

HOW WILL THIS LABORATORY AFFECT ROAD SAFETY?

Data indicates that most crashes and fatalities are a direct result of driver error. The long-term goal of the Intelligent Vehicles Laboratory is to develop and test innovative technologies that reduce driver error. Because of the clear and immediate benefits that driver-assistive systems offer, these technologies already have been deployed and tested on snowplows, emergency vehicles, buses, and other specialty vehicles. In the future, these systems will be deployed on passenger vehicles to further increase roadway safety.



"Results from the IV Laboratory's high-accuracy digital-map technology could enable a whole class of safety-enhancing systems that will ultimately be deployed on all vehicles and will save thousands of lives. The IV Laboratory has both the vision and the down-to-earth practicality to propose real-life solutions."

— *Dave Acton*
Executive Director
Global Telematics, General Motors

"The IV Lab is one of a select group of leading institutions worldwide working to apply advanced technology to help drivers drive better, improving the road environment for all of us. Research results from the IV Lab will be crucial in bringing safer cars and trucks to the road, and better services to public transit users."

— *Richard Bishop*
Editor in Chief, IVsource.net

UNIVERSITY OF MINNESOTA



Intelligent Vehicles Laboratory

FOR MORE INFORMATION

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AFFILIATED SITES

ITS Institute
www.its.umn.edu
HumanFIRST Program
www.humanfirst.umn.edu

Minnesota Road Research Project (Mn/ROAD) test track
www.mnroad.dot.state.mn.us/research/Mnresearch.asp

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A program within the University of Minnesota developing innovative, human-centered technologies that improve the operational safety, mobility, and productivity of road and transit vehicles

CENTER FOR TRANSPORTATION STUDIES

ITS INSTITUTE



OUR MISSION

The Intelligent Vehicles Laboratory is affiliated with the Intelligent Transportation Systems (ITS) Institute of the University of Minnesota's Center for Transportation Studies (CTS). The IV Laboratory focuses on developing and testing innovative, human-centered technologies that improve the operational safety, mobility, and productivity of vehicles. These human-centered technologies integrate sensors, actuators, computer processors, and custom human interfaces to provide drivers with needed information

under difficult driving conditions, including low visibility, severe weather, and narrow and congested roadways. Initially, these driver-assistive systems have been tested on specialty vehicles, including snowplows, patrol cars, ambulances, heavy vehicles, and transit vehicles. Ultimately, these systems will also be able to warn drivers and assist them with collision-avoidance and lane-keeping tasks on passenger vehicles.

OUR EXPERTISE

The University of Minnesota is recognized as a leader in developing and testing driver-assistive systems and is one of a small number of universities nationwide conducting this work. Specifically, the IV Laboratory's core staff is made up of engineering and computer science professionals. They work closely with an interdisciplinary team of specialists, including cognitive psychologists specializing in human factors from the ITS Institute's HumanFIRST Program and experts in visibility, geospatial databases, road-weather and other traveler information systems, virtual environments, image processing, and traffic-signal operations.

"These technologies have implications to help drivers of all vehicles.... We have an opportunity to test these systems under the harshest winter conditions, and to help ensure that our rural roads stay open to the public."

— Dr. Max Donath
Director, ITS Institute

OUR RESEARCH

IV Laboratory research seeks to increase driver safety in difficult driving conditions through the use of vehicle-guidance and collision-avoidance technologies. Several vehicles serve as experimental testbeds, including the SAFETRUCK (an International 9400 tractor-trailer), the SAFEFLOW (an International 2540 crew-cab snowplow), a state highway patrol car, and the recently added TechnoBus (a Metro Transit bus).



Using these vehicles, IV Laboratory researchers are leading the way in developing, testing, and integrating advanced technologies such as:

- centimeter-level differential global-positioning systems (DGPS)
- high-accuracy digital-mapping systems
- range sensors, including radar and laser-based sensors
- a windshield head-up display (HUD), a virtual mirror, and other graphical displays
- haptic and tactile feedback

The custom-designed HUD allows drivers to "see" the road via projected images from a high-accuracy digital road map. Fixed roadside features are also projected on the HUD, as are radar-identified roadway obstacles. The head-up display is paired with lane departure warnings provided via tactile feedback. This feedback uses DGPS and digital road maps to determine position within the lane and vibrates the driver's seat on one side or the other when the vehicle departs the lane. This warning modality is effective for visually and audibly distracted drivers.

Haptic feedback uses DGPS and digital, lane-level road maps to determine position and orientation, and then applies steering-wheel torque feedback, felt by the driver's hands, to "correct" steering and help the driver stay in the lane.

The IV Laboratory's technology is unique in that it uses DGPS and does not require hardware in the roadway surface. The technology is transferable between various transportation modes and works in all low-visibility situations, including snow, fog, smoke, heavy rain, and darkness. In addition, these systems use human-centered technologies to enhance driving

ability and reduce driver error due to distractions, fatigue, and other factors related to difficult driving situations.

Other current research topics include:

- design and testing of custom human interfaces
- collision-avoidance sensors and algorithms
- intersection-surveillance sensors
- wireless communication among vehicles and with the infrastructure

The IV Laboratory's special partnership with the Minnesota Department of Transportation provides access to roads and other infrastructure, including the Minnesota Road Research Project (Mn/ROAD) test track. The IV Laboratory also has relationships with a number of other organizations and government agencies, including:



the U.S. Department of Transportation's Research and Special Programs Administration, Federal Highway Administration, and Federal Transit Administration; the Twin Cities' Metro Transit; and Minnesota's Local Road Research Board. These partnerships provide additional support for implementing research that will influence transportation safety in the United States and around the world.

OUR INVITATION

We invite you to contact us to discuss your research needs and interests, as well as collaboration opportunities.

"Because every driver, at one time or another, is faced with difficult driving conditions, the Intelligent Vehicles Laboratory is working with partners to deploy this technology wherever needed."

— Dr. Craig Shankwitz
Director, IV Laboratory