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Requirements for AIDE HMI and safety functions

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Executive Summary

This deliverable aims to describe the requirements for a fully integrated in-vehicle HMI including all IVIS and ADAS functionalities and their interaction with the driver. The main requirement for such an AIDE HMI is to improve driver system interaction in terms of distraction and usability to increase driving safety and improve user comfort. In order to reach this goal, the AIDE system, in contrast to usual approaches, has to focus on:

- explicitly considering the effects of HMI interdependences, i.e. for example preventing interference between different I/O events presented at the same time to the driver;
- taking into account the driving situation, driver state and driver preferences to adapt the HMI dependent on these conditions, i.e. the interaction may be changed in critical conditions or due to preferences to reduce driver distraction and to draw the drivers attention to the driving task;
- including nomad devices in a common in-vehicle HMI in a way that they do not differ in terms of the HMI strategy from integrated applications.

Consequently the AIDE system has to offer specific functionality for HMI adaptation and I/O management. Thus, a central intelligence controlling the interaction between driver and system, specifically integrated IVIS and ADAS applications and the availability of knowledge about the driver status, the driving situation and driver preferences is needed. This intelligence is called the Interaction and Communication Assistant (ICA) and ensures that information is given to the driver at the right time and in the right way and that only functions that are relevant in the present driving context are active. The core system requirements for this intelligence are named meta-functions in AIDE and they are listed below:

- **Derivation of priorities for the individual (inter-)actions.**
- **Conflict recognition for the actions taking into account**:
    - *user needs (driver model)*
    - *the HMI strategy and philosophy*
    - *the environment model*
    - *the I/O constellation*
- **Selection of a conflict solution:**
    - *time scheduling*
    - *channel selection/alteration*
    - *Change the physical layout (volume, size, form, colour)*
    - *change spatial layout (location)*
    - *modality selection/alteration*
- **Device allocation (Control the access on I/O devices).**

For the derivation of the driver vehicle environment states three main conditions are necessary which are the relevant criteria for adapting the HMI. Those conditions have to be considered in different dimensions, which are also given below (see 2.1.3 for more information):

- **driver's availability** in terms of the primary task demand, the secondary task demand, the driver intend and the environment/traffic risk;
- **driver's ability** is only considered in one dimension which is the driver impairment reflecting the decrease of attention allocation to the current driving task in terms of driver's physical state (due to drowsiness, substance use, or a low level of arousal);
- **traffic and environment factors** which gives an estimation of the potential risk determined by the driving environment and traffic situation.

It has to be stressed that there exist no "best in-vehicle HMI". Thus, the most crucial requirements are derived from the fact that the "HMI" is strongly competitive and OEM specific. So, the AIDE system needs to be flexible and scalable concerning the detailed system behaviour, the extend of applications and the used I/O device constellation. That leads to the requirements of modularity and independence

between individual components. Those and other system requirements are listed and described in 2.2 in order to provide an easy access on the important requirements for the development and also for later evaluation.