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Q-LEACH: AN ENERGY EFFICIENT CLUSTER BASED ROUTING PROTOCOL FOR WIRELESS SENSOR NETWORKS

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ABSTRACT

Wireless Sensor Networks is type of interacting and calculating, where a node may be self-powered and discrete node have the proficiency to intellect and interconnect. Because sensors have restricted battery power, energy efficient routing is vital. In this report, we present a new sensor routing scheme Q-LEACH[1] that conglomerates the Q-DIR[3] protocol and clustering model in LEACH protocol. Quadrant Based Directional Routing Protocol (Q-DIR) which integrates dissimilar methods via location based routing, restricted flooding. Q-DIR margins the broadcasting region to a quadrant where the destination node and source node sited. The location information of the destination node, the source node and the current node is used by the Q-DIR. With Q-DIR as a reactive routing protocol routing overhead will be reduced and subsequently reduces total network power consumption through limited flooding .Leach is one of the fundamental protocols in the clustering technique hierarchical routing protocols that can be used for hindering the energy consumed in gathering and distributing data. The report will be concluded by mentioning the observations made from scrutiny of results about these protocols.

KEYWORDS: Wireless sensor network, Q-DIR, Clustering model.

INTRODUCTION

Wireless Sensor Network, consists of hefty number of sensor nodes having the proficiency of wireless communication, limited computation and sensing. WSN was initially developed for military purposes but because of the availability of ISM band (2.4GHz), the technology is now developing in public applications. The striking features in Wireless Sensor Network are:

a) Self-organize
b) Low power
c) Low memory
d) Low bandwidth for communication
e) Large-scale nodes
f) Self-configurable
g) Wireless and Substructure less

Therefore, WSN design must encounter these features in order to afford a consistent network. However Sensor nodes are inhibited by energy supply and bandwidth.

The projected protocol Q-LEACH unites three different methods via location based routing, restricted flooding and clustering. Q-LEACH reduces energy[7][9] consumption and elongates the network lifetime.

Data Centric Routing Protocol

In this sink ask for particular node data by broadcasting message. After this message is reached to the specific node which sink is interested in its data. It will send the information back to sink. Flat Routing Allocating a global identifier to each node is not viable because of the large number of nodes. This attention has led to the data- centre routing in which the base station sends queries to certain regions and it waits for data from the sensors located in the particular region. Flooding The routing protocol[4] which is based on the broadcasting procedure, very simple is the flooding

but it is the pricy routing protocol. Several replicas of the packet is created by each sensor node which in turn forwards it to all its neighbors.

Directed Diffusion [11] It is a characteristic routing protocol of data centric which is based on the request. Directed diffusion differs from SPIN two traits as query methods and communication methods. Matching a data to queries might require some extra overhead.

Hierarchal Routing Protocol
LEACH: Low-Energy Adaptive Clustering Hierarchy LEACH is the first and also the most fundamental energy efficient hierarchical cluster based routing protocol which was used for the purpose of reduction in power consumption. PEGASIS: (Power-coefficient Gathering in Sensor Information Systems)
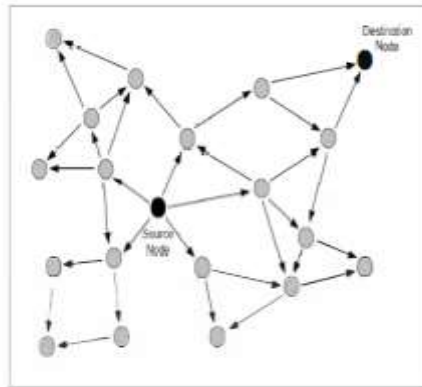

FIG. 1: PARTICIPATING NODES IN TOTAL FLOODING ALGORITHM

PEGASIS is an extension of the LEACH protocol. This implicates the creation of chain structures that is comprised of all nodes and recurrently data wholes across the chain rather than forming multiple clusters. Thus this algorithm reduces the energy consumption. TEEN: Threshold Sensitive Energy Efficient Sensor Network Protocol
TEEN, a receptive protocol (a hybrid of data centric protocol and hybrid of hierarchical clustering) to abrupt changes of some of the attributes spots in WSN APTEEN

This adaptive threshold sensitive energy effectual sensor network protocol is an extension which is proposed to improve the limitations of TEEN.

Location Based Routing
The sensor nodes in the location based routing protocols are addressed by means of their locations. In order to save energy, some of the location based schemes will demand that nodes should go to sleep if there is no activity. By having as many as sleeping nodes in the network as possible, more energy savings will be achieved.

Restricted Flooding
In this module node that are located nearer to the destination or in a forwarding zone, will broadcast packet. It can be implemented whereby limited nodes will participate in the flooding and not network -wide participation and also reduce the number of routing packets.

QUADRANT BASED DIRECTIONAL ROUTING PROTOCOL
Q-DIR is a restricted flooding routing protocol that focuses on a quantified zone using location information provided by a location service.

Upon receiving the RREQ, destination node will send a route reply message (RREP) back to source via the path taken to reach the destination that was appended in the RREQ as it criss-crosses across the network. By applying restricted

flooding on the quadrant, and the path accumulation feature in AODV, the number of nodes contributing in the route discovery will be condensed and hence eases the routing overhead.

The final result is that the amount of energy used between the source and destination is limited thereby increasing the energy proficiency of the network. The energy efficiency is based upon the number of nodes between the source and destination.
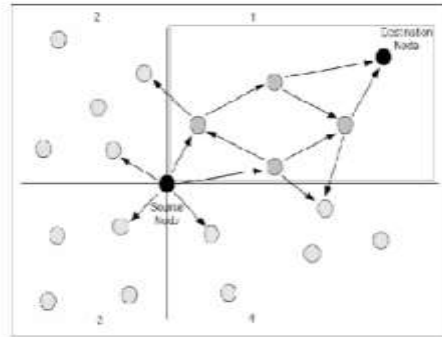

FIG. 2: LESS PARTICIPATING NODES IN Q-DIR ALGORITHM

Figure 1 show the participating nodes if total flooding is employed that will result in the more routing packets being broadcast in the network. Normally, Flooding works on broadcasting technique.

Figure 2 shows less participating nodes if restricted flooding is employed based on the same quadrant an intermediate is located compared to source and destination. It reduces the number of routing packets that traverse through the network.

Cost Value Calculation:
The Cost value (CV) is calculated based on following criterion:

Residual energy (E):
The residual energy of a node preferably is greater than the approximate energy dissipated in previous round by the cluster head.

Distance to coordinator node (D):
The nodes having less distance from coordinator node should have higher probability to become cluster head. As energy consumption is directly proportional to the square of distance.

Cost value is based on the residual energy and the distance to the coordinate node. The cost is high, when the residual energy is high and the distance to the coordinator node is less.

$$CV = (a \times E) + (b \times \frac{1}{D})$$

Where a & b are normalization constants.

Loss Ratio Calculations
Each node maintains a forward node count (CFN), which denotes the broadcast or rebroadcast probability.
Initially CFN [Nk] = CFN min, for all nodes Nk, k=1, 2……. N
CFN min is the minimum number of forwarding nodes. Without loss of generality, we can assume that CFN min =1.

CONCLUSION

The network is divided into four quadrants. Clusters [16][17] are formed within each of these quadrants and cluster head is allotted to each cluster. These cluster heads show a central role of updating and forwarding the node locations and pointing the Route Request Packets (RREQ) to the next cluster. The shortest route is determined by using the RREQ[10] which limits the announcement region to the relevant quadrants where source and destination nodes are sited. Q-LEACH[13] reduces the energy consumption and lengthens the network lifetime. The restricted flooding, location based and techniques reduces the number of participating nodes as the RREQ navigates in the network towards the destination node and hence reduced overhead and energy intake are attained in Q-LEACH.

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