Dynamic Cluster Head Selection Method for Wireless Sensor Networks

K. Vijayalakshmi*, S. Jayalakshmi**, S. Abinaya***, S. Indhumathi**** & J. Hemavathi*****

*Assistant Professor, Department of Electronics and Communication Engineering, S.K.P Engineering College, Tamil Nadu, INDIA.
E-Mail: vijimahi30{at}gmail{dot}com
**UG Scholar, Department of Electronics and Communication Engineering, S.K.P Engineering College, Tamil Nadu, INDIA.
E-Mail: jayaasureesh21{at}gmail{dot}com
***UG Scholar, Department of Electronics and Communication Engineering, S.K.P Engineering College, Tamil Nadu, INDIA.
E-Mail: abinayasankar16{at}gmail{dot}com
****UG Scholar, Department of Electronics and Communication Engineering, S.K.P Engineering College, Tamil Nadu, INDIA.
E-Mail: indhumathi98sekar{at}gmail{dot}com
*****UG Scholar, Department of Electronics and Communication Engineering, S.K.P Engineering College, Tamil Nadu, INDIA.
E-Mail: hemajayapalan25{at}gmail{dot}com

***Abstract*—**Wireless Sensor Network (WSN) requires communication protocols to minimize the energy consumption. A Cluster-based scheme is proposed as a solution for this problem. A WSN is generally composed of hundreds and thousands of distributed mobile sensor nodes, with each node having limited and similar communication, computing and sensing capabilities. The proposed scheme extends High Energy First (HEF) clustering algorithm and enables multi-hop transmissions. The MIMO scheme prolongs the network lifetime with 75% of nodes remaining alive when compared to LEACH protocol.

***Keywords*—**Cluster; Communication; Energy; Power Consumption; Sensor Node.

***Abbreviations*—**Cluster Head (CH); High Energy First (HEF); Sensor Nodes (SN); Wireless Sensor Network (WSN)

I. INTRODUCTION

A wireless sensor network consists of sensor nodes capable of collecting information from the environment and communication with each other. since multi hop routing is generally needed for distant sensor nodes from the sinks to save energy. Sensor nodes spend their energy during transmitting the data, receiving relaying packets delivering information of each individual nodes as fast as possible to the base station become an important issue. In most Wireless Sensor Network (WSN) applications nowadays the entire network must have the ability to operate unattended in harsh environments in which pure human access and monitoring cannot be easily scheduled or efficiently managed or it's even not feasible at all [Shah & Rabaey, 1]. Based on this critical expectation, in many significant WSN applications the sensor nodes are often deployed randomly in the area of interest by relatively uncontrolled means (i.e., dropped by helicopter) and they form a network in an ad hoc manner [Lindgren et al., 2; Sinan & Mehmet, 3]. Moreover, considering the entire area that has to be covered, the short duration of the battery energy of the sensors and the possibility of having damaged nodes during deployment, large populations of sensors are expected; it's a natural possibility that hundreds or even thousand so of sensor nodes will be involved. In addition, sensors in such environments are energy constrained and their batteries usually cannot be recharged. Therefore, it's obvious that specialized energy aware routing and data gathering protocols offering high scalability should be applied in order that network lifetime is preserved acceptably high in such environments [Duan et al., 4]. Naturally, grouping sensor Nodes in to clusters has been widely adopted by their search community to satisfy the above scalability objective and generally achieve high energy efficiency and prolong network lifetime in large-scale WSN environments. The corresponding hierarchical routing and data gathering protocols imply cluster-based organization of the sensor nodes in order that data fusion and aggregation are possible, thus leading to significant energy savings. In the hierarchical network structure each cluster has a leader, which is also called the Cluster Head (CH) and usually performs the special tasks refer above (fusion and aggregation), and several common Sensor Nodes (SN) as members. The cluster formation process eventually leads to a two-level hierarchy where the CH nodes form the higher level and the cluster-

member nodes form the lower level. The sensor nodes periodically transmit their data to the corresponding CH nodes.

II. RELATED WORKS

In this section most of the topics are related to increase. In network lifetime has been discussed here. In this Cluster heads are elected in energy efficient manner. We have also focused on some topics relating to the mobility, packet delay and some other parameters. Padmalaya Nayak & Anurag [7] "A Fuzzy Logic based Clustering Algorithm for WSN to extend the Network Lifetime" 2016. Here the network lifetime is increased by using fuzzy logic and clustering algorithm (LEACH Protocol). LEACH protocol is one of the most popular clustering algorithms for energy consumption reduction of wireless sensors. This protocol uses randomization to distribute the energy load evenly among the sensors in the network.

The battery power consumed is less. Fuzzy Logic is the derivative process so it takes more time. Praveen Kumar et al., [8] "Energy balanced dynamic cluster routing approach for WSN" 2016 IEEE International conference on recent trends in electronics, information and communication technology. The network lifetime increased by using efficient cluster head selection technique and Dynamic route selection. Dynamic route selection provides reliable transmission of data. Time consumed to transmit the packet is more. Manisha Rathee & Sushil Kumar [9], "Quantum inspired genetic algorithm for energy efficient clustering in wireless" 2016 IEEE 1st international conference on power electronics**.** The Network lifetime is increased by using Evolutionary algorithm (Genetic).NP hard problem is solved by genetic algorithm. This process increases only 34% of the network. Ajay Sharma et al., [10] "Tree based heuristic algorithm for maximizing network lifetime" 2016 International Conference in Advanced Communication Control and Computing Technologies (IACCCT). The network lifetime is increased by using local optimization (Spanning tree).Power efficient data gathering and aggregation. Balanced tree implementation is difficult. Nandkumar et al., [11], "H-MOHRA: Heterogeneous Multi-Objective Hybrid Routing Algorithm for Mobile Wireless Sensor Networks**.** The network lifetime is increased by using H-MOHRA and data packets are serviced using cost function based on many metrics such as Mean energy utilization, control overhead, response time, connection quality measures Mobility and heterogeneity have been increased-MOHRA improves jitter only by a factor of 22.70% and 18.16% as compared to SHRP and DyMORA [Chung et al., 5; Yu et al., 6]. Thus by making a survey and using the concept of High Energy First (HEF) when energy of the node decreases then it automatically changes its cluster head, the packet have been sent without traffic. Thus the performance of the network has been improved compared to other algorithm.

III. DISCUSSION

3.1. HEF Algorithm

Wireless sensor nodes will be divided into several clusters in the WSN. One node will be chosen as the cluster head in each cluster area. This cluster head will use a negotiation system to send joining messages to the nodes near the cluster head. The cluster-heads will send invitations to the wireless sensor nodes in each cluster asking them to join the cluster-heads to form the clusters. During the forwarding of the message to the destination, the rate at which power is consumed by the cluster head will be calculated based on the energy model.

3.2. System Model

Level 1: Cluster Head Selection

Data aggregation and data compression in order to reduce the number of transmission to the base station.

Level 2: Energy Consumption

The communication model that wireless sensor network uses is either single hop or multi hop.

Level 3: Energy Efficient Routing

Transmission power control and load distribution are two approaches to minimize the active communication energy.

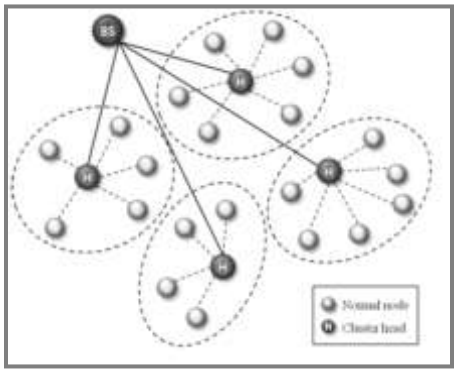

Figure 1: Grouping of Clusters

Figure 1 shows the ability to cover long transmission range. All nodes of each cluster are easily reachable. If it is not reachable, it is recommended to add another Server Node (SN). The purpose of introducing SN is to closely monitor the operation of sensor nodes in a cluster and command them for specific operations. The Tool Command Language (TCL).In the back end C, C++ is used. The Operating System used is LINUX (Ubuntu 10.04).The technology used is network simulator 2.

The first step in figure 2, is Start establishing the network. The network is divided into clusters. Then choose the cluster head. The cluster nodes will join the cluster head and establish it into clusters. Next starts the message from source to destination. Check whether the route exist in the route table. If this condition is satisfied then insert message in the queue after send the RREQ pocket to the neighbours. Otherwise check energy consumption speed of the cluster head. If the consumption speed is high then forward the message to next hop. If the speed is low then change the

cluster head based on value on remove the route. Then the process end. If the source is not a gateway host, it forwards the packets to a source gateway, which is one of the adjacent gateway hosts. This source gateway acts as a new source to route the packets in the induced graph generated from the connected dominating set.

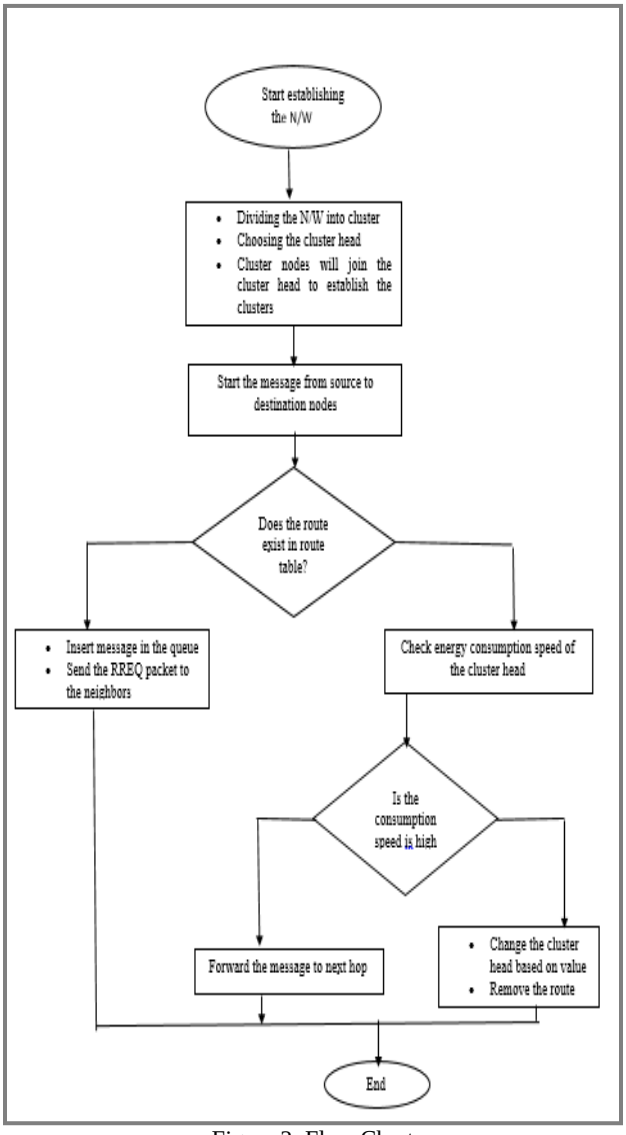

Figure 2: Flow Chart

IV. PROBLEMS AND SOLUTION

Limited battery power is used to operate the sensor nodes and is very difficult to replace or recharge it, when the nodes die. This will affect the network performance. Energy conservation and harvesting increase lifetime of the network. The clusters are constructed and the cluster heads communicate data with base station. This method proved that the network lifetime can be efficiently prolonged by using fuzzy variables. It is important to be aware of whether all sensors can meet their mandatory network lifetime requirements. The HEF algorithm achieves significant performance improvement over LEACH.

V. RESULT

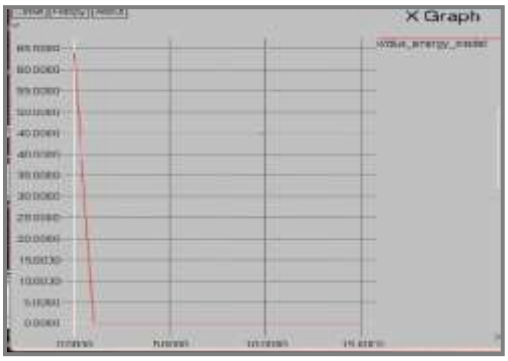

Figure 3: Dynamic Cluster Head Selection Method by using HEF Algorithm

From figure 3, it is found that when the energy is decreased then the throughput gets increased. By using HEF algorithm if the energy is decreased then it chooses the other cluster head and it continues the process then the same process is continued for other nodes.

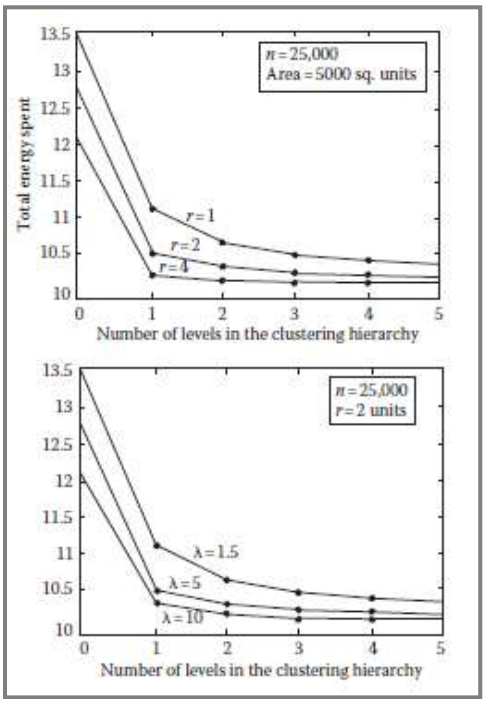

Figure 4: Energy Consumption of Multi Level EEHC

Figure 4, considering the multi level EEHC a valuable extension (that includes additional CH selection criteria) where the expected number of CHs at each level is Determined considering the formation process, they follow a top down approach starting from the formation of level 1 clusters. Where N is the total number of nodes in the network is the area that the network conversers are minimum transitions range, r is the current slot number is expected number of nodes. At the beginning the algorithm sets and initial percentage of CHs announcements to the other sensor. Each sensor sets is probability of becoming a CH, CHprob. CH prob is not allowed to fall below a certain threshold pmin, which selected to be inversely proportional to E max.

VI. CONCLUSION

The communication is flexible by using wireless sensor network. The cluster head is selected unreasonably this can be solved by using HEF algorithm. The overlapping coverage does not exist. The sensor nodes are designed with low energy consumption they can survive only for a limited period. The MIMO scheme prolongs the network life time with 75% of nodes remaining alive when compared to LEACH protocol. The energy of the cluster is detected by using sensors but in case of using hierarchical algorithm the energy of the sensors cannot be detected.

REFERENCES

[1] R.C. Shah & J.M. Rabaey (2013), "Energy Aware Routing for Low Energy Adhoc Sensor Networks", *Proceedings of the 3rd IEEE Wireless Communications and Networking Conference (WCNC)*, Orlando, Pp. 151–165.

[2] A. Lindgren, A. Doria & O. Schelen (2012), "Probabilistic Routing in Intermittently Connected Networks", *Mobile Computing and Communications Review*, Vol. 7, No. 3, Pp. 19–20.

[3] I. Sinan & Y.D. Mehmet (2011), "Cross Layer Load Balanced Forwarding Schemes for Video Sensor Networks", *Ad Hoc Networks*, Vol. 19, No. 3, Pp. 265–284.

[4] D. Duan, L. Yang, Y. Cao, J. Wei & X. Cheng (2014), "Self-Organizing Networks: From Bio-Inspired to Social-Driven", *Intelligent Systems IEEE*, Vol. 29, No. 2, Pp. 86–90.

[5] W.Y. Chung, B.G. Lee & C.S. Yang (2009), "3D Virtual Viewer on Mobile Device for Wireless Sensor Network-based RSSI Indoor Tracking System", *Sensors and Actuators B-Chemical*, Vol. 140, No. 1, Pp. 35–42.

[6] X. Yu, C. Li & Z.N. Low (2008), "Wireless Hydrogen Sensor Network using AlGaN/GaN High Electron Mobility Transistor Differential Diode Sensors", *Sensors and Actuators B-Chemical*, Vol. 135, No. 1, Pp. 188–194.

[7] Padmalaya Nayak & D. Anurag (2016), "A Fuzzy Logic based Clustering Algorithm for WSN to Extend the Network Lifetime", *IEEE Sensors Journal*, Vol. 16, No. 1, Pp. 137–144.

[8] K.V. Praveen Kumar, M.K. Banga & V. Udaya Rain (2016), "Energy Balanced Dynamic Cluster Routing Approach for WSN", *IEEE International Conference on Recent Trends in Electronics, Information and Communication Technology*.

[9] Manisha Rathee & Sushil Kumar (2016), "Quantum Inspired Genetic Algorithm for Energy Efficient Clustering in Wireless", *IEEE 1st International Conference on Power Electronics*.

[10] Ajay Sharma, Padmavati Khandnor & Sandeep Harit (2016), "Tree based Heuristic Algorithm for Maximizing Network Lifetime", *International Conference in Advanced Communication Control and Computing Technologies (IACCCT)*.

[11] Nandkumar Kulkarni, Neeli Rashmi Prasad & Ramjee Prasad (2014), "H-MOHRA: Heterogeneous Multi-Objective Hybrid Routing Algorithm for Mobile Wireless Sensor Networks", *IEEE Global Conference on Wireless Computing & Networking (GCWCN)*, Pp. 249–253.

