Improving cyclists' safety via new C-ITS technologies in automated and connected mobility

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1. Introduction

Recent studies argue that the rollout of connected and automated vehicles (CAVs) will have significant impact on vulnerable road users (VRUs). New technological developments in the field of Vehicle-to-X-communication (ITS-G5, Cellular-V2X), combined with sensor systems, lay the ground for cooperative detection and mitigation of collision risks, not only focusing on the reliable detection of VRUs as passive traffic participants, but enabling them to play an active role by transmitting their own position.

2. Objectives

The Austrian research project Bike2CAV (the acronym stands for "Bicycle to **C**onnected **A**utomated **V**ehicle") aims at improving cyclists' safety via C-ITS technologies. Using an integrated proof-of-concept prototype and real-world data, the project's goal is to validate methods for applying the cooperative detection of collision risks and non-distracting warning systems[1] to benefit cyclists.

3. Methods

Within the scope of the project, methods in four research areas are developed and evaluated:

(1) precise self-localisation of cyclists

(2) cyclists' perception of CAVs

(3) detection of cyclists' intentions

(4) cooperative detection of collision risks for cyclists

Methods (1) to (3) are the prerequisite for the cooperative detection of collision risks (method (4)).

4. Results

In the first 15 months of the project, the above-mentioned methods were developed. The validated methods will then be combined for the first time in a proof-of-concept prototype. This prototype will be tested in two real-world scenarios at intersections in a rural and an urban area in Salzburg through controlled experiments.

At the EU Safety Conference, preliminary results of the first real-world tests on the precise self-localisation of cyclists (method (1)) will be presented. In a real-world study, the localisation accuracies of the following three technologies will be compared and evaluated with the help of a high-precision map (HD-map): 1) prototype with external INS-supported multi-frequency GNSS-RTK, 2) Smartphone Xiaomi Mi9 with a multi-frequency and IMU-supported GNSS sensor, 3) C-ITS enabled bike with IMU/GNSS-sensor. The main focus is on positioning accuracy and reliability, whereby values of less than 50 cm and 99.9% respectively are targeted.

5. Conclusion

This study is a contribution to test new methods for a more precise self-localisation of cyclists and thus to increase the safety of cyclists in road traffic.

6. Keywords

[1] The non-distracting warning systems are the subject of a separate abstract submitted by Eva Hollauf et al..

connected and automated vehicles, V2X-communication, C-ITS, vulnerable road users, cyclists, cooperative detection, self-localisation methods