A SURVEY: ENHANCING THE NETWORK LIFETIME OF WIRELESS SENSOR NETWORK USING ENERGY MANAGEMENT TECHNIQUES

Divya Parmar[1,] Dhiraj Patel[2]

M.E. Students[1], Department of EC, S. N. PATEL INSTITUTE OF TECHNOLOGY & RC, UMRAKH, GUJARAT, INDIA

Assistant Professor[2], Department of EC, S. N. PATEL INSTITUTE OF TECHNOLOGY & RC , UMRAKH, GUJARAT, INDIA

Abstract: wireless sensor network are family of network in wireless communication system. The sensor network is composed of large number of low cost and low power sensor nodes that can be spread on a densely populated area and Base Station (BS) in order to monitor and control various physical parameters. The major source of sensor network failure is battery exhaustion and replacing this energy source in the field is usually not practical. Therefore, the use of energy efficient infrastructure, such as repositioning the BS in clustered WSN is able to prolong the lifetime of the network and improve the overall network data. In this paper, different energy efficient routing techniques are discussed. Here, routing protocols like LEACH, HEED, PEGASIS etc.

Keywords: Wireless Sensor Network, Base Station, Routing Protocols, WSN lifetime, energy efficiency, Algorithms.

I. INTRODUCTION

WSN consists of large number of tiny sensor nodes who have sensing, communication and computation capabilities. Each node is equipped with sensors, memory, microprocessors, battery and wireless transceiver [1].Wireless sensor network comprise of thousands of motes which are used to exchange information with the user either directly or through the external base station (BS). Each of these sensor nodes sense data from environment surrounding the sensors and send it to the outside world through the external base station. A base station is a mobile node or may be a fixed node which has a capability of connecting the sensor network to an existing

communications infrastructure or to the internet [2]. A typical node is made up of four basic components: a sensing unit, a processing unit, a transceiver unit and a power unit, e.g. a battery, Battery capacity (related to its size) is the factor limiting node longevity [3].There are numerous areas of Applications of WSNs e.g. environment and Agriculture monitoring, industrial control and, monitoring, home automation, security monitoring and defense also [4] [5].WSNs are used to collect information of hazardous areas such as battle fields, monitoring and tracking of animals in forest etc in which battery cannot be replaced easily so the power must be consumed efficiently to remain in working condition for long time. Lifetime of network is determined from energy consumption by sensor nodes.

The structural view of sensor network is shown in figure 1. Sensing unit, processing unit, transmission unit, and power unit are the four major constituent of sensor nodes assigned with dissimilar jobs.
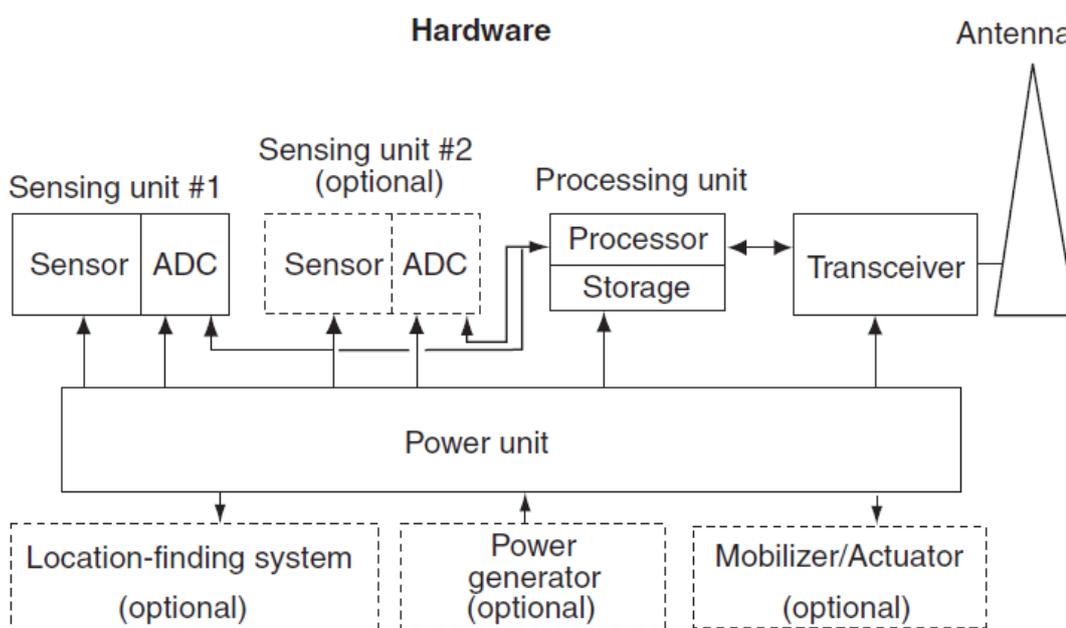

Figure-1 Architecture of Sensor Node

The end device in WSNS, the sensor node, is composed of four basic units [6]

1) Sensing Unit

It consists of an array of sensors that can measure the physical characteristics of its environment, like temperature, light, vibration, and others. Each sensor has the ability to sense environmental characteristics via the sensing unit and then use the Analog to Digital Converter (ADC) to convert the sensed Analog data into digital.

2) Processing Unit

It is, in most cases, composed of an internal memory to store data and application programs, and a microcontroller to process the data. The microcontroller can be considered as a highly constrained computer that contains The memory and interfaces required to Create simple applications. This unit should be able to work with a limited resource of energy and process efficiently the digital data delivered by the sensing unit.

3) Power Unit

A wireless sensor node is a popular solution when it is difficult or impossible to run a mains supply to the sensor node. However, since the wireless sensor node is often placed in a hard-to-reach location, changing the battery regularly can be costly and inconvenient. An important aspect in the development of a wireless sensor node is ensuring that there is always adequate energy available to power the system. The sensor node consumes power for sensing, communicating and data processing. More energy is required for data communication than any other process.

4) Transceiver Unit

It is able to send and receive messages through a wireless channel. In other words, it gives the sensor the ability to talk to other sensor nodes and form an Ad Hoc Network.

II. BASE STATION POSITIONING IN WIRELESS SENSOR NETWORK

There are two types of Base Station repositioning:

(1) Static and

(2)Dynamic

Static: this Creates unbalanced energy consumption among all sensor nodes which results in reduces network energy efficiency.

Dynamic: Dynamic repositioning the BS improve the performance even through the network is operational.

III. ENERGY EFFICIENCY IN ROUTING

In wireless sensor networks energy efficiency is more important than any other networks, more research works have already been done in routing in WSN. Data transmission in wireless communication takes more power than data processing. Whenever the nodes are transmitting more Number of data proportionately their battery power also get reduced. To reduce the data size we can go for data fusion or aggregation techniques. Data fusion is that in which the sensed data from different

nodes are fused at certain point suitable for Even in the data aggregation concept there are two types of aggregation. The first type of data aggregation fuses the data gathered from different sources and sends the final fused data in reduced size. But the problem behind this approach is it lacks in accuracy and precision of data from various sensor Nodes. The second approach combines the data from different sources under the single header and forwards it to the base station. Here header packets consolidates and pass it to the base station without any modification to the original data from the sensors. Hence accuracy is improved .Study on energy efficient routing in WSN brings this two broad classification of approaches. They are the transmission in its reduced size.

(1)Clustering approach

(2)Tree based approach

I) Clustering Approach:

Dividing the sensor networks into small manageable units is called as clustering. Though the main reason behind the Implementation of the clustering scheme is to improve the scalability of the Network; it is an important factor in achieving energy efficient routing of data within the network. Apart from achieving scalability of the network it has more advantages like conserving communication bandwidth within the clusters, avoiding redundant message transfer between the sensor nodes, Localizing energy efficient route setup within the clusters. Some of the energy efficient routing protocols based on clustering are LEACH, HEED [7]

LEACH: Low Energy Adaptive Clustering Hierarchy (LEACH) is an adaptive Clustering routing protocol proposed by Wendi B. Heinzelman , et al. LEACH arranges the nodes into small clusters and chooses one of them as the cluster-head [8].node first senses the vicinity around and sends the relevant information to cluster-head. Job of the cluster-head is to aggregates and compresses the information received from all the nodes and sends it to the Base Station. Cluster head drain out more energy as compared to the nodes as it has to sand data to the Base Station [8].

Advantages in LEACH Protocol:

(1) It is one of the mostly used hierarchical routing algorithms in sensor networks.

 (2) LEACH protocol erstwhile divides the total wireless sensor network into many clusters. Any node that served as a CH in present round cannot be selected as the CH again; therefore each node can share the load equally which is imposed on Cluster heads.

(3) The cluster head node is randomly selected and chance of every node to be selected as cluster head is equal attributable to which energy consumption of whole network is averaged. Thus LEACH will prolong the network life cycle.

HEED: O. Younis and S. Fahmy projected [9] Hybrid Energy Efficient Distributed clustering Protocol (HEED) protocol in 2004. It extends the fundamental or the basic scheme of LEACH by using residual energy as primary parameter and network topology features such as node degree, distances to neighbors are only used as secondary parameters to shatter the tie between the candidate cluster heads, as a metric for cluster choice to attain power balancing. The clustering process is split into a number of iterations, and in every iteration nodes that are not covered by any cluster head doubles their probability of becoming a cluster head. As these energy-efficient clustering protocols further enables each node to probabilistically and independently decide its role in the clustered network. Moreover they cannot guarantee optimal elected set of cluster heads.

Advantages in HEED protocol:

(1) It is a distributed clustering method that benefits from the use of the two important parameters for CH election.

(2) Low power levels of clusters endorse an increase in spatial reuse while high power levels of clusters are needed for inter-cluster communication. This imparts uniform Cluster-Head distribution across the network and load balancing.

(3) In a multi-hop fashion, communication between Cluster-Heads and Base Station provides more energy conservation and scalability in contrast with the single-hop fashion, i.e. long range communication directly from CHs to the sink, as within the LEACH protocol.

 (2)Tree based approach

PEGASIS: PEGASIS and Hierarchical-PEGASIS PEGASIS (Power-Efficient Gathering in Sensor Information Systems) is optimal chain-based protocol that is an improvement over LEACH. Instead of forming multiple clusters, PEAGSIS construct a node chain when nodes are placed randomly in a play field then each node communicates only with a close neighbor, take turns and transmit data to the base station, thus reducing the amount of energy spent per round [10].

 5

Although PEGASIS performs better than LEACH by eliminating the overhead of dynamic cluster formation, because transmission is asynchronous, the time of transmission will be prolonged too much. Hierarchical-PEGASIS makes a further improvement; it allows concurrent transmission when the nodes are not adjacent. Compared with LEACH, the two algorithms eliminate the overhead of forming cluster, but both of them do not take the energy condition of next hop into Consideration when choosing a routing path, so they are not suitable for heavy-loaded network. When the amount of nodes is very large in WSNs, the delay of data transmission is very obvious, so they do not scale well and also are not suitable for sensor networks where such global knowledge is not easy to obtain.

Advantages in PEGASIS protocol:

(1) It is an improved version of LEACH.

(2) This protocol is in position to outgo LEACH for different or various network sizes and topologies cluster formation in LEACH, and reduces the number or quantity of data/information transmission volume through the chain of information aggregation.

(3) The energy load is distributed uniformly within the network. To prevent the subsequent early death of sensor node, all sensor nodes act as leader successively.

IV GENETIC ALGORITHM

Genetic algorithms are dominant search technique belongs to evolutionary algorithm class that are used effectively to solve problem in different aspects of areas. GAs can be implemented straightforward and provide significant gains in performance. Genetic Algorithms are direct, parallel, stochastic method for global search and optimization of problems. A GA initiated with a set of randomly generated possible solutions for a task called a population. Included individual solution in the population recognized as chromosomes. Every chromosome may possibly be represented as a simple string or an array of genes enclosed with part of solution. A Genetic Algorithm takes into account fitness to test on new structures to choose the best population. Fitness provided the fitness value to each individual [11]. The fortune of an individual chromosome relies on the fitness value.

Working of GA: There are some steps of how the GA works is shown below:

❖ First, at random population created known as initial population.

❖ The Algorithm creates the series of next generations by considering the individual population in current scenario.

❖ Following steps are consider:

- Assign scores to each member in the current population.

- Convert these score into more useful range of values

- Based on the fitness select members as parents

- Reproduction takes place. Mutation children produce from single parent by making small changes in it. Crossover-vector pairs of both parents are connected Children of the current scenario used to form next generation

❖ Procedure stops when any condition of the stopping criteria is met.

CONCLUSION

In this paper, to maximize the network lifetime an efficient routing scheme for wireless sensor network has been implied. The routing protocols like LEACH, HEED, and PEGASIS are explained. They are proved to be energy efficient protocols. The objective of the implied GA methodology is to minimize the energy consumption and minimize the number of orphan nodes and maximize the coverage.

REFERENCES

[1]I.F.Akyildiz,W.su,y.Sankarasubramaniam and E. Cayirci,"Wireless Sensor network a survey,"ELSEVIER, 2001.

[2] Jamal N.Al-Karaki and Ahmed E. Kamal, "Routingtechniques in wireless sensor networks:A survey",wireless communications, IEEE, vol. 11, pp. 6-28,Dec. 2004.

[3]I.F.Akyildiz,W.su,y.Sankarasubramaniam and E. Cayirci,"Wireless Sensor networks: A survey."ELSEVIER, computer Networks,vol. 38(4),pp.393-422,2002.

[4]Xiangqian chen Kia Makki,Kang Yen,and Niki Pissinou,"Sensor Network Security:A Survey",Communication Survey & Tutorial,IEEE Second quarter 2009,pp52-73,vol.11(2).

[5] I.F.Akyildiz,W.su, y. Sankarasubramaniam and E. Cayirci,"A survey on SensorNetworks,"IEEE,communications Magazine,November 7,2002,pp.102-114,vol.40(8).

[6]Wireless Sensor Network, Technology Protocols and Applications by KAZEM SOHRABY, DANIEL MINOLI,TAIEB ZNATI.

[7] B. Baranidharan , B. Shanthi "A Survey on Energy Efficient Protocols for Wireless

Sensor Networks,*" International Journal of Computer Applications (0975 – 8887)*

Volume 11– No.10, December 2010

[8]Mu Tong; Minghao Tang, "LEACH –B; An Improved LEACH Protocol for Wireless Sensor Network",WICOM-2010,6[th] international Conference , Chengdu,2010,pp 1-4.

[9]Ossama Younis and Sonia Fahmy. 2004. Distributed Clustering in Ad-hoc Sensor Networks: A Hybrid, EnergyEfficient Approach. In Proceedings of IEEE INFOCOM, Hong Kong, an extended version appeared in IEEE Transactions on Mobile Computing, 3(4)

[10] S. Lindsey, C.S. Raghavendra, "PEGASIS: power efficient gathering in sensor information systems", in Proceedings of the IEEE Aerospace Conference,Big Sky, Montana, March 2002, vol. 3.

[11]Kumar, N., kaur j.,"An efficient clustering protocol increasing wireless sensor networks lifetime", 7th international conference on wireless communications, Networking and mobile computing, 2011,pp.1-5.