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Editorial

Bio-Inspired Mechanisms in Wireless Sensor Networks

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Wireless sensor networks (WSNs) are gaining significant interest of academia and industry. Multihop wireless networks are self-organizing and self-healing with cost effective deployment and maintenance, yet a lot needs to be done in terms of efficient and robust solutions. WSN has been an interesting area of research in the last years for various disciplines. WSN is the most appropriate choice for different environments monitoring. There are many protocols and algorithms based on natural behaviors that are able to sense data and take decisions.

This special issue is dedicated to consider the technical and theoretical applications and challenges of bio-inspired networking and communication in WSN. The topics in the issue included but were not limited to

(i) adaptive security mechanisms;
(ii) scalable network architecture;
(iii) self-organizing systems;
(iv) self-healing mechanisms;
(v) evolutionary algorithms;
(vi) ant colonization and swarm intelligence techniques;
(vii) artificial neural networks;
(viii) artificial immune methodologies.

We welcomed papers about techniques and applications, awareness, experiences, and best practices as well as future trends and needs related to all aspects of bio-inspired mechanisms in WSN.

The papers have been peer-reviewed and have been selected on the basis of their quality and relevance to the topic of this special issue.

The paper "Systems and Algorithms for Wireless Sensor Networks Based on Animal and Natural Behavior" realizes a survey of the actual systems based on natural behaviors that are currently used for several purposes in WSN. The novelty of this work is that authors recompile systems based on animal behavior and also systems based on other natural behaviors such as plant behavior, bacteria behavior, or immune systems behavior. In this study, authors analyzed the percentage of behaviors in bio-inspired systems, the percentage of bio-inspired main purposes (routing, node location, enhance lifetime, etc.), and even the main purposes of each bio-inspired behavior. Their results show that the bioinspired behaviors which bring more contributions are the animal behaviors (75% of total). Moreover, the ant colony behavior is the most important one between the animal behaviors (35% of the animal based behaviors). The most important function of natural behavior systems is the routing protocol (almost 50% of the total amount), followed by node location (almost 12% of the total amount); meanwhile, coverage optimization or security systems are not so common (less than 3% of the total amount).

Power consumption can increase considerably if data collection is required from all nodes in a WSN. The authors in "In-Network Filtering Schemes for Type-Threshold Function Computation in Wireless Sensor Networks" propose two nature-inspired schemes to forward only relevant data

towards a sink node for processing purposes instead of forwarding all measurements. One scheme is based on the well-known simulated annealing search process and the other one is inspired by the ant colony behavior. Both schemes show significantly communication costs reduction compared to traditional data collection schemes.

The paper "Energy Efficient Routing in Wireless Sensor Networks Based on Fuzzy Ant Colony Optimization" also focuses its contribution on the reduction of power consumption for a WSN but for a different context. Particularly, the authors try to reduce the energy consumption when the nodes dynamically self-organize themselves. They propose a nature-inspired routing protocol for WSN, imitating the foraging behavior of ants. They obtain lower energy consumption amount, lower routing request packets, and a higher network lifetime in comparison with the well-known AODV routing protocol.

WSNs are highly vulnerable to different security attacks. To solve this issue, we have included the paper entitled "Web Spider Defense Technique in Wireless Sensor Networks." In particular, fake wireless sensor nodes are located in the WSN that monitor network and system activities for malicious activities or policy violations. These honeypots attract intruders in order to gather all information about them as possible to report to a central system in order to stop the intrusion.

The authors of the paper "A Framework for Obesity Control Using a Wireless Body Sensor Network" present hardware and software architecture to assist people trying to lose weight. Harnessing the low-cost and low-power consumption small wireless sensor devices to deploy a wireless body area network (WPAN) for the individual, the proposed framework is capable of giving recommendations for the patient by fusing all the data sensed in the WPAN.

We hope that this special issue will be useful for researchers from the academia and the industry, standard developers, policy makers, professionals, and practitioners.

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