ZalaZONE overview, R&I activities
Intelligent infrastructure application

18.11.2020
Dr. Viktor Tihanyi
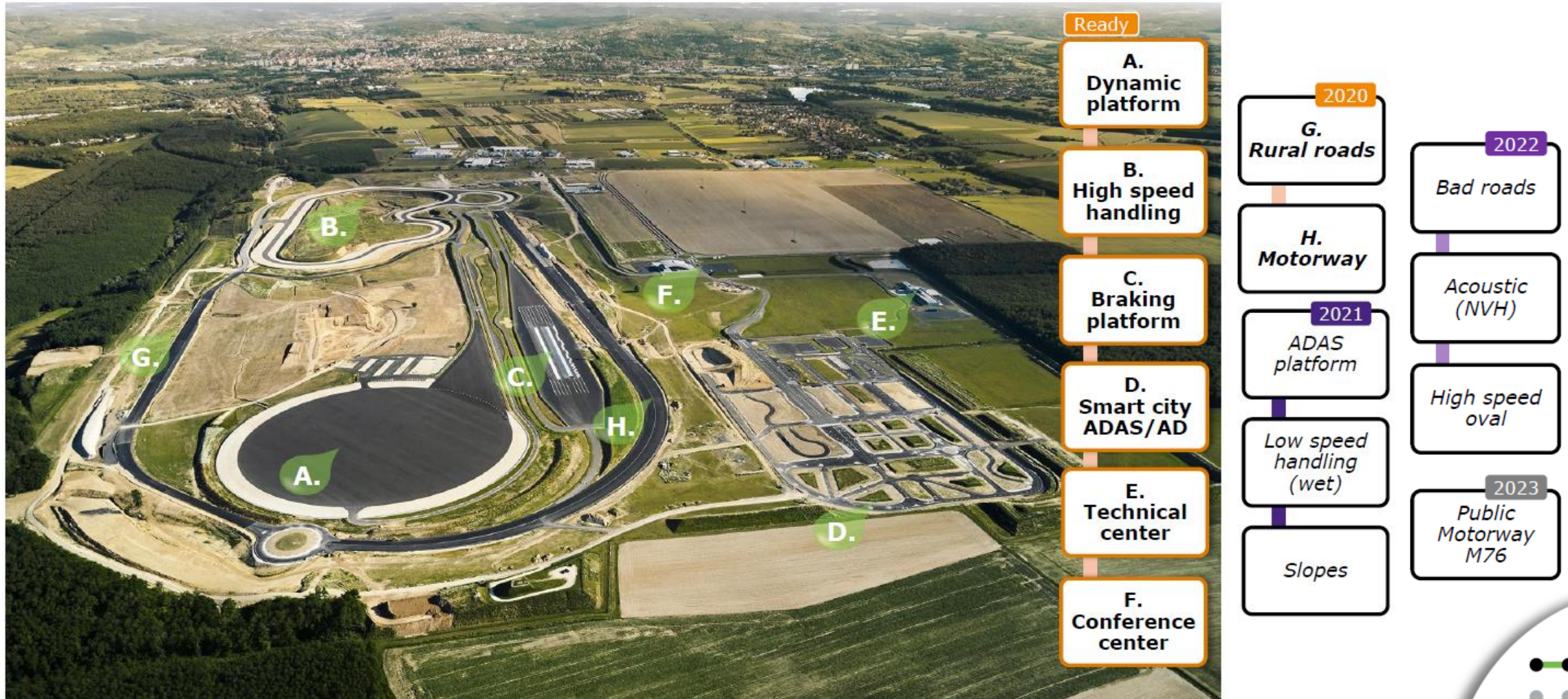
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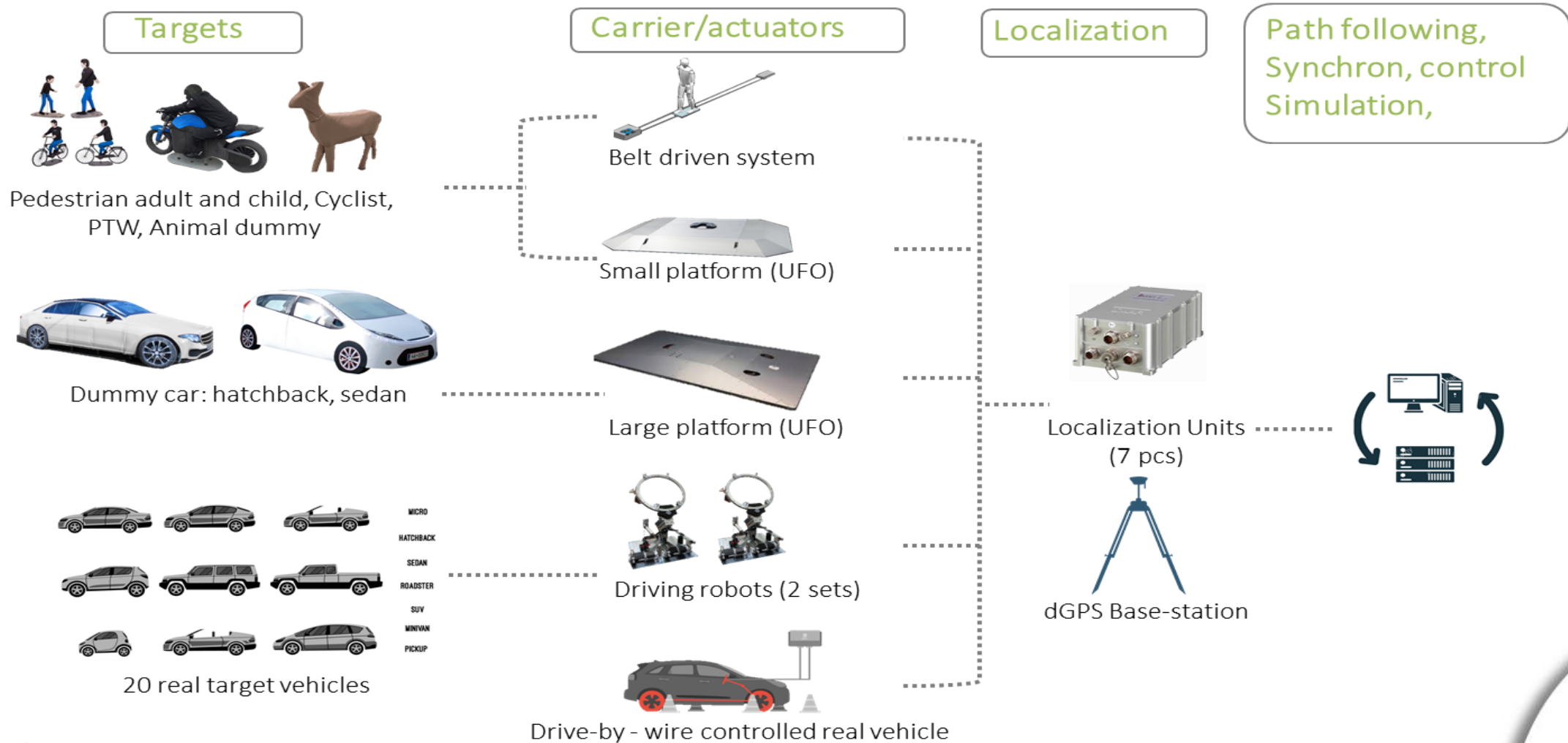ZalaZONE test track Status

Layout of the proving ground

Communication

- **Full coverage** of test track

- **5G cellular** test network available for future ITS applications (T-System, Vodafone)

- **ITS G5** V2X network:
  - **30** static RSU, **5** mobile RSU
  - **Standard** setup or
  - V2X developer environment: **free configurable**, open interface for application developers, full data logging infrastructure

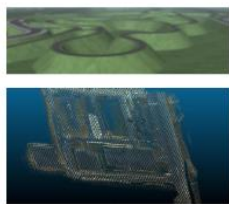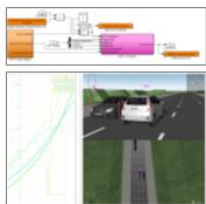- **Redundant physical layout** for parallel customer networks

RSU-201

OBU-201x or
DSRC V2X OBU
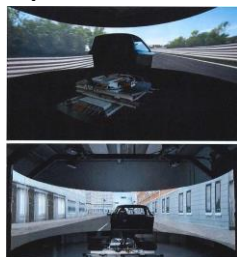
Project development

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Services

Targets

Pedestrian adult and child, Cyclist, PTW, Animal dummy

Dummy car: hatchback, sedan

20 real target vehicles

Carrier/actuators

Belt driven system

Small platform (UFO)

Large platform (UFO)

Driving robots (2 sets)

Drive-by - wire controlled real vehicle

Localization

Localization Units (7 pcs)

dGPS Base-station

Path following, Synchron, control Simulation,
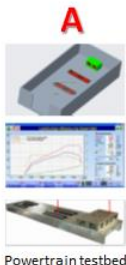
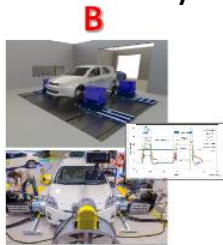ZalaZONE science park

Simulation and special testing lab

Driver-in-the-Loop simulation lab (2022)

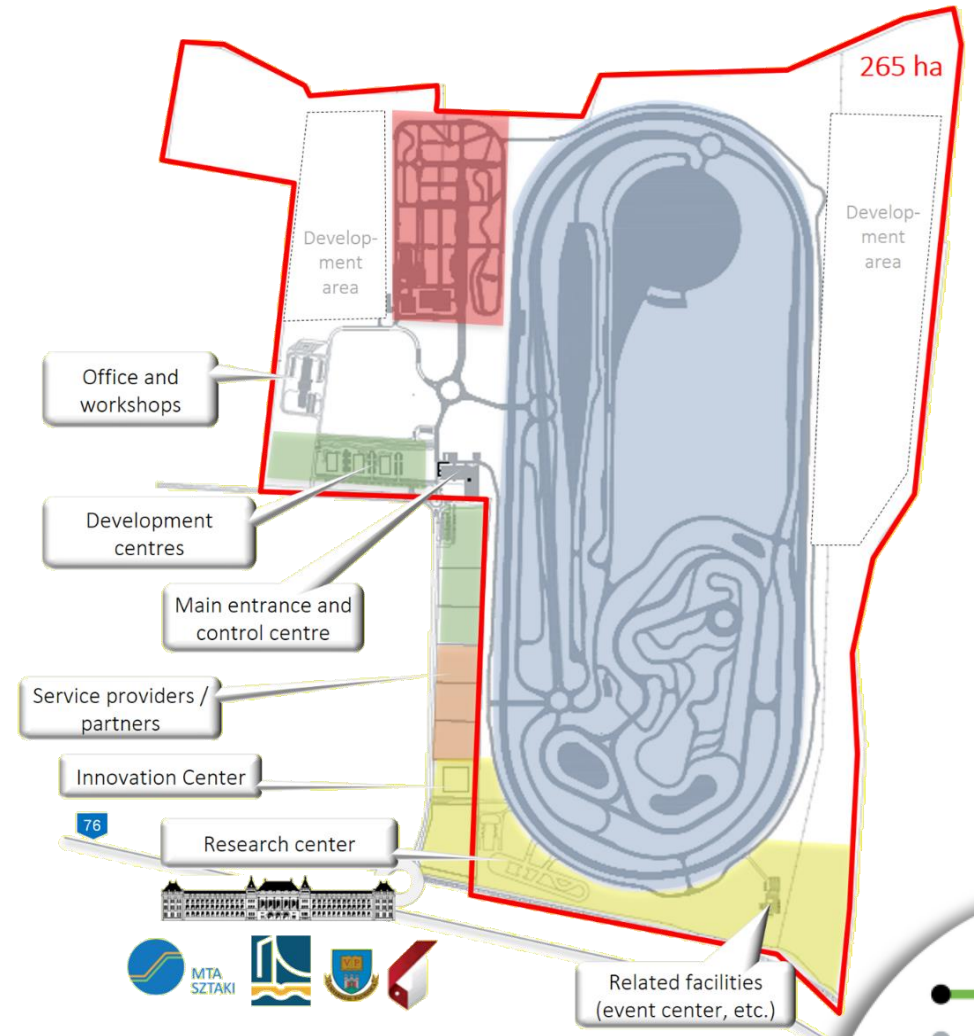Vehicle analysis lab (2021)

A   B   C

Powertrain testbed   Hub dyno   Calibration lab
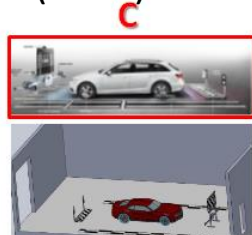
ZalaZONE Research & Technology Center

- University research groups
- Dual-education programs
- Industrial laboratories
- Start-up incubation

265 ha

Development area

Development area

Office and workshops

Development centres

Main entrance and control centre

Service providers / partners

Innovation Center

76

Research center

MTA SZTAKI

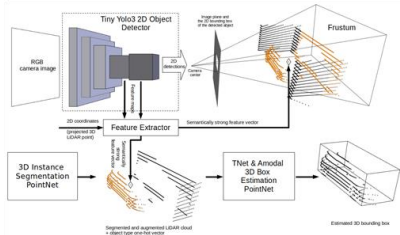Related facilities (event center, etc.)

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ZalaZONE Research & Innovation

✓ **Cutting-edge Research**

✓ Future-proof Education

✓ Wide dissemination of research results

✓ Value-creating knowledge transfer

Fundamental research activities in CAM topic

Environment perception

- Sensor signal processing
- Object level fusion
- Object tracking methods
- AI based raw data fusion
- Testing methods of perception systems
- HD map application in autonomous vehicles
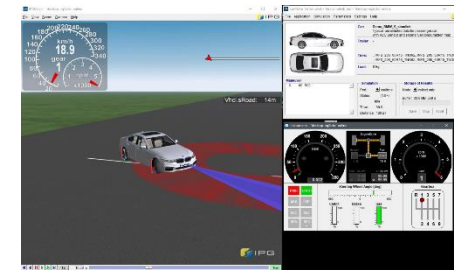- HD map generation and formats
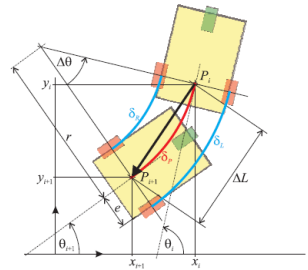
Cameras   LiDAR   RADAR   DGPS   FLIR

Decision control

- AI based decision methods
- Static and dynamic trajectory planning
- Trajectory following
- Lateral and longitudinal control
- Vehicle control in case of instability

$$x_{i+1} = x_i + \Delta L \cos\left(\theta_i + \frac{\Delta\theta}{2}\right)$$

$$y_{i+1} = y_i + \Delta L \sin\left(\theta_i + \frac{\Delta\theta}{2}\right)$$

$$\theta_{i+1} = \theta_i + \Delta\theta = \theta_i + \frac{\delta_R - \delta_L}{2e}$$

Simulation technology

- Own tools
- Commercial SW customization

Communication technology

- DSRC technology research
- 5G technology research
- Cybersecurity

Applied research activities in CAM topic

Automated vehicles

➢ Smart fortwo (completely autonomous)
  ➢ Valet parking
  ➢ Traffic jam pilot
  ➢ Platooning

➢ BMW M2
  ➢ Automated steering and throttle control
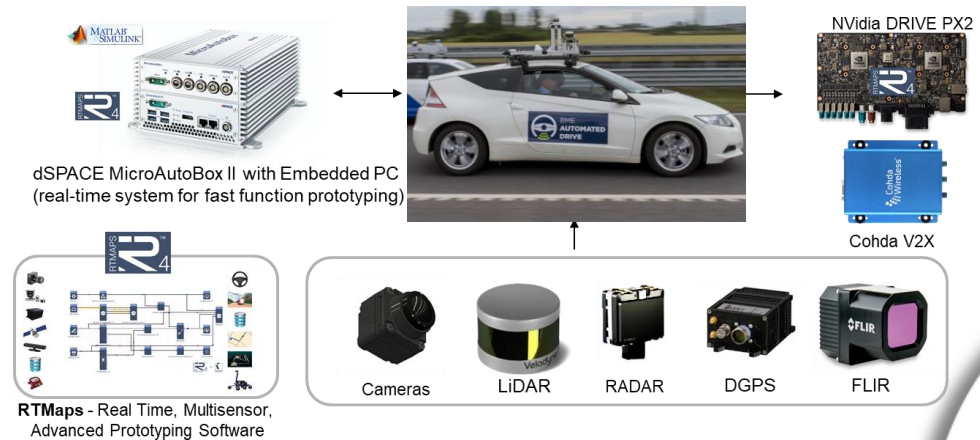 ➢ Automated drifting

Environment perception applications

➢ Vehicle with full sensorset
  ➢ Data collection
  ➢ Real time operation

➢ Infrastructure sensors

dSPACE MicroAutoBox II with Embedded PC
(real-time system for fast function prototyping)

NVidia DRIVE PX2

Cohda V2X

RTMaps - Real Time, Multisensor,
Advanced Prototyping Software

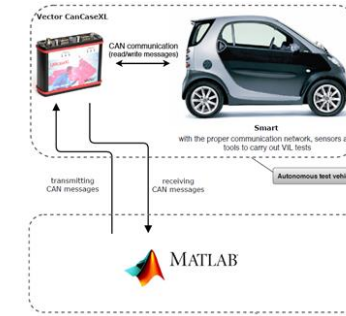Cameras   LiDAR   RADAR   DGPS   FLIR

Research of testing methods of CAM on proving grounds

Special testing methodologies

➤ **Vehicle in the loop methodology**

    Safe testing with bypassing perception

➤ **Scenario in the loop methodology**

    Simulation with digital twin of Vehicle under test
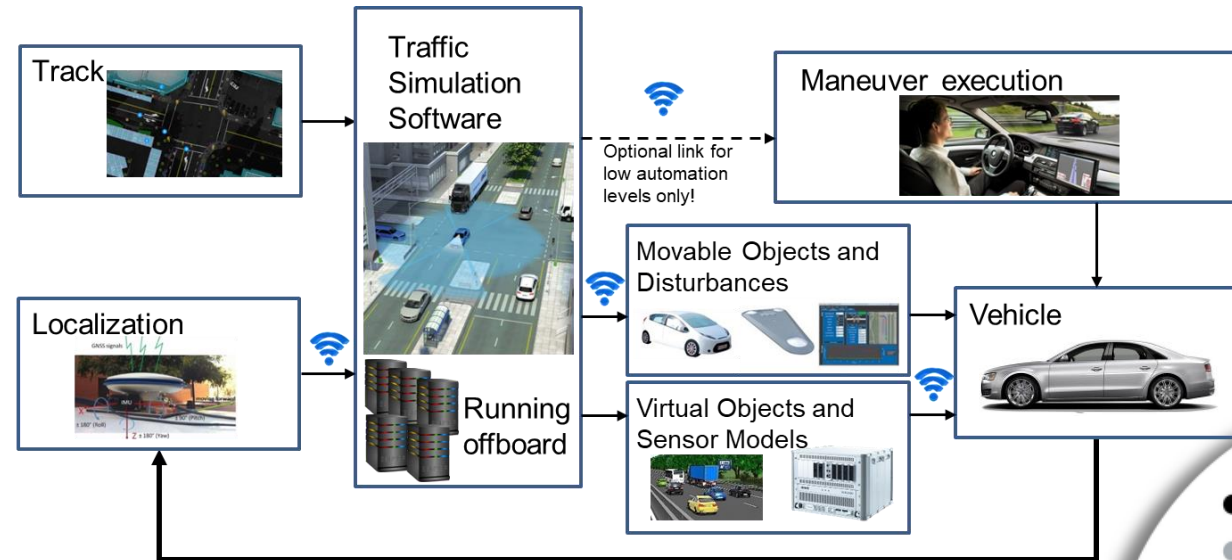
    Virtual object injection possibility

    Repeatable test with controlled elements

    Status

        PoC done

        Ongoing application with Bosch systems

Research of complex cloud based central architecture for supporting CAM

System properties

- Real time digital world model including
- Static 3D HD Map
- Low dynamic information (road works, weather, traffic)
- High dynamic information, vehicles, pedestrians…
- Central, real time fusion combining in vehicle and infrastructure sensor set
- Data record buffer
- Using international standards for overall system (OpenDrive, Sensoris, Adasis…)
- Support automated vehicles with real time environment data
- Ability to control automated vehicles, infrastructure elements (e.g. traffic lights), proving ground elements (dummy, platform)
- Handle scenario in the loop testing
- Cloud based distributed computation system, may include in vehicle resources
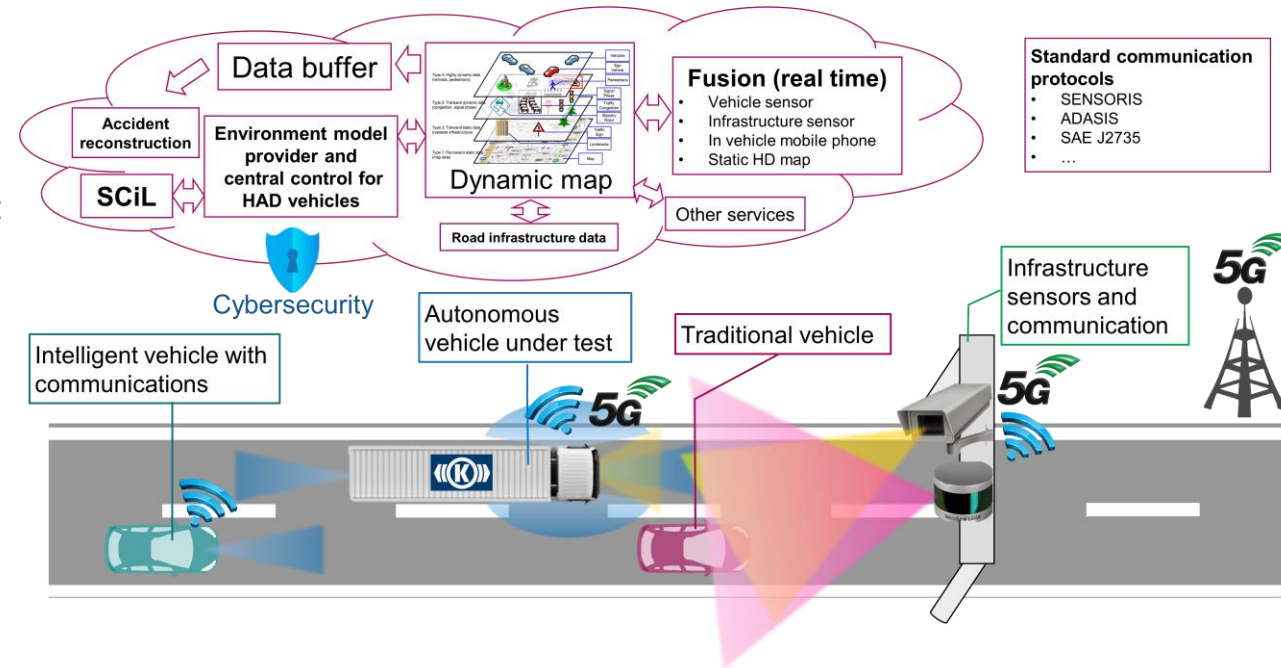
Partners

Research of complex cloud based central architecture for supporting CAM
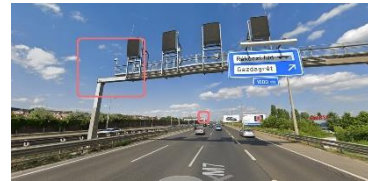
Application of system

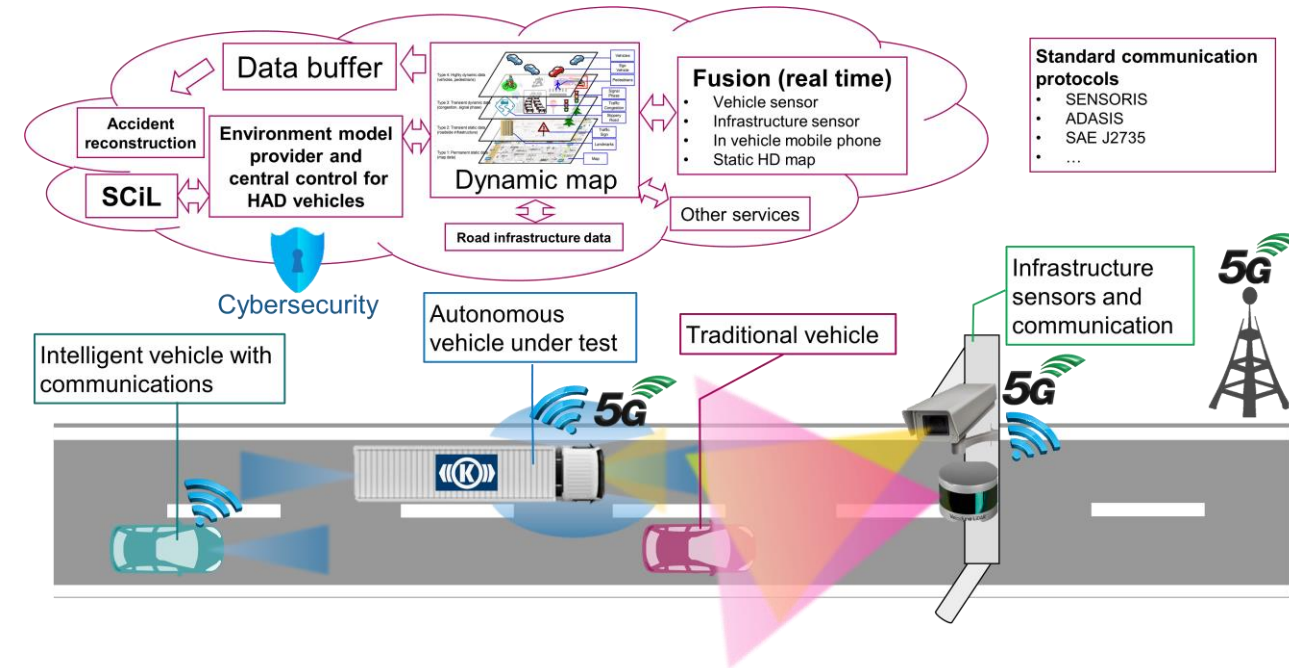➢ **ZalaZONE proving ground**
   First tests 2021

➢ **M1-M7 common section**
   CCAM Living lab, 2021-2022

➢ **M76 Smart road section**
   2022-2023

Partners

Highlights from ZalaZONE research achievements

➢ PoC demonstration of SciL with 5G new radio

➢ Automated driving on dynamic limits - Autonomous drifting

Scenario in the loop youtube video link

Scenario in the loop demonstration using 5G network

The video was captured during the opening ceremony of ZalaZONE proving ground in 2019 May. The fully automated smart vehicle do automated Valet parking and traffic jam pilot while a simulation server communicates with it through 5G network and provides the SCiL simulation with virtual object injection as well as real dummy control

https://www.youtube.com/watch?v=Ue3W7cjUtf8

Virtual object
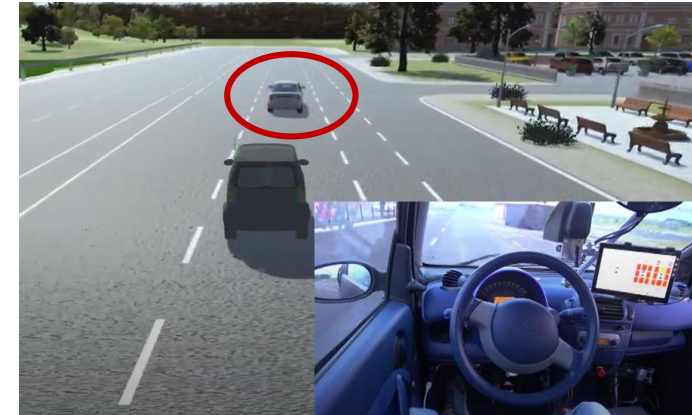
Real object (Dummy)

BMW M2 automated drift youtube video link

BMW M2 automated drifting

We are presenting our BMW M2 automated drift demonstrator vehicle. During the video, the vehicle fully controls the stabilized drift

https://www.youtube.com/watch?v=saFgazF2bcs

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ZalaZONE - Region Zala

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