NeuroFleetX : AI-Powered Taxi Fleet Manager

NeuroFleetX is an innovative, AI-powered solution designed to revolutionize taxi fleet operations. This report outlines the project's vision, functional and non-functional requirements, and the technical architecture behind this advanced fleet management system. Our goal is to address critical challenges in traditional dispatch, ETA prediction, and real-time monitoring through a unified, intelligent platform.

Addressing Core Challenges in Fleet Operations

Inefficient Dispatch & ETA

Traditional systems struggle with optimal taxi assignment and accurate trip duration predictions, leading to customer dissatisfaction and operational delays.

Lack of Real-time Visibility

Operators often lack immediate insights into taxi status, battery levels, and precise locations, hindering effective daily management.

Manual Decision-Making

Reliance on manual processes for operational decisions results in suboptimal resource utilization and increased operational costs.

The primary problem identified is the absence of a unified, intelligent, AI-powered platform for comprehensive taxi fleet management. NeuroFleetX aims to fill this void by providing automated dispatch, ML-driven ETA prediction, and robust real- time monitoring capabilities, ultimately streamlining operations and reducing costs.

NeuroFleetX : Functional Requirements

Taxi Management

Full control over taxi details: add, update, delete. Real-time tracking of status, battery, and location.

CSV Upload & Training

Facilitates easy upload of datasets, model retraining, and display of performance metrics (R^2, RMSE, MAE).

Dashboard & Visualization

Comprehensive overview with total taxis, active rides, pending requests, and performance metrics graphs.

Ride Management

Create new requests, view history, and update ride statuses (Pending, Assigned, Completed).

ETA Prediction

ML model for precise trip duration estimates, adaptable to custom datasets via CSV upload.

Intelligent Dispatch

Automated assignment of optimal taxis considering distance (Haversine formula), ETA, and battery levels.

These functional requirements are designed to create a comprehensive system that empowers fleet managers with granular control and predictive capabilities. From managing individual vehicles to optimizing ride assignments, NeuroFleetX Lite offers a complete suite of tools for modern taxi operations.

Ensuring Robustness: Non-Functional Requirements

Performance

API response times under 200ms for all core operations, ensuring a swift user experience.

Scalability

The system is engineered to seamlessly support up to 1000 concurrent taxis without performance degradation.

Reliability

Utilizes PostgreSQL for persistent data storage, guaranteeing data integrity and availability.

Maintainability

Modular architecture leveraging MVC and service layers promotes ease of maintenance and future enhancements.

Deployability

Fully containerized with Docker, enabling consistent and straightforward deployment across environments.

Beyond core functionalities, NeuroFleetX prioritizes reliability and performance. Our non-functional requirements lay the groundwork for a stable, scalable, and secure platform that can adapt to evolving operational demands and provide a dependable service to fleet managers.

The Power Behind the Platform: Our Tech Stack

Frontend: React & Vite

Modern, responsive UI built with React, Vite, Tailwind CSS, and Axios for a seamless user experience.

Backend: Spring Boot 3

Robust and scalable REST APIs using Spring Boot 3, Spring Data JPA, and Java 17+ for business logic.

ML: DL4J

Deep Learning for Java (DL4J) powers the accurate ETA prediction model.

Database: PostgreSQL

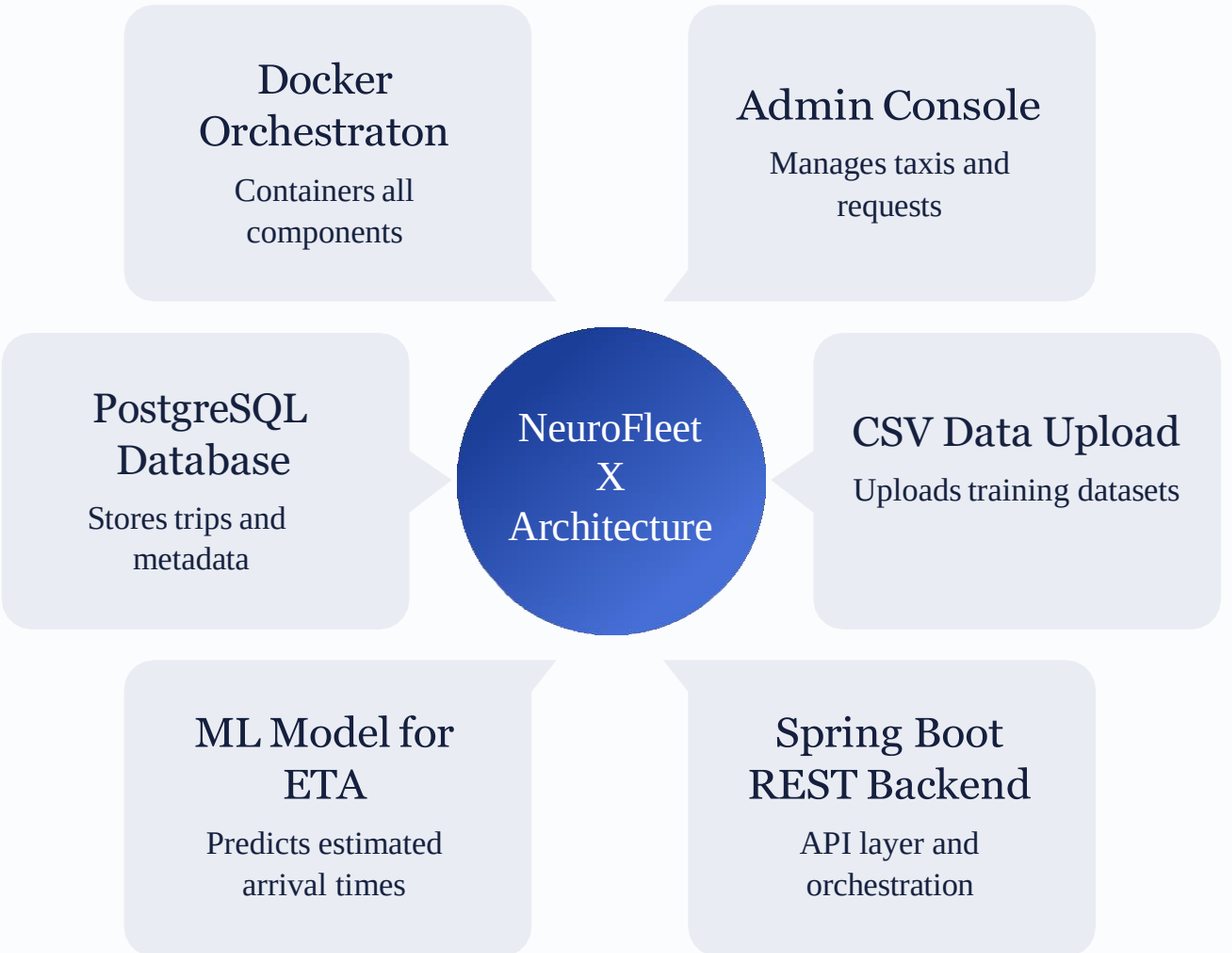
Reliable and performant data persistence with PostgreSQL.

DevOps: Docker

Containerization with Docker and Docker Compose ensures simplified deployment and environment consistency.

Our meticulously selected tech stack combines cutting-edge technologies to deliver a high-performance, maintainable, and scalable solution. From the intuitive React frontend to the powerful Spring Boot backend and the intelligent DL4J-driven ETA prediction, every component is chosen to contribute to NeuroFleetX robust capabilities.

NeuroFleetX : High-Level System Overview



NeuroFleetX operates as a full-stack fleet management system, enabling administrators to efficiently manage taxis and ride requests. At its core, a sophisticated machine learning model predicts travel times, while an automated system assigns the most optimal taxi for each request. The platform also features a responsive dashboard for comprehensive real-time insights.