Vision for Automated Driving

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28 partners
Examples of driver assistance systems

**Longitudinal control**
- City Break Assist
- ACC & Front Assist

**Lateral control**
- Side Assist
- Lane Assist

**Park assist systems**
- Park Assist
- Park Pilot
- Rear Assist

**Light**
- Light Assist

**Recommendation**
- Pause Recommendation

**Driver information**
- Road sign
- Sign Assist
// Examples for automated driving - industrial projects

<table>
<thead>
<tr>
<th>Project</th>
<th>Year</th>
<th>Company</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bertha Benz drive</td>
<td>2013</td>
<td>Mercedes</td>
</tr>
<tr>
<td>Traffic jam pilot</td>
<td>2012</td>
<td>Audi</td>
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<tr>
<td>Motorway pilot</td>
<td>2011</td>
<td>BMW</td>
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<tr>
<td>Google car</td>
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<td>Google</td>
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<td>Audi</td>
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<tr>
<td>Junior</td>
<td>2007</td>
<td>VW</td>
</tr>
</tbody>
</table>
Examples for automated driving - funded projects

- **eT!: Follow me!**
  - 2011 eT! (BMU)
  - © VW

- **AutoNOMOUS**
  - 2011 FU Berlin (BMBF)
  - © FU Berlin

- **Emergency stop assistance**
  - 2011 SmartSenior (BMBF)
  - © BMW

- **Temporary auto pilot**
  - 2011 HAVEit (EU)
  - © VW

- **Platooning**
  - 2012 Sartre (EU)
  - © Volvo

- **Parking and charging**
  - 2011-2015 V-Charge (EU)
  - © VW
Motivation for automated driving functions

**Zero emission**
- Reduction of fuel consumption & CO₂ emission
- Optimization of traffic flow

**Demographic change**
- Support unconfident drivers
- Enhance mobility for elderly people

**Vision zero**
- Potential for more driver support by avoiding human driving errors
Terms related to automated driving

- Driverless
- Full automation
- High automation
- Partial automation
- Conditional automation
- Autonomous
- Piloted
- Self driving
- Partial autonomy
- Semi automated
- Fully autonomous
Levels of driving automation acc. to SAE and VDA

<table>
<thead>
<tr>
<th>Level 0</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
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<tr>
<td>No automation</td>
<td>LDW</td>
<td>LKA</td>
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<td>Traffic Jam Chauffeur</td>
<td>Parking Garage Pilot</td>
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<td>level 1</td>
<td>level 2</td>
<td>level 3</td>
<td>level 4</td>
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**Driver in the loop**
- No significant change with respect to existing driver assistance systems

**Driver out of the loop**
- Not in accordance with regulatory law (Vienna Convention of 1968, national road law)
- Shared responsibility for control between driver and system

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/
Widespread application of automated driving to improve traffic safety, efficiency and comfort
Automation Scenarios

< 30
< 70
< 130
// Introduction scenario

ACC: Adaptive Cruise Control  
LKA: Lane Keep Assist  
LDW: Lane Departure Warning  
FCW: Forward Collision Warning

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<thead>
<tr>
<th>2</th>
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<tr>
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<td>FCW</td>
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ADAS today  
ADAS tomorrow
Partial automated parking into and out of a parking space

On public parking area or in private garage

Via Smartphone or key parking process is started, vehicle accomplishes parking manoeuvre by itself

Driver is located outside of the vehicle

Driver has to constantly monitor the system, stops parking manoeuvre if required

Safety benefit due to avoidance of parking damages and improved environment observation

Comfort benefit because getting into and out of the car is simplified, especially for narrow parking spaces or garages
## Introduction scenario

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<table>
<thead>
<tr>
<th>ADAS today</th>
<th>ADAS tomorrow</th>
<th>Automation Gen. 1</th>
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</thead>
</table>
Traffic Jam Chauffeur // level 3

- **Conditional automated driving** in traffic jam up to 60 km/h
- On motorways and similar roads
- System can be activated, if **traffic jam scenario** exists: detection of slow driving vehicles in front
- Driver must deliberately activate the system, but does not have to monitor the system constantly

- Driver can at **all times override** or switch off the system
- Take over request if traffic jam scenario does not exist any longer
- **Safety benefit** via relief of the driver: no exhausting, manual driving during traffic jams
- **Comfort benefit** via relaxing and use of selected infotainment functionalities
## Introduction scenario

<table>
<thead>
<tr>
<th>Automation Level</th>
<th>ADAS Today</th>
<th>ADAS Tomorrow</th>
<th>Automation Gen. 1</th>
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<td>LKA</td>
<td>Traffic jam chauffeur</td>
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</table>
Highway Chauffeur // level 3

- Conditional automated driving up to 130 km/h on motorways or similar roads
- From entrance to exit, on all lanes, incl. overtaking
- Driver must deliberately activate the system, but does not have to monitor the system constantly
- 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
Parking Garage Pilot // level 4

- Highly automated parking including maneuvering to and from parking place (driverless valet parking), in parking garage
- Driver does not have to monitor the system constantly, may depart
- Via Smartphone or key parking manoeuvre and return of the vehicle is initiated

- Safety benefit due to avoidance of parking damages
- Comfort benefit due to time saving: short distances, customer does not have to access the parking garage
### Introduction scenario

<table>
<thead>
<tr>
<th>No</th>
<th>Full automation</th>
<th>Partial automation</th>
<th>Conditional automation</th>
<th>High automation</th>
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<td>Highway Chauffeur</td>
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<td>5</td>
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<td>Robot Taxi</td>
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</table>

**ADAS today**

**ADAS tomorrow**

**Automation Gen. 1**

**Automation Gen. 2**

n.a.
Demonstrators

Parking assistance, garage, special areas, multi-level garage, Stop & go

City cruise, City chauffeur, Supervised city control

Enter & exit highway, following lane, lane-change, filter-in, overtaking, danger spot intervention, Stop & go

Safe stop

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