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CALTRANS DIVISION OF RESEARCH, INNOVATION AND SYSTEM INFORMATION

TRANSFORMING IDEAS INTO SOLUTIONS

Research Notes

Maintenance, Operation and Enhancement of Cellular Vehicle-to-Everything (C-V2X) Communication Infrastructure Phase III

California Connected Vehicle Test Bed Maintenance – Phase 3

Research Support

NOVEMBER 2024

Project Title:
Connected and Automated Vehicle (CAV) Infrastructure Development

Task Number: 3904

Start Date: December 15, 2022

Completion Date: October 31, 2025

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WHAT IS THE NEED?

U.S. DOT, in the past, has provided financial and technical support to Caltrans for developing the, now defunct, DSRC communication infrastructure on its test-bed site along El Camino Real in Palo Alto. The test-bed is fully operational but needs to be maintained and supported so that it will be useful for other Caltrans projects, as well as for projects to be conducted by a variety of other public and private sector organizations in the region.

Dedicated Short Range Communication (DSRC) at 5.9 GHz (75 MHz Bandwidth) has been rendered obsolete by Federal Communication Commission (FCC) and a new standard has been introduced called Cellular Vehicle-to-Everything (C-V2X). This new standard has introduced new challenges for the test bed as the existing hardware now needs to be replaced and the new hardware needs to be purchased to replace the existing obsolete hardware. The new hardware also needs to be integrated to the existing traffic controllers which is quite challenging. The test bed provides a unique capability to deliver time-critical, safety-critical messages between the roadside infrastructure and vehicles with high reliability and low latency. This new 30 MHz band has been allocated by Federal Communication Commission (FCC) for Intelligent Transportation System (ITS) use. Caltrans, in conjunction with private and academia, is in the process of developing applications based on connected vehicle technology.

This task is a part of the Connected and Automated Vehicle (CAV) Infrastructure Development project. The primary goal of this project is to develop the hardware and applications and to keep the test bed fully functional so that various applications can be developed in the CAV area. These

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applications include, but not limited to, Curve Over speed Warning System, Traffic Probe Data Processing, Intersection safety and Mobility Applications, etc.

WHAT ARE WE DOING?

This task will take care of the following activities.

1. Upgrade the test bed to the new C-V2X standard
2. Regular maintenance of the test bed including special setup requests from various users
3. Support to new users
4. Provide liaison to national network of test beds
5. Increase the awareness among the possible users of the test bed
6. Regular upgrades and enhancement of test-bed capabilities
7. Providing demonstrations to the other states and agencies.

WHAT IS OUR GOAL?

The end goal of this task is to have a fully functional test-bed with complete support to its users.

WHAT IS THE BENEFIT?

This test-bed will provide a platform for software developers who will be developing transportation applications that will help drivers in reducing travel times, saving fuel, and drive with augmented safety. Caltrans will be the primary beneficiary as the developed applications will help Caltrans to manage the traffic flows better while reducing the carbon footprint.

WHAT IS THE PROGRESS TO DATE?

January 1, 2024 – March 31, 2024

Task 1. Upgrade the Test Bed to the New C-V2X Standard

The 22-intersection (16 regular + 6 HAWK) devices has been delivered to District 4 for hardware mounting. The firmware of RSUs have been upgraded.

PATH and District 4 engineers conducted an on-site observation regarding the following tasks

- Checked if the facility components are complete for both the 16+6 intersections to be updated at Palo Alto and the 15 at Mountain View.
- Verified the status of the network connection in the cabinets.
- Identified the status of device activation, such as RSPs and RSUs, for both the old DSRC-only and DSRC C-V2X dual-mode intersections.

Task 2. Test Bed Regular Maintenance including Special Setup Requests from CV Application Developers

A CV-Testbed website has been set up to show the status of the test bed in real time for all the 31 intersections. But only 10 out of the 31 intersections are operating due to the preparation of the facility upgrade activity.

Task 3. Provide Technical Support to New Users

Provided support to District 4 engineers in resolving technical issues associated with the 2070 traffic controller, RSUs and RSPs.

No new user in this quarter.

Task 4. Provide Liaison to National Network of Test Beds

No activities in this quarter.

Task 5. Increase the Awareness among the Possible Users of the Test Bed

No activities in this quarter.

Task 6. Regular Upgrade and Enhancement of Test-Bed Capabilities

The new model of C-V2X RSUs without external antennas have been upgraded. The new RSUs will be installed and tested at ECR testbed in November.

Task 7. Provide Demonstrations to Other States and Agencies

No activities in this quarter.

WEBSITES

https://caconnectedvehicletestbed.org/