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An energy efficient approach to extend network life time of wireless sensor networks

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Abstract

The energy consumption in wireless sensor networks is a significant matter and there are many ways to conserve energy. The use of mobile sensors is of great relevance to minimize the total energy dissipation in communication and overhead control packets. In a WSN, sensor nodes deliver sensed data back to the sink via multi hopping. The sensor nodes near the sink will usually consume more battery power than others; consequently, these nodes will quickly drain out their battery energy and decrease in the network lifetime of the WSN. The presence of mobile sinks causes increased energy reduction in their proximity, due to more relay load under multi hop communication. Moreover, node deployment technique can also be used to improve the life time of the network. Performance comparisons have been done by simulations between different routing protocols and our approach show efficient results.

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Keywords: Wireless sensor networks, Energy hole problem, Node deployment, mobile sink, Average Energy, Network lifetime.

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1. Introduction

Node deployment is an significant issue in wireless sensor networks (WSNs) [10] because it has an important impact on the performance of the network. There are two deployment methods: 1) random and 2) deterministic deployments [11].

In the random, the sensor nodes are usually scattered by aircraft and results in a randomized distribution.

In a Wireless sensor network, sensor nodes send the sensed data back to the sink via multi-hopping. In predetermined deployment, the locations of node are specified [8].The sensor nodes close to the sink will generally consume more energy than other node leading to a phenomena known as **energy hole problem**. Therefore shorten the network lifetime of the WSN. The presence of mobile sinks causes less energy consumption in their proximity. So, node deployment technique can also be used to improve the life time of the network.

Network lifetime can be defined as the time from the start of network functioning to the instant when the first node in the network runs out of energy [4-7].One approach for network lifetime maximization is to reduce node's transmission power in order to reach their farthest selected neighbour, which not only save energy but can also improve network throughput. However, because of the reducing the transmission range may strongly affect the network connectivity due to the decline of the number of neighbour nodes connected to a given one (called node degree). Another efficient means of conserving energy is to schedule nodes to sleep mode (i.e., turning off their radios) when they are not needed, without changing global connectivity and spatial coverage of the sensing field.
The main objective of this research is to investigate the effectiveness of existing approaches as well as our approach for solving energy consumption problem based on Sink mobility and Node deployment strategy.
Energy conservation in sensor has two aspects:

1) Both device and protocol (algorithm) in use should be highly efficient.
2) The rate of energy consumption in different parts of the network should be even.

2. Related Work

There are several parameters based on which the performance of WSNs can be analyzed. Some of these parameters are as follows. There are various methods to improve the Network life time:

Node deployment technique: Given some sensor nodes that can be deterministically deployed, where to deploy them and how to schedule them so as to achieve the required target coverage level and increase the network lifetime. One of the basic requirement of node placement is to accomplish desired coverage and connectivity. NODE deployment is one of the most critical issues in wireless sensor networks (WSNs).
Node deployment can be divided into continued-point based deployment and grid point based one. Due to specific advantages, the latter becomes necessary in a broad range of applications [1], [2]. The fundamental requirement of node placement is to achieve desired coverage and connectivity, where coverage is to guarantee that every point of interest (PoI) is monitored by at least one sensor, and connectivity is to ensure sufficient routing paths [3].

Sink mobility: The task of the sink is processing the data for the final users. Sink mobility is considered as one of the way to reduce energy consumption. Sensors can send data to sink through single hop or long distance transmission. WSNs with mobile sinks have attracted a lot of interest recently [9]–[10]. PEGASIS-Based routing protocol (MIEEPB) has been presented in [9]. MIEEPB introduces the sink mobility in the multi-chain model and divides the sensor field into four regions, therefore achieving smaller chains and decreasing load on the leader nodes. The sink moves along its trajectory and stays for a time at fixed location in each region to guarantee data collection. A new optimizing LEACH clustering algorithm with mobile sink and rendezvous nodes was introduced in [10]. This algorithm combines the use of the LEACH algorithm, mobile sink and rendezvous points to preserve