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Energy Efficient of Path Consist of Communication In Wireless Sensor Network

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Abstract

Wireless sensor network is one of the most familiar concepts in the global technology which plays a vital role in communication network. Some of the drawback discussed in sensor network is network delay, high energy consumption and link failure. We propose a novel approach of routing algorithm for an enhanced wireless sensor networking services. For these we evolved a two novel energy routing algorithm such as reliable minimum energy cost routing (RMECR) and reliable minimum energy routing (RMER). To adopt the RMECR there are three factors required for ansensor networks such as reliability, energy efficiency and prolonging networking lifetime. The concept in which it operates is energy consumption, node structure, link quality for analyzing the network performance and dependable nodes which increase the networking life time. According to RMER, it is also an energy efficient routing algorithm which effective in finding a prominent route for the nodes to transfer the packets to reach the destination point. As a result the minimized route results in reduced the energy consumption during the network. Our proposed system with RMER and RMECR is either works by the concept of hop-by-hop or end-to-end retransmissions targeting in achieving a reliable performance in the whole network. The prominent work in the proposed system is finding the best route for the nodes during communications which gives solutions for the problems like increase energy-efficiency, reliability, and lifetime of wireless ad hoc networks. The process which should be considered during the process are energy taken by the transceivers, packet size,retransmission held packets and packet

acknowledgement whether it reached the ending point or not. The result this shows the efficiency of the proposed system as compared to tradition system.

Index: Wireless sensor network, Energy-aware routing, battery-aware routing, reliability, end-to-end and hop-by-hop retransmission

Introduction

In general wireless sensor network is a decentralized which does not have any structure. In which any node can join and leave independently. Its main purpose is packet sharing and resource sharing, but there are lots of drawbacks making the network performance unreliable and unsecure. The network is connected for packet sharing in which best routing path is an important factor. Because a effective energy routing protocol can reduce the energy cost in a communication also makes reliable service a possible one. Routing protocol is nothing but which specifies a best routes on the communication path inorder to reach the destination point. To more efficient an energy aware routing protocol is to be a prominent solution as energy awareness becomes an essential consideration in a routing protocol today. In which residual energy of nodes improves the quality of service as well as the operational lifetime of the network.

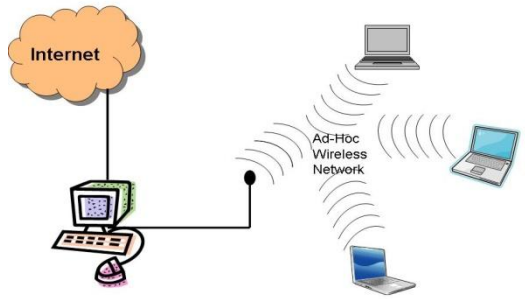

Figure 1: A wireless ad hoc network

Moreover designing a routing protocol for a wireless sensor network is a challenging task because of following characteristics. There is a difficulty in deploying a global addressing scheme for the multiple nodes in the network. Next thing a number of nodes carrying a sensed data moving towards a particular sink. Thirdly data redundancy, multiple nodes carrying same data may leads to redundancy which should be avoid to improve the energy performance and bandwidth utilization. The other terms should be considered during the routing is on-board energy, processing capacity and transmission power. Commonly routing protocols are segregated as data-centric, hierarchical or location-based by means of it network flow or QoS awareness. In which data centric protocol s avoid transmitting redundant data as it's of query based whose data desirably named. Hierarchical protocol, as the name

shows it is of cluster based in which the cluster head plays a vital role in data aggregation and reduction targeting to save the energy. The next one is location based in which it calculates source node, destination node and intermediate node re done by nearby location. The another thing should taken in consideration is wireless network are not structured so task maintaining and finding the routes are most complex process as a sudden change of node status because of unpredictable topology.

The reason energy awareness is becomes more prominent in routing algorithms the reason behind this is, according to the real-time scenario certain data's (sensed data) should be delivered within a particular period of time otherwise those data will be useless. Along with in real time data the bounded latency for data delivery is also an important factor. In certain application the energy conservation is more predicted than the quality of data sent. Sometimes network may reduce the result quality to avoid energy dissipation in a network. In this aspect the best route which not only to attain optimal energy consumption but also has the minimum end to end delay. The above statement implies the necessity of energy efficient awareness while establishing a routing protocol for wireless sensor networks.

Related Works

The various technical enhancement and wider wireless networking usages put way for the research interest on sensor networks. From the past decades there is various routing protocol algorithms are evolved and discussed about the overall networking performance. In which energy awareness protocols are still a complex one requires more improvements in the overall performance. Even though tradition routing protocols are attain much result these are not succeeded an effective result in the field of energy consumption. The main intention of the researchers in previous works is designing a routing algorithm by achieving energy-efficiency, reliability, and the lifetime of wireless ad hoc networks. In this According to De Couto et al. [1] in his algorithm he discussed about the reliability of links and finding multiple routes in the network. For this he introduced expected transmission count (ETX) in finding the best route by means link taking minimum retransmission for lost packets during communications. The concept behind this is minimum consumption as less number of transmissions. In this the nodes are frequently applied for packet forwarding but the major drawback is link fails quickly as it has to forward many packets instead of other nodes in a networks. Some researchers [2] [3] [4] [5] [6] [7] concentrated their work on battery energy of the nodes as it avoid overuse it achieves the energy-efficiency and reliability together. But the problems those researchers faced on these algorithms are, the actual energy consumed by the nodes were not considered in order to discover an energy-efficient routes. Behalf of that they can only able to find out the transmission power of nodes which is only a fraction of actual energy cost by the nodes during transmission. These aspects will affect the performance of energy-efficiency, reliability and network lifetime also.

According to the researchers in [8] [9] [10] [11] [12] [13] [14] [15], their algorithm not compromise the aspects of reliability and energy-efficiency instead of that they are energy efficient but not reliable. That is either they results in increasing power

consumption or reducing network life time. By [16] they discussed E2E (end-to-end) retransmission but it is failed to applicable for HBH (hop-by-hop) environments. In [17][18] [19] [20] they have discussed about the reliability of links, link weight , energy consumed for computing and total energy cost but these algorithms are not effective in some cases deal with real time scenarios. On which according to Dijkstra's algorithm he discovered a algorithm based on shortest-path routing but it is not applicable for the links in forward and reverse paths till that intermediate node reaching the destination nodes.

Proposed System

On the above analysis we propose two novel energy-aware routing algorithms known as reliable minimum energy cost routing (RMECR) and reliable minimum energy routing (RMER). The main motto of these proposed algorithms are enabling effective results in energy-efficiency, reliability, and the lifetime of wireless ad hoc networks. We establishing the proposed algorithm in finding the minimum energy cost path (MECP) from the source till it reach the destination point. The key concept of discussing about the energy cost is to attain a reliable network. If there is no reliable routes it results in retransmission of packets. The proposed energy-aware reliable routing algorithms is designed for HBH (hop-by-hop) and E2E (End –to-End) systems.

Energy-Aware Reliable Routing Algorithms for the HBH System

HBH system is transmits the packet in which the lost packets are retransmitted by the sender ensuring link reliability in the network. In this process successful transmission known by acknowledgement (ACK) in which the receiver send the ACK after receiving packet from the sender if not means the sender has to resend the packet until he receives the ACK. The algorithm supporting HBH retransmissions analyze the energy cost between the packets transmit from sender to receiver. The packet size and minimum routing path cost are considered by the protocol.

Energy-Aware Reliable Routing Algorithms for the E2E System

In E2E systems the ACK is sent only if the transmission fails in reaching the destination point. The ACK is done by end point which means the packet or the ACK is lost during the packet transmission. Our proposed algorithm RMER and RMECR supports E2E retransmissions in the same manner HBH system by analyzing the cost of a path from source to destination.

Analysis of path's energy cost: The energy cost is calculated by four steps such as;

- Calculating the transmission count between the data and ACK packets
- Examining the link energy cost to the retransmission
- Investigating the End –to – End reliability
- Calculating the cost between routing paths, links and reliability of the paths.

Minimum Energy Cost Path:

The success of the algorithm implies in designing a minimum energy cost by means of detect their neigh boring nodes. Thus finding the shortest path between source nodes to destination node the energy cost is also minimized in achieving maximum network lifetime. Fig 2 shows the algorithm for finding the shortest path;

```
1. state ← candidate
2. broadcast Node_Residual_Msg to all neighbor nodes
3. receive Node_Residual_Msg from all neighbor nodes
4. update neighborhood table NT []
5. t ← computation result of the broadcast delay time for competing a cluster head
6. while (the timer for cluster head election is not expired)
7.  if(CurrentTime <t)
8.          if (a Compete_Msg is overheard from a neighbor NT [i])
9.    state ← plain
10.    NT [i].state = head
11.   else
12.    continue
13.   endif
14.  else
15.         if (state = candidate)
16.    state ← head
17.    broadcast Compete_Msg
18.    wait (2*Δt )
19.    if (have not received any Compete_Msg)
20.     continue
21.    else
22.     if (the weight for head election is the largest one)
23.      continue
24.     else
25.      state = plain
26.      if (the value in weight broadcasted by NT [i] is the largest one)
27.       NT [i].state = head
28.      endif
29.     endif
30.   endif
```

Figure 2: Algorithm for finding shortest path

System Design
The proposed algorithm is implemented in the designed architecture in order to achieve its performance by below factors;

Node Deployment
It is the topology creation in which every node are comes into the networks based on the authentication and also satisfies neigh boring node to overcome security issues. Every node has a unique identity either by its IP address or its location. These deployments can be deterministic or self-organizing based on that the data is routed in a predefined path. In this node distribution must be uniform otherwise it cannot achieve the optimal performance.

Data delivery Models
In this initially the two nodes are essential one is the source node and other one is destination node. For this intermediate node is the path in which the packet travel. For the optimum one it should be shortest path and free from link failure as well as network traffic. This can be achieved by our proposed algorithms reliable minimum energy cost routing (RMECR) and reliable minimum energy routing (RMER) for both HBH and E2E systems.

Energy Consideration
In this phase the direct routing performs efficiently to the neigh boring nodes which close to the sink node. Here the packet size which is to be transformed which also to be considered that plays a major part in energy consumption as well as network traffic and packet loss criteria's. In order to minimize the multiple nodes carrying same packet redundancy is controlled by eliminating the duplicates as minimum routes limited energy consumption. This data aggregation technique is implemented in order to achieve energy efficiency and traffic optimization in the proposed system.

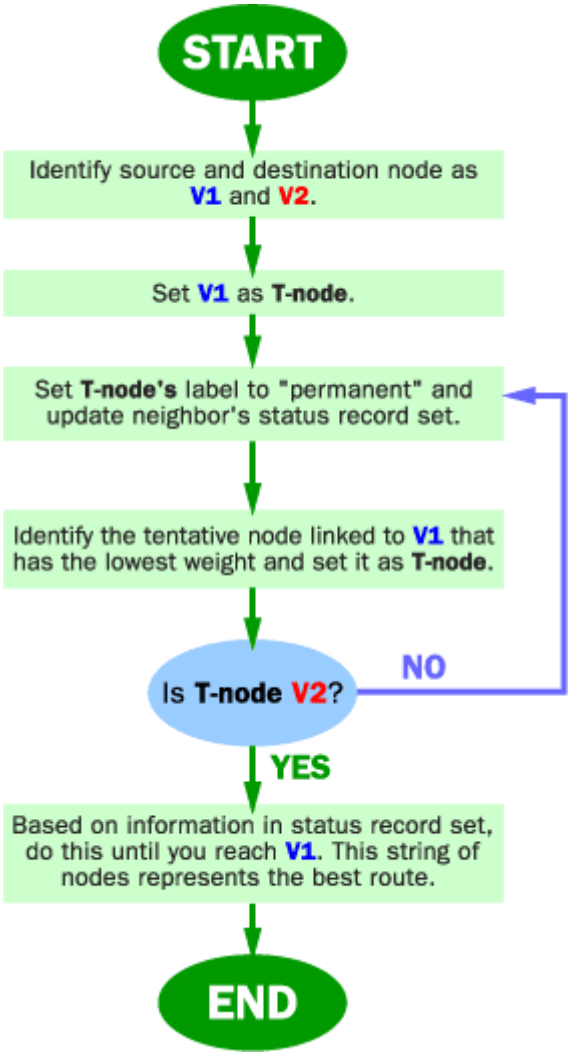

Figure 3: A design mechanism of proposed system

Expected Result

In this section we have discussed about the result achieved by the combining algorithms of RMER and RMECR together. In which both the algorithms were implemented to E2E systems and HBH system according to the real-time cases. The analyzed report based on the packet size, packet delivery ratio, ACK, retransmission cases are formulated to find the energy cost. As discussed earlier finding minimum path cost by both system along with the link failure in the overall network system. As a result the proposed architecture that requires addressing of each sensor node which is done by the nearby node it is connected t. It also supports fault tolerance which updates the routing table and energy levels of nodes are done to examine its performance. In the same manner number of packets increased which are sent from source node to destination by calculating the time period in order to verify its performance on multiple stages. For example the average relative error of the

estimation is computed by choosing 300 pairs of nodes in each of 50 randomly deployed networks with 200 nodes.

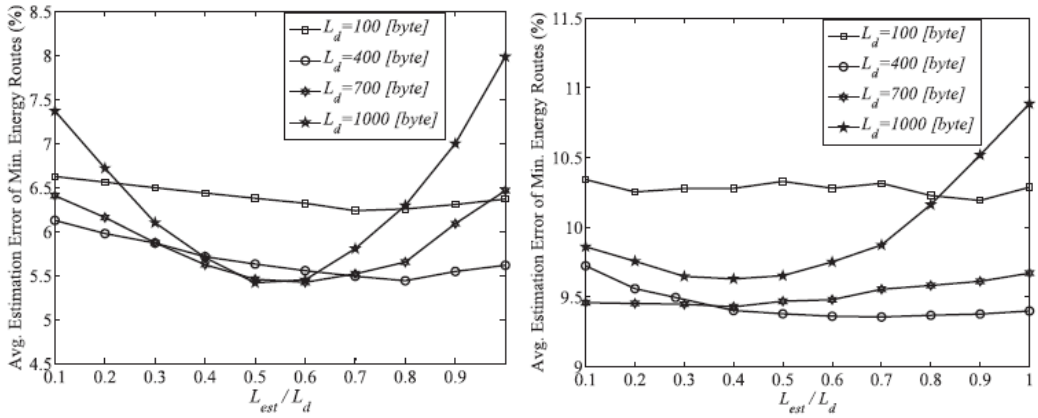

Figure 4: A sample Result

Conclusion

In this paper we presented a prominent energy efficient routing protocol with reliable minimum energy cost in routing. It is successfully implemented on hop-by-hop retransmissions and end-to-end retransmissions ensuring its reliability. The results comparison by RMER and RMECR are seem to be similar in the aspect of energy-efficiency and reliability by choosing the shortest routing path to transmit the packets. Thus achieving the result of minimum energy cost with increased network life time as it is better than the traditional routing protocols discussed earlier.

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