

# WSN Challenges and Applications: A Review

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**Abstract**— Wireless sensor networks refers as a group of dedicated sensors in a geographical area to monitoring and examining the physical parameters. In the last few decades Wireless Sensor Network has become a major area of research work. A Sensor or node is a device that responds and detects input from both the physical or environmental conditions, such as sound, pressure, heat, light, motion, vibrations etc. It is the most popup technology in the wireless communication and it has gained more popularity day by day. Wireless sensor networks are more useful in the military and agriculture applications. During the designation of wireless sensor network many design issues and challenges come across. This paper represents the review on challenges and applications of WSN.

**Keywords:** Wireless Sensor Network (WSN), Sensor, Node, Signal, output

## I. INTRODUCTION

A wireless sensor network is an interconnection of the sensor node to observe and monitor physical parameters in the environment. These physical parameters are such as heat, light, pressure and vibrations etc. A sensor is a small on-chip component that senses the changes in surrounding area and convert them into a readable signal. A wireless sensor network is an interconnection of few sensor nodes with at least one sink node or base station. The nodes collection information from the surrounding area and pass it to the base station by network route. The base station is a special node in WSN with more computational energy and communications resources.

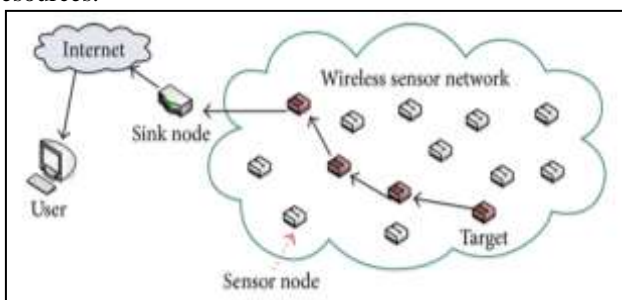


Fig. 1: Configuration of WSN

It acts as a router among the end user and sensor nodes to transfer the data. The sensor nodes communicate through the radio waves. WSN acts as a mediator between the real physical world and the virtual world [1].

## II. ARCHITECTURE OF THE WSN

Advancement in wireless communication has made possible the development of wireless sensor networks comprising of devices called sensor nodes [1]. It is an important issue to understand the full architecture of the wireless sensor network before its implementation in any application. It has four main units power supply, sensing unit, processing unit and communication unit [3].

### A. Power Supply:

The most important component of WSN is Power supply. It provides the electricity to all nodes and other units of WSN [4].

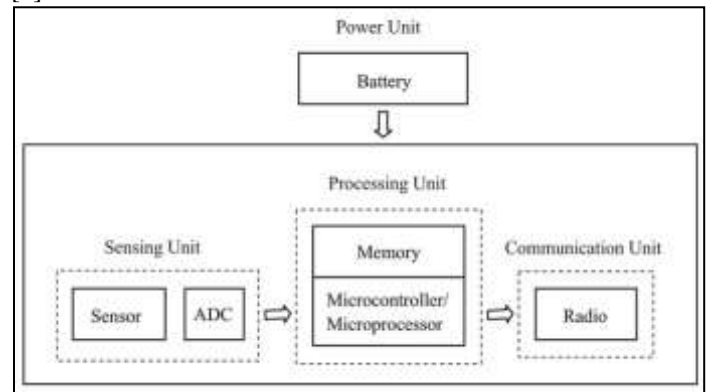


Fig. 2: Architecture of WSN

### B. Sensing Unit:

This unit holds the special types of sensors or transducers to collect data in surrounding area. It observes the external parameters such as heat, light, etc and pass it to the processing unit.

### C. Processing Unit:

The processing unit manages the all information's collected by the sensors. This process is done by special types of microcontrollers and microprocessors.

### D. Communication Unit:

When the results are ready to use, these results are passed to the central base station using communication unit. It contains the Antennas and RF transceivers for the signal transmission and reception.

## III. CHALLENGES IN WSN

The designing issues and challenges are the major factors in the implementation of the Wireless sensor network such as energy consumption, deployment, self-maintenance, security, fault-tolerance etc.

### A. Energy:

It is an important factor for the life time of wireless sensor network. All the operation of WSN like sensing, data sharing is run on energy. Energy provided by small batteries need to be recharged and replaced, but it is not possible for all time. There are also several methods for producing energy, but they cannot eliminate the need for energy management. The most important challenge is to manage limited battery by designing and implementing various energy efficient hardware and software protocols for WSN [5].

### B. Node Deployment:

Deployment is defined as the implementation of the active wireless sensor network in the real world. The sensor node deployment can be done in two way i.e., managed way and random way. Sensor nodes can be dropped from helicopters, at hard-to-reach places. In case deployed sensor nodes are too dense, network congestion might occur due to many concurrent transmission's attempts made by them. Self-configuration property is important, if the sensor nodes deployed randomly [5].

### C. Scalability:

Scalability is crucial challenge in the designing of routing base wireless sensor network. It is the property of sensor node to adapt the changes in the network topology. The WSN is said to be scalable if it accommodates more nodes at a later stage after the design [6].

### D. Fault Tolerance:

fault tolerance is the most critical challenge in the WSN. It is the capacity of a sensor node to provides a high-level of operation without any interference even if there is any fault in the network. Fault tolerance has to be high when sensed data are critical i.e., WSN used in a battlefield for surveillance [7].

### E. Coverage:

Area coverage is a big challenge in WSN Sensor nodes have a limited range of coverage. For the good coverage, sensor nodes must be selected in such a manner so that whole network should be covered. There efficient technique such as minimal and maximal exposure path algorithms and coverage configuration protocol are suggested [8].

### F. Self-Maintenance:

WSNs contains numbers of sensor nodes. During the sensing operations the network strategies changes quickly. The additional sensor nodes can be redeployed at any time which leads to a reorganization of network. Hence, it is required that a sensor network system be adaptable to changing connectivity. Once the sensor nodes are deployed. These should be capable of Self repair and maintenance.

### G. Hardware Cost:

As wireless sensor network uses huge sensor nodes. The price of each node plays a big role in the designing of WSN. Present technology allows a Bluetooth based system to be less than of few dollars. Pico Node's manufacturing cost is to be kept as low as of one dollar. The nodes production cost is a challenging issue and it should be kept as low as possible [7].

### H. Quality of Service:

In many applications, conservation of energy is considered more important than the quality of data sent. - It provides better service to selected network traffic over various technologies. The sensor network has to trade-off between quality of data and energy consumption. In particular, the sensor network has to satisfy certain QoS metrics like data latency, energy, packet loss, bandwidth, error rate etc. [9,10].

## IV. APPLICATIONS OF WSN

Wireless sensor networks have a wide range of applications. These are practically implemented in the remote area. Some of the main applications of WSN are discuss below.



Fig. 3: Applications of WSN

### A. Environmental Application:

These applications are mainly related the water monitoring, air monitoring, marine life observation, Forest, volcanoes and glaciers. Some biosensors are deployed in these field to monitor and examine the environmental conditions. Some other applications like tracking the movement of birds and insects, forest fire detection, flood detection, and precision agriculture fall under this category.

### B. Health/Medical Applications:

WSN plays a huge role in the medical science. Many of the health applications for sensor networks are providing interfaces for the disabled; telemonitoring of human physiological data; diagnostics; drug administration in hospitals; integrated patient observation; and pursuit, monitoring the movements. Sensor networks are also helpful in tracking and monitoring doctors; drug administration in hospitals; tele-monitoring of human physiological data and providing interfaces for the disabled. Small sensor nodes can be attached to each patient to record various results. Each sensor node has its specific task [1,10].

### C. Military Application:

Due to self-maintenance and fault tolerance feature WSN plays a major role in the military applications. Possibly, WSNs is an essential fragment of military intelligence, facility, control, communications, computing, frontline surveillance, investigation and targeting systems. WSN plays a vital element of armed command, control, communications, computing, intelligence, surveillance, reconnaissance and targeting (C4ISR) systems. The quick exploitation, self-organization and error acceptance distinctiveness of sensor networks create them a very hopeful sensing technique for military C4ISR [11].

### D. Industrial Application:

In industry, WSNs can be used to monitor manufacturing process or the condition of manufacturing equipment. For example, chemical plants or oil refiners can use sensors to

monitor the condition of their miles of pipelines. These sensors are used to alert in case of any failures occurred [12].

#### E. Home Intelligence Application:

As the WSN has many areas for working. It is growing its performance in house holding applications. These sensors can be found in refrigerators, microwave ovens, vacuum cleaners, security systems and also in water monitoring systems.

#### F. Structural Application:

Wireless sensors can be used to monitor the movement within buildings and infrastructure such as bridges, flyovers, embankments, tunnels etc... enabling Engineering practices to monitor assets remotely without the need for costly site visits, as well as having the advantage of daily data, whereas traditionally this data was collected weekly or monthly, using physical site visits, involving either road or rail closure in some cases. WSN offer remote home security to develops an automatic wireless sensor network for civil engineering structures [12].

#### G. Some other Applications of WSN

- Vehicle monitoring
- Light conditions
- Temperature
- Soil conditions

## V. CONCLUSION

Wireless sensor network is becoming a wide area for research because of its fault tolerance, less energy consumption and self-maintenance features. In this paper we have surveyed and studied various challenges and Applications of Wireless sensor networks. Before deployment of sensor node, it is necessary to understand the full working and strategies of its architecture. WSNs make effects on our daily lives' activities. The future prospects of WSN applications are highly promising to revolutionize our everyday lives.

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