DRISI

Caltrans Division of Research, Innovation and System Information

Research Results

C1 Traffic Detector Reader and Analyzer

Develop an inexpensive tool to diagnose vehicle detector problems while they are still online and reporting data to the TMC.

Transportation Safety and Mobility

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Project Title:
Roadway Detector System Evaluation

Task Number: 1546

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WHAT IS THE NEED?

Effciently managing and operating California's highway system requires accurate, timely, and reliable information on traffic speed and flow. This information is derived from data collected throughout the state by either loop detectors installed in the pavement or roadside side-fire radar. However, many of the traffic sensors do not operate properly, making the data unreliable. To maximize the return on the investment made in these traffic detectors, tools are needed that can diagnose and fix the problems.

WHAT WAS OUR GOAL?

The goal of this project was to develop eï¬€ective tools and techniques to diagnose and troubleshoot vehicle detection station malfunctions, thus allowing Caltrans to repair as many of the unreliable systems as possible.

WHAT DID WE DO?

The objective of this project is to develop the ability to collect 100% of the real-time data flowing between Caltrans controllers and controller cabinets and validate it by comparing it to video ground truth.

To that end, we have designed and developed an electronic circuit that samples all the logic signals flowing in and out of a controller via a flex cable that makes individual contacts with each C1 connector pin. The data is stored by a Raspberry Pi microcontroller that transmits it to a local USB thumb drive and/or a web server program via TCP/IP. These components are mounted in an environmental enclosure that includes a female C1 connector into which plugs the standard male C1 connector from the cabinet. This assembly, in turn, plugs into the controller

via another standard male C1 connector. The installation is completely transparent to the controller and cabinet.

In order to analyze the captured data, we have developed a software program called VideoSync that can display ground truth video alongside a graphical representation of the logic signals on selected C1 pins. An arbitrary time offset can be applied to synchronize the video and the C1 pin signals. In this way, false detections, missed detections, double counts and other erroneous data reported by detectors are readily visible. The software includes tools that use these data sets, once compiled and analyzed, to generate statistics on the accuracy of any vehicle detector under test.

WHAT WAS THE OUTCOME?

A prototype device was developed and tested in type 332 (traffc signal) and type 334 (vehicle detection station) cabinets. It proved capable of capturing and storing logic signals from each C1 connector pin. It is small enough to easily fit in any Caltrans cabinet, simple enough so that field staff can operate it, and accurate enough to catch even the smallest intermittent error.

The data from the C1 Reader assembly can be loaded into the VideoSync software and displayed alongside, and synchronized with, video from any source, e.g. CCTV, camcorder, iPhone, etc. in order to determine the accuracy of any vehicle detector compatible with Caltrans cabinets.

WHAT IS THE BENEFIT?

Caltrans now has a method to improve the reliability of the vehicle detection information received at its Traï¬ƒc Management Centers (TMCs). Additionally, this method can be used to evaluate new vehicle detection technology as it comes to market by comparing available products to traditional inductive loops and video ground truth. For example, a prototype is currently being used to assess the ability of a new detector to recognize bicycles and distinguish them from cars and trucks.

IMAGES

Figure 1: C1 Reader/Analyzer in Environmental Enclosure (closed)

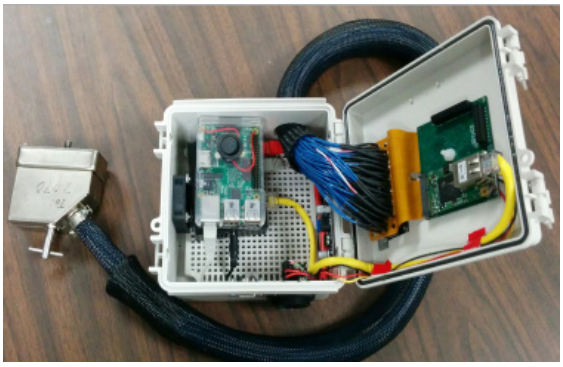

Figure 2: C1 Reader/Analyzer in Environmental Enclosure (open)d

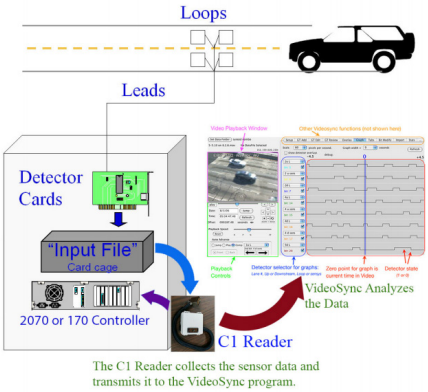

Figure 3: C1 Reader & VideoSync Vehicle Detector Anaysis System