Interface Outside: Extending the V2X Communication Framework for Vulnerable Road User Protection

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ABSTRACT

For more than a decade, Vehicle-to-X communication has been a flicker of hope in the urge to make our roads safer. Numerous research projects advanced the underlying technology. Many technological hurdles were taken such as reliable sensor-based detection of local dangers, e.g., traffic jams. However, researchers have only recently begun to systematically investigate suitable user interfaces for the V2X-induced driver assistance. In this paper we propose a low-cost, "outsourced" interface to incorporate vulnerable road users in the V2X community.

1. INTRODUCTION

Recent work investigated suitable user interfaces for C2X based warnings. [3] compared the performance of auditory versus visual modalities for local danger alerts. According to this study, icon only warnings were perceived fastest while text-only needed the most time to be interpreted by the driver. Combined modalities lie in between. [4] pointed out the potential danger of the technology by relating it to the reliance-compliance model of automation dependence. The so called lateral cross traffic assistant uses an additional outside interface in situations where a crash of a car (A) and a motorcycle (B) is imminent: B turns on the conspicuity enhancement, e.g. flashing lights, autonomic from A. In this paper, we propose a low-cost framework with the aim to extend this idea to vulnerable road users, namely bicycles.

2. PROPOSED APPROACH

The way how Figure 1 (bottom, left) depicts the motorbike conspicuity enhancement from an user interface point of view is idealized. Here, B does not really act as a subsystem of A taking over parts of A's interface. Rather than that, B possesses its own application logic observing the environment and thereby detecting the possible threat. In order to provide this functionality, B needs to have access to various knowledge sources (a map, the most probable path, ...) as well as a fairy complex collision detection algorithm. It is plausible that one would accept the costs for such a complex system, because motorbikes are expensive vehicles compared

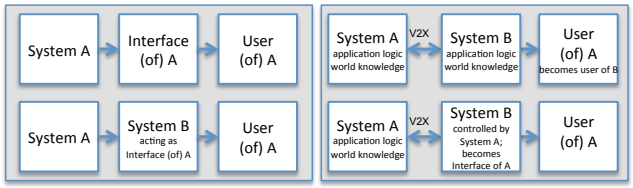

Figure 1: Top, left: conventional interface. Bottom, left: interface "outsourcing" – system B serves as an interface for system A. Top, right: The outside interface realized in the described motorbike scenario. Bottom, right: Streamlined version proposed here that allows incorporating bicycles.

to for example bicycles. In order to successfully widen the scope of the approach to other vulnerable road users such as drivers of bicycles, the technology should be a lot less complex (and therefore a lot less expensive). Consider for example the following scenario: A car (A) is driving on a major road; a bicycle is driving alongside this road. A recognizes that the driver is going to turn right. In regular intervals, the bicycle sends out its position and vehicle type which is transmitted via V2X and received by the car. The possible threat is detected only by the more complex system A. In return, A sends out an instruction to turn on the conspicuity enhancement on the bicycle.

We propose such a small-footprint system for bicycles: A customary smartphone, which is mounted to the handle bar is connected via bluetooth to the communication unit which itself joins the V2X-Community via 802.11a Wavelan. The communication unit itself is also connected to the conspicuity enhancement component, which serves as the "outside interface" for the car driver. The communication unit is built upon a low priced Routerboard [2] and runs a modified version of the popular OpenWRT [1] distribution which is publicly available.

3. REFERENCES

[1] http://openwrt.org/, last accessed 2010-07-02.
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AutomotiveUI'10, November 11-12, 2010, Pittsburgh, Pennsylvania
Adjunct Proceedings.