RESEARCHERID
THOMSON REUTERS

[Kaur, 5(7): July 2018]
DOI: 10.5281/zenodo.1319569

ISSN 2348 – 8034
Impact Factor- 4.022

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES

A REVIEW ON ENERGY EFFICIENT PROTOCOL FOR HETEROGENEOUS WIRELESS SENSOR NETWORK

Supreet Kaur[1] & Dr. Rajeev Kumar[2]

[*1]MTech Student, Department of Computer Science and Engineering, DAV College of Engineering and Technology, Jalandhar, India

[2]Assistant Professor, Department of Computer Science and Engineering Designation, DAV College of Engineering and Technology, Jalandhar, India

ABSTRACT

Wireless sensor networks had observed a enormous growth in recent years. As the sensor nodes used in WSN are battery powered, the consumption of battery decides the life time of network, as it can neither be recharged nor replaced. Therefore different protocols for heterogeneous WSN have been introduced to increase the life of network. In heterogeneous networks the nodes with the higher energy have more chances to become cluster head than the nodes have low energy. It simply means that selection of cluster head and giving tasks to them will increase energy efficiency. Various energy efficient protocols for Heterogeneous WSN have been developed in recent years and are discussed in this paper.

Keywords: *Energy Efficiency, Clustering, Heterogeneity.*

I. INTRODUCTION

Wireless sensor network (WSN) become increasingly useful in many areas. It senses the data from the environment and sends that data to a centre point called base station (BS). The huge application space of WSNs covers smart offices, transportation, health, battlefield surveillance, environment and many more. WSN consists of thousands of unattended compact size of sensor nodes. Nodes in the network are interconnected to each other and to the sink. These nodes are deployed randomly in inside the area of interest or in particular network [2].

Nodes sense the data and send it to the BS. If a node is unable to send data direct to the base station then it used the multihop method. In this method nodes near to the BS create Hotspot and collect data from the nodes then send to the BS. Thus hotspot node depletes the power faster than other nodes. In WSN energy consumption is the main issue [11].

ISSN 2348 – 8034
Impact Factor- 4.022

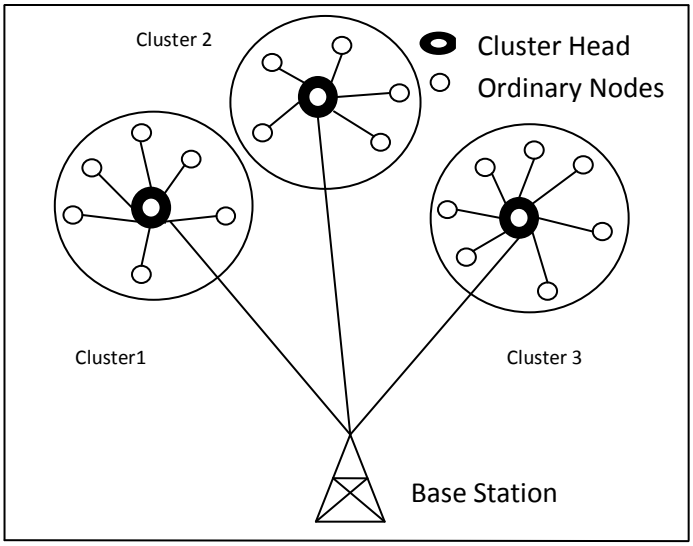

Fig 1 clustering based wsn

Clustering is the one of the best method used for the nodes to reduce the energy loss. In clustering the network is divided into the clusters. Every node has the part of a cluster and one node from the cluster is formed as a cluster head [4]. The cluster head node receives the data from ordinary nodes and passes it to BS. In homogeneous clustering every node has the same starting energy, where as in heterogeneous clustering every node has the different starting energy [12].

II. LITERATURE SURVEY

G. Smaragdakis et. al. [1] proposed a heterogeneity based protocol SEP. In SEP there are two levels oh heterogeneity. Weighted election probability of node is used to elect the CH. The two parameter of heterogeneous protocol are the quotient of advanced nodes m and the supplemental energy factor between advanced and normal nodes α. $Pnrm = \frac{Popt}{1+m.\alpha}$ is used to calculate probability of node for CH election and $Padv = \frac{Popt\ .(1+\alpha)}{1+m.\alpha}$ is used for Normal nodes. . The different threshold equations are used to for the advance node and normal node.

Li. Qing et. al. [2] has implemented distributed energy efficient clustering scheme for heterogeneous WSN. In DEEC protocol cluster heads election is based on possibility of ratio of remaining energy of every node and the network's average energy. The process of CH selection is performed on the behalf of starting and remaining energy of the node. The node with more remaining and starting energy has the more possibility to become a CH. Each nodes of the network have the dissimilar initial energy. Initially, every node should be familiar with the absolute energy and lifespan of the network. In DEEC, all the nodes get the information regarding absolute energy and lifespan of network from the BS.

Femi A. Aderhunmu et. al. [3]presented a new approach SEP-E. It is extension of SEP (Stable Election Protocol). In this paper new nodes are proposed called intermediate nodes. The intermediate nodes have the energy between the advanced and normal nodes. Each node has become CH on behalf of possibility of that node and each node become CH once in every round. Energy consumption in this approach is managed at some extent because of three level heterogeneity.

Brahim Elbhiri et. al. [4] presented the DDEEC protocol for heterogeneous WSN. It is extension of DEEC protocol, where CH selection is performed on the basis of starting energy and leftover energy of nodes. Like DEEC also in this scheme all the nodes should be familiar with the total energy and lifespan of the network. In this possibility of advanced nodes is more to being CH than the normal nodes. To avoid this problem of DEEC protocol,

the DDEEC introduced some changes in Threshold Residual Energy ValueTh_{REV}. In Th_{REV} all the nodes must have the same probability to being a CH. The advanced nodes are mainly elected as CH for the first round then after that their energy decreases in first round then these nodes have the same probability as normal nodes, to be selected as CH. So in that case election of CH will be more balanced and equitable.

Parul Saini et. al.[5] suggested E-DEEC protocol used the technology of DEEC protocol. It uses the three level heterogeneous networks. In this paper author introduced new nodes called the super nodes. That super nodes have additional energy than advanced nodes and normal node. Probability of the nodes is the base if CH election. The probabilities are calculated by the average energy of the network at each round.

Parul Saini et. al.[6] implements TDEEC protocol with different levels of heterogeneity. Three level heterogeneous networks have super nodes with higher energy, advanced nodes with middle level energy and normal nodes with lower energy. By this protocol lifespan and durability of the network is increased. In this paper author uses the same strategy as DEEC, but arrange the Threshold for election of the CH on the basis of ratio of remaining energy and average energy of that particular round. The nodes choose the random number between the 0 to 1, if the number is lower than the threshold T(s), the node is elected as the CH and otherwise it will be an ordinary node.

A.A. Khan et. al. [7] has proposed a new protocol HSEP, that decreases communication rate from CH to BS. Starting energy of the node as compare to the other nodes is relied on the weighted election probabilities. This enhances the Stability Period. It utilizes two categories of CHs i.e. primary CH and secondary CH. HSEP contains two categories of Sensor nodes i.e. Advanced and Normal nodes. Node's possibility to be a CH is calculated by starting energy of nodes. So the Secondary CHs may be from predefined primary CHs, and selection based on the probability, from these sensor nodes that previously be primary CH and just primary CHs may get part in a procedure of selecting secondary CHs.

M. M. Islam et. al. [8]has suggested an ESEP algorithm for CH election in hierarchically heterogeneous WSN to rearrange the network structure in more efficient way. The presented algorithm regard as the sensor nodes are stationary and arbitrarily scattered in the heterogeneous WSN, the location dimensions of the BT and the measurement of the sensor area are recognized. A three-tier clustered heterogeneous network is defined where the intermediate and advanced nodes choose as CHs for the growing quantity of rounds relied on their advanced starting energy comparative to other sensor nodes. A CH election procedure is regarded relied on the battery power and remaining energy of sensor node. During this procedure, advanced and moderate nodes contain advanced possibilities to be a CH in a given particular round rather than the normal nodes.

In this paper [9]T. N. Qureshi proposed BEENISH protocol. The BEENISH uses the same scheme as DEEC protocol that election of cluster head is based on residual energy of nodes and the overall average energy of the network but in BEENISH Multi level heterogeneity is used. Nodes with the higher probability have more chances to become cluster head. Ultra super nodes are usually chosen as CH as compare to super nodes, advanced nodes and normal nodes. Nodes select the random number between the 0 and 1. If that number is lower than the threshold number then that particular node is elected as the CH. In simulation the BEENISH provides the better results than other comparative protocols.

Shekhar Kumar et. al.[10] proposed the ETSSEP. It is a reactive protocol means nodes react immediately to the changes in the sensed value. It uses the three level of heterogeneity. That means ETSSEP has the three types of the nodes with different energy levels. The process of CH formation is performed on the basis of probability of the node. The probability of node is calculated on the behalf of average energy of network and node's remaining energy particular round. In ETSSEP the value of threshold value has adjusted to elect the cluster head. The threshold value is calculated by residual energy of node, average energy of the overall network and optimal number of cluster per round. In simulation, results are compared with SEP and TSEP. ETSSEP Performs better in terms of stability period, instability period, life time of the network and throughput.

ISSN 2348 – 8034
Impact Factor- 4.022

III. COMPARISON OF ENERGY EFFICIENT HETEROGENEOUS ALGORITHM

These Energy Efficient algorithms of Heterogeneous WSN have various similarities and dissimilarities. They are suitable in different environment with different parameters. So comparison of these energy efficient heterogeneous clustering based algorithms is given in table 1. Comparison is performed based on some parameters like energy efficiency, cluster stability, network life time, heterogeneity level and objectives of algorithm.

Table:

Table 9. Comparison table for HeterogeneousProtocols

Protocol	Energy Efficiency	Cluster Stability	Network Lifetime	Heterogeneity Level	Objectives
SEP[1]	Low	Moderate	low	Two level	To prolong the stable region
DEEC[2]	Medium	Good	low	Two/Multi	To control the energy expenditure
SEP-E[3]	Medium	Moderate	Average	Three level	Robust network lifetime and resource sharing
DDEEC[4]	High	Good	Middle	Two/Multi	Increase stability and lifetime of network.
E-DEEC[5]	High	Good	High	Three	Prolonging Lifetime and stability
TDEEC[6]	High	Good	High	Three/multi	Prolonging the life time of network
HSEP[7]	High	Good	High	Three	Increase the energy efficiency
ESEP[8]	Medium	Moderate	Middle	Three	Enhance the performance of network
BEENISH[9]	High	Excellent	High	Four	Enhance network life time
ETSSEP[10]	High	Excellent	High	Three	Increase stability and lifetime.

IV. CONCLUSION

In this paper we discuss the heterogeneous wireless sensor networks protocols. All these protocols are developed to increase energy efficiency, network lifetime, stability and instability of network. Some of the protocols have certain deficiencies while others are best suited in order to save the energy. In this paper different protocols used in heterogeneous WSN have been compared and the results of BEENISH and ETSSEP are found suitable for energy conservation and network stability.

REFERENCES

1. *G. Smaragdakis, I. Matta, A. Bestavros,"SEP: A Stable Election Protocol for clustered heterogeneous wireless sensor networks." in: Second International Workshop on Sensor and Actor Network Protocols and Applications, 2004.*

ISSN 2348 – 8034
Impact Factor- 4.022

2. *L. Qing, Q. Zhu, M. Wang, "Design of a distributed energy efficient clustering algorithm for heterogeneous wireless sensor networks". ELSEVIER, Computer Communications 29, pp 2230- 2237, 2006.*
3. *Femi, A. A., & Jeremiah, D. D. (2009). An enhanced Stable Election Protocol (SEP) for clustered heterogeneous WSN. Department of Information Science, University of Otago, New Zealand.*
4. *Brahim Elbhiri, Rachid Saadane, Sanaa El fldhi, Driss Aboutajdine, "Developed Distributed Energy-Efficient Clustering (DDEEC) for heterogeneous wireless sensor networks", In I/V Communications and International conference on I-SMAC (IoT in Social, Mobile, Analytics and cloud), 2010.*
5. *Parul Saini, Ajay. K. Sharma, "E-DEEC- Enhanced Distributed Energy Efficient Clustering scheme for heterogeneous WSN", Parallel Distributed and Grid Computing (PDGC), IEEE, 2010 1st International Conference on, 6 January 2011*
6. *Parul Saini, Ajay. K. Sharma, "Energy Efficient Scheme for Clustering Protocol Prolonging the Lifetime of Heterogeneous Wireless sensor networks", International Journal of Computer Application, volume 6-No .2, September 2010.*
7. *A.A. Khan, N. Javed, U. Qasim, Z. LU, Z. A. Khan, "HSEP: Heterogeniety-Aware Hierachical stable Election Protocol for WSN", IEEE 7th internaltional conference on Broadband, wireless computing, Communications and Applications, 2011.*
8. *M. M. Islam, M.A Matin, T. K. Mondol, "Extended Stable Election protocol for Threelevel Hierarchical Clustered Heterogeneous WSN", IEEE Conferance on Wireless Sensor System (WSS), 2012.*
9. *T. N. Qureshi, N. Javaid, A.H. Khan, A. Iqbal, E. Akhtar, M. Ishfaq, "BEENISH: Balanced Energy Efficient Network Integrated Super Heterogeneous Protocol for Wireless Sensor Networks", The 4th International Conference on Ambient Systems, Networks and Technologies (ANT 2013), Volume 19, 24 June 2013, Pages 920-925*
10. *Shekhar Kumar, Shashi Kant Verma, Awadhesh Kumar " Enhanced Threshold Sensitive Stable Election Protocol for Heterogeneous Wireless Sensor Network" Wireless Personal Communication,2015*
11. *Wenbo Zahang, Ling Li, Guangjie Han, Lincing Zhang, "E2HRC: An energy efficient Heterogeneous Ring clustering routing Protovol for Wireless sensor network," Journal of Latex class files, vol.*
12. *Anurag Chatap, Sumedha Sirsikar " Review On Various Protocols For heterogeneous wireless sensor network" International Conferance on I-SMAC 2017*