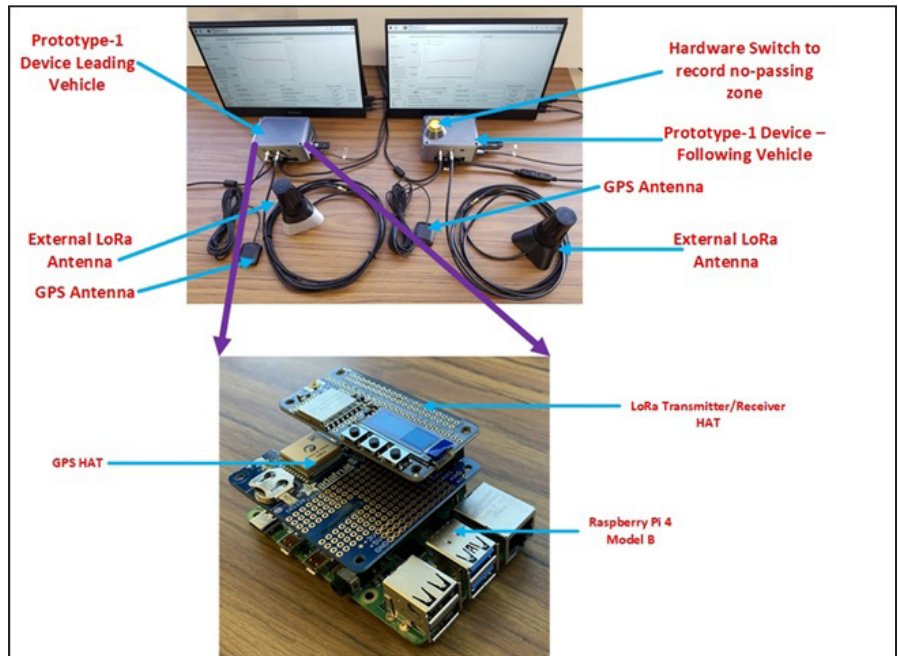


MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 24-535 (project 600 | July 2024

Developing Prototype Systems for Establishing Two-lane Highway Passing and No-Passing Zones



the ISSUE

Establishing passing and no-passing zones (NPZs) is essential in ensuring the safety of the driving public. Inadequate passing sight distance can result in dangerous passing maneuvers that may result in wrong-way driving crashes such as head-on and opposite-direction sideswipe crashes. Accurate markings can reduce these types of crashes, saving significant costs and lives.

the RESEARCH

This project aimed to establish passing/no-passing zones in the field according to the minimum required passing sight distance (PSD). The outdated Range Tracker System used by WYDOT became non-functional, leading to the development of two advanced prototypes utilizing intelligent transportation system technologies.

Prototype 1 was developed, tested, and delivered to WYDOT to replace the Range Tracker System, while Prototype 2 automated some functions of Prototype 1 and produced more accurate results. Both prototypes establish vehicle-to-vehicle (V2V) communication via wireless long-range (LoRa) or IEEE's 802.1p customs and estimate PSD using GPS and speed data from both vehicles. A switch in the following car signals whether the lead vehicle is obscured or visible, setting the no-passing zone boundaries with GPS.

Prototype 2 incorporated two algorithms to automatically detect and record the beginning and end of the NPZ using terrain maps, GPS coordinates, and a computer vision device. Instead of operating a switch, the following vehicle used video cameras with machine vision systems to automatically detect changes in the lead vehicle's visibility status, thus defining the NPZ boundaries more accurately.

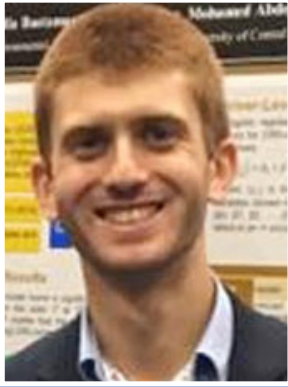


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Project Title

Developing a Prototype System for Establishing Passing and No-Passing Zones of Two-Lane Highways

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Wyoming DOT

USDOT, Research and Innovative Technology Administration

the FINDINGS

The no-passing zone plans outputted by the prototypes and WYDOT's existing marking were compared. As per the comparison results, overall discrepancies of 3.1% and 7% were obtained for the eastbound and westbound lanes of WY-210's test section, respectively. Concerning US-287's testing route, the overall discrepancies were 1% and 2.5% for the southbound and northbound directions, respectively. Prototype 2 was designed to automate some of its functions and produce more accurate results. Instead of operating the switch, the following vehicle was equipped with video cameras having machine vision systems that automatically detect the change in the lead vehicle's visibility status and hence the no-passing zone boundaries. This reduces the following vehicle driver's burden and improves accuracy by minimizing the PRT associated with switch operation.

the IMPACT

With multiple units of the state-of-the-art prototypes, WYDOT, counties, and local jurisdictions in Wyoming, such as the Wind River Indian Reservation, would be able to continuously conduct their two-lane highway striping/re-striping operations without experiencing the difficulty arising from an equipment shortage. Also, WYDOT and local government agencies would be protected from liability when passing-related crashes occur.

For more information on this project, download the Main report at <https://www.ugpti.org/resources/reports/details.php?id=1179>

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.



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