Mobilità connessa, cooperativa, automatica: l'esperienza di PAVE Europe, del Progetto IN2CCAM e della Città di Milano

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POLITECNICO DI BARI

Connected, cooperative and automated mobility

Today's vehicles are already **connected devices.**
In the near future they will **interact directly with each other and with the road infrastructure.**

This interaction is the domain of Cooperative Intelligent Transport Systems, which will allow road users and traffic managers to share information and use it to coordinate their actions.

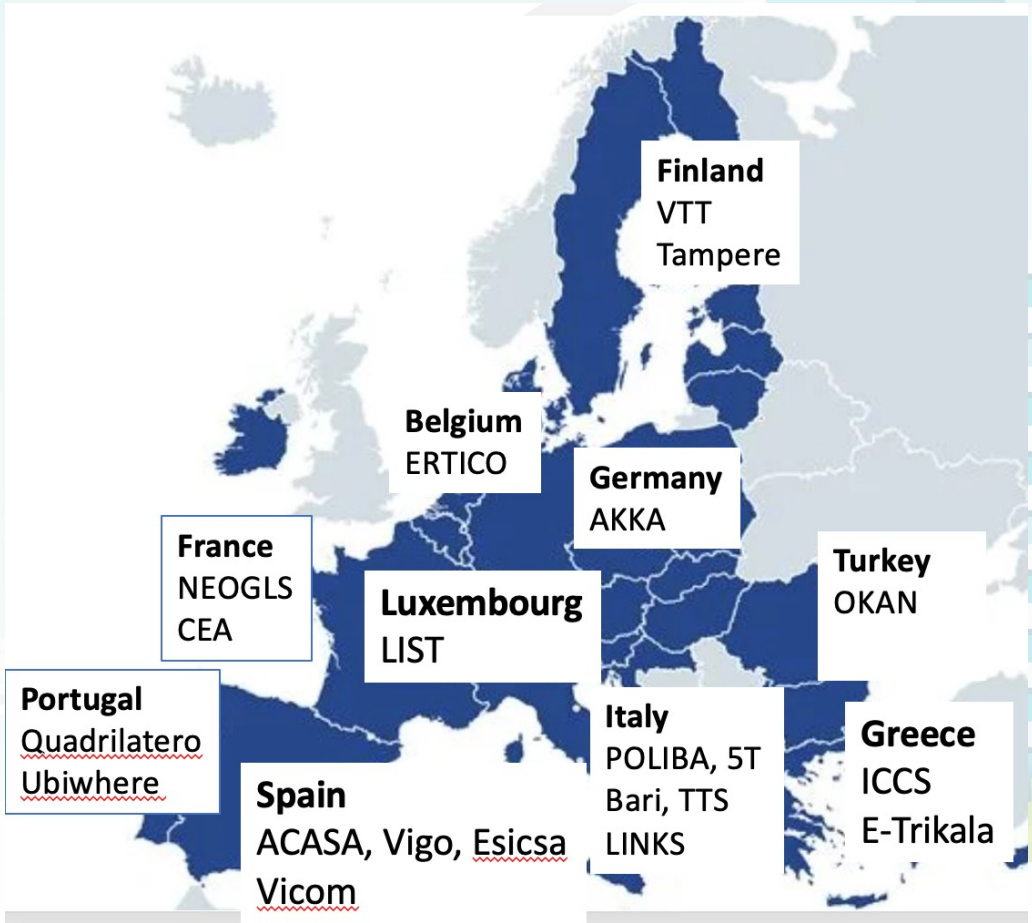
This cooperative element – enabled by digital connectivity between vehicles and between vehicles and transport infrastructure – **is expected to significantly improve road safety, traffic efficiency and comfort of driving, by helping the driver to take the right decisions and adapt to the traffic situation.**

Enhancing Integration and Interoperability of Connected, Cooperative and Automated Mobility: a project of Horizon Europe

Presentation Outline

- IN2CCAM at glance
- Strategic Objectives
- Concept
- Digital, physical and operational infrastructure
- Living labs description

IN2CCAM at a glance



Horizon Europe project

Call identifier: Horizon-CL5-2022-D6-01

Topic: Horizon-CL5-2022-D6-01-04 "Integrate CCAM services in fleet and traffic management systems (CCAM Partnership)"

EC funding: 4.979.626.00 €

Duration: November 1st, 2022– October 31, 2025

21 partners, 10 Countries

Demonstrations in **six living labs:**

4 lead living labs, 2 follower living labs

Strategic Objectives

IN2CCAM consortium intends

- **develop, implement and demonstrate innovative services for connected and** automated **vehicles, infrastructures and users**
- **accelerate the implementation of innovative CCAM technologies and systems for passengers and goods**
- **providing benefits to all citizens** by implementing a full integration of CCAM services in the transport system.

Strategic Objectives

Impacts for society

- i) **safety:** reducing number of road accidents caused by human error
- ii) **environment:** reducing transport emissions and congestion by smoothening traffic flow and avoiding unnecessary trips
- iii) **inclusiveness:** ensuring inclusive mobility and good access for all

The approach: implementation and integration of enhanced Physical, Digital and Operational Infrastructures to enrich CCAM services and increase safety and traffic efficiency.

The proposed actions will help to develop **new mobility concepts for passengers and goods** leading to healthier, safer, more accessible, sustainable, cost-effective and demand-responsive transport everywhere.

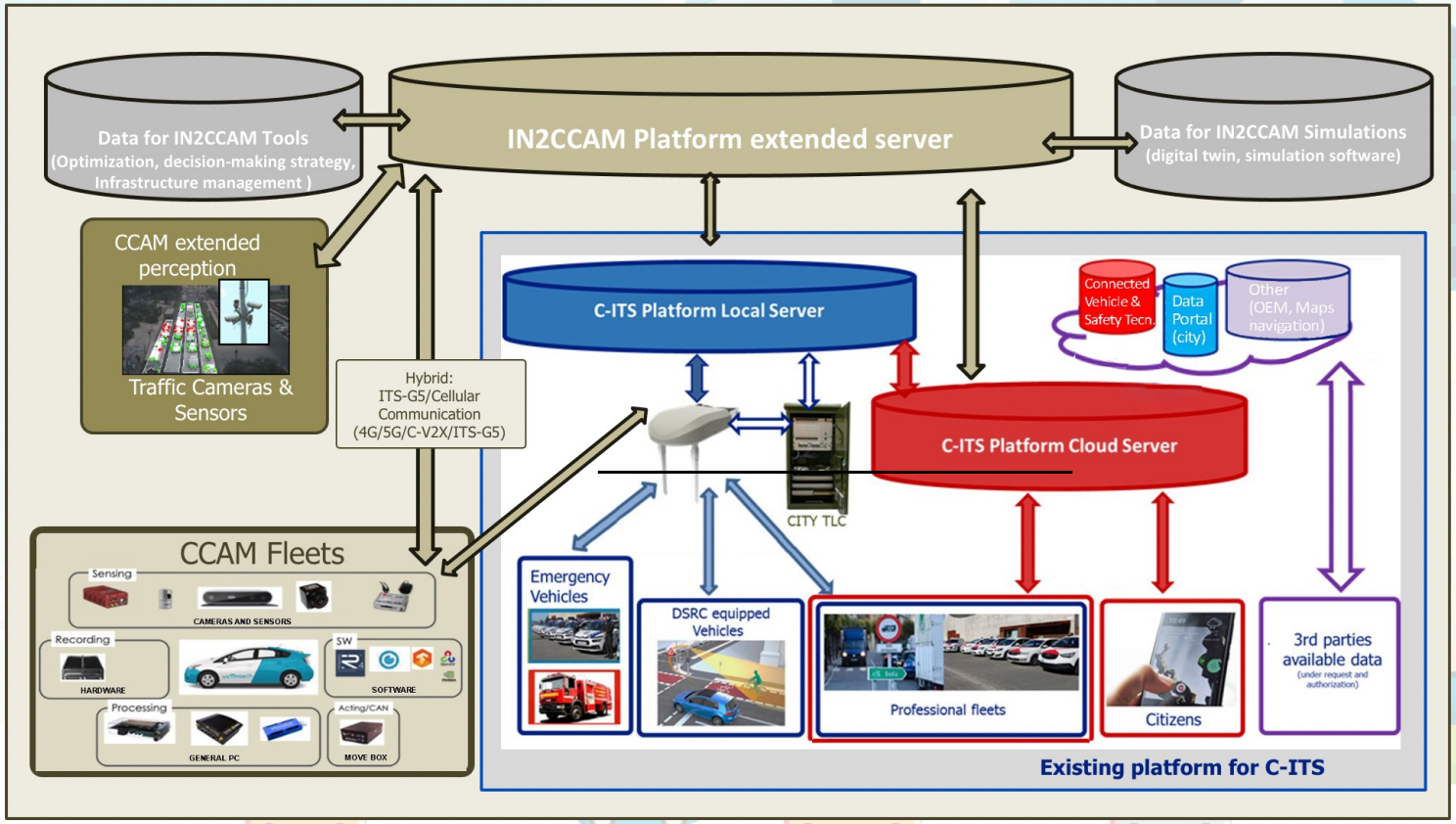
Physical Infrastructures

Physical infrastructures in each LLs will be updated so that the autonomous vehicles can travel considering the possibilities of:

- **dynamic dedicated lanes**
- **intelligent traffic lights**
- **intelligent road signs.**

Digital Infrastructure

Start from the existing traffic management systems in the LLs



- **Traffic management systems** are upgraded by extended server with a high level of automation.
- Design and implementation of **interoperability** between different transportation means
- **Using data from road sensors, traffic lights, cameras,** external providers satellite-based earth observation
- **Data and services based on the use of Copernicus and Galileo**
- **Implementation of HD maps** to improve the environmental awareness of CCAVs.

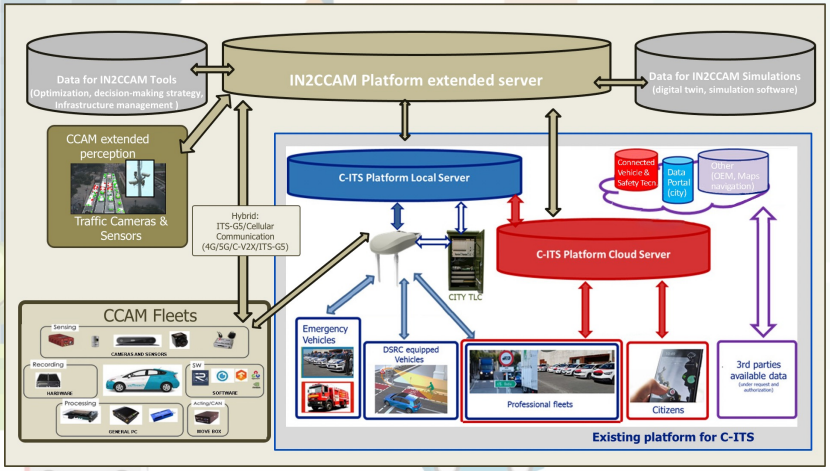
Digital Infrastructures

New services and applications for smart devices

- for traffic balancing by proposing alternative less congested roads, road selection to decrease traffic and congestion
- Freight transport and logistics
- Vulnerable Road Users (VRU) enablers.

Innovative technologies

- **Artificial Intelligence** (Machine Learning, Deep Reinforcement Learning)
- **Digital Twin**
- **V2V algorithms** for controlling intersection flow without traffic lights
- coordinating **platooning**



Operational Infrastructures

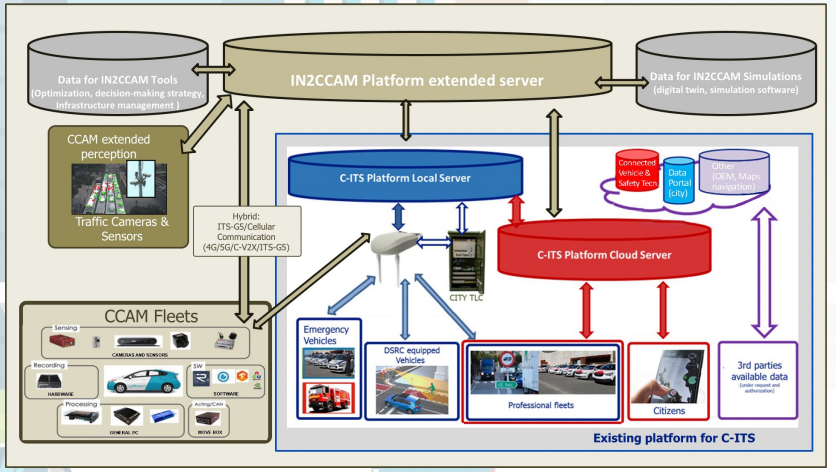
Appropriate governance models:

- to integrate the services in urban planning and urban economics
- to ensure collaboration between stakeholders.

Providing Business Models

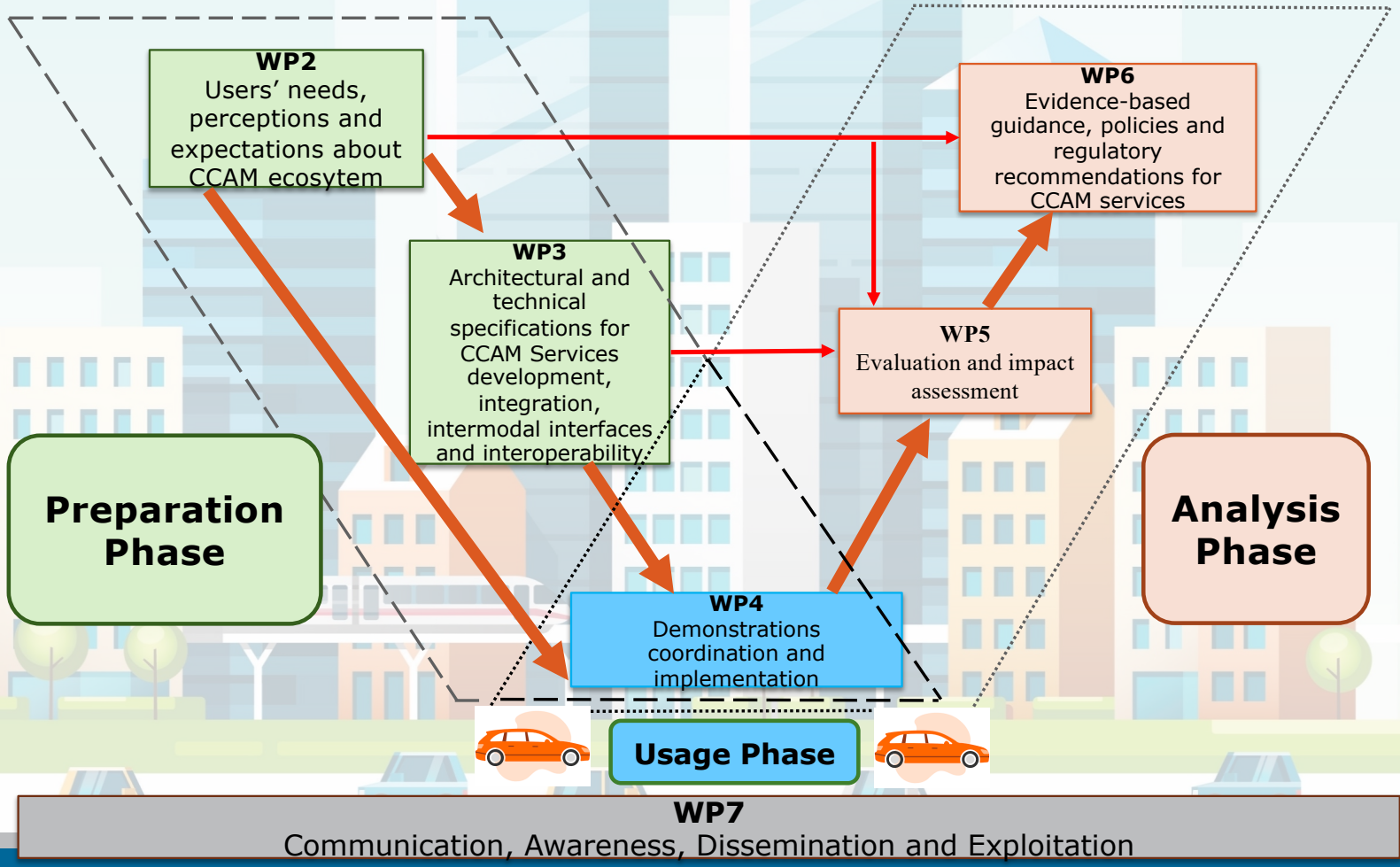
- for automated and shared vehicles
- For interoperability and integration with public transport.

The actions should develop and demonstrate concepts of traffic and fleet management **to achieve integration of CCAM vehicles in the entire mobility system**



Methodology

Guidelines of the FESTA European project



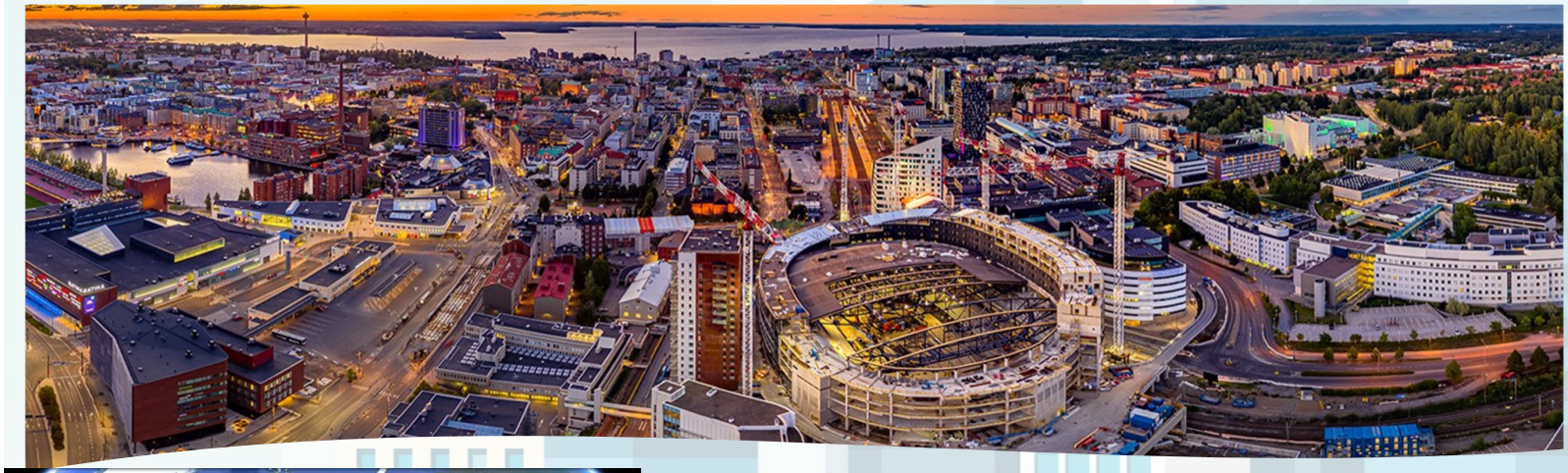
Living labs

4 Lead LLs implement the new services and the IN2CCAM **platform extended server**, the Digital Twins for maintenance and prediction, **collect data** from the field, evaluate the perception and the reactions of the involved people, provide data and information for the governance models and rules determination: **Tampere (Finland), Trikala (Greece), Turin (Italy), Vigo (Spain)**

2 Follower LLs follow the results obtained by the Lead LLs and apply their proposed services by implementing simulation campaigns: **Bari (Italy), Quadrilatero (Portugal)**

Follower LLs are implemented with reduced budget amplify the results of the Leader LL, increase the project outcome dissemination and also enrich the impact.

Living lab: Tampere (Finland)



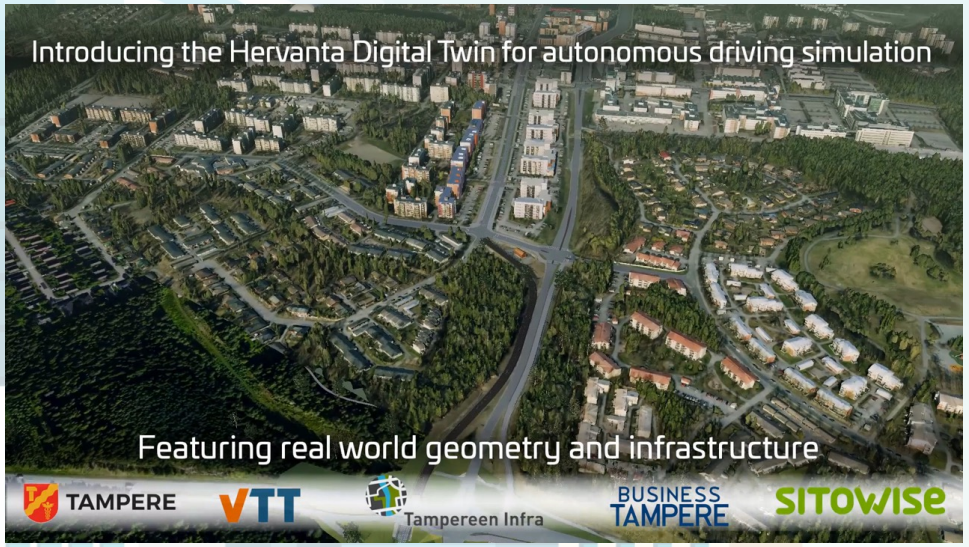
Tampere serves as **a living lab** and testbed for smart city innovation.

Cities **play a key role in digital transformation.**

Hervanta Testbed and digiTwin

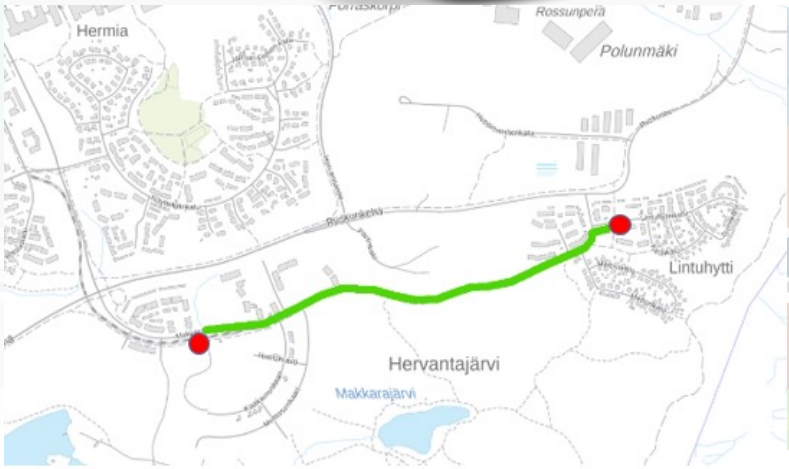
Tampere Testbed Hervanta offers companies, equipment and sensor manufacturers, automotive operators and researchers a central **location for testing and developing automated mobility solutions**.

Hervanta Mobility hub connecs the **brand-new tramline**, bus lines, pedestrian zone, bicycle routes and CCAV operations.

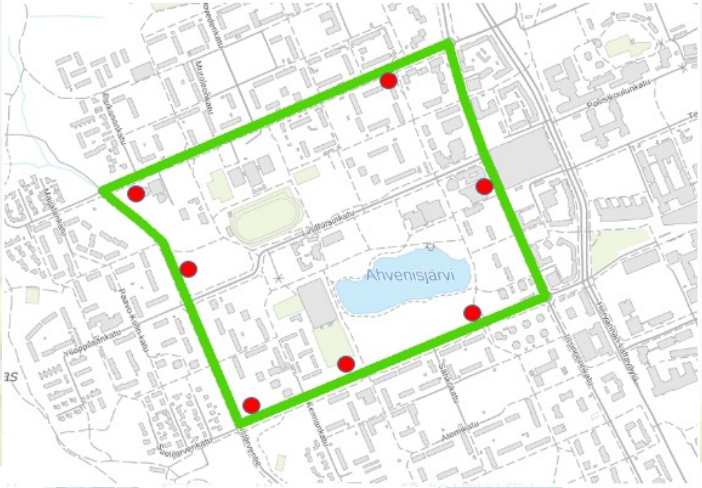


Automated last-mile pilots 2023 in Hervanta

The five automated vehicles used in the project are SAE Level 4 shuttles owned by public and private entities for mobility of people.



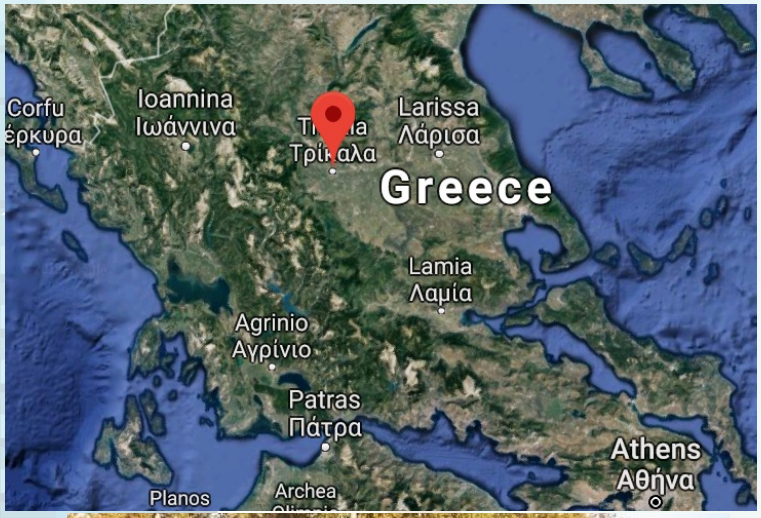
1.2 km route



3.5 km route

Living lab: Trikala (Greece)

- **Remote Control Center** has been developed where a live feed of cameras mounted on the vehicle uses **5G/4G network**
  Communication includes:
  - **emergency phone line is provided inside the vehicle**
  - **emergency button** giving the ability to smooth breaking and immobilization of the vehicle
  - **Real-time alerts of critical incidents** via smart data management platform
  - **Fleet management for real-time monitoring** of bus position, events, traffic and route-related reports with the cooperation of the TMC.
    - monitor in real time the current geographical location of a bus on a digital map and receive information about its position, speed, direction, and other statuses of the bus, such as starting, stopping, speed, low battery, door opening.



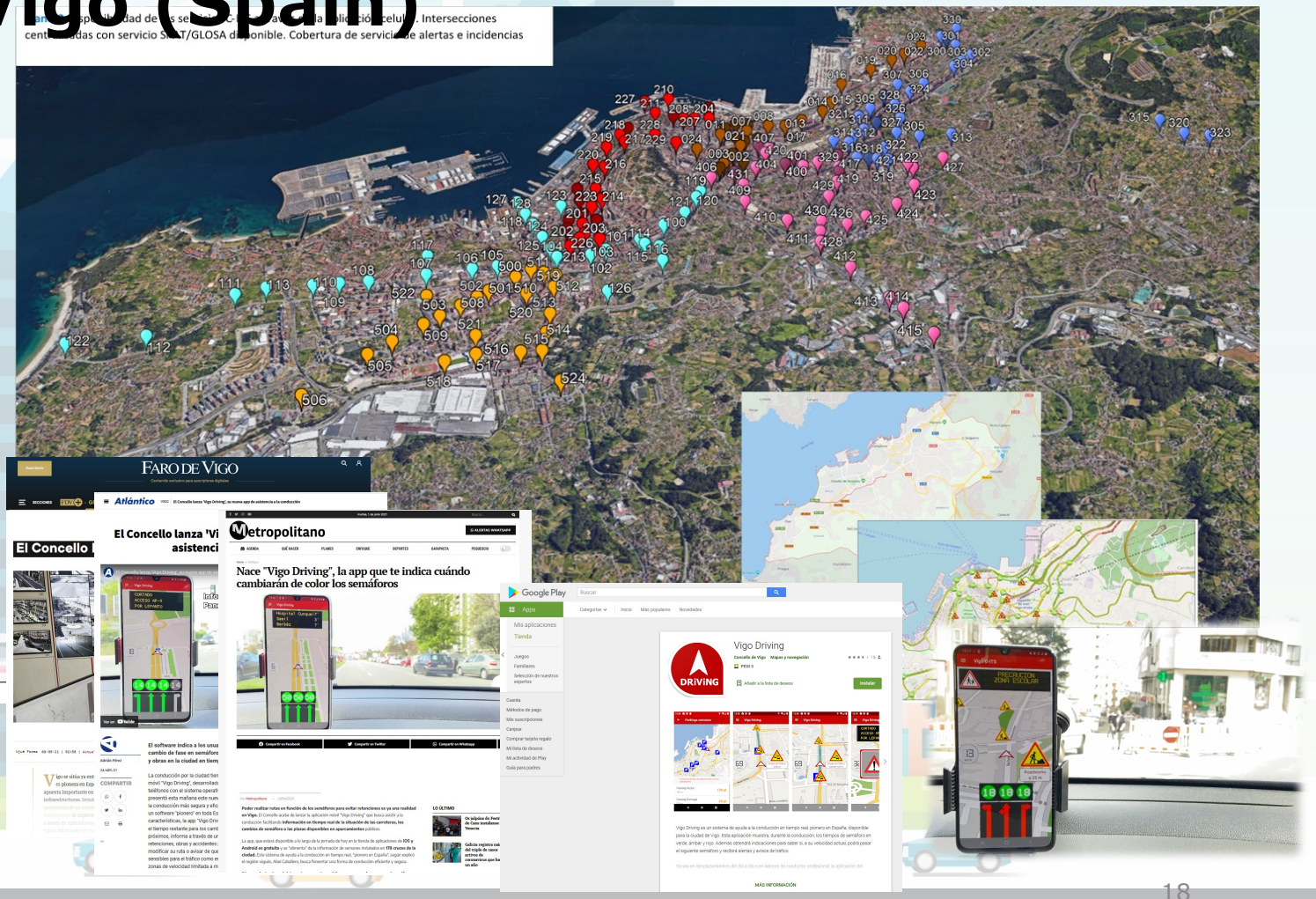
Living lab: Turin (Italy)

- **Expected outcomes:**
  - ***To complete*** an urban CCAM ecosystem for the city of Turin
  - **to *apply and demonstrate*** new traffic management strategies focusing on / supported by the CCAM ecosystem
  - **to *simulate and evaluate the impacts*** on the road network of traffic management strategies in different CAV adoption scenarios (e.g., different market penetration rates, etc.)

Living lab: Vigo (Spain)

APP Vigo Driving (Android & IOS):

- GLOSA/SPAT available in 181 from 270 intersections
- Road works, traffic jam and accident warnings.
- Parking info of location and availability of spaces
- **Emergency vehicle approaching warning**
- User data reported.



IN2CCAM Vigo Test environment

Gran Vía CCAM corridor for IN2CCAM Early used in AUTOPILOT H2020 Project

IN2CCAM Lane

Follower living lab: Bari (Italy)

Developing and simulating a Route Planner

- support users of different social groups
- allow overcoming acceptance barriers in the usage of autonomous vehicles,
- calculating and proposing different plans based on user profile.

ICT tools and services to be simulated

***AI solutions**: machine learning* and *deep reinforcement learning* techniques will allow to identify the best route and facilitate the CCAVs during the trip, also by controlling and managing traffic lights.

Follower living lab: Bari (Italy)

Innovative urban freight transport and last mile logistics

To propose and simulate new urban freight transport and last mile logistics to reduce the circulation of vehicles especially in urban areas. The idea is to create several networked HUBs

- storage of good
- shunting and distribution of goods.

ICT tools and services to be simulated

***AI solutions**:* Innovative strategies to localize the micro HUBs, optimize loads, reduce empty miles, utilization of dynamic routing and on demand services will be proposed

Follower living lab: Quadrilatero (Portugal)

The urban data platform integrates multiple sets of information (traffic flow observations, incidents, weather and buildings).

A management system collects real-time data in the Quadrilatero's associated cities to monitor more than 900 on-street and off-street parking spaces.

This solution sets the baseline to experiment new mobility scenarios and use cases with AI and simulation for a **greater efficiency** and **better quality of life**.

Figure 12 – Quadrilatero LL

Next steps

- Implementation
- Demonstration in the field
- Data collection
- Evaluation
- Impact assessment
- Evidence-based guidance
- Policies and regulatory recommendations for CCAM services

Thank you for your attention!

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