

Editorial Protocols and Architectures for Next-Generation Wireless Sensor Networks

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The massive deployment of Wireless Sensor Networks (WSNs) is expected to increase exponentially in the next few years, allowing millions of wireless devices to work autonomously for new applications. These next-generation WSNs are also expected to interact with other devices such as RFID tags, home appliances, cars, and mobile equipment. When integrated with the cloud, these networks could provide pervasive and ubiquitous services to the users by providing powerful and unlimited storage infrastructure. The current challenges for next-generation WSNs are scalability, decentralization, resource scarcity, heterogeneity, and dynamicity. These requirements and challenges cannot be fulfilled by traditional WSNs. In addition, the network, Medium Access Control (MAC), and Physical (PHY) layer protocols developed for traditional WSNs are not applicable to the next-generation WSNs, where millions of batterypowered nodes should operate for longer durations. In other words, the next-generation WSNs require the development of novel protocols at each layer that must be able to extend the network lifetime from months to years. These protocols may allow seamless integration of next-generation WSNs with other networks and platforms including internet of things and cloud computing.

The aim of this special issue was to attract high quality papers on protocols and architectures for the next-generation WSNs. We have received forty one articles, which were

rigorously peer-reviewed by experts, and have finally selected twenty one articles for publication. The paper entitled "Load Balanced Routing for Lifetime Maximization in Mobile Wireless Sensor Networks" proposes a novel lifetime maximization protocol for heterogeneous and homogenous networks with uncontrolled mobility by considering residual energy, traffic load, and mobility of nodes. Simulation results show that the proposed scheme provides significant improvement in network lifetime, data packet latency, and load balancing compared to minimum hop routing and greedy forwarding schemes. The paper entitled "Wireless M-Bus Sensor Networks for Smart Water Grids: Analysis and Results" investigates wireless metering bus protocol for consideration in future smart water grids. Simulation and experimental results show the effectiveness and feasibility of the proposed protocol. The paper entitled "ZEQoS: A New Energy and QoS-Aware Routing Protocol for Communication of Sensor Devices in Healthcare System" proposes a novel and QoS-aware routing protocol using two main modules and three algorithms for resource allocation. Simulations conducted in a real hospital scenario using Castalia 3.2 show that the proposed protocol offers good performance in terms of throughput and packet dropping rate at MAC and network layers. The paper entitled "Energy Consumption Optimisation for Duty-Cycled Schemes in Shadowed Environments" proposes a metric for low-power wireless links by considering shadow fading and truncated

ARQ schemes. NS-3 simulations are used to determine the optimal operating regions for direct, multihop, and CDC-ARQ forwarding. The paper entitled "Game-Theoretic Based Distributed Scheduling Algorithms for Minimum Coverage Breach in Directional Sensor Networks" formulates the problem of direction set K-Cover as a direction scheduling game and proposes synchronous and asynchronous gametheoretic based distributed algorithms. Experimental results show that the proposed algorithms (Nash equilibria) provide a near-optimal and well-balanced solution. The paper entitled "Altruistic Backoff: Collision Avoidance for Receiver-Initiated MAC Protocols for Wireless Sensor Networks" presents a novel collision avoidance method called altruistic backoff that reduces a significant amount of energy by minimizing the idle listening period of the nodes. The performance of the proposed backoff method is validated by several experiments using TI eZ430-rf2500 nodes. The paper entitled "A QoS-Based Wireless Multimedia Sensor Cluster Protocol" presents a new protocol for delivering multimedia stream features and guaranteeing quality of communication. Real experiments show performance of the proposed protocol for several video and audio cases in terms of bandwidth, delay, and jitter.

The paper entitled "WSN4QoL: A WSN-Oriented Healthcare System Architecture" presents network coding and distributed localization solutions for achieving efficiency in communication and indoor people tracking. Preliminary results show the efficiency of the proposed solutions. The paper entitled "An Improved User Authentication Protocol for Healthcare Services via Wireless Medical Sensor Networks" proposes an improved user authentication scheme for healthcare applications and proves that the proposed scheme eliminates security problems that are identified in the existing security schemes. The paper entitled "Wireless HDLC Protocol for Energy-Efficient Large-Scale Linear Wireless Sensor Networks" proposes a wireless HDLC architecture that supports half-duplex communication and point-to-point and multipoint networking. A hardware prototype for self-powered wireless sensors, based on XBee PRO modules, is developed for a large-scale infrastructure monitoring system. The paper entitled "Protocol and Architecture to Bring Things into Internet of Things" proposes a Communication Things Protocol (CTP) that provides interoperability among things with different communication standards. CTP considers an ontological representation and interaction model of things and implementation feasibility in standard communication protocols. Performance analysis shows the feasibility of CTP in terms of energetic cost, data efficiency, and message latency. The paper entitled "Energy-Efficient Node Selection Algorithms with Correlation Optimization in Wireless Sensor Networks" first proposes a new cover set balance algorithm to select a set of active nodes with partially ordered tuple, and then it proposes a new algorithm to find the correlated node set for a given node. In addition, a high residual energy first algorithm is proposed for reducing the number of active nodes. Experiments show that the proposed algorithms significantly increase the network lifetime. The paper entitled "Securing Cognitive Wireless Sensor Networks: A Survey" presents an overview of the recent progress in the area of cognitive sensor networks and highlights open research issues and challenges.

The paper entitled "Collection Tree Extension of Reactive Routing Protocol for Low-Power and Lossy Networks" presents an extension to the Lightweight On-Demand Ad hoc Distance Vector Routing Protocol-Next Generation (LOADng) routing protocol for efficient construction of a collection tree. The extended LOADng imposes minimal overhead and complexity and avoids complications of unidirectional links in the collection tree. The complexity, security, and interoperability of the proposed protocol are analyzed using extensive simulations. The paper entitled "Design and Experiment Analysis of a Hadoop-Based Video Transcoding System for Next-Generation Wireless Sensor Networks" presents a hadoop-based video transcoding system for accommodating hundreds of high-definition video streams in the nextgeneration sensor networks. Experimental results show that there is an optimal value of the number of mappers, which is closely related to the file size. In addition, it is also shown that the time consumption of video transcoding depends on the duration of video files rather than on their sizes.

The paper entitled "RFID Localization Using Angle of Arrival Cluster Forming" presents a test-bed comparison of power control and RSSI distance estimation approaches for active RFID tags. It also presents an angle of arrival cluster forming localization approach that utilizes the angle of arrival of the tag's signal and the reader's transmission power control in order to localize the active tags. The paper entitled "Energy Efficient and Load Balanced Routing for Wireless Multihop Network Applications" presents a novel, energy-efficient, and traffic balancing routing protocol that provides a weighted and flexible trade-off between energy consumption and load dispersion. Simulation results show that the proposed protocol achieves high energy efficiency, decreases the number of failed nodes, and extends the network lifetime. The paper entitled "A Cross-Layer Approach to Minimize the Energy Consumption in Wireless Sensor Networks" presents a crosslayer solution to reduce idle listening period by triggering the node whenever a packet is detected. The wakeup circuit or MAC scheduler wakes up the nodes using a commercial power detector connected to the nodes. Experiments are conducted to show effectiveness of the proposed solution. The paper entitled "A Survey on Deployment Algorithms in Underwater Acoustic Sensor Networks" overviews the most recent advances of deployment algorithms in underwater acoustic sensor networks. It classifies the algorithms into static deployment, self-adjustment deployment, and movementassisted deployment. The paper entitled "Maximizing Network Lifetime of Directional Sensor Networks Considering Coverage Reliability" addresses the Directional Cover-sets with Coverage Reliability (DCCR) problem by presenting a Coverage Reliability model and a Directional Coverage and Reliability (DCR) greedy algorithm. The Coverage Reliability model considers the detection probability of each node in the cover-sets. The DCR algorithm solves the DCCR problem. Simulation results show that the proposed approaches increase network lifetime while guaranteeing the minimum coverage reliability. The paper entitled "A QoS Model for a RFID Enabled Application with Next-Generation Sensors for Manufacturing Systems" proposes a quality model for RFID systems. The criterion for the quality model is borrowed

from ISO 9126 and the DeLone and McLean models. The proposed model consists of functionality, reliability, usability, efficiency, maintainability, and business criteria. When the manufacturing system addresses these criteria and satisfies users and developers, RFID system benefits can be obtained.

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