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A Survey Paper on Modified SPIN for WSN

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Abstract: ***Wireless sensor networks consists of small nodes with sensing, computation, and wireless communications capabilities. The life time of a sensor node depends on its energy consumption. Saving energy and increase network life time are main challenges of wireless sensor networks. The efficiency of the sensor node depends on the routing protocols used. Routing protocols provides a best data transmission route from sensor nodes to sink node to save energy for nodes in the network. Aggregating the data from the common sensor nodes using the concept of the sink nodes is used to preserve the battery of the nodes. The sink nodes collect data from the sensor nodes and forward the data to the base station node.***

Keywords: Energy, Routing, SPIN and WSN.

1. Introduction

Wireless sensor network (WSN) iswidely use in different applications like environment, defense, medical, house, media and education. Wireless sensor network is a network of large amount of sensor nodes which are densely deployed in an ad-hoc manner. A sensor network consists of multiple detection stations called sensor nodes, each of which is small, lightweight and portable.

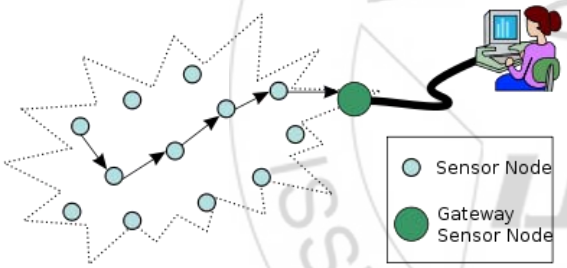

Figure 1: Wireless Sensor Network nodes.

The power for each sensor node is derived from a battery. These sensor nodes have limited battery capacity. In wireless sensor networks, prolonging the lifetime of these sensor nodes in major issue. The sensors nodes always send data to the base station. In such kind of network the sink nodes are also used to collect data from the nodes and forward the data to the base station node. In this paper we have analyzed various approaches in wireless sensor networks which focus on increasing the lifetime of the sensor nodes.

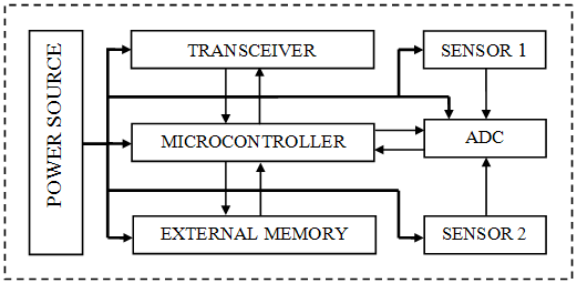

Figure 2: Sensor Node Architecture

2. Related Works

In [1], authors propose a new strategy in which nodes send their data through multi hop path of reduced length by offering nodes the possibility to buffer data while waiting the sink coming closer (not necessarily at node range), which exempts more sensors from relaying these data. This strategy allows saving energy, while ensuring no data is lost due to buffer overflow. They model the problem of optimizing WSN lifetime with limited buffer capacity and controlled mobile sink using a Linear Program (LP). For arbitrary topologies, LP determines the sink sojourn times at each possible location, the data transfer rates between nodes and the buffered packets quantities. Compared to previous models, their solution achieves better lifetime and enables to generate and transmit more data to the mobile sink. The proposed scheme also better balances the load among nodes. Finally, a distributed algorithm is derived from the numerical results for data collection in WSN. Simulation shows that approach leverages latency for energy saving, and its performance is compared with single-hop and multi hop forwarding protocols.

In [2], authors proposed an efficient routing protocol for single mobile sink and multiple mobile sinks for data gathering in WSN. In this approach, a biased random walk method is used to determine the next position of the sink. Then, a rendezvous point selection with splitting tree technique is used to find the optimal data transmission path. If the sink moves within the range of the rendezvous point, it receives the gathered data and if moved out, it selects a relay node from its neighbors to pass the packets from rendezvous point to the sink. Proposed algorithm reduces the signal overhead and improves the triangular routing problem. Here the sink acts as a vehicle and collect the data from the sensor. The results show that the proposed model effectively supports sink mobility with low overhead and delay when compared with Intelligent Agent-based Routing protocol (IAR) and also increases the reliability and delivery ratio when the number of sources increases.

In [3], authors propose a novel clustering schema EECS for wireless sensor networks, which better suits the periodical data gathering applications. This approach elects cluster

heads with more residual energy through local radio communication while achieving well cluster head distribution; furthermore it introduces a novel method to balance the load among the cluster heads. Simulation results show that EECS outperforms LEACH significantly with prolonging the network lifetime over 35%.

In [4], authors propose a novel network construction and routing method by defining three different duties for sensor nodes i.e. node gateways, cluster heads and cluster members and then by applying a hierarchical structure from sink to the normal sensing nodes. This method provides an efficient rationale to support the maximum coverage to recover the missing data with node mobility and to reduce overall energy dissipation. All this lengthens the lifetime of the network significantly.

In [5], author focuses on maximizing lifetime of a WSN by using an optimum approach. Protocol Leach-C is used for better performance by dispersing the cluster heads throughout the network. Sink finds its own optimum path to collect data from CH by using travelling salesman problem. Leach-C and travelling salesman problem are implemented to reduce energy consumption. Mobile sink is used for data gathering thus reducing energy consumption and extending overall lifetime of network and is a better approach than direct transmission and hop-by-hop.

In [6], the paper investigates the advantages of using controlled sink mobility in clustered wireless sensor networks (WSNs) which increases network lifetime. In a clustered sensor network, all Cluster Heads (CHs) have to transmit their buffered data to the sink during a specified interval, called data reporting time (tdr). In this paper, authors propose a scheme that prescribes the sink path for collecting all CHs data in tdr time span while maximizing network life time using the mathematical model MILP (Mixed Integer Linear Programming). The proposed scheme is compared with other related schemes by means of various simulation scenarios. Simulation results show that the proposed scheme significantly outperforms other schemes.

In [7], authors focus on using a mobile sink node which is considered as an important technique to improve network performance by collecting the data from each sensor node and then communicate through the network. There are certain techniques to consume the communication energy of sensor node. The distance between the transmitter and receiver is estimated before available transmission and then lowest transmission power needed to transmit the measurement data is then calculated and determined. The sensor nodes are also set to sleep/wake-up mode for energy saving in normal operating condition.

In [8], authors analyze the basic distributed clustering routing protocol LEACH (Low Energy Adaptive Clustering Hierarchy) and then propose a new routing protocol and data aggregation method in which the sensor nodes form the cluster and the cluster-head is elected on the basis of the residual energy of each individual node without re-clustering and the node scheduling scheme is adopted in each cluster of the WSNs. In the node scheduling scheme (ACTIVE and SLEEP mode) the energy efficiency is increased near to 50% than LEACH protocol and lifetime of the networks are also increased.

In [9], the authors proposed a concept that balances reliability and residual energy to control the success rate of message transmission. By formulating the weights of the reliability and residual energy, the reliability-energy metric is designed to measure routing path and an efficient algorithm is developed based on Dijkstra algorithm to search a reliability-energy disjoint path set.

In [10], the authors have proposed the concept of Clustering and multi-hop routing algorithm which are the most widely used in hierarchical routing protocol for Wireless Sensor Networks (WSN). In existing clustering and multi-hop routing algorithms, cluster head (CH) is randomly selected and the nodes near the Base Station (BS) which are called `hotspot nodes' are responsible for forwarding the data, both of which lead to unbalance energy consumption in entire network. This paper proposes an Energy-efficient routing Protocol Based on `Hotspot-aware' uneven clustering and Dynamic Path Selection (PHADPS). In `hotspot', this protocol increases the number of CH for forwarding data so it can balance the energy consumption between CHs in `hotspot' and other regions. After completion of the clustering, each CH establish a route table and dynamically choose the next hop node from the route table when sending every single frame of data. This protocol is able to cope with the unbalance `hotspot' issue and can prolong the network lifetime obviously.

In [11], authors consider a target-tracking sensor network and improve its energy awareness through predicting a target trajectory and decreasing sampling rate of sensors while maintaining an acceptable tracking accuracy. The tracking problem is formulated as a hierarchical Markov decision process (MDP) and is solved through neuro-dynamic programming. Improvements in performance of the network are achieved by use of a reinforcement learning algorithm to solve the MDP that converges faster than the preceding used methods, since the energy efficiency and speed of convergence of the solution are tightly coupled.

3. Problem Definition

In wireless sensor networks, the nodes which are deployed to sense the certain data from the environment are usually supplied with limited energy or battery resources. In such conditions, the nodes which run out of energy die soon, and it is very difficult to replace the sensor nodes since they are deployed in hostile environments. So conserving their energy becomes the important focus in the research to develop energy efficient schemes for data transmission between them and the sink node. In the research work done by the authors ZeenatRehenaet. al the data transmission between the source nodes and the sink is achieved by modified spin protocol which takes into account three phases namely, Distance discovery phase, Negotiation phase and Data transmission phase, to make the paths between source nodes and the sink and to send the data between them. In Distance discovery phase, the sink broadcasts message to the nodes, and the receiving nodes stores the distance to the sink node in terms of hop count.

However, hop count is not an accurate measure to find the distance between the two nodes in the wireless sensor networks. The nodes located in the communication range of a particular node will all be located at the same distance i.e. one hop but when distance is measured using the Euclidean formula, one can have exact distance between the node and its neighbors. This gives the exact shortest path between the source nodes and the sink node. So the path measured by the hop count which can be the longer one, will lead to more energy depletion of the nodes.

In the past the researchers have also worked upon the optimizing the route between the source and destination using route finding behavior of the ants and have proved that their behavior when applied on the networks exhibit better performance than the traditional routing protocols. In this work we tend to optimize the distance discovery phase of the modifies spin protocol with the route searching behavior of the ants to increase the performance of the network.

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