Data Collecting in Wireless Sensor Networks using Middle Nodes Networks using Middle Nodes

M. Deepika[1] Dr. Antony Selvadoss Thanamani[2]
[1]Research Scholar [2]Associate Professor & Head of Department
[1,2]Department of Computer Science
[1,2]NGM College, Pollachi, India

Abstract— Energy consumption is an essential concern to Wireless Sensor Networks (WSNs).The major cause of the energy consumption in WSNs is due to the data aggregation. A data aggregation is a process of collecting data from sensor nodes and transmitting these data to the sink node or base station. An effective way to perform such a task is accomplished by using clustering. In clustering, nodes are grouped into clusters where a number of nodes, called cluster heads, are responsible for gathering data from other nodes, aggregate them and transmit them to the Base Station (BS). In this paper we produce a new algorithm which focused on reducing the transmission path between sensor nodes and cluster heads. A proper utilization and reserving of the available power resources is achieved with this technique compared to the well-known LEACH_C algorithm.

Key words: WSN, BS, Clustering, Cluster Head, Data Aggregation

I. INTRODUCTION

Wireless Sensor Networks (WSNs) are composed of large number of low power, small size and low cost sensor nodes. A sensor node is an electronic device with the capability of detecting physical conditions, computation and communication. Those sensor nodes can be scattered to perform a variety of applications such as wildlife monitoring, habitat monitoring, fire surveillance, etc. Figure 1 shows the basic structure of a WSN. A sensor node typically consists of several parts including: a radio transceiver, a sensing unit, a microcontroller and power source usually a battery. The sensor nodes might vary in cost from few to hundreds of dollars depending on the functionality of each sensor node the constraints of cost and size of the sensor nodes .A sink node is a resourceful node having unrestricted communication and computational capabilities in addition to energy source, it can be stationary or dynamic and act as an interface between the sensor network and management center. The event being monitored may by stationary or mobile,

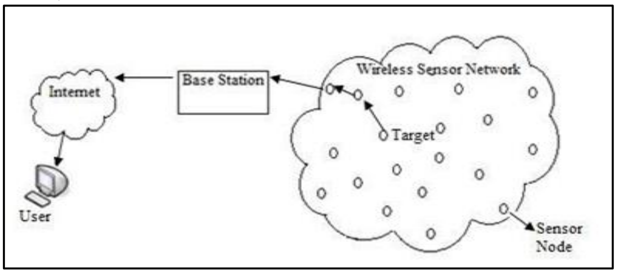

Fig. 1: Basic structure of WSN

On the application of WSN. Mounting sensor nodes on wild animals for behavior monitoring, where these animal move in an unexpected manner, is an example of mobile sensor nodes applications. On the other hand, sensor nodes may be deployed on stationary and known locations. In this paper, a new data gathering algorithm is proposed. The key idea behind this algorithm is to recursively divide the sensor network into four partitions symmetrical about a central id node. Furthermore, a set of cluster heads in the middle of each partition are defined in order to aggregate data from cluster members and transmit these data to cluster heads in the next hierarchical level. This procedure continues until a prescribed number of sensor nodes in each partition are reached. At the end of this procedure, a set of partitions of almost equal number of nodes are produced. The advantages of this algorithm are threefold. Firstly, equalizing the number of sensor nodes in each partition would greatly help to distribute the load among sensor nodes and therefore leads to proper utilization of the available power resources. Secondly, a set of cluster heads are assigned to each partition in each level. These nodes are selected as intermediate nodes in the cluster. This step is essential in order to prolong the network life time of cluster heads since these nodes usually consume their power more quickly compared to other normal nodes.

II. RELATED WORKS

In each cluster a single node is elected to be a cluster head. Each cluster head aggregates data from its cluster members and sends this data directly to the base station. The cluster head eliminate redundant data and uses one of the aggregated functions to minimize the transmitted data to the sink node. LEACH protocol consists of two phases: setup phase and steady state phase. In the setup phase, the clusters are arranged and the cluster heads are selected. Distance-based Clustering Routing Protocol in Wireless Sensor Networks algorithm [6] proposed a different approach to picks cluster heads based on distance. In this algorithm, non-cluster head nodes fined the cluster head which is closest to the center point between the node itself and the sink node. Each round in this method is consists of two phases; the setup and steady phases. The setup phase defines clusters and cluster heads as proposed in LEACH, and each node selects its cluster according to the distance. Another clustering algorithm, known as Energy-Aware Routing Protocol (EAP), was introduced in this protocol a novel scheme for inter cluster communication is proposed and used new parameters for selecting cluster heads. Each node has a table of the remaining energy of all neighboring nodes within its cluster area. This table helps each node to compute the average remaining energy of its neighbors. Any node whose remaining energy is higher than the average value will be assigned higher probability to become a cluster head. a clustering and leveling algorithm, called Energy Efficient Threshold Sensitive Hierarchical Routing Algorithm for Cognitive Wireless Sensor Networks (ETSHRA), was proposed. ETSHRA is composed of four phases. In the first phase, which is called leveling, nodes are divided into logical levels based on the power level of the received signal from BS. After leveling, clustering phase is initiated, first cluster heads are selected randomly, and then the nodes start to belong to a cluster head based on the level which they locate. Once the leveling and clustering phases are completed, a chain from cluster heads to BS is established. At the last phase, the soft and hard thresholds are used to allow sensors to transmit their data. The authors in developed a model to form clustering in sensor area. The clusters formulated in this method are heterogeneous-sized clusters, where the largest clusters are those located farther from the sink. A greedy algorithm was used to choose cluster heads. Firstly, the nodes with the highest energy needed to reach the sink are marked, and then every node computes the gain achieved by being a cluster head. Those with the highest gain are selected to act as cluster heads.

III. PROPOSED ALGORITHM

The problem considered in this paper is to gather data generated from sensor nodes. Every seconds. Cluster-heads are defined to receive data from all member nodes of their clusters and transmit the aggregated data to the sink node directly or through other cluster heads. The network is assumed to be homogenous in that sensor nodes are required to sense identical type of information. The goal of this algorithm is to present a strategy for defining intermediate cluster heads to minimize the distance between the cluster heads and their member node, so that the total energy consumed in the WSN is reduced. Our algorithm is divided into two phases; setup phase and steady state phase. In the setup phase a recursive algorithm is used to define clusters and cluster heads, which remain fixed over the network lifetime. The setup phase is occurred once over the network lifetime, as a result of this phase, the network is grouped into clusters, where each cluster defines its cluster heads.

IV. WIRELESS SENSOR NETWORKS WITH MOBILE ELEMENTS

To better understand the specific features of Wireless Sensor Networks with Mobile Elements (WSN-MEs), let us first introduce the reference network architecture, which is detailed according to the role of the MEs. The main components of WSN-MEs are the following. Regular sensor nodes (or just nodes, for short) are the sources of information. Such nodes perform sensing as their main task. They may also forward or relay messages in the network, depending on the adopted communication paradigm.

Sinks (base stations) are the destinations of information. They collect data sensed by sensor nodes either directly (i.e., by visiting sensors and collecting data from each of them) or indirectly (i.e., through intermediate nodes). They can use data coming from sensors autonomously or make them available to interested users through an Internet connection. —Special support nodes perform a specific task, such as acting as intermediate data collectors or mobile gateways. They are not sources nor destinations of messages, but exploit mobility to support network operation or data collection .Note that mobility might be involved at the diff erent network components. For instance, nodes may be mobile and sinks might be static, or vice versa. In any case, we define a WSN-ME as a network where at least one of the above-mentioned components is mobile. Depending on the specific scenario, the support nodes might be present or not. When there are only regular nodes, the resulting WSN-ME architecture is homo-geneous or flat. On the other hand, when support nodes are (also) present the resulting WSN-ME architecture is non-homogeneous or tiered.

V. RESULTS AND DISCUSSION

This algorithm is compared to the LEACH-C algorithm. The performance of both algorithms was assessed in terms of total energy dissipation under different network diameter, network lifetime of the network and number of dead nodes over the simulation time.

A. Energy Dissipation under Different Network Diameters

It is also shown that further improvement of consumed energy is achieved with our algorithm as the diameter of the network increases. For a small network diameter both

B. Network Lifetime with different Death Node Percentage

The network lifetime is described as the amount of time elapsed during which the network is functioning properly. One important factor that affects the network from functioning well is a number of dead
Nodes.

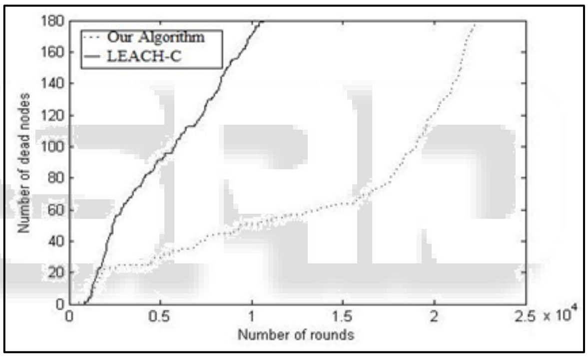

Fig. 2:

Algorithms exhibited an identical performance. In fact, when the network diameter is increased, transmission path between sensor nodes and cluster heads is also increased and so higher transmission power is needed. In addition, in the presence of large inter-sensor distances the shadowing channel model described by equation (4) is used, which greatly affected the energy dissipated of the network.

Despite this, dividing the network into smaller cluster sizes as in our algorithm and select the intermediate nodes to play as cluster heads led to minimize the total amount of the dissipated energy.

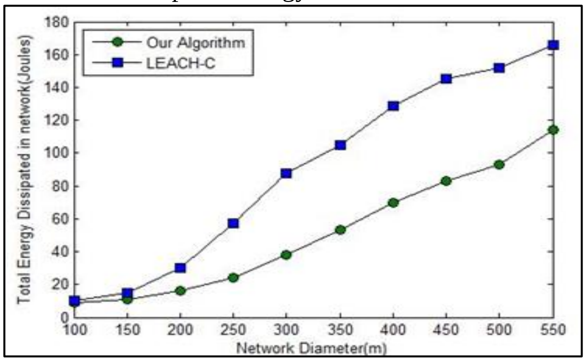

Fig. 3: Number of dead nodes

The results of the two algorithms showed that the death of the first set of nodes appeared around 2000 rounds. After that, the nodes for LEACH-C sharply die, in contrast to the proposed algorithm which showed gradual death of sensor nodes.

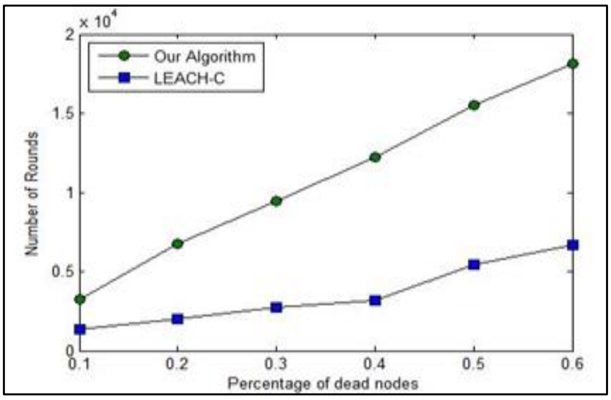

Fig. 4: Total Number of Dead Nodes over the Simulation Time

VI. CONCLUSION

This paper, we proposed a new energy efficient data aggregation protocol in wireless sensor networks. The key idea behind this algorithm is to recursively divide the sensor network into four partitions symmetrical about a central id node. Furthermore, a set of cluster heads in the middle of each partition are defined in order to aggregate data from cluster members and transmit these data to cluster heads in the next hierarchical level. The new algorithm adopts the concept of hierarchical clustering which prevents cluster heads from sending their data for long distances and thus the energy consumption of the sensor nodes is significantly improved. This algorithm focused on avoiding the overhead of dynamic clustering, reducing the transmission path between sensor nodes and cluster head nodes, and minimizing the direct communication between the sink node and cluster heads. Simulation results showed that the proposed algorithm achieved better performance in comparison with the LEACH-C algorithm in terms of energy consumption, network lifetime, and number of dead nodes.

REFERENCES

[1] Ramesh Rajagopalan and Pramod K. Varshney; “Data aggregation techniques in sensor networks: A survey”, Communications Surveys and Tutorials, IEEE Issn: 1553-877X , Volume:8 , Issue: 4 , pages: 48 – 63, 2006.
[2] KiranMaraiya, Kamal Kant and Nitin Gupta; “Wireless Sensor Network: A review on Data Aggregation”, International Journal of Scientific & Research, Volume 2, Issue 2, 2011.
[3] Wendi RabinerHeinzelman et al. “Energy-Efficient Communication Protocol for Wireless Microsensor Networks”, in Proceeding of the 33rd Hawaii International Conference on System Sciences，January 2000, pages: 1-10.
[4] X. Lin and I. Stojmenovic. “Power-Aware Routing in Ad Hoc Wireless Networks”, In SITE,University of Ottawa, TR-98- 11, Dec. 1998.
[5] Heinzelman W. B., Chandrakasan A. P., Balakrishnan H., ”An application specific protocol architecture for wireless microsensor networks,” IEEE Trans on Wireless Communications, Volume 1, No. 4, 2002, pages: 660-670.
[6] T.Rappaport, Wireless Communications: Principles & Practice. Englewood Cliffs, NJ: Prentice-Hall, 1996.
[7] “PIC microcontroller with 2.4GHz IEEE 802.15.4 transceiver and ZigBee stack,” FlexiPanel Ltd,2008.
[8] Ying Liang and Hongwei Gao, “An energy-efficient clustering algorithm for data gathering and aggregation in sensor networks,” Industrial Electronics and Applications, 2009. ICIEA 2009. 4thIEEE Conference on 25-27 May2009.
[9] Soro,Heinzelman,W.B.‘‘Prolonging the Lifetime of Wireless Sensor Networks via Unequal Clustering’’, 19th IEEE International Parallel and Distributed Processing Symposium, 2005.