Intelligent Transportation and Pervasive Computing

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Pervasive computing has its roots in how computers interact with people and the world around them. One of the most important examples of people interacting with the world is their use of transportation systems. Today's global economy exists because of the movement of goods by airplane, ship, train, and truck, and most of us use public or private transportation every day to get to work or for pleasure.

A challenging domain for pervasive computing

Numerous applications emerge when computing intersects transportation, such as vehicle safety, route planning and optimization, entertainment and communication systems, and simple data collection for maintenance or planning. These applications span several domains, including within-vehicle communications, coordination between vehicles and transportation systems, and even roadside detection and vehicle tracking.

Transportation draws on the whole range of technology behind pervasive computing as well. Networks stretch from embedded "car-area networks," to short-distance Wi-Fi, to global connectivity via mobile telephone networks. Users must discover the services offered by cars, ships, trains, and airplanes, which may themselves be discovered by other transportation systems or information services in the environment. These services must reach users already busy, for example, driving their vehicles, navigating, and perhaps interacting with passengers. Consequently, intelligent transportation intersects all areas of pervasive computing research, from networking and systems to user interfaces.

As intelligent transportation is a broad area, we focused this special issue on one dimension of intelligent transportation—intelligent (road-based) vehicular transportation. This focus reflects the importance that public and private transportation plays in our daily lives, and the significant amount of ongoing work in this area to improve vehicular transportation.

In this special issue, we sample the developing area through four feature articles and the Spotlight department, which consists of two interviews and two short articles. These contributions were written by automotive industry and academic experts and provide a diversity of views on a range of topics. We hope you'll find their ideas stimulating and thought-provoking. Finally, while the contributions focus on intelligent vehicular transportation, we believe you'll find that you can readily apply some of the technologies discussed to other transportation systems.

In this issue

"The Last Inch at 70 Miles Per Hour" evaluates the security, privacy, usability, and reliability challenges raised in getting pervasive services into the hands of a driver and passengers. TJ Giuli, David Watson, and K. Venkatesh Prasad give examples of how a service-oriented architecture helps Ford integrate entertainment, communication, navigation, and safety components into a shared driver experience.

In "Turn-Intent Analysis Using Body Pose for Intelligent Driver Assistance," Shinko Yuanhsien

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Cheng and Mohan Manubhai Trivedi propose a human-centric driver assistance system that uses computer vision to detect the driver's intent from his body pose seconds or fractions of seconds before he acts. The authors describe an intersection-turn prediction system they implemented on a car equipped with cameras, which shows a very good detection rate.

Baik Hoh, Marco Gruteser, Hui Xiong, and Ansaf Alrabady explore the privacy issues surrounding vehicle location reporting in "Enhancing Security and Privacy in Traffic-Monitoring Systems." They consider both how you can securely and anonymously report vehicle tracks and the privacy risks that arise when you analyze already anonymized data.

In the final article, "Scalable, Distributed, Real-Time Map Generation," Jonathan J. Davies, Alastair R. Beresford, and Andy Hopper describe an approach to harvesting GPS data from vehicles to automatically generate road maps. As vehicles are increasingly augmented with computing and localization, they'll be able to automatically collect data not just on where we drive but also perhaps how well those roads serve us. The article describes some of the challenges in deriving information from this data.

We then complete the special issue with the Spotlight department, featuring two interviews and two short articles. The interviews highlight and expand on some of articles' themes. The first is with Jean-Pierre Hubaux, a professor at L'Ecole Polytechnique Fédérale de Lausanne, well-known for his work in wireless ad hoc networking and security and, most recently, in vehicular network security. The other is with Wieland Holfelder, vice president and CTO of DaimlerChrysler Research and Technology North America, one of the most active advocates for the emerging vehicular computing technologies. Holfelder and Hubaux share with us their views on the field's evolution, its challenges, and the key milestones to measure its success.

Both interviewees agree that safety applications represent the driving force in promoting vehicular networking, a trend that is causing safety research to slowly transition from passive to active accident avoidance. In Hubaux's interview, he talks about challenges in vehicular networking research, emphasizing the need to go beyond traditional evaluation methods for ad hoc networking. Although led by industry, vehicular networking and intelligent transportation research can significantly benefit, according to Hubaux, from the academic research. His area of interest is a successful example of this.

In the short articles, perspectives from both BMW and Toyota show how telematics can improve vehicle safety. Timo Kosch and Markus Strassberger of BMW consider the requirements for communication with beyond-line-of-sight vehicles to avoid accidents, highlighting the communications, privacy, integrity, and user interface requirements. Ken Laberteaux, Lorenzo Caminiti, Derek Caveney, and Hideki Hada of Toyota explore how cars that communicate with each other and with roadside signals can help detect and prevent collisions, and they review the engineering solutions needed to make this possible.

Transportation has traditionally been the realm of the machine. Today, as vehicles become increasingly computerized, we begin to see this technology moving from under the hood to pervasively connect with passengers and other vehicles, and the world around us.

the GUEST EDITORS

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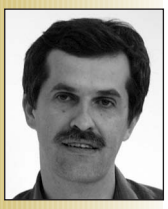

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