Final Event

**Highly Automated Driving: Fiction or Future?**

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VOLKSWAGEN AKTIENGESELLSCHAFT
Motivation

- The driver as the unpredictable factor: Human error is the cause of 95% of all fatal accidents

Source: Volkswagen accident research
Motivation

- ACATECH - Scenario: Progression in road traffic 2002 – 2020

  - Passenger traffic: + 20 %
    disproportional on motorways (+ 30%)

  - Goods traffic: + 34 %
    disproportional on motorways (+ 45 %)

  (mileage, i.e. traveled kilometers)
Motivation

- Application field of automated driving functions

- Driver underload
  - Vigilance / drowsiness
  - E.g. boring situations like traffic jams or long distance driving

- Optimum
  - Driving fun

- Driver overload
  - Multiple task
  - E.g. intensive situations like turning maneuvers at intersections

Driver performance

- Driver performance
  - Negative

Optimum

- Activation
- Low
- High

Need for assistance

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Status of Automated Driving at Volkswagen

- **2005**
  - **Stanley**
  - Desert race of autonomous vehicles

- **2006**
  - **GTI 53+1**
  - Automated driving at the dynamical limits

- **2007**
  - **Junior**
  - Urban race of autonomous vehicles

- **2007**
  - **Paul**
  - Automated parking with driver outside

- **2010**
  - **Pikes Peak**
  - Automated driving at the dynamical limits at Pikes Peak

- **2011**
  - **TAP**
  - Automated driving on motorways
Status of Driver Assistance Systems at Volkswagen

**Actuators:** Longitudinal and lateral control can already be triggered electrically in many vehicles.

**Passat**  
**Passat CC**  
**Golf**

**Sensors:** Existing products offer a good basis for the implementation of automated driving functions.

**Longitud. Control**  
**ACC**  
**Front Assist**

**Lateral Control**  
**Side Assist**  
**Lane Assist**

**Parking**  
**Park Assist**  
**Rear Assist**  
**Park Pilot**
Roadmap: Evolution instead of Revolution

- **Longitudinal**
  - ACC Follow to Stop
  - ACC Stop & Go

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

- **Longitudinal and Lateral**

  - Automated Queue Assistant (AQUA) (Vmax = 30 km/h) VOLVO trucks
  - Temporary Auto Pilot (TAP) (Vmax = 130 km/h) VOLKSWAGEN AG

Time

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Challenge Environment Sensors
Is there a sufficiently powerful but affordable sensor platform?

For initial highly automated driving functions a powerful, redundant and comparably conventional sensor platform can be found. Example: Temporary Auto Pilot

- **77GHz radar**
  - vehicles

- **mono camera**
  - Lane markings

- **ultrasonic sensors**
  - vehicles, pedestrians

- **laser scanners**
  - vehicles, pedestrians

- **E-horizon**
  - traffic signs, curvature
Challenge Environment Perception
Based on sensor data: Is there a consistent image of the vehicle environment?

Approach of a modular sensor data fusion is essential. Example: Temporary Auto Pilot

Environment sensors
- 77 GHz radar
- Mono Camera
- Laser Scanner
- Ultrasonic sensors
- Map

Environment model
- Grid fusion (Free areas)
- Object fusion (Obstacles)
- Lane fusion (Path)

Situation interpretation
- Cut-in prediction

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Challenge Legal Aspects
Are automated driving functions in accordance with the Vienna Convention (VC)?

Highly automated driving functions (driver in the loop) are expected to be in accordance with regulatory law (VC), fully automated driving functions (driver out of the loop) probably not.

Working Group of the German Federal Highway Research Institute (BAST)

Title: Legal consequences of an increase in vehicle automation


Participants: bast, BMW, BOSCH, DLR

Approach: Define hypothetical automated driving systems
Legal assessment with respect to regulatory law and liability law

Result: See above
Challenge Controllability
Is the driver always aware if he or the system steers, accelerates or brakes?

The sophisticated HMI concept developed in the HAVEit project is an enabler for the integration of highly automated driving functions with current driver assistance systems.

Driver only

Driver only
ACC ready

ACC active

ACC active
Pilot ready

Pilot active
Challenge Misuse
How to detect distracted and sleepy drivers in the automated driving mode?

The HAVEit approach of combining different information sources for the detection of distraction and fatigue is very promising.
Thank you for your kind attention!