New Science

Volume 20 | Issue 1 Article 11

9-1-2012

Creating the future Detroit through innovative wireless networking and applications

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Wayne State University researchers are helping create the future in metropolitan Detroit with the help of national initiatives.

Hongwei Zhang, Ph.D., assistant professor of computer science in WSU's College of Engineering, and Patrick Gossman, Ph.D., deputy chief information officer for special projects in WSU's Division of Computing and Information Technology, with the help of a three-year, $300,000 grant from the National Science Foundation (NSF), are building an experimental wireless networking infrastructure for research, education and application exploration.

The network will comprise multiple sectors, or cells, using WiMAX (worldwide interoperability for microwave access), a communication technology for wirelessly delivering high-speed Internet service to large geographical areas. WiMAX is a part of "fourth generation," or 4G, wireless-communication technology, which far surpasses the range of conventional Wi-Fi local area networks.

WSU's WiMAX network will be connected to the NSF's Global Environment for Network Innovations (GENI) backbone network. Wayne State already is among nine institutions nationally equipped with WiMAX technology funded by the foundation. (In a separate project funded in part by the John S. and James L. Knight Foundation and Clearwire Corp., the university already is using that technology to provide Internet service to about 750 low-income Detroit residents).

GENI is an experimental infrastructure through which researchers unite to envision and create new possibilities of future internets. Organizers say it will open the way for transformative research at the frontiers of network science and engineering, as well as inspire and accelerate the potential for groundbreaking innovations of significant socioeconomic impact.

GENI allows users of software to define how the network will work, as opposed to today's Internet, which does not. User experiments can include transmission of video, sensor nets or transportation data to see if they can be moved better or easier than on the traditional Internet.

Gossman likened the function of cellular networks to roads, saying GENI is more of freeway with on- and off-ramps that allows traffic to continue at faster speeds without being stopped and started by the Internet's control mechanisms, which serve as stop lights and signs.

"We needed a different kind of road to handle high volumes of high-speed traffic," he said. "The Internet can cause big delays in the arrival times of pieces of data traveling the current roads, and for any real time application, that can be an issue."

"WiMAX is expected to play a major role in areas such as smart grids, smart transportation, vehicular infotainment, health care and community Internet access," Zhang said. "We want to enable experiments and ensure that different experiments don't interfere with each other."

Such experiments can lead to the development of applications that better address today's data transmission needs, which involve far greater use of mobile devices than creators of the original Internet ever envisioned, he said.

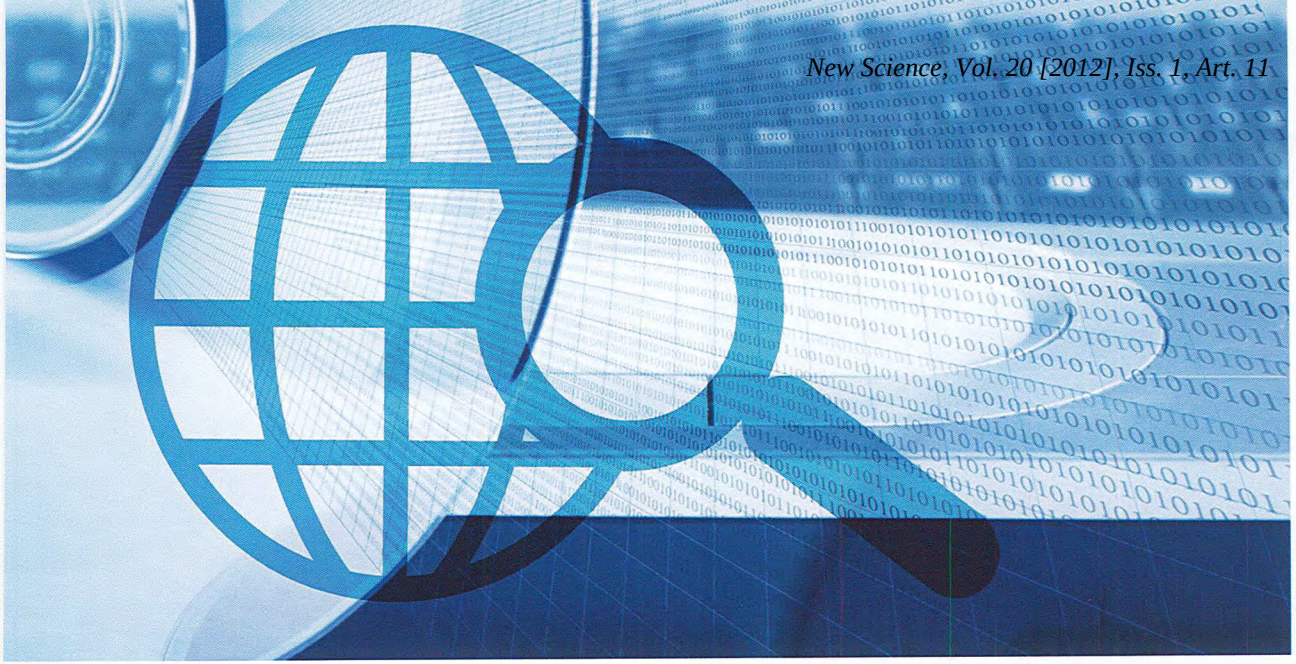
Collaborators on the project include TJ Giuli, Ph.D., and Jayanthi Rao, Ph.D., of Ford Motor Co.; and Jing Zhu, Ph.D., and Xiangying Yang, Ph.D., of Intel Corp.

Zhang also is working on a related wireless network and control project with a three-year, $900,000 NSF grant. He and Le Yi Wang, Ph.D., professor of electrical and computer engineering, and George Yin, Ph.D., professor of mathematics, will examine the use of a concept called platoon control to optimize the efficiency and safety of vehicle transportation. The team will enable creation of a system in which vehicles are operated and controlled as groups instead of individually.

Platoon control will be combined with wireless networking to minimize the impact of cyber-physical uncertainties, such as movements of individual vehicles and real-time network capacity. Novel wireless networking technologies will be used to control co-channel interference and to ensure timeliness and throughput of broadcasts from one vehicle to another (single-hop) and from one vehicle to multiple others (multihop).

Researchers believe the technology ultimately will lead to cars that can drive themselves and communicate with each other, better utilizing road systems and minimizing traffic accidents and delays. It also can be applied to unmanned aerial vehicles and smart power grids.

"This project will enable the development of wireless vehicular cyber-physical systems (CPS) toward safe, efficient and clean transportation," Zhang said. "It also will enable integrative research and education in wireless CPS through a multilevel, multicomponent education practice."



About Dr. Hongwei Zhang:

Dr. Zhang received a B.S. and M.S. in computer engineering from Chongqing University in China, and a Ph.D. in computer science and engineering from The Ohio State University. He joined Wayne State in 2006.

To learn more, visit:

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