Advanced Research

January 2019

Project Title:
Vehicle Infrastructure Integration

Task Number: 3405

Start Date: February 01, 2019

Completion Date: January 31, 2020

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Connected Autonomous Vehicles: Safety During Merging and Lane Change and Impact on Traffic Flow

A study focuses on how smart-driver technologies and autonomous vehicles can alleviate traffic congestion and improve safety.

WHAT IS THE NEED?

It has been estimated that 25% of surprise traffic disruptions are caused by vehicle accidents; generally, traffic congestion is one of the factors that affects traffic accident rate. Surprise or non-recurring traffic flow disruptions are unanticipated temporary disruptions that occur as a result of an accident, blocking one or more traffic lanes. Therefore, in this study, the researchers aim at developing applicable solutions to the problem of autonomous lane changing on highway with connected vehicles; to improve traffic flow by reducing the number of vehicle accidents; and improve traffic safety by reducing the number of surprise traffic congestion events.

WHAT ARE WE DOING?

The research team will evaluate the impact of smart-driver technologies and autonomous vehicles on driver performance and traffic safety, and model the effects of these technologies on surprise traffic disruptions. Task-relevant technologies, such as adaptive cruise control, intersection collision avoidance, and dynamic route guidance are expected to reduce congestion and freeway delay; and improve traffic safety.

These technologies have been categorized by Society of Automotive Engineers J3016 standard in terms of the level of autonomy in the vehicle, ranging from level 0 (no autonomous vehicle control) to level 5 (complete autonomous vehicle control). In order to be effective, these technologies must be designed to avoid potential human-automation problems that are associated with automated systems in other domains such as aviation (e.g., mode control errors, reduced situation awareness, mistrust in automation, and workload transitions).

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WHAT IS OUR GOAL?

The goal is to provide applicable solutions to alleviate the autonomous lane changing problem with connected vehicles in a highway scenario. The research team will focus on the tactical and operational stages, which include evaluating the feasibility of possible lane changing maneuvers, finding an appropriate gap, taking the vehicle to the appropriate longitudinal position and velocity, and performing the maneuver. All tasks must be performed under safety and comfort constraints with minimum impact on the traffic flow.

Furthermore, under the assumption of proper vehicle connectivity, it is proposed that vehicles negotiate with each other to create proper spacing, either to increase maneuver safety or to optimize performance indices, such as overall traffic flow or fuel consumption.

WHAT IS THE BENEFIT?

The research results will help in formulating strategies that will enable efficient lane changing maneuvers under full vehicle automation. In addition, the results will be published in peer-reviewed Journals and presented at conferences.

WHAT IS THE PROGRESS TO DATE?

The project is expected to begin in early February 2019.