Új technológiák a közlekedésbiztonság jövőjéért

Dr. Szászi István
Chassis Systems Control
Occupant Safety
Robert Bosch Kft.
Outline

1. Active and Passive Safety - definition
2. Driver Information Functions
3. Driver Assistance Functions
4. Predictive Safety Functions
5. Combined Active and Passive Safety Systems
6. Summary and Outlook
1960: Vision

“The development of semiconductors is just at the beginning...

Using semiconductors, ideas like electronic gasoline injection as well as control systems that allow steering, accelerating and braking through a small control stick, or steering systems that guide the car automatically on the road, or radar units that show obstacles even in dense fog, as well as some others, can become reality...

Electronics is starting to change and to improve the electric vehicle system and is thus adding increased safety to the car.”
Accident Statistics in Germany

Percent change (1970 = 100%)

- Traffic density
- Total accidents
- Injuries
- Fatalities

Source: German Federal Office of Statistics and Bosch

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Active & Passive Safety - Definitions

Automotive Safety

Accident Avoidance
(active safety, primary safety)

pre crash / preventive

Accident Mitigation
(passive safety, secondary safety)

pre crash
in crash
post crash
Accident Mitigation - Passive Safety Today

source: Daimler AG
Influences on Active Safety

Accident Avoidance
(active safety, primary safety)

Driver
- Perception
- Handling (Driver - Vehicle - Environment)
- Driver status (physical, mental)

Vehicle
- Chassis
- Brake, Acceleration
- Steering
- Handling & HMI
- Comfort, Acoustics, Climate
- Lighting, Visibility

Environment
- Weather, Road condition
- Road Network, Street course
- Road signals
- Other road users
- Information systems

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Road Safety Action Plan - EU25

Goal until 2010: reduction of fatalities from 50,000 (2001) down to 25,000

- Current systems: 41,500 fatalities
- Future systems: 25,000 fatalities

50% reduction

PreCrash

Future driver assistance & PSS-systems

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IFFK-Konferencia, 2009. szeptember 3-5.
Our Vision: the sensitive vehicle

**Long Range Radar**
- long range ≤ 200 m
- horiz. opening angle: ± 8°

**Infrared Light**
- night vision range ≤ 150 m
- horiz. opening angle: ± 10°

**Video**
- mid range ≤ 80 m
- horiz. opening angle: ± 22°

**Ultrasonic**
- ultra short range ≤ 4 m
- horiz. opening angle: ± 60° (single sensor)

**Short/Mid Range Radar**
- short range ≤ 20 – 70 m
- horiz. opening angle: ± 30°

**Video**
- rear area
  horiz. opening angle: ± 60°
Driver Information Functions:

- support the driver actively for his tasks

- Night Vision
- Pedestrian-/Object-Detection
- Video Camera
- Ultrasonic Sensors

Road Sign Recognition

Park Steering Measurement

Park Steering Information
Information Functions: Road Sign Recognition
Stereo-Video for Robust Pedestrian Detection

Crossing Pedestrian

Flow Evaluation

Disparity Evaluation

Combination Flow/Disparity
Driver Assistance Functions: relieve the driver of routine tasks

- **Full-Range ACC**
  - ACCplus

- **Lane Keeping Support**
  - *haptic (steering) feedback*

- **Park Steering Control**

- **Future:**
  - **Integrated Cruise Assist**
    - Combination of longitudinal and lateral guidance control

- **Future:**
  - **Fully Automated Parking**
    - Longitudinal + lateral guidance control

**Future:**
- Fully Automated Parking
- Integrated Cruise Assist

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IFFK-Konferencia, 2009. szeptember 3-5.

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Lane Keeping Support

Robustness

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Accident Causes in German Traffic

- Collision w. Obstacle
- Pedestrian Collision
- Crossing collision
- Frontal collision
- Rear end collision
- Lane change
- Lane departure
- other

*Predictive Safety Systems PSS*:
60% less rear end collisions and 30% less frontal collision if the driver could react earlier by 0.5 sec!
Predictive Safety Functions: reduce accident frequency and severity

- Predictive Brake Assist *SOP 2005*
- Predictive Collision Warning *SOP 2006*
- Predictive Emergency Braking

Vision: Preventive Safety Functions
- Collision Mitigation/Avoidance

Long Range Radar
- Long Range Radar + Video Camera

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Predictive Emergency Braking (PEB)
CAPS – Combined Active and Passive Safety

**Driver Assistance**
- Radar based systems
- Ultrasonic based systems
- Video based systems

**Vehicle dynamics**
- Brake functions
- Vehicle stabilizing

**CAPS**
- Preventive information
- Coordinated interaction
- Added value functions

**Targets:** Accident mitigation and reduced accident severity

**Passive Safety**
- Detection & sensing
- Occupant protection
- Pedestrian protection

**Active Safety**
- Communication
  - Car-to-x communication
  - Visualization
  - Navigation systems

**Targets:** Accident mitigation and reduced accident severity
### Multiphase Safety Concept

**Risk phases (e.g. front crash):**

1. **Risk avoidance: Route guidance**
   - Warn driver in advance in case of e.g. traffic jam or improper speed

2. **Increased risk: Brake preparation**
   - Raise brake efficiency

3. **High risk: Driver warning / accident mitigation**
   - Guide the drivers attention towards crash avoidance

4. **Crash inevitable: Accident preparation**
   - Prepare occupant protection, slow down vehicle

5. **In-crash: Passenger protection**
   - Optimize occupant protection, crash mitigation

6. **After crash: Rescue and information/ protection**
   - Inform rescue services, warn following traffic

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CAPS: Secondary Collision Mitigation (SCM)

Features:

- Addresses accidents with a minor initial collision and impending subsequent collision
- Automatic brake intervention - with or without deployment of irreversible restraint systems

Customer benefits:

- Reduced kinetic energy of impending subsequent crashes
- Improved controllability by driver due to reduced velocity
CAPS: Early Pole Crash Detection (EPCD)

Features:

- Deployment of restraint devices if a door intrusion is experienced after a lateral trip of the vehicle (indicated by a high lateral velocity).
- Side airbags are triggered using pressure sensors in doors and additional ESP sensor informations (yaw rate, velocity, steering angle,..)

Customer benefit:

- Early deployment in case of real world pole crashes - no waiting for plausibility signal from central acceleration sensor.
Cars will soon have 360-degree “surround sensing” which is the basis for innovative driver assistance systems.

Key components are intelligent Radar and Video sensors. Significant developments regarding performance of cost improvements.

Radar offers excellent measurement of distances and speeds. Video allows determination of size and shape of objects. By combination of Radar and Video, the relevance of recognized objects for predictive safety functions can be solidly derived.

Further developments in Video Algorithms allow detection of object movements and improved object classification. Complex scene interpretations will allow for future accident mitigation functions.
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Köszönöm a figyelmet!