COMPARTIVE STUDY AND OVERVIEW ON TIME SYNCHRONIZATION AND OPTIMAL ROUTING ENERGY EFFICIENT WIRELESS SENSOR NETWORK

Shiv Kumar[1], Dr. Vijay K. Lamba[2], Dr. Ravinder Khanna[3]
[1]Research Scholar, ECE, IKG PTU Jalandhar (Punjab) India, [2]Professor, Global college of Engineering, Ropar (Punjab) India,
[3]Dean R& D, MMU, Sadopur, Ambala (Haryana) India.

ABSTRACT

The studyof the behaviour of different nodes is a remarkable achievement in the wireless sensor networks. Wireless sensor network are hierarchical clustered. Cluster based routing protocols are proven to be energy efficient when compared to other routing protocols. Most of the cluster based routing protocols, especially low energy adaptive clustering hierarchy (LEACH) protocol, follows dynamic, distributed and randomized (DDR) algorithm for clustering. Since there is a lot of randomness present in the cluster process, number of cluster heads generated varies highly from the optimal count. An overview to design a better variant of LEACH MAC protocols for heterogeneous network is proposed in this paper. The proposed study introduces the time synchronization in sending packets and optimal data aggregation table.

Keywords: Wireless sensor network; energy efficiency; clustering; time synchronization; optimal data aggregation table;

INTRODUCTION

Wireless sensor network has become a topic of great interest due to its widespread applications in health sector, industrial sector, military sector and automation security. One of the major issues in wireless sensor network is the energy efficiency. To deal with this issue here are several energy efficient protocols. Amongst them the most important protocol to deal with network lifetime problem is the clustering based algorithm. In this paper, the energy efficiency problem in the heterogeneous network is discussed.

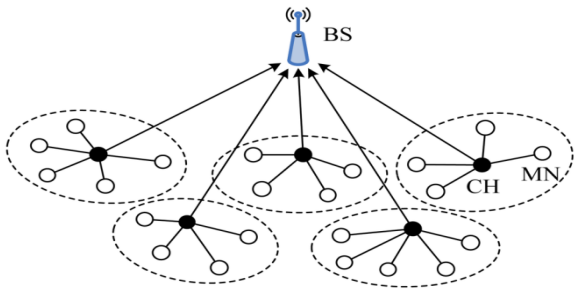

figure1. architecture of wireless sensor network

The architecture of wireless sensor network is shown in Figure1. A sensor network consists of large number of sensor nodes and base station. Sensor nodes are used to sense and collect the information or data and transmit it to the base station from where the end user can access the data with the help of internet. The

transfer of data from sink to base station takes place in multi hop pattern. Sensor nodes can vary from hundreds to thousands therefore it is essential to make them cheap and energy efficient.

The sensor network consists of four basic units such as processing unit, sensor units, transceiver and GPS system. Apart from these units, mobilizer and power unit are also used. Analog to digital converters (ADC) and sensor are employed in sensing units [4]. First of all signals is applied to ADC then passed through processing unit. The processing unit is a storage unit which used to perform various tasks in sensor network with other sensor node. Further, the power unit is an important component of sensor node to limit the power. However, location finding system is common component in sensor nodes for getting accurate knowledge of sensed data by the use of sensing routing technique.

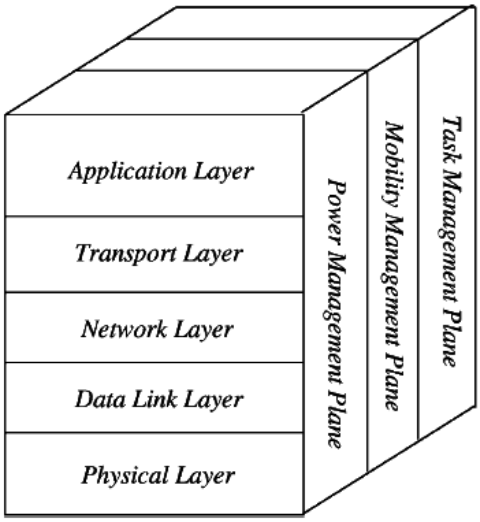

figure2. protocol stack for sensor nodes

The protocol stack for the sensor nodes andsink requires five layers of the OSI model, as shown in Figure2 with three cross layer planes. These vertical planes cover all of the basic of the node which are power, mobility and task management planes monitor the power, movement and task distribution among sensor nodes by coordinating the sensing tasks while minimizing overall power consumption.

Sensor nodes are the battery powered devices and most of the batteries cannot be replaced due to the application of limited energy. A huge portion of energy is wasted in the process of data transmission and route discovery. The lifetime of the network is directly affected by the energy consumption of the node. So this is the main problem for the protocol designer to adjust the energy of the nodes so as to increase the lifetime of the network. This paper will address the same problem and proposes an energy efficient algorithm which will provide the enhancement in the energy efficiency about increased by 40% in comparison to the traditional LEACH protocol. The main problem in the wireless sensor network is optimization of energy.

Literature review

This section will provide the brief description and highlights the contribution, remarks and factorsof the work done by the researchers. Many attempts have been made in the past to achieve the maximum throughput while the transfer of optimum amount of energy from source to destination.

P. K. Batra*et al.* in 2015 demonstrated an efficient approach LEACH's clustering to control the randomness.Network Simulator tool was used to find out the results. Results shows that first node death is 21% and last node death is 24 % over leach and same as 10 % for first node death and 20% last node death over advance leach [1].

Roslin, S. E. *et al.* in 2015 presented a hierarchical network using GA. Without disturbing the network properties, network topology was control by this method. Keeping in viewthe same, two tier wireless sensor network was design using GA to obtain local minima. Thecomparison was made with the help of simulated annealing for global minima [2].

A. S. Uma Maheswari *et al.* in 2014 designed a new phenomenon based on AHYMN and genetic algorithm was used to enhance the performance. From these approaches, cluster heads were selected on the basis of energy. Higher energy nodes were taken as cluster heads [3].

K. Kaurinin in 2015 proposed an effective cluster technique such as EDC-HBO for improvingthe energy and distance. The result demonstrates that applied technique had been more efficient energy than LEACH [4].

R. Aiyshwariya *et al.* in 2014 offered the selection of cluster heads using the efficient energy. The performance parameters were lifetime and energy efficiency. In this paper FAHP algorithm was used to improve accuracy and efficiency [5].

Ebin Deni Raj *et al.* in 2012 presented a new protocol based on clustering having maximum lifetime for WSN. The new algorithm EDRLEACH protocols was used for maximum efficiency. LEACH protocols were improved by equal distribution of cluster. Various applications of these protocols to improve the life period of sensor network are discussed [6].

Nabil Ali Alrajeh*et al.* in 2007 innovated special security as compare to wire line network. Keeping in view, a protocol was designed in such a way that network provides low energy and low computational power. A new game theory probability approach was presented to restrict the different attacks having utility [7].

Ioannis Krontiris *et al.* in 2009 devised a secure mechanism having limited resources of wireless sensor networks. Paper developed a generic algorithm for intrusion detection a new type of IDs was used. Results evaluated the effectiveness of the approach [8].

Joseph Rish Simenthy *et al.* in 2014 demonstrated security as main criteria for designing of wireless sensor network. The authors also proposed an advanced Intrusion detection system which improves detection rate, efficiency and lifetime of the network [9].

D. E. Boubiche *et al.* in 2012 proposed an new intrusion detection system which works on the interaction between the different layers of the system. The authors used the NS simulator to demonstrate the results that the new intrusion detection system maintains the security between the different layers of the OSI model [10].

P. S kumar *et al.* in 2011 presented clustering as an important issue in wireless sensor network for efficient energy and stability of the network. Authors implemented both the centralized and k means algorithm on the NS simulator platform. Further it has been observed that the clustering algorithm was better in terms of efficiency than that of the centralized algorithm [11].

G. Anastasi *et al.* in 2009 demonstrated various techniques of energy conservation in wireless sensor network. It was noticed that more energy is consumed during the data sensing and collection process therefore an energy efficient technique should be used in the processing of data acquisition [12].

Proposed Implementation

The main objectives of research work is generation of actual scenario for testing the energy of nodes, the system will utilize the inbuilt mechanisms of the simulation tool for each node in the scenario. Each WSN will be simulated individually. Finally, the evaluation of the performance comparison in terms of various parameters will test the Energy of sensing nodes.
There are three types of routing techniquesnamely flat, location based and hierarchal. In present work the hierarchal clustering based routing technique is proposed. Initially, N number of input nodes are generated where each node act as a round. Then random positions are allocated to N number of nodes. Each random allocated nodeis then assigned a number to identify the neighboring node. Each node has their neighborhood nodes connected to one another. Then a cluster head is selected on the basis of maximum energy. Generally a loop is created on the basis of energy of the different nodes. A cluster head is selected amongst the nodes during each round.

On the basis of different routing position and mode of data transfer routing table is created. These nodes have different dynamic time and have communication from base station to the cluster heads. Energy efficiency is directly related to the lifetime of the network. Therefore, an advanced LEACH protocol is proposed which deals with the energy efficiency problem. The proposed flow chart of the process explained above is as shown in Figure3.

The nodes are generated; their positions are randomly assigned and displayed. Once the nodes are deployed, every node uses the neighbor discovery algorithm to discover its neighbor nodes. Using the cluster head selection algorithm cluster heads are selected among the nodes. These cluster heads broadcast the advertisement message to all its neighboring nodes and thus clusters are formed with a fixed bound size. Each node in the cluster maintains routing table in which routing information of the nodes are updated.

Distributed randomized time slot assignment algorithm method is used which allows several nodes to share the same frequency channel by dividing the signal into different time slots. The cluster head aggregates the data from all the nodes in the cluster and the aggregated data is transmitted to the base station.

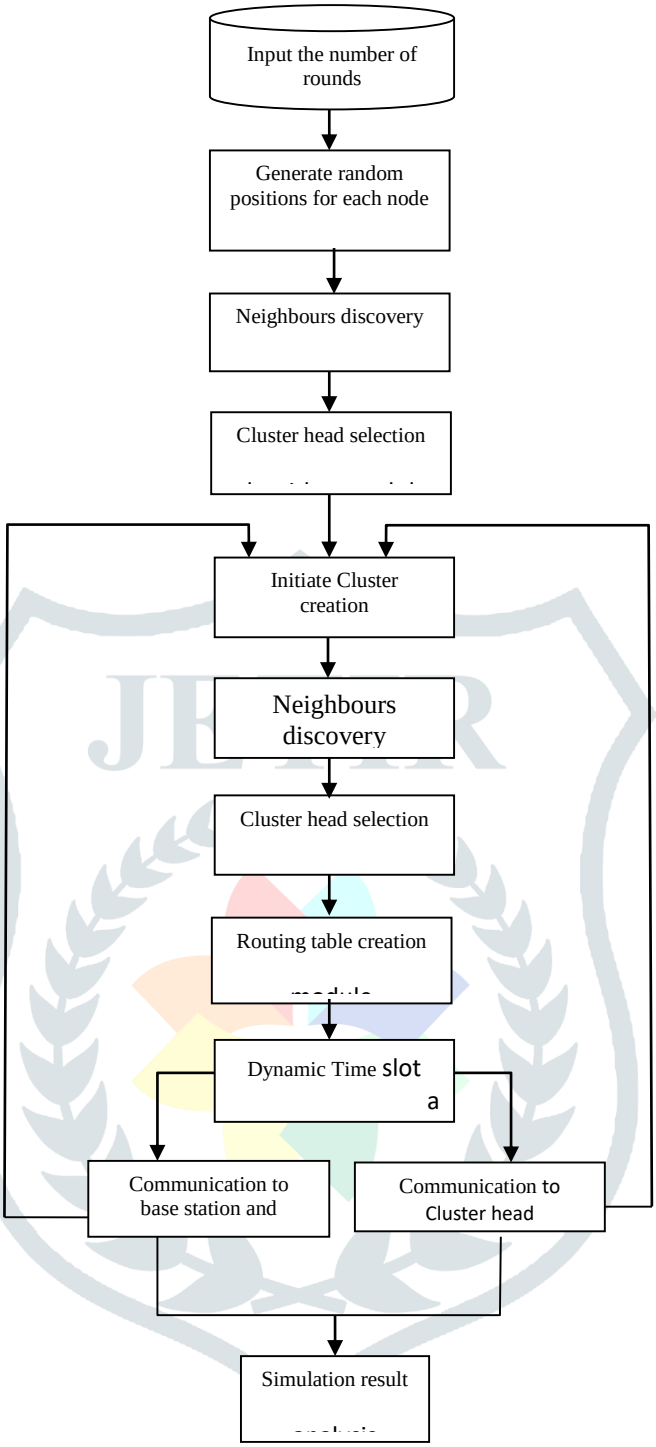

figure3. Proposed flow chart of the process

The complete network is divided into different cluster. Different sensor nodes are assigned the time slot to send the data from the clusters. One is all the nodes have send the data, but the transmit data is next level by choose an optimal from its routing table. The routing table is selected by heuristic function is shown in following equation:

$$h = k\ (E_{avg}/h_{min}) \qquad \text{(i)}$$

Where k is constant, E_{avg} is average energy of current path,h_{min} is the minimum hop count in the path, t = traffic in the current path. The threshold T (n_{nrm}), T (n_{int}), T (n_{adv}) for normal, intermediate and advanced respectively presented as follows:

$$T(\eta_{nrm}) = \begin{cases} \frac{P_{nrm}}{1-P_{nrm[r\times mod(1/P_{nrm})]}} if \eta_{nrm} \in G' \\ 0 \qquad otherwise \end{cases} \qquad \text{(ii)}$$

From Eq. ii, n × (1 − m − b) are normal nodes, which ensures that our assumption is exact. Where G' is the set of normal nodes that is not become cluster head in the past ($1/P_{\text{nrm}}$) round$r$. The same analogy follows for the intermediate and advanced nodes is presented in Eq. iii,

$$T(\eta_{int}) = \begin{cases} \frac{P_{int}}{1-P_{int[r\times mod(1/P_{int})]}} if \eta_{int} \in G'' \\ 0 \qquad otherwise \end{cases} \qquad \text{(iii)}$$

It has been ($n \times b$) intermediate nodes; with G'' as the set of intermediate nodes that has not become cluster head in the past

$$(1/P_{\text{int}}) \text{ round } r.T(\eta_{adv}) = \begin{cases} \frac{P_{adv}}{1-P_{adv[r\times mod(1/P_{adv})]}} if \eta_{int} \in G'' \\ 0 \qquad otherwise \end{cases} \qquad \text{(iv)}$$

($n \times m$) advanced nodes; with G''' as the set of advanced nodes that has not become cluster head in the past ($1/P_{\text{adv}}$) round r.

The average total number of cluster heads per round will be:

$$n.(1-m-n) \times P_{nrm} + (n.b) \times P_{int} + (n.m) \times P_{adv} = n \times P_{opt} \qquad \text{(v)}$$

The time synchronization and optimal data aggregation protocol will increase the network lifetime.

CONCLUSION

The proposed algorithm is based upon time synchronization to send data packets which increases the throughput of the network. Further, minimum spanning tree optimal data routing protocol routes the data optimally.

REFERENCES

[1] .P. K. Batra, Krishna Kant; 2015. LEACH-MAC: A new cluster head selection algorithm for Wireless Sensor Networks. Journal of Springer: 417-424.

[2] Roslin, S. E.; 2015. Genetic algorithm based cluster head optimization using topology control for hazardous environment using WSN.Innovations inInformation, Embedded and Communication Systems: 1-7

[3] A. S. Umamaheswari, S. Pushpalatha; 2014. Cluster Head Selection Based On Genetic Algorithm Using AHYMN Approaches in WSN. International Journal of Innovative Research in Science, Engineering and Technology; 3(3): 49-54.

[4] Kiranpreet Kaur, Harjit Singh; 2015. Cluster Head Selection using Honey Bee Optimization in Wireless Sensor Network .International Journal of Advanced Research in Computer and Communication Engineering ;4(5): 424-430.

[5] R. Aiyshwariya Devi, M. Buvana; 2014. Energy Efficient Cluster Head Selection Scheme Based On FMPDM for MANETs. International Journal of Innovative Research in Science, Engineering and Technology; 3(3). 235-239.

[6] EbinDeni Raj; 2012. An Efficient Cluster Head Selection Algorithm for Wireless Sensor Networks –Edr leach. IOSR Journal of Computer Engineering; 2(5): 40-45.

[7] Nabil Ali Alrajeh, S. Khan, and Bilal Shams; 2013. Intrusion Detection Systems in Wireless Sensor Networks: A Review. International Journal of Distributed Sensor Networks; 5(3)116-121.

[8] Ioannis Krontiris Zinaida Benenson, Thanassis Giannetsos, Felix C. Freiling, and Tassos Dimitriou1; 2009. Cooperative Intrusion Detection in Wireless Sensor Networks .Wireless sensor networks, Springer Berlin Heidelberg: 263-278.

[9] Joseph Rish Simenthy, K. Vijayan; 2014 Advanced Intrusion Detection System for Wireless Sensor Networks IJAREEIE; 3(4): 221-226

[10] Djallel Eddine Boubiche, Azeddine Bilami ; 2012 . Cross Layer Intrusion Detection System for Wireless Sensor Network. International Journal of Network Security & Its Applications; 4(4): 431-436.

[11] S Kumar Singh, M P Singh, D K Singh; 2011.Intrusion Detection Based Security Solution for Cluster-Based Wireless Sensor Networks .International Journal of Advanced Science and Technology; 30(5) : 327-332.

[12] Giuseppe Anastasi, Marco Conti, Mario Di Francesco, Andrea Passarella; 2009. Energy conservation in wireless sensor networks: A survey. ELSEVIER; 7(2):537–568