Automotive HMI: Current status and future challenges

Major achievements last ten years

- Advanced display technologies have changed the dashboard layout from a rather static to a more flexible, dynamic and adaptable design
- Haptic devices have become available, providing new channels to give feedback to the driver.
- Speech input lower driver's distraction when commanding the vehicle or its options (e.g. navigation devices, radios or mobile phones)
- Better understanding of human factors (e.g. prioritising of tasks)

Major problems, now and in coming ten years

- Market forces are driving towards increased complexity of the driver's working environment
- Nomadic devices are increasing safety risks unless integrated

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Most promising solutions

- Agreed and implemented design principles according to the European Statement of Principles (ESoP) on HMI
- Integration of ADAS requirements into the ESoP
- Fostering the discussion between nomadic device manufacturers and automotive industry in view of better integration into the car environment (in the eSafety Forum Working Group “Nomadic Devices”)

Research needs

- Human centred design and functional HMI integration for intelligent vehicle and cooperative systems
- Flexibility and individualisation of HMI
- Warning and automation strategies

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1. Major achievements in the last ten years

Driver assistance systems enter the market

- ESC is standard equipment for premium to compact cars
- Mass market for navigation and parking systems
- Safety & comfort systems introduced (ACC, LDW, ...)

Significant changes in HMI technology established

- Information is moving closer to the driver
- Input: Steering wheel control, touch screen, central control
- Output: Head-up display, central display, voice, etc

General understanding of DIS/DAS development

- European Statement of Principles, eSafety HMI group
- RESPONSE Code-of-Practice
- Stakeholder awareness by information campaigns

RESPONSE 3
a PReVENT Project

Input to round table discussion
Dietrich Manstetten, Robert Bosch GmbH

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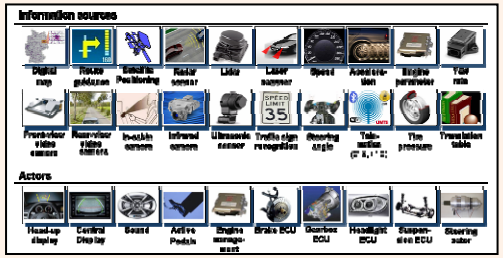
2. Major problems and challenges in next ten years

Integration of multiple assistance systems

- Multiple usage of sensors and actors
- Multiple usage of HMI input and output devices
- Architecture with scaling of functions



Driver distraction and overload

- Distraction as major accident cause (100-car study)
- Increased workload by non-driving related information
- Additional challenge with nomadic devices

Verification of safety and comfort improvement

- Safety requirements in a range of 10^{-6}/h
- High amount of driving tests
- Driver models not validated for safety proof

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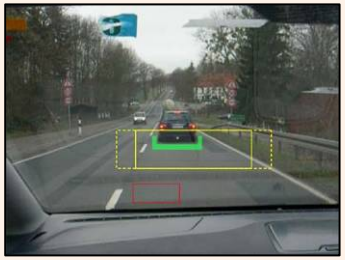
3./4. Most promising means and research needs

Understanding the driver

- Naturalistic driving studies for driver behavior, modeling
- Driver status and driver intention recognition
- For (semi-)autonomus driving: driver-vehicle cooperation

HMI technology improvements

- Natural language interaction
- Head-up displays with wider field of view
- … and more: gesture, finger writing, dual view displays



Management of HMI ressources

- Distraction issue can not be solved by HMI technology alone
- Integration of driving assistance, infotainment, telematics
- Requirements: scalability, flexibility, adaptability

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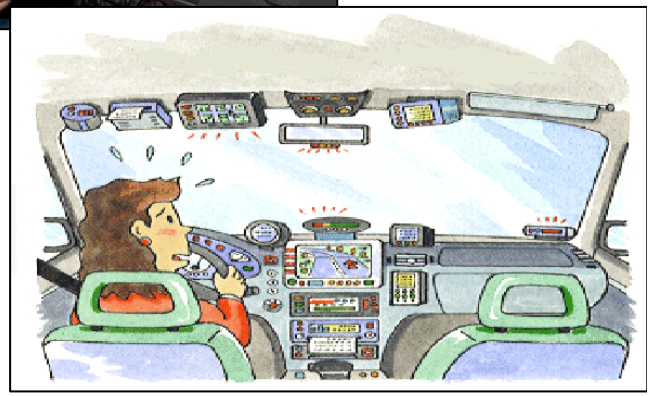

Major achievements ten last years

- Driving task related
- From complex to simple visual representations
- From HMInterface towards HMInteraction
- Multimodal
- First forms of integrated HMI
  - use one HMI,
  - integration of functions and services,
  - manage information
- Take workload and driving environment into account
  - -> workload manager

Major problems, now and in coming ten years

- Safe use (minimal distraction, which criterion to use?)
- Adaptive HMI (workload not the same in each situation)
- Adaptable HMI (workload not the same for different drivers; drivers have their own needs and preferences)
- Driver state monitoring

Automotive HMI: Current status and future challenges

Most promising solutions

- Integrated and adaptive (and adaptable) interfaces important for safe and effcient interaction between driver and system
- Workload related
- Monitoring of road and traffic environment
- Driver state monitoring and development of normative driver model

Research needs

- Integral test and development environment, including dynamic task environment

- Naturalistic driving studies and long-term and large scale FOTs