NITTE (Deemed to be University) | NMAM INSTITUTE OF TECHNOLOGY

Finite Loop *Inspire the Rest*

HACKFEST – 2025

Team Name: Witty Hackers

College Name: NMAM Institute of Technology, Karnataka

Track: Logistics

Problem Statement: Fleet operators struggle with unexpected breakdowns and high maintenance costs due to reactive servicing. Traditional maintenance methods are inefficient and lead to downtime. **Smart Fleet Guardian** uses real-time data and predictive analytics to detect potential issues early, optimize maintenance schedules, and improve fleet reliability while reducing costs.

Approach:

•**Data Integration & Storage:** Collects vehicle health data via APIs and stores structured and unstructured insights in PostgreSQL and MongoDB.
•**AI-Driven Predictions:** Uses TensorFlow, PyTorch to analyze historical data, detect failure patterns, and forecast maintenance needs.
•**Dashboard & Optimization:** A React-based interface with D3.js/Chart.js visualizes insights, optimizes scheduling, and continuously refines predictions.

Technology Stack:

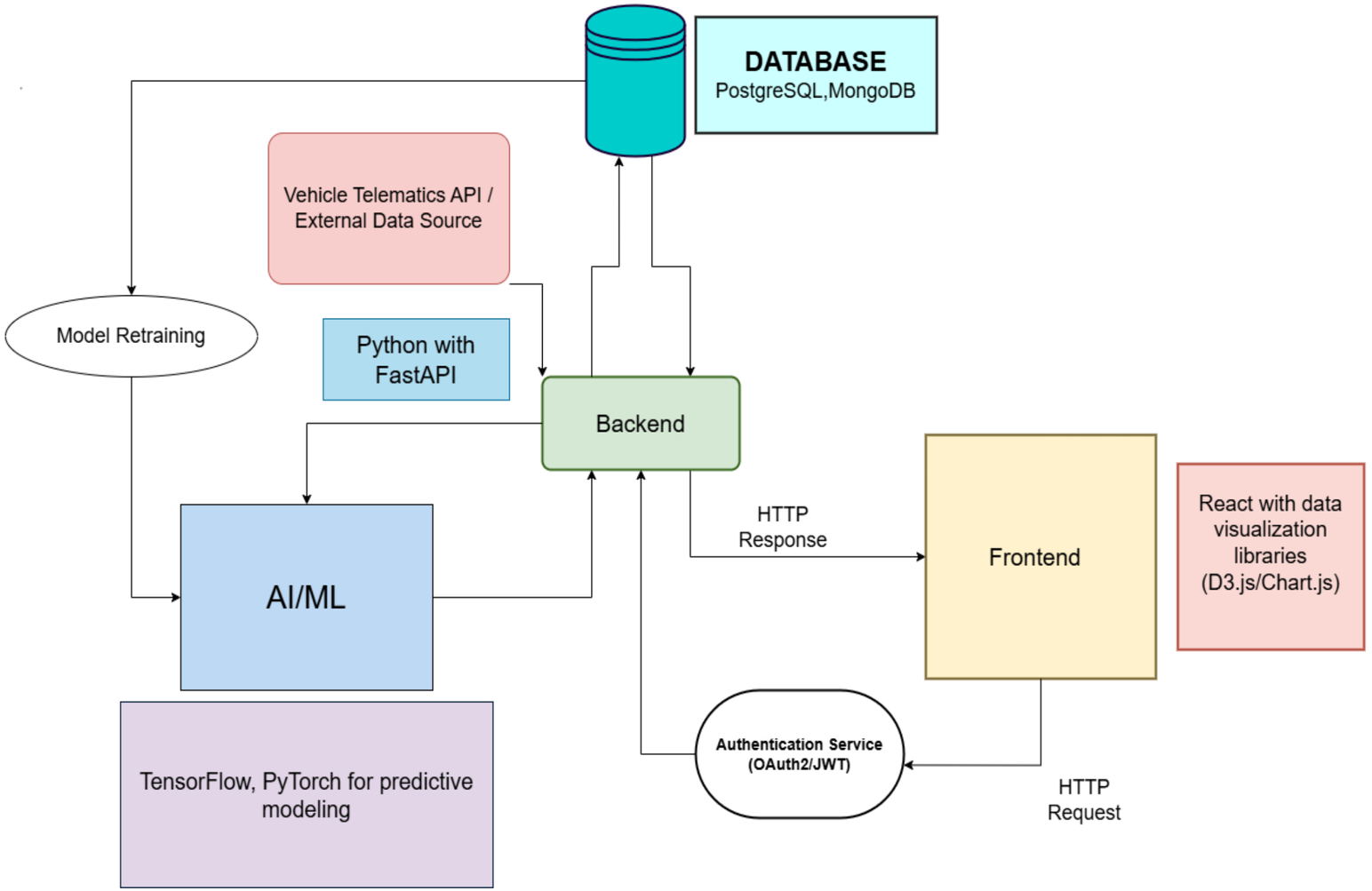
- **Backend:** Python with FastAPI for data processing and model serving
- **AI/ML:** TensorFlow, PyTorch for predictive modeling
- **Data Storage:** PostgreSQL for structured data, MongoDB for maintenance knowledge repository
- **Frontend:** React with data visualization libraries (D3.js/Chart.js)
- **Integration:** REST APIs for telematics systems and fleet management software

Use Cases:

- Predict vehicle failures early using existing telematics data.
- Help fleet managers schedule maintenance proactively.
- Reduce unexpected breakdowns and service delays.
- Cut maintenance costs by targeting actual vehicle issues.
- No extra hardware needed—fully software-based solution.

Smart Fleet Guardian: Software - Based Predictive Maintenance System

Architecture



Additional Information:

🔷 **Key Functionalities:**
- API-based data collection from existing vehicle systems
- Predictive analysis using historical and real-time data
- Maintenance scheduling recommendations
- Centralized, searchable maintenance history repository
- Real-time fleet health dashboard

🔷 **Scalability & Deployment:**
- Cloud-ready deployment (AWS, Azure, or on-prem)
- Supports fleets of varying sizes
- No additional hardware installation required

🔷 **Security Considerations:**
- Secure API communication (HTTPS, OAuth2)
- Role-based access control for fleet managers
- Data privacy compliance (GDPR, industry standards)

🔷 **Potential Enhancements:**
- Mobile app for fleet managers/drivers
- Integration with fuel consumption & route optimization systems
- Custom ML model fine-tuning per fleet type
- Battery health monitoring for electric vehicles