Dear Ladies and Gentlemen, Dear Colleagues,

we are very pleased to present you today our 19th 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

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- ***News from the impulse project 6: Mixed Reality-supported safeguarding of safety-critical automated driving functions (MIRASOFT)***

SAFIR IP6 "MIRASOFT" investigates the mixed-reality-based validation of automated driving functions. The aim is to evaluate and improve the safety and reliability of automated vehicles in various driving scenarios. Building on the results of the first SAFIR project, the mixed-reality methods developed are intended to be improved and further developed in an application-oriented way.

Mixed reality methods offer an immersive and flexible platform for investigating complex traffic situations and driving behavior. In contrast to resource-intensive real-world tests, they make it possible to test a wide range of scenarios under controlled and safe conditions.

A major challenge in the homologation of automated driving functions is predicting the behavior of other road users. Especially in urban environments, where pedestrians and other vulnerable road users cross the road frequently and unpredictably, autonomous systems must be able to react quickly and precisely to human behavior. Only through detailed and realistic simulation of pedestrian movements can algorithms and sensors of vehicles be optimized to cope with these complex situations.

In **sub-project 1**, motion-capture methods will be used to create a data-based pedestrian model that can be used for testing edge cases in road traffic. This will include not only pedestrian movements at the trajectory level but also a complete set of skeletal data.

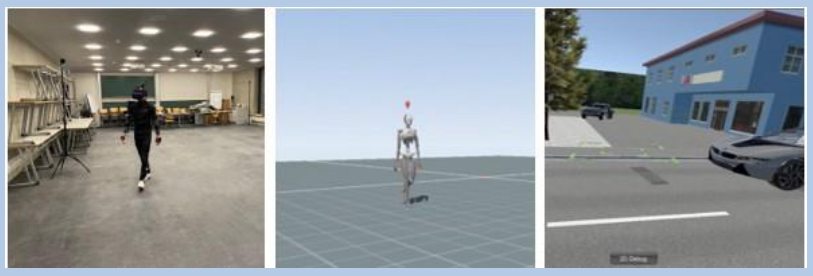

Figure 1: Overview of the setup of the motion-capture studies in subproject 1: test person in the XSens motion-capture suit (left), result of the motion-capture in the software (center), view of the test person in VR (right).
Source: THI

In the first step, human motion data was recorded in several motion-capture studies. For this purpose, test subjects interacted with vehicles in intersection situations, both in real situations and in virtual reality (VR).

Simultaneously, possible use cases for this pedestrian model are already being worked on in close coordination with the project partners EFS and Audi. Based on the pedestrian definition available since v3.6.0 in the Open Simulation Interface (OSI), open connections to the existing shared simulation are being worked on. This should enable the pedestrian model, which is one of the main results of this research project, to be made available to other researchers and industry.

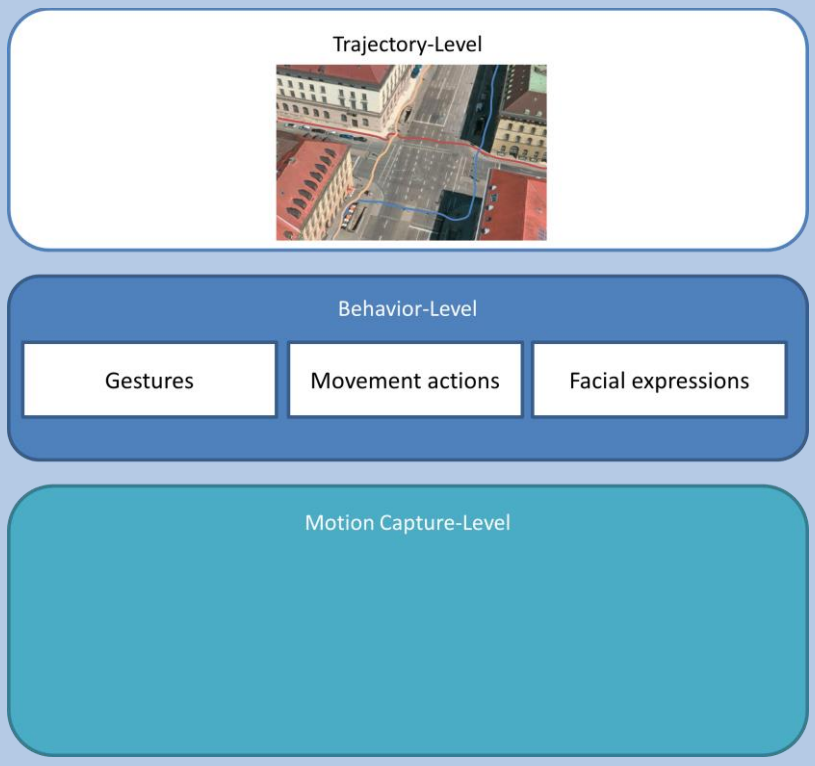

Figure 2: Hierarchical structure of the OSI pedestrian model. Trajectory and motion capture levels were implemented in v3.6.0 through collaboration in the ASAM committee. Source: THI

Sub-project 2 focuses on the behavior of the driver and vehicle occupants. Through experimental driving simulation studies in virtual reality and driving simulators, it is being investigated, how different display concepts can affect trust in automated vehicles, the perception of safety, or the general user experience. The current studies focus in particular on investigations into cooperative approaches to automated driving, in which human drivers and automated vehicles work together to enable more efficient and safer driving behavior. Based on fundamental psychological studies of human cooperative behavior and perception of control, cooperation scenarios, and strategies are derived [2, 3, 4]. Furthermore, the focus is on the explainability and transparency of vehicle behavior, especially in safety-critical or unexpected driving situations. [5, 6].

Abbildung 3: . Examples from the user studies in sub-project 2: Driving simulation and virtual reality studies can be used to investigate new display concepts for automated driving, for example regarding acceptance, trust and the general user experience. Source: THI

In both thematic areas, multimodal information transfer is examined, which includes visual, auditory, and haptic concepts [7]. **The aim of the studies carried out in sub-project 2 is to develop user-centered [8] human-machine interaction concepts for safe and efficient automated mobility.**

[2] J. Peintner, C. Manger and A. Riener, "Communication of Uncertainty Information in Cooperative, Automated Driving: A Comparative Study of Different Modalities," in 15th International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI '23), Ingolstadt, 2023.

[3] J. Peintner, B. Malve, S. Sadeghian and A. Riener, ""Do You Want to Drive Together?" - A Use Case Analysis on Cooperative, Automated Driving," in ACM Conference on Automotive Interfaces and Interactive Vehicular Applications, Ingolstadt, Germany, 2023.

[4] J. Peintner, B. Escher, H. Detjen, C. Manger and A. Riener, "How to Design Human-Vehicle Cooperation for Automated Driving: A Review of Use Cases, Concepts, and Interfaces," Multimodal Technologies and Interaction, vol. 8, no. 16, 2023.

[5] C. Manger, J. Peintner, M. Hoffmann, M. Probst, R. Wennmacher and A. Riener, "Providing Explainability in Safety-Critical Automated Driving Situations through Augmented Reality Windshield HMIs," in 15th International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI '23), Ingolstadt, 2023.

[6] C. Manger, A. Vogl, E. Rosbach, C. Ziegler and A. Riener, "Automation's Not Perfect But Neither Are We: Unveiling Illusionary Control And Automation Bias In Automated Driving," in 15th International Conference on Automotive User Interfaces and Interactive Vehicular Applications (AutomotiveUI '23), Ingolstadt, 2023.

[7] C. Manger, J. D. M. Peintner and A. Riener, "Good Vibes Only: A Comparative Study of Seat Vibration Concepts for Redirecting Driver Attention During Visual Distraction," in 22nd International Conference on Mobile and Ubiquitous Multimedia (MuM'23), Vienna, Austria, 2023.

[8] DIN EN ISO 9241-210, *https://www.din.de/de/mitwirken/normenausschuesse/naerg/veroeffentlichungen/wdc-beuth:din21:313017070* (abgerufen 29.06.2024)

Research assistants in the MIRASOFT project

M.Sc. Jakob Peintner
Jakob completed the bachelor's program in Industrial Design at the OTH Regensburg and then the master's program in 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 is a research associate in the Human-Computer Interaction Group (HCIG) led by Prof. Andreas Riener and has been employed on the MIRASOFT project since summer 2021. She studied Psychology at the University of Vienna and Human Factors at the TU Munich and is now investigating at THI and in her PhD how automated driving functions can be made explainable and safe.

Funding reference number MIRASOFT: 13FH7I06IA

- ***News from the impulse project 7: COSINUS - COSIdia Network and System Test***

Test beds play a crucial role in validating car2X communication and its applications, leading to improved road safety and enhanced traffic efficiency. Over the years, car2X test beds have primarily focused on four-wheeled vehicles rather than motorcycles.

Thus, the COSINUS (COSIdia Network and System Test) project aims to increase the traffic safety of powered two-wheelers (PTWs) by developing fully reactive test environment for car2x use cases of motorcycles. Since Car2X communication was originally designed for the special properties of cars, separate requirements for PTWs must be defined and tested. The impulse partner KTM contributes to integrating the special needs and properties of motorcycles into COSINUS and additionally define the requirements for Car2X based driver assistance systems for motorcycles. We therefore conduct simulations, prototypical implementation of use cases and develop a test environment, which allows PTW-specific properties to be covered and evaluated. The implemented testbed will be validated with the help of simple and complex scenarios. This validation of Car2X-based driver assistance systems for PTWs therefore enables an increase in road safety and thus contributes to smarter and sustainable transport.

Figure 4: System test of applications based on Car2X communication. Source: THI

Research Assistant in the COSINUS project

Gnanambica Chouta

Gnanambica Chouta received her master’s degree in computer applications from Andhra university, India. She is a Research Assistant at car2x lab, CARRISSMA, Technische Hochshule Ingolstadt. Her current research is testing environment to validate car2x applications for PTW.

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