

# Enhancing Energy of Sensor Node to Increase Efficiency in Wireless Sensor Network

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**Abstract---** The applications of wireless sensor networks are rapidly increasing in day to day life. Energy efficiency plays a very important role in functioning of wireless sensor network. In recent years clustering technique is came as a promising solution to achieve energy efficiency in wireless sensor network. Most of the clustering algorithms presented in literature works on random clusterhead election and rotation scheme. These schemes are capable of reducing energy consumption of WSNs but they do not involve any qualitative parameters such as residual energy, node centrality, degree of neighborhood, distance etc. if these parameters are chosen as criteria for CH election, they will make clustering even more powerful solution to the energy efficiency problem. In this regards, this research work is dedicated towards finding the energy optimal solution for clustering scheme with the help of soft computing techniques such as Genetic algorithm and Fuzzy logic. The proposed simulation scenario is developed on MATLAB (2014a) and simulated for various heterogeneity levels. Simulation results based on network lifetime, throughput and alive nodes has been presented. It is clear from the simulation results that the “proposed algorithm” provides better stable and unstable period as compared to conventional LEACH based clustering algorithm as well as Improved LEACH algorithm.

**Keywords---** Cluster Head, Data Aggregation, Fuzzy Logic, Wirelss Sensor Network (WSN).

## I. Introduction

Wireless sensor Networks (WSNs) have stirred up the world of wireless communications. The basic idea of wireless network architecture connecting different users with the help of ultra-wideband frequencies rather than conventional wired approach is depicted in fig-1.1. Wireless sensor network is an alternate option for home or business networking. Wireless networking technology increases mobility for network users but consequently the communication range is decreased. This technology can be either ad-hoc or it can be infrastructure based. An Ad-hoc network contains several computers equipped with wireless networking capabilities where each user can communicate with all of the other users. While infrastructure based networks have a centralized base station as an access point. The access point connects all the devices in the network to each other. Wireless sensor networks can be homogeneous or heterogeneous based on their network configuration. Network composed of all similar kind of devices is known as homogeneous while the network composed of devices with different capabilities is called as heterogeneous.



Figure 1.1: Wireless Network

### What are Sensor Nodes?

A sensing node has following basic components:

- Various types of sensors such as camera, temperature and pressure sensors.
- Transceiver circuitry to make them capable of transmit and receive gathered data.
- Brain i.e. CPU
- Battery to power sensor node
- On-board battery storage
- May have actuators too

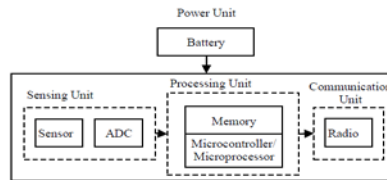


Figure 1.2: Block Diagram of Wireless Sensor Node[1]

The basic architecture of sensor node is presented in fig-1.2, it can be clearly seen that sensor unit is composed of four major parts namely powering unit, sensing unit, processing unit and communication unit. Power unit is the most important part of any sensor node as it supplies power to all the other units. Power unit is basically consisting of a small battery but some other component may also be added to this unit as per the requirement. Sensing Unit (SU) consists of different sensors such as camera, pressure and temperature sensors etc. as well as analog to digital converter (ADC). The sensor nodes are used to gather information about the operating environment while ADC converts the analog information to digital domain to make it transferable to other nodes and base station. After converting signals to digital domain they are supplied to processing unit. Processing unit is made up of microprocessor and memory to fully control the sensor unit. The last part of sensor node is a communication unit which contains radio circuit for data transmission and reception among sensors. For some applications, location information is also required which is achieved by deploying global positioning system (GPS) in sensor nodes. Furthermore to make sensor nodes mobile a motor can be installed. [2]

### Types of Sensors

Sensor node is main part of wireless sensor networks (WSNs). The major types of sensor nodes are as follows:

- Physical sensors (accelerometer, vibration, power, strain, stress etc.)
- Temperature sensors
- Gas sensors
- Biometric sensors
- Optical sensors
- Sensors based on LED such as chemical deposition sensor, proximity sensor, light sensor.
- Sensors based on CMOS circuit such as humidity sensor, temperature sensor etc.
- Sensors based on micro-electro-mechanical systems (MEMS) such as magnetometer, acoustic sensor, pressure sensor, accelerometers and gyroscopes etc.

### Wireless Sensor Network Applications

WSN can be found in variety of applications worldwide. Some of these applications are listed below:-

1. **Industrial Process Control-** Wireless sensors like gas sensors to measure pollution, physical sensors to measure pressure, strain, stress etc., optical sensors to detect human presence it can be used for security purpose.
2. **Biometric Application-** The sensors nodes can be used to detect unique identity of an individual. It can also be used in medical hospitals to analyze Electrocardiogram (ECG), Oximetry, Pulse, fall, Sweat levels.
3. **Military Applications-** WSN architecture are easy to deploy furthermore it can be used in harsh environments. These capabilities of wireless sensor network make it best suitable for military applications such as to monitor forces their movement and vehicles etc.

## II. Problem Identification and Proposed Methodology

Wireless sensor network (WSN) is composed of several number of tiny devices known as sensor nodes, which are connected with each other over wireless medium. These sensor nodes are required to have characteristics like sensing, processing and communicating with neighbouring nodes. The data packets travel through these sensors nodes from source node to destination node via several intermediate nodes. With the technological advancements wireless sensor networks found enormous applications in various fields such as rescue operations, military fields etc. these networks are usually deployed in hostile areas or adverse environmental conditions where human involvement is not possible. Furthermore these sensor nodes are usually operated by battery which is normally not easy to replace. Hence energy efficiency is of prime need in wireless sensor network. To achieve energy optimal solution for wireless sensor network this research work is divided in three parts. In first part, Genetic algorithm based optimised clusterhead election scheme is presented. In second part improved cost function based cluster formation