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Load-Enabled Deployment and Sensing Range Optimization for Lifetime Enhancement of WSNs

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Abstract : Wireless sensor nodes are resource constrained battery powered devices usually deployed in hostile and ill-disposed areas to cooperatively monitor physical or environmental conditions. Due to their limited power supply, the major challenge for researchers is to utilize their battery power for enhancing the lifetime of whole network. Communication and sensing are two major sources of energy consumption in sensor networks. In this paper, we propose a deployment strategy for enhancing the average lifetime of a sensor network by effectively utilizing communication and sensing energy to provide full coverage. The proposed scheme is based on the fact that due to heavy relaying load, sensor nodes near to the sink drain energy at much faster rate than other nodes in the network and consequently die much earlier. To cover this imbalance, proposed scheme finds optimal communication and sensing ranges according to effective load at each node and uses a non-uniform deployment strategy where there is a comparatively high density of nodes near to the sink. Probable relaying load factor at particular node is calculated and accordingly optimal communication distance and sensing range for each sensor node is adjusted. Thus, sensor nodes are placed at locations that optimize energy during network operation. Formal mathematical analysis for calculating optimized locations is reported in present work.

Keywords : load factor, network lifetime, non-uniform deployment, sensing range
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