Abstract

In wireless sensor networks (WSNs), a primary objective is to extend the lifespan of sensor nodes. Cluster head selection algorithms play a crucial role in electing and rotating cluster heads among nodes, significantly impacting the network's energy utilization. Over the years, various energy-efficient routing protocols have been developed to reduce energy consumption and thereby prolong the network's lifespan. Current energy-efficient routing protocols, such as HEED, TEEN, APTEEN, SHPER, and LEACH, have not fully addressed the challenge of energy consumption in WSNs. LEACH, which stands for Low Energy Adaptive Clustering Hierarchy, is a well-known clustering protocol designed for energy-efficient data gathering in WSNs. However, the processes of selecting cluster heads and the effectiveness of data aggregation in the basic form of LEACH can be complex. This study aims to develop an extended version of the Low Energy Adaptive Clustering Hierarchy routing protocol that employs an extended K-Means Cluster Head Selection Algorithm to choose cluster heads more effectively. The developed protocol is intended to enhance the longevity of WSNs. A quantitative approach has been utilized to measure performance by simulating various routing protocols. To demonstrate the advantages of the proposed protocol, we compared it against previous protocols using several metrics, including residual node energy, packet delivery ratio, throughput, network longevity, average energy consumption, and the number of live and dead nodes. The results indicate that the proposed protocol outperforms existing protocols, such as LEACH and SEP.