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PERFORMANCE ANALYSIS AND COMPARISON OF ROUTING PROTOCOLS IN WIRELESS SENSOR NETWORK

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Abstract - *A Wireless sensor Network is an organized collection of a large number of small nodes with a capability of sensing, measuring and computing. Scalability is the increase in the number of nodes after the WSN was established. A new energy effective routing algorithm is presented which is based on static clustering and multi-hop transmission. The SCMR (Static Clustering Based Multi-hop Routing) Algorithm is verified with NS2 simulator. Performance evaluation from simulation results demonstrates a significant performance improvement comparing with existing protocols in terms of average network throughput, packet delivery ratio, and energy consumption.*

Key Words: Static Clustering Based Multi-hop Routing, Energy efficient ,performance analysis.

1.INTRODUCTION

Energy source of sensor nodes in Wireless Sensor Networks (WSN) is usually powered by battery, which is undesirable even impossible to be recharged or replaced. Therefore, maximizing energy efficiency and prolonging networking lifetime are the major challenge in sensor networks. In recent years, many algorithms mainly focus on energy balance of the nodes to prolong the lifetime [1][2]. These theories obtain a better energy-efficiency and enhance the network lifetime. However, there is a general difficulty that how to balance the energy consumption between cluster heads and their members, and maximize the energy efficiency of each cluster.

The process of finding the data transmission route is termed as routing. In wireless sensor network large amount of nodes are present that are used for the sensing, transmitting, receiving of the data between the nodes present in the network. The route selected for the data transmission between source and sink node affects the lifetime or performance of the network. Because the energy consumed by the nodes while data transmission will be less if the selected route is small and energy consumption will be high if the route is long. The network efficiency depends on the energy consumed for transmitting the data by the nodes.

2. RELATED WORK

LEACH-Centralized [4] uses a centralized clustering algorithm. In setup phase, the base station receives all information about each node regarding their location and energy status. The base station run local algorithm for the formation of cluster heads and clusters and broadcasts a message that contains the cluster head ID for each node. The steady-state phase of LEACH-C is identical to that of the LEACH protocol. EACH with Fixed clusters (LEACH-F) the base station uses the same algorithm used in LEACHC to form the clusters then LEACH-F uses fixed clusters that are formed once in the first setup phase by the base station. The cluster head position rotates, and every node can become cluster head of its cluster.

Therefore LEACH has a high energy cluster which is random so that it can move or rotate among all sensor nodes to drain the battery of single sensor. Due to the advantages of LEACH such as reduced control messages, bandwidth reusability, enhanced resource allocation, improved power control and lest wastage of energy it is proved efficient for Autonomic Sensor Network which has mobile battery power nodes.

Disadvantages

1. It affects the network robustness due to its feature of random selection of clusters heads. Because in this the chances of a node to become a cluster head is more or equal in every round irrespective to its remaining energy. Hence if the node with the lowest energy is selected as the cluster head then it can effect or reduce the lifetime of the network. Because the node with the minimum amount of energy will die quickly as compare to other nodes.

2. The randomization of cluster head leads to the unequal distribution which increases energy consumption and leave a negative impact on overall performance of the network.

3. In his scenario the cluster heads directly communicate to the sink node. It means the cluster heads which are located at the distance from the sink node also have to communicate directly to the sink node which results in the more energy consumption. Hence the far located cluster heads will crash earlier which decreases the performance of the network.

PEGASIS [6] is an improvement of the LEACH protocol. Rather than forming multiple clusters, PEGASIS forms chain from sensor nodes so that each node transmits and receives from a neighbor and only one node is selected from that chain as leader node to transmit to the base station. The main objectives of PEGASIS are to increase the lifetime of

network and allow only local coordination between nodes that are close together so that the bandwidth consumed in communication is reduced. PEGASIS eliminate the overhead caused by dynamic cluster formation in LEACH, and decreasing the number of transmissions and reception by using data aggregation although the clustering overhead is avoided. However, this achievement faded by the excessive delay introduced by the single chain for the distant node.

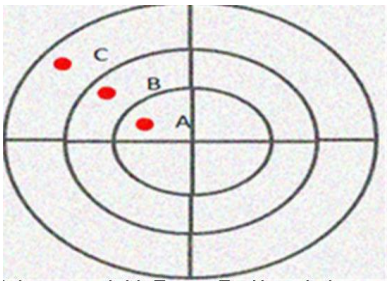
3. PROPOSED METHOD

In this paper an efficient clustering method has been presented in which some clusters include a pair of cluster heads. The organization of the rest of this paper is as follow. The cluster heads aggregate the received data and transmit it to the base station. The advantage of our scheme is reducing overhead which increase the system throughput, prolong network lifetime and also allow new nodes to be added to the network.

3.1 SCMR METHOD

Thus, the clustering type is static and clusters will be formed before the network formation and will not be changed until the end of its lifetime[1]. This model uses multi-hop data transmission. Each cluster head collects data from the normal nodes of the same cluster and sends it to the next cluster head. Here next cluster means the cluster in the closer inner group with the same sub-group number. This work continues until the node in the innermost main group receives information and sends it to the sink. To select the cluster heads in each round, the node with the greatest amount of energy will be selected as the cluster heads. In this way the maximum distance between some normal nodes and their corresponding cluster heads may be as large as the circle diameter that causes the high power consumption. But with dividing the circle into four equal parts, , and assign a cluster head in the each distinct part, the distance will be shorter which implies less energy consumption.

3.2 AN EXAMPLE



Node B collects data from normal nodes of its cluster and fuses data received from node C and then sends to nearest node , which located in the main group1 and sub-group2. Node collects data from ordinary nodes of its cluster and fuses it with node nearest data and then sends all to the sink.

4 .SIMULATION AND ANALYSIS

Transmission in WSNs is more energy consuming compared to sensing, therefore the cluster heads which performs the function of transmitting the data to the base station consume more energy compared to the rest of the nodes. Clustering schemes should ensure that energy dissipation across the network should be balanced and the cluster head should be rotated in order to balance the network energy consumption.

4.1 Simulation Parameters

To compute energy consumption for each sending and receiving, we use radio model as describe in [4].The energy used to send n-bit data a distance d for each sensor node is

$$E_{Tx}(\mathrm{L,d}) = \begin{cases} LE_{elec} + L\varepsilon_{fs}d^2, & \mathrm{d} \le d_0 \\ LE_{elec} + L\varepsilon_{mp}d^4, & \mathrm{d} > d_0 \end{cases}$$

$$E_{Rx}(\mathrm{L}) = LE_{elec}$$

Where E_{elec} represents the energy consumed to send or receive one bit message, ε_{fs} is the amplification coefficient of free-space signal, ε_{mp} is the multi-path fading signal amplification coefficient, their value depends on the circuit amplifier model; d represents the distance between sender and receiver; L is the bit amount of sending information.

d_0 is calculated by formula (4) [19]:

$$d_0 = \sqrt{\frac{\varepsilon_{fs}}{\varepsilon_{mp}}}$$

S.NO	PARAMETERS	LEACH	SCMR
1	AREA	800*800	1600*1000
2	NO OF NODES	47	47
3	INITIAL ENERGY	100	10
4	BS LOCATION	(380.642,327.285)	(854.326,407.636)
5	Eelec	50nJ/bit	50nJ/bit
6	Efs	10pJ/bit/m2	10pJ/bit/m2
7	Emp	0.0013pJ/bit/m4	0.0013pJ/bit/m4
8	EDA	5nJ/bit	5nJ/bit

Table 1:Comparison table for Existing and Proposed

4.2 Analysis of simulation results:

Ns2 has been used as simulation platform to evaluate the performance of the new algorithm SMCR and compare it with LEACH protocol.

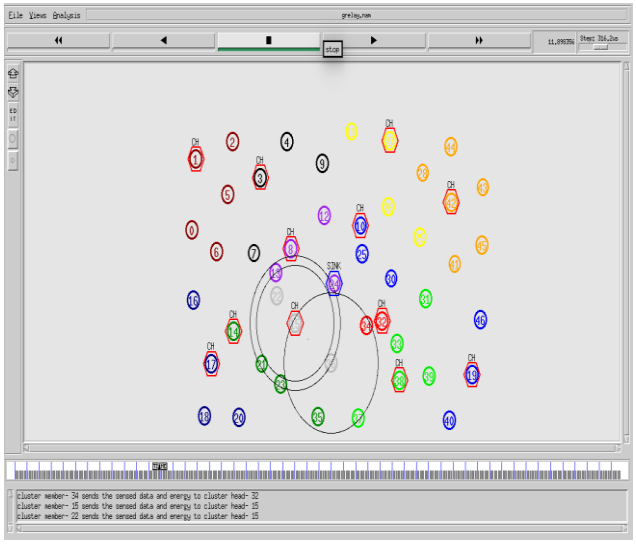


Fig:Cluster Head Selection

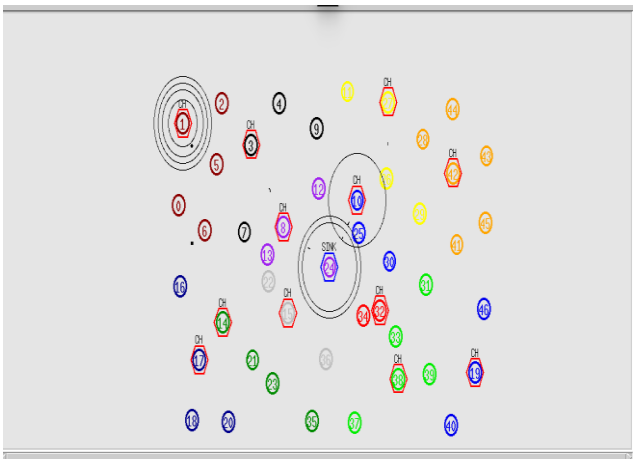


Fig: Static clusters data transfer

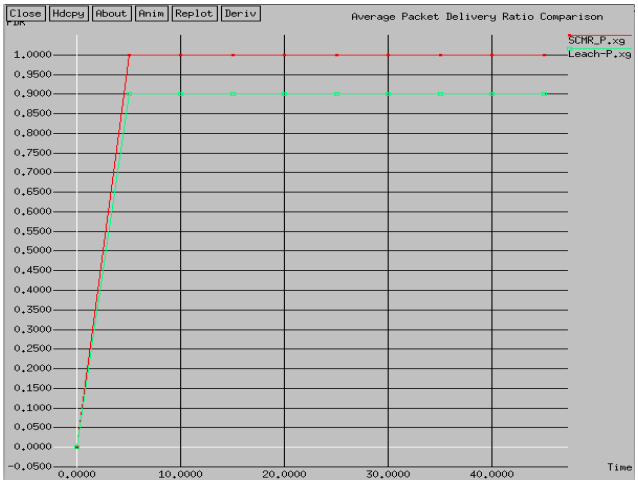


Fig: Average packet delivery ratio comparison

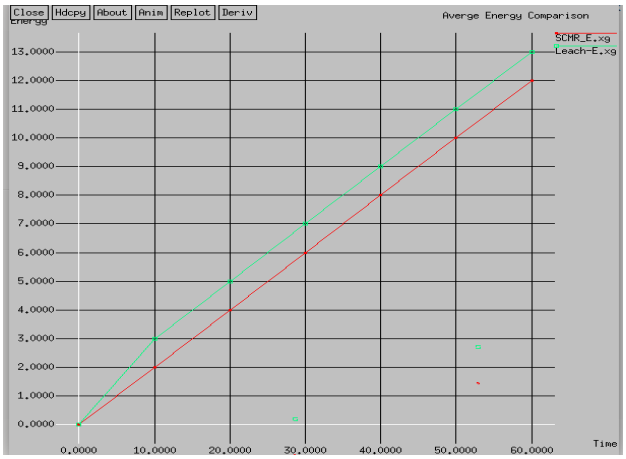


Fig: Average energy comparison

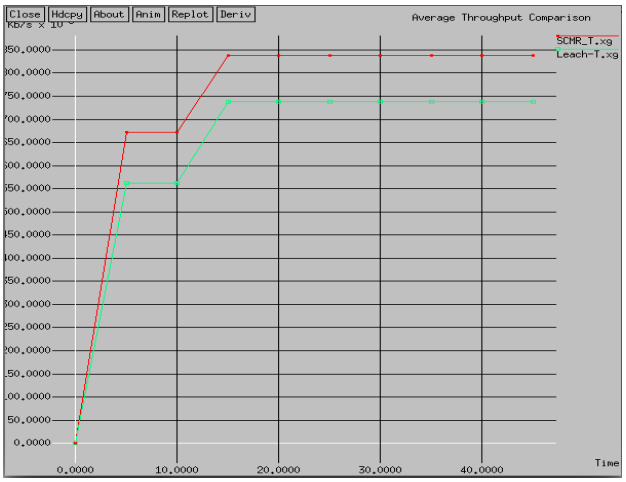


Fig: Average throughput comparison

The percentage of stable period in whole lifecycle of the network in LEACH Protocol is 86% where in our SCMR protocol is 96%. The stable period percentage in SCMR algorithm has 10% improvement. This indicates that the performance of improved protocol is much better than the LEACH Protocol.

5. CONCLUSION

A Static Cluster-based Multipath Routing protocol (SCMR) for WMSNs designed to handle the additional requirements of reliable data delivering of different traffic classes and provide load balancing by using multipath routing. A new method using multi-hop routing and static clustering is presented NS2 simulation results of these methods proves that SCMR method in compared to the algorithms with dynamic clustering such as LEACH has lower energy consumption and longer network lifetime. So in future there is a need to develop such a system which can increase the efficiency of the network and also enhances the lifetime of the network.

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