



VTT

# VTT:n ajankohtaiset tutkimukset

11/11/2025 VTT – beyond the obvious

# Basic content slide

- VTT:n älyliikenteen liittyvät tiimit
- Automaattinen ajo
- Langaton lataus
- Tietoavaruudet

# Automated Vehicles team

## What we offer

**develop, implement and test:**

novel automated driving solutions for ground vehicles\* extending its operational design domain (ODD)

*\*Cars, Trucks, Buses  
Work machines, Trains  
(& DefSec machines)*

## Our strengths

Perception and situational awareness in abnormal environmental conditions

IP portfolio for licensing:

- Sensor fusion algorithms
- Sensor interfaces
- V2X connectivity
- Automated driving functions
- Data space interfaces
- Positioning modules & HD-maps

## The team

- 14 experts in team
- 100 experts from other complementing domains
  - Impact analysis
  - 5G
  - Functional safety
  - Cyber security
  - Electrical powertrains
  - Data spaces
- 8 vehicle 'testbeds'
- 13 patent applications and >40 innovations

# Automated vehicle fleet



**'Martti'**  
5G / V2X  
Arctic conditions



**'eLvira'**  
360° sensing solutions  
Remote operation



**'Heluna'**  
Newcomer - sensing  
Artificial Intelligence



**'Aune'**  
Door2door mobility  
Concept vehicle



**'Bus'**  
Large dimensions  
Located in Turku



**'Jarno II'**  
5G, sensing  
Rider support



**'Pate'**  
Off-road  
Machinery & military



**'AVANT'**  
Metaverse  
Remote operation



**'Marsu'**  
Smart traffic hub  
Traffic enforcement

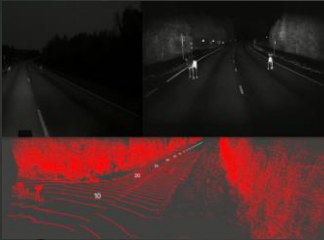


**'Marilyn' - retired**  
First robot car in Finland!  
Vaasa automobile museum

# Key technologies

VTT

## Sensing



- Radars, laser-scanners, cameras
- Filtering artefacts
- Artificial intelligence

## Positioning



- Landmark based positioning
- Error correction for GNSS

## V2X



- C-V2X, 5G => 6G
- Obstacle avoidance
- New 6G features (e.g. holograms)

## Functionality



- Piloting
- AV functions in adverse weather**
- Field trials, data collection and counter-measures

## Digital world



- Data replayer
- HD maps
- Remote operation
- Data spaces

# ARTIC CHALLENGE

VTT

- Invisible lane markings
- Positioning accuracy in lane
- Turbulent “snow wall” in front of vehicle
- Sensing performance degradation due to temperature
- Braking distance variations



## EU project Hi-Drive organized a roadshow in Muonio



- VTT develops automated driving components and also provides integration options for testing: here Bosch HD map

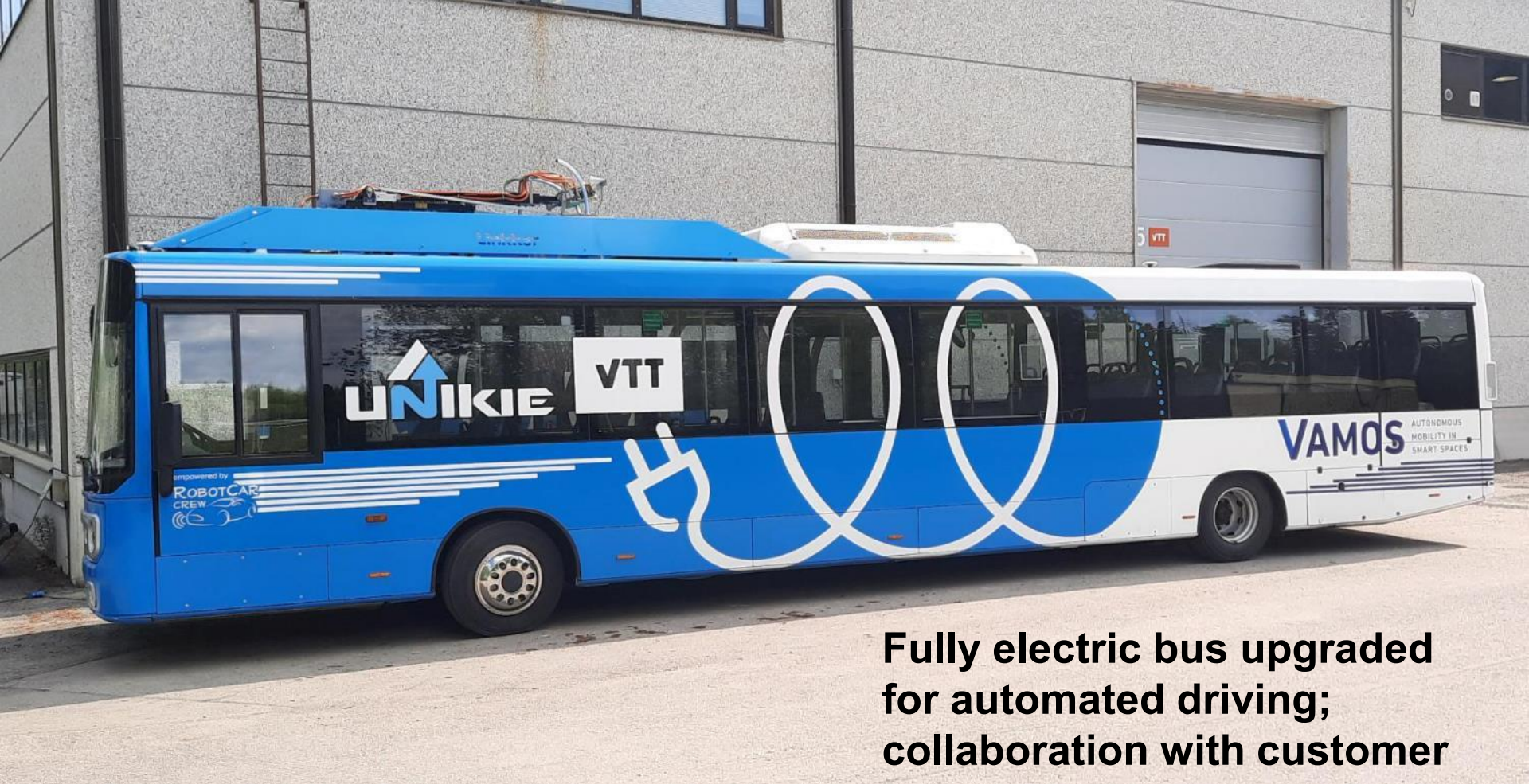


# Safety & visibility tests on proving grounds as part of certification



Airport luggage tractor in safety tests.  
EU research project AWARD, together with EasyMile and Digitrans





**Fully electric bus upgraded  
for automated driving;  
collaboration with customer**

# Stora Enso pulp mill at Uimaharju

- VTT automated the current vehicle for testing. In the future, one option could be to carry out such transfers with two smaller but automated vehicles.

## Truck sensor implementation

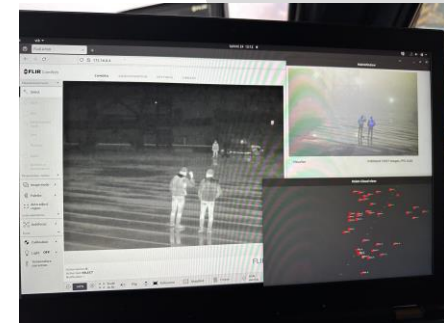
- 2 x 4G communication modules
- 2 x GNSS + RTK positioning
- 3 cameras (*behind wind screen*)
- Computer system (*at the rear of cabin*)
- 3 LiDARs
- 4 radars (one in trailer)



**Truck & trailer fully loaded ~ 70 tn**  
**Distance to unloading site and back is ~3 km**  
**among other traffic on narrow roads**

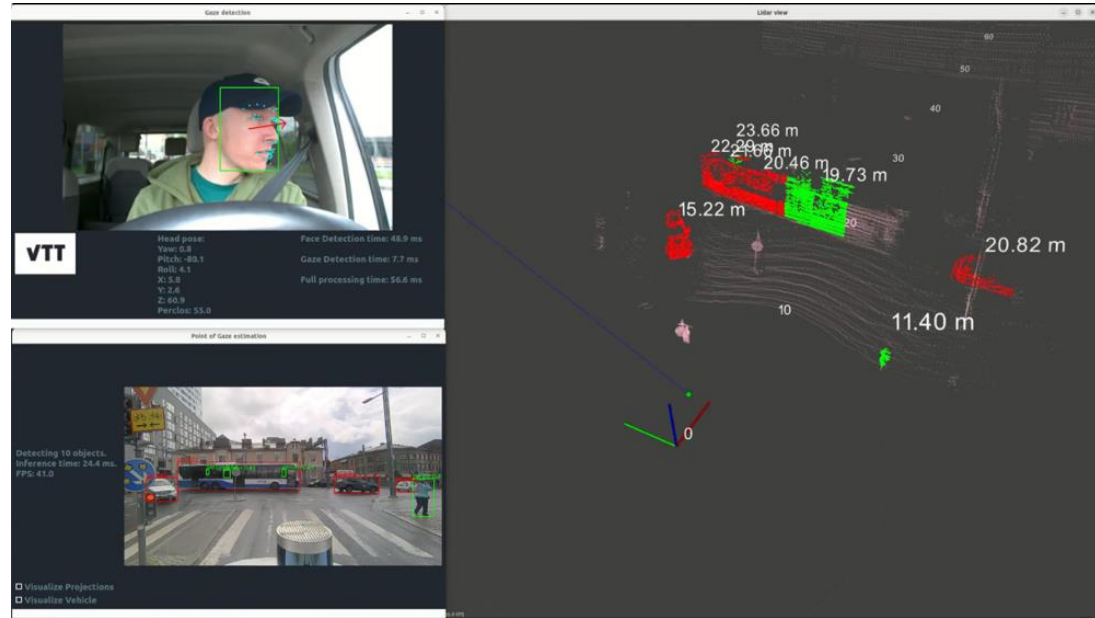
# Construction automation – Indian railways + TATA Steel + ToolTech

- Extended environment perception in foggy condition / Indian mines and railways
- Field studies done in 02/2024 on site
- Further step – horizontal view to be extended but work fine
- Unit price of hardware 35 k€ + software licences



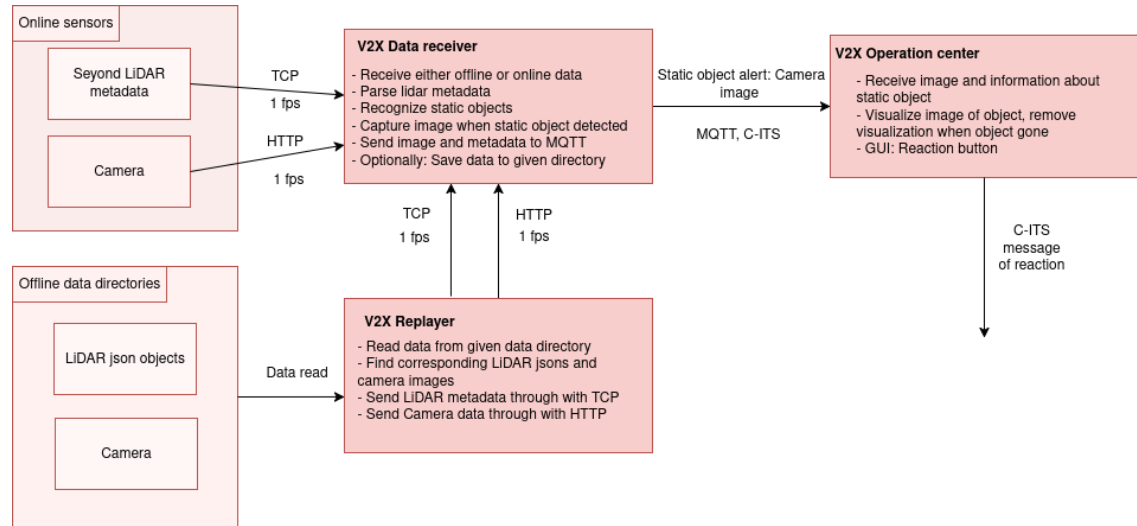
# DistriMuSe: Driver's situational awareness

- Monitoring the driver inside the vehicle (gaze direction)
- Detection of VRUs outside the vehicle
- ⇒ Matching these two to assess if the driver has noticed a VRU
  - If not,
    - ⇒ The driver is notified about the approaching VRU
    - ⇒ or, Automatic braking or obstacle avoidance is initiated



# SmartRail3: Two way communication: static object warning system

- Issue: static objects or people block the road/rail tracks
- Solution: Use LiDAR to recognize unmoving objects, take an image with camera and send to operation center.
- Operation center chooses action: call authorities, sound loudspeaker, inform tram driver, etc.
- Demonstration:
  - Collect data that is used for offline algorithm development. Create different interesting scenarios for dataset.
  - Use developed algorithms for online static object recognition.



# Tram Warning for Automated Shuttle

- Tram warning mobile app for the safety driver
- Aim of the service is to
  - **Increase tram efficiency** by prevent a slow-moving AV blocking tram on overlapping lane.
  - **Help automated shuttle operation in mixed traffic** by reducing shuttle caused disturbance to other traffic and reduce safety driver stress
- Warnings implemented using 5G-SA and C-ROADS specification:
  - Hazardous Location Notification -
    - Public Transport Vehicle at a Stop
    - Public Transport Vehicle Crossing



Safety driver seat



# 5G for CCAM

- Use of MEC and Virtual Network Functions for automated collision avoidance
- Use of low-latency communications for collective perception
- Low-latency video transmission between vehicles and control centre
- Hybrid cellular-satellite and multi-hop connectivity to extend range of cellular communications

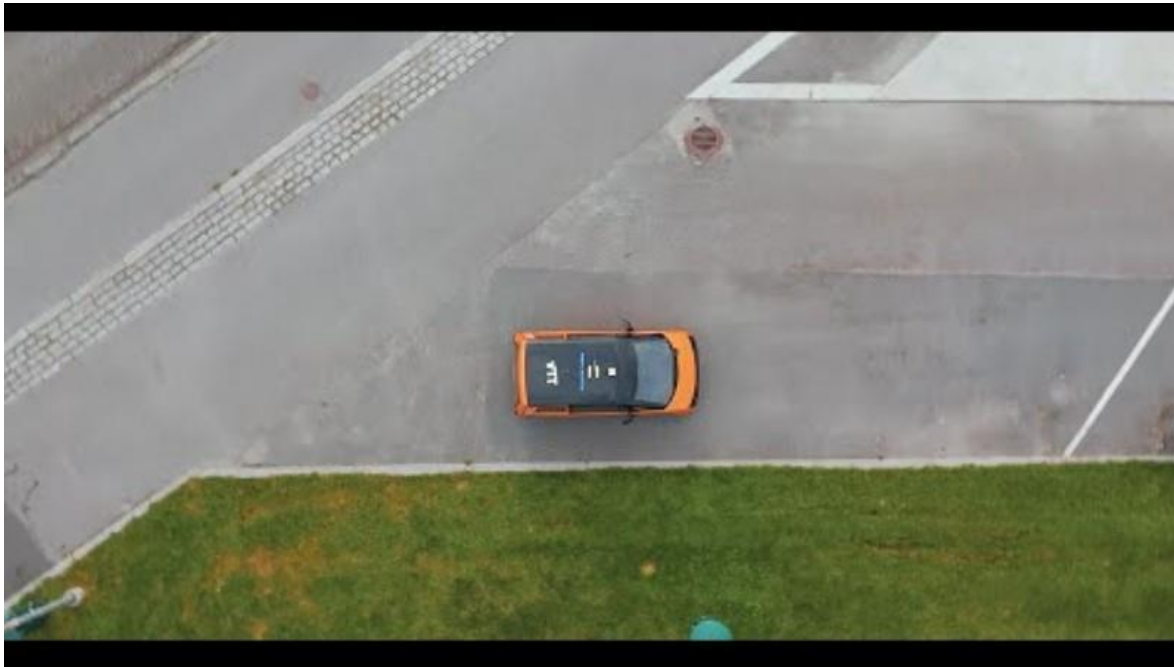


# Reflective project

- Developed and demonstrated a light electric vehicle (LEV) combining compact size and scalable design
- <https://www.reflective-h2020.eu/>
- **Special features**
  - Automated driving system (ADS) for improved usability and attractiveness
  - User-friendly ADS + wireless charging system
- **Evaluation**
  - ADS + wireless charging field tests in Tampere
    - Video: <https://www.youtube.com/watch?v=5I41nMVKGqM>
  - End-user testing in Helsinki
- **Verdict**
  - Reconfigurable LEV is **desirable, applicable, and suitable** for various purposes in urban traffic



# REFLECTIVE project



# deployEMDS: towards the European mobility data space



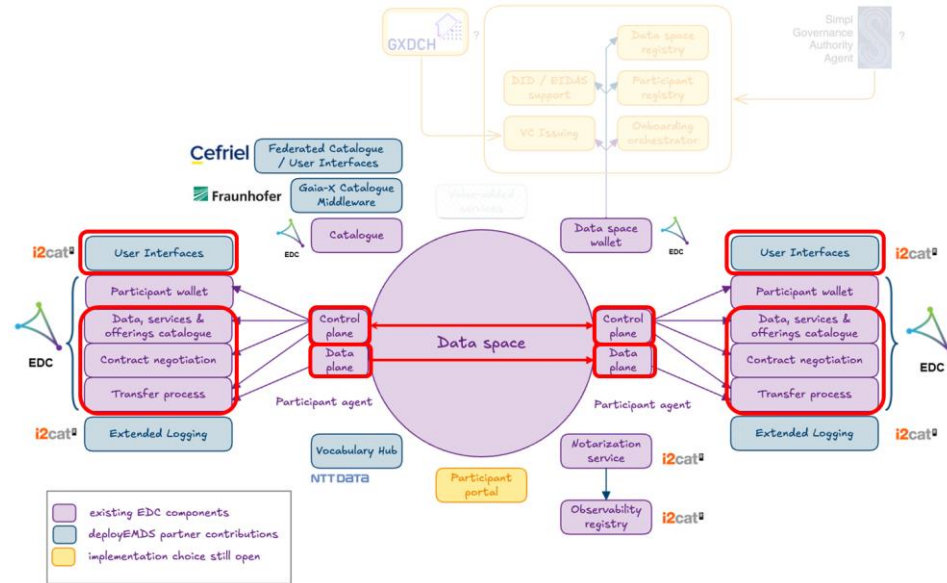
Use of data space technology for mobility use cases



Development and application of connectors for data spaces



Governance of data spaces



# bey<sup>0</sup>nd

the obvious

Thank you!

[vttresearch.com](http://vttresearch.com)