Optimized Routing Mechanism in MANETs using AOMDV Protocol

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Abstract -- MANET stands for Mobile Ad hoc Network. Nodes in MANET are self-organizing nodes and do not need any centralized base station or physical connection. Since the nodes are mobile, the network doesn't have any fixed topology. If the path is broken by nodes' moving in network, a path has to be again established and data should be rerouted from the beginning. Loss of connectivity due to movement of nodes is one of the serious challenges to MANET. Nodes in MANET are battery operated. There are chances of a battery getting down during data transfer due to the battery drain which again results in loss of connectivity between the nodes. In this paper, for the above problem we propose an idea with AOMDV (ad hoc on-demand multipath distance vector) protocol which takes the mobility and energy level of the node into consideration during the routing of data from source to destination. In the proposed system we make the routing of data using the nodes that are less mobile and also the nodes that poses sufficient energy to make the data transfer.

Keywords - MANET, Routing protocols, Mobility, AOMDV, Energy, link Stability

I. INTRODUCTION

In recent years mobile ad hoc networks (MANETs) have gained tremendous attention because of their self-configuration capability. Devices in mobile ad-hoc networks are capable of detecting the presence of other devices and perform necessary set up to facilitate communication. Nodes in such a network are fitted with a battery for their operation.Breakage of link between nodes in network happens for mainly two reasons, when the node move out of its position and when the node goes down due to loss of energy.

The energy-aware routing protocols consider factors like residual energy, total transmission power or both. But, there exist a very few protocols in the literature that consider both stability and energy during route discovery and maintenance. Due to the mobility of nodes, maintaining the stability of a path is one of the main issues. If the path is broken by a node's high mobility, the control overhead for repairing the path increases. For this reason, considering of node's mobility for setting up the path is needed to increase the stability of the path. As and how the nodes are used, the energy keeps draining in those nodes. It requires energy aware efficient routing protocols to improve the robustness of the system.

This paper is with an idea to make an optimum routing in such a network using AOMDV protocol by checking the level of energy in each node that the packets are passing through. When energy level is considered, probability of packet loss decreases. When the message is being propagated in the network, the AOMDV protocol checks for the less mobile nodes and makes a list of paths from source to destination, so that the routing is done with less mobile nodes where the chances of link breakage is less and also checks for the energy level present in each node, considers the node with sufficient energy level for sending of data. Overall it enhances the performance of the network.

II. RELATED WORK

Protocols in MANETs are mainly classified into three types. *Table driven* routing protocols are called proactive routing protocols. The route is already known when the packet is to be forwarded. They make use of routing table to store the list of all routes to destination. Routes are formed based on destination sequence number. *Source initiated on-demand* driven protocols create a route only when there is a need to send data. The two main procedures of on-demand routing protocols are route discovery and route maintenance. Route request and route reply packets are used for route setup. *Hybrid routing* protocols combining both table driven and on-demand approaches which reduce the overhead in route discovery and route maintenance.

Distance-Sequenced Distance Vector (DSDV), Wireless Routing Protocol (WRP), Global State Routing (GSR) are the examples of table driven protocols. Dynamic Source Routing protocol (DSR), Ad hoc On-demand Distance

Vector (AODV), Cluster Based Routing Protocol (CBRP) are the examples of On-demand routing protocols. Zone Based Routing Protocol (ZBR), Inter-Zone Based Routing Protocol (IERP), Intra-Zone Based Routing Protocol (IARP) are the examples of Hybrid routing protocols.

AOMDV Protocol – AOMDV (ad hoc on-demand multipath distance vector) protocol is an extension of AODV protocol. AODV is a single path routing protocol whereas AOMDV is a multipath routing protocol. All the paths discovered will be stored in the table. The RREQ will be flooded in the network and all nodes examine the RREQ packet for setting up of alternate reverse route. The destination node sends a RREP in response to every RREQ. When any link is broken, the broken link is immediately replaced with other route without any overhead due to re-establishing of the path.

Power aware AOMDV[4] protocol is proposed to overcome the problem of energy in routing. It helps in updating the routing table with both node route and their corresponding energy level. Node state AOMDV[10] is a protocol based on node state which helps in improving the efficiency of AOMDV protocol. Node Alarming Mechanism (NOAL)[12] presents an alarming mechanism where an intermediate node having low energy alarms its statusto others.

III. PROPOSED PROTOCOL

We consider AOMDV protocol for data transfer. Since AOMDV protocol comes up with multiple paths, we can select the optimal math among the various paths. AOMDV is the extension of AODV protocol. Like AODV it initially sends the RREQ to its neighbor nodes and the nodes set a path to destination if they have a route ready in their routing table or else they forward it their neighboring nodes. Destination node replies with the RREP packet. Destination node considers all the RREQ packets from different nodes and replies with different RREP for the setting up of multiple paths.

In the proposed protocol we make use of three important fields, *MLevel, ELevel* and *Relieve*. MLevel is for recording the Mobility of the node, Relieve field is to see that the node with high MLevel does not be excluded continuously for data transfer. ELevel is just to store the battery level of the node. Initially these fields don't have any effect on the route setup. Setting up of the route takes place normally in the same way as AOMDV works. The structure of routing table of a node is shown below.

Destination	Seq no	Next hop	*MLevel*	*Relieve*	*ELevel*	Expiration timeout

Fig 1: Structure of routing table

IV. WORKING OF PROPOSED PROTOCOL

The working of the proposed protocol is shown in below steps.

1. Finds the mobility of each node and updates in the neighbor routing table.
2. Find the nodal residual energy of each node.
3. Set the multiple paths by sending RREQ.
4. Send RREP and update the ELevel and MLevelin RREP by comparing with each node.
5. Sets in order the paths with different MLevel values of links and ELevel obtained.
6. Makes a decision on route with adequate nodal residual energy nodes and less mobile nodes

Since the source and destination are two main source of data transfer, MLevel will not be calculated for them. Nodes in network have different transmission range and the node that comes under its transmission will receive any data sent by the node. The node that goes out of range for one node will come under the range for other node. Nodes with high mobility frequently move out of range for different nodes and possess high mobility value.

All intermediate nodes' MLevel will be calculated by sending of Hello packets from their neighbor nodes. Initially MLevel will be zero. A maximum value is set for the MLevel so that the MLevel does not reach much enlarged high value. Every time any node that fails to receive the hello packet, its MLevel is compared with the *Max* value and if it is less than the Max value, then MLevel will be incremented by one in the routing table of its neighbor. If the MLevel is equal or greater than Max, then the Relieve value will be incremented by one and MLevel will be made zero. The value of Relieve field shows the no of times MLevel have reached Max. Timeout of Hello packet indicates that the node has moved out of its place and MLevel will be incremented. The algorithm for finding the mobility of node in the proposed protocol is shown below.

1. Nodes form an Ad hoc network
2. ***MLevel*** = 0
3. *While (true)*
4. do
5. Broadcast ***HPck*** to next hop

6. *if* ***HPck***received
7. then
8. wait for 'T' seconds
9. *go to* step5
10. *else if* ***MLevel>= Max***
11. then
12. decrement ***MLevel***
13. increment ***Relieve***
14. *else*
15. increment ***MLevel***
16. *end if*
17. *end if*
18. *go to* step5
19. *end while* when simulation ends

Fig 2: Algorithm to find mobility of a node

The MLevel and ELevel of the each node is considered and copied to RREP packet. Based on the size of packet, threshold ELevel is set and compared with ELevel of each node on the RREP path. ELevel of node that is equal to or greater than the threshold Elevel is copied to the RREP packet. MLevel of the each node is compared with its neighbor node and the higherMLevel is copied to the RREP and the process continues till the source node is reached.

The algorithm for the working of proposed protocol is shown below.

1. Start
2. Calculate ***Threshold ELevel***
3. $E_{tx}=(P_{size}*P_{tx}) / BW$
4. $REQ_e= n*E_{tx}$
5. Set a ***Threshold ELevel*** from above calculation
6. ***Src***Broadcasts ***RREQ*** to next hop
7. Intermediate nodes with different ***ELevel*** forward the ***RREQ***
8. ***Dest***sends multiple ***RREP*** to next hop
9. ***MLevel***of RREP=***MLevel*** of Routing table
10. ***ELevel*** of RREP =***ELevel*** of Routing Table
11. *While* (node!= **Src**)
12. *do*
13. *if****ELevel (***node ***i)*** <***ELevel (***node ***i+1***)
14. ***ELevel*** of RREP =***ELevel*** of Routing Table
15. *else* do nothing
16. *if****MLevel (***node ***i)*** >***MLevel (***node ***i+1***)
17. ***MLevel*** of RREP=***MLevel*** of Routing table
18. *else* do nothing
19. go to next node
20. *end if*
21. *end if*
22. *end while*
23. Src receives '***n***' multiple path **ELevel** from Dest
24. *for* ***i***=1 &***i***<=***n***
25. *if* ***ELevel(i) >= Threshold***
26. *then* consider the path
27. *else*
28. exclude the path
29. increment***i***
30. *end if*
31. Arrange different ***MLevel*** and ***ELevel***in order
32. Select the Optimal path and transfer data
33. Stop

Fig 3: Algorithm for working of proposed protocol

E_{tx} - Threshold energy for transmission

P_{size} - Data Packet size

P_{tx} - Power required for transmitting one datapackets

BW - Band width

REQ_e– Energy required to transmit 'n' data packets

Before forwarding RREP, the intermediate node compares MLevel value in its own table and MLevel in the received RREP. If its own value is greater the MLevel is updated, or if not, it does not update. Similarly the ELevel is compared. If its own value is less than the value is updated, or if not, it does not update. All nodes in the route transfer the MLevel value and ELevel value to the source with above process. In conclusion, the MLevel value of RREP arrived at the source is the highest MLevel value of the node which has the highest mobility over the path and the ELevel value reached is the lowest ELevel value of the node with lowest energy over the path.

V. RESULT ANALYSIS

Here the performance of proposed modified AOMDV protocol is compared with existing AOMDV protocol by varying the no of nodes and simulation time. The main focus is on efficiency of protocol under the dynamic environment. And the performance metrics for routing performance evaluation are Throughput, End to End Delay, Packet Drop Ratio, and Average Energy of the Path.

Throughput: It is defined as the amount of data transmitted over the network for a period of time. It is measured in kbps. Network throughput is affected by the node mobility, routing overhead, frequent topology changes, limited bandwidth etc. It is desirable to achieve high network throughput for every protocol.

Throughput = No. of packets received / duration

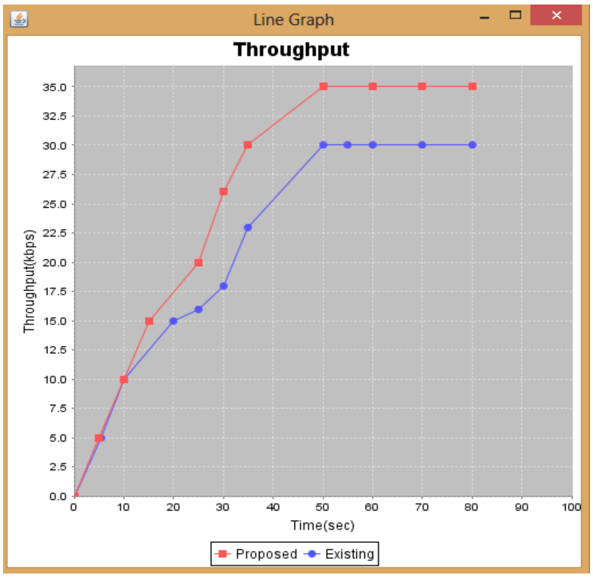

Fig 5.1: Line chart of comparison of throughput between existing AOMDV protocol and modified AOMDV protocol

End to End Delay: refers to the time taken for a packet to be transmitted across a network from source to destination. It is measured in terms of seconds. It also includes the delay caused by route discovery process and the queue in data packet transmission. Only the data packets that successfully delivered to destinations are counted.

End to end delay = packet received time – packet sent time

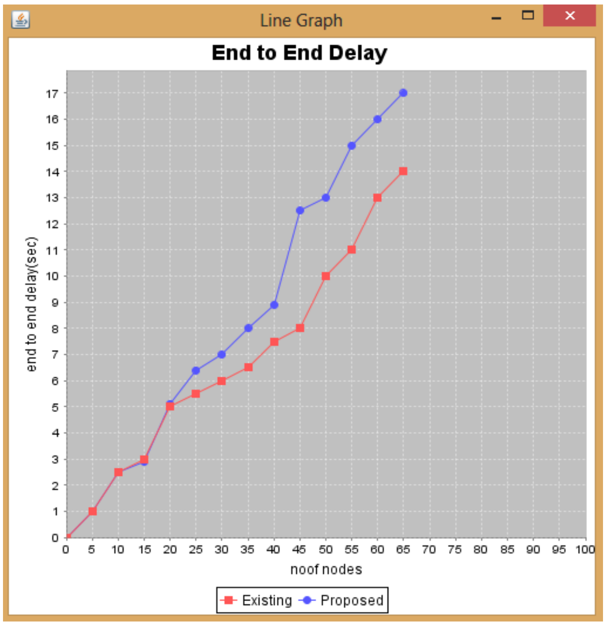

Fig5.2: Line chart of comparison of delay between existing AOMDV protocol and modified AOMDV protocol

Packet drop ratio: is defined as the ratio of no of lost packet to the no of packets sent. It is measured as %. This illustrates the level of lost data to the destination.

$$\textbf{Drop ratio} = \frac{(\text{No. of packets send} - \text{No. of packets received}) * 100}{\text{No. of packets sent}}$$

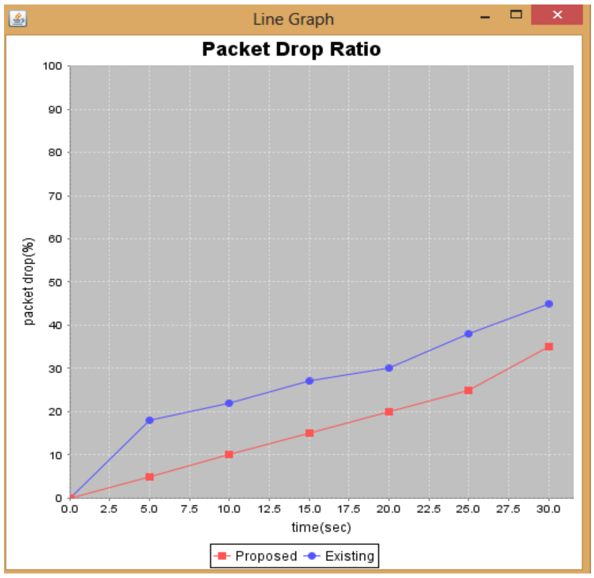

Fig5.3: Line chart of comparison of packet drop ratio between existing AOMDV protocol and modified AOMDV protocol

Average energy of the path: Tells about the average energy level present in the data transmission path. It is measured in % of energy present. It is affected by the node going down during the data transfer.

$$\textbf{Avg Energy of the path} = \frac{\text{sum of energy level of all nodes in path}}{\text{No. of nodes in the path}}$$

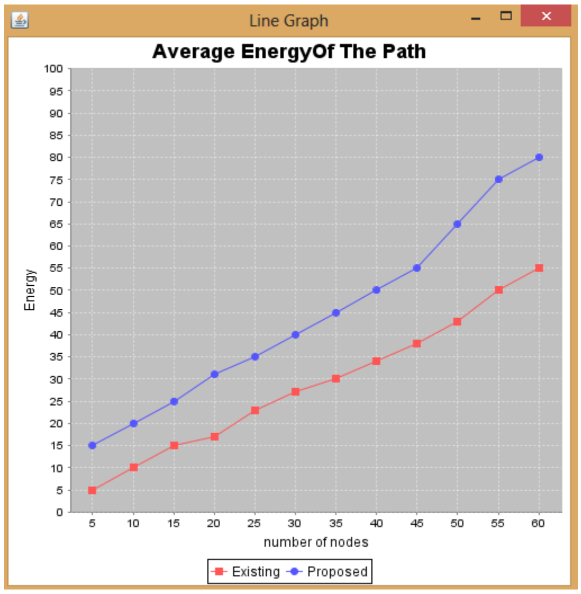

Fig 5.4: Line chart of comparison of average energy of the path between existing AOMDV protocol and modified AOMDV protocol

VI. CONCLUSION

The proposed protocol finds the information on mobility of a node and battery charge and helps in increasing the stability of the link. The source node selects the path which has a low mobility value and sufficient energy level over the path. The node that makes frequent path breaks is the node with high mobility. Another reason for frequent path break is node battery going down during data transfer. Data is transferred only with the node that has low mobility value and sufficient energy level in the nodes. Overall a more stable path can be chosen. Therefore it increases the overall performance of the routing.

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VIII. REFERENCES

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