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Cluster Head Selection using Node Mobility and Energy in (HM-LEACH) Multipath Routing MANET

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ABSTRACT: The battery power or energy of nodes is unnecessary consumes because of link breakage due to energy depletion or nodes rapid motion. The LEACH protocol is only proposed for better energy utilization but it possible to utilize energy more through modified LEACH protocol. The MANET is forming multi-hop connectivity and multi-hop wireless connectivity upholding is very right utilization of battery power could be very much crucial to forming strong network connectivity. As a way to overcome the network from inefficient routing obstacle, this research is proposed specific energy efficient proposed HM-LEACH protocols for Mobile Ad hoc Networks. This proposed HM-LEACH centre of attention of efforts on approach to reduce the energy consumption in communications between mobile nodes. The proposed LEACH mechanism is selects the cluster head (CH) on the basis of minimum node velocity and maximum node energy. Routing is a valuable difficulty in MANET and for that reason the point of interest of this thesis along with the efficiency evaluation of routing protocols. If the energy of a node drains rapidly then its connectivity in its nearby shall be lost. So the be maintenance of connectivity for lifetime is very much difficult so in this research consider the multipath routing mechanism for routing and the path of nodes is selected on the basis of higher energy level. Because of this significance we make an attempt to simulating the routing efficiency of proposed HM-LEACH protocol and normal LEACH protocol in MANET. The performance of these protocols is measures through performance metrics and number of live nodes remaining up to end of network simulation.

Index terms—*MANET, multipath, LEACH, Cluster Head, Energy.*

1. INTRODUCTION

Technological advances achieved in recent years in the field of computer networks have enabled the development of new types of low-cost smart sensors which can be configured to form autonomous networks. These sensor mobile nodes have particular characteristics (low storage capacity, a standalone energy source, etc.). They access the network through a wireless mobile ad-hoc communication interface. They must be robust and need to be able to survive in extreme conditions due to their environment. In addition to environmental constraints, an important constraint is the energy saving (they operate using a battery that can hold a small amount of energy). Indeed, a sensor mobile network cannot survive if the loss of nodes is high as this causes loss of communication due to the large distance between the nodes and affect the overall network performance. So it is very important that the batteries last as long as possible [2].

In this work motive to design the efficient energy based communication and minimum energy utilization technique with low overhead and equal distribution of load between available path that combine work provide strength to increase the network life time and perform best for future mobile ad-hoc communication.

In this paper, we studied various energy based routing protocol of mobile ad-hoc network (MANETs). We also study the importance of energy conservation for improving network life time. In this paper we also describe about our enhanced low energy adaptive cluster hierarchical routing that increase the performance of the network and also minimized the energy consumption from the network, because proposed approach based cluster head are responsible to provide higher energy based path between communicator nodes and also provide efficient inter cluster communication with minimum overhead. Further this proposed approach simulates by the network simulator-2 and analyzes the network behaviour during communication

2. Literature Survey

Abedelhalim Hnini et. al. [1] in his title "Effect of a Node's Death on Behavior of the LEACH Protocol and its Descendants" analyze the different LEACH variation protocol and identifies the pros and cons

of all existing LEACH protocol, author also proposed a approach to enhances the performance based on dead node and end-to-end delay minimization of all existing LEACH protocol.

Bhavna Sharma et. al. [2] has an title ”Energy Efficient Load Balancing Approach to Improve AOMDV Routing in MANET” in this work author proposed energy based multipath routing and compare with AOMDV. During his proposal they analyze result and summarized that proposed work is provide reliable communication with low overhead and load distribution between communicator nodes. but that work further enhances while efficiently energy based route selection process take place and that is fulfil by apply LEACH protocol with AOMDV routing.

Djamila Mechta et. al. [3] proposed “LEACH-CKM Low Energy Adaptive Clustering Hierarchy protocol with K-means and MTE“ in his work they solve the node isolation problem and provide better reliability to every member nodes and also save the energy consumption and efficient utilized the energy where needs. But in further enhanced that work while distributed decision making take place.

Bao Zhenshan et. al. [4] has proposed ”HT-LEACH: An Improved Energy Efficient Algorithm Based on LEACH” in that work they enhance the LEACH protocol with the hierarchical routing based technique, in that technique deploy the cluster using nearest BS and draw arcs with centre at BS, radius of r(i). Then network area will be divided n parts. That mechanism minimized the cluster head overhead as compare to LEACH protocol but hierarchical cluster based routing form more clusters rather than normal LEACH and that is increase end to end delay time for communication, so that work need to enhanced by delay minimization method.

Ningbo WANG et. al. [5] has an title ” An Energy Efficient Algrithm Based on LEACH Protocol” in his proposal they use LEACH-R (low energy adaptive cluster head with residual energy) algorithm and is also divided the work into set-up phase and steady state phase. In the set-up phase, they use an improved threshold to decided which node would become the cluster head, this threshold ensures nodes of higher residual energy have a greater chance of being elected as cluster-head, which effectively balances energy consumption of the network and After the formation of clusters, the select R node from the cluster-head, based on the residual energy and distance from the base station of cluster-head communication established between members and base station. In their work authors analyze the result of the number of alive nodes in different round times and conclude that LEACH-R is better than LEACH. They only analyze single dimension such as alive node, but their work need to enhance by various network aspect that is packet delivery ratio, throughput, overhead, and number of cluster head in different time and comparatively analyze with existing LEACH.

M. Tripathi,, M.S. Gaur, V. Laxmi and R.B. Battula [6] has an title “energy efficient leach-c protocol for wireless sensor Network” in this proposal author enhanced the LEACH protocol with Energy Efficient LEACH-C (EELEACH-C) protocol, in this mechanism base station runs a sorting algorithm to obtain a list of candidate cluster head nodes sorted in descending order with their residual energy. After examining the candidate cluster head nodes it selects those with maximum residual energy and then calculate the quadratic sum of the distances from each cluster heads to its member nodes to find the optimal solution. In this work they identifies that their proposed EELEACH-C perform better than LEACH but their work will enhanced, while combining the proposed work with node speed based cluster head selection under MANET.

Aarti Jain et. al. [7] has proposed “Sink as Cluster Head: An Energy Efficient Clustering method for Wireless Sensor Networks“ in his title author identifies that previous cluster based approach, Cluster-head nodes near to sink ,dissolve more energy because these nodes have to relay data of far off placed nodes. Due to this fast dissipation of energy, energy holes are created near to sink which in turn decreases network lifetime. So that problem resolve by the present energy efficient clustering method and propose to select sink as one of the cluster-heads. By selecting sink as cluster head, the nodes placed near to it can be spared from performing duties of cluster-heads and thus the problem of energy hole creation near to sink can be avoided. The proposed method has been named as energy efficient clustering with sink as cluster head (EEC-SCH). In this proposed (EEC-SCH) compare with LEACH-ERE, LEACH and WCA and conclude that their proposed work increase the network life time as well as more balance and uniform energy utilization from the nodes, but in future that work also enhanced while apply AOMDV routing under proposed routing and

increases the network load balancing factor as well energy utilization.

Jingqing Wang and Xi Zhang [8] proposed "AQ-DBPSK/DS-CDMA Based Energy-Efficient and Interference-Mitigation Scheme for 3D Clustered WCSNs with Minimum Coverage Rate Constraint" in his work they applied the NEW LEACH algorithm based architecture to derive the corresponding minimum sensor density yielding the optimal probability of selecting cluster heads for energy efficiency and interference mitigation. Then, using the Nakagami-*m* model and developed the novel DS-CDMA based AQ-DBPSK modulation scheme to implement the energy-efficient and interference-mitigating wireless communications over they developed 3D clustered WCSNs. Also, derived the optimal data rate to optimize the transmit power and data-rate trade off at each camera sensor node which needs to transmit its observed data. Finally, author conducted the simulations evaluations, and gets proposed schemes significantly outperform the other existing schemes based on energy efficiency and SNR ratio, but that technique require more time complexity because that depends various mathematical calculation so in further need to minimize the time complexity and enhanced them.

Ashlyn Antoo et. al. [9] proposed "EEM-LEACH: Energy Efficient Multi-hop LEACH Routing Protocol for Clustered WSNs" in this work they presented that chooses a multi-hop path with minimum communication cost from each node to the base station. This minimizes cost per data packet. If the cost for direct data transfer is less than the cost for communication via cluster head, nodes send data directly to the base station preventing the nodes near the base station from dying quickly. Since cluster heads are selected according to the residual energy and average energy consumption of nodes, the network lifetime can be prolonged. But that work follow the partial rule of cluster based approach, in further enhanced their work while TDMA based with load balancing routing mechanism are used.

3. PROPOSED MULTICAST ROUTING ALGORITHM

Mobile ad-hoc network is a recent trends of new communication technology and while MANET completely develop than solve the lot of problem's i.e. cost less communication, everywhere and easy deploy, no needs of centralized controller and distributed decision making to strengthen the communication network but now a day MANET face number of challenges i.e. energy issue, security, mobility control, location prediction and radio range etc. from that above point encourage to take the challenge and to provide the some contribution in the field of MANET communication for enhanced the research so in this work aim to design A Combine approach of LEACH and AOMDV and provide the communication with low overhead and low energy utilization in MANET.

Leach protocol one of the best solution for energy management of battery constraint devices, in this work initially deploy the mobile node in random environment with random mobility and set the all initial configuration of mobile node i.e. antenna, Mac standard, routing strategies, energy etc. while that part completion, apply (HM-LEACH) and AOMDV that identifies the best feasible paths between communicator node's. During the route establishment time HM-LEACH executed and allot the rank to the mobile node on the base of movement as well as energy of the node (low mobility, high energy, rank-I and so on) and select rank-I node as a cluster head in particular zone. that process are apply all different zone's and create cluster head's for management of the network for smooth communication. After cluster head selection process head are responsible to establish the multipath between sender to receiver for load balancing and delay minimization with the help of AOMDV routing. And start the communication process but node dynamicity and infrastructure less network arises the problem of communication break done due to node mobility and node dead problem. for that purpose cluster head change in time to time. That mean TDMA (time division multiple access) based cluster head change in every 20^{th} second of periodic time in our work. While the paths are selected, sends the data packet using transport layer agent from sender to receiver and simulate the work with the NS-2 simulator tool. That gives the output files name as trace file and NAM (network animator file), and use AWK (abstract window tool) and retrieve the result from trace file, the result i.e. energy utilization of each nodes, cluster head information, number

of member under the per individual head in every pause time, and transmission and receiving energy use by nodes as well as node motion information from one zone to other, packet delivery ratio and throughput etc.

1.1 **A. Proposed Algorithm:**

In this section proposed the algorithm for low energy consumption and high reliability achieving from the intermediate nodes, who's participated in communication. The algorithm is energy aware mechanism using LEACH protocol and established the route with the help of AOMDV routing. Here the formal way we describe the algorithm in step by step process.

Initialized Parameter:
N: Mobile nodes
Source: S
Destination: D
Radio Range: R_r
Route packet: r_pkt
Energy: e
Cluster head: C_h
Motion of node: m
Energy-protocol: HM-Leach
Routing: AOMDV
Election: Message generation
$N_i \leftarrow$ generate election msg
Broadcast msg to all neighbours
While neighbour in R_r **do**

Compare (mobility, energy)
If min(mobility, m) && max(energy, e) **Then**
$C_h \leftarrow N_j$
End if
End do
Routine: S execute AOMDV
If route found && motion of nodes is slow && e_i is high **Then**
Identifies three best path
Sends Ack to S node
Else
Broadcast the conventional RREQ packet;
End if
If Sender *S* receives an RREP packet **Then**

Send data packets with the selected paths;
Destination *D* receives data
End If
Stop

4. SIMULATION PARAMETERS AND PERFORMANCE METRICS

We use the NS2 Network Simulator. This is an object oriented simulator, written in C++, with an OTCL interpreter as a front-end. The simulator supports a class hierarchy in C++ (also called the compiled hierarchy) and a similar class hierarchy within the OTCL interpreter (also called the interpreted hierarchy). The two hierarchies are closely related to each other; there is a one-to-one correspondence between a class in the interpreted hierarchy and one in the compiled hierarchy. The root of this hierarchy is the class TCL Object. Users create new simulator objects through the interpreter; these objects are instantiated within the interpreter and are closely mirrored by a corresponding object in the compiled hierarchy. The interpreted class hierarchy is automatically established through methods defined in the class TCL Class. User instantiated objects are mirrored through methods defined in the class TCL Object [10].

A. Performances Metrics

The performance of network is evaluated in case of AODV, Byzantine attack and secure IDS scheme.

B. Routing Load

The number of routing packets (RREQ, RREP, and RERR) transmitted per data packet delivered at the destination.

C. Packet delivery ratio:

The ratio between the numbers of packets originated by the application layer to those delivered to the final destination.

D. Average end to end delay:

This is the average of the time taken by the packets to reach the destination in the network. The average time to packets sends by sender and received by receiver is network.

E. Member in Cluster Head:

In the course of the simulation pause time, quantity of member node ménage per cluster head is calculated by way of useless nodes and that relies of TDMA situated slot ***F. Packet loss***
The calculation of number of data packets in network are dropped due to energy depletion and out of coverage or any other reason..

G. Simulation Parameters

The simulation parameters like area of simulation is 800m *600m in transmission range of 550m. Rest of them that are consider for simulation is mentioned in table 1

Table I Simulation Parameter

Area of Simulation	800m x 600m
Simulation Time (sec)	50
Mobile Nodes	500
Radio Range (meters)	550
Transferring Mode	Multi-hop, Multipath
Maximum Speed (ms)	30
Routing Protocol	AOMDV,HM-LEACH
Transport Layer	TCP , UDP
Traffic	CBR, TTP
Application Layer	FTP
Simulation Time (sec)	500
Packet Size	512 bytes

5. Results Discussion

The results of all protocols like ODMRP, MAODV and enhanced version of MAODV i.e. the better channel sense mechanism results are evaluated in this section. The performance of proposed multicast routing proposed MAODV is provides efficient results.

A. Cluster Nodes Alive Analysis

The nodes in MANET are completely dependent on the battery power or energy. If the energy of the nodes are completely deplete then no source is instant available for changing these mobile devices.

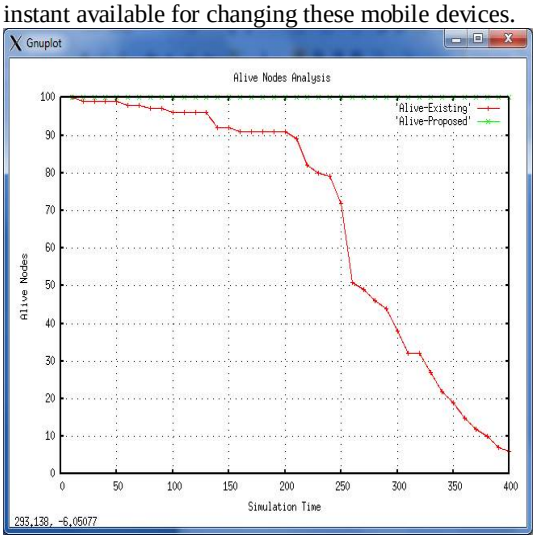

Figure 1. Nodes Alive Analysis

The every communication through nodes are required some energy and by that energy proficient consumption is necessary for long time for working of mobile devices. In this graph we proposed the number of lives nodes analysis of normal LEACH (Existing) protocol and proposed LEACH (Proposed) protocol. In this analysis the quantity of number of survival nodes in including Cluster Heads (CH) and Cluster Members (CM) in proposed LEACH is more that is the indication of fine energy efficient routing and also improves network performance.

B. Cluster Formation and members at each cluster at 400 Seconds

The number of nodes in MANET is continuously moves with random velocity and also the nodes having higher mobility are not established strong connection.

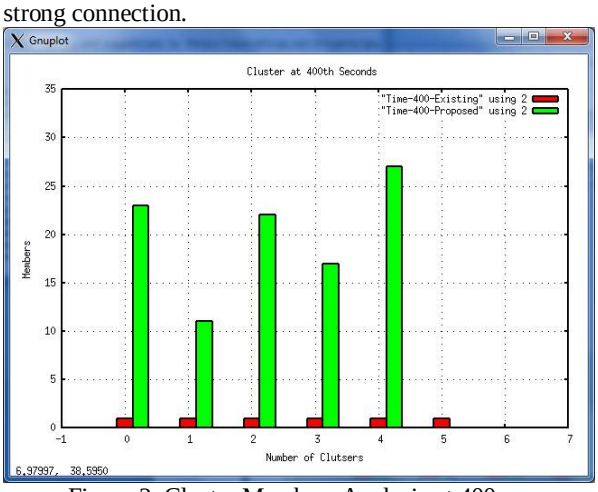

Figure 2: Cluster Members Analysis at 400 Seconds

The CH in network is control the communication of group members and these members are work under the CHs (Cluster Heads). The CH is the node i.e. necessary to survive long time to maintain the communication of cluster members to next CHs members. In this graph the number of clusters and member exist in each cluster analysis of proposed LEACH and existing LEACH is evaluated and examine that the number of members in proposed scheme at the end of simulation time 400 is remaining more as compare to normal LEACH protocol. Here the performance of proposed LEACH is provides enhanced and efficient routing performance to improve energy utilization.

C. Packet Delivery Ratio (PDR) Performance Analysis

The number of nodes are continuously degrades energy resource in transmitting packets, receiving packets and the nodes is sensing for neighbour or in idle state. The numbers of node energy are necessary to utilizes efficiently for proper and enhanced routing performance. The PDR performance is evaluated here to measures the performance analysis of existing protocol and proposed protocol. The proposed LEACH is provides about 99% packets receiving and the original LEACH is provides about 87% of packets receiving. The proposed LEACH is provides the 13% more performance in term of PDR.

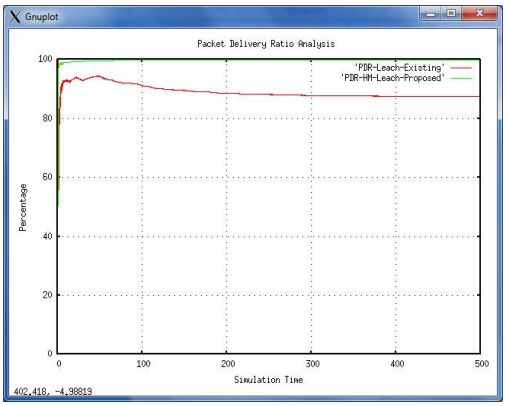

Figure 3: PDR Analysis

D. Routing Packets Flooding Analysis

The number of data packets sending is possible to first established route in between sender and receiver. The control packets or routing packets are flooded by senders to finding the destination. The routing packets are also consumes equivalent energy as consumes by data packets. The multipath protocol is able to establish multiple paths for reliable communication but if the node energy is exhaust completely then variation in path is also possible that improves the routing overhead and packets flooding. In this graph the routing packets flooding of normal LEACH protocol is more and about their quantity is 12400 up to the end of simulation time 500 seconds. The main reason of flooding is to deficiency of energy in network. In proposed LEACH packets flooding quantity is about one third as compare to normal that shows the efficient energy consumption and better routing performance in MANET.

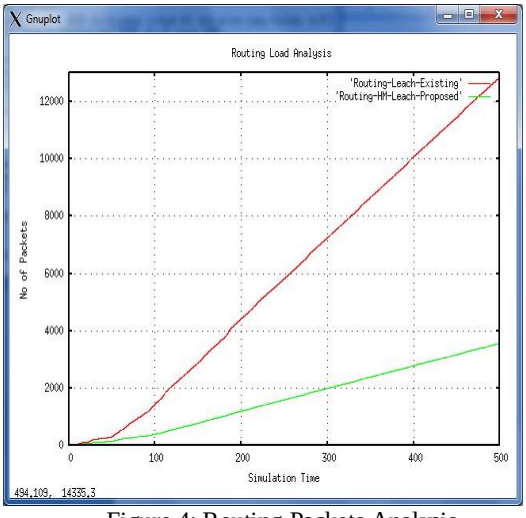

Figure 4: Routing Packets Analysis

E. Throughput Performance Analysis

In MANET the successful data delivery is possible to established strong link in dynamic topology and sufficient amount of energy is required for communication. The normal LEACH protocol is only LOW energy adaptive (that means minimum energy consumption base selection of CH) for improving energy utilization. The number of packets receiving counting in per unit of time is evaluated through performance metrics. In this graph the throughput performance of proposed leach is really good that provides about more than 1100 packets/second in network up-to end of simulation time of 500 seconds but the performance of normal LEACH is really embarrassing because of receiving of only little more than 800 packets/second in MANET. The throughput performance of proposed leach is improving the energy utilization and enhances the possibility of nodes survival.

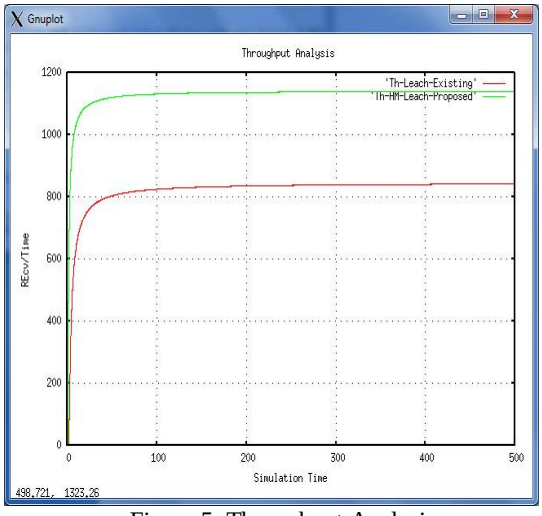

Figure 5: Throughput Analysis

5 CONCLUSION AND FUTURE WORK

The unnecessary energy consumption is reduces the working capability cost of mobile nodes. The nodes in MANET is forming temporary link for sending data in between sender and receiver. The dynamic topology characteristics are changing the position and number of nodes availability for communication. In this research the normal LEACH protocol is considered for improving energy utilization but still the modification in LEACH (proposed LEACH) is possible on the basis of nodes mobility, maximum residual energy and multipath routing. The evaluation of the value of power saving for bettering network life time is necessary and this power utilization is more in proposed LEACH. In this paper we also describe about our enhanced proposed Low Energy adaptive Cluster Hierarchical (LEACH) routing that extend the performance of the network and also minimized the energy consumption from the network, on description that proposed approach founded cluster head are liable to provide higher energy based

multiple path between communicator nodes and also provide efficient inter cluster communication with minimal overhead. The proposed scheme established multiple paths by that the reliability of link establishment is improves and also the effect of dynamic topology is handled. The performance of LEACH and proposed LEACH is evaluated through performance metrics like throughput and routing overhead. The minimum overhead is shows the possibility of link breakage is less in proposed LEACH with enhancement of packets receiving in unit time as opposite to LEACH the performance is just opposite.

REFERENCES

[1]. Abedelhalim Hnini, Abdellah Ezzati, Abdelmajid Hajami "Effect of a Node's Death on Behavior of the LEACH Protocol and its Descendants" 2014 Fifth International Conference on Next Generation Networks and Services (NGNS) May 28-30, 2014, Casablanca, Morocco 978-1-4799-6937-1/14/$31.00 ©2014 IEEE.

[2]. Bhavna Sharma et. al. "Energy Efficient Load Balancing Approach to Improve AOMDV Routing in MANET" 2014 Fourth International Conference on Communication Systems and Network Technologies, 978-1-4799-3070-8/14 , 2014 IEEE, DOI 10.1109/CSNT.2014.247.

[3]. Djamila Mechta, Saad Harous, Ismahane Alem, Dounya Khebbab "LEACH-CKM: Low Energy Adaptive Clustering Hierarchy protocol with K-means and MTE" 978-1-4799-7212-8/14 ©2014 IEEE.

[4]. Bao Zhenshan, Xue Bo, Zhang Wenbo "HT-LEACH: An Improved Energy Efficient Algorithm Based on LEACH" 2013 International Conference on Mechatronic Sciences, Electric Engineering and Computer (MEC)

[5]. Dec 20-22, 2013, Shenyang, China, 978-1-4799-2565-0/13 ©2013 IEEE

[6]. Ningbo WANG et. al." An Energy Efficient Algrithm Based on LEACH Protocol" 2012 International Conference on Computer Science and Electronics Engineering, 978-0-7695-4647-6/12 © 2012 IEEE

[7]. DOI 10.1109/ICCSEE.2012.150

[8]. M. Tripathi,, M.S. Gaur, V. Laxmi and R.B. Battula [2] "Energy Efficient Leach-C Protocol For Wireless Sensor Network" Malaviya National Institute of Technology, Jaipur, India pp. 402-405, IET

[9]. Aarti jain , B.V.R.Reddy "Sink as cluster Head: An Energy Clustering method for Wireless Sensor Networks. pp. 4799-4674-7/14/IEEE-2014.

[10]. Jingqing Wang and Xi Zhang "AQ-DBPSK/DS-CDMA Based Energy-Efficient and Interference-Mitigation Scheme for 3D Clustered WCSNs With Minimum Coverage Rate Constraint" 2014 IEEE Military Communications Conference.

[11]. Ashlyn Antoo et. al."EEM-LEACH: Energy Efficient Multi-hop LEACH Routing Protocol for Clustered WSNs" 2014 International Conference on Control, Instrumentation, Communication and Computational Technologies (ICCICCT), 978-1-4799-4190-2/14 ©2014 IEEE

[12]. The Network Simulator – ns-2 http://www.isi.edu/nsnam/ns