Optimization technique to improve the lifetime of wireless sensor network

Rani rathi[1], Er.Anuj Aggerwal[2]

[1] *P.G. Student, computer engineering, Kurukshetra Institute of Technology & management, Kurukshetra, India*
[2] *Asst. professor, computer engineering, Kurukshetra Institute of Technology & management, Kurukshetra, India*

ABSTRACT

Abstract - wireless sensor network (WSN) [1] consists of a collection of wireless sensor nodes that sense the application environment, collect the information and send it to the sink node or to the base station. Presently wireless sensor networks are becomes very popular. But the nodes associated with wsn have restricted energy and every node operation required some energy so an efficient energy consumption by the node is main design issue in wsn. Here in last decades various clustering and power management protocols are proposed to improve wsn lifetime. This paper represents a survey on recent wsn clustering protocols.

Keyword:- *Wireless Sensors Network, Clustering algorithm, energy efficiency*

1. INTRODUCTION

WSN (wireless sensor network) is an emerging information technology integrating the latest technological advancements in micro-electronics and network communications. WSN forms an intelligent network application system consisting of thousands of energy limited and low cost nodes. Typically, sensors send the sensed data to an external base station for further processing. These sensor nodes have small-capacity batteries which are mostly non-rechargeable and irreplaceable. The elementary components of a sensor node are sensing unit, processing unit, a transceiver unit and a power unit. The sensor node senses the application area and collect information in the form of electrical signal. Sensor nodes work with some limited resources like battery power, bandwidth, memory etc. Wireless sensor networks lifetime depends upon battery power of nodes as every node operation consumes energy, hence nodes gets out of energy. And it is not possible to replace or recharge the battery of nodes. So, efficient energy consumption by nodes is the prime design issue for wireless sensor network. [2]

Clustering algorithms are considered energy efficient approach for wireless sensor network. Clustering divides the nodes into independent clusters and selects a head for each cluster. Nodes send the collected data to respective cluster head; cluster head (CH) applies data fusion/aggregation to reduce the collected data to some useful information and sends aggregated data to base station (BS). Communication between two nodes is the main energy consuming process that depends upon the distance between the two nodes. Clustering avoids long distance communication between two nodes and only cluster heads are communicating to base station (BS). To load balance the network, the cluster head is rotated among all nodes. The dynamic clustering protocol allows us to space out the

lifespan of the node, allowing it to do only the minimum work it needs to transmit data.Hierarchical clustering protocols have extensively been used toward the above directions. Moreover, they can greatly contribute to the overall system scalability, lifetime, and energy efficiency. The need for clustering in WSNs is first motivated and a brief description of implied hierarchical network pattern is given. In the main body of the chapter the most significant of the existing WSNs clustering algorithms are concisely presented and commented according to the previously stated parameters and classification scheme. [3]

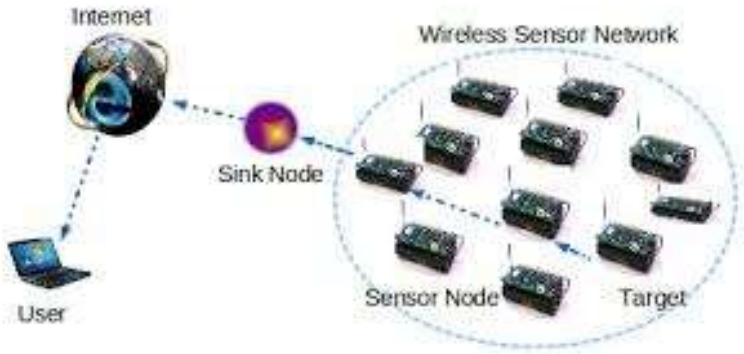

Fig.1: wireless sensor network architecture [4]

2. WSN CHALLENGES

There are various types of challenges occurred within WSN these are:

1. **Node deployment:**

Node placement in WSN is application-dependent and can be whichever manual or randomized. In manual placement, the sensors are manually allocated and data is routed across predetermined paths. The node deployment in wsn should in such way that the communication between nodes never failed. So to maintain the proper communication between these nodes an excellent routing protocol is required.

2. **Fault tolerance:**

Some sensor nodes could flounder or be blocked due to lack of domination, physical damage, or environmental interferences. The wreck of sensor nodes ought to not alter the finished task of the sensor network. If countless nodes flounder, medium admission manipulations (MAC) and routing protocols have to accommodate formation of new links and paths to the data collection BSs.

3. **Coverage:**

In WSNs, every single sensor node obtains a precise think of the environment. A given sensors think of the nature is manipulated in both scope and accuracy; it can only cover a manipulated physical distance of the environment. Hence, distance coverage is additionally an vital design parameter in WSNs.

4. Power consumption:

WSN is made up of thousands of nodes and these nodes are energy restricted and cannot replaceable and rechargeable. WSN lifetime depends on these nodes energy and every nodes operation consume some energy. So an efficient energy consumption by the node is the main design issue in WSN.

5. transmission media:

In WSN the transmission medium between sensor nodes is radio waves or infrared waves. The communication medium should be universally present it should not bound with any standards and should not require any license to operate.

3. APPLICATIONS

Some important applications of wireless sensor networks are:

a) Military Applications:

Since wireless sensor networks are based on the dense deployment of expandable and low-cost sensor nodes, destruction of some nodes by warlike actions does not affect a military operation as much as destruction of a traditional sensors, which makes sensor networks concept a better. Some of the military applications of wireless sensor networks are approach for battlefields

1. Monitoring forces, equipment and inspect the area.
2. Battlefield surveillance
3. Activities of opposing forces and terrain
4. Biological, Nuclear and chemical attack detection and reconnaissance

b) Health Applications:

Some of the health applications of sensor networks are providing interface for the disabled; integrated patient monitoring; drug administration in hospitals; diagnostic; monitoring the internal processes and movements of insects or other small animals; monitoring the human physiological data; and tracking the location of doctors and patients inside a hospital.

c) Home Appliances:

As technology advances, smart sensor nodes can be engaged in appliances, such as, vacuum cleaners refrigerators, micro-wave ovens, and VCRs. These sensor nodes inside the indoor devices can interact with each other and with the external networks via the Internet or Satellite. These sensors allow end users to manage home devices locally and remotely more easily.

d) Environmental Applications:

Some environmental applications of these sensor networks include tracking the movements of birds, insects and small animals; monitoring the environmental conditions that affect crops; chemical/ biological detection; disease detection; precision agriculture; biological, pollution, and environmental monitoring in sea, soil, and atmospheric contexts; forest fire detection; pressure monitoring; meteorological research such as; flood detection; bio-complexity mapping of environment; and pollution study.

4. LITERATURE REVIEW

V.Loscri et al., 2005 [5] Wireless sensor networks with thousands of sensor nodes are expected to find wide applicability and increased deployment in coming years, as they enable reliable monitoring and analysis of the environment. Here proposed a modification in a well-known protocol for sensor networks called Low Energy Adaptive Clustering Hierarchy (LEACH). This is last designed for sensor networks to remotely monitor the environment. In such situation, the data from the individual node sent to a central base station (BS), often located far from the sensor network, through which the user can access the data In this work our contribution was represented by building a two-level hierarchy to realize a protocol that saves better the energy consumption.

Fan Yiming et al., 2007 [6] Presented the communication protocol named LEACH. The protocol focus on reducing the power consumption by the wireless sensor networks, which can have the significant impact on the overall energy dissipation of these network. LEACH, used data fusion into the routing protocols to reduce the amounts of information that must be transmitted to the base station. In addition, LEACH helps in load balancing of network by distributing energy dissipation evenly throughout the sensors, increase the system lifetime for the networks. Increased of network lifetime about 30% can be achieved.

Fei Song et al., 2008 [7] Here proposed a trust-based LEACH i.e low energy adaptive clustering hierarchy protocol which provide secure routing, while preserving the essential functions of the original protocol. The decision-making scheme is based on the decision trust, that evaluated separately and dynamically for the different decisions by basic situational trust. The situational trust was maintained by a trust management module integrated with a trust-based routing, having novel technique in trust update model and cluster-head-assisted monitoring control.

Wei Wang et al., 2009 [8] In order to increase the WSN's lifetime, a refined protocol named LEACH-H (hybrid cluster head selection LEACH) is proposed. In the first round of Leach-H, the base-station (BS) selects a cluster head (CH) set through adopting simulated annealing algorithm; in the followed rounds the cluster heads (CHs) will select new cluster heads within same cluster. This will not only solved the problem that the cluster heads are unevenly distributed in LEACH, but also helps to maintain the characteristics of distribution. The energy consumed by the network is cut down and the lifetime of WSN is extended in Leach-H.

Wu Xinhua et al., 2010 [9] Presented the pollination based optimization algorithm also called OLEACH-C give the improvement of LEACH-C protocol. The PBO algorithm is utilized for clustering in WSN. The node with maximum remaining energy will be selected as a cluster head. If the two nodes have the same energy then cluster head (CH) will be selected based on distance. The node that has minimum distance from the base station will be selected as CH. LEACH-C protocol selects the best CHs that provides a routing optimization with the minimum energy consumption and minimum cost of communication links between nodes within each cluster.

Mu Tong et al., 2010 [10] Based on the analysis on the defect in LEAC-H including the fluctuations of the number of cluster heads and the ignorance of the nodes residual energy, presented a novel protocol called LEACH-B (LEACH-Balanced). In each round, after first selection of cluster head (CH) according to LEACH protocol, a second selection is introduced by LEACH-B to modify the number of cluster head (CH) in consideration of nodes residual energy. As a result the number of cluster head is constant and only 3% or 5% cluster heads are near optimal per round.

Ningbo Wang et al., 2012 [11] Proposed an effective version of LEACH protocol in extending the lifetime of wireless sensor networks. LEACH-R protocol is an improvement of LEACH protocol. LEACH-R improves the selection of cluster-head (CH) and proposed to choose relaying node as compare to LEACH. Residual energy of the nodes is considered during selection of cluster-head (CH), so the possibility of low-energy node being selected as cluster-head is reduced. Based on both residual energy and distance from base station, relay node is chosen from cluster heads to become the relay node between base station (BS) and other cluster-heads.

Asha Ahlawat et al., 2013 [12] Presented a new version of LEACH protocol called Improved V-LEACH which aims to increase network life time. The work to be done is improved V-LEACH protocol by selecting a vice cluster head. The Vice Cluster head is that alternate cluster head that will work only when the cluster head will die. Then process of vice cluster head selection based on three factors i.e. Minimum distance, maximum residual energy. The proposed approach improved the network lifetime as never the cluster head will die. As a cluster head died it will be replaced by its vice Cluster head. The new version of improved V- LEACH out performs the original version of LEACH protocol to increase the network life time 49.37%.

Chunyao FU et al., 2013 [13] Due to the limitation of nodes energy in wireless sensor networks, energy efficiency is an important factor that is considered when the protocols are designed. As a typical representative of hierarchical routing protocols, LEACH Protocol played an important role in the uneven energy distribution that is caused by the randomness of cluster heads (CHs) forming, this paper proposed a new improved version of LEACH protocol i.e (LEACH-TLCH) which was intended to balance the energy consumption of the entire network by selecting two cluster heads within same cluster. And improve the lifetime of the network.

Richa Garg et al., 2014 [14] Proposed an algorithm called genetic algorithm is an optimization technique that generate possible solutions to optimization problems. Optimization is the central to any problem involving whether in engineering or economics. Genetic algorithm performs the number of iterations and produced possible number of solutions called initial population. Genetic algorithms solve the problems step by step and produced next generation. All evolutionary algorithms including (GA) Genetic Algorithm can find near optimal solution.

Mu Tong et al., 2015 [15] Wireless sensor networks becomes more popular because of their wide range of application. Efficient energy consumption by the nodes is the prime design issue for these networks. Clustering approaches increase the network lifetime with the load balanced network. To achieve load balancing of network clustering algorithm rotate the role of cluster head (CH) among the nodes, so cluster head selection process is important for clustering algorithms. Presented a genetic algorithm based on cluster head selection for centralized clustering algorithm to have a better load balanced sensor network than the traditional clustering algorithms. Proposed solution finds the optimal cluster heads and has prolonged sensor network lifetime than the traditional clustering algorithms.

5. CONCLUSION

After having gone through different literatures published on the topic of energy conservation in WSN. Mainly energy consumption in CH is due to its sending and receiving operations. Although LEACH is best protocol amongst all the routing protocols to increase the energy efficiency of WSN still it needs to be improved ,here in future efforts we will implement a technique for the cluster head selection which not only provides optimal cluster head solutions but also increase the energy efficiency in WSN.

6. REFERENCES

[1]. Wendi B. Heinzelman and P. Chandrakasan, ”An Application specific Protocol Architecture for WSN”, IEEE transactions on wireless communication, vol. 1, No.-4, pp. 660-670, 2002.

[2]. Parul Khurana and Inderdeep Aulakh, ”Wireless Sensor Network Routing Protocols: A Survey”, International journal of computer applications, vol. 75, No. 15, 2013.

[3]. Md. Faruqul Islam, Yogesh Kumar , saurabh ,” Recent Trends in Energy Efficient Clustering in WSN”, International Journal of Computer applications, vol. 95, No.-20, pp. 44-48,2014.

[4]. Pankaj Chauhan and Tarun Kumar," Power Optimization in Wireless Sensor Network: A Perspective", International Journal of Engineering and Technical Research (IJETR) ,vol. 3, issue-5, May 2015.

[5]. V.Loscrì, G.Morabito, S.Marano,” A Two-Levels Hierarchy for Low-Energy Adaptive Clustering Hierarchy (TL-LEACH), vehicular technology conference IEEE 38th· 2005.

[6]. Fan Yiming, Hangzhou, Yu Jianjun," The Communication Protocol for Wireless Sensor Network About LEACH, IEEE International Conference on CISW, 2007.

[7]. Fei Song and Baohua Zhao," Trust Based LEACH Protocol For Wireless Sensor Network, IEEE 2nd International Conference, Vol. 1, pp. 202-207, 2008.

[8]. Wei Wang, Qianping Wang ; Wei Luo," LEACH-H: An Improved Routing Protocol for Collaborating Network", IEEE International Conference on Wireless communication, pp.1-5, 2009.

[9]. WU Xinhua And Wang Sheng, " Performance Comparison of LEACH And LEACH –C Protocols", IEEE 9th International Conference on Distributed Computing And Applications to Business, pp. 255-258,2010

[10]. MU. Tang and Minghao Tang," *LEACH-B:* An Improved LEACH Protocol For Wireless Sensor Network", IEEE, PP. 1-4, 2010.

[11]. Ningbo Wang And Hao Zhu ," An Energy Efficient Algorithm Based On LEACH Protocol", IEEE International Conference On Computer Science And Electronics Engineering , PP. -339-342, 2012.

[12]. Asha Alawat and Vineeta Malik," An Extended Vice-CH Selection Appraoch to Improve LEACH Protocol in WSN", IEEE 3rd International Conference on advance Computing & Communication technologies, pp.236-240, 2013.

[13]. Chunyao FU, Zhifang JIANG, Wei Wei, " An Energy Balanced Algorithm of LEACH Protocol in WSN", International journal of computer science IJCSI, vol. 10, issue 1, No. 1, 2013.

[14]. Richa Garg and Saurabh mittal ,"Optimization by Genetic Algorithm", International Journal of Advanced Research in Computer Science and Software Engineering, vol.4, issue.4, 2014.

[15]. Vipin Pal, Yogita, Girdhari Singh , RP.Yadav," CH Optimization based on Genetic Algorithm to prolong lifetime of WSN", Elsevier: third international conference on recent trends in computing, pp. 1417-1423, 2015.