

Experimental Integration of Especially Vulnerable Road Users (eVRU) in Vehicle-to-Human (V2H) Communications Research

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With the rise of automated vehicle (AV) technologies in recent years, the topic of external human machine interfaces (eHMI) for intent communication between AV and other traffic participants, and in particular vulnerable road users (VRU), has gained huge interest in research and development [1]. Offering a possibility to overcome the social interaction void that arises with the introduction of AV, the development and testing of eHMI in AV-VRU communication concentrated mainly on interactions between pedestrians and AV so far. It has been argued that a large variety of different eHMI concepts has been proposed due to a lack of standardization, and that certain eHMI concepts may elicit various negative effects such as distraction, confusion and overreliance. [2] Additionally, the needs of especially vulnerable road users (eVRU) – such as people with reduced mobility, impaired vision or cognitive disorders, elderly and children – are recently being emphasized in automotive and traffic engineering, contributing to the goals of equity, safety, accessibility and social sustainability of intelligent transportation systems. A safe and clear intent communication of AV interacting with eVRU has to be ensured to avoid the previously mentioned negative impacts of eHMI on the most vulnerable population. Different methodologies have been used for evaluating the potential effects of different eHMI concepts, such as desktop-based video studies, virtual reality studies or studies employing physical prototypes (partially utilizing the Wizard of Oz method). Due to perceptual differences in virtual reality and video use when compared to real-life scenarios, the reliability of such study results has to be interpreted with high prudence. Therefore, studies employing physical prototypes are recommended for the evaluation of vehicle-to-human (V2H) communication concepts and their effects. [3] In order to study and demonstrate V2H concepts, especially with eVRU, in real-life scenarios under controlled experimental setups, a test bed is currently being built together with the IABG mbH, the State of Bavaria and the TUM Chair of Traffic Engineering and Control. This test bed embodies a large asphalt area where various infrastructure layouts can be set up dynamically. Together with traffic lights, pedestrian walkways, curbstones, artificial buildings and other infrastructure elements, this allows for the evaluation of various urban scenarios and real-world situations involving eVRU. An additional installation of video and LIDAR sensors together with state of the art communication equipment (traffic controllers, road side units, etc.) via ITS-G5 as well as an own cellular 5G network enables all different ways of research in the field of vehicle-to-vehicle (V2V), vehicle-to-human (V2H) and vehicle-to-infrastructure (V2I) communication. [4] The active involvement of members and representatives of eVRU associations, which will be inquired as associated partners, will ensure an appropriate focus on the special needs of eVRU in future traffic systems with high degrees of traffic automation.

Additional Keywords and Phrases: Vehicle to Human (V2H) Communication, Especially Vulnerable Road Users (eVRU), Test Bed for Urban Connected and Automated Traffic

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