HoliDes
HOLISTIC HUMAN FACTORS AND SYSTEM DESIGN
OF ADAPTIVE COOPERATIVE HUMAN-MACHINE SYSTEMS

Overtaking

ARTEMIS

Domain

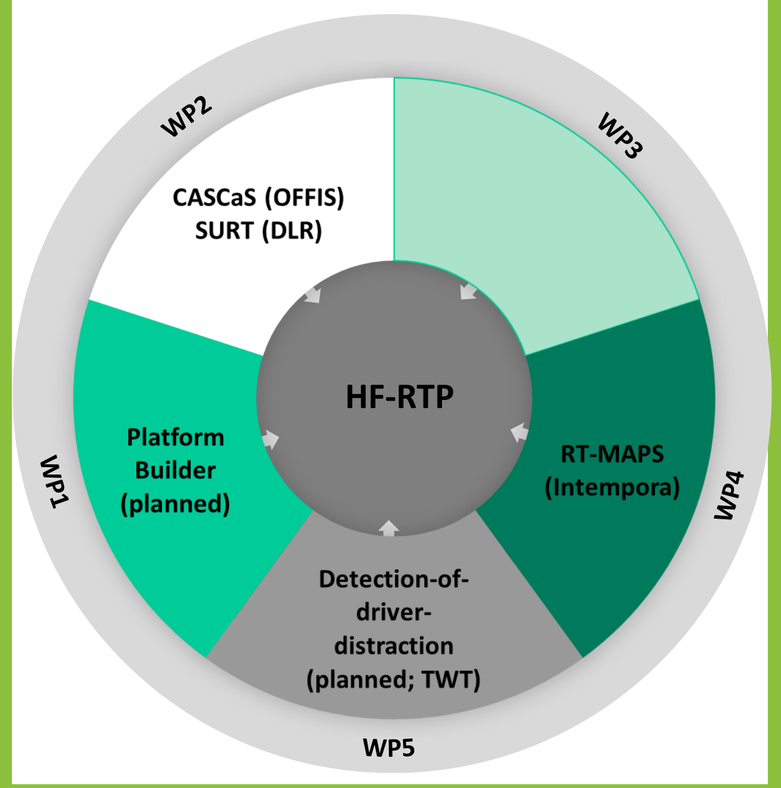
Motivation

Overtaking on motorways is the key scenario for automated driving.

The adaptivity of the HMI AdCoS is based on situational demand and driver distraction. This selection is based on its relevance both for safety and for automation: while it is one of the most relevant accident causation factors when driving manually (Regan et al., 2013) engaging in non-driving related tasks is the major benefit when driving in automatic mode. In the latter case, detecting phases of non-driving related activities is crucial to adapt the start-time of warnings and information.

The TAKATA AdCoS consists of an HMI that comprises the instrument cluster and a generic entertainment system on which a secondary task is presented.

Applied MTTs



Current State: Tailored HF-RTP

To model the adaptivity of the AdCoS - based on situation demand and distraction - both factors have to be assessed reliably and must be made available to a higher order instance that decides on the level of automation or support and warnings via the HMI. To do so, several MTTs from the HF-RTP were selected and adapted to the needs of the adaptive HMI AdCoS: RT-MAPS is used to model the entire system and integrate the different data-sources. Distraction-detection is used to assess the level of distraction (both cognitive and visual). The use of CASCaS will allow the evaluation of future designs.

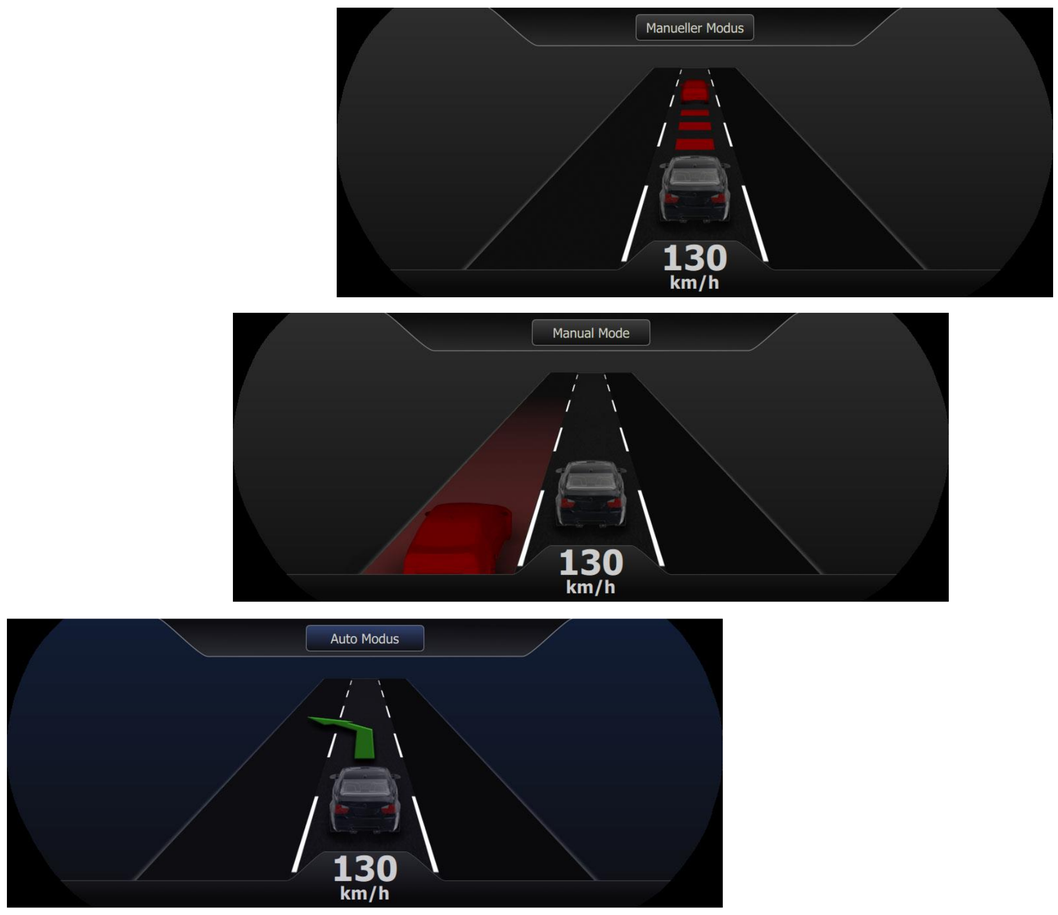


Figure: different views of the instrument cluster.

In the first generation AdCoS described here, visual distraction was induced via the surrogate reference task (SURT).

When the adaptive mode is activated and the situation is critical the source of distraction (in this case the SURT) is deactivated and the time of the warnings is adjusted. The entire AdCoS is integrated into the TAKATA simulator and was evaluated in predefined overtaking scenarios.

Figure: simulator setting and scenarios.

Results

An evaluation study was conducted with the first generation AdCoS. The main results are as follows:

- The modelling and implementation of the AdCoS proved to be successful.
- No positive effects of the adaptivity were found.
- A post-hoc analysis of gaze data revealed the reason: the induction of distraction via SURT was not successful, as drivers stopped engaging in the SURT before the AdCoS could show its positive effects.
- In the second generation AdCoS, the SURT characteristics will be changed to induce a higher level of distraction and an algorithm will be implemented that allows the real-time detection of distraction.

As part of the simulator study the KPIs addressed came from the field of safety measures:

- Robustness & system limits
- Behavioral changes
- Distraction time
- Dynamic indexes measurement
- Predictability
- Workload
- Economic measures.

The impact on these KPIs will be shown in the final version of the AdCoS. This will be done as part of a second simulator study.

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