Energy Efficiency Routing Protocol for WSNs

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Abstract—*Advance in the WIRELESS SENSOR NETWORK (WISENET) technology is energy efficient routing protocols that promises a wide range of potential applications in both civilian and military areas. In the WISNET the sensor node have a limited transmission range and their processing and storage capabilities as well as their energy sources are limited. So the Equalized Cluster Head Election Routing Protocol (ECHERP) and PEGASIS with Double Cluster Head (PDCH) pursues energy conservation through balanced clustering for Energy Efficiency. In WSN, energy efficient routing protocol is important to increase the network lifetime. ECHERP and PDCH both protocol claims to be energy efficient.*

Keywords—Energy Efficiency, ECHERP, Network lifetime, PDCH algorithm, Wireless Sensor Networks (WSN).

I. INTRODUCTION

The routing protocol in WSNs can be divided into flat-based routing protocol, hierarchical routing protocol, location-based routing protocol and QoS based routing protocol. Hierarchical routing is proved to be an efficient routing protocol to lower energy consumption in WSN and increasing the network lifetime. In Hierarchical routing each node will either act like a Cluster Head (CH) or a Sensing node(SN), where node with higher energy will be selected as CH , the role of CH is to process data received by sensor node and transmit it to BS and role of SN is to sense the parameter from environment and send the data to CH. Hierarchical routing is proved to be an efficient way to lower energy consumption within a cluster and by performing data aggregation and fusion in order to decrease the number of transmitted messages to the BS. The ECHERP, in order to increase the network lifetime elects a node as cluster head that minimizes the total energy consumption in the cluster and the node with the higher energy. ECHERP also adopts multihop routing scheme to transfer data to base station.

The PDCH, is a chain based double cluster head protocol that is near optimal data transmission algorithm in sensor network. This protocol distribute the work load among two cluster heads, nodes were selected in suitable ways to transmit the data to BS to balance the energy depletion in the network and preserve robustness of the sensor web as node dies at random location. As the ECHERP uses a more efficient method to select a node as CH by considering the current and estimated future residual energy of node along with number of rounds that they can be CH in order to maximize the network lifetime and ECHERP perform better than PEGASIS that we discussed in this paper, whereas PDCH by using double CH increase the efficiency of energy sing and the load balance and extend the lifetime of whole network.

The comparison of the routing protocols ECHERP and PDCH on various network and QoS parameter may give better result when implemented as which protocol is more energy efficient, the network lifetime, delay and end to end characteristic may also be improved in this comparison.

II. ECHERP

Equalized Cluster Head Election Routing Protocol (ECHERP) [2] is proposed which pursues energy conversation through balanced clustering. It elects CH by considering the current and the estimated future residual energy of the nodes. ECHERP model the network as a linear system and the Gaussian elimination algorithm in order to find the candidate CH nodes. In ECHERP, the BS is predictable to have unlimited energy residues and communication power. It is also supposed that the BS is located at a fixed position, either inside or away from the sensor field. The longer the distance between the BS and the center of the sensor field, the higher the energy expenditure for every single node transmitting to the BS. Each cluster consists of member nodes and a cluster head (CH). CH is responsible for collecting and aggregating data from the member nodes and sending it to other CH or BS. The objective of the CH election is to provide energy efficiency so as to enhance the lifetime of the WSN. Data aggregation is one of the ways which can provide energy efficiency.

III. PDCH

Power-Efficient GAthering in Sensor Information Systems (PEGASIS) [10] is an energy efficient protocol, which provides improvements over LEACH. In PEGASIS, each node communicates only with a nearby neighbor in order to exchange data. It takes turns in order to transmit the information to the base station, thus

reducing the amount of energy spent per round. The nodes are organized in such a way as to form a chain, which can either be formed by the sensor nodes themselves using a greedy algorithm starting from a certain node, or the BS can compute this chain and broadcast it to all the sensor nodes.

The PDCH shown in fig. (1), is a chain based double cluster head protocol that is near optimal data transmission algorithm in sensor network. This protocol distribute the work load among two cluster heads, nodes were selected in suitable ways to transmit the fused data to BS to balance the energy depletion in the network and preserve robustness of the sensor web as node dies at random location.

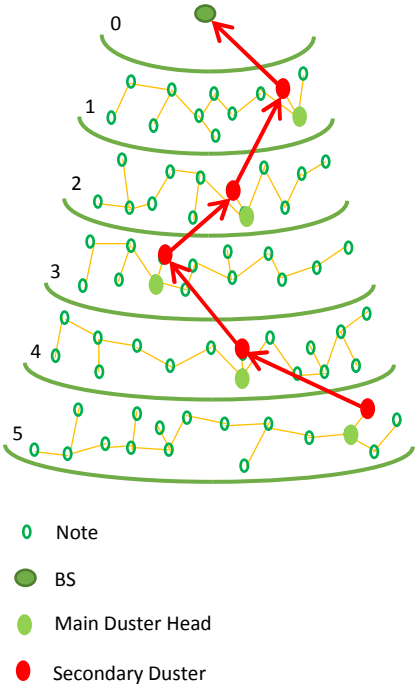

Fig. 1: Double cluster head method

All of the above observation motivates the need for routing protocol that reduces the energy consumption and increases the lifetime of network. As both the above routing protocol are energy efficient and increases the network lifetime, this motivates us to compare performance of two routing protocols, ECHERP and PDCH. The performance of these routing protocols will be analyzed by using various metrics like energy usage in terms of network load, throughput, and delay and end-to-end performance characteristics of both algorithms. PDCH, a double cluster head choosing protocol that is near optimal for a data-transmission algorithm in sensor networks. In this, we propose an energy efficient routing algorithm to prolong the network lifetime for WSNs based on ECHERP and PDCH routing algorithms. The comparison of the routing protocols ECHERP and PDCH on various network and QoS parameter may give better result when implemented as which protocol is more energy efficient, the network lifetime, delay and end to end characteristic may also be improved in this comparison [11].

3.1 Algorithm of PDCH

In PDCH Algorithm the steps in order to structure double clusters and then choose cluster heads are the following:

1. Network initialization: Initially network is created using 'N' nodes within nxn m2 area. One BS is defined at some random location which is at greater distance from sensing region.
2. BS Found Distance from node: Now the distance from BS to all other nodes in the network is found using the Straight line distance formula. Now the levels are formed based on the distance from base station and each level is given an ID.
3. Formation of Chain: Now in each level node will form a chain by connecting itself to closest neighbor with the same level nodes only. After forming the chain, 2 head node is randomly elected on basis of highest energy in each cluster.
4. Selection of Two Cluster Heads: At every level, it selects two CH. One is main cluster head with highest residual energy and node with second highest residual energy will be selected to be the second cluster head. If there is no branch chain in one main chain note at last.
5. Form Chain between each level of Cluster Heads: After the building chain in every level, we should chain up all the secondary cluster heads with the same method of building chain, and at last level secondary cluster head will receive and confusion all of the data and send them to BS.

IV. SIMULATION ENVIRONMENT

We performed simulation in network simulation (NS-2). Simulation Configuration is conducted within the Network Simulator NS2.34 environment on a platform Ubuntu 10.04. The system is running on a laptop with Intel(R) Core(TM) i7-4510U CPU and 8-GB RAM. In NS2.34, the configuration specifies 50 and 100 nodes in a flat space with a size of 1000m × 1000m with single source and destination with possible of multiple routes. Both the physical layer and the 802.11 MAC layer are included in the wireless extension of NS2.

V. SIMULATOIN RESULTS

We evaluate Comparison of ECHERP and PDCH mainly in following metrics using cutting-edge tools in algorithm of PDCH. As per simulation environment worked on different metrics like Average Energy, Control Overhead, Delay and Throughputs.

In figure (2) shows comparison of Average Energy of ECHERP and PDCH protocols performed in very balance condition. PDCH consume less energy by comparing with ECHERP. PDCH shows Energy Efficiency in WSN. In figure (3) shows control overhead of data transmission increases smallest with respect to time in seconds. Next in figure (4) which is Delay of both protocols. PDCH have minimum delay. In figure (5) throughput of ECHERP and PDCH. In that ECHERP required more packets than PDCH.

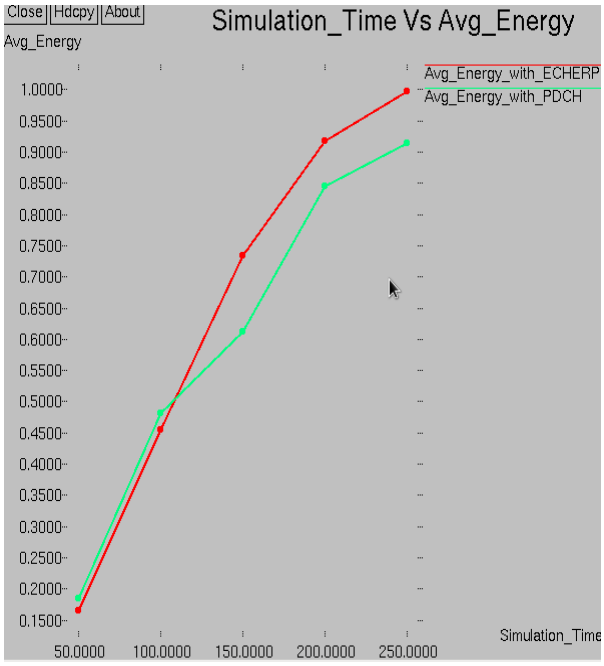

Fig.2: Comparison of ECHERP and PDCH in Average Energy

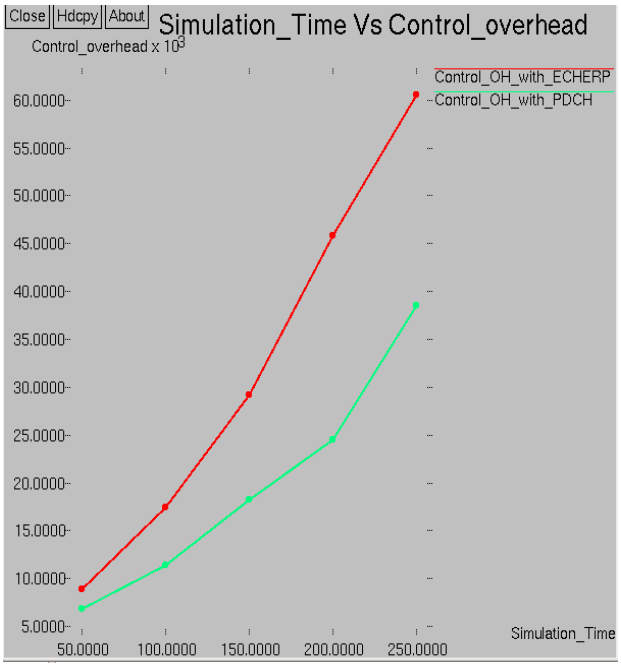

Fig.3: Comparison of ECHERP and PDCH in Control overhead

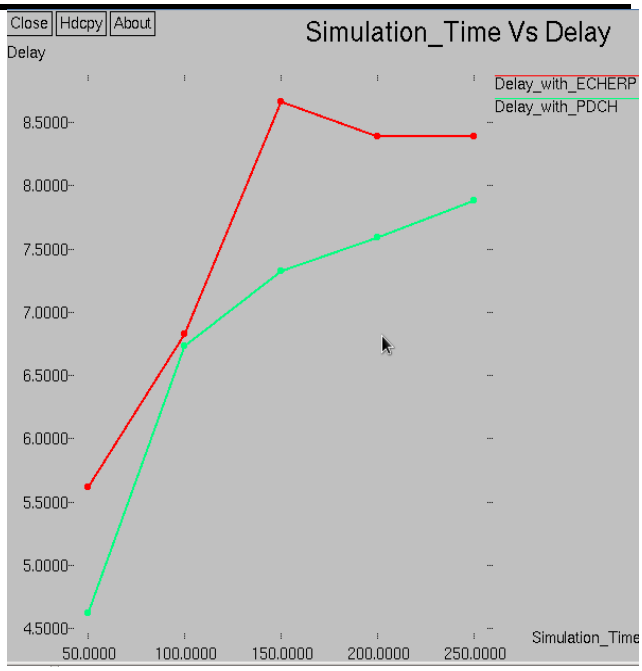

Fig.4: Comparison of ECHERP and PDCH in Delay

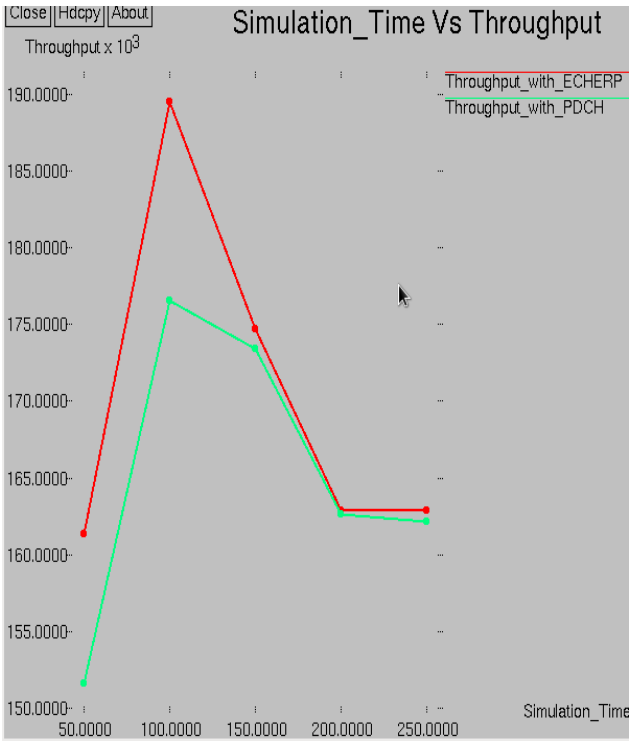

Fig.5: Comparison of ECHERP and PDCH in Throughput

VI. CONCLUSION

In Hierarchy type of protocols our main objective to elect cluster head with higher energy for better network life span. As per simulation results we observed that each metric shows better performance of PDCH protocol. By election process of double cluster heads we achieved our goals. We hope that the simulation results presented by us will be useful to other researchers to analyses.

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