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*Editorial*

# Planning and Deployment of Wireless Sensor Networks

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The area of monitoring and control of physical environments has recently become a hot spot in the technology landscape. Currently, a number of companies are offering a plethora of sensing devices with different phenomena's monitoring capabilities. These devices, a.k.a. sensors, can be tiny with limited energy and processing capabilities; they can stand alone or be integrated in various structures (buildings, human bodies, vehicles, objects, etc.), and they can be deployed to form a wireless sensor network (WSN) in support to a variety of military, civil, and environmental applications.

In a WSN, the sensors are also capable of communicating with each other and in a multihop way propagating sensing information to data sinks and operations centers. In the last few years, wireless sensor networking has been a very active research area in both academia and the industry with a wide variety of applications such as area monitoring, environmental sensing, industry automation, structural monitoring, water and wastewater monitoring, surveillance, health monitoring, tracking of materials, and many others. While the set of challenges in sensor networks are diverse, researches have mainly focused on fundamental networking challenges, which include routing protocols, energy minimization, and data gathering. However, the performance of the proposed solutions strongly depends on the way sensors were positioned in the sensed area. To that end, the goal of this special issue is to report on recent advances in wireless sensor network planning, deployment, and management. Its scope includes both theoretical and practical contributions related to WSN architecture, planning, deployments, and applications.

This special issue starts with a paper focusing on the problem of cluster heads selections in cluster-based wireless sensor network architecture. The main objective is to select the optimal location and the optimal number of cluster heads that minimize both the intra- and intercluster energy consumption, when considering multihop routing protocol. To achieve this requirement, the authors start by modeling both the intra- and intercluster architecture and thus were able to determine the optimal size of each cluster and thus the optimal number of cluster heads.

*"Optimal planning of distributed sensor layouts for collaborative surveillance"* focuses on the WSN deployment issue in the case of surveillance coverage against moving targets. The authors develop a numerical optimization approach to place distributed sets of sensors to perform surveillance of moving targets over extended areas. To overcome the complexity of this problem the authors use a genetic algorithm based solution to find spatial sensor density functions that maximize effectiveness against moving targets. Finally, they numerically evaluate the performance of their solution using example use cases in general area surveillance and risk-based surveillance in protection of an asset.

*"Optimal management of rechargeable biosensors in temperature-sensitive environments," "Dynamic sensor scheduling for thermal management in biological wireless sensor networks,"* and *"Wireless sensor network modeling and deployment challenges in oil and gas refinery plants"* focus on the usage of wireless sensor networks in specific application domains. In particular, "*Optimal management of rechargeable biosensors in temperature-sensitive environments*" and

"*Dynamic sensor scheduling for thermal management in biological wireless sensor networks*" focused on biological applications, where biosensors are attached or implanted into the body of a human or animal. Specifically, "*Optimal management of rechargeable biosensors in temperature-sensitive environments*" tackles the problem of finding an optimal policy for operating a rechargeable biosensor inside a temperature-sensitive environment characterized by a strict maximum temperature increase constraint. In this case, the authors model theoretically the problem using a Markov Decision Process (MDP). Moreover, to handle large-size MDP models they also show how operating policies can be obtained using a Q-learning approach. On the other hand "*Dynamic sensor scheduling for thermal management in biological wireless sensor networks*" focuses on the scheduling problem. Here also, the authors formulate the problem using an MDP approach and propose two specific types of states aggregation to produce a tractable solution. Finally, "*Wireless sensor network modeling and deployment challenges in oil and gas refinery plants*" considers the issue of wireless sensor network deployment in oil and gas refinery plants. More precisely, the authors propose different channel models based on the diffraction theory to assess the link quality in radio environments affected by highly dense metallic building blockage. The main idea is to split the wireless links into mutually exclusive attenuation classes based on the 3D structure of the building blockage. Each class is characterized by a different amount of obstruction loss; therefore a separate channel model is proposed to predict the QoS for each link type. Experimental results confirm the effectiveness of the proposed method as it provides a practical tool for virtual network planning.

"*A multipath routing approach for secure and reliable data delivery in wireless sensor networks*" focuses on the security issue in WSNs. More precisely, the authors present and evaluate a secure and reliable routing mechanism offering different levels of security in an energy efficient way for WSNs. The main idea of the authors is to use a node-disjoint routing approach in order to split the messages according to different paths with different coding methods. The authors show that using this approach security and reliability can be enhanced while respecting the resource constraints of WSNs.

"*A cross-layer framework for network management in wireless sensor networks using weighted cognitive maps*" tackled the problem of WSNs management and proposes a cross-layer framework for network management that considers different conflicting network objectives, such as network lifetime, connectivity, and coverage. To achieve this requirement, the authors use the Weighted Cognitive Maps (WCM) tool to provide a parameterized representation of conflicting system processes. The WCM continuously monitors the required QoS levels specified by the user and takes fast and efficient actions whenever those levels are violated.

"*An Internet of Things approach for managing smart services provided by wearable devices*" focuses on the generalization of the wireless sensor network concept to the emerging area of Internet of Things (IoT). Specifically, the authors presented an autonomous physical condition performance application, based on a WSN, bringing about the possibility of including several elements in an IoT scenario: a smart watch, a physiological monitoring device, and a smartphone.

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