DRISI

Caltrans Division of Research, Innovation and System Information

Research Results

Support for Avalanche Sensing and Communications

Sensors can gather the needed data to support maintenance decisions to induce controlled avalanches to improve safety

Maintenance

DECEMBER 2016

Project Title:
Support for Avalanche Sensing and Communications

Task Number: 2771

Completion Date: September 30, 2015

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WHAT WAS THE NEED?

Avalanches pose a challenging problem for roadways traversing mountainous areas of California. An unexpected avalanche can shut down roads and endanger motorists. Conducting controlled avalanches reduces the number of naturally occurring avalanches, resulting in improved safety and lower maintenance costs. To safely trigger an avalanche requires accurate information to determine the best time and conditions. Sensors can provide the needed data, such as snow depth, temperature, wind speed, and wind direction, as well as camera imaging. This research task is the continuation of a previous effort: Task ID 1810 Field Operations for GPS assisted Winter Maintenance Vehicles (Avalanche Sensing). Task ID 1810 built a prototype avalanche sensing and detection system which measures wind speed, temperature, and snow surface heights, and provides video to give maintenance workers data to support decisions on when to initiate a controlled avalanche. Task ID 2771 was needed to complete the field testing of the prototype that was developed in Task ID 1810.

WHAT WAS OUR GOAL?

The goal was to investigate commercially available components to build an avalanche sensing and detection system and test it for one snow season.

WHAT DID WE DO?

Caltrans, in partnership with the University of California, Davis Advanced Highway Maintenance and Construction Technology (AHMCT) Research Center, designed and built a prototype avalanche sensing and detection system using commercially available parts. This system was partially completed under Task 1810.

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DRISI provides solutions and knowledge that improves California's transportation system

The system includes an outdoor network video camera to allow remote monitoring and visual corroboration of the sensor measurements. The wind speed sensor can detect wind speeds up to 224 mph, with an accuracy of 2.2 mph. The temperature sensor can detect temperatures down to –58° F, with an accuracy of 0.54° F. The equipment is powered by a wind generator that can supply up to 350 watts. These sensors will provide measurement data regularly through to the Caples Lake maintenance staff. Many features have been developed to ensure that the system functions in all scenarios so that no on-site visits are required throughout the winter season.

This current research effort included four tasks.

- Task 1: Update and support the prototype
- Task 2: Install the fully bench- tested prototype in the field
- Task 3: Collect and analyze sensor data for one snow season
- Task 4: Document research in final report

WHAT WAS THE OUTCOME?

Due to the substantial challenges of the site installation, the prototype was not installed in the field. As a result, the four research tasks were only partially executed. The site challenges are well documented in the final report and must be accounted for in any similar future efforts. Because the prototype was not installed at the site, Task 1 support was restricted to improvements to the system in preparation for the final installation. Task 2 was limited to the conceptual design of table and graphical-based user interfaces to support visualization. Task 3 was limited to lab data collection and analysis to better quantify system performance and power usage. Task 4 was completed and documented the results of this research task.

WHAT IS THE BENEFIT?

Inducing controlled avalanches reduces the number of spontaneous avalanches. As a result, motorist and worker safety increases, avalanche control costs decrease, and delays to the travelling public are minimized.

LEARN MORE

The final report documenting this research is available through the AHMCT Research Center website:
http://ahmct.ucdavis.edu/pdf/UCD-ARR-15-09-30-04.pdf

IMAGES

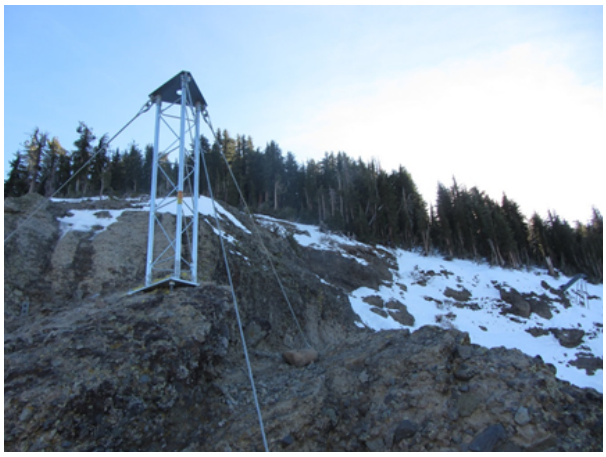

Image 1: Tower installed on Carson Spur to hold the instrumentation equipment

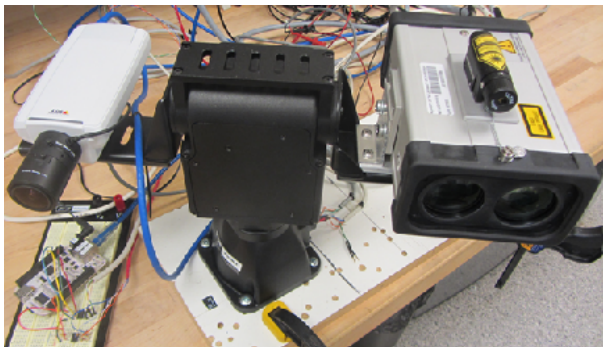

Image 2: Prototype system in lab