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Improvement in Divide and Conquer Scheme Using Relay Nodes

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Abstract: A wireless sensor network is a network of large number of sensor nodes, which can perform sensing, computation, and transmission of sensed data. Long distance transmission by sensor nodes is not energy efficient. One approach to extend the network lifetime while protecting network connectivity is to set up a small number of costly, but more powerful relay nodes whose main task is to communicate with other sensor or relay nodes. There are many issues in wireless sensor network like energy consumption, node deployment, network lifetime, etc. In this paper, we focused on the divide and conquer scheme which help to increase the throughput and reduce the packet loss in the network. To overcome these problems a new technique will be proposed. Experimental results show the throughput and packet loss of all the regions
.

Keywords: Sink node, throughput, divide and conquer scheme, relay nodes.

1. Introduction

The Wireless Sensor Networks consists of large number of low cost devices that are deployed in the region. Sensor Nodes communicate through a wireless medium and

used for military, hazard monitoring, battlefield inspection etc. Sink node is located inside the network where it sends queries to the source. Sensor nodes sense the data and send it to the sink that is also called base station. All the sensor nodes communicate with each other through a wireless medium. The wireless medium may be radio frequencies, infrared or any other medium having no wired connection. In a wireless sensor network the node that gathers the data called sink. The base station may be connected to the outside world through internet. Base station collects the data from sensor nodes, perform simple processing on the collected data, then sends appropriate information (or the processed data) via the internet to the user who requested it and use the information. The base station may also be an individual user who needs the desired data. The features of the environment within which sensor nodes typically do functioning, coupled with harsh resource and energy restraint, make the routing problem very challenging. The wireless sensor networks can be predicted as a network consisting of sensor nodes, which are very basic in terms of their components like sensing unit, processing unit, communication unit, and a power unit. Sensor nodes carry restricted power resources that are inimitable therefore; there is a need to design an energy efficient technique to raise the life of wireless sensor networks. An inbuilt operation method should be made so that the end user should have option for extending network lifetime. The Wireless sensor networks design follows some advances as energy-conscious techniques, processing, multi-hop communication and density

organize techniques so that throughput should be improved . But these advances still need to be improved. Energy exhaustion or physical damage of nodes may lead to failures in the wireless sensor networks. Developing a procedure to arrange sensor nodes in an ordered way is the most important challenge.

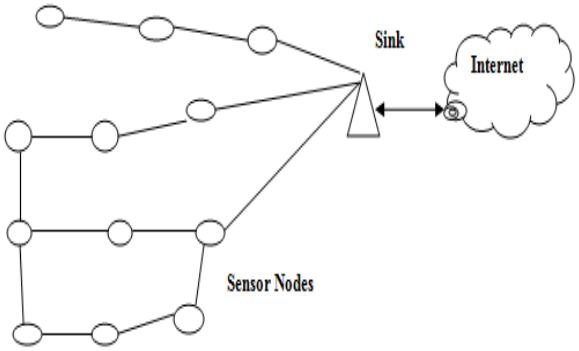

Fig 1.1 A Wireless Sensor Network

To increase the throughput and reduce delay divide and conquer scheme will be used. In this whole area is divided into inner, middle and outer regions. It is based upon static clustering and minimum distance of a cluster head selection. In this paper, we will study about divide and conquer scheme in detail. In 2nd section we will do literature survey. In 3rd section we will study about divide and conquer scheme. In the last section we will focus on the proposed technique and conclusion respectively.

2. Review of Literature

In [1] *Kiran Maraiya et.al* presented an overview of wireless sensor network, how wireless sensor networks work and various applications of wireless sensor networks. In this paper, it has been described that characteristics of wireless sensor network are dynamic network topology, lower power, node failure and mobility of nodes, short-range broadcast communication and multi-hop routing and large scale of deployment. But low power of sensor nodes is one of the limitation of wireless sensor network as in harsh environments, it is difficult to replace sensor nodes so low power may cause an energy hole in wireless sensor networks. Also multi-hop routing may cause more nodes deplete their energy while routing as compared to single hop routing. In [2] *Basilis Mamalis et.al*, describe the concept of Clustering and described various design challenges of clustering in Wireless Sensor networks. The paper also describes various clustering Protocols including Probabilistic Clustering Approaches and Non-Probabilistic Clustering Approaches. The algorithms discussed in these protocols consider periodically re-election of Cluster Heads (rotation of Cluster Head role) among all nodes. The main drawback of these algorithms is that the time complexity of these algorithms is difficult to be kept low as the size of the Wireless sensor Networks becomes larger and larger, the extension in multi-hop communication patterns are unavoidable which increases the routing path. In [3] *H.Dubois-Ferries et.al* proposed an algorithm based on Voronoi clusters to handle multiple sink nodes. This Voronoi algorithm designates a sink for each cluster to perform data acquisition from sensors in the cluster. Each node keeps a record of its closest sink and of the network distance to that sink. When a message arrives from a sink, the recipient checks whether the distance traversed by the packet is less than the current estimate of closest sink distance. If so, the node updates its closest sink and parent entries and resends the message. A node also re-forwards the message if the distance traversed is equal to the closest distance and the message came from the closet sink. A drawback of this algorithm is that it does not consider residual energy sensor node. In [4] Prashat krishan *et.al*, has presented a Study on Dynamic and Static Clustering Based Routing Schemes for Wireless Sensor Networks various cluster head selection algorithms for data aggregation in wireless sensor networks. This paper proposed that a Wireless sensor network is an infrastructure comprised of sensing (measuring), computing, and communication elements that gives an administrator the ability to instrument, observe, and react to events and phenomena in a specified environment. The administrator typically is a civil, governmental, commercial, or industrial entity. The environment can be the physical world, a biological system, or an information technology (IT) framework. Routing is very difficult in

wireless sensor network due to a large number of sensor nodes. In wireless sensor network, Routing can be divided into Flat Routing, Hierarchical Routing, Location - aware Routing. Hierarchical Routing can be further divided into two parts: Dynamic and Static Hierarchical Routing or Clustering-based Routing. Dynamic Clustering based protocols are those in which the clusters are formed and diminished dynamically. Static Clustering based Routing Protocols are those in which clusters once formed remain same throughout the network lifetime. In our paper, we discuss all dynamic and Static Clustering based Routing Protocols and its pros and cons. the algorithm for efficient cluster head selection in which there is no need to select the cluster head periodically, so lots of energy is saved in the wireless sensor network. The limitation of this algorithm is that in this algorithm the base station decides the location of sensor node, i.e. to which cluster it belongs by first receiving information from sensor node about its current location but if the base station is located far away from the sensor node then energy is wasted in deciding to which cluster the sensor node will be located. In [5] Ebin Deni Raj *Sudhanshu Tyagi et.al*, have presented An Efficient Cluster Head Selection Algorithm for Wireless Sensor Networks –Edrleach the most popular protocol for clustering in WSNs that is Low Energy Adaptive Clustering Hierarchy (LEACH) which is based on adaptive clustering technique. This paper provides The Cluster-head Gateway Switch Routing protocol (CGSR) uses a hierarchical network topology. CGSR organizes nodes into clusters, with coordination among the members of each cluster entrusted to a special node named cluster-head. The cluster head selection is done with the help of any of the algorithm for cluster head selection. Energy is the primary constraint on designing any Wireless Networks practically. This leads to limited network lifetime of network. Low-Energy Adaptive Clustering Hierarchy (LEACH) and LEACH with deterministic cluster head selection are some of the cluster head algorithms that enable to optimize power consumption of WSN. There are various factors like density & distance, threshold based, power efficient. Load balancing and scalability are the other factors which plays important role in the selection of Cluster head. Algorithms based on load balancing reduce communication cost to a great extent. The algorithms that this study is focused are A Density and Distance based Cluster Head, An Energy Efficient Algorithm for Cluster-Head Selection in WSNs, Consumed Energy as a Factor for Cluster Head. These three algorithms are analyzed and studied in this paper. The analysis of these algorithms gave birth to a new algorithm called EDRLEACH, which is proposed through this paper. In [6] *K. Latif et.al*, have presented routing technique called Divide-and-Rule, which is based on static clustering and minimum distance based Cluster Head selection. Network area is logically divided into small regions (clusters). Old fashioned routing techniques such as LEACH, LEACH-C are not as energy efficient as present day clustering techniques such as Divide-and-Rule scheme. The benefit of Divide-and-Rule scheme is that when it is compared with LEACH and LEACH-C this scheme provides better results in terms of stability period, network life time, area coverage and throughput. But the limitation of this scheme is that during routing each node in outer region sends its data to Primary level Cluster Heads which then forwards the aggregated data to the secondary level Cluster Head present in the Ms. Secondary level Cluster Heads then, aggregate all collected data and forward it to Base Station which will lead to more energy consumption of cluster heads nodes present in the Middle Square and Inner Square regions which may lead to energy hole and may cause data routing problems.

3. Divide and Rule Scheme

Divide-and-Rule scheme is based on static clustering and minimum distance based Cluster Head selection. Network area is divided into different regions which are inner, middle and outer regions. In this technique, the communication distance also reduces.

a.) Formation of different regions:

- In 1st step, the network area is divided into *n* number of equal distant regions (have same

reference point). Here we take n=3 therefore, network area is divided into three concentric regions namely inner region, middle region and outer region. Base station is located in the centre of the network. For the formation of regions base station is used a reference point.

- In 2nd Step, the area between inner region and middle region is divided into four quadrilaterals which are named as non corner regions and corner regions taking inner region coordinates as reference points.
- We take D as distance to get the co-ordinates of the middle and outer region. By adding D in the x-coordinate of top right and bottom right corner of inner region we can get the co-ordinates of the non corner region in the right side of inner region.
- By adding D , in the y-coordinate of top right and top left corner of inner region we can get the co-ordinates of the non corner region in the upper side of inner region.
- By subtracting factor D, in the x-coordinate of top left and bottom left corner of inner region we can get the co-ordinates of the non corner region in left side of inner region.
- By subtracting factor D, in the y-coordinate of bottom right and bottom left corner of inner region we can get the co-ordinates of the non corner region at the bottom side of inner region.
- Remaining regions are four corner regions: corner region in left, top, bottom, right of the inner region.
- Following the same steps, the part between the middle and outer region is divided into four non corner regions and four corner regions taking the coordinates of the middle region as reference points.

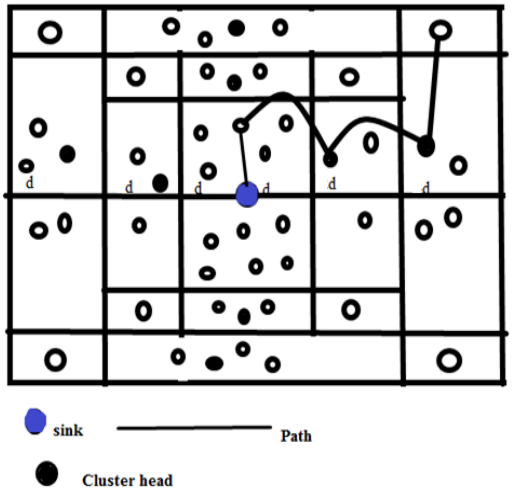

Fig.1.2 Path Establishment in Divide and Rule Scheme

Protocol Operation

In the first phase, the base station divides the network section into different regions. Nodes in the inner region can send data directly to the sink. In each region one cluster head is selected in each round. Nodes of the outer region send data to the cluster heads of the outer region and then they send data to cluster heads of inner region and then the data is received by the base station. The nodes which are positioned in the corner areas select cluster heads of close by regions and the base station as their next hop depending upon the minimum distance. If both sensor nodes are placed at the same distance then cluster head with more outstanding energy is selected. In the second phase, each node sends its data to cluster head in its allocated time. The cluster heads which are placed in the middle region collect their data and send to the outer region cluster heads. Cluster heads of the outer region collect all received data and then send it to the sink.

4. Proposed Methodology

The communication between sensor node to sink is based upon multi-hop communication. The energy of the sensor nodes positioned near the base station will exhaust very fast as compared to those that are located distant. This happens because sensor nodes near sink are shared by more sensor-to-sink paths,

heavier load and therefore consume more energy which corrupt network performance. Researchers have developed many energy models but these models still need to be improved. Clustering technique in routing protocols plays an important role to increase the throughput, stability period and network lifetime. Divide and Rule scheme is one of the energy efficient routing protocols for wireless sensor network. The sensor nodes which are positioned near base station participate to communicate with base station and intermediate nodes. The communication stops when battery of the nodes near sink exhaust. Because base station can communicate with nodes placed in the outer region only with the help of nodes placed near it. To overcome this problem relay nodes will be introduced in the inner region. In the planned work, we will place N number of relay nodes in the inner region to communicate with the nodes in middle and outer region.

5. Experimental Results

The fig.1.3 and fig.1.4 shows the throughput and packet loss. In fig.1.3 Red line shows new throughput and green line shows old throughput. In fig.1.4 Green line shows old packet loss and red line shows new packet loss.

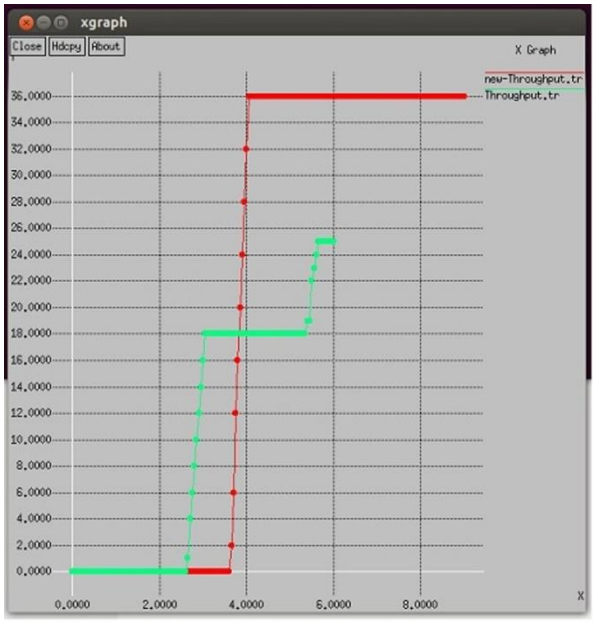

Fig. 1.3 Shows throughput of all the regions

Fig.1.4 Shows packet loss of all the regions

5. Conclusion

The nodes which are placed near sink are the nodes which communicate with sink and intermediate nodes. The communication stops when energy of the nodes near base station exhaust .This happens because base station can communicate with sensor nodes in the outer region only with the help of nodes placed nearby. To overcome this problem relay nodes will be used instead of sensor nodes. In this paper a novel technique will be proposed to improve the throughput and packet loss.

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