COMPARATIVE PERFORMANCE ANALYSIS OF TEEN SEP LEACH EAMMH AND PEGASIS ROUTING PROTOCOLS

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Abstract: *Advancement in wireless sensor network (WSN) technology has provided the opportunity of small and minor-cost sensor nodes with potential of sensing various arrangements of physical and environmental conditions, data processing, and wireless communication. The consequence of diversity of sensing effectiveness is in the excess of application areas. However, the originality of wireless sensor networks requires extra effective approach for data forwarding and processing.*

In WSN, the sensor nodes have a finite transmission range, and their refining and storage potential as well as their energy systems are also restricted. Routing protocols for wireless sensor networks are responsible for maintaining the routes in the network and have to establish reliable multi-hop communication under certain situations. In this work, a survey of routing protocols for Wireless Sensor Network and compare their strengths. One of the prime design points for a sensor network is maintenance of the energy available in each sensor node. Expanding network lifetime is critical in wireless sensor networks. Many routing algorithms have been developed in this regard. Out of all these, clustering algorithms have gained a lot of relevance in increasing the network lifetime thereby the efficiency of the nodes in it. Clustering provides an sufficient way for prolonging the lifetime of a wireless sensor network. This work elaborately compares five renowned routing protocols namely, TEEN, SEP, LEACH and EAMMH, PEGASIS for several general scenarios, and brief analysis of the simulation results against known metrics with energy and network lifetime being major among them. In this research work the results and observations made from the analyses of results about these protocols are presented.

Keywords: sensor networks, Energy, Nodes, Lifetime.

1. INTRODUCTION

The aim of routing protocols is to determine of convenient routes that remain on the enterprise network, build routing tables and make routing decisions. There are two elementary routing protocol types specify plentiful different routing protocols defined with those two types. Link state and distance vector protocols comprise the primary types. Distance vector protocols advertise their routing table to all directly connected neighbors at regular frequent intervals using a lot of bandwidth and are slow to converge. When a route becomes unavailable, all router tables must be updated with that new information. The issue is with every router having to communicate that advanced information to its neighbors, it takes a high time for all routers to have a ongoing definite view of the network [1].

2. METHODOLOGIES

Routing protocols in Wireless Sensor Networks (WSNs) indicate on data dissemination, limited battery power and bandwidth constraints in order to facilitate efficient working of the network, thereby increasing the lifetime of the network.

LEACH (Low Energy Adaptive Clustering Hierarchy) is designed for sensor networks where an end-user wants to remotely monitor the environment. In such a situation, the data from the individual nodes must be sent to a central base station, often located far from the sensor network, through which the end-user can access the data. There are several desirable properties for protocols on these networks:

- Use 100's - 1000's of nodes
- Maximize system lifetime
- Maximize network coverage
- Use uniform, battery-operated nodes [2]

Conventional network protocols, such as direct transmission, minimum transmission energy, multi-hop routing, and clustering all have drawbacks that don't allow them to achieve all the desirable properties. LEACH includes distributed cluster formation, local processing to reduce global communication, and randomized rotation of the cluster-heads. Together, these features allow LEACH to achieve the desired properties. Initial simulations show that LEACH is an energy-efficient protocol that extends system lifetime [2].

TEEN (Threshold Sensitive Energy Efficient Sensor Network Protocol) In this design, at every cluster adjustment time, in inclusion to the attributes, the cluster-head broadcasts to its members, ***Hard Threshold (*HT*)***: This is a threshold cost for the sensed attribute. It is the absolute cost of the attribute beside which, the node sensing this cost commitment switch on its transmitter and report to its cluster head. ***Soft Threshold (*ST*)***: This is a slight shift in the cost of the sensed attribute which triggers the node to shift on its transmitter and transmit [3]. The nodes sense their environment continuously. The first time a framework from the attribute set reaches its hard threshold cost, the node switches on its transmitter and sends the sensed data. The sensed cost is stored in an internal variable in the node, called the *sensed value (SV)*. The nodes will adjacent transmit data in the current cluster period, only when *both* the following conditions are true [4]:

1. The current value of the sensed attribute is greater than the hard threshold.
2. The current value of the sensed attribute differs from *SV* by an amount equal to or greater than the soft threshold.

Whenever a node transmits data, *SV* is set equal to the current value of the sensed attribute. Thus, the hard threshold tries to reduce the number of transmissions by allowing the nodes to transmit only when the sensed attribute is in the range of interest. The soft threshold further reduces the number of transmissions by eliminating all the transmissions which might have otherwise occurred when there is little or no change in the sensed attribute once the hard threshold.

SEP (Stable Election Protocol) a heterogeneous-aware protocol to prolong the time interval before the death of the first node (we refer to as stability period), which is crucial for many applications where the feedback from the sensor network must be reliable. SEP is based on weighted election probabilities of each node to become cluster head according to the remaining energy in each node [5].

PEGASIS (Power-Efficient Gathering in Sensor Information Systems), which is near optimal for this data gathering application in sensor networks. The key idea in PEGASIS is to form a chain among the sensor nodes so that each node will receive from and transmit to a close neighbor. Gathered data moves from node to node, get fused, and eventually a designated node transmits to the BS. Nodes take turns transmitting to the BS so that the average energy spent by each node per round is reduced. Building a chain to minimize the total length is similar to the traveling salesman problem, which is known to be intractable [6].

EAMMH (An Energy Aware Multi-hop Multi-path Hierarchical) routing protocol was developed by inducing the features of energy aware routing and multi-hop intra cluster routing. 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. It organizes the sensor nodes into clusters and forms a multi-hop intra-cluster network. It establishes multiple paths from each sensor node to the cluster head and provides an energy aware heuristic function to choose the optimal path.

3. RESULTS

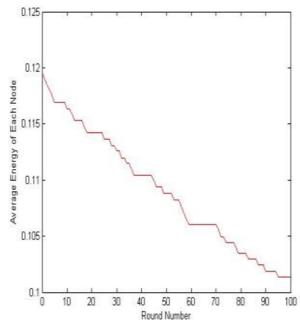
Simulation and Analysis of Results

TEEN, SEP, LEACH, PEGASIS and EAMMH are simulated using MATLAB. The parameters taken into consideration while evaluating these techniques are as follows.

- Round Number vs Number of Dead Nodes (with variation of probability)
- Round Number vs Average Energy of Each node (with variation of probability)
- Round Number vs Number of Dead Nodes (with variation of number of nodes)
- Round Number vs Average Energy of Each node (With variation of number of nodes)
- The set of results represent the simulation of protocols at 0.01 and 0.05 probability that is the percentage of total nodes which can become cluster head is 1% and 5% of the total number of nodes.

A. Implementation Results of Protocols for 0.01 Probabilities with average energy per round vs round no.

This section shows the results of different approaches and compares the quality of enhanced images. Following are the results of enhancement algorithms for the techniques discussed in previously.



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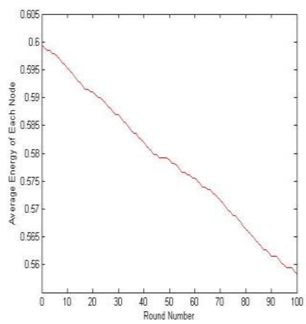

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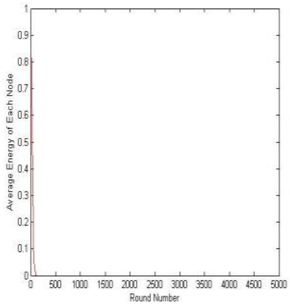

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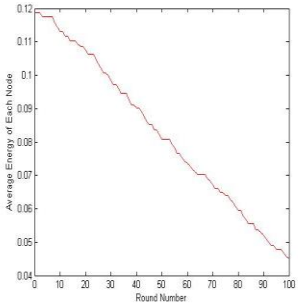

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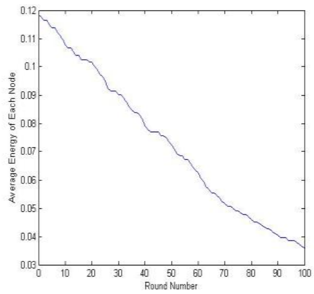

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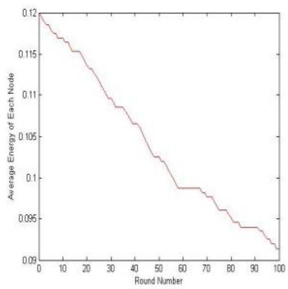
Figure 3.1 (a,b,c,d,e): Average energy of each node with probability of 0.01 of 100 nodes of TEEN, SEP, PEGASIS, LEACH and EAMMH



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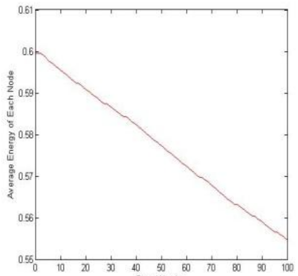

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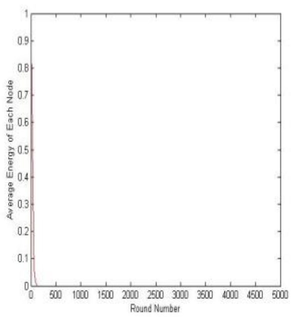

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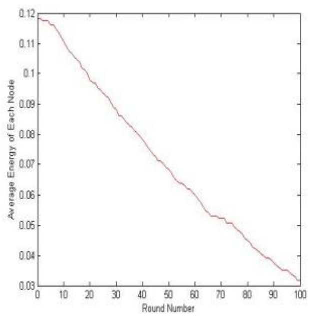

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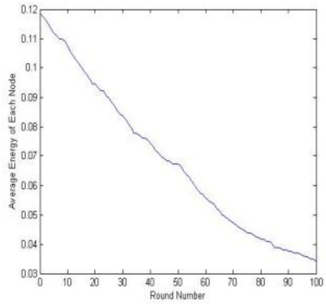

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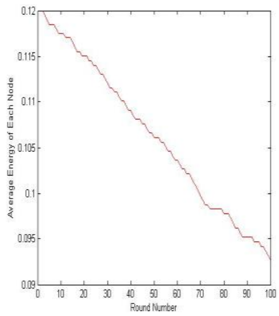
Figure 3.2 (a,b,c,d,e): Average energy of each node with probability of 0.01 of 150 nodes of TEEN, SEP, PEGASIS, LEACH and EAMMH

B. Implementation Results of Protocols for 0.05 Probabilities with average energy per round vs round no.

This section shows the results of different protocols and compares the energy at different nodes.



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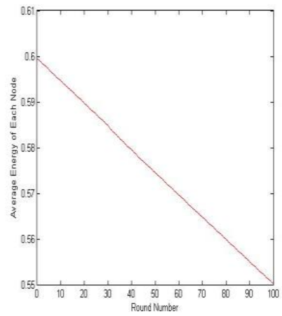

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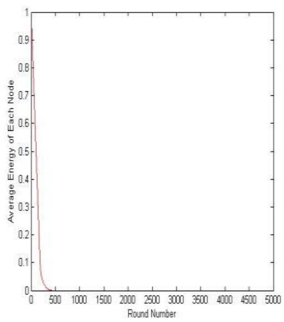

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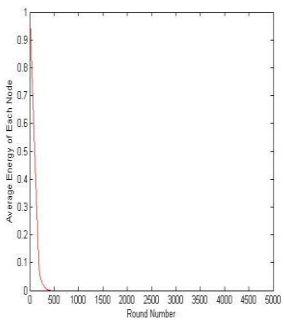

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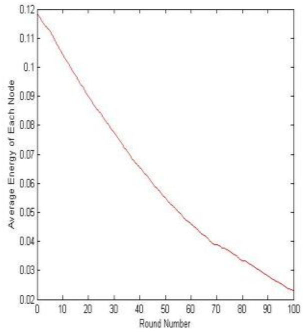

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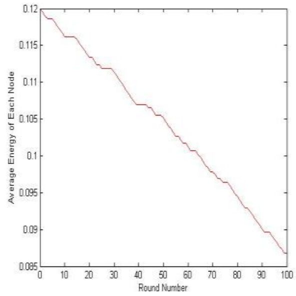

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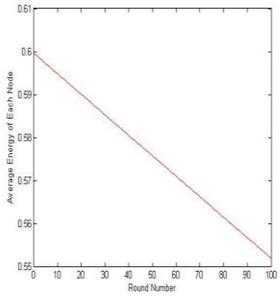

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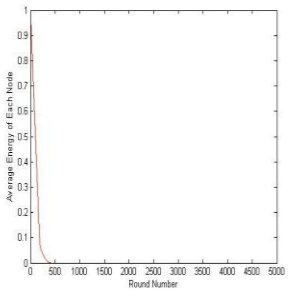

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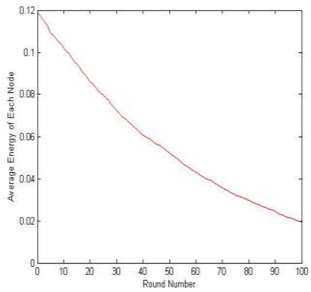

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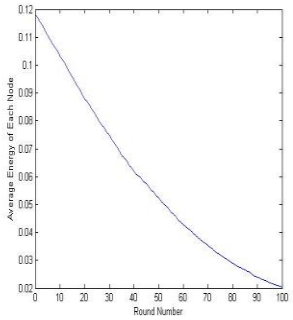

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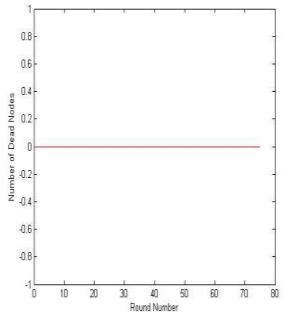
Figure 3.4 (a,b,c,d,e): Average energy of each node with probability of 0.05 of 150 nodes of TEEN, SEP, PEGASIS, LEACH and EAMMH

C. ***Implementation Results of Protocols for 0.01Probabilities with No. of Dead nodes vs. round number***



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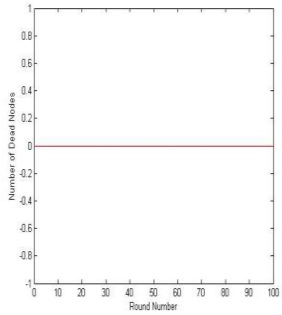

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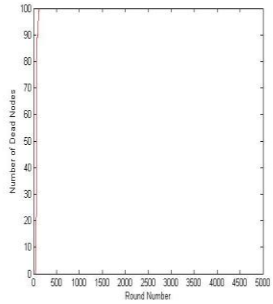

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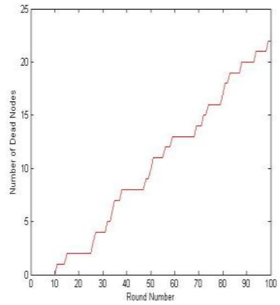

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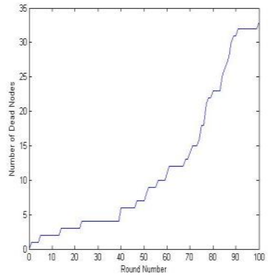
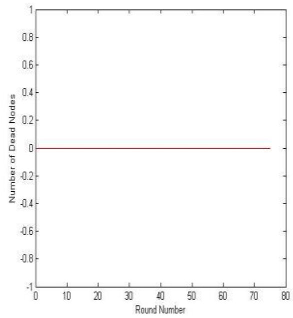


(e)

Figure 3.5 (a,b,c,d,e): Number of dead nodes with probability of 0.01 of 100 nodes of TEEN, SEP, PEGASIS, LEACH and EAMMH

D. Implementation Results of Protocols for 0.05 Probabilities with No. of Dead nodes vs. round number



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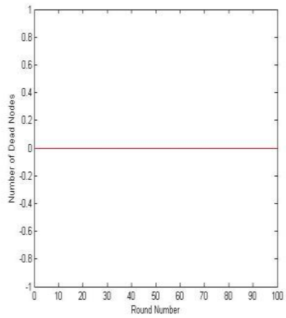

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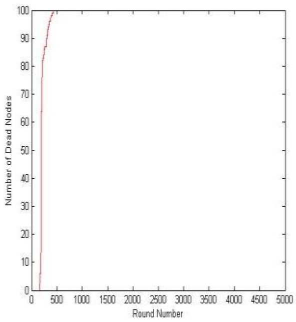

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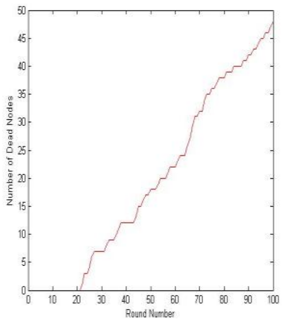

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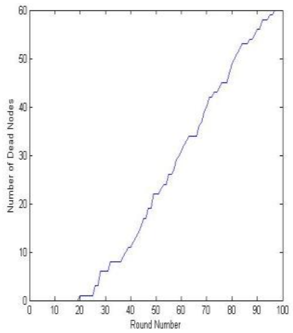

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Figure 3.6 (a,b,c,d,e): Number of dead nodes with probability of 0.05 of 100 nodes of TEEN, SEP, PEGASIS, LEACH and EAMMH

4. CONCLUSIONS

In this paper we 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 performs 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.

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