29-30 October 2026 | Filoxenia Conference Centre
Nicosia, Cyprus

8th Conference
Sustainable Mobility and Intelligent Transport Systems

Innovations & Systems in ITS

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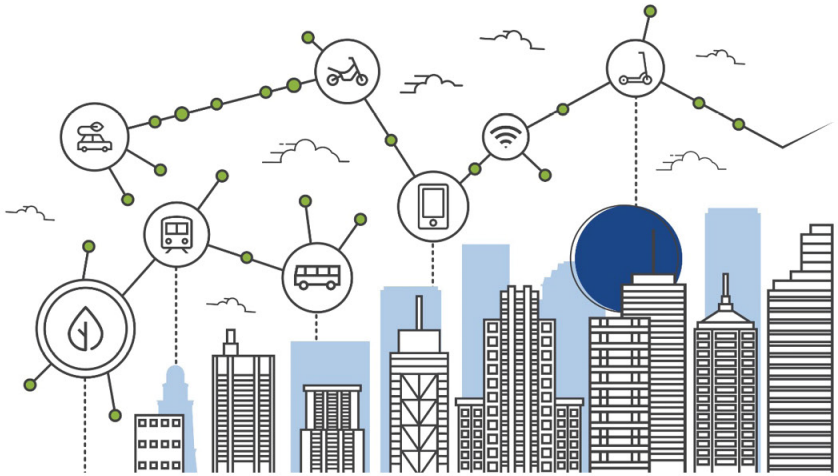
SWARCO ITALIA



The Conference is implemented within the framework of the Cohesion Policy Programme "THALIA 2021–2027", Co-financed by the European Union.

Co-funded by the European Union

REPUBLIC OF CYPRUS

DEPARTMENT OF PUBLIC WORKS

Towards a livable future for us all with a safer, smarter and truly connected mobility for everyday life

The world we live in ….

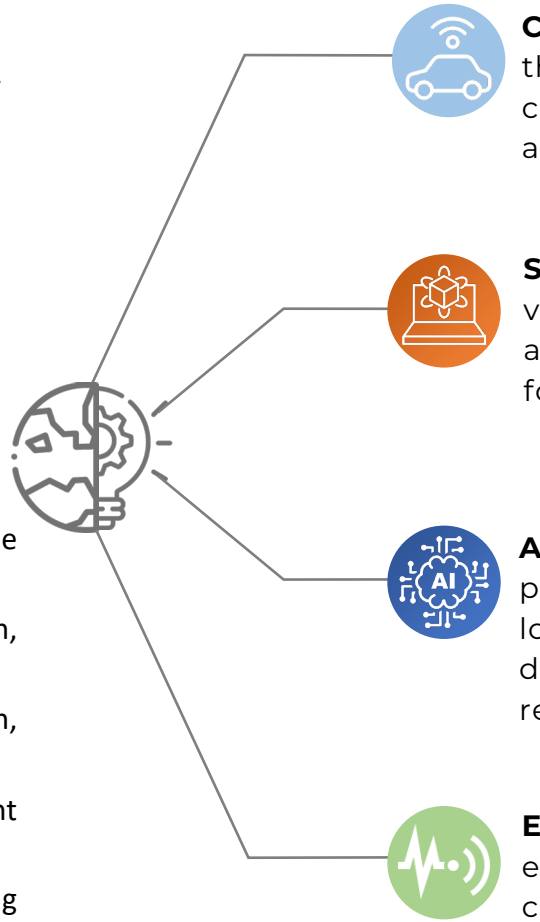
The USER

- **Infrastructure modernization & lifecycle renewal:** aging roadside assets under budget pressure and rising performance expectations.
- **Rising network complexity from urbanization & multimodal mobility:** increasing coordination needs across modes, corridors, and events.
- **Sustainability and policy-driven mobility goals:** emissions, safety, and congestion targets redefining performance expectations.
- **Advanced traffic management & "what-if" operations:** shift in demand from reactive monitoring to predictive and scenario-based control.

TECHNOLOGY

- **Shift from isolated assets to connected ecosystems:** corridor- and network-wide system integration.
- **Data volume explosion & real-time decision pressure:** scalable ingestion, fusion, and low-latency control becoming essential.
- **AI adoption moving from pilots to operational use cases:** predictive, detection, and decision-support use cases entering production environments.
- **Cloud + edge as standard architecture:** scalable cloud platforms with resilient roadside processing.
- **Cybersecurity, safety & resilience by design:** security and compliance becoming core differentiators.
- **Interoperability & open standards as mandatory:** vendor-neutral integration across multi-system environments.

… Innovation domains



Connected Mobility, strengthening mobility through CCAM-driven connectivity to support cooperative traffic management and emerging automated mobility services.

Simulation and Digital Twins, to simulate and validate changes before deployment, enriching available data and aligning it with AI objectives for stronger decision-making.

AI-Driven Traffic Intelligence, to analyse and predict traffic patterns for smoother mobility and lower emissions, while emphasizing thoughtful data governance to maintain reliable and responsible systems.

Edge AI + Advanced Sensors, combining edge-native AI with advanced sensors like cameras, radar, and LiDAR to enable low-latency, real-time insights and improve safety, resilience, and situational awareness.

Connected, Cooperative and Automated Mobility

Connectivity and cooperation are the prerequisites for safe automation

CCAM connects vehicles, road infrastructure and road users so they can exchange information and coordinate their actions. It raises road safety and traffic efficiency today - and it is the foundation on which automated vehicles can be safely integrated into the transport system tomorrow.

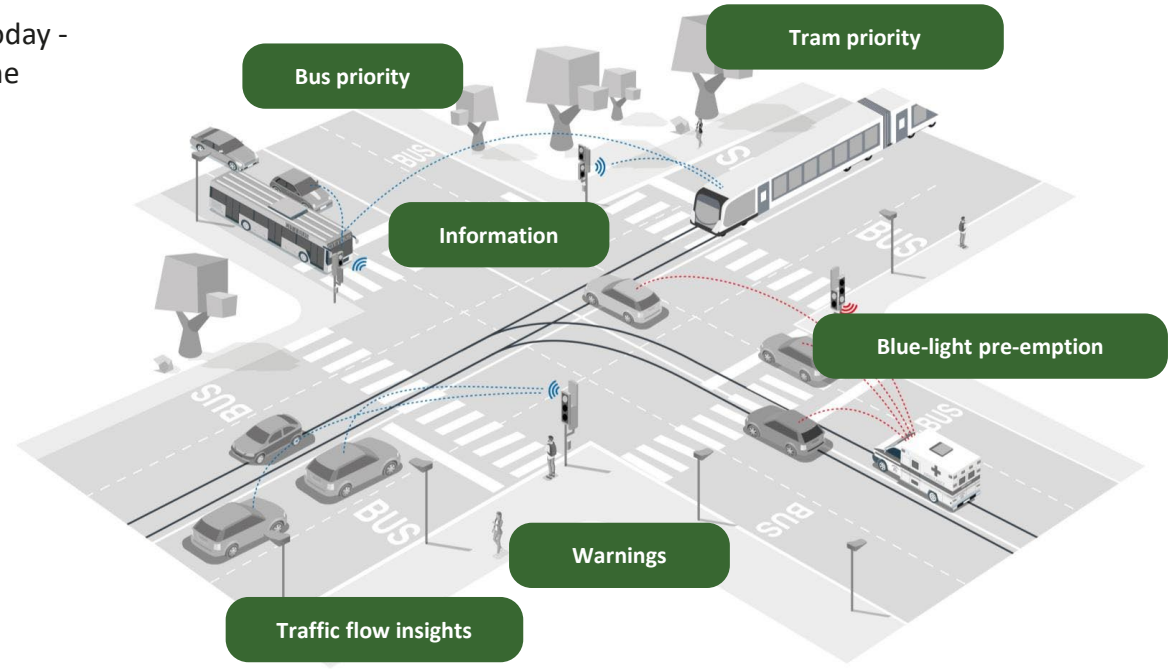
What CCAM delivers

20% — **Traffic efficiency**
Traffic flow optimised by up to 20 % through cooperative signal control and speed advice (GLOSA).

10% — **Energy & emissions**
Fuel consumption reduced by up to 10 % - less stop-and-go, less noise, less pollution.

EVP — **Safety & lives saved**
Early hazard warnings prevent accidents; priority for emergency vehicles cut response times.

Value for public authorities, road users and fleet operators alike.



+100
realised CCAM projects - from a single RSU to nationwide roll-outs

4
continents - Europe, North America, Africa and the Middle East

+5,000
connected vehicles (OBUs) and RSUs

Connected, Cooperative and Automated Mobility

From a single Road Side Unit to turnkey, nationwide CCAM traffic management

ROADSIDE

Road Side Unit (RSU)



- ITS-G5 and C-V2X radio communication
- SPaT / MAP, SRM / SSM, DENM, CAM, IVI, CPM
- V2X vehicle detection, virtual loops and priority management
- Interfaces to traffic-light controllers
- ETSI security stack, PKI-ready
- Outdoor, DIN-rail or virtual RSU



ON-BOARD

On-Board Unit (OBU)

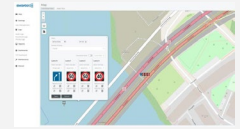


- Rugged unit for buses, trams and emergency vehicles
- Triggers signal priority and pre-emption requests
- Precise positioning with dead reckoning
- 4G / 5G, ITS-G5, C-V2X and Wi-Fi
- API to fleet-management systems; vehicle interfaces (doors, odometer)
- Virtual OBU (software) option

CENTRAL

MyCity Connect

- Asset management: overview, status and lifecycle of all devices
- Live monitoring of RSUs / OBUs, event visualisation, dashboards
- Services configuration and dynamic deployment of messages
- Gateway to traffic centres, navigation providers and apps
- Hybrid delivery: short-range V2X plus cellular



Urban services

Signalised intersections and vulnerable road users

- Emergency vehicle priority
- Public transport prioritisation
- Signal phase & timing (SPaT / MAP)
- Green light optimal speed advisory (GLOSA)
- Imminent signal violation warning
- Collective perception & probe vehicle data

Interurban services

Motorways, tunnels and road-works

- Hazardous location notification
- Road-works warning
- In-vehicle signage
- Weather & slippery-road warning
- Automated vehicle guidance
- Navigation guidance & probe vehicle data

Standardised ETSI / ISO messages · C-Roads compliant · Short-range (ITS-G5, C-V2X), cellular and hybrid delivery · EU C-ITS PKI security

From Data to Decisions: Digital Twin

Digital Twin delivers a real-time, data-driven virtual model of the city's road infrastructure to improve traffic management and support urban planning. By leveraging AI and simulation-based traffic and environmental insights, it enables smarter mobility decisions and positions our customers as leaders in urban digitalization.

Virtual replica of

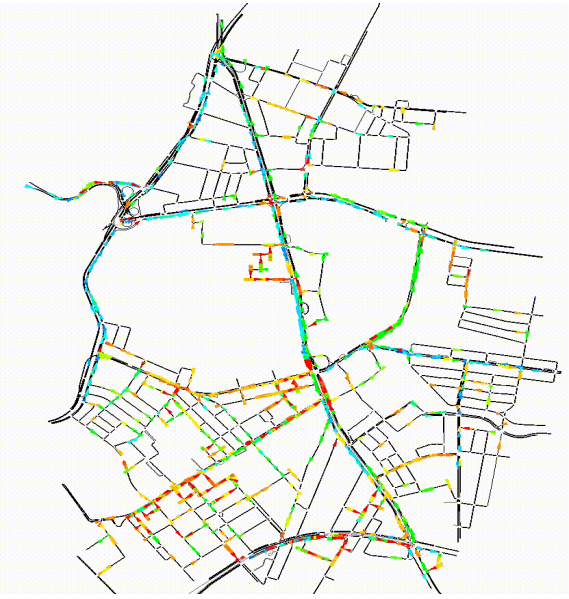
- Road network (lane-level)
- Traffic control systems (signals, plans)
- Traffic demand & behavior

Continuous loop

- Real-world data → update model
- Model insights → support interventions

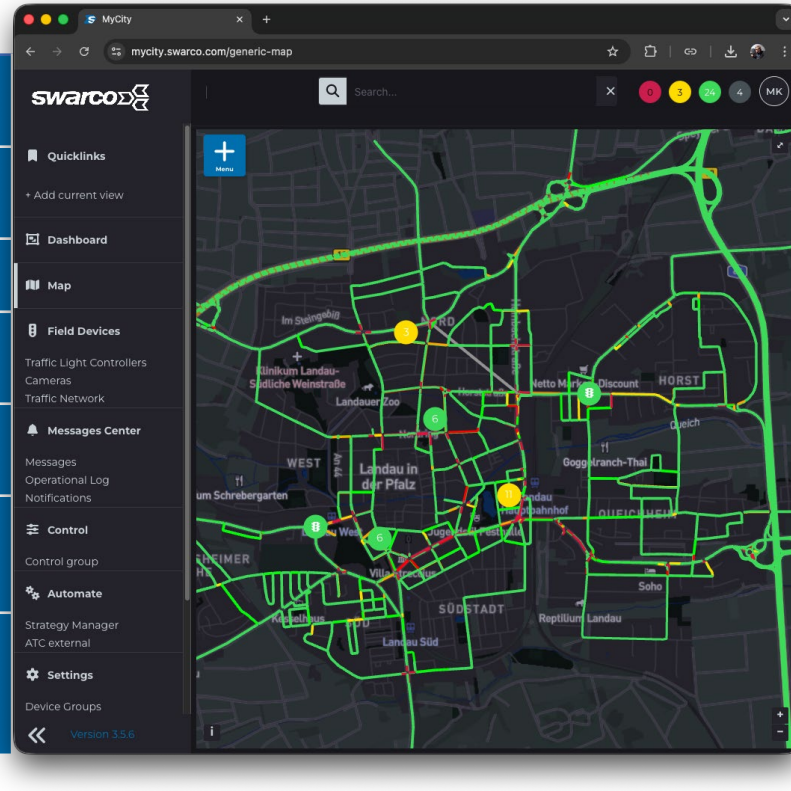
Key capabilities

- Real-time state estimation
- One-hour traffic prediction
- "What-if" scenario analysis



Features

- **Extended Real-Time Traffic View**
- **Short-Term Traffic Forecast**
- **Emission Forecast**
- **Historical Analysis with Simulated KPIs**
- **Infrastructure Scenario Simulation**
- **Strategy Manager Actions based on KPIs**
- **Strategy Manager Action based on Emission-KPI**

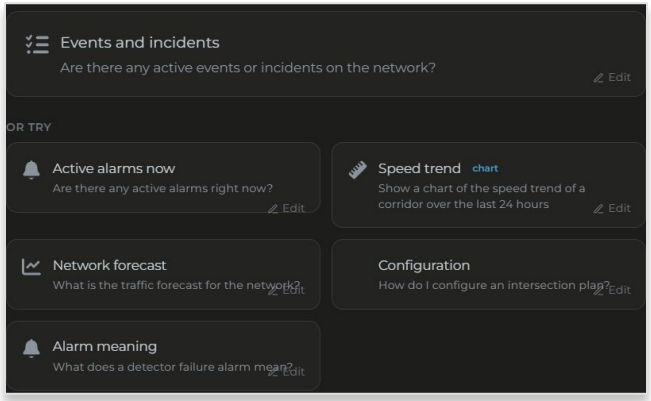


AI Crew for Smarter Mobility Operations

THE ASSISTANT – 24/7 Support - Assists Operators with insights, analysis, strategy evaluation and report.



- LLM-based
- OpenAI API
- Multilanguage (IT/EN/GR/AR)
- Multiple Manuals
- Controller plug-in
- Diagnostics plug-in
- Chat history



44
live-data tools

0
write operations · operator's own login

What operators can ask

Alarms	Events & incidents	Device health	Measurements
Congestion & KPIs	Forecast	Corridors & assets	Users & activity

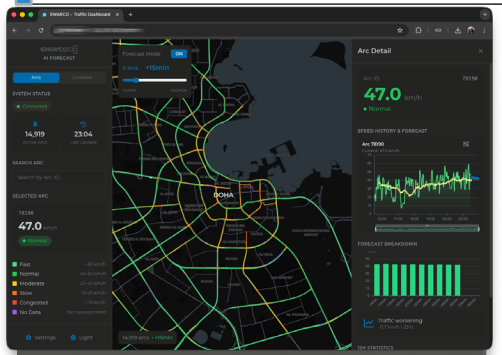
Answers in the right format

- **Charts:** 10 types from live data
- **Maps:** interactive corridor map
- **Pickers:** list for vague questions
- **@ mentions:** tag any asset
- **Follow-ups:** “last 24 h”, “open only”
- **Voice:** optional, hands-free mode

THE SENTINEL – Monitoring and Forecasting - Continuously monitors traffic conditions and predicts network evolution up to 1 hour ahead



- 15k Arcs
- 15’ interval
- 60’ horizon
- FCD integration
- Vehicles Speed
- Motorways
- Urban



12
steps to +60 min

12 h
speed history

≤5%
gap over 8 h

Arc details

- **Day so far:** measured speed + forecasts
- **Zoom:** 1–12 h, video-wall full screen
- **Live:** speed, class, last update

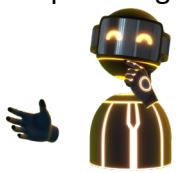
Accuracy check

- **Every forecast kept,** by horizon
- **Gap in %** per step
- **+5 vs +60 min** shows how far to trust

Operators see if a drop was anticipated and how much time is left to act.

AI Crew for Smarter Mobility Operations

THE STRATEGIST – Strategic Decision Support - Provides AI-powered decision support for optimizing traffic management strategies.



- Historical Traffic Data
- Sentinel forecasting input
- Event Strategy model
- Forecast integration
- Strategy recommendation
- AI Recommendations

THE ACTUATOR – Incident Response and Strategies Execution - Supports coordinated incident response and execution of traffic mitigation actions.



- Mitigation Strategy
- VMS/Controllers info
- Strategy handoff
- Infrastructure check
- Strategy Manager
- Strategy activation

The **strategic decision-making agent**, focusing on **optimizing mobility policies and performance objectives**. It empowers traffic operators by offering recommendations and improving decision-making strategies.

Traditional Traffic Management Systems use rule-based decision support and static demand models (hourly O/D and day types), which works well under predictable conditions but lacked adaptability to dynamic traffic shifts.

The STRATEGIST Agent enhances this aspect through dynamic, **AI-driven strategic recommendations**, supported by in-depth performance impact assessments. The agent analyzes the input problem and identifies **the most effective solution**, selecting it based on the success or failure of previously applied strategies.

The ACTUATOR is designed to **analyze the probabilities of the risk of accidental events and applies mitigation strategies.**

It ensures that unexpected events, such as accidents, are mitigated efficiently, applying efficiently the STRATEGIST's solutions minimizing disruptions to urban mobility.

The ACTUATOR introduces adaptive strategies based on AI, using historical incident data, information provided by the STRATEGIST agent, and real-time data of infrastructure conditions to anticipate disruptions and adjust traffic flows before incidents or congestion occur.

AI-based Traffic Control

- Adaptive systems have existed for decades and solve real world problems every day, with enormous benefits for the road users.
- Every single traffic actuated or adaptive system in use relies on one type of input above all else: **zone-based detection** (loops or loop emulators). And while we have had above-ground detection for years, only recently the performance and output of these deliver a quality and reliability that is high enough for more than zone-based detection.
- With **object tracking**, the intersection can now "see" the **traffic around** it, in real time, but algorithms are still build on zone-based detection, extensions of green, estimations of the real situation based on the zones.
- Right time and right conditions for a new era in traffic control algorithms.



If the intersection is suffering from queues and delays, **immediate** improvements can be delivered.

Delay is reduced, queues are shortened, with savings in emissions and time.

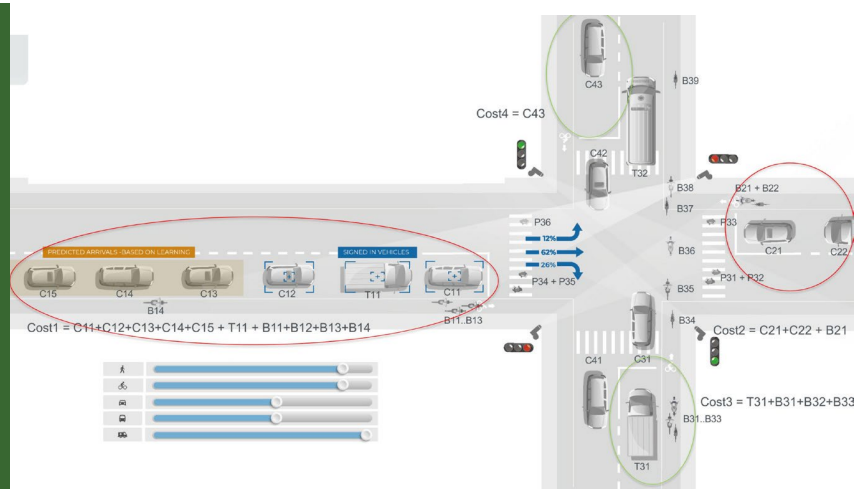
Over time traffic changes. Both in volume, but also the patterns.

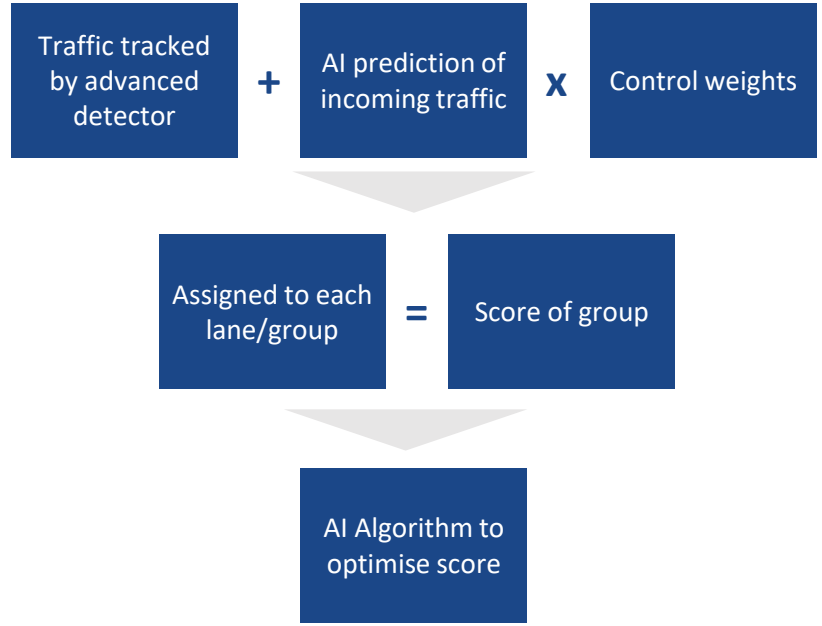
A new residential areas is built, or a shopping center. And the traffic changes completely.

SmartAI deals with the traffic no matter how it flows to the intersection, so it will be as optimal in 5 years as it is today

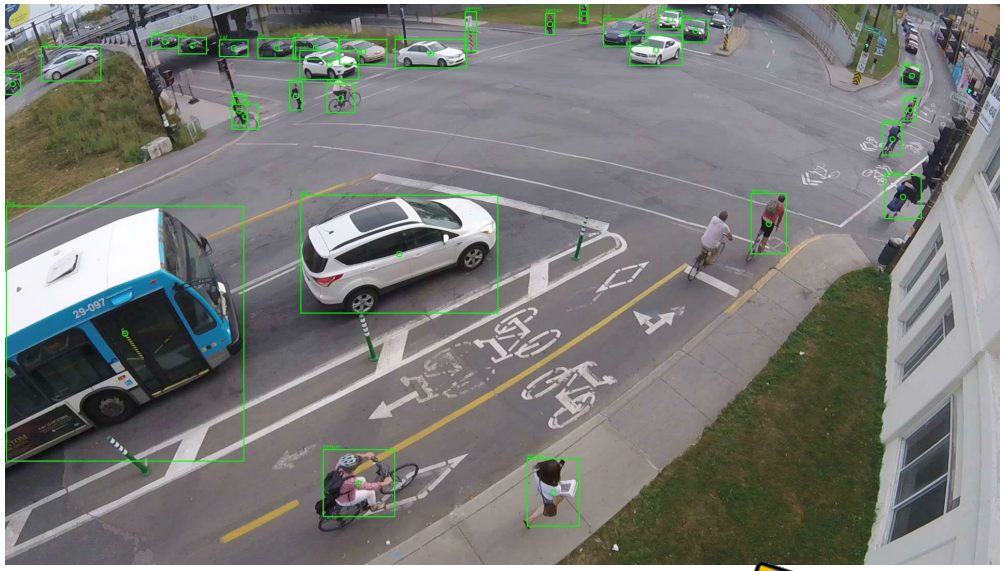
Accidents, road closures, big **events**. These all introduce disruptions and changes to the flow of traffic. A less-used side direction is suddenly flooded with traffic.

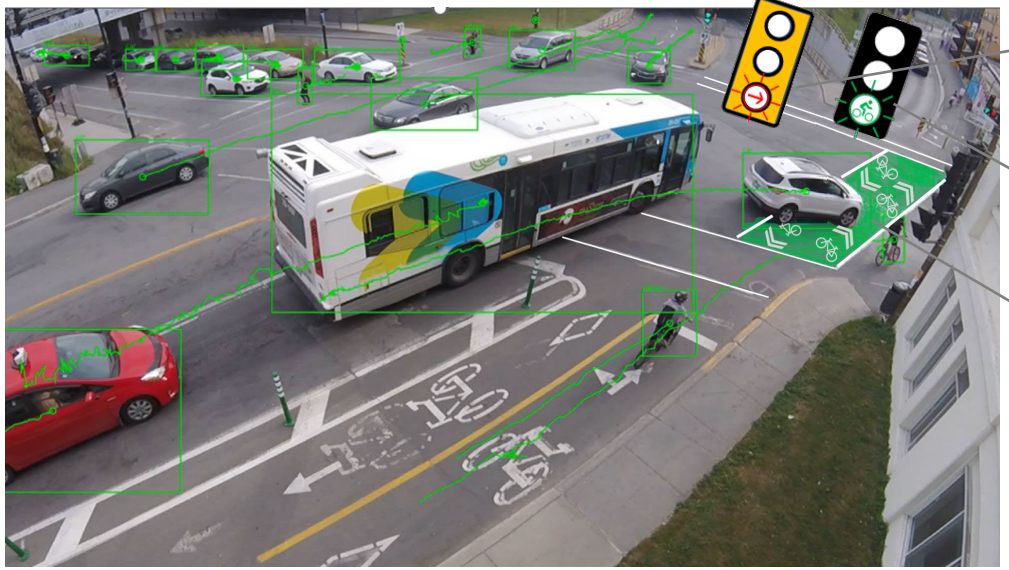
SmartAI reacts instantly and handles the situation, not through slow ramp-ups or downs of splits and cycle lengths, but by controlling the actual traffic that needs to pass the junction.





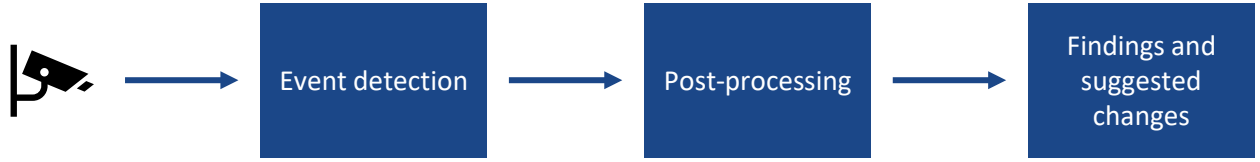
Edge AI: Near-miss





Near-miss events are any hazardous circumstances where a collision is narrowly avoided.

AI based detection, by analyzing cameras video stream, identifies near-miss events when trajectories of moving subjects (cars, pedestians, cyclists, …) intersect.



- Signal heads installation
- Separate phasing
- Road marking enhancement

Organisers

Ministry of Transport, Communications and Works

DEPARTMENT OF PUBLIC WORKS

SUSTAINABLE MOBILITY

Co-Organisers

University of Cyprus

Κοῖος Research and Innovation Center of Excellence

Σύλλογος Συγκοινωνιολόγων Κύπρου

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Thank you for your attention!

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