Research Fact Sheet

Research project:

Developing and Testing an Advanced Hybrid Electric Vehicle Eco-Cooperative Adaptive Cruise Control System at Multiple Signalized Intersections

What's the issue?

Connected vehicles and infrastructure can provide real-time information and recommendations to drivers to get them through signalized intersections without idling, reducing emissions and backups. But these eco-driving strategies were developed for gasoline engines. How will they work with hybrid electric vehicles (HEVs), which have become increasing popular? What about with a string of traffic lights?

What did the research discover?

In this system, a simple HEV energy model is used to compute the instantaneous energy consumption level for HEVs. In addition, a vehicle dynamics model is used to capture the relationship between speed, acceleration level, and tractive/resistance forces on vehicles. The constraints of energy model and vehicle dynamics are used to develop two HEV Eco-CACC-I controllers for single- and multiple intersections, respectively. The controllers include two modes: automated and manual, for vehicles with or without an automated control system. The automated mode was implemented into the microscopic traffic simulation software so that connected and automated vehicles (CAVs) can directly follow the energy-optimized speed profile. Simulation tests using the INTEGRATION software validated the performances of the proposed controllers under the impact of signal timing, speed limit, and road grade. The simulation tests also demonstrated the benefits of using the proposed HEV Eco-CACC-I controllers in a traffic network with multiple intersections. Lastly, the manual model of the proposed HEV Eco-CACC controller was implemented in a driving simulator at Morgan State University to see if drivers in connected vehicles could follow the recommended speed advisories. The data collected by the driving simulator with 48 participants demonstrated that the speed advisories calculated by the proposed controller can help drivers drive smoothly and save fuel while traversing signalized intersections.

How can I implement this?

Well, you can't, just yet. The technology is still being developed, but these controllers promise to improve fuel consumption even on vehicles that are already efficient, while also keeping traffic moving.

Learn more:

Details about this research project and a link to the full report can be found at https://www.morgan.edu/school_of_engineering/research_centers/urban_mobility_and_equity_center/research/completed_research/hev_eco-cacc_study.html

The Urban Mobility & Equity Center is a federally funded research consortium led by Morgan State University and includes the University of Maryland and Virginia Tech. www.morgan.edu/umec