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# Performance Analysis of Multihop-Gateway Energy Aware Routing (M-Gear) Protocol for Wireless Sensor Networks

Velanati Mohana Gandhi[1], M.V.H.Bhaskara Murthy[2],M.Lakshmu Naidu[3]
*1(Electronics and Communication Engineering Department, AITAM,Tekkali ,India*.

**ABSTRACT:-** A Wireless Sensor Network (WSN) is a wireless network subsists of spatially dispersed autonomous devices using sensors to informant physical or environmental conditions. A WSN system consolidates a gateway that provides wireless connectivity back to the wired world and distributed nodes. A key concern in WSN technology is to enhance the network lifetime and to diminish the energy consumption of the sensor network. Many routing protocols are available for maximizing the network lifetime. Thus, this paper suggested a Multihop-Gateway Energy Aware Routing (M-GEAR) protocol for Wireless Sensor Networks (WSNs) and also compares the performance of proposed protocol with LEACH, DEEC and EAMMH. Performance analysis and compared statistic results show that the proposed protocol perform well in terms of energy consumption and network lifetime.Keywords: Wireless Sensor Network, Routing Protocol, Network Lifetime and Energy Consumption.

## I. INTRODUCTION

Routing in WSNs is a very formidable problem due to the inherent characteristics which differentiate such networks from other wireless networks such as cellular networks and ad hoc networks. Wireless Sensor Network (WSN) is a wireless network subsists of small nodes with sensing, computation, and wireless communications capabilities. Each sensor convokes data from the monitored area (such as temperature, sound, vibration, pressure, motion or pollutants). Then it romp data back to the base station BS. Data transference is usually a multi- hop, from node to node propitious the base station. As wireless sensor networks subsist of hundreds to thousands of low-power multi functioning sensor nodes, operating in an abandoned environment, with limited computational and sensing proficiency. Due to the clustering protocols consume less energy, these protocols for WSNs have attained extensive acceptance in copious applications. Many state of the art WSN Protocols exploit cluster based scheme at manifold levels to minimize energy expenditures. Cluster Head (CH) in most cluster based protocols is selected on the base of probability. It is not obvious that CHs are distributed evenly throughout the sensor field. Therefore, it is utterly possible that the selected CHs concentrate in one region of the network. Hence, a number of nodes will not get any CHs in their environs. In this paper, we introduce various routing protocols like LEACH, DEEC, EAMMH and M-GEAR protocols to improve the lifetime of the wireless sensor network.

## II. ROUTING PROTOCOLS

A routing protocol enumerates how routers communicate with each other, disseminating information that enables them to select routes between any two nodes on a computer network. Routing algorithms determine the distich choice of route. Each router has a priori knowledge only of networks adhere to it directly. A routing protocol contribute this information first among prompt neighbors, and then throughout the network. This way, routers gain knowledge of the topology of the network. In this section we describe some routing protocols.

**Low-Energy Adaptive Clustering Hierarchy (LEACH) protocol**

LEACH [1] is a hierarchical clustering protocol; it provides an elegant solution for such protocols. It uses the appliance of cluster-head rotation, select cluster-heads randomly, and each node has an equal chance. So LEACH algorithm stasis the energy consumption of the unified network prolongs the lifecycle of the whole network. In LEACH the nodes form local clusters with one of the nodes acting as a local sink or cluster head. If the same node would endure as the cluster head throughout the working of the network, it would die quickly because of the pervasive load from the participating sensors in the cluster. Hence the rotation of the cluster head

in every round is decisive to distribute the load uniformly. Further energy dissipation can be reduced by aggregating the data from various sensor nodes at the cluster head.

LEACH assumes that the base station is immobile and is located far from the sensors. All nodes are adept of communicating with the BS directly. At any point of time, all the nodes have data to send and nodes located close to each other have co-related data. The cluster head (CH) can perform data aggregation and data dissemination.

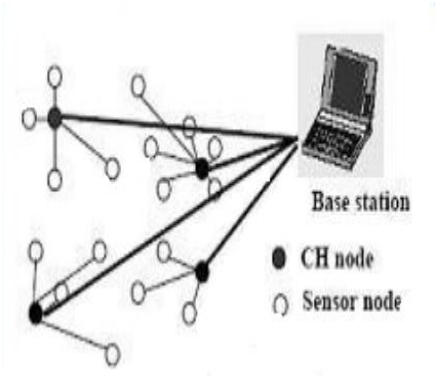


Figure1: LEACH Protocol Architecture

**Distributed Energy Efficient Clustering (DEEC) protocol**

In DEEC [2] protocol all nodes use the initial and residual energy level to designate the cluster heads. DEEC appraisal the ideal value of network lifetime to reckon the reference energy that each node should expand during each round. In a two-level heterogeneous network, where two categories of nodes, m. N advanced nodes with initial energy equal to Eo(1+a) and (1 − m)N normal nodes, where the initial energy is equal to Eo. Where 'a' and 'm' are two variables which curb the nodes percentage types (advanced or normal) and the total initial energy in the network $E_{total}$.

**Energy Aware Multi-hop Multi-path Hierarchical (EAMMH) Protocol**

EAMMH routing protocol was developed by inducing the features of energy aware routing and multi-hop intra cluster routing [3]. The operation of the EAMMH protocol is broken up into rounds where each round begins with a set-up phase, when the clusters are organized, followed by a steady- state phase, when data transfers to the base station occur. The below flow chart describes the overview of the protocol initially the user has to give the input which is in the form of number of nodes.

For the nodes generated, their positions are randomly assigned and displayed. Once the nodes are deployed, every node uses the neighbor discovery algorithm to discover its neighbor nodes. Using the cluster head selection algorithm cluster heads are selected among the nodes. These cluster heads broadcasts the advertisement message to all its neighboring nodes and thus clusters are formed with a fixed bound size. Each node in the cluster maintains routing table in which routing information of the nodes are updated. DRAND (Distributed Randomized time slot assignment algorithm) method is used; it allows several nodes to share the same frequency channel by dividing the signal into different time slots. The cluster head aggregates the data from all the nodes in the cluster and this aggregated data is transmitted to the base station.

**Multi-Hop Gateway Energy Aware Routing (M-GEAR) Protocol**

In this paper, we assume S sensors which are deployed randomly in a field to monitor environment. We represent the$i^{th}$ sensor by $S_i$ and consequent sensor node set S= $s_1$, $s_2$...$S_n$ .We assume the network model shown in Figure 2.

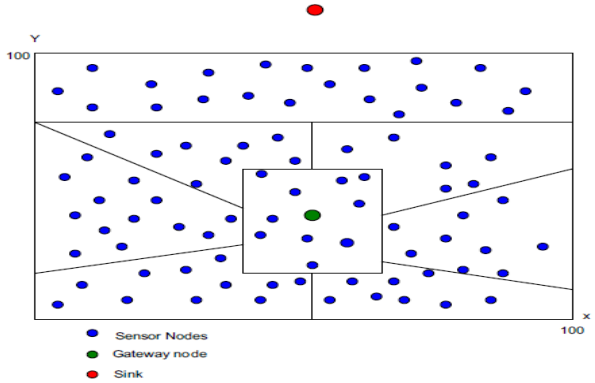

Figure 2: Network Model

- We deploy the BS far away from the sensing field. Sensor nodes and the BS are stationary after deployment.
- A gateway node is deployed in the same network field at the center of the network. Gateway node is stationary after deployment and rechargeable.
- We use homogeneous sensor nodes with same computational and sensing capabilities.
- Each sensor node is assigned with a distinctive identifier (ID)Flow Chart
- Periodically the base station starts a new round by incrementing the round number.
- Selects cluster heads on the basis of leach protocol with probability 0.1 and the CH should not be more than 10 in number, in each round. In each round a sensor node elects itself as a cluster head by selecting a random number to compare to the threshold value.

The threshold $T(n)$ is set as: $T(n) = \{P / 1 - P * (r \bmod 1/P)\}$ if n belongs to G, if not its 0. P is the desired percentage of cluster heads, r is the current round, and G is the set nodes that have not been cluster heads in the last (1/P) rounds.

- As soon as a CH is formed, it selects a gateway node which lies closest to it.
- Make Clusters by allocating the cluster head to each node of the network on the basis of minimum distance between nodes to Cluster head (CH).
- Sensor nodes wake up, senses data, and forwards sensed data to respective CHs.
- The CHs aggregates data receiving from all cluster members and then send data to the gateway nodes on the basis of one-to-one communication.

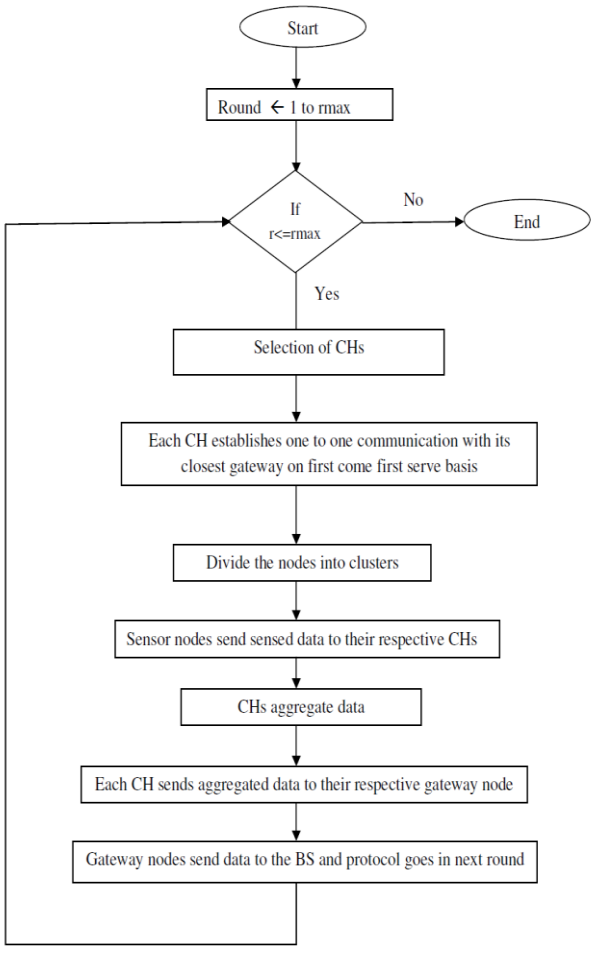


Figure 3: M-GEAR Flow Chart

- Now the gateway nodes further send the data to the BS and protocol goes in next round till the last round is not encountered.

## III. SIMULATION SETTINGS

In order to assess the performance of our proposed protocol, our own selves simulated proposed protocol using MATLAB. Consider a wireless sensor network with 100 nodes dispersed randomly in 100m × 100m field. A gateway node is set up at the interior of the sensing field. The BS is located by far from the sensing field. Both gateway node and BS are stagnant after deployment. Consider packet size of 4000 bits. Let us compare proposed protocol with LEACH protocol. To assess performance of proposed protocol with LEACH, ignore the effects caused by signal collision and interference in the wireless channel.

**Table 1: Presents the radio parameters**

| Parameter | Value |
|---|---|
| EO | 0.5J |
| $E_{elec}$ | 5nJ/bit |
| Efs | 10pJ/bit/m2 |
| Emp | 0.0013 pJ/bit/m4 |
| Eda | 5pJ/bit |
| Message size | 4000 Bits |

## IV. PERFORMANCE PARAMETERS

In this section, represent performance metrics. In this work, evaluated two performance parameters given below.

- Network lifetime: It is the time interval from the start of the network operation till the last node die.
- Throughput: To evaluate the performance of throughput, the numbers of packets received by BS are compared with the number of packets sent by the nodes in each round.

## V. RESULTS & DISCUSSIONS

In this section, we show the simulation results. We run extensive simulations and compare our results with LEACH.Network LifetimeIn figure 4, 5 show the results of the network lifetime. Nodes are premeditated dead after consuming 0.5 Joule energy. M-GEAR protocol attain the longest Network lifetime. Because of the energy consumption is well distributed among all nodes. Network is cleft into logical regions and two of them are further separate into clusters. M-GEAR topography balance energy consumption among sensor nodes. On other hand, in LEACH, nodes die hurriedly as stability period of network ends. It is not an indisputable that predestined CHs in LEACH are distributed an evenly throughout the network field. Accordingly, there is a possibility that the selected CHs will be potent in one region of the network. Hence, some nodes will not have any CHs in environs. Fig 4 shows interval plot of network lifetime with 99% confidence interval. Note that, the results of M-GEAR protocol are statically different and perform well.

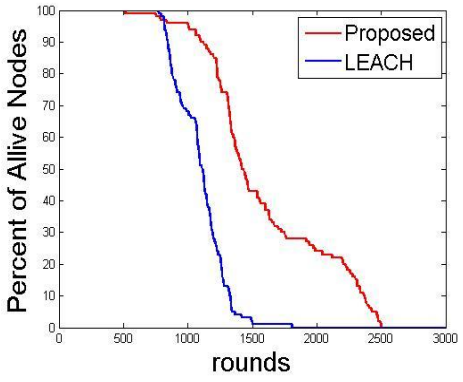


Figure 4: Interval plot- Analysis of network lifetime interns of alive nodes

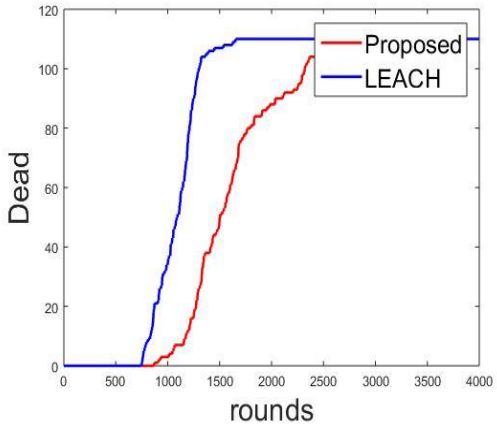


Figure 5: Interval plot- Analysis of network lifetime interns of dead nodes

**Throughput:** Average packets sent to BS are assessed through capacious simulations. Simulation results of M-GEAR protocol depict throughput. Interval plots of M-GEAR and LEACH in figure 6 clearly shows the performance of both protocols. To calculate throughput, speculate that CHs can communicate willingly with gateway node. A simulation result shows an increase throughput of 5 times then a LEACH. Sensor nodes nearby gateway send their data directly to gateway; equivalently nodes nearby BS transmit data directly to BS. Sensor nodes in both regions devour less transmission energy therefore; nodes sojourn alive for longer period. More alive nodes subsidize to transmit more packets to BS.

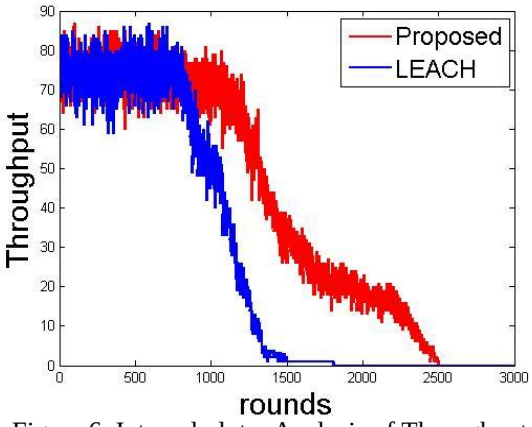


Figure 6: Interval plots- Analysis of Throughput

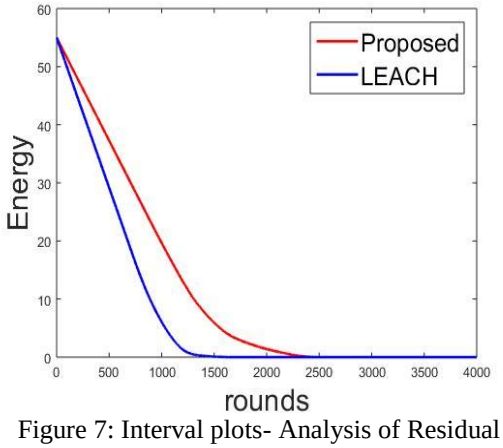


Figure 7: Interval plots- Analysis of Residual Energy

Residual Energy of M-GEAR is very high compared with the LEACH protocol demonstrated in figure 7. The comparison of statistic results is shown in table2.

Table 2: Comparison Results of routing protocols at 1000 rounds

| Technique | Alive Nodes | Dead Nodes | Throughput | Residual Energy |
|---|---|---|---|---|
| LEACH | 69 | 31 | 45 | 8 |
| MSIEEP | 18 | 82 | 31 | 2 |
| EAMMH | 64 | 26 | 52 | 17 |
| Proposed | 96 | 4 | 68 | 26 |

## VI. CONCLUSION

In this paper, an energy-aware multi-hop routing protocol using gateway node to minimize energy consumption of sensor network. In this work, divide the network into logical regions. Each region use different communication hierarchy. Two regions handling direct communication topology and two regions are further separate into clusters and use multi-hop communication hierarchy. Each node in a region determine itself as a CH independent of other region. This technique buoy better distribution of CHs in the network. Simulation results reveal that the proposed protocol performs well compared to LEACH, EAMMH & MSIEEP. Further in this work, study the three performance metrics: Network lifetime, Residual energy and throughput.

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## REFERENCES

[1] W.Heinzelman, A.Chandrakasan, and H.Balakrishnan, ”Enegy-efficient routing protocols for wireless microsensor networks,” in Proc. 33rd Hawaii Int. Conf. SystemSciences(HICSS), Maui, HI,Jan.2000.

[2] L. Qing, Q. Zhu, M. Wang, "Design of a distributed energy-efficient clustering algorithm for heterogeneous wireless sensor networks". ELSEVIER, Computer Communications 29, pp 2230-2237, 2006.

[3] Monica R Mundada, V CyrilRaj and T Bhuvaneswari. “Energy Aware Multi-Hop Multi-Path Hierarchical (EAMMH) Routing Protocol for Wireless Sensor Networks” European Journal of Scientific Research ISSN 1450-216X Vol. 88 No 4 October, 2012

[4] Valerie Galluzzi and Ted Herman “Survey: Discovery inWireless Sensor Networks” International Journal of Distributed Sensor Networks Volume 2012.

[5] I.F. Akyildiz, W. Su, Y. Sankarasubramaniam, E. Cayirci, Wireless sensor networks: a survey, Computer Networks, Volume 38, Issue 4, 15 March 2002, Pages 393-422, ISSN 1389-1286, 10.1016/S1389-1286(01)00302-4.

[6] Liu X. A survey on clustering routing protocols in wireless sensor networks Sensors(Basel). 2012;12(8):11113-53. Epub 2012.

[7] NitishaGarg and SohanGarg ”A characteristics study of routing protocols in Wireless sensor Network” , 27 june 2015, Vol.5, No.3.

[8] Mohammed Abo-Zahhad, sabah M. Ahmed, Nabil sabor and shigenobusasaki, ”Mobile sink-Based Adaptive Immune Energy-Efficient clustering protocol for Improving the lifetime and stability period of wireless sensor networks ” IEEE sensors Journal, VOl,. 15, NO, 8, August 2015.

[9] Siva D. Muruganathan, Daniel C. F. Ma, Rolly i. bhasin, Abraham O. Fapojuwo”ACentralized Energy-Efficient routing protocol for wireless sensor networks”, IEEE Radio communication, March 2005.

[10] D.Mahmood, N. Javaid, S. Mahmood, S. Qureshi, A.M.Memon, T.Zaman ”MODLEACH:A variant of LEACH for WSNs”

About The Authors

Mr. **V. MOHANA GANDHI** is presently pursuing his M.Tech in Digital Electronics and Communication Systems in Electronics and Communication Engineering Department, AITAM, Tekkali. His areas of interest are Digital Electronics and Communication Systems. He has attended for one international conference. The author may be reached at gandhi3809@gmail.com.

M.V.H. BHASKARA MURTHY is presently working as Associate Professor in the Department of Electronics and Communication Engineering, Aditya Institute of Technology And Managament, Tekkali, Srikakulam District, India. Mr. Murthy obtained B.E. from Andhra University and M.Tech from JNTU Hyderabad in 1993 and 2006

respectively. He is pursuing his Ph.D., in the area of Wireless Communications from JNT University Kakinada, India. He has 16 years of teaching and 7 years of Industrial experience. He handled various subjects at Undergraduate and Post Graduate levels. He published more than fifteen technical papers in National and International journals and conferences. He has membership in MIE.The author may be reached at mvhbmurthy@gmail.com.

M. LAKSHMU NAIDU is presently working as Sr.Assistant Professor in Electronics and Communication Engineering Department, AITAM, Tekkali. He is pursuing his Ph.D in GITAM University, Visakhapatnam. He completed his M.Tech from JNTU Kakinada in the Dept. of Electronics and Communication Engineering with specialization Digital System Computer Electronics. He has 10 experience years in teaching. The author may be reached at laxman.naidu@gmail.com.