

Energy Efficiency in Distributed Clustering of WSN using HEED Protocol

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Abstract— A wireless sensor network is a static ad hoc network which consists of hundreds of sensor nodes arranged in a random manner in a predefined or affected area. It is a specialized wireless network that composes of number of sensor nodes deployed in a specified area for monitoring environment conditions such as temperature, air pressure, humidity, light, motion or vibration. The main design issue for a sensor network must be conservation of the energy available at each sensor node so to increase energy of each node in distributed clustering HEED protocol is used. By using HEED protocol energy of sensor node and network lifetime may be increased.

Keywords— WSN; Energy efficiency, Cluster, Sensor, HEED

I. INTRODUCTION

Wireless sensor networks (WSN) have become progressively more attractive and have found their way into huge variety of applications because of their self organizing behaviour, low cost and sensing ability in easy or hard environments. A WSN is a collection of nodes organized to form a network. The energy efficiency and network lifetime are the two important performance parameters in designing of WSN. A sensor network is one of the major rising technologies that required the data transmission at high rate with higher reliability ratio. The wireless sensor network has many sensor nodes these nodes can forward the information and cooperate with each other to accomplish some specific tasks through the application of communication with wireless self organization. The application of sensor nodes can be used in many areas such as the military monitoring, environmental, industry, medical, and agriculture.

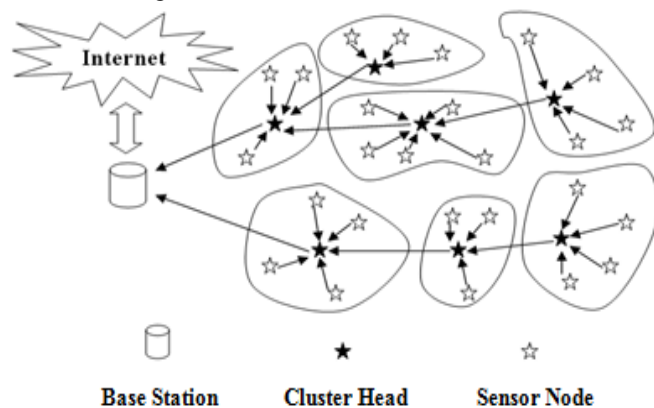


Figure1: Architecture of Wireless Sensor Networks

The sensor nodes are usually programmed to monitor or collect data onto surrounding environment and pass the information on the base station for remote user access to various communication technologies. A sensor node is a small device that consists of four basic components:

1. Sensing subsystem for data gathering from its environment.
2. Processing subsystem for data processing and data storing.
3. Wireless communication subsystem for data transmission.
4. Energy supplies subsystem which is a power source of the sensor node.

Hybrid Energy Efficient Distributed clustering (HEED) Protocol that is used for Clustering and brings an energy-efficient clustering routing with explicit consideration of energy. HEED does not select the cluster head randomly manner. HEED was designed to select different cluster heads in a field according to the amount of energy that is distributed in relation to a neighboring node. In this selection of cluster head is primarily based on the residual energy of each node. In this residual energy can be estimated by knowing the energy consumed per bit for sensing, processing and communication. In this to break the ties intra cluster communication cost is considered as secondary parameter and tie means that a node falls within the range of more than one cluster head. In this intra-cluster communication cost is considered as a secondary parameter. The clustering process is divided into a number of iterations. It is based on the two parameters.

1. The first parameter depends on the residual energy of the node.
2. The second parameter is considering the cost of communications with the intra-cluster.

Phases of HEED

Initialization phase: Sensors become cluster head.

Processing phase: Sensors go through for electing the cluster head.

Finalization phase: Sensors join the communication cost to cluster head.

II DESIGN OF WSN USING HEED PROTOCOL

1. Configure the network:- In this part the network will be configured by heterogeneous nodes. There may be same type or different type of nodes which will arrange in a network in random manner. In proposed work we will take 300 no. of nodes and assign an area of 150 x 150.

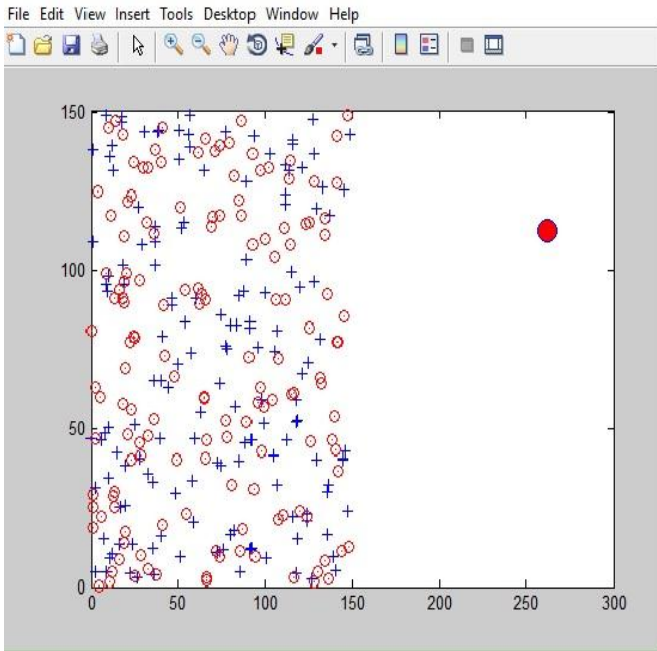


Figure 2: Sensor nodes deployed in the area

2. Formation of Clusters- In this part different clusters will assign in the area in random manner. Clusters will define in such a manner that there will be minimum one node in a cluster and a maximum of five nodes in a cluster. The nodes regularly updates their sets of neighbors.

3. Selection of Cluster Head- Single cluster head will be selected based on residual energy and intra cluster communication. This cluster head will be responsible to take information from other nodes and transmit to base station or other cluster head. The information may be of any type for example temperature, pressure, humidity, sound etc.

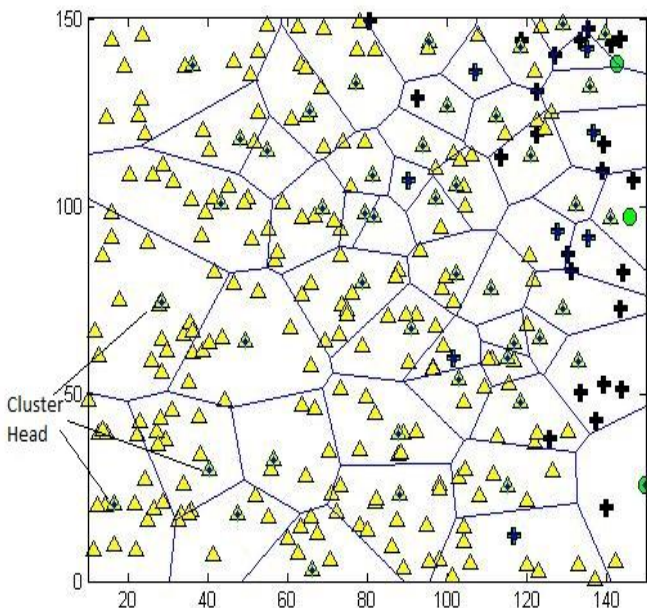


Figure 3: Cluster formation and cluster head selection

4. Transmission of Data - Some data may be transmitted from nodes of base station and check the performance of model according to number of rounds. It has been noted that the average dissipation energy of nodes is decreasing with continue increase of no. of nodes. It is also clear from figure no.4. The maximum dissipation energy at the start is 0.14J and is 0.01J at the end of number of rounds. There is also a comparison of network life time and no. of nodes shown in figure no.5. At the starting time the value of network life time is 710s and is continue decreases with number of rounds and reach to a value of 140s at the end of 50 rounds. When we compare no. of dead nodes with round number it is clear that dead nodes will increase with the increase of round number. At the starting time there were no dead nodes but it will increase with round number and reaches to a value of 255 at the end of 50 rounds shown in figure no 6.

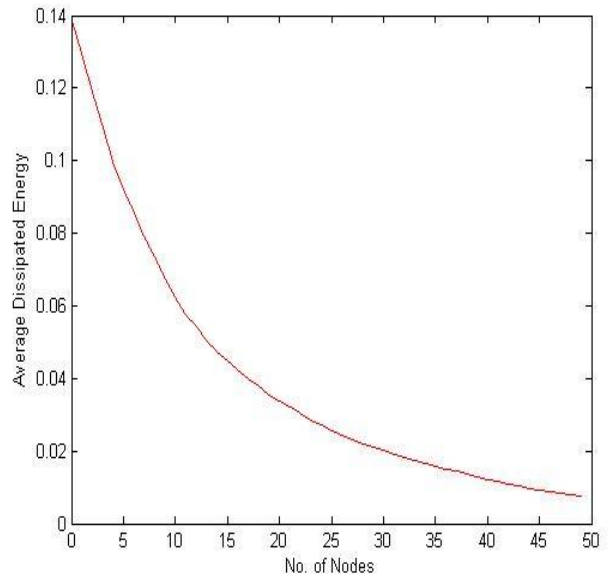


Figure 4: Graph showing the dissipation energy

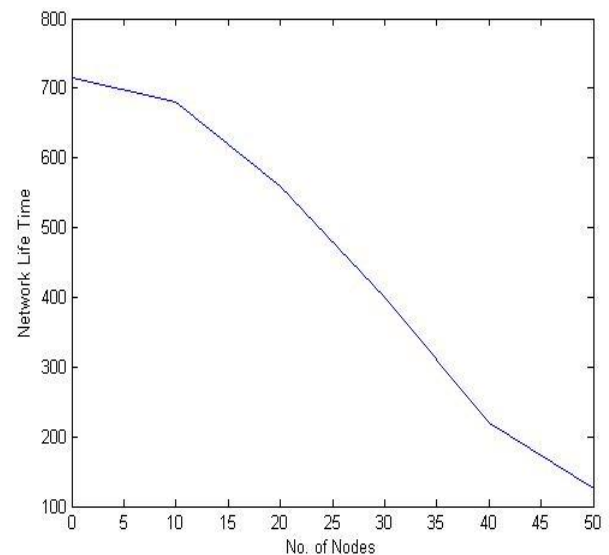


Figure 5: Graph showing the network lifetime

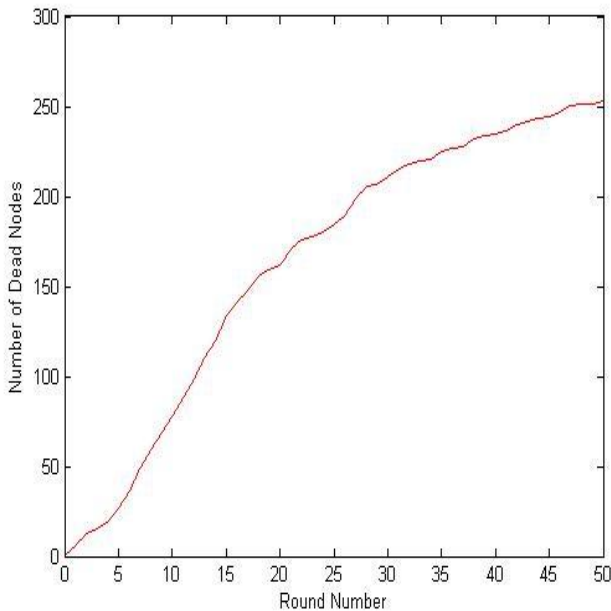


Figure 6: Graph showing the number of dead nodes

III. RESULTS AND DISCUSSION

To evaluate the performance of the proposed model of WSN using HEED protocol Matlab is used. The results vary the number of sensor node from 0 to 50. The heterogeneous nodes are deployed, randomly within a square area of 150 x 150. The performance of WSN using HEED is clearly seen from the graph shown in figure 4, 5 and 6. A comparison of different values of average dissipation energy is shown in figure 4 with no. of nodes. With the increase of no. of nodes the value of dissipation energy is continuously decreases. The value of dissipation energy is 0.14J at the start of rounds is 0.03J when the no. of rounds is 25 and 0.01J when the no. of rounds is 50. The different values of network lifetime is shown in figure no. 5 with no. nodes. The value of lifetime is maximum 720s at the start of rounds and is decreases with no. nodes. It reaches to 450s when the no. of rounds is 25 and becomes 130 when the no. of rounds is 50. So the life of WSN decreases with increases of rounds. A different value of dead nodes is shown in figure 6 with round number. The value of dead nodes increases with increase of round number. At the start of round no. the value of dead nodes are nil but it reaches to a value of 180 when the rounds are 25 and becomes 252 when the rounds are 50. Total nodes taken in this proposed work is 300 in which 252 becomes dead in first 50 rounds.

IV. CONCLUSION AND FUTURE SCOPE

In this proposed work we will design a WSN using HEED protocol. The main design issue for a sensor network must be conservation of the energy available at each sensor node so to increase energy of each node in distributed clustering HEED protocol is used. By using HEED protocol the energy of sensor nodes and lifetime of sensor nodes will be improved. In future of this work WSN will be designed using some more reliable protocols to increase further energy and lifetime of network.

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