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Modified Pegasis in WSN to Increase Network Lifetime Introducing Double Cluster Heads

[1] Uttara Gogate, [2]Asmita Pote, [3] Darshana Wakpate
[1] Associate Professor , [2] [3] UG Students
[1][2][3] Shivajirao S. Jondhale college of Engineering, Dombivali, MS, India

Abstract: One of the key problems for Wireless Sensor Networks (WSN) is the energy efficient design. This paper presents a more energy efficient routing protocol for the applications of Wireless Sensor Network (WSN). PEGASIS protocol is a chain-based routing algorithm because sensor energy is limited. Earlier PEGASIS protocol is based on two parameters i.e. Distance and Residual energy. In this paper, the modification is being carried out in decision parameter i.e. response which check the response of nearby node before transmitting the data as well as specify the proposed algorithm for the modified pegasis protocol. By using two cluster heads in each cluster we can increase the lifespan of the nodes, resulting in an increased battery life of WSN. We are going to apply PDCH (Pegasis with double cluster heads) in this paper.

Index Terms— Wireless Sensor Network, PEGASIS, Routing Protocol.

I. INTRODUCTION

Autonomous Sensors are those which are generally able to perform its own task without being connected to Interrogation unit. Wireless Sensor Networks (WSNs) are spatially (related to space) distributed autonomous sensors to monitor physical or environmental conditions such as temperature and to cooperatively pass their data through the network to other locations. WSN (Wireless Sensor Network) is a collection of nodes, which can vary from few to several hundred or even thousand, where each node is connected to one (or sometimes many) sensors. Each sensor network contains a radio transceiver with internal antenna/connection to the external antenna, a microcontroller, an electronic circuit for interfacing with sensors & energy source which is usually a battery. So as an energy source is an important aspect in WSN we need to take a step to increase the battery life of WSN nodes [1].

Classification of some WSN protocols:

WSN protocols have mainly two groups: Homogeneous and Heterogeneous. Homogenous is where all nodes are of properties (identical types in size, shape, network configuration, mode of energy supply etc). Heterogeneous is where all the nodes are of different types in the sense of size, shape, hardware configuration etc. Homogeneous and Heterogeneous are further classified into Clustered and non-clustered. Homogeneous Clustered are the one where nodes with same properties are grouped to form clusters and date from nodes belonging to the single cluster are combined (example: PEGASIS, TEEN, LEACH, A-LEACH). Homogeneous non-clustered are the ones where nodes with same properties are not grouped to form a cluster and each and every node is free to send data to the base station(example: SPIN, SPEED, GEAR etc).

II. LITERATURE SURVEY:

Some WSN Protocols:

LEACH: Low Energy Adaptive Clustering Hierarchy: As seen above, LEACH is a homogeneous clustered based protocol. It has a concept called cluster heads which collect data and applies process and aggregation on data before forwarding it to base station (BS). It randomly selects a few sensor nodes as cluster head among different sensor nodes and periodically changes the role of cluster head (CH).It has one drawback that sometimes it may happen that the user may not need all the data immediately which is wastage of energy [2].

ADVANCED LEACH:

LEACH suffers with the problem that cluster head node spends more energy in comparison to others. LEACH improves system lifetime and energy efficiency in terms of different simulation performance. It propose new CH selection algorithm that enables selecting best suited node for cluster head [2].

GENERAL PEGASIS:

General PEGASIS (Power-Efficient Gathering in Sensor Information Systems) is an optimization of LEACH algorithm. It forms a chain among sensor nodes so that each node will receive from and transmit to close neighbor. The data moves from one node to other and get combined until designated node transmits to BS. The

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chain construction starts with the farthest node from BS to closest. The process is repeated until the closest node to BS is chosen as another end of the chain. Chain formation is done using Greedy approach. The Drawback of PEGASIS is that when a node dies the whole chain has to be reconstructed.

III. PROBLEM DEFINITION:

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One of the key problems for Wireless Sensor Networks (WSNs) is the design of energy efficient routing algorithm because sensor energy is limited. Earlier PEGASIS protocol is based on two parameters i.e. Distance and Residual energy. In this paper modification is being carried out in decision parameter i.e. response which check the response of nearby node before transmitting the data as well as specifies the proposed algorithm for the modified PEGASIS protocol. Main aim is to increase network lifetime as well as increase the presence of live nodes so that more nodes will remain exist [2][3].

Thus we conclude the above protocol in Table 1 based on complexity, number of clusters and energy efficiency. [2]

Table1. Comparison of 3 routing protocols

Parameters	LEACH	A-LEACH	PEGASIS
Complexity of Algorithm	Complexity of algorithm is low.	Complexity of algorithm is medium.	Complexity of algorithm is high.
Clusters	No of clusters is multiple.	No of clusters is multiple.	No of clusters is single.
Energy	Efficiency of energy is low.	Efficiency of energy is medium.	Efficiency of energy is high.

IV. ALGORITHM:

This paper presents a new PEGASIS based routing protocol called PDCH. PDCH mainly has double cluster head instead of single cluster head. It uses both the cluster head to distribute energy load among all nodes to increase the network lifetime. In PDCH, there are 4 phases:

(i) Cluster Formation Phase:

In PDCH, network is created using random node deployment and BS is plotted at the given location. After that the distance from BS to all other nodes in the network is found using the Euclidean distance formula in equation (1).

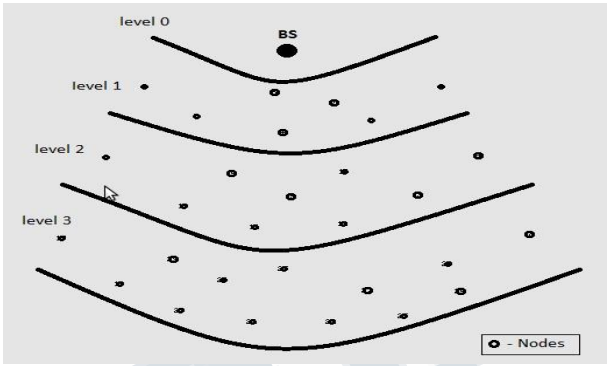

Fig.1 Cluster formation

$d_i = (xbs - xi)^2 + (ybs - yi)^2$…..(1)

Now distance of every node to the BS is decided the level which node belongs to.

Every level has a unique ID. The first level 0 belongs to BS. The second level is 1, in which nodes are closest to BS and so forth. For example, the nodes which are less than or equal to 250 meters comes under First cluster (level id = 1). 250 meters to 350 meters come under second cluster (level id = 2), 350 meters to 450 meters come under third cluster (level id=3) and 450 meters to 600 meters come under fourth cluster (level id=4).

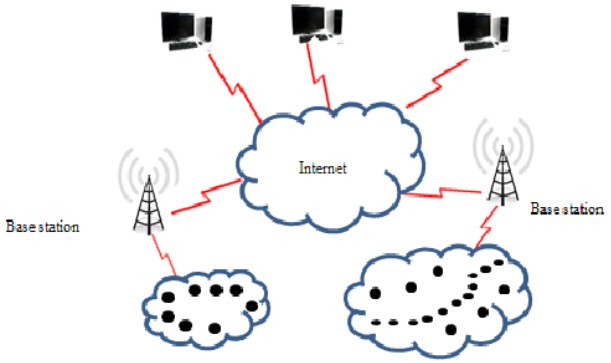

Fig.2 Design of the system

(ii) Chain Construction Phase:

Once when cluster formation is done, we use the EEPB algorithm for chaining in every cluster level.

Nodes with same level id can only involve in same chain.

Nodes with different level id cannot involve in one chain.

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(iii) Cluster Head Selection Phase:

In PDCH, we use the double cluster head method.
One is the main cluster head (MCH) and another is the secondary cluster head (SCH).

1) Selection of MCH:

Initially set up a parameter „n" on every node N(i), where i indicates number of nodes. If node N(i) haven't join in the chains, then n=0, when node N(i) was selected by N(i-1) to join the chain, we set n=(n+1), every time when a new node join in a chain, the parameter „n" of select node automatic increment by 1.

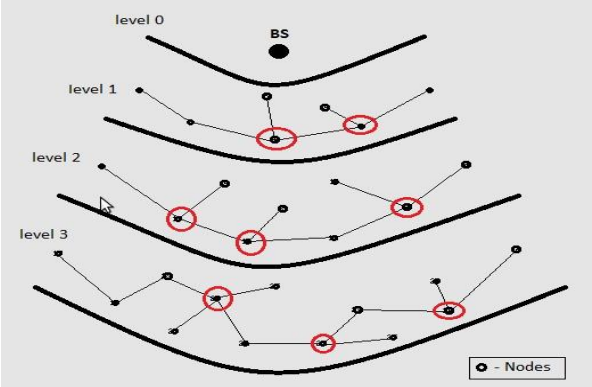

Fig.3 Selection of MCH.

When chain construction is complete, we will analyze the parameter n, if n>2, we consider that N(i) has branch chain.

Node having a branch chain has a bigger chance to be selected as CH than other nodes in every chain.
Node having the highest neighbor is to be selected as MCH.

If more than one node have the same number of neighbors, than from them, node with high energy to be selected as MCH. Figure 2 shows chain formation and branch chain concept.

The marked nodes show that the number of neighbors is more than 2. These nodes have one or more than one branch chain, so they have greater opportunity to be selected as MCH in every level.

2) Selection of SCH:

If only MCH is responsible for gathering local level data and transmitting this data to upper level, then it becomes a burden for main node. So we choose SCH in every level.

If MCH has exactly 3 neighbors, then there is only single branch chain, we will select a node belong to the branch chain as the SCH.

If the neighbor of MCH more than 3, then there is more than one branch chain exist with main CH. In this situation, we will select the node belong to the branch chain which is more closer to the BS or minimum distance from BS as the secondary CH. Figure 3 shows the double cluster head method.

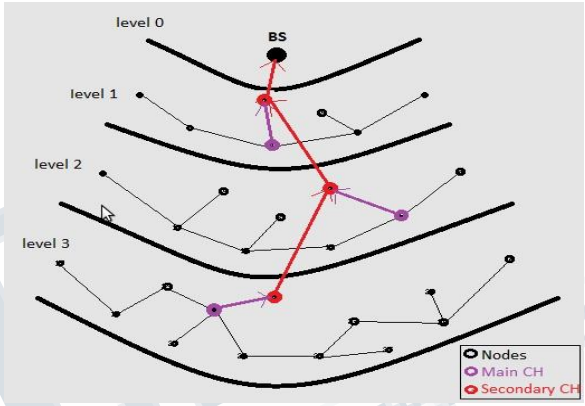

Fig.4 Selection of SCH

(PEGASIS with Double Cluster head)PDCH has been discussed and performance of both the protocols (Echerp and PDCH) is analyzed based on various QoS parameters like Delay, Throughput, Packet Drop Ratio and Energy consumption.

V. RESULT:

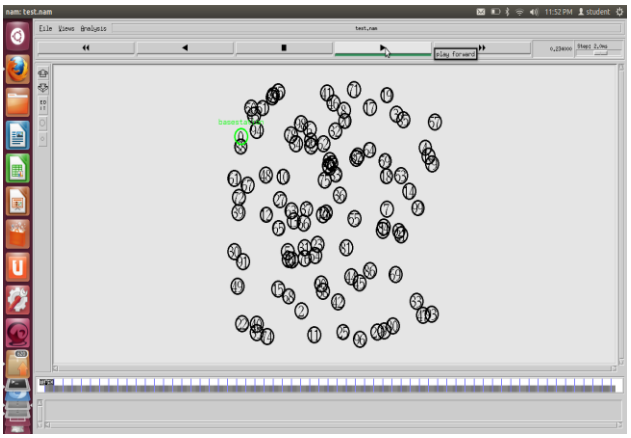

Fig.5 Initial positons of nodes

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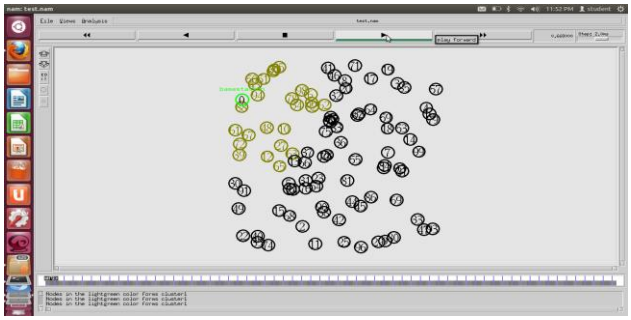

Fig.6 cluster 1 selection(green colour)

Fig.7 cluster 2 selection (violet colour)

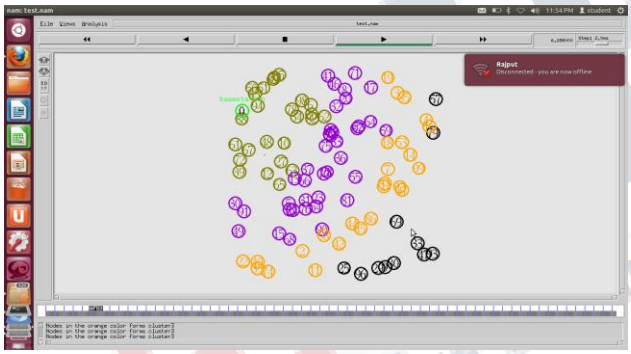

Fig.8 cluster 3 selection(orange colour)

Fig.9 cluster 4 selection(blue color)

VI.SIMULATION:

We evaluate performance of our scheme by using simulation on NS-2.

We will evaluate the performance of our proposed system for that we are going to simulate PEGASIS and PDCH, EEPB using several random 100-node networks. The BS is located at (0, 0) in a 100m x 100m field. We will run the simulations to determine the number of rounds of communication and the number of dead note in every round. EEPB and PEGASIS, PDCH with each node having the same initial energy level-0.5J. Once a node dies it is considered dead for the rest of the simulation. We will use the radio model as discussed in, and have some different from it, there is no consumption of energy at building chains in, but in my radio model, the building chains need energy consumption. Results of simulation are shown in fig.5 to fig 9.

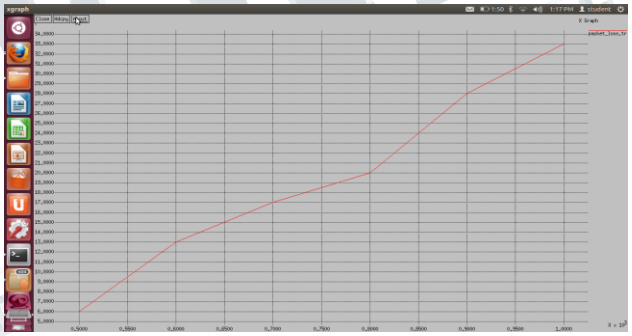

Fig.10 Graph of the packet loss

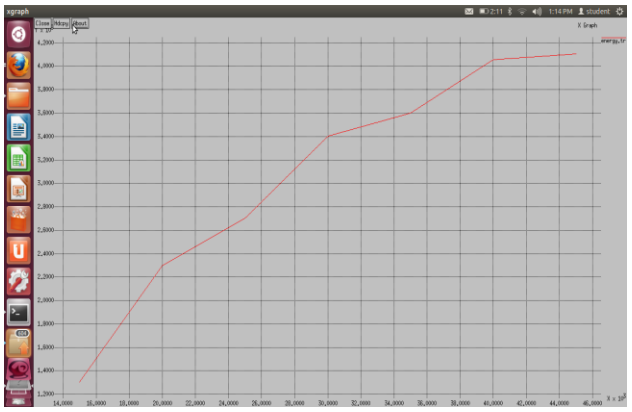

Fig.11 Graph of energy

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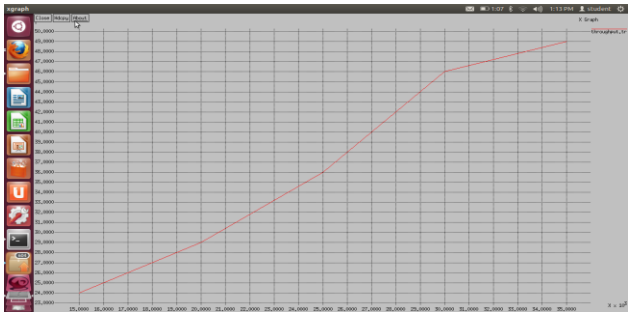

Fig.12 Graph for Throughput

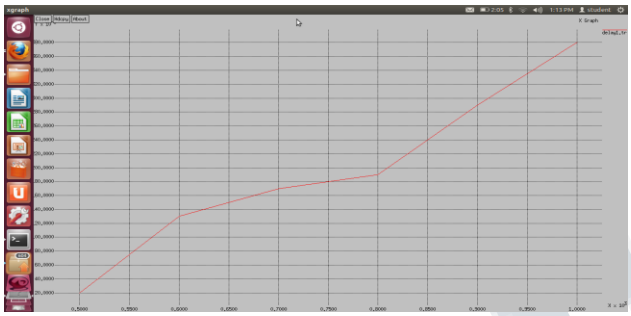

Fig.13 Graph for Delay

VII. CONCLUSION:

In this paper, we describe, a double cluster head choosing protocol that is near optimal for a data transmission algorithm in sensor networks. The novel protocol adopts a new distance based cluster selection method as well as double cluster head method in every cluster to balance the overall network load. This technique improves the performance of the overall network. This project outperforms Modified PEGASIS and PDCH by eliminating the overhead of dynamic cluster formation, minimizing the distance non cluster heads must transmit, limiting the number of transmissions. Distributing the energy load among the nodes increases the lifetime and quality of the network. Our simulations show that this protocol performs better than Modified PEGASIS and PDCH. This project shows an even further improvement as the size of the network increases.

FUTURE WORK:

As every protocol has its advantages ,it also has some drawback .Although we know , PDCH has good performance in terms of delay, energy consumption, dead nodes, network overhead, and throughput and packet loss ratio. In future research, PDCH protocol can be compared with other WSN based protocols and QoS can be analyzed.

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