EcoPath: Ai Integrated smart Traffic management system

Problem Statement

Urban areas are facing severe traffic management challenges due to rapid urbanization. Traditional fixed-time traffic signal systems cannot adapt to real-time conditions, resulting in inefficient traffic flow. This leads to:

- **Congestion:** Roads are overburdened, slowing down mobility.
- **Environmental & Economic Costs:** Prolonged idling increases fuel consumption, emissions, and economic losses.
- **Safety Risks:** Higher chances of accidents, frequent violations, and dependence on manual monitoring make roads unsafe.

Project Overview

Eco path is an AI-powered intelligent traffic management system designed to optimize urban mobility. It integrates advanced computer vision, automation, and scalable infrastructure for real-time traffic monitoring and enforcement. Key features include:

- AI Detection: YOLOv8 model for real-time vehicle and violation detection.
- Automated Enforcement: ANPR (Automatic Number Plate Recognition) for identifying violators.
- Scalability: Microservices architecture with Docker and Kubernetes.
- Real-time Monitoring: Live analytics and video feeds via a Next.js dashboard.

Solution Offered

Ecopath provides an end-to-end **smart traffic control system** that:

- Automates violation detection and evidence collection.
- Reduces congestion through adaptive signal management.
- Provides actionable insights for urban planners using AI-driven analytics.
- Ensures eco-friendliness by reducing idle emissions.
- Enables rapid response through instant alerts (<2 seconds).

Who Are The End Users?

Ecopath serves multiple stakeholders:

- **Traffic Enforcement Agencies:** Automating violation detection and reducing manual monitoring errors.
- **Urban Planners & City Authorities:** Data-driven planning and smart city initiatives.
- **Commuters & Citizens:** Reduced travel times, safer roads, and smoother journeys.

Technology Used To Solve The Problem

- **YOLOv8 (AI Model):** Detects vehicles and traffic violations in real time.
- **ANPR (Automatic Number Plate Recognition):** Identifies violators accurately.
- **Microservices Architecture:** Modular, scalable system using **Docker** and **Kubernetes**.
- **Next.js Dashboard:** Provides live monitoring, analytics, and alert management.
- **Databases & Logging Systems:** Store traffic events and violations securely.
- **Roadside IP Cameras:** Capture real-time RTSP video feeds for analysis.