What We Don’t Know About Autonomous Vehicles

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Abstract

From the self-driving Google car to plain old cruise control, automation in vehicles is an important issue. We are interested in the topic of autonomous vehicles on U.S. roads and highways and have been engaged in research to collect knowledge and write a report for the Mid-America Transportation Center. We believe there is a need for knowledge dissemination on this topic to both the general public as well as transportation professionals. We have seen similar reports that survey the world and national markets and consider the socio-economic issues surrounding autonomous vehicles. The goal of this effort is to focus more on the technical issues (both engineering and human factors), some of which may be unfamiliar to transportation professionals, the intended audience for our report.

The promise and the requirements of autonomous vehicles can be summarized with a few key statements. First and foremost, autonomy in ground vehicles must not reduce the general level of transportation safety, but should enhance it. Autonomy should significantly increase the efficiency of the traffic system, allowing for increased density of traffic with reductions in slowdowns and jams. Autonomy should increase the overall level of repair in the fleet, and should bring with it increased diagnostic capabilities. Autonomy should benefit environmental sustainability by reducing stop-and-go driving and lowering net trip times, reducing the need to build new roads, and create new opportunities for ride-sharing and car-sharing.

Despite the rapid and impressive advancement in the technology of autonomous vehicles, there are still many open questions and research needs to be addressed. This presentation will cover some of the major ones identified to date including both short-term and mid-term needs. The common thread that ties them together is the state of flux and rapid innovation the technology currently finds itself in. Some of the major research needs are:

- Improved performance on snow-covered or otherwise obscured roads
- Handoff of control as the car changes automation level
- Strategies to manage mixed manual/automatic traffic
- Understanding the many combinations of sensors and AI
- Ensuring security and privacy in highly computerized vehicles

Future work at the NADS will hopefully advance understanding and standardization specifically in the second and third topics at the interface between drivers and automation.

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