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COMPARATIVE STUDY OF PEGASIS-ANT AND PDCH ROUTING PROTOCOL IN WSN

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ABSTRACT

The energy efficiency in the WSN is very important Performance Parameter. This paper proposed the two new algorithm named as PDCH and ANT colony algorithm. PDCH works on the bases of PEGASIS to make every nodes load balance and extent the network lifetime. Protocol PEGASIS is based on the chain structure, every chain has only one cluster head and every node's receiving and sending messages who belong to this chain, the cluster head consumes large energy and the times of every round increasing. In this situation, We select double cluster heads in one chain and used hierarchical structure in the new algorithm on the basis of avoiding the long chain existing. Whereas ANT colony algorithm is an improved algorithm over the greedy algorithm used to construct the chain. Compared with the original PEGASIS, PEG-ANT achieves a global optimization. It forms a chain that makes the path more even-distributed and the total square of transmission distance much less. For constructing the chain process, the energy factor has been taken into consideration, which brings a balance of energy consumption between nodes. In each round of transmission, according to the current energy of each node, a leader is selected to directly communicate with the base station (BS).These two new algorithms increased the efficiency of energy-using and the load balance, and extend the lifetime of the whole network

Keywords: **PDCH, PEGASIS, PEG-ANT, WSN**

I. INTRODUCTION

The WSN routing protocols have been likely based on the network topology. It can be classified as flat routing protocols and hierarchical protocols. In hierarchical protocol, number of sensor nodes forms the clustering so that cluster heads can perform some aggregation and reduction of data in order to accumulate energy. In fact PEGASIS is not a hierarchical protocol, but it follows the same basic idea of hierarchical protocol. In basic PEGASIS, at the beginning all of the sensor nodes are structured to form a chain using greedy algorithm. The greedy algorithm used to build the chain in the original PEGASIS is to achieve a local optimization. The energy supply is the key limitation of WSN. Hence more attention is needed to resolve the energy problem. This process is done by the base station (BS) like starting from the far node; it chooses each node's closest neighbour as the next one to the chain. Once the chain has been constructed, then in each round of communication, one node will be selected as the leader. Along this chain, in the direction of the leader, each node fuses the received

data with its own to transmit to the other neighbour. The process goes on until data reaches to the leader. Then the leader transmits the final fused and aggregated data to the BS.

In this paper, we use an improved ant colony algorithm to form the chain to make the global sum of distance's square least. In the processes of chain building and leader selection, the energy factor is taken into account to maximize the lifetime of WSN. The rest of the paper is organized as follows. In section II, the ant colony algorithm is introduced. In section III, the PDCH algorithm is presented. Then in section IV simulation is taken to compare our protocol-PEG-ant with the original PEGASIS-PEG-greedy and PDCH

II. ANT COLONY ALGORITHM

The concept of ant colony optimization is to reduce the path and power consumption. The ant colony optimization ACO take inspiration from behavior of real ant colonies and it is used to solve discrete optimization problems. Ant colony algorithm originates from the behavior of ants which communicate with each other by pheromone. Ants go through the foods while laying down the pheromone trails. The Pheromone is a chemical substance released by ants and in turn affecting their moving decisions. The shortest path is discovered by pheromone trails first each ant moves at random and pheromone is deposited on the path. The shortest path leads to more pheromone trails and ants follows the most intense pheromone trails.

Initially no pheromone is laid on the branches and ants have no bit of information about the length of branches. However once a shorter one is found it will receive pheromone at a higher rate. The more quantities ants leave pheromone on the path, the larger probability they visit this path next time. Thus, there will be a positive feedback in the group of ants. It seems that this method only gets a local shortest, but in fact, it approaches to the global shortest. There is some probability that ants make errors to go through other branch rather than the shorter one. When ants arrive at the destination as for the total distance, such progress may find a much shorter way. Therefore, it is dynamically close to the global minimum. [1][2].

It is obvious that the chain built by improved ant colony algorithm is more even-distributed which a result in the decrease of the global sum of distances square reduces. Such decrease will be favorable to save energy.

2.1 Chain Building Process

In basic PEGASIS the chain is formed by using greedy algorithm. In PEG-ANT an improved ant colony algorithm is used to construct the chain of PEGASIS. In the building process, to pick a node as the next one on the chain, all of the current node's neighbours makes as candidates and consider its remained energy that is the amount of energy consumed. Here it is assumed that the BS has infinite energy and all of the nodes have the same amount of energy and are located in fixed positions. BS acts as the controller. It is knowledgeable about each node's current condition such as its position and the remained energy of the node in time [3]. In data transmitting, the amount of consumed energy is in proportion to the total square of distance. Therefore considering the square sum of neighbour's distance along the chain is the minimum as the standard to judge whether it is an optimization.

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2.2 Leader Selection

The leader selection is based on current energy of each node during each round of communication; the node whose energy is the maximum is elected as the leader. Along the constructed chain, starting from the end nodes, each node fuses the received data with its own as one packet and transmits to the other neighbour in the direction of the leader. Finally the leader transmits the final fused data to the BS.

III. PDCH ALGORITHM

In PDCH, initially an EEPB algorithm is used to build chains in every level, the nodes belong to different levels can't build in the same chain, only the nodes with same ID can be built in the same chain. In this hierarchy structure, base station (BS) is the center of a circle and every node's distance to BS decided the level to which it belongs too. The BS will configure itself by the number of levels. Every node receives the signal from the BS then according to the signal strength to detect the distance to BS. The number of nodes and the density of distribution, the location of BS will affect the number of level. And every level has unique ID. The first level is 0 it belongs to BS. The second level is 1 nodes belong to this level is the most closest to BS and so forth. Figure 1 and 2 shows the hierarchical structure and connection establishment of node in the chain

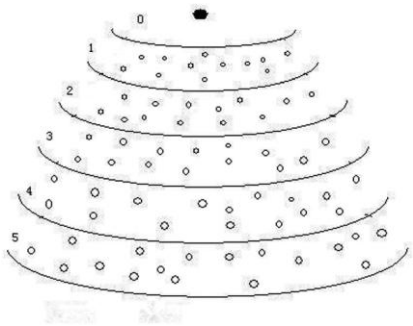

Fig. 1: Hierarchical structure [4]

In PDCH, first the process of selecting cluster head starts at the low level. At every level, the nodes belong to main chain can be the main cluster head; the nodes belong to branch chain will be selected to be the secondary cluster head. If there is no branch chain in one main chain, nodes at last use the method of unique cluster head. The node which has more energy to be selected as the main cluster head, Then the node selected on the main chain as the main cluster head, and the node on the branch chain as the secondary cluster head. The main cluster head and secondary cluster head are both the cluster head in one chain, and they have different job to do. The main cluster head is receiving data and doing fusion of data, then transmit data to secondary cluster head so the secondary cluster head transmitting the lower-level data and the local level data from main cluster head to upper-level cluster-head for example “0 level” is the top-level and “ 5 level” is the lowest level and so on. Each sensor node has supremacy control and the ability to transmit data to any other sensor node or directly to the BS [5].

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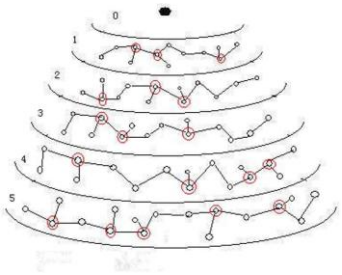

Fig. 2: Chain building process [4]

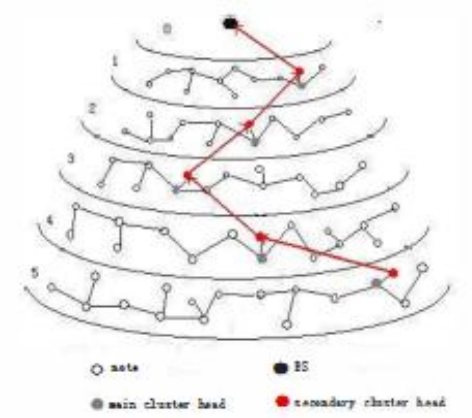

Fig. 3: Double cluster head selection method [4]

It doesn't need to rebuild chain in every round. When node die; so as to the cluster head, when the average energy of all main cluster head lost 50%, this algorithm select the cluster head again in time to make sure the main cluster head working. When the secondary cluster head die, its work will performed by the main cluster head till this round have done, then consider whether to change the cluster head. When the process going to the last, there have not branch chain nodes to leave, the algorithm will turn to the PEGASIS method.

IV. SIMULATION RESULT

To evaluate the performance of PEG-ANT and PDCH NS-2.35 simulator is used. This simulation shows various performance parameters of PEG-ANT and PDCH such as bits from cluster, number of alive nodes and number of frames per round.

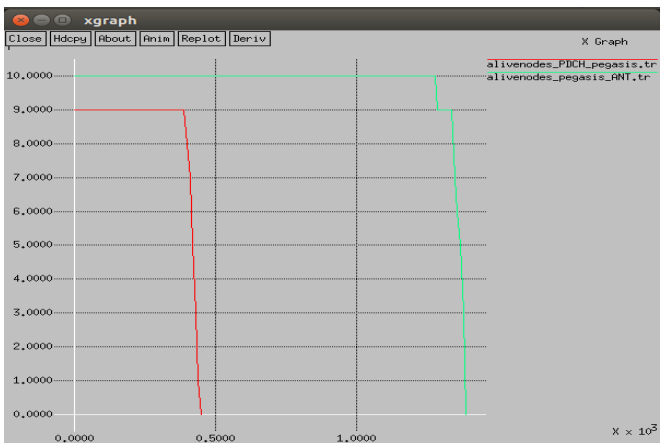

Fig. 4: alive nodes Vs time

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Figure 4 shows the number of alive nodes for both the protocols. It can be seen that in PEG-ANT number of alive nodes are more as compare to PDCH.

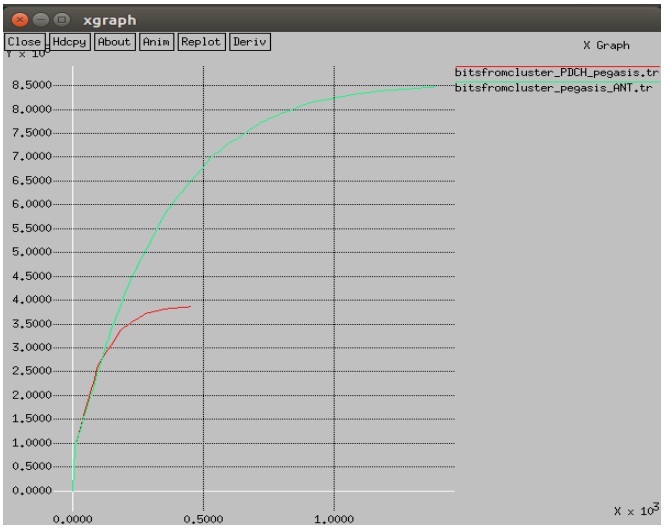

Fig. 5: Bits from cluster Vs time

Figure 5 shows the number of bits from cluster for both the protocols. It can be seen that PEG-ANT transmits more number of bits as compare to PDCH.

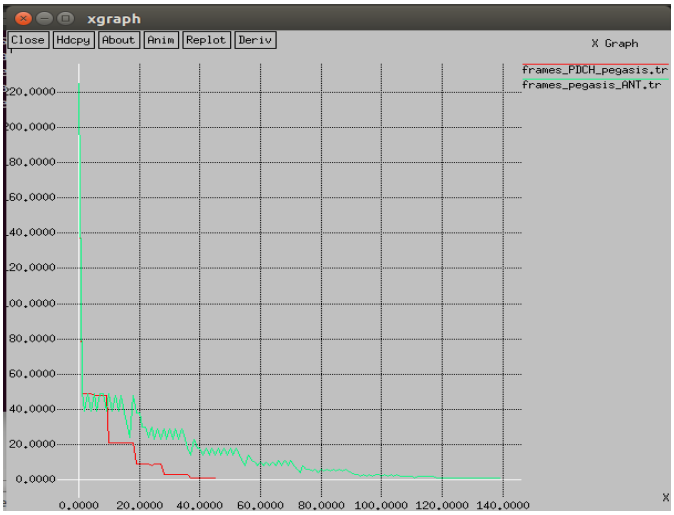

Fig. 6: Number of frames per rounds

Figure 6 shows the number of frames after every round for both the protocols. It can be seen that PEG-ANT provides more number of frames as compare to PDCH.

V. CONCLUSION

PDCH using a double cluster head is near optimal solution for a data-transmission to BS in sensor networks. PDCH outperforms PEGASIS by reducing as well as eliminating the overhead of dynamic cluster formation, minimizing the distance between non cluster heads which transmits data, limiting the number of transmissions and receives among all nodes, and using only one transmission to the BS per round and balances the energy

depletion in the network. PEG-ANT provides better performance as compare to PDCH in terms of its bits from cluster transmitted, number of alive nodes after every round and number of frames per round.

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