BMW 2021: ROADMAP TOWARDS AUTOMATED DRIVING.
THE DEVELOPMENT OF AUTONOMOUS DRIVING IS STRONGLY DRIVEN BY CUSTOMER, COMMUNITY AND TECHNOLOGY.
FIRST IDEAS BEING IMPLEMENTED MORE THAN TEN YEARS AGO.

<table>
<thead>
<tr>
<th>Product/Feature</th>
<th>Year</th>
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</thead>
<tbody>
<tr>
<td>BMW Track Trainer</td>
<td>2006</td>
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<tr>
<td>Remote Controlled Parking</td>
<td>2008</td>
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<tr>
<td>Emergency stop assistant</td>
<td>2009</td>
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<tr>
<td>Highly automated driving on the motorway (Gen1: 2011; Gen2: 2014)</td>
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<tr>
<td>Highly automated driving at the limits of vehicle dynamics (2014)</td>
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<tr>
<td>Fully automated remote valet parking</td>
<td>2015</td>
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</tbody>
</table>

Automated driving. Dirk Wisselmann, BMW Group.
DRIVER ASSISTANCE IN THE NEW BMW 5 SERIES: 23 SENSORS SCANNING THE ENVIRONMENT.
DRIVER ASSISTANCE IN THE NEW BMW 5 SERIES: DRIVING COMFORT, DRIVING SAFETY, PARKING

- Crossing traffic warning rear / front
- Lateral parking aid
- Night Vision
- Distance information
- Lane departure warning
- Wrong Way Assist
  - Lane change warning
  - Speed Limit Assist
    - Approach control warning with braking function
- Active Park Distance Control
- Parking assistant
- BMW Selective Beam
- Remote Control Parking
- Panorama View
- Speed Limit and No Pass information
- Speed Limit Device
CROSS-INDUSTRY-COOPERATIONS: TOGETHER WITH OUR PARTNERS WE’RE SHAPING THE FUTURE OF AUTONOMOUS DRIVING.

COOPERATION
- Sensors: camera, radar, lidar
- Object fusion
- Road model
- Driving strategy / planning

HD-MAP
- Centimeter precision
- Real-time capable
- Highly available and reliable

INFRASTRUCTURE 5G
- Ultra low latency
- Ultra high reliability
- Ultra high data rates

TEST FIELDS
- Worldwide regulation
- Unified homologation
- Safe and secure development
- Public funded projects

Automated driving. Dirk Wisselmann, BMW Group.
HAD AND FAD: VIRTUAL ASSESSMENT OF THE ENTIRE DRIVING SITUATIONS.

Assessment Results

Virtual Assessment

Software in the Loop
Hardware in the Loop
Driving Simulator

Vehicle Testing
(NDS, fleet, proving ground, …)

Model Database

Scenarios
(exposition, environment, …)

Road Users
(driver, pedestrian, …)

Vehicle
(driving dynamics, …)

Sensors
(radar, lidar, camera, …)

Situation space mainly covered by virtual assessment

Legend:

relevant situations for further investigation
validation, verification

results

models

10^6 scenarios
10^3 scenarios
10^2 scenarios

Source:
Requirements on tools for assessment and validation of assisted and automated driving systems

Udo Steininger, TÜV SÜD Auto Service, Dr. Hans-Peter Schöner, Daimler, Dr. Mark Schiementz, BMW

Automated driving, Dirk Wisselmann, BMW Group.
VISION OF ACTIVE SAFETY EVALUATION. PROCESS AND ROLES.

Neutral (scientific) institutions

- Accident data
- Traffic data
- Human factor data

Industry

- Stochastic scenarios
- Simulation and analysis
- ADAS model

Results

Test institute

- Case selection
- Spot testing
- Weighting of simulated results
- Rating

Automated driving. Dirk Wisselmann, BMW Group.
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**Homologation and Certification**
- Germany enacted in June 2017 the worldwide first law to regulate the operation of L3/4-vehicles.
- Further legal adaptations are required (STVO, UN-ECE).

**Liability**
- Less accidents caused by individual driving faults. Increasing relevance of technical mistakes and product liability.
- We see the existing liability-principles as particularly suitable for partially, highly and fully automated vehicles.

**Ethics (machine decisions)**
- Qualification-Algorithms violate the human rights. Priorization of material damage to avoid injuries of persons should be possible.
- Ethical decisions („qualification“) nearly not to find in today's accident studies.
- With further improvement of perception capabilities realization of vision „zero“.
EXCITING TIMES AHEAD – THANK YOU FOR YOUR INTEREST.