



Weighted Sum Method Scheduling Chaining System for Efficient Data Routing

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Abstract: *Wireless Sensor Network may consists of a large number of wireless sensor nodes deployed in the desired network area in order to sense the specific changes going in there. As these sensor nodes are limited source of energy so we focuses on utilizing the energy of these nodes as efficiently as possible to maximize the network time. One of the field in which researchers continuously explore WSN lifetime enhancement is with the help of scheduling sleep and wake time for different criteria's, in this paper we are going to use weighted sum method to predict predefined wake up sequence for each cluster, focusing on selecting the shortest path for data routing. The simulation results are taken by MATLAB 2011b simulator to illustrate the accuracy of our proposed work.*

Keywords: *Wireless Sensor Network, network lifetime, Leach, Pegasus, GSSC, Weighted Sum Method.*

I. INTRODUCTION

A Wireless Sensor Network consists of a number of energy constrained sensor nodes. These nodes are deployed in a random fashion and can communicate among themselves to make an ad-hoc network. The sensor nodes communicate with the sink node in a wireless fashion. The wireless medium may either of radio frequencies, infrared or any other medium having no wired connection [1]. The primary concern in Wireless Sensor Network (WSN) is to maximize the network lifetime as long as possible, as it is not possible to replace or recharge the batteries of thousands of sensor nodes as they are often deployed in a remote or impractical environment.

As the sensor nodes have limited energy, and network lifetime is dependent on the remaining energy of the of the sensor nodes, so utilizing the energy of these nodes is an important concern. As in [2] one of the major source of energy wastage is communication. Therefore a large number of researchers are focusing on managing the communication so as to expanding the network lifetime. A number of data routing algorithms has been proposed to maximize the network lifetime.

Weighted Sum Method can increase the network lifetime with the aim is to conserve the energy of the network by choosing the shortest path i.e. the path that is closest to the sink node for sending the collected information to the sink.

This remainder of the paper is organized as follows. Section 2 describes the related work. Section 3 describes the energy model. The proposed scheme is discussed in Section 4. Then simulation result of our proposed work with LEACH, PEGASIS and GSSC is presented in section 5. The last section involves the results and conclusion.

II. RELATED WORK

The energy usage must be decreased can double system lifetime, resulting in a large increase in the overall usefulness of the network. In order to reduce the energy wastage, the protocols must be robust to node failures, fault-tolerant and scalable enough to maximize system lifetime [3].

2.1 LEACH

LEACH protocol uses the hierarchical routing for wireless sensor networks to increase the life time of the network. In a cluster based architecture one node acts as a cluster head and all other nodes in a network are the member nodes of the network. The member nodes collect the information and send their collected data to the cluster head and cluster head receives data from all these nodes, process it and send it to the destined base station [4]. So cluster head is more energy demanding than other nodes. When a cluster head dies all other cluster member nodes become unable to communicate. LEACH incorporates randomized rotation of the cluster head position such that it rotates among the sensors to avoid draining the battery of any sensor node in the network [5]. So, the energy load associated with being a cluster head is evenly distributed among the nodes to save the network energy. However it has a number of disadvantages, one of them is that the Cluster head directly communicates with BS ignoring the distance between CH and BS.

2.2 PEGASIS

This is an improvement over LEACH protocol. PEGASIS is a chain-based near optimal solution on energy efficiency. As described in [6] it forms a chain including all nodes of the network using a greedy algorithm. The main idea in PEGASIS is for each node to receive from and transmit to only close neighbors and take turns being the leader for transmission to

the BS. This approach will distribute the energy load evenly among the sensor nodes in the network and decreases the energy spent per round.

2.3 GSSC

GSSC is proposed in [7]. GSSC conserves energy by finding out equivalent nodes from routing perspective by using their geographical information i.e. the nodes which sense almost same information and then turning off unnecessary nodes to remove data redundancy and chaining based routing scheme to route the sensed data from active nodes to the base station is used for further reducing the energy consumption of network.

III. ENERGY MODEL

We are taking the same energy model as taken in [8] and is shown in fig. 1.

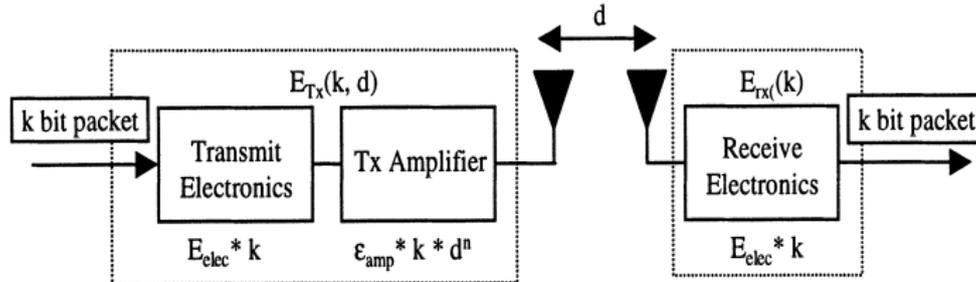


Fig.1

Different assumptions about the radio characteristics, like energy spent during the transmit and receive modes, will change the advantages of different protocols. The energy required by the transmitting node to transmit a k-bit packet over a distance d using our model is:

$$E_{Tx}(k,d) = E_{Tx-elec}(k) + E_{Tx-amp}(k,d) \\ = k * E_{elec} + k * E_{amp} * d^n \quad (1)$$

And the energy required to receive a k-bit packet is:

$$E_{Rx}(k,d) = E_{Rx-elec}(k) \\ = k * E_{elec} \quad (2)$$

Here E_{Tx} and E_{Rx} are the energies required by the nodes to transmit and receive their data respectively. E_{elec} is the energy required to run the radio electronics and E_{amp} is the the energy required by the radio amplifier.

IV. PROPOSED SCHEME

The Weighted-Sum-Method (WSM) is a traditional, popular method that parametrically changes the weights among objective functions to obtain the Pareto front. [9] describes the Weighted Sum method for multi-objective optimization (MOO) continues to be used extensively not only to provide multiple solution points by varying the weights consistently, but also to provide a single solutions point that reflects preferences presumably incorporated in the selection of a single set of weights.

In our proposed scheme we implement the path scheduling of sensor nodes with the help of Weighted Sum Method then routes the data from cluster-head nodes to the (master cluster head that will ultimately send that data to the)destined energy unconstrained sink node (via the shortest path). An example of the basic structure (used for data routing) that we are considering in the proposed scheme is shown in fig. 2.

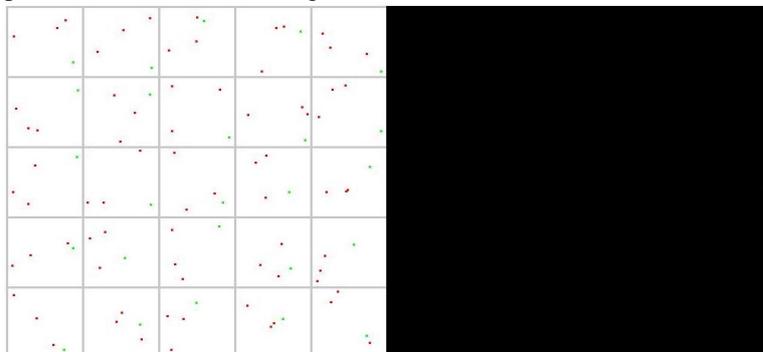


Fig.2

The total number of 100 sensor nodes are deployed in the considered network of 100m x 100m and then process it for the number of rounds until 100% nodes of the network die. The sensor nodes are deployed uniformly randomly in the network field and whole network is divided into various grids (i.e. forming the clusters). Hence, total number of 25 grids (clusters) are formed by using the information about the node location. The sink node is deployed at 50 x 200 to receive the transmitted data. One node in a grid is selected as cluster head based on the remaining energy of the nodes in the cluster, and the node with the height energy and shortest distance from the sink node is taken as the master cluster head.

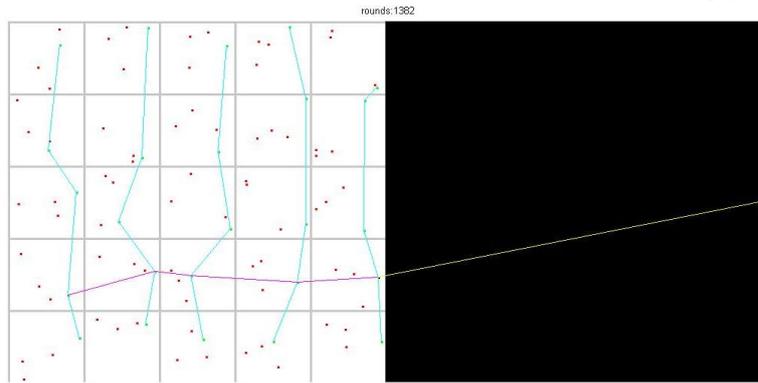


Fig.3

Then the chain is formed for sending the data from the cluster heads to the master cluster head and then finally sent it to the final destination i.e. the base station (or sink node). The chain formation moves in the horizontal direction towards the central cluster-heads and finally moves to the base station through the master cluster head. Once the chain is formed the data collected in that round is routed towards the base station through it. The example of data routing (through proposed scheme) is shown in fig. 3.

V. SIMULATION

In this section we presents the performance evaluation of LEACH, PEGASIS, GSSC and compare it with the performance of the proposed Weighted Sum Method scheme for path scheduling(optimization). The MATLAB 2011b simulator is used to implement our proposed work.

As in [7] the total number of 100 sensor nodes are deployed randomly in 25 grids that are formed by using the information about the node location with each node having .5 initial energy. Data packet size for traffic generation is 2000 bits in packet. The simulations results will represents the comparison of total number of rounds of communication when 1%, 20%, 50% and 100% of the nodes die using LEACH, PEGASIS, GSSC, and our proposed Weighted Sum Method scheduling and chaining system for efficient data routing with each node having the same initial energy 0.5J. Table I shows the parameters taken in the considered scenario.

Table I: Parameters

Parameters	Values
Area	100m X 100m
Nodes	100
Initial energy	0.5J
Packet size	2000 bits
Clusters	25

The performance comparison of our proposed scheme in terms of energy efficiency and increased network lifetime with LEACH, PEGASIS, GSSC is shown in table 2 and fig.4.

Table II: number of rounds when 1%, 20%, 50% and 100% nodes die.

Energy in J/node	Protocol	1%	20%	50%	100%
0.5	LEACH	485	576	681	970
	PEGASIS	857	1412	1743	1975
	GSSC	982	1685	2154	4524
	Proposed	1159	2939	4355	5477

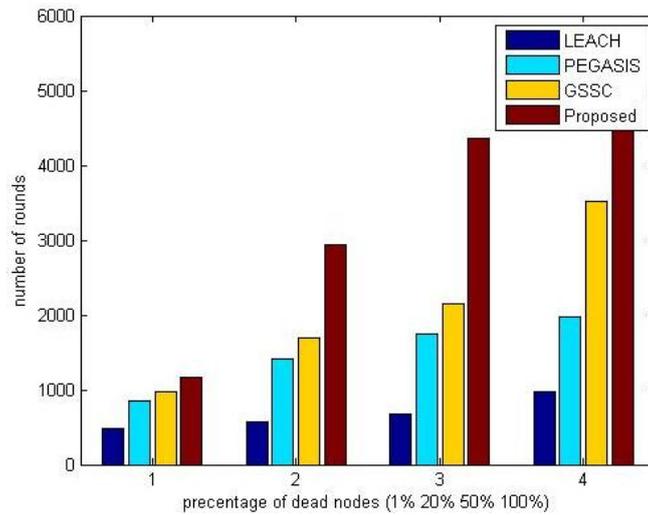


Fig.4

VI. CONCLUSION

In this paper, we proposed a weighted sum method scheduling chaining system for efficient data routing in wireless sensor networks (WSN). The chaining based routing is done to send the data from the cluster heads to the sink node. The chain is formed by selecting a node with highest energy and minimum distance to the sink node so as to utilize the energy of the network more efficiently. We are using Weighted Sum Method to select the shortest path between the sensor and sink node. Thus it will improve the network lifetime. The MATLAB Simulator is used to show that the network lifetime is improved by using our proposed routing scheme over the LEACH, PEGASIS, GSSC routing schemes.

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