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A Review on Wireless Sensor Network

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ABSTRACT:Wireless Sensor Network has evolved from just being used in military to the new avenues of everyday usage. It is been there for quite some time now and lot of research has been carried out by academicians over the years for making it efficient. Lot of industries have also implemented it in varied forms for sensing and controlling purpose. Wireless sensor nodes forming a cluster collects data and then feeds to the base station, where it processes data and outputs the information to server. The applications of wireless sensor networks are limitless, some of those are in health industry, security, environment, industrial establishments and nuclear facilities. This paper exhibits a review on wireless sensor network.

KEYWORDS: Wireless Sensor Network,Sensor nodes, Sink node, Software application.

I.INTRODUCTION

A WSN comprises of tiny computer like sensor nodes interacting among each other wirelessly, these sensor nodes sense the parameters and feeds data wirelessly to the base station which processes these data and stores it to server. The data are displayed on application software. Sensor nodes comprises of sensor subsystem, processor subsystem and communication subsystem. Previously the sensors were not accurate as it measured analogue value, now most of the sensors are digital. Modern processors/micro-controllers processing speed is high; hence lot of data are processed fast. The communication in WSN includes radio frequency, Wi-Fi, ZigBee, near field communication (NFC) and ultra-wide band (UWB) [1].

Deployment of WSN is in structured and unstructured manner. In structured deployment it follows a set of specific order to place sensor nodes, while unstructured or ad-hoc deployment does not follow any order to place sensor nodes, they are simply placed on a particular region. The unstructured deployment covers wider area than structured deployment. Terrestrial WSN, underground WSN, underwater WSN, multimedia WSN and mobile WSN are the different types of WSNs. Terrestrial WSNs are deployed over land in a structured or unstructured order, underground WSNs are placed underground like in caves and mines, deep underwater exploration vehicles use underwater WSNs which is expensive, multimedia WSNs involves monitoring of parameters in the form of video, audio and image and in mobile WSNs the sensor nodes are not stationary, they keep on moving and forming a WSN to monitor and control environment [2].

WSNs application is grouped as monitoring application and tracking application. Health monitoring is one application of WSN. With the advancement in electronics and sensors, it has become really cheap to develop WSNs for monitoring health which ultimately leads to the wellbeing of human life. In WSN health monitoring setup temperature sensors, ECG, optoelectronic sensors, GSR and other sensors form nodes to input the physical values from patients. Sensor nodes have microcontroller, radio module and memory coupled. They communicate wirelessly by single-hop or multi-hop communication using wireless communication standards such as IEEE 802.15.4, IEEE 802.15.1, RF, Wi-Fi and optical(laser) communication. The base station which processes the data has micro-controllers and stores it to server or feeds to cloud. As per the software application the parameters measured are displayed. Therefore, such technology like health monitoring, has made it convenient for care givers and patients to monitor their vital signs and maintain proper health records with timely treatments [3], [4], [5] and [6].

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The indoor as well as outdoor environment conditions have deteriorated so much due to pollution and effluents from cars, paints, industries and other human activity. Sensors that measures these parameters from environment and then communicate wirelessly forms WSN which includes base station, server and application software. Sensors measure temperature, pressure, gas, light, humidity and other parameters according to requirement. In [7] all physical parameters which are being sensed are stored at real time, the specific sensor location is also recorded at server and live display curve is being shown for better understanding of the information processed. The WSN for Water environment monitoring [8] uses unattended WSN to cover vast area, measuring the pH value, temperature and dissolved oxygen and it relays this information to monitoring hub using GPRS.

Many WSNs is being deployed to monitor and track miscreants. This sort of monitoring and tracking would make any neighborhood safe and secure. The present scenario in security monitoring is mostly done by using cameras which are placed at one location at a certain angle which isn't flexible for implementing security monitoring function. In [9] a ZigBee security monitoring system is discussed where a remote PC or PDA connected with internet accesses home server, data is stored from a camera mounted on top of jumping robot which captures image of 3 KB. The working of this system is, as intruder is detected it relays to jumping robot, which captures image and stores in server and the image is accessible to house owner through a remote PC connected with internet.

The WSNs in industry plays vital role to monitor the health and safety of workers and to enhance their productivity, which ultimately leads to an enhanced production. WSNs are used to monitor the condition of various parts of machines in industries, leaks in oil and natural gas pipelines and reservoir status. The WSNs in oil and gas pipelines has wider scope as these products travel a long distance from the well to end users. There are thousand kilometers of pipelines laid on ground, underground and sea so, it becomes a full-time job for oil companies to monitor, in order to maintain safety and quality, reduce downtimes for maintenance and allow for energy management by keeping constant view on system. The WSN system in oil refinery consists of local oil field monitoring system, main data acquisition server and the plant's local area network, local monitoring system comprises of data acquisition module, GPRS communication module, Remote Terminal Unit, on-field data acquisition computer and local main server [10].

Currently WSN is used for single domain-specific and task-oriented application. On introducing new applications current WSN is incapable in handling these requirements thus, technologies like WSN virtualization [11] needs to be implemented for IoT applications. The sensor node lacks energy, which is mainly attributed to the radio module attached, as energy gets dissipated in radio module due to modulation and coding, antenna direction and power transmission [12].

II.SYSTEM MODEL

The WSN shown in fig. 1, bundles sensor nodes, sink node, cloud/server and graphical user interface (GUI). Sensor nodes are wirelessly connected to sink node which has either a wired or wireless connection to the server. User software application display data, fetched from server or cloud.

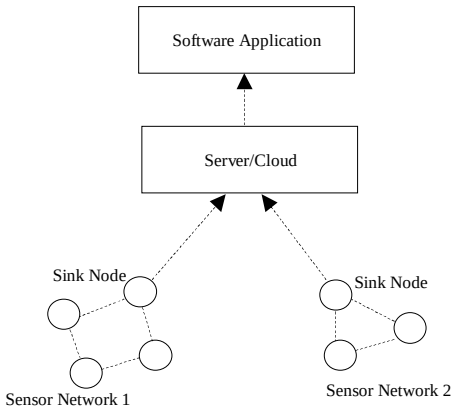

Fig. 1 A Wireless Sensor Network

In WSNs different communication modules are used in sensor fields, like Wi-Fi, RF, ZigBee, Bluetooth and UWB which has varying data rates and latencies. The sensor nodes are deployed in cluster-tree or star topology in sensor

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field. On analyzing these topologies on beacon-enabled mode of IEEE 802.15.4, while taking on various parameters such as throughput, energy consumption, delay and probability success packet, it shows cluster-tree topology is better than star topology [13]. As of some sensor fields remote location sensor nodes risks security threats, which in turn affects the working of sensor network. Sensor nodes that are close to the sink node is always at risk of intrusion by malicious nodes. Use of MERS algorithm in the sink node helps to send a feedback to source node for secure routing [14].

Operating system (OS) of WSN is essential in saving energy of its system hence, the operating system should consider the energy constraints faced by the system [15]. The Operating systems installed in WSNs are TinyOS, LiteOS, Contiki, SOS, and Mantis. The LiteOS has a small code footprint comparing with other WSNs OS [16]. The TinyOS is a component-based event driven programming model. The nesC programming language is used to write component. The Contiki has modular architecture and this module are written in threads [17] and Mantis is light-weight multi-thread operating system that offers multitasking on energy starved sensor node which is easy to use for programmers [18]. In SOS wireless reprogramming is possible thus, it establishes balance between flexibility and resource efficiency.

On defining the lifetime of a WSN, we need to consider factors such as, energy scarcity and energy consumption of the system. Some of the solution to energy problems in WSN is energy harvesting (EH) techniques, optimization techniques and wireless energy transfer techniques. The EH technique harvest energy from different sources like radiation (RF waves, solar), mechanical (vibrations, wind, water flow, blood flow) and thermal (external heat, body heat) [19]. To prolong the network lifetime of WSN an energy-efficient on-demand multicast routing protocol (EMP) is better than classical multicast routing protocol, it is because on comparing EMP with classical multicast routing protocol, EMP acknowledges the energy criticality avoidance and destination-driven property and is easy and simple to implement and therefore, it prolongs the network lifetime of WSN [20].

III.CONCLUSION

WSN today is being researched by scholars with many different and efficient uses mushrooming and the WSN technology is improving a lot. This makes WSN technology the most sought-after technology in this century. For different applications there are different sensors to choose. It presents us with wide scope of installing and utilizing this technology. WSN is being used everywhere from hospitals to mine fields to classrooms. With a very rapid development of microcontroller, it has made swift data processing and quick information relay possible. In certain applications sensor nodes left unattended faces a risk of security, which makes the WSNs vulnerable to malicious attacks and security breaches. WSNs also requires an energy efficient power source and routing protocols to increase the lifetime of the system.

In future our work is designing a wireless sensor network that includes different sensor modules which measures physical parameters and display it on a remote device.

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