Editorial

Hui Chen

Department of Mathematics and Computer Science,
Virginia State University,
Petersburg, VA 23806, USA
Email: huichen@ieee.org

Biographical notes: Hui Chen studied geophysics and computer science, and worked in related industry. He is currently with Department of Mathematics and Computer Science, Virginia State University. He primarily works in the area of computer networking. He served as journal guest editors and various IEEE conference programme committees, and publishes frequently. He is a member of ACM and IEEE.

As computing is gradually integrated with every aspect of our lives and activities, sensing technology is becoming pervasive. We believe that the integration of networked sensor technology into many physical systems leads to many exciting applications which continuously help improve human lives and productivity, and satisfy our curiosity on the physical world.

Technical innovations are essential to bring the sensor networks and their applications into practice. To provide a platform for researchers and practitioners to exchange exciting ideas and developments in this area, we organised the First International Workshop on Sensor Networks (SN 2008). This workshop was held in conjunction with the 2009 International Conference on Computer Communications and Networks (ICCCN 2009). We are delighted to see that this workshop has attracted more than 60 submissions from many recognised organisations around the world. Based on the review results, we invited the authors of the best papers to submit extensions to this journal. Fortunately, the authors of nine papers accepted our invitation. We would like to introduce the nine papers as follows.

In many sensor applications, sensor nodes are deployed without prior knowledge on their locations. However, it is crucial to know the locations of the sensor nodes, for example, in a sensor network application that detects movement of tanks in enemy territory. GPS receivers are considered to be too expensive and consume too much energy. Nevertheless, it has been considered as a fundamental problem to determine sensor node locations in sensor networks.

Stefano Tennina et al. proposed an optimisation algorithm to perform distributed localisation of Wireless Sensor Networks (WSNs) without access to GPS. For details, readers are referred to their paper entitled 'ESD: a novel optimisation algorithm for positioning estimation of WSNs in GPS-denied environments – from simulation to experimentation'.

F. Bagci et al. paper proposed a cost-effective location tracking system based on sensor nodes with wireless connectivity in their paper 'Optimisations for LocSens – an indoor location tracking system using wireless sensors'. This location track system was targeted in indoor environments, where the reception of GPS signal is poor.

Juo-Yu Lee and Kung Yao consider sensors with two-dimensional direction sensing capability. They studied localisation problem of sensor networks containing such sensors in their paper 'Exploiting low complexity motion for ad-hoc localisation'.

Wireless sensor nodes are often powered by batteries. It is often a difficult task to recharge or replace the batteries. A sensor node loses its function when its battery runs out. Energy efficiency is an essential aspect in designing protocols for WSNs.

In a WSN, multicast or broadcast is often used to disseminate control messages or sensing data. In the paper entitled 'A message complexity oriented design of distributed algorithm for long-lived multicasting in wireless sensor networks', Song Guo et al. aim at maximising the lifetime of a multicast tree rooted at the source node and including all the destination nodes. Both consumption and residue of battery power are considered simultaneously. They proposed a heuristic algorithm that runs in a distributed fashion with linear message complexity and performs suboptimal in practice, and studied the tradeoff between the algorithm optimality and message complexity.

Denial of Service (DoS) attacks can be launched to exhaust batteries of a sensor network. For example, Chien-Chun Ni et al. demonstrate that such attack can be realised by forcing an intermediate node to broadcast repeatedly to drain its power. They designed and studied a broadcast protocol that is capable of withstanding this attack. Details of the work can be found in their paper entitled 'A power-preserving broadcast protocol for wireless sensor networks'.

Though analytical analysis and computer simulations are powerful tools to study sensor networks, experiences tell us that many problems can only be discovered in actual sensor network implementations. Sensor network testbeds are powerful platforms to evaluate proposed protocols and algorithms closer to reality.

Luis D. Pedrosa et al. describes their experience in working with wireless sensor network testbeds in their paper 'A flexible approach to WSN development and deployment'. They designed and built a flexible WSN testbed for easier implementation of

diverse applications. To demonstrate the network's capabilities and measure its performance, a few applications including an environmental interaction application, a vibration monitoring application, a temperature gradient map and a remote monitoring and control application were developed and tested.

IEEE 802.15.4 standard specifies the physical layer and the media access control layer for wireless personal area networks with low data rate and low power consumption. It forms the basis for many body sensor networks. Next two papers are dedicated to IEEE 802.15.4 sensor networks.

In A. Haffiz Shuaib and A. Hamid Aghvami's paper 'Dynamic topology control for the IEEE 802.15.4 network', four specific problems associated with the default IEEE 802.15.4 topology formation process in unattended deployment scenarios were identified and studied. To alleviate some of the effects of those problems, a so-called Super Frame (SF) Resolution algorithm is then proposed.

Kuang-Ching Wang et al. studied an IEEE 802.15.4 sensor network whose sensor nodes are mounted on rotating structures. They analysed the expected packet error rates with different rotation speeds and error region distributions, and proposed a transmission error avoidance approach based on online error pattern inference and transmission time for IEEE 802.15.4 wireless sensors on rotating structures. Readers are referred to their paper entitled 'Transmission error analysis and avoidance for IEEE 802.15.4 wireless sensors on rotating structures' for details.

Emerging grid applications that collect various measurements in real time using networked sensors pose new system and application requirements which are different from stand-alone systems. In their paper entitled 'ASGrid: autonomic management of hybrid sensor grid systems and applications', Xiaolin Li et al. present a comprehensive autonomic managing framework ASGrid for managing hybrid sensor grid systems and applications, and demonstrated the functionalities and performance of the framework via experiments and simulations. As claimed, this is the first proposal of the notion of autonomic sensor grid systems in a holistic manner, aiming at non-trivial large applications.

In summary, these papers span diverse domains of sensor networks, and they are a representation of the advancement of networked sensing technology. It is our distinct honour to include these papers in the special issue. We are most grateful for their contributions. We are very grateful that many authors have submitted the papers to or expressed interests in the workshop. Though having a tight schedule, our unselfish technical committee members and external reviewers handled and reviewed the papers in a timely manner. Without the encouragement, guidance and help offered by the ICCCN'08 organisation committees, it would be impossible to run the workshop and to have this special issue. Finally, we would like to express our sincere gratitude to the workshop coorganisers and the journal editorial staff.