



Caltrans Division of Research,
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Research



Notes



Advanced
Research

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Project Title:
Connected and Automated
Vehicle Application Development

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Collect Data using Connected Vehicles (CV) for Real-Time or Future Use

A research project to address the technology gap in gathering useful information from CV data and integrating this new information with Traffic Management Center (TMC) operations through real-time CV data collection, analysis, and information dissemination between connected infrastructure and the TMC.

WHAT IS THE NEED?

Connected Vehicles (CV) can provide real-time data to California Department of Transportation, used to not only monitor the traffic condition on the road, but also optimize the throughput in real-time, support ITS planning activities, and keep travelers informed about travel conditions.

As connected vehicles become more prevalent, CV will produce massive quantities of data that will need to be reduced, managed, analyzed in order to provide useful information for real-time traffic management, and archived for offline planning and evaluation purposes. There is a need for a mechanism in place for data collection, processing, analysis, dissemination of information to the TMC, and data archiving.

Furthermore, messages transmitted between connected vehicles and connected infrastructure include mandatory and optional data elements. Some of the optional data elements would be beneficial to collect for the use of traffic management but are subject to OBU (on-board unit) vendors' support.



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WHAT ARE WE DOING?

The objective of this research is to use CV to collect the following real-time data so that it can be used by TMC to monitor the traffic condition on the road and optimize the throughput in real-time:

1. Vehicle speed/travel times
2. Origin and destination
3. Vehicle classification
4. Vehicle lane position (which lane is the vehicle in)

The main steps include:

1. Development of a data collection plan to ensure that CV data are appropriately collected, processed and disseminated to meet the project object
2. Development of roadside applications to collect and process cv data and disseminate the data to transportation management systems
3. Collection and evaluation of data to assess the accuracy of the estimated metrics

WHAT IS OUR GOAL?

The goal of this research project is to address the technology gap in gathering useful information from CV data and integrating this new information with TMC operations through real-time CV data collection, analysis, and information dissemination between connected infrastructure and the TMC.

WHAT IS THE BENEFIT?

Conducting testing and evaluation of the mechanism for data collection, analysis, and information dissemination in a real-world setting with OBUs from different vendors will help to address the interchangeability issue (use of OBUs from various vendors), leading to more robust and efficient use of CV data for TMC operations

WHAT IS THE PROGRESS TO DATE?

Message Forward software was modified on Savari RSUs to include the Store-and-Repeat functionality as defined in USDOT v4.1 RSU specifications. Broadcasting of MAP messages at the RSU now have two options:

1. The intersection Linux computer sends the MAP message to the RSU at the 10 Hz rate, utilizing RSU's Immediate-Forward API, or
2. The RSU stores the MAP message and broadcasts the MAP on the radio interface at 1 Hz, utilizing the Store-and-Repeat API.

This modification helps to standardize the software module running on the Linux computer to communicate with the RSU. The standardized interfacing software module has been tested to not only work with Savari RSUs but also Cohda and Siemens RSUs, and it is expected to work with District 11 selected RSUs.

The expansion of the SAE J2735 message library which include encoding and decoding of Probe Vehicle Data Message (PVD), and Probe Data Management Message (PDM) has also been completed. The expanded J2735 message library has been tested in the lab environment to generate BSM, PVD, and PDM messages, transmit the messages between various RSUs and OBUs, and process the messages on the receiving end.

The RSUs and OBUs used in the lab testing include:

- RSU: Savari, Cohda, and Siemens
- OBU: Savari and Cohda

The Siemens RSU has a built-in function to verify the messages sent to the RSU via the Immediate-Forward API and only transmit the validated messages over the radio interface. This provides a validation that the Probe Vehicle Data Message (PVD), and Probe Data Management Message (PDM) messages encoded by the expanded J2735 message library are correctly formed.

DRISI is also helping District 11 (D11) in setting up the message porting from the RSU to the D11 TMC. This work is expected to complete in the first quarter of the year 2022.