IJFANS INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 6, June 2022

A Wireless Sensor Networks (WSN) and it application in electrical system

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ABSTRACT: ***A wireless sensor network is a particular kind of wireless network made up of a great deal of moving, self-propelled, tiny, low-powered objects containing sensor nodes known as motes. These networks undoubtedly encompass a sizable number of sparsely placed, diminutive, battery-operated, embedded devices which are networked to gather, process, and send data to users, and this has resulted in the control of computing and processing capacities. The challenges occur in WSN such as security issue, cross-layer optimization, performance, energy efficiency, as well as node failure tolerance. Hence author focusses on the advantages of WSN in electrical system such as because it is scalable, any new node or device may be added at any moment. Since it is malleable, physical division is possible. Access to any WSN node is possible via a centralized monitoring system. In this paper author discusses on the different types of wireless network, structure of a wireless sensor network, and application of wireless sensor network. It concluded that small nodes having wireless communication, processing, and sensing capabilities make up wireless sensor networks. Numerous protocols for data distribution, power management, including routing have been created especially for WSNs, wherein energy awareness is a crucial design consideration. In future, the use of the wireless sensor network will become more extensive and varied as a result of the quick development of sensor as well as communication technologies.***

KEYWORDS: ***Architecture, Internet, Monitor, Technology, Wireless Sensor Network.***

1. INTRODUCTION

Due to advancements in the low-power utilization of processors, communications, as well as embedded computing devices, WSNs (Wireless Sensor Networks) are presently the most widely used services in commercial and industrial applications. The nodes that make up the wireless sensor network topology are used to monitor environmental factors including temperature, moisture, pressure, location, vibration, sound, etc. These nodes may be utilized in a variety of real-time applications to carry out different operations, including smart detection [1],[2]. Discovering nearby nodes, data storage and processing, data collecting, target tracking, monitoring, and control, synchronizing, node localisation, and efficient routing between base stations and nodes are all examples of neighbor node functionality. WSNs are currently starting to arrange themselves at an advanced stage [3],[4]. It is reasonable to anticipate that in 10 to 15 years, WSNs will be used to safeguard the Internet and the entire planet. The physical n/w becoming of the Internet may be used to gauge this. Innumerable opportunities exist for this technology's use in a variety of industries, including healthcare, the environment, infrastructure, the military, entertaining, homeland defense, disaster response, as well as smart spaces [5],[6]. In order to monitor system, physical, or environmental parameters, a substantial majority of wireless sensors are placed in an infrastructure-free wireless network known as a wireless sensor network (WSN). WSN employs sensor nodes with built-in CPUs to administer and keep an eye on the local environment. They are

ISSN PRINT 2319 1775 Online 2320 7876

Research paper UGC CARE Listed (Group -I) Journal Volume 11, Iss 6, June 2022

linked to the base station, which serves as the WSN system's processing hub. For data exchange in the WSN system, each base station must be connected through into the Internet.

A wireless sensor network is a particular kind of wireless network that consists of a lot of moving, self-propelled, tiny, low-powered objects with sensor nodes known as motes [7], [8]. These networks undoubtedly include a huge number of widely dispersed, compact, battery-operated embedded devices which are networked to gather, process, and transport data to operators, which has resulted in the control of computing overall processing power. A network is made up of little computers called nodes. The Sensor Node is a wireless, multipurpose gadget that uses little energy. Motors have a wide range of industrial uses. Data from the environment is gathered by a group of sensor nodes in order to fulfill certain application goals. A transceiver can be used to connect the motors to one another and communicate with them. The number of motors in a wireless sensor network might range from hundreds to thousands. Ad-hoc networks will also have fewer nodes without even any structure than sensor n/was.

1.1. Wireless Sensor Network Architecture:

The OSI architectural model is used in the construction of the majority of wireless sensor networks. Three cross layers and five layers make up the WSN architecture. They require five layers, primarily in sensor n/w: application, transportation, n/w, data connection, and physical layer [9, 10]. Power management, mobility management, as well as task management are the three cross planes. These WSN layers are being used to implement the n/w and to coordinate the sensors in order to maximize the network's efficiency. Please click the link below to learn more about the WSN topology and just kind of wireless sensor network.

2. DISCUSSION

Wireless devices vary in a number of ways, most notably in their bandwidth capacity and the range of communications node distances. The electromagnetic fields (EMFs) they suggest and exactly the range of power they use are other significant distinctions that are likely involved; this is crucial for mobile nodes. The different categories of wireless network.

2.1.Wireless Personal Area Network (Wireless PAN):

It is a WSN that communicates via a short-range, low-power WN technology like Bluetooth, IrDA, wireless USB. Wireless PAN has a range of few meters to several kilometers.

2.2.Wireless Local Area Network (Wireless LAN):

It is a WSN or wireless computer network (WCN) that links or connects two or more devices using wireless communication (WC) to create a LAN inside of a constrained environment like a home, office, institution, or research facility for computers. Is. It allows users to roam between different locations within the same place while staying connected to or connected to the WN. Through a gateway, wireless LANs can also provide connectivity to the Internet and other areas of the larger cyberspace. Because of how simple they are to install and operate, wireless LANs are already widely used in households. They are also common in company physical identities that give their staff and clients Wi-Fi access.

2.3. Wireless Metropolitan Area Network (Wireless MAN):

ISSN PRINT 2319 1775 Online 2320 7876

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In a region the size of a metropolitan area, it is a computer network (CN) that links users to various computer resources. The word man refers to the process of joining LANs in metropolitan areas to form a bigger network that may also effectively link. The term wireless MAN is also used to refer to the point-to-point connections that are used to connect several LANs in an urban setting.

2.4. Wireless Wide Area Network (Wireless WAN):

It is an additional WN variant. Technology must be changed since WAN is much greater than LAN. Data is sent by WNs of varied sizes like web pages, calls, and streaming media. When transmitting data utilizing mobile telecommunications cellular network (MTCN) technology like 2G, 3G, 4G LTE, and 5G, a wireless WAN frequently varies from a wireless LAN. Mobile broadband is another name for wireless WAN (MBB). These devices are offered by a wireless service provider and can be found locally, nationally, or even internationally (WSP). A user with a CN as well as a wireless WAN card may access the internet, check their email, or connect to either a virtual private network (VPN) from everywhere inside the WN thanks to wireless WAN connection. Wireless WAN capabilities may be integrated with the help of many CNs. A closed network that spans a big geographic area can also be a wireless WAN. A mesh network or MANET, for instance, may include nodes on towers, vehicles, airplanes, and buildings. A "low-power, low-bit-rate (LBR) wireless WAN, also known as a LPWAN, is another option that is used as a battery-powered sensor to transmit tiny data packets between devices. Wireless WANs especially combine an authentication and access control technique to make these more secure as RMSs rarely provide such a physically secured connection line. Security experts have reportedly warned that many early GSM encryption methods are insufficient and that MTCN, particularly wireless WANs, is not as safe.

2.5. Wireless Global Area Network (Wireless GAN):

It describes any network that consists of several interconnected CNs (WANs) that spans an unlimited area of land. It's comparable to the Internet, which is a GAN. GANs have a far wider geographic coverage than LANs and WANs. One of the key difficulties about any wireless GAN is moving user communications through one LAN to another as GANs are used to provide MTCN across several wireless LANs. Broadband (BB) wireless GANs are one of the most well-liked wireless GAN types. A global satellite Internet network (SIN) that uses portable terminals for calling is called the BB Wireless GAN. The CN in the LAN is connected to the BB Internet through terminals.

2.6. Structure of a wireless sensor network:

The basic components of the WSN's structure include a variety of radio communication network topologies, including star, mesh, and hybrid star. These topologies are briefly in the segment.

2.6.1. Star network:

In a communication architecture similar to a star network, only the base station is able to send and receive messages to distant nodes. There are several nodes accessible that are restricted from communicating with one another. The simplicity of the network and its ability to minimize remote nodes' power consumption are its key benefits. Low latency communication across base stations and distant nodes is also made possible by it. The fundamental disadvantage of this network is that

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each node must be within radio range of the base station. Due to the reliance on a single node to manage the network, it is less reliable than other networks.

2.6.2. Mesh network:

This kind of network enables the transmission of information from one network node to another which is within the radio transmission's range. A node can utilize another node as an intermediary to convey a message to a desired node if it needs to communicate with another node through radio but is out of range. Scalability and redundancy are mesh networks' primary benefits. When one node fails, a distant node can communicate with another kind of node nearby and then send the message to the desired destination. In addition, the network length is not automatically constrained by the range of single nodes; rather, the system can only be expanded by adding more nodes. The fundamental disadvantage of such networks is that network nodes that engage in multi-hop-like communication typically consume more power than other nodes that are unable to repeatedly restrict battery life. Additionally, if low power computing of nodes is necessary, the time it takes to convey messages will rise as the number of communications hops to a destination increases.

2.6.3. Hybrid Star-Mesh Network:

A mix of the two networks, like Star and Mesh, offers a reliable and adaptable communication system while minimizing the power requirements of wireless sensor nodes. Low-power sensor nodes are still not permitted to send messages in this sort of network design. This makes it possible to maintain low power consumption. However, some network nodes are permitted to have the multi-hop capability, allowing them to send messages from one network node to another. Nodes having multi-hop capability often have more power and are connected to the mains line more frequently. It is a topology used with the future ZigBee mesh networking standard.

2.7. Application of wireless sensor network:

Military: It's conceivable that the WSN is a crucial component of military targeting, facilities, control, communications, and computer systems, as well as frontline surveillance and investigative systems. Field monitoring: In one sense, sensor nodes are placed near a performance target. One of the Base Stations (BS) receives notification of a sighting event via sensors (such as temperature, pressure, etc.), which BS then responds to accordingly. Application for Transportation: The WSN generates real-time traffic data that are used to notify vehicles to anticipated traffic jams and congestion. Applications for medicine and healthcare: Some of the advantages of WSNs for medicine and healthcare include management, supporting interfaces, drug administration, random drug testing, and diagnostics. Disabled, integrative patient management and monitoring, tracking and monitoring of medical professionals or patients inside a medical institution, including tele-monitoring of human physiological data. Applications for structural projects: WSNs can be used to track the progress of a variety of structural projects, including buildings as well as other infrastructural projects like flyovers, bridges, roadways, embankments, tunnels, etc. This enables construction and engineering procedures to be carried out on the job site as needed. This enables remote property monitoring and lowers the costs that would have been associated with on-site site inspections. Applications in agriculture: According to reports, using WSNs can aid farmers with a variety of tasks, including maintaining wires in challenging areas and automating irrigation systems to use water more efficiently and save waste.

3. CONCLUSION

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The usage of WSN already offers a number of domains of human activity notable advantages. The capabilities of sensor nodes will keep growing, and their production prices will go down, because technology is always improving. The variety of WSN applications is anticipated to expand for this reason. Through the examination of particular cases, both new and well-known, the application of WSNs in the analysis of the military, environment, flora and fauna, health, industrial, and urban sectors. This analysis showed that, in contrast to the conventional means and methods, the usage of WSN offers not only a number of benefits in particular sectors but also innovative applications. Furthermore, issues and solutions created for a variety of applications were noted and debated. It was claimed that wireless sensor networks are made up of tiny nodes with wireless communication, processing, and sensing capabilities. For WSNs, where energy awareness is a key design consideration, several routing, transmission power, and medium access control protocols have been developed. Depending on the required and network architecture, several WSN routing protocols may be used.

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