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Performance Analysis of Energy Efficient Clustering Protocol using TABU-PSO Technique in WSN

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Abstract - *WSNs are getting popular day by day. But due to the constrained of resources and limited battery supply of sensor nodes, this becomes the major areas of research, General Self-organized Tree-based Energy-balance Routing Protocol (GSTEB) is studied, where network structure is in the form of tree. The formation of cluster head selection is based upon the average remaining energy of nodes. GSTEB has shown quite significant results over the available WSNs protocols. But it has neglected many issues. In order to overcome the constraints, a new improved technique is proposed. The proposed technique has the ability to overcome the limitations of the GSTEB routing protocol by using TABU-PSO search. The proposed technique outperforms over the available techniques.*

***Key Words*: Wireless sensor network, General Self-organized Tree-based Energy-balance Routing Protocol (GSTEB), Clustering, TABU-PSO.**

1. INTRODUCTION

A remote system is tremendous system that joins with different physical gadgets, for example, server and customers machines alongside equipment. Remote system are comprehensively classifications as remote neighborhood), remote individual zone network (WPAN), Wireless Metropolitan Area Network (WMAN), Cellular Network, Mobile Ad hoc Network and Wireless sensor organize and so on. Remote sensors arrange is one of the pieces of remote system, it is additionally called actuator network. Wireless sensor network (WSN) made up of substantial number of sensor hubs that interrelated with one another to accomplish information conglomeration [1, 2]. The remote sensor systems (WSNs) can be used in a wide land space to deal with physical event with sensible rightness and consistency. The sensor hubs can watch different elements, for example, temperature, weight, moistness, daylight, metallic articles, and so forth.; this checking capacity can be productively utilized in assorted territory, for example, agribusiness, military, and ecological applications. A sensor hub is comprised of different segments like sensors (for detecting something), processor (for preparing the information), and handset and power units. The sensor hubs are spreaded in a sensor field as appeared in Fig. 1. All these spotted sensor hubs can total data and transmit data to the base station and furthermore the end clients. Data is steered back to the end client by multi bounce correspondences plan through the sink as appeared in Figure. 1. The sink fills in as a door; it could chat with the assignment administrator hub by means of web or Satellite. As we realize that while manipulative a productive directing convention a sensor hub is limited vitality supply, so accessible vitality at that hub must be a noteworthy limitation. Various directing conventions have been gotten ready for WSNs to fulfill vitality utilization and proficiency prerequisite. Proficiency, adaptability and lifetime of WSNs can be enhanced utilizing bunching. In bunch based steering conventions, sensors are isolated into various groups in the wake of picking a few hubs as bunch head among them, with the goal that sensor hubs impart data just to group heads and aggregate data to based station. Group is a productive method to lessen the vitality usage and there extend the existence time of the system, doing information collection and blend so as to diminish the quantity of transmitted messages to the Base Station. Grouping is an effective method to lessen vitality consumption and broaden the existence time of the system, doing information conglomeration and fusion so as to decrease the quantity of transmitted messages to the base station. Grouping systems is utilized for check the solidness, half system time.

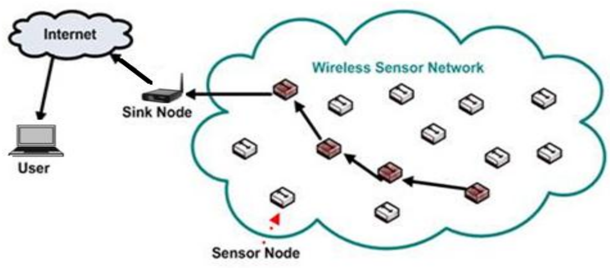

Fig -1: WSN Diagram

1.1 Clustering

Clustering algorithms [3, 4] are classified based on two main criteria: according to the stability and energy efficiency. Selection of CH in energy-efficient techniques generally depends on the initial energy, residual energy [5], the average energy of the network and energy consumption rate or combination of these. The stable election protocols for clustered WSN prolong the time interval before the death of first node, that is, stability period.

2. GSTEB PROTOCOL

General Self-Organized Tree-Based Energy-Balance Routing Protocol

General Self-Organized Tree-Based Energy-Balance Routing Protocol (GSTEB) builds a routing tree employ a process where for every single circular, the base station (BS) assign a root node and broadcast this option to each one detector nodes. Then, each node selects its close relative by taking into thought solely itself and it's neighbor's information, so creating GSTEB a robust protocol. Simulation results reveal that GSTEB embodies a much better performance than alternative protocols in leveling energy consumption, so prolong the period of WSN.

It considers a condition wherever within the network collects info at regular intervals from topography wherever every node regularly senses the environment and sends the information back to Base Station. Normally there are unit 2 definitions for network life span: [6, 7]

- The time from the start on of the set of connections method to the loss of initial node among the network.
- The time from the start on of the set of connections method to the loss of last node among the network.

Two extreme cases in knowledge fusion are:

Case (1): The information among any detector nodes may utterly coalesce. Every node transmits the identical volume of information despite what proportion data it receives from its kids.
Case (2): The information can't coalesce. The distance end to end of communication transmitted by each relay node is that the totals of its own detect data and received information from its offspring.

The chief set up of GSTEB is to realize an extended network production for several applications. In each spherical, BS assigns a root node and broadcast its ID and its coordinates to each detector nodes then the network computes the trail either through transmittal the trail info from Bachelor of Science to detector nodes or by having an equivalent tree organization being dynamically and severally designed by each node. For each case, GSTEB will modify the basis and Structure of the routing tree with very little delay and small energy consumption.

2.1 Operation of GSTEB

A. Initial part
B. Tree Constructing part
C. Self-Organized information assembling and transmittal Part.
D. Information Exchanging part.

3. Hybrid TABU with PSO

An algorithm based on TS and PSO is proposed for optimizing the routing in WSN and CH selection. This hybrid technique is energy efficient in response to the network. The proposed system selects efficient CHs, optimization of routing as well as increment the lifespan of the network. Proposed Tabu PSO shows the reduction of average packet rate and average end to end delay. An algorithm based on TS and PSO is proposed for optimizing the routing in Wireless Sensor Network.

PSO hold benefits such as greater convergence, resolving optimization efficiently, minimized population diversity and directing early converging towards local optima. On the other hand, TS is an optimization method that could hypothetically congregate to the global optimum solution, however it acquires more time span to attain near global minima. The integration of TS to PSO allows the algorithm to sustain the population diversity and avoiding directing to misguiding local optima. Average energy consumption is high in TS as compare with PSO and less calculation time is utilized in TS than PSO. By combining both tradeoffs between the two is avoided. Proposed Tabu PSO shows the reduction of average packet rate and average end to end delay. [8, 9, 10]

4. Simulation Results

In this simulation environment, the 100 sensor nodes are deployed in the area of 100*100. The MATLAB simulator is used for this experiment. The parameters are listed below in the given table. The metrics used for the simulation are:-

- Number of Dead nodes
- Packets Transferred
- Energy remain

Parameters	Value
Area(x,y)	100*100
Base Station(x,y)	X(sink)=50,Y(sink)=50
Number of nodes	100
Probability	0.1
Initial Energy	0.5J
Transmitter Energy	50nJ/bit
Receiver Energy	50nJ/bit
Free space Energy (amplifier)	1.0nJ/bit/m^2
Multipath Energy	0.0013nJ/bit/m^2

Table-1: Simulation Parameters

5. Simulation Scenario

This is the environment of mat lab 2013 a. Here, the environment of simulation begins.

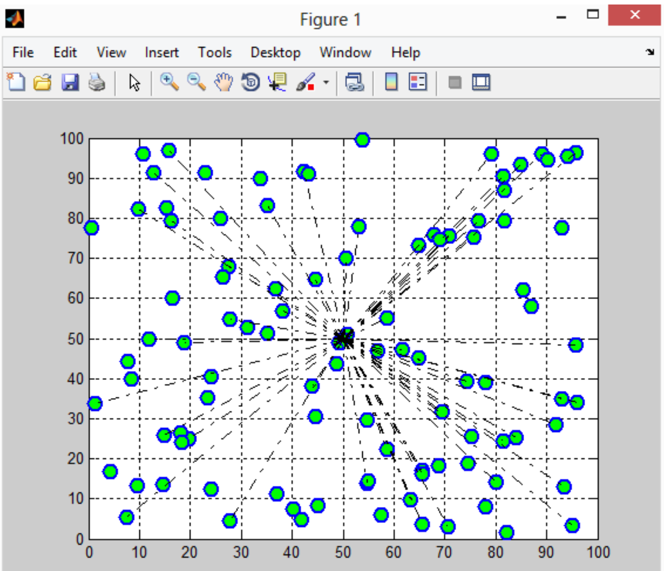

Fig 2 Simulation Enviornment

In the simulation environment, all the simulation is done under the MATLAB. In the GSTEB, the 100 nodes are taken in the environment of 100*100 m. Here, the performance metrics are dead nodes, energy remains and packets transferred.

5.1 **Dead Nodes**:-It tells how many nodes are dead according to the rounds.

5.2 **Remaining Energy**: - It tells how much energy is consumed over the rounds.

5.3 **Packets transferred to Base Station**:-It is the total number of the packets or we can say messages that are received by the base station.

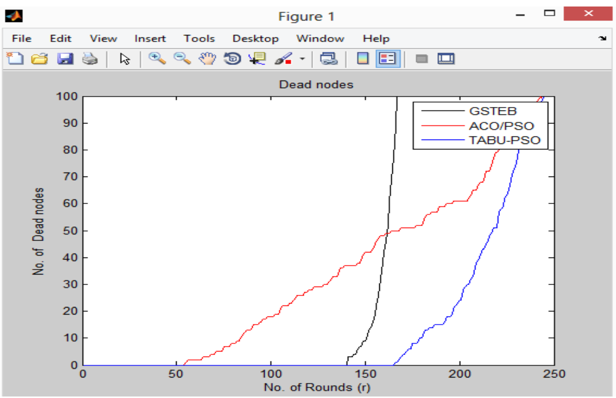

Fig 3. Dead nodes Vs no. of rounds

The figure is showing the graph of dead nodes where X-axis is representing the rounds and Y-axis is representing the number of nodes become dead. The black dotted line represents the performance of GSTEB protocol and the red dotted line represents the performance of ACO/PSO protocol, while the blue dotted line represents the TABU-PSO protocol. From the figure, we observe that in case of the GSTEB all nodes are dead at 150 rounds and in case of ACO/PSO protocol, all nodes are dead after 230 rounds and in case of TABU-PSO protocol, all nodes are dead after 240 rounds. The network is more alive with TABU-PSO technique.

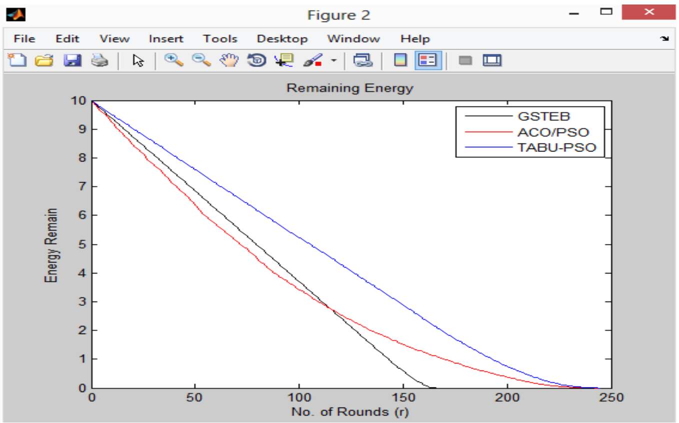

Fig 4. Energy remain Vs no. of rounds

Figure is showing the graph of energy remain where X-axis is representing the rounds and Y-axis is representing the energy remain. The black dotted line represents the performance of GSTEB protocol and the red dotted line represents the performance of ACO/PSO protocol, while the blue dotted line represents the TABU-PSO protocol. From the figure, we observe that in case of the GSTEB all nodes are dead at 160 rounds and in case of ACO/PSO protocol, all nodes are dead after 240 rounds and in case of TABU-PSO protocol, all nodes are dead after 250 rounds. The network is more alive with TABU-PSO technique.

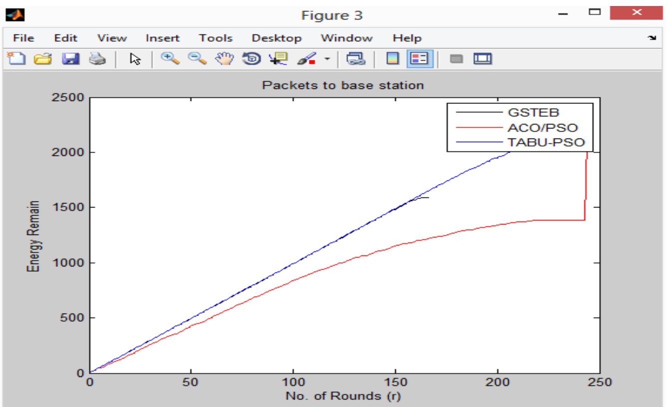

Fig 5. Packet send to base station Vs no. of rounds

Figure is showing the graph of number of packets send to base station, where X-axis is representing the rounds and Y-axis is representing the number of packets send. The black dotted line represents the performance of GSTEB protocol and the red dotted line represents the performance of ACO/PSO protocol, while the blue dotted line represents the TABU-PSO protocol. From the figure, we observe that at the round of 150, the total number of packet send to base station is 1500 and in case of ACO/PSO protocol, the total number of packet send to base station is 1200 and in case of TABU-PSO protocol, the total number of packet send to base station is 1800.

6. Conclusion

In this paper, we have proposed the hybrid TABU-PSO based GSTEB protocol. This protocol adopts the routing selection using TABU-PSO approach which outperforms GSTEB. The proposed protocol shows a better improvement over the existing protocol. In future work, we can implement some other optimization technique on cluster head selection and also work on WSN 3D environment.

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