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Editorial

Energy Conservation and Harvesting in Wireless Sensor Networks

Mile Stojcev,[1] **Zoran Stamenkovic**,[2] **and Bojan Dimitrijevic**[1]

[1]*University of Nis, Niš, Serbia*
[2]*IHP–Leibniz-Institut für Innovative Mikroelektronik, Frankfurt (Oder), Germany*

Correspondence should be addressed to Mile Stojcev; mile.stojcev@elfak.ni.ac.rs

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Wireless Sensor Networks (WSNs) have attracted significant attention in monitoring and controlling plants, resources, and infrastructures. These networks are composed of a large number of smart devices called Sensor Nodes (SNs) aimed to work autonomously. The spatially distributed nature of WSNs often requires that the individual SNs be powered by batteries. One of the major limitations on performance and lifetime of SN is the limited capacity of its finite power source, which must be manually replaced when its battery runs out. A viable alternative then is to endow the SNs with appropriate harvesting technologies such as solar, vibrational, wind/water flow, thermal gradient scavenging, electromagnetic direct conversion, and others. These sources can supplement or even entirely replace the battery energy supply. There are complex tradeoffs to be considered when designing energy harvesting and conservation circuits for WSNs arising from the characteristics of the energy sources, energy storage devices used, power management functionality of the SNs and protocols, and the applications' requirements. This special issue contains nine papers that roughly cover some topics that are important for future applications of harvesting and conservation techniques in WSNs. The following paragraphs give an overview regarding the content of this special issue.

In the paper "Harvested Energy Maximization of SWIPT System with Popularity Cache Scheme in Dense Small Cell Networks," X. Peng and J. Li, from Xidian University, China, concentrate on energy minimization problem of simultaneous wireless information and power transfer (SWIPT) system.

K. Ho-Van and T. Do-Dac, from HCMUT, Vietnam, in "Relaying Communications in Energy Scavenging Cognitive Networks: Secrecy Outage Probability Analysis" evaluate the performance of relaying communications system in terms of the secrecy outage probability.

"The Smaller the Better: Designing Solar Energy Harvesting Sensor Nodes for Long-Range Monitoring" by M. Mabon et al., from University Rennes, France, describe an energy autonomous node architecture with long-range communication capabilities. In addition, an optimization methodology for energy harvesting and storage elements of the sensor node is presented.

In "Novel Energy-Efficient Data Gathering Scheme Exploiting Spatial-Temporal Correlation for Wireless Sensor Networks," Y. Zhou et al., from Nanjing University of Posts and Telecommunications, Nanjing, China, propose an energy-efficient data gathering scheme exploiting both spatial and temporal correlations for clustered WSNs.

In the paper "Priority-Based Pipelined-Forwarding MAC Protocol for EH-WSNs," K. Shim and H.-K. Park, from KOREATECH, Cheonan, Republic of Korea, concentrate on priority-based pipelined forwarding MAC protocol that determines the priority of relay nodes based on the residual power and energy-harvesting rate.

In the paper entitled as "Actor–Critic-Algorithm-Based Accurate Spectrum Sensing and Transmission Framework and Energy Conservation in Energy-Constrained Wireless Sensor Network-Based Cognitive Radios," H. A. Shah et al., from Inha and Ulsan Universities, Republic of Korea, focus on solving the Markov decision process problem which deals with an actor–critic-algorithm-based solution intended for optimization the action taken in a sensing–transmission framework.

M. Ke et al., from PLA Army Engineering University, Nanjing, China, in the paper entitled as "Robust Power Allocation for Cooperative Localization in Jammed Wireless

Sensor Networks" investigate the robust power allocation strategies for cooperation in jammed wireless sensor localization systems.

R. N. Jadoon et al., from University of Science and Technology of China, Hefei, China, and COMSATS University, Islamabad, Pakistan, describe an efficient data delivery technique called RD^2T for wireless sensor networks. This technique divides the network into static zones by eliminating the control overhead and hence extends the network lifetime.

Finally, in the paper "A Self-Powered PMFC-Based Wireless Sensor Node for Smart City Applications," D. Ayala-Ruiz et al., from Technology Institute of Sonora, Autonomous University of Yucatan and University of Quintana Roo, Mexico, propose a WSN composed of self-powered plant microbial fuel cells as long-range sensor nodes for environmental analysis in smart cities.

We sincerely thank the authors for their outstanding work and the anonymous reviewers who made contribution to the review process. Both the authors' and the reviewers' efforts guaranteed the high quality of the published papers in this special issue. A special thank goes to the Editorial Board who has the overall responsibility of the journal quality and to Monica Nabil for assistance during the publication process. We believe that the technical details presented in the papers in this special issue will be interesting and useful to the journal readers and will provide a good snapshot of the state of art in WSNs.

Conflicts of Interest

The guest editors declare no (existing and anticipated) conflicts of interest.

Mile Stojcev
Zoran Stamenkovic
Bojan Dimitrijevic