International Journal of Advance Research in Science and Engineering
Vol. No.5, Special Issue No. (01), February 2016
www.ijarse.com
IJARSE
ISSN 2319 - 8354

LQN-MAC: A LOCATION BASED QOS AWARE NOVEL MAC PROTOCOL FOR ACHIEVING HIGH THROUGHPUT IN MANETS

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ABSTRACT

Mobile Ad-Hoc Networks (MANETs) are wireless networks consisting of a collection of mobile nodes with no fixed infrastructure. In MANET Cooperative communication is a technique for realizing spatial diversity through a virtual antenna array formed by antennas of multiple nodes. There has been a growing interest in designing and evaluating efficient cooperative Medium Access Control (MAC) protocol in recent years. The existing Network Coding Aware Cooperative MAC protocol (NCAC-MAC) and Distributed Energy-adaptive Location based CMAC protocol (DEL-CMAC) works only for the small scale network with less throughput, high delay. In the proposed system a Location based QoS aware Novel MAC (LQN) protocol is introduced to improve the network performance in terms of high throughput for larger size networks.

Keywords: Cooperative Communications, Energy, Medium Access Control (MAC) Protocol, Relay, Throughput.

I. INTRODUCTION

MANET is called as Mobile Ad Hoc Network. It is a type of ad hoc network that can change location and configured themselves on the mobility. Because MANETs are mobile, they use wireless connection to connect to various networks. MANET is the Wireless ad hoc network that usually has a routable networking environment on top of a Link Layer ad hoc network. MANETs consist of self-forming, peer-to-peer, self-healing network. In MANET one of the most popular methods for data transmission is cooperative communication. Here each node can serve as a data source or destination node or a relay node that can help forwarding data from one to another or its neighbouring nodes. When a destination node transmission is range out of the transmission range of its source node, at that time multi-hop forwarding can be carried out it is an effective technique to enhance the network connectivity and extend the network coverage.

Cooperative communication is the promising technique for conserving the energy consumption in MANETs. The broadcast nature of the wireless medium is exploited in cooperative manner. The wireless transmission between a pair of terminals can be received and transmitted at other end for performance gain, rather than be considered as an interference traditionally. In an infrastructure network cooperative communication is a one of the technique for data transmission. Here each node can serve as a data source or destination node or a relay node that can help forwarding data from one to another or its neighbouring nodes. When a destination node is

out of the transmission range of its source node, at that time multi-hop forwarding can be carried out it is an effective technique to enhance the network connectivity and extend the network coverage. In recent years the number of mobile users is increasing rapidly more and more users are enjoying the multimedia services because of their high usage the network performance will be getting down. This type of data transmission will consume high energy Cooperative Communication is not always energy efficient compared to direct transmission. It is a method for gains in transmitting power and the losses in extra energy consumption overhead. So here the high energy consumption will reduce used energy aware greedy forwarding algorithm. The data transmission is motivated here by the Medium Access Control (MAC) protocol. Before starting the data transmission the network will be partitioned based on the x, y coordinates.

II. RELATED WORK

Many approaches have been done in MANET to provide an efficient data communication. The energy consumption of the mobile nodes is high due to the dynamic nature of the network. The nodes in the network had the limited resource constraints and energy drains quickly in case of network overload, high dynamic etc. Hence improving the network lifetime of the MANET becomes a major challenge in today's network. In the existing literatures QoS parameters has been analyzed for large scale networks in MANET.

One of the approaches is that performing the cooperative communication by using DEL-CMAC protocol it was proposed by Xiaoyan Wang and Jie Li. In this method the relay node will be set based on the utility based best relay selection strategy. In energy model power is optimally allocated to the source and intermediate nodes so the packet loss is reduced in this method.

X. Wang , J. Li and M. Guiana proposed a approach is Network Coding Aware Cooperative Medium Access Control for Wireless Networks (NCAC-MAC) here the network coding will be introduced to the cooperative retransmission process. It enables the relay node to assist other nodes while serving its own traffic simultaneously.

Another one is CMAC protocol for wireless sensor network by using this protocol network life time will be maximized under the BER (Bit Error Rate) analysis technique. Using this BER constraint power is optimally allocated to the intermediate nodes then it will perform the data transmission through the intermediate nodes this was proposed by C. Zhai, J. Liu and L. Zheng and H. Xu.

Energy-efficient Topology control algorithm is introduced by Y. Zhu, M. Huang, S. Chen and Y. Wang. This method is used to build the cooperative energy spanner so that the individual path energy will be guaranteed.

The another approach is CooperativeMAC (CoopMAC) it was proposed by P. Liu , Z. Tao ,S. Narayanan, T. Korakis and S.S. Panwar. Using CoopMAC protocol overheard transmission is performed. Each low data rate nodes maintains a table called Cooperative table during the transmission the low data rate node starts either direct transmission or transmission through the helper node with the objective of minimizing the total transmission time.

Another type of data transmission is done by COMAC it is used to provide robustness to the wireless channel. This protocol is proposed by M. Gokturk and O. Gurbuz.

The final approach is space–time coded cooperative diversity protocols proposed by J.N. Laneman and G.W. Wornell. This protocol will exploit the spatial diversity available among the group of distributed terminals that

relay messages for one to another in such a manner that the destination terminal can average the fading. The summarization of our contributions as follows.

- LQN-MAC protocol mainly focused on increasing high throughput for the large scale network that is the very less explored aspects in related work. By partitioning the network into four zones will makes easier for identifying the destination location.
- The Energy Aware Greedy Forwarding algorithm is used to check the energy level of all the nodes.
- Using Energy Aware Greedy Forwarding algorithm the high energy node will be fixed as a relay point.
- The simulation result revel that LQN-MAC protocol can significantly increase the throughput for the larger size network.

The remainder of this paper written as follows. Section III describes about the System Model, Section IV describes the proposed LON-MAC protocol and Section V describes the Energy Aware Greedy Forwarding algorithm, Section VI Describe the Simulation Result and Section VII shows the conclusion of proposed work.

III. SYSTEM MODEL

Consider a Mobile ad hoc network with n nodes which are capable of receiving and combining partial received packets in accordance with the Cooperative Communication model.

3.1 Cooperative Communication

In CC model there is no direct communication between the source and destination. Here all information or data send through the relay point.

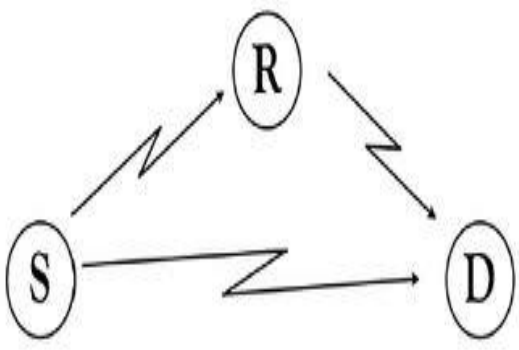

Fig 1.Cooperative Communication

A multi-hop MANET with randomly deployed mobile terminals is considered, where all terminals have the capability to relay. In this system model, assume that data connections among terminals are randomly generated and the routes are established by running Ad hoc On-demand Distance Vector (AODV), it is a widely used routing protocol for MANETs. There are two types of relay terminals in this network that is cooperative relay terminals and routing relay terminals. Here AODV builds the route in a proactive manner by selecting the routing relay terminals firstly.

The overall process of the proposed work is to perform the data transmission by using LQN-MAC protocol. MANET will be consider as a rectangular network, Split all nodes using horizontal partition and Vertical

partitioning finally all the nodes are set into the partitioned network. Here Energy Aware Greedy Forwarding algorithm is used for check the energy level of all the nodes.

IV. LQN-MAC PROTOCOL

LQN-MAC stands for Location Based QoS aware Novel – Medium Access Control which is perform the data transmission in a cooperative manner before starting the transmission LQN-MAC protocol will check the source and destination zone. Based on the destination zone the relay point will be selected using Energy aware Greedy Forwarding Algorithm.

4.1 Zone Partitioning

Assume the entire MANET network area is generally a rectangle. The information of the upper left and bottom-right boundary of the network area is configured into each and every node when it joins in the system.

The rectangular area has horizontally partitioned into two zones A1 and A2. We then vertically partition zone A1 to B1 and B2. After that, we can horizontally partitioning the zone B2 into two zones. Such zone partitioning consecutively splits the smallest zone in an alternating horizontal and vertical manner. This partitioning process is called as hierarchical zone partition. LQN-MAC uses the hierarchical zone partition and it can randomly chooses a node in the partitioned zone in each step as an intermediate relay point, then it dynamically generating an unpredictable routing path for a data transmission.

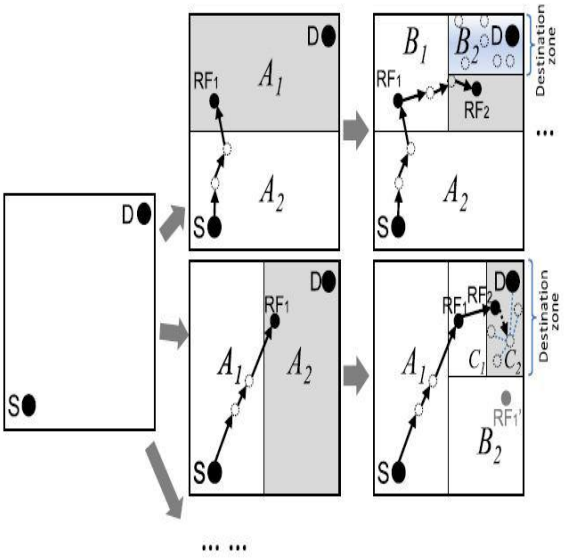

Fig 2 Zone Partition

Finally all the nodes are set into the portioned network. This is used to perform the data transmission much easier here we can easily identify the source and destination zone. Based on the location of destination we set the relay point with objective of successful data transmission.

4.2 Energy Aware Greedy Forwarding Algorithm

The Energy Aware Greedy Forwarding algorithm used to check the energy level of each node. Let as (XD, YD) and (XF, YF) respectively then denote the locations of the destination node and the forwarding node namely as D and F that has the data packet addressed to the destination node D.

Then we can first form a candidate set of neighbouring nodes, and Candidate-Neighbour-List (F), which is the subset of the Neighbour-List (F). for every neighbour node I ξ Candidate-Neighbour-List (F), then calculate the Weight (I), mentioned as the sum of the (a) fraction of the initial energy that is currently available at I, referred to the Residual Energy (I), and the (b) fraction of the distance covered with the potential selection of I, referred to as Progress (F, I), which is the difference in the distance between I and D and the distance between F and D divided by the distance between F and D.

Among such intermediate nodes, the intermediate node that has the maximum Weight value is chosen by F as the next iteration node to forward the data packet.

If the forwarding node F could not find the intermediate node that lies closer to the destination than itself, the Candidate-Neighbour-List is empty and the node switches to perimeter forwarding.

Using this algorithm all the node energy will be calculated energy level of all nodes are ordered in a sequence order which node energy will be higher that node is consider as a relay point. Next high energy node will be considered as a next relay point.

Input: Forwarding node F, Destinations D, Neighbor – list (F)

Auxiliary variables: Progress (F, I) where I £Neighbor – list (F)

Candidate - Neighbor – list (F), Residual Energy (I) , Available energy (I), Initial Energy (I), weight (I) I £ candidate Neighbor – list (F), maximum-weight

Output: Next-Hop-Node // if Greedy forwarding is successful

NULL // if Greedy forwarding is not successful and // perimeter forwarding is needed

Initialization: Next-Hop-Node = NULL; maximum-weight 0.0

Candidate - Neighbor – list (F) ← ϕ

Begin–GPSR Greedy forwarding algorithm

$$\text{Distance F-D} = \sqrt{(XF - X\,D\,)^2 (YF - Y\,D)^2}$$

For every Neighbor node I £Neighbor – list (F) do

$$\text{Distance I-D} = \sqrt{(XF - X\,D\,)^2 (YF - Y\,D)^2}$$

If (Distance I-D<Distance F-D) then

CandidateNeighbor – list (F) ←candidate Neighbor – list (F) U {I}

end if

end for

for everyNeighbor node I £ candidate Neighbor

list (F) do Residual Energy

(I) =A variable Energy (I) / Initial Energy (I)

Progress (F, I) = Distance F – D/ Distance1 – D

Weight (I) ←ResidualEnergy (I) + Progress (F, I)

If (maximum-Weight < Weight (I)) then

Next-Hop-Node ← I

end if

end for

if (maximum-Weight > 0.0) then

return Next-Hop-Node

else

returnNULL

end if

end–GPSR Greedy forwarding algorithm

VI. SIMULATION RESULT

Using NS2 simulator the performance will be analysed. The proposed LQN-MAC algorithm result will be compared with the existing DEL-CMAC algorithm.

6.1 Analysis for Throughput

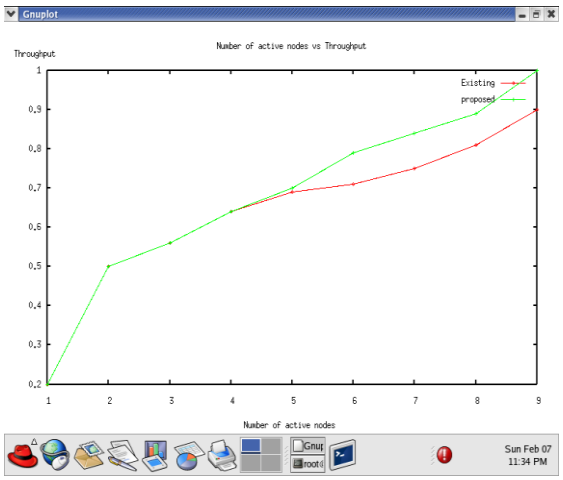

Fig 3.analysis for number of active nodes vs. Throughput

The performance will be analysed between the numbers of active nodes vs. throughput. In existing DEL-MAC protocol the amount of transmission failure will be higher the proposed LQN-MAC protocol with energy aware greedy forwarding algorithm significantly increase the amount of packet delivery ratio. The greedy forwarding algorithm selects the best relay node so the packet delivery failure does not occur here.

6.2 Performance for Energy Consumption

The performance will be analysed between average energy consumption vs. the number of nodes. In existing system some of the nodes are consumes high energy while the packet transmission. In the proposed system we can reduce the high energy consumption of nodes with the help of energy aware greedy forwarding algorithm.

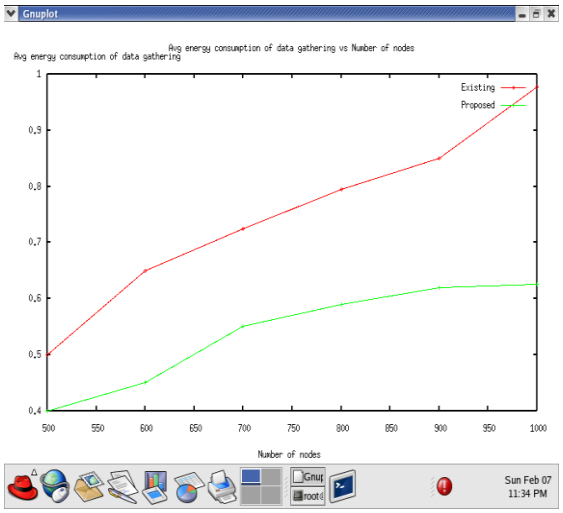

Fig 4.analysis for average energy of data gathering vs. number of nodes

6.3 Analysis for Delay

In DEL-MAC protocol node speed of the data transmission is very less compared with the LQN-MAC protocol. Here the data transmission will requires more time for reaching the exact destination.

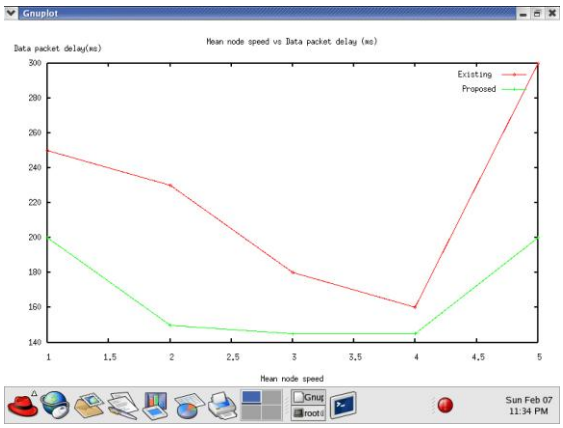

Fig 5.Analysis for Mean node speed vs. data packet delay

But the LQN-MAC protocol performs the packet delivery within the predefined time with the concept of zone portion. So we can easily identify destination zone and deliver the packet soon. It will significantly reduce the delay comparing to the existing protocol.

VII. CONCLUSION

Previous Distributed Energy-adaptive Location-based CMAC protocol (DEL-CMAC) will consumes high energy while the data transmission. Sometimes intermediate nodes are failed to transfer the packet because of these reasons network performance will be get down and this protocol works only in the small scale network. So in the proposed system LQN-MAC is introduced. It partitions the rectangular network into four zones then we can easily identifying the destination zone then starts the data transmission through the relay point. Using Energy aware Greedy Forwarding Algorithm we can easily identify the high energy node. This method will reduce the pack failure and it will significantly increase the throughput for the large size network.

REFERENCES

[1]. Xiaoyan Wang, Jie Li, "Improving the Network Lifetime of MANETs through Cooperative MAC Protocol Design." IEEE Trans. parallel and distributed system vol 26 no.4, April 2015 "

[2]. X. Wang, J. Li, and M. Guizani, "NCAC-MAC: Network Coding Aware Cooperateive Medium Access Control for Wireless Networks," Proc. IEEE Wireless Comm. and Networking Conf. (WCNC '12), pp. 1646- 1651, Apr. 2012.

[3]. C. Zhai, J. Liu, L. Zheng, and H. Xu, "Lifetime Maximization via a New Cooperative MAC Protocol in Wireless Sensor Networks," Proc. IEEE GLOBECOM, pp. 1-6, Dec. 2009.

[4]. Y. Zhu, M. Huang, S. Chen, and Y. Wang, "Energy- Efficient Topology Control in Cooperative Ad Hoc Networks," IEEE Trans. Parallel and Distributed Systems, vol. 23, no. 8, pp. 1480-1491, Aug. 2011.

[5]. P. Liu, Z. Tao, S. Narayanan, T. Korakis, and S.S. Panwar, "CoopMAC: A Cooperative MAC for Wireless LANs," IEEE J. Selected Areas in Comm., vol. 25, no.2, pp. 340-354, Feb. 2007.

[6]. J. Wu, M. Cardei, F. Dai, and S. Yang, "Extended Dominating Set and Its Applications in Ad Hoc Networks Using Cooperative Communication," IEEE Trans. Parallel and Distributed Systems, vol. 17, no. 8, pp. 851-864, Aug. 2006.

[7]. M. Gokturk and O. Gurbuz, "Cooperation in Wireless Sensor Networks: Design and Performance Analysis of a MAC Protocol,"Proc. IEEE Int'l Conf. Comm. (ICC'08), pp. 4284-4289, May 2008.

[8]. J.N. Laneman and G.W. Wornell, "Distributed Space-Time-Coded Protocols for Exploiting Cooperative Diversity in Wireless Networks," IEEE Trans. Information Theory, vol. 49, no. 10,pp. 2415-2425, Oct.2003.

[9]. J.N. Laneman, D.N.C. Tse, and G.W. Wornell, "Cooperative Diversity in Wireless Networks: Efficient Protocols and OutageBehaviour," IEEE Trans. Information Theory, vol. 50, no. 12,pp. 3062-3080, Dec. 2004.

[10]. J.N. Laneman and G.W. Wornell, "Distributed Space-Time-Coded Protocols for Exploiting Cooperative Diversity in WirelessNetworks," IEEE Trans. Information Theory, vol. 49, no. 10,pp. 2415-2425, Oct. 2003.

[11]. A.K. Sadek, W. Yi, and K.J.R. Liu, "On the Energy Efficiency of Cooperative Communications in Wireless Sensor Networks," A C M Tras.Sensor Networks, vol. 6, no. 1, article 5,Dec. 2009.

[12]. H. Shan, P. Wang, W. Zhuang, and Z. Wang, "Cross-Layer Cooperative Triple Busy Tone Multiple Access for Wireless Networks,"Proc. IEEE GLOBECOM, pp. 1-5, Dec. 2008.

[13]. S. Moh and C. Yu, "A Cooperative Diversity-Based Robust MAC Protocol in Wireless Ad Hoc Networks," IEEE Trans. Parallel and Distributed Systems, vol. 22, no. 3, pp. 353-363, Mar. 2011.