

# A Survey on Various Routing Protocols in Wireless Sensor Networks

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**ABSTRACT-** Wireless Sensor Networks are particular networks composed of various tool in huge number and they distributed the space. The sensor nodes are used to sense the data and collect the information and send to the sink to complete the task. The network is composed of sensor nodes that are relay on the energy and the network lifetime is stand on the energy if energy of nodes are dead then the network lifetime of network is dead. To improve the energy level the clustering is used and routing protocol is used to increase the energy rate and efficient routing. There are various energy efficient routing protocol that increase the performance of WSN. In this paper we have discussed the various routing protocols for heterogeneous and homogeneous networks. The various routing protocols that are clustering based to increase the network lifetime.

**Keywords:** Clustering, Routing Protocol, Heterogeneous Network, Homogenous Network.

## I. INTRODUCTION

Wireless Sensor Network are new generation of the computer networks. WSN features large number of compact sensor node having constrained calculation potential, minimal recollection, restricted electric power and restricted abortment communicating appliances. All the sensor nodes send there data to the sink through routing protocol. There are several routing protocol that are used for routing the data from cluster head to sink. Most of the sensor nodes will be used above as a substantial geographic area to watch natural or even the enviornmental conditions, for example: heat range, appear, demand, etc. The most important parameter of WSN is sensor node. WSN has surfaced seeing that an important area with regard to investigation and development. In WSN ther are two components that is cluster head deployment location and sink deployment locations. In WSN the clustering technique that is used for solving the problem of network lifetime that is based on the energy of the network. The clustering is used to solve the energy limitation problem

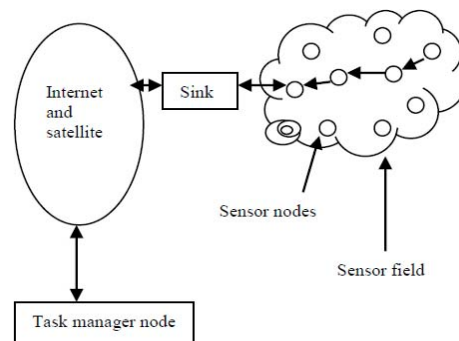


Figure 1: Architecture of WSN

In the architecture of WSN there is sensor field consist of sensor nodes contain information all sensor node send there information to the cluster head and that cluster send the data to base station by using routing protocol. The sink is known as the base station that send the data to the task manager by using channel that is: internet or satellite. Clustering is operation of collecting objects into groups whose associates are similar where we create homogenous groups, collection of objects which are similar and dissimilar between the objects belonging to other cluster which are known as the heterogeneous group. Clustering consist of two categories (I) Supervised (II) Unsupervised in supervised there is a target value or specified value is given, in unsupervised there is no target value is given and it is used for various data mining. The clustering should have high intra similarity and low inter cluster similarity. Intra-cluster is at local level where inter-cluster is globally declared. The main aim of cluster-based routing would be able to maintain the vitality usage of sensor nodes by relating them around multi-hop transmission with a demanding cluster. Cluster development is utilizing the vitality save connected with receptors i.e sensors along with receptors i.e. nearness to the Cluster-Head (CHs). Clustering works the significant position regarding vitality saving around WSNs. Having clustering around WSNs vitality utilization, length of time from the system along with capability of network can be upgrade. Since simply cluster-head nodes per cluster is required to complete directing employment along with the first kind sensor nodes simply ahead their points of interest to cluster-head. Clustering has basic applications throughout high density sensor networks, as it would be easier to control a set of cluster representatives originating from just about every set as contrasted with control complete sensor nodes. In WSNs your sensor nodes are resource handled so this means they've confined vitality, transmit power, storage, along with computational capacities. Vitality devoured from the sensor nodes for interacting details beginning with sensor nodes to the sink may be the main bring about of energy weariness in sensor nodes.. The routing protocols are used to improve the energy efficient rate of wireless sensor network.

*Clustering Protocols deal with two types of networks:*

**Homogenous Networks:** The sensor nodes that have same energy level to deal with hardware or software of the system and have same functionality. These are used for short range transmission of information.

**Heterogenous Networks:** Consist of sensor nodes that are same but have different energy level to deal with the system. They improve the network lifetime and these networks are best and used for longer transmission. The network lifetime is improved by using heterogeneous networks for data transmission because energy level of the each node is different.

## II. PROTOCOLS FOR HOMOGENOUS NETWORKS

### A. LEACH:

(Low energy adaptive clustering hierarchical) is a energy efficient cluster routing protocol based on hierarchical based approach. It is the most common clustering based protocol whose major function is to form the clusters. The chief goal of LEACH is to improve the network lifetime and less network energy consumption. All cluster is controlled by a prime Cluster Head (CHs). Different nodes are connected with CH for transfer of data from nodes to CH, CH then transmit the data to the BS via sink.

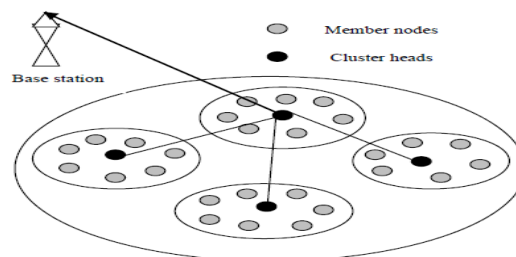


Figure 2: Cluster formation in WSNs

The CH used the scheduling technique of a Time Division Multiple Access based schedule to allocate a time slot to each cluster member(CM) for periodic data transmission to CH. CH then total the information to remove redundancy among connected qualities and finally it transmit the collected information directly to BS through sink. Haphazardly sensor node is selected for cluster head, so the high energy dispersal communicating with the sink in the system. The LEACH protocol based on the two phases:

Set-up phase : In the setup phase from each nodes the cluster head is elected.The cluster-head is selected on the basis of energy and the node that is near to the sink. Then the cluster-head collect the information from clusters, the information is send on the basis of TDMA. The scheduling technique is used on the clusters to send there information to CH. This phase of LEACH consume less time as compare to other phase.

Steady phase: In this phase the cluster-head that has been chosen in the set-up phase has been maintained and the cluster send there information to the cluster-heads. The sensor nodes start sensing the information and send data to the cluster head by using TDMA scheduling. After collecting all the data by the cluster-heads, they furthure communicate with the base station and transmitt all the information (data) to the base station.

If this random number is less than the threshold T(s), the sensor node is a cluster-head.

$$T(s) = \begin{cases} \frac{P_{opt}}{1 - P_{opt} \left( \frac{r}{r_{max}} \right)^{\alpha}}, & \text{if } s \in G^t \\ 0 & \text{Otherwise} \end{cases} \quad (1)$$

the vitality distribution is done and refurbish the hauling energies in it. Where separation will be assessed and upgrading of vitality will be hinge upon the accompanying given conditions.

$$d_{toCH} = \frac{r}{\sqrt{2\pi k}}, \quad d_{toBS} = 0.765 \frac{r}{\sqrt{2}} \quad (II)$$

$$E_{Tx}(1,d) = 1E_{elec} + \alpha_{fs}d^2, \quad d \leq d_0$$

$$E_{Tx}(1,d) = 1E_{elec} + \alpha_{sp}d^4, \quad d \geq d_0$$

$$\text{Where } d_0 = \sqrt{\frac{E_{fs}}{E_{mp}}}$$

**S** is the space of wsn

where,  $E_{fs}$  is the addition energy of free space

and  $E_{mp}$  is the mp  $\frac{dy}{dx}$  expansion energy field is more

1.1 where  $E_{elec}$  is the vitality devoured by the device for transmitting one piece of information.  $dov$  is the cross-over distance,  $E_{fs}$  and  $E_{mp}$  are amplifier energy to the collector, depending upon the distance and acceptable bit-error. If the distance is less than  $d_0$ , this used ( $d^2$  power loss); generally multipath model is utilized ( $d^4$  power loss).

B. Q-LEACH:

A new protocol for WSNs. WSNs can be used lifelong monitoring area and also required to function without unexpected changes. Additionally, obtaining better coverage area. By keeping these needs in mind a new protocol Quadrature-LEACH (Q-LEACH) can be created that's better with regards to network life span and also stability. This specific protocol where nodes usually are post in the area. Network splits into four parts to increase clustering. Splitting the network into parts that helps in improving coverage. In addition, it definitely indicates precise dissemination of nodes in field. This reduction into parts brings about high energy expenditure of sensor nodes. It may also help to make the decision absolute best position of CHs. In addition, communication load is also reduced. In LEACH clusters usually are not accurately characterized with regards to dimension a number of the clusters might be placed far-off. Simply because of the haphazard cluster formation remote nodes endures via high vitality drainage and also limit network performance. Interestingly with Q-LEACH the system is divide into quadrants(parts) and therefore, clusters shaped in these quadrants are unquestionably all the more acceptance. Subsequently, points are very well distributed inside of a certain cluster and also this leads to vitality utilization. Above mentioned understanding of localized association can be connected in every one sectored place of the offered idea. Q-LEACH, drastically expand network parameters and might be viewed as brilliant selection for WSNs just by upgrading network quality parameters. To acquire better clustering we isolate the networks into four quadrants or area by dividng better coverage of the entire network accomplished.

#### C. HEED:

HEED (Hybrid Energy-Efficient Distributed clustering), which regularly occasionally choose cluster heads(CHs) in view of a combination of the node remaining vitality alongside the second parameter, like node nearness to its neighbours and also node degree. It has demonstrated that making use of the appropriate bounds on node denseness along with intra-cluster transmitting stages, HEED might asymptotically practically certainly guaranteed connections of clustered networks. In this the dissemination of energy improve the lifetime of nodes within the network. The location-awareness and other capabilities are not required. It can't dissemination of the energy on the basis of assumption. It works effectively not withstanding when nodes are not synchronized.

#### D. PEGASIS:

PEGASIS("Power- efficient gathering in sensor information systems") proposed a technique titled PEGASIS. Its about ideal convention in addition to is desirable over LEACH convention.. In the proposed strategy every single sensing unit node sends which has a adjacent neighbor solely plus sends information to the BS(Base station) around turns, as a result small amount of energy is definitely put in every single cycle. PEGASIS follow the chain algorithm which is supreme for data collecting in sensing unit networks. Seeing that burden of data is distributed among all the nodes of network life range and brilliance of network is increased.PEGASIS use token passing methodology.

### III. PROTOCOLS FOR HETEROGENOUS NETWORKS

#### A. DEEC:

DEEC(Distributed Energy Efficient Clustering). In this the nodes are isolated into two classification that is: normal node and advance node. The cluster head is elected on the basis of residual energy. The advance node residual energy level is high as contrast with the normal node .DEEC prolong the stability point ,network lifetime and throughput for heterogenous network. The cluster head is elected on the premise of level of threshold value.

$$T(s) = \begin{cases} \frac{P_{opt}}{1 - P_{opt} \left( \frac{t}{n \text{ mod } P_{opt}} \right)}, & \text{if } s \in Q^i \\ 0 & \text{Otherwise} \end{cases} \quad (1)$$

In this way, DEEC figure perfect number of CHs for each cycle from the following two conditions[17]. The two probability capacity for the normal node and advance are as given below.

$$P(i) = \begin{cases} \frac{Pop_i E_i(r)}{(1+m)E(r)} \\ \frac{Pop_i(1+\alpha)E_i(r)}{(1+m)E(r)} \end{cases} \quad (III)$$

where,  $E(r)$  is the undistinguished vitality of the network at cycle  $r$  and is given by:

$$E(r) = \frac{1}{N} \sum_{i=1}^N E_i(r) \quad (IV)$$

$E_i(r)$  is the halting vitality of the node at cycle  $r$ . Based on  $P_i$ , it calculates threshold as:

$$P(Sadv) = \frac{Pop_i N(1+\alpha)}{(N + \sum_{i=1}^N \alpha)}$$

DEEC calculates if the remaining vitality of the node is higher than the normal vitality of the network, then it has enhance opportunities to transform into a (CHs). Thus, energy is well disperse in the network as it extend.

**B. SEP:**

SEP(Stable Election Protocol) it is the modification of LEACH for the heterogeneous networks. The nodes that have high energy are known as the advance nodes the advance nodes has more chances to become cluster-head as compare to normal nodes. No information about energy level that are required at every cycle of the election. The major drawback of the SEP is that the election of cluster head between the normal and advanced node are not dynamic, which result that the node die before the powerful node.

**C. EDDEEC:**

EDDEEC(Enhanced Developed Distributed Energy Efficient Clustering). This protocol is sent for the heterogeneous network. It is the idea of three level heterogeneity the nodes are separated into sub classes that are normal, advance and super advance. The whole function is performed in rounds,since this networks is heterogeneous in this all the nodes divided into different energy levels in their initial stage. The chances of super advance nodes are more to become the cluster head as its residual energy level is high as compare to the normal and advance. The probability function for three nodes are as :

$$P(i) = \begin{cases} \frac{Pop_i E_i(r)}{[1 + m(a + m_0 b)]E(r)} \\ \frac{Pop_i(1 + a)E_i(r)}{[1 + m(a + m_0 b)]E(r)} \\ \frac{Pop_i(1 + b)E_i(r)}{[1 + m(a + m_0 b)]E(r)} \end{cases}$$

The scalability and the network lifetime by using this protocol is more efficient as compare to DEEC. The cluster head is elected on the basis of level of threshold value as in DEEC.

**D. BEENISH:**

Normally, heterogeneous systems utilize 2 or 3 imperativeness level of sensor nodes. Having said that really, heterogeneous WSNs incorporate extraordinary number of imperativeness levels. In the wake of inquiring about essentials utilization by the clusters alongside incredible number of imperativeness level in heterogeneous WSN, BEENISH (Balanced energy efficient network integrated super heterogeneous) convention

is presented. It is viewed as that WSN having four vitality levels of nodes. Amid this standard protocol cluster head (CHs) tend to be decided on simply by looking at residual vitality levels of nodes. This is superior to anything as of late composed bunching systems of heterogeneous WSNs. BEENISH utilizes the same origination, for example, DEEC, relating to decision of CH. In heterogeneous system the nodes are categorized in this the nodes are divide into four level that are normal node,advance node,super node,ultra-super node. The probabilities of these four level node are as:

$$P(i) = \begin{cases} \frac{Pop_n E_i(r)}{(1+m_1(a+m_2(-a+b+m_3(-b+u)))E_i(r))} & \text{normal} \\ \frac{Pop_a(1+a)E_i(r)}{(1+m_1(a+m_2(-a+b+m_3(-b+u)))E_i(r))} & \text{advance} \\ \frac{Pop_s(1+b)E_i(r)}{(1+m_1(a+m_2(-a+b+m_3(-b+u)))E_i(r))} & \text{super} \\ \frac{Pop_{us}(u)E_i(r)}{(u+m_1(a+m_2(-a+b+m_3(-b+u)))E_i(r))} & \text{ultra} \end{cases} \quad (v)$$

This P(i) is calculated on the basis of normal,advance super and super-ultra the value of this probability is used in threshold equation to select the cluster head(CH). This protocol enhance the stability period,throughput and network lifetime as compare to DEEC,SEP,EDDEEC .

#### IV. RELATED WORK

The main aim of routing protocol is energy efficiency of nodes(sensor nodes) by using less power consumption of WSN. Different routing protocols are utilized to keep up the scalability,time and system lifetime. Some of routing protocols are hierarchical based ,use information collection techniques. Some of them are hierarchical based,location based and so on. GSTEB(General Self-Organized Tree-Based Energy –Balance directing protocol)[15],[8] EERRP(Energy Efficient Reliable Routing Protocol),[13] EEHC(Energy efficient heterogeneous clustered),[12]Q-LEACH (Quadrature-low energy adaptive clustering hierarchical),[9] HEED(hybrid energy efficient distributing clustering),[14] BEENISH(Balanced energy efficient network integrated super heterogeneous convention) Z.Han et al. [2014] proposed a General Self-Organized Tree-Based Energy –Balance directing convention (GSTEB) which thusly made some kind of steering tree using an undertaking where, each round ,BS assign some kind of root hub notwithstanding transmit this sort of collection to all sensor hubs. At that point, every one hub pick the guardian or gatekeeper through into thought just themselves and neighbors' data, this makes GSTEB a dynamic convention. B. S. Mathapati et al. [2012] outlined another force productive steering convention known as An Energy Efficient Reliable Routing Protocol for Wireless Sensor Networks (WSN) that regularly be gathering based i.e group based. Information accumulation appeared to be basically used to gather furthermore total data in a force effective way so that length of system appeared to be improved. Dilip kumar et al. [2009] in paper "EEHC: Energy efficient heterogeneous cluster plan for wireless sensor networks present a energy efficient heterogeneous cluster plan for WSN set up upon thought choice probabilities of every last hub(node) to for the most part be chosen similar to a group head (CH) as indicated by the residual energy in every sensor hub. Key favorable circumstances of Hierarchical or cluster based routing are adaptability and effective communication. Low-energy adaptive clustering hierarchy (LEACH) has turned into distributed cluster-based routing protocol bunch based steering in WSN. B. Manzoor et al. [2013] in paper "Q LEACH: A new routing protocol for WSNs " . WSNs can be utilized enduring checking with fields furthermore are required to work without sudden changes. Furthermore, getting better scope range. By remembering these necessities another convention Quadrature-LEACH (Q-LEACH) can be made that is better as to network life range furthermore steadiness. In this specific convention hubs for the most part are positioned in the area. System parts into four quadrants to upgrade bunching. Division of system into quadrants helps in enhancing scope. What's more, it unquestionably shows precise dissemination of hubs in field. This division into quadrants achieves more noteworthy vitality utilization of sensor hubs. O. Younis et al.

[2004] exhibited another convention, HEED (Hybrid Energy-Efficient Distributed clustering), which frequently sporadically pick group heads taking into account a half and half of the hub lingering vitality alongside the second parameter, similar to hub closeness to its neighbors furthermore hub degree. It has exhibited that making utilization of the suitable limits on hub thickness alongside intra-group transmitting stages, HEED may asymptotically for all intents and purposes surely ensured associations of bunched systems. T.N. Qureshi et al. [2013] in paper "BEENISH: Balanced energy efficient network integrated super heterogeneous protocol for wireless sensor network " considered that Clustering is a brilliant procedure to facilitate enhance vitality productivity. Generally, heterogeneous systems utilize 2 or 3 imperativeness level of sensor hubs. Having said that really, heterogeneous WSNs incorporate incredible number of imperativeness levels. In the wake of exploring essentialness utilization by the bunches alongside awesome number of imperativeness level in heterogeneous WSN, BEENISH convention is presented. In this paper it is viewed as that WSN having four vitality levels of hubs. Amid this standard convention group head (CHs) have a tendency to be settled on just by taking a gander at residual energy levels of hubs(nodes).

## V . DENSITY GRID-BASED CLUSTERING

### *DENSITY GRID-BASED CLUSTERING:*

Is the combination of two algorithm i.e density-based clustering and grid-based clustering. This clustering is used on dense network. In this system is separated into the different grids(cell). This calculation is use for high element systems. The braces' methodology utilized as a part of this examination is executed on thick system and partitions the system range into numerous network cells with various densities (High, Low, and empty)(18). Information total at the base station by individual hubs causes flooding of the information which results in most extreme vitality utilizationThe new technique is used for data aggregation is density grid-based clustering algorithm in this the densely deployed nodes are clustered and the one CH(cluster head) is selected among all the clusters then cluster head communicate with the base station. The nodes is divided into two i.e normal and advance nodes. The advance nodes has innumerable chances to develop into a cluster head (CHs). The cluster head(CH) is elected on the premise of minimum distance of advance node to the base station. The threshold value:

$$\sigma = \sqrt{\frac{1}{N} \sum_{i=1}^N (x_i - \bar{x})^2}$$

Where  $x_i$  is a single node and the  $\bar{x}$  is the mean of the number of nodes in the network and N is total number of nodes in the space. If node are more then or double than the standard deviation  $\sigma$  the grid is considered as high dense grid.

## VI. CONCLUSION

WSNs based on clustering. In the application WSNs based on energy and bandwidth of the sensors are valued resources and essential to consume proficiently. The different clustering algorithms are used for data aggregation and the . Data gathering at the base station by individual nodes causes flooding of the data which consequences in maximum energy consumption. The survey has been done in this paper on various protocols for the hetrogenous and homogeneous network.but the effect of the mobile sink in this energy efficient protocol have been ignored. The new data aggregation algorithm that is density grid-base algorithm for dense area network will be considered by using artificial bee colony advancement system for energy effective routing furthermore the utilization of density grid-based clustering for new enhanced energy efficient routing protocol.

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