SMART 64 DEFINITION OF NECESSARY VEHICLE AND INFRASTRUCTURE SYSTEMS FOR AUTOMATED DRIVING

Project period: January-June 2011
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Main project contents

Definition of automated driving

• Automated driving means driving enhanced by autonomous (sub)systems that support the driver, while he/she still is in control
• Automated systems can operate continuously or can operate at specific moments when dedicated interventions become necessary
• Automation can cover a spectrum from relatively weak support to highly automated driving
The project in short, aim and approach

Aim of the study: Overview of current state and of strategies towards broad deployment of automated driving

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Process

- Data gathering
  - Technical
  - Non-technical
- Interviews/discussions
- Pressure cooking
  - Joining visions

Result

Answers and Deployment strategies
Vision on automated driving in 2025 – technical view

Infrastructure/Environment

• All traffic participants are connected to each other in some way
• High precise navigational systems are standard
• Smart lanes enhances the level of automation
• Local dynamic maps optimize traffic flow
• Mixed traffic scenarios are established

Every new vehicle...

• Contains a copilot system interacting with the driver
• Communicates with other traffic participants
• Knows its position with high accuracy and reliability
• Comes with a reliable dynamic environmental view (360°)
• Is equipped with actuators that enables active copilot intervention
• Supports the driver actively in many different situations with individualized focus
Roadmap to automated driving – Scenarios on the road

• Mixed traffic on highways
  • Combination of longitudinal and lateral control
  • Cooperative platooning (CAAC)
  • Active lane change and merging

• Mixed traffic in urban environment
  • Automated speed, emergency braking and automated parking applications
  • Protecting vulnerable objects

• Mixed and temporarily dedicated lanes
  • Optimal speed and traffic density
  • CACC, road pricing

Long-term: highly intelligent vehicle capable to manage all situations in all thinkable scenarios
Towards deployment

Two types of issues to be addressed

Technical
- Actuation
- State of the art
- Reliability
- Control units
- Sensor systems
- Positioning, applications

Non-technical
- Driving across Europe
- Key players
- Legal issues
- Liability
- The user
State of the Art – Technical view

• Technical basis today
  • Smart in-car sensors, beginning to be connected
  • Environment detection, fusion and tracking of objects
  • Active assistance by actuation partly takes over control
  • Beginning coverage with broadband communication information
  • Positioning and digital maps for routing

• Hurdles
  • Sensor accuracy and reliability
  • Reliability of wireless communication,
  • Real time performance
  • Cost-performance ratio of components, complexity of on-board software
  • Liability
  • Human driver: acceptance, what’s in it for me?
State of the Art – Application view now ↔ future

There already are a lot of applications...

- Platooning
- Traffic management
- Platooning urban
- Emergency
- Platooning highway
- Lane change assist
- Lane merge assist
- Book a ferry?
- Leave nose snake
- Eco-driving
- Comfort
- Warning
- Active green driving
- Curve speed control
- Powertrain optimisation
- Traffic management
- City car sharing

...and they’re becoming more diverse in the future

Highly intelligent vehicle
Automated driving needs further development on...

- Sensors
  - Reliability
  - Accuracy
  - Costs

- Driver
  - User needs
  - Transitions
  - Training

- HMI
  - Bringing driver into the loop
  - Different feedback channels

- Datafusion
  - Open architecture

- ECU
  - Redundancy
  - Failure levels

- Powersupply

- Supporting technologies
  - Development tools
  - Homologation procedures
  - Standards

- Communication

- Applications

- Powertrain
  - Actuation by wire
  - Failsafe components

- Standards
Liability

- Automated driving applications must comply with the Vienna convention
- The vehicle manufacturer is obliged to deliver a product that is fully tested in all situations and under all circumstances
- The driver remains in control and must be able to overrule the system in any situation
Driving across Europe

- Issues to be solved:
  - Interoperability and standardisation
  - Technical and legislative borderline
Keyplayers involved.... That is changing!
But don’t forget...

What are the drivers for the end-users to go for automated driving?

What’s in it for me?
Human Factors Aspects

Human Factors aspects **within the vehicle:**

- Define the **role of the driver** in highly automated vehicles and develop an appropriate interaction design
- Interaction design and testing how to **bring the driver back in the loop** if there is a need for a transition of control
- Prepare for standardization of critical interaction element (e.g. take-over requests) among OEMs

**Display Components** for a Highly Automated Vehicle (example from HAVEit)
Conclusions

• Three key elements: it is the driver that needs to understand, accept and buy it, it is the technology that has to fulfill the safety requirements and the business models that make deployment reality!

• Technology:
  – Affordable accuracy and reliability of automated systems are needed
  – Standardisation
  – Fail safe, graceful degradation

• Deployment:
  – New parties will take a role in the deployment of automated systems
  – Depending on role governments, dedicated infrastructure will be realised

• Driver:
  – Driver in control: responsibility remains with the driver
  – Adaptation by driver (HMI, training, benefit) is necessary
Issues for discussion

Would fully automated driving be legally possible, accepted by drivers, and desired by other participants in traffic?

Is there anything else beyond automated driving combined with V2X communication?