



Implementation of (DEL) A Dynamically Enhanced Low Energy Adaptive Clustering Hierarchical approach for Proficient Routing in Wireless Sensor Network

Sushma Singh¹¹Mtech Scholar,Department of Computer Science & Engg., YIT Jaipur
IndiaAnkur Goyal²²Asst. Professor,Department of Computer Science & Engg., YIT Jaipur ,
India

Abstract—Wireless Sensor Network, One of the emerging technology that improved the network procedure of information processing and exchanging in today's era. Network is collection of the sensor node that scattered spatially. Wireless Sensor network is an assortment of self-organized, self-powered, small and economical nodes connected through wireless channels and work collectively as per application requirement of the network with the ability of sensing, computing and featured for the main objective of providing communication between different component to make global decision in physical environment. Due to its optimum cost and simple network architecture large number of real time application uses WSN. Energy and network life time are two critical factors for WSN performance. Routing plays an important role in sensor network. An efficient routing facilitates the network with high energy response and life time. This research paper deals with the overture of the one of the most promising and widely used technology wireless sensor network. This paper also propose DEL (dynamic enhanced Low Energy Adaptive Clustering Hierarchy) protocol for proficient routing. It improves the routing by finding path based on optimum routing path selection with dynamic demand concept and even distribution and selection of cluster head is implemented for the assorted network in which the nodes can have different initial energy within a defined range.

Keywords— Wireless sensor network (WSN), routing protocol, clustering, Low Energy Adaptive Clustering Hierarchy component.

I. INTRODUCTION

The term Wireless sensor network [1] has been turned out to be a basic word that is used for communication or information exchange. WSN is set of number of communication unit known as sensor nodes and controlling unit that are used for data access or sensing, processing and exchanging as in figure 1. The node deployment is accomplished in a random manner in a physical environment. WSN, the term that is widely used in recent environment. The primary goal of the network is to provide of rapid and efficient processing of data with the optimum amount of energy and resource usage for different domain of application.[1] WSN provides wide-scale connectivity to physical world at a lower cost compares to other technology available in market. In addition to the cost advantage, wireless sensor networks provide self-configuring, robustness against node failure with its distributed operation, ease of deployment, reliable services and uniform coverage. In recent scenario sensor network turn out to be most advanced stimulating technique for sensed data collection and perform the action with restricted battery capability. Sensor network infrastructure is composed of various key components. Deployment of the wireless network includes various components as the basic unit like sensor node, communication through media like radio, optical or infrared etc. Deployment of the wireless network includes various components as the basic unit like sensor node, communication through media like radio, optical or infrared. Sensor nodes are the heart of the wireless network [2, 3]. The sensor node of the sensor network is available in various sizes from economically small to large with a limited amount of energy, memory, bandwidth. The basic functionality of sensor node includes sensing and processing of information from real environmental condition and the transformation of these variables into a form that can be easily understood by the network device. Wireless sensor network, one of the imminent used technology for a wide range of application as in figure 1[4,5,6]



Fig 1: Wireless sensor network Applications Scope.

Sensor network applications contribute appreciably to more efficient use of resources to manage ecological challenges and affects segments in our economy and life. A countless applications in today era use WSN as a base technology that ranges from monitoring and conservation, to manufacturing and business asset management, to automation in the transportation and health care industries, from personal care (home automation) to agriculture, ranging from a home automation to complex military application, a research issue in wireless sensor network is consumption of power [7]

II. GROWTH OF ROUTING

Routing is the term that is abbreviated for path discovery from one node to another node for transferring the data or control information. This paper defines an approach to enhance the routing using the dynamic routing with dissimilar nodes in term of energy which tends an improvement in lifetime. Effective path selection is very important for the efficient utilization of network resources. The network works in layer architecture and each layer has its dedicated responsibility. Wireless sensor network layer has one of the significant accountability of determining the route for incoming data. Communication with effective utilization of energy is an important factor in WSN. Plenty of research work mainly focused towards efficient communication for minimizing the energy consumption and also the lifetime improvement [8]. Many routing techniques have been announced from the relevant research work but clustering architecture is one of the most dominant, and scalable. In Wireless sensor network routing protocol are categorized basis on various mode figure 2 [9, 10].

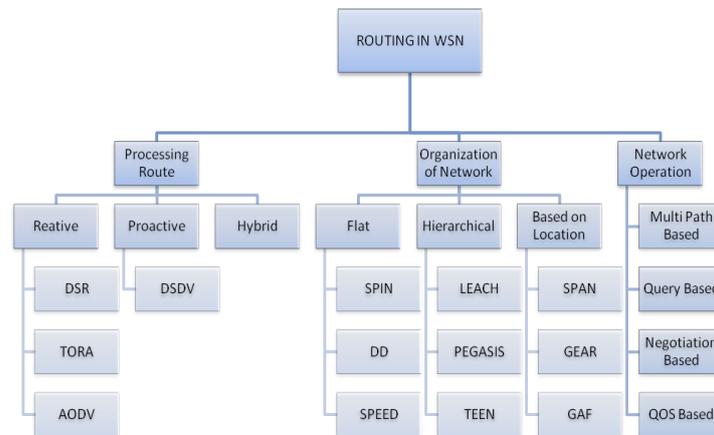


Fig. 2: Wireless Sensor Network Routing Structure

In general, routing is categorized hierarchal routing, flat or data-centric and location-dependent. Hierarchical routing is widely used routing technique in which each node act differently and manages energy utilization by means of the multi hop concept. LEACH is solitary extensively used dynamic hierarchical clustering routing protocol in sensors networks .

A. Low Energy Adaptive Clustering Hierarchy(LEACH)

W.R.Heinzelman, A.P.Chandrakasan and H.Balakrishnan [11] introduced a wireless sensor network routing protocol which employed as a widely known communication protocol in today’s era based on the concept of hierarchical routing. The prime focus of this protocol is to enhance the energy utilization. It works as a stand in protocol for wireless sensor network which help to deal with consumption of energy at particular level. LEACH protocol, network nodes are arranged in cluster, random algorithm select some number of node that act as cluster head. Cluster head which are the nodes that having their own significant and added rights than normal cluster node. Cluster head accumulates data and aggregate to the base station. LEACH has two phase protocol as in figure 3.

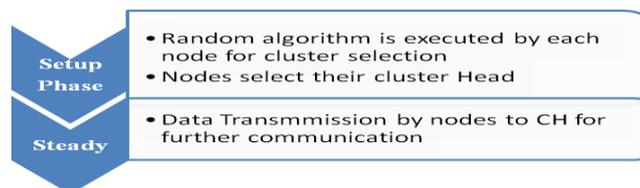


Fig. 3: Phases of LEACH

To balance energy dissipation node in the network randomly change in CHs is performed over time with is a function of desired percentage and round as

$$T(n) = \begin{cases} \frac{p}{1-p*(r \bmod \frac{1}{p})} & \text{if } n \in G \\ 0 & \text{otherwise} \end{cases} \quad (1)$$

where p is percentage of CHs, r is round number, G is set of nodes not selected as CH till last 1/p rounds.

B. Relative merit of LEACH

This method provides efficient method with improvement energy and life time still some shortcoming exist in the protocol that effect the performance parameters.

- 1) *Advantages:* The concept of random selection provides effective network that facilitate the network with improve life time.
- 2) *Shortcoming:*
 - The nods in the network are assumed to initialize with equal energy that is not always in real actually happens in real environment
 - The load distribution is done in uneven manner that results in improper utilization of energy.
 - The path distance for data aggregation to the base station is large.

3) *LEACH adaptations*

LEACH protocol has its significant role in routing with its random behaviour. There are a number of version for LEACH protocol are implemented for the routing as C-LEACH[12], M-LEACH, S-LEACH, A-LEACH[13], MR-LEACH [14], Q-LEACH [15], MOD LEACH[16].

C. Problem Identification

In view of reasonably huge amount and closely energy embarrassed sensor nodes, requires a frequent change in routing protocol which provide energy enhancement and overcome energy loss take place due to

- Random formation of cluster leads non-uniform in term of size or distribution of nodes.
- Highly energy retention by the network due to varying and comparatively large distance.
- High rate of failure in wireless sensor network due to uneven load.

III. PROPOSED METHOD

Clustering of nodes and selection of cluster head plays a vital role for the effective utilization of energy and lifetime management with proper load balancing. This approach provides an enhanced way of clustering and cluster head selection procedure by a uniform distribution and approximate equal size cluster creation. At the initial stage it focuses on the problem of inconsistent distribution of node. It uses the dynamic K-means algorithm for cluster creation, which provides a uniform distribution of node or uniform clustering. For the path discovery the demand or proactive method is used that provides an efficient path as in figure 4.

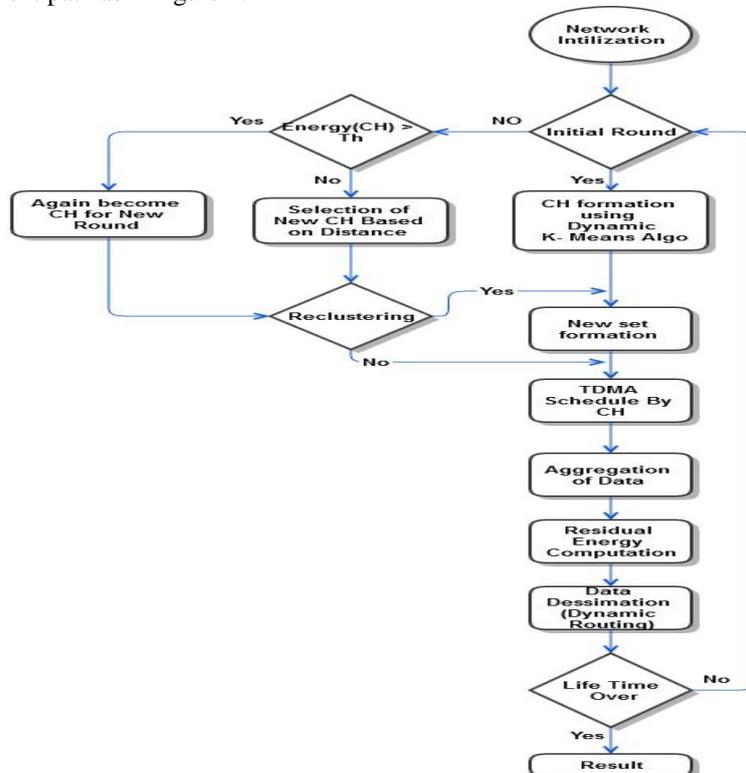


Fig.4 : Flow Chart of Daynamic Enhanced LEACH

IV. SIMULATION AND RESULT

The simulation is performed in MATLAB 2012a (matrix laboratory), a software package that is widely used for high performance numerical computation and visualization.

A. Network Deployment and Cluster Head Selection

At the initial development phase the network deployment accomplished with the initialization network parameter is done. The deployment of the network node is done in random manner with some base value. The simulation result provides a comparative study for the performance of proposed Dynamic Enhanced LEACH enhanced with K-means algorithm over dynamic created nodes and with LEACH protocol in under the continuous delivery model. Simulation result has been captured with some predefined parameter after random number of round as in table 1.

**TABLE I
SIMULATION PARAMETERS**

Parameter Name	Value
Network or geographical area	200 X 200 m2
Number of nodes	50
Amplification Energy	0.0013pJ/bit/m2 ~ 10pJ/bit/m2
Threshold	2* (n)
Number of rounds	1500
Initial Energy	0.04~0.05 joule
Transmission utilization per bit (ETx-amp)	50 X 10 ⁻⁹
Transmitter circuit utilization (ETx-elec)	50 X 10 ⁻⁹

In initial round the dynamic k-means protocol is used. In which the euclidean distance based clustering of nodes is done as in fig. 5. The number of CH nodes per round for both LEACH and proposed algorithm is defined as in table 2.

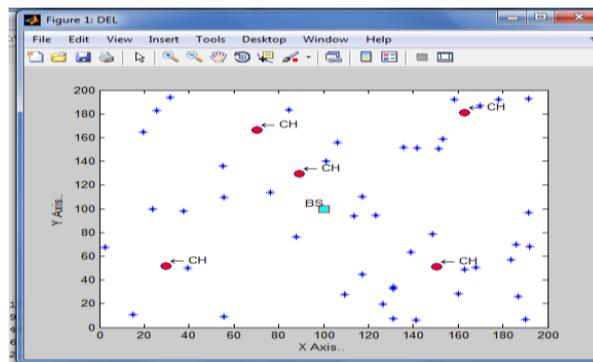


Fig. 5. Selection of Cluster Head in Intial round

**TABLE 2
Number of CH in First Round in LEACH and DEL**

Protocol	Number of CH
LEACH	08
DEL	05

Once the cluster head is elected, the CH transmits the advertisement message to other node for cluster formation and data aggregation. The transmission/ reception of information between two clusters head can be termed as inter transmission. Cluster head transmitting its data to base station. As the cluster formation finishes in round the data is forwarded to BS using the TDMA schedule with multihop transmission and threshold consideration. Simulations result illustrate that DEL get better metrics. DEL improves almost 25 % of the network lifetime and throughput to a considerable amount as shown in fig 6.

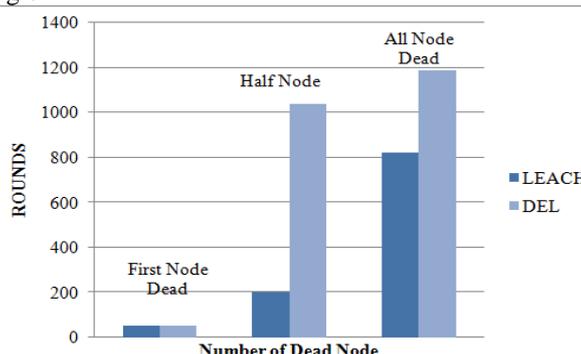


Fig. 6 Comparison Chart of LEACH and DEL

This algorithm improves the network lifetime by limiting the number of transmissions with efficient cluster head replacement as in fig.7. When energy value of the node is greater than a threshold level, data packet transmission will take place.

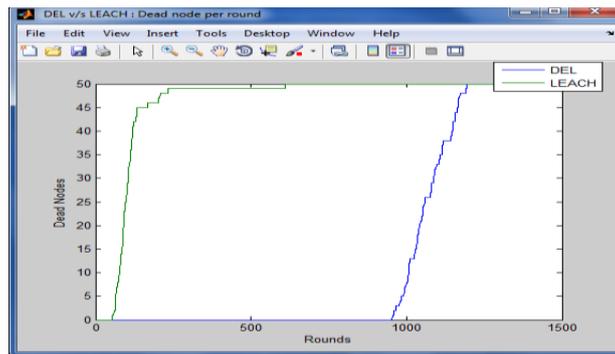


Fig. 7 Dead Node v/s Round in LEACH and DEL

With the lifetime improvement the throughput is also improves as base station receives more data packets than standard LEACH as in fig. 8.

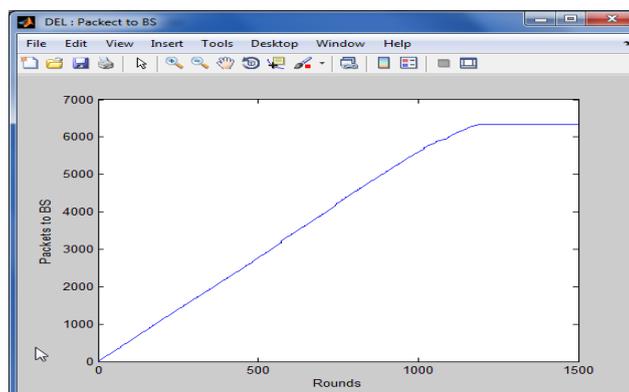


Fig. 8 Packets to Base station per round

This algorithm enhances the throughput with energy efficient data transmission between cluster head and base station and between node and its cluster head. By efficient cluster head substitution and dual level of power transmission it improves the energy consumption which leads to a better life time.

V. CONCLUSIONS

ACKNOWLEDGMENT

Wireless sensor networks can provide low cost solution to verity of real-world problems. Sensors are low cost tiny devices with limited storage, computational capability and power. They can be deployed in large scale for performing both military and civilian tasks. As sensors have limited power and computational capability, mechanism for sensor network must be energy efficient and should not be computational intensive. There exist several protocols for data routing which uses different approaches to provide energy efficient in resource limited wireless sensor networks. This thesis presents a design to an energy efficient Routing protocol for energy constraints wireless Sensor Networks. Using cluster based topology. This algorithm provides an energy efficient method for data routing. This work presents a protocol uses dynamic clustering and reactive routing which provide optimum cluster organization in order to minimize energy consumption. A proper cluster formulation enhances a network life to a considerable amount. Simulation results demonstrate that the proposed approach provides promising solutions for routing in the wireless sensor networks.

Firstly as the work is done is implemented in MATLAB is can be done in NS2 in future and in this paper the work is based on single and stationary base station in the network so it can be extended to multi and moving base station in future.

REFERENCES

- [1] I. F. Akyildiz, W. Su, Y. Sankarasubramaniam and E. Cayirci, "A Survey on Sensor Networks," in IEEE Communication Magazine, vol.- 40, no. 8, pp. 102-114, 2002.
- [2] Stephan Olariu, "Information assurance in wireless sensor networks," in 19th International Parallel and Distributed Processing Symposium (IPDPS), Denver, CO, USA, 2005.
- [3] David Culler, Deborah Estrin, Mani Srivastava, "Overview of Sensor Networks," in Special Issue in Sensor Networks, IEEE Computer- 37(8), pp 41-49, Aug 2004.
- [4] J. Yick, B. Mukherjee and D. Ghosal, "Wireless Sensor Network Survey," in Science Direct-Computer Networks, vol. -52, Issue 12, pp. 2292-2330, Aug. 2008.
- [5] S. Slijepcevic and M. Potkonjak, "Efficient organization of wireless sensor networks," in IEEE International Conference on Communications (ICC), pp. 472-476, 2001.

- [6] Jamal N. Al-Karaki Ahmed E. Kamal, "A survey on routing protocols for wireless sensor networks," in Adhoc Networks, Elsevier 2004.
- [7] Kazem Sohraby, Daniel Minoli, Taieb Znati, "Wireless sensor networks: technology, protocols, and applications," John Wiley & Sons, ISBN 978-0-471-74300-2, Inc. 2007.
- [8] John A. Stankovic, "Research challenges for wireless sensor networks," in ACM SIGBED Rev-Special issue on embedded sensor networks and wireless computing Homepage archive in ACM, vol.- 1, Issue-2, pp. 9-12.
- [9] S. Hedetniemi, A. Liestman, "A survey of gossiping and broadcasting in communication networks," in IEEE Networks, vol.- 18, no. 4, pp. 319-349, 1988.
- [10] Kemal Akkaya, Mohamed Younis, "A survey on routing protocols for wireless sensor networks," in Ad Hoc Networks, vol.- 3, issue-3, pp 325-349, May 2005
- [11] Wendi Rabiner, Heinzelman, Anantha Chandrakasan, and Hari Balakrishnan, "Energy-Efficient Communication Protocol for Wireless Microsensor Networks" in IEEE Proceedings of the 33rd Hawaii International Conference on System Sciences 0-7695-0493, 2000.
- [12] Muruganathan, Canada, Bhasin, Fapojuwo, A, "A centralized energy-efficient routing protocol for wireless sensor networks", in Communications Magazine, IEEE , Volume 43, Issue 3, pp. S8 – 13, ISSN 0163-6804, March 2005
- Aslam. M, Javaid. N, Rahim. A, Nazir. U, Bibi. A, Khan. Z. A, "Survey of Extended LEACH-Based Clustering Routing Protocols for Wireless Sensor Networks", 5th International Symposium on Advances of High Performance Computing and Networking (AHPCN-2012)in conjunction with 14th IEEE International Conference on High Performance Computing and Communications (HPCC-2012), 25-27 June, Liverpool, UK, 2012.
- [13] Farooq, M.O., Dogar, A.B. ; Shah, G.A., "MR-LEACH: Multi-hop Routing with Low Energy Adaptive Clustering Hierarchy" in Fourth International Conference on Sensor Technologies and Applications (SENSORCOMM), IEEE, pp 262 – 268, ISBN 978-1-4244-7538-4 July 2010
- [14] B.Manzoor, N. Javaid, O. Rehman, M. Akbar, Q. Nadeem, A. Iqbal, M. Ishfaq, "Q-LEACH: A New Routing Protocol for WSNs", International Workshop on Body Area Sensor Networks (BASNet-2013) in conjunction with 4th International Conference on Ambient Systems, Networks and Technologies (ANT 2013), 2013, Halifax, Nova Scotia, Canada, Procedia Computer Science, Volume 19, 2013, Pages 926-931, ISSN 1877-0509.
- [15] D. Mahmood¹, N. Javaid, S. Mahmood, S. Qureshi, A. M. Memon, T. Zaman, "MODLEACH: A Variant of LEACH for WSNs" in IEEE 8th International Conference on Broadband and Wireless Computing, Communication and Applications (BWCCA'13), Compiegne, France, July 2013.