A Review: Energy Efficiency using Various Protocols in Wireless Sensor Networks

Abhay Chander Bhatnagar[1], Ruchi Varshney[2], Kumar Manu[3]
1 M.Tech Student, 2 Assistant Professor, 3 Assistant Professor
Department of Electronics & Communication Engineering.
Moradabad Institute of Technology, Moradabad,
Dr. A.P.J.Abdul Kalam Technical University, Lucknow, U.P., India.

Abstract

An operative and manageable network is always required to fulfill the many practical applications ranges from small scale industry to large scale power conserved environment tracking. In case of wireless sensor networks (WSNs), energy devastation of network node is a tremendous confrontation in the context of maximizing the lifetime span of the WSN. It will always be risky, very costly or in some cases even impossible to charge or replace the overexerted batteries because of the contentious nature of the network. There are many researches for designing energy efficient protocols while as actualizing the desirable WSN operation. We are focusing on many different schemes which are used to degrade the energy utilization factor of the sensing nodes. When we diagnosed the causes for energy dissipation by the nodes, we are able to classify energy efficient schemes such as topology control, duty cycling, control reduction, energy efficient routing and data reduction.

Keywords: *Artificial Neural network, Wireless Sensor Networks, PEACH, PEGASIS.LEACH*

I. INTRODUCTION

Modern technological investigations has given the economical bulk production of sensor nodes which are having advance sensing, processing and processing potentiality in very small sizes. A wireless sensor network (WSN) is a network of especially scattered sensing nodes connected wirelessly. These sensing nodes senses the environment and shares the information over the wireless channel to other nodes of the same network and to a labeled sink point which is called as Base station (BS). The dynamic power management is an approach for reducing the energy consumption in wireless sensor network (WSN) nodes while designing and establishment of the network.

Now the days, there is a strong interest of using smart tools such as neural network for energy efficient wireless sensor network (WSN) because of their simple parallel divided calculation, distributed storage, data vagueness, auto-analysis of sensing nodes and sensor readings. The use of neural network algorithms leads to reduced communication cost and energy conservation.

In present scenario, WSNs can provide a variety of various applications due to their plentiful utilization in many areas such as agriculture, biomedical, traffic control, object tracking, surveillance, environment monitoring, machine failure diagnosis, fire detection, inventory control, energy management and reconnaissance[10][11].

But due to their energy consumption posed by the sensor, the WSNs uses are limited. The energy exhaustion of the sensing nodes eventuates during the internetwork communication, the wireless sensing and data processing. So that the main focus of routing protocol in wireless sensor network (WSN) is about to energy conservation. Most of the routing protocols are designed for the wired network to provide great quality of service (QoS) but in case of wireless sensor networks, these protocols are not good so that due to these reasons many other protocols are examined for data communication in wireless sensor network (WSN).

II. ANN (Artificial Neural Network)

The Neural Network considered here, is a three-layer perception with a hidden layer, which has two neurons in hidden and output layers and 5 neurons in the input layer.

Activation functions for the first and second layers ($f1(x)$, $f2(x)$ respectively) are radial basis functions for NN1 and sigmoid for NN2 and their relations are as in below Equations:

$$f_1(x) = m_{0e^{(-cx^2)}} \; or \; f_{1(x)=m_0} \frac{1 - ze^{(-cx)}}{1 + ze^{(-cx)}} \quad (1)$$

$$f_2(x) = n_{0e^{(-cx^2)}} \; or \; f_{2(x)=} \frac{n_o}{1 + ze^{(-cx)}} \quad (2)$$

In Equations (1) and (2), $n0$ and $m0$ are parameters to be designed, which can be varied to achieve an optimum response. For initial weighting, the

following 3-stage so called Nguyen-Widrow algorithm is used:

Step 1: β parameter is defined as follows:

$$\beta = .7(p)^{\frac{1}{n}} \quad (3)$$

In which n and p are the number of neurons of the input and output layers.

2: For each hidden layer *i*, the weights between input and hidden layer *Wij* (j = 1... *p*) are chosen values between -0.5 and 0.5 and by calculation of |Wj| the updated weights can be calculated as follows:

$$W_{ij} = \beta \frac{W_{ij\,(old)}}{\|W_{j\,(old)}\|} \quad (4)$$

Step 3: The weights between hidden and output layers are random values chosen between −β and β.

III. LITERATURE SURVEY

W.R.Heinzelman, A.Chandrakasan and H.Balakrishnan [1] proposed protocol for distributing energy load among the sensor nodes in network. LEACH handling single-hop routing in which all sensor node transfer data precisely to the cluster head or the sink. It works in two phase: 1)The setup phase- In the setup phase ,the cluster are formed and the cluster heads are chosen and each round stochastic algorithm is used by each node to resolve whether it will become a cluster head. 2) The steady state phase- The information is sent to the base station the duration of the steady state phase is longer than the period of the setup phase in order to minimize overhead. Cluster head creates a TDMA (Time Division Multiple Access) schedule situated on the number of nodes in the group. CDMA (Code Division Multiple Access) code is used for random transmission inner the cluster. LEACH is inappropriate for large network areas.

Lim, Jong Chern and Bleakley [2] presented that it was conceivable to preserve an important quantity of energy concluded the appropriate use of data forecast and node scheduling without a major loss in accuracy. Their results demonstration that it is conceivable to growth lifetime through up to 2600% at the cost of increasing average error by 0.5C0 for temperature or 1.5% for humidity capacities.

Stojkoska, Biljana and Solev [3] had established data reduction approaches which decrease the quantity of sent data by forecasting the dignified values both at the basis and the sink, needful broadcast only if a positive receiving error differs by an assumed border from the forecast values. Their method is based on using mutable stage size LMS algorithm. They had accomplished supreme data reduction of over 95%, while retentive a practically high precision.

S Yi, J Heo, Y Cho and J Hong In [4] suggested a power-efficient and adaptive clustering hierarchy protocol for wireless sensor networks. In wireless sensor networks, by overhearing a node can remember the origin and the target of packets broadcast by the neighbor nodes. Based on the overheard data, PEACH design the clusters without additional packet transmission overhead such as broadcast, announcement, joining, and arranging messages. As a result of the protocol design, PEACH is usually more scalable and efficient to the distinct circumstances than the existing clustering protocols of the wireless sensor networks. PEACH can be used for both location-unaware and location-aware wireless sensor networks

S Lmdsey and Cauligi S. Raghvendra [5] proposed a greedy chain protocol i.e. PEGASIS (Power efficient gathering in sensor information systems), which resolves the data-gathering complication of the wireless sensor networks. The main point is for each node to share information to adjoining nodes and take turns as leader for sending data to the base station. This approach will distribute the power load equally between the sensor nodes of the network.

Initially the nodes are placed casually in the network, and the sensing nodes are regulated in a manner to form a chain, which can either be refined by the sensing nodes by self using a stingy algorithm starting from some node. The base stations analyzed this chain and simulcast it to all the other sensor nodes. when all nodes have all information about the network, the chain will formed and then exploit the algorithm.

A link will be matured to make sure that all nodes have adjoining neighbors is difficult. The stingy scheme for making the chain is done before the first round of communication starts. It gives improved results as compared with LEACH by removing the overhead of dynamic cluster formation; eliminate the number of transmissions, and using only one transmission to the base station per round and shows better enhancement if the network size is not decreases.

Peng Guan and Xiaolin Li [6] shows a non-identical instruction on how to grant neural networks in a wireless sensor networks (WSNs) such that the energy feasting is decline while improving the exactness and training effeteness. Artificial neural network (ANN) learning has been discovered forceful to noisy and indeterminacy sensory data for desired evaluation and arrangement system utilizations. With the enhancement of small hardware machineries for truthful sensor nodes, imbed neural networks will show up as symbolic decision-making brains for WSNs and great examination function to allow adaptive data perfection and self-managing capabilities. To allot neural networks in WSNs in an energy-efficient method, we

propose parallel broadcast and adaptive neural selection algorithms (ANSA) in multilayer back propagation (MLBP) learning procedure of neural networks, which is a new controlled learning method used for training feed-forward artificial neural networks. They advertise examine the power consumption workings in the online training action and determine the reduced power consumption using our projected algorithms.

Arati Manjeshwar and Dharma P. Agrawal [7] is the first protocol 'TEEN' designed for sensitive networks, in which , when every cluster change time, the cluster-head has shown to the members of the cluster. Thus, the hard threshold tries to reduce the sum of transmissions by grant the nodes to broadcast only when the sensed aspect is in the area of interest. The soft threshold further shorten the figure of transmissions by ignoring all the transmissions which might have otherwise appear when there is little or no change in the sensed attribute once the hard threshold. TEEN is well suitable for time critical applications and is also perfectly efficient in terms of power consumption and response time. It also allows the user to control the power consumption and accuracy to uniform the application.

T Camilo, C Carreto, J S Silva, and F Boavida [8] shows ABR (Ant-Based Routing for energy efficiency) which is based over the Ant Colony Optimization probing**.** In starting, the forward ants are sent to no particular target node so it means that sensing nodes broadcast with each other and the routing tables of each node have the recognition of all the sensor nodes in For large networks, it can be a problem since nodes would requires to have big size of memory to save all the information about the network. The algorithm can be easily changed to save memory. If the forward ants are moving towards to the sink, the routing tables only requires to save the nodes that are in the pathway of the sink. This reduces the size of the routing tables and, in consequence, the memory needed by the nodes. The quality of a given path between a sensor node and the sink-node should be determined not only in terms of the distance, but also in terms of the energy level of that path.

J ZhaoIn [9] proposed cluster architecture of LEACH with multi-hop routing to reduce transmission power is studied. In many WSN multi-hop routing scheme is used. This generates a node that wish to transmit data to a destination node find one or various intermediate nodes. The communication appears among all the nodes until the data packets reach the destination.

IV. NEURAL NETWORKS AND ENERGY CONSERVATION OF WSN'S

Neural Network (NN) is a huge arrangement containing parallel or distributed processing components called neurons associated in a graph topology. These neurons are associated through weighted connections called synapses. Weight vectors (synapses) linked the network input layer to output layer. Absolutely, the knowledge of neural network system is collected on weights of its networks and it doesn't need to any data storage.

In other words, one can say that Artificial Neural Networks are computation algorithms which are capable to learn challenging mappings between inputs and outputs according to supervisory imposed training or they can allocate input in an unsupervised way. One of the difficulties with neural network system is deciding of topology which is used for the complexity. This selection depends over the properties of the complexity, the most possible methods for solving the complexity and also the properties of neural network system.

In fact, Neural Networks are not only energy preserving techniques and cannot independently help to preserve energy but they can help energy preservation techniques as intelligent tools to work in more efficient, desirable and easier way. So the energy preservation techniques are the same previous techniques which can use neural network as a tool to better approach to their goals.

However there is enough motivation to implement full ANNs on each single sensor node due to analogy between WSNs and ANN as in [13]. Neural Network based energy efficient schemes can also be classified according to the role Neural Networks play on them or according to the appropriated neural topologies applied.

V. APPLICATION OF WIRELESS SENSOR NETWORK

1. Environmental control in office buildings.This is the purpose to design a routing strategy for large scale building utilization which consumes lowest energy; this planning is always required and done using WSN strategy planning and management [12].
2. Robot control: in order to enhance utility capability such as sensor, navigation, localization in WSN is required.
3. Guidance in automatic manufacturing environments. Automatic manufacturing requirement in environmental planning strategy in WSN is required which consume low emerging communication.
4. Seismic Monitoring: monitoring to Volcano, tsunami, earth quack such tragedy using application of WSN been applied.

5. Health care monitoring: in order to patient's physiological parameters consistently application of wan is required.

VI. DISCUSSION

In beyond numerous works in literature survey accessible by numerous Authors, we examine about various or many present research idea in terms of concept of the gateway node to route data to the destination, data prediction and node scheduling, Leach algorithm, MAC protocols, QoS, Artificial neural network, PEGASIS, multilayer back propagation and MAC protocols built-up for wireless body area networks, and ABR which are given us to developing technique about WSN system on the base of energy security theme that deliver reliable communiqué and conscious from the user. Paper tries to cover various protocol of each protocol. We discussed classification of different data traffic in WSN including characteristics of it. WSN is a system that provides smooth, less expensive and ambulatory inspection during routine functions works in close association with wireless network. It also provides better and cheap substitutions for achieving good health conditions. These systems reduce the enormous costs as patient can connect with their doctor more easily, for instance, won't need to make expensive and perhaps unnecessary trips as monitoring can take place in real-time even at home and over a longer period. Thus a great benefit goes to patients, physicians as well as the whole society.

VII. CONCLUSION

Energy conservation is the most important matter in WSN's applications which should be considered in all aspects of these networks. Neural Networks as smart device show huge rapport with WSN's characteristics and can be applied in various energy conservation and consumption schemes of them. Thus the presently activated routing approaches in the wireless sensor networks and their correlate protocols had been explained. Though the protocol like LEACH, Qas, ABR, MAC, and PEGASIS are verified for energy efficiency than their earlier models. The main drawbacks in these protocols are that nodes are assumed to be static and stationary. The energy efficiency model is untested while the sensor nodes exhibit mobility.

REFERENCES

[1] Wendi Rabiner Heinzelman, Anantha Chandrakasan, and Hari Balakrishnan, "Energy-Efficient Communication Protocol for Wireless Micro sensor Networks," IEEE. Published in the Proceedings of the 33rd Hawaii International Conference on System Sciences – 2000 January 4-7. pp.1-10.

[2] Lim, Jong Chern, Bleakley, Chris J, "Extending the lifetime of sensor networks using prediction and scheduling," IEEE, 2008.

[3] Biljana Stojkoska, Dimitar Solev, Danco Davcev, "Data prediction in WSN using variable step size LMS algorithm," 2011. Proceedings of the 5th International Conference on Sensor Technologies and Applications (Sensor Comm.), pp.191-196.

[4] Sangho Yi, Junyoung Heo, Yookun Cho, Jiman Hong, "PEACH: Power-efficient and adaptive clustering hierarchy protocol for wireless sensor networks," ELSEVIER Computer Communications 30 (2007).pp. 2842–2852.

[5] Stephanie Lmdsey and Cauligi **S.** Raghavendr, "PEGASIS: Power-Efficient Gathering in Sensor Information Systems,"2002 IEEE IEEEAC paper #242, Updated Sept 29, 2001.pp.3-1125-3-1130.

[6] Peng Guan and Xiaolin Li, "Minimizing Distribution Cost of Distributed Neural Networks in Wireless Sensor Networks", Scalable Software Systems Laboratory, Department of Computer Science Oklahoma State University, Stillwater, OK 74078.

[7] Arati Manjeshwar and Dharma P. Agrawal, "TEEN: A Routing Protocol for Enhanced Efficiency in Wireless Sensor Networks," 0-7695-0990-8/01 2001 IEEE.

[8] Tiago Camilo, Carlos Carreto, Jorge S´a Silva, and Fernando Boavida, Energy Efficient Ant-Based Routing Algorithm for Wireless Sensor Networks," M. Dorigo et al. (Eds.): ANTS 2006, LNCS 4150, 2006 Springer.pp.49-59.

[9] Jichuan Zhao, Ahmet T. Erdogan, "A Novel Self-organizing Hybrid Network Protocol for Wireless Sensor Networks," Proceedings of the First NASA/ESA Conference on Adaptive Hardware and Systems (AHS'06) 0-7695-2614-4/06 2006 IEEE.

[10] Wen-Hwa Liao, Kuo-Chiang Chang, Sital Prasad Kedia, "An Object Tracking Scheme for Wireless Sensor Networks using Data Mining Mechanism," In Proceedings of the Network Operations and Management Symposium, Maui, HI, USA, 2012 IEEE, pp. 526–529.

[11] Anthony D. Wood, John A. Stankovic, Gilles Virone, Leo Selavo, Zhimin He, Qiuhua Cao, Thao Doan, Yafeng Wu, Lei Fang, and Radu Stoleru, "Context-Aware wireless sensor networks for assisted living and residential monitoring,"IEEE Network July/August 2008, pp.26–33.

[12] Nguyen Duy Tan and Nguyen Dinh Viet, "Sleep scheduled and Tree –Based Clustering Routing Protocol for Energy – Efficient in Wireless Sensor Networks,"2015 IEEE RIVF, International Conference on Computing & Communication Technologies.pp.180-185.

[13] Frank Oldewurtel and Petri Mahonen, "Neural Wireless Sensor Networks," International Conference on Systems and Networks Communications, 0-7695-2699/06 2006 IEEE ICSNC '06,

[14] Reza Ghazalian, Ali Aghagolzadeh, Seyed Mehdi Hosseini Andargoli, "Energy Consumption Minimization in Wireless Visual Sensor Networks Using Convex Optimization," 2014 7th International Symposium on Telecommunications (IST'2014).pp.312-315.