Modified Reliable Energy Aware Routing Protocol For Wireless Sensor Network

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Abstract-**In this paper, a novel reliable energy aware routing protocol is proposed, which is based on reliability and energy efficiency. Since in the wireless environment, link quality is difficult to guarantee, the reliable routing protocol is quite important issue to study. In this protocol, a backup path, alternative path and critical value is used for reliability and low energy conservation. MREAR attempts to take precaution against error, instead of finding a solution after encountering an error.**

Keywords*:* Wireless sensor network, Routing Protocol, Source Node, Intermediate Node, Destination Node.

I. INTRODUCTION

Due to the nature characteristics of wireless sensor network, the energy saving and reliability are two important issues for designing the effective routing protocol. In order to improve the reliable performance, some multipath routing mechanism have been proposed. Some previous setup several path between the source and destination node, furthermore, separated the original packet into several subsection to achieve the goal of reliable transmission. The main shortcoming is that it is hard to guarantee all the subsection could reach the destination successfully at the same time. This will lead the result of retransmission and it will cost the more energy. Some researchers combine the issue of reliable requirement, link quality to design the routing protocol. This method can determine the fixed path between the source and the destination node. Since there are too many nodes participate in the forwarding process, the main disadvantage is the relative short network lifetime and difficult to be implemented in the large scale sensor network. In this paper novel reliable routing protocol is proposed and it can avoid the issue mentioned above.

II. RELIABLE ENERGY AWARE ROUTING PROTOCOL

In this routing protocol the sensor nodes are divided into three types : source node, intermediate node and target node. Also the unique ID is assigned to all nodes which belong to the network.

A. P*rincipal Path setup process*

In this section, the setup process of principal path for routing is introduced. The routing path selection is initiated by the target node, not the intermediate node and source node. As for any source node, they need to

setup the service path and backup path for their packets. The process of service path is setup by the target node, furthermore the target node broadcast the service the service requirement to the neighbors. The service requirement includes the ID information of the source node, the packet lifetime (TTL), and the ID information of the intermediate nodes. By using the flooding based mechanism, the path requirement discovers the pat from the source node. Due to the flooding characteristic, the shortest time path would be obtained, not the optimal energy path. To avoid this result, the factor of energy efficient is inserted during the broadcast process. Therefore the broadcast delay is a important factor for the new protocol. When the intermediate node receive the path discovery information, first of all, they will check their residual energy instead of broadcast the information immediately. If the residual energy of their own is less than the operating energy, they will drop the information. In order to calculate the broadcast delay, the following equation (1) is shown.

$$Pr = K / Eav + a \quad (1)$$

Here K and a are two energy parameters and they are shown in the following equation (2) and (3).

$$K = (Ei * Pr\ max * Eav\_min) / (Ei - Eav\_min) \quad (2)$$

$$a = -(Pr\ max * Eav\_min) / (Ei - Eav\_min) \quad (3)$$

from equation (1), it can be conclude that in case Pr=0, the residual energy of the node is maximal. Also as for the Pr=Pmax, the residual energy of the node is minimal. Meanwhile, towards the different application scenarios, the Prmax has the different values. In some special application scenarios , in case that there are two intermediate node receive the path requirement packet at the same time, the two intermediate node are denoted as a and b, and also their residual energy are denoted as Ea and Eb , if Ea>Eb, that means the intermediate node a can send the path requirement to the source node faster than node b. As for the source node , when it receives the first requirement packet from the intermediate nodes, it will find the path from these nodes. This path is the optimal one between the source and the destination node.

B. Path Storing

In this routing protocol, by using the mechanism of path storing , the energy consumption reduces. It is easy to see that, the path storing and residual energy have the close relationship. In order to evaluate the available path, the communication amount of source node needs to be accessed. The source node will generate one packet, which include the backup energy for the path storing.

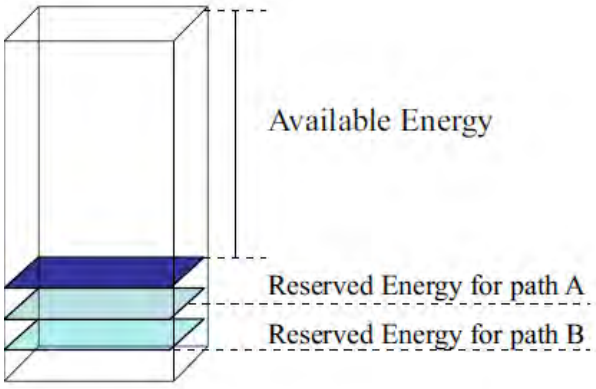

Figure 1 Logical energy partitions at intermediate nodes

As for the intermediate nodes which are located in the link path, they will reserve the equal energy compared with the backup energy, to guarantee the communication of the selected link path. In the new protocol, the energy keeping is a key point for broadcast delay. In this kind of storing mechanism, the network will have many redundant paths to share the source nodes. Once the routing path is setup, the broadcast delay of the nodes which are located in this path will increased. Therefore, the link path will drop this node and select the nodes which have the more residual energy to be the intermediate node to finish the communication process.

C. Backup Copy Of The Path

In wireless sensor networks routing issues, if the routing path was setup, it is difficult to change to another un-know path immediately. Therefore in the new routing protocol, in order to avoid the link failure, the backup copy of the path is prepared to guarantee the routing service. In the real application scenario, if the main path could not be used, the protocol will switch to the backup copy of the path to finish the communication process. Until the new routing path is found, the protocol switches back to the new one. By using the backup copy of routing path, the new protocol reduces the transmission delay of the packets. The main difference between the main path setup and the backup copy routing path is that the intermediate nodes participate in the process of backup path setup, and also, the nodes which have been located in the service path will not send the requirement of the backup copy path. Towards to every packet source node, the different two path are setup respectively. However, during the communication process, the new routing protocol only uses the main path to finish the routing service. Since in the initial phase, the source node will determine which path should be used, the routing path switch is dynamic and seamless, and it will not impact the routing performance.

III. MODIFIED WAY FOR RELIABILITY AND ENERGY EFFICIENCY

A. *Threshold values: Providing Energy Efficiency*

The destination broadcast the attribute hard threshold (HT) and soft threshold (ST) value to its source. The sensor nodes start sensing and transmit the sensed data when it exceeds HT. HT is the minimum attribute range above which the values are expected. The transmitted sensed value is stored in an internal variable called sensed variable (SV). The source node again starts sensing, when it exceeds the ST i.e. the minimum change in the sensed value it switches on its transmitter and transmits.

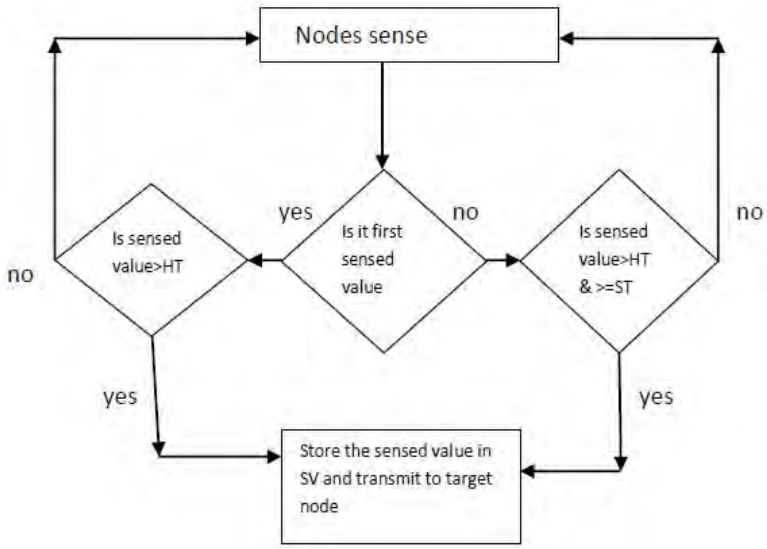

Fig:role of threshold value

In this way, the energy is conserved since the sensor nodes in the source node senses continuously but transmits only when the sense value is above HT. The ST f reduces the transmission which could have been occurred when there is a little change (or) no change in sensed attribute.

B. *Alternative To Use Of Backup Path: nearest neighbor failure to destination in main path*

If the link failure is occurred near to the destination node then it will be expensive to use the backup path because first intermediate node will send data to source node then it will be transmitted to the destination node. So we use a alternative path instead of backup path.

If data packet transmitted from source node has travelled more than half of its main path length, then node near to the destination node will broadcast a request packet to get a path to the destination node, same as main path setup process and node will send packet through this path. If the path length travelled is less than half of the main path length from the source then it will use the backup path.

Path length from source>1/2(L) USE ALTERNATE PATH

Path length from source<=1/2(L) USE BACKUP PATH

Where L: length of the main path.

IV. RELIABLE TRANSMISSION

From the above description, it can be seen that the routing protocol affords the reliable transmission circumstances. By using the ACK packet, the source node determine that whether the original packet be received completely by the intermediate or destination node. If the packet exceed of their lifetime, the network will generate error packet and be transmitted back to the source node. In such case, the original packet will be retransmitted in the backup copy path to the destination node. In this routing protocol, the NACK message are not used. Once the retransmission is failure, the original packet will be announced dead. It means that the source node could not obtain the logical path and the NACK message is useless. In case, the main path is available, the destination node uses the NACK message to detect the ordered packets.

V. RELEASE OF THE STORING ENERGY

A. Intermediate Link Failure

If the source node does not receive the ACK message from the destination node within a specified packet lifetime TTL. It means that there are some error occurred in the link path or on the intermediate nodes. In this case, the source node will generate the message and broadcast it. The broadcast message includes the broke path ID and the un-successful transmission packet. When the intermediate node which located in the in broken path receive the broadcast message, they would remove the broken routing information from their buffer and release the reserved energy. In this protocol, the routing path buffering and local repair mechanism are not to be adopted. Since the routing path selection is based on the efficient energy and furthermore, during the process of path selection, all the nodes and path would be mutually affected.

B. Source Failure

If the destination node does not receive error message from the source node within specified constant time, then the destination node will send ALIVE message to the source node. If the source is still alive, it will respond by sending ALIVE message to the destination otherwise, source will be declared as dead and the broken path packet will be packet, the intermediate node will release the energy

VI. PERFORMANCE ANALYSIS

A. Packet transmission

The packet transmission rate measures the key point performance for wireless sensor network. It is shown in the following equation (4).

V = Data_success/Data_reques (4)

B. Control message:

The control message includes the path requirement and path storing requirement, the control message reduce the packet exchanging times.

C. Energy consumption:

Some node die earlier than others as their energy is exhausted. This is mat be because they are more popular than other nodes or they are close to the destination node. A smaller value indicate a better connectivity and a longer functional life of the network.

VII. CONCLUSION

Energy consumption in the network depends on activities of each node. Data reliability is affected by unexpected events, including internal problems of the node, such as energy depletion and device failure or external impacts, such as channel error and interference. The protocol that we present, focuses on the solution to the problem of internal energy depletion of nodes ,by trying to establish a robust transmission environment for data delivery. Energy conservation is achieved by avoiding unnecessary retransmission.

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