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[Sudha * *et al.*, 6(9): September, 2017]
IC™ Value: 3.00

ISSN: 2277-9655
Impact Factor: 4.116
CODEN: IJESS7

IJESRT

INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY

# A SURVEY ON WIRELESS SENSOR NETWORKS

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**DOI**: 10.5281/zenodo.884865

## ABSTRACT

A Wireless Sensor Network (WSN) can communicate the information through wireless devices. WSN consists of base stations and wireless sensor nodes. These networks are used to monitor various condition are sound, pressure, temperature and cooperatively pass data through the network to the main location. The functionality parameters of a sensor are energy consumption, computational speed rate, bandwidth, memory. In this paper, it embraces application of WSN, types of WSN, security issues and security mechanism.

**KEYWORDS:** Wireless Sensor Network (WSN), Node, Sensors, Applications, Security, Keys.

## I. INTRODUCTION

A wireless sensor network is the large number of sensor nodes where each node to detect physical phenomena such as light, heat, pressure, etc. Nodes are the tiny sensor network which works jointly to form the networks. It has controlled the capabilities of computing & processing. The WSN used to accomplish the network and make the sensors work together of the network. In fig(1.1) main components of WSN are nodes, gateways, and software. The distributed measurement nodes interface with sensors to monitor their environment. The gateway is used to communicate between the wireless and wired medium that can be collect, process, analyze, and present the measurement. Routers are a measurement of the node can use to extend distance and reliability.WSNs is collect information method to build the data and communication with the system which will improve the reliability and efficiency of the sensor systems. WSNs feature easier development and flexibility of the system and rapid technological development of sensors

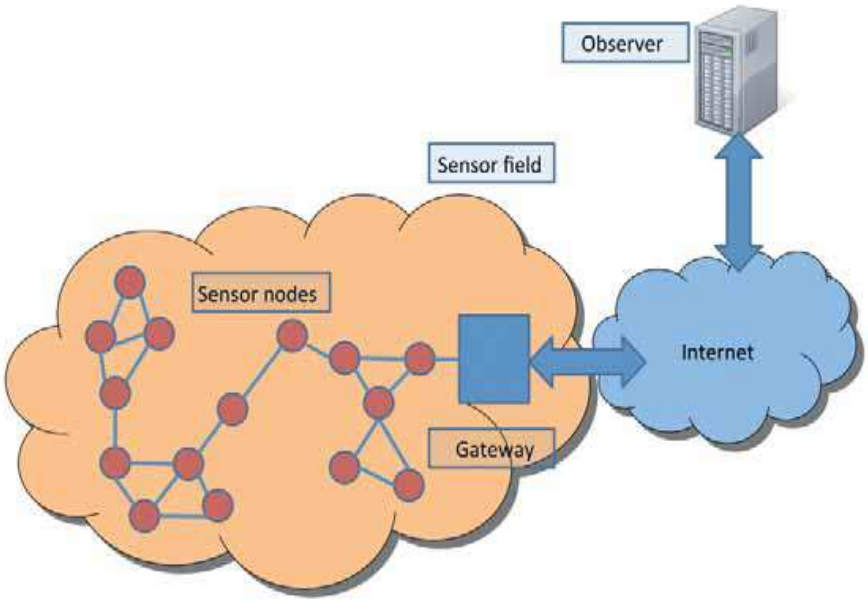


***FIG.1.1 Components of Wireless Sensor Network***

ISSN: 2277-9655
Impact Factor: 4.116
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## II. APPLICATIONS OF WSN

The WSN is used in many fields such as health applications, environmental applications, area monitoring, environmental/earth sensing, industrial monitoring as shown in fig(2.1).

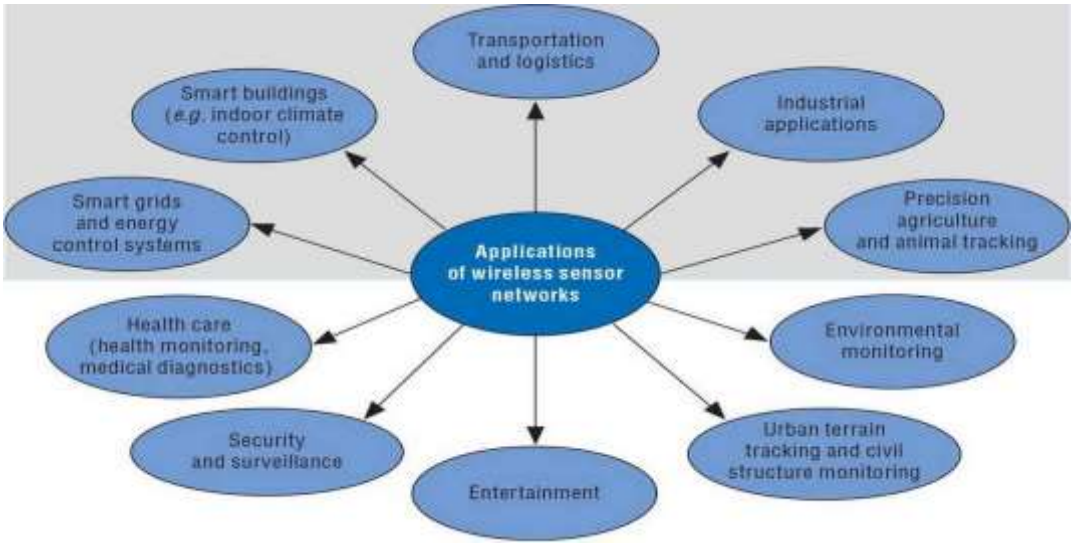


***FIG.2.1 Application of WSN***

**Health Care Monitoring:**

In the system, sensor networks for medical applications can be of several types they are implanted, wearable, and environment-embedded. The implantable medical devices used on inside the human body. Wearable devices are used on the body surface of a human. The applications include body position measurement a location of persons, overall monitoring of ill patients in hospitals and at homes [1][2].

**Environmental/Earth Sensing:**

The environmental sensor is mainly used for detecting the Forest fire detection, Air pollution monitoring, landslide detection, water quality monitoring, and natural disaster prevention. Forest fire detection is used to detect fire in the forest through the sensor nodes. Air pollution monitoring is to monitor the concentration of dangerous gases for citizens in several cities. Landslide detection detects the slight movements of soil and changes in various parameters that may occur before or during a landslide. Water quality monitoring is used to analyzing water properties in dams, rivers, lakes, oceans as well as underground water reserves. Natural disaster prevention is an act to prevent the consequences of floods [1][5].

**Industrial Monitoring**

The industrial monitoring is used to sensing the machine health monitoring, waste water monitoring, data center monitoring, structural health monitoring. The machine health monitoring sensor networks have been developed for machinery condition-based maintenance as cost savings and enable new proposal. The waste water monitoring the quality and level of water includes many activities such as checking the quality of underground 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. The Data center monitoring due to the high density of servers racks in a data center, often cabling and IP addresses are an issue. The structural health monitoring can be used to observe the condition of civil infrastructure and connected to geophysical processes close to real time and over long periods through data logging, using appropriately interfaced sensors[6][7].

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**Area Monitoring**
Area monitoring is a common application of WSNs. In area monitoring, the WSN over a region where some phenomenon is to be monitored. The area monitor sensors detect enemy intrusion and geofencing of gas or oil pipelines [2][5].

## III. CATEGORIES OF WSN

The various types of wireless sensor network such as terrestrial WSNs, underground WSNs, underwater WSNs, multimedia WSNs, mobile WSNs as shown in fig(3.1).

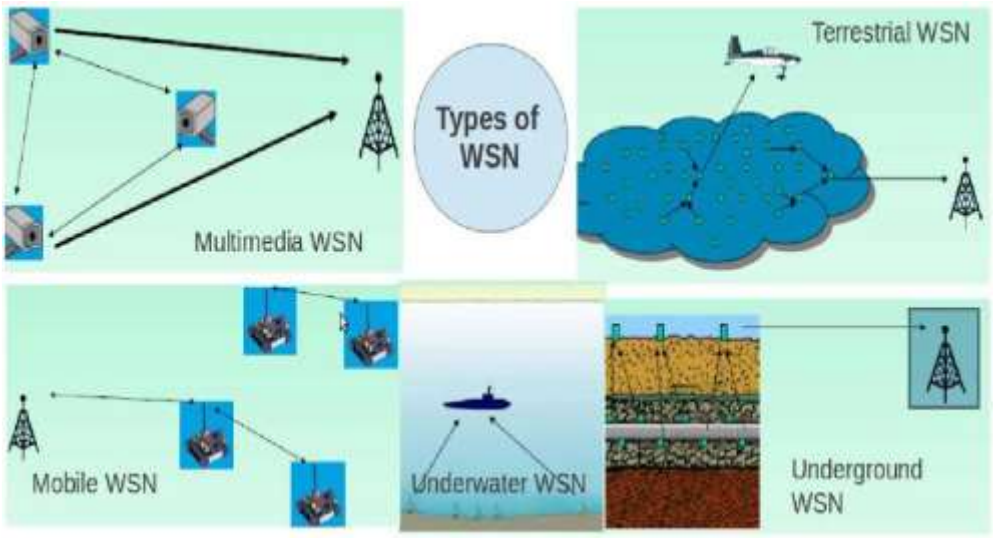


***Fig.3.1 Types Of WSN***

**Terrestrial WSNs**
Terrestrial WSNs communicate the base stations and wireless sensor nodes arrange either in unstructured or structured manner. In an unstructured mode, the sensor nodes are randomly distributed within the target area that is dropped from a fixed plane. The structured mode used as optimal placement, grid placement, and 2D, 3D placement models [2][6].

**Underground WSNs**
The underground wireless sensor networks are more expensive than the terrestrial WSNs in terms of deployment, maintenance, and equipment cost considerations and careful planning .It consists of a number of sensor nodes that are concealed in the ground to supervise the underground conditions. The information from the sensor nodes to the base station, additional sink nodes are located above the ground [1][5][7].

**Under Water WSNs**
These networks consist of a number of sensor nodes and vehicles deployed under water. Autonomous underwater vehicles are used for gathering data from these sensor nodes. A challenge of underwater communication is a long propagation delay, and bandwidth and sensor failures [7].

**Multimedia WSNs**
Multimedia wireless sensor networks have been proposed to enable tracking and monitoring of events in the form of multimedia, such as imaging, video, and audio. In addition to this, multi-media contents require high bandwidth for the contents to be delivered properly and easily [5].

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**Mobile WSN**

The mobile wireless sensor networks are much more versatile than the static sensor networks. The advantages of MWSN over the static wireless sensor networks include better and improved coverage, better energy efficiency, superior channel capacity[6][7].

## IV. SECURITY COMPONENTS IN WSN

The security is major challenges in WSN require security protection of integrity, availability, confidentiality, non-repudiation, and user privacy.

**Data Confidentiality**

Data confidentiality in WSN impedes access of unauthorized people to obtain data which is one of the crucial requirements in sensitive WSN applications. A sensor node should not rely on the data derived from the environment to its neighbors. The data collected on the nodes can be very sensitive, particularly in military applications. Furthermore, in numerous applications, nodes have to transmit highly sensitive data to other sensor nodes by means of wireless transmission environment [3][4]

**Data Integrity**

Data integrity ensures that the message will not be altered during communication. A malignant node can cause the network to work improperly by disrupting the message[4].

**Data Authentication**

Authentication mechanisms aid a node in verifying the identity of a node that it is in contact with. If there is no authentication, a malicious node can behave as if it was a different node and might acquire some sensitive data and also hamper proper operation of other nodes. In case only two nodes are in contact, authentication can be achieved by symmetric key cryptography. Transmitter and receiver can compute the verification code of all the messages sent by a common hidden key [4][8].

**Data Freshness**

In WSN structures, sensors send measurement data related to the environment are present through specific time intervals and then a matter is the delivery of the measurement times. It is possible that an attacker can retransmit the copy of old measurement values. It is therefore important to check that the data is new. The message packet can be used during encryption to maintain data freshness [3][4][8].

**Availability**

Availability focuses on technical terms, hacking, attacks and making the system capable of all the sources of that system [3][8].

## V. SECURITY ATTACKS IN WSN

Comparable to any wireless network, WSNs are suffering from many different attacks. In this section, we introduce the major attacks to WSNs.

- Jamming
- Tampering.
- Collision
- Exhaustion
- Unfairness.
- Sinkhole Attack
- Sybil Attacks.
- Wormholes Attacks
- Flooding.
- Desynchronization

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## VI. SECURITY MECHANISM

WSNs require categorized as follows:

- Key Management
- Secure Routing
- Data Aggregation
- Crypto Algorithms

**Key Management**

Key management is focused on the area in WSN security. Key management includes key generation, distribution, verification, update, and storage, backup, valid and destroy. An effective key management mechanism is also the foundation of other security mechanisms, such as secure routing, secure positioning, and data aggregation [8].

**Secure Routing**

WSNs use data transfer in multi-hop to that each node also needs routing discovery, routing establishment, routing maintenance. Many secure routing networks have been specifically designed for WSNs can be divided into three categories according to the network structure: flat-based routing, hierarchical-based routing, and location-based routing [3][8].

**Data Aggregation**

Data aggregation is to ensure each node data is secure. Therefore, the general processes of secure data aggregation are as follows: first nodes should be possible to provide the reliable data and securely transmit them to the higher aggregation nodes. The higher aggregation nodes judge the credibility of data and do aggregation calculation based on redundancy [3]

**Crypto Algorithms**

Crypto is an algorithm used by modern computers to encrypt and decrypt messages. The crypto algorithm has two keys symmetric and asymmetric. Symmetric means the key will be same and it has given to everyone. It is also called as public key cryptography. The asymmetric must be kept private and it has used as a secret key. Encryption is a special algorithm to change the original information of the data sensor node, which makes an unauthorized user not recognize the original information even accessed the encrypted information [3][4][8].

## VII. CONCLUSION

WSN is used in various fields and many security attacks occur in a different manner also discussed. In WSN, the major issue is security to overcome the issues different security mechanisms also discussed in this paper. With the help of these mechanisms protect the secured data from hackers.

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## CITE AN ARTICLE

Sudha, R., & Shamile, B. (2017). A SURVEY ON WIRELESS SENSOR NETWORKS. *INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY*, *6*(9), 66-71. Retrieved September 5, 2017.