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Caltrans Division of Research, Innovation and System Information

Research Results

Mountain Pass Road Opening (MPRO) Implementation and Training

This task built eight new MPRO units that will help maintenance crews on three different highways open snow covered mountain passes that are closed for winter.

Maintenance

NOVEMBER 2021

Project Title:
Driver Assistance for Winter Maintenance Using GPS

Task Number: 3255

Start Date: August 1, 2018

Completion Date: November 30, 2021

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WHAT WAS THE NEED?

Due to limited usage and difficulties maintaining high mountain pass roadways, California Department of Transportation (Caltrans) allows several of them to close over each winter season. In the spring, Caltrans Maintenance must re-open these passes for the traveling public. In heavy snowfall winters, closed mountain pass highways can build up 30 to 40 feet of snow, making it extremely difficult and hazardous to locate and clear the road.

Caltrans had a need to improve the safety and efficiency of mountain pass opening operations. The Advanced Highway Maintenance and Construction Technology Research Center (AHMCT) at UC Davis previously developed, tested, and successfully demonstrated a field-ready GPS-based MPRO system in a Caltrans funded research task. That system was tested over several seasons on both State Route (SR) 108 (Sonora Pass) and SR 120 (Tioga Pass). Caltrans Division of Maintenance had a need to develop more Mountain Pass Road Opening (MPRO) systems that can be easily transferred between pieces of equipment used during pass opening operations.

WHAT WAS OUR GOAL?

The goal of this effort was to provide Caltrans with an efficient and safe way to open the three snow-covered mountain passes each spring. To accomplish this goal AHMCT modernized the previous MPRO system, and redesigned it for enhanced portability, updated the software for compatibility with a new operating system, and provided training to Caltrans staff.

Caltrans

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WHAT DID WE DO?

The first part of the research developed a digital base map of the three mountain passes. AHMCT worked with a Caltrans survey crew to get a mobile terrestrial laser scan (MTLS) of the three roadways. The MTLS scan data was processed and then used to develop a detailed digital base map that included guardrail roadways signs and other roadside features.

AHMCT also worked with Caltrans Division of Equipment to prepare eight different snow blowers and loaders with the necessary cables and mounts to be able to install the new MPRO system. The new system included a new Global Navigation Satellite System (GNSS) receiver that acts as a compass and provides both vehicle position and heading. The GNSS receiver also communicates with a satellited based augmentation service (SBAS) that provides digital corrections to the GNSS signal that improves the accuracy of the system. The GNSS receiver is connected to a junction data box inside the cab of the snow blower. The data from the junction box is then fed to a Samsung tablet that is mounted inside the cab of the snow blower. When the system is turned on it will provide the operator with a display that shows a birds-eye view of the roadway. The tablet display shows the lateral and longitudinal position and heading of the vehicle in the roadway. The display also shows the height above the roadway and the accuracy in centimeters of the system. The accuracy of the system is determined by how many satellites the GNSS receiver can communicate with.

AHMCT also developed an MPRO user manual that contains details on how to configure the MPRO android application as well as how to activate the SBAS subscription.

In April 2021 AHMCT held operator and installation training at the three different maintenance yards that are used to open Sonora pass, Tioga pass, and Ebbetts pass. During the training Caltrans operators were surprised and impressed with the MPRO accuracy even under dense trees. The operators liked having the map displaying above-ground obstacles, such as snow post, postmile markers, guardrails, road signs, and buildings (rest stop bathrooms) at visitor points. The displayed map will help them avoid damaging snow posts, postmile markers, and guard rails, which are often completely covered in snow. Any damaged snow posts, signs, and postmile markers would require repair or reinstallation after the snow removal operation and before the road opens to the public.

AHMCT is working with the Division of Maintenance on a plan to ensure that the MPRO system is maintained and ready to deploy at the start of each mountain pass opening season.

WHAT IS THE BENEFIT?

Caltrans benefits by having a modernized MPRO design that is easy to operate and is portable. This system provides a safer environment for the maintenance crews responsible for opening these mountain passes and allows for the passes to be opened sooner. Another benefit is a reduction in costs to repair equipment that has been damaged by hitting guardrail, rocks, or other roadway features hidden by snow.

LEARN MORE

Final Report has not been posted yet.

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IMAGES

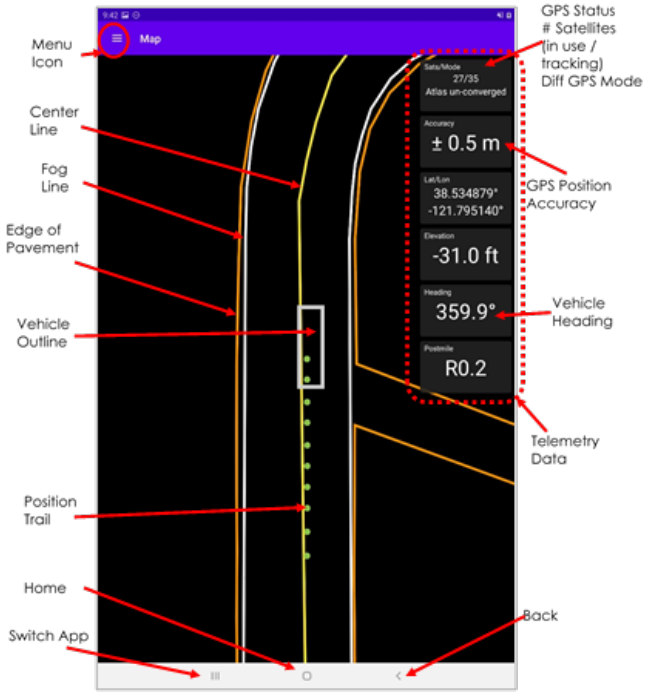

Image 1: Photo of graphical user interface (GUI) showing the snow blowers position, heading, and elevation above roadway.

Image 2: Photo of inside the cab of snow blower during snow removal operations.

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