

# Analysis Of Energy Consumption In Wireless Sensor Networks

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**Abstract:** *Energy is a one of the important factor for Wireless Sensor Network. Sensors in the environment will work very efficiently, due there loss of charge it stops its working; end user cannot able to get the information from the environment. Various algorithms and models are proposed to save energy but still there no efficient way to save energy of a sensor. In this paper we analysed a number of factors which affects energy of a sensor.*

**Keywords:** *Sensors, energy, sink node, energy consumption.*

## 1. INTRODUCTION

Wireless Sensor Network [1] consists of number of sensors which are scattered in an environment to monitor the environment. Sensors can be used in military, agriculture, building, highways etc. Sensors in an environment will monitor the environment and send the information about the environment to the base station or sink node. End user can retrieve the information about the environment from the base station.

Generally sensors are used in an environment where the places cannot be able to access by the human. Some places are very risk to reach by a human being that places are monitored and information will be send by the sensors. For example volcano, deep forest, underground, under water or ocean. Sensors are very tiny device it will access the information about the environment where it is mounted.

A sensor has been made up of four components; they are communication, processor, energy and sensing. Communication component is used to connect with the neighbouring sensors and sending and receiving the information is also handling by this part. Processor component which used to process the received information like shortest path algorithm can be used to route a packet. Battery is a place where the energy of a sensor will be stored.

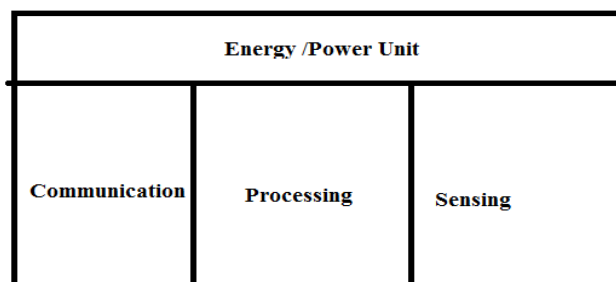


Figure-1.1 Components of Sensor node

Below figure shows the number of nodes scattered in the environment.  $n_1, n_2, \dots$  are the sensor node. Common used sensor network architecture is flat network and hierarchical or clustered network. Flat architecture fig 1.2 sensors are scattered in an environment all the sensors has to report the sink node. Each and every sensor in flat architecture can directly connect to the sink node.

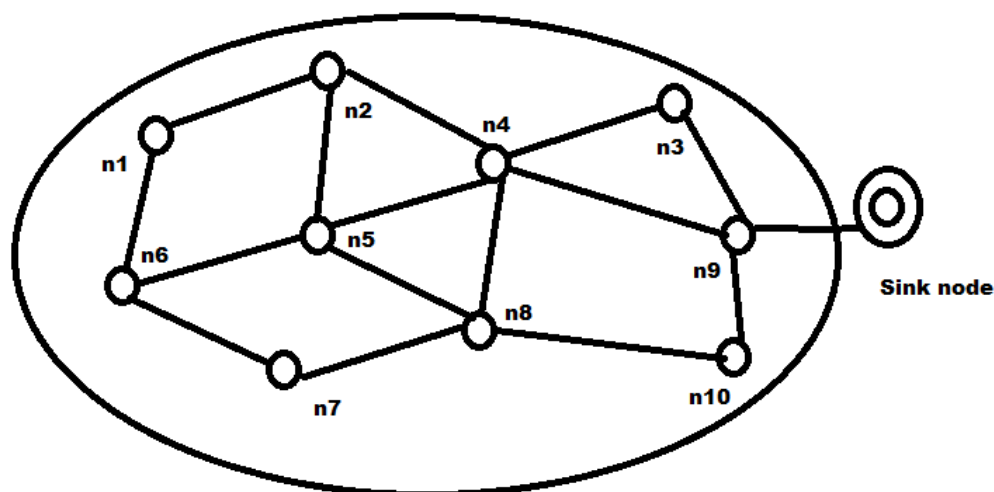


Figure1.2 Sensor nodes in monitoring environment

In hierarchical or clustered architecture fig 1.3, node will be grouped as a cluster, within a cluster there is some number of sensors, and these sensors are controlled and managed by the cluster head. In this architecture node cannot able to directly communicate to sink node. A node has to send the monitored information to the cluster head then the cluster head will send the information to the sink node.

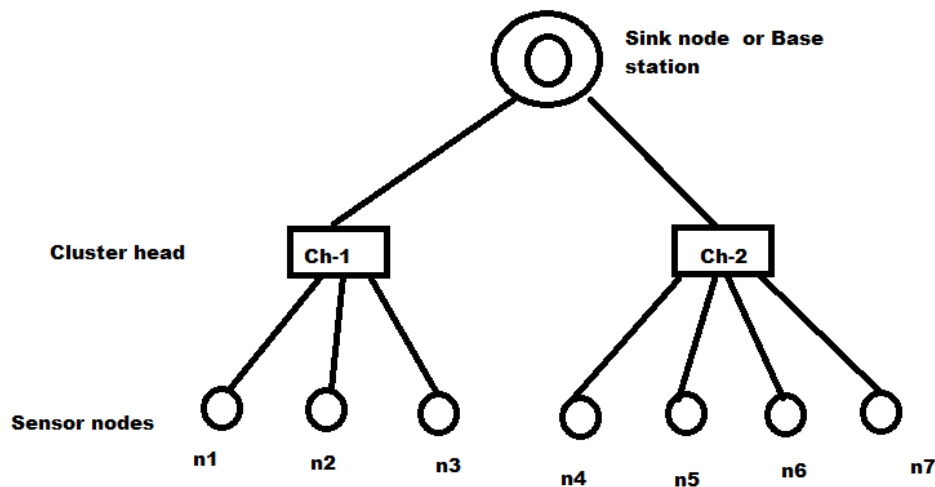


Figure 1.3 Sensors scattered in Clustered Architecture

But compared to energy factor with flat and hierarchical, it is found that energy lost by the sensors in flat are high. In a sensors [2] there are number of types in it, like a sensor can monitor the temperature, find the moisture of soil, humid of air, pollution in air, animal monitoring sensors. All those sensors will work in any environment to monitor and send the information about the monitored environment.

Monitored information will be sending in two ways one is event based and another one is time based. Event based [3] sensors will monitor the environment if the event happened then it will send the information about the event to the sink node. Example: forest fire, animal monitoring sensor will send the information about the particular animal if it is found in the forest or else it will not send the information to the sink node.

Time based [4] sensors will monitor and send the information to the sink node based on time. Every 30 minutes sensors will send the information about the environment to the base station. For example: temperature monitoring, climate monitoring. If an end user wants a time basis data for that places we can apply time based sensors.

Sensors cannot be recharged by a special device and all. Due to unattended environment batteries can be drained. Some network will offer mobile sink node, sink node will send to the sensor place there it collect the information and also charge the sensors but in all environment it is not possible, this type of recharging batteries will be costly.

## 2. RELATED WORK

[5] Proposed a new model which solves the contradiction between service quality and survival time of WSN. This new model proposed by an algorithm SFLA-Shuffled Frog leaping Algorithm. It reduces long range dependence of the signal. The result shows that SFLA algorithm has greater advantage such as error frame, number of survival nodes and network lifetime. [6] Provide an energy model for WSNs considering the physical layer and MAC layer parameters by determining the energy consumed per payload bit transferred without error.

They show how the transmission power must be chosen in order to achieve energy efficient communication over AWGN. They are also finding, for each modulation there are optimal transmission power at which the energy consumption is minimized. Investigated that the energy saving is gained from optimizing the constellation size.

[7] This paper mainly focuses on unification of the node energy consumption in WSN. The distribution of energy consumption for various scenarios in the hierarchical network are analysed for the first time and two main reasons are found for energy consumption. One is Communication between nodes and base station. From Cluster head for receiving data from other nodes. Proposed SECHC algorithm Segment Equalization Clustering based on Cluster head Energy Consumption, which can effectively improve the network lifetime and ensure the availability of the system within its entire life span.

[8] An approach for evaluating the power consumption of WSN applications by using simulations models along with a set of tools to automate the proposed approach. They automatically generate consumption models used to predict the power consumption of WSN applications. Energy factor and time delay factor functions are implemented to find a route having minimum time delay and high energy node's for forwarding a message to sink node [9].

[10] Proposed an Energy Consumption (ECON) model to save energy of a node, this model will filter the same message transmitted repeatedly. This model is suited for clustered network. It will also increase, the total network lifetime.

### 3. FACTORS FOR ENERGY LOSS

#### **Retransmission**

A node lost its energy very quickly by retransmission. Various researches show that 90% energy lost by retransmission. In a WSN, number of nodes is present in network; all the sensors are sending the same information to the sink node. If the information is lost by the intermediate sensors then the sender sensor will send the information. During the retransmission, nodes which are act as an intermediate will lost its energy by sending the same information several time.

#### **Close to sink node**

A node which is closer to the sink node will lost its energy quickly. Because the node which can be connected by the three or four sender nodes means then it drain its energy very quickly. A node which is closer to the sink node has a multiple sender, by receiving the message and forwarding that to the sink node, it will lose its energy.

#### **Distance**

Distance is also one of the main factors to drain the battery. Distance among the sensors large means then it has to increase its signal to reach its neighbour then the energy will lost quickly. Distance among the node will increase the signal power of a node to send and receive the messages then it drain its battery.

#### **Cluster head**

Cluster head in a hierarchical architecture network will lost its energy fast compared with the nodes in the network. Cluster head will receive the information from the sensor and aggregate the information from the sensors then it will process it and then only it will send the information to sink node. If the sensor node activity also whether the malicious node is present or dead node found or any link failure. Cluster head processing is high so its lost its energy very quickly when compared with the normal node.

#### **Sensing or monitoring**

Nodes in flat architecture will lost its energy for sensing and monitoring the environment. In monitoring environment, node will sense the environment whether the event is occurred or not. If the event occurred it will send the information or else it will not send but it will

monitor the environment. Without gathering the information a sensor node will sense the environment. Due to this sensing a sensor node will lose its energy.

#### **Neighbour to dead node**

A node which lost its energy or faulty node is considered as dead node. If the dead node will be an intermediate node for more than three or four node then the node closer to the dead node will be act as an intermediate node for those nodes. Node closer to dead node will be used as an intermediate node for packet switching. Transmitting information between many to onenode leads to lost nodes energy.

#### **Routing**

Most of the algorithms are proposed to create a route for packet routing. Routes are selected based on energy level of node. A threshold is calculated to send a packet between the node. A node having certain energy level will be used again and again for packet routing then that sensors also lost its energy.

#### **Malicious Node**

Malicious node is a node which will drop the information or change the information send by the sender or it will inject wrong information into the wireless sensor networks due to this severe lose will happen. Unaware of this malicious node, a normal node will process the wrong information send by the malicious node. For processing this information it will lose its energy. After aware about the malicious node, normal node will follow the algorithm or model that will leads to storage. Storing a large amount of data by the tiny device leads to energy loss.

## **4. CONCLUSION**

These are the factors which affects energy of sensor node in wireless sensor networks. A sensor can have a different categories but the most of the energy is lost for sensing the environment and retransmitting the messages. It is analysed a node which is present in the clustered architecture will save more energy when compared to the flat architecture. To solve this energy loss issue various algorithm and models are proposed but still it will be efficiently saves the tiny sensor energy. Sleep and wake sensors are used to solve the overall energy loss by the sensor node in an environment. Various studies shows that energy lost by the sensors during sensing can be overcome by the sleep and wake sensors.

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