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SECTOR BASED ENERGY EFFICIENT ROUTING PROTOCOL

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ABSTRACT

Wireless Sensor Networks have been increasingly used with the advent of advanced methods to develop these kinds of networks in various fields like biometrics, weather monitoring, military applications etc. In most of the cases the sensor nodes have to be largely dependent on the fixed non rechargeable batteries. Thus it is for utmost importance to save the energy as much as possible and preserve the network energy and hence its lifetime. There have been several routing protocols designed and all are primarily focused to provide maximum network lifetime by ensuring the efficient use of sensor node energy. Among these protocols the clustering based protocols such as LEACH, TEEN, EICCP, SEP etc. are the most widely used and are extensively researched to devise new routing protocols to preserve the network energy. In this research work the main focus is to study the various available clustering based routing protocols and observe their rules and features.

Keywords: Wireless sensor Networks, Routing, Clustering, LEACH, network lifetime

I. INTRODUCTION

Wireless sensor networks (WSNs) have been increasingly used in many applications, such as volcanosurveillance and fire monitoring, urban sensing, and perimeter surveillance. Wireless sensor networks have many sensor devices that send their

data to the sink i.e. base station for further processing. This is called direct delivery. But this leads to heavy traffic in the network and as the nodes are limited with energy, this decreases the lifetime of the network.The sensor

network comprises sensor field, where the sensor devices or nodes are scattered in network field. Here, each of these nodes will have the capability to gather information and then route information back to sink and end users. With the help of multi-hop infrastructure and less architecture the information is routed back to the final user through sink. The routing protocols for wireless networks must be designed in such a way that limited power in the sensor nodes is most efficiently used. In addition,the environment in which these nodes operate and respond are dynamic, with rapidly changing physical parameters. The following are few of the parameters which might change dynamically depending on the application:

- Power availability of nodes.
- Position (i.e. if the nodes are mobile).
- Reach-ability of the network.
- Type of task (attributes the nodes need to operateon)

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So, the requirement is that routing protocol should be fault-tolerant in such adynamic environment. The traditional routing protocolsthatdefinedfor wireless ad-hoc networkare not well suiteddue to the following reasons:

1. Wireless Sensor networks are "data centric", unlike traditionalnetworks where data can be requested from a specificnode, data is requested based on various attributes suchas, which area has temperature > 50F?

2. The requirements of the network might change with the applicationand so, it is application-specific. For example,in various applications the sensor nodes are fixedand not mobile, while others need data based only onone attribute (attribute is fixed in this network).

3. Adjacent nodes may have similar data. So, rather thansending data individually from each node to the requestingnode, it is desirable to aggregate similar data andsend it.

4. In traditional wired and wireless networks, each nodeis given a unique id, used for routing. This cannot beeffectively used in sensor networks. This is because,the networks being data centric, routing to and fromspecific nodes is not required. Also, the large numberof nodes implies large number of ids, whichmight be substantially larger than the actual data beingtransmitted.

In this paper, we present a novel approach of dividing the total area into sectors with each sector having equal number of nodes. The REECH-ME protocol[1] which uses a similar kind of approach divides the total network area into a number of regions with unequal number of nodes. In our proposed method, however we have divided the total network area into sectors having equal number of nodes in each sector.

II. RELATED WORK

Clustering techniques have been devised to deal with energy management issues in WSNs. Low Energy Adaptive Clustering Hierarchy (LEACH) [8] is a pioneer work in this respect. LEACH is a clustering-based protocol, using randomized election and rotation of local cluster base station (so-called 'cluster-heads' for transferring data to the sink node) so as to evenly save the energy among the sensors in network. The rotation of cluster head is also a means of fault tolerance [1]. The sensororganize themselves into clusters using a probabilistic method to randomly elect themselves as heads in an epoch. However, in the LEACH protocol, sensors are not heterogeneity aware, in the sense that when there is an energy difference to some threshold between the nodes in the network, the sensors die out faster than a more uniform energy setting [12]. In Distributed Energy- Efficient Clustering algorithm acronym as DEEC [10], a probability based clustering algorithm has been proposed. DEEC elects cluster heads based on the information of the ratio between residual energy of each nodes and the average energy in the network. This knowledge though requires additional information about energy consumption to be shared among the sensor nodes. Stable Election Protocol, acronym SEP [12] is another heterogeneity-aware protocol. It does not require energy knowledge sharing but is based on assigning weighted election probabilities of each node to be elected cluster head with respect to theirrespective energy. This approach ensures that the cluster head election is randomly selected and distributed on the basis of the fraction of energy of each node therefore assuring a uniform use of the nodes energy. H-DEEC and MH-DEEC[17], routing protocol have been proposed as energy aware adaptive clustering protocols for heterogeneous networks. In H-DEEC, the network is divided into two parts on the basis of initial and residual energy. Normal nodes elect themselves as cluster heads and Beta nodes collect data from cluster heads and send

it to Base station using multi-hopping. Unlike SEP or DEEC, H-DEEC and MH-DEEC perform better in a heterogeneous wireless sensor network. Moreover, it also considers the problem of locating base station outside the network.

III. MATHEMATICAL MODEL

The first order radio model is used in many researches on wireless sensor network. Energy is dissipated during transmitting and receiving the data and energy consumption for short distance communication is d2 when propagation is in line of sight and d4 for the long distance due to multipath fading propagation. It works on the route measurements and sensing takes place constantly resulting in steady volume of data being transmitted to the sink. The following assumptions are considered in an analytical implementation:

1) Base station is fixed: Wireless sensors are densely deployed and are static. Number of clusters is predetermined for the WSN. They will pass the data on the predefined routes in which clusters, the cluster heads are numbered according to their distance based on received signal strength (RSS).

2) Some sensors are fartheraway from the base station that is why the cluster head will consume the d4 energy for transmitting l bit data in direct transmission. So data is passed through multiple hops and reach the base station by cluster very near to the base station

3) Links are symmetric i.e. same level of power is required in the communication between any two nodes. No changes in the topologies and the load are considered.

Thus, to transmit a message of length to a distance d, the energy is given as:

$d_0 = \text{sqrt}(Emp/Efs)$ …… (1)

if $d<d_0$

$Etx(k,d)=Eelec*k+Emp*k*d4$ ……(2)

if $d \geq d_0$

$Etx(k,d)=Eelec*k+Emp*k*d4$ ……(3)

Reception Energy:

$Erx(k)=Eelec*k$ …...(4)

Where Eelec is the energy dissipated in transmission and reception, Efs and Emp are free space and amplifier enegy respectively.

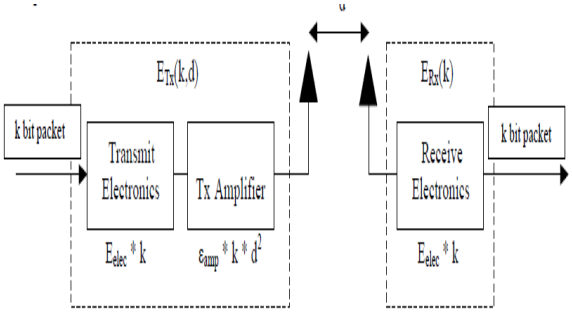

Fig 1:The First order radio model

The above diagram shows a block diagrammatic representation of a first order radio model. The transmitter and receiver use the same kind of electronics circuit and thus their energies are accumulated as Eelec, for each data

bit transmitted. The sensor nodes are thus symmetric to each other.

IV. PROPOSED WORK

The proposed protocol in this research takes thebasics of LEACH protocol, but uses a more deterministic way of cluster head selection, so as to provide efficient use of energy. In the original leach, the cluster head selection is probabilistic, where the cluster head are selected on comparing the energy of all the nodes. It is always on for receiving data from cluster members, aggregates this data and then send it to the base station that might be located far away from it. The cluster head will die earlier than the other nodes in the cluster because of its operation of receiving, sending and broadcasting.When the cluster head dies, the cluster will become useless because the data gathered by cluster nodes will not reach the base station.

In this protocol the network area is divided into sectors, with each sector having a definite number of equal nodes. This helps to maintain uniformity and is more like a pre-aggregagtion which can save a considerable amount of energy. In a particular sector all the clusters, will have the same distance from the base station and thus will consume much less energy because they can avoid the long hop communication, being in line of sight for all communications within sector nodes. There can be a number of clusters and respective clusters heads in one sector. Thus, this can be analogous to a decentralization of control of base station to the the sectors, and it will only have to deal at the sector level.

The below figure shows, the division of network area into various sectors as mentioned. The network area has been divided into four sectors, showing different nodes. Each sector contains 25 nodes, though as can be seen due to uncertain nature of node deployment, there has been slight overlapping of some nodes. The nodes belonging to various sectors has been shown in different colors, as shown in figure 2.

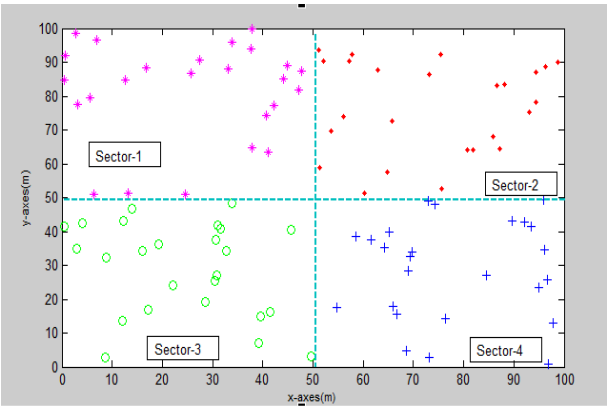

Fig 2:The Sectors of Network area

V. CONCLUSION AND FUTURE WORK

The area of energy efficiency has been always a key concern in a wireless network paradigm and has attracted research from various spheres in this field. This research work is also aimed at making an attempt in achieving an efficient routing protocol, based on this novice method of sector based division of the network area. A number of existing protocols have been studied for this purpose thoroughly in the make up to this idea, and the proposed method has been suggested. The future work will be centred around the implementation of this

suggested protocol, in a virtual software environment to analyse its actual practical performance.

REFERENCES

[1] A. Haider,et. al,(2014), "REECH-ME: Regional Energy Efficient Cluster Heads based on Maximum Energy Routing Protocol with Sink Mobility in WSNs" , J. Basic. Appl. Sci. Res., 4(1)200-216, 2014.

[2] K. Sohrabi, et al, (October 2000) "Protocols for self-organization of a wireless sensor network," I IEEE Personal Communications, Vol. 7, No. 5, pp. 16-27.

[3] R. Min, et al., (January 2001), "Low Power Wireless Sensor Networks," Internation Conference on VLSI Design, Bangalore, India.

[4] J.M. Rabaey, et al., (July 2000), "PicoRadio supports ad hoc ultra low power wireless networking," IEEE Computer, Vol. 33, pp. 42-48.

[5] R. H. Katz, J. M. Kahn and K. S. J. Pister, (August 1999), "Mobile Networking for Smart Dust," 5th Annual ACM/IEEE International Conference on Mobile Computing and Networking(MobiCom'99), Seattle, WA.

[6] I.F.Akyildiz,W.Su,Y.Sankarasubramaniam,E.Cayirci, (Dec 2002), "Wireless Sensor Networks:A survey", Elsevier science B.V.

[7] Shio Kumar Singh, M P Singh and D K Singh, (August 2010), "A Survey of Energy-Efficient Hierarchical Cluster-Based Routing in wireless Sensor Network," Int J. of Advanced Networkingand Applications Volume:02, Issue:02, Pages:570-580.

[8] Abbasi, A.A.; Younis, M. A survey on clustering algorithms for wireless sensor networks. Comput. Commun. 2007, 30, 2826–2841.

[9] Lindsey S. and Raghavendra C., "PEGASIS: Power-Efficient Gathering in Sensor Information Systems, in Proceedings of IEEE Aerospace Conference, vol. 3, pp. 1125- 1130, 2002.

[10] N. Israr and I. Awan. Multihop clustering algorithm for load balancing in wireless sensor networks.University of Bradford, UK.

[11] Arati Manjeshwar, Agrawal and D.P., "TEEN: A Routing Protocol for Enhanced Efficiency in WirelessSensor Networks" Proceedings 15th International on Parallel and Distributed Processing Symposium, 2000.

[12] Akshay, N.Kumar, M.P., Harish, B. and Dhonarkar and S., "An efficient approach for sensor deploymentsin wireless sensor network"International Conference on in Robotics and Communication Technologies(INTERACT), 2010.

[13] Z. Chaczko, R. Klempous, J. Nikodem and M. Nikodem, "Methods of Sensor Localization in WirelessSensor Networks" 14th Annual IEEE International Conference and Workshops om the Engineering ofComputer-Based Systems, ECBS '07, 2007.

[14] Javaid, N.Ullah, M.Djouani, K., "Identifying Design Requirements for Wireless Routing Link Metrics,"Global Telecommunications Conference (GLOBECOM 2011), 2011 IEEE , vol., no., pp.1,5, 5-9 Dec. 2011.

[15] N. Javaid, A. BiBi, K. Latif and M. Ishfaq, "Investigating Quality Routing Link Metrics in Wireless MultihopNetworks" Springer's Annals of Telecommunications, 2013

ISSN: 2454-9665

[16] Javaid, N., Bibi, A. Khan, Z. A.,Djouani, K., "On using multiple quality link metrics with DestinationSequenced Distance Vector protocol for Wireless Multi-hop Networks," Electrical & ComputerEngineering (CCECE), 2012 25th IEEE Canadian Conference on , vol., no., pp.1,4, April 29 2012-May 22012.

[17] M. Y. Khan, N. Javaid, M. A. Khan, A. Javaid, Z. A. Khan, U. Qasim, "Hybrid DEEC: Towards Efficient Energy Utilization in Wireless Sensor Networks", World Applied Sciences Journal 22 (1): 126-132, 2013.