Foreword

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Biographical notes: Wen-Hwa Liao received the PhD in Computer Science and Information Engineering from National Central University, Taiwan, in 2002. He is currently a Full Professor in the Department of Information Management, Tatung University, Taiwan. His research interests are internet of things, wireless sensor networks, wireless networks, mobile computing, and cloud computing. He serves as the Editor of the *International Journal of Distributed Sensor Networks* and Guest Editor of *International Journal of Ad Hoc and Ubiquitous Computing*. He is a member of the IEEE Computer Society and the IEEE Communication Society.

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The Internet of Things (IoT) consists of sensors and smart things/objects that are connected to the internet anytime and anywhere. Acting as a perception layer of IoT, wireless sensor networks (WSNs) play an important role by detecting events and collecting surrounding context and environment information. Since sensors are generally powered up by batteries, replacing the batteries sometimes is very difficult due to environmental conditions. For the sustainability of network operations, energy harvesting and energy management technologies have recently gained much attention. Energy management is the most important technology for prolonging the network lifetime of WSNs. The design of efficient energy management involves several aspects, including physical, MAC, and network communications as well as application context. Energy harvesting is a novel and promising solution which guarantees wireless sensor networks working with unlimited lifetime.

This special issue is a collection of the selected outstanding papers devoted to the original and high quality contributions including experimental and theoretical research in energy harvesting and energy management in wireless sensor networks. Each paper submitted to the *International Journal of Ad Hoc and Ubiquitous Computing (IJAHUC)* was rigorously reviewed by at least three reviewers in its corresponding research area. On the basis of reviewing results, finally, 9 of 46 papers were recommended to be included in the special issue.

Chao and Huang propose a distributed and energyefficient broadcast protocol for low-duty-cycled WSNs. By giving a higher priority to the node with less awake slots and reducing the number of forwarders, the proposed protocol supports broadcast in an energy efficient way. Because positive acknowledges may incur the ACK implosion problem, a pre-defined reception threshold is known to all the nodes. Each node in the network should receive a broadcast message with a probability no less than this threshold. To avoid unlimited delay, another constraint, one-hop delay bound is defined. This delay bound is set as a time constraint for a node to receive a broadcast message.

Chen et al. propose a back-end scheduling algorithm which aims to achieve energy conservation in event-driven WSNs. In event-driven WSNs, when a newly event occurs, sensors must be active until the event has been handled. In this situation, virtual clusters can efficiently perform parallel computing tasks to quickly respond these sensors, so as to reduce the working time of sensors for saving their energy.

Li et al. propose a grey multistage model with a buffer operator in WSNs. The delivered information is predicted by a PSO algorithm and is amended by Kalman filtering. Thus, the fuzzy reasoning based on vague set is applied to get the time value of sensor networks' uncertain events. The state transition of each sensor node is controlled by the timestamps of uncertain events and the input signal. As a result, the sensor nodes can get into the optimal working mode and achieve the purpose of extending the life cycle by saving the node's energy.

Lin and Ssu propose the geographic cluster-based sink location determining (GCSLD) algorithm in WSNs. To prolong the network lifetime, sensors operate in a lowduty-cycle mechanism for reducing energy consumption. Thus, to maintain the end-to-end delay in WSNs, the proposed algorithm reduces the transmission latency by searching for an appropriate location for the sink node.

Gopikrishnan and Priakanth propose an energy-efficient data (HCED) aggregation in WSNs. The proposed algorithm provides energy-efficient data aggregation among the sensor nodes. To minimise the energy consumption during data aggregation, the shortest path is exploited for the tree construction. On the basis of the constructed aggregation tree, the proposed delay-efficient data aggregation performs fast data aggregation along the tree structure.

El Alami and Najid propose a routing technique to enhance energy efficiency in WSNs. The concept of the proposed algorithm is to divide the network area into one inner grid and clustered grids. In the inner grid, the nodes directly transmit data to the base station (BS). On the other hand, in each clustered grid, each node transmits data to cluster head and then the cluster head further forwards data to BS. Therefore, the proposed algorithm evenly distributes workloads on nodes, aiming to balance energy consumptions of all sensors. Simulation results show that the proposed routing protocol is more efficient than existing protocols, such as LEACH, TEEN, SEP and DEEC.

Chang et al. propose an energy balanced movement schemes in WSRNs to prolong the network lifetime. In order to construct a delivery (or back-up) path between BS and each event, this paper arranges a set of robots to the appropriate positions. Through the communication path, the sensory data of each event can be transmitted back to the BS for further analysis.

Touil et al. propose a performance evaluation model of contention-based MAC protocols in WMSNs. The re-implementation of existing MAC protocols that will be used in comparison is high time complexity. To cope with this problem, this paper designs an approach by considering all the elements to fit in the defined simulation environment and parameters. As well, this approach supports rapid comparisons of MAC protocols.

Bouain et al. propose an information system for patients triage and referral in emergency departments. To facilitate and accelerate the process of triage and referral in emergency departments, the constructed environment contains a set of sensors, such as Glucometer, electrocardiogram (ECG), pulse and oxygen in blood sensors (SPO2), Airflow sensors, body temperature sensors, and so on. As a result, the proposed information system can prioritise urgent cases which require intensive medical care and normal cases which require general treatment.