*Proceedings of 1st Shri Chhatrapati Shivaji Maharaj QIP Conference on Engineering Innovations*
*Organized by Shri. Chhatrapati Shivaji Maharaj College of Engineering, Nepti, Ahmednagar*
*In Association with JournalNX - A Multidisciplinary Peer Reviewed Journal, ISSN No: 2581-4230*
**21st - 22nd February, 2018**

# STUDY OF LOAD BALANCING TO MINIMIZE THE VARIABLE NODE POWER FOR INCREASING THE NETWORK LIFETIME IN WSN

Miss.Bangar Dipika N.
Department of computer Engineering.
S.C.S.M.C.O.E., Nepti, Ahmednagar-414005.
Maharashtra, India.
deepikabangar11@gmail.com

Miss. Joshi Neha A.
Department of computer Engineering.
S.C.S.M.C.O.E., Nepti, Ahmednagar-414005.
Maharashtra, India.
joshi.neha2013@gmail.com

Miss.Patil Priti A.
Department of computer Engineering.
S.C.S.M.C.O.E., Nepti, Ahmednagar-414005.
Maharashtra, India.
pritipatil930@gmail.com

Miss. Shende Poonam B.
Department of computer Engineering.
S.C.S.M.C.O.E., Nepti, Ahmednagar-414005.
Maharashtra, India.
poonamshende55@gmail.com

**Abstract—** Wireless technology growing rapidly now a days. Information congregation is a rapid increasing and challenging field in today's world of computing. This interacts with the various kinds of Things, Objects, Technological devices, Sensors in various fields. Wireless sensor networks consist of small battery powered devices with restricted energy resources. The main merit of the sensor network is that it includes power utilization constraint for sensor nodes with the help of battery life. The sensor nodes are typically out of the way for the user; therefore substitution of the energy source or battery is not practicable. For this reason, energy efficiency is a main design concern that wants to be improved in order to extend the lifetime of the sensor network. To extend the lifetime of sensor nodes, energy utilization and routing design issues are considered. The clustering based approach for communication is conceived as the mainly appropriate for the wireless sensor networks. The most important monitoring system is wireless sensor networks. All of the sensor nodes act as an event detector as well as a data router. It consists in selecting a set of cluster heads from the set of sensor nodes. The cluster members transmit the data to the cluster head and all received data at cluster head is aggregated and transmit it to the base station. Clustering reduces and balances the energy utilization and prolongs the lifetime and scalability of the wireless sensor network. Clustering is frequently used with a data aggregation method. Proposed method is work in three phases; Initialization Phase, Setup Phase, Transmission Phase.

**Keywords—** Computer communication Network, Wireless Sensor Network, Clustering, Network Lifetime, Power Consumption.

## I. INTRODUCTION

Wireless networks consist of several hundred of minute sensor nodes to supervise physical or ecological conditions such as high temperature, clamminess, etc. every sensor node having the capability of sensing, computing, and wireless communication. Information congregation is a rapid increasing and challenging field in today's world of computing. The most important monitoring system is wireless sensor networks. All of the sensor nodes act as an event detector as well as a data router.

The sensor nodes are deployed in the particular environment for sensing data from the surrounding and supervise particular targets. It also collects the data. After data collection sensor node transmit data to the sink node or to the base station with the help of wireless transmission. These base stations are connected to the switching center which plays a role of gateways between the sensor network and internet. Fig. 3.1 shows that direct data transmission in the wireless sensor network. In this strategy every node is communicating its sensing information directly to the base station.

Wireless sensor networks are comprehensive in a variety of applications including, military, healthcare systems, environment monitoring etc. Fig 4.1 shows that the sensor network is divided into the clusters which are nothing but the collection or a group of sensor nodes. Among these sensor nodes based on the residual energy cluster heads are selected and nodes other than head node transmit data towards head node. The head node aggregates the data and forwards it to the base station.

In the wireless sensor network energy efficiency plays a vital role to minimize the overhead through which the Network Lifetime can be achieved. To extend the lifetime of sensor nodes, energy consumption and routing design consequences must be considered. In the wireless sensors networks, the major aspect is the power supply of a sensor node which is relay on the battery, and a sensor node consumes the majority of its energy in transmitting and receiving data in the form of packets. On the other hand, in the wireless sensor network the battery power is limited in a sensor node, and a sensor node that has its battery exhausted could make the sensing region uncovered. For this reason, energy preservation becomes a serious anxiety in wireless sensor networks.[11][16] To minimize the energy consumption and to extend the network lifetime, a novel and efficient energy technique based on the uniform clustering approach is implemented.

## II. LITERATURE SURVEY

Yunxia Chen and Qing Zhao originated a general formula for the life span upgrading of wireless sensor networks which holds autonomously of the underlying network model ,network architecture protocol and data collection commencement.[3]

Ioan Raicu, Loren Schwiebert, Scott Fowler and Sandeep K.S. Gupta contributed by a new algorithm, e3D

(energy-efficient Distributed Dynamic Diffusion routing algorithm), with a comparison done with two algorithms, i.e. directed, and random clustering communication algorithm. The algorithm has been developed using setup cost with the analyzation of energy efficiency and useful life time of the network.[4]

Othman, Nizar Bouabdallah and Raouf Boutaba study the conservation of potential energy which is achieved by balancing the traffic throughout. They studied and concluded distributing the traffic by multiple paths save more energy than the single path hence energy efficiency is increased in multi path system. For this a new analytical model for load balancing system has been introduced.[5]

Isabel Dietrich and Falko Dressler introduced the algorithm to be used in analytic evaluations as well as in simulation models for focusing on a formal and concise definition of network that has been accumulated and its total network lifetime. This algorithm introduces some additional life time measures to the network life time. There new concept is to make network tolerance and disruption free. With another new additional feature is to fulfill the requirement in certain period of time other than every point of time.[6]

Vinay Kumar, Sanjeev Kumar and Sudharshan Tiwari introduced a survey which increases the network lifetime in Wireless Sensor Networks (WSNs) .Here the route for data transfer are selected in such a way that the total energy consumed along the path is minimized. For this clustering concept was used as cluster helps energy utilization in limited resources which extends and maximizes network lifetime. [7]

## III. PROBLEM STATEMENT

Energy efficiency is a main design concern that wants to be improved in order to extend the life time of the sensor network. The main motive of this research is to reducing the energy consumption and extending the lifetime of wireless sensor network using the clustering approach by balancing the network load. To extend the lifetime of sensor nodes, energy utilization and routing design issues are considered. The proposed technique introduced an Extended Energy Efficient Clustering Algorithm (EEECA) for the wireless sensor networks. Research will be able to show the energy efficiency of the network as compared to existing .In existing system the node consumes more energy. It decreases the life span of a network.

## IV. PROPOSED SYSTEM

Generally it is assumed that node in a sensor network are homogeneous in nature. But in actuality the sensor nodes are almost not be present. The sensor nodes are having different capabilities including initial energy, reduction rate, etc. The heterogeneous sensor networks consists of large number of inexpensive nodes capable for sensing, among them a small amount of nodes having relatively extra energy which are able to perform data filtering, aggregation and transmission. Heterogeneity in wireless sensor networks can be used to improve the life time and trustworthiness of the network.[16][20] Heterogeneous sensor networks are very popular in the clustering approach for sensor network.

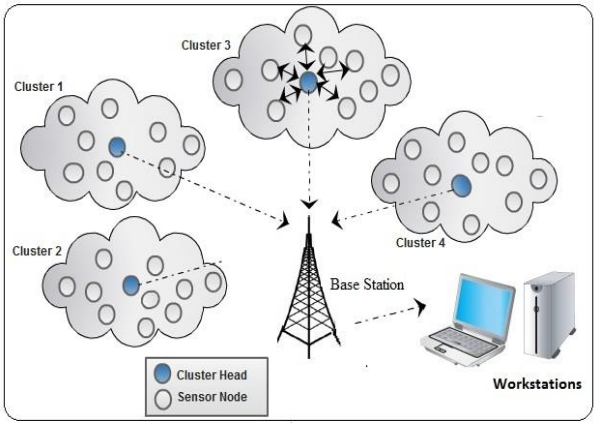


**Fig 4.1. Clustered WSN**

## V. MATHEMATICAL MODEL

### A. System Model

The system communications is composed of a base station (BS) and sensor nodes. In the system model the sensor nodes are working and operational to be used outdoors, and the moving condition is a random movement inside the sensing area. All of the sensor nodes classfied into non Cluster Head (n-CH) nodes and Cluster Head (CH) nodes. The n-CH nodes operate in the sensing mode to monitor the environment information and transmit data to the CH node. In addition, the sensor node becomes a CH to gather data, compress it and transmit it to the base station (BS) from the CH mode. The transmission power is adjustable according to the data transmission distance for each sensor nodes. In wireless sensor networks, data communications consume a large amount of energy. Energy consumption for data collection and for data aggregation of CH nodes is considered.[1][2][3]

### B. Energy Model

This model is for radio hardware energy dissipation, where the transmitter dissipates energy to run the radio electronics and the power amplifier, and the receiver dissipates energy to run the radio electronics. In this model, both the free space (d2 power loss) and multi-path fading (d4 power loss) channels are used depending on the distance between the transmitter and receiver. When the distance is less than a threshold value l0, then the free space (FS) model is used, otherwise, the multipath (MP) model is used. As shown in Fig. the radio energy dissipation model in the wireless sensor networks.[2][3] In this model, to exchange an m-bit message between the two sensor nodes, the energy consumption can be calculated by,

$$ET(m,l) = EeT * m + Eamp(m) \quad (5.1)$$

$$ER(m) = EeR * m \quad (5.2)$$

Where l is the distance between the two sensor nodes, ET (m, l) is the transmitter energy

consumption, and ER(m) is the receiver energy consumption. EeT is the electronics energy consumption per bit in the transmitter and receiver sensor nodes. Eamp is the amplifier energy consumption in transmitter sensor nodes, which can be calculated by,

$$E_{amp} = \begin{cases} \epsilon_{FS} x l^2 & when \quad l \leq l_0 \\ \epsilon_{FS} x l^4 & when \quad l \geq l_0 \end{cases}$$

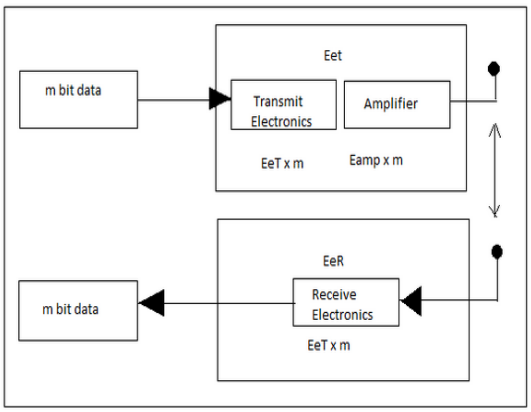


**Fig. 5.2.1. Radio Energy Model**

**ss**

Let NCH, CCH be the distance between the non-cluster head node N and its cluster head node CH. LetCCH, BS be the distance between the cluster head node CH and the BS. Due to the multi-hop communication, a non cluster head node only sends data to its cluster head node. The residual energy of the non-cluster head node NCH is equal to,

**Residual energy of the Non Cluster Head (n-CH)**

$N_{CH} = E_{initial} - E_t(m_{NCH}) \; l_{NCH,CH}))$

$N_{CH}$ = Non Cluster Head

$m_{NCH}$ = Transmits m bits BS

$l_{NCH,CH}$ = Distance between Non- Cluster Head and its CH.

**Residual energy of the Cluster Head (CH)**

$C_{CH} = E_{initial} - E_r(m_{NCH}) - E_{DA} - E_t(m_{NCH}, l_{NCH,BS})))$

$C_{CH}$ = Cluster Head (CH)

### C. Network Model

We assume a WSN model where all the sensor nodes are randomly deployed along with a few gateways and once they are deployed, they become motionless. The data gathering operation is divided in two rounds. In each round, all sensor nodes sense local data and send it to their CH. Then CHs perform data aggregation to discard the unnecessary and uncorrelated data and send the aggregated data to the base station. Between two adjacent rounds, all nodes turn off their radios to save energy. Current implementation supports TDMA protocol to provide MAC layer communication. Various definition of the network life is given in the literature such as this is the time until first node dies, the time until last node dies or the time until a desired percentage of nodes die.[1][3]

**Table 5.3.1. Energy Parameters**

| Parameter | Value |
|---|---|
| Electronics Energy (Ee) | 50 Nj/bit |
| Communication Energy(FS) | 10 PJ/bit/m4 |
| Communication Energy(MP) | 0.0013 PJ/bit/m4 |
| Energy for data Aggregation(EDA) | 5 Nj/bit |
| Einitial | 100J |
| sPacket size | 512 byte |
| No. of nodes | 50,100,150,200 |
| Sensing Area | 100 x 100, 200 x 200 |

**Table 5.3.2. Clustering Algorithm Methods**

| Method | Environment for operation | Structure for routing | Techniques |
|---|---|---|---|
| LEACH | Distributed | Cluster | Random |
| HEED | Distributed | Cluster | Random and residual Energy |
| Proposed Model | Centralized | Cluster | Resudual Energy & Sensor position |

## VI. Acknowledgment

With immense pleasure, we are presenting this Project Stage-I report on "Survey of Load balancing to reduce the Overhead for Achieving the Network Lifetime of Wireless Sensor Network" as a part of the curriculum of B.E. Computer. I am truly grateful to Project guide Prof. Mrs. Lagad J.U. for his valuable guidance and encouragement. His encouraging words went a long way in providing the patience and perseverance, which were needed to complete this report successfully. I would like to express our gratitude to B.E Project Coordinator Prof. Mr. Tambe R.S. for their support and guidance. Inspiration and guidance are invaluable in every aspect of life especially in the field of academics, which I have received from respected Prof. Mrs. Lagad J.U. Head of Computer Department. I would like to express my sincere thanks to Dr. Deshpande R.S., Principal of Shri Chhatrapati Shivaji Maharaj College of Engineering, for supporting me for this Project Stage-I work.

## VII. Advantages

i. Aggregated data transmitted towards head node.
ii. Reduce number of nodes at the time of data transmission.
iii. Constructive Energy utilization.
iv. Reliability and scalability for large number of nodes.
v. Minimizes communication transparency.
vi. Proficient use of resources in WSN.

## VIII. Conclusion

The energy saving is a challenging issue in the wireless sensor networks. We Understand and studying the need of clustering in wireless sensor network. Study and development of an algorithm for increasing the lifetime of the sensor nodes by load balancing techniques in wireless sensor networks.

## IX. References

1) Jau-Yang Chang, Pei-Hao Ju, An efficient cluster-based power saving scheme for wireless sensor networks. EURASIP Journal on Wireless Communications and Networking 2012, 2012:172.
2) W.R. Heinzelman, A. Chandrakasan, H. Balakrishnan, Energy-efficient communication protocol for wireless microsensor networks, Proceedings of the 33rd Hawaii International Conference on System Sciences (HICSS'00), vol. 2, IEEE Computer Society, Washington, DC, USA, 2000, pp. 3005–3014.
3) WB Heinzelman, P Chandrakasan, H Balakrishnan, application-specific protocol architecture for wireless microsensor networks. IEEE Trans Wireless Commun. 1(4), 660–670 (2002). doi:10.1109/TWC.2002.804190.
4) Navneet Kaur "Review on Load balancing in wireless sensor network", International Journal of Advanced Research in Computer Science and Software Engineering, Vol 3,Issues 5,May 2013 ISSN: 2277 128X International Journal of Advanced Research in Computer Science and Software Engineering.
5) Dipak Wajgi, Dr.Nilesh singh V. Thakur "Load Balancing Algorithms in Wireless Sensor Network: A Survey" IRACST –International Journal of Computer Networks and Wireless Communications (IJCNWC), ISSN: 2250-3501Vol.2, No4, August 2012.
6) Y. Chen, Q. Zhao, on the lifetime of wireless sensor networks, IEEE Communications Letters 9 (11) (2005) 976–978, http://dx.doi.org/ 10.1109/LCOMM.2005.11010.A. Karnik, "Performance of TCP congestion control with rate feedback: TCP/ABR and rate adaptive TCP/IP," M. Eng. thesis, Indian Institute of Science, Bangalore, India, Jan. 1999.
7) Ioan Raicu, Sandeep K.S. Gupta, Loren Schwiebert and Scott Fowler "Local Load Balancing for Globally Efficient Routing in Wireless Sensor Networks", Ad International Journal of Distributed Sensor Networks, 1: 163–185, 2005.
8) R Vidhyapriya , Dr P T Vanathi "Energy Efficient Adaptive Multipath Routing for Wireless Sensor Networks", IAENG International Journal of Computer Science, 34:1, IJCS_34_1_8 (2007).
9) Fatma Othman, Nizar Bouabdallah and Raouf Boutaba "Load-Balanced Routing Scheme for Energy-Efficient Wireless Sensor Networks", Global Telecommunications Conference, 2008. IEEE GLOBECOM 2008. IEEE.
10) Isabel Dietrich and Falko Dressler, "On the Lifetime of Wireless Sensor Networks", ACM Transactions on Sensor Networks, Vol. 5, No. 1, January 2009, Pages 138.
11) Rahim Kacimi, Riadh Dhaou , André-Luc Beylot "Load balancing techniques for lifetime maximizing in wireless", Communications (ICC), 2010 IEEE International Conference.
12) Vinay Kumar, Sanjeev Jain and Sudarshan Tiwari, "Energy Efficient Clustering Algorithms in Wireless Sensor Networks: A Survey", IJCSI International Journal of Computer Science Issues, Vol. 8, Issue 5, No 2, September 2011.
13) Jin Wang, Tinghuai Ma and Jinsung Cho, "An Energy Efficient and Load Balancing Routing Algorithm for Wireless Sensor Networks", ComSIS Vol. 8, No. 4, Special Issue, October 2011.
14) J´anos Levendovszky, K´alm´an Tornai, Gergely Trepl´an, Andr´as Ol´ah, "Novel load balancing algorithms ensuring uniform packet loss probabilities for WSN" , 978-1-4244-8331-0/11/$26.00 ©2011 IEEE.
15) J S Rauthan, S Mishra, "An Improved Approach in Clustering Algorithm for Load Balancing in Wireless Sensor Networks", ISSN: 2278 – 1323, International Journal of Advanced Research in Computer Engineering & Technology, Volume 1, Issue 5, July 2012.
16) K R Yadav, Vipin Pal, Girdhari Singh and R P Yadav, "An Efficient Load Balancing Clustering Scheme For Data Centric Wireless Sensor Networks", International Journal of Communication Network and Security (IJCNS), Vol-1, Issue-3 ISSN: 2231-1882.
17) Philipp Hurni and Torsten Braun, "Energy Efficient Multipath Routing in Wireless Sensor Networks", ADHOC NOW 2008, LNCS 5198, pp.72-85, 2008.
18) Hui Dai, Richard Han, "A Node-Centric Load Balancing Algorithm for Wireless Sensor Networks", Global Telecommunications Conference, 2s003. GLOBECOM '03. IEEE.
19) Rahim Kacimi, Riadh Dhaou , André-Luc Beylot "Load balancing techniques for lifetime maximizing in wireless", Communications (ICC), 2010 IEEE International Conference.
20) Yaxiong Zhao, Student Member, IEEE, Jie Wu, Fellow, IEEE, Feng Li, Member, IEEE, and Sanglu Lu, Member, IEEE On Maximizing the Lifetime of Wireless Sensor Networks Using Virtual Backbone Scheduling, IEEE transactions on parallel and distributed systems, vol. 23, no. 8, august 2012.
21) D.Sharmila, R.Sujithaand G.Rajkumar On Improving the Lifetime of Wireless Sensor Networks Using Virtual Scheduli ng Backbone Replacement ,Proceedingsof2013 IEEE Conference on Information and Communication Technologies (ICT 2013).
22) O. Younis, S. Fahmy, HEED: A hybrid, energy efficient, distributed clustering approach for ad hoc sensor networks, IEEE Transactions on Mobile Computing 3 (4) (2004) 660669.
23) Endre Laszlo, Kalman Tornai, Gergely Treplan, Janos Levendovszky , Novel Load Balancing Scheduling Algorithms for Wireless Sensor Networks , CTRQ 2011 : The Fourth International Conference on Communication Theory, Reliability, and Quality of service.