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Energy Efficient Hybrid Leach Protocol on WSN Using Different Clusters

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ABSTRACT: -

Sensors nodes in WSNs' applications are battery constrained thus innovative techniques are needed to eliminate energy inefficiency that shorten the network lifetime. There is dead node identification problem during the transmission of data because at that time path is not identified. Another problem is the network life time problem due to the redundancy. During the transmission energy is lossed, so there is energy consumption problem. There is NP-hard scheduling problem that we have seen in the literature survey. Another problem is the more bandwidth and less network life time problem. When a node becomes more aggressive at the time of transfer and previously it was not in the cache memory, the other node is bound to receive a packet from it and in such a way it can cause damage to existing routes. To implement Hybrid Algorithm for routing in Wireless sensor network using CH-leach and DEEC. To ACO and LEACH protocol on wireless sensor network using Clustering. CH-Leach Protocol, an approach of algorithm proposed, this proposed research used number of connection in cluster, and for each cluster head (CH) communicate with base station, however the selection of the cluster head based on the number of cluster on the network gird area, this method allow the network to adopted the best scenario to extend life time of the network, different ways of cluster are formed, in order to avoid the condition that one cluster will contain large of connection nodes and the rest is not, the maximum number of the cluster head is chosen in different scenario to test the network coverage. a series of experiments on different scenarios were implemented and tested. The life time of the network in CH-Leach shows major extension compared to CH-Leach, Deec protocols and proposed protocol. The main aim of this work was to design and implement a protocol which enhance exiting protocols in order extend the Life Time of Network. Further directions of this study will be deal with clustered sensor networks with more than two levels of hierarchy and more than three types of nodes. For energy consumption in wireless sensor network EEUC protocol, zone-divided and energy-balanced clustering routing protocol (ZECR) is used to enhance this work.

Keywords: - Energy, Sensor, WSN, Leach, packet, data etc**.**

I. Introduction

Wireless sensor networks (WSNs) have been identified as one of the most important technologies for the 21st century. The tiny, low cost and low power sensors are able to communicate within a short range and work together to form a sensor network for gathering data from a field. [1]

These sensors have data processing and communication capabilities. They have also enabled us to monitor and collect data in any environment. They sense the conditions in which they are surrounded and transform their data to electronic signals. The electronic signals are transmitted over radio waves to the base station (BS). [2]

Processing such electronic signals reveals some valuable characteristics of that environment. The usefulness of WSNs is more noticeable when they are used in inaccessible areas since there is no need to adhere to a specific network structure. Another unique feature that represents a significant improvement over traditional networks is the cooperative effort of sensor nodes [3].

The recent advances in wireless technologies have enabled the smaller and less expensive products which enhance communication speed significantly. Since early 1990s, the research on wireless sensor networks has intensified due to important applications they support such as target tracking and remote environmental monitoring. Two examples of applications of WSNs include biomedical health monitoring [11, 12] and natural disaster relief [13]. Annually, numerous workshops and conferences with focus on WSNs are being held.

Components and Characteristics

Wireless Sensor Networks consist of hundreds or thousands of nodes. Since most of the times the position of the sensors does not need to be pre-determined, they randomly deployed in any inaccessible area. For measuring the properties of the environment, in which they are located, they can be equipped with various sensors such as optical, thermal or mechanical. Having an onboard processor enabled this type of network to carry out some computations and transmit the required data instead of transmitting the raw data. Figure shows a typical WSN with nodes scattered in the field [4].

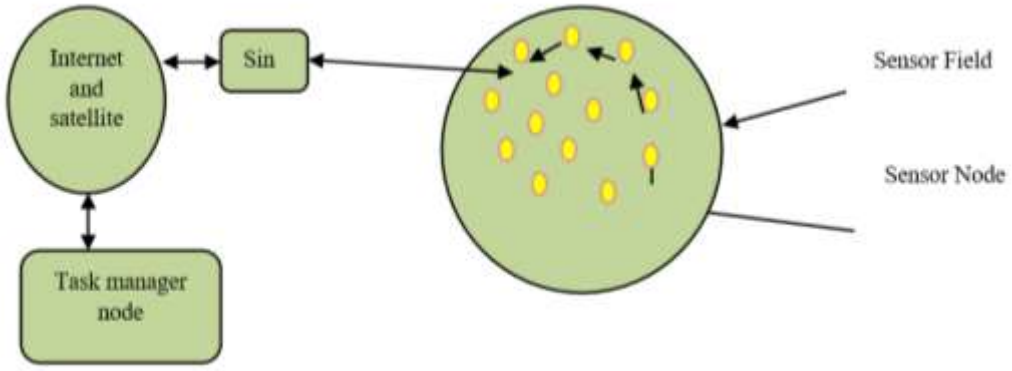

Figure 1: Sensor nodes scattered in a field [1]

In Figure 1. the sensor field is the total area covered by sensor nodes. Each of the sensor nodes shown in Figure 1.1 has the ability to sense the environment parameters. When node A transmits data to the base station it follows multi-hop routing protocol. Node A transmit data to node B which then transmits to node C. Node C then forwards the data to Node D. Finally node E aggregates its own data with data sent from nodes A, B, C and D and then sent it to the base station. In this type of the network sink (base station) has more computational, power and communication resources and acts as gateway between the sensor nodes and other type of networks such as internet or satellite

II. LEACH: Low-Energy Adaptive Clustering Hierarchy

LEACH [9] is designed for sensor networks where an end-user wants to remotely monitor the environment. It is a clustering-based protocol, self-organizing that uses randomization to distribute the energy load uniformly among the sensor devices in the network. Thus LEACH utilizes randomized rotation of the cluster head (CH) position to distribute the energy to all nodes pertaining to its group evenly. It uses localized coordination to robustness for dynamic networks and incorporates information aggregation (or fusion) into the routing protocol to decrease the size of data that needs to be transmitted to the base station (BS) intern reducing energy dissipation to prolong the nodes lifetime. CHs normally lose more energy compared to regular nodes. Hence, it is necessary to carry outer clustering at regular intervals in order to choose nodes with higher energy to serve as CHs, thus distributing the energy uniformly on all the sensor nodes. LEACH is completely distributed and requires no global knowledge of network.

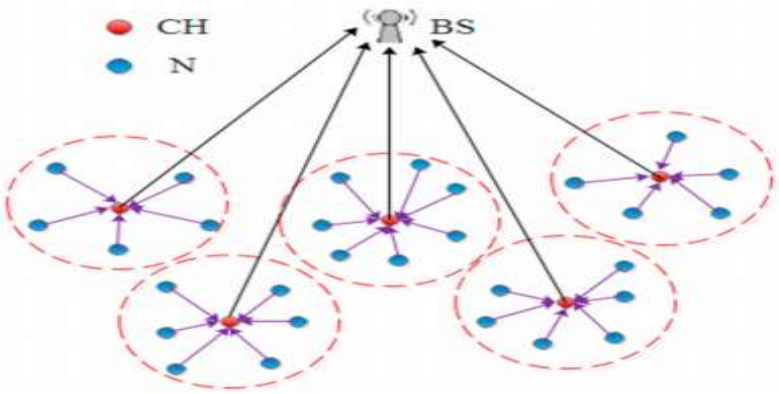

Figure 2: The topology of Wireless Sensor Networks (WSN) using the Low Energy Adaptive Clustering Hierarchy (LEACH) protocol [4]

LEACH-C: LEACH-Centralized

A cluster scheme out of LEACH and developed LEACH-C is to use a Centrally Controlled algorithm to establish clusters. The Base Station (BS) receives data from each and every node about their local information and energy status. According to author the sensor nodes may get their present location information by using a global positioning system (GPS) receiver, which must be activated at the beginning of each and every round. The cluster with sufficient node will involve in CHs selection. Soon after the selection of CHs, the message will be broadcasted to all belonging sensor nodes. Each of the member nodes, excluding the CHs, determines its TDMA slot for the data transmission. Then, the sensor node will go to rest (sleep) till other team members transmit data to its cluster head.

LEACH-F: LEACH with Fixed clusters

Again the same authors [10] improvised this algorithm as LEACH-F (LEACH with Fixed clusters). LEACH-Fis depending on clusters that are derived once - and then fixed. To decide clusters, LEACH-F employs the same centrally controlled cluster formation algorithm as LEACH-C. The CHs position rotates among the member nodes within the cluster.

EECS: Energy Efficient Clustering Scheme

Energy Efficient Clustering Scheme which has a cluster head election. In this a definite number of nodes participates and elect their CH purely based on nodes residual energy status. That is candidate nodes sends its candidature to all member nodes which are in its radio range and checks for most powerful node with more energy and if it find some node ,it withdraw its candidature from the competitions. If node it will become the cluster head. In this cluster formation stage each and every CHs sends out a broadcast message across the sensor network and let the sensor nodes decide which CHs to join. The decision of these nodes purely depends on distance cost from the sensor node to the CH and distance cost from the CHs to the Base Station (BS).

HEED: Hybrid Energy-Efficient Distributed Clustering

A multi-hop clustering algorithm for WSNs, which employs a distributed algorithm that can converge quickly with low overhead, is called HEED. HEED uses an iterative cluster formation algorithm, where sensors assign themselves a "cluster head probability" that is a function of their residual energy and a "communication cost" that is a function of neighbor proximity. The Clustering Head (CH) formation is purely determined on residual energy of the node and intra cluster communication cost of the node that it want to join the respective cluster. The advantages of HEED are that sensor nodes only require neighborhood data to form the clusters, the algorithm terminates in O(1) iterations, the scheme ensures that every sensor nodes is part of just one single cluster, and the cluster heads (CH) are well-distributed. HEED has advantage over generalized LEACH, i.e., LEACH randomly selects cluster heads (CHs), which results in a quicker death of some sensor nodes [12]. HEED avoids quicker death with better distributing cluster heads throughout the network.

DEEC (DISTRIBUTED ENERGY EFFICIENT CLUSTERING)

DEEC, this protocol is designed for heterogeneous wireless sensor network, cluster-head selection is determined by probability according to the remaining energy of each nodes and average energy of the network. Nodes which have more remaining energy have more probability to become cluster-head than nodes have less remaining energy.

IMPROVED LEACH PROTOCLS

ED-LEACH [14] studied Euclidean distance between nodes to improve location of cluster heads in a region, due to random deployment of the nodes which become placed closed or sometimes far away from each other. A new cluster-head selection method for Leach. The remaining energy of nodes and the protocol has two level of operation alike to that on Leach, introducing a random delay before sending ADV messages by cluster-head nodes made it better for cluster to join the process which results in 17% of the reduction in cluster-head but no unreachability nodes are mention.

LEACH-CE (Leach-Centralized Efficient)

This protocol although the improvement is made to leach, but still the nodes with highest energy in region will become a cluster-head, due to nodes that chosen with less energy in some round will die sooner. Leach-CH in setup phase choose the higher nodes as cluster-head in each round, this will eliminates the average life time of the network. ME-LEACH also based on LEACH, and more an energy efficient compare to original LEACH, by reducing the communication distances between sensor nodes, but this achievement comes by powerful radio which will not work efficiently on large scale networks.

Leach has been improved in various areas, both in setup and steady phase, for instance cluster-head selection, cluster formation algorithms and energy reduction. There for this work aims to apply a concept conserving energy overall and using it to enhance Leach protocol in terms of novel cluster-head selection.

III. Methodology

In this section we discuss the network modeling and the proposed routing method DEEC, CH- LEACH and Hybrid routing Protocol in detail. We have created a network with randomly deployed nodes N. We have taken the area of 100 square meters. We have computed the distance d of all the nodes from their neighbors and we have compared their distance with the threshold th value of distance, so that they could be connected only when their distance is less than or equals to the threshold value. We have used this algorithm to make it sure that all the nodes are connected with a minimum distant value.

To find the optimal route in the large coverage set of nodes. If source node and destination nodes come under coverage set, then transmission will take place, otherwise again path searching will done.

Algorithm

Step 1: Create a Network creation with following

1. Network. height=100

2. Network. Width=100; N=Total_Nodes.

3. For each n′ in N

counter = 1;

x= rand (1, 1)*xm.

y = rand (1, 1)*ym.

Node. name (n) = counter; counter = counter + 1;

Endforeach

4. Cov_set = [ ]; //it would contain the limited area node.

for i =1 to N

cov_count=2;

for j=1: N

if (i! =j) // a node cannot compute distance to itself

d = √ ((CL (m).x-SN (i).x) ^2 + (CL (m).y-SN (i).y) ^2);

t= (p/ (1-p*(mod (rnd, 1/p))));

end if end for end for

Above algorithm describes the node deployment in the whole network. In proposed network 100*100 network development takes place with coverage set = 1.

Step 2: Find the path

1. For i=1: Network.Simulation.Rounds

2. Source=Initialize. Source;

3. Source.Id=Node.name (source); Path= [ ]; Pathelement=2; Path [1] =Source;

4. Source.Packet.count=100;

5. Destination.Id=Node.name (Destination);

6. Current_cov_set_source=cov_set (source.Id,:)dest_found=0; possible_nodes=[ ];

7. While (dest_found! =1)

8. For each all n in current_cov_set

If(x(all n)>xloc(Source.Id) && (x(all n)-xloc(Destination.Id) < 0

Possible_nodes [possiblenoedcount] = all n;

Possiblenodecount+=1;

Endif

9. Selection=possible node count*Random;

10. Selected_node=Possible_nodes [selection];

11. Possible_Nodes=[ ]; Path(Path element) = selected_Node

12. End

Step 3: Set the different energy.

Step 4: Apply the random election of normal and advance Node.

Step 5: Apply the counter to count the distance between nodes, clusters and Base station and apply distance formula to find the distance.

Step 6: Choose the multiple paths with energy

S(i).E=S(i).E- ((tx_energy)*(4000) + multipath*4000*(dist*dist*dist*dist));

Step 7: Apply the CH-LEACH , DEEC and Hybrid Routing Protocol for transmission of data from Base station to different nodes through BS.

Step8: Find the first dead, half dead and full dead nodes during transmission of data from BS to nodes and clusters.

Step 9: Calculation of Energy dissipated based on distance

if (distance>do)

S(i).E=S(i).E- ((ETX+EDA)*(4000) + Emp*4000*(distance*distance*distance*distance));

end

if (distance<=do)

S(i).E=S(i).E- ((ETX+EDA)*(4000) + Efs*4000*(distance * distance));

end

Step 10: Draw Varnoi diagram for network.

Step 11: if Step 2 to Step 9 is completed then

Calculate

Rho1 = (number of bit error)/ (total number of bit send)

Bit Error Rate = Rho1 +Em

p= N/R

N is the number of bits, and

R is the rate of transmission (say in bits per second)

Delay=abs(p +Em),

Remaining_Energy = ETx (k, d) = Eelec * k + Єamp *k * d2, d>1

ERx (k) = Eelec * k

Energy Consumption= mean(Remaining_Energy)+Em

and

Size of the packet= abs ((abc) +Em)*packet

Transmission time =datatxperiod*10

Throughput= (Size of the packet / Transmission time)

End

IV. RESULTS &DISCUSSION

In this the different problems are faced and all these problems are resolved with different Objectives. The Complied result snap shorts are given below:

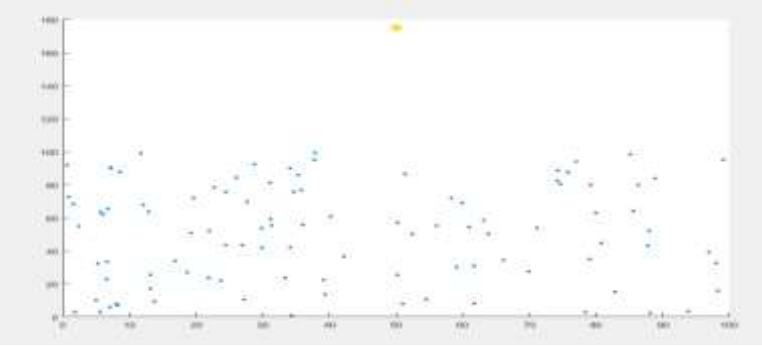

Figure 3: Deployment of sensor nodes

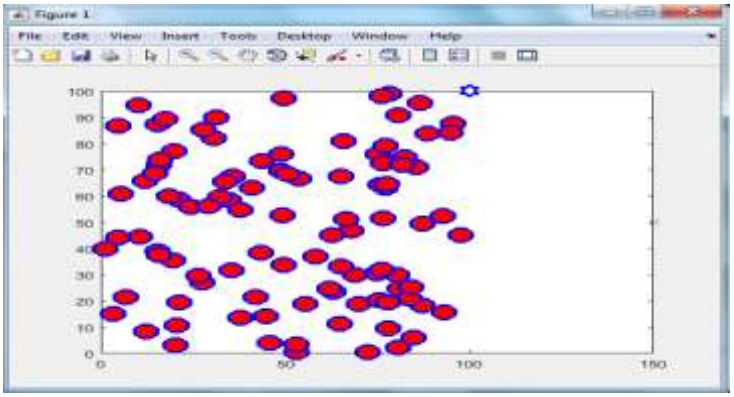

Figure 4: Nodes and Base Station on 100x100 areas

The figure 3 and figure 4is the deployment of sensor nodes on wireless sensor network. In these figure nodes are displayed in red and blue color and base station is marked with yellow and white color. All these nodes are used to transfer the data through base station.

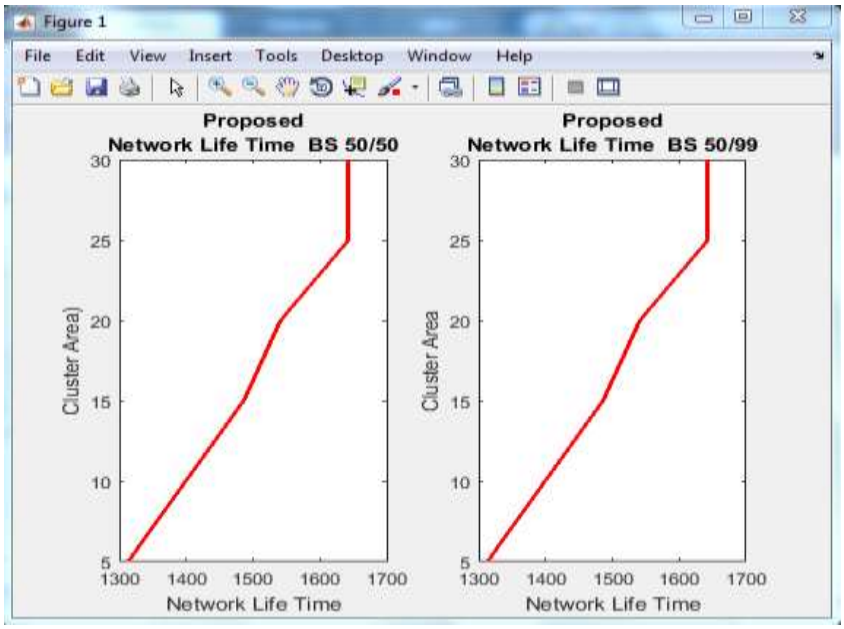

Figure 5: Network life time for 50/50 and 50/99 BS position

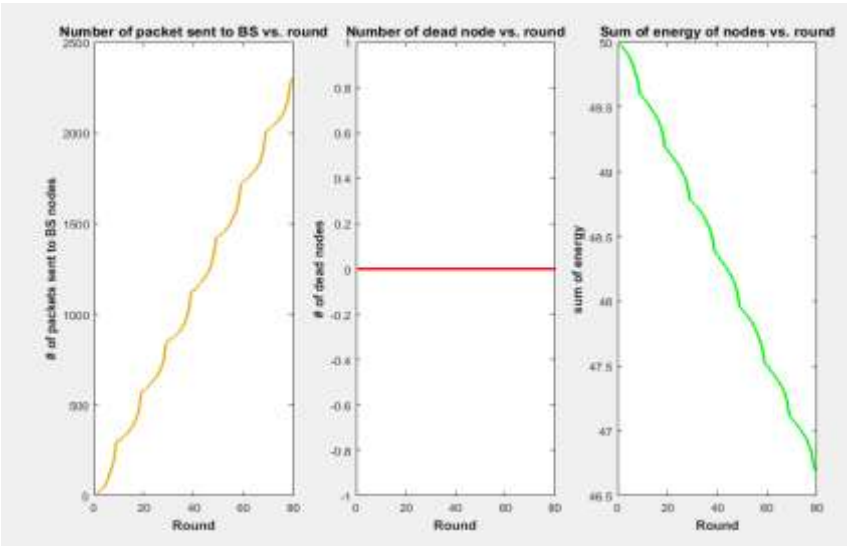

Figure 6: Packet to BS nodes vs. Round

The figure 5 is the representation of network life time with different position of Base station. In this figure the position of base station is 50/50 and 50/99. The graph is plotted between cluster area and network life time. The figure 6 is the representation of packet to Base station node vs. round. In this figure 3 graphs are plotted. The first graph is the number of packet sent to BS vs. number of rounds. The second graph is the Number of dead nodes vs. round and the third figure is Sum of energy of nodes vs. round. In this figure 1st the energy is high and then it is decreased , then the remaining energy is 45 joule.

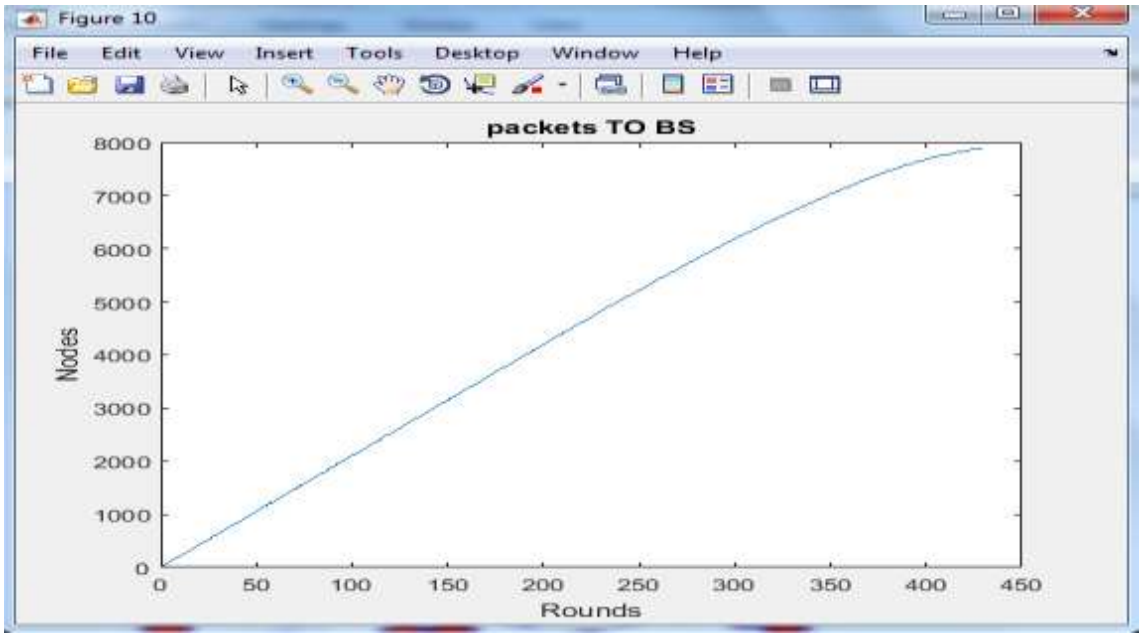

Figure 7: Nodes vs. Round

The figure 7 is the representation of packet to base station. In this figure nodes are represented on y-axis and the numbers of rounds are represented on x-axis. In this figure the packet are transferred on different round within different nodes. Initially the rounds value and nodes value is zero and then it is increased by every round and packet is transferred on every round and every node.

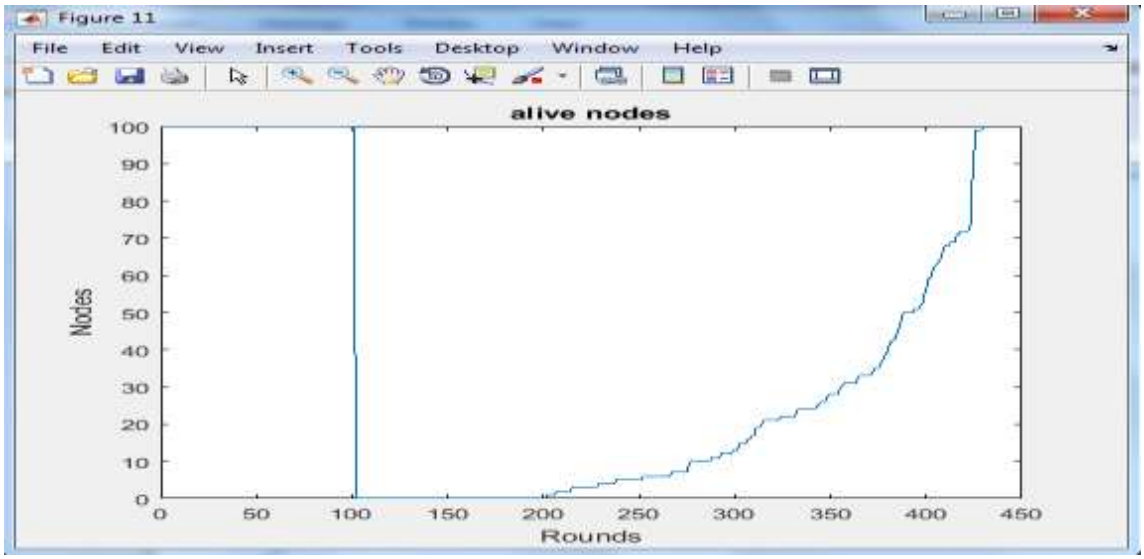

Figure 8: Alive Nodes vs. Round

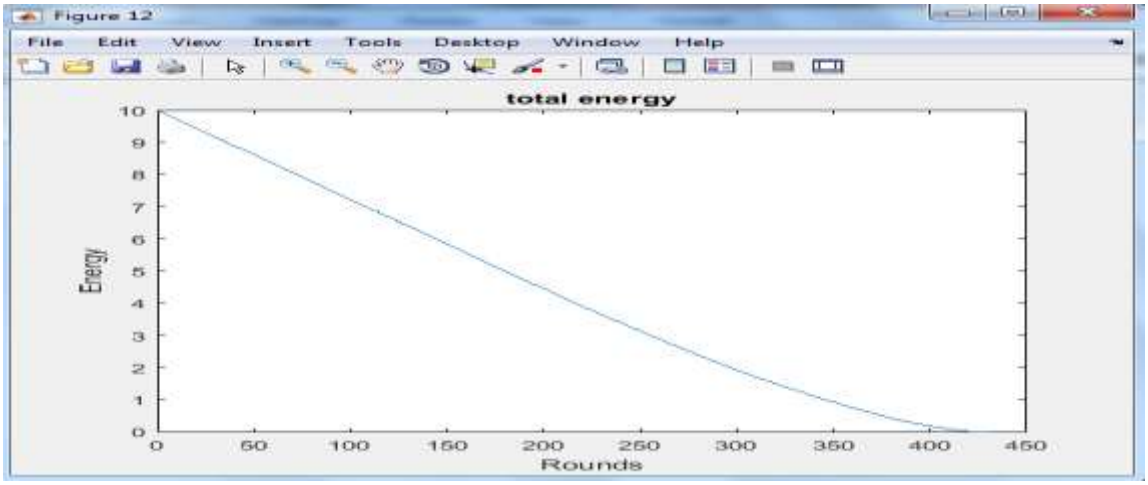

Figure 9: Total energy vs. Round

The figure 8 is the alive nodes on network with respect to round, because when energy is decreased then the nodes going to become dead. In this figure 1st round all nodes are alive and along with the round 100 it is zero and then it became re-energetic and be alive on network. The figure 9 is the total energy on WSN. In this figure first the nodes have high energy on network and then it is decreased when the numbers of rounds are increased.

Table 1: Network life time of different protocols

Number of Cluster Area	Network Life Time					
	DEEC		CH-Leach		Proposed work	
	BS 50/50	BS 50/99	BS 50/50	BS 50/99	BS 50/50	BS 50/99
5	1228	1177	1330	1310	1332	1313
10	1227	1198	1412	1397	1413	1399
15	1224	1204	1543	1484	1545	1486
20	1229	1198	1553	1539	1557	1541
25	1249	1261	1695	1641	1697	1643
30	1228	1216	1756	1641	1759	1642

Table 2: Life Time of the Network on Different Cluster area, Base Station located on (50/50).

Number of cluster area	Number of Rounds		
	DEEC	CH-LEACH	Proposed work
5	1177	1300	1410
10	1200	1388	1460
15	1200	1450	1490
20	1200	1500	1550
25	1250	1620	1670
30	1210	1635	1690

Table 3: Life Time of the Network on Different Cluster area, Base Station Located on (edge).

Number of cluster area	Number of Rounds		
	DEEC	CH-LEACH	Proposed work
5	1210	1350	1400
10	1205	1400	1450
15	1200	1570	1600
20	1220	1580	1620
25	1230	1630	1670
30	1210	1780	1820

V. CONCLUSION

Wireless sensor network (WSN) can be considered as an uncommon breed of wireless ad hoc networks with decreased or no mobility. These networks combine wireless communication and negligible on board computation facilities with detecting and monitoring of physical and environmental phenomena. Sensing is a technique used to gather information about a physical object, process, environmental phenomenon or the occurrence of events (e.g. changes in the state such as rise or drop in temperature). These little sizes, low-cost sensor gadgets have inserted on board radio transceiver, micro-controller, memory, power supply and the real sensors. There is dead node identification problem during the transmission of data because at that time path is not identified. Another problem is the network life time problem due to the redundancy. During the transmission energy is lossed, so there is energy consumption problem. There is NP-hard scheduling problem that we have seen in the literature survey. Another problem is the more bandwidth and less network life time problem. When a node becomes more aggressive at the time of transfer and previously it was not in the cache memory, the other node is bound to receive a packet from it and in such a way it can cause damage to existing routes to implement Hybrid Algorithm for routing in Wireless sensor network using CH-leach and DEEC. Analyze the result being obtained with different parameters like Network lifetime, average energy, dead nodes and number of rounds. In this work novel strategies for both topology and a routing algorithm are proposed to maximization of the network life time. CH-Leach Protocol, an approach of algorithm proposed, this proposed research used number of connection in cluster, and for each cluster head (CH) communicate with base station, however the selection of the cluster head based on the number of cluster on the network gird area, this method allow the network to adopted the best scenario to extend life time of the network, different ways of cluster are formed, in order to avoid the condition that one cluster will contain large of connection nodes and the rest is not, the maximum number of the cluster head is chosen in different scenario to test the network coverage. a series of experiments on different scenarios were implemented and tested. The life time of the network in CH-Leach shows major extension compared to CH-Leach, Deec protocols and proposed protocol. The main aim of this work was to design and implement a protocol which enhance exiting protocols in order extend the Life Time of Network.

Further directions of this study will be deal with clustered sensor networks with more than two levels of hierarchy and more than three types of nodes. For energy consumption in wireless sensor network EEUC protocol, zone-divided and energy-balanced clustering routing protocol (ZECR) is used to enhance this work.

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