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!

News from the Impulse Project 3

The Impulse Project "Global and Cooperative Safety System" has set itself the goal of contributing to the global safety system based on integral vehicle safety using digitalization. To this end, the focus is on innovative subsystems and on communication per se.

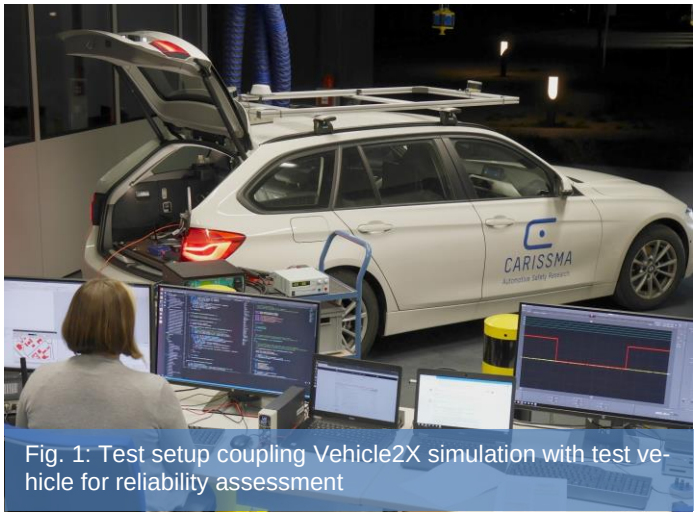

Fig. 1: Test setup coupling Vehicle2X simulation with test vehicle for reliability assessment

The consideration of global and cooperating road users poses a variety of challenges for the automotive industry. The linchpin here is the cross-vehicle communication. With this newsletter we would like to give you an insight into the research work in the SAFIR Impulse Project 3, which is headed by Prof. Dr. Christian Facchi. In the following, the current, scheduled status of the individual sub-projects will be discussed less, but rather future projects as well as individual networking projects, which are particularly important with regard to the Intensification Phase.

DFG Workshop on "Vehicle2X communication to support autonomous driving"

On 25.9.2019, scientists of the DFG Priority Programme SPP 1835 "Cooperatively interacting automobiles" (https://www.coincar.de) met at the CARISSMA research and test centre.

Headed by Prof. Andreas Festag and Prof. Christian Facchi, topics of Vehicle2X communication in the context of automated driving were addressed.

Fig. 2: Participants of the DFG-Vehicle2X-Workshop

Starting from the state of the art in WLAN and mobile radio based systems for vehicle communication, the workshop focused on two current topics relevant for the realization of autonomous driving functions: 1) Cooperative environmental perception uses Vehicle2X communication to exchange sensor data between vehicles or with the traffic infrastructure and expands the perception horizon. 2) During maneuver coordination, the vehicles exchange information on trajectories and maneuver intentions. Both topics contribute to improving safety and sustainability in transport. Thus a bridge was built between the project members of the different research projects of SAFIR and the DFG priority program SPP 1835, "Cooperatively interacting automobiles".

Vehicle2X communication for motorcycles

Subproject III deals with the testing of Vehicle2X control units using a Hardware-in-the-Loop (HiL) test bench. A real-time simulating environment for Vehicle2X ECUs will be created, which allows to simulate realistic Vehicle2X scenarios.
The reproducibility of test scenarios in simulation allows ECUs and their reactions to be tested and validated in a well-defined environment. For realistic test scenarios, which primarily involve so-called Vulnerable Road Users (VRU), a deeper cooperation with the motorcycle manufacturer KTM is being sought in the Intensification Phase. First Vehicle2X scenarios, especially for motorcycles, have already been validated by field tests in cooperation with KTM. The experience gained in these field tests will enable a more realistic definition of scenarios that can be used in connection with one of the most vulnerable groups of people in road traffic: the motorcyclists.

Due to KTM's extensive experience in the field of driver assistance systems for motorcycles, an improved test environment for Vehicle2X-based applications and control units, specially adapted to motorcyclists, will be created by the planned intensification of the cooperation.

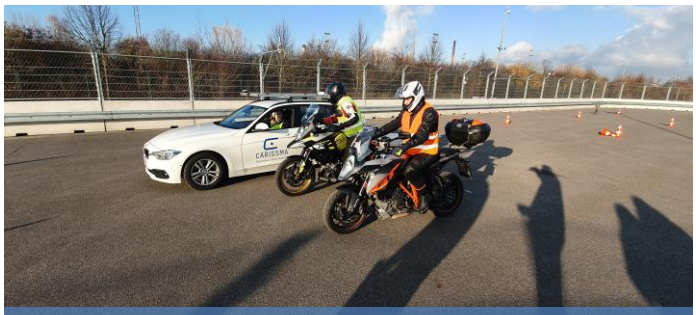

Fig. 3: Validation of Vehicle2X scenarios with motorcycles

Reliability of Vehicle2X communication

Two radio technologies currently compete for the provision of information between road users: Wifi-based 802.11p (synonym: DSRC) and mobile-derived LTE-V (synonym: c-V2X). The project partner S.E.A. Datentechnik GmbH uses Software Defined Radio (SDR) technologies for both radio technologies. This enables the emulation of the V2X communication scenario with extensive possibilities, e.g. channel emulation or targeted error generation in the radio message. These flexible possibilities are used to realistically simulate V2X traffic situations in the laboratory and to test the behaviour under different conditions in a variety of ways. In addition to V2X communication, the GNSS signals and the relevant driving state of the test vehicle are simulated and manipulated simultaneously as physical signals and the reactions of the test vehicle are evaluated. This simulation can be feed back to the DUT in a precise and highly synchronous manner using existing so-called open loop test systems. This allows basic V2X functions (Day 1 Use Cases) to be tested. Within the SAFIR Impulse Project, the simulation using the Closed Loop Method (HiL) is being investigated and improved in cooperation with S.E.A. In a HiL simulation, the entire traffic situation and the resulting signals are cyclically calculated several hundred times per second and the reactions of the test object are considered during this calculation, too. This test method is indispensable for testing cooperative methods or interaction with a driver.

The optimization of V2X HiL systems will be intensively methodically investigated together within the framework of Subproject III in order to provide efficient, practical solutions for the increasingly important V2X technology as future products for industry. The focus of the investigations is on the performance of the simulation and its applicability, such as simple definition of scenarios.

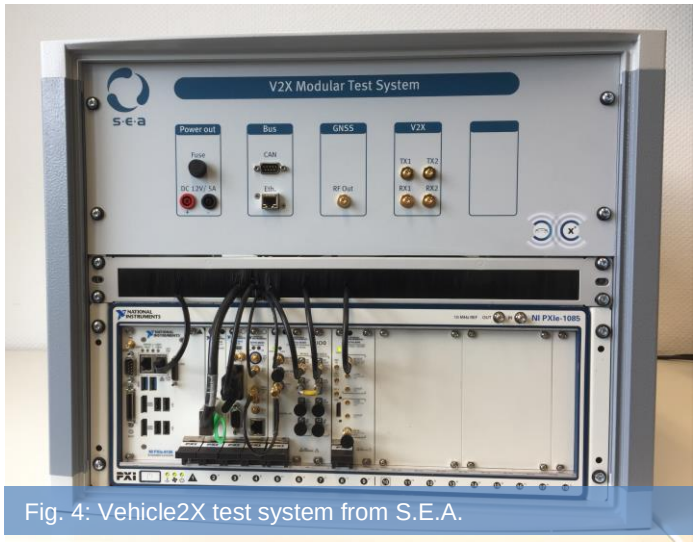

Fig. 4: Vehicle2X test system from S.E.A.

Test possibilities in real road traffic

The ANTON project application in the "Global Security System" SAFIR Cluster provides an experimental platform for automated driving. For this purpose, a vehicle with a commercially available standard architecture and open system interfaces will be integrated into the existing infrastructure so that prototypes of driving functions can be tested in real traffic. As a preparatory step, a test in the CARISSMA off-road area can be used. The subsequent test in real traffic will then be carried out by the infrastructure-side environment perception systems for safeguarding automated driving functions provided in the aplied R&D project In²Lab (**In**golstadt **In**novation **Lab**).

[1] Christina Obermaier, Raphael Riebl, Christian Facchi; Fully Reactive Hardware-in-the-Loop Simulation for VANET Devices; ITSC 2018, 21st IEEE International Conference on Intelligent Transportation Systems

[2] Christina Obermaier, Raphael Riebl, Christian Facchi; Limitations of HIL Test Architectures for Car2X Communication Devices and Applications; 3rd ACM Computer Science in Cars Symposium (CSCS); 2019

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FORSCHUNG AN FACHHOCHSCHULEN

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