An Overview on Wireless Sensor Network

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Abstract- *Wireless sensor network (WSN) refers to a group of spatially dispersed and dedicated sensors for monitoring and recording the physical conditions of the environment and organizing the collected data at a central location. WSNs measure environmental conditions like temperature, sound, pollution levels, humidity, wind, and so on.*

I. INTRODUCTION

These are similar to wireless ad hoc networks in the sense that they rely on wireless networking and spontaneous network creation to facilitate wireless transmission of sensor data. WSNs are autonomous sensors that are spatially distributed to track physical or environmental conditions, such as temperature, sound, pressure, etc., and to transmit their data to a main location cooperatively via the network. The more advanced networks, both collecting data from distributed sensors and allowing sensor activity control, are bi-directional. Military applications such as battlefield surveillance inspired the creation of wireless sensor networks; today, such networks are used in many industries process monitoring and control, machine health monitoring, and so on.

The WSN consists of "nodes"-from a few to many hundreds or even thousands, where one (or often many) sensors are attached to each node. Typically, each of these sensor network nodes has many components: a radio transceiver with an internal antenna or an external antenna link, a microcontroller, an electronic sensor interface circuit and an energy source, normally a battery or an embedded type of energy collection. A sensor node can vary in size from that of a shoebox down to the size of a grain of dust, while "motes" of actual microscopic dimensions still have to be produced to operate. The Sensor Expense

Nodes, depending on the complexity of the individual sensor nodes, are equally variable, ranging from a few to hundreds of dollars. Size and cost constraints on sensor nodes result in sufficient resource constraints such as resources, memory, computational speed, and bandwidth of communications. The WSNs' topology will vary from a simple star network to an advanced wireless multi-hop mesh network. Routing or flooding may be the propagation method between the hops of the network.

II. APPLICATION

1. Area monitoring

Area tracking is a prevalent feature of WSNs. The WSN is deployed over a region in the field monitoring where certain phenomena are to be tracked. Using sensors to detect enemy interference is a military example; the geo-fencing of gas or oil pipelines is a civilian example.

2. Health care monitoring

For medical applications, there are many types of sensor networks: implanted, wearable, and environment-embedded. Those that are implanted inside the human body are implantable medical devices. Wearable devices are used on the surface of a human body or just near the user. Environment-embedded devices use environmentally-contained sensors. Possible applications include assessment of body position, location of people, overall monitoring of ill patients in hospitals and at home. Environmentally interconnected systems monitor a person's physical state for continuous health diagnosis, using data from a network of depth cameras, a sensing floor, or other related data as an input. Body-area networks can collect information about an individual's health, fitness, and energy expenditure. In health care applications the privacy and authenticity of user data has prime importance.

Especially due to the integration of sensor networks, with IoT, the user authentication becomes more challenging; however, a solution is presented in recent work.

3. Environmental/Earth sensing

There are many applications in monitoring environmental parameters,[11] examples of which are given below. They share the extra challenges of harsh environments and reduced power supply.

4. Air pollution monitoring

Wireless sensor networks have been deployed in several cities (Stockholm, London, and Brisbane) to monitor the concentration of dangerous gases for citizens. These can take advantage of the ad hoc wireless links rather than wired installations, which also make them more mobile for testing readings in different areas.[citation needed]

5. Forest fire detection

A network of Sensor Nodes can be installed in a forest to detect when a fire has started. The nodes can be equipped with sensors to measure temperature, humidity and gases which are produced by fire in the trees or vegetation. The early detection is crucial for a successful action of the firefighters; thanks to Wireless Sensor Networks, the fire brigade will be able to know when a fire is started and how it is spreading.

6. Landslide detection

A landslide detection system makes use of a wireless sensor network to detect the slight movements of soil and changes in various parameters that may occur before or during a landslide. Through the data gathered it may be possible to know the impending occurrence of landslides long before it actually happens.

7. Water quality monitoring

Water quality monitoring involves analyzing water properties in dams, rivers, lakes and oceans, as well as underground water reserves. The use of many wireless distributed sensors enables the creation of a more accurate map of the water status, and allows the permanent deployment of monitoring stations in locations of difficult access, without the need of manual data retrieval.

8. Natural disaster prevention

Wireless sensor networks can be effective in preventing adverse consequences of natural disasters, like floods. Wireless nodes have been deployed successfully in rivers, where changes in water levels must be monitored in real time.

9. Machine health monitoring

Wireless sensor networks have been developed for machinery condition-based maintenance (CBM) as they offer significant cost savings and enable new functionality.

Wireless sensors can be placed in locations difficult or impossible to reach with a wired system, such as rotating machinery and untethered vehicles.

10. Data logging

Wireless sensor networks also are used for the collection of data for monitoring of environmental information. This can be as simple as monitoring the temperature in a fridge or the level of water in overflow tanks in nuclear power plants. The statistical information can then be used to show how systems have been working. The advantage of WSNs over conventional loggers is the "live" data feed that is possible.

11. Water/waste water monitoring

Monitoring the quality and level of water includes many activities such as checking the quality of underground or surface water and ensuring a country’s water infrastructure for the benefit of both human and animal. It may be used to protect the wastage of water.

12. **Structural health monitoring**

Wireless sensor networks can be used to monitor the condition of civil infrastructure and related geo-physical processes close to real time, and over long periods through data logging, using appropriately interfaced sensors.

III. CHARACTERISTICS

The main characteristics of a WSN include

1. Power consumption constraints for nodes using batteries or energy harvesting. Examples of suppliers are ReVibe Energy and Perpetuum
2. Ability to cope with node failures (resilience)
3. Some mobility of nodes (for highly mobile nodes see MWSNs)
4. Heterogeneity of nodes
5. Homogeneity of nodes
6. Scalability to large scale of deployment
7. Ability to withstand harsh environmental conditions

Cross-layer is becoming an important studying area for wireless communications. In addition, the traditional layered approach presents three main problems:

Traditional layered approach cannot share different information among different layers, which leads to each layer not having complete information. The traditional layered approach cannot guarantee the optimization of the entire network.

IV. CONCLUSION

The traditional layered approach does not have the ability to adapt to the environmental change. Because of the interference between the different users, access conflicts, fading, and the change of environment in the wireless sensor networks, traditional layered approach for wired networks is not applicable to wireless networks.

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