Project Description

This project aims to develop a logistics monitoring and optimization platform that integrates computer vision and vehicle routing optimization to enhance efficiency in loading docks and distribution centers. The system processes live video streams from cameras to automatically detect anomalies and damages during cargo loading, estimate truck and warehouse occupancy, and perform real-time route optimization based on dynamic conditions.

Key Objectives

1. **Anomaly & Damage Detection:** Detect crushed boxes, torn packaging, misplacement, and unsafe stacking through live video using deep learning models.

2. **Occupancy Estimation:** Estimate truck and warehouse fullness by combining object detection.

3. **Dynamic Route Optimization:** Optimize delivery plans using multi-depot vehicle routing with capacity and time constraints, re-planning based on real-time CV events.

Value and Impact

The proposed system provides a holistic view of logistics operations by merging perception and planning layers:

- **Operational Efficiency:** Reduces manual inspection time and optimizes fleet usage.

- **Cost Reduction:** Minimizes late deliveries and unnecessary travel through adaptive route planning.

- **Safety and Quality:** Prevents shipment damage by generating real-time alerts.

- **Scalability:** Ensures low latency and privacy by storing only short event clips instead of full video feeds.

Basic Diagram:

Computer Vision Module
- Live Video Streams
- Object Detection & Tracking
- Anomaly & Damage Detection
- Occupancy Estimation

Backend Services
- Event Processing API
- Database: Events & Metrics

Route Optimization Engine
- Real-Time Route Planner
- Multi-Depot VRP Solver
- Optimized Routes & Schedules

Dashboard & Alerts
- Analytics Dashboard
- Real-Time Notifications