

Smart Traffic Lights Powered by Reinforcement Learning

Our system uses cameras and AI to make traffic lights adapt automatically to real-time traffic conditions.

Objective

We develop an adaptive traffic-light system that continuously learns from live video feeds to optimise urban traffic flow in real time. Instead of relying on fixed traffic light schedules, the system dynamically switches light phases based on actual conditions at each intersection, reducing congestion, waiting times, and emissions.

How It Works

The system combines Computer Vision (CV) and Reinforcement Learning (RL) algorithms. Cameras and sensors detect incoming traffic and pedestrian movement. The RL agent, an AI model that learns through trial and feedback, continuously improves its decision rules to balance flow and fairness across directions.

The algorithm was first trained using real-world data from a New York intersection (4th Av. - Atlantic Av.) and then validated in a simulation with measurable improvements in average queue length, waiting time, and total delay compared to fixed-time and heuristic systems.

Benefits

- Up to 45% reduction in total delay and 44% shorter queues in simulations.
- GDPR & EU AI Act compliant through anonymised data, transparent decision logic, and fail-safe mechanisms.
- Can operate directly on edge hardware (NVIDIA Jetson) for real-time performance without cloud reliance.
- Fully compatible with existing European traffic controllers via standard APIs.

Alignment with ERTICO and EU Goals

- Supports EU Green Deal emission-reduction targets by cutting idle time.
- Advances EU Smart Mobility Strategy through adaptive, connected infrastructure.
- Contributes to ERTICO Vision 2035 for cooperative and automated mobility.