

Looking at Traffic with an Open Eye

David Gillo
Exelerate Smart Traffic



Exelerate
Go with green.

Working in AI



WHAT MY FRIENDS THINK I DO



WHAT MY PARENTS THINK I DO



WHAT MY BOSS THINKS I DO



WHAT SOCIETY THINKS I DO



WHAT I THINK I DO



WHAT I ACTUALLY DO

What is AI and Why Does it Work

- Artificial Intelligence (AI) is focused on creating systems that can perform tasks such as learning, reasoning, problem-solving, perception, and language understanding.
- AI detect patterns, make predictions, and improve over time.
- What does it need?
 - Large quantities of digital data.
 - Advanced algorithms.
 - Affordable, scalable computing infrastructure.
 - Open-source communities and pre-trained models.

It is not magic – It is data-based statistics

Traffic Data Sources – The Common

Data Source	Usage
Inductive Loops	Basic counting of vehicle detection of average speed
Traffic Cameras	Using analytics can provide vehicle counting and classification, incident detection
Radar Sensors	Detect vehicle speed, volume, and presence in multiple lanes and weather conditions.
Infrared Sensors	night-time vehicle/pedestrian detection at crosswalks/intersections.
Bluetooth/Wi-Fi Trackers	Monitor vehicle movement and average travel time

But What About?

Data Source	Usage
Mobile Network Data	Crowd and mobility patterns
Public Transport Data (AVL, Fleet Manag.)	GPS and schedule adherence from buses, trams, etc., from delivery fleets, ride-share, or navigation apps
Emergency Services	Reports from police/fire/EMS for road closures, accidents, and emergency prioritization.
Weather Data	Rain, fog, snow, or temperature alerts can trigger signal timing changes or warnings.
Apps (e.g., Waze)	Real-time reports of accidents, hazards, and congestion from users.
Parking Sensors/Systems	Detect occupancy in parking lots/streets to manage traffic searching for parking.
Connected Vehicle (V2X) Data (Future)	Vehicle-to-Infrastructure (V2I) and Vehicle-to-Vehicle (V2V) communications share location, speed, and intent.

Some AI Models Used in Traffic

AI Model	Purpose in Traffic Applications
Convolutional Neural Networks (CNNs)	Used in image and video analysis for vehicle detection, license plate recognition, and traffic surveillance.
Reinforcement Learning (RL)	Adaptive traffic signal control, dynamic route optimization, and autonomous vehicle navigation.
K-Means Clustering	Traffic pattern segmentation, origin-destination clustering, and identifying congestion zones.
Random Forests / Decision Trees	Road accident prediction, traffic rule violation detection, and classification of vehicle behavior.
Genetic Algorithms (GA)	Optimization of traffic signal timings and vehicle routing in complex networks.
Deep Q-Networks (DQN)	Reinforcement learning variant for real-time traffic light optimization and adaptive decision-making.
Graph Neural Networks (GNNs)	Modeling traffic as a network (nodes = intersections, edges = roads) for more accurate flow prediction.

So why is this not on your street?

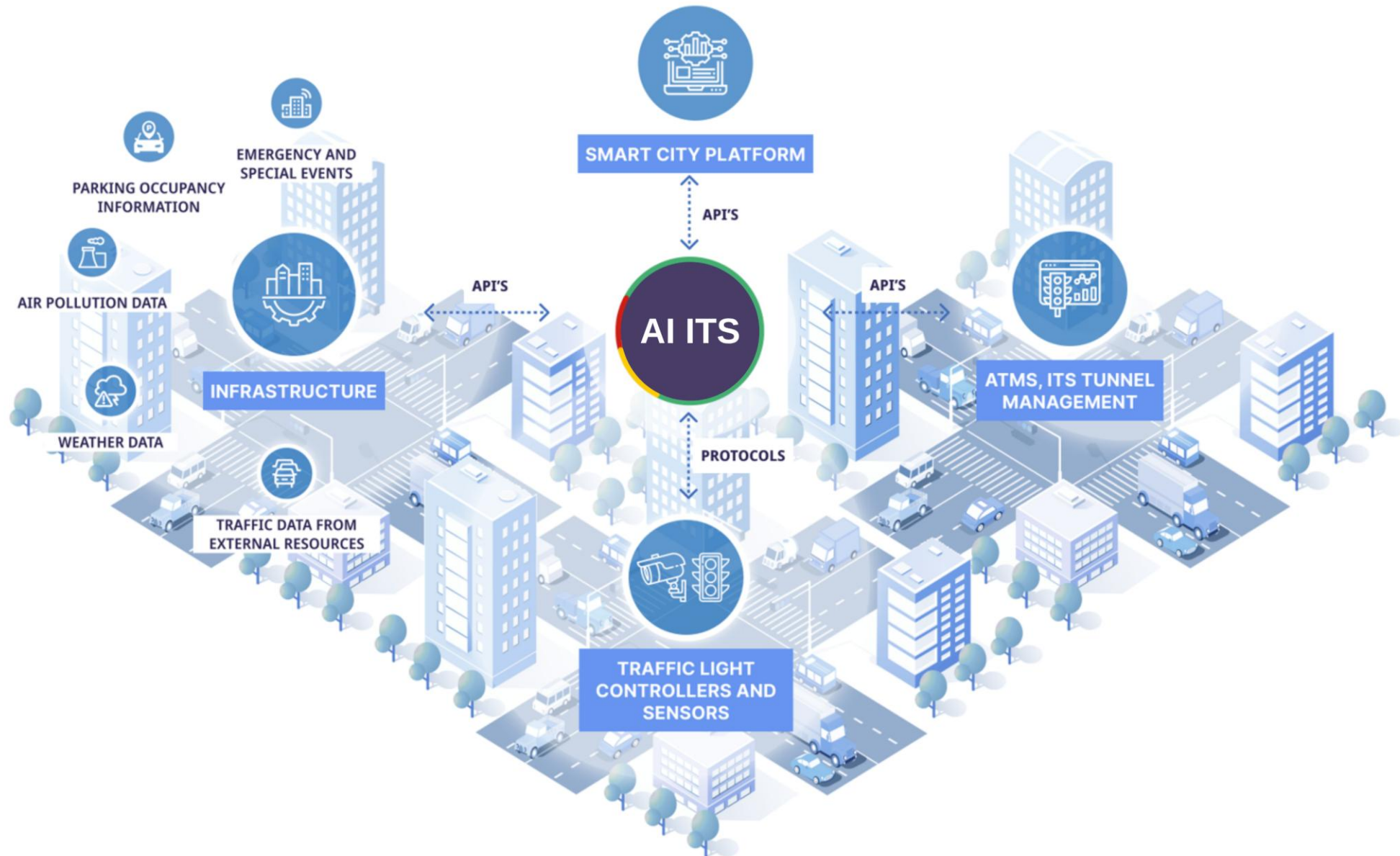
AI is not yet common in traffic control because of legacy systems, funding gaps, fragmented governance, lack of knowledge and trust issues — not because the technology isn't ready.



Is the data there?

Data Source	Available in Cities?	Considered in city traffic control?
Inductive Loops	Available, not always operational	Yes
Traffic Cameras / Infrared	Available. Analytics is rare	Mostly for visual. Analytics rare
Radar Sensors	Available, mostly for enforcement	No
Bluetooth/Wi-Fi Trackers	Uncommon	If available
Mobile Network Data	Available	No
Public Transport Data / Fleet Management	Available	No
Emergency Services	Available	No
Weather Data	Available	Sometimes
Apps (e.g., Waze)	Available	No
Parking Sensors/Systems	Available	No
Connected Vehicle (V2X)	Future	Future

The Solution – An “Open” System



- A humanistic approach to traffic management and control
- Considers all aspects of city life in real time.
- Allows traffic control engineers and operators to adapt the traffic according to city life, not only traffic conditions.
- Converts different data sources into actions.
- Can compensate on lack of on-street sensors or complicated hardware systems.

The Baseline – AI-based Adaptive Traffic Control

Adaptive intersection



Adaptive corridors



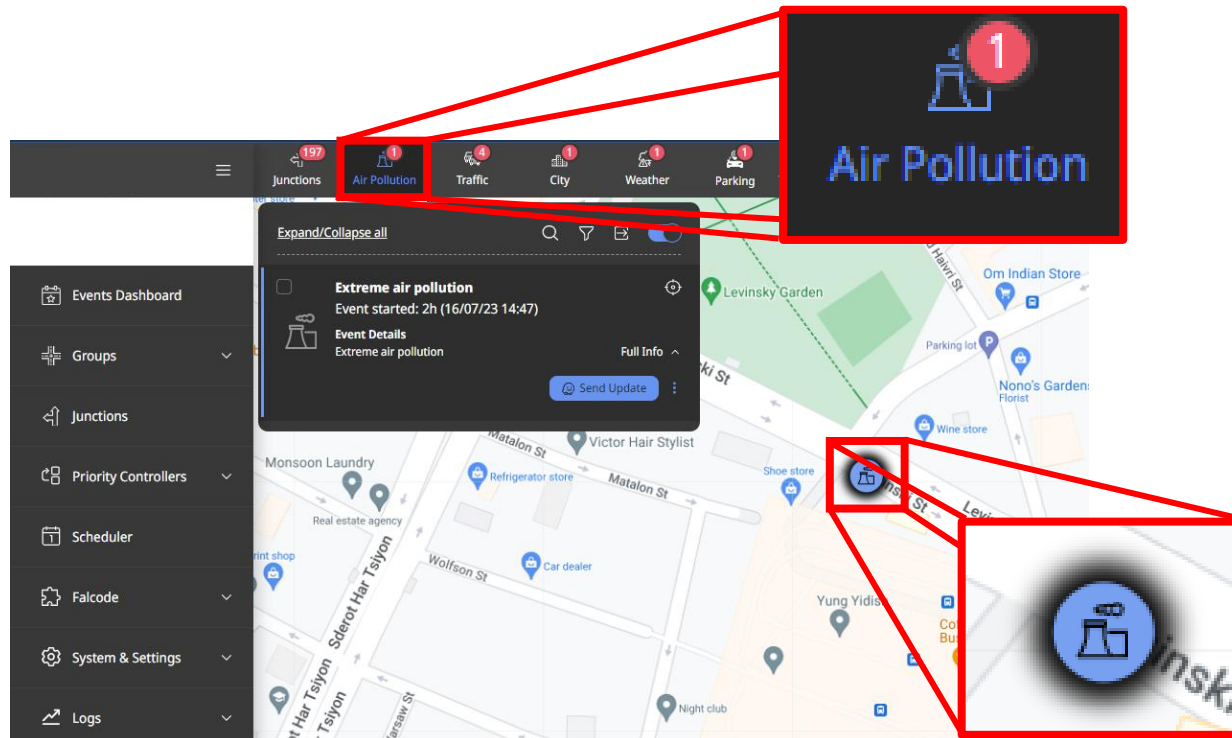
Adaptive cities



- A family of algorithms that optimizes split, cycle and offset adaptively.
- Uses predictive algorithms based on historical and real-time data.
- Automatically switches between algorithms in accordance to changes in real time conditions.

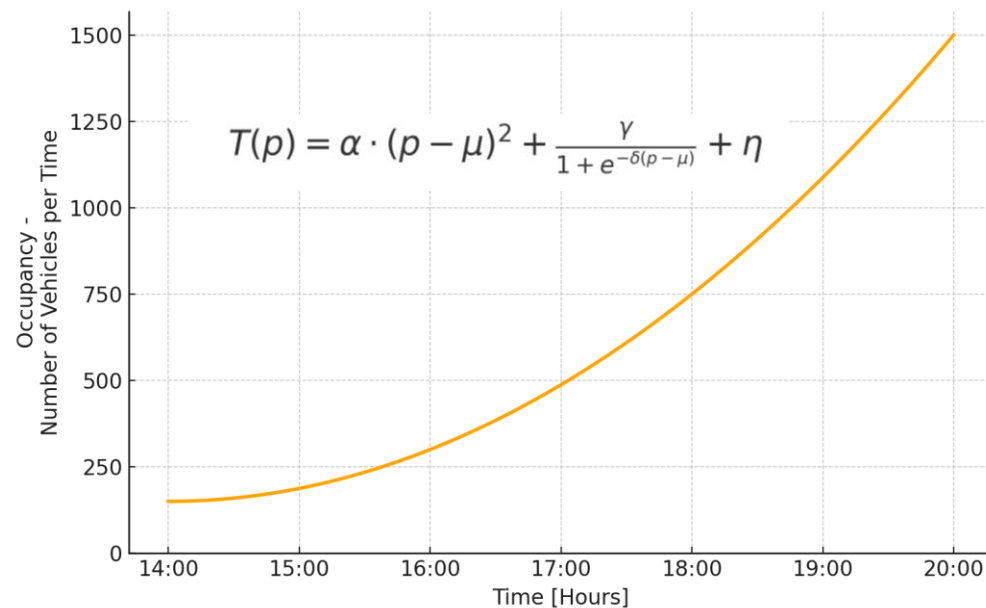
Use Cases – Air Pollution

Integrating with air pollution sensors and generating automated changes in traffic in response to high values reducing CO₂ emissions



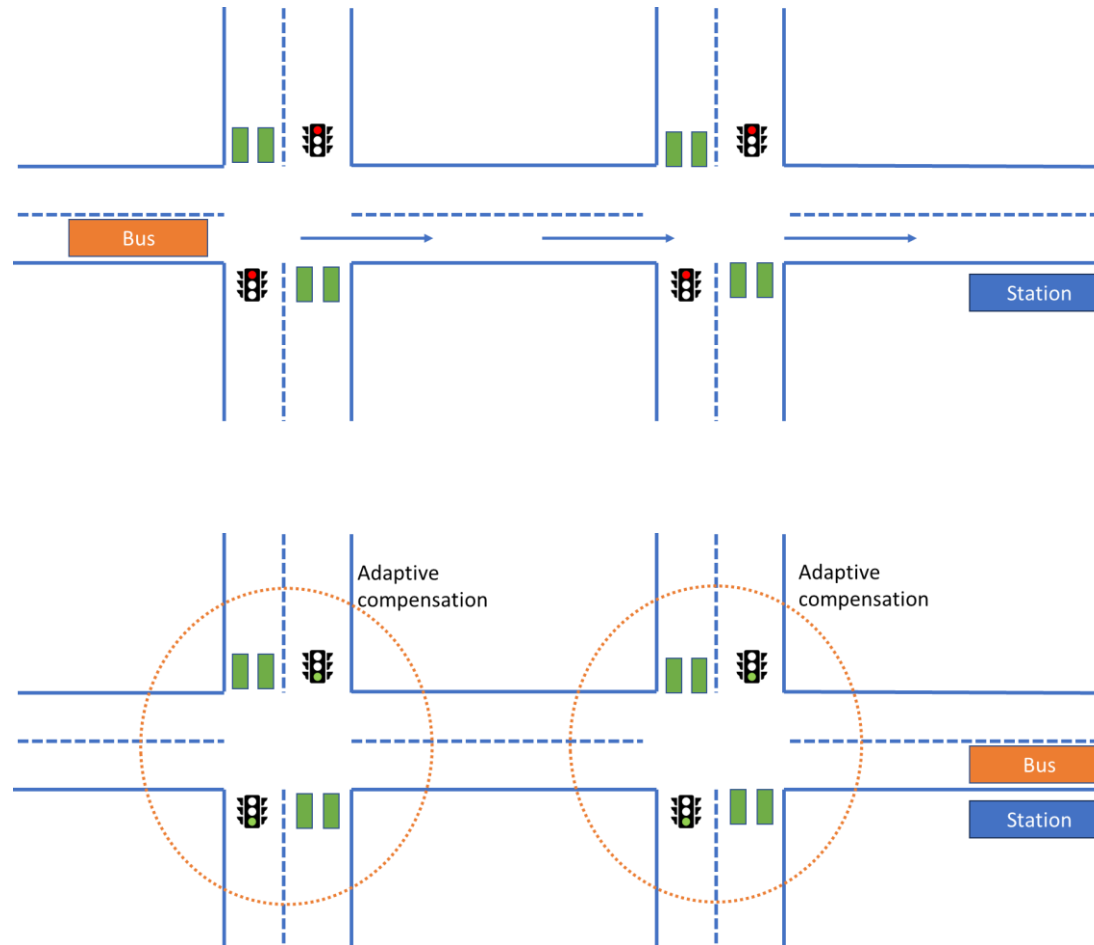
Use Cases – Coordinate Events

Integrate parking systems and activating changes in signal control as a function of changes in parking planning and real-time occupancy.



Priority for designated vehicles

Provide priority for public transportation (buses, rail, light rail) by integrating with AVL and/or fleet management.



Thank You

E: main@exelerate.com | www.exelerate.com/.pl

