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Optimization of the reliability of NRF-E-LEACH and NRF-RN-LEACH protocols

Communication Info

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Abstract

Wireless sensor networks use clustering protocols to optimize energy consumption and extend network lifetime. The LEACH[1] protocol is the benchmark for hierarchical approaches. It relies on random and periodic selection of cluster leaders to balance the energy load. However, this random selection can lead to suboptimal energy distribution and instability in the cluster structure. To improve these limitations, variants such as NRF-RN-LEACH and NRF-E-LEACH have been proposed[2]. NRF-RN-LEACH introduces a new threshold formula[3] and stabilizes the network structure for several rounds, reducing frequent reconfigurations and lowering overall energy consumption. NRF-E-LEACH integrates residual energy into the cluster head selection process[4], allowing for better energy balancing and delaying the death of the first nodes. However, premature failure of cluster heads remains a critical factor affecting network reliability. To address this issue, the selection of a vice-cluster head has been introduced[5]. This mechanism ensures continuity of communications in the event of failure of the main head and reduces transmission interruptions. The improved versions, demonstrate a significant improvement in reliability and the number of packets received at the base station. Nevertheless, a slight decrease in network lifetime is observed due to the additional energy consumption associated with maintaining the secondary node.

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