

Wireless Sensor Networks : Applications and its Challenges

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ABSTRACT

Wireless sensor networks have recently become famous because they grip the potential to change many sectors such as environment monitoring, agriculture, health, automation, and security. They have a vast potential for long term applications and also have the capacity to change human lives in different phases. Sensor nodes with wireless interface can transmit with each other to form a network. Depending on the resources limitations and used applications of WSNs security and energy management is a main reason in increasing the network lifetime. The study presents an impression of different applications of the wireless sensor networks and its Challenges.

1. Introduction

A wireless sensor network (WSN) is a shared networks and it consist vast range of allocated, independent, small, low-energy tools called sensor nodes. It logically includes spatially separated, tiny, battery driven, fixed machines that are on networked to generally assemble, processes & pass information's to end user & it has controlled calculating and handling capabilities. In today's world WSNs are well recognized services in Business and Engineering purposes over its technological development in processor, spread information and usage of low energy fixed software equipments. Sensor nodes are applied to examine ecological conditions like climate, moisture, strain/stress, noise, vibration

and location etc. Many real time applications the sensor nodes are playing distinct functions like stylish sensing, information storage and processing, neighbor node discovery, information collections, target tracking, node positioning, efficient routing and management among nodes & base station. Moreover, due to the availability of low cost hardware and a variety options for the radio communication frequency and several WSN topologies can be adopted.

2. Components of Wireless Sensor Network

Wireless sensor network (WSN) is based on hardware and software bunch that classically contains four elements and that are mentioned below :

SENSORS	NODES	BASE STATION	GRAPHICAL USER INTERFACE
'Sensors' are connected to every node by a wired connection.	'Nodes' gather information from sensors and broadcast to 'base station' computer through single or two-way radio.	It attached the system to internet, so that information can be received from nodes.	It is web--- based software package and this permits the information received sensors to be observed.
It can used to evaluate soil moisture & temperature, electrical conductivity, water pressure and range of climate changes (light, air temperature, wind, humidity, etc.).	Nodes can basically observe natural and soil situation or can be used to formulate control assessments.	Broadcast to base station system and can be observed anyplace an internet connection is accessible.	This application are also used to set and controlled irrigation strictures

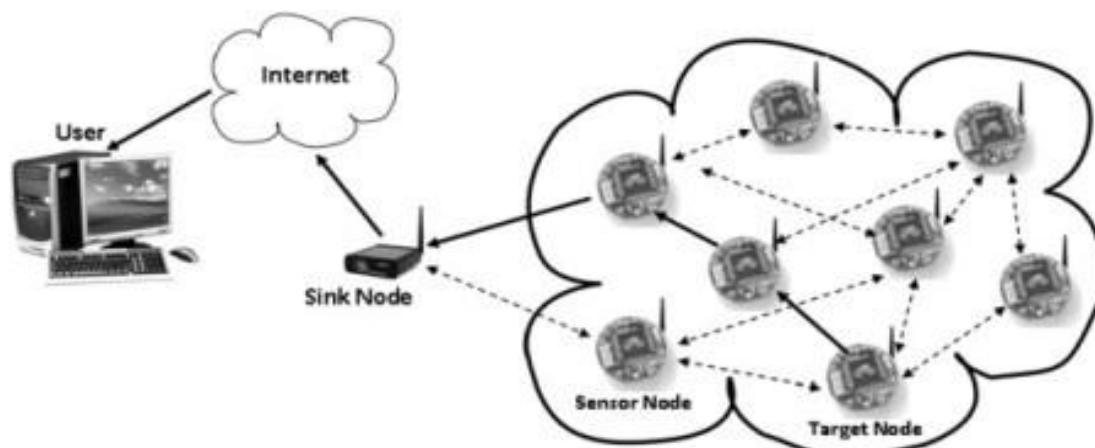


Figure1. Components of Wireless Sensor Networks

3. Applications

There are some of the applications of WSNs in industrial automation, traffic screening and control, medical appliance

checking and in many other areas. Some of applications are discussed below:



Figure 2. Applications of Wireless Sensor Networks

- ❖ **Military Surveillance** : WSN devices are playing very important role for military command, power, communiqué & intelligence systems. It can be installed in fight grounds to check army movements and also track their vehicles to enable secure observation of rival military.
- ❖ **Environmental** : The wireless sensor networks have many applications in the environment. The information is sensed through sensors and is broadcast to the master station via Internet. They can be utilized to track the movement of animals/birds, monitor soil, irrigation, and agriculture through these sensors. Further, it can also be used in tsunamis, coal mining, earthquakes, torrent detection, jungle fire forecast, tornados, rainwater range, water worth, gas leakage, volcanic explosion and so on. The environment applications aware and facilitates inhabitants, how to making protection from the disaster that is about to come.
- ❖ **Area Tracking** : In WSNs, It helps in area checking through sensors are arranged over a area where various physical movement or incident is to be checked. When sensors judge the event being observed (via sound, vibration) and event is reported to the base station, which takes appropriate action. WSNs are also organized in safety systems to check unwanted movements of traffic control system to recognize the occurrence of speedy automobiles.
- ❖ **Health Care** : WSNs are playing a very important role in medical sciences and it consists sensors to sense different physiological constraint . Then it passes to the practitioner for further investigation and opinion. Most of the tasks have done through WSN and their results/investigations are very accurate as desired by medical practioners. It helps in the following :
 - It provides the facilities like, memory enhancement medical observation, health-care- information access & communication in emergency situations through the SMS or GPRS to the public.
 - It provides valuable techniques to purposely contact and observer the physiological indications without having any interruption of the patient’s normal life.
 - Most of multi specialty hospitals are using sensor based equipments that help to monitor the patients conditions/behaviors.
- ❖ **Production & Stock Management** : Stock checking to maintain documentation of the items in the registers and also validate and provide chain management system
- ❖ **Agriculture** : Agricultural industry is gradually more common with the help of wireless sensor networks. With the help of wireless network the farmers are free from protection of electrical system in a difficult environment. Gravity feed water systems can be checked using pressure transmitters to observe water tank levels, pumps can also be controlled through wireless I/O components & utilization of water can be measured and wirelessly transmitted back to control center for records. Irrigation automation facilitates more efficient water use and reduces wastage.
- ❖ **Smart Buildings** : It is competent to check & manage its mechanism according to building structure, outdoor, indoor atmosphere. The workings and their uniqueness are directly connected to building scope. The system observed the current and voltage consumed by the household appliances. The benefits

of this system are low price tag and flexible in functions.

- ❖ **Vehicle Detection:** In this application sensors are used to observe and reduce traffic flow, tracking vehicles on city for traffic violation and to detect illegal activities around the critical infrastructure like airports, railway station etc. the application of WSN in smart transportation provides the possible benefits of using WSN based traffic monitoring system for the improvement of quality and safety of vehicle transportation.
- ❖ **Disaster Management :** It is used to have been suffering from some type of disaster such as wildfires, then drop the sensor nodes on the fire from an aircraft. Observe the data of nodes and create a temperature chart to develop right ways and techniques to beat the fire.

4. Challenges

Some of the challenges we face in wireless sensor network systems :-

- ❖ **Energy Management:** Energy management is a major challenge in all sectors wherever WSNs applications are running, because sensor nodes trust on batteries for power and that are not to provide continual power to the nodes as the batteries will regularly exhaust at a little point. There are various procedures for generating energy, but they are not able to reduce the requirements of energy management. Another major challenge to manage limited battery by designing and implementing various energy efficient hardware and software protocols for WSN.
- ❖ **Quality of Service:** In today's growing market wireless sensor applications are running in various fields where quality of service to be one of main problems. Quality of service promised in wireless sensor networks (WSNs) is complex and extra challenging due to the information resources available of sensors and several applications functioning over these networks and have various restrictions in their temperament and conditions. Normally (QoS) quality of service was concentrate on system point with interest in metrics like tango, jam, thrash out etc.
- ❖ **Network Lifetime:** The major challenges facing (WSNs) have limited power supply, because sensor nodes conditions regularly differ in power utilization. Energy utilization is rigorously unbalanced to the reliable power consumption for the given network topology, which badly reduces the lifetime of the sensor networks. In regards to boost the lifetime of the network, load balancing techniques using efficient routing systems must be occupied.
- ❖ **Security :** It is another serious challenge in the real time applications of WSN, such as controlling battlefields, structural monitoring and surveillance.

The security requirements of wireless sensor based data reliability, responsibility, availability, checking system are confidentiality and access control. WSNs are always installed in open area; attackers may aim to jam or fiddle with node in the network and some have mentioned that attackers find opportunity to lunch attacks on the network through physical access or wireless communication.

- ❖ **Limited Hardware:** In WSN it is another major challenge that every sensor node has limited storage, communication facilities, limited energy and bandwidth.
- ❖ **Lack of Resources :** In WSN lack of resources is also a major challenge. It has limited energy, communication and computation resources. The poor calculation and communication resources can be trust on poor energy available to sensor nodes in WSNs. Due to lack of these effects sensor nodes are over to trade off computation and communications by collapsing information requirements.
- ❖ **System Reliability:** In WSNs medical research & healthcare applications require reliable and accurate collection and delivery of information. In health care systems wireless sensor requires high range of accuracy. These factors may influence the accuracy of a wireless sensor system environment where it is deployed. At the design stage of the system is a major challenge to WSNs in biomedicine. In order to enhance reliability, the system has to healthy so as to be able to perform optimally in unkind and unpredicted circumstances
- ❖ **Risk-Tolerance:** Another one more major challenge in WSN to organized sensor nodes in an uncontrolled or harsh atmosphere; it is not exceptional for the sensor nodes to become illogical and untrustworthy.
- ❖ **Scalability:** It is very significant and crucial challenge in design of routing protocols for WSN. Most of the applications are desirable; the amount of sensor nodes organized must be in sort of hundreds, thousands or extra. The protocols must scalable sufficient to answer and work with such large amount of sensor nodes.

5. Conclusion

In this study we have discuss a variety of WSNs applications and also discussed Components, Characteristics and challenges of WSNs. Wireless sensor network is very hot topics in the area of Technology World, Education, Medical science and Research. Most of the times WSN work automatically and communicate within a short range. The implementation of wireless sensor network is not just limited to computing devices these sensors can be used in every aspect of our daily life. In future more research is desired for extension of application in the areas of WSN.

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