

Wireless Sensor Networks and Applications

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Unit - 1

Introduction to Wireless Sensor Networks

Chapter - 1

Network Applications and Technological Background

Overview of Wireless Sensor Networks (WSNs)

Wireless Sensor Networks (WSNs) are widely recognized to be among the most vital innovations of the modern era. Small, inexpensive, and intelligent detectors stationed in a tangible region and connected via wireless connections and the web offer unprecedented possibilities for an array of non-military and defense-related uses, such as ecological monitoring, combat, and business procedure management, due to the latest developments in microelectronic mechanical structures (MEMS) and wireless communication innovations. WSNs differ from conventional wireless communication networks (WCN), such as cell towers and mobile ad hoc networks (MANET), in that they have thicker node installation, larger uncertainty of sensor points, and major power, calculation, and preservation limitations, which visible numerous novel obstacles in WSN growth and usage. WSNs have attracted a lot of interest over the past ten years from academics and businesses all around the globe Study has made tremendous progress in developing and deploying WSNs, addressing design and application challenges. WSNs are expected to change our interactions with the tangible environment in the civilian and defense sectors in the coming years.

Network Features

A WSN is frequently formed by many inexpensive, lightweight, multipurpose sensor units distributed in an area of concern. Sensor nodes are compact yet filled with detectors,

integrated microprocessors, and wireless transceivers. They can sense, analyze data, and communicate. Wireless communication allows for collaboration on fundamental tasks such as ecological tracking, combat surveillance, and manufacturing procedure management. Sensor networks differ from standard WSNs like cellular and MANET due to their distinctive features and limits, including:

- Dense node setup. Sensor hubs are often distributed intensively in an area of concern. Sensor networks can have far more nodes than MANETs.
- Sensor nodes are driven by a power source. Sensor units typically use batteries for energy. Typically, these devices are used in tough or hostile environments where battery replacement or recharging is challenging.
- Strong power, computational, and storage limitations. Sensor units have restricted power, computing, and storage capabilities.
- It can be configured by itself. Sensor points are often placed without adequate scheduling and engineering. Sensor nodes must self-configure into a communication system after deployment.
- Specific Applications. Sensor systems are tailored for particular uses. A network is often built and installed for a particular use. Network configuration requirements vary depending on the application.
- Undependable sensor points. Sensor units typically function autonomously in tough or hostile situations. They are susceptible to physical harm or breakdown.
- Periodic topology changes. The network's structure is regularly altered owing to node collapse, destruction, growth, energy loss, or channel drifting.
- No worldwide recognition. A worldwide addressing method for a sensor network is typically not feasible due to the

substantial overhead associated with identification management.

- Multiple-to-one traffic sequence. It is observed in the majority of sensor-based applications, where data perceived by sensor units flows from several source sensor units to a specific sink.
- Redundancy in data. The majority of sensor network-based uses include the dense deployment of sensor units inside an area of interest, whereby they cooperate to achieve a shared sensing objective. That's why there's usually a connection or redundancy in the data detected by several sensor units.

Numerous new difficulties in sensor network layout arise from their special qualities and limitations.

Applications of Network

A range of tangible characteristics or states may be detected or seen with detectors; for instance,

- Humidity
- Sound
- Pressure
- Light
- Soil composition
- Temperature
- Water or Air quality

Comparing wireless sensors to traditional wired sensors, there are some notable benefits.

They may be used in any surroundings, particularly those where traditional wired sensor networks cannot be established, such as hostile terrain, combat zones, space, or deep seas. They may additionally decrease installation expenses and times. WSNs were first driven by military uses, which included everything from massive acoustic tracking devices for monitoring the seas to tiny networks of unguarded ground-based detectors for identifying

targets on the ground. Nevertheless, the growth of a broad spectrum of uses in both civilian and military areas has been guaranteed by the accessibility of inexpensive detectors and wireless communication. Several instances of sensor network-based uses are presented in the next part.



Figure 1: Wireless Networks

A. Environmental Surveillance

Sensor systems were first used for ecological surveillance. A range of ecological characteristics or situations are monitored using detectors in ecological surveillance.

- The surveillance of Habitat. Aside from the ambient characteristics of the habitats, detectors may be employed to track the state of wild vegetation or animals in their natural environments. In a study, for instance, the College of California, Berkeley, and the School of the Atlantic, located in Bar Harbor, monitored the Great Duck Land in Maine breeding petrel habitats by utilizing 190 wireless detectors, which measured