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Lightweight and efficient dynamic cluster head election routing protocol for wireless sensor networks

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Abstract

Wireless Sensor Networks (WSNs) have gained great significance from researchers and industry due to their wide applications. Energy and resource conservation challenges are facing the WSNs. Nevertheless, clustering techniques offer many solutions to address the WSN issues, such as energy efficiency, service redundancy, routing delay, scalability, and making WSNs more efficient. Unfortunately, the WSNs are still immature, and suffering in several aspects. This paper aims to solve some of the downsides in existing

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routing protocols for WSNs; a Lightweight and Efficient Dynamic Cluster Head Election routing protocol (LEDICHE-WSN) is proposed. The proposed routing algorithm comprises two integrated methods, electing the optimum cluster head, and organizing the re-clustering process dynamically. Furthermore, the proposed protocol improves on others present in the literature by combining the random and periodic electing method in the same round, and the random method starts first at the beginning of each round/cycle. Moreover, both random and periodic electing methods are preceded by checking the remaining power to skip the dead nodes and continue in the same way periodically with the rest of the nodes in the round. Additionally, the proposed protocol is distinguished by deleting dead nodes from the network topology list during the re-clustering process to address the black holes and routing delay problems. Finally, the proposed algorithm's mathematical modeling and analysis are introduced. The experimental results reveal the proposed protocol outperforms the LEACH protocol by approximately 32% and the FBCFP protocol by 8%, in terms of power consumption and network lifetime. In terms of Mean Package Delay, LEDICHE-WSN improves the LEACH protocol by 42% and the FBCFP protocol by 15%, and regarding Loss Ratio, it improves the LEACH protocol by approximately 46% and FBCFP protocol by 25%. © 2021 by the authors. Licensee MDPI, Basel, Switzerland.

Author keywords

Cluster head election method; Dynamic self-organization method; Energy consumption; Service redundancy phenomenon; Wireless sensor network

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