

Insights to Sensor Technology and it's Applications

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Abstract:

A **sensor** is a device which is able to convert any objective quantity to be measured into a signal which is interpreted, displayed, stored or used to control some other data. The signal formed by the sensor is equal to the quantity to be measured. Sensors are used to calculate a particular characteristic of any object or device.[1] This paper provides the overview about What is sensors, different fields where sensors are used, how sensors are used in day to day life, its advantages and disadvantages and types of sensors. Paper also gives idea about how sensors plays an important role in cyber security.

Keywords: - Sensor, WSN

Introduction:

In our daily life we regularly use various types of sensors in numerous applications such as Infrared (IR) sensor is used for functioning of television remote, Passive Infrared sensor used for automatic gate opening system of showrooms or malls and Light-Dependent Resistor (LDR) sensor used for open-air lighting or road lighting system, and so on. In this paper we will consider about a few types of sensors and their applications in brief.

What is Sensor?

A sensor is a piece of equipment that detects and responds to some type of input from the physical surroundings. The particular input could be sunlight, heat, motion, pressure, moisture etc. The output is a signal that is converted to human-

readable format at the sensor place or send electronically over a network for further processing.

How Sensors are used? [3]

In Business

In factory, networked vibration sensors warn that a compartment is start to fail. Mechanics plan overnight maintenance to prevent an expensive unplanned shutdown. Inside a refrigerated grocery truck humidity and temperature sensors monitor individual containers, to reduce spoilage in eatable things.

In the Environment

Wireless humidity sensor network watch fire danger in forests which are far away. Nitrate sensors identify industrial and agricultural overflow in rivers, streams and wells. Distributed

Seismic Monitors gives before time warning for earthquakes. Meanwhile built-in Stress Sensors report on the structural veracity of bridges, buildings and roadways, and other man-made constructions.

For Safety and Security

Fire fighters spread wireless sensors right through a burning building to identify hot spots and explosion. Concurrently, the sensors provides communications network in urgent situations. Miniature chemical and biological sensors are used raise an alarm at the first sign of any disease.

In the Classroom

Sensor technology also helps teachers in observing experiments of students. Instead of using old devices such as stopwatches, thermometers and barometers, if students uses sensors and powerful software to collect and analyze data during their experiments then it provide more accurate data readings than the old manual methods.

Sensors in Education

Sensor technology can have a vast impact on the techniques used to teach science in the classroom. This technology can bring important improvements in the teaching and learning of subjects like science and mathematics. Anyone can use sensors as they are easy to utilize. Sensor technology provides students with a means of considering, understanding, investigating and communicating association graphically.

The analytical approach helps those students who find science very hard and also help them on collecting and analyzing data. Students

can do again experiments number of times because data get collected rapidly. As science syllabuses move away from content towards development, the exercise of modern measuring tools should be obvious in every classroom.

Types of Sensor:-

a) Speed Sensor

Speed Sensors are used for detecting speed of an vehicle or an entity. Speedometers, Light Detection and Ranging (LIDAR), Ground speed radar, Wheel speed sensors, Doppler radar, air speed indicators, pitot tubes(to measure air speed) etc. are some examples of Speed sensors.

Temperature Sensor provides temperature measurement as an electrical signal which is in the form of electrical voltage and is proportional to the temperature amount.

b)PIR Sensor

PIR sensor or Pyro-electric sensor are electronic sensor used to determine the infrared light radiation produced from things. Objects that has a temperature above zero release heat energy in the form of radiation which is invisible by human eye and detected by PIR motion sensors.

c)Ultrasonic Sensor

The ultrasonic sensors are very much similar to radar technology in which interpretation of echo from radio or sound waves to estimate the attributes of a target by generating the high-frequency-sound waves. The transducer used for converting energy into ultrasound or sound waves with ranges above human hearing range is called an ultrasonic transducer.

d) Motion Sensor

Motion sensor is the main device which detects motion of a person who took unauthorized entry in your home. It uses different technologies to detect movement in particular area. When it finds the movement, sensor get tripped and signal is sent to control panel of security systems which is connected to central monitoring centre, alerting both about possible threat in your home.

Along with sending an alert to your control panel, motion sensor also sense an burglar. Sensors work when you are not at home. In few sensor systems camera also gets incorporated which helps the system in motion detection. They are able to capture the movement from any room of your house.

Wireless Sensor Networks and their Applications [5]**Wireless Sensor Networks (WSNs)**

When wireless network of devices communicate to gather information from monitored field then it called as Wireless Sensor Network. Wireless Ethernet is used to connect and send data to different networks. It consists of base stations and number of wireless sensors i.e. nodes which are used to observe physical or environmental conditions like sound, pressure, temperature and co-operatively transfer data through the set of connections to a main location.

Types of WSNs[5]

Depending on the situation, the types of networks are decided so that those can be install anywhere

for ex. underground, underwater, 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

1. Terrestrial WSNs

Terrestrial WSNs are deployed in structured or unstructured manner and consists of about hundreds to thousands of Wireless sensors that are competent in communication with base stations. In an unstructured manner, the sensor nodes are indiscriminately spread within the target area. The pre planned or structured manner considers finest placement, grid placement, and 2D & 3D placements. In this WSN, the battery power is inadequate; however, the battery is designed with solar cells as a secondary power supply. Use of low duty cycle operations, minimum delays and optimal routing achieves the energy management of these WSNs.

2. Underground WSNs

The underground wireless sensor networks requires more operational, maintenance, and equipment cost and alert planning, hence they are further costly than terrestrial WSNs. Underground conditions are monitored by number of nodes which are hidden in the ground.

Above the ground some additional sink sensors are placed to transmit information captured by the sensor to the base station.

Recharging of Underground WSNs are very difficult. The underground environment attenuates sensor signals that generates communication problem.

3. Under Water WSNs

Under water WSNs consist of number of sensors deployed under water. For gathering of data from sensor nodes self-governing vehicles are used. As we keep sensors in water sensor failure is a big problem. Beside this Under Water WSNs have to face problems like bandwidth and propagation delay etc. Sensors cannot be recharged in these networks.

4. Multimedia WSNs

To track and monitor events in multimedia format such as audio, video, images, Multimedia WSNs are used. These sensors are interconnected with each other using wireless connection and capable for data retrieval, data compression etc. In this network microphone sensors and cameras are used

High bandwidth demand, compression techniques, information processing are some challenges with these type of networks. In addition to this, for rapid multimedia data transmission high bandwidth is required.

5. Mobile WSNs

When group of sensors can be moved on their own and do communication with physical environment, then it is called as Mobile WSNs.

These sensors have the capacity to communicate and calculate sense. The mobile WSNs are much more flexible than the static sensor networks. Enhanced and better coverage, higher channel capacity, better energy efficiency, and so on are the advantages of Mobile WSNs.

Conclusion:

This paper highlights importance of sensor technology in today's world. Above information elaborates multiple mechanisms to enable how sensors are useful in development, integration, automation and security framework implementation. Wireless Sensor Mechanism helps to build robust security system.

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