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Integration of Robust Different Hierarchical Routing Protocol for Wireless Sensor Network

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Abstract**: Wireless sensor network is nowadays very popular important in the field of research because the world is now switching faster from wired communication to the wireless communication. In our research work, we have to compare different protocols TEEN, PEGASIS, ECHREP LEACH. It is used in environmental monitoring, habitat monitoring, battlefield etc. WSN is made up of tiny sensor nodes which sense the data and communicate to the base station via other nodes.WSN networks are data-centric rather than node centric. So, main issues in WSN networks are energy consumption of network, a lifetime of a network, delay, latency, quality of service etc.WSN has defined many routing protocols for the network. The main challenge in WSN is to design a routing protocol which gives the maximum energy efficient routing because nodes in a sensor network are equipped with the battery. So, as time passes the battery of nodes will decrease so in turn network lifetime will decrease. There are many routing protocols which are classified as their working and their application to different conditions. This paper describes brief information about routing protocols. The main focus of this paper is to give the comparison of different hierarchical routing protocols. In this Dissertation, we were comparing four routing protocol LEACH, PEGASIS, TEEN and Proposed ECHERP. So we conclude that according to overall performance in hierarchical network ECHERP performance better compare to other routing protocol in WSN.

Keywords: LEACH, WSN, ECHERP Routing Protocols, Hierarchical Routing, Flat Routing Protocols.

I. INTRODUCTION

Wireless Sensor Network is an advanced technology and lot of work already have been done and right now smart grid concept also introduced in WSN and this technology have a wide range of application. This kind of network usually consists of a large number of nodes that bring themselves together to form a wireless network. The components of a WSN are sensor nodes, BS and monitored events (that is, an event that is required to be sensed in the environment) [7]. A typical sensor node is made of four building blocks: power unit, a communication unit, a processing unit and sensing unit [1]. The wireless communication components of a sensor node are responsible for transmission or reception of captured data from one sensor node to another node or to an end user through the cluster head to the base station (BS). The sensor node, it's processing, and communication component require energy to function as expected, and the power component, which is of limited amount, is solely responsible for the provision of energy to the three other components [2].

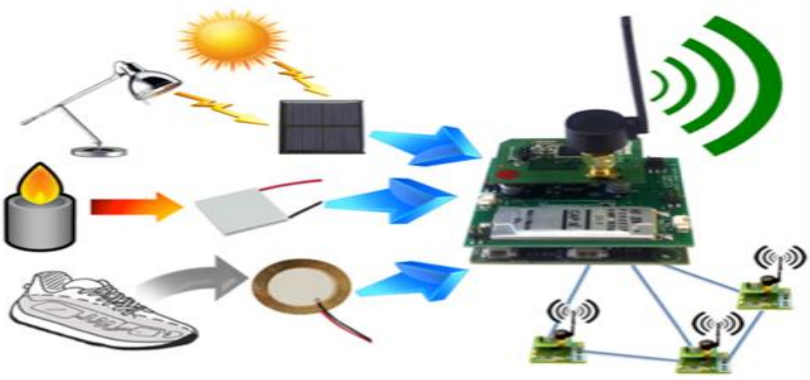

Figure1. Wireless Sensor Network

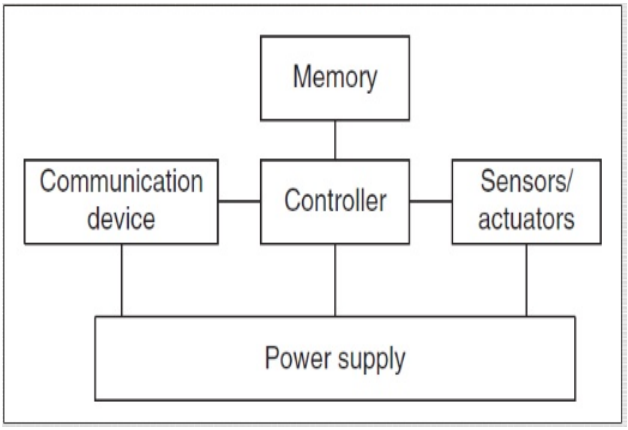

Figure2. Node Architecture

II LITERATURE SURVEY

Energy saving or consumption is an important aspect of wireless sensor networks, its precise usage is highly desirable both for the faithful performance of the network and to increase the network life time. Through the experimental analysis, we can conclude that MECRT is better for medium to large network size, where node selects a path that consumes minimum energy among all available paths for data forwarding as compared to the HE algorithm where node delivers the data to the neighboring node having the highest energy for homogeneous network [14-16]. Comparison of various network parameters is done in the form of tables and graphs. The main concern of this work is to examine the energy efficiency and performance of LEACH protocol using an own set of parameters. We compare the lifetime and data delivery characteristics with the help of analytical comparison and also from our simulation results. From this work, we find that LEACH provides better results for a number of cluster heads as 3 and 4. These papers have covered performance of LEACH protocol only, we can also compare this protocol with other routing protocols that may or may not be hierarchical in nature. The process of data aggregation and fusion among clusters is also one of an interesting problem to explore. It is needed to satisfy the constraints introduced by factors such as fault tolerance, topology change, cost, environment, scalability, and power consumption for the realization of sensor networks [18-20].

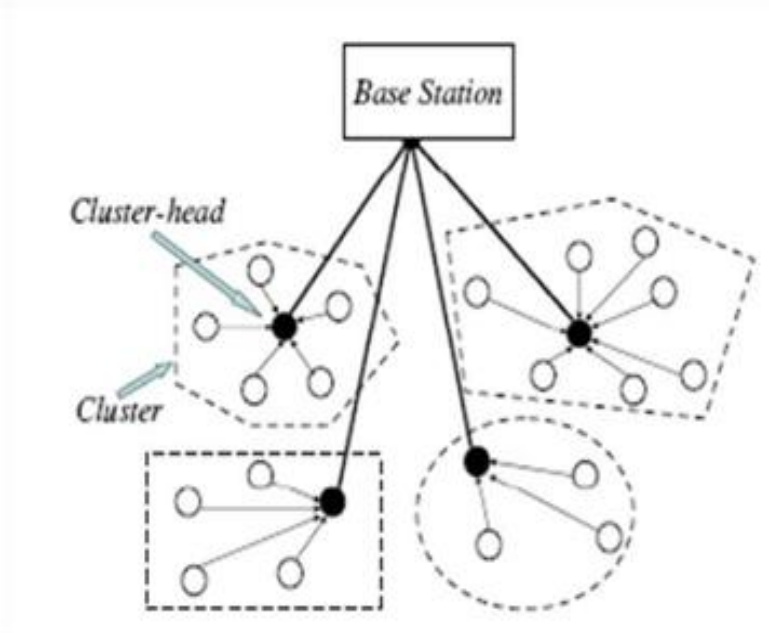

Figure3. Clusters and CHS formation in Hierarchical Routing Protocols

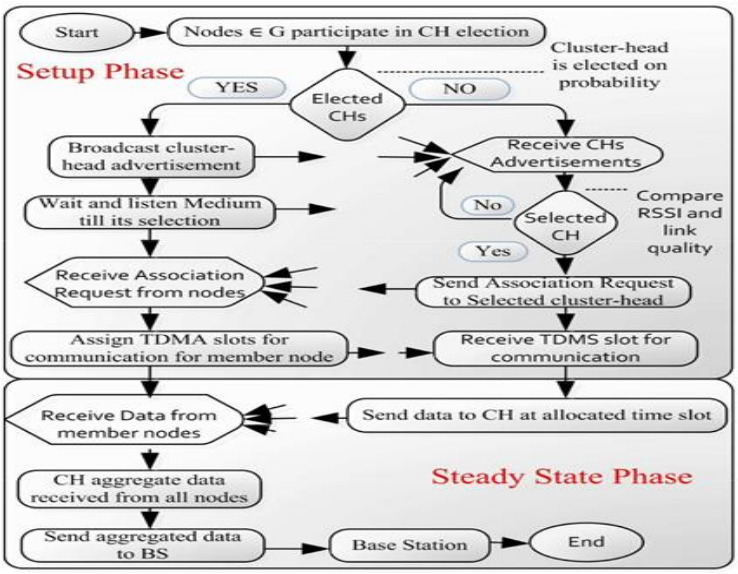

Figure4. Flow chart of LEACH routing protocol

III METHODOLOGY

PEGASIS: PEGASIS is a routing protocol in which a chain based approach is followed. This protocol follows a greedy algorithm starting from the farthest node and all the sensor nodes form a chain like structure. It works on the principle that each node will transmit to and receive from its close neighbors. There is a leader in the chain which is responsible for transmission of the combined data to the sink node [4]. Nodes take turns being the leader in the network which evenly distributes the energy load amongst the nodes. This even energy distribution and high energy efficiency leads to the extension of the network lifetime. It attempts to reduce the delay that the data acquire on the way to the base station [6]. Fig. 1b) shows the connectivity of sensor nodes in PEGASIS protocol.

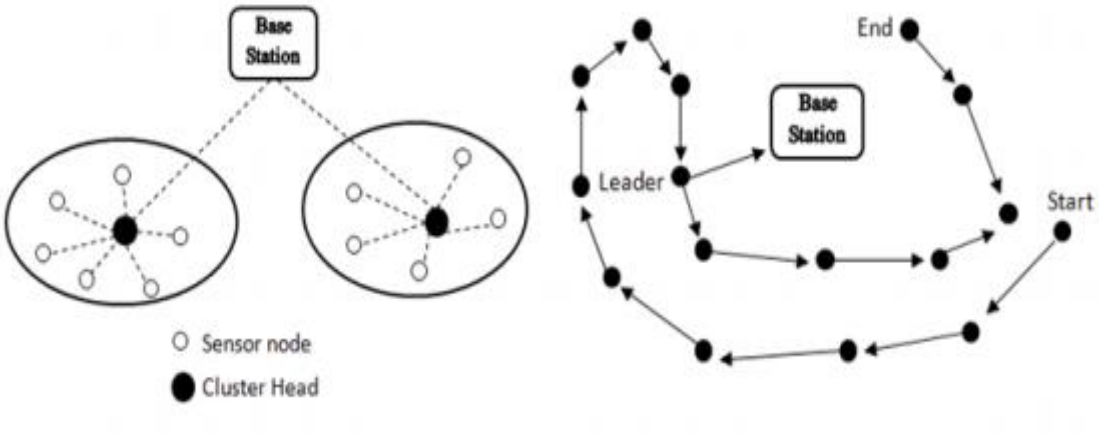

Figure5. Connections between nodes and base station for a) LEACH and b) PEGASIS

TEEN

A reactive network protocol called TEEN is Threshold sensitive Energy Efficient Sensor Network. In Reactive Networks, sensor nodes continuously sense the environment and transmit the value as soon as the sensed parameter exceeds a user specified threshold value. This enables time critical data1 to reach the user almost instantaneously, making such a network most suitable for time critical applications. TEEN (Threshold-sensitive Energy Efficient Sensor Network) protocol has been developed specifically for such networks [9-10]. However, if the thresholds are not reached, the user cannot determine the state of the network, making it inadequate for applications that require periodic data from the network.

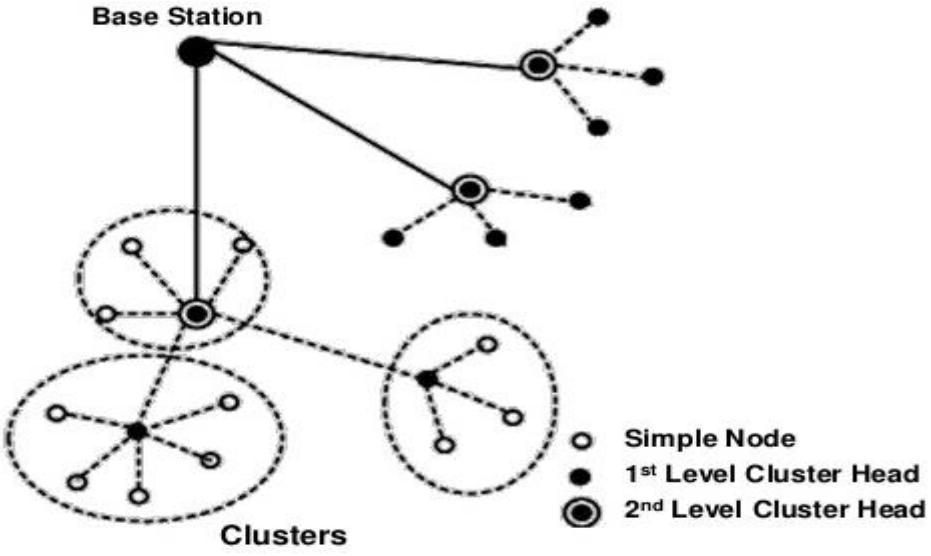

Figure6. Multi level Hierarchical Clustering

In this scheme, at every cluster change time, in addition to the attributes, the CH broadcast the following message to its members: Hard threshold (HT): This is a threshold value for the sensed attributes developed for reactive networks. It is the absolute value of the attributes beyond which the node sensing this value must switch on its transmitter and report to its CH. Soft threshold (ST): This is a small change in the value of the sensed attributes that triggers the node to switch on its transmitter and transmit. The nodes sense environment continuously. The first time a parameter from the attribute set reaches its hard threshold value, the node switches on its transmitter and sends the sensed data. The sensed value is also stored in an internal variable in the node, called SV. The nodes will next transmit data in the current cluster period only when both the following conditions are true.
1) The current value of the sensed attribute is greater than HT.
2) The current value of the sensed attribute differs from SV by an amount equal to greater than the ST. The HT tries to reduce the number of transmission by allowing the nodes to transmit only when the sensed attribute is in the range of interest. The ST further reduces the number of transmissions by eliminating all the transmissions which have otherwise occurred when there is little or no change in the sensed attribute once the HT. But the main drawback of this algorithm is that if the thresholds are not reached, the nodes will not communicate, the user will not get any data from the network, and will not come to know even if the nodes die.

ECHERP

An energy efficient routing protocol Equalized Cluster Head Election Routing Protocol (ECHERP) has been proposed. The current and future estimated remaining energy of the nodes are considered to make the cluster head in every round. The main purpose of using energy for making cluster head is to increase the lifetime of a network. At every round, the Gaussian elimination algorithm used to calculate the energy consumed in the network and reduce the overall energy consumption in the network. ECHERP also used the multi hop routing scheme to force the data to send backward to the base station. ECHERP is analysed and compared with an earlier protocol like LEACH, PEGASIS, and TEEN through simulation in terms of last node depletion time and first node depletion time. This algorithm could be expanded in terms of quality of service and time constrictions. An energy-efficient competitive clustering algorithm [11] has been proposed for wireless sensor networks using a controlled mobile sink. Sensor nodes have effectively organize by clustering algorithm and controlled mobile sink lead to lessening the problem of energy holes problem has used to select the optimal moving trajectory for sink nodes. This algorithm has changed the cluster head in each round and selected the cluster head based on their range and remaining energy. Sink has mobile in nature as compares to fixed nature. The sink node has moved in the predefined path at a certain speed and stayed at park position to collect the data packets. The simulation has done on the ns-2.35 environment to analyze the performance of an energy-efficient competitive clustering algorithm and compared with predefined algorithm LEACH.

V SOFTWARE USED AND SIMULATION RESULT

Software: NS-2 (2.35), a network simulation tool to simulate wireless communication network. NS2 is discrete event simulator developed. It provides a good platform for wsn simulation. The random way point model is selected as a mobility model in a rectangular field (1000*1000m2). LEACH, PEGASIS, TEEN, HEED is used for simulation at the network layer. Nodes send constant bit rate (CBR) traffic at varying rates. The performance of Energy Efficient based Cluster Protocol in Wireless Sensor Network (WSN) is being estimated with the help of simulation on network simulator-2. Following results will be calculated by using performance .awk script. Using the output we plotted the bar graphs of following parameters.The result is carried out by NS-2 Simulator using following Parameters.

- Throughput
- Packet Delivery Ratio

- Energy Consumption
- Average End to End Delay
- Normalized Over Load

Simulation Setup

TABLE I: SIMULATION PARAMETERS IN NS2

Simulation Tool	NS-2.35
Operating System	Ubuntu 12.04
No. of Nodes	10,20,30,40,50
No. of Cluster Head	3
MAC/PHY layer	IEEE 802.11
Antenna model	Omni directional
Interface queue size	50 packets
Data payload	512 bytes
Pause time	20 seconds
Channel bandwidth (data)	12Mbps
Transmission range	250m
Examined protocol	LEACH, PEGASIS, TEEN,ECHERP
Interface Queue Type	Queue/Drop Tail/PriQueue
Mobility model	Random way point
Simulation area	500M*500M
Link Layer Type	LL
Rx Power	0.6
Tx Power	0.6
Data Rate	200k
Simulation Time	100 sec

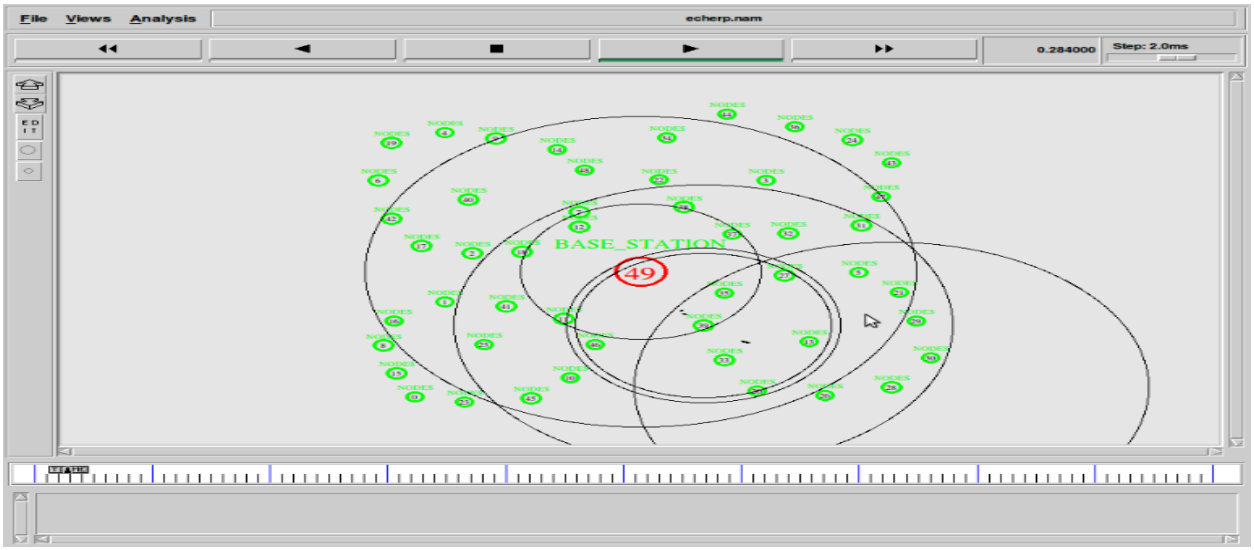

Figure7. Communication started between nodes

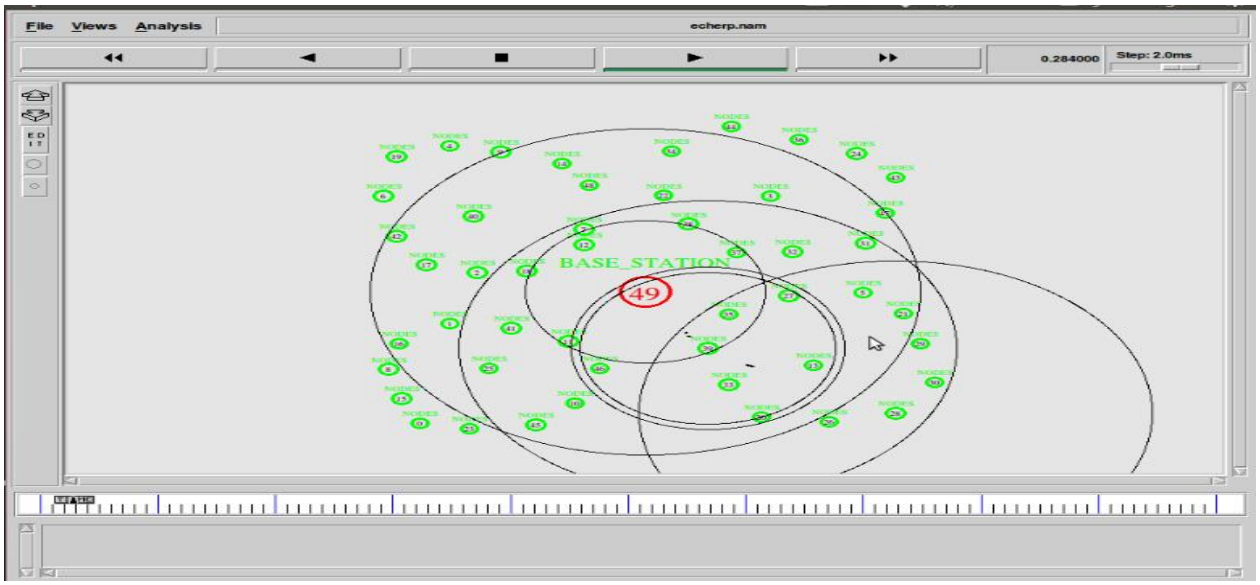

Figure8. Communication started between nodes, transmission started

Figure9. Communication started between nodes and Base Station

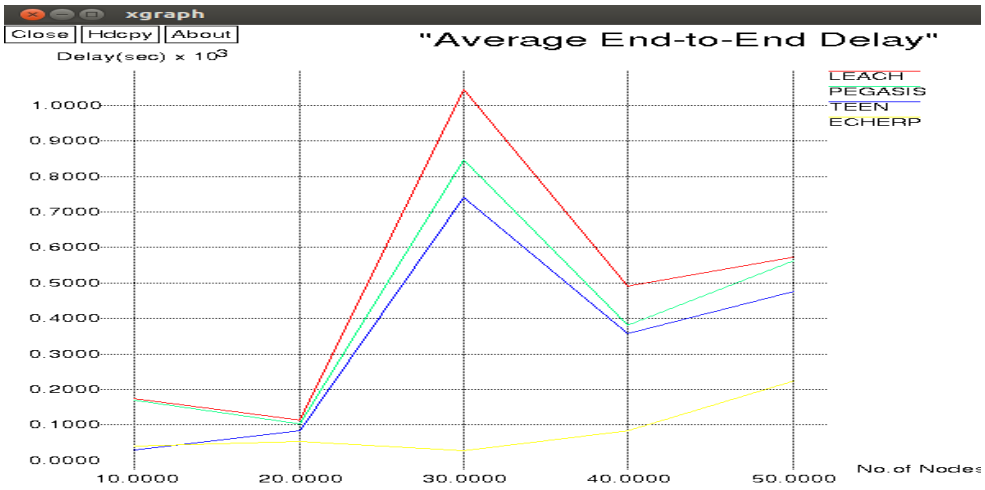

Figure10. Comparison of average end-to-end delay

Average End-to-End Delay –The average time packets take to traverse the network. This is the time from the generation of the packet by the sender up to send at the destination application layer and expressed in second. It, therefore, includes all the delay in the network such as buffer Queue, transmission, and delay induced by routing protocol activities and MAC control data exchanges. The figure shows that the less delay in ECHERP routing protocol.
End to End delay = [(Sum of Individual data packet delay) / (Total number of data Packets delivered)]

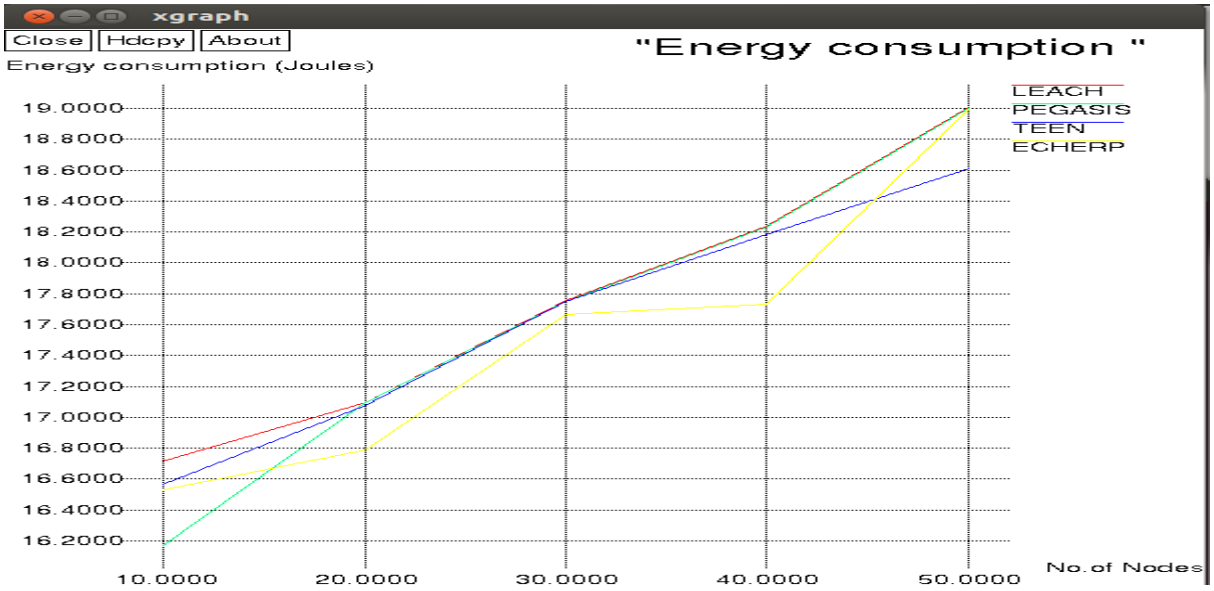

Figure11. Comparison of Energy Consumption

Energy Consumption – Energy is converted in joules by multiplying power with time. The graph below shows the energy consumed by mobile nodes in WSN. Energy consumption represented in Joule per Second. Figure 3 shows that the LEACH routing protocol consuming more energy compared to other Routing Protocol and ECHERP consumed less energy.

Energy Consumption = [(Sum of Energy expended by each node) / (Total number of data packets delivered)]

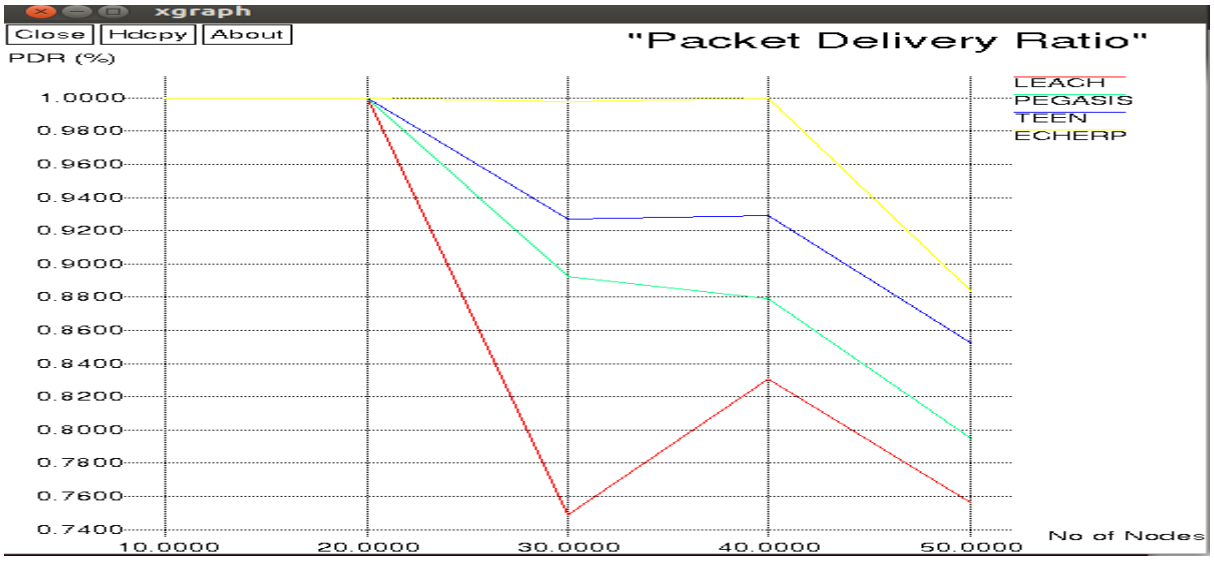

Figure12. Comparison of Packet Delivery Ratio

Packet Delivery Ratio (PDR) – The ratio between the numbers of packets delivered to the receiver to the number of packets sent by the source is called as Packet Delivery Ratio. It denotes the maximum throughput a network can achieve. A high average packet delivery ratio is desired in the network

Packet Delivery Ratio = (Packets Received / Packets Generated) * 100

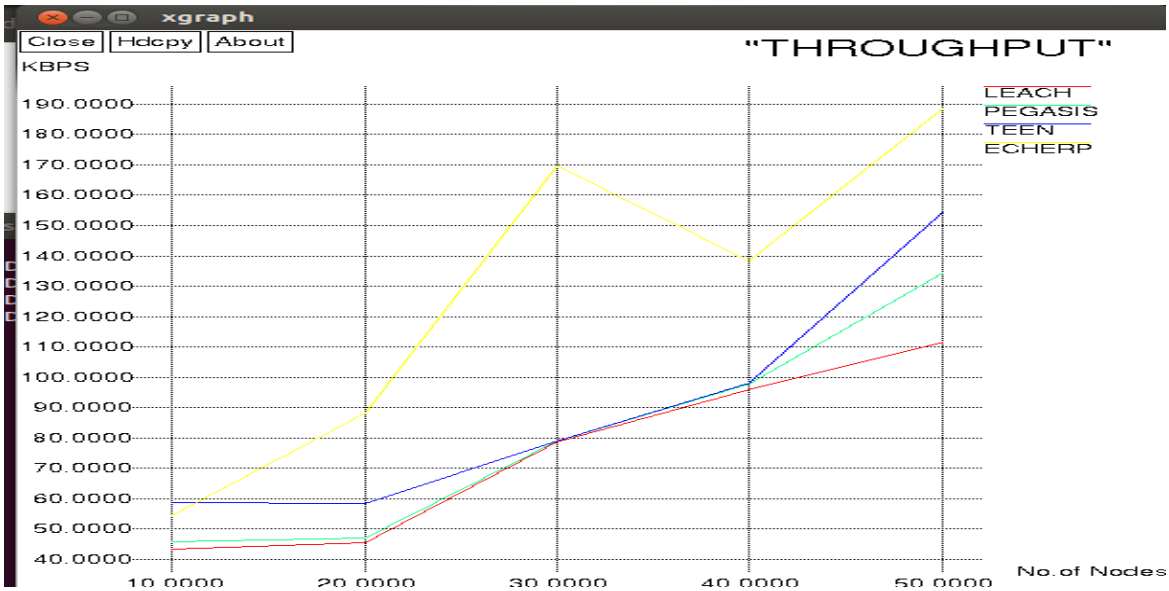

Figure13. Comparison of Throughput

Average Throughput – The ratio of total amount of data that reaches from a sender to receiver to the time for the receiver to get the last packet is referred as Throughput. It includes frequent topology changes, unreliable communication of messages, limited bandwidth and insufficient energy in WSN's. A network with high average throughput is desirable.

Throughput = (Number of data packets received*Packet size*8) / Simulation time

CONCLUSION

In this research work routing protocols based on clustering protocols for selection of Cluster Head are developed for both Homogeneous WSNs. Through this research work, it has been proved that –Homogeneous protocols are a novel energy efficient data gathering protocols, where clustering is based on allocating the growth budget to neighbors, multi-hop, multipath. Whereas the ECHERP routing algorithm outcome of this research work chooses the alternative path based on heuristic function values (routing table information). ECHERP protocol organizes the sensor nodes into clusters and forms a multi-hop intra-cluster network. Further, this research work attempts to establish multiple paths from each sensor node to the cluster head and thus provides an energy aware heuristic function to choose the appropriate path. Protocol for heterogeneous wireless sensor network –ECHERP is based on the residual energy and location information of the sensor nodes. In this Dissertation, we were comparing four routing protocol LEACH, PEGASIS, TEEN and Proposed ECHERP. So we conclude that according to overall performance in hierarchical network ECHERP performance better compare to other routing protocol in WSN. There are so many routing protocols which are used in WSN and our main objectives are to calculate some parameters like throughput, an end to end delay, packet delivery ratio, energy consumption and more. Our main work is to achieve higher throughput and consume less energy and propagation delay must minimum so that overall efficiency can be enhanced. Therefore to achieve these we design new algorithm and integrate them into the NS2 software so that higher efficiency can be achieved.

REFERENCES

[1] Kemal Akkaya, Mohamed Younis, "A survey on routing protocols for wireless sensor networks", 26 November 2003

[2] Tintu Devasia, Gopika S, "Statistical Analysis of Energy Efficient Hierarchical Routing Protocols in WSN", International Journal of Advanced Research in Computer and Communication Engineering, Vol. 2, Issue 5, May 2013.

[3] Fan Xiangning, Song Yulin, "Improvement on LEACH Protocol of Wireless Sensor Network", 2007 International Conference on Sensor Technologies and Applications, IEEE.

[4] Mu Tong, Minghao Tang, "LEACH-B: An Improved LEACH Protocol for Wireless Sensor Network", 978-1-4244-3709, 2010 IEEE.

[5] Jindal V, Verma AK And Bawa S, "How The Two Adhoc Networks Can Be Different: Manet & WSNs", International Journal Of Computer Science & Technology, 2011, 2(4), 122-126.

[6]Wang J, Yang G and Chen S,"Secure Leach Routing Protocol Based On Low-Power Cluster-Head Selection Algorithm For Wireless Sensor Networks", International Symposium On Intelligent Signal Processing And Communication Systems, 2007, 341-344.

[7]Liu Y, Gao J, Jia Y and Zhu L, "A Cluster Maintenance Algorithm Based on LEACH-DCHS Protocol", International Conference on Networking, Architecture, and Storage, 2008, 165-166.

[8] Jumping h, Yuhui J and Liang D, "A Time-based Cluster-Head Selection Algorithm for LEACH", In Computer and Communication, 2008.

[9] Zhixiang D and Bensheng Q, "Three-layered routing protocol for WSN based on LEACH algorithm", IEEE Xplore, 2007, 72-75.

[10] Tong M and tang M, "LEACH-B: An Improved LEACH Protocol for Wireless Sensor Network", 6th International Conference on Wireless Communications Networking and Mobile Computing, 2010.

[11] Heinzelman WB, Chandrasekaran PA and Blakrisshnan H, "An Application-Specific Protocol Architecture for Wireless Microsensor Networks", IEEE Trans. on Wireless Communication, 2002, 1(4), 660-670.
[12] Zhi-Jun L and La-Yuan L, "Based on Energy Balance LEACH-DC Protocol Design", 6th IEEE Joint International Conference on Information Technology and Artificial Intelligence Conference (ITAIC), 2011.
[13]Kumar N and Kaur J, "Improved LEACH Protocol for Wireless Sensor Networks", 7th International Conference on Wireless Communications, Networking and Mobile Computing (WiCOM), 2011.
[14] Tang L and Liu S, "Improvement on LEACH Routing Algorithm for Wireless Sensor Networks", International Conference on Internet Computing and Information Services, 2011.
[15] Sunita Rani, Tarun Gulati, "An improved PEGASIS protocol to enhance energy utilization in wireless sensor network", International Journal of Advanced Research in computer science and software engineering, Volume:2, Issue 11. November 2012
[16] Saraswati Mishra, Prabhjot Kaur, "comparison of energy efficient data transmission approaches for flat wireless sensor networks", International Journal of Advanced Smart Sensor Network Systems (IJASSN), Vol 4, No.3, July 2014
[17] Shivakumara S Sasanura, Prof. B Sreenivas, "Comparative Performance Analysis of Routing Protocols in Mobile Ad-Hoc Networks" , International Journal of Computer Science and Information Technologies, Vol. 4 (6) , 2013, 813-817
[18] Meena Malik, Dr. Yudhvir Singh, Anshu Arora, "Analysis of LEACH Protocol in Wireless Sensor Networks", IJARCSSE, Volume 3, Issue 2, February 2013 ISSN: 2277 128X
[19] Nirbhay K. Chaubey, Dharti H. Patel, "Routing Protocols in Wireless Sensor Network: A Critical Survey and Comparison", International Journal in IT and Engineering, Impact Factor- 5.343, Vol.04 Issue-02, (February 2016) ISSN: 2321-1776
[20] Ankita Bindlish, Anish Soni, "Comparative Analysis of Hierarchical Routing in Wireless Sensor Networks" International Journal of Innovative Research in Computer and Communication Engineering, Vol. 2, Issue 6, June 2014

