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APPLICATIONS OF WIRELESS SENSOR NETWORKS: AN OVERVIEW

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ABSTRACT

A wireless sensor network is a type of wireless network consist a collection of tiny device called sensor node. Sensor node has a resource constraint means battery power, storage and communication capability. These sensor nodes are set with radio interface with which they communicated with one another to form a network. Wireless sensor network has very necessary application like remote has remote environmental monitoring and target tracking. The goal of our survey is to present a comprehensive review of the recent literature on various aspects of WSN and also discuss how wireless sensor network works and advantages and disadvantages over the traditional network. Wireless Sensor Networks are networks composed of a number of sensor nodes that communicate wirelessly. It's utilized over a wide range of applications. This paper looks at the Wireless Sensor Networks from the applications point of view and surveyed different application areas where the use of such sensor networks and their specifications, capabilities.

KEYWORDS: Wireless Sensor Networks (WSNs), Sensors, Applications.

INTRODUCTION

Recent advances in wireless networks and electronics have led to the emergence of Wireless Sensor networks. It has been considered as one of the most important technologies that can change the future into perfect. These networks consist of small battery–powered motes with limited computation and radio communication capabilities. Each sensor in a sensor network consists of three subsystems: The sensor subsystem which senses the environment, The processing subsystem which performs local computations on the sensed data, and the communication subsystem which is responsible for message exchanges with neighboring sensors. Advances in wireless sensor networking have opened up new opportunities in healthcare systems. Sensor-based technology has invaded medical devices to replace thousands of wires connected to these devices found in hospitals. This technology has the capability of providing reliability in addition to enhanced mobility. In future, we will see the integration of an enormous array of wireless networks into existing specialized medical technology. This paper will investigate the application of current state-of-the-art of wireless sensor networks in health care systems and will address how these concepts are integrated in our computer engineering program.

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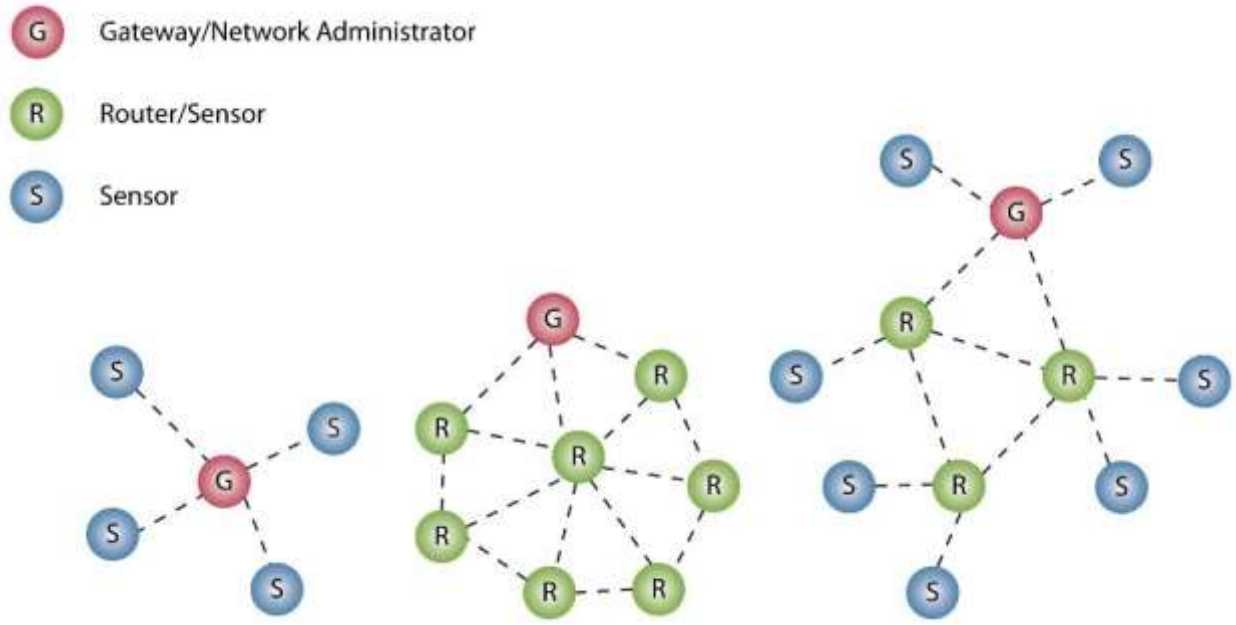

Figure 1: Architecture and its Type

Figure 1 represents architecture of wireless sensor networks and Topologies. Three types of topologies are present in sensor networks namely Star, Mesh and Tree topology. Each topology must have Gateway i.e., network administrator and sensors. Present, Wireless sensor networks is an important technology with great potential for improving many current applications in medicine, transportation, home, agriculture, industrial process control, and the military as well as creating new revolutionary systems in each areas such as global-scale environmental monitoring, precision agriculture, home and assisted living medical care, smart buildings and cities, and numerous future military applications.

APPLICATIONS

Major applications of Wireless Sensor Networks are

- Healthcare
    1. Home monitoring
    2. Health monitoring
    3. Biomedical
    4. Food safety
- Industry
    1. Factory
    2. Supply chain
    3. production
- Environment
    1. Habitat preservation
    2. Agriculture
    3. Animal tracking
- Infrastructure
    1. Transportation and Logistics
    2. Energy control system
    3. Water distribution
    4. Traffic
    5. Flood
- Military

Healthcare Applications

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Sensor networks are also widely used in health care area. In some modern hospital sensor networks are constructed to monitor patient physiological data, to control the drug administration track and monitor patients and doctors and inside a hospital. Long-term nursing home: this application is focus on nursing of old people. In the town farm cameras, pressure sensors, orientation sensors and sensors for detection of muscle activity construct a complex network. They support fall detection, unconsciousness detection, vital sign monitoring and dietary/exercise monitoring. These applications reduce personnel cost and rapid the reaction of emergence situation.

Medical

Different wireless technologies are used in medical applications such as WBAN, WPAN, WWSN etc., Wireless Body Area Network (WBAN) technology used in medical applications with continuously operating sensors, which measures the patient physiological signals such as mobility, blood pressure, heart rate and glucose levels. Two categories of wireless sensor networks in this area are wearable and implanted. The survey is presented with Wearable Wireless Sensor Networks (WWSN). The performance analysis of the wireless sensors networks how will they perform in healthcare or hospital environment in a secured manner such as packet segmentation, packet loss, access delay etc., Implement a Wireless Personal Area Network(WPAN) to monitor the patients periodical activities such as (EEG,ECG,GSR etc.,) and communicate with personal server integrates information from different sensors. To address the fast growing sensor technology in this area, a new field known as Wireless Body Area Networks (WBAN) has emerged. Applications of wireless sensor networks mainly focused on the monitoring of health status of patients have been in demand and various projects are in the development and implementation stages. Sensor technology in healthcare application scenario is shown in Figure 2. Wireless body area network is used to capture the patient's sensitive data so need to secure them in a proper way from unauthorized access.

Figure 2: Wireless Technology in Healthcare Monitoring System

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Environmental Data Collection

In environmental data collection application, are used collect various sensor data in a period of time. If a data to be meaningful so collecting sensor data at regular interval and the nodes would remain at known locations. In the environmental data collection application, a large number of nodes continuously sensing and transmitting data back to a set of base stations that store the data using traditional methods. In typical usage scenario, the nodes will be evenly distributed over an outdoor environment. In environmental monitoring applications, it is not essential that the nodes develop the optimal routing strategies on their own. Instead, it may be possible to calculate the optimal routing topology outside of the network and then communicate the necessary sensor data to the nodes as required. This is possible because the physical topology of the network is relatively constant. While the time variant nature of RF communication may cause connectivity between two nodes to be intermittent, the overall topology of the network will be relatively stable.

Home Application

Along with developing commercial application of sensor network it doesn't so hard to image that Home application will step into our normal life in the future. Many concepts are already designed by researcher and architects, like "Smart Environment: At the sometime five sensors in every corner in the room are measuring the temperatures. Originally there is also sensor in the air condition. But it can only get the temperature at the edge of the machine not the real temperature in the room. So the sensors in the room will be detecting the environment.

The air condition will turn to sleep mode until all the sensors get the right temperature. The light on the corridor, in the washing groom and balcony are all installed with sensor and they can be turned on or turn out automatically. Even the widows are also attached with vibratory sensors connected to police to against thief. How nice! You become nurse and bodyguard at the same time.

Military Applications

Most of the elemental knowledge of sensor networks is basic on the defence application at the beginning, especially two important programs the Distributed Sensor Networks (DSN) and the Sensor Information Technology form the Defence Advanced Research Project Agency (DARPA), sensor networks are applied very successfully in the military sensing. Now wireless sensor networks can be an integral part of Military, Control, Communications, Computing, Intelligence, Surveillance, Investigation and Targeting Systems. In the battlefield context, rapid deployment, self-organization, fault tolerance security of the network should be required. The sensor devices or nodes should provide following services: like Monitoring Friendly Forces, Equipment and Missiles, Battlefield Surveillance, Investigation of opposing forces, Targeting, Battle damage estimation Nuclear, Biological and Chemical attack detection investigation.

Node tracking scenarios

In which wireless sensor network is the tracking of a tagged object through a area of space monitored by a sensor network. There are many conditions where one would like to track the location of important assets or personnel. Current inventory control systems attempt to track objects by recording the last checkpoint that an object passed through. However, with these systems it is not possible to determine the current location of an object. In typical work environments it is impractical to expect objects to be continuously passed through checkpoints. With wireless sensor networks, objects can be tracked by simply tagging them with a small sensor node. The sensor node will be tracked as it moves through a field of sensor nodes that are deployed in the environment at known locations. Instead of sensing environmental data, these nodes will be deployed to sense the RF messages of the nodes attached to various objects. The nodes can be used as active tags that announce the presence of a device. A database can be used to record the location of tracked objects relative to the set of nodes at known locations. With this system, it becomes possible to ask where an object is currently, not simply where it was last scanned. Unlike sensing or security networks, node tracking applications will continually have topology changes as nodes move through the network. While the connectivity between the nodes at fixed locations will remain relatively stable, the connectivity to mobile nodes will be continually changing.

Security Monitoring

Security monitoring networks are collected of nodes that are placed at fixed locations throughout an environment that continually monitor one or more sensors to detect an anomaly. A key difference between security monitoring and environmental monitoring is that security networks are not actually collecting any data. This has a significant impact on the optimal network architecture. Each node has to frequently check the status of its sensors but it only has to transmit a data report when there is a security violation. The immediate and reliable communication of

alarm messages is the primary system requirement. These are "report by exception" networks. It is confirmed that each node is still present and functioning. If a node were to be disabled or fail, it would represent a security violation that should be reported. For security monitoring applications, the network must be configured so that nodes are responsible for confirming the status of each other. One approach is to have each node be assigned to peer that will report if a node is not functioning.

The optimal topology of a security monitoring network will look quite different from that of a data collection network. In a collection tree, each node must transmit the data of all of its decedents. The accepted norm for security systems today is that each sensor should be checked approximately once per hour. Combined with the ability to evenly distribute the load of checking nodes, the energy cost of performing this check becomes minimal. A majority of the energy consumption in a security network is spent on meeting the strict latency requirements associated with the signaling the alarm when a security violation occurs. In security networks, a vast majority of the energy will be spend on confirming the functionality of neighboring nodes and in being prepared to instantly forward alarm announcements. Actual data transmission will consume a small fraction of the network energy.

Advantages:
Here are the advantages of using wireless sensor networks in all fields.

1. Low cost compared to GPRS modems.
2. Minimum energy consumption compared to traditional networks.
3. Coverage area is easy to expand and reduce.
4. Avoid wiring.
5. Accommodate new devices anytime
6. Centralized monitoring system

Disadvantages:
Here are the lists of disadvantages of wireless sensor networks.

1. Lower speed compared to wired network
2. Less secure
3. Affected by surroundings such as Walls, Bluetooth, and long distance.
4. Easy for hackers to hack

ISSUE TO BE FOCUSED

Power-Consumption:
A wireless sensor node can be a popular solution when it is difficult or impossible to perform a mains supply towards sensor node. However, because the wireless sensor node is normally positioned in a hard to reach location, changing the battery regularly will not be free and inconvenient. An essential take into account the introduction of a wireless sensor node is making sure that there's always adequate energy accessible to power the system. The facility consumption rate for sensors in the wireless sensor network varies greatly good protocols the sensors use for communications. The Gossip-Based Sleep Protocol (GSP) implements routing and many MAC functions in a energy conserving manner. The effectiveness of GSP has already been demonstrated via simulation. However, no prototype system has become previously developed. GSP was implemented for the Mica2 platform and measurements were conducted to discover the improvement in network lifetime. Results for energy consumption, transmitted and received power, minimum voltage supply necessary for operation, effect of transmission power on energy consumption, and different methods for measuring time of a sensor node are presented.

Security:
Security is often a broadly used term encompassing the characteristics of authentication, integrity, privacy, non-repudiation, and anti-playback. The greater the dependency on the info supplied by the networks may be increased, the more potential risk of secure transmission of information in the networks has increased. To the secure transmission of numerous kinds of information over networks, several cryptographic, steganography and other techniques are utilized that happen to be renowned. In this section, we discuss the network security fundamentals you bet the techniques are meant for wireless sensor networks.

CONCLUSION

Wireless Sensor Networks are networks composed of a number of deployed sensors that have the functionality of sensing an event and transmitting it wirelessly to the sink. In this paper some of the most recent applications of WSN that appears in literature, are surveyed. The demand on WSN is increasing rapidly due to the fact that these

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networks have opened the possibility of performing critical tasks that humans cannot perform. To conclude, healthcare technology is expected to take a role in everyday life in years to come. This paper studied the application of Wireless Sensor Networks in various fields. Further research will go on with Healthcare monitoring systems including home management. The application of the Wireless Sensor Networks in healthcare systems was divided into three categories: Monitoring of patients in clinical settings, Home and Elderly care center monitoring for chronic and elderly patients, and collection of long-term databases of clinical data. This study revealed that the existing application of WMSNs in the healthcare system have some shortcomings that need to be addressed. The WSN research community has done an admirable job of addressing some of the limitations that currently exist for healthcare-related applications; however, improvements are still needed regarding security and privacy issues in addition to further upgrades to wireless communication.

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