Preface

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1 Introduction

Since wireless sensor networks (WSNs) enable us to collect the information of the nearby environment, the networks are regarded as core component to establish ubiquitous computing environment. Through the numerous test-bed of WSN in the world, various technologies achievements are proposed and presented in the literature. Energy-efficient or fault-tolerant routing protocols are typical technologies achievements. Still, many problems should be addressed to be deployed the WSN into our real life. For instance, security and privacy issues will be critical problem because the WSN can collect any private information of the end-user. In order to support the number of citizens in a city, scalability is also considered. To enable ubiquitous networks and WSNs successfully, it is necessary to integrate advanced technologies and theories, many of which are highly heterogeneous, from various fields including pervasive computing, ubiquitous networking, and wireless communications. These networks are continuously deployed in various computing environments such as military, healthcare, environment monitoring, and manufacturing.

Additionally, widespread and unrestricted deployment of ubiquitous networks and WSNs makes them exposed to a number of security vulnerabilities. Security and privacy are critical issues to many ubiquitous and sensor network applications. A number of trust and reputation issues arise in ubiquitous and WSNs since trust is a fundamental consideration for operation and stability of wireless networks. Providing a proper security and privacy to these networks is challenging, due to the open nature of wireless communication and the limited capabilities of ubiquitous sensor nodes in terms of processing power, storage, bandwidth, and energy. This special issue aims to address a variety of advanced technologies, theory, and applications in ubiquitous network and WSNs. It solicits high-quality theoretical as well as practical works on a broad range of issues important to wireless communications.

2 Related works

The consecutive development in micro-electronics enabled sensor node with small size, low-power, low-cost, high-performance processing ability with communication facility. Each node in WSN gathers various information of surrounding environment after deploying in a small or large area (Carle and Simplot-Ryl, 2004). For the successful operation of this network, many researches are done at all areas of the hardware, middleware, protocol, management, security and application fields (Akyildiz et al., 2002; Al-Karaki and Kamal, 2004; Kumar et al., 2006). More, emerging technologies and application services have posed various challenges for the development of efficiency, scalability and reliability in WSNs (Reddy et al., 2006).

The most important thing among the previously mentioned is the configuration of the long-live network although the node has many limited aspects of the operating energy for the sensor node. Usually, the sensor node deployed broad areas with an attached small battery. Sometimes the node can be feed from the environment like a solar energy, but most of all nodes cannot be supplied with energy sufficiently. In these weak condition, a more energy efficient sensor network is required that overcomes the problem effectively. The most basic method for reducing energy dissipation is the use of multi-hop communication (Woo et al., 2003; El-Hoiydi and Decotignie, 2004; Watfa et al., 2011). The received power at the free space is inversely proportional or even more with the square distance

from the signal source. So, multi-hop communication scheme consumes less energy than the single-hop case.

The hierarchical architecture and the clustering scheme use multi-hop communication inherently (Ammari and Das, 2012). Each node sends data to the parent node or cluster head for sending data to the sink. But, the parent nodes or cluster head nodes are exhausted and turned down faster than other nodes because of the lack of node energy. For overcoming this, the nodes abundant with remaining energy take the role of parent or cluster head, or they enlarge the lifetime of the network by turning around the role of data transfer in a round robin manner (Heinzelman et al., 2000).

The other method for reducing the operational energy of the sensor node is the use of wake-up and sleep scheduling scheme (Wei et al., 2002; Guo et al., 2012; Ollos and Vida, 2011; Chi-Tsun and Leung, 2011; Sthapit and Jae-Young, 2011). When there is a node that has no data to send or receive, the node goes into the sleep state and locks energy dissipation of waiting and hearing for the signal. The load balancing and intelligent routing scheme also enlarge network lifetime by taking short and efficient route to the sink effectively (Sergiou and Vassiliou, 2011; Pan and Li, 2011). Reducing collision and increasing data transfer efficiency at the MAC layer can also reduce the energy dissipation of each sensor node (Lee, 2010; Yue et al., 2011; Fan et al., 2011). For maximising the energy efficiency, a cross-layer approach at the routing and MAC layer is also investigated (Demir et al., 2011).

Also, as many nodes are deployed in a wide area and many obstacles are existed in sensor network, the flexibility and the reliability are particularly important. The weather can be changed so frequently, and a new obstacle affects the operating status of the node, so the connections between nodes are on and off frequently. So, a reliable network and routing technology is required that can solve efficiently the link or node failures of a short or long time ranges. Multi-path scheme is just there for that solution. The most important data can be sent to the primary path from several paths. And, if the primary path is down or degraded, one of the other paths is switched to the primary path and the data transfer is continued seamlessly (Lee, 2012). Self-organisation of each sensor node and the control and management scheme for sensor node are also great concern that we must solve together. Location management and time synchronisation scheme also have great concern continuously (Enyang et al., 2011).

As the ability of the sensor node is increasing and for more concrete information of the sensing event, multimedia data sending at the sensor network also emerged already (Nayyar et al., 2011). Achieving quality of service (QoS) objective in WSN that deals with multimedia information is of paramount importance in the WSN research community. From the application point of view, meeting application specific QoS constraints is equally important as designing energy efficient embedded circuitry for WSN nodes. Among various WSN communication protocol stack, the transport layer functionality has gain fundamental fame lately in addressing the application specific QoS objectives by supporting source prioritisation besides the reliability and congestion control aspects of the design that helps in gaining high throughput with minimum end-to-end packet latency (Sharif et al., 2010).

For collecting data from sensor nodes, a sensor network that connecting the sensor nodes and a sink node must be formed. Sink node can be in a specific location and does not move. But in some cases, it needs that a sink node moves around the sensor network and collects data from sensor nodes directly. This can be more efficient in energy consuming aspects, and more accurate data collection can be possible at some specific interest area (Guoliang et al., 2012; Silva et al., 2011; Sarma et al., 2011). There are two cases of this application, a pull-based data collection or aggregation application and the other is a push-based data dissemination case (Ye et al., 2002; Kim et al., 2003; Hwang and Eom, 2006).

WSNs have become a highly active research area because of their potential of providing diverse services to a broad range of applications. Underground, underwater and healthcare applications with body area network are such good examples (Wang et al., 2011; Cheng et al., 2011; Sghaier et al., 2011). For the development of structured sensor applications, modelling, testing and performance evaluation are done from the design phase (Glatz et al., 2011; Merentitis et al., 2012). Also, measurements and experience from experimental systems and test-beds are reported consecutively. Integration of WSNs and web-based services are other interesting topics. For the sensor cloud and sensor web, efficient data store and processing algorithm are very required theme of this fields. System-on-chip design put it in a small devices altogether for one specific application development (Hempstead et al., 2011).

Finally, security in sensor network should be core concern in upcoming issues (McCusker and O'Connor, 2011; Ruj et al., 2011). The provision of security services such as confidentiality and authentication is a fundamental requirement in order to ensure the safety and privacy of the users and data (Yan et al., 2011; Ortolani et al., 2011; Daojing et al., 2011; Hassanzadeh et al., 2011). The technical realisation is challenging due to the high mobility of users accessing a multitude of WSNs.

We received seven manuscripts. Each manuscript was blindly reviewed by at least three reviewers consisting of guest editors and external reviewers. After the review process, four manuscripts were finally selected for this special issue.

The first paper in this special issue is on 'Area coverage enhancement schemes in directional sensor networks', by Chiu Kuo Liang, Yin Chung Hsu and Ting Hao Chu. This paper studies the area coverage enhancing problem and proposes two coverage-enhancing algorithms to maximise the sensing area of directional sensors only with local topology information. Extensive simulation is conducted to verify the effectiveness of our solutions and detailed discussions are also given on the performance compared with previous approach.

The second paper in this special issue is on 'Exploring the green features of converged networks', by Xiaodong Yang. This paper presents the converged network-based solution and shows that the converged networks consume less network operation resources compared with non-converged networks and converged networks also perform better when the network operation scale is increased.

The third paper in this special issue is on 'The space-time trellis codes with improved performance for fading channels', by Ik Soo Jin. In this paper, the 8-state 8-PSK STTC with proportional mapping is presented. From the simulation results, it is shown that new code is superior to the corresponding TSC code and the BBH code over slow fading channels.

The fourth paper in this special issue is on 'Routing in WDM based wireless mesh networks with capacity estimation', by Neeraj Kumar, Naveen Chilamkurti, Jongsung Kim. In this paper, they propose a dynamic grooming with capacity aware routing and wavelength (DGCRW) assignment algorithm, which solves the linear programming (LP) problem without violating the constraints.

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