Final event

20. - 21.11.2013
Eurogress Aachen
+ driving demonstrations
in Lommel

Accident avoidance by active intervention for Intelligent Vehicles

interactive

Content

»Regardless of how many precautionary measures a driver may take, preventing road accidents is not always possible. The human cognitive system does not react well in situations that are unlikely to happen. As a result, the road user becomes vulnerable to scenarios with low probability of occurrence. interactIVe addresses the »human factor« on the road by developing the next generation of safety systems, ready to support the driver in a continuous manner and independently of the likelihood of the event.«

Aria Etemad | Project Coordinator

interact|ve

The challenge: better protection for road users

interactIVe targets active safety systems as integrated and affordable solutions for all vehicle classes.

The interactIVe systems actively intervene in hazardous situations, before an accident happens. The vehicle brakes and steers autonomously. In case an accident can not be avoided, the impacts are mitigated. The assistance systems continuously support the drivers, disburden them in overdemanding situations and warn in potentially risky moments.

State-of-the-art safety technologies have shown outstanding capabilities for supporting the driver. Currently available systems are effective, but they are typically implemented as independent functions. This results in multiple expensive sensors and unnecessary redundancy, limiting their scope to premium-vehicle classes.

The research project PReVENT has made the first attempt towards a comprehensive solution by realising a safety zone around vehicles. All drivers who have so far tested advanced driver assistance systems (ADAS) have approved such solutions. Yet, the system cost is an obstacle for application in day-to-day-life. Reducing costs is a prerequisite for the implementation of ADAS in all vehicles.

interactIVe goes far beyond existing work:

interactIVe systems increase the perception horizon: environment information is recognised through a new integrated and comprehensive sensor platform.

interactIVe systems improve decision strategies for ADAS: the systems are using new prediction techniques and integrating advanced human-machine interface (HMI) concepts, balancing human and system interventions.

interactIVe systems suit the ordinary driver: several tests enhance the knowledge about driving behaviour and impact of the systems.
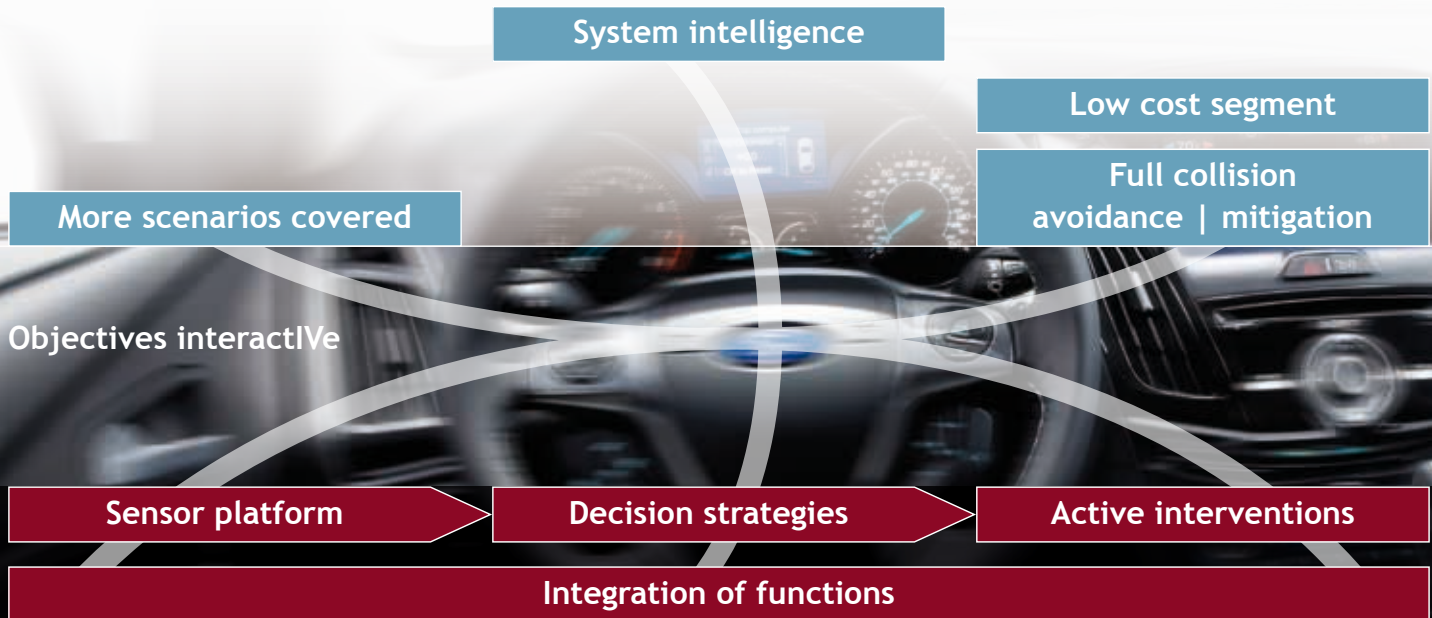
interactIVe systems are affordable: system cost is reduced by the implementation of low cost sensors as well as the integration of previously independent functions.

interactIVe systems apply to all vehicle classes: to test and evaluate the systems, six passenger cars of different vehicle classes and one truck are being built.

interactIVe paves the way for broad deployment of ADAS for continuous driver support and emergency intervention.

The vision of the European research project interactIVe is accident-free traffic realised by active safety systems in all vehicles.

interactIVe started in January 2010 and is running for four years.

System intelligence

Low cost segment

Full collision avoidance | mitigation

More scenarios covered

Objectives interactIVe

Sensor platform → Decision strategies → Active interventions

Integration of functions

The mission: advance intelligent vehicle systems

In the field of preventive and active safety, the socio-economic benefits have been demonstrated by several systems over the last years. Collision warning, lane departure warning, and assisted braking have been introduced to the market. However, further improvements of the applications for assistance and emergency intervention still pose technical and implementation challenges that the interactIVe project tackles:

offering continuous support to the driver, integrated as a natural and well accepted part during ordinary driving, allowing for natural interaction between the driver and the technical applications,

implementing the full capability of collision avoidance, improving performance in the interpretation of the environment, so that the typology of situations covered can be extended,

optimising the integration of multiple functions in terms of communication, data processing, and driver interaction, with a good trade-off between costs, redundancy and usability, and

extending active safety systems towards lower price vehicle segments.

The project strategy is therefore to choose a comprehensive and integrative approach. For the development of interactIVe applications this means to base the research concept on:
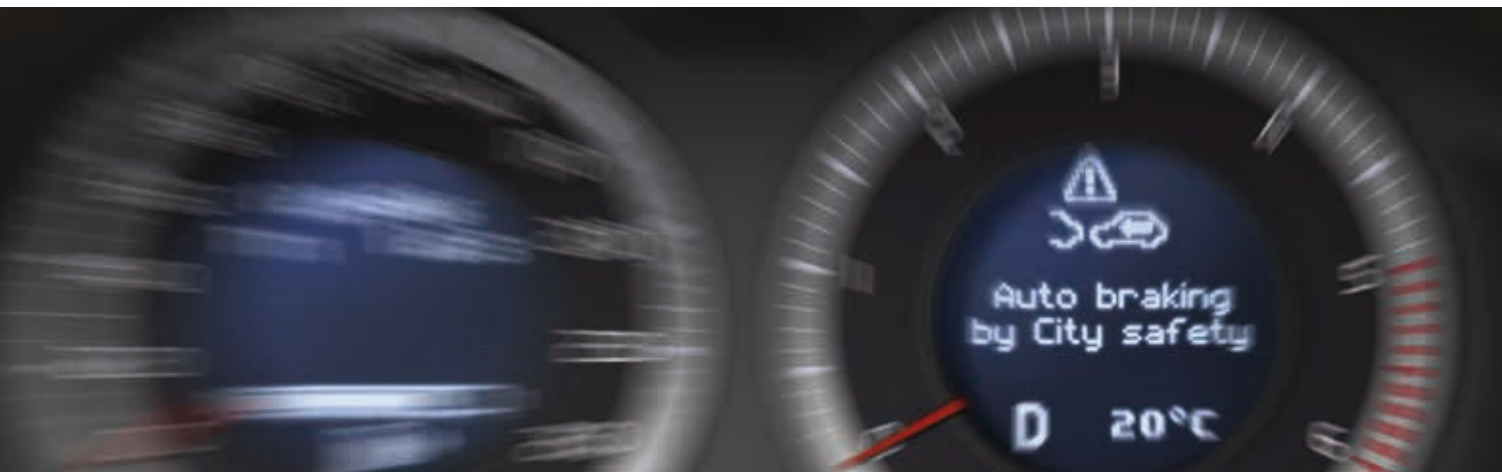
the integration of previously independent functions,

new concepts for the sensor fusion platform,

decision strategies and novel techniques for the driver-vehicle interaction,

active interventions in given dangerous situations, and

low cost sensors and architectures customised to passenger cars in the lower price segments.

Phase 1 | **Analysis**

interactive

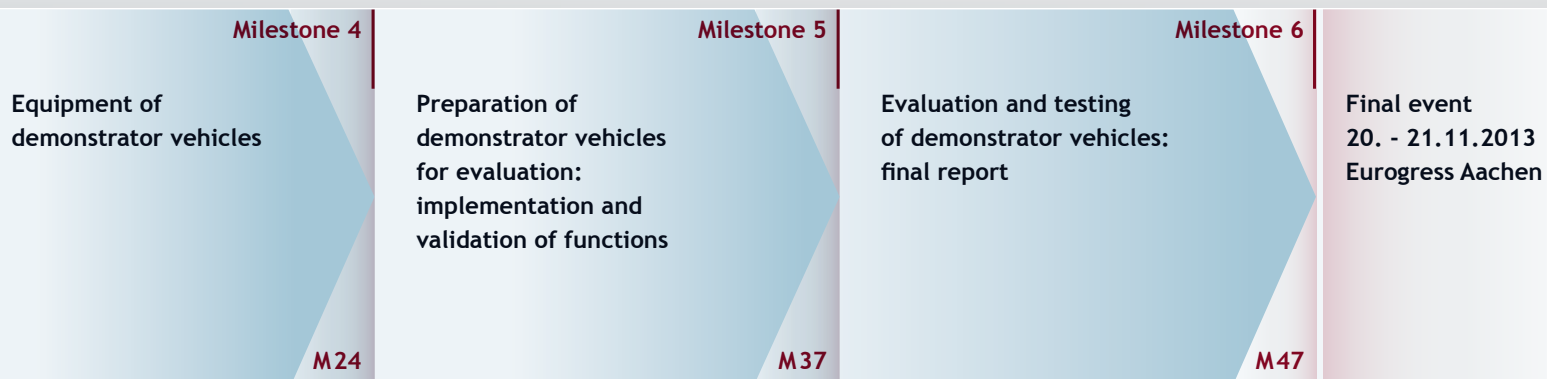|	Milestone 1	Milestone 2	Milestone 3
Timeline interactIVe **January 2010 - November 2013**	**Definition of use cases and requirements**	**Definition of the system specifications**	**Definition of the system architecture**
	M07	**M10**	**M15**

The objectives: five major tasks

I	**Extend the range of possible scenarios and the usability of ADAS:**	focus on joint steering and braking activation
		investigate continuous driving support and emergency interventions
		increase the effectiveness of collision mitigation systems
II	**Improve decision strategies for active safety and driver-vehicle-interaction:**	introduce new techniques for the dynamic prediction of a safe trajectory ahead
		develop decision strategies that are able to balance human and system interventions
		devise advanced HMI concepts integrated with the primary driving controls
III	**Develop solutions for collision mitigation with market potential for lower price segments:**	further develop ADAS concepts for reducing accident severity
		pay special attention to vehicle architectures in the low to medium segment of passenger cars
		focus on cost effective sensors in combination with relevant accident scenarios
IV	**Create an innovative platform for enhancing perception of the driving situation:**	integrate environment sensing information as a part of a unified perception layer
		include inertial sensors, digital maps, and vehicle-to-vehicle and vehicle-to-infrastructure communication
V	**Advance the application of standard methodologies for the evaluation of ADAS:**	continue the work of PReVENT and other European projects using structured methods for the evaluation of safety functions
		define a modular evaluation framework for all interactIVe systems

interactIVe goes beyond the number and choice of scenarios covered by previous research: the combination of lateral and longitudinal active interventions by autonomous braking and steering offers new possibilities to avoid accidents. For the development of the applications, challenging use cases like adverse visibility and hard-to-judge pre-accident situations (e.g. head-on) are considered. The perception platform significantly increases the intelligence of the system by providing a complete view of the environment and thus understanding the situation as a whole.

Phase 2 | Development

Milestone 4	Milestone 5
Equipment of demonstrator vehicles	Preparation of demonstrator vehicles for evaluation: implementation and validation of functions
M24	M37

Phase 3 | Evaluation

Milestone 6	
Evaluation and testing of demonstrator vehicles: final report	Final event 20. - 21.11.2013 Eurogress Aachen
M47	

The timing: three stages

Phase 1 Analysis	Once the interactIVe use cases and requirements are selected, the architecture concept and the specifications are defined.
Phase 2 Development	After all preconditions for testing are assigned, the seven demonstrators are equipped and prepared for evaluation.
Phase 3 Evaluation	The vehicles are subjected to extensive tests. Upon their completion they are evaluated. All results and findings are included in a final report.

Project structure interactIVe

Sub-project 1: **Integrated project (IP) management**

Integrated advanced driver assistance systems (ADAS) for continuous support and emergency intervention

Sub-project 2: **Perception**
Development of the fusion modules for monitoring and interpretation of the road environment.

Sub-project 3: **Information, warning and intervention (IWI) strategies**
Definition of use cases and requirements | Specifications for IWI strategies

Sub-project 4: **SECONDS**
Safety **e**nhancement through **con**tinuous **d**river **s**upport

Sub-project 5: **INCA**
Integrated **c**ollision **a**voidance and vehicle path control

Sub-project 6: **EMIC**
Cost-efficient **e**mergency intervention for **c**ollision mitigation

Seven demonstrator vehicles: six passenger cars and one truck

Sub-project 7: **Evaluation and legal aspects**
Test and evaluation framework for interactIVe applications | Analysis of legal aspects

The realisation: seven sub-projects

Sub-project 1	**Integrated Project (IP) management**	carries out IP coordination, operational management, technical management support and dissemination.
Sub-project 2	**Perception** (Sensor data fusion research and development)	advances multi-sensor approaches with a focus on sensor data fusion processes. A common perception framework for multiple safety applications and the unified output interface from the perception layer to the application layer is developed. The Perception sub-project integrates different information sources like sensors, digital maps, and communication systems to extend the range of possible scenarios for the applications and the usability of ADAS by multiple integrated functions and active interventions. This innovative model of a unified platform enhances the perception of the traffic situation in the vicinity of the vehicle.
Sub-project 3	**IWI strategies** (Information, warning and intervention)	defines detailed use cases, based on target scenarios developed by the sub-projects SECONDS, INCA, and EMIC. On the basis of those use cases the requirements for IWI decision strategies are defined to improve the driver-vehicle interaction. An iterative design as well as prototyping and user testing of IWI strategies based on the initial requirements is performed.
Sub-project 4	**SECONDS** (Safety enhancement through continuous driver support)	develops and tests the continuous driver support functions realised in four demonstrator vehicles. Here, input from other sub-projects is used: evaluation guidelines and the test plan developed by Evaluation, the perception platform developed inside Perception, and the IWI strategies defined by sub-project 3.

interactIVe consists of seven sub-projects. Three sub-projects address the specification, design, and realisation of interactIVe applications. They analyse the use cases, define requirements, and develop the interactIVe applications. Thereafter, the relevant components, such as sensors, software modules, algorithms and hardware devices are integrated and implemented in seven demonstrator vehicles. The other sub-projects are of horizontal nature and deal with technical and methodological aspects of all applications.

Sub-project 5	**INCA** (**I**ntegrated **c**ollision **a**voidance and vehicle path control for passenger cars and commercial vehicles)	implements a "vehicle path control" module that is able to dynamically evaluate a collision-free trajectory in rapidly changing driving scenarios. The combination of lateral and longitudinal active interventions by autonomous braking and steering extends the range of scenarios. Both rear-end collisions, lateral and head-on collision situations are addressed by the research. Studying the special case of an equipped heavy truck is also part of the work in INCA. A total of three demonstrators is being equipped and tested; the two passenger cars are shared with SECONDS.
Sub-project 6	**EMIC** (Cost-efficient **em**ergency **i**ntervention for **c**ollision mitigation: development and implementation)	develops cost-efficient collision mitigation systems. These systems mitigate a collision by emergency braking and steering based on perception of the environment ahead. A high penetration rate shall be achieved by means of low cost system architectures or low-cost additions to existing ADAS. EMIC advances existing concepts for collision mitigation with specific attention to the vehicle architecture and to cost-effective hardware and software components. A driver model is being developed and implemented into the collision mitigation system in order to improve the warning and intervention strategy. EMIC equips two demonstrator vehicles with cost-efficient collision mitigation systems. One is equipped with an emergency steering assistance system, while the other one contains an autonomous emergency braking and steering system.
Sub-project 7	**Evaluation** (Tests and evaluation, analysis of legal aspects)	provides a test and evaluation framework for the assessment of each interactIVe application with respect to human factors and technical performance. Test scenarios, concrete evaluation methods, and test procedures are provided. Tools for evaluation such as equipment, test catalogues, procedures, questionnaires or software and support for testing are offered to the other sub-projects. Test and evaluation criteria are defined. The corresponding legal aspects for broad exploitation of the applications are analysed.

Contacts

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Final event

On the 20th and 21st of November 2013 interactIVe is hosting its final event at the Eurogress facility in Aachen. Included with the event will be driving demonstrations at the Ford Proving Ground in Lommel, Belgium, with transfer shuttles for those participants who wish to attend. For information and registration please visit the interactIVe website.

www.interactive-ip.eu

interactIVe

SEVENTH FRAMEWORK PROGRAMME

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