



An Efficient Energy Consuming Protocol For Wireless Sensor Networks

KEYWORDS

WSN, data gathering, energy consumption

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ABSTRACT *Wireless sensor networks are highly distributed network in which small light weight wireless nodes are deployed in large numbers to monitor the environment or system by the measurement of physical parameters such as temperature, pressure or relative humidity. The major operations involved in sensor networks are data gathering and data dissemination. The important issue in sensor networks is energy consumption which cannot be replaced or recharged. In this paper we propose a energy conserving data gathering protocol which performs better than LEACH, PEGASIS protocols*

I. INTRODUCTION

A wireless sensor network consists of smaller sensor nodes. Each sensor nodes has three subsystems. Sensor subsystem which senses the environment, the processing subsystem computes local computation on the sensed data, and the communication subsystem performs message exchange with neighboring sensor nodes.

Networking a large number of sensors gives rise to a robust, reliable and accurate sensor network to cover a wider area since individual sensors have limited sensing region, processing power, and energy. To make network fault tolerance the nodes cooperate and collaborate on their data.

II. ENERGY CONSUMPTION IN WSN

Available energy in sensor nodes is an important bottleneck operation of sensor network. Sensors usually depend on their battery for power, which cannot be recharged or replaced. A major constraint while designing protocols for sensor networks is available energy.

Hardware design of sensor nodes should also consider energy efficiency as a primary requirement. The operating system, micro controller, and application software should be designed to conserve power.

III. MAJOR SOURCES OF ENERGY WASTE IN WSN

Due to idle listening (listening an idle channel in order to receive possible traffic) Due to collision when a node receives more than one packet at the same time, these packets are termed collided even when they coincide partially. All packets that cause collision have to be discarded and retransmissions of these packets are required which increase the energy consumption.

Due to overhearing, a node receives packet that are destined to other nodes.

Due to transmitting or receiving data processing queries and forwarding data to neighboring nodes.

Due to result of control packet overhead. Finally over-emitting which is caused by the transmission of a message when the destination node is not ready.

IV. OTHER DATA GATHERING PROTOCOLS

a. Direct Transmission

All sensor nodes transmit data directly to the cluster head or BS. This is extremely expensive in terms of energy consumed, since the BS may be far away from some nodes. To avoid collision nodes must take turns while transmitting to the BS, there media access delay is also large. This scheme performs poorly with respect to the energy * delay metric.

b. Binary Scheme

This is also a chain based scheme like PEGASIS . All nodes which receive messages at one level rise to the next. The number of nodes is halved from one level to the next.

For instance consider a network with eight nodes labelled s0 to s7. The aggregated data reaches the BS in four steps which is $O(\log_2 N)$ where N is the number of nodes in the network this scheme is possible when nodes communicate using CDMA so that transmissions of each level can take place simultaneously.

c. Chain Based Three Level Scheme

A binary scheme is not applicable for non CDMA sensor nodes. As in PEGASIS the chain based three level scheme addresses this situation. The chain is divided into a number of groups to space out simultaneous transmissions in order to minimize interference. Nodes transmit one at a time within a group. In each group one node aggregates data from all group members and rises to the next level. Leader node is decided as priori. in the next level all nodes are portioned into two groups, and in the third level message exchanges can be done between one node from each group of the second level. Finally leader transmit a single message to the BS. The network has 100 nodes and the group size is ten for the first level and five for the second level.

V. MINIMUM SPANNING TREE ALGORITHM

Our data gathering algorithm is based on minimum spanning tree.

The data gathering protocols assume the locations of all nodes are known by base station a priori. They are both centralized algorithms where the base station is responsible for computing the routing information. This is because, in systems where some elements are resource limited whereas one or more elements are powerful, it is desirable to give the computation load to the more powerful elements of the system.

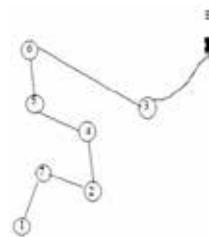


Figure 1. Chain based routing scheme on a sample network

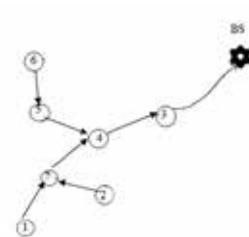


Figure 2. Minimum spanning tree based routing scheme on a sample network

The routing information is computed using Prim's minimum spanning tree algorithm where base station is the root.

The algorithm works as follows:

Initially, we put a node in the tree which is the base station in our case.

After that, in each iteration we select the minimum weighted edge from a vertex in the tree to a vertex not in the tree. Then add that edge to the tree.

In our case this means that the vertex just included in the tree will send its data through that edge.

We repeat this procedure until all nodes are added to the tree. In Figure, the resulting routing paths are illustrated for a sample network.

After some certain number of rounds passed (e.g.100) the base station re-computes the routing information excluding

the dead nodes. After each computation, the base station sends each node the required information for that node (i.e. the node's parent in the tree in order to reach to the base station; the time slot number when the node will send its data to its parent in a round; from how many different neighbors the node will receive packets in a round and when; etc.). So, the cost of setting-up the system with the new routing information is equal to only the sum of costs of running the receiver circuitry of each node. Therefore, the set-up cost for periodically establishing the scheme is very small compared to LEACH and PEGASIS.

IV. CONCLUSION

In this work, we present energy efficient data gathering protocol based on minimum spanning tree routing scheme. This protocol outperforms previous approaches, LEACH and PEGASIS, by constructing minimum energy consuming routing for each round of communications. Hence this protocol is more efficient that consumes energy and increases the lifetime of the sensor networks.

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