CPS: Small: Behaviorally Compatible, Energy Efficient, and Network-Aware Vehicle Platooning Using Connected Vehicle Technology

Submitted by nmasoud on Thu, 05/02/2019 - 3:57pm

Project Details

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Performance Period:	01/01/19 - 12/31/21
Institution(s):	University of Michigan Ann Arbor
Sponsor(s):	National Science Foundation
Award Number:	1837245

Abstract: The goal of this project is to explore vehicle platooning at scale in Smart and Connected Communities. The approach is the development of techniques and models that provide incentives for vehicles to join platoons and maintain their platoon memberships. Connected vehicle technology helps in forming vehicle platoons (virtual trains of vehicles traveling with small gaps between them) with benefits including improved energy efficiency, increased road capacity, and enhanced mobility. Vehicles in a platoon may benefit differently depending on where they are in the virtual train (for example, the lead saves less energy compared to a vehicle in the middle). As such, some vehicles may not be willing to join a platoon, or stay in one as better opportunities for platoon formation arise. This project explores how platoons with these competing goals will be formed and controlled, so as to understand how to motivate vehicles to participate in them. The Mcity testbed is part of the validation of the research work, and workshops involving local high-school and college students are planned. A stable platoon structure does not contain any coalition of vehicles who could increase their individual utilities by trading their platoon memberships. Given the dynamic nature of traffic streams, forming and maintaining stable platoon structures is a complex task, and requires accounting for both local and network-level conditions at the time of platoon formation. This proposal introduces a general framework that enhances optimal-control-based trajectory planning models by enabling them to also account for network level traffic conditions. This proposal further integrates stable platoon formation into the enhanced trajectory planning models, enabling them to incorporate both local and network-level information to form behaviorally

compatible platoon structures that stay stable in a dynamic traffic stream.

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