A Novel approach for identifying greedy nodes in wireless sensor network by using EEGN algorithm

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Abstract:
WSN have attracted a great deal of research attention due to then wide range of applications. The life span of the sensor network is limited to its residual power. In order to increase the energy of the nodes it is necessary to implement energy algorithms. Current work is focused on two main issues: the problem which occurs in the multipath routing and how to identify and remove the greedy node which causes energy loss. In this paper, we propose an energy efficient algorithm by removing greedy node (EEGN) which helps to increase the energy of the nodes and its lifetime.

Keywords: sensor nodes, network, multipath,

I INTRODUCTION

Sensor networking is an emerging technology that has the ability to monitor and manipulate the environment. The sensor network consists of a large number of sensor nodes that are densely deployed in the environment to monitor light, temperature, national security, health care, biological detection, etc. The base station collects data from all the nodes and analyzes the data to get the conclusion about the activity in that particular area. A sensor node has only finite energy supplied from a batter. It is often unfeasible to recharge the node's battery.

The energy consumption in a sensor node can be due to either "useful" or waste" resources. The useful energy consumption can be due to sending/receiving data, processing all the requests, sending the data to the neighboring nodes. Wasteful energy can be due to retransmitting data due to collision, idle listening, redundant nodes, wrong routing to send the data. Communication between nodes consumes a lot of energy in sensor network. A centralized system also leads to more energy depletion, as some of the sensor has to communicate a larger distance. Many routing techniques have been used to send the packets from a source to the destination.

In this paper, we propose a mechanism to find the greedy node which occurs in the multipath routing using an algorithm. This paper is organized in following section: Section II gives the related work in the multipath routing. Section III gives an idea about how the greedy node occurs in the multipath section. Section IV describes about the new algorithm and how can it detect the greedy node in the path. Section V concludes this paper.

II RELATED WORK

Recently, there has been a lot of interest in WSN. Most of it is related to energy aware routing protocols. In particular routing problem, has received a great deal of interest from their research community with a great number of proposals being made. The majority of the routing protocols can be classified into data centric, hierarchical, location based, network flow. Energy sensor node is assumed to know its own position as well as that of its neighbors which can be obtained with some localization schemes [1] [2]. Each node can forward packets to its neighbours within its transmission range that are closer to the sink node than itself. LEACH [3] is a hierarchical routing algorithm for sensor networks. Nodes are bunched together into local cluster based on the signal strength. The cluster head of each cluster takes part in routing the data towards the sink. LEACH can't be applied to sensor networks that are deployed on a large scale since it assumes a single hop communication between a node and its cluster head. In [4]], the authors propose a Minimum Energy Gathering Algorithm (MEGA). The algorithm maintains coding tree and shortest path tree for delivering compressed data to the sink node.

Tubaishat et.al [5] proposes an energy efficient level based hierarchical routing protocols. Additionally it also provides secure routing protocol for sensor network [SRPSN] which provides protection against different kinds of attacks. In [6], proposes an algorithm which will route data through a path whose nodes have the largest residual energy. The path is changed whenever a better path is discovered. Directed Diffusion [7] is a good candidate for robust multipath routing and delivery. In [8] [9], a multipath extension of Dynamic Source Routing (DSR) and Ad-hoc On Demand Distance Vector (AODV) were proposed to improve the energy efficiency of ad-hoc networks by reducing the frequency of route discovery.

III. PROBLEM IDENTIFICATION

A. Multipath Routing

The sensor nodes are distributed randomly in the sensing field. A network is composed of a sink node and many wireless sensor nodes. The sensor nodes have only limited power energy while the sink nodes have powerful resources to communicate with other nodes. The sensor nodes can be send or receive messages from other nodes. Each node has to select a particular and correct path to send the data. If the path is wrong, it may loss the data and loses its energy. As in [10], the path is selected based on the energy sufficient of nodes. The nodes with the more energy are selected to send the data packets. The destination node upon receiving the packet will reply with a route reply packet.

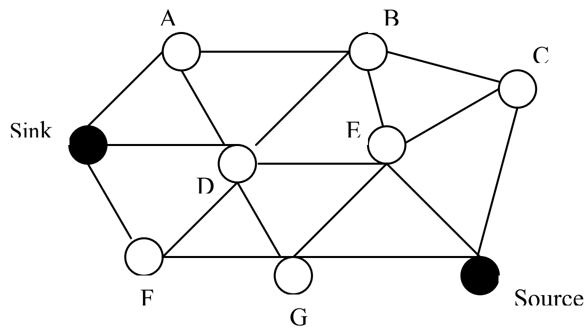

Fig 1. Network connectivity

As in fig.1 when the data is send from the sink, the nodes A, D, F receives the message. The node with the highest energy is chosen. The process is continued and the path is chosen like A, B, E. When the data is send, there is a chance for occurring a greedy node.

B. Greedy node

These nodes aims to get the more benefit from the network like trying to preserve their energy or battery life or bandwidth. A greedy node may or may not send the data packets in a proper way. A greedy node can do any of the possible actions in the network:

(i) it may turn off its power when it does not have action communications with other nodes
(ii) it may not forward all packets received from any of its surrounding neighbouring nodes to its correct neighboring destinations
(iii) sometimes the node sends some packets and drops others.
(iv) When a request is passed, it does not forward the reply request on reverse route.

IV. EEGN ALGORITHM

We have developed a new monitoring algorithm which can detect the misbehaviouring node. By means of this, we can avoid the path which has the greedy node. We can turn off the greedy node by relying only on information from the neighboring nodes. By turning off the greedy node we can save the energy as well as power of the nodes.

This algorithm relies on the information, sent/received by the neighbouring nodes. Each node x maintains a table of its current neighbouring y.

S(xy) – number of packets the node x send directly to neighbour y, further y has to send to another node.

R(xy) – number of packets the node x received from y, which has been sent from some other node.

Then fro a set of nodes Z that surround a single neighbour y, we found that

$$\sum S\ (xy) = \sum R\ (xy)$$

The algorithm can be demonstrated in the following manner. Consider about 36 nodes which is placed in 6x6 matrix way. (as shown in fig 2).

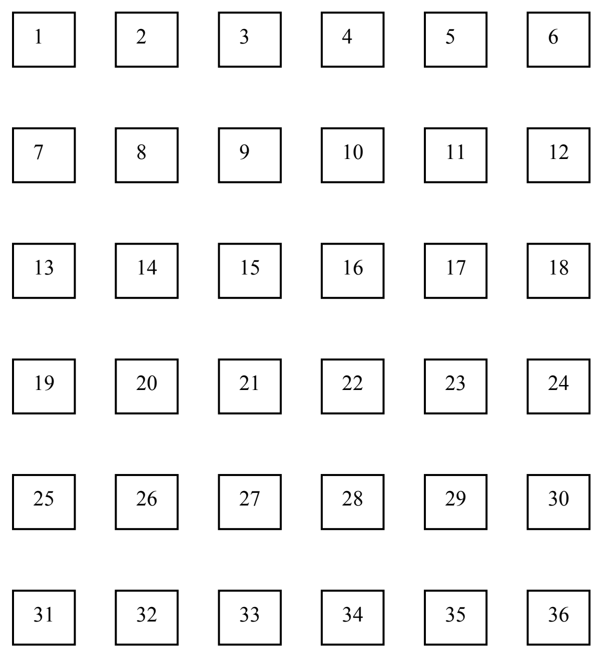

Fig 2. Network topology

If any data is send from node 1 to any other destination, it may follow a multipath technique. When it is following a multipath technique there is chance for occurring a greedy node. Now we can examine whether node 15 is greedy or not. Two sets of data is send thorough node 15. About 10 packets is send from node 1, which follows a multipath routing and passes its packets through node 8, 15, 22 and reaches the destination 29. Similarly another 30 packets is send from node 5 (follows the multipath routing) and passes through nodes 10, 15, 20 and reaches the node 25. In both the cases, it follows the multipath routing to send the packets. Even though they are from different sources, they passes through same node i.e., node 15. (as in fig 3)

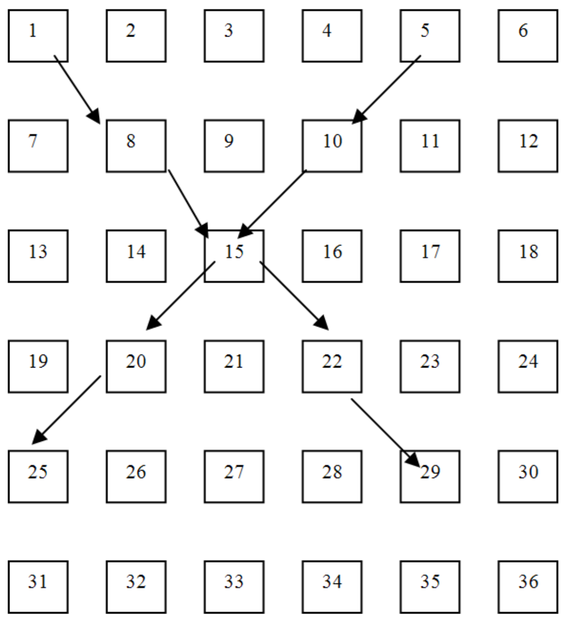

Fig.3 Nodes behavior correctly

Now we can calculate for ∑S (xy).

S(14,15)=S(20,15)=S(21,15)=S(22,15)=
S(16,15)=S(9,15)=0

S (8, 15) =10 and S (10, 15) =30
∑S (xy) =10+30=40

Now calculating for ∑ R (xy)

R(14,15)=R(8,15)=R(9,15)=R(10,15)=R(16,15)=R(21,25)=
0

R (20, 15) =30 and R (22, 15) =10
∑ R (xy) =30+10=40

We can see that ∑S (xy) = ∑ R (xy). It shows that the path is correct and there is no energy loss or data loss.

Similarly in the next scenarios, we can identify whether any of the node act as a greedy node or not, and we can find whether the energy is lost or not.

Consider (as shown in fig 4) that there are three different multipaths passing through node 14. The first path is from node 1 sending 10 packets through node 7, 14, 21 to reach node 28. Second from node 4, 30 packets are sending through node 9,15,14,20 to reach node 26. Third from node 1, 40 packets are sending through node 8, 14, 19 to reach node 25.

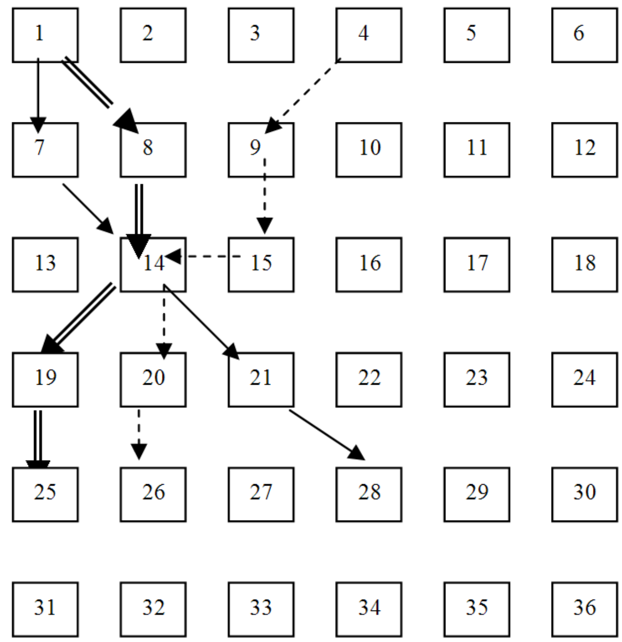

Fig 4. Network with greedy node

Now we can calculate for ∑S (xy) and
∑R (xy).
Calculating ∑S (xy).
S (13, 14) =S (20, 14) =S (19, 14) =
S (21, 14) =0

S(7,14)=10,S(15,14)=30 and S(8,14)=40
∑S (xy) =10+30+40=80

Now calculating ∑R (xy).
R (13, 14) =0

R(14,21)=5,R(14,20)=20, R(14,19)=30
∑R (xy) =5+20+30=55

We can find that ∑S (xy) ≠ ∑R (xy).

This shows that in a multipath routing, there can occur a greedy node as node 14, which leads to energy loss of the nodes 19, 20, 21(as not send the full packets) and waste of time. In case this, it has to again send the packets from the source to the destination. So when the greedy node is identified it can be turned off and can follow another path, in such a manner that all the three different packets are sent in three different path not flowing through a same node.

V CONCLUSION

In this paper, we have identified the greedy node which occurs in the existing multipath routing. We have described the two different scenarios to illustrate how the EEGN algorithm works does. The results shows that when the same node is used to send different packets , it may not send all the packets to the destination and this leads to energy loss of the nodes which occurs in that path. There are also future works we would like to focus on. The algorithm has to be included with some specific path to be followed.

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