Performance of Clustering LEACH, EAMMH Protocols in Wireless Sensors Network

M. DIVYA[1], T. KANTHA RAJU[2], CH. SUDERSAN RAJU[3]
[1]PG Scholar, Dept of ECE, B.I.T Institute of Technology, Hindupur, AP, India, Email: nandinitech22@gmail.com.
[2]Associate Professor, Dept of ECE, B.I.T Institute of Technology, Hindupur, AP, India, Email: kantha006@gmail.com.
[3]Associate Professor, Dept of ECE, B.I.T Institute of Technology, Hindupur, AP, India, Email: sudarsan4francis@gmail.com.

Abstract: Wireless Sensor Networks (WSNs), are self-configured 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 specific instructions. Finally, they can be equipped with actuators to act upon certain conditions. These networks are sometimes more specifically 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) 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, Network density, Transmitter and Receiver Energy, Average Energy of Node, Number of Dead Nodes.

I. 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-configured 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 specific instructions or provide sensing samples. Finally, wireless sensor devices can be equipped with actuators to act upon certain conditions. These networks are sometimes more specifically referred as Wireless Sensor and Actuator Networks [2]. 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 efficient 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].

II. EXISTING PROTOCOLS

In this basic 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 [2]. 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. 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 [1] [2] [3]. 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. 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 [6] . 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.

III. PROPOSED PROTOCOLS

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 [11] 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] [10] 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.. EAMMH 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. EAMMH are good for larger networks and LEACH can be used for smaller networks.

IV. SIMULATION AND RESULTS

In this paper, we are going to show the results obtained from the work we have done using gnu plot. In this section we are going to show the simulation results at different conditions i.e. By varying number of connections By varying number of nodes By varying speed of nodes
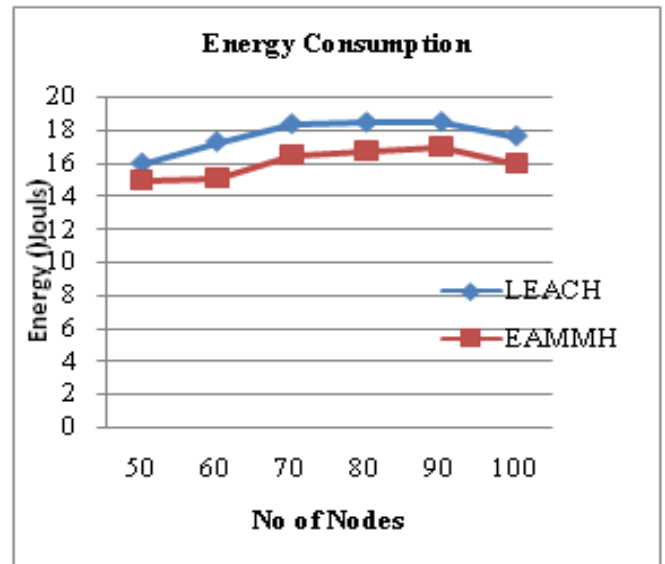
A. Energy Consumption in Nodes

The below graph shows the energy consumption of LEACH and EAMMH protocols for varying number of nodes.
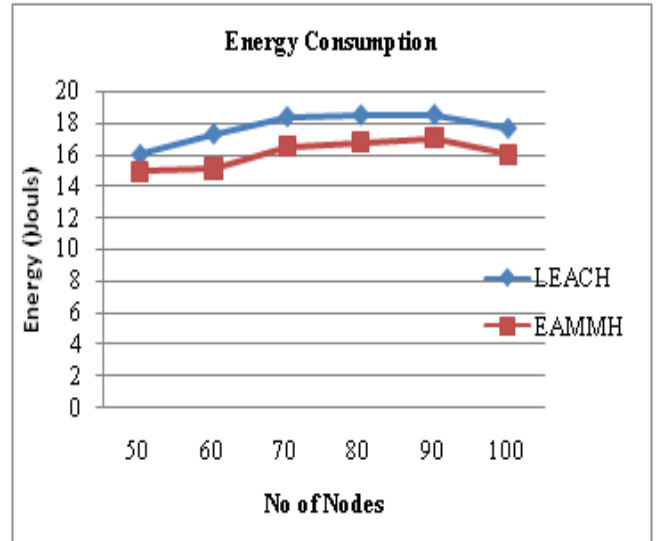
Fig1. Energy Consumption v/s No Nodes.

Their comparison is given by the superimposed plot shown in. We can observe from the graph that the energy consumption of LEACH is much higher than EAMMH. Hence EAMMH is more energy efficient than LEACH protocol because of it consumes less power than EAMMH protocol by varying number of nodes. The number of nodes varied from l0 nodes to l00 nodes as shown in above graph. The average power and reaming power in a node can be estimated by

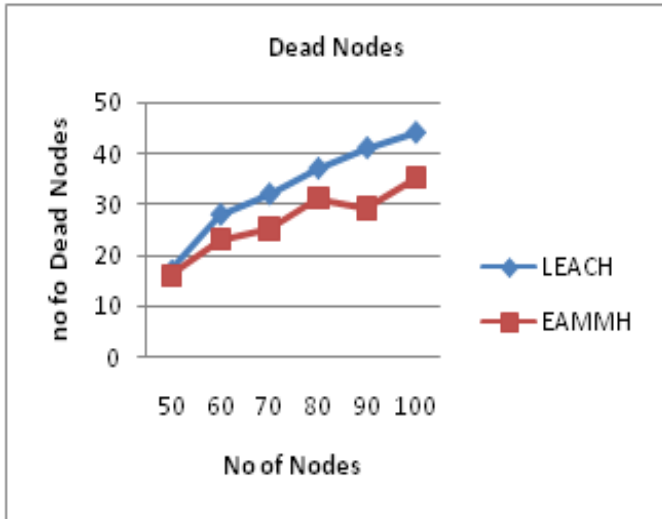
Fig2. Energy Consumption v/s No Nodes.

Average Power Consumed: $\dfrac{\text{Total power consumed}}{100}$

Average Power Remaining: $\dfrac{\text{Remaining power}}{100}$

Power variance: $\dfrac{\text{Total power consumed}}{\text{Remaining power}} \times 100$

B. Dead nodes Vs No Nodes

Fig3. Dead nodes Vs No Nodes.

The comparison is given by the superimposed plot shown above we can observed from the graph that the number of dead nodes of EAMMH is always lower than that of LEACH. Which makes it more desirable for increasing the network lifetime is always higher in EAMMH than LEACH protocol by varied number of node in wireless sensor network. The transmission from sensors nodes to sink node happens either between cluster node and its head or between cluster head and sink node.

C. Packet Delivery Fraction w r t Nodes

The figure below shows that Packet Delivery Fraction in case of LEACH and EAMMH protocols at 50, 60, 70, 80, 90, and l00 nodes. Results show that the EAMMH is having more PDF compared to LEACH when no of nodes increases.
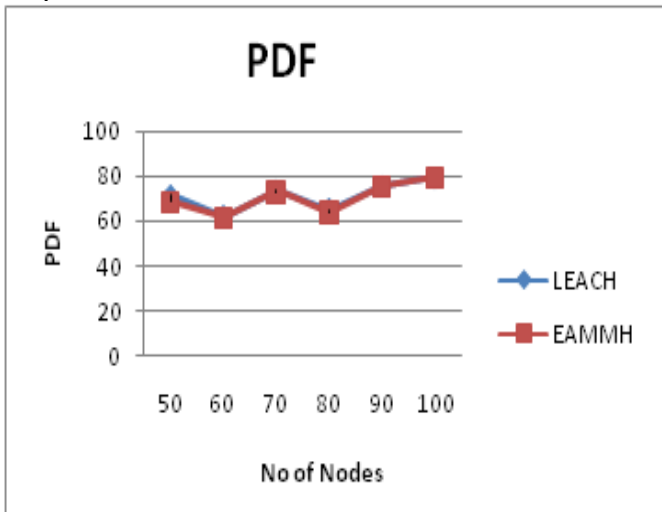
**Fig4. Packet Delivery Fraction Vs No Nodes.**

PDF can be obtained by using

Packet Delivery Fraction: $\frac{\text{Received packets}}{\text{Sent packets}} \times 100$

D. Average End to End Delay Vs No Nodes

The figure5 shows that Average End-to-End Delay in case of LEACH and EAMMH protocols at 50, 60, 70, 80, 90, and l00 nodes. Results show that the ESEP is having less delay compared to LEACH when no of nodes increases.
The end to end delay can be obtained by

End to End Delay: $\frac{\text{Sum}}{\text{Received packets}}$
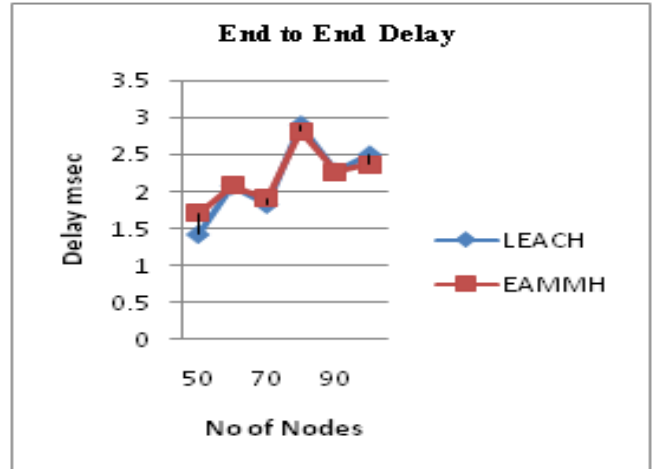
Fig5. Average End to End Delay Vs No Nodes.

E. Simulation Parameters

This below table shows types of simulation parameters and values, this values can be further utilized

Table1. 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	Base station 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

From our simulation it observes that the stability of EAMMH protocol is more than LEACH 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. 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, and LEACH. Again simulation results depicts that the number of nodes effects on the performance of cluster EAMMH, and LEACH routing protocols. An important result observed that we can derive from all figures are instability faced by routing protocols that EAMMH has minimum and LEACH has maximum unstable region.

V. CONCLUSION

Different transmitter and receiver energy and efficient 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 efficiency 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 routing protocols. It is concluded from our analytical simulation results the stability of EAMMH protocol is more than LEACH 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.

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