DRISI

Caltrans Division of Research, Innovation and System Information

Research Results

Managing Avalanches Along Roadways

Sensors can gather the needed data to initiate controlled avalanches and improve safety

Maintenance

DECEMBER 2015

Project Title:
Field Operations for GPS-assisted Winter Maintenance Vehicles (Avalanche Sensing)

Task Number: 1810

Start Date: June 29, 2009

Completion Date: September 30, 2014

Product Category: New or improved tool or equipment

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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 snow slides, 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.

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.

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Caltrans provides a safe, sustainable, integrated and efficient transportation system to enhance California's economy and livability.

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WHAT DID WE DO?

Caltrans, in partnership with the University of California, Davis Advanced Highway Maintenance and Construction Technology Research Center, designed a prototype avalanche sensing and detection system using commercially available parts. The system was placed in the avalanche zone on State Route 88, known as chute 4 of the Carson Spur.

The project involved several steps. To determine the best location to place the prototype, Caltrans Surveys measured the entire face of the Carson Spur using a stationary laser scanner. The researchers then installed a 5-foot tower to hold the instrumentation equipment on the rock face. The system included 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 was powered by a wind generator that can supply up to 350 watts.

The sensors transmit measurement data regularly through wireless communications 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.

Tower installed on Carson Spur to hold the instrumentation equipment

WHAT WAS THE OUTCOME?

The instruments were successfully bench-tested, but installing the equipment was more challenging than anticipated. In particular, it was difficult to find a location for the tower that provided the right field of view for imaging and distance measurements as well as secure mounting and system survivability. For this reason, the system was not installed by the end of the project. Final system installation, field testing, and analysis are occurring in follow-up research.

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. To ensure that controlled avalanches are executed at the right time and under the right conditions requires data that the sensing and detection system developed under this research provides.

LEARN MORE

To view the complete report:
http://ahmct.ucdavis.edu/pdf/UCD-ARR-14-09-30-01.pdf

Prototype system in lab