The Digital Future of Driving

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State Secretary for Education

MINISTRY
OF HUMAN CAPACITIES
1. WHAT IS THE CHALLENGE?
## Mobility Challenges

### Inspirating factors for development

<table>
<thead>
<tr>
<th>Number</th>
<th>Challenge</th>
<th>Improvement/Strategy</th>
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</table>
| 1      | Zero Emission                      | - Fuel-consumption reduction
                               | - Reducing emission                                                                 |
| 2      | Demographic pressure               | - Support of insecure leaders
                               | - Increase the elderly mobility                                                      |
| 3      | Risk of accidents                  | - Avoidance of the accidents by reducing the effect of human mistakes                 |
| 4      | Increasing traffic density         | - Management of transport process
                               | - Comfortable, time-saving travel                                                   |
| 5      | Assistance systems                 | - Intelligent sensors for appropriate process
                               | - Intelligent actuators (steering, brakes, etc.)                                    |

Source: VDA
Multi-level Approach

What is the challenge?

There is no one single good solution

Optimization of the components and the whole conventional drive train system

Introduction of new alternative fuels, drive systems, enhance energy recuperation

Control of vehicle groups on different levels: traffic control, platoon control, fleet control
2. TECHNICAL AND LEGAL ANSWERS
Is this the future? In some sense: Yes

Technical and legal answers

Optimal bio-intelligent system

- Transferred goods and navigation system
- Primary environment observer
- Redundant observer
- Transfer of the motion demand
- Motion coordination
- Biomechanical motion realization
Architecture in more technical way

Corresponds to the bio-intelligent system

**PHYSICAL SEPARATION**

- CABIN
  - Only Electrical Interface

- DRIVELINE

**FUNCTIONAL SEPARATION**

- New operating philosophy: sidestick, ...
- ACC, lane follower, autonomous driving
- Collision avoidance
- Translation to powertrain component inputs
- ESP, ESP with steering
- Mechatronic subsystems: steering, engine, transmission...

- MMI (Man-Machine Interface)
- Automation of inputs
- Predictive input correction
- Powertrain co-ordination
- Reactive input correction
- Execution

speed vector

Corresponds to the bio-intelligent system
Impact of Driver’s Responsibility Change

New architecture will be required

TODAY 2017
- Lane departure warning
- Longitudinal control
- Emergency brake system
- Active steering
- ACC
- Object detection in dead spot
- LKA

TOMORROW < 2020

FUTURE > 2020
- Automated driving: The driver can do other activities
- Autonomous driving: Low following distance, lower fuel consumption

**DRIVER IS PART OF THE VEHICLE CONTROL „FAIL SAFE“ SYSTEM**

**DRIVER IS INACTIVE „FAIL TOLERANT“ SYSTEM**

Source: Volvo, Knorr-Bremse
Legal, Moral, Safety issues...

Non-technical questions will also appear

- Can we take away the enjoyment of driving from the driver?
- As different to the other co-operatively drivable vehicles (plane, boat, rail) we must be ready to manage the vehicles to handle the dangerous situations while having human participants with unperfect and very different abilities?
- What is the base of decision if we must choose from two bad options?
- Liability and legal concerns remain open for a while...
- New business models/players will appear
- New concerns will rise: how can we guarantee, that autonomous vehicles will not be put in non-proper use, etc.

Number of test/use cases can exponentially increase

Source: Technologiereview, VDA
Technical and legal answers

New Business Models will Appear – Partner Portfolio

Letter of Intent (LoI)

Memorandum of Understanding (MoU)

Memorandum of Understanding (MoU) WG

Non-Disclosure Agreement (NDA)

Non-Disclosure Agreement (NDA) WG

Indication of Interest...

Need follow-up...
3. HOW TO SECURE THESE SOLUTIONS? WHY HUNGARY?
How to secure these solutions?

Long term competency in electronic vehicle control

Participation in all relevant large scale EU FP projects
How to secure these solutions?

Supported Research – Comprehensive Program

Scientific Areas

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<tbody>
<tr>
<td>• Knowledge representation • Intelligent Data Analytics • Machine Learning and Conclusions • Human-Machine-Interaction</td>
<td>• Autonomous, Distributed, Hierarchic and Cooperative Modeling and Control • Human-Machine-Interaction • Energy Management</td>
<td>• Platforms and Standards • Design, Testing and Validation • Reliability • Virtualization</td>
<td>• Data Mining and Analytics • Cloud Technologies • Internet, IoT • Sensor Fusion • Mobile Technologies • Wired and Wireless Communication</td>
<td>• Functional Safety • Cyber Security • Data Ownership and Access Control • Privacy • Traffic Safety • Accident reconstruction</td>
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Research Directions

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<th>Vehicle</th>
<th>Vehicle-Environment Connection</th>
<th>Environment</th>
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<td>• Automated Vehicle Control (Level2-5) • Driverless • Human Factors • Testing and Validation</td>
<td>• Environment Sensing • Cooperative Control • V2X Communication</td>
<td>• Intelligent Transportation Systems • Mobile Communication Systems • Smart Infrastructure • Electromobility</td>
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Scientific Publications and Know-how

BME KJK

MTA SzTAKI
How to secure these solutions?

Public road tests are allowed in Hungary

Today

- Public road tests are allowed in Hungary since 12th of April, 2017
- Anywhere in Hungary for automotive R&D companies after registration at Ministry

... and tomorrow

- Specific routes on public road with enhanced services for automated and connected vehicle tests
- Integration to Prove Ground in Zalaegerszeg
- Smart city zone in Zalaegerszeg
- Part of cross-border cooperation between Zalaegerszeg-Graz-Maribor
  - 2018 Q2: M7 highway
  - 2019: M70
  - 2020: Zalaegerszeg smart city
  - 2021-2022: R76 highway
Decision on a 140 Millions Euro Public Investment

Requirements are determined by the Industry

- Capacity constraints in Europe in area of vehicle dynamic testing
- Technology change in vehicle industry – single vehicle vs. co-operative vehicle control: different development environment is required
- Decision of Hungarian Government in 2016: „contribution to the success of the European automotive industry”

Test field for classic and automated and connected vehicles in Hungary

![Map showing test field](image-url)
Status of the project

Project Phases

Phase 1: 2017-2018
(70MEUR)

1 Dynamic platform
2 Brake surface
3 Handling track
4 Smart city I.
5 Rural road
6 Motorway section
7 Diverse tracks
8 Smart city II.
9 High speed oval

Phase 2: 2018-2020
(70MEUR)
How to secure these solutions?

Proving Ground Modules - Example

**Motorway**

**Parameters:**
- 1500m 2 x 2+1 lane motorway
- 100m real tunnel
- Partly watered surface
- VMS, 5G test network
- V2X communication coverage
- GPS base station
- Public road like layout (junctions, road surface, geometry)

**“Simulation”:**
- Platooning on motorway at realistic conditions, exits and entrances
- Platooning and cooperative control with limited communication (tunnel)
- Moving and static obstacles
- Construction site situation
- Multi level junction
How to secure these solutions?

Proving Ground Modules

SMART City Zone – Separated Function Zones

Project Phase I. (2017-2018)

1. Low-speed, parking area
2. Multi-lane high speed area
3. Downtown area
4. Suburban area
5. T-junction area
How to secure these solutions?

Proving Ground Modules

3 level approach:

- **1\(^{st}\) level:**
  ITS G5 basic V2X test environment

- **2\(^{nd}\) level:**
  V2X developer environment: freely configurable, open interface for application developers, full data logging infrastructure

- **3\(^{rd}\) level:**
  fully customer defined test environment

- 5G cellular test network for future ITS applications
- Redundant layout for parallel customer networks
How to secure these solutions?

Fully Automatized Complex Test Scenarios

Scenario-in-the-Loop (SciL) Simulation
How to secure these solutions?

Leaving the Closed Testing Environment ...

Zalaegerszeg as Smart/Digitalized City environment for Testing

Test track modules and scenarios for controlled and repeatable tests in a safe environment

City environment for random real-life testing
Public Road Test in 3 Countries

Extended testing zone – test field to city to public roads

- **Loop_1** Local roads (City Zalaegerszeg – being turned into “smart city”)
- **Loop_2** Hungarian roads (Zalaegerszeg-Gyor-Budapest) – Actually designed R76 for automated driving, M7 with modified communication
- **Loop_3** International roads (Graz-Zalaegerszeg-Maribor zone)

*How to secure these solutions?*

Extended testing zone – test field to city to public roads

- Test road (R76) plan
- High level communication technologies for test (M7) plan
- Highway with RSUs (M1)
- Normal highway (M85-86)
- Normal road (86/76)
4. STATUS OF THE PROJECT
Status of the project

Project milestones and basic data

May- Dec, 2017

Aug, 2017 – Jun, 2018

Oct, 2018

DYNAMIC PLATFORM

End of Phase I. Jun, 2018

HIGH-SPEED OVAL
Preparation PART I. Oct, 2018

SMART CITY ZONE I. completion

HANDLING COURSE

BRAKING PLATFORM

INTERNAL ROADS AS TEST ROADS
rural roads, highway (lane 1)

BUILDINGS
main entrance, technical building, control center
Status of the project

Project milestones and basic data

2019-2020

ADDITIONAL MODULS
- Slopes
- Kick-plate
- Bad roads
- Aquaplaning
- Noise measurement plate

ADDITIONAL BUILDINGS
- University Research Center
- Related buildings

SMART CITY ZONE II.

HIGH-SPEED OVAL COMPLETION
Thank you for your attention and check the website www.zalazone.hu