The AIDE Project on in-vehicle HMI Results and Next Steps

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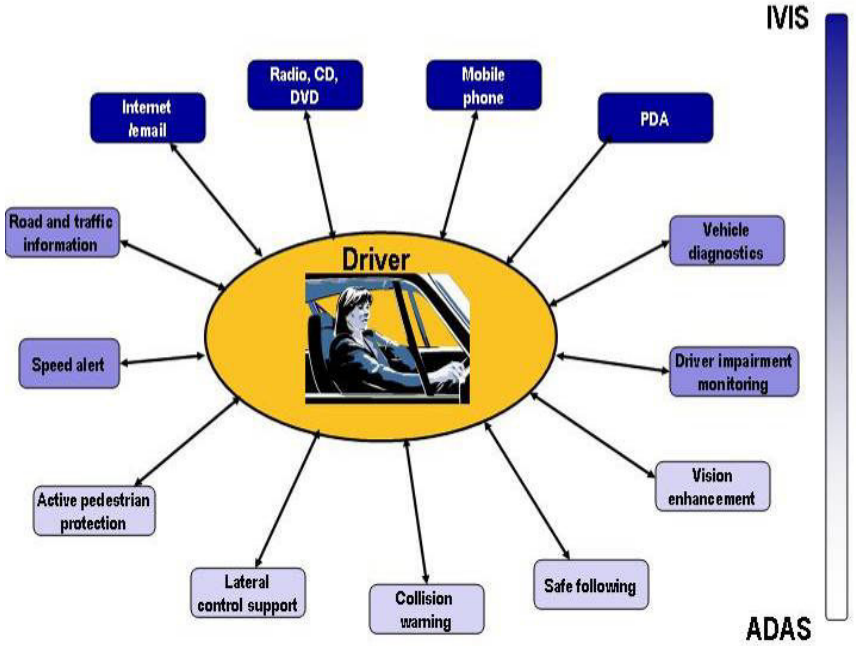
adaptive integrated driver-vehicle interface

General Project information

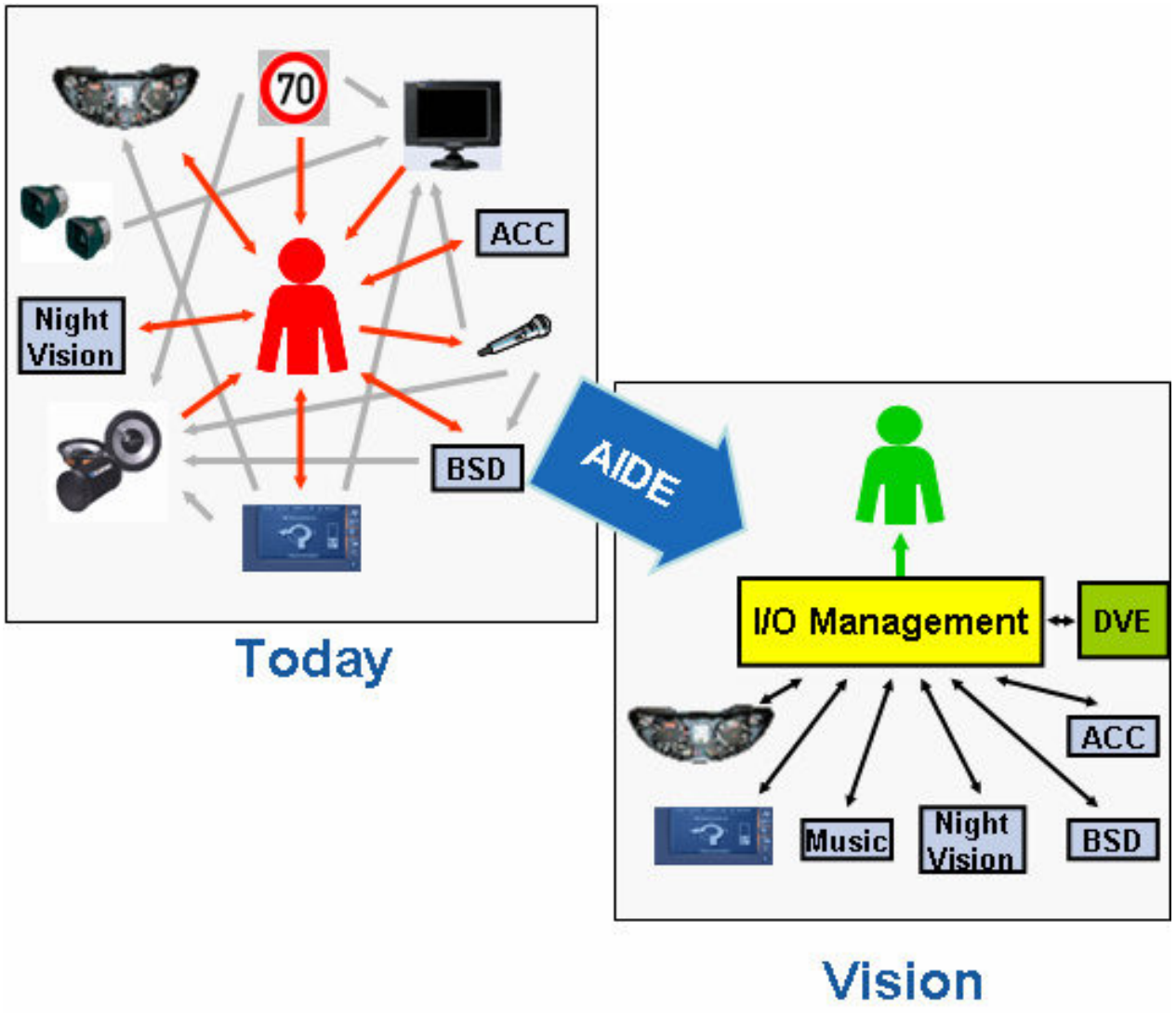
Project name:	Adaptive Integrated Driver-vehicle interfacE (AIDE)
Coordinator:	Volvo Technology Corp. (VTEC), Gustav Markkula
Project main partners:	BMW, CRF, DC, FORD, OPEL, PSA, REGIENOV, SEAT, VTEC, BOSCH, ICCS, TNO… (31 partners)
Starting Date:	2004-03-01
Ending Date:	2008-04-30
Budget Total / Funding:	12.4 MEURO / 7.3 MEURO
FP6 Thematic Area:	IST (eSafety for Road and Air Transport)

Integration aspects

- Prevent **interference** between systems (e.g. information presented simultaneously)
- Exploit **synergies** (reduce HW costs, enhance performance)
- Requirements on system architecture
- Adaptation to the driver state and /or the driving situation



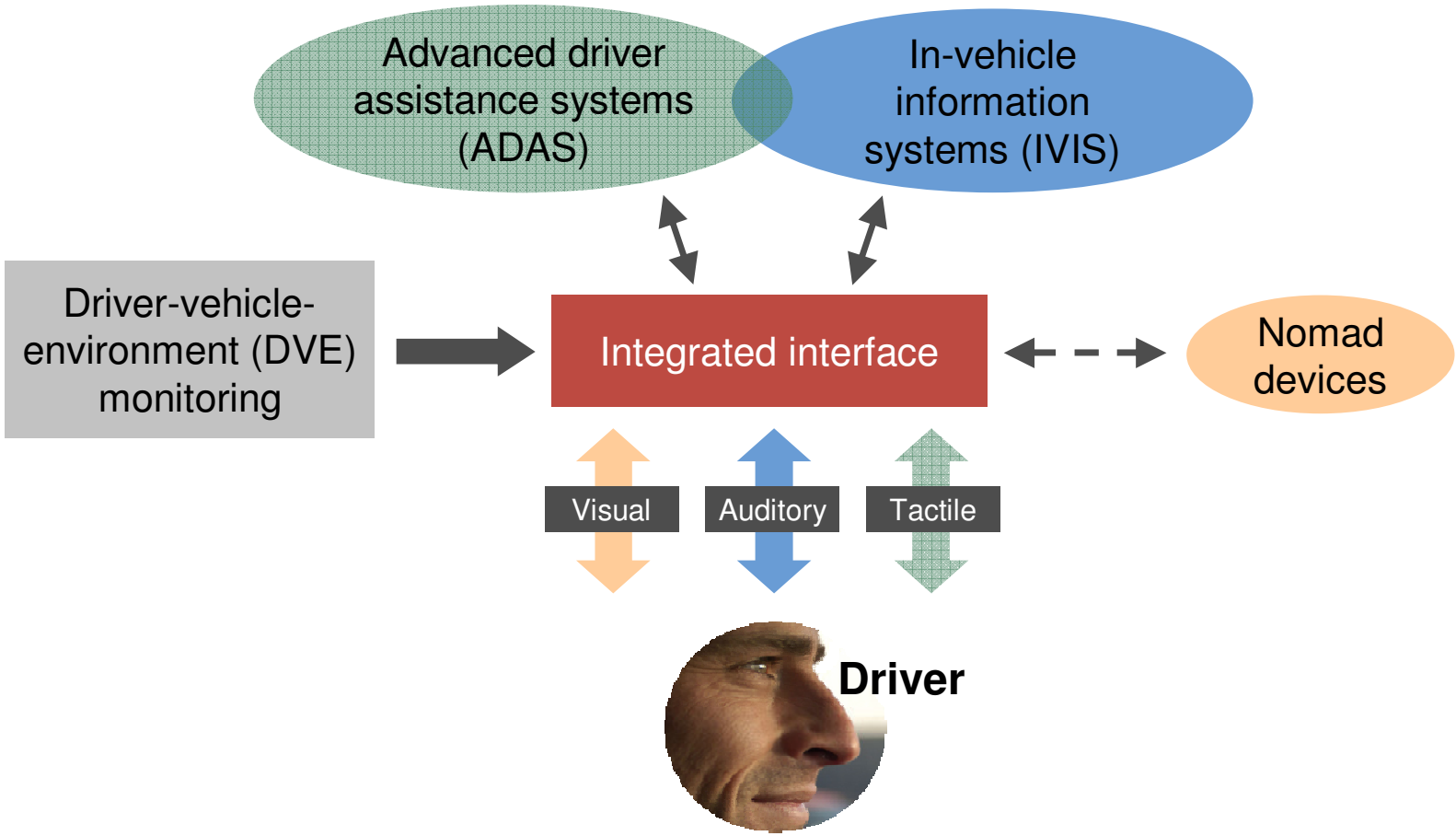
AIDE Approach



AIDE Functionality

- Adaptive User Interface
- Personalisation
- Real-time monitoring driver/car/environment
- All traffic scenarios functionality
- Common architecture
- Dynamic information management
- New input/output devices
- Integrated management of all messages and I/O devices within the car interior

Vision: Adaptive Integrated Interface



AIDE Core Objectives

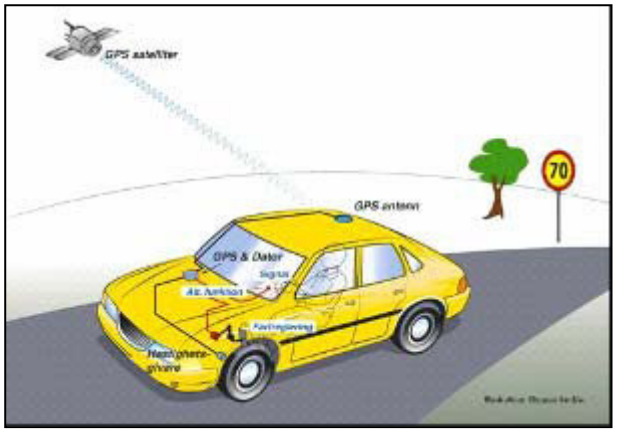
- Develop methodologies and technologies for **safe and efficient integration of multiple ADAS and IVIS** into the driver workplace.
- Evaluate the potential of technologies and integration approaches
- Bring methodologies and technologies closer to the market.

Behavioural Effects of ADAS and IVIS

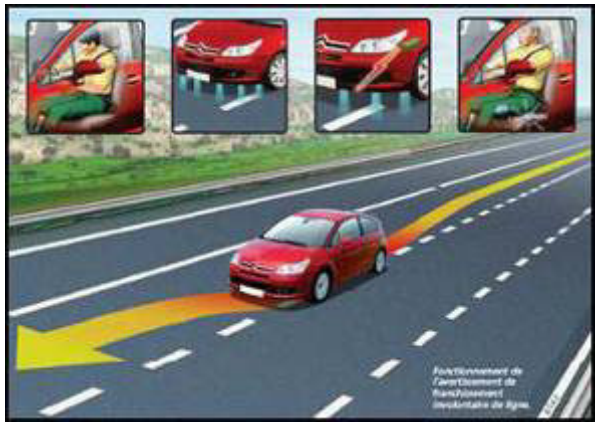
Cruise Control and Speed Limiter
Integrated HMI

TLC < 4s

Frontal Collision Warning
Lane Departure Warning



Intelligent Speed Adaptation



Citroën Lane Departure Warning

Behavioural Adaptation

General observations and conclusions

Manuals are almost never read!

System compliance, acceptance depends on

- Personality traits and individual characteristics
- Environment and usage situation in which the system is used

Non-integrated ADAS can cause irritation and system deactivation

Input to AIDE Implementation:

→ **Taking into account driver and environmental characteristics**

→ **Managing multiple ADAS to ensure lowest intrusiveness and high acceptance**

Evaluation Aspects

How to evaluate integrated adaptive solutions

- Focus on

  Performance Metrics

  Mental Workload Measurement

  Visual Demand Measurement

- Experimental Procedures

Performance Metrics

Speed (average and variability)

Headway

SDLP

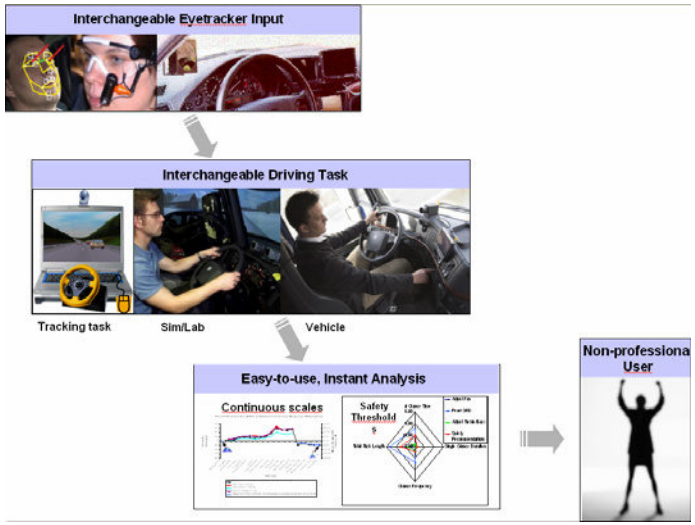
Reversal rate

LANEX

RSME

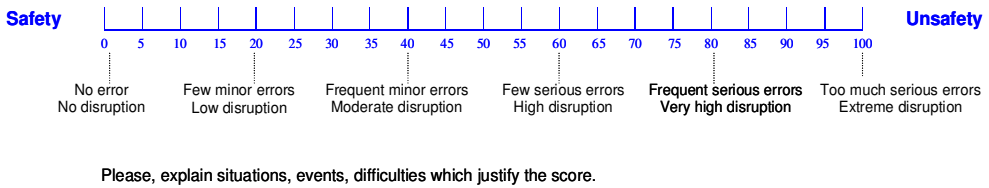
PDT

Methodologies - Examples



Eye Tracking – VDM Tool

Tactile Detection Task



Please, explain situations, events, difficulties which justify the score.

DALI
PSA-TLX

The AIDE "Cookbook"

1. Define aims
2. Describe system
3. Define scenario
4. Define sample
5. Define parameters and instruments
6. Define study design
7. Develop instructions
8. Finalize set-up
9. Carry out
10. Analyze
11. Apply risk estimation procedure

HMI - Design and development

Objective

- Design, develop and demonstrate an adaptive
- Integrated driver-vehicle interface

Key activities

- System architecture development

- Design of the adaptive integrated interface
- Multimodal HMI and integration of nomad systems
- Intelligence for Interaction Management
- Development of driver-vehicle-environment state (DVE) monitoring modules (to enable adaptivity)

- Prototype vehicles integration (city car, luxury car and heavy truck)

Information and Communication Assistant

ICA is the central intelligence of the AIDE system

ICA defines the communication and data exchange protocol

ICA is responsible for managing all the interaction and communication between the driver, the vehicle and the driver's personal nomadic devices

Based on the conditions of the Driver-Vehicle-Environment (DVE) the ICA selects:

- the information prioritisation and scheduling
- the information format and display modality
- the output channel

Architecture of DVE Modules

DVEM

CAA module

Driver's Cockpit activity assessment
+
detection of driver intention

DAE module
Driver's availability assessment with respect to the primary driving task

DSD module
Driver's physiological and behavioural diagnostic

TERA module
traffic and environment risk assessment functions
+
detection of driver intention

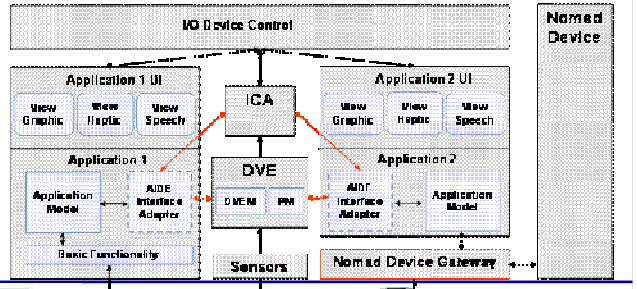
DVE component

PM

Profile data

DC module
Driver's characteristics and preferences parameters

Sensor array



User Centered Design

Demonstrators

Final Evaluation

Three evaluations were performed

City car (CIDAUT/SEAT), truck (VTI/VTEC) and luxury car (TNO/CRF)

Within subjects design – minimum 18 participants

Three conditions: Baseline, Non AIDE, AIDE

Different scenarios along a pre-chosen route

Some scenario's were DVE-dependent

More than 162 hours of driving behaviour data

Final Evaluation

Data collection:

- Questionnaires (evaluation of HMI, general acceptance, workload)
- Driving behaviour (longitudinal, lateral and steering wheel)
- Video recordings (VDM tool)
- Tactile Detection Task

Scenarios/Usecases

- Participants had to find a certain mp-3 song during which a message (low oil) was triggered.
- While negotiating a roundabout a phone call was triggered.
  In the basline condition no scenarios were ‘triggered’.

Conclusions

Recommendations for future R&D efforts in the area of automotive HMI could include:

- Improved HW/SW flexibility for vehicle interior and HMI layouts
- Further work on automotive integration of innovative human machine interaction concepts (e.g. natural speech interaction)
- Probing the limits of HMI integration (further functional growth, nomadic devices – how many functions can one driver handle?)

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