Power efficient in WSN supported clustering and tree technique

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Abstract. WSN (Wireless Sensor Network), an outsized quantity of sensor nodes are establish and that they for the most part devour power in communicating information over significant distances. Sensor nodes are power unit managed and their power is compact. Compact power unit face the problem of limited power unit lifetime that has become the main issue in these networks and which represents to a test to their plan and the board. There are several forward (routing) protocols are implemented on WSN to transfer the info supported the top user need. The main goal (target) of the forward protocols is to compress the consumption of nodes power and develop the nodes life time. Between many forward protocols, In PEGASIS, there are so many used protocols; each protocol overcomes their drawbacks on further improvements. In this paper proposed a novel procedure by establishes a crossover calculation for clustering and cluster follower choice inside the WSN. After the decision of cluster leader and follower nodes, the proposed Tree method is set up for apportioning and preparing the information. The proposed plot productively reduces the unseeing transmission messages yet additionally diminishes the sign overhead in light of the fact that the aftermaths of cluster arrangement. Inevitably, the forward strategy is given upheld the layered design. The proposed Tree engineering productively limits the forward ways toward the base station. Complete investigation is performed on the proposed plot with cutting edge unified bunching and circulated clustering procedures. From the outcomes, it is indicated that the proposed plot performs better than LEACH.

1. Introduction
Current updating inside the field of remote specially appointed and sensor network has advanced the occasion of minimal effort and low force sensors. Ordinarily, the remote sensor gadget is a scaled down and little gadget that is worked by power unit, which is regularly hard to charge continuously conspire. These sensors have expanded an area of intrigue, where they can detect, gather, and cycle data. Inside the expand area, these gadgets are worked self-sufficiently in distant or threatening territories where human contribution is incredible. Clustering is one among the most efficient forward techniques to beat the constraints imposed by the WSN environment and to realize power balancing within the network getting to arrange the network in clusters where each member node sends its collected data to its CL via the low-power link, which then aggregates them and sends them to the depth stage. This paper proposes a hybrid protocol called “Power efficient in WSN supported Clustering and Tree Technique. Its partitions the organization into clusters, each cluster includes a cluster leader and is chosen supported the utmost residual power. In sensor nodes each cluster impart the data to its cluster leader. The cluster leader aggregates the info sent by its members and therefore the aggregated data forwards to the neighboring cluster leaders communicated to the sink using Hop Tree. Since this protocol uses to eliminates transfer of redundant data, thereby minimizing the power consumption and maximizing the duration of the system. Rest of the paper is sorted out as follows: inside the following area, we'll present related work; Section 3 examines the proposed calculation. Area 4 presents reenactment results and Section 5 presents the ends.
2. Related work

Low Power Adaptive Clustering Hierarchy (LEACH)” [1] [9][12] is one among the preeminent mainstream grouping conventions. It structures groups by utilizing a disseminated calculation. Every node has a comparable likelihood of turning into a cluster leader and subsequently the assignment of being a cluster leader is pivoted between nodes reliable with a round time. This guarantees reasonable force dissemination between nodes. A non-cluster leader node in each cluster sends its information to its cluster leader. The cluster leader packs the information got from part nodes and sends the compacted information to the base station.

In LEACH-C [2] [10], clusters are shaped by concentrated control calculation and it creates better clusters by spreading the Cluster leader all through the organization. The consistent stage is similar to thereto of LEACH, however, varies in arrangement stage. Inside the arrangement stage, each sensor nodes sends its capacity data to far off Base Station and this data is utilized to pick the Cluster leaders [11]. The base Station at that point communicates the ID of bunch head to other part nodes. During this strategy, the nodes with more force have more odds of turning into the Cluster leader inside the current round. Be that as it may, during this stage, each sensor node must send its ID and force data to far off Base Station to vie for the function of Cluster leader which devours power in significant distance change.

Lindsey et al. proposed “(PEGASIS) Power-Efficient Gathering in Sensor Information Systems” [3] [13], a force effective convention which gives improvement over LEACH. In PEGASIS, every node discusses just with a near to neighbor to trade information. It alternates to communicate the information to the base station, in this way decreasing the amount of intensity spent per round. The nodes are sorted out in such how before long structure a grouping, which may either be shaped by the sensor nodes themselves utilizing a covetous calculation extending from a specific node or the base Station can figure this chain and broadcast it to all or any the sensor nodes.

Vaibhav V. Deshpande et al. proposed "Power Efficient Clustering in Wireless Sensor Network utilizing Cluster of Cluster Leaders” [4] [15]. To adjust power utilization among the Cluster Leaders, this convention proposes to have cluster of cluster leaders inside the group of sensor nodes. Given a glimmer, one cluster leader go about as ace of the given cluster and accordingly the ace boat is turned among cluster leaders after determined number of rounds of correspondence. This improves the force use of sensor organization, boosts the organization lifetime and makes the Wireless Sensor Network deficiency lenient somewhat.

Neng-Chung Wang [5] [14] proposed “Cluster-Support Info Together in Wireless Sensor Networks” (GBDAS) during which the network is split into 2-D logical cluster of rooms. Where each room, the node with most extra power is selected in room head. In room head from each room aggregates its own data with the info sent by all other nodes. All the room heads are linked to make a sequence. The chain leader is designated supported the foremost residual power of all the room heads. During this protocol, (IJWWMN) International Journal of Wireless & Mobile Networks No.3, Vol. 7, June 2015
Since the room heads and therefore the chain leader are designated supported the power state, the power depletion of the nodes is distributed evenly.

An Adaptive Power aware Data aggregation Tree” (AEDT) [6] uses the utmost power available node because the data aggregator. The tree incorporates sleep and awake technology, where the communicating node and therefore the before the parent node are in awake state and the remaining nodes attend sleep state. When the traffic load crosses the edge value, the packets are accepted adaptively consistent with the communication capacity of the parent node. It maintains a memory table which stores the worth of every selected path. Path selection is predicated on shortest path algorithm where the node with highest available power is usually selected because the forwarding node.
A Cluster-support and Tree-support Energy Efficient Info Group and Collection Protocol for Wireless Sensor Networks’ (CTPEGCA) [7] is predicated on clustering and Minimum Spanning Tree forward master plan for cluster leaders. The performance of CTPEGCA is best than that of LEACH protocol. It prolongs the lifetime of the network and its time difficult are little i.e., \(O(E\log V)\), where \(V\) is that the stand of cluster leaders.

### 3. Proposed algorithm

The proposed framework for example "Power Efficient in WSN upheld Clustering and Tree Technique comprises of two stages: Setup Phase and Steady Phase. Arrangement Phase shapes a group of sensor nodes and chooses a Cluster Leader. In each group, the node with the absolute best leftover force is chosen in light of the fact that the Cluster Leader. Inside the Steady Phase, the sink node builds a base station. The sensor nodes in every one of the bunch send information to the chosen group leaders. These chosen bunch leaders total the data and accordingly the equivalent is sent to the sink utilizing the developed Base station.

#### 3.1 Cluster leader election

In the Setup Phase, every node communicates its remaining force inside the radio range \(r\). Each node subsequent to getting the message from every one of its neighbors refreshes the local table. The node with the absolute best lingering power is chosen on the grounds that the group chief. Moreover, every node is haphazardly allotted value esteem. When quite one node has an equivalent highest residual power, then the nodes with more cost are going to be the Cluster Leader. Table 1 shows the Cluster Leader Election Algorithm.

| Table 1. Cluster Leader Election |
|---------------------------------|
| 1. Emax <-0                     |
| 2. Nmax <-NULL                  |
| 3. Costi<-rand( )               |
| 4. for each Ni, iem(Ni: ID of node) |
| 5. Broadcast available power Ei within i cluster range |
| 6. Compare Ei and Emax          |
| 7. if (Ei > Emax)               |
| 8. Emax <- Ei                   |
| 9. Nmax <- Ni                   |
| 10. end if                      |
| 11. if (Emax == Ei)             |
| 12. if (cost(Ni) >cost(Nmax))   |
| 13. Nmax <- Ni                  |
| 14. end if                      |
| 15. end if                      |
| 16. end for                     |
| 17. return Nmax                 |
| 18. Nmax broadcast status to its neighbors as Room Leader |

#### 3.2 Forward tree generation

Once the room leader is elected and therefore the nodes within the room want to transfer data to the sink, it becomes essential for the room leader to speak the info to the sink using shortest path. A Hop Tree is made for locating the shortest path from the room leaders to the sink. Table 2 below depicts the Hop Tree Construction Algorithm.

| Table 2. Hop Tree Construction Algorithm [8] |
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| 3 |
1. Every Room Leader sends its status to Sink
2. HTS sink <- 0
3. HTS Ni <- ∞
4. Sink floods HCM( Type, ID, HTS) to Room Leader List
5. if ( HTS(u) > HTS(HCM)+1)
6. NH (u) = ID (HCM)
7. HTS (u) = HTS (HCM)+1
8. ID (HCM) = ID (u)
9. HTS (HCM) = HTS(u)
10. end if
11. u transmits HCM to its neighbors

The good ways from the sink to each node is processed in jumps. The sink floods the Hop Configuration Message (HCM) to all or any the room chiefs. The HCM message contains three fields: Type, ID and HopToSink where Type is kind of the message i.e., HCM, ID is hub identifier that began or retransmitted the HCM message and HopToSink is that the separation in jumps by which a HCM message has passed.

The HopToSink esteem begins with esteem zero at the sink and advances it to its neighbors (toward the beginning, all Room Leaders set the HopToSink as boundlessness). Every room chief after accepting the HCM message checks if the HopToSink esteem inside the HCM message is a littler sum than its own. Assuming this is the case, the hub refreshes its Next Hop an incentive with the value of the ID field in HCM message, moreover, the estimations of HopToSink variable and ID field of HCM message is refreshed as in Table 2. Room leader currently transfers the refreshed HCM message. Something else, the room chief disposes of the got HCM message. The above advances are rehearsed until the whole organization is arranged. All the refreshed data for example NextHop and HopToSink for every Room Leader is put away in forward table rTable.

3.3 Intra-cluster correspondence
In their allocated schedule opening, the non-leader nodes in every framework impart the detected information to their individual room leader. When all the room individuals in the organization wrap up their detected information, between Intra-Cluster correspondence stage starts. In a thickly populated sensor organization, the zone identified by sensors may cover and in this way the information detected might be related. This causes information repetition at the phone chief during intra-cluster correspondence. In addition, much vitality is devoured in handling comparative information and results in more vitality utilization. Consequently, information conglomeration is performed during intra-cluster correspondence.

Table 3 shows the Intra-Cluster Correspondence Algorithm. The nodes in each cluster transmit the sensed degree info to the elected Room Leader. The Room Leader in each cluster aggregates its own data with the info received from all other nodes in that room using an average function

| Table 3. Intra-Cluster Correspondence Algorithm |

1. n <- no. of Room Member in each room
2. for every room Ci
3. for every Room Member j in Ci
4. Send degree (CM j) to Ch
5. end for
6. sum <- Σj=1 to n degree (CM j)
7. Avg( CL I) = Sum/n
In Figure 1, beneath represents Intra-Cluster Communication. Every node is marked with node id followed by its leftover power level. Taking the case of base furthest right network, it tends to be seen that the node with id 42 has the most elevated remaining power of 95 Joules and subsequently it is chosen as cluster leader. The wide range of various nodes in that network sends its degree information to the node with id 42. This node totals its information with the information of all different nodes utilizing normal capacity.

In Inter-Cluster Correspondence, steering happen between room heads of various rooms and the information is transferred to the sink. Ways are set up from each room chief to sink utilizing Hop Tree Construction (HTC) Algorithm of Table 2 and the following jump data for each room chief is refreshed in the directing table. Each room chief gets to the following jump data and advances its information until its HopToSink (HTS) tally diminishes to zero. Table 4 beneath represents the Inter-Cluster Correspondence Algorithm.

3.4 Inter-cluster correspondence

In Inter-Cluster Correspondence, steering happen between room heads of various rooms and the information is transferred to the sink. Ways are set up from each room chief to sink utilizing Hop Tree Construction (HTC) Algorithm of Table 2 and the following jump data for each room chief is refreshed in the directing table. Each room chief gets to the following jump data and advances its information until its HopToSink (HTS) tally diminishes to zero. Table 4 beneath represents the Inter-Cluster Correspondence Algorithm.

Table 4. Between cluster Correspondence Algorithm

1. for each CLi in directing table rTable
2. src <- CLi
3. while (hoptosink(CLi ≠ 0))
4. Send Avg(CLi) from src to nexthop(src)
5. hoptosink(CLi)= hoptosink(CLi) - 1
6. src<- nexthop(src)
7. End while
8. End for

In Figure 2, beneath represents how the information totaled from every one of the Room Leader is sent to the sink utilizing the built Hop Tree. The accumulated information from Room Leader C4 and C6 is sent to Room Leader C3. The Room Leader C3 totals its own information with that of C4 and C6 and sends it
to Room Leader C1. The Room Leader C1 totals its own information with that sent by C3 and the equivalent is dispatched to the sink.

Figure 2. Inter-Cluster Correspondence

4. Simulation results
The recreation condition models a group based organization during which 50 hubs are conveyed haphazardly or consistently over an area of 1500 x 1500 m2. The recreation is managed utilizing NS2. NS2 is an open source occasion driven test system apparatus. Table 5 beneath shows the rundown of boundaries utilized for reenactment.

Table 5. Simulation settings

| Simulation Parameters        | Values                       |
|-----------------------------|------------------------------|
| Topology size               | 1500 x 1500 m2               |
| Number of sensors           | 60                           |
| Deployment type             | uniform/Random               |
| Transmission range          | 500 m                        |
| Data Packet Size            | 1000 bytes                   |
| Traffic Type                | Constant Bit Rate            |
| MAC protocol                | 802.15.2                     |
| Initial power               | 100 J                        |
Simulation results show the comparison of ECT with LEACH protocol. In 'figure 3' shows the presentation of throughput fluctuating with reproduction time. The chart unmistakably shows that ECT has a more noteworthy throughput contrasted with LEACH. Filter accept direct correspondence between cluster leader and sink. Information foreordained from far off cluster leaders gets dropped and thus throughput is less. Though in ECT, the cell chiefs use multi-cluster transmission to hand-off information to the sink and these outcomes in higher throughput.

![Throughput comparison](image)

**Figure 3.** Throughput comparison

In 'figure 4' shows the exhibition of ECT contrasted with LEACH dependent on bundle conveyance proportion. At time nine seconds, the bunch heads total the information from the particular framework and send to the sink. ECT utilizes bounce tree for between group correspondence and subsequently the accumulated information sent by each cluster leader will be effectively gotten by the sink. In this manner, it very well may be seen from the diagram that the parcel conveyance proportion is 1 for ECT, implying that the quantity of bundles produced in the organization is effectively gotten at the objective. Then again, LEACH expect direct correspondence between each group leader and the sink. Thus, bundles communicated by bunch takes which is off of the inclusion territory of the sink will be dropped and subsequently its parcel conveyance proportion is under 1. In this way, the proposed convention has a more prominent parcel conveyance proportion.
Figure 4. Delivery Ratio Comparison

In 'figure 5' shows the normal energy staying in the organization after information transmission. In LEACH, since the cluster leaders are chosen utilizing probabilistic methodology, there is a likelihood that nodes with lesser residual energy might be picked and may bite the dust first. Accordingly, information must be retransmitted bringing about more energy utilization. In any case, such a circumstance doesn't emerge with ECT and thus ECT has more normal energy staying in the organization, after the information is communicated to the sink.

Figure 5. Average Energy Comparison

5. Conclusion

Wireless Sensor Network, the nodes are power unit powered and this act as a major limitation on the power. Power is consumed in sensing and transmission. During a thickly open up network, close by nodes sense an equivalent information and this leads to transmission of unnecessary data to the sink. To keep power, it's important to use power efficient forward techniques and to avoid transmitting unnecessary data to the sink. This paper proposes an power efficient hybrid protocol named “Power efficient in WSN supported Clustering and Tree Technique” (ECT). ECT divides the sensing area into clusters. The cluster leader from each cluster receives the sensed data, aggregates it and transmits it to the sink using the
constructed hop tree. Recreation results show that the proposed convention is more force proficient contrasted with LEACH convention.

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