Energy Efficient-Long Life LEACH Variant Protocol for MANET Environment

Sugandh
Dept. of Computer science and Engineering
OIST,Bhopal, INDIA

Prof.**Rakesh Panday**
Assistant Professor
Dept. of Computer science and Engineering
OIST,Bhopal, INDIA

Abstract: - MANET is an autonomous system which is connected with wireless technology. now in the current time and a huge demand of MANET devices like mobile phones, palmtop, laptop, cellular phones, PDA,s and other devices this technology is consist consisting lots of very small sensor nodes. This technique is able to monitor both the environment for civil and military applications. In this technique communication protocol which consists important effect of energy indulgence of such networks.Mobile adhoc network consist a cluster that have mobile nodes and these are capable to communicate with others without any special infrastructure.

I. INTRODUCTION

Mobile Ad hoc Networkis a group of wireless nodes, which rapidly and suddenly moves, for one end to another end without any centralized controlling. Mobile adhoc network communicate with other nodes without any infrastructure. MANET allow nodes to share or exchange data with different types and characteristics among various nodes, if the sender or receiver nodes are not lie in the range of transmission with each other, with emendate effect intermediate nodes will considered as the middle router for the contactconnecting the nodes [5][6].

The wireless sensor which is idea is fully scalable and networked, able to handle fault tolerance, absorb small power, software is programmed very smartly, effective and able of speedily data acquisition, reliable andaccurate over long term, cost little to purchase and required no real maintenance. There are some techniques to know the efficient route that is wisely collect the data among several nodes. As well as, that is the most significant MANETs due to the sensor nodes of less power.Leach is taken as one of the finest and famous routing protocol which utilized the routing based on cluster and able to reduce the consumption of energy;Low Energy Adaptive Clustering Hierarchy (LEACH) [7],[8] is very useful protocol of routing in the field of wireless mobile sensor networks.The main motive from cluster of the sensor nodes that is based on the signal which is received and its strength that utilizes the cluster head of local category just like sink routers. Conventional network protocol, like direct transmission, minimum transmission energy, multi-hop routing, and

clustering also have drawbacks which are not desirable. LEACH consist the cluster information that is dispersed, various processes that know how to decrease the communication which is global and randomly cycles of the clusters. Such kinds of features give permission to get the expected properties. MANET contains mobile nodes which depend on the battery operated. As well as, it contains inadequate battery resources. Also topology of this network is active and based on the nodes movement so accordingly and easily alters rapidly and unexpectedly. The alteration of topology directly affects the packet's routing those impacts the overhead, packet loss, and delay. To increase the packets the performance of network, some protocols didn't work effectively in mobile ad hoc network as desired. Hence, routing protocol which is based on energy efficient is used. It is used to search the perfect routes among the various communicating nodes.Micro sensor networks can contain hundreds or thousandsof sensing nodes. It is desirable to make these nodesas cheap and energy-efficient as possible and rely on theirlarge numbers to obtain high quality results. The protocols is designed to get the fault tolerance point in the energy consumption.[9] Additionally, the bandwidth is shared which is limited and wireless as well among the numerous number of sensors in the network, the protocols are also able to perform collaboration which is local to minimize the need of bandwidth. There are many possible models for these micro sensor networks.

- The base station is fixed and located far from the sensors.
- All nodes in the network are homogeneous and energyconstrained.

The classification performed on the aggregated data might be performed by a human operator or automatically. Both the method of performing data aggregation and the classification algorithm are application-specific [10].

The main task of MANET is to grouped and intellect the data from a specified domain, data processes and forward the information directly to the specified node. But this process isn't able as the need of transmission energy that significantly enhances and proportional to the distance of the square. Consequently, the routed data use multi-hop communication method. To get the effective task, the individuals need the energy development and to set up the paths among the sensor nodes anddata sink. As several

alternative routes to a destination node may exist, therouting decision has an important affect on load balancing, end-to-end reliability and latency. The path selection must be lifetime of thenetwork is maximized. Due to resource constraints, MANET poses considerablechallenges ranging through network organization, topology discovery, communication scheduling, routing control and signal processing [11].
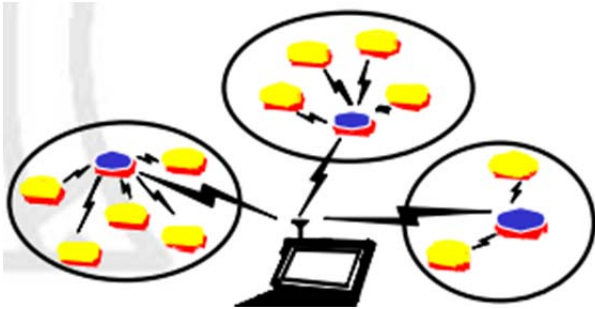

Fig 1: LEACH Structure

The networks of mobile ad hoc are not able to centralized one as no static infrastructure exists. Peer-to-peer communication exists between nodes. The reason of multi-hopping network is able to cause a node of sensor to contact along with another node which is beyond the range through the middle nodes.Therefore,MANET is able to facilitate the flexibility of inserting and eliminating the network nodes. It can be classified in distinct clusters and known as clustering. Every cluster consist sensor nodes that is selected as the head of cluster "cluster head/ CH" and other ones called CM – Cluster members. The entire nodes of sensor collaborate in work among the other nodes for serving the request. The head of cluster gather the information via its members and the aggregation of data is accomplished by the cluster head to diminish the redundancy and ahead to the sink. The cluster head absorbs the energy more than the members of cluster; the workload of cluster heads is distributed among all nodes in MANET by rotating their roles to equalize energy consumption called Cluster Head rotation.

II. APPLICATIONS

There are some of the applications of LEACH [12]:

a) Data delivery model:
The model of Data delivery eliminates the fault tolerance issue via facilitating the path for saving the data packets from various nodes and failures of link. [14]. It seriously the routing protocol in MANET, especially with regard to use the limited energy of the node, for security purpose [15], energy consumption and route immobility.

b) Scalability:
The system which said for scale if it is effectiveness increases
Whenever any of the hardware is adding and also relative to the added capacity[16]. The schemes of routing put efforts for motes collection in the ad hoc network that is

scalable and able to talk back to the events take place in the environment.

c) Resilience:
In certain circumstances, the issue of environment or the sensors of battery consumption significantly stop and not able to work properly [19]. Hence, this issue is eliminated by searching the way when such nodes are pause and doesn't operate.

d) Production cost:
The single node's price is easily satisfied the entire price of the sensor network. Hence, the price of every sensor node must be less.

e) Operating environment:
The network is easilyarranged inside the machinery which is large at the ocean base. It is contaminated via the chemicals or biological ways in the battle field at the back of the enemy line like warehouse or a building.

f) Power consumption:
The need of network for long life is restricted storage capacity of sensor nodes and directed to find the different scope to alleviate power consumption. Sidra Aslamshared thoughts for various techniques like protocol of power aware, optimization of cross-layer and harvesting methods that can able to help the power consumption constraint in MANETs [4]. In such networks, the functionalities of few nodes like sending and data router can create an issue of power failure due to topology which generally need a latest path for transferring the data and reconstruct the network.

g) Data aggression/fusion:
The actual purpose of data aggregation is to collect the information from several resources via utilizing the functionalities like average, min, max for getting the effective energy and optimized traffic protocols so thatnetwork lifetime is enhanced [2].

III. ENERGY EFFICIENCY WITH LEACH

The heads of cluster are completely depend on the sensor nodes as these are taking the duty of data communication to the base station, dissipate more energy. Therefore the character of cluster heads along with the vitality to alter just like the consumption of energy at a very high level in data transmission to the base station is distributed to all the sensor nodes in the system. LEACH -C used centralized approach and considers the remaining energy. The operation of LEACH head and LEACH head-C is controlled by rounds, which consist of two stages setup stage and steady state stage.

The heads of cluster are grouped in a phase which is setup and situated the TDMA schedule to the specific CMs.whereas in the stable state, the communication of data between the CMs and the cluster head is performed. A CM in a cluster is active only at the time of situated slot,though cluster heads are active all the time in steady state phase.

LEACH head performs periodic cluster head selection; the energy utilization burden of the cluster heads is also shared. The stable position phase is seriously longer as compared to the setup phase duration. This study represents that LEACH facilitatesa factor of consumption of energy than the architecture of routing protocol which is flat. Major drawback of such protocol is,it is not considerable in the field of residual energy of sensor nodes and assumes zero energy consumption for the formation of cluster [1] [17].
In LEACH-E protocol, initially the nodes contain equal amount of energy and same probability of becoming the cluster head. Later on the first round, the level of enrgy alters and varies to every node. Hence, the quantity of residual energy of every node is start selecting the nodes of cluster head. The nodes with highest residual energy are preferred on rest of the nodes. LEACH-E enhance lifetime of network by balancing the load of energy among the different in the network [18] [13].

The LEACH is based on a hierarchical clustering structure model and energy efficient cluster based routing protocols for sensor networks. This model use a cluster head in the local network and also with the same process for the another network which is making another local cluster heads, then sender send the information or data to the local heads the heads sent the same information or the data to another heads, other head receive the data, there after cluster head send information to the end nodes of receiver, this process will take least energy for the process. A final conventional procedure for networks which are wireless isClustering, where every node is arranged in distinct clusters to communicate along with a base station that is local. Also, such kinds of local stations can easily transmit the information to the overall stations like global one which is accessible by the end-user.This will quickly drain thebattery of the nodes and reduce the system lifetime.

However, the responses in this protocol happen at the base station. If this station is close to the entire nodes or can say that the needed energy for receiving the information is large, this may be anacceptable (and possibly optimal) method of communication.A final conventional procedure for such networks isclustering, where nodes are arranged in several clusters and contact with the local base station. These stations send the information to the global station whereas users can access it without any problem. Lets discuss about LEACH which is organized by its own, the clustering method is adaptive which uses the random techniques to spread the load of energy midst the sensors in wireless network. In this network, different nodes arrange automatically in number of clusters, single node act as a station which is local or can say that cluster head. If the clusters were selected and fixed though the entire life of system and in traditional algorithms, it is very simple to check the sensors that are not lucky and chosen via the cluster heads that die as soon as possible. As well as, it stops all nodes for lifetime which belongs to the clusters. Therefore, it involves the rotation which is randomized of the cluster that has higher energy level and revolves amongst the sensors orderly and no need to drain an

individual sensor's battery. Additionally, it performs the fusion of data which is local to compress the significant quantity of information which transmitted from the several clusters to the base station. Furthermore, the energy indulgence and increase the lifetime experience of system.
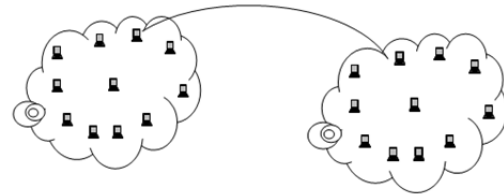

Figure 1 *Low-Energy Adaptive Clustering Hierarchy*

IV. ADVANTAGES AND DISADVANTAGES OF LEACH

Advantage of LEACH [14] [15]
1. The heads of the cluster collect entire data that goes to decrease the overall network's traffic.
2. When individuals check the network, so there is a solely routing hop from nodes to cluster head it results in saving energy.
3. It increases the sensor network's lifetime.
4. In this, location information of the nodes can establish the clusters which are not come under the list of required items.
5. This network is absolutely spread and it is not controllable or can say that, no need to control the data from base station and without global knowledge of the network.

Disadvantage of LEACH
1. It doesn't provide any information related to the clusters in the network.
2. The major drawback of LEACH is when due to any reason Cluster head dies, the cluster will become useless because the data gathered by the nodes that is not able to reach the specific place i.e. Base Station.

The cluster nodes are classified in a random order that gives cluster distribution which is not even. For e.g. some clusters consist more nodes and some containvery less nodes. Some cluster heads at the center of the cluster and some cluster heads may be in the edge of the cluster; this phenomenon can create the enhancement of energy consumption and put an higher affect on the network overall performance.

IV. LITERATURE REVIEW

Energy efficient routing protocols in MANET and classified them according to the approaches employed by each of them for minimizing the energy consumption. The transmission control should be employed when the message between the nodes take place at regular intervals whereas

the load distribution approach is used where the node density or the traffic density is not uniform and hence need is to employ the equal distribution of load to minimize the energy consumption. The approach of power down is utilized at that place where the power of nodes is really low. Therefore, it is easy to use their energy due to the unbalance issue of energy.Hence, the available energy is controlled in mobile ad hoc network and researchable which is accomplished to search the energy efficient protocols. [16]

DAA stands for Data Aggregation and Authentication protocol that aggregate the data recognition which is false and projected by Ozdemir& Cam. If an individual wants to support this aggregation of information, then each node start working of data aggregator's conducted data aggregation and computed corresponding small-sizeverification codes of message for data verification as pair mates. To sustenance the private data broadcast, the sensor nodes amongst the various information need to verify integrity of data on encrypted data instead of plain data. Performance analysis exposed that data aggregation recognized the information which is inserted by up to T and sacrifice the nodes which the uncorrected data will not go beyond the next oneon path. Despite the incorrect information enhances the communication overhead, simulation showed that DAA could reducetransmitted data up to 60% through data aggregation and early false datadetection [19].

Major differences between sensor and ad-hoc networks[17-4]:
- Number of nodes can be orders of magnitude higher.
- Sensor nodes are densely deployed.
- Sensor nodes are prone to failure.
- Frequent topology changes.
- Broadcast communication paradigm.
- Limited power, processing and power capabilities.
- Possible absence of unique global identification per node.

A basic theory to gather the information via the sink node is to sent from the nodes of sensor by multi-hop functionalities. This thing creates two issues which are hotspot in which the sensor points are very close to the sink and run out of the energy which is near as compared to the other nodes.As the result, the network lost its service ability, despite the quantity of residual energy of the nodes. In MANETs, sensors significantly create information and monitor the field. The main operation of this network is meeting which is orderly and send data to the base station for added procedures.

The basic challenge in MANETs is to schedule nodes' activities to reduce energy consumption. This research work focused on deceitful protocols of energy effective for lesser dataratesMANETs, where sensors absorb lot of energy in dissimilar statesof radio(sleeping, listening, receiving, transmitting, and keep idle) and consume energy for state transition.

Katiyar, Chand, Gautam, Kumar, [2] worked on Improvement in LEACH protocol for large-scale MANETs. The LEACH protocol is a hierarchical clustering protocol that provides an elegant solution for such protocols. One deficit that affects the presentation of the procedure is endurance of very large and very small clusters in the network at the similar time. This leads to reduce in life span of MANETs. This research work focused to analyze a new energy proficient clustering protocol (FZ-LEACH) that eliminates the above problem by forming Far-Zone. The collection of sensor nodes and situated at various places in which their energies are lower as compared to the threshold. The outcomes and discussions represent the algorithm of FZ-LEACH and signify in network existence and consumption of energy.

A node in the network is not useful for a long time and the battery stops so we use LEACH. It space out the lifespan of the nodes allowing it to do the only minimum work it needs to transmit data. It has 2 phases: setup phase, where cluster head are chosen and steady phase, in which CH is maintained when data is transmitted between nodes. Goal of LEACH is to increase the life of network. It is clustering based routing protocol minimizes global energy usage by distributing load to all nodes at different point in time.

DSDV, AODV, DSR for better network performance in MANET without much packet loss using simulation on NS2 based on parameters mobility, load and size of the ad hoc network.

Design issues of routing protocols consists of fault tolerance, scalability, production costs, operating environment, power consumption, data delivery models, data aggregation/fusion, quality of service, data latency and overhead, node deployment and classification of protocol based on flat, hierarchical, data centric, location centric, power usages, data aggregation, scalability, overhead, data delivery model, and quality of service. [3]The main purpose in the setup phase is to establish the clusters and choose its head for every cluster via selecting the sensor nodes along with the energy at a maximum level. The stable phase is relatively longer when individuals discuss towards duration as compared to the deals of setup in which information's aggregation. The protocol of this network utilizes the radio model to guess the consumption of energy in transmission of data. Leach contains severalnumbers of associate nodes along with a cluster head. The responsibility of a cluster head is to congregate the data from member node, compress and transmit it to the base station. Every node is provided with a time slot to respond in order to prevent collision.

V. PROPOSED WORK
There are various versions of LEACH protocol. Following section is talking about the proposed work of this article. This article is using the concept of average left energy of the nodes in MANETs.

Figure 1 show the working of the proposed work. According to this figure, after getting initialization and starting of the network the first thing is happened which is energy calculation of every node under cluster? Based on the average energy of every cluster the cluster head is selected. These all process is shown in figure 2.
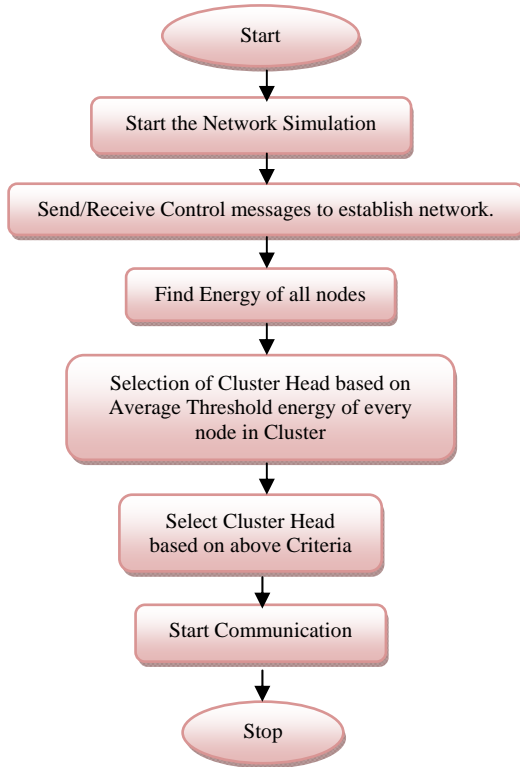

Figure 2: Proposed Architecture

VI. RESULT ANALYSIS

This section is divided into three parts:
1. Simulation Parameters
2. Result
3. Analysis

Simulation Model

Table I: Simulation

Simulation Time	500 seconds
Protocol	LEACH and Energy Efficient LEACH with Threshold
Area:	800 x600
Traffic	TCP/FTP
Channel	Wireless
Operation mode	MAC_802.11
Mobility	Random waypoint
Antenna	Omni directional
IFQ	Queue/DropTail/PriQueue
Nodes	50
IFQLEN	6

This section is dealing with the energy consumption of these nodes in MANET. These energy consumptions are in the percentage f the consumption.

$$\text{Energy Consumptions Ratio} = \frac{EC * 100}{Initial\ Energy}$$

Where EC is energy consumptions.

Total Energy consumption in both the case, it means in existing work and proposed work is shown in table III along with the figure 3.

Table II: Energy Consumption in percentage

Existing Work-Energy Utilization (in %)	Proposed Work-Energy Utilization (in %)
4.98989899	2.353535354
0.034048349	0.026102845
4.853658537	0.200736032
20.86956522	8.815545078
10.91584512	4.555638536
0.02199978	3.780793044
0.253882915	4.166666667
0.263435195	5.6875
0.011640088	0.028710881
1.144444444	2.63024785
2.275	1.48
0.028608211	3.704185079
3.179916318	0.044474094
0.13	0.038885288
7.368542435	2.248077302
0.233918129	1.867538184
6.248948696	4.61313156
3.165645491	7.77567055
2.115787026	0.025281254
9.361382419	0.463471155
0.118413262	3.100859537
11.39877742	2.071625344
0.050106476	0.066688896
7.074313769	0.01176886
2.06031092	0.046224961
7.164179104	0.035735557
4.743114833	0.162828565
0.086701347	0.011650938
16.57496561	0.054247586
13.72767857	0.028216704
0.541711809	5.226093403
0.073349633	3.247788894
0.146359312	
0.174064404	
7.002115106	
0.06667778	
10.63768945	
24.858002	
13.48888079	
8.733058338	
0.02381803	
0.157888801	
0.011645511	
6.530657501	
0.042167405	
0.027181299	
0.314989809	
6.696664902	
7.046541975	

Table III: Comparison of total Energy consumption

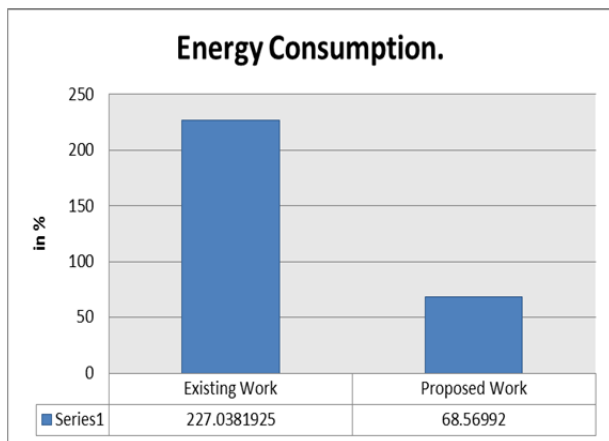| Existing Work	Proposed Work
227.0381925	68.56992

Figure 3: Energy Consumption comparison

V. CONCLUSION

The study of these routing algorithms shows that some of the desirable features of a good energy effective protocol of routing for sensor network are: In proposed variant of LEACH Protocol the nodes have limited energy and it has the more energy consumption as compared to existing Protocol because of cluster head rotation .In LEACH Protocol after a given interval the cluster head are rotated and they also consume energy while rotating so it consume more energy where as proposed average cluster threshold criteria in selecting cluster head. The founded procedure is suitable for the required monitoring via the cluster nodes in network.

REFERENCES

[1] Shilpi Sharma and Prof. SourabhJain,"Simulation Based Comparative Performance Analysis of Routing Protocol over Adhoc Networks Using AODV, TORA and LEACH," International Journal of Innovative Research in Computer and Communication Engineering,Vol. 4, Issue 2, February 2016.

[2] Mr. Hemant Wade and Prof. Jagdish pimple," Survey on Comparative analysis of Cluster Formation and Cluster Head Selection algorithms," International Journal on Recent and Innovation Trends in Computing and Communication ISSN: 2321-8169 Volume: 4 Issue: 4, 2016.

[3] MrunalGavhale and Pranay D. Saraf , "An Algorithm for Intrusion Detection and Prevention in MANET," International Journal of Advanced Research in Computer and Communication Engineering Vol. 5, Issue 4, April 2016.

[4] Mandeep Singh and Mr.Gagangeet Singh," A Secure and Efficient Cluster Head Selection Algorithm for MANET," Journal of Network Communications and Emerging Technologies (JNCET) Volume 2, Issue 2, June (2015).

[5] Singh Mandeep, KaurAmanpreet and AroraTanvi,"HIERARCHICAL ROUTING PROTOCOLS FOR LEACH: A REVIEW," International Journal of Computer Engineering and Applications, Volume IX, Issue V, May 2015, www.ijcea.com ISSN 2321-3469.

[6] Shilpi Sharma, Prof. Sourabh Jain and Prof. ShardaPrashad Patel," Scenario based performance and comparative simulation analysis of routing protocols AODV LEACH & TORA," International Journal of Innovations in Engineering and Technology (IJIET), Volume 5 Issue 4 August 2015.

[7] JayshreeJaunjalkar, NutanDhande and DhananjaySable,"A Comprehensive Performance analysis of energy efficient routing protocol OLEACH in the mobile ad-hoc network," International Journal of Engineering Research and General Science Volume 3, Issue 4, July-August, 2015, ISSN 2091-2730.

[8] KhushbooManohar and A. I. Darvadiya,"Clustering Based Routing Protocol (LEACH Protocol)," International Journal of Innovative Research in Computer and Communication Engineering (An ISO 3297: 2007 Certified Organization) Vol. 3, Issue 4, April 2015.

[9] Bharath Chandra Mummadisetty, AsthaPuri and ShahramLatifi,"Performance Assessment of MANET Routing Protocols,"Int. J. Communications, Network and System Sciences, 2015, 8, 456-470.

[10] RajatKandpal, Rajesh Singh and H L Mandoria,"Analysis on Enhancements in LEACH Protocol for WSN,"SSRG International Journal of Computer Science and Engineering (SSRG-IJCSE) – volume 2 issue 9 September 2015.

[11] Sujeet Singh and AishwaryAgarwal,"Energy Consumption and Performance based Analysis of LEACH-DSR Protocol in MANET," International Journal of Engineering Technology and Applied Science, Vol. 1 Issue 1 February 2015.

[12] RajbirKaur and RupinderKaurGurm,"A Research on Comparison of TCP and SCTP over MANET'S," International Journal of Advanced Research in Computer Science and Software Engineering, Volume 5, Issue 9, September 2015 ISSN: 2277 128X.

[13] M. Rajkumar, Dr. S. Subramanian and Dr. S. Shankar," Internal and External factors based clustering algorithm for MANET," IJET, Vol 6 No 4 Aug-Sep 2014.

[14] Jayshree G Jaunjalkar and Nutan M Dhande,"A Survey on energy efficient routing protocol LEACH in the mobile ad-hoc network," JETIR, Dec 2014 (Volume 1 Issue 7).

[15] Muhammadarshad, mohamad y. aalsalem and farhan a. siddiqui," Energy Efficient Cluster Head Selection In Mobile Wireless Sensor Networks," Journal of Engineering Science and Technology Vol. 9, No. 6 (2014) 728 - 746.

[16] SyyedJavadMohammadiBaygi and MehranMokhtari," Evaluation Performance of Protocols LEACH, 802.15.4 and CBRP, Using Analysis of QoS in WSNs," Wireless Sensor Network, 2014, 6, 221-236 Published Online October 2014.

[17] Khalid Hussain, Abdul Hanan Abdullah, SaleemIqbal, Khalid M. Awan and FarazAhsan," Efficient Cluster Head Selection Algorithm for MANET," Journal of Computer Networks and Communications Volume 2013, Article ID 723913, 7 pages.

[18] SonaMalhotra and Naveen Kumar,"Performance Evaluation of Routing Protocols for Mobile Ad hoc Networks through Simulation," American International Journal of Research in Science, Technology, Engineering & Mathematics, AIJRSTEM 13- 163, 2013.

[19] Shahzad Ali1, Sajjad A. Madani, Atta urRehman Khan and Imran Ali Khan," Routing Protocols for Mobile Sensor Networks: A Comparative Study," 2013.