# NeuroFleetX: AI-Powered Traffic Management System

## Introduction

NeuroFleetX is an intelligent fleet and traffic management system designed to optimize vehicle tracking, driver allocation, and route management through a centralized web platform. The system currently uses static route computation but is structured to integrate AI and LLM models for dynamic route optimization in future updates.

## Problem Statement

Managing fleets efficiently is a challenge due to manual route calculations, lack of real-time driver tracking, and absence of predictive insights into vehicle health. Existing systems often result in inefficient resource utilization and delays. NeuroFleetX addresses these problems by centralizing fleet operations, visualizing data, and providing a base for AI-powered traffic management.

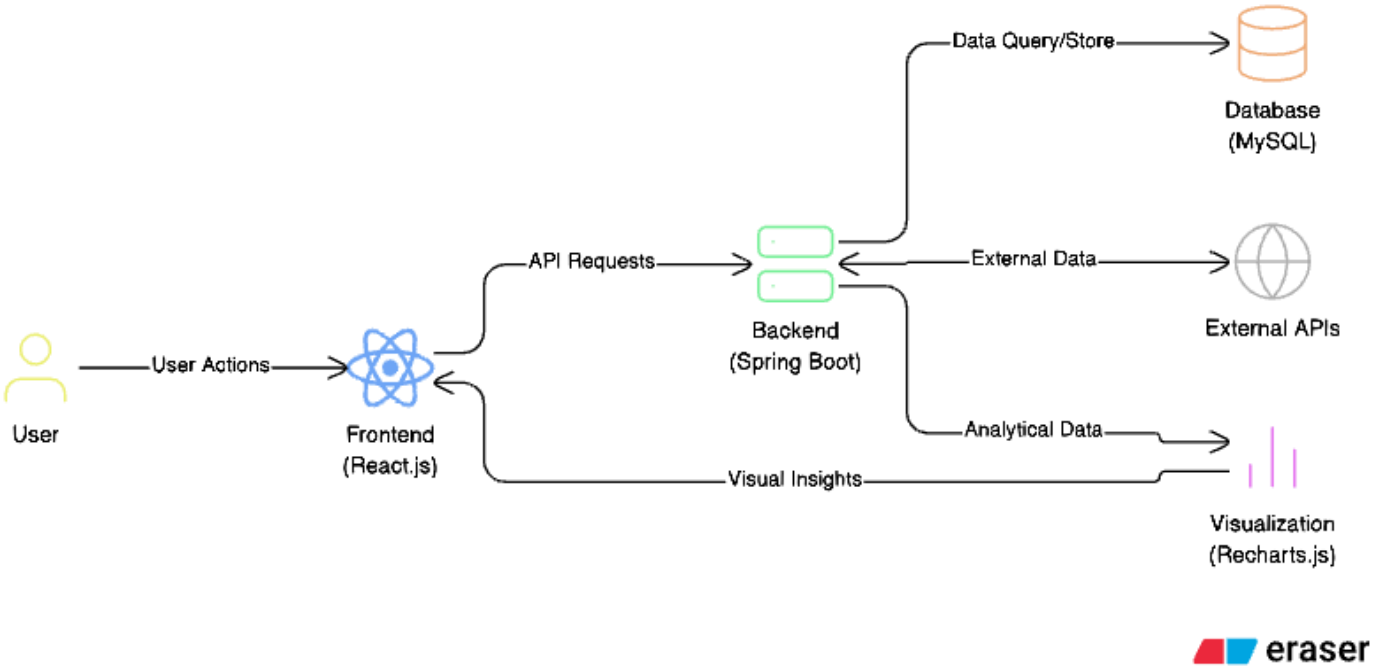
## System Overview

NeuroFleetX integrates a React.js frontend with a Spring Boot backend and a MySQL database. The frontend interacts with REST APIs to fetch vehicle, driver, and booking data. Data visualization is implemented with Recharts.js to provide analytical insights. Currently, route computation is static, and driver bookings are linked via a Gmail account. The system is modular and scalable for future enhancements including AI-based route optimization and dynamic driver management.

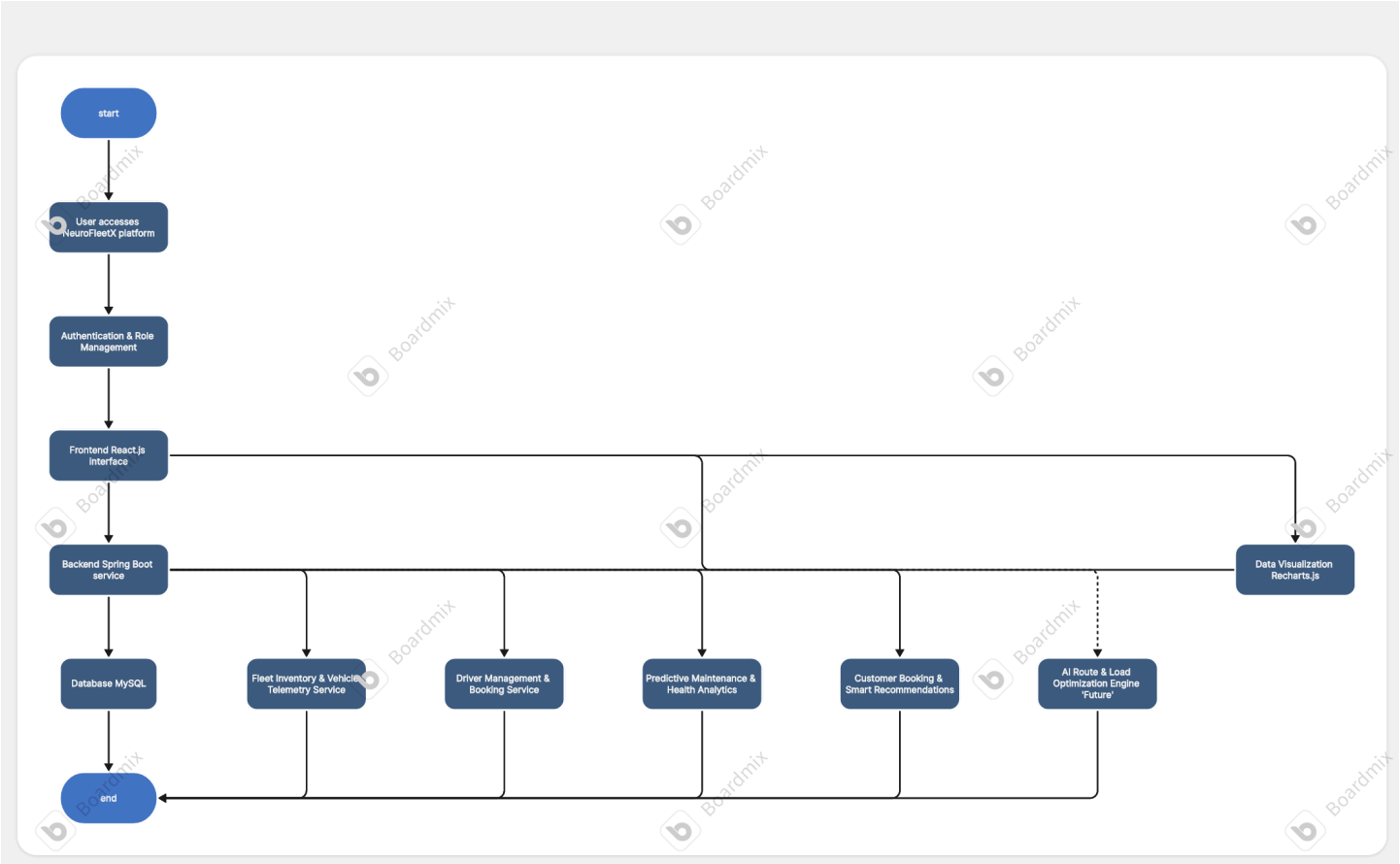
## Technology Stack

| Layer | Technology | Description |
|---|---|---|
| Frontend | React.js | Responsive UI with reusable components |
| Backend | Spring Boot | RESTful API handling vehicles, drivers, and bookings |
| Database | MySQL | Stores structured data for vehicles, drivers, and bookings |
| Visualization | Recharts.js | Interactive charts and graphs for analytics |
| Tools | IntelliJ IDEA, VS Code, Postman | Development, testing, and debugging |

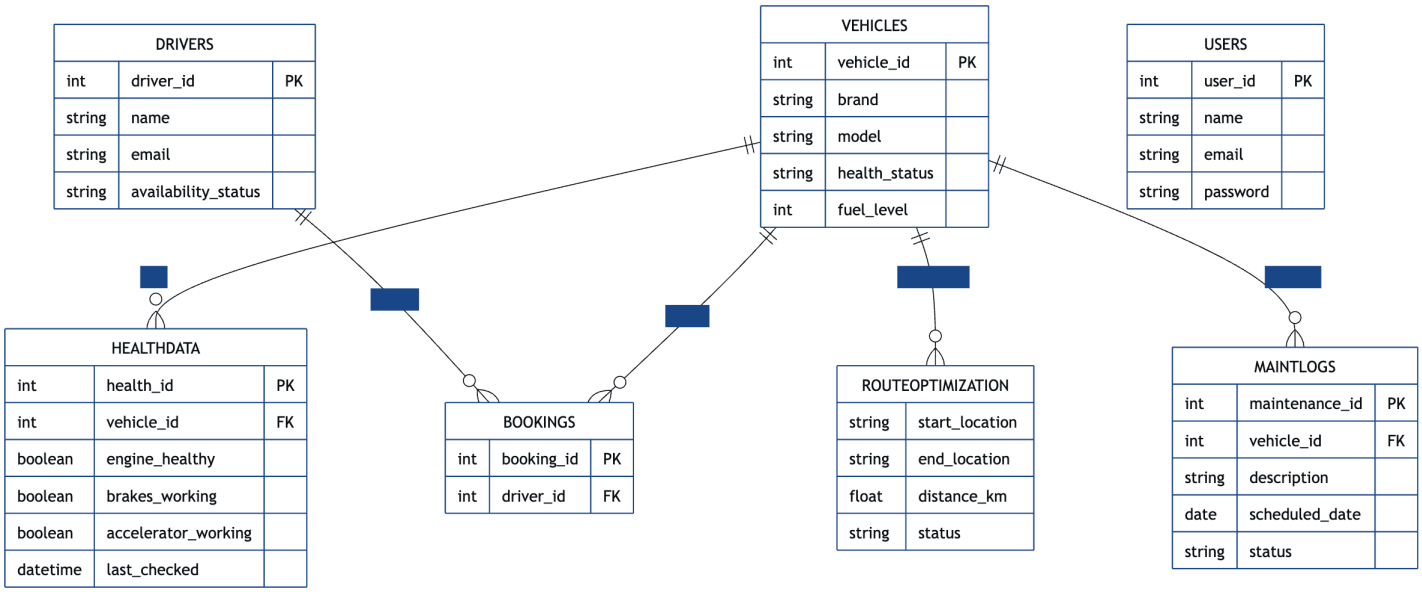
## System Architecture



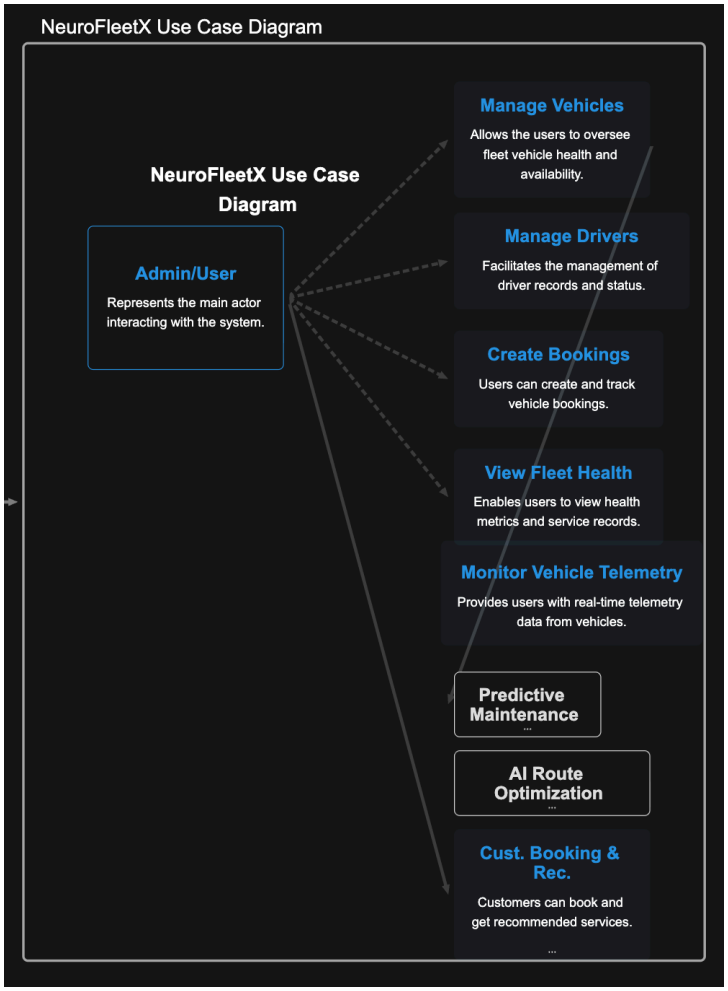

## Workflow Diagram




## ER Diagram




## Use Case Diagram




## System Features

- Add, update, and delete vehicle records- Monitor vehicle health and fuel levels- View and manage driver availability- Book drivers and assign vehicles- Display analytics via charts and dashboards- Compute static route distances between points

## Milestones

| Milestone | Description |
|---|---|
| 1. Authentication & Role Management | Setup of login system and user roles (currently static) |
| 2. Fleet Inventory & Vehicle Telemetry | Management of vehicles and real-time telemetry integration |
| 3. AI Route & Load Optimization Engine | Static route calculation now, AI-based optimization planned |
| 4. Predictive Maintenance & Health Analytics | Monitoring vehicle health metrics for predictive maintenance |
| 5. Customer Booking & Smart Recommendations | Booking system with future AI-powered recommendations |

## Project Demo

Attach screenshots here:- Dashboard- Vehicle Management- Driver Management- Booking Interface- Route Computation- Analytics Charts

## Future Enhancements

- Integration with Spring AI and LLM models for dynamic route optimization- Role-based authentication for drivers and admins- Real-time driver availability tracking- Traffic-aware routing using live data sources- Predictive maintenance notifications and alerts

## Conclusion

NeuroFleetX demonstrates a scalable, modular approach to fleet and traffic management. It centralizes vehicle and driver management, visualizes key metrics, and establishes a base for future AI-driven traffic optimization. The system effectively combines full-stack technologies to provide a professional, extensible solution for fleet operations.

## References

- React.js Documentation (https://react.dev)- Spring Boot Documentation (https://spring.io/projects/spring-boot)- MySQL Documentation (https://dev.mysql.com/doc)- Recharts.js Documentation (https://recharts.org/en-US)- OpenAI and Spring AI resources for AI integration