GRADUATE STUDENT RESEARCH SEMINAR SERIES (2020)

ENERGY AND FLOW EFFECTS FROM OPTIMAL AUTOMATED DRIVING IN MIXED TRAFFIC

SPEAKER: TYLER ARD

This talk covers the energy and traffic impact of a proposed Cooperative and Anticipative Cruise Controller in a PTV VISSIM microsimulation environment. The controller is dissected into two parts: 1. the anticipative mode, more immediately beneficial when automated vehicle fleet penetration is low, and 2. the connected mode, beneficial in coordinated platooning scenarios and high automated vehicle penetrations appropriate for autonomous vehicle specific applications. In-horizon and terminal constraints handle safety considerations, and vehicle constraints for acceleration capabilities are implicitly understood through the use of powertrain maps. Real traffic scenarios are then modeled using time headway distributions from traffic data. To study impact over a range of demands, we vary input vehicle volume from low to high and then vary automated vehicle penetration from low to high. When examining all-human driving scenarios, network capacity failed to meet demand in high-volume scenarios, such as rush-hour traffic. We further find that with automated vehicles introduced which utilize probabilistic constraints to balance safety and traffic compactness, network capacity was improved to support the high-volume scenarios. Finally, we examine energy efficiencies of the fleet for conventional, electric, and hybrid vehicles. We find that our vehicles perform at a 10% - 20% higher fuel efficiency over human drivers. Due to secondary effects of smoothing traffic flow, fuel benefits also apply to human-driven vehicles that interact with automated ones. Such simulated humans were found to drive up to 10% more fuel-efficiently than they did in the baseline all-human scenario. Further work in relation to experimentally verifying results through a novel vehicle-in-the-loop interface concludes the talk.

MONDAY, MARCH 2 3:00 PM

EIB 132