Dear Ladies and Gentlemen, Dear Colleagues,

we are very pleased to present you today our 12th SAFIR Newsletter and hope you enjoy reading it.

You can also find all previous newsletter issues for download on our website www.thi.de/go/safir in the "Newsletter" section. There you can also view the data protection information. If other colleagues or partners of yours would like to receive our newsletter automatically in the future, please contact Camila Heller by e-mail, at camila.heller@thi.de.

Our newsletter aims to provide you with regular updates on news, current topics and dates of interest relating to the SAFIR research partnership. We look forward to your feedback as well as constructive suggestions and requests for changes!

With best regards from the entire

SAFIR team

Starting signal for the "Safe Mobility of the Future"

The SAFIR project (Safety for all - Innovative Research Partnership on Global Vehicle and Road Safety Systems) started its second round on, 1 April 2022.

For this purpose, the SAFIR management team invited network partners from science and industry to start the intensification phase together. Under the name SAFIR, Technische Hochschule Ingolstadt is building a strategic partnership in cooperation with automotive manufacturers, suppliers and highly specialised small and medium-sized enterprises to research innovative technologies in vehicle and road safety.

Fig. 1: Group photo of the participants of the SAFIR kick-off for the start of the intensification phase on 1 April 2022 at THI
Source: THI

News from the Impulse Project 6 Mixed Reality-gestützte Absicherung sicherheitskritischer automatisierter Fahrfunktionen (MIRASOFT)

The MIRASOFT project focuses on the validation of automated driving functions using mixed reality methods. After the mixed reality test environment MiRE was built and tested as a proof-of-concept in the first project phase (SAFIR IP1), it will be further developed and tested for its validity in use in the second project phase (MIRASOFT).

Fig. 2: Motion capturing system (left), real pedestrian dummy with object recognition (top right) and pedestrian model in the simulation (bottom right)
Source: THI

Subproject 1 focuses on vulnerable road users (VRUs). In order to be able to realistically depict their behavior and movements in the mixed reality environment, a pedestrian model is being developed from motion data of real pedestrians. For this purpose, motion data of pedestrians on the outdoor track (CARISSMA) will be recorded in the first project year.

For this purpose, a motion tracking system based on the MVN XSens was built in the first project year, which will be used for these recordings. In these recordings, different weather conditions, as well as the resulting different behavior of pedestrians, are also taken into account. The models created from the data collected are intended to replace the foam dummies currently used in the Euro NCAP tests. These dummies can only reproduce very limited movement behavior and therefore do not represent a realistic substitute for humans. Through the model created from the data, realistic pedestrians in the mixed-reality test environment should increase the validity of these tests.

For the recording of the motion data, selected EuroNCAP test cases are simulated. Test subjects are put into their role as pedestrians and can experience the scenario. Their behavior is recorded during this time and then evaluated.

Fig. 3: The mixed reality test environment MiRe with the components simulation (top), pedestrian tracking (bottom left) and real vehicle (bottom right)
Source THI

Since this data must also be forwarded to other components or simulators, an extension of the Open Simulation Interface (OSI) standard is being worked on at the same time, with which data can be exchanged between simulators. However, this standard still lacks a comprehensive description of a human model. In perspective, this extension of the OSI standard should make it possible for every simulator and every component supporting this standard to send and receive data describing humans in certain situations.

In subproject 2 "Driver modeling and support by augmented reality HMIs", the focus lies on the behavior of the driver and the vehicle occupants. The

driver's behavior is determined experimentally in several driving simulation studies in order to derive and evaluate HMI concepts that aim to increase the explainability and transparency of the vehicle's automated driving behavior.

In Subproject 3 " Evaluating the validity of Mixed Reality for testing automated driving functions" the mixed reality architecture built in SAFIR IP1 will be further developed in MIRASOFT with a focus on performance and modularity. A combination of open source tools such as CARLA Simulator, ROS2 and OSI will be implemented to ensure easy exchange of the components under test and their level of realism. The entire architecture is adapted to the SAFIR EP1 test vehicle to provide a seamless transition between virtual test, mixed reality and real test track.

In addition to the design and implementation of the architecture responsible for the exchange and management of data in the mixed reality environment, the integration of a simplified driving function in MIRASOFT is planned. This will allow Euro NCAP scenarios to be tested in all degrees of reality, including interaction with VRUs and with other traffic vehicles.

The mixed reality environment extended in MIRASOFT should make it possible to perform complex test cases of automated driving functions with little effort. Current and future project partners can then be offered individual solutions for system and component validation. In addition, the test vehicle based on open interfaces and the model-based methods developed in the project can be used for structured test case generation to validate ADAS functions in a time- and cost-efficient manner.

Research Staff in MIRASOFT

M.Sc. Jakob Peintner

Jakob Peintner is a research associate in the Human-Computer Interaction Group (HCIG) led by Prof. Andreas Riener at the CARRISMA Institute of Automated Driving (C-IAD) and has been employed at SAFIR since 2020. He studied Industrial Design at the OTH Regensburg and subsequently the Master Human Factors Engineering at the TU Munich. As part of the MIRASOFT project, he is working on both the role of humans in automated driving and the technical implementation of a mixed reality test environment for testing automated driving functions.

M.Sc. Carina Manger

Carina Manger is a research associate in the Human-Computer Interaction Group (HCIG) led by Prof. Andreas Riener at the CARRISMA Institute of Automated Driving (C-IAD) and has been employed on the MIRASOFT project since summer 2021. She studied psychology at the University of Vienna and human factors engineering at the Technical University of Munich and is now investigating at THI and in her doctorate how automated driving functions can be made explainable and safe.

M.Sc. Maikol Funk Drechsler

Maikol Funk Drechsler works as a research assistant in the Hardware-in-the-Loop laboratory of the Research Center CARISSMA at THI and researches the use of simulation-based testing for the automotive industry. He graduated from the Federal University of Santa Catarina in Brazil in automotive engineering. He also completed his Master's degree in a cooperation between the Federal University of Santa Catarina and THI in the same field.

News from Impulse Project 5 - Automated and Connected Electric Vehicles before, during and after an Accident (AVENUE)

Regulation (EU) 2019/2144 [1] makes it mandatory for new type-approved trucks and passenger cars in Europe to be equipped with numerous safety-relevant Advanced Driver Assistance Systems (ADAS) by this month. This includes amongst others the Blind Spot Information System. According to UN Regulation No. 151 [2], the system should warn the driver of a possible collision with a cyclist crossing from the right during the turning process. The warning shall be given by a visual signal, an acoustic signal, a haptic signal or a combination of these signals if the risk of a collision increases. The driver shall have the possibility to deactivate the system manually, whereas it shall reactivate automatically each time the vehicle is restarted. The system shall operate in a speed range from standstill to 30 km/h and in light conditions above 15 lx. It is designed to detect a cyclist traveling at a speed of 5 km/h to 20 km/h at a lateral distance of 0.9 m to 4.25 m between the truck and the cyclist. The UN regulation does not require the system to engage the brakes actively.

Therefore, in the context of the SAFIR impulse project 5 "AVENUE", the Blind Spot Information System of several truck manufacturers was investigated on the CARISSMA outdoor test facility (see the following figure).

Fig. 4: Dynamic functional test of the Blind Spot Information System [own illustration]
Source: THI

The focus was on various static and dynamic functional tests as well as the determination of system limitations in order to gain knowledge on the following questions of forensic accident analysis:

- How and when was the warning of the Blind Spot Information System perceptible for the driver in case of a collision?
- Did the system fail to warn the driver of the occurrence of the dangerous driving situation in time or at all due to a limitation?
- When should the system have warned the driver at the latest to enable that driver to avoid the collision while considering the reaction time and speed?

Based on the test results, which are currently being evaluated and will be published in the winter, new methods for reconstructing the ADAS driver interactions will be developed. In addition, the need to equip heavy commercial vehicles with an Event Data Recorder (EDR) in the future, which records the activities of the systems in interaction with the driver's actions in the event of a collision, will be demonstrated. Because the related questions that arise in court can only be answered beyond doubt and entirely with the help of these digital traces.

Bibliography

[1]: European Parliament and Council, Verordnung (EU) 2019/2144 des Europäischen Parlaments und des Rates vom 27. November 2019 über die Typgenehmigung von Kraftfahrzeugen und Kraftfahrzeuganhängern sowie von Systemen, Bauteilen und selbstständigen technischen Einheiten für diese Fahrzeuge im Hinblick auf ihre allgemeine Sicherheit und den Schutz der Fahrzeuginsassen und von ungeschützten Verkehrsteilnehmern, zur Änderung der Verordnung (EU) 2018/858 des Europäischen Parlaments und des Rates und zur Aufhebung der Verordnungen (EG) Nr. 78/2009, (EG) Nr. 79/2009 und (EG) Nr. 661/2009 des Europäischen Parlaments und des Rates sowie der Verordnungen (EG) Nr. 631/2009, (EU) Nr. 406/2010, (EU) Nr. 672/2010, (EU) Nr. 1003/2010, (EU) Nr. 1005/2010, (EU) Nr. 1008/2010, (EU) Nr. 1009/2010, (EU) Nr. 19/2011, (EU) Nr. 109/2011, (EU) Nr. 458/2011, (EU) Nr. 65/2012, (EU) Nr. 130/2012, (EU) Nr. 347/2012, (EU) Nr. 351/2012, (EU) Nr. 1230/2012 und (EU) 2015/166 der Kommission. [Online]. Verfügbar unter: https://eur-lex.europa.eu/eli/reg/2019/2144/oj

[2]: United Nations Economic Commission for Europe, Regulation No 151 – Uniform provisions concerning the approval of motor vehicles with regard to the Blind Spot Information System for the Detection of Bicycles, 2020. [Online]. Verfügbar unter: http://data.europa.eu/eli/reg/2020/1596/oj

Research Staff in AVENUE

M.Eng. Daniel Paula

Daniel Paula is employed at the CARISSMA Institute C-ECOS of TH Ingolstadt and at the same time a doctoral student at the University of Žilina at the Chair of Forensic Engineering. In addition, Mr Paula works as an expert for traffic accident reconstruction at DEKRA Automobil GmbH. As part of his doctoral thesis, Mr Paula is investigating the effects on forensic accident analysis associated with the automation of vehicles.

M.Sc. (TUM) Thomas König

Thomas König is employed at the CARISSMA Institute C-ECOS of TH Ingolstadt and also works as an expert for traffic accident reconstruction at DEKRA Automobil GmbH. In the context of his research work, Mr König is concerned with the effects on accident analysis associated with electromobility and with the further development of simulation and mixed reality methods in accident analysis.

M.SC. Robin Langer

Robin Langer joined the CARISSMA Institute C-ECOS as a research associate at the end of 2020. He obtained his Bachelor's degree in automotive engineering at TH Ingolstadt and his Master's degree in mechanical engineering at the Friedrich Alexander University Erlangen-Nuremberg (FAU). His current field of research is vehicle forensics with regard to the periodic technical inspection (main inspection) of vehicles.

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