INTELLIGENT TRANSPORTATION

VEHICLES ARE ABOUT TO GET A LOT SMARTER—AND SAFER—WITH HELP FROM TRICIA CHIGAN

VEHICULAR COLLISIONS ARE A LEADING CAUSE of death and injury in many countries around the world. On an average day in the United States, auto accidents kill 116 and injure over 7,900, making it the leading cause of death for people under age thirty-five. The US spends more health-care dollars treating crash victims than any other cause of illness or injury. With an annual economic impact of close to $200 billion, the US Department of Transportation has declared the reduction of vehicular fatalities its top priority.

▲ Tricia Chigan

"Vehicular ad hoc network communications could greatly enhance traffic safety and traffic operation," says Chunxiao (Tricia) Chigan, an assistant professor of electrical and computer engineering at Michigan Tech.

Chigan is studying a new form of wireless technology, the vehicular ad hoc network, or VANET for short. VANET provides inter-vehicle communications capability and more.

"VANET has genuine life-saving potential," she notes. "In the coming years as this new technology is adopted around the world, I hope to see a substantial reduction in the rate of automobile accident-related death."

Chigan is a 2007 National Science Foundation CAREER Award winner. Her CAREER project addresses major challenges in VANET-related access technology, dynamic power control, multi-hop communication, and security and privacy.

The success of Chigan's project will open the door for many new VANET applications in the areas of traffic safety, cooperative traffic operation, vehicle probe data acquisition, and information sharing.

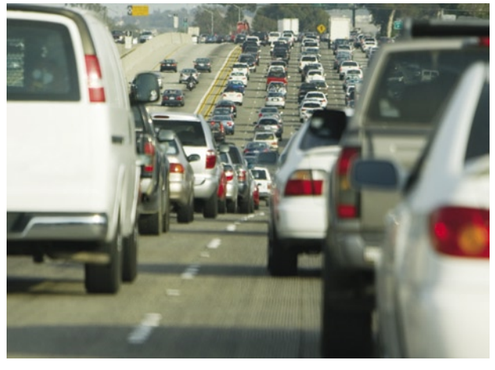
VANET provides its users with "the ability to form a communication system anytime, anywhere, dynamically, without pre-established communication infrastructures such as the optical network and the cellular network," she explains. It can provide real-time collision avoidance via warning technology to improve driving safety. It has the potential to improve traffic conditions by making 'cooperative driving' possible. And it can potentially notify drivers of road hazards, road blocks, traffic conditions, auto accidents and rush-hour re-routing.

"The highway horrors experienced during the evacuation of Hurricane Rita demonstrated the strong need for dynamic traffic planning in emergency situations," adds Chigan. "And there are several other potential applications. For instance, once equipped with the appropriate sensors, VANET can be used for data acquisition, such as collecting and processing traffic data to calibrate national bridge live-load models."

Another bonus: cooperative driving could reduce fuel usage. "Smarter, VANET-supported driving could mean less carbon in the atmosphere—reducing air pollution and helping to preserve the environment."

According to Chigan, wireless mesh networking has drawn extensive attention as an emerging wireless paradigm to resolve the limitations and significantly improve the performance of ad hoc networks, wireless local area networks (WLANs), wireless personal area networks (WPANs), and wireless metropolitan area networks (WMANs).

"Included as one special element of an ad hoc network, VANET can serve as a fully opportunistic network extension in the wireless mesh network paradigm," says Chigan. "This has great potential for emergency crews, who can then quickly establish a network when working at a disaster site."



CHUNXIAO (TRICIA) CHIGAN is an assistant professor of electrical and computer engineering. She is a recipient of the National Science Foundation CAREER Award (2007).

Prior to joining the faculty at Michigan Tech, Chigan was a visiting scholar with High Performance Communications Systems at Bell Labs, Lucent Technologies (Holmdel, New Jersey).

She received MS and PhD degrees in electrical engineering from the State University of New York, Stony Brook, in 2000 and 2002 respectively.

Research interests include:

- vehicular ad hoc networks
- wireless ad hoc and sensor networks
- wireless network security
- adaptive network protocol design for cognitive radio networks
- dependable computing and communication systems
- network resource allocation and management