Poster: Visual Cue-Based VRU Protection on Smartphones

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1. MOTIVATION

As autonomous vehicles loom as reality, and the vehicle communication starts to be enforced by law from 2020, protecting vulnerable road users (VRUs) using vehicle communication is receiving attention. The current vehicle-to-pedestrian (V2P) communication as stipulated by the standards such as SAE J2735 implies that it is the vehicles that take the responsibility for VRU protection. User devices are essentially beacons that transmit Personal Safety Messages (PSMs), and upon receiving PSMs, the drivers (or autonomous vehicles) take necessary measures to protect them. We, however, believe that the road users also need information about nearby vehicles to protect themselves from dangerous situations.

Using other technologies than the standard Dedicated Short Range Communication (DSRC), there have been existing works for VRU protection. They use Wi-Fi or Wi-Fi Direct as replacements of DSRC [1]. An automaker tested DSRC for VRU protection [2], but no technical detail has been presented. An important issue with the existing VRU protection proposals is that they are fraught with *false alarms*, which lowers the utility of the whole idea. Although one can come up with a highly precise collision prediction model, any such model will generate a huge number of false alarms, especially in urban environments. For example, if a pedestrian walks along a sidewalk well protected from the driveway, all passing vehicles will generate an alert to the pedestrian and *vice versa*. So our approach instead provides intuitive visual cues to the smartphone user looking at the screen, so that they can use their discretion to determine the level of danger for themselves.

2. VRU PROTECTION PLATFORM

In this work, we propose visual cue-based VRU protection method, particularly targeting the road users whose head is buried in a smartphone. First, we develop the working DSRC module that can be connected to a smartphone (Fig.1) and the software module including Wireless Access in Vehicular Environments (WAVE) and SAE J2735 protocols, so that the smartphone can communicate with other vehicles. The DSRC module not only transmits PSMs, but receives the other vehicle's Basic Safety Messages (BSMs) using IEEE 802.11p/ 1609.4 protocols through a wireless channel. After receiving the BSMs, the module provides the messages to the smartphone via the USB port.

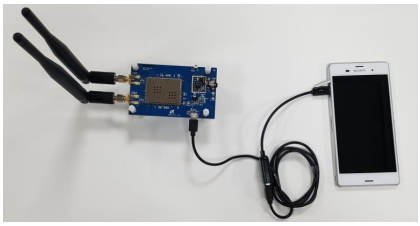

Figure 1: DSRC V2P prototype module attached to smartphone via USB port

3. VISUAL CUE-BASED VRU PROTECTION

Second, we propose a method to inform smartphone users of the risk by using visual cues on the edges of the smartphone. In a sense, it is similar to the LED-lighted crosswalks in the Netherlands that gives visual cues in the peripheral vision of the smartphone user [3]. We implement an application that highlights the screen edge on the incoming vehicle side, and the highlighted part moves along the edge and changes color and intensity according to the relative speed and location of the passing vehicle (Fig.2). It is computed using the GPS coordinate, heading and speed information of the vehicle in the BSM and those of the smartphone, along with the attitude of the phone that is detected by sensors.

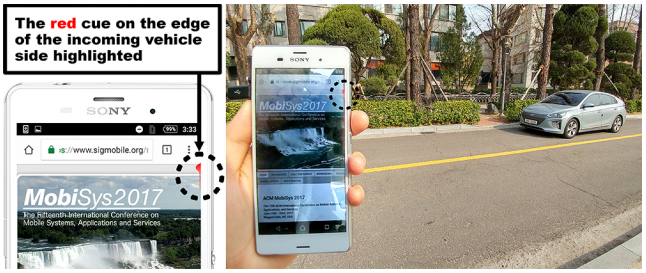

Figure 2: Smartphone screen with the edge on the incoming vehicle side hightlighted

4. ACKNOWLEDGEMENT

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5. REFERENCES

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