Dear Ladies and Gentlemen, Dear Colleagues,

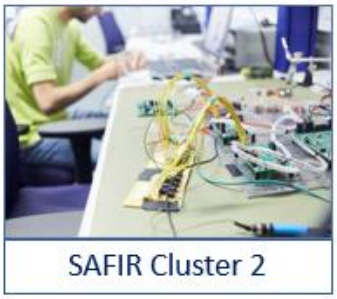
we are very pleased to present you today our 18th SAFIR Newsletter and hope you enjoy reading it.

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



Content

- ***News from the Impulsprojekt 10: Localization and control in combined indoor and outdoor scenarios (KASINO)***

The SAFIR IP10- KASINO project was initiated in cooperation with our project partners AVL Software and Functions GmbH and iMAR Navigation GmbH to increase the degree of automation in modern vehicles. To achieve this goal, various challenges must be overcome, including the determination of the vehicle's position. While modern GNSS (Global Navigation Satellite System)- technologies such as RTK (Real-Time Kinematic) can provide good accuracy, difficulties can arise when GNSS signals are blocked, especially in urban canyons, forests, tunnels, or enclosed spaces. The first sub-project of KASINO focuses on improving the localization of vehicles in the transition between indoor and outdoor areas.

The technologies used in the transition scenario are identified as ultra-wideband (UWB) for indoor positioning and inertial sensors and GNSS for outdoor positioning. The required components are purchased from the leading manufacturers (Racelogic GmbH and iMAR Navigation GmbH).

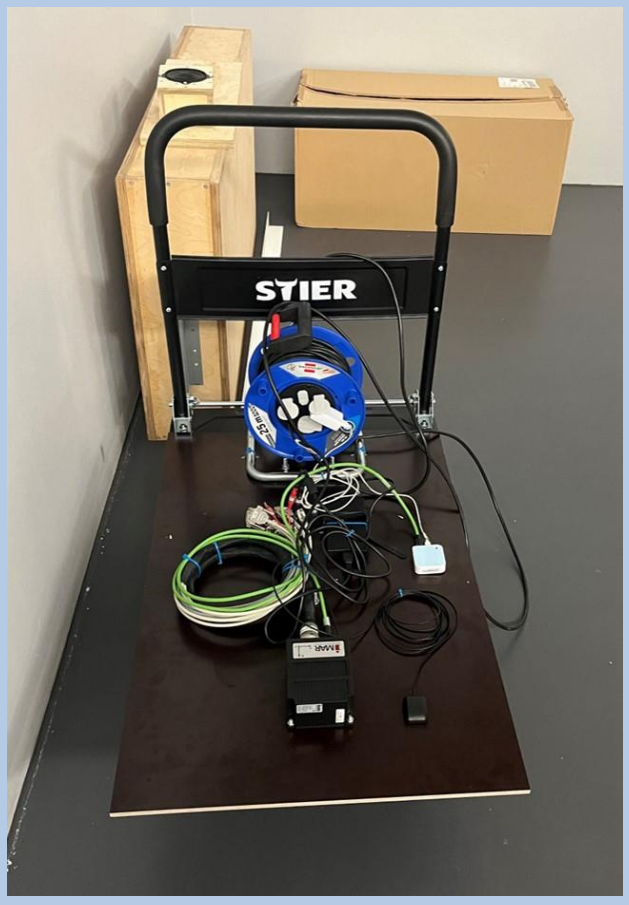


Figure 1: Prototype with Inertial Sensors + GNSS. Sourc: THI

The complexity of the driving functions to be tested requires a variety of test scenarios with both real and virtual components. Automation is partially possible, but interfaces and the smooth linking of simulation and reality pose challenges. The second sub-project focuses on the expansion of an architecture for mixed real-virtual driving tests based on OSI. The aim is the automated, flexible execution of high-quality driving tests involving real and virtual components. To this end, the final driving scenario of the project has already been fully defined and interfaces to the real and virtual entities are being analyzed and modules created that will enable control in different test executions of real driving test scenarios at the test facility of AVL at Roding.

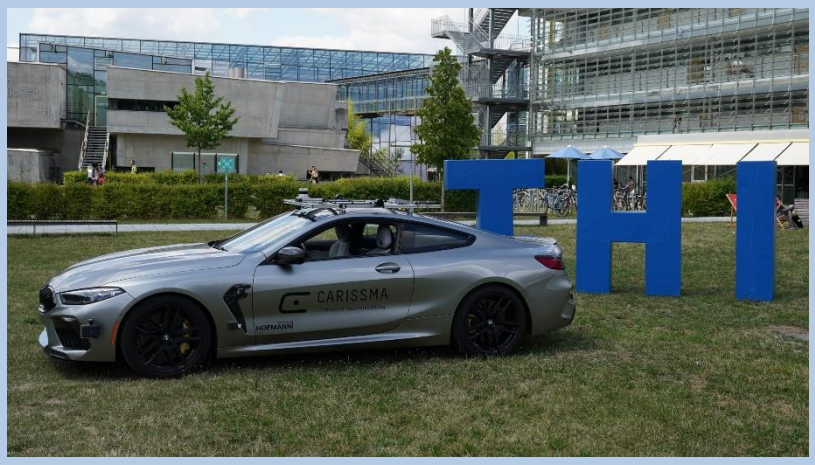


Figure 2: BMW M8 test vehicle, which is used to carry out the real tests. Source: THI

Research assistant in the KASINO projekt

Saravanan Palanisamy received his master's degree from RWTH Aachen University. He works as a research assistant in the research group of Prof. Dr. Martin Ebert and is responsible for the first subproject, which focuses on localization.

The second subproject is being worked on by **Christoph Sell** and **Felix Fröhling**.

Felix Fröhling is a PhD student in the field of simulative validation of autonomous driving functions and focuses primarily on vehicle perception.

Christoph Sell is a Master's student focusing on software architectures and interface design for automated vehicles and has already completed his Bachelor's degree in Vehicle Informatics at THI.

Funding reference number KASINO: 13FH7I10IA

- ***News from Impulse Project 5: "AVENUE" - Automated and Connected Electric Vehicles before, during and after an Accident***

It is known from international reporting in recent years that driver assistance systems and automated driving functions are far from being able to avoid every accident, but on the contrary can even be a contributing cause of a traffic accident due to automation risks and changes in driver behaviour. This has been confirmed by published driving tests [1] and a simulator study [2] based on it in the AVENUE project, and it has also been shown that human drivers are often not able to immediately compensate for a misbehavior of the assistance systems, as corresponding driver reaction times have to be taken into account.

Based on these findings, methods are being developed to be able to demonstrate the influence of driver assistance systems on the course of the accident in the forensic reconstruction of a traffic accident. Two approaches are being pursued to achieve this:

On the one hand, the data of the Event Data Recorder (EDR), which has been mandatory in passenger cars and light commercial vehicles since June 2022 in accordance with Regulation (EU) 2019/2144 [3], can be comprehensively evaluated. According to the current version of UN-ECE R160 [4], the EDR also contains information on the activity status of various assistance systems, but the extent to which these have actually interfered with vehicle control is not recorded. Here, only the data sets on speed, brake and accelerator pedal actuation, and steering wheel angle can be analyzed in detail in order to identify patterns that may indicate corresponding system interventions in the pre-collision approach phase or immediately before the accident. To this end, EDR data sets from real accidents are currently being evaluated in a targeted manner in the

AVENUE project. The accidents are reconstructed using common methods of forensic accident analysis in order to be able to determine whether the EDR data can be reconciled with the determined course of events and the conditions at the scene of the accident. The results of this ongoing process are expected to be published later this year.

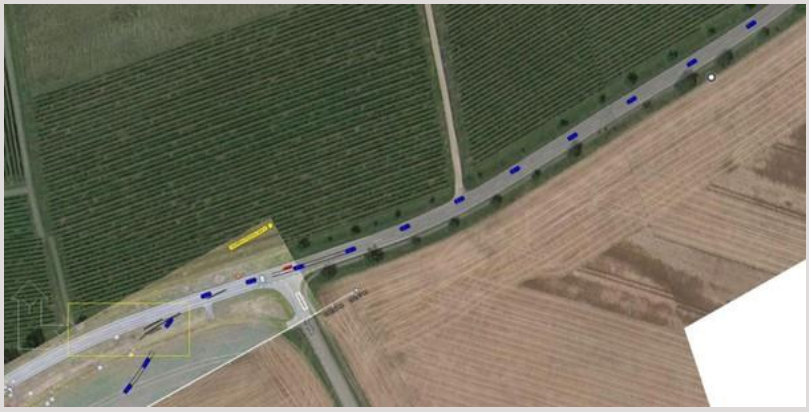


Figure 3: Reconstruction of a single-vehicle accident based on the EDR data sets with the PC-Crash software. Source: THI

On the other hand, in many cases – especially if there are no sufficient digital traces, for example in the form of EDR data – it will be unavoidable to simulate the course of the accident to be investigated in an experiment in order to fathom the behaviour of the assistance systems in the specific situation. In order to be able to simulate the accident scenario correctly, the possible factors influencing the performance of driver assistance systems and their environment sensors were first systematically recorded and structured using the "Safety of the intended functionality" (SOTIF) method according to ISO 21448 [5]. The result, entitled "Systematic investigation of influences on advanced driver assistance systems for accident reconstruction" [6], was presented at the annual congress of the European Association for Accident Research and Analysis (EVU) 2023. The resulting abundance of influencing factors must now be limited to such an extent that it is possible to carry out tests with reasonable effort in the context of court proceedings, both for reasons of time and cost, while at the same time maintaining the necessary level of detail for realistic and forensically verifiable behavior of the driver assistance systems. Taking into account various accident scenarios, environment sensor systems and driver assistance systems, a method is currently being developed for this purpose, which is to be published in mid 2024.

References

[1] Paula, D., König, T., Bauder, M., Petermeier, F., Kubjatko, T., Schweiger, H.-G.: 'Peformance Tests of the Tesla Autopilot and VW Travel Assist on a Rural Road', Transport Means Conference, 2022

[2] Paula, D., Bauder, M., Pfeilschifter, C., et al.: 'Impact of Partially Automated Driving Functions on Forensic Accident Reconstruction: A Simulator Study on Driver Reaction Behavior in the Event of a Malfunctioning System Behavior', Sensors (Basel, Switzerland), 2023, 23, (24)

[3] Europäisches Parlament und Europäischer Rat: 'Verordnung über die Typgenehmigung von Kraftfahrzeugen und Kraftfahrzeuganhängern sowie von Systemen, Bauteilen und selbstständigen technbischen Einheiten für diese Fahrzeuge im Hinblick auf ihre allgemeine Sicherheit und den Schutz der Fahrzeuginsassen und von ungeschützten Verkehrsteilnehmern: EU 2019/2144' (27.11.2019)

[4] 160: 'Einheitliche Bedingungen für die Genehmigung von Kraftfahrzeugen hinsichtlich des Ereignisdatenspeichers', 30.09.2021

[5] 21448: 'Road vehicles - Safety of the intended functionality', 06/2022

[6] Paula, D., Bauder, M., König, T., Kubjatko, T., Schweiger, H.-G.: 'Systematic investigation of influences on advanced driver assistance systems for accident reconstruction', 31st Annual Congress of the European Association for Accident Research and Analysis (EVU), 2023

Research assistant in the AVENUE project

M. Eng. Daniel Paul

Daniel Paula is employed at the CARISSMA Institute C-ECOS at THI and at the same time a PhD student at the University of Žilina at the Department of Forensic Engineering. In addition, Mr. Paula works as an expert for traffic accident reconstruction at DEKRA Automobil GmbH. As part of his PhD thesis, Mr. Paula investigates the impact of vehicle automation on forensic accident analysis.

M. Sc. Robin Langer

Robin Langer has been working as a research associate at the CARISSMA Institute C-ECOS since the end of 2020. He holds a bachelor's degree in automotive engineering from the THI and a master's degree in mechanical engineering from the Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU). His current field of research is the verification of the perception of the environment of automated vehicles.

M. Ing. Maximilian Bauder

Maximilian Bauder has been working as a research assistant at CARISSMA since the beginning of 2021. He holds a bachelor's degree in mechanical engineering with a focus on automotive engineering and a master's degree in mechanical engineering from THI. His current field of research is vehicle forensics with regard to vehicle-to-everything (V2X) communication and driver assistance systems.

M. Sc. (TUM) Thomas König

Thomas König is employed at the CARISSMA Institute C-ECOS of the THI and also works as an expert for traffic accident reconstruction at DEKRA Automobil GmbH. As part of his research work, Mr. König investigates the influence of driver assistance systems on the course of traffic accidents as well as the further development of simulation and mixed reality methods in accident analysis.

Funding reference number AVENUE: 13FH7I05IA

Hinweis:
Wer den Newsletter nicht mehr erhalten möchte, teilt uns dies bitte per E-Mail mit.

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