An approach for Cluster Head Selection using Hybrid Selection and Recovery approach in WSN

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Abstract— WSNs are used research area due to their several application domains. The presentation of WSNs depends on the topology of sensors and their ability to adapt to changes in the network. Sensor nodes are often resource constrained by their limited power, communication distance capacity is low, and restricted sensing capability. Therefore, they need to co-operate with each other to achieve a specific task. [1] [3] Thus, clustering enables sensor nodes to communicate through the cluster head node for constant communication process. In this paper, we introduce a dynamic cluster head selection technique. Every node in the cluster calculates its residual energy value to determine its candidacy to become the Cluster Head Node (CHN). [1] With this mechanism, each sensor node estimates its residual energy level to other nodes in the same cluster. Lean on the unused energy level the sensor node acts as the second cluster head. Interpretation of the dynamic CHN selection mechanism is shown using network simulator-2 (ns2). The simulation results show that the recommended methods drag out the network lifetime and adjust the energy utilization model among the nodes of the cluster. [2].

Key words: Cluster, Traffic, Cluster Head, Energy Factor, Resources, Life Time

I. INTRODUCTION

Wireless sensor networks involvement limited communication bandwidth and energy constraints. WSN is based on data-centric wireless network that does not need focusing on sender and receiver. Unlike, traditional wired network, mobile wireless network and ad hoc network care extra about the sender and receiver.[2] Therefore, a general IP based mechanism and multi-hop routing scheme for mobile ad hoc network is not suitable for WSNs. The hierarchical routing protocol is one kind of typical network protocol for WSNs to handle the faults of the flat traditional cluster based routing scheme. Thus it spreads the network lifetime as well as guarantees better connectivity of whole network. [1] Energy feasting is one of the serious problems in WSNs that creates challenges for academic and industrial sectors. Therefore, energy handling is one of the key skills to spreads the network lifetime.[2] There is a quadratic increase in energy ingesting as the distance among sensors increases. Thus, the distance should be kept under thought while designing the WSNs to minimize energy consumption and prolong network lifetime.[3] Scalability is the second major threat in WSNs where thousands of sensor nodes are deployed in confident applications. In WSN's these matters are addressed at the cluster level by using different cluster-based architectures.

II. CLUSTERING APPROACH IN WIRELESS SENSOR NETWORK

Hierarchical clustering is the efficient way [5] to use the energy in the best manner. The group of clusters performs the same task is known as the clusters. Clusters head, regular nodes and base station are the main components of the hierarchal cluster. When the cluster head is selected it gathers all the data from all its member nodes and fuses it in order to abolish the reiteration. Thus it restrains the amount of data transmission to Base Station, hence remaining energy level is improved and network lifetime is also prolonged. There are various key aspects [6] which must be thoroughly considered, while designing the clusters in WSN:

A. Clustering Detail

1) Multiple Clusters
Multiple clusters may be switch as per the CH selection algorithm.

2) Intra-Cluster Communication
Conversation between the regular node and CH may be one-hop communication or multi-hop communication.

3) Nodes and CH Mobility
Construction of cluster is dynamically commutated in the case of sensor nodes are in mobility.

4) Types of Nodes and its Role
The nature of the node may be homogeneous or heterogeneous. In homogeneous, all sensor nodes have same abilities such as same energy level, configurations. In heterogeneous, nodes are changes in configurations.

5) Cluster Head Selection
Based on the benchmarks such as connectivity, outlay of communication, resting energy mobility CH is elected from the distributed nodes. CH selection may be in deterministic or opaque way.

6) Multiple Levels
Multi-level clustering approach is used to achieve better energy distribution, in very large networks.

7) Overlaying
Overlaying of different clusters in not supported by most of the protocols.

B. Matter of dispute in clustering

To create a managerial structure between sensor nodes in WSN, it has the capabilities to distribute them in an ad hoc manner, because it is not possible to maintain these nodes into groups, pre distribution. To achieve the managerial structure there has been a large amount of researches are in the progress. The clustering inconsistency having an important part not just in protect the network, but can seriously affects the network achievements. There are number of impediments that clustering scheme must consider.

1) Confined Energy
Wireless Sensor Nodes having limited energy storage and the able use of this energy will be required in determining the rang of suitable application for this network. The confined energy in the sensor nodes must be considered as proper clustering that can overcame the complete energy usage in a network.

2) Network Life-Spam

The energy limitations of the nodes resulting in confined network lifespan for the nodes in the network. Proper clustering should attempt to reduce the use of energy, and hereby increase network lifespan.

3) Confined Abilities

The limited physical size and limited amount of stored energy in sensor node confined many abilities of nodes in the term of processing and communicational abilities. A good clustering algorithm should make use of shared resources within a managerial structure, while taking into account the limitation on individual node abilities.

4) Application Metonym

Often a given application will densely depends on cluster organization When designing a clustering algorithm, application strength must be considered as a good clustering algorithm should be able to adapt to a variety of application requirements.

III. PROPOSED METHODOLOGY

A. Hybrid Selection and Recovery Approach

For a wireless sensor network, the following criteria are followed for the implementation:

The base station (BS) is located far from the sensors and immobile.

- All nodes in the network are heterogeneous and energy-constrained.
- All nodes are able to reach BS.
- Nodes have no location information.
- Symmetric propagation channel
- Cluster-heads achieve data compression.

For cluster head selection, the basic algorithm is followed named as leach approach. In this approach, the process is divided into two rounds. Each of these rounds consists of an selection round and data transfer phase. During the selection phase cluster-heads are elected and the clusters are organized. During the data transfer phase the transmission and reception of data to the base station occurs. These cluster-heads gather sensor data from other nodes in the network and transfer the collected data to the base station. Since data transmission to the base station acquires much energy, the nodes take turns with the transmission – the cluster-heads "rotate". This rotation of cluster-heads leads to a balanced energy consumption of all nodes and hence to a longer lifetime of the network. Thus, the best selection and selection of a cluster head for a cluster is needed to maximize the lifetime and throughput of network.

IV. HYBRID SELECTION AND RECOVERY APPROACH (HERA)

- Pseudo code of Cluster Head selection & Recovery Approach

A. Procedure of cluster head selection by counting

- Input: C, no of cluster heads in a round N, total no of sensors

1) no of cluster heads CH=0
2) while CH< C do
   - if (Sid =elect=etx=erx)
     - S is a clusterhead
     - broadcast an advertisement
     - increment CH by 1

Endif

B. Procedure selection of backup node(S,RE)

1) if (min_dis>do)

S(i).E=S(i).E-(ETX*(4000)+Emp*4000*(min_dis*min_dis* min_dis));

End

2) if (min_dis<=do)

S(i).E=S(i).E-(ETX*(4000)+Efs*4000*(min_dis*min_dis));

End

3) (RE)= b(Eelec +εFS) d< do
   b(Eelec + εMP) d> do
4) Select Active Node
5) broadcast an advertisement

C. Procedure recovery node (S, A)

1) wait to receive an advertisement
2) if (advertisement is received) then replace dead node to active node
3) increment CH by 1

V. RESULTS AND DISCUSSION

Type	Parameter	Range
Network	Network Size Nodes Initial Energy Sink	(0,0) to (100,100)m 10-50 2 joule (0.5) (0.5)
	Threshold Value Packet Size Communication range	0.1 128 bits 10-50 m
Radio Model	Eelec Emp Efs	50Nj/bit 0.004pJ/bit/m^4 10 pJ/ bit/ m^2

Table 1: Performance Evaluation and Analysis

This chapter focuses on result and its analysis based on the simulation performed in MATLAB. All the experimental results provided in figures gives variation in network nodes define the actor failures. The actor nodes are randomly deployed in an area of 100m × 100m consisting of number of actor nodes (10–50) with fixed communication range (R = 50m) and variable range between 10 and 50m. After examining the cut vertex and non-cut vertex nodes; the backup actors are elected on the basis of remaining energy and healthy node is selected as a backup node for recovery.

A. Performance Analysis

1) Energy Consumption

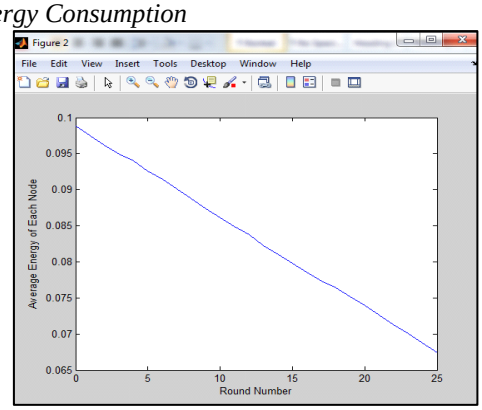

Fig. 1: Average Energy of cluster head while round number 25

After evaluating the proposed approach for cluster head selection, the results show that as there is less number of rounds to communicate the average energy of cluster head remains high or equal to the threshold value.

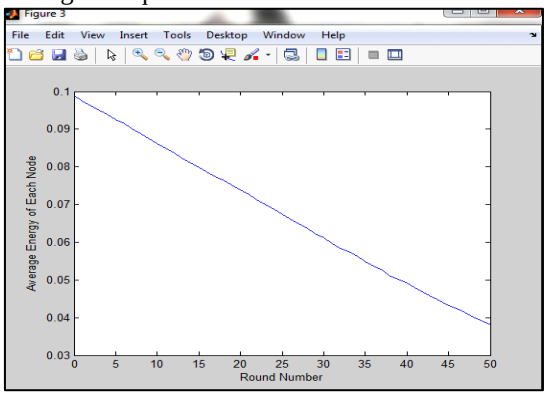

Fig. 2: Average Energy of cluster head while round number 50

As there is increase in round numbers to communicate such as we have taken the value 50, shows that the average remaining energy of cluster head to serve there cluster members remains equal to the desired threshold value.

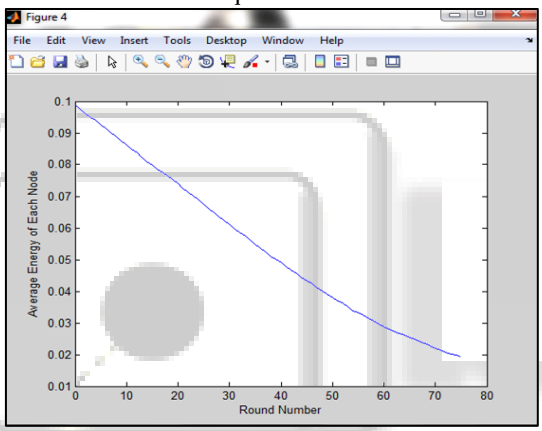

Fig. 3: Average Energy of cluster head while round number 80

The increased value of round numbers doesn't hinder the energy level of cluster head in a large network, shows that the proposed approach for cluster head sselection is efficient for the optimal sselection of cluster head for a large cluster with large number of cluster members.

B. Failure Accusation Probability

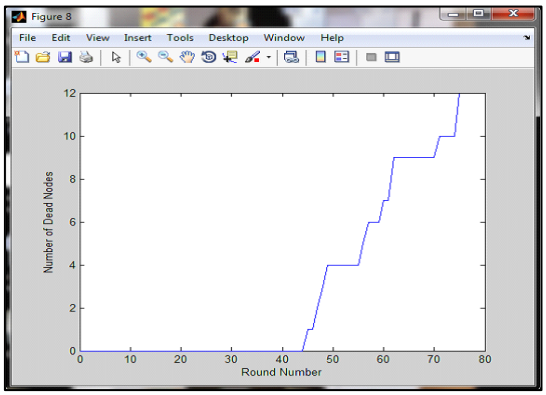

Fig. 4: Number of failure nodes while round number is 80 per nodes

The proposed approach results into less number of failures as the round number increases to 80 per node.

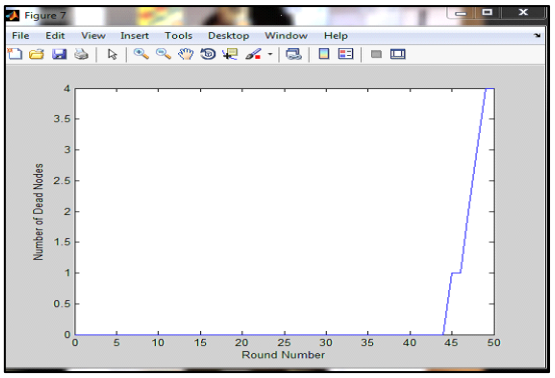

Fig. 5: Number of failure nodes while round number is 50 per nodes

With the decrease in round number as 50 per node, the ratio of dead nodes are also decreased, with less amount of data loss.

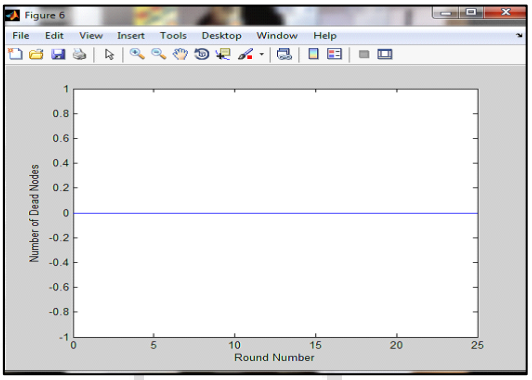

Fig. 6: Number of failure nodes while round number is 25 per nodes

Through this proposed approach, the network finally comes in stable state with zero dead nodes with round number 25 per node.

VI. Conclusion

Hybrid selection and recovery approach method over WSNs to prolong the network lifetime.[2] We have displayed dynamic selection process of cluster head node. The cluster head node is elected on the source of residual energy of sensor nodes. The residual energy is calculated after accomplishment the event monitoring process using the mathematical model. In our scheme, the nodes can switch to their special of cluster even with increased power loads. To establish the strength of CH,. Two types of scenarios are used by algorithm which is characterized by the amount of activity supposed in the environments. On basis of simulation results and the mathematical model, we believe that the proposed scheme significantly extends the network lifetime as compared with other schemes.[3]

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