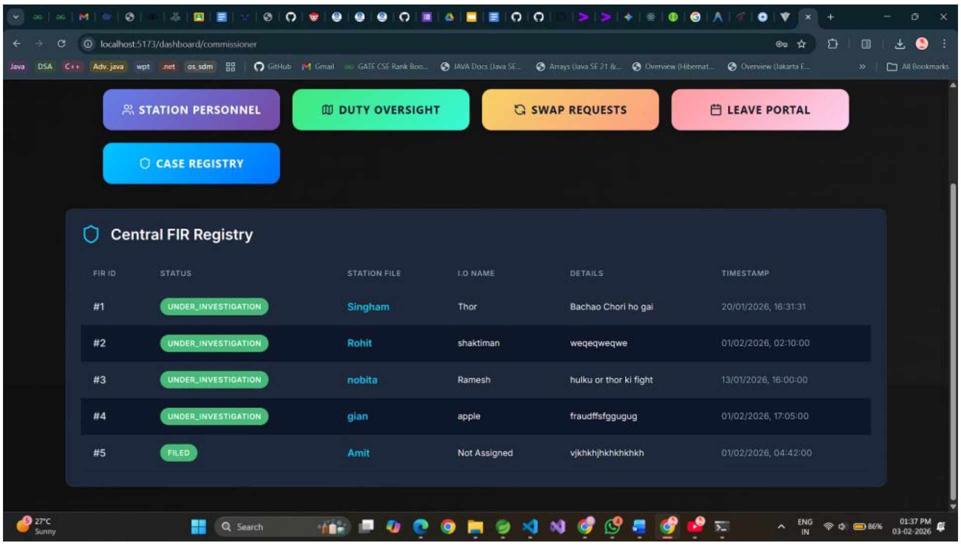
#17	nobita POLICE OFFICER	F: 2026-02-05 T: 2026-02-28	asdasdasdasdasdasdasdasd	APPROVED	ReadOnly
#18	gian POLICE OFFICER	F: 2026-02-16 T: 2026-02-20	adggkggkgklkglkgl	APPROVED	ReadOnly
#19	Amit POLICE OFFICER	F: 2026-02-10 T: 2026-02-21	ajjadhkjhdkhakjdsh	APPROVED	ReadOnly
#20	Inspector Singh STATION INCHARGE	F: 2026-02-22 T: 2026-03-07	asdjasjdkashdkjashdkja	PENDING	✓ ✕
#21	Inspector Singh STATION INCHARGE	F: 2026-02-17 T: 2026-02-27	dasasasdasdasdads	PENDING	✓ ✕
#22	Amit POLICE OFFICER	F: 2026-02-11 T: 2026-02-25	asdkjahskjdhkuiuakjsgkgajsgdjkg...	APPROVED	ReadOnly
#23	Amit POLICE OFFICER	F: 2026-02-16 T: 2026-02-19	health checkup	PENDING	ReadOnly
#24	Inspector Singh STATION INCHARGE	F: 2026-02-11 T: 2026-02-20	travelling	PENDING	✓ ✕



Notifications

Station Incharge Inspector Singh applied for leave

03/02/2026, 13:33:13



Central FIR Registry

FIR ID	STATUS	STATION FILE	I.O NAME	DETAILS	TIMESTAMP
#1	UNDER_INVESTIGATION	Singham	Thor	Bachao Chori ho gai	20/01/2026, 16:31:31
#2	UNDER_INVESTIGATION	Rohit	shaktiman	weqeqweqwe	01/02/2026, 02:10:00
#3	UNDER_INVESTIGATION	nobita	Ramesh	hulku or thor ki fight	13/01/2026, 16:00:00
#4	UNDER_INVESTIGATION	gian	apple	fraudffsfggugug	01/02/2026, 17:05:00
#5	FILED	Amit	Not Assigned	vjkhkhjhkhkhkhkh	01/02/2026, 04:42:00

6. FUTURE SCOPE

1. Advanced Analytics and Decision Support

DutyMatrix can be enhanced with analytics dashboards that analyze historical data related to leave patterns, duty allocation, shift utilization, and FIR assignments. These insights would help senior officers make data-driven decisions, optimize manpower distribution, and identify operational inefficiencies across stations.

2. Mobile Application Integration

A mobile application can be developed to allow police personnel to access DutyMatrix features directly from the field. Officers could receive real-time notifications, view duty schedules, apply for leave, and track approvals, improving responsiveness and reducing dependency on desktop systems.

3. Persistent Notification Storage

Currently, notifications are handled through an in-memory notification microservice. Integrating a database-backed notification system would allow users to view past notifications, ensure reliability during service restarts, and support auditing and compliance requirements.

4. AI-Based Duty and Shift Optimization

Artificial Intelligence can be applied to automatically suggest optimal shift schedules, predict staff shortages, and detect conflicts in duty assignments. This would reduce manual planning effort and improve workforce utilization, especially during high-demand periods.

5. Centralized State-Level or National-Level Deployment

DutyMatrix can be scaled for centralized deployment across multiple stations, districts, or states. This would provide higher authorities with a unified view of police operations while maintaining strict role-based access and station-level data isolation.

7. CONCLUSION

In conclusion, **DutyMatrix – Police Duty and Leave Management System** addresses the critical administrative and operational challenges faced by modern police departments by providing a secure, efficient, and role-based digital solution. The system establishes a structured framework for managing duty allocation, leave approvals, shift management, and operational oversight, thereby reducing manual dependency and improving organizational efficiency. Its modular design and strict adherence to security best practices make it a reliable platform for real-world law enforcement environments.

The DutyMatrix project demonstrates a well-structured approach to police administration by leveraging modern full-stack technologies and a microservice-based notification architecture. The application is designed to meet the requirements of police officers, station incharges, and commissioners, ensuring seamless coordination across different levels of authority while maintaining data integrity and access control through JWT-based authentication and role-based authorization.

The integration of real-time notifications, hierarchical workflows, and centralized data management enhances transparency, accountability, and operational continuity. With its scalable architecture, robust security mechanisms, and user-centric design, DutyMatrix provides a strong foundation for future enhancements. The system is well-positioned to adapt to evolving technological advancements and expanded operational requirements, making it a valuable and sustainable solution for police duty and administrative management.

8. REFERENCES

1. Spring Security Reference Documentation.
   https://docs.spring.io/spring-security/reference/

2. Spring Boot Official Documentation.
   https://docs.spring.io/spring-boot/index.html

3. Node.js Official Documentation.
   https://nodejs.org/en/docs/

4. React Official Documentation.
   https://react.dev/

5. JWT (JSON Web Token) Introduction and Specification.
   https://jwt.io/introduction

6. Oracle. (2023). *Java Platform, Standard Edition Documentation*.
   https://docs.oracle.com/en/java/