Information Sciences Letters

Volume 7
Issue 2 *May 2018*

Article 3

2018

Performance Evaluation of Clustering EAMMH, LEACH SEP, TEEN Protocols in WSN

Hamdy.H El-Sayed
Mathematics Department, Faculty of Science, Sohag University, Egypt., hamdy2006x@gmail.com

Information Sciences Letters
An International Journal

http://dx.doi.org/10.18576/isl/070202

Performance Evaluation of Clustering EAMMH, LEACH SEP, TEEN Protocols in WSN

Hamdy.H El-Sayed

Mathematics Department, Faculty of Science, Sohag University, Egypt.

Received: 13 Jan. 2018, Revised: 23 Mar. 2018, Accepted: 2 Apr. 2018
Published online: 1 May 2018

Abstract: Wireless Sensor Networks (WSNs), are self-con?gured and infrastructure less wireless networks. That network consists of small devices which equipped with expert sensors and wireless transceivers. The main goal of a WSN is to make a connection data from the environment and send it to the base station (BS) where the data can be observed and analyzed. Wireless sensor devices also respond to queries sent from the base station (BS) to perform speci?c instructions. Finally, they can be equipped with actuators to ?act? upon certain conditions. These networks are sometimes more speci?cally referred as Wireless Sensor and Actuator Networks. In the work of this paper work, clustering Energy aware multi-hop multi-path hierarchical protocol (EAMMH), Low-energy adaptive clustering hierarchy protocol (LEACH), Stable Election Protocol (SEP) and Threshold sensitive energy efficient sensor network protocol (TEEN) routing protocols for Wireless Sensor Network are compared. Average energy of node and number of dead nodes are used to measure the performance of theses protocols. Different values of number of nodes (node density) and energy of transmitter and receiver parameters are used. These routing algorithms have been developed in this regard. This article showed that the changes values of these parameters have clear effects on the performance of cluster protocols in WSN. In this research work the results and observations made from the analyses of results about these protocols are presented.

Keywords: WSN, EAMMH, LEACH, SEP, TEEN, Network density, Transmitter and Receiver Energy, Average Energy of Node, Number of Dead Nodes

1 Introduction

Recent advances in sensor and wireless communication technologies in conjunction with developments in microelectronics have made available a new type of communication network made of battery-powered integrated wireless sensor devices. Wireless Sensor Networks (WSNs), as they are named, are self-con?gured and infrastructure less wireless networks made of small devices equipped with specialized sensors and wireless transceivers [1]. The main goal of a WSN is to collect data from the environment and send it to a reporting site where the data can be observed and analyzed. Wireless sensor devices also respond to queries sent from a ?control site? to perform speci?c instructions or provide sensing samples. Finally, wireless sensor devices can be equipped with actuators to ?act? upon certain conditions. These networks are sometimes more speci?cally referred as Wireless Sensor and Actuator Networks [2].

At present time, due to economic and technological reasons, most available wireless sensor devices are very constrained in terms of computational, memory, power, and communication capabilities. This is the main reason why most of the research on WSNs has concentrated on the design of energy and computationally ef?cient algorithms and protocols, and the application domain has been restricted to simple data-oriented monitoring and reporting applications. However, all this is changing very rapidly, as WSNs capable of performing more advanced functions and handling multimedia data are being introduced. New network architectures with heterogeneous devices and expected advances in technology are eliminating current limitations and expanding the spectrum of possible applications for WSNs considerably. This chapter provides a general view of wireless sensor networks describing the node and network architectures, examples of application domains, and the main challenges faced by WSNs with an emphasis on energy conservation [3].

* Corresponding author e-mail: hamdy2006x@gmail.com, Hamdy.H@science.sohag.edu.eg

2 Previous work

W. B. Heinzelman et al. [4] proposed first well known clustering protocol LEACH for wireless sensor networks. In this sensors are organized into clusters and randomly select a few nodes as cluster head with a certain probability of becoming a cluster heads per round. The task of being a cluster head is rotated between nodes. The rotation role balances the energy dissipation of the nodes in the networks. LEACH is a distributed algorithm but cluster count (cluster head) is not fixed in each round per epoch. Due to distributed algorithm each node is capable to select itself as a cluster head by choosing random number. There is possibility that each node choose same number for cluster head selection, due to randomness property of random number generator. So cluster head count is varying in each round.

W. B. Heinzelman et al. [5] this protocol uses a centralized approach where the information of node location and energy level was communicated to base station. The base station decides about the cluster head selection and cluster formation. In this protocol the selection of cluster heads is random and the cluster head number is limited. The base station sure those nodes have less energy than it cannot become a cluster head. This protocol is not suitable for large scale network because there is a problem to send the status of a node which is far from the base station. The cluster head role rotates every time so it is not feasible to send information every time in a quick time. It increases the latency and delay.

Georgios S. et al. [6] introduces the heterogeneity that prolongs the time interval before the death of first node called stability period. This protocol is based on the weighted election probabilities of each node to become cluster head according to the remaining energy in each node. In this there are two types of nodes was considered as normal and advanced. This protocol does not require global knowledge of energy at every round to select cluster heads. Authors extended the LEACH protocol except the heterogeneity awareness. Cluster count is variable in this algorithm and also unstable period is not good.

O. Younis et al. [7] improves the LEACH protocol by using residual energy, node degree or density as a main parameters for cluster formation to achieve power balancing. This protocol was proposed with three main parameters: First parameter is to enhance network lifetime by distributing energy consumption, second clustering terminates within a fixed number of iterations third minimum control over head and fourth the cluster heads was well distributed. The algorithms proposed in this protocol periodically selects cluster heads based on the two basic parameters. The first primary parameter is the residual energy of each node; second parameter is the intra-cluster communication cast as a function of cluster density or node degree. The primary parameter selects initial set of cluster heads probabilistically which secondary parameter is breaking ties. HEED is not able to fix the cluster count in each round and it is also not aware of heterogeneity. M. R. Mundada, et al. [8] has presented clustering as a means to overcome this difficulty of energy efficiency. Detailed description about the working of two protocols, namely LEACH and EAMMH are presented. They have also presented the details about the simulation and the results of it. From the brief analyses of the simulation they have come to a conclusion that LEACH can be preferred in cases of smaller networks where the total number of nodes is less than fifty where it performs slightly better than EAMMH and EAMMH can be chosen in larger networks and also when the heuristic probability of Cluster Head selection is more.

Neha Jain and Manasvi Mannan. [9] They have given the comparison of the five routing techniques. Since the goal of this comparison is to maximize the lifetime of the network or to minimize the energy consumption. Results show that stability of TEEN is more than LEACH and SEP. EAMMH and PEGASIS perform better than leach protocol. LEACH on the other hand has a delayed time in getting the first dead node but a larger number of nodes run out of energy in a short period of time subsequently. TEEN, EAMMH are good for larger networks and LEACH can be used for smaller networks.

3 Simulation and Results

We have carried out a number of experiments and used them for the comparison of EAMMH, LEACH, SEP and TEEN for various performance metrics. Number of rounds is 500 and cluster head probability is 0.03.

Simulation and Analysis of Results TEEN, SEP, LEACH and EAMMH are simulated using MATLAB. The parameters taken into consideration while evaluating these techniques are as follows. ? Number of Dead Nodes with variation of number of nodes. ? Average Energy of Each node with variation of number of nodes. ? Number of Dead Nodes with variation of energy of transmitter and receiver. ? Average Energy of Each node With variation of energy of transmitter and receiver. ? The set of results represent the simulation of protocols at round Number 500 and 0.03 probability that is the percentage of total nodes which can become cluster head is 3

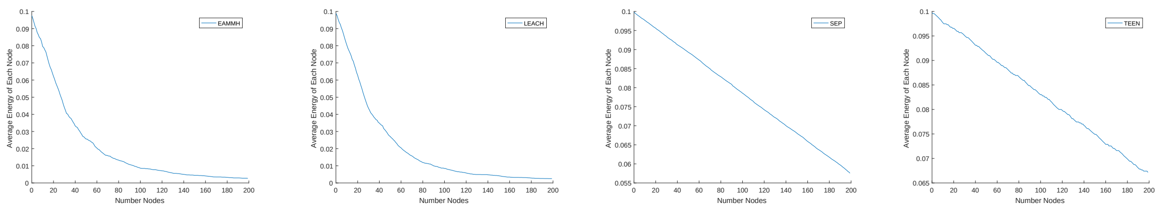
3.1.1-First simulation runs the simulation with changes number of nodes 200, 400 and 500 and constant energy of transmitter and receiver 10*0.000000001 effects on average energy

3.1.2 - second simulation runs the simulation with changes number of nodes 500 and constant energy of transmitter and receiver 10*0.000000001 effects on average energy node and number of dead nodes. 3.2-Second simulation runs with changes energy of transmitter and receiver to 50*0.000000001 and 100*0.000000001 with 200 nodes

3.2.1- The simulation run with number of node with 50*0.000000001 energy of transmitter and receiver used

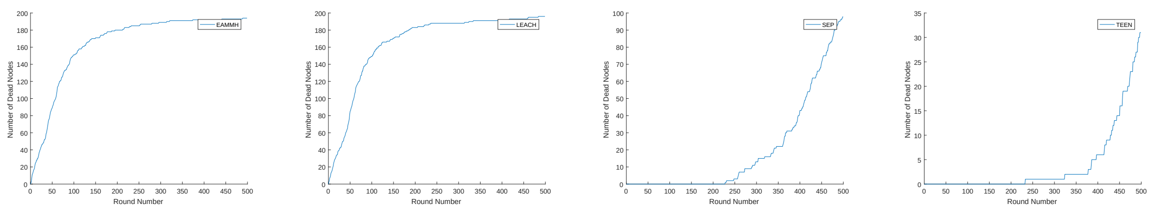
Table 1: Table 1: list of simulation parameters

S. No.	Parameters	Values
1	Network Area	100*100
2	Number of Nodes	200,400,500
3	Cluster head Probability	0.03
4	Basestation Location	(150,150)m
5	Initial Energy	0.1
6	Transmiter Energy	10*0.000000001, 50*0.000000001, 100*0.000000001
7	Reciever Energy	10*0.000000001, 50*0.000000001, 100*0.000000001
8	Aggregation Energy	5*0.000000001
9	Amplification Energy	0.0013*0.000000000001
10	Number of Rounds	500



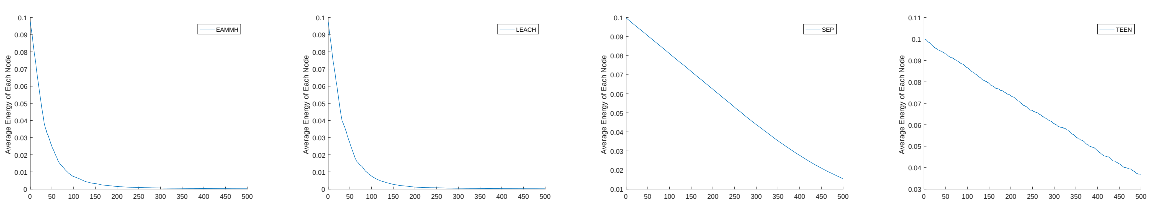
(a) (b) (c) (d)

Fig. 1: effects of average energy of each node with 200 nodes in network and transmitter and receiver 10*0.000000001 energy.



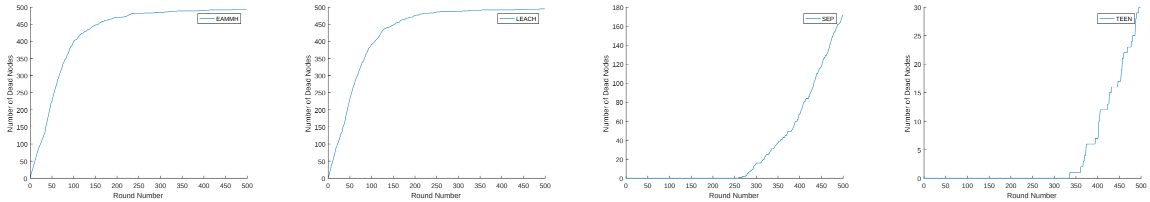
(a) (b) (c) (d)

Fig. 2: dead node number effected with 200 nodes in network in the same energy.



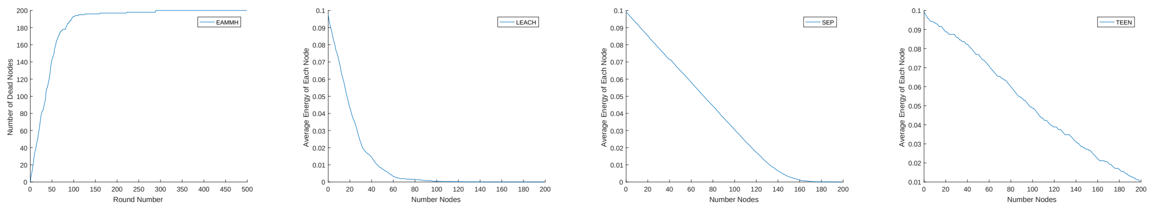
(a) (b) (c) (d)

Fig. 3: effects of average energy nodes with 500 nodes in network.



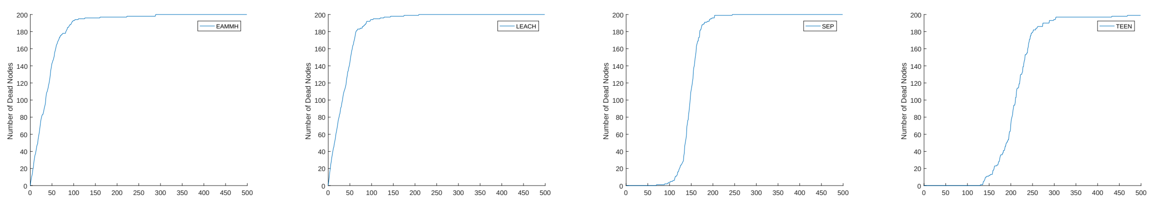
(a) (b) (c) (d)

Fig. 4: shows the effected of dead nodes with 500 nodes in network.



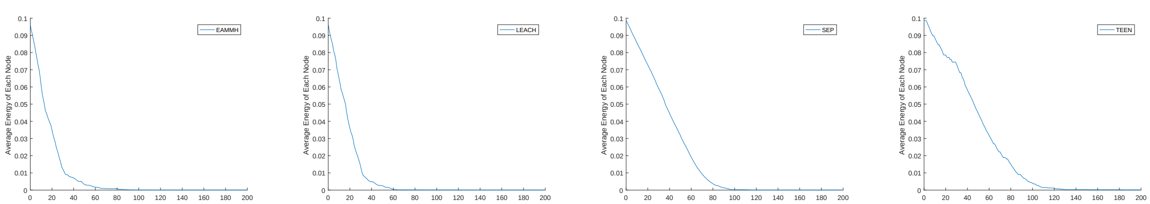
(a) (b) (c) (d)

Fig. 5: depicts the average energy of each node with 200 nodes in network and transmitter and receiver energy 50*0.000000001.



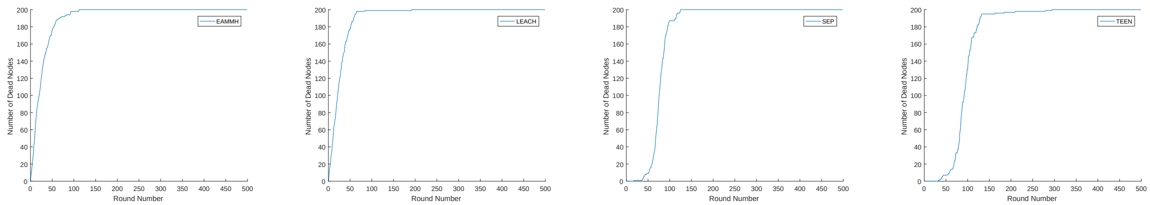
(a) (b) (c) (d)

Fig. 6: shows the number of dead nodes with 200 nodes in the network with transmitter and receiver energy value is 50*0.000000001.



(a) (b) (c) (d)

Fig. 7: explain the average energy of each node effects with 200 nodes network and transmitter and receiver energy value is 100*0.000000001.



(a) (b) (c) (d)

Fig. 8: shows the effects number of dead nodes with 200 nodes in network and transmitter and receiver energy value is 100*0.000000001.

3.2.2-The simulation run with number of node with 100*0.000000001 energy of transmitter and receiver .

4 Results

From our simulation it observes that the stability of TEEN protocol is more than LEACH and SEP protocols. The performance of EAMMH protocol is better than LEACH protocol. on the other hand LEACH protocol has a delayed time in getting the first dead node but a larger number of nodes run out of energy in a short period of time subsequently. TEEN, EAMMH are very well for larger networks and LEACH is good for smaller networks. Also simulation results depict the clear effect of transmitter and receiver energy on the performance of cluster routing protocols EAMMH, LEACH, SEP and TEEN. Again simulation results depicts that the number of nodes effects on the performance of cluster EAMMH, LEACH, SEP and TEEN routing protocols. An important result observed that we can derive from all ?gures are instability faced by routing protocols that SEP has minimum and TEEN has maximum unstable region.

5 Conclusion

Different transmitter and receiver energy and effcient protocols are challenging issues in WSNs. Different techniques have been proposed up till now to address these issues. Clustering technique is one of them, and this work is devoted to evaluate and compare the ef?ciency of different clustering schemes. For this purpose we first make the transmitter and receiver energy constant with respect to maximizing network size by increasing network nodes. To check the feasibility of different clustering techniques, we select clustering EAMMH, LEACH, SEP and TEEN routing protocols. It is concluded from our analytical simulation results the stability of TEEN protocol is more than LEACH and SEP protocols. The performance of EAMMH protocol is better than LEACH protocol. on the other hand LEACH protocol has a delayed time in getting the first dead node but a larger number of nodes run out of energy in a short period of time subsequently. TEEN, EAMMH are very well for larger networks and LEACH is good for smaller networks.

Acknowledgement

El-Sayed received the PhD degree in computer science department sohag university egypt.
The authors are grateful to the anonymous referee for a careful checking of the details and for helpful comments that improved this paper.

References

[1] Hamdy.H El-Sayed : " Data Aggregation Energy and Probability Effects on the Performance of EDEEC and MODLEACH Protocol in WSN", Applied Mathematics & Information Sciences An International, Appl. Math. Inf. Sci. 12, No. 1, 1-7 (2018).

[2] Sanjeev Kumar Gupta, Neeraj Jain and Poonam Sinha. Article: ?Clustering Protocols in Wireless Sensor Networks: A Survey?. International Journal of Applied Information Systems 5(2):41-50, January 2013. Published by Foundation of Computer Science, New York, USA.

[3] I.F. Akyildiz et al. 2002. ?Wireless sensor networks: a survey?, Computer Network.

[4] M. R. Mundada, N. Thimmegowda, T. Bhuvaneswari, V. Cyrilraj: "Clustering in Wireless Sensor Networks: Performance Comparison of EAMMH and LEACH Protocols Using MATLAB", Advanced Materials Research, Vol. 705, pp. 337-342, 2013.

[5] W. Rabiner Heinzelman and H. Balakrishnan, 2000: ?Energy-Efficient communication Protocol for Wireless microsensor networks?, IEEE, Proceeding of the 3rd Hawali International Conference on System Science.

[6] Georgios Smaragdakis and Ibrahim Matta, 2004. SEP: ?A Stable Election Protocol for Clustered Heterogeneous Wireless Sensor Networks?, Boston University Computer Science Department , 2004.

[7] O. Younis, S. Fahmy, 2004. HEED: A Hybrid, Energy Efficient, Distributed clustering approach for Ad Hoc sensor networks, IEEE Transactions on Mobile Computing.

[8] M. R. Mundada, N. Thimmegowda, T. Bhuvaneswari, V. Cyrilraj, ”Clustering in Wireless Sensor Networks: Performance Comparison of EAMMH and LEACH Protocols Using MATLAB”, Advanced Materials Research, Vol. 705, pp. 337-342, 2013.
[9] Neha Jain, Manasvi Mannan,? COMPARATIVE PERFORMANCE ANALYSIS OF TEEN SEP LEACH EAMMH AND PEGASIS ROUTING PROTOCOLS ?, International Research Journal of Engineering and Technology (IRJET), Volume: 03 Issue: 01 — Jan-2016.

Hamdy H. El-Sayed Hamdy.H El-Sayed received the PhD degree in computer science department sohag university egypt. His research interests are in the areas of ad hoc routing protocols and sensor networks, cloud computing and security.