DRISI
Caltrans Division of Research, Innovation and System Information

Research Notes

Mobile Device App for Wrong Way Driver Detection and Warning

Evaluating the Accuracy and Effectiveness of the Bosch Mobile Device App for Wrong Way Driver Detection and Warning

Transportation Safety and Mobility

OCTOBER 2022

Project Title:
Wrong Way Driver Mitigation

Task Number: 3948

Start Date: October 1, 2021

Completion Date: June 30, 2022

Task Manager:
John Slonaker
Sr. Transportation Electrical Engineer (Specialist)
john.slonaker@dot.ca.gov

WHAT IS THE NEED?

Only 0.14 percent of collisions on California state highways from 2012 to 2021 were caused by Wrong Way Driving (WWD), but WWD accounted for 2.2% of fatal collisions during the same period. Most wrong-way events are head-on collisions caused by drivers entering the exit ramps of controlled-access highways. Many drivers currently use mobile applications such as Waze and Google Maps to assist them in finding their destination and making informed route decisions. Such applications leverage the vast amount of roadway network data collected and maintained by companies such as Google as well as the real-time driving data collected from drivers using the applications. This real-time driving data is transmitted by users' mobile devices, allowing these services to estimate traffic flow and to provide functionality such as route guidance and hazard warnings to their users.

Bosch has taken advantage of these rich sources of roadway and driver data to develop software to detect wrong way drivers in Europe. Bosch currently partners with several cellular phone app providers in Germany to embed their software in the apps. When the app is running on a driver's cell phone, an alert can be sent when he or she is detected by Bosch's software to be heading in the wrong direction. The software can also alert drivers of proximate vehicles whose cellular phones have a Bosch-enabled app running. Caltrans would like to test the functionality and accuracy of the Bosch wrong way driver detection and alert system in California. If UC Davis were to publish positive test results, it could help introduce Bosch's wrong way driver detection and alert technology to California and the rest of the United States.

WHAT ARE WE DOING?

Bosch held several Caltrans-facilitated meetings with researchers at UC Davis wherein they agreed to share their software development kit for iOS and Android and work with UC Davis to devise a method for testing their system. UC Davis signed a non-

disclosure agreement (NDA) with Bosch to work with their proprietary technology.

After The researchers finalized the test plan with input from Bosch and the Caltrans Project Manager, they procured the following test equipment:

Two magnetic antennas
Two SparkFun RTK Surveyors (GPS loggers)
Two microSD cards
Google Pixel 6 phone (1)
Samsung Galaxy S12 phone (1)

Bosch reversed the direction of allowed travel on its map server for five on-ramps in the Sacramento area to facilitate testing without the researchers having to drive in the wrong direction. The researchers performed test runs on the ramps while in communication with Bosch. They successfully recorded wrong-way movement warnings from the Bosch mobile device app (running on the Google and Samsung cell phones) as they drove in the correct direction on the ramps. The researchers also successfully recorded GPS coordinates and corresponding timestamps as they drove on the ramps. These measurements correlated with the wrong-way movement warnings sent from Bosch.

WHAT IS OUR GOAL?

The anticipated outcome of this research is a report that demonstrates the effectiveness and reliability of the Bosch cloud-based mobile device WWD detection and alert system. The report could increase awareness of the technology and lead to its implementation in California and the United States.

WHAT IS THE BENEFIT?

Implementation of cellular/cloud-based WWD detection and alert technology in California could lead to the detection of wrong way movements on all state highways in a cost-effective way, whereas statewide deployment of hardware-based in situ WWD detection systems would be cost-prohibitive.

Detecting WWD and sending real-time warnings to the offending driver and other proximate drivers could reduce the number of crashes caused by wrong way entries onto state highways. This would enhance the safety of California's freeways and save lives, which would align with the Caltrans Strategic Goal of Safety and Health.

WHAT IS THE PROGRESS TO DATE?

The researchers performed six more data collection runs on each of the five Sacramento area ramps, successfully recording wrong-way movement warnings, along with corresponding timestamps, from the Bosch app on the two procured cellular phones. At the same time, they recorded GPS coordinates, along with corresponding timestamps, on the two procured GPS loggers. They documented the successful correlation of these measurements in an interim report.

The researchers plan to perform four more data collection runs on each of the five ramps to achieve a total of 50 data sets (ten per ramp). They will document all test results in an updated report, the format of which will be adjusted according to suggestions from the Caltrans Project Manager.

IMAGES

Image 1: Cellular phones with the Bosch WWD app installed

Image 2: Data collection route for two on-ramps in the Sacramento area.

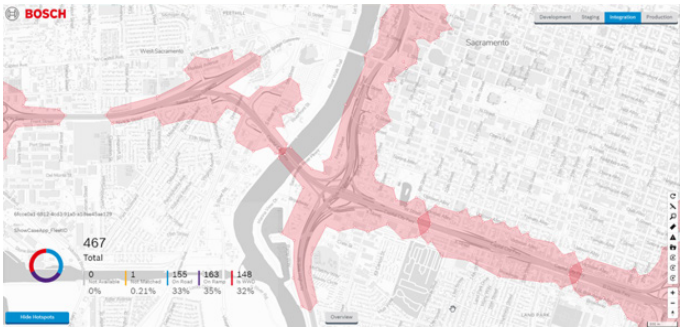

Image 3: The area in which devices running the Bosch WWD app are tracked