2nd Newsletter

24 May 2005

AIDE PROJECT
2nd Newsletter

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Editorial

A year passed since the start of AIDE project and a lot has happened since. The 1st scheduled EC review was completed successfully while 2 open workshops on AIDE related issues were realised. One was the User Forum workshop and the other the Nomadic devices Forum. Articles on the results of both forums are presented to this edition.

The year also closed with a General Assembly meeting that brought together once again all AIDE partners in Athens.

Of course the most exciting news were the new developments and results brought in light after the research efforts of the AIDE consortium.

Subproject 1 issued the Literature review of behavioural effects, also available to AIDE's website while the requirements for the HMI design and Driver modelling were also defined.

At the same time the 2nd subproject issued the review of existing Tools and Methods and the Review of existing techniques and metrics for IVIS and ADAS assessment. Both documents are available for download from AIDE's website. In addition the review and Taxonomy of IDIS/ADAS applications was issued.

Subproject 3 finalised the AIDE design scenarios based on a thorough User Needs analysis and a SoA review.

AIDE requirements were also finalised recently while the first HMI Software Architecture draft was realised. The AIDE Nomadic Forum was also organised in cooperation with ERTICO.

Finally a thorough Analysis of HMI related standards was performed by SP4 .

Advanced driver assistance systems

Nomadic Device Forum – Official Launch and 2nd Plenary Workshop- Brussels, 23 June 2005

Meet AIDE consortium to the next Nomadic Device Forum scheduled for the 23rd of June 2005, at Brussels.

The workshop is jointly organised by the AIDE consortium and ERTICO, at VOLVO premises. The objectives are to:

- Launch the AIDE Nomadic Device Forum and its first two working groups.
- Approve the proposed Forum work programme. Identify scenarios and use cases for nomadic device integration.
- Identify requirements and architecture approach for vehicle-nomadic device integration.

Workshop Higlights:

- Case studies of new mobile services for drivers
- Latest technology developments for personal navigation
- AIDE project: Progress towards an architecture for nomadic device management
- Breakout group: Scenarios, use and business cases
- Breakout group: Options and requirements for the intelligent vehicle-device gateway

There is no fee for attendance at this workshop, but the number of places is limited – so reserve now your place! For registration forms please contact:

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adaptive integrated driver-vehicle interface

Inside this issue:

Editorial	1
Nomadic Device 2nd Workshop	1
The AIDE concept	2
How to predict accident risk from driver behaviour?	3
Nomadic devices 1st workshop	3
Cockpit Activity Assessment module	4
1st AIDE User Forum workshop	5
Special AIDE News	5
The AIDE IP: Building the future HMI architecture	6
International workshop on Modelling Driver Behaviour in Automotive Environments	7
AIDE Forums	8

Created by AIDE Dissemination Manager
ICCS

THE AIDE CONCEPT:
THE DESIGN OF THE DRIVER VEHICLE INTERACTION

"The design of the driver-vehicle dialogue will be the core of the "Interaction and Communication Assistant" (ICA) that will define the communication and data exchange protocol."

Three main phases of design can be identified within AIDE Design plan for an adaptive Integrated HMI:

1. INTERFACE PHASE: the addition of HMI systems integrated into the vehicle cockpit to provide additional driving services;
2. INTERACTION PHASE: the development of on vehicle systems introducing new interaction channels (vocal, haptic, etc.);
3. COMMUNICATIVE PHASE: the introduction of continuity in the on vehicle interaction which is transformed into a true dialogue with the vehicle.

To enable phase 3,the design of the driver-vehicle interface as a dialogue needs an administrator of the information complexity, designed with a user centred design approach, which make use of all the information available. That information can come from the environment (visibility, bad weather), the road scenario (dangerous situations, road signs, road surface, traffic density, road typology), the current interactions (driver's actions, incoming / outcoming messages in course) and the driver itself (his/her workload due to the activity on the primary and secondary task).

The step forward that will be made by AIDE is to keep into account more deeply the driver behaviour, his/her profile, status and availability (physical conditions, distraction, mental workload, performance). Increasing drivers' situation awareness will also be a key task, thus optimising driver's workload, promoting a change in driving behaviour, reducing distraction while extending the use of information services to all users.

The AIDE system is extending

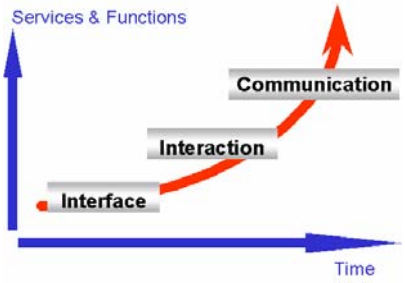


Fig 1 "From the design of different interfaces to the design of a dialogue communication"

the concept from the use of rule based algorithms to the development of a dynamic predictive model conceived to take into account in a more extensive way driver's behaviour and profile, vehicle dynamics and driving context.

The AIDE concept is thus to create a sort of "real time virtual awareness layer" gathering all relevant information about the context, the vehicle dynamic and the driver's behaviour and status to close the loop and to put the driver into the loop itself. In this way the subsequent communication channel selection and information prioritisation will become a powerful way to increase driving comfort and safety.

The design of the driver-vehicle dialogue will be the core of the "Interaction and Communication Assistant" (ICA) that will define the communication and data exchange protocol.

The ICA will be the central intelligence of the AIDE system, it will be responsible for managing all the interaction and communication between the driver, the vehicle and the driver's personal nomadic devices. Starting from the assessment of the Driver-Vehicle-Environment (DVE) status/ situation provided by the DVE monitoring modules it will enable the selection of the presentation modality, the message prioritisation and scheduling and the global adaptivity of the driver-vehicle interface (e.g. display configuration and function allocation).

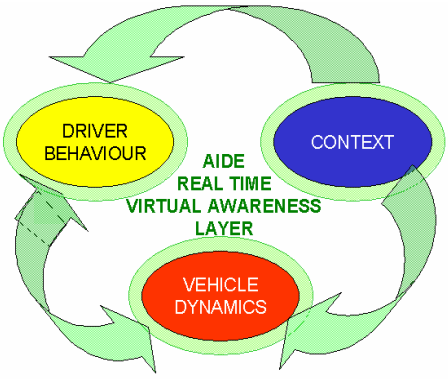
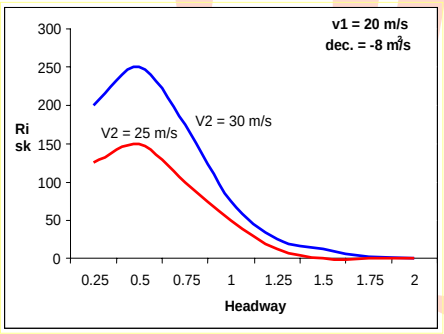


Fig. 2 Scheme of the interactions considered by AIDE

HOW TO PREDICT ACCIDENT RISK FROM DRIVER BEHAVIOUR? - AIDE SP 2 Solution

Driver behavior studies usually result in a list of effects that some experimental treatment, such as the introduction of an in-vehicle support system, has on parameters that describe the driver's handling of the vehicle, his lane keeping performance, his car-following performance, and so on. This is useful knowledge, but it is not sufficient to estimate what this all means in terms of accident risk. Thus, we are still left with the question of what consequences the introduction of the particular support system will have on accident risk in a population of drivers if they were to use the system.



Relative risk of following at a certain time headway for two speed differentials with respect to a leading vehicle: leading vehicle drives at 20 m/s, following vehicle at either 25 or 30 m/s. Case: lead vehicle decelerates strongly.

AIDE SP 2 studies these questions, so as to check whether one could be able to produce the desired accident risk (reduction) estimates whenever the project's prototype evaluation is due.

An example of what we have found thus far is given in the figure below. This shows the relationship that exists between a driver's time headway to a preceding vehicle and the risk of a rear-end collision with that vehicle in case it suddenly brakes. This risk is determined by the chosen time headway, by the following driver's reaction time (which determines the probability of the collision happening itself), and by the speed difference between the vehicles (which determines the severity of the collision when it happens).

It is perhaps surprising to see that following a vehicle at a slightly longer headway is actually somewhat riskier than following at a minimal headway. The reason for this is that while the probability of the collision happening is obviously larger at an extremely short headway, its severity is slightly less because the speed difference between the vehicles will be relatively less (than at a longer headway) when they hit. Taken together, the risk is less than at the shortest headways.

Similar graphs, relating a behavioral parameter to ensuing accident risk, have been shown to exist for speed, speed variability, and lane keeping variables. Together, they could permit us to extrapolate the behavioral findings that we will obtain when testing the AIDE prototypes.

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Nomadic Devices 1st Workshop

The first European Nomadic Device Workshop was held under the auspices of the AIDE Integrated Project on 20 January 2005, in cooperation with ERTICO. Presentations by the representatives of Motorola, Nokia, Renault and the eSafety Forum, as well as of the AIDE project were given.

Breakout groups discussed issues on driver safety and Human-machine Interface (HMI), nomadic device integration in the vehicle, the market perspective of nomadic devices and of vehicle and device manufacturers, operators, service providers and other players. The workshop indicated that nomadic devices posed certain safety risks unless properly installed in the vehicle, but could also bring benefits for drivers. Vehicle makers were increasingly interested to offer products and services using nomadic devices, but were held back by the lack of standards and concerns about safety. They were prepared to work towards industry standards for interfaces to nomadic devices.

It was agreed that there is a need to set up a permanent Nomadic Device Forum that will bring together all key stakeholders. The Forum should work towards the resolution of the safety issues as well as the requirements and specifications for a nomadic device interface or gateway into the vehicle.

The workshop results will also be a valuable input to help the AIDE project develop an integrated adaptive HMI manager that can incorporate links with nomadic devices. The workshop's minutes are available for download at AIDE website.

Cockpit Activity Assessment (CAA) module

Fig 1. The faceLAB stereo vision system in a laboratory.

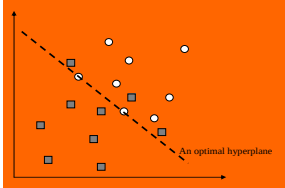

Fig 3. Classifying with SVM in a two dimensional feature space.

Purpose

The objective of the CAA module is to determine what the driver is doing inside the cockpit. A set of two cameras (fig 1.) mounted in front of the driver, measuring the momentary position and rotation of the driver's head and eyes, provides the most important input. Using this input and others (e.g. vehicle control measures, driver speech detection) the level of distraction due to secondary tasks (e.g. phone conversations, radio operation) is estimated, and the driver's direction of visual attention is continuously measured to detect what regions of the exterior or the interior he or she is focusing on.

Typical uses of such information are warning adaptation and information filtering. A forward collision warning may for example be given earlier if the driver is distracted by a secondary task or if the driver is checking a mirror when a vehicle ahead of him brakes. Further, information of very low time and safety criticality (e.g. SMS, e-mail, low washer fluid warning) may be filtered out and put on hold while the driver is busy with some secondary task.

Rule based visual distraction estimation

The visually distracted driver is recognised using the head and gaze rotation data.

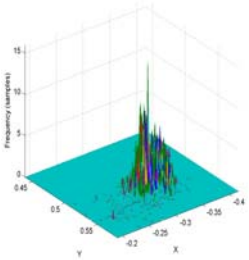

Fig 2. A head rotation histogram while attention is toward the road ahead.

Signal enhancement and clustering algorithms will be applied on the raw data to get a mapping to a momentary real-world point of attention. In the simplest case it is then detected whenever the driver's attention is not on the road ahead. More elaborate metrics, detecting time sharing behaviours (i.e. when the driver divides his visual attention between the road ahead and some other region) are also envisioned.

Cognitive distraction estimation with support vector machines

Cognitive distraction while driving is typically due to phone conversations or daydreaming/heavy thinking. It causes long glance fixations with small variations in direction, increased high-frequency steering wheel movements and smaller lane position variations.

Reliable recognition of cognitive distraction is a complicated task. Due to the large number of input features a syntactic classifier would be insufficient and a more advanced method is needed. Support vector machines gives an "optimal" separation of clusters in the multi-dimensional feature space. An SVM based kernel will be the core of the algorithm used for measuring cognitive distraction levels.

Driver intent estimation

The driver's head/eye behaviour and his control of the vehicle can also be used to detect when the driver intends to perform maneuvers such as overtaking, lane changes and stopping.

References

Burges C. 1998. A Tutorial on Support Vector Machines for Pattern Recognition. *Data Mining and Knowledge Discovery 2*. pp 121-167.

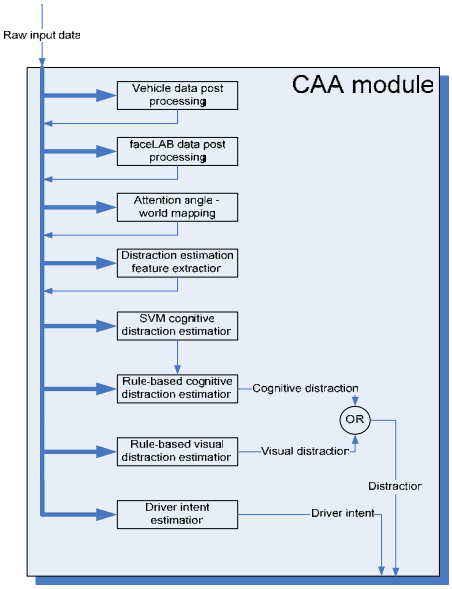

Fig. 4. General architecture of the CAA module.

1st AIDE User Forum Workshop

The first User Forum Workshop was held at BAST premises in Cologne, Germany, on 15-16 of March 2005, and was jointly organised by BAST and the AIDE consortium.
AIDE User Forum is the first major European initiative towards a common understanding between industry, institutes and drivers, on HMI issues.

The forum also intents to promote road safety and converse with similar initiatives outside Europe. Its wide-open and flexible profile makes AIDE User Forum attractive for a broad part of automotive society. Whilst it is based on a core consisting of selected experts from the automotive area, the AIDE User Forum invites also people involved in related fields and can contribute their experience from their position in a university, an institute or a governmental office.

The basic issues that were addressed in the first User Forum related to the AIDE project were: HMI architecture, Design scenarios for an adaptive HMI, Driver-vehicle-environment modelling for HMI design, behavioural adaptation to ADAS and IVIS and Nomadic Devices integration within the automotive environment. Moreover, HMI evaluation issues related to the European Statement of Principles were discussed towards the future possibility of the derivation of useful guidelines and standards with respect to future automotive HMI design which should guarantee road safety. Finally, a round table discussion concerned with all aspects of integration and HMI adaptivity was carried out where the positions of EC, industry and research institutes had the chance not only to be commuted but also weighted.

The Report on AIDE User forum results is going to be available for download soon at www.aide-eu.org

SPECIAL NEWS SECTION

AIDE first official review ended successfully

AIDE project, as any EC co-funded project had the obligation to pass an official EC review with the presence of expert reviewers from around Europe.

Since AIDE is still a young project it was only the first official review. This was scheduled for the 3rd of March 2005 at Brussels. The AIDE core group represented the project and under the coordination of Jan Arfwidsson the project results and developments so far were presented in detail.

The final outcome of the review was very satisfactory since very good comments were addressed both for the management and the technical work performed.

The suggestion of course was to continue working and a few specific instructions were given for future reference.

A very good climate of cooperation between

AIDE supported the update of the ESoP

In the new Implementation Plan of AIDE, support to the efforts of EC to update the European Statement of Principles for HMI is foreseen. More specifically AIDE will support OEMs and suppliers that participate as AIDE partners that participate to this work while HUMANIST NoE will support the relevant Institutes.

AIDE demonstration and presentation to ITS Hannover conference

The 5th European Congress and Exhibition on ITS will be held on 1-3 June 2005 in Hannover,Germany. AIDE is participating to the conference with a special presentation to the strategy session No 4 “Safe Use of ITS: Human Machine Interaction (HMI) by Mr. Johan Engstrom (VOLVO). A demonstration of SP2 tools and of the project in general will take place in parallel at the exhibition area of the conference. Visitors are welcomed to meet us to our stand!

AIDE General Assembly meeting in Athens

While individual subproject meetings are constantly scheduled there are rare the occasions where all partners meet together even if they are not working together. The AIDE General Assembly meeting realized at Athens on the 30th of April and hosted by ICCS provided a unique opportunity to discuss common issues and reconfirm the good cooperation among the entire AIDE consortium. Next two days though were business as usual since they were devoted to separate SPs Plenary meetings.

The AIDE Consortium

Athens, 30/03/2005, General Assembly

The AIDE IP: Building the future HMI architecture

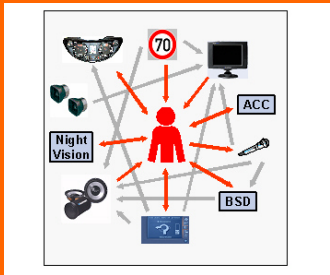

Figure 1: Usual installation of in-vehicle applications

Today more and more IVIS (in-vehicle information systems) and ADAS (adaptive driver assistance systems) are integrated in vehicles which individually interacts with the driver and which sometimes use dedicated I/O devices (see Figure 1). Consequently the systems and the communication between the driver and the individual systems are designed independent from each other. Frequently the design process of each individual system takes into account human factor aspects and the HMI is optimised in terms of distraction and usability, but much too less effort is spend on the interdependence of the individual systems and the corresponding influence on the driver. Thus the higher the amount of applications the more interdependences between I/O events from different systems occur. This dramatically effects the driver distraction and leads to driving safety risks.

The main objective of AIDE 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 project, in contrast to usual approaches, 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.

The AIDE specific functionality for HMI adaptation and I/O management comprises least of all the I/O devices and user interface design itself, but 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. This functionality and knowledge is used to manage the driver-vehicle interaction in order to increase driving safety and comfort.

This intelligence is called the Interaction and Communication Assistant (ICA) (see Figure 2). It 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.

> ***"A fully integrated common in-vehicle HMI allows the exploitation of synergies, reduces HW costs and enhances system performance"***

ICA is responsible for managing all the interaction and communication between the driver and the vehicle, based on the assessment of the driver-vehicle-environment (DVE) state/situation provided by appropriate monitoring modules (DVE module) (see Figure 2). This includes the selection of modality for presentation, the message prioritisation and scheduling and the general adaptation of the driver-vehicle interface (e.g. display configuration and function allocation).

Furthermore such a fully integrated common in-vehicle HMI allows the exploitation of synergies, reduces HW costs and enhances system performance.

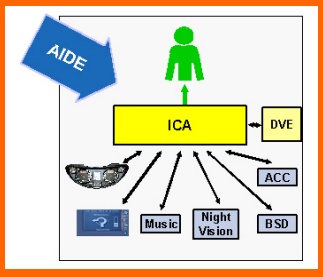

Figure 2: Integrated in-vehicle HMI from AIDE

It has to be stressed that there exists no "best in-vehicle HMI". Thus, the most crucial requirement is derived from the fact that the "HMI" is strongly competitive and OEM specific. In this case "HMI" stands for the "look and feel" and the used strategy to interact with the driver. 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.

The AIDE HMI software architecture has to reflect those requirements. Consequently the development is based on a strictly generalized and categorized functional description of the in-vehicle interactions and also of the solutions which can be selected by the car manufacturers according to their needs and desires.

The AIDE software architecture assumes a strict separation of the functional logic of an application and their HMI (e.g. a Model-View-Control pattern approach) (see Figure 3), whereas the model can be connected via an arbitrary bus system to an application ECU (electrical control unit) providing the basic functionality like a broadcast receiver, the navigation unit or obstacle detection unit. The model itself provides the "HMI functionality" of an application, i.e. for example the navigation map rendering, a meta data based approach to access music or an in-vehicle suited browser for accessing telematic services via a nomad device. In the latter case data and functionality of nomad devices can be used in the vehicle, whereas an in-vehicle application accesses via a well defined gateway the nomad device and uses the integrated I/O devices to control the nomad device functionality.

In order to realize I/O management taking into account the interdependences of interactions

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with the driver, the applications have to have a specific interface to the mentioned ICA module (see Figure 3). The ICA module has to be requested by the applications for any I/O action. It prioritizes the requests and decides which interaction is allowed to take place, when and in which form. One of the most important aspect is that the ICA has to be independent from those applications, i.e. it must not have knowledge about the semantics of the applications. This is realized using a set of generalized parameters for the request which objectively charac-terize the application.

In the case of integration of already existing applications in an AIDE system the communication between application and ICA is done by an AIDE interface adapter, which naturally can also be integrated in the application model.
The information about the driver status, the driving situation and the driver preferences is provided by a DVE component which provide not only the applications but also the ICA with those information to adapt the HMI strategy or individual output events only known by the applications itself.

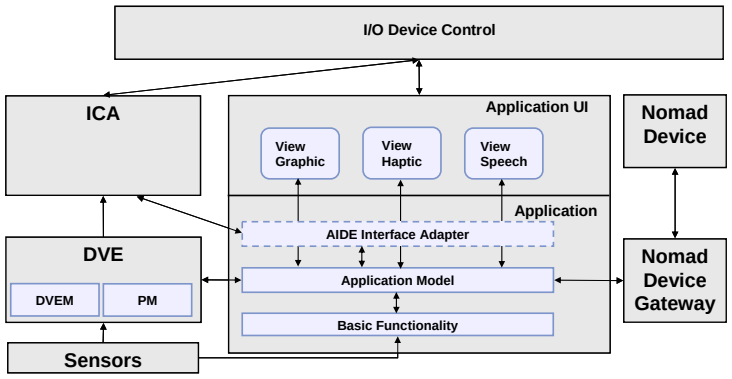

Figure 3: Logical structure of the AIDE software architecture

INTERNATIONAL WORKSHOP ON MODELLING DRIVER BEHAVIOUR IN AUTOMOTIVE ENVIRONMENTS
Sponsored by IP-AIDE in collaboration with NoE HUMANIST

A common workshop between HUMANIST Network of Excellence and AIDE Integrated Project on Modelling Driver Behaviour in Automotive Environments took place in Ispra, at JRC premises, organised by JRC on the 25th to 27th of May 2005. By this the close link and cooperation between HUMANIST and AIDE was reconfirmed.

The objective of the Workshop was to present the state of the art in modelling and simulation of Driver Vehicle and Environment systems and in particular of driver behaviour that can be applied and utilised in modern automotive. Hence, this workshop focused on issues regarding the Modelling of the Driver Behaviour. The study of all technological systems in terms of design, safety assessment or training purposes requires that significant attention is dedicated to human perspective. Techniques for user centred design, assessment of user needs and field approaches are normally applied and exploited before implementing new control devices or safety systems that are managed by a user or operator.

The workshop attracted many people from the automotive industry, research institutes, insurance companies and academic domain. It also supported the exchange of ideas between the relevant stakeholders and mainly promoted the communication and interaction between the designers, engineers and psychologists community.

AIDE FORUMS

AIDE User Forum

The AIDE User Forum aims to bring together all stakeholders in the area of the Automotive HMI and to create a community where AIDE concepts and developments will be discussed, reviewed and updated.

The User Forum will involve external organizations including end users, unions, NGOs, Industrial and Research organizations that are not participating to AIDE etc. This forum will play a major role not only to the dissemination of AIDE but also to the exchange of information, to the evaluation of AIDE concepts, designs and later results. Members of this forum can be invited to review public deliverables and documents of AIDE, as well as to meetings and workshops. AIDE User Forum will be done in close cooperation with the AIDE NOMAD Forum that will focus to the nomadic devices and their inclusion to the vehicle environment.

Within User Forum two major European Workshops will be organized in order to discuss a number of issues regarding HMI architecture, Design scenarios for an adaptive HMI, Standards and Guidelines, Driver-vehicle-environment modeling for HMI design, behavioural adaptation to ADAS and IVIS and HMI evaluation issues.

AIDE Nomad Forum

If Nomadic Devices are not well designed, controlled and installed they could pose a safety threat. There were calls for more research to understand their risks, the need to extend existing guidelines (e.g. ESOP) to include nomadic devices, and for a wide-ranging safety charter to include the full range of stakeholders. Working towards this end within the AIDE project, a Nomad Device Forum is organised as a focus group for all issues relating to nomadic devices in the project, leading to the validation of user and stakeholder requirements at the start of the project, and of the AIDE solution that emerges.

A broader aim of the Nomad Forum is to establish itself as the principal European body in the area of Nomadic Devices, continuing its work after the end of the AIDE project and supporting the take-up of the AIDE results and application of future guidelines for nomadic systems. Many stakeholders such as vehicle manufacturers, automotive suppliers etc are involved or interested in nomadic devices.

The aim is to attract the most active and influential participants, who are willing to help create and validate a cross-industry consensus for a single solution that should be accepted and implemented across Europe.

AIDE ArchitectureForum

Since all architectural aspects are highly important already at an early stage of the project, an Architectural forum is established with the participation of OEMs, suppliers, and all interested parties, which will follow the state-of-the-art on automotive standards, buses and in-vehicle networks to ensure a common and high-level design and performance. A core team comprised of OEMs and other partners of AIDE consortium will be responsible for the creation of a common architectural platform for AIDE.

The forum will operate as a communication and decision platform for all important steps and results of the system architecture development. Moreover, close links will be established with the EASIS STREP, which is also part of the Integrated Safety Program, and aims at the development of general electronics architecture for vehicle safety functions. Links will also be formed, through the project partners, with ongoing projects in this area, e.g. EAA-EAST.

To join to AIDE Forums visit AIDE website:

www.aide-eu.org

And register to the Forum area

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Sixth Framework Programme (FP6)

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