PROJECT NAME

Survey of Applications of Wireless Network Sensor

Prepared by & email address:

Sarmad Jamal MohammedGharib/sarmadjamal.sj@gmail.com

SoftWare Engineer

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Contents

Conceptual:

Wireless Sensor Networks (WSNs) have come to the most important Part of the scientific community recently. Spatially spread independent sensors to track physical objects or monitor environmental data and collectively transmit the data to the main server. WSN is using in numerous fields like animal tracking, Smart Transportation, environmental monitoring, security and surveillance, Smart buildings, Health care, and so on and have many advantages such as unmanned operation, easy deployment, real-time monitoring, and relatively low cost. This Article various applications of WSN to scatter various applications of fields daily life for the better understanding of the research community to apply WSN in further innovative fields.

Introduction

A wireless sensor network (WSN) is made up of many dedicated sensor nodes that have sensing and computing capabilities and can sense and track physical parameters as well as transmit data to a central location through wireless communication technologies[1]. Transmission via cellular phones, computers, WLAN, Wi-Fi, and other wireless distribution techniques are among the options. When the data from the collection station enters the master station, it is analyzed and further processed. Energy gathering, ability to cope with node failure, mobility of nodes, heterogeneity of nodes, scalability to large-scale deployment, ability to withstand hard environmental conditions, and ease of use are some of the key characteristics of WSN. The mentioned features ensure a wide range of applications of sensor networks[2]. The main features of wireless sensor networks are Self-organization, multi-hop route, dynamic network Topology, node resources limited, data-centric, and security problems. Sensor nodes in a wireless sensor network are usually installed in areas where there is no access to a base network. This allows the sensor node to have the self-organization capacity to configure and handle automatically, such as a large area of virgin forest or a dangerous area that people cannot reach. When a node is unable to communicate directly with the gateway, it must rely on other nodes to send data, resulting in multi-hop routing[3]. The report classifies wireless sensor network's major application areas that can be applied.

Application Wireless network sensor

A- Accuracy Agriculture

Temperature, humidity, carbon dioxide gas levels, soil moisture, and other WSN play. Sensor data is utilized to establish the best sowing density, calculate fertilizer and other input requirements, and better predict crop yields. [2].Monitoring various crop parameters is a valuable method for improving agricultural production. Crop monitoring in precision agriculture can be accomplished using a variety of technologies; however, the use of Wireless Sensor Networks (WSNs) results in deployments that are both low-cost and low-power[4]. The data can be used to improve crop production control and optimization strategies. The collected data can also be used to investigate the intertemporal variability of environmental impacts, which is crucial for the transition from traditional to organic and sustainable crop production. Farmers may access real-time data from the fields at any time to assist them to adjust their crop production strategy, without having to utilize a tractor or other vehicle to get to each sampling spot. As a result, considering that present cropping methods are often associated with significant fossil energy input, the adoption of WSNs results in a reduction in agricultural energy consumption to some extent.[5].

B-Environmental Monitoring

While sensor networks have several uses, environmental monitoring is one area where they could have a significant effect. Recent climate change-related disasters have shown how important it is for humans to have a thorough understanding of our world and its evolution. It's critical to think about the application's particular specifications, particularly when it's as demanding as environmental monitoring. Typically, such campaigns include installing a range of sensors in the field to monitor meteorological and hydrological parameters such as wind speed and direction regularly [6]. The use of wireless sensor networks in the environment extends its application in coal mining, earthquakes, tsunami, flood detection, forest fire prediction, gas leakage, cyclones, rainfall range, water quality, and volcanic eruption, and so on[2].

1. Air Pollution

The effects of air pollution on human health have been extensively studied, and various studies have demonstrated that air pollution has a major impact on humans. The ramifications of this worrisome occurrence will become increasingly problematic in future smart cities as a result of greater industrialization, economic expansion, and vast urbanization. For these reasons, we agree that pollution control, as well as pollution detection and monitoring, should be at the forefront of smart city development.[7].

2. Fire on Forest

Forest fires, also known as wildfires, are uncontrolled fires occurring in wild areas and cause significant damage to natural and human resources. Aside from preventative measures, the only way to reduce damage and injuries is to detect and contain fires early. As a result, the most important aspect of a forest fire warning system is the quick response to reduce the disaster's scope. This necessitates continuous monitoring of the forest environment. Due to low resolution and long scan periods, current medium and large-scale fire surveillance systems do not achieve timely detection. As a result, a scalable solution that can provide high-accuracy real-time fire detection is needed. Wireless sensor networks, we assume, might be able to provide this solution[8].

3. Leak of Gases

Another potentially dangerous problem is gas leakage, which can endanger both human and animal life. In, the use of wireless sensor networks in the detection of gas leakage is addressed. In the nation, a remote online carbon dioxide monitoring system is being established. A central processing unit, air environment sensor arrays, GPS, receiver module, protected digital memory card storage module, LCD, and GPRS are all part of the device. The data will be saved and displayed, and it will also be able to sound an alarm if the situation becomes out of hand. In the discovery of oil and gas, an ultra-wideband sensor network is used[2].

C) Smart Buildings

During their long-term use, buildings are exposed to natural hazards such as earthquakes and waves, as well as artificial hazards such as fires and crimes. One of the most promising emerging technologies for reducing these hazards is risk monitoring through a network of wireless sensors. A smart sensor based on the Berkeley Mote platform was recently launched, with a potential application for next-generation structural health monitoring and control[9]. “Smart Building” techniques, whose aim is to provide smart sensing and efficient management capabilities, have been shown to minimize energy consumption in buildings in the sense of IoT technologies. However, marked differences between the as-designed and as-built conditions, as well as changes in building condition and use over time, buildings around the world continue to underperform and fail to achieve their required energy efficiency[10]. Wireless sensor networks can be used to make human living conditions more comfortable and intelligent. Wireless sensors, for example, may be used to remotely read utility meters in a house, such as water, gas, and electricity, and then transmit the readings to a central location through wireless communication[11].

D) Healthcare Monitoring

Wireless sensor networks (WSN) are becoming increasingly common in healthcare applications. Heart rate monitors, blood pressure monitors, and endoscopic capsules are only a few of the applications that are currently in use. In recent years, sensor systems that can be used to track human activities have sparked a lot of research interest. Medical and nonmedical applications are the two main types of service. Wearable and embedded medical applications are two types of medical applications. Wearable devices are those that can be placed on a human's body surface or close to the user. Temperature measurement, respiration monitor, heart rate monitor, pulse ox meter SpO2, blood pressure monitor, pH monitor, glucose sensor, and other wearable medical devices and applications are examples. Implantable medical devices are those that are implanted into the human body. Cardiac arrhythmia monitor/recorder, Brain liquid pressure sensor, Endoscope capsule, and other devices and applications are among them. Real-time video streaming using an mp4 video player and real-time audio streaming using an mp3 player are examples of non-medical devices and applications. There can also be scope for remote-controlled applications, data file transfer, and sports and gaming applications. Apart from the above traditional monitoring examples, there are also applications such as calculating body positions and location, overall monitoring of ill patients in hospitals and at home, and so on[12]. The patient will be wearing the ECG sensor and the sensor will continuously transmit the data to the hospital or the physician without any fail which will result in the continuous monitoring of the patient[2].

E) Military Applications

New and evolving technology, such as networks, aid military operations by transmitting vital information quickly and reliably to the right person or entity at the right moment, boosting combat efficiency significantly. Military activities are influenced by new missions influenced by world events and by enabling technology. These emerging developments must be easily incorporated into a larger architecture. A flexible and modular system is needed to detect threats and produce data in real-time for the Common Operating Picture (COP)[13]. Collaborative sensing nodes with several transducers, a processor, memory, batteries, and radio support the formation of an ad hoc network for extended communication coverage in this new generation of WSNs. To enter a gateway, sensor nodes communicate in a multi-hop fashion. A planar wireless sensor network is the name for this form of architecture. The gateway connects the sensor nodes to the backend command and control station through wireless long-haul connectivity. Using beyond-line-of-sight (BLOS) communication, the gateway connects the sensed data and alarms to a remote user. The benefits of making the sensor nodes interact ad hoc are that the network is more stable, and the network is more flexible[14]. In, the author describes a wireless sensor network for detecting and tracking enemy vehicles. The device constantly tracks and detects the vehicle's movement, location, and position[2].

F) Vehicle Tracking

The field of Intelligent Transportation Systems is an intriguing area where the use of WSNs has proven to be successful. An Intelligent Transportation System (ITS) makes use of computer and information technology advancements to increase the productivity of both new and existing transportation systems. Traffic situations in both urban and rural areas can be constantly tracked by providing monitoring and tracking services. As a result, addressing the traffic congestion issue by correctly steering traffic away from heavily crowded and congested roads is a direct result. ITSs can also be used to control parking lots, monitor emergencies, navigate to destinations, broadcast traffic conditions on highways, provide traveler information, prevent vehicle accidents, and improve driver safety. ITSs depended on traditional monitoring sensors including inductive loops, video cameras, ultrasonic sensors, radar. However, these sensors had significant flaws that jeopardized the prime objective of integrating intelligence into transportation systems. These sensors, in particular, are bulky, power-hungry, costly to mount, maintain, and repair, and wired to central data processing locations. These characteristics limit the scalability of ITSs and affect their primary goals, such as traffic control and collision avoidance. Wireless sensor nodes are lightweight, inexpensive, easy to set up, densely distributed, power-efficient, and can easily self-configure to deal with node failures. The scalability problem of conventional ITSs was solved by the fact that a single WSN is made up of a large number of sensor nodes. Wireless sensors have greater coverage of the transportation infrastructure, allowing better traffic management decisions to be made[15].

G) Animal Tracking

Monitoring animal behavior and correlating it with environmental data to assess optimal management action methods may help reduce the environmental effect on animals. However, tracking is complicated by the need to document animal activity alongside landscape conditions, which affects animal behavior in and of itself. Ecologists and environmental scientists have long tracked and monitored the behavioral ecology of free-ranging animals using radio-transceivers and location data from the Global Positioning System (GPS). the behavior of the animals. More recently, there has been a focus on integrating data from various sensing platforms using emerging technologies such as wireless sensor networks (WSNs), which enable a wide range of data to be transmitted wirelessly and facilitate analysis of the data collected by the animals' devices[16]. Animal tracking is another use of wireless sensor networks in which a sensor is connected to an animal's body to monitor its movement and location. Zebra Net, which is used to track zebras in the field, is an example of using wireless sensor networks in animal tracking. The sensors are implanted in the animal's body to monitor their position, location, and the type of food they consume. One of the most common uses of WSN in animal husbandry is zebra tracking[2].

H) Smart Cities

In large cities, the regulation of several characteristics is crucial for inhabitants' ideal living conditions. WSNs can be used for a variety of purposes, including delivering real-time data to authorities to ensure that a city runs smoothly when a high number of vehicles are driving to the same location, increased people mobility causes complications and costs time.WSNs may be used to track traffic to minimize congestion, show car parking spaces, and so on. A WSN-based method for measuring and classifying road traffic is proposed. This system's nodes have magnetic sensors built-in and are placed along the road to provide real-time traffic monitoring. The WSN-based framework for street lighting monitoring and control. This device uses Doppler sensors to detect vehicles and allows for remote control of street lighting lamps. In the presence of approaching vehicles, the light intensity of the lamps is increased to a preset amount, and in the absence of them, it is decreased[17].

I) Green Houses

The main goal was to save heat energy in greenhouses by smoothly measuring temperature with high resolution horizontal and vertical data to achieve acceptable and valid results using the previously listed modules in conjunction with an agricultural chamber. In Punjab, India, Pahuja et al. (2013) used a method for greenhouse climate management. They devised a device that tracks and analyzes ambient atmospheric parameters to aid plant growth. They implemented and integrated a framework that automatically tracks, analyzes, and addresses issues relating to their problems for the improvisation and enhancement of the techniques. Liu et al., 2016 created an intelligent monitoring system for their greenhouse grape farming. They took into account the variables that play an important role in the production of the grapes. The whole device or process may be tracked in real-time or on the internet. Additionally, sensors used a video and image capture technique to record every developmental level. The real-time sensors provided the data collection, which was then stored in an active database for further investigation and analysis[18].

J) Smart Grid

Improvements in power electronics technology and the use of renewable energy sources for power generation have led to the use of distributed generation and the creation of the concepts of smart grids and microgrids to address the rapid rise in electricity consumption and the depletion of conventional energy sources. Monitoring power system parameters such as voltage, current, and power at the distribution level is critical for smart grid efficiency[19]. Switching is used to transfer power between the smart grid and the utility grid. The smart grid and the utility grid must be completely synchronized for this switching to work. It's critical to have a cost-effective and dependable communication backbone, as well as an accurate monitoring system. The communication module serves as the backbone of the power system monitoring system, while the sensor module senses various parameters such as voltage, current, and power. The basic communication architecture is straightforward, but network topologies vary widely and are largely determined by the field-level network. WSNs have recently been recognized as a promising technology that can improve various aspects of today's electric power systems, such as generation, delivery, and utilization, making them an important component of next-generation electric power systems, smart grids[20]. In wind power plants, wireless sensor networks in conjunction with SCADA have been utilized. The wireless sensor network can give a wealth of real-time data for the reliable operation of wind-powered generators, ensuring the wind power plant's uptime[21]

Discussion:

Wireless Sensor Networks have been deployed in a variety of ways, with attributes such as flexibility, reliability, high sensing dependability, minimal cost, and quick installation. examined This wide variety of deployment areas will continue in the future. makes sensor networks essential in our daily lives.

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