Red Light Violation Warning (RLVW) over Cellular Network

A comparative Study between Dedicated Short Range Communications (DSRC) and Fourth-Generation Long Term Evolution (4G/LTE) Technologies for RLVW.

WHAT IS THE NEED?

Connected Vehicle (CV) technologies and applications have shown the promise in improving safety, mobility, and the environment. The communications component in the form of vehicle-to-vehicle (V2V), vehicle-to-infrastructure (V2I), and vehicle-to-everything (V2X) of the CV system has been focused on the use of Dedicated Short Range Communication (DSRC). Until the market penetration rate of DSRC-equipped vehicles reaches critical mass, the potential of CV technologies in making surface transportation safer, smarter, and greener cannot be fully realized.

DSRC communications is essential for V2V critical safety applications, such as V2V-based collision warning and avoidance, as these applications require short response times. Many V2I applications, such as transit signal priority (TSP), RLVW, and CV-based intelligent traffic signal control, could tolerate certain level of communication delay. Utilizing the existing Cellular 4G/LTE network for V2I applications can complement DSRC-based applications by applying the existing infrastructure, vehicle, and communication technologies; Caltrans perceives a need to assess the impacts of different types of V2I communication on the RLVW application.

WHAT ARE WE DOING?

The goal of this project is to compare how two different communications technologies (DSRC and 4G/LTE cellular) can support a specific CV application utilizing the California CV Test Bed in Palo Alto. RLVW aims to warn the drivers of the danger of potentially violating an upcoming red signal based on their speed, distance to the signalized intersection, and intersection signal phase and timing (SPaT) information.
The California CV Test Bed is compliant with the latest CV standards and is broadcasting SPaT and Map Data (MAP) over DSRC. Each test bed intersection has 4G/LTE backhaul for supporting this proposed project by simultaneously streaming SPaT and MAP over 4G/LTE.

The research team will perform the following tasks:

• Detailed assessment of how other organizations quantify a RLVW

• Overseeing the integration effort to identify infrastructure challenges, setup, and variations that can lead to unacceptable findings

• Detailed analysis of baseline system performance checking that all systems are functioning properly

• Tests on the CV testbed along El Camino Real using a vehicle equipped with both DSRC and the proposed cellular solution

• Evaluation of the collected corridor results against the metrics and requirements

RLVWs are highly dependent upon accurate high-resolution SPaT information in conjunction with vehicle telemetry data. It is proposed that the cellular latency can be accounted for by in-vehicle processing systems. This research will connect the current roadside data stream to SinWaves’ cloud, so that SinWaves’ in-vehicle communication software can demonstrate its ability to accurately estimate phase remaining timing using vehicle telematics and geosynchronous timing.

WHAT IS OUR GOAL?

The objectives of this research are:

• To quantify point-to-point communication delay over 4G/LTE and DSRC for message transmitting and receiving

• To develop and test a 4G/LTE cloud-based RLVW system, and compare its performance with DSRC-based system

WHAT IS THE BENEFIT?

This study will ensure that the designed RLVW algorithm performs to specification. The research findings will have the potential to advance intersection efficiency and safety by leveraging the existing CV technologies.

WHAT IS THE PROGRESS TO DATE?

The expected start date for this research is October 15, 2018.

IMAGE

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