

## Energy Efficient Techniques of Wireless Sensor Networks: A Review

Kiran Kapalta

Ruchi Singh

Astha Gautam

**Abstract:** Wireless Sensor Networks are basically a type of self configuring networks. These types of networks consists of large number of nodes known as sensor nodes. These sensor nodes are responsible for sensing the various environmental conditions. To reduce energy consumption of wireless sensor network, various techniques have been proposed so far. A review has been done upon various techniques for comparisons and outcomes in terms of energy efficiency, which helps in prolonging the lifetime of WSNs.

**Keywords:**

Sensor nodes, Energy Efficiency, Base station, Clustering, LEACH

### I. Introduction

Wireless Sensor Networks (WSNs) is the most important technology in this century.

WSN is a network in which various number of sensors nodes are deployed in physical area for monitoring that particular area. Embedded microprocessors and radio transceivers are combined with sensors nodes. Sensor nodes are used for sensing the

data, processing the data and for communication purpose. These deployed sensors are connected with wireless link. Sensors sense the information of particular area in which they are deployed and forward that information to the common point for further processing on that information.

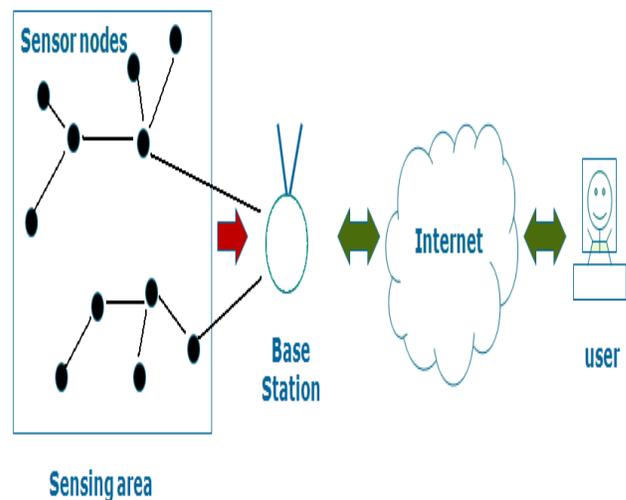


Figure1. A general layout of a wireless sensor network

As shown in Figure1, a wireless sensor network is usually deployed within a geographical area (called sensing area shown as a rectangle border), where there are some physical phenomena to be measured. Sensor nodes (shown as black

dots) are distributed inside the sensing area in order to achieve the sensing task effectively and accurately. When sensor nodes obtain data from sensing their respective vicinities, they send the data continuously or periodically to the base station (shown as circle with antenna) directly or following an appropriate routing path (shown as solid lines). A base station, on the other hand, is responsible for processing, analyzing and extracting meaningful information from the collected data to provide an entire view of the sensing area being detected. Sink nodes and Sensor nodes basically two components in the infrastructure of a wireless sensor network. Sink nodes are considered as base stations in the network that wirelessly receive and collect data packages generated from all the sensor nodes in the network and provide them to users. From the base station users can access the data, possibly through internet, for further processing of the data and to extract useful information.

## **II. Challenges in Wireless Sensor Networks**

Wireless Sensor Networks faces the following major challenges:

### **➤ Network lifetime**

Network lifetime is the main challenge of the wireless sensor networks. The lifetime of a sensor node depends strongly on the battery power. A small portion of “dead” sensor nodes could directly affect the entire network lifetime, and possibly lead to a huge loss in the network due to the routing path reallocation and failure of sensing and reporting events in the environment. Therefore, in order to prolong network lifetime and guarantee the robustness of the sensor network, efficient energy consumption and energy conservation are of great importance in wireless sensor networks when designing and deploying networks for practical use.

### **➤ Limited battery supplies**

Sensor nodes which are near to the sink node use energy at very high rate because the traffic of other nodes is also forward by this node. Sensor node near to the sink, drain their energy resources at faster rate than other nodes which leads to the decreasing in network lifetime. The mobile sink can lessen energy dissipation of those nodes which

are closer to the sink by collecting information from the sensor network while moving within the monitored area.

➤ **Performance**

Performance of the network depends on sensor nodes. In some environments, sensor network systems are required to be highly sensitive to the change in some ambient conditions (for example, the temperature of the reactor in a nuclear power plant) and require rapid response to the events or phenomenon within the environment. Therefore the assurance of successful data delivery and quickness of data processing and data transmission plays a crucial part in providing reliable sensing services. Usually researchers take the transmission delay as a measurement to assess the performance and quality of service of a sensor network system and hence, to minimize the transmission delay and maximize the output in an energy-efficient way is also a primary concern in the research works.

➤ **Energy consumption**

Sensor nodes which are deployed in particular region to perform any application of wireless sensor network must consume energy at same rate. If the energy

consumption rate becomes different, then any one of node depletes their batter at fast rate and that particular node becomes useless and network will dead. To avoid this, energy consumption rate must be equal.

### **III. LEACH Protocol**

LEACH Protocol is one of the efficient clustering algorithm. LEACH is a kind of self-adaptive cluster-organized topological algorithm. In it, nodes organize themselves into clusters, one node in every cluster would act as a Cluster Head [8][9]. The selection procedure of cluster head is based on the criteria that the node which has maximum energy and least distance is applicable to be selected as a cluster head[7]. Each node in the cluster will aggregate its data to the cluster head. After that, cluster head to cluster head communication is done. This approach will increase the lifetime of the network. The process is executed in periodical manner. Every round is divided into two phases: Cluster building phase and stable data communication phase[6]. In the phase of cluster building, close nodes make a cluster dynamically, and one certain be selected as cluster head randomly. In the phase of stable data communication, nodes in one cluster would send their data to the cluster head,

then cluster head would fuse the data and send it to the sink node. Because cluster heads need to fuse the data and communicate with sink node, they consume more energy than ordinary nodes. LEACH

algorithm could guarantee that every node in one cluster would be selected as cluster head in equal possibility, which makes every node consume energy relatively equally.

#### IV. Table of Comparisons for Literature Review

S.No.	Author	Year	Description	Outcomes
1.	Zhang Bing Zhou et al.	2015	They proposed an energy-balanced heuristic for Mobile sink Scheduling in Hybrid WSNs. In this method, they proposed a three-phase energy balanced heuristic. The network region is firstly divided into grid cells with the same geographical size [1].	This technique generates an optimal grid cell division. Also, mobile sinks are similar in energy consumption for both data gathering and sink movement, thus prolongs the network lifetime.
2.	M. Guerroumi et.al	2015	They proposed new data dissemination protocol based energy-efficient called energy-based data dissemination protocol. In this protocol, they propose new energy management scheme using a dynamic power threshold and also introduce new sink mobility scheme [2].	This technique helps in balancing the network load between sensor nodes and thus improve the performance of networks.

3.	<i>Chu-Fu Wang et al.</i>	2014	proposed a network lifetime enhancement method for sink relocation[3]. Energy-Aware Sink Relocation (EASR) is on residual energy of sensor node and according to that residual energy of sensor node, the transmission range of sensor would adjust and also the relocation of sink is taken place according to the residual energy of sensor node.	This method enhances the lifetime of wireless sensor networks.
4.	<i>Maciej Nikodem et al.</i>	2011	focussed on the theoretical aspects of clustering in wireless sensor networks, as a mean to improve network lifetime. They investigate whether clustering itself (with no data aggregation) can improve network lifetime in particular application when compared to non-clustered networks[4].	Outcomes depicts that clustering itself cannot improve network lifetime. So, additional techniques and means are required to be used in synergy with clustering.
5.	<i>Chi-Tsun Cheng et al.</i>	2011	proposed a delay-aware data collection network structure for wireless sensor networks. Delays in the data collection processes of wireless sensor networks are minimized using this proposed network	Results shows that this network structure is able to shorten the delays in the data collection process significantly.

			structure.	
<b>6</b>	<i>WU Xiaoping et al.</i>	<i>2010</i>	proposed an improved routing algorithm based on LEACH protocol which involves choosing of cluster head, multi-hop routing and the building of its path.	Energy utilizing rate is higher in this improved routing algorithm, and network's lifetime is increased.

**V. Problem Formulation:** Hot spots formed near the sink which causes major problems in wireless sensor network. The other problem in the wireless sensor network is the formation of energy holes. Sensor node near the sink depletes energy at faster rate than other sensor nodes because that node forward all the data generated by other nodes which are far away from the sink. Therefore that node near to the sink dies faster than others. Result of faster dyeing of sensor node near to the sink decreases the lifetime of network.

**VI. Research Methodology**

Network is established having number of nodes. Sink is placed at the centre of the network. Sink is gathering data from all the nodes. At one condition sink relocates its position to the particular area where it

gets more data. Now it starts gather data directly. In the previous work, various techniques had been proposed which are not efficient. In the proposed work we will work on biological techniques to follow an efficient path. The technique which gives best result will be used for path establishment.

**VII. Conclusion**

To reduce Energy Consumption, various energy efficient techniques have been proposed so far. Also, several protocols have been used. Among these techniques, Clustering is the most appropriate one in terms of energy efficiency, throughput and packet loss. Thus based on the signal strength and multiple mobile sensors, the network lifetime can be enhanced which enables the users to have an effective and efficient communication using Wireless Sensor Networks.

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