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A State of Art Approaches on Energy Efficient Clustering Techniques in WSN

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Abstract— Nowadays, Wireless sensor network (WSN) exhibits growth in application such as disaster management, wildlife monitoring and military surveillance. As the environment is unfriendly, human cannot access the place to sensor monitory or to deploy the sensor in this applications. Hence, the sensor must be deployed remotely and to be operated in a robotic mode. The nearby nodes are linked to produce a cluster without disjoint or overlap to aid scalability. From the different published WSN clustering method, clustering attributes classification are projected in this paper. The clustering methods are compared depending on the measures like uniform clustering, position awareness, sensor mobility, efficient energy-based, cluster stability, clusters overlap.

Keywords— *WSN; Energy; Clustering; CH* (key words)

I. INTRODUCTION

Current advancement in WSN tends to enhance the multi-functional sensors, low-cost, limited-power, tiny-sized which are able to communicate on short distance rate. To allow data processing, sensing and communication [1], sensors are placed with power components, radio receiver and microprocessor. Therefore, sensors operate with batteries; reduction in the energy utilization to extend network life span is a main difficulty in the WSN.

The sensors are undergoes arbitrary deployment with BS in the sensing domain. The sensor's function is to observe the physical circumstances such as light, humidity, disaster, temperature and disaster and send the information to base station (BS). The BS might be deployed long away from sensing field. Every sensor node has to intimate the observed data to the BS directly or indirectly. While comparing to the far placed sensors, the sensors which are closer to the BS use low energy. More the utilization of energy, sensors lifespan will be reduced. WSN comprise applications ranges such as area monitoring, military surveillance, health monitoring, disaster management, air pollution monitoring. It is not feasible for the user to interact with the nodes or manage them since the surrounding is so hard in few applications such as disaster management. These applications need numerous nodes that to be placed. In a remote way, the sensors requires to be placed and operated robotically[2]. To handle the thousands of sensors, WSN must be scalability feature. Clustering method is employed to aid scalability and to diminish the sensor node energy utilization. In the subsequent section, a detailed discussion of clustering is projected.

Clustering is a way of grouping sensor nodes to a various number of clusters. A node known as Cluster head (CH) will be elected from each node to a various cluster count and the rest of the nodes termed as cluster member (CM). The CM of the nodes is elected from the cluster and senses the physical environment and sends it to the data to the CH. The CH acts a process of data aggregation that are gained and reported from the data to the BS. The CMs send the data to the CH via directly and are called as intra-cluster arrangement [3]. The major benefit of clustering is that it support high scalability [2]. The CH is arbitrarily selected from the collection of the nodes, or it will chosen by the WSN itself. In some situations, the CHs will be present and offered with resources [2]. It makes the cluster construction stable throughout the WSN as the CH is stationary.

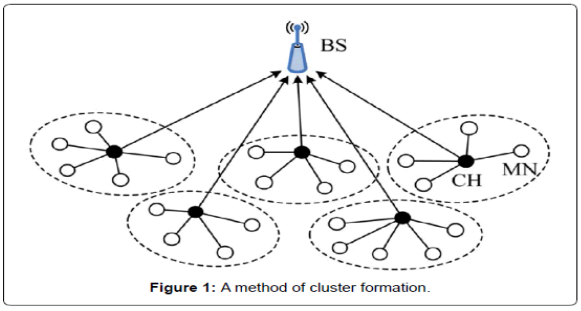

Fig. 1. Clustering technique in WSN

When the CHs are chosen arbitrarily, then the clusters become stable and modify in a dynamic way. On comparing with the CMs, the CHs should be supported by high energy and it should be in active condition.

II. SURVEY OF EXISTING CLUSTERING TECHNIQUES

The description of available clustering approaches is given and against the measures of position awareness, uniform clustering, sensor mobility, efficient energy-based, cluster stability, cluster overlap are compared.

A. Improved EADUC Protocol

In [4], the nodes are haphazardly deployed and the available energy is not unique. BS is situated a long way from the sensing region. It works in two phases. Once the nodes are set, BS communicates a sign to every one of the nodes. The nodes at that point inexact its separation to the BS using signal strength that is received. Each round includes two phases: cluster setup phase and construction phase. Setup phase comprise of three sub-stages. The main sub-stage is the data gathering in neighbor node. In the next stage, the choice of CHs happens. In the last sub-phase, the cluster development begins. When the system is isolated into clusters, the enduring state organize starts in which the transmission of data carry out. The standard state comprises of number of real openings. After one main space, the CH pivot occurs. An augmentation of EADUC protocol is projected so as to decrease the cluster load and furthermore to adjust the energy.

B. CH Rotation Mechanism

In [5], for an arbitrary time frame the sensors move into inert mode. The node itself chooses and proclaims them as a CH and communicates a notice message to every one of the nodes inside the range. Subsequent to accepting the reaction from the adjacent nodes, it chooses whether to proceed as a CH or to merge as a part node in any of the previous clusters. For CH pivot, it utilizes a method where the underlying CH names the successor CH depending on the data gathered by the underlying CH. This data comprises the recognizable proof of part nodes arranged according to signal strength perusing and arranged in a packet known as NODE pkt. This packet comprises net area region with the ID of the descendant CH. The underlying CH imparts the packet to the successor CH. Along these lines, the CHs are turned.

C. DUCF Protocol

In [6], at first every one of the sensors is haphazardly sent. Signal strength is utilized to figure the separation among the sensors. Three measurements are assumed for choosing the node as a CH specifically node remaining energy, node level, and separation from the node to BS. Likewise, two yield factors are additionally utilized specifically possibility and size. It works in two phases: cluster development phase and data accumulation phase. The CHs are chosen in first phase by utilizing fuzzy logic. In the data accumulation stage, a TDMA plan is created by every CH and the nodes ought to throw the data to the CH inside that plan.

D. Hierarchal Clustering Algorithm with CH Selection

For the most part, a hierarchical protocol had done using two layers. The principal one is utilized for choice of CHs, and the next one is utilized for data routing. The clustering method component referenced in [7] is utilized for CH choice. Here, CH determination is the main element which goes for diminished energy utilization. And, three parameters are utilized specifically, remaining energy of the hub, remove from the BS, and level of the hub (encompassing nodes). In each round, the heaviness of every hub is determined utilizing the previously declared three attributes. The node with the most extreme weight will be chosen as CH.

E. Mobile Sink-Based Method

In [8], sensor nodes are arbitrarily sent and are stationary. However, the BS is movable So as to lessen the traffic on the solitary mobile BS, two mobile BSs are utilized and they are in movement in the counter clockwise way for each 50% of the round. LEACH protocol is utilized for the cluster arrangement and CH determination. The detecting field is similarly isolated into areas and every district comprised of clusters which are of unequal sizes. At first, the hub which is at the jog of the area is chosen as a CH. Toward the finish of each round, the hub that is nearer to the jog point and the hub that is having higher leftover energy are chosen as a CH. As the sink is mobile, nodes must set up the course to convey the data comparing to the new area of the sink. Just a single CH is in charge of keeping up the new course data of the mobile sinks.

F. SECC Protocol

In [9], the SECC comprises of two stages. In the main stage, the energy of a particular hub and the separation among its contiguous sensor nodes is determined. Sensor nodes with almost same normal separation run are assembled into identical clusters. In the following stages, energy-mindful clusters are framed using the threshold concept. The nodes which has the energy rate is not as much as edge is handicapped and don't take an interest in the sensor activities.

G. P-LEACH Protocol

In [10], P-LEACH utilizes the blend of both PEGASIS and LEACH protocols. From PEGASIS, chain development execution is assumed and from LEACH, data transmitting by the CH is assumed. The nodes are isolated into clusters depending on the detecting scope of the REQ message passed by the BS. At that point, every one of the nodes of each cluster sends their area and the energy data to the BS.

Table 1 Comparison of reviewed approaches under several aspects

Reference	Sensor mobility	Overlap of clusters	Position awareness	Efficient energy based	Uniform clustering	Stability of cluster	Scalability
[4]	No	No	No	Yes	No	Yes	Yes
[5]	No	No	No	Yes	Either balanced or unbalanced	Yes	Yes
[6]	No	No	No	Yes	Yes	Yes	Yes
[8]	No	No	No	Yes	No	Yes, nodes-static, BS- mobile	Yes
[7]	No	No	No	Yes and delay is also considered	Clusters are constructed	Yes	Yes
[9]	Yes	No	No	Yes	Distance metric	No, because new clusters are produced in every round	Yes
[11]	No	No	No	Yes	Initialization of clusters generated by any method	Yes	Yes
[12]	No	No	No	Yes	Yes	Only cluster formation is discussed	Yes
[13]	No	No	No	Coverage area issue	Using cover set	No	Yes
[14]	No	No	No	Yes	Yes	Yes	Yes
[15]	No	No	No	Yes	Intra cluster distance	No	yes

Presently for CH determination, the BS chooses a hub with higher outstanding energy as a CH for each cluster. After the decision of the CHs, the CH with least separation to the BS and with greatest energy is chosen as a pioneer.

H. H-LEACH Protocol

H-LEACH presented in [11] is the mix of HEED and LEACH approaches. At the point when the setup stage is begun, at first the normal energy of the considerable number of nodes is determined by utilizing the necessary variables. At that point, the limit esteem is determined. Presently, an irregular number is picked by the hub in the scope of 0 and 1. In the event that the irregular number is not exactly the edge and the sensor holds the energy more prominent compared to the normal energy, at that point the relating hub is chosen as a CH. The energy needed to transmit data is deducted from the node energy.

I. Clustering Using Fuzzy Logic

In [12], the approach works in two stages. Remaining energy and the needed energy are the two etymological info factors utilized in the fuzzy logic framework. In the primary stage, every sensor hub ascertains the energy needed to transmit 'k' number of bits to the BS using signal strength of the message transmitted by the BS. Nodes set its clock esteem contrarily relative to the yield variable of the fuzzy logic framework known as 'shot'. The higher the estimation of shot, the more will be the likelihood of the node to end up a CH. Every sensor node sets the commencement, and in the event that it achieves zero, the hub promotes itself as a CH and clusters are framed based on the separation between the sensors. In the second stage, TDMA plan is utilized by the CH and sends it to the cluster individuals.

J. Area Coverage-Aware Clustering Protocol (ACACP)

In [13], the setup phase arranges comprises of data refresh, sensor enactment, CH race, and hand-off hub choice stages for the development of clusters. Consistent state arrange comprises of data correspondence stage in which the dynamic sensor hub gathers the data now and again and sends this data to the CH nodes. At that point, CHs total the data and transmit these data to the BS through the relaying node.

K. Virtual Grid Margin Optimization and Energy Balancing Scheme (VGMEB)

In [14], the system is sorted out as networks so as to accomplish uniform clustering. Here, every matrix of the system utilizes cluster evaluation model to choose the CH. The cluster evaluation demonstrate is the likelihood of

choosing the CH which is situated at the lope of the lattice with the goal that the utilization of energy can be decreased. The load factor of the hub is determined to discover the likelihood of determination of a CH. The chose CH is in charge of forwarding the data to the sink by performing data fusion. As the sink is mobile, it is in charge of advising its area to all the CHs while moving starting with one lattice then onto the next.

L. Hybrid Backtracking Search Optimization Algorithm (BSA)

The protocol in [15] is a hybrid of genetic algorithm and k-means. Crossover, Selection and mutation activities are performed. This algorithm has two determination organizes so as to refresh population 'P' with definite trial population 'T' people, in the event that they have preferred wellness esteem over 'P'. Next, k-means algorithm is hurried to discover the centroids for the clusters. These centroids are mapped to the closest sensor nodes to acquire new CHs and again new clusters are framed. Table 1 shows the summary of all the clustering protocols with their attributes.

III. CONCLUSION

Few clustering methods have been studied in this paper and these methods are divided depending on the clustering attributes, position awareness, clusters overlap, sensor mobility are the measures that are compared for the methods of clustering. At the end, clustering method highly reduces the energy consumer through the nodes and hence extend the network stability. Every method that are illustrated can be treated as the domain milestone, a distinct solution or a considerable enhancement over previous method. We try to tend useful resource for practitioners and researchers in the domain of WSN.

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