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CLASSIFICATION OF MOBILE WIRELESS SENSOR NETWORK (WSN) ON STRUCTURE AS WELL AS THE COMMUNICATIONCHANNELS

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ABSTRACT

Wireless networks are typically used to supplement wired networks, and they are often the final few steps in the link among a mobile device as well as a wired network. An ad-hoc network is a network made up of individual devices that connect with one another directly without the need for a central access point, a router, or a base station to be present. As sensor systems develop in size, bandwidth allotment turns out to be progressively basic. A sensor organizes necessities to distribute its bandwidth to amplify add up to data pick up. A mobile WSN outperforms a static WSN in a wide range of application situations. Wirelessnetworks provide greater design and application flexibility than wired networks. Because of advancements in Micro-Electro-Mechanical Systems (MEMS) technology, low-power wireless sensor nodes have begun to emerge. We can say that a Wireless Sensor Network (WSN) is a remote network made up of geographically procured self-ruling devices that use sensors to amiably monitor physiological or environmental conditions such as temperature and sound levels as well as vibration, mass, motion, and contaminations at various locations.

Keywords:channel, communication, mobile,structure, wireless network, wireless sensor network.

INTRODUCTION

The term "wireless network" refers to the connecting of computers, peripherals, servers, and other hardware devices that does not need the use of cables. It communicates by the use of a wireless media, specifically radio frequency. When information is transmitted or received over the air, there is no hardware device between the sender and the receiver. Wireless networks are typically used to supplement wired networks, and they are often the final few steps in the link among a mobile device as well as a wired network. An ad-hoc network is a network made up of individual devices that connect with one another directly without the need for a central access point, a router, or a base station to be present [8]. These networks are able to operate without the assistance of a permanent infrastructure [5]. When a base station or a router is not available, the routing process becomes more complicated. A wireless ad hoc network, also known as WANET or a mobile ad hoc network, sometimes known as MANET, is an ad hoc wireless network in which

routing is performed decentralised. The network is referred to as ad hoc since no infrastructure, such as routers in wired networks or base stations in infrastructure-based wireless networks, exists prior to the establishment of the network.Taking advantage of recent advances in embedded systems and communication devices, the design and development of small-sized multifunctional devices that are both technologically and economically feasible have become both technologically and commercially feasible, with a wide range of potential applications. Wireless networks provide greater design and application flexibility than wired networks. Because of advancements in Micro-Electro-Mechanical Systems (MEMS)technology, low-power wireless sensor nodes have begun to emerge.

Currently, the Wireless Sensor Network (WSN) is the most widely used, most flexible, and most scalable paradigm. It is comprised of a large number of sensing nodes that can assemble information from their surroundings and coordinate with one another in order to relay the information to a central base-station [2]. By establishing a collaborative network, these sensor nodes are able to perceive, process, and send data to the base-station as needed.

- **Wireless Sensor Network**

Generally speaking, a Wireless Sensor Network (WSN) is a remote network made up of geographically procured self-ruling devices that use sensors to amiably monitor physiological or environmental conditions such as temperature and sound levels as well as vibration, mass, motion, and contaminations at various locations. A WSN is a collection of a great amount of battery-powered, ease-detecting gadgets, commonly referred to assensors, as seen in figure 1, that collaborate to execute a distributed sensing task in a domain. For each type of sensor, these sensors have a corresponding detection type of gear, a central preparation unit, an electrical power supply unit, and a radio transceiver.

A sensor node is a device that detects an occurrence or monitors the status of the entire planet (Ex, temperature, pressure, moistness). The information about the remote situational state is obtained and communicated to a remote Base Station (BS), which allows for the rapid analysis of the data from the remote contextual situation in real time [1]. Despite the reality that solitary sensors can only do a tiny portion of their assigned tasks, a large number of sensors may be grouped together to perform a significant detecting task when organised into a network. Sensors are normally battery-operated, and once delivered, they remain in the branch of knowledge unsupervised for an extended period of time.

Because the sensors are located in remote areas, if the battery power falls below a certain level, the battery can only be partially revived or replaced. As a result, sensors are created as a result of the energy source. When it comes to juncture of confinement energy, they don't transmit signals to distantly placed sensors in able to reach a remote

sink; instead, they frame a multihop correspondence situation with their short-range radio types of nodes, transmitting information every time to the prompt neighbours and integrating it into the entire network [7].

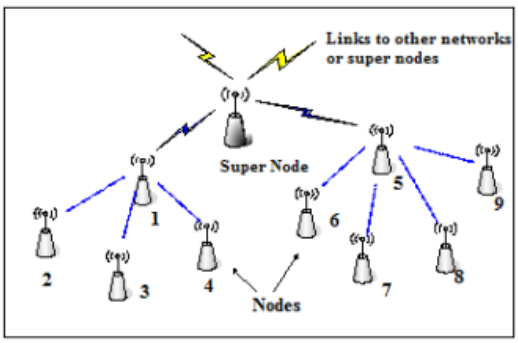

Figure 1: Sensor node communication

WSN innovation is distinguished by IEEE 802.15.4 wireless innovation, which is a short-range communication architecture intended to meet the throughput and idleness requirements of applications in Wide Area Networks (WPAN).

2.PROTOCOL LAYERS OF WSN

Following is a diagram of the protocol stack for WSN, which comprises of five network protocols as seen in figure 2. The fundamental components of IEEE802.15.4 remote innovation is to be less complicated, to need little effort, to consume little power, to transmit information at a low rate, and to be supported by cheap costs, whether the devices are stationary or mobile [15]. The principal application of this breakthrough is in the field of wireless sensor networks (WSNs).

- **Physical Layer:**
  Specifically, the physical layer is in responsible of converting bit streams from the data link layer into flags that are acceptable for transmission across a communication channel such as a telephone line. As a result, it is responsible for a variety of critical topics, such as the transmission medium, bandwidth selection, signal modulation, signal revelation, and information encryption. It is also responsible for the configuration of the fundamental equipment, including the various electro - mechanical interfaces.

- **Data Link Layer:**
  In order to provide a solid point to direct and signal multipoint transmissions, the data link layer manages information multiplexing, information frame construction and identification, media access, and error management, all of which are handled by the data link layer. Medium Access Control (MAC) is one of the most critical parts of the data connection layer and is distinguished from the rest (MAC).

- **Network Layer:**
  Information gathered by source sensor nodes is sent to the information sink through the network layer, which is mainly the responsibility. Due to the fact that sensor nodes are densely conveyed and that neighbour nodes are close to each other, it is possible to use multihop short range communication in sensor systems.

  A source node must use a routing protocol in this case in order to convey the detected information to the sink. The routing protocol must pick the most energy-efficient multihop route from the node to just the sink.

- **Transport Layer:**
  Due to the energy, computation, and capacity needs of sensor nodes, traditional transport protocols cannot be coupled particularly to sensor systems without modification. The transport layer provides dependable end-to-end data transmission among sensor nodes and the sink.

- **Application Layer:**
  The query dissemination, node restriction, time synchronization, and system security functions are all performed at the application layer. Consider the Sensor

Management Protocol (SMP), which is an application layer government protocol that allows programming operations to perform a variety of tasks such as the interaction of region data, the synchronization and movement of sensor nodes, and the recognition of each node's current status, among others.

- **Power Management Plane:** Controls how a sensor node makes use of its available electricity. It is in charge of controlling the power output of sensor nodes used for processing, sensing, and communication. It is possible, for example that the sensor node willswitch off its receiver upon receiving a text from one of its neighbors. This is performed to prevent receiving duplicate communications.

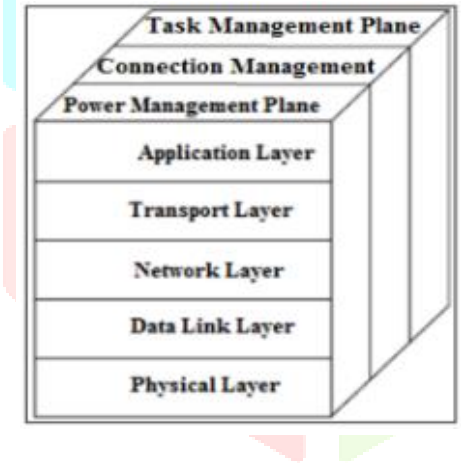

Figure 2: WSN protocol layer stack

The quickest route or the most secure route, based on their needs. Thepathways selected by two sensor nodes are depicted in Figure 3 by the green and red lines, respectively. The data from the sensor nodes makes its way to the base station for analysis. The received signal is transferred to the server by the base station, whether by wired transmission or through the web.

- **Task Management Plane:**
  A sensor node's job is to distribute jobs across sensor nodes in order to extend the lifespan of the WSN and enhance energy economy. It also balances and schedules the sensing activities assigned to a certain location.

3. CLASSIFICATION OF WIRELESS SENSOR

Wireless Sensor Networks may be divided into the following types, based on their architecture:

1. **Flat WSN:**
   Figure 3 depicts the WSN Flat design as well as thecommunication pathways that exist inside the network.

- **Connection Management Plane:** When it comes to network access, it is in charge of configuring or reconfiguring sensor nodes in an effort to establish or preserve network access. The sensor nodes interact with one another and determine the most appropriate way for data transfer.

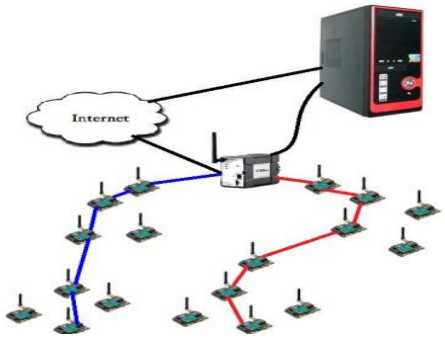

Figure 3: Design of WSNs and communication channels

2. **Star WSN:**
   A star topology is characterised by the fact that each node is directly linked to the base station. There are a number of distant sensor nodes that the base station communicates with and gathers data from. It is not permitted for the sensor devices to connect with one another. Due to this, information flow between the base station and sensor nodes occurs with very little

delay. Due to the fact that the base station serves as a single controller, it must be positioned within the transmission range of all of the individual sensor nodes. The advantages include lower power usage at remote sensornodes as well as network control from a single node. The length of the WSN is defined by the numberof nodes that are linked to the base station.

- **Hierarchical WSN:** The WSN tree topology is utilized in hierarchical WSN. A tree topology may be thought of as a collection of star topologies that are arranged in a cascade [16]. This design is based on a hierarchical framework.

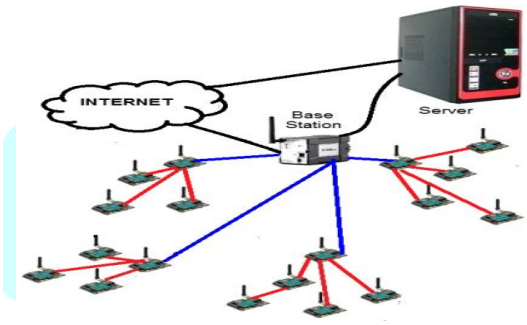

Figure 4: Hierarchical WSN

In the tree, each sensor node connects with a node that is positioned higher up in the hierarchy. The nodes at the upper positions of the tree will then aggregate and communicate with the cell tower as a result of their placement. The extension of the network and the identification of errors are both simple in these networks.

- **Cluster based WSN:** Figure 5 depicts the cluster-based architecture of the WSN as well as the communication channels that exist inside the network. Sensor nodes are clustered together to form clusters in this configuration. Each cluster has a cluster head, which is one of the sensor nodes in the cluster. This cluster head is responsible for routing all communication. The sensor nodes in each cluster communicate with the cluster members, which receives the data. The data is sent to the base station via the member nodes. The communication with the base station is no longer shared by all sensor nodes; rather, only the cluster heads connect with the base station. The Fuzzy clustering method is used to accomplish the task of cluster generation.

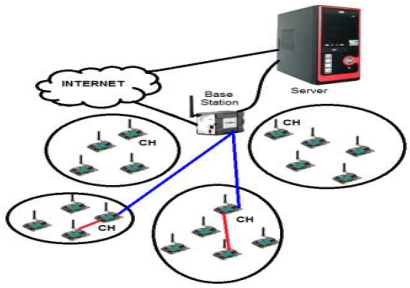

Figure 5: Cluster Based Architectureof WSN

4. MOBILE SENSOR NETWORK

As sensor systems develop in size, bandwidth allotment turns out to be progressively basic. A sensor organizes necessities to distribute its bandwidth to amplify add up to data pick up [10]. An alluring bandwidth designation plan ought to disperse the given bandwidth with the end goal that it is delicate to spilling data attributes, inquiry accuracy, accessible assets (communication, power, CPU), and sensor need (data from a few sensors may be more critical than others). We can spur this research utilizing the accompanying two illustrations.

- ✓ Wireless sensor-systems are being utilized for living space monitoring applications. Sensors enrolling light, temperature, and sound are sent in tunnels of Storm Petrels (a seabird) for monitoring purposes. Amid the day time, the tunnels are relied upon to be vacant, and hence we can have a low sampling rate.
- ✓ In video reconnaissance applications like, numerous cameras are mounted at key areas to screen exercises of

vehicles and individuals in a parking area.

A naive answer for the previously mentioned issues is over-sampling. Anyway this comes at expanded cost of assets, specifically:

- CPU — The CPU at the focal server may need to process pointless data from various sources, yet this would not influence the outcome essentially.
- Network Bandwidth — the communication channel would transmit pointless data. Also, in instances of low bandwidth organizes the alternative of over-sampling probably won't be accessible by any means.
- Power Usage — Power preservation is basic for wireless sensors. Over-sampling prompts expanded power utilization of a sensor's estimating gadgets, radio transmitter, and processing unit.

4.1 Applications of Mobile WSNs

The application areas where mobile WSN can be employed are discussed in further detail in this area. The applications shown here are focused on the mobility element of mobile WSNs, which can be regulated or random in its movement. Mobility can also be passive, as in the case of movable nodes that are propelled by the wind or the current of water. Using a mobile WSN with regulated movement, it is possible to implement the part of a specific:

- ✓ The purpose of this is to improve network services. Examples of network services include activities such as maintenance service, mobile anchor node dependent static node localization, and region exploration.
- ✓ In order to discover and rectify coverage gaps in the network, the following steps must be taken: Manual involvement in the sensor field is challenging when the deployed region is distant or hostile. It is possible to employ mobile nodes to add connections to the network and restore network connectivity in this situation. Many WSN network applications may not be able to establish the ideal deployment pattern until the nodes begin sensing and relaying data back to the base station.

5. Advantages and Challenges of Mobile WSN

A mobile WSN outperforms a static WSN in a wide range of application situations. A few of the benefits of integrating mobile nodes into limited research available WSN are discussed in the following sections.

- In the event of a static sensor network, a dense deployment is desired in order to get higher quality sensing. As a result, the cost of running the network rises significantly. With the aid of mobile WSN, it is possible to create a sparse deployment in order to counter this.
- Mobile nodes have the ability to reposition them in order to provide improved sensing and focused monitoring.
- It is possible to take use of the mobility of sensor nodes to lower the energy consumption of a multi-hop network by employing them as relays or data mules. Mobile nodes may be utilised to extend the life of a network by utilising mobile sinks to do so (mobile base-station)

6. CONCLUSION

We can conclude that a Wireless Sensor

Network (WSN) is a remote network made up of geographically procured self-ruling devices that use sensors to amiably monitor physiological or environmental conditions such as temperature and sound levels as well as vibration, mass, motion, and contaminations at various locations. A WSN is a collection of a great amount of battery-powered, ease-detecting gadgets, commonly referred to as sensors that collaborate to execute a distributed sensing task in a domain. As sensor systems develop in size, bandwidth allotment turns out to be progressively basic. Wireless networks provide greater design and application flexibility than wired networks. Because of advancements in Micro-Electro-Mechanical Systems (MEMS) technology, low-power wireless sensor nodes have begun to emerge. A sensor organizes necessities to distribute its bandwidth to amplify add up to data pick up. A mobile WSN outperforms a static WSN in a wide range of application situations.

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