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Glance Of Wireless Sensor Network

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ABSTRACT

Wireless Sensor Network (WSN) is an infrastructure-less wireless network that is deployed in a large number of wireless sensors in an ad-hoc manner that is used to monitor the system, physical or environmental conditions. It can be used for processing, analysis, storage, and mining of the data.WSN can accommodate new devices in the network any time with ease.A wireless sensor network consists of spatially distributed wireless devices which use sensors for monitoring physical and environment conditions.WSN applications are used in the various fields. Some of the WSN applications are area monitoring, air pollution monitoring, health care, water quality monitoring, industrial monitoring, landslide detection, natural disaster prevention.

INTRODUCTION

Originally, sensors were electromechanical detectors for measuring physical quantities. Their first use can be traced back to 1933, in the first room thermostats. Early micro electro mechanical systems (MEMS) consisted of a multi-chip, where a sensor and its electronics and mechanics were housed on separate chips and packages. This resulted in larger size, more cost and lower yield of the sensor .Recent advances in micro electro mechanical systems (MEMS) and integrated circuits (IC) have enabled the development of small-scale sensors and the integration of its actuators and electronics into one cost-effective high-performance chip.

COMPONENTS OF WSN

1. **Sensors:**
   Sensors in WSN are used to capture the environmental variables and which is used for data acquisition. Sensor signals are converted into electrical signals.
2. **Radio Nodes:**
   It is used to receive the data produced by the Sensors and sends it to the WLAN access point. It consists of a microcontroller, transceiver, external memory, and power source.

3. **WLAN Access Point:**
It receives the data which is sent by the Radio nodes wirelessly, generally through the internet.

Evaluation Software:
The data received by the WLAN Access Point is processed by a software called as Evaluation Software for presenting the report to the users for further processing of the data which can be used for processing, analysis, storage, and mining of the data.

TYPES

Depending on the environment, the WSNs are decided so that they can be deployed underwater, underground, on land, and so on. Different types of WSNs include:

1. Terrestrial WSNs
2. Underground WSNs
3. Underwater WSNs
4. Multimedia WSNs
5. Mobile WSNs

- **Terrestrial WSNs**
Terrestrial WSNs are capable of communicating base stations efficiently, and consist of hundreds to thousands of
Wreless sensor nodes deployed either in unstructured or structured manner.
In this WSN, the power of the battery is limited; however, the battery is equipped with solar cells as a secondary power source.

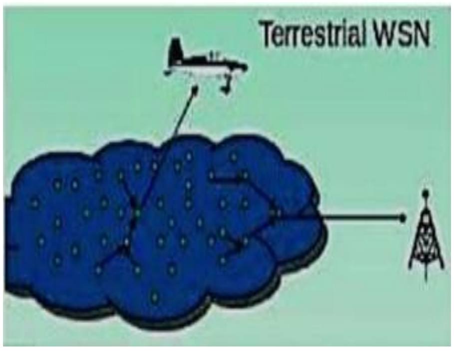

FIGURE 1:TERRESTRIAL WSN

- **Underground WSNs**
The WSNs networks consist of several sensor nodes that are hidden in the ground to monitor underground conditions. To relay information from the sensor nodes to the base station, additional sink nodes are located above the ground. he underground wireless sensor networks deployed into the ground are

difficult to recharge. The sensor battery nodes equipped with a limited battery power are difficult to recharge.

- **Under Water WSNs**
  These networks consist of several sensor nodes and vehicles deployed underwater. Autonomous underwater vehicles are used for gathering data from these sensor nodes. A challenge of underwater communication is a long propagation delay, and bandwidth and sensor failures. Underwater, WSNs are equipped with a limited battery that cannot be recharged or replaced.

FIGURE 2 UNDERWATER WSN

- **Multimedia WSNs**
  Multimedia wireless sensor networks have been proposed to enable tracking and monitoring of events in the form of multimedia, such as imaging, video, and audio. These networks consist of low-cost sensor nodes equipped with microphones and cameras. The challenges with the multimedia WSN include high energy consumption, high bandwidth requirements, data processing, and compressing techniques.

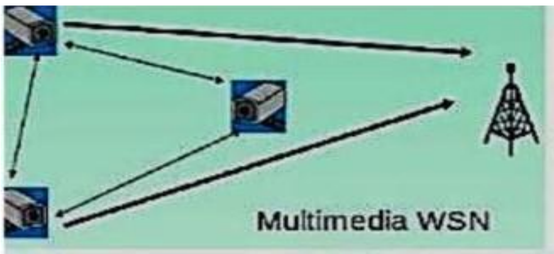

FIGURE 3:MULTIMEDIA WSN

- **Mobile WSNs**
  These networks consist of a collection of sensor nodes that can be moved on their own and can be interacted with the physical environment. The mobile nodescan compute sense and communicate needed when a system is planned to contact other networks.

FIGURE 4:UNDERGROUND WSN

WSN ARCHITECTURE

The most common WSN architecture follows the OSI architecture Model. The architecture of the WSN includes five layers and three cross layers. The five layers, namely application, transport, n/w, data link & physical layer. The three cross planes are namely power management, mobility management, and task management.

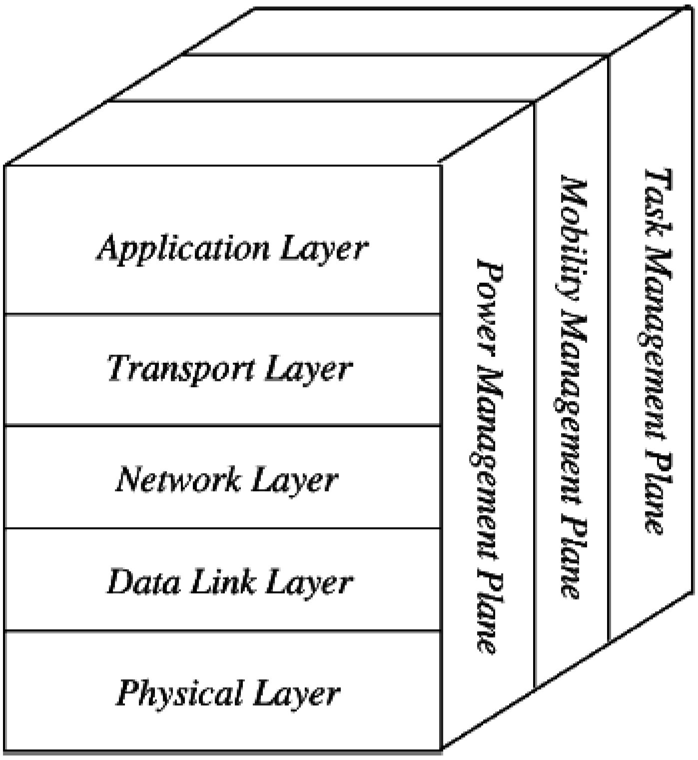

FIGURE 5: DIFFRENT LAYERS

Application Layer

The application layer is liable for traffic management and offers software for numerous applications that convert the data in a clear form to find positive information

Transport Layer

The function of the transport layer is to deliver congestion avoidance and reliability where a lot of protocols intended to offer this function are either practical on the upstream. The transport layer is exactly needed when a system is planned to contact other networks.

Network Layer

The main function of the network layer is routing, it has a lot of tasks based on the application, but actually, the main tasks are in the power conserving, partial memory, buffers, and sensor don't have a universal ID and have to be self-organized.

Data Link Layer

The data link layer is liable for multiplexing data frame detection, data streams, MAC, & error control, confirm the reliability of point–point (or) point– multipoint.

Physical Layer

The physical layer provides an edge for transferring a stream of bits above physical medium. This layer is responsible for the selection of frequency, generation of a carrier frequency, signal detection, Modulation & data encryption.

CHARACTERISTICS

- The consumption of Power limits for nodes with batteries
- Capacity to handle with node failures
- Some mobility of nodes and Heterogeneity of nodes
- Simple to use
- Cross-layer design

APPLICATIONS

1. Internet of Things (IOT)
2. Surveillance and Monitoring for security, threat detection
3. Environmental temperature, humidity, and air pressure
4. Noise Level of the surrounding
5. Medical applications like patient monitoring
6. Agriculture
7. Landslide Detection

ADVANTAGES

- Can be used in those harsh and hostile environments where wired networks can't be deployed. Ex. in a forest, wireless sensor nodes are dropped from the air because going down there and deploying a wired setup is not possible.

- wireless sensor networks are scalable, that is why they are actively being used in applications such as Structural Health Monitoring where there is a need of dense deployment and with a dense wired set up, it may lead to a chaos at the time of deployment.

- Can accommodate new devices in the network any time with ease.

- WSNs save a lot of wiring cost and sensors like PIR detectors are relatively cheaper than wires.

DISADVANTAGES

- Limited computation and communication resources are the major drawbacks in wireless sensor networks.
- Requires minimal energy – constrains protocols.
- Works in short communication range – consumes a lot of power.
- Possess very little storage capacity
- Possess very little storage capacity – a few hundred kilobytes
- Works in short communication range – consumes a lot of power

FUTURE DEVELOPMENTS

The future developments in sensor nodes must produce very powerful and cost-effective devices, so that they may be used in applications like underwater acoustic sensor systems, sensing based cyber-physical systems, time-critical applications, cognitive sensing and spectrum management, and security and privacy management.

Cognitive Sensing

Cognitive sensor networks are used for acquiring localized and situated information of the sensing environment by the deploying a large number of sensors intelligently and autonomically. Managing a large number of wireless sensors is a complex task. examples of cognitive sensing are swarm intelligence and quorum sensing.

Spectrum Management

As application of low-power wireless protocols is increasing, we can envision a future in which wireless devices, such as wireless keyboards, power-point presenters, cell phone headsets, and health monitoring sensors will be ubiquitous. But the pervasiveness of these devices leads to increased interference and congestion within as well as between networks, because of overlapping physical frequencies.

Cognitive radios and multi-frequency MACs are some approaches that have been developed to utilize multiple frequencies for parallel communication.

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