interACT
Designing cooperative interaction of automated vehicles with other road users in mixed traffic environments

Press Release

For immediate release

Athens, 27 October 2020

How do we interact with Automated Vehicles in the future?

After 41 months, the journey of the EU project interACT ends with great research achievements in the field of Automated Vehicles with human traffic participants

Automated Vehicles (AVs) are going to be integrated in our future traffic environment, but traffic will never be fully automated. Think of pedestrians, cyclists or other human driven vehicles. Thus, the interACT project aimed to integrate AVs safely in mixed traffic environments. For this, it is important that an AV can understand the intentions of other road users, modify its driving path and communicate its "decision" in real time.

The **interACT project**, funded by **EU Horizon 2020**, worked on this complex topic from 2017 till the official project end in autumn 2020. During this time, the interACT cross - European research team made big progress toward the integration of AVs in mixed traffic environments in complex urban traffic environments.

Last face-to-face meeting of the interACT project partners in November 2019 at the Technical University Munich. Due to the COVID-19 pandemic the Final Event of the project was held virtually (see https://www.interact-roadautomation.eu/final-event-overview/).

Development of socio-physiological models as basis for the project

As basis for all project work, the researchers of the **interACT project** developed **socio-psychological models** by observing how humans interact in real life in complex traffic environments. Therefore, they studied traffic behaviour in **three different European countries** *(UK, Greece, Germany).* The developed socio-psychological models helped the interACT researchers to derive promising interaction strategies, to improve vehicle sensors and data processing algorithms for the decision making of the AVs, and to evaluate their project results.

Implementation of project results in two demonstrator vehicles

The main results of the project were demonstrated in two research demonstrator vehicles by **BMW** and **CRF,** with the support of all project partners.

BMW demonstration car with interACT system installed during the evaluation study

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CRF demonstration car with interACT system installed during the evaluation study

- Communication via light signals

In the BMW demonstrator you can experience the communication via light signals with surrounding traffic participants. Within interACT, solutions for internal (iHMI) and external human-machine interfaces (eHMI) were developed using mainly the visual channel. Therefore, easily understandable **light signals** were created to transfer messages from the AV to human traffic participants. **Two different interaction strategies** for light signals were developed within the interACT project:

- The **Perception-signalling design** is characterised by giving explicit information to other traffic participants that they were perceived by the AV.

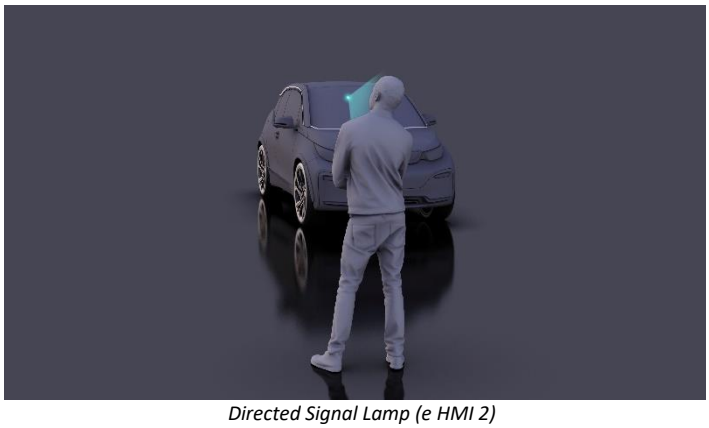
- In contrast, the **Intention-signalling design** provides explicit information regarding the current vehicle manoeuvres and intentions. In addition to the development of the interaction strategies the technical realisation also took place in interACT.

Hardware prototypes were created and implemented, bringing the interACT strategies to real-life. Two methods were chosen by the interACT researchers, the **360-degree Light Band** *(eHMI 1)* and **Directed Signal Lamp** *(eHMI 2).* In particular:

The **360° Light band** was mounted on the exterior of the interACT demonstrator. By using the 360° approach, both interaction strategies could be realised, ensuring high visibility from all sides of the demonstrator vehicle.

360° Light band (e HMI 1)

A **directed signal lamp** is a newly developed hardware component of the project. It transfers light signal to only one specific traffic participant. Using this technology, light signals can be addressed to a specific traffic participant without interfering with others. The directed signal lamp was used to transfer the perception-signalling interaction strategy.



Directed Signal Lamp (e HMI 2)

- The "Brain" of the interACT system

In the CRF demonstrator vehicle you can experience the algorithms for intention recognition of other traffic participants and the main software component of the interACT project for controlling the AV.

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The "Brain" of the interACT system, the **Cooperation and Communication Planning Unit (CCPU)** collects all the traffic information from the environment and the machine. Using an a-priori available digital map of the points of interest providing lane-level information (Common Road Format developed by TUM), the CCPU is able to predict the future behaviour of each detected traffic participant on the map (e.g. pedestrians, human operated vehicles).

Based on this prediction and the catalogue of the project digitalized scenarios, the CCPU recognizes traffic conflicts, classifies the traffic scene and develops a safe trajectory. If the scenario is classified as time and safety critical, the developed **safety layer** running in the background intervenes in almost real time. Taking the planned trajectory into consideration, the CCPU also triggers the HMI (eHMI and iHMI) to communicate the planned activities to the involved traffic actors. As a result, the CCPU ensures that vehicle movement patterns are matched with the messages communicated via HMI, which leads to an avoidance of collisions and other types of accidents while moving in real traffic.

The Cooperation and Communication Planning Unit (CCPU), the brain of the interACT system

Evaluation of the project solutions

For the development and evaluation of the interaction strategies different methods were used in interACT: **i)** simulator experiments, **ii)** test-track studies **iii)** real-world studies **iv)** quantitative modelling, and **v)** observations. One of the project highlights was the evaluation of the project-specific demonstrator vehicles from BMW and CRF. More than **300 participants** tested the interACT solutions in evaluation studies in the UK, Germany, Italy and Greece.

The different study results show for instance that the interACT solutions were well accepted and, in some cases, increased the subjective safety and comprehensibility of AV interaction strategies, while effects have to be evaluated in further research.

Virtual reality studies during simulator experiments

The interACT Solutions at a Glance

- Socio-psychological models which were derived from real traffic observation in three different European countries.

- Interaction strategies were developed for iHMI and eHMI, which provide information to the on-board users and other traffic participants for an efficient interaction.

- The directed signal lamp as new hardware component for Automated Vehicle to give information to specific traffic participants.

- Elaborated sensor algorithms for intention recognition to allow the Automated Vehicle to interpret complex traffic scenes.

- Cooperation and Communication Planning Unit (CCPU) collects all information from the map, the vehicle sensors and vehicle to plan and control a safe trajectory and

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efficient interaction via HMI. This includes the **Safety Layer** which is used to eliminate or reduce the severity of collisions and intervenes only if necessary.

- Evaluation methodologies for the evaluation of complex interaction of traffic participants with Automated Vehicles.

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www.interact-roadautomation.eu

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Consortium

DLR, BMW, CRF, BOSCH Invented for life, HELLA, ICCS, Technical University of Munich, UNIVERSITY OF LEEDS

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