

Unique Constraints And Challenges:Challenges in WSN:

- * High bandwidth demand
- * High energy Consumption
- * Quality of Service provisioning
- * Data processing
- * Compression techniques and
- * Cross layer design

Constraints of WSN:

There are two types. They are

- 1) Resource Constraints
- 2) Design Constraints

Resource Constraints:

Resource Constraints include

- * Limited Energy
- * Short Communication Range
- * Low bandwidth
- * Limited processing
- * Limited storage

Design Constraints:

It include two types

- 1) Application Dependent
- 2) Environment Dependent

The Environment dependent is based on following factors.

- * Size of the network

* Deployment Scheme

* Network Topology.

Advantages of Sensors Networks:

* Energy Advantage:

$$P_{\text{receive}} \propto \frac{P_{\text{send}}}{\sigma^\alpha}$$

Where

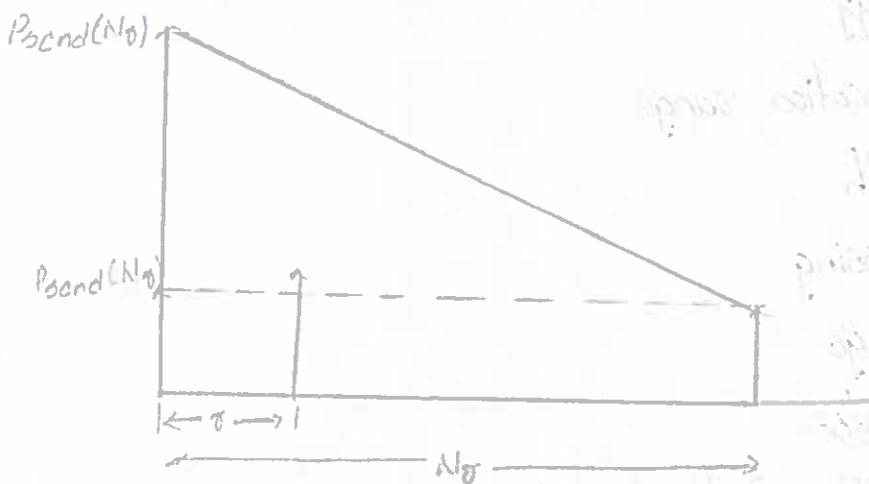
σ is transmission distance

α is RF attenuation Constant

$$P_{\text{send}} \propto \sigma^\alpha \cdot P_{\text{receive}}$$

Due to Multipath and other interference effects, α is in range of 2 to 5.

$$\begin{aligned} N_{\text{op}} &= \frac{P_{\text{send}}(N_s)}{N \cdot P_{\text{send}}(\sigma)} \\ &= \frac{(N_s)^\alpha \cdot P_{\text{receive}}}{N \cdot \sigma^\alpha \cdot P_{\text{receive}}} \end{aligned}$$



Detection Advantage:

power received at a distance σ is

$$P_{\text{receive}} \propto \frac{P_{\text{source}}}{\sigma^\alpha}$$

Which assumes an inverse distance squared attenuation

The SNR is given by

$$SNR_0 = 10 \log \frac{P_{\text{receive}}}{P_{\text{noise}}}$$

- * WSNs can be applied on large scale and in various domains such as mines, healthcare, agriculture etc.
- * It is scalable and hence can accommodate any new nodes or devices at any time.

Applications of Sensor Networks:

- * Military Applications
- * Air pollution Monitoring
- * Health Applications
- * Landslide detection
- * Commercial Applications
- * Forest fire detection
- * Water quality monitoring
- * Environment Applications
- * Industrial Monitoring

Types of Wireless Sensor Networks:

1. Terrestrial Wireless Sensor Networks:

Terrestrial WSNs are used for communicating base stations efficiently and comprise thousands of wireless sensor nodes deployed either in an unstructured or structured manner.

In an unstructured mode, the sensor nodes are randomly distributed within the target area that's dropped from a set plane.

2) Underground Wireless Sensor Networks:

In terms of deployment, maintenance, equipment Cost Considerations and Careful planning, Underground Wireless Sensor networks are more expensive than terrestrial WSNs.

The Underground Wireless Sensor networks UWSNs Comprises several sensory nodes that are hidden in the ground to observe background Conditions.

Additional Sink nodes are located above the bottom to transfer information from the sensor nodes to base station.

3) Underwater Wireless Sensor Networks:

About more than 70% of the earth's planet is occupied with water. These networks contain several sensor nodes and vehicles deployed underwater. Autonomous underwater devices and vehicles are used to collect data from these sensor nodes.

A challenge of Underwater Communication may be a long propagation delay and bandwidth and sensor failures. Underwater WSNs are equipped with a limited battery that can't be recharged or replaced.

4) Multimedia Wireless Sensor Networks:

Multimedia Wireless sensor networks are proposed to enable tracking and monitoring of events in the form of multimedia, like video, imaging and audio.

These networks contain low-cost sensor nodes equipped with camera as and microphones. These sensory nodes of Multimedia WSNs are interconnected together over a interconnected together over a wireless connection for data retrieval, data compression and correlation.

5) Mobile Wireless Sensor Networks (MWSNs):

Mobile WSNs networks comprise a group of sensor nodes that can be moved on their own and can be interacted with the physical environment. The mobile nodes can also compute sense and communicate respectively.

Mobile Wireless sensor networks are more versatile than static sensor networks. The benefits of mobile WSNs over static WSNs include better and improved coverage, superior channel capacity, better energy efficiency and so on.

These structures contain low-cost sensors

equipped with sensors as well as microprocessors. These sensors are often interconnected with a network of other sensors, and the data is often processed locally. This allows for real-time monitoring and control of the system.

Electronic devices are used to monitor and control the system.

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