AdaptIVe: Automated driving applications and technologies for intelligent vehicles

Jens Langenberg
Aachen
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## Facts

<table>
<thead>
<tr>
<th>Budget:</th>
<th>EUR 25 Million</th>
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<td>European Commission:</td>
<td>EUR 14.3 Million</td>
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<tr>
<td>Duration:</td>
<td>42 months (January 2014 - June 2017)</td>
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<td>Coordinator:</td>
<td>Aria Etemad, Volkswagen Group Research</td>
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<td>8 Countries:</td>
<td>France, Germany, Greece, Italy, Spain, Sweden, The Netherlands, United Kingdom</td>
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29 partners
# Motivation for automated driving functions

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
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<tbody>
<tr>
<td>Zero emission</td>
<td>Reduction of fuel consumption &amp; CO\textsubscript{2} emission</td>
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<td>Optimization of traffic flow</td>
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<td>Demographic change</td>
<td>Support unconfident drivers</td>
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<td>Enhance mobility for elderly people</td>
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<tr>
<td>Vision zero</td>
<td>Potential for more driver support by avoiding human driving errors</td>
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Aachen Colloquium 2015, Aachen
Potentials for automated driving

Drivers are supported in demanding or repetitive tasks. Travel comfort increases.

Vehicles dynamically adapt the level of automation according to the current situation.

Vehicles react more effectively to external threats.

Vehicles are resilient to different types of system and human failure.
Objectives
Demonstrators and Functions

e.g. automated parking, parking assistance, ...

e.g. intersections and traffic lights, urban roundabouts, ...

e.g. cooperative merging, predicted driving, ...

minimum risk manoeuvre
Levels of driving automation acc. to SAE and VDA

Source: SAE document J3016, “Taxonomy and Definitions for Terms Related to On-Road Automated Motor Vehicles”, issued 2014-01-16, see also http://standards.sae.org/j3016_201401/
Automation in highway scenarios: Innovation

- Improve energy efficiency using information of traffic control systems, digital maps and vehicle sensors, *predictive automated driving* style
- Particular manoeuvres like the minimum risk manoeuvres *transparently indicated* to other traffic participants
- Fault-tolerant and resilient *system architecture* for highly automated driving functions
Automation in highway scenarios: Innovation

- V2V communication protocols based on ITS G5 will be specified to enable dialog and negotiations before and during lane change or filter-in manoeuvres.
- Driver take-over situations e.g. from “partial automated” to “driver only” or “conditional automated” to “driver only” demonstrated and evaluated.
Level 3 Highway Chauffeur

- Conditional automated driving up to 130 km/h on motorways or similar roads
- 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
- Safety benefit via relief of the driver: no exhausting, manual driving during long distance driving
- Comfort benefit via relaxing and use of selected infotainment functionalities
Functions Level 3 Highway Chauffeur

- Level 0: No automation
- Level 1: Assisted
- Level 2: Partial automation
- Level 3: Conditional automation
- Level 4: High automation
- Level 5: Full automation

Minimum risk manoeuvre:
- Enter and exit highway
- Cooperative response to emergency vehicles
- Following lane and vehicle
- Lane change and overtaking manoeuvre
- Stop & go driving
- Speed and time-gap adaptation
- Cooperative merging
- Danger spot intervention
- Predictive automated driving
Automation in highway scenarios: Filter-in manoeuvres

This situation is hard to solve for an automated vehicle of the first generation!
Automation in highway scenarios: cooperative driving

Within AdaptIVe, a cooperative automated driving vehicle will send / receive and process the following information via vehicle-2-vehicle communication:

- status information
- information about the environment (collective perception)
- information about intention
Filter-in manoeuvres: Phase 1
Find a Gap!

sharing information about the environment (collective perception)
Filter-in manoeuvres: Phase 2
Discuss about intention!

sharing information about the intention
Filter-in manoeuvres: Phase 3
Conduct manoeuvre!
As long as there are no fully autonomous systems, systems always have to interact with humans at different times and to different degrees.

Goal: Safe and efficient transitions
Human Factors: Ironies of Automation

- Automation takes over tasks that humans find annoying or are bad at
  - But: Operator has to monitor if the system is doing the right thing
- The more reliable the automated system, the lesser the human has to intervene and correct the automation
  - But: The lesser the human has to intervene, the harder it will be
Tasks

- Develop **high-level use cases** for test and development throughout the project
- Collect **research issues** on the interaction of drivers with automation in vehicles that currently remain uninvestigated or unresolved
- Conduct **experiments** in different laboratory settings, including dynamic driving simulators, and, if suitable, also instrumented test vehicles
- Create **functional requirements** and decision strategies for collaborative automation in particular situations
Thank you.

Jens Langenberg
jens.langenberg1@volkswagen.de

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