Automated driving on highways

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The main objective is the development and demonstration of automated and cooperative driving functionalities intended for motorways or motorway-like roads with velocities up to 130 km/h.

Bayrische Motoren Werke AG

Continental AG

Ika, RWTH-Aachen

Volvo Group

Volkswagen AG
Challenges and motivation

Traffic conditions’ variety

Demanding and repetitive tasks

Human failures
Automated driving on highways: Objectives

- Conditional automated driving up to 130 km/h on highways for long distances
- From entrance to exit, on all lanes, incl. overtaking
- Driver must activate the system, but does not have to monitor the system
- Driver can at all times override or switch off the system
- Take over request in time, if automation gets to its system limits
- Comfort benefit via relaxing and use of selected infotainment functionalities
- Safety benefit via relief of the driver: no exhausting, manual driving during long-distance driving
Automated driving on highways: Achievements

- Continuous automated driving from entrance to exit for long distances
- Driver take-over situations e.g. from “partial automated” to “driver only” or “conditional automated” to “driver only” demonstrated and evaluated
- Improve energy efficiency using information of digital maps and vehicle sensors, predictive automated driving style
Automated driving on highways: Achievements

• **V2V communication** protocols based on ITS G5 specified to enable **dialog** before and during lane change or filter-in manoeuvres
• Fault-tolerant and resilient **system architecture** for highly automated driving functions
Achievement: Cooperative merging on highways

Use of V2V communication for cooperative merging
- status information
- information about the environment (collective perception)
To be continued...

Please attend presentation in exhibition room tomorrow at 10:45!
Achievement: System Architecture

Hazard & Risk Assessment → Safety Goals → Functional Safety Requirements

Logical System Architecture

Function & Requirements Mapping

Duo-Duplex Architecture

Harmonization of Driving Maneuvers
Lane Change, Minimal Risk, Stop & Go, Green Driving

Technical Safety Concept

Use cases & Requirements
Achievement: System Architecture

Hazard & Risk Assessment → Safety Goals → Functional Safety Requirements

Logical System Architecture

Harmonization of Driving Maneuvers

Functional Safety Concept

Duo-Duplex Architecture

Use cases & Requirements

To be continued...

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Achievement: Demonstrators

- Combines highway and urban functions in a single car
- Automated changes between motorways

- Fail-tolerant, multimodal lane perception
- Driver- and system-initiated lane changes
Achievement: Demonstrators

- Fully integrated Human-vehicle interaction
- Cooperative merging based on V2V communication

- Lane change request handling on drivers discretion
- Cooperative merging based on V2V communication
Outlook

- Handling complex scenarios such as automated guidance through highway intersections and cooperative manoeuvre planning in dense traffic
- Integrating precise maps and a robust localization into the environment representation using standard sensors, including automatically updates of maps via information aggregated from on-board perception
- Automated vehicles must be designed and implemented as fail-operational systems and need to ensure safe operations, even in case of a failure
Thank you.

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