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New Measure Routing Algorithm for PEGASIS Wireless Sensor Network

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Abstract— The sensor node spends the maximum energy in data transmission for maintaining this issue we proposed a new routing protocol for sensor nodes in WSN. A sensor network is organized into many sets and all sets collect the data with minimum edge weight in a parallel way so doing this all sets create a minimum edge weight chain. Further, the sets make a head node that is near the base station. All sets have a unique chain in this round after that all set again to select a head node on the basis of high residual energy, less mobility, and minimum distance to the base station that the head node sends the data to the base station. Further, our proposed routing algorithms save energy. We simulated the proposed model in MATLAB all simulation result is better than both routing algorithms.

Keywords-wireless sensor network, chain-based routing protocol, energy efficiency.

I. INTRODUCTION

The energy efficiency of a wireless sensor network depends upon a good routing protocol whichimproves the performance of the wireless sensor network and saves the node energy. At present time wireless sensor networksare used for both small purpose and big purposesat little cost in comparison to wire networks. Wireless sensor nodes suffer many limitations such as limited battery power and limited memory spacebut we cannot do some things. But the routing algorithm helps better wireless sensor networks. The data-gathering process performs a main role to improve the performance of WSN. This paper applies new measure routing algorithms for PEGASIS.

A wireless sensor network is a very challenging field that is very responsible for both small and big fields. At the time most all fields use a sensor node-based network and different routing strategies apply on the network for better performance. In parallel, our sensor suffers many environmental problems and limitations such as weather, temperature, humidity, noise, limited battery power, processing ability, and memory limitation [4][6][19].

Mostly sensor nodes consume energy in data collection, and data gathering to transmit to the base station. In the simple approach, the sensor node collects the data and sendsits data directly to the base station at that point sensor node drainsits energy quickly. Many routings algorithm is available that improves the power of sensor energy [5] [8].Various approaches are available for removing the problem of long links and data gathering problem energy-aware method. Chain-based routing in a wireless sensor network that follows the greedy approach decrease the energy consumption of node and increases the lifetime Shahrokh Vahabi (2021) [13]. Joint Shortest Chain and Fair Transmission Design for Energy-Balanced PEGASIS in WSNs. Which work based on the length of a node from the base station that minimizes energy consumption and balances the energy with respect to packet transmission Kun Wang (2022) [3].

In this paper, we proposed a new routing protocol that follows the chain-based network model. It is different from other routing protocols. The proposed algorithmnetwork is divided into many subs networks and all subnetworks also follow the chain-based concept. Every subnetworkis connected on the basis of the minimum edge weight of each vertex and data is collected in a parallel way. Our algorithm works in different steps.In the first step, a node is parallel connected with a minimum edge weight of each vertex for this came out many sets of networks from a network after that all sets are combined with minimum edge weight means only one head node is qualified for the leader. In last that the node is connected toa base station

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thathas less mobility,minimum distance, and high residual energy that sends the data to a base station. This algorithm removes the problem of long links and data gathering problems.

II. SYSTEM MODEL

In our proposed model sensor area is divided into some sets and all sets have a head node and the base station located in a middle has an infinite power supply for data gathering. Every node is homogenous and has good knowledge of the location and makes communication in every round of the sensor network.

A. Energy Model

In our proposed model we use an energy model and discuss how many factors are involved between transmitting and receiving one-bit data over a distance. The sensor area is divided into many sets and all sets have a chain and chain head. Supposed the chain node transmits the kbit on distance d that is Et (k d)and receiving node spend energy for kbit data Er(k d) and another term is added as a path between two node distance is α that is dependent upon the channel behavior[16].

$Et(k,d)=(Et+Eamp*d^{\alpha}) *k,$ (1)

$Er(k)=Er*k,$ (2)

Where Et and Er is an energy that is spent for transmission and receiving and k is a data bit that is transmitted over the distance d.A_{mp}represents the energy that is needed to transmit a one-bit signal on electronic devices.

B. RESIDUAL ENERGY OF THE PROPOSED MODEL

Suppose n sensor node in every set S and P is the probability for a node to select an option for the head node each node I generate a random number between 0 and 1. If the chain head found a threshold value of T(n) then the node will become the chain head for that round [8].

$$T(n) = \begin{cases} \frac{P}{1-P(r \bmod \frac{1}{P})} \times \frac{E_{\text{residual}}}{E_{\text{initial}}} k_{\text{opt}}, & \text{for all } n \in G \\ 0, & \text{otherwise} \end{cases}$$

C.Proposed Routing Algorithms

1-Give input as a weighted connected graph G= (V, E) with unique edge weight. That is shown as weight connected network.

2-Find the output in the form of minimum spanning tree M for graph G

where M is a subgraph of G that contains the vertices in V While

M has less than V-1 edges

do

for each connected node Ni, of M

do

let e= (v, u) be a less-weight edge in E with v belonging to Ni and u not belonging to Ni

3-Add e to M

4-return M.

D. Proposed Model

A. Chain Formation.

Sensor nodes are randomly established in the network and nodes follow the greedy concept. All nodes keep good knowledge of their network and node has one are more degrees with some edge weight.Chain formation starts on the basis of the least weight edge of each vertex, considering the vertex does not reselect again. The algorithm does not give the permission of the nearest neighbor selection process because if a node is already selected with minimum edge weight so no need to revisit, for doing this process in parallel before the cycle we find many single chains that are unique chains. Suppose the graph is G (V, E) after that we find G (V^1, E^1-1). That is simply shown in figure1.

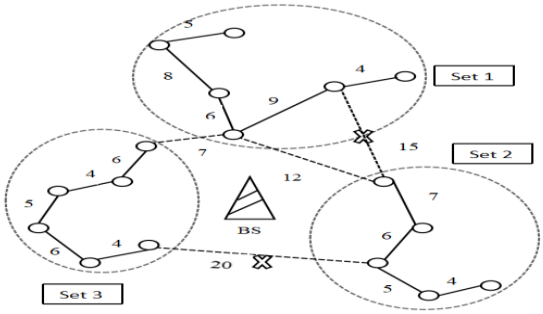

Fig.1. proposed typical routing protocol.

In this proposed model we take a network that has some sets and all sets have a minimum edge weight nodechain, that chain is unique for that round, and combine the sets using the edge with the least weight. In this figure, no 1set1, set2, and set3 have three chains, and all chainsare connected with minimum weight and other paths are disconnected according to proposed routing algorithms that are different in every round in the network.

B. Head Selection Process.

The head node selection process is a very critical process in WSN and affects the network result. This algorithm follows the multi-chain-based routing protocol. The leader selection process in each round will be random, all nodes are homogenous and greedy approach. From the first step of chain formation, we find many unique chains for that round in parallel.

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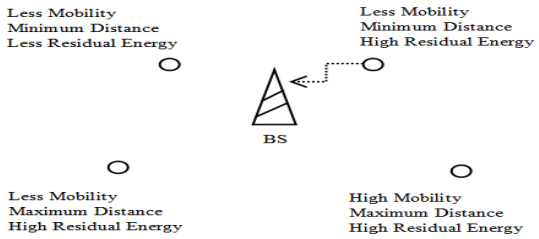

Fig.2.Head Selection Condition.

Many nodes are available to the base station but all nodes send data to the base station. We will check some conditions and parameters such as residual energy, distance from the base station, and mobility of a node that node send the data to the base station.

Find the all condition of nodes according to the above three parameters. This condition is checked in every round. Many nodes are available near the base station which will become the head node but only one node will become the head node according to my algorithms. The condition is if the distance of the node to the base station is less than another competitive node, residual energy is high, and less mobility that node becomes the head node. Many conditions will be possible such as the distance of a node to the base station is less than another competitive node, residual energy being high and high mobility, and others but select the first condition. For understanding, we show the above figure 2.

C. Data Transmission.

In our algorithms, we find many sets and all sets have their own chain and head node, that combines the sets using the edge with the least weight in a network. For data transmission, in every round, we use a token-passing mechanism and allow long link avoidance. A token-passing mechanism is initiated by the leader node and starts the data transmission from the end of the chain. The data transmission is simply shown in figure figure1.

In our algorithms is flow at every round with minimum edge weight neighbor node in parallel. Every node will collect neighbor data with itself to generate a single packet of the same length after forwarding data to its other neighbor in the last qualified head node according to my proposed algorithms that send data to the base station [5].

III. RESULTSANDDISCUSSION

This section uses MATLAB software for simulation and implementation. We test our proposed routing algorithms with two routing protocols that are IEERP and PE PEGASIS and show the related result during the simulation period. The simulation happens in 100m*100m with 60 sensor nodes that are randomly distributed with respect to edge weight the base station is set in the middle of the sensor area and base the station node is 41. Each sensor node has equal initial energy of 0.5j. Packet size 512 bytes, simulation duration 3600s, and round duration 20s.

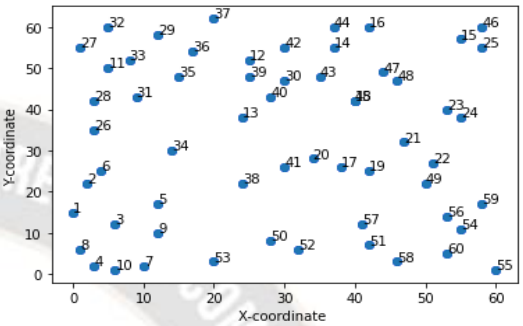

Fig.3.simulation of proposed routing protocol.

The design network radius is 100m*100m which is shown in figure no 3. The sensor area is divided into three sets each setisequally distributed and each set follows the proposed algorithms. Which head nodes send the data to the base station which is decided by the algorithms that are discussed in the proposed routing algorithms? After implementing the proposed model, we achieved the comparative result in terms of energy consumption, alive node, and dead sensor node.

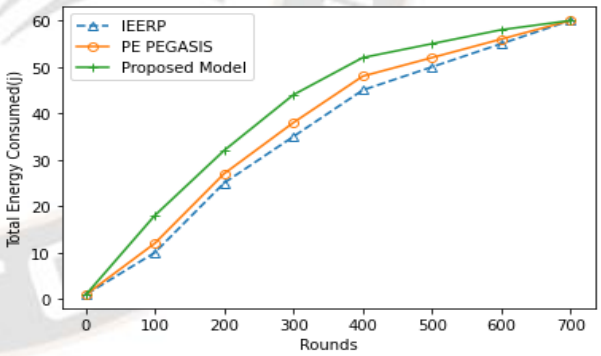

Fig.4.Energy consumption of nodes

With the help of the graph, we compare IEEFP, PE PEGASIS,and proposed routing algorithms. The simulation is completing many rounds. other routing algorithms consume more energyand our proposed algorithm consumes very less energywhich is shown the above figure4.

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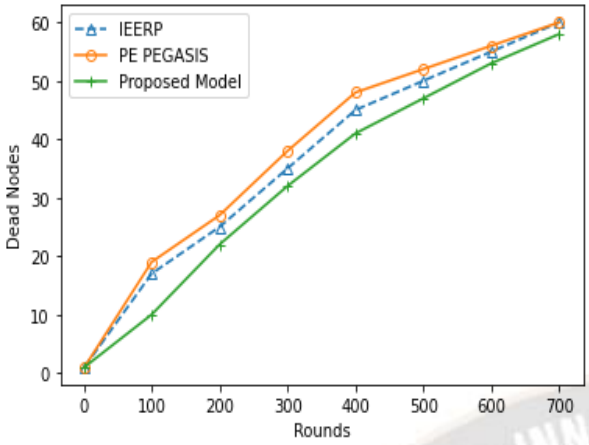

Fig.5. Number of dead nodes.

Figure 5 shows the number of dead nodes compareto IEERP, PE PEGASIS algorithms, and purposed algorithms. The number of dead nodes is very less compared to comparative algorithms because our proposed algorithms consume very less energy. Above comparative routing algorithms spend most of the energy in the data transmission process.

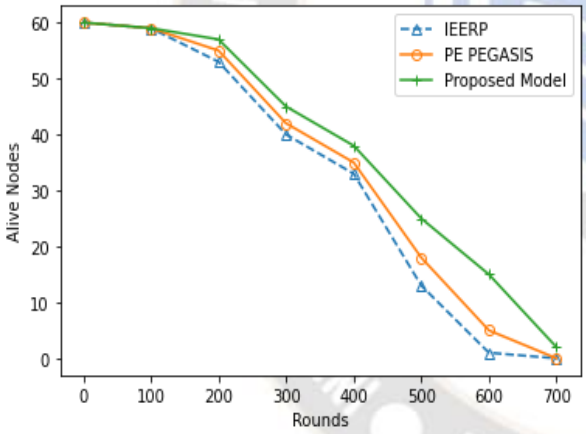

Fig.6. Number of Alive nodes.

Figure 6 presents a graph that clearly represents the alive node count of sensor nodes of the above mention algorithms with 60 nodes and 700 rounds. The Alive node of the proposed algorithms is more than the IEERP, PE PEGASIS routing protocol because our proposed routing protocol takes very less amount of energy in a wireless sensor network environment.

IV. CONCLUSION

This paper proposed an energy-efficient data-gathering routing protocol for wireless sensors network. The networkis divided into some sets and all sets have a head node but all head node are not send the data to the base station only the qualified head node sends the data to the base station. With the help of simulation, we show clearly that our proposed algorithms consume very less energy in the data transmission phase, dead nodes are less and the Alive node is more in comparison to IEERP, PE PEGASIS.

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