International Journal of Research in Advent Technology (IJRAT) Special Issue
E-ISSN: 2321-9637
Available online at www.ijrat.org
*International Conference "*INTELINC 18*", 12th & 13th October 2018*

Improved Energy Efficient Sleep Scheduling Algorithm In Wireless Sensor Networks

M.Janani Priya
Deparment of ECE
Email: jananipriyaa.m@gmail.com

Abstract- In Wireless Sensor Network most of the devices operate on batteries in order to save energy Sleep Scheduling Algorithm is used to maintain network connectivity. In sleep scheduling algorithms most of the nodes are put to sleep to conserve energy and increase network life time and Data aggregation is an effective technique to solve energy-constrained issue in Wireless Sensor Networks. Therefore the objective of this paper is advancement in protocols of delay-efficient sleep scheduling method needs to be designed to ensure the energy conservation and low broadcasting delay to increasing the lifetime in any node in the WSN. Therefore the proposed algorithm is compared with results of two known existing algorithm: the Low Energy Adaptive Clustering Hierarchy (LEACH) and Information Fusion-Based Role Assignment (InFRA). As sensor nodes are mostly battery operated for event monitoring are expected to work for a long time without recharging their batteries, also it is undesirable or impossible to recharge or replace the battery power of all the sensors. Therefore, the new trend towards the energy efficient is sleep scheduling design which extends system lifetime without sacrificing system reliability.

Keyword- Sleep Scheduling Algorithm(SSA), Wireless Sensor Networks (WSN).

I. INTRODUCTION

The WSNs generally is an intelligent, low power small in size and low cost solution that enables the efficiency and reliability improvement of many industrial applications such as safety and security surveillance, home and building automation, and smart grids. However, there are many challenges to bring the WSNs into real-life application. In many applications, a sensor node is powered by a finite energy source such as a battery or a super capacitor that restricts the WSNs lifetime. Therefore, energy consumption of the WSNs needs to be taken into account when planning the network operation. Also in the critical event monitoring, alarming message has to be broadcasting during most of the time. When a critical event is detected, the alarm packet should be broadcast to the entire network as soon as possible. Unfortunately, a very little previous work on distributed systems can be applied to WSNs. Compared with traditional computer networks, WSNs have fixed or predefined infrastructure as a hierarchical structure, which resulting the difficulty to achieve routing scalability and efficiency. Therefore, innovative energy-aware, scalable, and robust algorithms for WSNs are highly required. A problem that is closely related is the energy efficient topology control, delay between the transmission packets which maintains energy efficient network connectivity by controlling the transmission power at each node, or selecting a small subset of the local links of a node. Recently, there are many sleep scheduling protocols has been implemented for the energy efficiency in the WSN. But, it gives the limitations on the network. Obviously, sleep scheduling may cause broadcasting delay because source nodes should have to wait until destination nodes are active and set to receive the broadcasting message. Hence, broadcasting delay is also an important issue for the application of the critical event monitoring. Therefore, the advancement in the methodology or algorithms in existing method related to the main concerns when developing the WSNs is to improvement in their parameters such as energy efficiency, transmission delay, data packet loss, network lifetime etc. contributes us to work in the research of new protocol concepts to improve or enhance the WSN in real time applications.

II. SENSOR NODE IN WSN

A WSN consist of large number of sensor nodes equipped with various sensing devices to observe different phenomenon changes in the real world. A sensor node is composed of typically four units- a)

sensing unit: - sense the desired data from the interested region. b) Memory unit: - store the data until it is sent for future use. c) Computation unit: - computes the aggregated data d) power unit: - provides power supply for entire process. Since sensor nodes are battery powered devices therefore they have limited energy. WSN are usually deployed in inhospitable terrain such as mountainous region where it's very difficult to recharge or replace batteries. Therefore the main aim of any energy efficient routing protocol is to prolong the network lifetime which is possible by minimizing energy consumption of individual nodes. In addition it is also necessary to ensure that the average rate of consumption of energy by each node is also same. This would ensure that the connectivity needed to transmit data from a source node to sink node is also maintained. Since lifetime of a network is defined as time in which a single node losses its energy and get exhausted. More ever, the transceiver is the major unit of energy consumption in sensor node even when sensor nodes are in idle state. Therefore sensor nodes must be put to sleep (radio off) if they are not required to transmit or receive data. It is assumed that transceiver, processor and sensing unit can be put to sleep independently. It is assumed that when sensor nodes are put to sleep it means that the transceiver and processor are put to sleep. The challenge is to integrate sleep scheduling scheme with routing protocols for WSNs.

III. ENERGY EFFICIENCY AND BROADCASTING DELAY IN WSN

A. Energy Efficiency

As we have already known that mostly the Wireless Sensor Network is battery operated which are located at remote place. Since the sensor nodes utilizes the energy in different ways such as transmitting or receiving message packet,ideal listening, sleeping mode or any cause of hardware. To improve the energy efficiency of the network it is necessary to avoid the ideal listening of the sensor nodes in the network because it the reason to waste energy unnecessarily. For this the sleep scheduling mechanism gives efficient way to increase network lifetime. Various wake-up patterns has to be implemented in WSN for energy efficiency. But it gives the broadcasting delay in WSN. The data aggregation also gives the energy efficiency in the network by collecting the redundant information at center node.

B. Broadcasting Delay

In WSNs, for monitoring a critical event in network a small number of messages has to be broadcast mostly. As after detection of any critical event; the overall network has to be woken up immediately. Hence it is necessary to have a minimum broadcasting delay. To extend network lifetime, the sleep scheduling methods has always implemented in the WSNs. So it causes the broadcasting delay mostly in large sensor network. Therefore, the task is to implement a protocol which gives the trade-off between energy efficiency in network with minimum broadcasting delay for any nodal configuration which completes the requirement of any application.

IV. COMPARATIVE STUDY

A. Low Energy Adaptive Clustering Hierarchy (LEACH)

It gives the best suitable method for clustering in the network which ultimately reduces the energy consumption in WSNs. The LEACH utilizes a TDMA schedule-based structure, this avoids the conflicts such as collusion, hidden and exposed terminal, overhearing, ideal listening problems and allows nodes to turn themselves ON and OFF at appropriate time given by schedule. Also it allows the aggregation in the network, gives randomized, adaptive, self configured cluster forming algorithm in the network. It is necessary to use flexible protocol that fits with the objectives of the project. Though LEACH provides energy efficiency in the network, but it gives the transmission delay. Therefore, to improve these two parameters, the proposed algorithm will give the best results for these parameters of the designed network.

B. Information Fusion-Based Role Assignment (InFRA)

It has some key aspects as for energy consumption the cluster has formed based on the residual energy of sensor nodes in the network, highly correlation of data aggregation, overlapping of the data paths in the network, reliable transmission of aggregated data in the network. The proposed algorithm for the network has compared with the simulation results of these existing protocols as LEACH and InFRA which gives the better improvement in the performance parameters such as energy efficiency, broadcasting delay, packet

delivery ratio, normalized routing load and average throughput.

V. PROPOSED SLEEP SCHEDULING ALGORITHM

The routing protocol proposed in this section is intended for WSNs in which sensor nodes are static. Besides the applications running in the WSN require that the information gathered by the sensor nodes have to be transmitted immediately to the sink Furthermore, it is also assumed that each node has a unique id, and the communication between neighboring nodes is symmetric and bidirectional. It is also assumed that the clocks of the sensor nodes in the WSN are synchronized so that nodes can be woken up nearly at the same time, and they can execute the proposed algorithm.
The objectives of the proposed routing algorithm with sleep scheduling are as follows:

(i) Most sensor nodes should be in sleep mode most of the time so that the energy consumption by each node is
reduced.
(ii) Consumption of energy by all the sensor nodes remains balanced, i.e., at any time, every node should have
consumed nearly the same amount of energy.
(iii) Load shared by each node must be same so that no node is over used.
(iv) Time required to transmit data from a sensor node to the sink is as minimum as possible.

In proposed algorithm a broadcast tree is constructed using the approach given in. During the construction of the tree number of broadcast is kept as minimum as possible to ensure minimum energy consumption during tree construction. After the completion of tree construction, each node determines their parent node. Now each node is put into sleep mode. Whenever a node detects an event it transit in active mode and transmit their data to their parent node and after transmission they again transit into sleep mode. This way data is transmitted from source to sink node whenever a source node wants to send its data to sink node. The tree is reconstructed periodically to ensure balanced consumption of energy by all the nodes. As outlined above, the proposed routing algorithm with sleep scheduling consists of the following
(i) Construction of the broadcast tree at the beginning of the every period.
(ii) Transmission of the data from source to sink whenever required.

VI. SIMULATION

In this simulation, our experimental model performed Network Simulator .v2 (NS-2) on different nodal density which were randomly deployed and distributed in a 100m×100m square meter simulator area. We assume that all nodes have no mobility as the nodes are fixed in applications of most of the wireless sensor networks. The simulation model required for experiment uses the same parameters as shown in table 1.

TABLE 1: SIMULATION PARAMETERS

PARAMETERS	VALUES
Simulation tool	NS-2
Channnel used	WIRELESS
Initial energy	100 Joules for each node
Network area	100m*100m
Antenna type	Omni-directional
Routing MAC protocol	AODV
Data packet length in queue	50

VII. SIMULATION RESULT ANALYSIS

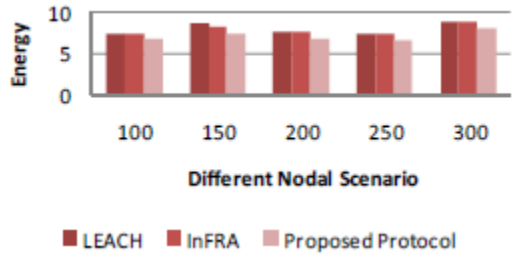

Fig.1 Average energy consumption for different algorithm

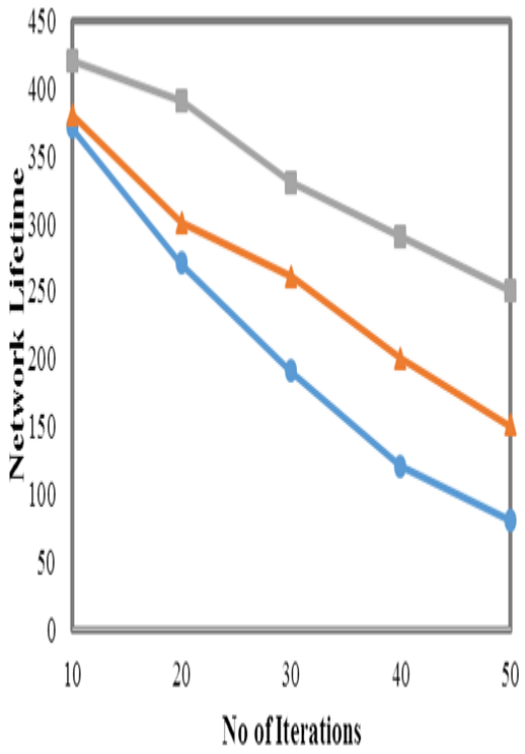

Fig2. Network lifetime

VIII. CONCLUSION

In this work, the improved sleep scheduling algorithm for the energy efficiency and improvement in routing path through the network which ultimately gives the minimum broadcasting delay. The simulation results of proposed algorithm compared with two other known algorithms, the LEACH and InFRA regarding the energy efficiency, broadcasting delay and average throughput. Therefore, with the reference of result of the performance parameters of conducted simulation the energy consumption and broadcasting delay of proposed algorithm is effectively lower than that of the other existing compared algorithms.

REFERENCES

[1] S. Mahajan, J. Malhotra, and S. Sharma, "An energy balanced QoS based cluster head selection strategy for WSN," *Egyptian Informatics Journal*, vol. 15, pp. 189-199, 2014.

[2] B. Singh and D. K. Lobiyal, "Energy-aware Cluster Head Selection Using Particle Swarm Optimization and Analysis of Packet Retransmissions in WSN," *Procedia Technology*, vol. 4, pp. 171-176, 2012.

[3] A. Wang, D. Yang, and D. Sun, "A clustering algorithm based on energy information and cluster heads expectation for wireless sensor networks," *Computers & Electrical Engineering*, vol. 38, pp. 662-671, 2012.

[4] T. Amgoth and P. K. Jana, "Energy-aware routing algorithm for wireless sensor networks," *Computers & Electrical Engineering*, vol. 41, pp. 357-367,2015.

[5] F. Saleem, Y. Moeen, M. Behzad, M. A. Hasnat, Z. A. Khan, U. Qasim, *et al.*, "IDDR: Improved Density Controlled Divide-and-Rule Scheme for Energy Efficient Routing in Wireless Sensor Networks," *Procedia Computer Science*, vol. 34, pp. 212-219, 2014.

[6] K. Latif, A. Ahmad, N. Javaid, Z. A. Khan, and N. Alrajeh, "Divide-and-Rule Scheme for Energy Efficient Routing in Wireless Sensor Networks," *Procedia Computer Science*, vol. 19, pp. 340-347, 2013.

[7] J. Hao, Q. Chen, H. Huan, and J. Zhao, "Energy efficient clustering algorithm for data gathering in wireless sensor networks," *Journal of Networks*, vol. 6, pp. 490-497, 2011.

[8] W. Yanwei, L. Xiang-Yang, L. YunHao, and L. Wei, "Energy-Efficient Wake-Up Scheduling for Data Collection and Aggregation," *IEEE Transactions on Parallel and Distributed Systems*, , vol. 21, pp. 275-287, 2010.

[9] G. Kannan and T. Sree Renga Raja, "Energy efficient distributed cluster head scheduling scheme for two tiered wireless sensor network," *Egyptian Informatics Journal*.

[10] Peng Guo, Tao Jiang, Senior Member, IEEE, , Qian Zhang, Fellow, IEEE, and Kui Zhang, "Sleep Scheduling for Critical Event Monitoring in Wireless Sensor Networks," IEEE Transactions On Parallel And Distributed Systems, Vol. 23, No. 2, February 2012.

[11] K. Somu, Mr. U.Gowri Sankar, "The critical Event Monitoring In Wireless Sensor Networks Using Sleep Scheduling," International Journal of Innovative Research in Computer and Communication Engineering, Vol.2,Special Issue 1, March 2014.