



## Review on Routing Protocols Used in Wireless Sensor Network

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**Abstract**— *Wireless sensor network (WSN) is large collection of interconnected sensor nodes wirelessly. WSN is made up of two or more interconnected sensor nodes. These nodes are relay on limited energy sources, lower transmission range, and lesser storage capability. As these nodes communicates wirelessly and deployed in open environment there is always possibility of network breakdown because whenever the sensor node's battery dies then the network will be breakdown because than the sensor will not able to communicate or transfer the data in the network. So we can say that routing is the most important part of wireless sensor network because the routing is deciding best way to transmitting the data from one location by using the minimum resources which help to increase the lifetime of the network. In this paper we proposed the different routing protocols used in wireless sensor network.*

**Index Terms** — *wireless sensors; protocols; routing; energy efficiency; clustering*

### I. INTRODUCTION

As we all know that Wireless sensor network [2] is in the demand from recent years. It emerged as a promising tool for monitor the physical world where the wired network can't reach such as under water, remote areas etc. As sensor nodes are relay on limited power backup so the power utilization is one of the most concern topic in wireless sensor network to make optimum utilization of network.

Advantages of wireless sensor network:

- Network setups can be done without fixed infrastructure.
- Ideal for the non-reachable places such as across the sea, mountains, rural areas or deep forests.
- Flexible if there is ad hoc situation when additional workstation is required.
- Implementation cost is cheap.

It is battery powered network that can sense, process and communicate. A WSN [3] consists of a large number of low cost, low powers and multifunctional wireless sensor network have been widely used in the industry, traffic, environmental protection, military and many other fields. Especially in the absence of the existence of the back bone of network, such as the dangerous region that man cannot get there, the battle field, and other destructive areas. These sensor nodes communicate over short distance via a wireless medium [4]. A sensor network is a network of many small disposable low power devices, called nodes.

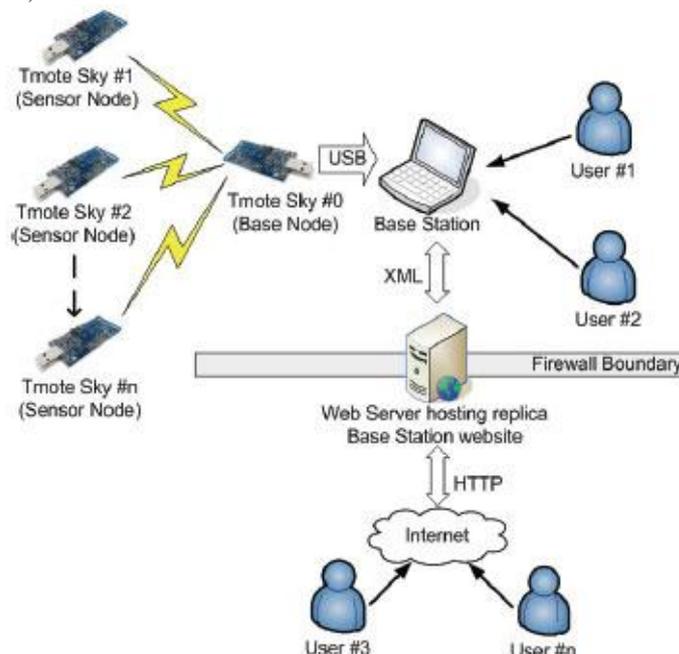


Fig.1. wireless sensor network structure

The important requirements of WSN are: Use large number of sensors, Low energy consumption, Self organization capability, and Querying ability. Networking unattended sensor has effect on the efficiency of many military and civil applications such as distributed computing, weather monitoring and security. In this paper, we analyze the current routing protocols and classify them into six categories on the basis of network structure. The reminder of this paper is organized as follows. First we discussed various routing protocols for wireless sensor network.

## II. ROUTING PROTOCOLS IN WIRELESS SENSOR NETWORK

The sensor nodes are constrained [6] to limited resources itself, so the main target is to design an effective and energy aware protocol in order to enhance the network lifetime for specific application environment. So energy efficiency, scalability, latency, fault-tolerance, accuracy and QOS are some aspects which must be kept in mind when the routing protocols term comes in wireless sensor networks. Classically most routing protocols are classified as below

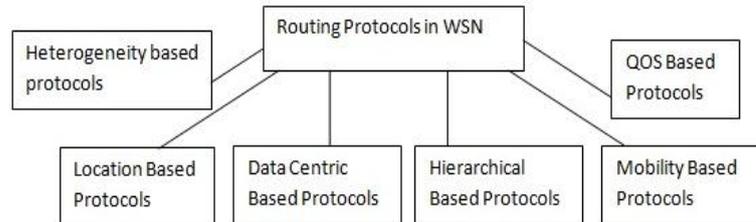


FIG.2. CLASSIFICATION OF WIRELESS SENSOR NETWORK PROTOCOLS

### 2.1 Heterogeneity Based Protocols

Heterogeneous wireless sensor network (heterogeneous WSN) consists of sensor nodes with different ability, such as different computing power and sensing range. Compared with homogeneous WSN, deployment and topology control are more complex in heterogeneous WSN. But in Heterogeneity based Protocols sensor nodes are different in respect of computing power and sensing ability.

### 2.2 Location Based Protocols

Location Based Routing Protocol uses location information to decide best route and as well as forwarding the data. Location Based Routing Protocols enables the directional based transmission of the information and avoiding the flooding in wireless sensor network. In Location Based Routing Protocol location of actuator is required in order to calculate the distance between two sensor nodes. By which the consumption of energy can be minimized [7].

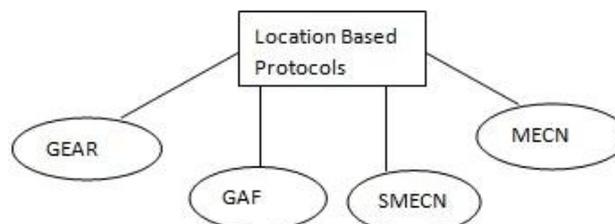


Fig.3. Classification of Location based protocols

#### 2.2.1 Geographic And Energy Aware Routing (Gear)

In this algorithm, every node is having the estimated cost and also having learning cost of reaching destination through their neighbors. The estimated cost is a combination of residual energy and distance to destination. Error occurs when a node does not have any closer neighbors to the target. The estimated cost equal to the estimated cost is and learned cost. The learned cost is propagated one hop back every time a packet reaches the destination so that route set up for next packet will be adjusted.

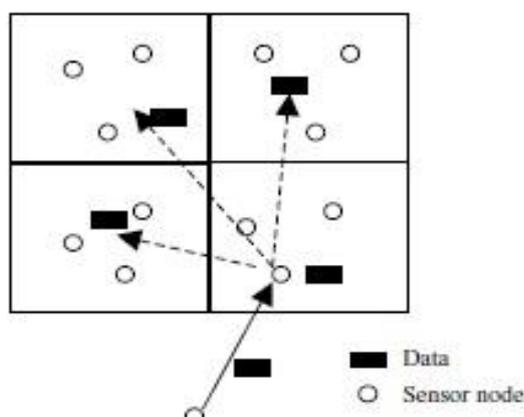


Fig.4. Geographic Forwarding in GEAR [3]

### 2.2.2 Geographic Adaptive Fidelity (Gaf)

Location Based Routing Protocol in wireless sensor network it uses Geographic Adaptive Fidelity (GAF) because it favors energy conservation. As shown in Fig.5 in GAF it has three states like Sleeping, Discovery and Active when a sensor enters in to sleeping state it turn off the radio signals for saving the energy. In discovery state, a sensor exchange discovery messages to know about other sensors in the grid. In active state, a sensor periodically broadcast its discovery message to inform equivalent sensors about its state.

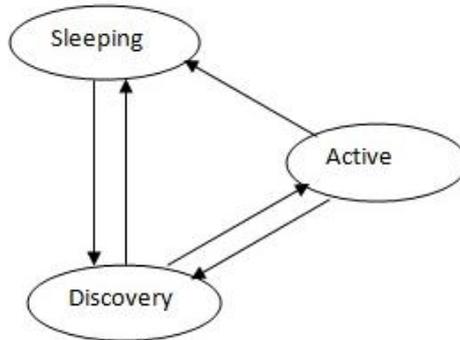


Fig.5. State Transition Diagram of GAF

### 2.2.3 Mecn and Smeecn

Minimum energy communication network set up and maintains a minimum energy network for wireless networks by utilizing low power GPS. We use this characterization to construct a protocol called SMECN (for small minimum-energy communication network). The sub network constructed by SMECN is provably smaller than that constructed by MECN. SMECN has lower link maintenance costs than MECN and can achieve a significant saving in energy usage. SMECN is also computationally simpler than MECN.

This protocol has two phases:

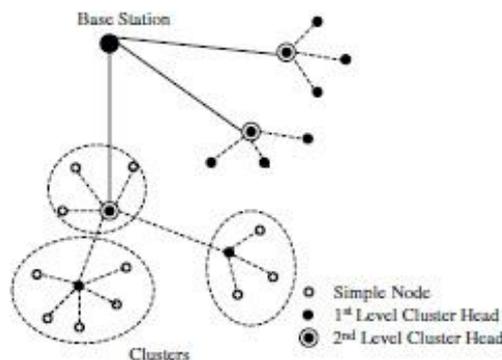
- The key property of the sub network is created by MECN is what we call the minimum energy property. It takes the positions of a two dimensional plane and constructs a sparse graph, which consists of all the enclosures of each transmit node in the graph. The enclosure graph contains globally optimal links in terms of energy consumption.
- It finds the optimal links on the enclosure graph. It uses distributed shortest path algorithm with power consumption as a cost metric. The small minimum energy communication network (SMECN) is an extension to MECN. In SMECN protocol; every sensor discovers its immediate neighbors by broadcasting a discovery message using some initial power that is updated incrementally.

### 2.3 Hierarchical Protocols

Hierarchical or cluster based methods [9] are well known techniques with special advantage of scalability and efficient communication. This protocol ensures the optimum utilization sensor nodes energy. Nodes play different roles in the network. In location aware routing protocols, nodes know where they are in a geographical region. Location information is used to improve the performance of routing and to provide new types of services. Clustering is an energy efficient communication protocol that can be used by the sensors to report their sensed data to the sink. Hierarchical routing is to efficiently maintain the energy consumption of network. This provides inherent optimization capabilities at the cluster heads. A network is composed of several clusters [8]. Where each cluster is managed by a special node called cluster head, which is responsible for operation of each and every node and coordinating the data transmission activities of all sensors in its cluster.

Representative Protocols of hierarchical routing are as follows:

- PEGASIS
- HEED
- TEEN
- APTEEN
- LEACH



### 2.3.1 Teen and Apteen

Threshold Sensitive Energy Efficient Sensor Network Protocol (Teen). The sensor network architecture is based on a hierarchical grouping where closer nodes from clusters and this process goes on the second level until base station is reached. TEEN is not a good for applications where periodic reports are needed since the user may not get any data at all thresholds are not reached. The Adaptive Threshold sensitive Energy Efficient sensor network protocol (APTEEN). The architecture of APTEEN is same as TEEN. APTEEN supports three different query types: historical, to analyze past data values, one time, to take a snapshot view of the network and persistent to monitor an event for a period of time.

### 2.3.2 Leach

LEACH routing Protocol. LEACH stands for Low-Energy Adaptive Clustering Hierarchy it is clustering based routing protocol to collect data from wireless sensor network. The reason we need network protocol such as LEACH is due to the fact that a node in the network is no longer useful when its battery dies. This protocol allows us to space out the lifespan of the nodes, allowing it to do only the minimum work it needs to transmit data.

LEACH is one of the first hierarchical routing approaches for sensor networks. In this algorithm formation of clusters is done on the basis of the received signal strength. The main objective of LEACH is to provide data aggregation for sensor networks.

The LEACH Network is made up of nodes, some of which are called *cluster-heads* the job of the cluster-head is to collect data from their surrounding nodes and pass it on to the base station. LEACH is *dynamic* because the job of cluster-head rotates.

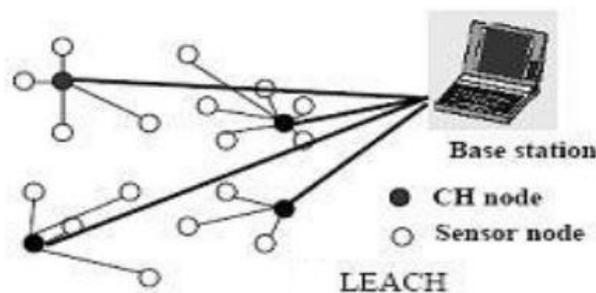


Fig.7. Basic LEACH

### 2.3.3 Power Efficient Gathering In Sensor Information Systems (Pegasis)

PEGASIS stands for Power Efficient Gathering in Sensor Information systems which are near optimal for this data gathering application in sensor networks. In PEGASIS there is a form like chain among the sensor nodes that means every node will receive data from and transmitting it to its closest neighbor. In that way data will be travelled from one node to another node and a designated node transmits to the base station [10]. For collecting the data in each round, each node will receives data from one of its neighbor, uses with its own data and transmits to other neighbor on the chain. In diagram node n2 is the leader, and it will pass the token along the chain to node n0. Node n0 will pass

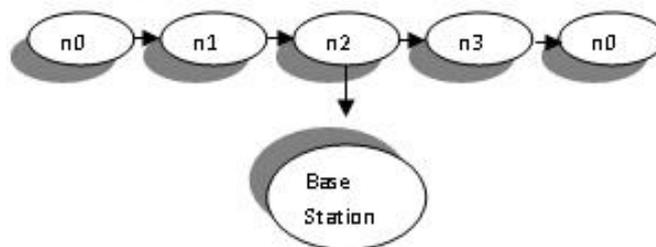


Fig .8 Chaining in Power Efficient Gathering in Sensor Information systems (PEGASIS)

### 2.3.4 Hybrid Energy Efficient Distributed (Heed)

Hybrid Energy Efficient Distributed (HEED) protocol is the clustering protocol. It uses using residual energy as primary parameter and network topology features (e.g. node degree, distances to neighbors) are only used as secondary parameters to break tie between candidate cluster heads, as a metric for cluster selection to achieve load balancing. In this all nodes are assumed to be homogenous i.e. all sensor nodes are equipped with same initial energy.

## 2.4 DATA –CENTRIC PROTOCOLS

Data centric routing paradigm has become popular in the area of sensor networks. Data-centric routing is based on queries that are issued by the sink to request data. These requests are not addressed to specific sensor nodes. Instead, the sensor nodes that can deliver the requested data will answer the query. Data-centric routing differs from topology-based and geographic routing in that sense, that messages are not forwarded to a specific host, which is determined by a network address or a geographic location. In data-centric routing, the sink issues a request for or interest in sensor data and the respective sensors will answer this query. As an example, the sink may request to be alerted, if a sensor measures a temperature increase by more than 10 degrees. This request is propagated throughout the network and answered by sensor nodes once the event occurs. In data centric routing, the end nodes, the sensors themselves, are less important than

data itself. The sink sends queries to certain regions and waits for data from the sensors located in a selected region. Data centric protocols are classified in to nine categories of routing protocols are as follows: SPIN, DD, RR, MCFA, GBR, IDSQ, CADR, COUGAR, ACQUIRE, EAR [11].

#### **2.4.1 Sensor Protocols for Information Via Negotiation (Spin)**

Sensor Protocols for Information via Negotiation was designed to improve classic flooding protocols. It is an application level approach; it shows a typical data-centric technique: First, a sensor advertises new data by sending a meta-data packet to its neighbors. The neighbor checks whether it already requested or obtained the advertised data. If not, it sends a request message that triggers the transmission of the actual data packet. The idea behind this protocol is to save the overhead of unnecessary transmissions of long data packets by negotiating requests beforehand using a small amount of meta-data. SPIN nodes use three types of messages for communication:

- ADV-When a node has new data to share; it can advertise this using ADV message containing Metadata.
- REQ-Node sends an REQ when it needs to receive actual data.
- DATA-DATA message contains actual data.

The SPIN family Protocol is made up of four protocols, SPIN-PP, SPIN-EC, SPIN-RL and SPIN-BC.

### **III. CONCLUSION AND FUTURE WORK**

Wireless Sensor Network has become large area in research from the recent years therefore in wireless sensor network there are many areas are available for study. In WSN one of the most concern thing is energy utilization of network. By then only lifespan of the network can be increased because sensor nodes are dependent on batteries. The network topology change dynamically. These essential properties bring addition challenges to routing protocols. In this Paper we are basically proposed routing protocols which are used in WSN and categorizing them in to three major categories like Data Centric (Flooding), Hierarchical Based Routing Protocols (Clustering) and Location Based Routing Protocols on the basis of network structure for the future point of view routing will be one of the most important topic in respect of node mobility and energy management.

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