Editorial

Chien-Chung Shen

Department of Computer and Information Sciences,
University of Delaware,
Newark, DE 19716, USA
Email: cshen@mail.eecis.udel.edu

Y-W. Peter Hong*

Institute of Communications Engineering,
National Tsing Hua University,
Hsinchu 30013, Taiwan
Email: ywhong@ee.nthu.edu.tw
*Corresponding author

Chih-Min Chao

Department of Computer Science and Engineering,
National Taiwan Ocean University,
Keelung 20224,Taiwan
Email: cmchao@ntou.edu.tw

Shun-Ren Yang

Department of Computer Science and
Institute of Communications Engineering,
National Tsing Hua University,
Hsinchu 30013, Taiwan
Email: sryang@cs.nthu.edu.tw

Biographical notes: Chien-Chung Shen is an Associate Professor in the Department of Computer and Information Sciences of the University of Delaware. He received his BS and MS degrees from National Chiao Tung University, Taiwan, and his PhD degree from UCLA, all in Computer Science. He was a research scientist at Bellcore (now Telcordia) Applied Research working on control and management of broadband networks. His research interests include ad hoc, sensor, and underwater networks, dynamic spectrum management, control and management of broadband networks, distributed object and peer-to-peer computing, and simulation. He is a recipient of NSF CAREER Award, and his research has been supported by NSF, Army, Navy, NASA, RAND, and industrial companies.

Y-W. Peter Hong received his BS degree from National Taiwan University in 1999 and his PhD degree from Cornell University in 2005, both in Electrical Engineering. He joined Institute of Communications Engineering at National Tsing Hua University in Fall 2005, where he is now an Associate Professor. He was also a visiting scholar at University of Southern California in 2008. His research interests include cooperative communications, distributed signal processing for sensor networks, and cross-layer designs for wireless networks. He is an Associate Editor of *IEEE Transactions on Signal Processing* and is the recipient of the 2010 IEEE COMSOC Asia-Pacific Outstanding Young Researcher Award.

Chih-Min Chao received the PhD degree in Computer Science and Information Engineering from National Central University in 2004. He joined the Department of Computer Science and Engineering, National Taiwan Ocean University where he worked as an Assistant Professor (2005–2008) and an Associate Professor (2008–present). His research interests include mobile computing and wireless communication.

Shun-Ren Yang received the BSCSIE, MSCSIE, and PhD degrees from the National Chiao Tung University, Hsinchu, Taiwan, in 1998, 1999, and 2004, respectively. During April 2004 to July 2004, he was a research assistant in the Department of Information Engineering, Chinese University of Hong Kong. Since August 2004, he has been with the Department of Computer Science and the Institute of Communications Engineering, National Tsing Hua University, Taiwan, where he is now

an Associate Professor. His current research interests include design and analysis of personal communications services networks, computer telephony integration, mobile computing, and performance modelling.

Wireless networks have gained much popularity in recent years due to their versatility and ease of access. However, as the dimension of wireless devices decreases and the network density increases, energy and bandwidth resources become increasingly scarce and innovative networking solutions must be developed to overcome these challenges. Moreover, due to the large demand for wireless connectivity in various applications, wireless networks have evolved into different forms, including wireless metropolitan networks, wireless local area networks, mesh networks, mobile ad hoc networks, sensor networks, etc. Integration of these heterogeneous systems becomes essential to fully capitalise on the functionalities and services they provide. In addition, advances in theory are required to achieve these goals and new applications may emerge to leverage these advantages.

This special issue of *IJSNet* has received a number of submissions over the past several months, each of which has gone through a rigorous review process. Among these submissions, a total of six papers have been selected for their high quality and timely subject. We summarise the rationale of selecting these papers as follows.

One of the most critical issues in sensor networks is the consumption of limited energy at the sensors. Without energy-efficient designs, the lifetime of sensor networks would be extremely limited and thus hinder the development of many practical applications. In this special issue, we have selected three papers that focus on this issue from both tracking and data gathering perspectives. Moreover, even though many sensor networking protocols have been developed in the literature, the growth of the sensor network industry still has not reached its potential due to the lack of important and innovative applications. We have selected two papers that describe practical deployment of sensors in interesting and novel applications. The experimental data provide promising results that may encourage further industrial development of sensor networks. Finally, we include one paper addressing the security issues in sensor networks, which is one of the fastest growing issues in this field. These six papers have been revised according to the comments and suggestions from the reviewers and provide exciting results as summarised in the following.

The first paper, entitled 'Energy-efficient collaborative tracking in wireless sensor networks' authored by Loredana Arienzo and Maurizio Longo, addresses the problem of collaborative tracking of mobile nodes in wireless sensor networks. A strategy combining target tracking with node selection procedures is proposed to select informative sensors in order to minimise the energy consumption of the tracking task. The authors also formulate the node selection problem as a cross-layer optimisation problem and determine the optimal solution by a greedy algorithm.

The second paper, entitled 'Enhancing lifetime of wireless sensor networks using multiple data sinks' authored by Amar Prakash Azad and A. Chockalingam, describes the deployment of multiple base stations as data sinks to increase the lifetime of wireless sensor networks. In particular, the paper addresses the fundamental question concerning the limits on the network lifetime in sensor networks when multiple base stations are deployed. The authors derive upper bounds on the network lifetime, considering the region of observation, the number of sensor nodes and base stations, the locations of base stations, the radio path loss characteristics, the energy available in each node, and the efficiency of nodal electronics. The authors also obtain optimal locations of the base stations that maximise these lifetime bounds.

The third paper, entitled 'Increasing energy efficiency in sensor networks: blue noise sampling and non-convex matrix completion' authored by Angshul Majumdar and Rabab K. Ward, proposes a method to reduce energy consumption of a sensor network by activating only a subset of sensors at each sampling instant. The authors model the problem of reconstructing the sample values of all the sensor nodes as a matrix completion problem. The authors solve this problem by coupling blue-noise sampling with a non-convex reconstruction algorithm, instead of relying on existing purely random sampling strategies and convex estimation algorithms.

The fourth paper, entitled 'Testing network protocols and signal attenuation in packed food transports' authored by Reiner Jedermann, Markus Becker, Carmelita Görg and Walter Lang, describes the testing and evaluation of the radio link quality and the performance of two wireless sensor network protocols which are designed for monitoring packed food product transports. The high signal attenuation caused by water-containing products was identified as the major problem. In order to address this problem, the authors suggest that it is necessary to change the sensor node hardware to either a platform with a higher transmission power or one with a carrier frequency that is less sensitive to the dielectric losses of water.

The fifth paper, entitled 'A uniform airdrop deployment method for large-scale wireless sensor networks' authored by Yoshiaki Taniguchi, Tomoya Kitani and Kenji Leibnitz, provides a deployment method to uniformly distribute a large number of sensor nodes from the air. Being equipped with a parachute and able to switch descending behaviour between gliding and free-falling in the air, each sensor node exchanges messages with its neighbouring nodes to coordinate its descending behaviour during its descent in order to achieve a uniform distribution in the monitored region.

The sixth paper, entitled 'Per node deployment based detection of controlled link establishment attack in distributed sensor networks' authored by Thanh Dai Tran, Johnson I. Agbinya and Adel Ali Al-Jumaily, proposes several schemes to defence against the 'controlled link establishment attack'. This attack is derived from two specific attack instances: node replication attack and key-swapping collusion attack. The

authors introduce a family of evolutionary defence solutions consisting of naïve, adaptive, and extended schemes. The first two light-weight schemes provide weaker security while the extended scheme achieves greater security gains by trading off small performance degradation.

Finally, we are grateful to the authors who have submitted their papers to this special issue and all the reviewers for their precious time in reviewing the papers. We would also like to thank Editor-in-Chief, Professor Yang Xiao, for giving us the capacity to organise this special issue.