

# PERFORMANCE ANALYSIS AND EVALUATION BY SIMULATION OF WIRELESS SENSOR NETWORK USING ENERGY EFFICIENT ALGORITHM

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## ABSTRACT

*The lifetime of sensor nodes and the energy of sensor is the major concern for building any algorithm in Wireless Sensor Networks. Wireless Sensor Algorithms works for both unicasting and multicasting. In this paper a new algorithm is proposed which enhance the performance of sensor nodes on various parameters like throughput, packet-delivery ratio, consumed energy of various sensor nodes. Evaluation of the new algorithm on various above said parameters has been done.*

**Keywords:** Sensor nodes, Wireless, energy efficiency, throughput

## 1. INTRODUCTION

Wireless Sensor networks is a type of network in which nodes are scattered throughout the specified area in an random position. WSN has its usefulness in all the areas now a days. They have been used to track any person, device, animals, temperature, etc. Sensors-They are the devices which respond to any change in their physical conditions. Study of various algorithms have been done before caring out this algorithm. In Wireless sensor network, if after deploying the sensors, the battery gets exhausted, then we need to change them.

But after once deploying the batteries, it is a very tough job to replace some of the overused batteries. Therefore, need to find certain algorithms, by using which, the batteries are used for a longer period of time, and thus the lifetime of the sensor nodes get increased. Energy efficient algorithm ensures that the energy of batteries will last for long and also they will cover more number of sensor nodes in the network i.e the lifetime of the sensor nodes will increase.

The various algorithms which have been studied are Load Balancing Protocol – It says that, more number of sensors should be kept alive by balancing the load amongst them. The three states of sensor nodes which are defined are Active, Idle and deciding state Deterministic Energy Efficient Algorithm-The main approach of this algorithm is to low the energy rate when it is required by low energy sensors, and to increase the energy consumption rate for high energy targets.

Given a sensor region P, various sensors  $p_1, p_2, p_3, \dots, p_n$  and a various targets  $r_1, r_2, r_3, \dots, r_n$  and energy supply for each sensor  $d_i$  and an assignment of range for each sensor in a set  $K_i$  such that

- each target should be covered by a sensor
- each sensor  $p_i$  does not appear in the set  $K_j, \dots, K_k$  for a time more than  $d_i$  where  $d_i$  is the initial energy of sensor of  $p_i$ [1]

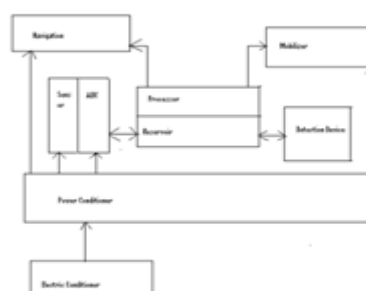


Fig 1 components of Sensor nodes

## 2. PROPOSED ALGORITHM

The algorithm which is proposed here is as follows-

Group Based Energy Efficient Algorithm (GBEE)

When the group Head  $g$ , is unable to get the data packets from a node  $d$  during the given time for two times in succession, at that time  $g$  informs the entry Node  $e$ , by giving the data packet  $\langle d, (z_d, z_{d+1}), Lo_g \rangle$ ; Here  $d$  is the id of the lost node,  $(z_d, z_{d+1})$  are the time slots during which packets are not reached at the destination,  $Lo_g$  is the current position of the group Head.

Begin

Step 1:  $e$  receives  $\langle d, (z_d, z_{d+1}), Lo_g \rangle$  from  $g$

Step 2:  $e$  sends a packet to  $d$  and asks for its position after a fixed interval of time till any further information and then waits for  $\langle ackn \rangle$  from  $d$

Step 3: if  $e$  receives  $\langle d, Lo_d \rangle$  update  $(stat)_d = \text{high}$  else  $(stat)_d = \text{low}$

if  $(stat)_d = \text{high}$

{Step 4:  $e$  computes the distance  $dist$  between  $Lo_g$  and  $Lo_d$  and compare  $dist$  with the radio transmission ranges of  $d$  and  $g$ .

Step 5: if  $d$  is out of range then  $e$  signals  $g$  for slot reassessment and also signals  $d$  for not sending any packet to  $g$ , else signal  $g$  to wait for data in the further expected time range of  $d$ .} else

{Step 6: signal  $g$  for time range reassessment}

Step 7: if  $g$  computes the location of  $d$  &  $g$  as within the Radio transmission range of each other then signal  $g$  to assign time range for  $d$  and also signal  $d$  to send the packets towards  $g$  and not to send position to  $e$  End

## 3. METHODOLOGY

The following steps are considered for simulating the above said algorithm

1) Sensor and target script is build, which have all the information like identifier of node, the position of several nodes, battery level or we can say the energy of the sensors.

2) Simulation is started via command prompt of Cygwin by writing "startx" on it. Then NS2 window appears, there only we executed our script. In that NS2 script, all the configurations have been done, that is, targets and sensors and various other parameters are defined.

3) Script is executed using those parameters.

4) After that a NAM window appears, the simulation is carried out uptill the targets are covered by the sensors. All this is shown in NAM(network animator) itself.

5) When the simulation is halted, the various results are being generated on the x-graph, like packet delivery ratio, throughput and energy consumed by sensor nodes.

6) The analysis of the x-graph has been done in the following sections.

7) Conclusion of findings have been done.

## 4. SIMULATION RESULTS

The simulation is performed 1000m\*1000m area. Number of sensors taken is 20 to 25, number of targets taken is 20 to 25. The sensing range taken is 0 to 30m. The maximum sensing range taken is 30m.

For the evaluation following parameters are considered-

Throughput – It is the ratio of time taken to actually deliver the packet at its destination to the total number of packets actually sent.

Consumption of energy-total energy consumed from time to time in the network process.

Packet-delivery ratio-It is amount of packets actually delivered at the sink.

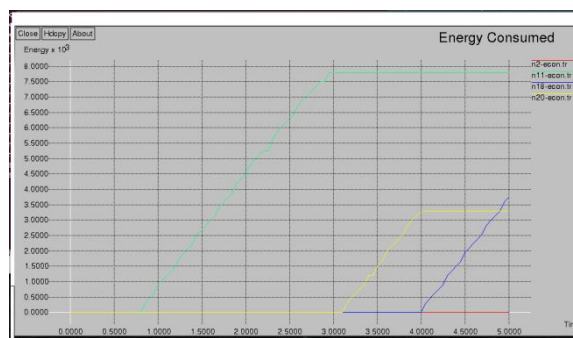
In the simulation of algorithm, the following results are obtained. These are the simulation results of algorithm, Group Based Energy Efficient Algorithm(GBEE).

```
No of Packets in 11th node: 52
No of Packets in 18th node: 25
No of Packets in 20th node: 22
Packet Delivery Ratio 02th node: 0.0
Packet Delivery Ratio 11th node: 80.0
Packet Delivery Ratio 18th node: 96.153846153846146
Packet Delivery Ratio 20th node: 88.0
Energy of the 02th node: 0
Energy of the 11th node: 9750.0
Energy of the 18th node: 3906.25
Energy of the 20th node: 3750.0
Energy consumed in the 02th node: 0
Energy consumed in the 11th node: 7800
Energy consumed in the 18th node: 3750
Energy consumed in the 20th node: 3300
Energy disappated in the 02th node: 0
Energy disappated in the 11th node: 1950
Energy disappated in the 18th node: 150
Energy disappated in the 20th node: 450
Total Number of Rounds: 3712
```

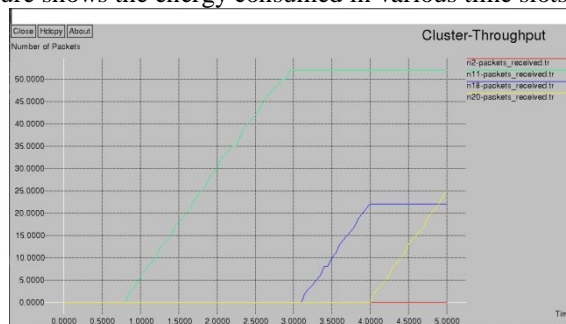
**Figure 2** this is the figure showing the console window of Group based Energy Efficient protocol



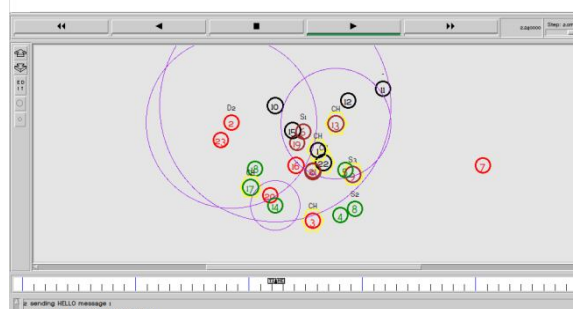
**Figure 3** shows the packet delivery ratio



**Figure 4** this figure shows the energy consumed in various time slots by different nodes.



**Figure 5** graph shows the throughput of the group



**Figure 6** shows the NAM window

## 5. ANALYSIS OF RESULTS

In this section, analysis of the results have been done. The performance of the above mentioned algorithm is evaluated on the parameters like throughput, energy consumption, packet-delivery ratio. Fig3 depicts, the various packets actually delivered at the destination. Fig5, depicts that as the network increases the throughput decreases. By fig4, it is observed that the energy is consumed less by using this algorithm and thus the lifetime of sensor nodes increases.

## 6. CONCLUSION

In this paper, Simulation using NS2 for an energy efficient algorithm is carried out. The name of the algorithm is “Group based energy efficient algorithm” The packet-delivery ratio, throughput, and energy consumption of sensor

nodes are the parameters which are being evaluated by using the algorithm in WSN. Thus the proposed algorithms improve the energy consumption of sensor nodes and thus increases the lifetime.

## REFERENCES

- [1] Aung, Aung, "Distributed Algorithms for Improving Wireless Sensor Network Lifetime with Adjustable Sensing Range" (2007).
- [2] Samayveer Singh and Ajay K. Sharma, "Distributed Algorithms for Maximizing Lifetime of WSNs with Heterogeneity for Adjustable Sensing Range", International Journal of Computer Communications, Elsevier Science, USA, July 2010.
- [3] Samayveer Singh and Ajay K. Sharma, "Distributed Algorithms for Maximizing Lifetime of WSNs with Heterogeneity and Adjustable Range for Different Deployment Strategies", International Journal of Physical Communications, Elsevier Science, USA, July 2010.
- [4] Ye Ming Lu and Vincent W.S. Wong, "An Energy-Efficient Multipath Routing Protocol for Wireless Sensor Networks".
- [5] M. Cardei, M.T. Thai, Y. Li, and W. Wu, "Energy-efficient target coverage in wireless sensor networks", In Proc. of IEEE Infocom, 2005.
- [6] Chee-Yee Chong and Srikanta P.Kumar, "Sensor Networks: Evolution, Opportunities and Challenges", Proceedings of the IEEE, Vol.91, no.8, Aug 2003.

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sanctioned project.