Safely and Effectively Communicating Non-Connected Vehicle Information to Connected Vehicles

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Connected vehicles (CVs) have the potential for increasing highway safety in ways not imaginable with traditional engineering and enforcement approaches. The largest safety impact of CV technology will occur only when a critical mass of vehicles and infrastructure is connected. However, this requires significant market penetration and improvements to our infrastructure; which is occurring at a relatively slow pace compared with autonomous vehicle (AV) technology. Until CVs are ubiquitous, strategies for communicating between CVs and non-CVs as well as with connected infrastructure will be critical in improving transportation safety. Communicating information from roadway infrastructure to CVs is key especially for scenarios in which the line of sight of in-vehicle sensors is obstructed by other vehicles, pedestrians, and buildings, among others.

As part of an active research project, the effectiveness of a warning system to communicate the presence of a potential red-light running vehicle to the driver of a CV was evaluated. Red-light running was selected as a test scenario because non-CVs who run a red light could be detected by existing roadway infrastructure, even when not detected by sensors in CVs. The motivation for studying the effectiveness of a warning message is providing the driver of a CV with a warning message (and the opportunity to react) prior to the point of engaging the collision avoidance features that are becoming standard in vehicles.

The evaluation of the effectiveness of a warning system was conducted using a driving simulator experiment. In the experiment, participants were exposed to an imminent collision scenario with a red-light running vehicle. The response to the scenario for a control and treatment group were studied. Participants in the control group did not receive any form of warning about the potential red-light running vehicle. Participants in the treatment group received a warning message displayed on the dashboard or as a head-up display. Both warning messages were accompanied by an auditory warning.

A separate component of the project evaluated the feasibility of communicating the presence of a potential non-connected red-light-running vehicle to CVs by using a radar-based vehicle detection system. The research team demonstrated the feasibility of detecting a potential non-connected red-light-running vehicle and communicating that presence via DSRC by using trajectory data from the vehicle detection system; thus, eliminating problem associated with blind spots in connected vehicles resulting from obstructions to the line of sight of sensors.

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