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ENHANCEMENT IN DIVIDE AND CONQUER SCHEME TO INCREASE EFFICIENCY OF THE NETWORKS

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ABSTRACT

Wireless sensor network is an application based network. The wireless Sensor Network may consist of multiple sinks which may be mobile or static. If any system has more than one sink, then it can generate the same query into the Wireless Sensor Network. There are many issues in wireless sensor network like battery consumption, deployment, security, etc. Battery consumption is a major issue which degrades the performance of the system. In this paper, we focused on the divide and conquer scheme which help to reduce the battery consumption in the network. To overcome this problem a novel technique will be proposed. Experimental results show the energy levels of all the regions.

Keywords: Sensor nodes, battery consumption, divide and conquer scheme, relay nodes.

INTRODUCTION

The Wireless sensor network (WSN) is a network of small light weight wireless nodes, which are highly distributed and deployed in large numbers. The Wireless sensor networks, monitor the system or environment by measuring physical parameters such as humidity, pressure and temperature. The wireless sensor networks provide a financial approach for the deployment of the control devices and dispersed monitors and avoid the costly wired system. Sensor nodes carry limited power resources that are irreplaceable therefore; there is a need to design an energy efficient technique to increase the life of wireless sensor networks. An inherent transaction method should be made so that the end user should have alternative for prolonging network lifetime at the cost of lower throughput or higher transmission delay. The Wireless sensor networks design follows some approaches as energy-aware techniques, processing, multi-hop communication and density control techniques so that lifetime of battery should be extended. But these approaches still need to be improved. Energy depletion or physical destruction of nodes may lead to failures in the wireless sensor networks. Developing a protocol to deploy sensor nodes in an organized and collaborative way is the most important challenge. A Wireless Sensor Network may consist of multiple sinks which may be mobile or static. If any system has more than one sink, then it can generate the same query into the WSN. For such type of

system each sink will have its own path developed to the source node which is someway not essential or there can be a way which avoids this. There are some issues in wireless sensor network like network deployment, energy consumption, dynamic changes and unattended operation. Battery consumption is a major issue which degrades the performance of the system. Sensor nodes can use their restricted supply of energy performing calculations and conveying information in a wireless network, but their lifetime is strongly depend on battery and hence energy-conserving forms of communication and computation are important. To overcome the energy consumption problem divide and conquer scheme will be used. In this whole area is divided into inner 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 section 2nd we will do literature survey. In section 3rd we will study about divide and conquer scheme. In the last section we will focus on the proposed technique and conclusion respectively.

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] *Kiran Maraiya et.al,* has studied various cluster head selection algorithms for data aggregation in wireless sensor networks. This paper proposed 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] *Sudhanshu Tyagi et.al*, have presented 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 taxonomy of various clustering and routing techniques in WSNs based upon metrics such as power management, energy management, network lifetime, optimal cluster head selection, multi hop data transmission, etc. LEACH forms clusters based on the received signal strength and use the Cluster Head nodes as routers to the base-station. All the data processing such as data fusion and aggregation are local to the cluster. LEACH forms clusters by using a distributed algorithm, where nodes make autonomous decisions without any centralized control. Initially a node decides to be a Cluster Head with a probability p and

broadcasts its decision. A node becomes a Cluster Head for the current rotation round if the number is less than the pre-defined threshold. The limitation of this approach is that since the decision to change the Cluster Head is probabilistic, there is a chance that a node with very low energy gets selected as a Cluster Head. When this node dies, the whole cell becomes dysfunctional. Also, the Cluster Head is assumed to have a long communication range so that the data can reach the base-station from the Cluster Head directly. This is not always a realistic assumption since the Cluster Heads are regular sensors and the base-station is often not directly reachable to all nodes due to signal propagation problems, e.g., due to the presence of obstacles. Consequently, it is not applicable to networks deployed in large regions. 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.

DIVIDE AND CONQUER SCHEME

Divide-and-Rule scheme is based on static clustering and minimum distance based Cluster Head selection. Network area is divided into small regions called clusters. In this technique, there is the formation of square and rectangular regions, which divides the network field into small regions, as a result the communication distance also reduces.

a.) Formation of regions:

- Step 1, the network area is divided into *n* number of equal distant squares (have same midpoint). For ease, take n=3 therefore, network area is divided into three concentric squares namely Inner square, middle square and outer square.
- Base station is located in the centre of the network therefore it can be used a reference point for the formation of regions.
- Division of the network area into different regions can be obtained by using following equations:

Coordinates of the top corner on the right side of inner square, Ur

$Ur = (Cp(x) + D, Cp(y) + D)$ (1)

Coordinates of bottom corner on the right side of inner square, Lr

$Lr = (Cp(x) + D, Cp(y) – D)$ (2)

Coordinates of top corner on the left side of the inner square, Ul

$Ul = (Cp(x) - D, Cp(y) + D)$ (3)

Coordinates of bottom corner on the left side of the inner square, Ll

$Ll = (Cp(x) - D, Cp(y) - D)$ (4)

Where D is the distance from central point of the network to the inner square boundary, the value of D for the middle region and outer region increases with multiple of 2 and 3 respectively. If there are n number of concentric regions (squares), then the equations for nth region are given as:

$Ur = (Cp(x) + Dn, Cp(y) + Dn)$ (5)

$Lr = (Cp(x) + Dn, Cp(y) – Dn)$ (6)

$Ul = (Cp(x) - Dn, Cp(y) + Dn)$ (7)

$Ll = (Cp(x) – Dn, Cp(y) – Dn)$ (8)

- Step 2, the area between two regions is further divided by taking coordinates of one region as reference points.
- To divide the area between inner region and middle region into four quadrilaterals which are named as non corner regions and corner regions, we have to take inner region coordinates as reference points.
- We can get the co-ordinates of the non corner region in right side of the inner region by adding D in the x-coordinate of top right and bottom right corner of inner region.
- Co-ordinates of non corner region in the upper side of inner region are taken by adding D in the y-coordinate of top right and top left corner of inner region.
- Co-ordinates of non corner region in left side of inner region are taken by subtracting factor d, in the x-coordinate of top left and bottom left corner of inner region.
- Co-ordinates of non corner region at the bottom side of inner region are taken by subtracting factor d, in the y-coordinate of bottom right and bottom left corner of inner region.
- Remaining regions are four corner regions: corner region in left, top, bottom, right of the inner region.
- Following 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 square as reference points.

Protocol Operation

In the first stage called setup stage, the base station divides network section into small regions. Inner region nodes send data directly to the base station. In each region one cluster head is selected in each round. Cluster heads of the outer region send data to cluster heads of inner region and then the data is received by the base station. The sensor nodes which are situated in the corner areas select cluster heads of nearby regions and the base station as their next hop depending upon the minimum distance. If both are at the same distance then cluster head with more residual energy is selected. In steady state phase, each node sends its data to cluster head in its allocated time. The cluster heads in the middle region aggregate their data and send to the outer region cluster heads. The outer region cluster heads aggregate all received data and then send it to the base station.

PROPOSED METHODOLOGY

The communication between sensor node to sink is based upon multi-hop message relay. The batteries of the sensor nodes placed near the sink will exhaust faster as compared to those that are placed far away. This is because sensors near base station are shared by more sensor-to-sink paths, heavier message relay load and therefore consume more energy. Energy depletion causes energy holes which degrade the network performance. Researchers have develop many energy models to give proper explanation but these models still need to be improved. Clustering technique in routing protocols plays an important role to increase the stability period and lifetime of the network. One of the energy efficient routing protocols for wireless sensor network is Divide and Rule scheme. In existing technique, suppose we had corner node which wants to communicate with sink through intermediate nodes. First of all it sends request to its cluster head of nearest cluster. Then this cluster head further sends data to its nearest available region. The nodes which are deployed near sink are main nodes which participate to communicate with sink and intermediate nodes. The problem arises when battery of the nodes near sink goes down, communication stop. Because sink node can communicate with outer nodes only with the help of nodes nearby it, not directly. To overcome this problem relay nodes will be used instead of sensor nodes. In the proposed work, we will insert N no, relay nodes in Inner and middle region to communication path between outer & middle region nodes and sink nodes.

EXPERIMENTAL RESULTS

The fig.1.1 shows the level of energy of different regions. Red line shows middle region energy level. Green line shows inner region energy level and blue line shows outer region energy levels.

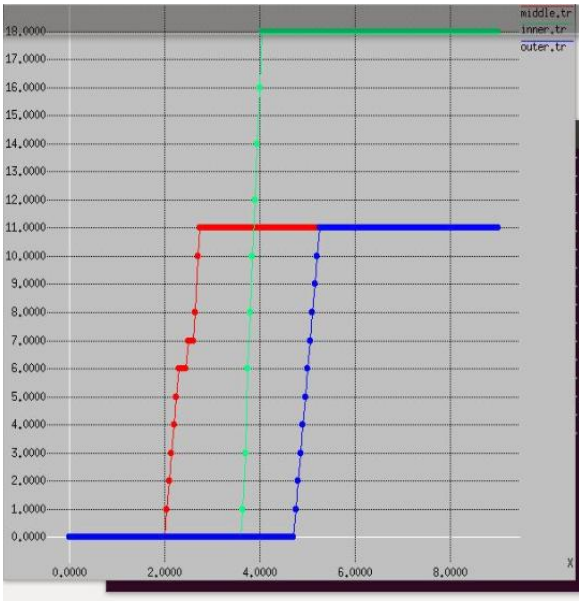

Fig. 1.1 shows energy level of all the regions

CONCLUSION

The nodes which are deployed near sink are main nodes which participate to communicate with sink and intermediate nodes. The problem arises when battery of the nodes near sink goes down, communication stop. Because sink node can communicate only with the help of nodes in nearby region not directly. 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 problem of battery consumption.

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