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Editorial

Wireless Access in Vehicular Environments

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Vehicular communications and networks based on the recent wireless access in vehicular environments (WAVE) technology comes into sight as a state-of-the-art solution to Intelligent Transportation Systems (ITS), which is anticipated to be widely applied in the near future to radically improve the transportation environment in the aspects of safety, intelligent management, and data exchange services. WAVE systems will build upon the IEEE 802.11p standard, which is still active and expected to be ratified in 2009.

WAVE technology is the next generation dedicated short-range communications (DSRC) technology, which provides high-speed V2V and V2I data transmission and has major applications in ITS, vehicle safety services, and Internet access. Operating at 5.850–5.925 GHz, WAVE systems adopt orthogonal frequency-division multiplexing (OFDM) and achieve data rates of 6–27 Mbs/s. In WAVE systems, an RSU can cover a range of up to 1000 feet.

The fast time-varying and harsh vehicular environment (doubly selective channel) bring about several fresh research topics on the study of WAVE systems, which include mobile channel modeling, the study of Doppler shift, fast synchronization, quick channel estimate and prediction, capacity evaluation when adopting multiple-input multiple-output (MIMO), smart antenna and beamforming, adaptive modulation, novel network configuration (delay tolerance networks, DTN), effective media access control (MAC) protocols, and robust routing and congestion control schemes.

This special issue collects 9 selected papers covering protocols for real-time safety message delivery, quality of service (QoS) for video packets, MIMO, space-time coding schemes, and WAVE system simulator. In addition, two relevant papers investigating electronic toll collection detection and UWB vehicular channel are included as well.

Three papers deal with the protocols for real-time safety message delivery in a vehicular environment for safety enhancement. In “A rule-based data transfer protocol for on-demand data exchange in vehicular environment,” H. Liao and W. Liao proposed a rule-based transfer protocol upon the so-called request-forward-reply mechanism for enhancing driving safety and efficiency under the situations of occluded view and traffic jam, which is thereafter validated by supportive simulations. Meanwhile in “Formal analysis on performance and reliability of DSRC vehicular safety communication,” Ma, Chen, and Refai studied the performance of safety message broadcasting in the context of message priorities and arrival, hidden nodes, fading channel, and wireless coverage as well as vehicle mobility. Analytic formulae for the throughput, delay, and packet rates are also derived, which provide a good reference for related research and engineering. Moreover, in “On the ability of the 802.11p MAC method and STDMA to support real-time vehicle-to-vehicle communication,” Bilstrup, Uhlemann, Strm and Bilstrup analyzed the requirements for real-time safety message delivery on the aspects of latency, reliability, and deadline with a conclusion that vehicles using CSMA/CA may experience unacceptable channel access delays and a self-organizing time division multiple access (STDMA) is proposed to respond to such a need, which is derived from the commercial application for collision avoidance between ships.

To support multimedia applications, in “A selective downlink scheduling algorithm to enhance quality of VOD services for WAVE networks," Ou, Yang and Chen researched on how to provide quality of-service guaranteed video on demand (VOD) services for WAVE systems. A selective downlink scheduling algorithm based on video packets' priority and playback deadline and vehicles velocities and dwelling times is proposed aiming to improve the quality of service of video in a vehicular environment.

The released conditions on size and power consumption make MIMO and STC suitable technologies for WAVE systems to further enhance the performance, efficiency and reliability. In "Orthogonal space time block codes in vehicular environments: optimum receiver design and performance analysis," He and Kam suggested an optimum decoder for orthogonal space-time block codes scheme dealing with fast time-varying wireless channel in a vehicular environment. While in "An Adaptive Channel Model for VBLAST in Vehicular Networks," Abdalla, AbuRgheff, and Senouci introduced an MIMO channel model for WAVE systems, and the correlation between the antennas was investigated. A channel update algorithm using single tap Kalman filters is then derived and evaluated.

Vehicular network simulator emerged as an efficient tool that helps propose, develop, simulate, and evaluate algorithms, protocols, and technologies applied to vehicular communications and networks. In "An empirical model for probability of packet reception in vehicular ad hoc networks," Killat and Hartenstein studied the framework of an advanced simulator for WAVE systems that can deal with more than thousands of vehicles with connections. A hybrid simulation model reflecting the probability of packet reception based on the factors of vehicle spacing, transmission power, date rate, and traffic density is introduced to facilitate the realization of an effective vehicular simulator.

In addition, in "Ultra-wideband channel modeling for intravehicle environment," Niu, Li, and Talty investigated the ultrawide-band radio in commercial vehicles under several scenarios. The channel characteristics are then described by modifying the related parameters of S-V model. And in "Real-time propagation measurement system and scattering object identification by 3D visualization by using VRML for ETC system," Kim, Takada, Ando, and Soma presented a novel method to measure the power density of radio without closing the electronic toll collection gates and a 3D visualization technology for identification.

Finally, the editorial team would like to thank the EURASIP Journal on Wireless Communications and Networks and the Editor-in-Chief for providing the opportunity to present a collection of papers reflecting recent progresses in vehicular communications and networks and WAVE technology. The Editorial team would also like to thank the EURASIP staff for their guiding and help on the review process, and to the many reviewers that provided valuable comments for the selection of the submitted papers.

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