

Analysis Of Electromagnetic Pollution Monitoring Using Wireless Sensor Network

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Abstract - Different parameters in environment are required to monitoring using different technology. Wireless sensor network is one the technology in which different parameter such as noise, light, pressure is monitor and provides the result if any violation is occur. Wireless device is danger for the human and must be monitoring using WSN technology. Wireless sensor network monitor the efficient power level. Different method is used for the increases the network's lifetime. Different parameters are affected the network's lifetime. Different node distribution technique is introduced in which 10x10 stars is the best technique to increase the network lifetime is 77% compare with homogeneous density distribution.

Key Words: *Wireless sensor network, Electromagnetic pollution, Cluster head, Active node, Monitoring*

1. INTRODUCTION

Wireless devices generate the pollution in environment which is required to monitor using wireless sensor network. Pollution generates in hidden form is called as electromagnetic pollution. The network is made of different sensor node which has maximum up to 100 sensor node. All nodes creates the group in network is called cluster and group of cluster is called the network. Node is considered as an active node or network master. Network master also called cluster head (CH).

Wireless sensor network provides the point to point, star and mesh network which is require by application. Wireless sensor network is use for the calculate network's lifetime.

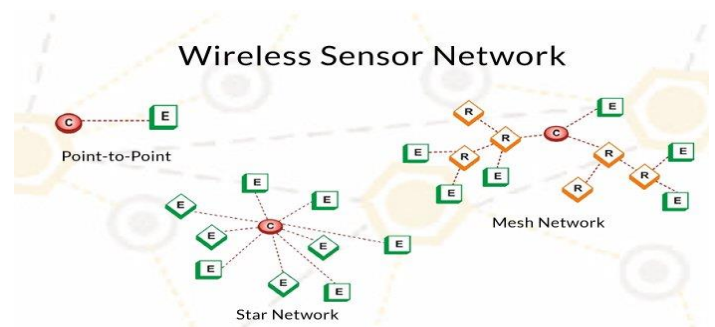


Fig-1: Point-to-Point, Star and Mesh Network in WSN

1.1 Wireless Sensor Network

Network Master (cluster Head) node:

If the node is network master, then network master receive the data from the active node and send to the sink node.

Active node:

If the node is active node, then monitor particular frequency and gives the result in any violation is occur. The entire active node gives the instructions to the network master. Active node also called participant node

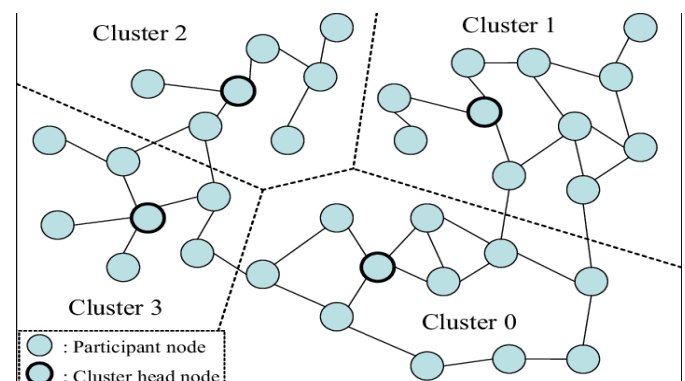


Fig-2: Network Master and Active Node in WSN

Different nodes are communicates with each other and pass the instructions to the destination through the internet. Particular path will be choosing with the help of routing

protocol which is LEACH and LEACH-C protocol. Some characteristic of wireless sensor network are:

Power Consumption: Less power consumption is required for the nodes.

Failure Node: If any nodes are failure, easy to handle.

Simple and Easy: Provides the simple and easy for the use.

Scalability: It is scalable for the large distribution.

Mobility: The entire nodes communicate with each other at anytime and anywhere.

Limited Memory: Limited memory is required.

Applications:

Military Application: Trace the enemy movement by remotely.

Traffic Management and Monitoring Application: Place the sensor in car to protect against the accident. Monitor the traffic flows using remotely.

Health Application: Detect the vital signs, heart rate and glucose in body by sensor.

Home Application: Light and temperature control in home by sensor.

1.2 Important Factor of WSN

Wireless sensor network has a two important factors which is used to collect the data from each other and pass the data to the network master.

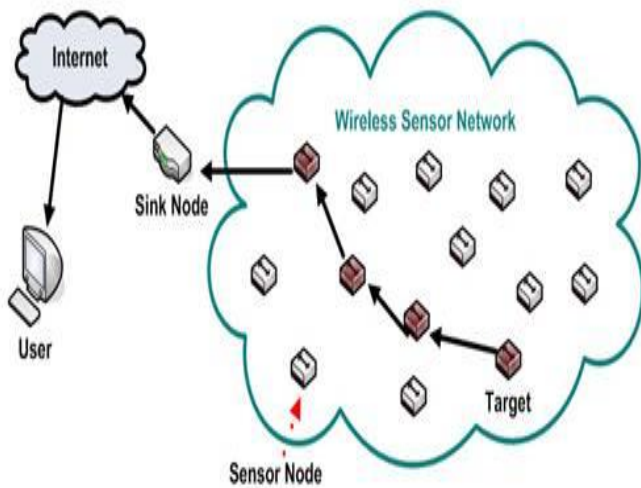


Fig-3: Architecture of the Wireless Sensor Network

Advantages:

- If any node is arrange in the network, then easy to place without any disturbance.
- No need to the cables or wires.
- No require the hubs and switches.

Disadvantages:

- Wireless sensor network has a slow speed compare with cable network.
- Wireless sensor network is not more secure because of any user connect with the laptop any data will be access any time.
- Network is affected by environment.
- It is very costly for the installation of the nodes.

Components of WSNs

The WSN consist of two main components:

1. Sensor Nodes, and
2. Base Station (Central Gateway).

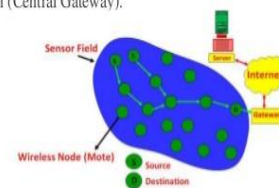


Figure: 1

From - Book "Ad Hoc and sensor networks" by Carlos de Maras Cordero.

Fig-4: Two Important Factor of the Wireless Sensor Network

1.3 Monitoring Electromagnetic Pollution Using WSN

Four frequency polluters placed around the wireless sensor network. Four frequency polluters like f1, f2, f3 and f4. All the frequency polluters has a maximum power for violate. At end of the first day f1 violates up to last 6 hours, and next second day f2 violates up to last 6 hours and so on. This process will be occurring at every four days.

Wireless sensor network is used for the increases network's lifetime and also used for the monitor electromagnetic pollution. Different ways provides to monitor the electromagnetic pollution which is wireless sensor network, GPS, GPS-GIS based etc.

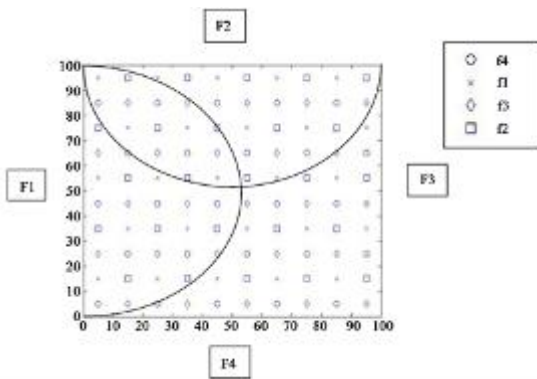


Fig-5: Placed the Frequency around the Network

2. NEW ALGORITHM FOR THE WSN

All the active nodes calculate the power of each frequency bands in every cycle. Active nodes send the data to the Network master if violation is occur.

2.1 NM Selection Algorithm:

LOA algorithm is used to continue monitor physical or environment parameter.

The NM selection algorithm is produced satisfy for the special condition according to the electromagnetic pollution. All the nodes act as a nm until it reach to the particular predetermined threshold, after it work as a active node. If active node is not capable to do complete the task, then assign the dead and entire network stop the work. Different technique is use for the fixe and random distribution.

If sensor will be distributes random such as uniform distribution, exponential distribution, and Gaussian distribution are require. If sensor will be distributes fixed such as homogenous density distribution required. NM selection algorithm uses the different parameter.

Different parameters are use in network which is the following.

- Size of the Network : 100x100m
- Sensor in each network :100 Sensors
- Participant node send the data packet size to the nm (k):64 bits
- Nm send the data packet size to the sink node(K1):512 bits
- Data packet size equivalent to sensing power levels(K2):1 bits
- Location of the sink: center
- Distribution of the network distribution of Homogeneous Density (figure 1)

2.2 failure nodes detect by sink using watchdog technique:

Each node is place in network. The entire active node calculates power level of particular frequency band. In one cluster assign the one network master at a time. Nodes send the instruction if violation is occurs. Sometimes violation is not occur, these time difficult to identify which node is dead or not perform the particular task.

Watchdog technique is implement and improve the reliability by sink to identify the failure node during violation is not occur. Data packet sends by active node to the network master in predefined period it is indicates that is "alive".

2.3 Different modes related to data packet:

Data packet sends by active node to the network master. Network master perform any task of data packet which is received by active node. Network master declare result about which data packet is "alive" or which data packet is "danger".

Network master collects the data packet from the active node. Perform the aggregation on the data packet, arrange into the appropriate format and transmit the data packet to the sink. Network master collects the data packet from the active node, perform the aggregation on the data packet, arranged into the appropriate format and sends the data packet to the sink.

No Danger Mode:

Do not send any message from the active node to the network master it is called no danger mode. During cycles they do not send message like "I am alive" packet.

Alive node:

Sends the message from the active nodes to the network master even violation is not occur it is called alive node.

Danger Mode:

Danger mode and alive mode both are same in related term of packet size and energy consumption and calculate energy. Difference between danger and alive mode in term of sends the data packet from active node to network master during the violation is occur.

3. PREDETERMINED THRESHOLD OF THE NM

Any node is capable to act as the network master. Eth_nm is predetermined threshold provides for the solving equations which is able to make the network master. Assign the threshold for the different network master. Different method is use for the increase network lifetime which following are: One of the techniques is average technique which has nm threshold. In LOA algorithm, nm calculates the average Econsumed and 137149 cycle increases in network.

3.1 Eth per NM Technique:

Econsumed provides by average technique. Substrate Econsumed by 2J provides the Eth per nm technique in LOA algorithm which is 18% increases network's lifetime.

3.2 Eth Max technique:

Consider the maximum value of Econsumed vector and subtract Econsumed_max into 2J.

$$\text{Eth_max} = 2 - \text{Econsumed_max}$$

Eth max technique increases 12.8% network's lifetime compare with the Eth per nm technique.

3.3 Iterative Search Technique:

Best nm threshold is search by iterative technique which is fixed and that will be increase the network's lifetime. Calculate the code in various times and increase network's lifetime. The maximum value is provides of the threshold when network's lifetime starts to decreases. When start to decrease the network lifetime, at this time to consider the nm threshold value.

4. PARAMETERS AND TECHNIQUES AFFECTES THE NETWORK LIFETIME

4.1 Change Frequency of Watchdog technique

If frequency of the watchdog technique will be increases, then result in a network's lifetime will be decreases. If frequency of watchdog technique will be decreases, then result in a network's lifetime will be increases. Frequency is one the affected parameter in network.

4.2 Magnitude of EMP is change

Most of the technology uses the sensor which is energy efficient and provides low value of magnitude.

4.3 Effect of change in node distribution

Different distribution technique is used in installation node pattern. 10x10 star is best for the increase network's lifetime compare with the 12x8 star and 14x7 star.

In 10x10 star distribution, iterative search technique increases 333236 cycles in network's lifetime. Eth_max technique increases 329192 cycles in network's lifetime and Eth per nm technique increases 278908 cycles. 77.74% increases network's lifetime compare with the homogenous density distribution.

TABLE – 1: Network's Lifetime of Different Node Distribution Technique

Different Distribution	Iterative Search Technique	Eth_Max Technique	Eth perNM Technique
Homogenous	187481	182450	161749
10 X10 star	333236	329192	278908
12 X 8 star	291002	289430	265456
14 X 7 star	295643	282191	274363

5. CONCLUSIONS

Wireless sensor network monitor physical parameter and detect if any violation is occur. Wireless sensor network also monitoring the electromagnetic pollution. In this paper, start with NM selection algorithm was use for the increase network's lifetime. Second the best energy threshold iterative search technique is finding to increase network's lifetime. Third, changes in frequency of watchdog technique effect the network's lifetime. If frequency of watchdog technique will be decreases, then result in a network's lifetime will be increases. In conclusion, frequency of watchdog technique is very in network's lifetime. Last the best distribution technique is used for the increase network's lifetime which is 10x10 star distributions. 10x10 star distribution technique increases 77.74% network's lifetime compare with the homogenous density distribution. Different parameter is used in network model which is used by Nm selection algorithm.

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