Dear Ladies and Gentlemen, Dear Colleagues,

we are very pleased to present you today our 15th 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

SAFIR Management

- ***Innovation Management February/March 2023***

The innovation management of the research partnership has made an active start to the new year. The first innovation barcamp took place on February 10th, 2022. A group of participants made up of scientific staff from the research partnership SAFIR devoted a whole day to finding a topic for new research proposals. For this, the innovation manager Teresa Maltry had support from Jan Glaser, managing director of CIHO UG and experienced moderator. Methodologically sound, the SAFIR employees asked themselves which topics are relevant in order to be further advanced in the direction of the research proposal. Own ideas and wishes have also found their place in the evaluation. At the end of the day, three topics were worked out, some of them in an interdisciplinary manner, which will now be pursued further.

Fig. 1: Innovationsbarcamp, Source. THI

Barely three weeks later, the SAFesight future workshop was on the agenda. SAFIR innovation management has developed a concept with the Bavarian Foresight Institute (THI) to address the topic of future mobility in a special way. Using futurology methods, images of the future were developed in three hours, which show mobility in the year 2035 with regard to both aspects of autonomous and shared mobility. The participants came to the conclusion that in 2035 we still have to reckon with a mixed form of mobility that has more or less autonomous components depending on the center of life (city or country). The methodology and the results of the

SAFesight future workshop were presented on March 9th, 2023 at the CoSMoS trade fair at the Technische Hochschule Ingolstadt.

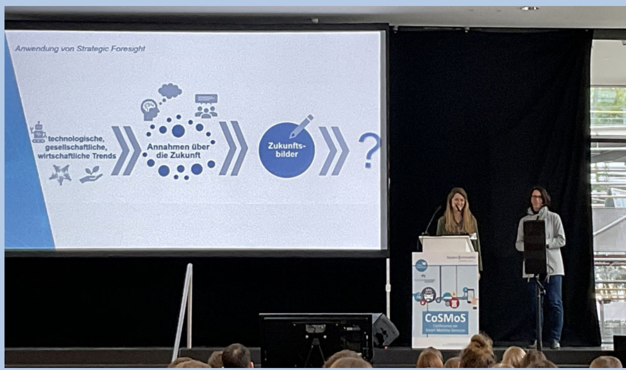

Fig. 2: CoSMoS 2023, Source: THI

- ***Impuls Project 10: Localization and control in combined indoor and outdoor scenarios (KASINO)***

The level of automation in modern vehicles is constantly increasing. Vehicles must take over more and more tasks from the driver and master them reliably. To make this possible, the vehicle must be able to determine its own position precisely in every situation, e.g. on highways, in inner cities, in tunnels and parking garages. Satellite-based systems are used for this purpose outdoors. In indoor areas, however, these are not available, therefore different positioning systems must be used. These systems often differ greatly from each other both in their interface and in their precision.

Thus, in the first subproject, continuous positioning in transitional situations between outdoor and indoor areas will be examined in more detail and improved. For this purpose, an abstraction layer is to be created that provides the information independently of proprietary manufacturers while automatically monitoring the signal quality. Different positioning systems will be investigated, abstracted in software and the quality will be ensured by means of driving tests. The goal of the subproject is to be able to position flexibly and reliably in transition areas and to provide a transparent interface for developers of driving functions.

As the complexity of the driving functions increases, so does the complexity and variance of the corresponding test scenarios. This requires both real- and virtual-test-components with a high degree of variability. The necessary variation can only be automated in parts and for specific situations. Challenging aspects are often the respective interfaces of the test components, but also the linking of entities in simulation and real tests. The simulation can only represent part of reality, so that the interaction between real and simulated system components often does not function without proper interference.

The second subproject focuses on test automation in a mixed-reality test drive. An architecture for networking real and virtual entities within a driving scenario exists from an earlier project. This architecture - based on the Open Simulation Interface - will be extended and supplemented by test automation. The architecture will be tested by means of driving experiments and a metric will be generated that can make a statement about its quality. The focus is again on the combination of real and virtual components. The goal of the subproject is to be able to perform high-quality driving tests in a mixed real-virtual environment in an automated and flexible manner.

The abstraction of positioning systems and the automation of the test infrastructure for mixed-reality driving scenarios will create a new possibility to efficiently and flexibly test a wide variety of critical driving situations. These can then not only be carried out on the outside or in the test hall, but can also be used, for example, for testing in parking garage entrances. By means of virtual shares, these tests can be carried out cost-effectively and with reduced hazards for people and material.

Fig. 3: Illustration of a driving test in a mixed reality test environment. The relative positioning of objects is difficult. Test automation is currently not possible. Source: THI

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

In recent weeks and months, there has been an increasing number of reports that driver assistance systems do not only influence the course of a traffic accident but could even have caused it. The focus here is mainly on SAE Level 2 vehicle systems. These can take over the lateral and longitudinal control of the vehicle in the long term and intervene in the vehicle's driving dynamics in the short term. Accordingly, accident participants reported that the vehicle suddenly left its lane or that phantom braking led to a rear-end collision. As a result, the US National Highway Traffic Safety Administration (NHTSA), for example, has initiated investigations against the manufacturer Tesla.

We have therefore investigated this behavior of the systems in more detail, as lane departure can lead to severe accidents. Therefore, performance tests were conducted on a country road in AVENUE with the "Autopilot" system of a Tesla Model 3 and with the "Travel Assist" system of a VW ID.4. For this purpose, a country road with little traffic and good visibility was chosen and also secured with track guards. It was found that the systems frequently steer out of their lane and into the opposite lane, especially in tight curves (see example in Figure 4). Several cameras and a drone filmed the vehicles' behavior/trajectory for scientific analysis afterwards. The possible reasons for this behavior were evaluated and published at the Transport Means 2022 conference titled "Performance tests of the Tesla Autopilot and VW Travel Assist on a rural road".

Fig. 4: Performance tests on the Tesla Model 3 Autopilot system. Source: THI

From a legal perspective, the driver is responsible for vehicle control even when a driver assistance system is activated, which the manufacturers also emphasize in a continuous loop. The test results showed that the events occurred in quick succession. However, it is assumed that the driver can recognize and control the occurrence of the hazardous situation in advance, thus enabling a safe continuation of the journey. Literature research showed that so far, no basic data on the controllability of false-negative and false-positive activities of ADAS by the driver exists that could be used in accident reconstruction. To gain insights into the driver's reaction behavior and reaction times during such critical driving situations, a driving simulator study was conducted in February 2023 in an inter-institute collaboration between the teams of Prof. Schweiger and Prof. Riener (see Figure 5 for an example). The implementation was preceded by a planning and design phase of about one year. The test data will be analyzed and published in the summer.

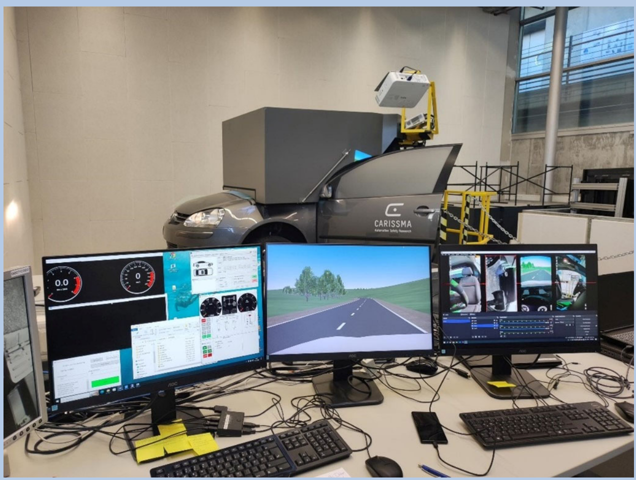

Fig. 5: Driving simulator (Hexapode in C 020) Source: THI