International Journal of Scientific Research and Management (IJSRM) ||Volume||5||Issue||02||Pages||5176-5181||2017||
Website: www.ijsrm.in ISSN (e): 2321-3418

Energy Efficient Optimized Protocols for Wireless Sensor Network

Nutan* Punit Kaushik**

*Assistant Professor, CSE Department, DCRUST, Murthal
** Lecturer, IC Department, Gov. Polytechnic, Sonipat

Abstract

We consider energy-efficient time synchronization in a wireless sensor network where a head node is equipped with a powerful processor and supplied power from outlet, and sensor nodes are limited in processing and battery-powered. It is this *asymmetry* that our study focuses on; unlike most existing schemes to save the power of all network nodes, we concentrate on battery-powered sensor nodes in minimizing energy consumption for time synchronization. We present a time synchronization scheme based on asynchronous source clock frequency recovery and reverse two-way message exchanges combined with measurement data report messages, where we minimize the number of message transmissions from sensor nodes while achieving sub microsecond time synchronization accuracy through propagation delay compensation. We carry out the performance analysis of the estimation of both measurement time and clock frequency with lower bounds for the latter. Simulation results verify that the proposed scheme outperforms the schemes based on conventional two-way message exchanges with and without clock frequency recovery in terms of the accuracy of measurement time estimation and the number of message transmissions and receptions at sensor nodes as an indirect measure of energy efficiency.

Key Words: - WSN, RTO, LEACH, IDS.

I. Introduction

Sensor networks are comprised of a group of nodes which are distributed in an environment. The nodes are placed either regularly or randomly in the environment. Such networks do not usually have a specific structure, and the nodes cooperate to collect and send data to a base station.

Sensor networks are widely used in different areas such as business, industry, military environments, fire alarms, tracing moving targets and traffic surveillance. These networks have some limitations such as energy level, limited radio range, low processing power and low storage memory [1].

In sensor networks, data are collected in the sensing radius of each node in the environment. Then the nodes cooperate to send data towards the sink node. Sensor network routing is completely different from wired network routing. Due to the constraints on energy in sensor networks, it is necessary to use an energy-efficient routing protocol. In other words, energy consumption requires close attention while sending data from a source node to a destination node. That is why, the network lifetime can be increased [1, 2, 3].

Wireless sensor networks (WSNs) are networks which consist of a huge of sensor nodes and connect together via a wireless network. The sensor nodes sense the interested information from the monitored environment such as temperature, humidity, and pressure depending on the designed application and then send to a sink node [1]. The sink node is a communication center of this network which is connected to a dedicated server for processing the information or connected to internet network. WSNs are application specific system which each application has its different requirement. However, there are important common characteristics of WSNs that should be considered in performing the system design [2], such as small node size, low node cost, scalability, reliability, self-configurability, low power consumption, and security. Normal application of

WSNs is used to monitor the environment, which is difficult or dangerous to reach. It means that these sensor nodes will have no maintenance during operation. Each sensor node is battery-powered, which has limited the amount of energy and cannot be recharged or replaced. One crucial role of system design on the WSNs is to prolong network life time as long as possible.

Therefore, all components of sensor node must be an energy efficient, not only hardware part, but also software part. Stage of the art of electronic components can reduce a lot of power consumption while new real time operation systems (RTOS) such as Free RTOS, MQX from Freescal or Tiny OS can improve the energy consumption performance [3].

Another important part that affects to the energy consumption is network protocol, which is very significant to the whole picture of WSN system. It is very important on balancing between network performance and network life time. In this work, the WSN network routing protocol is addressed.

The rest of the paper is organized as follows. Section II outlines the complete design of Turbo Decoder. Proposed Algorithm to analyzed BER is discussed in Section III. Section IV is concentrated on the simulated result of Turbo Decoder. The conclusions are given in Section V.

II. Earlier Research Work

[1] A hierarchical network is developed using genetic algorithm. This network controls the network topology without affecting the network properties. Here, a two tier WSN developed using GA can be implemented in any hazardous applications. Though genetic algorithm gives an optimized list of cluster heads, there are possibilities of local minima. This could be further improvised by simulated annealing which results in global minima.

[2] A new method which is based on AHYMN approaches and genetic algorithm is represented to choose a cluster head in WSNs in dynamically. Therefore, it is quicker and also more accurate to detect the node with higher energy and to select the cluster head. Moreover, this network has used nodes with heterogeneous characteristics. Some of the advantageous of heterogeneous nodes are: the long lifetime of networks, increase in network's reliability and decrease in data transference delay.

[3] On the basis of HBO algorithm, this paper proposes EDCHBO a cluster head selection algorithm for effective cluster head selection. This algorithm considers the energy and distance factor as parameter to improve cluster head selection. The main goal of EDC-HBO is to enhance the network lifetime as well as to improve the power consumption of network. Simulation results show that EDC-HBO is more energy efficient than LEACH and UCR protocol. As the WSN has data redundancy, how to design and realize routing protocol with optimal data aggregation will be our future research work.

[4] The hierarchical fuzzy integral is introduced into the scheme in order to make the most criteria that can influence energy efficiency become a single one to determine the selection of the CHs, which is the main innovation and improvement of the classical algorithms. The simulation results demonstrate that the lifetime and energy efficiency of FAHP is better than other classical algorithms, time synchrony and fault tolerant problems are overcome by using FAHP process it also improves the localization accuracy and efficiency, Classifying FAHP with FMPDM it improves Consistency of Decision making and also improves the parameters energy, lifetime and throughput will be efficient. It also improves Robustness.

[5] The suggested new protocol EDRLEACH is based on clustering with maximum lifetime for wireless sensor networks. It improves LEACH by using a very equally distributed cluster and decreasing the unequal topology of the clusters. The new network protocol can be built on the shortcomings of Leach to try and rectify them. The applications of the new algorithm are immense as the life period has increased considerably.

[6] This paper analyzed that WSNs have special vulnerabilities that do not exist in wire-line networks. Therefore, our protocols can't be simply transferred for wire-line networks to WSNs. Protocols must be designed with low computational power and low energy requirements in mind. In this paper it has been seen some of the protocols that are used, as well as some ways to determine where to check packets, including a new game theoretic approach in which it has been observed that by allowing the attack to have some utility, author is able to increase through energy saving for sufficiently large, resource constrained networks.

[7] This paper is a survey paper which states while designing a security mechanism, we must consider the limited resources of WSNs. Anomaly-based IDSs are lightweight in nature; however they create more false alarms. Signature-based IDSs are suitable for relatively large-sized WSNs; however they have some overheads such as updating and inserting new signatures. Cross layer IDSs are usually not recommended for networks having resources limitations, as more energy and computation are required for exchanging multilayer parameters.

[8] This paper proposes the development of an Intrusion Detection Program (IDP) which could detect known attack patterns. An IDP does not eliminate the use of any preventive mechanism but it works as the last defensive mechanism in securing the system. Three variants of genetic programming techniques namely Linear Genetic Programming (LGP), Multi-Expression Programming (MEP) and Gene Expression Programming (GEP) were evaluated to design IDP.

[9] We consider the problem of cooperative intrusion detection in wireless sensor networks where the nodes are equipped with local detector modules and have to identify the intruder in a distributed fashion. The detector modules issue suspicions about an intrusion in the sensor's neighborhood. We formally define the problem of intrusion detection and identify necessary and sufficient conditions for its solvability. Based on these conditions we develop a generic algorithm for intrusion detection and present simulations and experiments which show the effectiveness of our approach.

[10] Many intrusion detection system (IDS) have been proposed to secure WSNs. In this paper a new intrusion detection system based on cross layer interaction between the network, Mac and physical layers has been proposed. Indeed it addressed the problem of intrusion detection in a different way in which the concept of cross layer is widely used leading to the birth of a new type of IDS. The proposed is experimentally evaluated using the NS simulator to demonstrate its effectiveness in detecting different types of attacks at multiple layers of the OSI model.

III. Proposed Algorithm

A step by step algorithm for the proposed work is given as:

STEP1. Initialize the random positions and directions of bacteria.

STEP2. Consider the searching space dimension as number of total binary digits for bandwidth, energy and memory

STEP3. Initialize the chemotactic, swarming, reproduction and dispersion steps. The initial step size of bacteria is taken as 0.1.

STEP4. Initialize the weighting parameters of PSO as 0.2 and 0.5.

STEP5. In each chemotactic step, for every bacteria fitness function is evaluated (fitness function is discussed in next column) and position of bacteria is updated by position updating formula defined in previous chapter. It is

$$New\ pos = old\ pos + step\ size \times \frac{direction}{\sqrt{direction * direction'}}$$

STEP6. In swarming step the previous fitness function output is compared with the next position output of same bacteria. If found less then position of bacteria is updated again by formula given in step 5.

STEP7. The present position of bacteria is termed as current position of particle for PSO and output of fitness function is Jlocal for the PSO.

PSO Starts here:

STEP8. Take out the minimum value index from the J local and corresponding bacteria's position is termed as the local best position of particle for each bacteria.

STEP9. The velocity of each particle is further updated from random initial velocity to a PSO tuned velocity by using the formula:

$$new\ velocity = 0.9 * old\ velocity + c1 * R1(local\ best\ position - current\ posiiton) + c2 * R2(global\ best\ position - current\ posiiton)$$

Where c1, c2 and R1,R2 are initialized initially.

STEP10. This new velocity is the direction of bacteria in BFO as

$$direction = velocity$$

PSO ends here

STEP11. The chemotactic and swarming loop continues till all initialized steps are completed. In each loop PSO updates the direction of bacteria and move the bacteria into the direction of fast convergence.

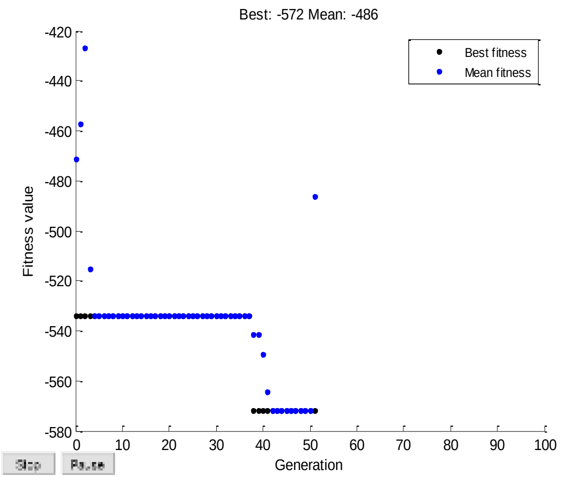
STEP12. Reproduction steps take place for bacteria with high fitness function values.

STEP13. To disperse or kill the weak bacteria, a probability of 0.25 is defined as the deciding probability. If random probability is higher than it, bacteria is dispersed or vice versa.

STEP14. Result will be positions of bacteria with minimum fitness function output. These positions are binary digits for remaining bandwidth, memory and energy for cluster heads.

IV. Simulation Result

The minimum value in this curve is -589 and to compare it, we used genetic algorithm from the base paper which is giving the minimum value of -575 which is higher than proposed work as shown in figure 5.3 for GA.



Though we need to maximize the residual energy and other parameters for each node after initial link establishment, yet we have designed the objective function for minimization since the genetic algorithm toolbox of MATLAB works for minimization and if it is to be used for maximization, a negative of objective function equation is used. So to compare proposed and GA algorithm, we kept the objective function same that's why our graph is minimizing rather than maximizing.

V. Conclusion

Our work is based on reducing the energy consumption in WSN. We have considered two tier topology of WSN in which nodes transmit their data to cluster head and which is forwarded to base station by their cluster heads. This way energy consumption is reduced and nodes can live long life even with bounded by battery available. It can be done either done by selecting the cluster head such that energy consumption in making communication with nodes is very less or selecting the optimum path with minimum distance to travel for data packets. In our work we have combined both approaches to reduce energy consumption. This is done by using optimization as it is a work of nonlinear mathematical problems bounded by many constraints.

References

[1]. Roslin, S.E., "Genetic algorithm based cluster head optimization using topology control for hazardous environment using WSN," in *Innovations in Information, Embedded and Communication Systems (ICIIECS), 2015 International Conference on* , vol., no., pp.1-7, 19-20 March 2015

[2]. A.S. Uma maheswari, Mrs. S. Pushpalatha," Cluster Head Selection Based On Genetic Algorithm Using AHYMN Approaches in WSN", International Journal of Innovative Research in Science, Engineering and Technology Volume 3, Special Issue 3, March 2014

[3]. Kiranpreet Kaur, Harjit Singh," Cluster Head Selection using Honey Bee Optimization in Wireless Sensor Network" International Journal of Advanced Research in Computer and Communication Engineering Vol. 4, Issue 5, May 2015

[4]. R. Aiyshwariya Devi, M.Buvana," Energy Efficient Cluster Head Selection Scheme Based On FMPDM for MANETs" International Journal of Innovative Research in Science, Engineering and Technology Volume 3, Special Issue 3, March 2014

[5]. Ebin Deni Raj," An Efficient Cluster Head Selection Algorithm for Wireless Sensor Networks –Edrleach", IOSR Journal of Computer Engineering (IOSRJCE) ISSN: 2278-0661 Volume 2, Issue 2 (July-Aug. 2012)

[6]. Nabil Ali Alrajeh, S. Khan, and Bilal Shams," Intrusion Detection Systems in Wireless Sensor Networks: A Review" International Journal of Distributed Sensor Networks Volume 2013.

[7]. Ajith Abraham, Crina Grosan, and Carlos Martin-Vide," Evolutionary Design of Intrusion Detection Programs" International

Journal of Network Security, Vol.4, No.3, 2007

[8]. Ioannis Krontiris, Zinaida Benenson, Thanassis Giannetsos, Felix C Freiling, Tassos Dimitriou," Cooperative Intrusion Detection in Wireless Sensor Networks", Wireless sensor networks, Springer Berlin Heidelberg,2009

[9]. Djallel Eddine Boubiche and Azeddine Bilami," Cross Layer Intrusion Detection System For Wireless Sensor Network" International Journal of Network Security & Its Applications (IJNSA), Vol.4, No.2, March 2012.

[10]. Shio Kumar Singh, M P Singh, and D K Singh," Intrusion Detection Based Security Solution for Cluster-Based Wireless Sensor Networks" International Journal of Advanced Science and Technology Vol. 30, May, 2011

[11]. A. Anbumozhi, K. Muneeswaran," Detection of Intruders in Wireless Sensor Networks Using Anomaly" IJIRSET Volume 3, Special Issue 3, March 2014

[12]. Joseph Rish Simenthy CEng , AMIE, K. Vijayan," Advanced Intrusion Detection System for Wireless Sensor Networks" IJAREEIE Vol. 3, Special Issue 3, April 2014

[13]. Nabil Ali Alrajeh , Mohamad Souheil Alabed, and Mohamed Shaaban Elwahiby," Secure Ant-Based Routing Protocol for Wireless Sensor Network" International Journal of Distributed Sensor Networks Volume 2013

[14]. Quazi Mamun, Rafiqul Islam, and Mohammed Kaosar," Anomaly Detection in Wireless Sensor Network" Journal Of Networks, Vol. 9, No. 11, November 2014

[15]. Jaime Lloret, "Intrusion Detection Algorithm Based on Neighbor Information Against Sinkhole Attack in Wireless Sensor Networks." The Computer Journal Advance Access published May 13, 2014.