FINDING ENERGY EFFICIENT PATH CONSIDERING RESIDUAL ENERGY FOR ENERGY SAVING IN WIRELESS AD HOC NETWORKS USING RMER AND RMECR ALGORITHM

T.Lamana

PG Scholar, Department of EEE, SNS college of Engineering, Coimbatore (India)

ABSTRACT

The most important issue that must be solved in designing a data transmission algorithm for wireless ad hoc networks is how to save sensor node energy while meeting the needs of applications/users as the sensor nodes are battery limited. While satisfying the energy saving requirement, it is also necessary to achieve the quality of service. In case of emergency work, it is necessary to deliver the data on time. Achieving quality of service in is also important. In order to achieve this requirement AODV (ADHOC on demand distance vector) routing protocol using alternate path for wireless ad hoc networks is proposed that saves the energy by efficiently selecting the energy efficient path in the routing process.. RMER and RMECR are proposed for networks in which either hop-by-hop or end-to-end retransmissions ensure reliability. Simulation studies show that RMECR is able to find energy-efficient and reliable routes similar to RMER, while also extending the operational lifetime of the network. This makes RMECR an elegant solution to increase energy-efficiency, reliability, and lifetime of wireless ad hoc networks. In the design of RMECR consider minute details such as energy consumed by processing elements of transceivers, limited number of retransmissions allowed per packet, packet sizes.

Keywords: Energy-aware routing, battery-aware routing, end-to-end delay, Hop-by-Hop retransmission, reliability, wireless ad hoc networks

I. INTRODUCTION

ENERGY-EFFICIENT routing is an effective mechanism for reducing energy cost of data communication in wireless ad hoc networks. Generally, routes are discovered considering the energy consumed for end-to-end (E2E) packet traversal. Nevertheless, this should not result in finding essential reliable routes or overusing a specific set of nodes in the network. Energy-efficient routing in ad hoc networks is neither complete nor efficient without the consideration of reliability of links and residual energy of nodes. Finding reliable routes can enhance quality of the service. A wireless AD HOC network consists of AD HOC nodes capable of collecting information from the environment and communicating with each other via wireless transceivers. The collected data will be delivered to one or more sinks, generally via multi-hop communication. Since multi-hop routing is generally needed for distant AD HOC nodes from the sinks to save energy, the nodes near a sink can be burdened with relaying a large amount of traffic from other node AD HOC nodes are resource constrained in term of energy, processor and memory and low range communication and bandwidth. Limited battery power is used to operate the AD HOC nodes and is very difficult to replace or recharge it, when the nodes die. This will affect the network performance. Optimize the communication range and minimize the energy usage, conserve the energy of AD HOC nodes. AD HOC nodes are deployed to gather information and desired that all the nodes works continuously and transmit information as long as possible.

AD HOC nodes spend their energy during transmitting the data, receiving and relaying packets. Hence, designing routing algorithms that maximize the life time until the first battery expires is an important consideration. Designing energy aware algorithms increase the lifetime of AD HOC nodes[2]. In some applications the network size is larger required scalable architectures. Energy conservation in wireless AD HOC networks has been the primary objective, but however, this constraint is not the only consideration for efficient working of wireless AD HOC networks. There are other objectives like scalable architecture, routing and latency.

II. SYSTEM MODULES

2.1 Network design

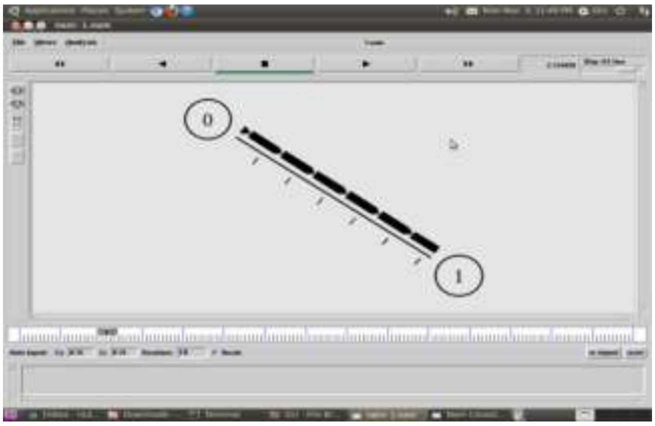

Figure 2.1 Network design

2.2 Route selection

In this method, user can select any type of broadcasting like as requesting and replying is the main process going to be done and so on. In this project taking three items spectrum availability, network resources, and licensed users. It included route selection module for setting the specific route with some fixed properties preferences.

2.3 Wireless network evolution

Design the network which is capable of selecting various network paths [10]. The proposed network broadcasting algorithm works on the choice of the user specified QOS parameters. A discovery and selection mechanism to find a new Base Station must be done.

2.4 Customizing parameters

In this module, after getting the network detail and separating the different parameters. After separating the parameters for each network, comparing that parameter to select best network .After comparison it provides the Rank list [15] for each parameter.

2.5 Network selection

Multi-parameter blind information is required to meet user needs in terms of automatic network selection during handover. All the parameter values are normalized so that they take on values in the range of zero and one and also in negative. After getting the rank for finding the path, the device going to select the best network automatically [15].

2.6 Protocols used

AODV (Ad Hoc On demand Distance Vector Routing): It is a reactive routing protocol, meaning that it establishes a route to a destination only on demand. In contrast, the most common routing protocols of the Internet are proactive, meaning they find routing paths independently of the usage of the paths. AODV is, as the name indicates, a distance-vector routing protocol. AODV avoids the counting-to-infinity problem of other distance-vector protocols by using sequence numbers on route updates, a technique pioneered by DSDV. AODV is capable of both unicast and multicast routing [5].

2.6.1 Working

In AODV, the network is silent until a connection is needed. At that point the network node that needs a connection broadcasts a request for connection. Other AODV nodes forward this message, and record the node that they heard it from, creating an explosion of temporary routes back to the needy node. When a node receives such a message and already has a route to the desired node, it sends a message backwards through a temporary route to the requesting node.

Each request for a route has a sequence number. Nodes use this sequence number so that they do not repeat route requests that they have already passed on. Another such feature is that the route requests have a "time to live" number that limits how many times they can be retransmitted. Another such feature is that if a route request fails, another route request may not be sent until twice as much time has passed as the timeout of the previous route request.

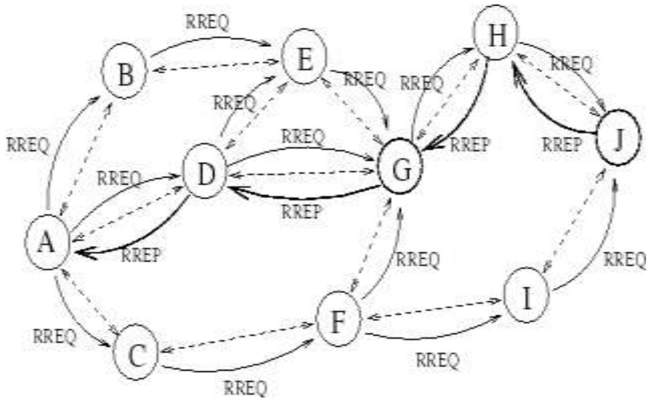

Figure 2.2 Processing of ad hoc network

2.7 Algorithms used

RMER and RMECR are proposed for networks in which either hop-by-hop or end-to-end retransmissions ensure reliability. Simulation studies show that RMECR is able to find energy-efficient and reliable routes similar to RMER, while also extending the operational lifetime of the network. This makes RMECR an elegant solution to increase energy-efficiency, reliability, and lifetime of wireless ad hoc networks. In the RMECR, it consider minute details such as energy consumed by processing elements of transceivers, limited number of retransmissions allowed per packet, packet sizes, and the impact of acknowledgment packets. It formulates the link weights for the RMER and RMECR algorithm in the HBH system. For RMECR, It defines the battery cost of a link as “the fraction of the residual battery energy of the two nodes of the link which is consumed to forward the packet”. To formulate the link weight in RMCER, let C_u be the remaining battery energy of u and C_v be the remaining battery energy of v. The energy consumed by u to deliver a packet to v is defined by $a_{u,v}(L_d)$, and the energy consumed by v for receiving the packet is defined by $b_{u,v}(L_d)$.

$E_{u,v}(L_d)= A_{u,v}(L_d)+ B_{u,v}(Ld)$ (1)

2.8 Modules Explanation

- Initializing the timer and the list
- Insert the values into the list
- Checking that values into the route discovery
- Energy calculation and path formation
- Energy loss
- Energy conserve using alternate path

2.8.1 Initializing the timer and list

First enable the timer and the list for the route discovery process. The list is enabled to store the various information about the nodes and packets.

2.8.2 Insert the values into the list

After initializing the list it store the various information about nodes and paths like source id, destination id, packet number, sequence number, hop count and the residual energy.

2.8.3 Checking that values and route discovery

The values which are stored in the list we have to check them and compare them to find a better path for data transmission. Whenever a node is trying to send a data it initially sends a request message i.e., RREQ in this it include some information like packet type, source id, destination id, sequence number .Based on this information the intermediate nodes check the destination id ,if it matches it will check about the source information if it is already available it will checks which is the better path based on the hop count and residual energy if it found new path is the better one it will generate route reply and send that in that path otherwise it will stick to old path. If the destination id is not matched means it will store that information in that list and forwards to its neighbors for the next process.

2.8.4 Energy calculation and path formation

Generally for the efficient data transmission, power of the nodes is very important. First calculate the power of the nodes and then make the transmission from source to destination. According to the power of nodes data transmission will occur.

$C[P(n1,nh+1))] =\sum[R_{ni}(L_d)e_{ni,}n_{i+1}(L_d)]$ (2)

In which $e_{ni},n_{i+1}(L_d)$ is the energy cost of (n_i,n_{i+1}) for packets of length Ld

2.8.5 Energy loss

Ad Hoc on Demand Distance Vector (AODV) The Ad hoc on-demand distance-vector (AODV) routing protocol is an on-demand routing protocol; all routes are discovered only when needed, and are maintained only as long as they are being used.

2.8.6 Energy conserves using alternate path

In energy conserves using alternate path, node choose alternate path for efficient transmission. The energy of each and every node is calculated. The sender knows when the energy of the nodes will be dry. If the energy of the nodes going to be low, the sender chooses the alternate path. The data is transmitted by the alternate path to the receiver. It will overcome the energy dry of the nodes and energy efficient reliable routing will occur. The energy will be conserved and lifetime of the network increases.

III.SIMULATION RESULTS

3.1 Energy calculation and path formation

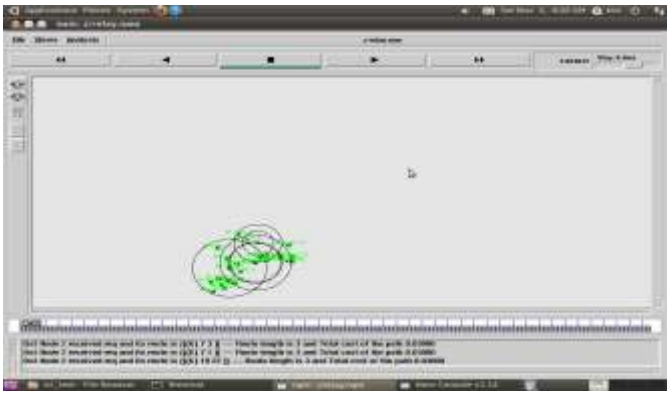

Figure3.1 Energy calculation and path formation

Generally for the efficient data transmission, power of the nodes is very important. First calculate the power of the nodes and then make the transmission from source to destination. According to the power of nodes data transmission will occur as shown in figure 3.1.

3.2 Energy loss

The ad hoc on-demand distance-vector (AODV) routing protocol is an on-demand routing protocol. In this, all routes are discovered only when needed, and are maintained only as long as they are being used. To transmit the data in reliable paths, the node needs some energy. If the energy of the node is dry, the data loss will occur in the particular nodes. After the node fails, it will discover another path then transmits the packets to the destination it will degrade the network as shown in figure 3.2

The green color indicates the energy of the node is full.
The yellow color indicates the energy of the node is medium.
The red color indicates the energy of the nodes is empty.

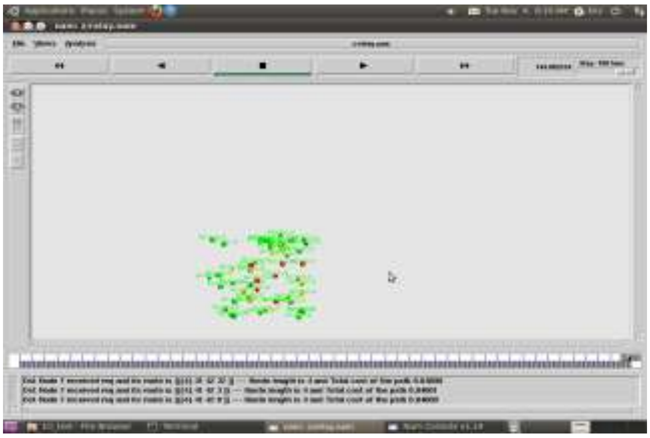

Figure 3.2 Energy Loss

3.3 Energy conserves using alternate path

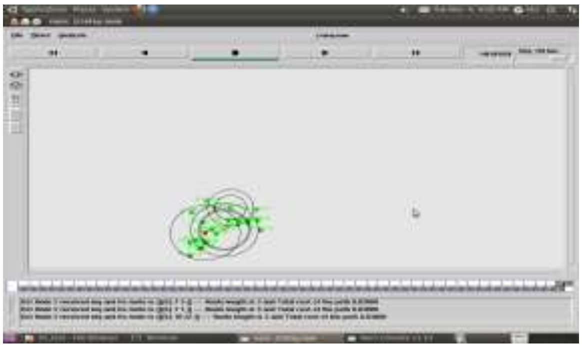

Figure3.3 Energy conserves using alternate path

In energy conserves using alternate path, node choose alternate path for efficient transmission. The energy of each and every node is calculated. The sender knows when the energy of the nodes will be dry. If the energy of the nodes going to be low, the sender chooses the alternate path. The data is transmitted by the alternate path to the receiver. It will overcome the energy dry of the nodes and energy efficient reliable routing will occur as shown in figure 5.3.The energy will be conserved and lifetime of the network increases.

The green color indicates the energy of the node is full.

The yellow color indicates the energy of the node is medium.

The red color indicates the energy of the nodes is empty.

IV. CONCLUSION

Proposed Energy efficient routing protocol for wireless ADHOC network invokes the residual energy and hop count as parameters. In the routing process path with largest minimum residual energy and least hop count is chosen. Transmission power of the node is adjusted according to neighbor's range of the node. Proposed Energy efficient routing protocol AODV using alternate path is compared with the existing protocols. Proposed protocol achieves the higher energy consumption. This improves the lifetime of the nodes in the network. Quality of Service of the communication network is also improved by achieving the lesser end-to-end delay. Thus proposed routing protocol provides better lifetime and Quality of Service.

V FUTURE WORK

In the future enhancement, it should be implemented in cognitive radio network and observe the energy consumption of the nodes. It also implements efficiency and reliability of the network.

REFERENCES

[1]. Javad Vazifehdan, R. Venkatesha Prasad, and Ignas Niemegeers "Energy-Efficient Reliable Routing Considering Residual Energy in Wireless Ad Hoc Networks,"2014.

[2]. Adeel Akhtar, Abid Ali Minhas, and Sohail Jabbar, "Energy Aware Intra Cluster Routing for Wireless ADHOC networks", International Journal of Hybrid Information Technology Vol.3,No.1, January, 2010

[3]. Zijian Wang, Eyuphan Bulut, and Boleslaw K. Szymanski, "Energy Efficient Collision Aware Multipath Routing for Wireless ADHOC networks", International Conference on Communication June 14-18, 2009.

[4]. "An Energy-Aware Routing Protocol in Wireless ADHOC networks" Ming Liu 1, Jiannong Cao 2, Guihai Chen 3 and Xiaomin Wang ADHOC 2009.

[5]. Liaskovitis.P and Schurgers.C, "Energy Consumption of Multi-Hop Wireless Networks under Throughput Constraints and Range Scaling," Mobile Computing and Comm. Rev., vol. 13, no. 3, pp. 1-13, 2009

[6]. Lu Su, Changlei Liu, Hui Songand Guohong Cao "Routing in Intermittently Connected ADHOC networks" 2008 IEEE.

[7]. X. Li, H. Chen, Y. Shu, X. Chu, and Y.-W. Wu, "Energy Efficient Routing with Unreliable Links in Wireless Networks," Proc. IEEE Int'l Conf. Mobile Adhoc and Sensor Systems (MASS '06), pp. 160-169, 2006.

[8]. Akkaya.K, and Younis.M, "A Survey on Routing Protocols for Wireless ADHOC networks", Elsevier Ad Hoc Network Journal, vol. 3, no. 3, pp 325-349, 2005.

[9]. Jiang.Q and Manivannan.D, "Routing protocols for ADHOC networks", Proceedings of CCNC 2004, pp.93-98, Jan. 2004.

[10]. Subramanian A.P, Anto A.J, Vasudevan.J, and Narayanasamy.P , "Multipath power sensitive routing protocol for mobile ad hoc networks", Proc. Conf. Wireless on Demand Network Systems, 2004, LNCS 2928, 2004, pp. 171-183.

[11]. Charles Perkins.E, "Ad hoc On-demand Distance Vector (AODV) Routing.", RFC 3561, IETF MANET Working Group, July 2003.

[12]. De Couto D.S.J, Aguayo.D, Bicket.J, and Morris.R, "A HighThroughput Path Metric for Multi-Hop Wireless Routing," Proc.ACM MobiCom, pp. 134-146, 2003

[13]. Banerjee.S and Misra.A, "Minimum Energy Paths for Reliable Communication in Multi-Hop Wireless Networks," Proc. ACMMobiHoc, pp. 146-156, June 2002.

[14]. Misra.A and Banerjee.S, "MRPC: Maximizing Network Lifetime for Reliable Routing in Wireless Environments," Proc. IEEE Wireless Comm. and Networking Conf. (WCNC '02), pp. 800-806, 2002.

[15]. Singh.S and Raghavendra.C, "PAMAS—Power Aware Multi-Access Protocol with Signalling for Ad Hoc Networks," ACM Computer Comm. Rev., vol. 28, pp. 5-26, 1999.