Wireless Sensor Network: A Technical Review

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KEYWORD

Keyword1; Keyword2; Keyword3; Keyword4; Keyword5

ABSTRACT

Sensor nodes in a WSN are powered by batteries and have the ability to sense, process information, and communicate. For analysts, the power consumption of sensor nodes presents a number of challenges. A battery provides limited vitality to the sensor nodes. Because of the large number of sensor nodes and their location in remote, dry, or hostile zones, it is extremely difficult to replace or revive the battery of a sensor node. The detecting and sending processes require energy from sensor nodes. It is necessary to build these nodes to be energy efficient in order to reduce the amount of energy used by the sensor node when the battery life is limited. In situations where a system must operate for a lengthy period of time on battery power, energy savings are critical.

1. Introduction

Wireless sensor network consists of a various small sensor nodes working in collaboration to gather the data from its environment and send the detected information to base station (BS) for further use by the users. The advancement of WSN technology is inspired by military application such as battlefield surveillance. Presently these technologies are utilized in many areas for example, military, natural, and scientific applications. The sensor network architecture is shown in the Fig.1.1.

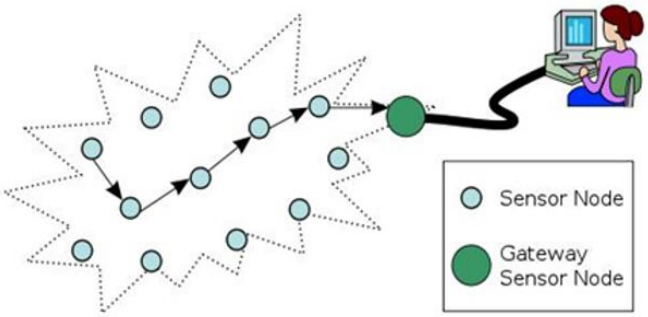

Fig 1. Architecture of Wireless Sensor Network

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1.1. Sensor

Sensor is an instrument having the ability to sense. The sensor node is an electronic device which aims to detect events or changes in its environments.

In WSN sensor nodes are connected with battery power, having the ability of sensing, information handling and communication. The power utilization of sensor node exhibits various difficulties for the analysts. The sensor nodes have restricted vitality provided by a battery. It is very hard to restore or revive battery of sensor node because of huge number of sensor nodes and node distribution in remote, arid region or antagonistic zones and so on. Sensor nodes expend power for performing the detecting and transmitting operations. It is needed to construct these nodes energy efficient to diminish energy utilization of sensor node in the circumstance of restricted battery life. Energy saving is significant in applications where a system need to activate for a long time on battery power.

1.2. Component of Wireless Sensor Node

The components of a sensor node are as shown in the Fig.1.2:

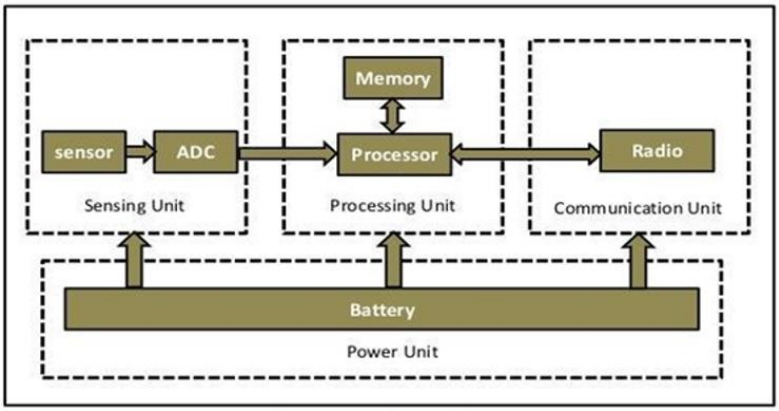

Fig 2. Components of Wireless Sensor Network

1.2.1. Sensing Unit

Sensing unit is responsible to capture data in the form of analog signal after that it is convert simple sign to computerized signal by ADC (simple to advanced converter) then forwarded to processing unit for further processing.

1.2.2. Processing Unit

Processing unit is liable for information handling and control the functionality between all other parts of the sensor node.

1.2.3. Communication Unit

Communication unit make sure the connectivity between nodes in network. It is responsible for sending and receiving data between two nodes. The transmitting and receiving functionality are combined into a single device

called transceiver. The wireless transmission media used in the sensor network are radio frequency, infrared and optical communication (laser).

1.2.4. Power unit

Power unit provides power to all components to execute its task. The power is stored in the form of battery. It may be rechargeable or no-rechargeable. The sensor nodes consume energy for sensing, data processing & communicating. It is observed that the communication takes more energy than other processes.

1.3. Limitation of sensor node

The limitations of a wireless sensor node are as:

- Associated with battery power.
- Sensing ability.
- Lack of processing power.
- Limited memory.

2. Application of wireless sensor network

2.1. Area monitoring

WSN are utilized for zone watching. In domain checking, the WSN is passed on over an area where some marvel is to be watched. A military case is the use of sensors perceives adversary interference; a normal resident case is the geo-fencing of gas or oil pipelines.

2.2. Health care monitoring

The restorative capacity can be of two sorts: wearable and inserted. Wearable devices are used on the body dimension of a human or precisely at closeness of the customer. The implantable remedial devices are those that are inserted inside human body. There are various applications unreasonably for example body position estimation and region of the individual, general checking of debilitated patients in recuperating offices and at homes. Body-district frameworks can accumulate information around a person's prosperity, wellbeing, and essentialness use.

2.3. Environmental/Earth sensing

WSN are used in environmental applications to monitor and record various ecological parameters as:

Forest fire detection: A sensor Nodes can be acquainted in forest with find the occurrence of flame. The hubs might be set up with sensors to measure dampness, temperature and gasses which are conveyed by fire in the trees or vegetation. The early disclosure is noteworthy for a powerful action of the firemen; the flame squad will be able to know when a flame is start and how it is diffusive.

Landslide detection: An avalanche location framework makes utilization of a remote sensor system to distinguish a little development of the clod and shift in different parameters that is happen prior to or amid an avalanche. After

the information accumulated it might be conceivable to know the looming event of avalanches some time before it really happens.

Water quality monitoring: Water quality observing includes breaking down water properties in dams, streams, lakes and seas, and additionally underground water holds. The use of various remote passed on sensors empowers the formation of an increasingly precise manual of the water status, and consent the incessant sending of checking stations in territories of fiendishness producer access, without the need of guide data recuperation.

Natural disaster prevention: WSN can successfully act to put the consequences of resurrection events, similar to surges. Remote nodes have effectively been conveyed in waterways where the water levels changes must be checked continuously.

Water monitoring: WSN are used in water monitoring applications for observing the quality and level of water. For example, testing the nature of secret or surface water and guaranteeing a nation's water foundation for an advantage of human and creature. It might be utilized to ensure the wastage of water.

2.4. Industrial Monitoring

There are following applications in which WSN is used:

Machine health monitoring: WSN have been created for equipment condition-based maintenance (CBM) as they offer noteworthy cost establish and enable new utility. Remote sensors can be put in areas troublesome or difficult to reach with a wired framework, for example, turning apparatus and untethered vehicles.

Data center monitoring: Frequent cabling and IP locations are an issue in WSN because of high thickness of servers' racks in a server farm. To overcome this issue an ever increasing number of racks are fitted out with remote temperature sensors to screen the admission and outtake temperatures of racks. ASHRAE prescribes up to 6 temperature sensors for each rack, coincided remote temperature innovation gives leeway contrasted with customary cabled sensors.

Data logging: WSN are additionally utilized for the accumulation of information for observing of natural data; this may be as basic the testing of the temperature in an ice chest to the level of water in flood pool in atomic power plants. A measurable data can be utilized to demonstrate how frameworks have been functioning. The upside of WSNs over traditional lumberjacks is the "live" information nourish that is conceivable.

3. TYPES OF SENSOR NETWORKS

WSN is categories into five categories: earthbound WSN, underground WSN, submerged WSN, multi-media WSN, and versatile WSN.

Terrestrial WSNs: TWSN usually contain hundreds to thousands of modest remote sensor hubs sent in a given area, either in a pre-masterminded or in a uniquely selected manner. In pre-orchestrated sending, there is lattice circumstance, perfect position, 2-d and 3-d circumstance models. In impromptu organization, sensor hubs can be dropped from a plane and surface put into the goal zone.

Underground WSNs: UWSN contains number of sensor hubs canvassed underground or in a cavern or mine that are used to screen underground conditions. Some additional sink hubs are arranged over the ground to hand-off information from the sensor hubs to the base station.

Underwater WSNs: These comprise of a few sensor nodes and vehicles that are sent underwater. When contrasted with earthbound WSNs, underwater sensor nodes are increasingly costly and less no. of sensor nodes are conveyed. Self-determine submerged vehicles are utilized for analysis or get-together information from sensor nodes.

Compared to solid distribution of sensor nodes in a TWSN, an infrequent organization of sensor nodes is put submerged. Run of the mill submerged remote correspondences are built up through transmission of acoustic waves.

Multi-media WSNs: These have been proposed to permit checking and following of events in multimedia. Multi-media WSNs comprise of a few minimal effort sensor nodes supplied with cameras and receivers. These sensor nodes ordinarily interconnect with one another over a remote association for information recovery, procedure, relationship, and pressure.

Mobile WSNs: MWSN consist a no. of sensor nodes that can proceed onward their own and collaborate with the physical condition. Mobile nodes can detect, register, and convey like static nodes. The mobile nodes can reposition and arrange itself in the system.

4. ISSUES RELATED TO WSN

4.1. DESIGN ISSUES

- Fault –tolerant Communication
- Low latency
- Scalability
- Transmission Media
- Coverage Problems

4.2. TOPOLOGY ISSUES

- Geographic Routing
- Sensor Holes
- Coverage Topology

4.3. CHALLENGES RELATED TO WSN

- Challenges in real time
- Challenges in power managements
- Network Scale and Time
- Management at a Distance

4.5. Types of Nodes

In the sensor systems, different kinds of sensor nodes are conveyed. The choice of appropriate hub relies upon the application where sensor nodes are utilized. The nodes in WSN are named static, portable, homogeneous and heterogeneous.

Static nodes: When these nodes are set in target field, they keep their position (xi,yi) fixed for as long as they can remember.

Mobile nodes: These sorts of nodes are equipped for changing their situation from (xi, yi) to (xj, yj) after their arrangement in the objective field.

Homogeneous nodes: Whenever sent sensor nodes are having same capacity as far as preparing power, correspondence run, detecting fury and battery control then nodes are named as homogeneous nodes.

Heterogeneous node: A heterogeneous gathering is one in which a few nodes are more dominant than different nodes.

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