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Recent Techniques And Protocols For Data Transmission In Wireless Sensor Network

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Abstract*: Currently, the wireless sensor networks are hugely demanded in every field instead of due to its vast applications specifically for the security purposes and for monitoring. Basically, the wireless sensor networks are the infrastructure less networks which consist of mobile nodes that have memory for storage and to process the data. There can be small networks or large networks. These days, due to the advancement of technology, several kinds of new challenges even though the technology change life, offering a lot of facilities. The most common problem in the atmosphere is the pollution and air pollution is hazardous for health. The wireless sensor networks (WSNs) are utilized for controlling and managing the air pollution. In WSN, the routing protocols are playing out a major role for the best communication of nodes to enhance the security in the network. In the present research work, the classification of different routing protocols is discussed in detail. The major routing protocols are SPIN, DD, RR, LEACH, PEGASIS, TEEN, APTEEN, HEED, GAF and so on. All these routing protocol come under different categories as namely as flat, hierarchical, location based and the hybrid. Additionally, a comparison is made to clarify different routing protocols with its relevant merits, demerits and classification. In this way, the current research is being more fascinating to work in the monitoring applications such as for the air pollution monitoring systems.

***Keywords* : LEACH, PEGASIS, HEED, TEEN and WSN.**

I. INTRODUCTION

The wireless sensor networks (WSN) are the networks that have a variety of mobile nodes which communicate with each other through the wireless signals. Basically, the ad hoc networks are demanding, rapidly and these are infrastructure less networks that processed in every field. Wireless sensor networks are sub-category of ad hoc networks which is being a fascinating topic for researchers and the developers.

Generally, WSN is the combination of static as well as dynamic nodes. These nodes have memory to store the data and to generate the signals. The main objective behind the use of WSN is to combine, transmit, process the data and specifically for the monitoring purposes. The sensor nodes are the key component of any wireless network which is responsible for the data transmission. Subsequently, it acquires the essential information from the nearest environment and may even sense data about temperature, humidity, pressure and so forth.

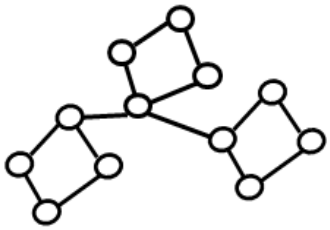

Fig 1. A Basic Connectivity of Sensor Nodes in WSN [1]

A. Types of WSN

The wireless sensor networks are classified into different categories. Some of the fundamental categories of WSN are described below:

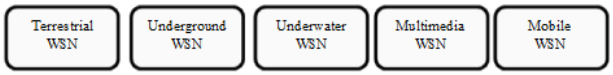

Fig 2. Classification of Wireless Sensor Networks [2]

- **Terrestrial Wireless Networks:** These networks are basically composed of the thousands of the wireless nodes, which are deployed in the specific region that is also pre-planned networks. The pre-planned regions are mostly seen in the grid placement, optimization, two dimensional and three dimensional. In this network the sensor nodes are placed randomly at the target point in the particular region. It is also named as TWSN [2].
- **Underground Wireless Networks:** These are the sensor nodes, which are deployed in underground ways. It is basically seen in the caves and the mine works. The purpose behind the use of the underground wireless network is to monitor the situations occurred underground and to acquire the crucial information for the betterment of the work. But the underground WSN is expensive and require more maintenance as compared with other networks.
- **Underwater Wireless Networks:** The purpose of creation of underwater WSN to monitor the situations which are required to be managed underwater. The vehicles are generated which are wireless in nature and moves to explore more land to gather the essential data from the other nodes and from the hidden regions in the water. The transmission of data is occurring by accessing to the acoustic waves in the oceans [3].
- **Multi Media Wireless Network:** These are the WSNs which is used for the tracking and for monitoring the events which come under the form of multimedia. The sensor nodes are linked with each other along with cameras as well as the microphones.

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- **Mobile Wireless Network***:* The mobile WSN included the count of sensor nodes which has the tendency to move in own ways and to interact with the closest area. The mobile sensor nodes have the capability to change the location and self-managed in the network. The data transmission is varied with the range of every sensor node in the specific region [2].

The sensor network has the nodes which are capable to sense through the pressure, signals, radio waves, temperature and air. Therefore, the demand of these wireless sensor networks raised enormously. The major applications of WSN are such as the environment monitoring applications, military areas, medical field, industrial sector, traffic management systems and for the entertainment with the home intelligent systems [2].

B. Advantages and Disadvantages in WSN

Wireless sensor networks have countless advantages due to the continuous development in the field of networking. The major advantages of wireless sensor network are given below-

- The size of sensor nodes is small, therefore the deployment of nodes is easy.
- The cost of sensor nodes is low.
- The consumption of energy is less.
- The nodes have the tendency to self- configure.
- High scalability and reliability.
- Data transmission is secured.
- It is supportive for fault tolerance [4].

The demand of wireless sensor network is flourishing almost in every sector. However, it faced certain kind of limitations related to:

- Restricted capacity of sensor nodes.
- Lack of more hardware resources.
- Random selection of nodes sometime generates more complications in the network.
- Maintenance of large networks.
- Large architectures of wireless networks.
- Programming issues in the network [2] [4].

Routing protocols are playing out a major role in the wireless sensor network for the better processing of data and to enhance the performance of the basic data processing in the network. There are various routing protocols which are trained for the wireless sensor networks such as flat routing, hierarchical routing and the location based routing [5].

II. RELATED WORK

Pavani, M., et al., (2017) [18] proposed the concept of the air pollution. The air pollution was the main concern in the environmental issues; it influenced the human beings and the other environment. The urban air monitoring system was proposed which is managed using WSN. In the previous monitoring systems, the data availability was restricted in the certain limit. Due to the advancement of the technology,Micro Electrical Mechanical Sensor (MEMS) and WSN both initialized the air monitoring systems to determine the pollutants such as CO_2, O_3 and SO_2. A detailed review was presented which described indoor and outdoor pollutions. Several methods and algorithms were shown for the detection of air pollutants. It was required to introduce the cost-effective monitoring systems for monitoring the urban air pollution that was more energy efficient. **Khedo, K.K., et al., (2017) [19]** designed the cost effective and energy efficient monitoring systems for air pollution. It was completed using WSN. In this era, the industrialization as well as the urbanization was being the witness of increased pollution in the environment specifically the air pollution. Because of this, the harmful gases like CO_2, O_3, SO_2 and so on effect the quality of air. The process of monitoring the air pollution was not considered as an easy task in the real time. Therefore, the goal of present research was to implement a cost effective and more energy efficient system for monitoring the air quality. It was initialized by using WSN. It had the tendency to be developed in highly pollutant areas like Mauritius. The research method was HBGA and it stands for the hierarchical based genetic algorithm. Its main motive was to sort out the challenges occurred due to the restricted energy of sensor nodes in the WSN. The proposed method simply utilized the index of air quality. The experiment depicted that, the research method overweigh the performance of the LEACH protocol specifically in the consumption of energy and the lifetime of the network. Subsequently, the research method cleared that it was more effective and achievable for the air quality monitoring purposes. Further, the system was improved by using the module for the predictions of the air pollutants. **Boubrima, A., et al., (2017) [20]** introduced a new developed method for the monitoring the air pollution. In the smart cities, the pollution was raised enormously. Air pollution was being the major cause of the bad health of people who live in these cities. There were various air monitoring systems using WSN were discussed in the content of the research. But the actual need was to develop the best system that had better performance with the minimum cost. The present work was introduced a citywide WSN. Along with this, a novel approach was utilized which searched out the optimal sensors and the exact position of the sink node. It was different from the other air monitoring systems because it was reliant on the spatial analysis and focused to detect the nature of the pollutants. For the better results and for the evidence, the proposed approach was applied on the real time data as namely as Paris Pollution. It was noticed in 2014. The outcomes obtained from the research were compared with the other systems to check out the effectiveness of the proposed approach. **Murugun, C.A., et al., (2018) [21]** in this research work described the monitoring system for air quality system which relied on the working criteria of WSN. Pollution was the impurities in the particles that occur in the air which changed the natural quality of air and harms the health of the habitants. The internal structure of the proposed system was consists of the microcontroller 16F887 that was associated with the sensors. These sensors were utilized for the concentration of CO, SO_2, NO_2 in the air. The results obtained from the sensors were amplified and sent to the micro controller. It was performed by Zigbee interface. The current system had the capability to determine dangerous pollutants of the gas. The future use of the current research was for the inclusion of the units that had the tendency to mage the different levels of gases.

Simbeye, D. S. et al., (2017) [22] recommended the air pollution monitoring system for managing the pollution of industries and the system was based on the WSN. The environmental conditions were impacted on the human beings. These days, the industries were being a major cause of air pollution. Therefore, in the smart cities and industrial sectors, the monitoring systems were required to manage the air pollutants. The current research was described the monitoring system for the industrial pollutions which makes the data available for delivery. The analysis was aimed at the six terms such as ozone, SO_2 (Sulphur Oxides), NO_2 (Nitrogen Oxides), CO_2 (Carbon Dioxide) and the lead. The research gives the explanation of new designs for the smart devices which had the tendency to enhance the environment conditions.

III. ROUTING PROTOCOLS IN WSNS

Generally, the wireless sensor networks (WSN) are the ad hoc networks which composed of the small wireless devices. The communication among these sensor devices is associated with the wireless links or the signals. There are sensor nodes, which are infrastructure free and are limitless. The major objective of the sensor nodes is to send and receive the data from one node to another [6]. The nodes in the wireless networks gathered the data and essential information from the specific source to the particular destination. Routing protocols in every wireless network performed a good job mainly to complete a task to organize the paths and routes between the source node and the destination node in a secure manner. It is happening because the selection of the route or path increased the lifetime of the network. The process initialized for the routing is not an easy task due to the presence of the restricted processing and capability of data transmission. Therefore, different kinds of routing protocols are utilized in the wireless sensor networks [7].

A. Classification of Routing Protocols

The routing protocols which assisted in the wireless sensor networks are generally classified into different categories. The path selection, routing is generally composed of three categories as the proactive, reactive and hybrid. The classification of routing protocols is shown [8] in figure 3.

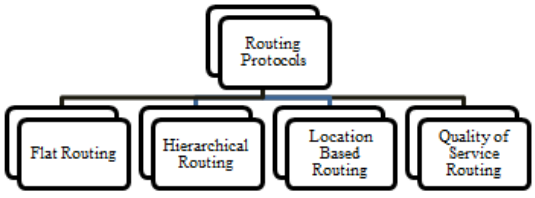

Fig 3. Classification of Routing Protocols in WSN [9]

- **Flat Routing:** The first category of routing is the flat routing. Every node in the network played out the major role mainly in sending the data from the nearest environment and later the enhancements in this category are seen in the data centric routing methods. In the data centric based routing, the destination node reverts the queries to a particular region and waits for gathering the information from the particular region. The main routing protocols utilized in the flat routing and data centric are Sensor Protocols for Information and Negotiation (SPIN), Directed Diffusion (DD) and Rumor Routing (RR).
- **Hierarchical Routing:** The other major category of routing protocols in the wireless sensor networks is the hierarchical or clustering based routing. Most of the researchers are working on the hierarchical routing mainly in the form of clustered layers of the network. Usually, the sensor nodes in the hierarchical routing are collaborating in the different clusters and there is a cluster head selected from every group of clusters. The cluster head (CH) basically performed the major tasks and responsible for the working of the other clusters. The processing of data for communication is initialized from the lower layer to the higher layer along with this; it is also capable to hop when there is coverage area is huge. The biggest advantage of hierarchical routing is the fastest processing of data. The common routing protocols which come under the category of hierarchical routing is Low Energy Adaptive Clustering Hierarchy (LEACH), Power Efficient Gathering in Sensor Information System (PEGASIS), Hybrid Energy Efficient Distributed Clustering (HEED), Threshold Sensitive Energy Efficient Sensor Network (TEEN), Adaptive Threshold Sensitive Energy Efficient Sensor Network (APTEEN).
- **Location Based Routing***:* These are the routing protocols which are basically dependent upon the location data. It is mainly utilized to give information about the discovery of a route, maintenance of the networks, data transmission and secure the private information of the nodes. The other major role in the WSN is the direct transmission of data from one node to the other and to alleviate the flooding data in the overall network. The basic need behind the use of the location routing is to determine the distance between the sensor nodes which energy is expelled. The basic location based routings are Geographic Adaptive Fidelity (GAF), Minimum Energy Communication Network (MECN), The Small Minimum Energy Communication Network (SMECN) [8] [9].
- **Quality of Service Routing:** These are the routing protocols which are created mainly for the applications that required more quality of services (QoS). The routing protocols are more reliable, scalable, highly efficient and contains the location information. The features of these routing protocols are mainly involved in the selection of a particular routing for a specific application [7].

IV. EVALUATION OF DIFFERENT ROUTING PROTOCOLS

Different routing protocols are evaluated according to the performance of their working criteria. The performance is required to be more reliable, highly scalable, low consumption of energy, less overhead, high throughput and the good delivery factors. The description of different routing protocols is given below:

A. Sensor Protocols for Information and Negotiation (SPIN)

SPIN is the first data centric and flat routing protocol and it is later utilized for the data negotiation among the different sensor nodes. Its main objective is to decline the redundant data and to save the most energy while data is transmitted from one place to another.

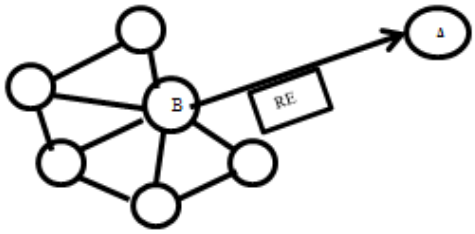

Fig 4. SPIN Routing [10]

It simply sorted out the issues of basic problem which is related to the data flooding in the network. Basically, there are the request to sensor node A.

Advantages of SPIN: There are various advantages of SPIN. The basic advantages are given below:

- It is supportive to the topology changes.
- Supportive to the mobility of sensor nodes in the network.
- Capable to create multiple paths.
- It is also used for the query purposes.

Disadvantages of SPIN: It has also faced some challenges while is the data is transmitted from one node to the other.

- Not surety about the data delivery.
- No information about the interest of source or destination nodes for the data transmission.
- The usage of power is restricted.
- No access to the quality of service.
- It is incapable to give the awareness about the locations of the sensor nodes [11].

B. Directed Diffusion (DD)

This the most important routing approaches in the data centric routing protocols. The focal point is about the diffusion of the information by using the nodes with the use of a name approach mainly for the accessibility of the data. It is mainly utilized to remove the unrequired operations to save the energy. The use of the attribute value is used for the primary needs of the sensor nodes to create the query. The query relies on the names of the objects, time intervals, and geographical location and so on. The required data are transmitted from the source to the sink node by using the interaction of the neighbor nodes. The other information acquired by the directed diffusion is assisted for the comparison of the collected data with the interested value (Required Data). After the completion of the data transmission, the sink node again sends the original data packets by accessing to the particular path which takes less time to deliver data packets.

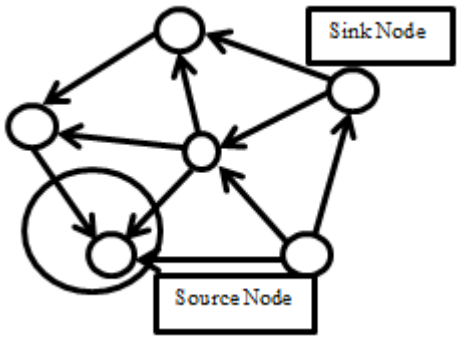

Fig 5. Directed Diffusion [11]

Advantages of Directed Diffusion: The common advantages of DD are given below:

- Save more energy
- Alleviated the un-necessity of the data operations.
- Capable for data aggregation.
- It has also the tendency to repair the route and path for the data transmission.
- Gives the alternative ways to transmit data in case of failure occurred.
- The process is data centric and the interaction of the neighbor nodes.

Disadvantages of Directed Diffusion: Some of the main disadvantages of DD are as follows:

- More overhead due to the alternative path creation.
- Need extra energy.
- Complicated process.
- Not supportive of the monitoring applications [11].

C. Rumor Routing (RR)

This is the other kind of flat routing , which is the enhanced variation of Directed Diffusion (DD) and it is mainly utilized in the situations when the content is not applicable to the geographical routing process. The major shortcoming of direct diffusion is the data flooding when the query is generated. The other method is introduced for the same purpose when the count of the queries is large. It employed the long data packets for the data transmission that commonly known as the agents. When the data are acquiring an event, it simply obtained the agent. The agents are transmitted in the network mainly to extract the useful information and to find out the distant nodes in the sensor network. In this way, the cost of flooding in the overall network is reduced to the maintenance of the path between the source and destination.

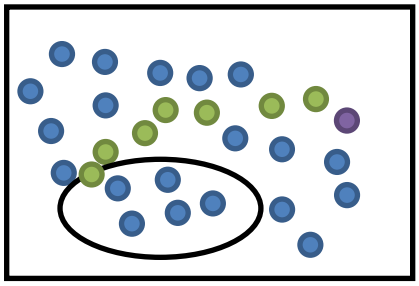

Fig 6. Rumor Routing and Query Creation [12]

In figure 6, the green nodes are representing the path creation for reaching at the event which is a colored region and the query node is colored as purple that initialized the searching process for accessing to the particular event. Rest of the nodes are describing as other operations in the WSN.

Advantages of Rumor Routing: There are a lot of advantages of rumor routing for using in the wireless network. Some of the advantages are mentioned below:

- It access to single path.
- Significant energy saved in the data processing.
- Capable to manage in the sensor node failures.
- Performed well under the fewer events.
- Controls the overhead of the network.

Disadvantages of Rumor Routing: It faced several challenges due to the disadvantages which are described as below:

- The process is only working in the small events.
- Overhead related to the maintenance of the agents and the event tables [12].

D. Low Energy Adaptive Clustering Hierarchy (LEACH)

LEACH is the hierarchical routing protocol which is the cluster based method. Its main motive is to gather the necessary information from the closest environment. The cluster heads (CHs) are selected from the other sensor nodes mainly for the data transmission from the base station (BS). It utilized the extreme energy for the transmission of data due to the consistency of the nodes. The cluster heads are aggregated, compressed and used for the data transmission. It is well performed without any need of knowledge about the considered network. Basically, for the query generation it referred to the complicated data delivery approach. The dependency of LEACH based on the aggregation of the original data in the compressed data, which described the only necessary information for all the other sensor nodes in the WSN. The entire network is partitioned into different clusters and these clusters are directly communicated with the other nodes in the group and directly transmitted the data to the sink node [13].

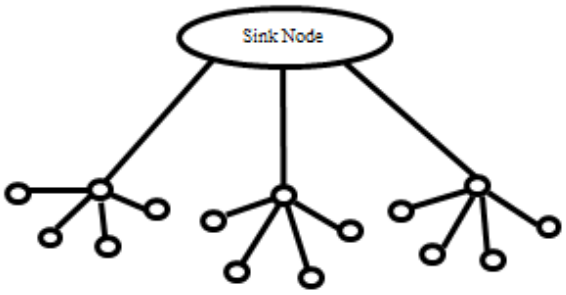

Fig 7. LEACH Routing Protocol [13]

In figure 7, the orange sensor nodes are the cluster heads, whereas the blue colored nodes are the member nodes in the WSN.

Advantages of LEACH: The advantages of LEACH protocols are given in the following section:

- No need to acquire the knowledge about the network.
- More energy efficient.
- Good scalability.
- Less overhead.
- Capable to rotate the cluster heads of different groups.
- It has synchronized clocks for the creation of the new cycles in the network.
- It reduced the amount of data and converts it into compressed data.

Disadvantages of LEACH: The disadvantages of LEACH protocols are described as follows:

- Supportive to single hop only.
- Member nodes sometimes increased the overhead in the network.
- Random selection of cluster heads.
- Mostly used in the constant monitoring purposes, not for all.

LEACH protocol is classified into three categories as the enhanced leach, centralized leach and the multi-hop leach [9] [14].

E. PEGASIS

PEGASIS routing stands for the power efficient gathering in the sensor information system. It is basically performed the routing procedure on the basis of the chain based process with the use of the greedy technique. The nodes in the networks are self-organized mainly to create the chain and to use the greedy approach. Sometimes, certain nodes are died, therefore the process of recreation of chain relied on the leader node (LN) specifically to send the data to base station. The major objective of the pegasis routing is to receive and to send the data by using the interaction with the neighbor nodes. The processed data is moving from node to node and the selection of the leader node is done randomly.

The enhancements in LEACH referred as PEGASIS in which all the sensor nodes are communicated by using neighbor nodes [9] [15].

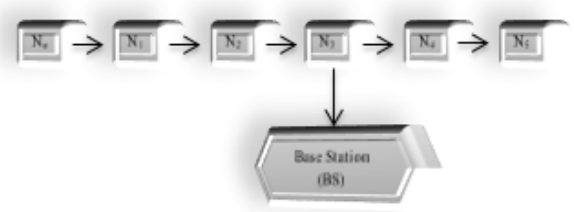

Fig 8. PEGASIS Chain Formation in WSN [15]

Characteristics of PEGASIS Protocol: The main characteristics of pegasis protocol are mentioned as follows:

- It performed the data fusion while data is transmitted.
- Improves the network performance and increases the lifetime of the network.
- The data is more reliable and scalable.
- The count of dead nodes is reduced.

Shortcomings of PEGASIS Protocol: Some shortcomings of pegasis areas:

- The sensor nodes are selected once.
- The location of nodes is required for the better processing [8] [15].

F. HEED Routing Protocol

HEED is the primary model for LEACH and it stands for the hybrid energy efficient distributed clustering (HEED). For the LEACH, it utilized the residual energy and the degree of sensor nodes in terms of the metric specifically for the selection of clusters. The major goal of HEED is to balance the power consumption. It processed in the single hop network and operated on the single network at a given time. The selection of cluster heads is based on the collation of two cluster groups. The first one is the residual energy and the other one is the communication of clusters. The selection of clusters is done randomly which introduced a common challenge related to the death of sensor nodes [9].

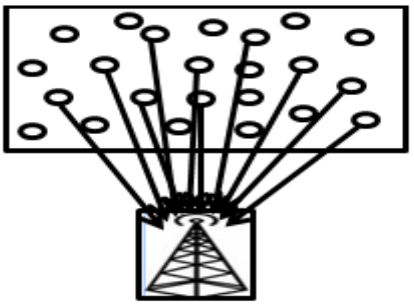

Fig 9. Single Hop Network [16]

Advantages of HEED: Advantages of HEED are mainly seen in terms to enhance the lifetime of the network, low consumption of energy, to terminate the clustering procedure, no need for the special nodes, the location is known and to decline the overhead of the network. Other advantages are:

- Supportive to the hybrid routing procedures.
- Cost effective for the creation of sensor nodes.
- More scalability, fault tolerance.
- Load balancing.

Shortcomings of HEED: The shortcomings of using HEED are the fixed base station, no awareness about the position of all the nodes, quality of service low. The creation of query is a difficult task [16]. Others issues are related to:

- Un-managed energy consumption.
- Complexity increased because of the multiple rounds in the network.
- More epochs [8].

G. TEEN Routing Protocol

TEEN routing is the threshold sensitive energy efficient sensor network, which comes under the category of hierarchical routing. It collaborate all the sensor nodes in the clusters and there are assigned different cluster heads for each group of clusters. The cluster heads are then initialized to aggregate the information to the highest level of the clusters to transmit the information at sink node. Therefore, the WSN using TEEN routing relied on the clustering of sections.

*Merits of TEEN Routing***:** Time critical information transmitted to the user

- Applicable for thresholding, controlled the data transmission.
- Declined the energy consumption
- Enhanced the effectiveness of the network.
- Accurate outcomes.

Demerits of TEEN Routing: Fixed base station, mobility of sensor nodes, restricted power consumption and no information about the location of the nodes.

H. APTEEN

Adaptive TEEN (APTEEN) is the enhanced version of TEEN routing protocol. It utilized for two functions as to capture the periodic data and to react on the time critical events in the network. APTEEN considered as the hybrid approach which allows the sensor node to transfer the data periodically. The other function is to perform the aggregation of the data mainly to save the energy. APTEEN routing has the tendency to represent the different kinds of queries such as the historical query and the persistent query.

Merits of APTEEN Routing :

- Scalability is good.
- Increased the lifetime of the network.
- Supportive to data aggregation.
- Save more energy.

Demerits of APTEEN Routing:

- Low stability and low load balancing.
- Increased overhead.
- Increased consumption of energy [9].

I. *Geographic Adaptive Fidelity (GAF)*

Basically, GAF is the energy aware location routing protocol. The biggest advantage of using GAF routing is that it saved the more energy without impacting on the different levels of routing in the network. There are countless sensor nodes in the wireless region. The single node is selected to rely in the active state for a specific time period. After this, the node is set to the sleep mode. The activated node is responsible for controlling and to transmit the data to the destination node on the basis of the network. Every node in the network associated with the GPS to find out the positions of the other nodes in the WSN. At the time when the time is terminated for the active node the node goes automatically to the sleep mode. It evaluated the neighbor nodes in the discovery mode to find out the other sensor nodes. For this purpose the virtual grid technique was used for the delivery of data as well as for the energy efficiency.

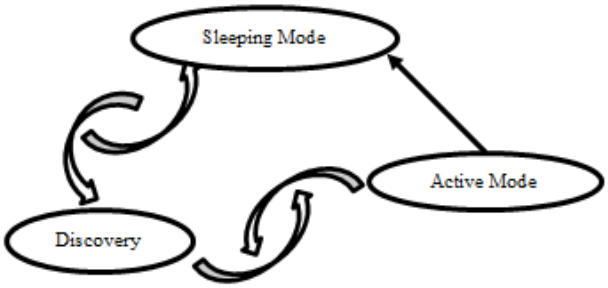

Fig 10. GAF Routing Protocol [17]

Advantages of using GAF Routing:

- It identified the equivalent sensor nodes mainly to transmit the data packets.
- It worked with the virtual grid to partition the region into different groups.
- To conserve energy, some nodes are considered in the sleeping mode.
- Load balancing [17].

J. MECN Protocol

Generally, MECN is standing for the minimum energy consumption which easily maintained the reduced energy for the betterment of the WSN by using the less power GPS. MECN protocol is working in two groups. The first group has included the locations of two dimensional plane and formed thin graph which globally fitted the links which is usually composed of the transmit nodes in the graph. It is considered as the finest link in the consumption of energy. The other group is working mainly to discover the possible links in the network and it simply utilized the shortest path approach to the use of the cost metric. The advantage of the MECN is a data aggregation and the common disadvantages are related to:

- Low quality of data.
- More power consumption.
- Mobility of nodes.
- Scalability related issues.

K. SMECN Routing Protocol

It is named as the small MECN (SMECN) routing protocol which is considered as the new version of MECN in which every node searched out the neighbor nodes in the network by passing the signal with the message. The beginning power is updated continuously.

The biggest advantage of this routing protocol is, the less consumption of energy to make the balance in the different kinds of the links [4].

Table 1. Assessment of Different Routing Protocols in WSN

Protocols	**Features/Characteristics**				
	Number of Sinks	**Mobility is given to**		**Reactive and Pro-active Types of Protocols**	**Mobility Structure**
		Destination	**CH (Cluster Head)**		
Hybrid	Double	Mobile	Fixed	Pro-active	Random
Clustering	Double	Mobile	Fixed	Pro-active	Random and Pre-defined
MAC	Individual	Fixed	Mobile	Both	Managed
Greedy Maximum Residual Energy	Individual	Mobile	Fixed	Pro-active	Random and Pre-defined
Max-Min RE algorithm	Double	Mobile	Fixed	Proactive	Managed
Energy Efficiency and Distributed Protocol	Twice	Mobile	Fixed	Pro-active	Pre-defined

Table 2. Proportional Revision in WSN (Wireless Sensor Networks) various routing methods

Protocols Name	Routing Type	Scalibility	Syn	Coverage	Security	Overhead	Energy Consumption	Maintenance
HEERP [29]	Hierarchical	✓	✓	-	-	Minimum	Minimum	✓
EADC [30]	Hierarchical	✓	✓	✓	-	Minimum	Minimum	-
U-Leach [31]	Hierarchical	✓	✓	-	-	Minimum	Minimum	-
ALS [32]	Location based	✓	X	-	x	Medium	-	-
MSDD [33]	Data –Centric	X	✓	✓	x	Medium	Minimum	✓

V. CONCLUSION

To conclude, the present research work is trying to describe all the main categories of routing protocols that are essential in the WSN for monitoring applications and to enhance the security in the system. The objective of the present work is to focus on the designing of routing protocols so that the efficiency of the network is enhanced. The routing protocols have the tendency to organize itself and these are classified into different categories as data centric or flat, hierarchical and location based. All these categories are deeply discussed. Consequently, the main routing protocols as LEACH, PEGASIS, SPIN, GAF, HEED are described that carried out the essential information from the nearest region with more efficiency and better reliability. The main purpose behind the study of routing protocols is to expel the common challenges occurred in the wireless sensor network and to increase the lifetime of the network with enhanced security. The benefits acquired by the research work are being useful for less consumption of energy, to decline the overhead and to increase the amount of data packets by selecting the best routing protocol according to the requirement. The demand of wireless sensor network is continuously raised, therefore, the revision of different routing protocols is becoming more essential rather than other terms in the network.

In the future, the sensor nodes are becoming thinner and therefore, the better processing is required, which is only fulfilled by selecting the best routing protocol, which gives more reliability, stability so that the performance of the network is enhanced. To design the better and efficient approaches for the next revolution in the networking mainly to diminish the barrier between the digital and physical work. The other advancements are related to decline the redundancy by giving the better methods for the secure communication and data transmission.

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