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# A Systematic review of wireless sensor networks with current research and challenges

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**Abstract :**Due to specific restrictions, wireless sensor networks (WSNs) enable necessitate unique protocol configuration paradigms and new applications. An acceptable balance between the connection and wave intensity is needed.So, that the power density and lower power consuption data could be achieved. Over the last decade, this has encouraged increased effort in exploration, the process establish, and industrial investment in the sector. The goal of this survey study is to provide a comprehensive review of WSN technology, essential applications and standards, design aspects, and evolution. A model study based on real use is given, and several uncommon applications, such as those based on environmental awareness, are examined and highlighted in design strategies. Trends and possible adjustments are discussed. IEEE 802.15.4 technology is highlighted because it enables the usage of numerous WSNs.

## I. Introduction

Wireless sensor networks (WSNs) are presently attracting increasing interest from researchers and other business and government partners. In general, a WSN is a small nodes of network capable of hearing, monitoring, recording, processing, tracking and controlling data and wave signals around an application, as well as it supports interactions between humans, program, & nearby objects. As a result, it have poor resource nodes and rely largely on battery management, storage capacity, duplication, data/signal size, and available bandwidth. The nodes are typically structured by a single node in a particular way in a remote area for personal data tracking and recording.

Wireless has become the most widely utilized broad term to represent communication wherein power waves are utilised to transfer signals to multiple or all communications. Any component of a computing system that uses data networks which are wireless to be connected through nodes is known as a wireless network (WN). Regardless of phase, computer systems are rarely connected to wires. Businesses can save money by adopting a wireless system instead of installing cables or connecting multiple equipment settings. Radio / microwave systems are the foundation of any wireless system, and their employment is dictated by the high degree of physical network architecture of both radio / microwave systems, radio communication systems (RCSs), and other appropriate Selectromagnetic waves (EMWs). These radio/microwave waves, RCS, and others suitable Emws are useful.

Although WSNs are stated to have everything that let new applications and so contribute significantly to potential new market areas, future WSN building may be impeded by a variety of restrictions that require changed models. According to researchers, the task acquiring, processing and transmitting under a limited amount of power(energy) necessitates as layer-by-layer design strategy that entails taking into account sources inform processing, centralised access control, and communication activities. Depending on the amount of bandwidth they transmit and the distance between network nodes, wireless devices come in a variety of sizes. Other notable differences are the potential magnetic fields (EMFs) they generate and the amount of energy they consume; this is

particularly important.

## II. Types of wireless sensor networks:-

The territory determines the types of networks, which can be built up undersea, underneath, on land, and etc. WSNs are vary in shape and size. Wireless sensor networks include lowland WSNs, subsurface WSNs, undersea WSNs, multimedia WSNs, and cellular WSNs.

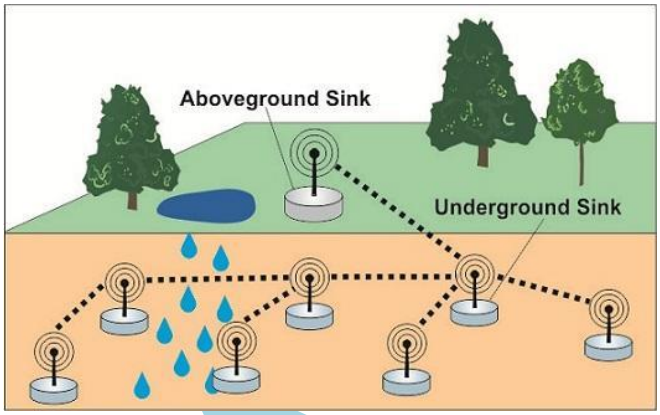
### lowland WSNs include:-

lowland WSNs typically made up of consisting of a large quantity of wireless sensors is distributed in both unformed and formed ways and are capable of communicating with base stations. The iot devices are dispersed at random throughout the target region, which is unformedly projected from a fixed plane. The developed approach considers the optimal placement., grid placement, and the placement of 2d and 3d models.

Although the WSN's battery power is restricted, it does include solar cells as an energy buffer. Low duty cycle actions, fast data, and optimal routing, among many other things, are used to keep these WSNs powerful.

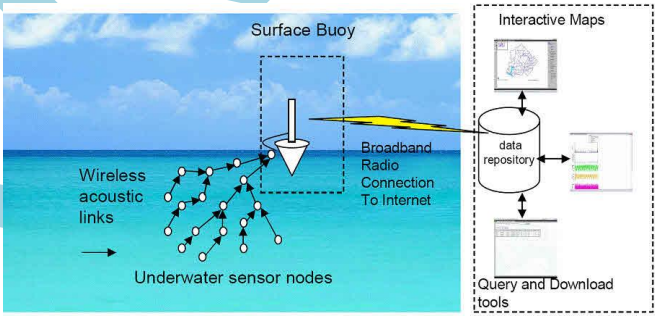
### Subsurface WSNs include:-

In term of sensing, preservation, and equipment cost considerations, as well as appropriate planning, subsurface wireless sensor networks are expensive than lowland WSNs. The WSNs networks consist of many sensor nodes concealed in the ground that monitor the underlying environment.




The wireless sensor networks buried beneath are difficult to recharge. Furthermore, due to significant levels of loss and signal loss, wireless communication in the subsueface environment is difficult.

### Underwater WSNs include:-




Water covers 75% of the planet's surface. Underwater wireless sensor nodes and motors make up these networks.Data from such sensor nodes is collected using self-driving underwater vehicles. A long propagation latency, as well as bandwidth and sensor loss, are issues with underwater communication.

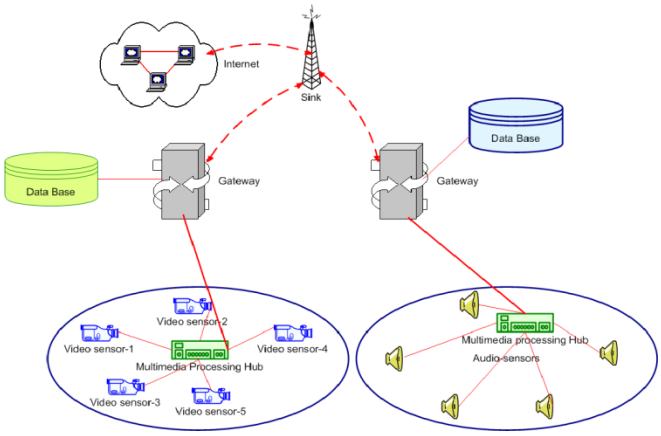
WSNs are designed with a waterproof cell which cannot be replaced under water. The issue of WSN subsea energy saving makes progress in subsea networking methods difficult.

### Multimedia WSNs include:-

Multimedia wireless mesh network is proposed for tracking and archiving multimedia events such as well as music,video,photography . These networks

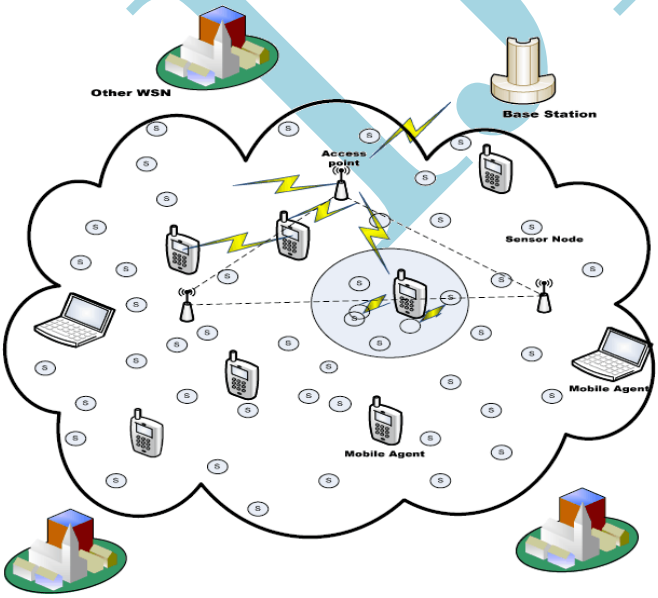
consist of cheap sensor nodes with cameras, microphones. When it comes to data compression, recovery and correlation, these nodes are wirelessly connected.




The challenges of multimedia WSNs include high energy usage, fast broadband demands, data analytics and compression techniques. Furthermore, multimedia content requires a large amount of bandwidth to be transmitted correctly and freely.

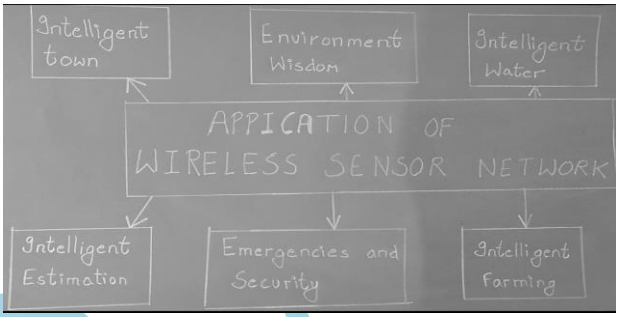
**Mobile WSNs include:-**

These networks are made up of a number of sensor network that can operate independently and connect to the physical environment. The participating devices can compute and send information.




Static sensor networks are less adaptive than mobile sensor networks. Mobile wsn has several advantages over static wsn, including increased power and coverage, efficient power planning, and a wider channel range.

**III. Wireless network sensor applications:**




**1. Intelligent towns:**

(i) Urban noise maps: Echt-time sound surveillance in bar areas and centers.

(ii) Mobile Detection: Detects devices that operate with the Wi Fi and Bluetooth interfaces on the i-Fi and Android devices and generally any devices.

(iii) Electromagnetic field levels: cell and Wi-Fi routers energy calculation.

(iv) Transport congestion: car and pedestrian traffic control for improving routes for driving and walking.

(v) Intelligent lighting: adaptive street lighting for smart and weather.

(vi) Waste management: identification of container waste levels to improve the routes of trash collection.

(vii) Intelligent highways with warning and diversion messages and incidents such as collisions or traffic congestion, depending on the environment.

**2. Environmental wisdom**

(i)Forest Fire Detection: Combustion gas control and preventive fire conditions for warning areas.

(ii) Air Pollution: CO2 emission control of factories, vehicle pollution, plant greenhouse gases.

(ii) Snow-level monitoring: measuring snow level to allow ski tracks to know the quality in real time and to prevent avalanche in security corps.

(iii) Landslide and avoidance of Avalanche: tracking soil moisture, vibrations and soil density in land conditions to detect hazardous trends.

(iv) Early early warning earthquake: distributed control in some tremor locations.

**3. Intelligent Water**

(i) Tracking drinking water: monitoring tap water quality in cities.

(ii) Identification of chemical leakage in rivers: detection of leaks and waste from river plants.

(iii) Automatic pool measurement: swimming pool conditions remotely monitor.

(iv) Sea level pollution: monitoring of leaks and waste at sea in real time.

(v) Water leakages: external presence and pressure changes in tanks observed. Water leakage.

(vi) Fluvial: control of changes in water levels in rivers, dams and depots.

**4. Intelligent estimation**

(i) Intelligent grid: Control and management of energy consumption.

(ii) solar power plants: control and performance enhancement. Photovoltaic plants.

(iii) Water flow: water pressure calculation in water transport systems.

(iv) Silos Stock Calculation: amount and weight measurement of products.

**5. Emergencies and security**

(i) Access monitoring perimeter: control of access and the identification of people in restricted areas in unauthorized areas.

(ii) Liquid Presence: fluid detection of cracks and corrosion at data centers, warehouses and sensitive building grounds.

(iii) Radiation level: distributed radiation level calculation in the atmosphere for the purpose of generating leakage warnings in nuclear power stations.

(iv) Toxic gases: gas detection and leakage detection in industrial, chemical and within mining environments.

**6.The logistics industry**

(i)Shipping consistency conditions: vibration control, strokes, container openings or maintenance of the cold chain for insurance purposes. I

(ii) Object location: search of objects on large surfaces, such as storage facilities or port premises.

(iii) Storage Incompatibility Detection: Pollution alert on containers that hold flammable products that are closed to other explosives.

(iv) Fleet Tracking: track possession of sensitive goods such as pharmaceutical items, gems or hazardous commodities.

**7. Management of industry**

(i)M2M applications: Auto diagnostic machine and management of properties.

(ii) Indoor Air Quality: Control for chemical plants with toxic gas and oxygen to ensure safety of staff and products.

(iii) Controlling temperature: Temperature regulation inside critical merchandise industrial and medical fridges.

(iv) Temperature monitoring: inside industrial and medical refrigerators regulate temperatures for sensitive products.

(v) Indoor Position: Triggered Indoor and passive tags asset location.

(vi) Auto-diagnostic vehicle: CanBus Information Collection to send real-time emergency alarms or to provide drivers with advice.

(iv) Protection of art and goods: monitoring of the conditions of museums and warehouses of art.

## IV. Issues in WSNs :

### Network bandwigth

(i) It work only in particular range or area.

(ii) And in long range the connection will be failed

(iii) As compare to wire devices the wire device is delay in data transfer.

### Production cost:

(i) The wsn are so much costly as compare from wire networks

(ii) In this we have to make another source of energy

(iii) In the manufacturing of wireless sensor network many type of circuit and transistor are used in of the increasing in frequence.

### Hardware Requirements:

(i ) In the wsns we need tracking component.

(ii) And we need also power component to give the power to wsns.

(iii) frequency detector requre in the wsn.

### Power Consumption:

(i) Wireless sensor networks take too much energy.

(ii) It is too much costlier to have it.

(iii) As a result when building both Software and Hardware the issue of efficient energy consumption must be careful considered.

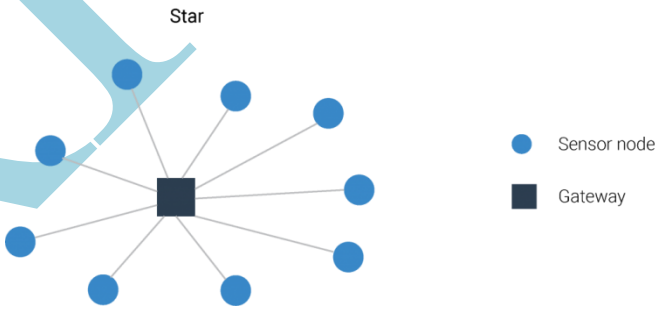
## V. A Wireless Sensor Network's Architecture

Cellulare device networks monitor physical and environmental factors like temperature, noise, moisture, vibrations, tension, and even pollutants.

### A Single-Purpose To-Multipoint Wireless Sensor Star Network's Structure:

#### Topology of communications:

In Star Network, one main station sends & receives messages to a multiplicity of remote nodes. However, it appears that faraway nodes in this network is not permitted to give each other sms. Low-latency communication between the remote server & as a result, the main station is possible due to the network.




### Advantages & disadvantages:

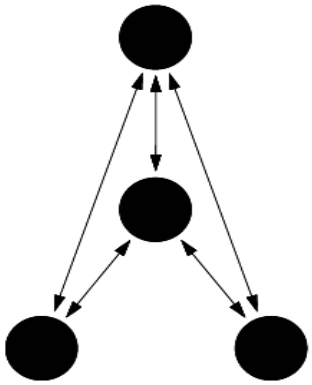
It could be a simple networking with the ability to decrease the power consumption of the remote node. Disadvantage of this system would be that the bottom nodes must constantly It is less robust than other networks since it must be within the transmission range of the all different nodes.

### Mesh Network :

#### Architecture:

Individual nodes can communicate with one another using the Mesh setup if they're in the same range of transmission. The following example will help to illustrate this: If a node wants to send a message to the other node its beyond of

transmission range, the message can be delivered to the requested node by the associate's intermediate node.

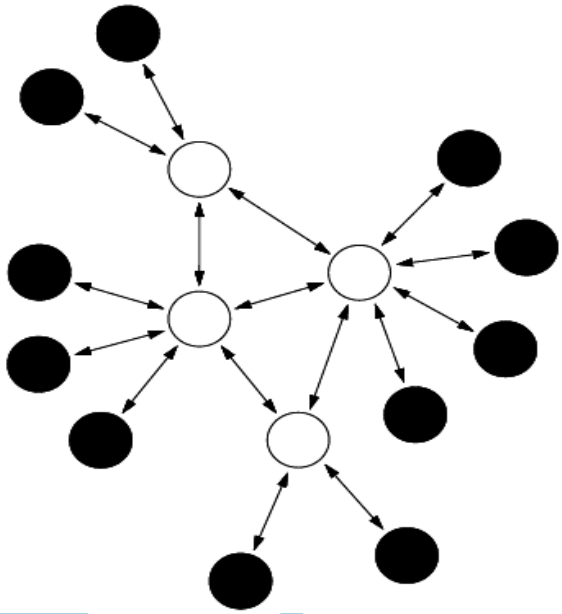


**Advantages & disadvantages:**

The system has the advantages of being dependable as well as scalable. Furthermore, in the unlikely event that a node fails, the transmission can be re- routed through onsumption of the remote node. Disadvantage of this system would be that the bottom nodes must constantly It is less robust than other networks since it must be within the transmission range of the all different nodes.another node. However, this will have an impact on ability consumption. Multi hop communication requires more power, which reduces the battery life of single device nodes.

**Hybrid Star & mesh network:-**

**Architecture:**



This topology combines the Star and Mesh topologies to create an extremely useful network communications . There are 2 types of different nodes in this network: low-power and high-power. High-power nodes also employed for multi-hop feature, which forwards messages from lower-power nodes. The higher-power nodes are generally strategically placed so that they may connect to the main power line immediately.

**Advantages & disadvantages:**

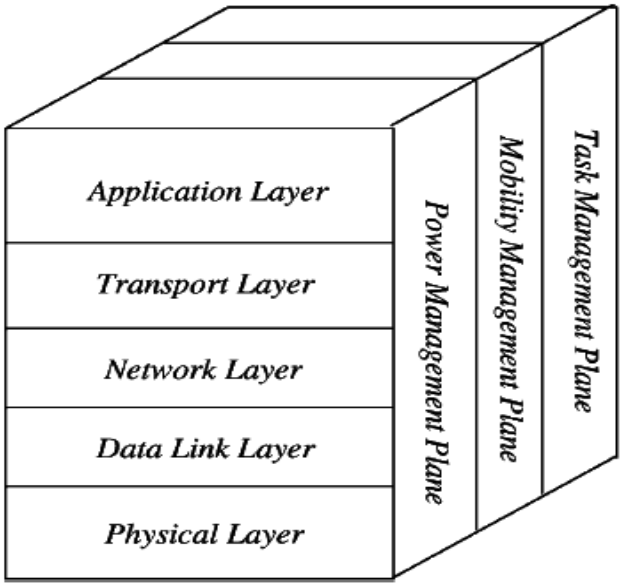
With the implementation of this network, it is possible to keep the ability consumption low.

**VI.A wireless sensor network's transmission structure is as follows:-**

Sensors node is generally strewn about a sensor topic. All these distributed sensor networks can collect data and send it directly to the sink and outlet users. The info is transmitted to the terminated person via several-hops infrastructure mechanism. Through the net or satellite, the sink can link with the project leader node. Sensor community's wireless protocol stack All sensor networks and the sinks use this protocol. This protocol stack integrates energy and route detection, merges protocols & information, efficiently transmits power over a wireless channel, and encourages sensor node cooperation. The

utility layer, transportation supply control plans, mobility control plans, network layer, data layer, body layer , mission control plane are all a party from the protocol stack.Depending on the sensing responsibilities, many On the application layer, various types of software applications could constructed & use.A give-up-person can see the bottom layer's equipment & software programme for this residue. When a sensor node utility needs it, the transporting layer enables data float to be maintained. The data collected by shipping layer, and also specialised The community layer communicates multi-hop wireless routing algorithm via sensor nodes and sinks. The statistical hyperlink Massive data multiplexing, visual recognition, access to media, and error handling are all handled by this layer.. Because When background is noisy & sensor node is cellular, a MAC protocol should be power conscious & capable of limiting broadcast collisions. The physical layer handles modulating, band allocation, records encrypting, and transmit and receiving procedures in a basic yet effective manner.




## VII. Conclusion and future projects

The main goal of this finding is to present a few basic/intermediate fundamental elements of WSNs from the technology, design and application viewpoint. In addition to the application requirements, we must consider a variety of criteria when developing a Wireless sensor networks, including fault tolerance, high sensing fidelity, cost must be low and it must be mini in size. Because their vast range of uses, we anticipate that sensor networks will become an increasingly important part of our day to day life in the upcoming time. Sensor Networks, on the other hand, must adhere to several obstacles, including Culpability Tolerance, scalibility, cost of production , hardware , topology adjustment , power consumption, and environment consideration. Because these constraints are so rigid and unique to sensor network, hoc network and new wireless protocols are essential.

Future wireless sensor network research will focus on increasing area processing capacity in grouped Wireless Sensor Networks for temporal and spatial irregular workflow assessment, making up for radio network, mac & also net protocol layers & web analytics methods, model and hardware verification of lifetime-aware route discovery, detecting geographic visibility, and improving preferred sensing geographical. Future sensor node advancements must result in extremely powerful and cost-effective devices for applications such undersea acoustic sensor systems, able to sense cyber-physical systems, moment application, intelligent detecting and spectral response management, and privacy and security management.

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