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Performance Analysis of Energy Efficient Clustering Protocol in WSN

A. Rana[1*], M. Bala[2], Varsha[3]

[1*]Dept. of CSE, CTIEMT(IKG PTU), Jalandhar, India
[2] Dept. of CSE, CTIEMT(IKG PTU), Jalandhar, India
[3]Dept. of CSE, CTIEMT(IKG PTU), Jalandhar, India

*Corresponding Author: er.atulrana@gmail.com, Tel.: +919465376804

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***Abstract*— Over the past decades, clustering is the main issue in the wireless sensor network. To make the clustering and cluster head selection is the main issue in the wireless sensor network. In this study, the authors propose and evaluate the performance of MSEEC (Multi level stable and energy efficient clustering protocol) protocol in heterogeneous wireless sensor network based upon the parameters number of alive nodes, dead nodes , packet transferred and average Total energy and also makes the network better by using the hybrid ACO-PSO (Ant-colony optimization-particle swarm optimization) optimization technique for cluster head selection in MSEEC protocol on the parameters packet transferred and alive nodes.**

***Keywords*— Clustering, Wireless sensor network, cluster head selection, number of alive nodes, dead nodes , packet transferred and averageTotalenergy,hybridACO-PSO**

I. INTRODUCTION

Wireless sensor networks which consist of group of sensor nodes which deploy in different classes of applications for accurate monitoring. Presently, the wireless sensor network is facing four major issues namely power management, routing, localization and deployment techniques. Out of these in power management, energy conservation is the major constraint due to irreplaceable and limited power sources of the sensor nodes. Therefore, the most important goal of the wireless sensor network routing protocol implementation is balancing network energy consumption and increasing the entire network lifetime[1].Wireless sensor networks(WSNs) are gaining popularity due to the fact that they offer low-cost solutions for a variety of application domains. The huge application space of WSNs covers national security, surveillance, military, health care, environment monitoring and so on. There are two cases of WSNs, a 'homogeneous' sensor networks when the nodes of the sensor network are equipped with the same amount of energy and a 'heterogeneous' sensor[2] networks when a percentage of the node population is equipped with more energy than the rest of the nodes in the same network. In heterogeneous WSNs (HWSNs), a large number of inexpensive nodes perform sensing, while a few nodes having comparatively more energy, perform data filtering, fusion and transport. Then, the life time and reliability of the network can be improved by heterogeneity in WSNs. HWSNs are very much useful in real deployments because they are more close to real life situations. Routing has been a challenging issue in the design of WSNs. A lot of literature proposes routing protocols in order to save node energy and enhance WSN routing. Clustering [3] is a key technique used to extend the lifetime of a sensor network by reducing energy consumption. A sensor network can be made scalable by forming clusters. Leader of the cluster is often referred to as the cluster head (CH) [4]. A CH may be elected by the sensors in a cluster or pre-assigned by the network designer. Classical clustering protocols in WSNs assume that all the nodes are equipped with the same amount of energy. As a result, they cannot take full advantage of the presence of node heterogeneity.

Clustering

Clustering algorithms [5] 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 [6], average energy of the network and energy consumption rate or combination of these. The stable election protocols for clustered HWSN prolong the time interval before the death of first node, that is, stability period.

II. M-SEEC PROTOCOL

Multi-level stable and energy efficient clustering protocol

M-SEEC depends on the network structure that is divided into the clusters [7]. In SEEC protocol, each cluster has an advanced nodes and normal nodes which deployed randomly in the cluster.

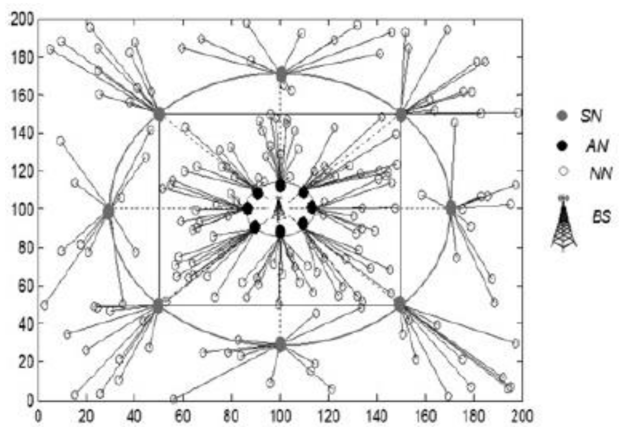

Fig 1. Network Model of M-SEEC

In M-SEEC, the most powerful supper nodes are assigned to cover the distant sensing areas. Each type of nodes has its role in the form of sensing, aggregation or transmission to the sink (Base Station). Nodes are deployed randomly in the field with a different group of energy values. The Network is divided into clusters and each cluster has a powerful super nodes, advanced nodes and normal nodes. In M-SEEC [7], M_{SN} is the percentage of the total number of nodes equipped with β times more energy than the normal nodes (NN), called as a super nodes (SN). Total initial energy of the 3 level heterogeneous networks is given by:

$$E_{total} = n. E_0 + M_{AN}. (1+\alpha) . E_0 + Msn .(1+\beta). E_0$$

Therefore, the three-level M-SEEC has **(α .M_{AN} +β. M_{SN})** times more energy.

III. HYBRID ACO WITH PSO

This hybrid algorithm exhibits better performances when compared to ACO approach. Ant Colony Optimization (ACO) algorithm uses mobile agents as ants to discover feasible and best path in a network. ACO helps in finding the paths between two nodes in a network and acts as an input to the Particle Swarm Optimization (PSO) technique [8], a Meta heuristic approach in SI. Particle Swarm Optimization (PSO) [9] finds the best solution over the particle's position and velocity with the objective of cost and minimum End-to-end delay.

IV. SIMULATION RESULTS

In this simulation environment, the 200 sensor nodes are deployed in the area of 200*200. The MATLAB simulator is used for the given experiment. The parameters are listed below in the given table. The metrics used for the simulation are:-

- Number of Dead nodes
- Number of alive nodes
- Packets Transferred
- Average Total energy

Table1:- Simulation Parameters

Parameters	Value
Area(x,y)	200*200
Base Station(x,y)	X(sink)=100,Y(sink)=100
Number of nodes	200
Probability	0.1
Initial Energy	0.5J
Transmitter Energy	50 nJ/bit
Receiver Energy	50nJ/bit
Free space Energy(amplifier)	1.0nJ/bit/m^2
Multipath Energy	0.0013nJ/bit/m^2

V. SIMULATION SCENARIO

This is the environment where area is 200*200 meter. Here, the environment of simulation is at the mid, where all the rectangles are normal nodes and green diamond shaped nodes are super nodes and diamond pink shaped nodes are advanced nodes and blue star is the base station.

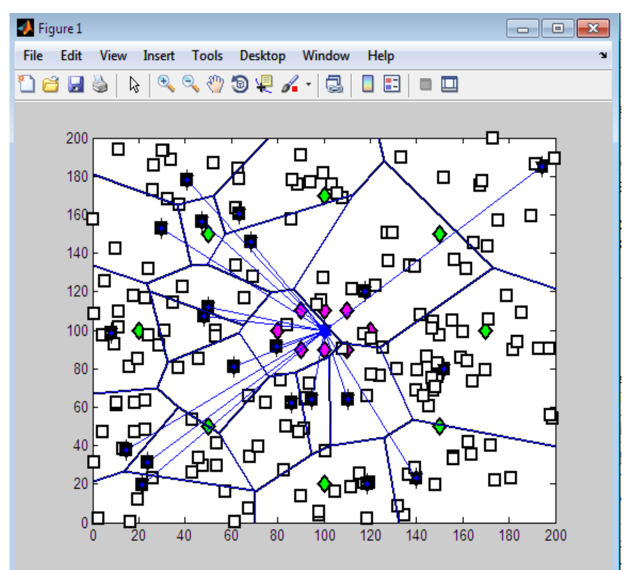

Fig 2 Simulation Enviornment

Here, the graph shows the simulation when all the nodes are dead. So all the red diamond shape nodes are die and again blue diamond shaped is the base station.

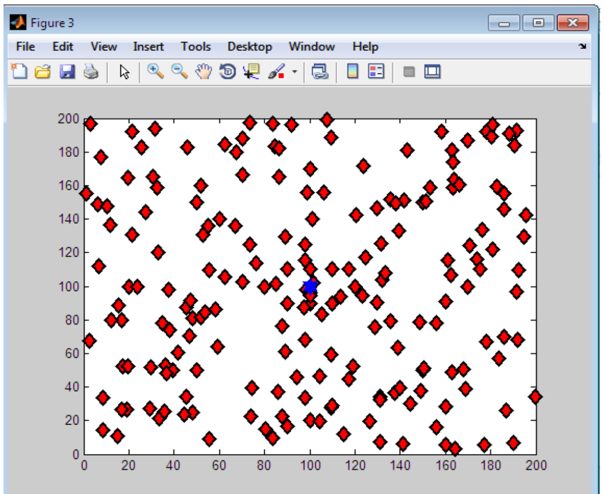

Fig 3. Simulation Enviornment at the end

In the simulation environment, all the simulation is done under the MATLAB. In the MSEEC, the 200 nodes are taken in the environment of 200*200 m. The number of AN is 8% of the total nodes and also the number of SN is 8%. AN is having three times more energy than normal nodes and SN is having four times more energy than normal nodes. Here, the performance metrics are alive nodes, average total energy, dead nodes and packets transferred.

Alive nodes:-it is the total number of the nodes that has not expended their energy. This particular metrics also indicates the network lifetime and also gives the idea of the area coverage of the network over time.
Average Total Energy:- it tells the how much energy is consumed over the rounds.
Dead nodes:-it tells the how many nodes are dead according to the rounds.
Packets Transferred:-it is the total number of the packets or we can say messages that are received by the base station.

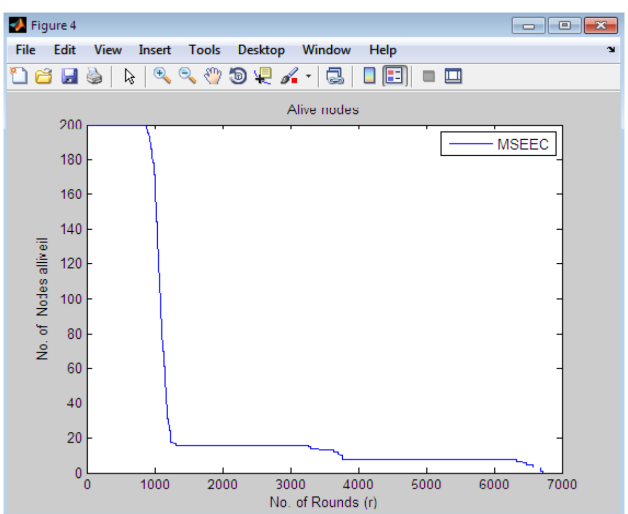

Fig 4. Alive Nodes

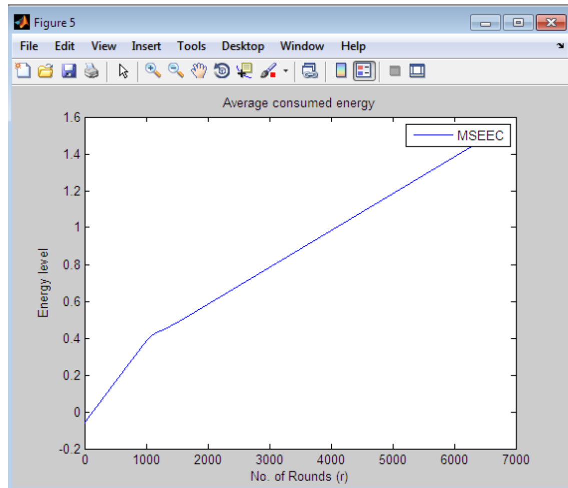

Fig 5. Average total Energy

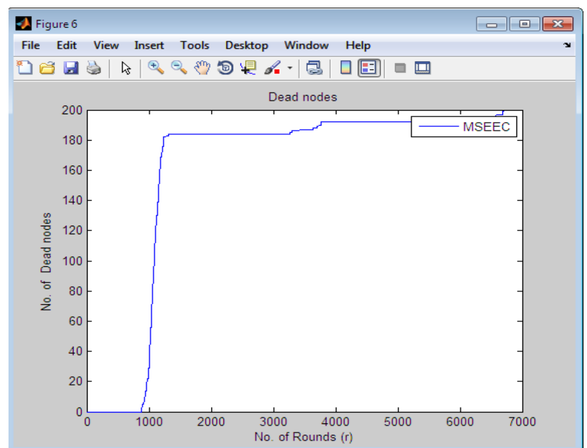

Fig 6 Dead Nodes

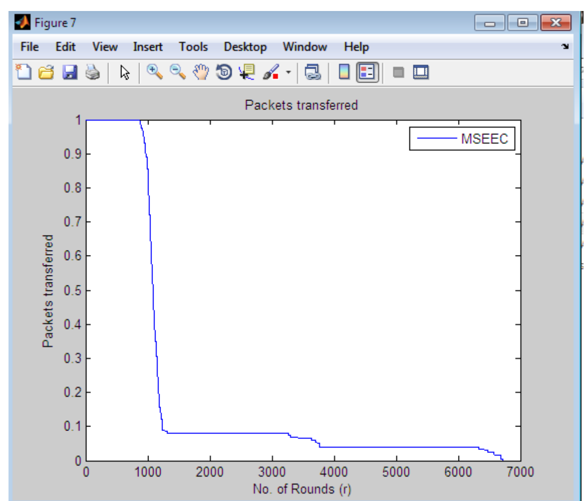

Fig 7 Packet Transfer

In the simulation environment, all the simulation is done under the MATLAB. In the EMSEEC, the 200 nodes are taken in the environment of 200*200 m. The number of AN is 8% of the total nodes and also the number of SN is 8%. AN is having three times more energy than normal nodes and SN is having four times more energy than normal nodes. The cluster head selection is done through the hybrid ACO-PSO optimization technique. Here, the performance metrics are alive nodes and packets transferred.

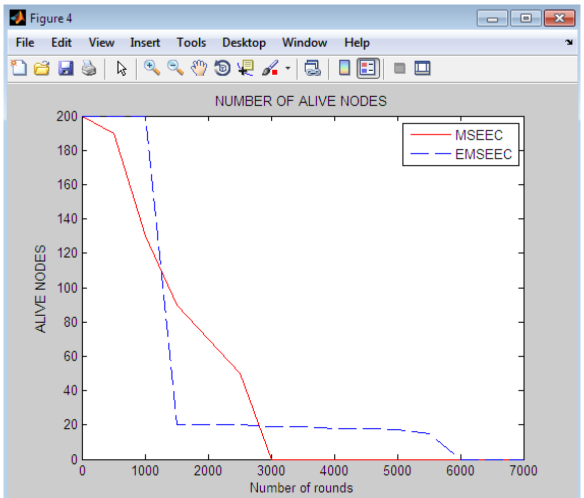

Fig 8 Number of Rounds and Alive Nodes in EMSEEC

Figure is showing the graph of alive nodes where X-axis is representing the rounds and Y-axis is representing the number of nodes become alive .The red dotted line represents the performance of MSEEC protocol, while the blue dotted line represents the EMSEEC protocol. From the figure, we observe that in case of the MSEEC all nodes are dead at 3000 rounds and in case of EMSEEC all nodes are dead after 6000 rounds. The numbers of alive nodes are more in case of EMSEEC protocol.

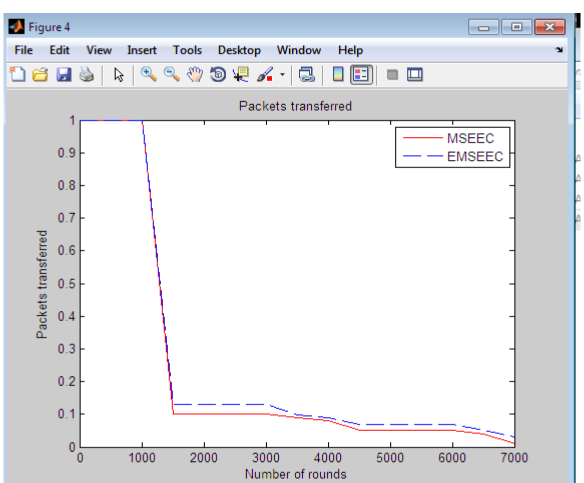

Fig 9 Packet Transfered

Figure is showing the data received at the sink. X-axis is representing the number of rounds and Y-axis is representing the packets transferred in bytes. This figure shows that the amount of data received at the sink is higher in the EMSEEC protocol than MSEEC protocol. The result indicates that the EMSEEC can help data transmission to the sink in the entire network.

VI. CONCLUSION

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

REFERENCES

[1]. Neelam, D. Khosla, "*The Energy Efficient Techniques for Wireless Sensor Networks: A review*", International Journal of Computer Sciences and Engineering, Vol.4(11), pp.38-41, 2016 .

[2]. A.S. Mandloi and V.Choudhary, "*An Efficient Clustering Technique for Deterministically Deployed Wireless Sensor Networks*", International Journal of Scientific Research in Network Security and Communication, Vol.1(1), pp.6-10, 2013

[3]. M Alnuaimi, K. Shuaib, K. A. Nuaimi, and M. A. Hafez, "*Performance analysis of clustering protocols in WSN*". In Wireless and Mobile Networking Conference (WMNC), 6th Joint IFIP, IEEE,UAE, pp. 1-6, 2013.

[4]. A.M. Kishk, Nagy W. Messiha, A. Nawal El-Fishawy, Abdelrahman A. Alkafs, Ahmed H. Madian, "*Proposed Jamming Removal Technique for Wireless Sensor Network*", International Journal of Scientific Research in Network Security and Communication, Vol.3(2), pp.1-14, 2015.

[5]. Zhu, Jiang, C.H Lung, V. Srivastava,"*H-DHAC: A hybrid clustering protocol for wireless sensor networks*". In Wireless Communications and Mobile Computing Conference (IWCMC), International Conference on IEEE,Canada , pp. 183-188, 2013.

[6]. J.S Leu, T.H Chiang, M. Yu, and K.W. Su, "*Energy Efficient Clustering Scheme for Prolonging the Lifetime of Wireless Sensor Network With Isolated Nodes*", IEEE, Vol. 19(2) ,PP. 259-262, 2015.

[7]. V Farouk, Fifi, R. Rizk, F. W. Zaki, "*Multi-level stable and energy-efficient clustering protocol in heterogeneous wireless sensor networks*", Wireless Sensor Systems, IET ,Vol.4(4), pp.159-169, 2014.

[8]. V. Raghavendran, N. Satish, P. S. Varma, "*Intelligent routing techniques for mobile ad hoc networks using swarm intelligence*", I.J Intelligence systems and applications, Vol. 5(1), pp 81-89, 2012.

[9]. K. Sayed, A. Fathima, T. Sumitha, "*To Enhance the Lifetime of WSN Network using PSO*", International Journal of Innovative Research in Computer and Engineering, Vol.2(1), 2014

[10]. A. Rana, M. Bala, Varsha, "Review Paper on Mseec: *Energy Efficient Clustering Protocol in WSN*", International Journal of Computer Science and Engineering , Vol.4(5), 2016.

Authors Profile

Mr. Atul Rana pursed Bachelor of Computer Science Engineering from IKG Punjab Technical University, Punjab in 2012. He is currently pursuing masters and currently working as Executive in IT sector in reputed company, Punjab. He has 4 years experience in IT sector.

Dr. Manju Bala pursed Bachelor, master's andPh. D of Computer Science Engineering. She is currently working as Head and Professor in Khalsa college of Engineering and Technology Amritsar,IKG Punjab Technical University,India. She is a member of IEEE & IEEE computer society. She has published more than 50 research papers in reputed international journals and conferences including IEEE and it's also available online. Her main research work focuses on Data communication & networking, Network security and wireless sensor networks. She has 12 years of teaching experience and 7 years of Industry.

Ms. Varsha Sahni pursed Bachelor of Computer Science and Engineering from malout institute of management and information technology in 2009 and master's from guru nanak dev engineering college in 2011. She is currently pursuing Ph.d from IKG Punjab Technical University and currently working as Assistant Professor in Department of Computer Science of Punjab, India. She is pulblished more than 41 research papers in reputed international journals including Thomson Reuters (SCI & Web of Science). Her main research work focuses on wireless sensor network and it's also available online. She has 5 years of teaching experience and Research Experience.