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Energy and Time Efficient Route Discovery in Manet using Modified Aodv Routing Protocol

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Abstract: ***In MANET usually nodes interact with each other either directly or by relaying nodes depending on whether nodes present are in vicinity of each other or not respectively. There are different routing protocols which work on the principle either of demand or not. AODV is a reactive routing protocol which performs on the strategy of shortest hop in its vicinity. Sometimes there is a route failure in network then some message is sent to the node if reply is not received with in time frame then for sure path is broken. So it is wastage of time and energy of all the participating nodes. Main reason behind the node failure is the sustaining energy of the participating nodes in the communication. Since nodes which have very less energy gets consumed when these try to send either data or reply to and from the nodes. Sometimes a node has minimum energy to send data. As soon as it sends data it is switched off and does not send delivery successful reply to the originating network. So in this case network thinks path is broken so message is again sent to another path. So here it again there is loss of energy of other communicating node and also wastage of time to send data to nodes. In this research work, an energy and time efficient approach will be proposed which will save time as well as energy of remaining nodes which further utilizes all the known linked paths simultaneously for transmitting data with the help of AODV routing protocol. Different simulation parameters are used to check the accuracy of approach. Simulation is performed on NS-3. There will be 50 to 100 nodes in the topology. Performance metrics like throughput, energy deviation, packet lost, packet delivery ratio and other will be used for performance checking with respect to standard AODV routing protocol. This research work provides the improvements to the existing algorithms of communication among network nodes in mobile ad-hoc networks (MANET) to obtain better results.***

Keywords: ***AODV, energy efficient, MANET, routing, time efficient.***

I. INTRODUCTION

MANetwork uses different nodes as well many available topologies for its effective connection process. In these systems there is not always a predefined connection among different nodes which are connected among each others.

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Also sometimes there is not a direct link among the neighboring nodes. Since the nodes are of dynamic nature so often the wireless routes become dead as soon as participating nodes energy crosses a particular threshold value so as a result of it the nodes cannot take part in communication further. Among different reactive protocols AODV used single path to destination. Nodes first forwards the RREQ (route request) to the other adjacent nodes to check whether there is link available or not then RREP (route reply) process initiated and then RACK (route acknowledgement) is sent to source node.

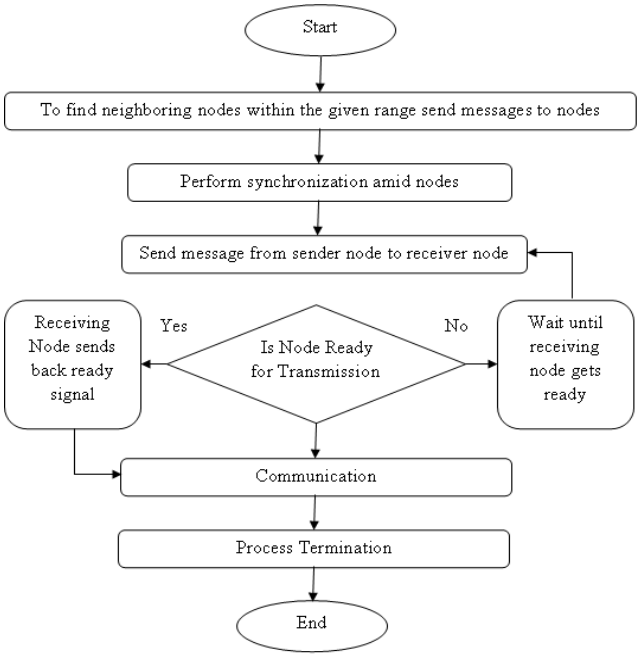

Fig. 1. Networking Principle of Adhoc Networks

Two other field entries RERR and HELLO are also sent in the control packets. RFC 3561 contains the documentation of Ad-hoc On-Demand Distance Vector protocol. When a route failure is detected then the route maintenance procedure is started. Then the HELLO messages are divided amid the nodes to show nodes are alive or not. If within a HELLO interval the HELLO messages are not collected by the nodes then it makes sure path is already broken.

II. RELATED WORK

G. Singh et al. [1] proposed an efficient way for competent route discovery that was supposed to be worked on the perception of how much energy was surplus for further discovery of routes. The supposed idea had two stages in development of protocol. The primary stage was the route discovery.

When one of the nodes available desired to maintain connection with the different available nodes, then algorithm first step was inspection the available routing table for the access of the required destination. If there was availability of the requested route then without wasting any moment it send data to destination. But if the source had not any desired route to that particular destination then the source again started the discovery of route. Secondary stage was the effective route maintenance. Whenever there was breakdown of route encountered then the procedure for maintaining the routes started. The proposed protocol by authors had some positive refinement over the standard AODV. The results had increased the overall activity of the network with fine improvement in ratio of delivery of packets and throughput but with the gain of number of hop counts.

G. Zinal et al. [2] proposed a strategy that utilized the principle of link quality among different nodes. The link quality is important as it checked the path among different nodes is broken or not. The algorithm showed that the path breakage rate was very much reduced as well as there was increase in the mean cost of airtime of the established links. Authors suggested either reroute the data or again send data on multiple paths. If the performance of the link was poor in comparison to a predefined threshold value then the particular node in the communication resumed for a particular interval so that recovering process could be started. If it did not work then the data was sent through another path. Proposed algorithm showed better values in terms of different objective parameters. But the two parameters routing overhead as well as end-to-end delay had very less refinement.

S. Tabatabaei et al. [3] proposed a fuzzy relied on demand routing protocol for MANETs, where the proposed system was working on sustained energies of the different nodes on the respective routes. Two parameters bandwidth as well as the mobility of nodes was utilized to consider a valid route to increase the effectiveness of the system. This protocol was helpful to improve the overall handling of an established network. It was used to calculate the remaining power of a node and used the present bandwidth amid two adjoining nodes as link stability which was based on minimum available bandwidth. Further to find the total sent control packets amid two sampling intervals, these inputs were combined using AND operation to find the stability routing path. Authors used terms like low, medium and high for link stability of a network.

M. Singh et al. [4] converted the strategy of one routing protocol to another protocol. The proposed SE-AODV was mainly based on two approaches. First one was the maintenance of the route which used the concept of whether there was a link breakage present or not. It was based on the methodology of guessing the working of active or dead nodes. The other way was the utilization of routing through multiple paths. In this strategy data packets were sent through all the available paths to a particular destination so that an efficient communication was possible. Authors both methodologies had a combined effect of lowering the ratio of link failures as well increasing in throughput.

Shukla et al. [5] had suggested a new MANET methodology by modifying the standard AODV routing protocol. Authors used the concept of Markov random walk algorithm where the available probability strength was used for an effective connection. The quality of service parameter was increased with the proposed model.

III. PROPOSED ALGORITHM

A. SCENARIO 1

Below in the figure the data has to be sent from source node **A** to destination node **K**. Here minimum energy left for each node is given.

Assumption:

- If energy is 0.1 then it can forward packet but as soon as it does this process node will become dead.
- If energy is more than 0.1 and less than 0.3 then it can send both data and acknowledgement to nodes.
- If energy is 0.3 more than that then node can efficiently work.

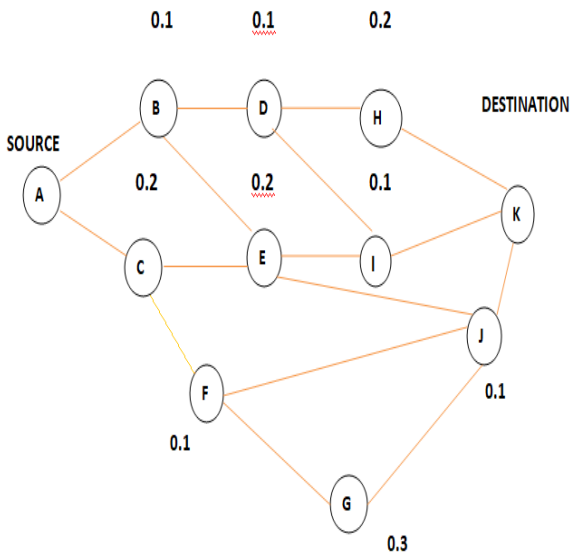

Fig. 2. Mechanism of proposed routing protocol

Now some of the possible paths for AODV are given below based on the Hop count.

A-B-D-H-K, A-C-E-I-K, A-C-F-J-K, A-B-D-I-K, A-C-E-J-K, A-C-F-G-J-K

Case 1: A-B-D-H-K

Here node **B** & **D** has only energy 0.1 each. So it means both can send data but not ack. But node **H** has sufficient energy.

Case 2: A-C-E-I-K

Here only node **I** has minimum energy that only can send data but not ack.

Case 3: A-C-F-J-K

Here node **F** & **J** has only energy 0.1 each. So it means both can send data but not ack. But node **C** has sufficient energy.

Case 4: A-B-D-I-K

Here all nodes **B, D** & **I** have only energy 0.1 each. So it means all can send data but not ack.

Case 5: A-C-E-J-K

Here only node **J** has minimum energy that only can send data but not ack.

Case 6: A-C-F-G-J-K

Here node F & J have 0.1 energy each which is not sufficient.

Now each node will create this table and maintain it. So AODV protocol takes the first case as it is displayed first on the list.

But problem is that B & D nodes have very small energy and acknowledgement will not be received.

So in our proposed algorithm strategy is that algorithm will not wait until all the routes are displayed it will start sending data as soon as its process completes.

Proposed algorithm will select case 2 where data path is A-C-E-J-K but acknowledgement is sent through A-C-E-I-K path. As our algorithm is intelligent enough that will keeps status of node I as busy till acknowledgement is not sent.

B. SCENARIO 2

Other intelligent part of the proposed algorithm is that if it thinks energy of a particular node is very less so it will send only one fourth or just one tenth of data so that acknowledgement can be received that it has sent data. Remaining either four-fifth or nine-tenth portion of data is sent through other nodes. So it will not allow node to become dead till the data is not sent and acknowledgement is sent back to neighboring node. So proposed algorithm balance the load of the network for effective communication.

C. PSEUDOCODE

1. **If (**desired route is available in the updated routing table) **then**
   Start the communication for delivering the data.
   Else
   Start the search for the new paths again.
2. Search for the all available routes from source to destination with how much energy available to nodes. As soon as first route is available check the nodes efficiency for transmitting data.
3. **If** (energy of the any intermediate node is less < desired threshold) (which means that particular node is not capable of sending acknowledgment back to the earlier node) **then**
   Search in the routing table for the node which is nearby to node and have same path structure with minimum hop count to send the acknowledgment through other path.
4. **If** (data reaches the destination) **then**
   Acknowledgement is sent through other path. The first allocated path is free as soon as it sends data to the destination.
5. **If** (acknowledgment is received at source) **then**
   Second allocated path is free for sending other data.
   Else
   Flood the data to all available paths. (If six paths are available then one sixth of data is sent to all the paths.)
6. Exit

IV. PERFORMANCE EVALUATION

The effectiveness of the above mentioned AODV protocol was tested against the standard AODV protocol. Different simulation parameters were used to check the accuracy of approach. Simulation was performed on NS-3. There will be 50 to 100 nodes in the topology. Performance metrics like throughput, energy deviation, packet lost, packet delivery ratio and other will be used for performance checking with respect to standard AODV routing protocol. Different simulation parameters are listed in the table below.

Table – I: Simulation Environment Parameters

Objective Parameters	Value or Range
Simulator	NS-3
Protocols	AODV
Number of nodes	50, 60, 70, 80, 90, 100
Simulation Area	1000m X 1000m
MAC Layer	IEEE 802.11
Simulation Times	200s
Radio Transmission Range	250m
Traffic Type	CBR
Mobility	11ms
Propagation	Two ray ground
Agent	UDP agent
Data Payload	512 bytes/packet
Transmission Power	0.02
Receiving Power	0.01
Maximum Speed	30 m/s
Minimum Speed	1 m/s

V. RESULT AND DISCUSSION

Table II -Objective performance analysis of AODV and Proposed AODV routing protocols with respect to Packet Size

Packet Delivery Ratio (%) VS Packet Size (bytes)		
Packet Size	**AODV**	**Proposed AODV**
500	51.1254	83.1567
600	51.9821	83.9815
700	52.9081	85.2365
800	64.8912	93.6712
900	71.2315	95.9841
1000	76.2376	96.2671
Average Energy VS Packet Size (bytes)		
Packet Size	**AODV**	**Proposed AODV**
500	0.26892	0.15023
600	0.27983	0.15283
700	0.31048	0.15512
800	0.31762	0.15982
900	0.32901	0.16124
1000	0.32896	0.16543
End to End Delay (ms) VS Packet Size (bytes)		
Packet Size	**AODV**	**Proposed AODV**
500	0.18870	0.010001
600	0.23984	0.010020
700	0.30126	0.010128
800	0.38921	0.020167
900	0.54980	0.021702
1000	0.76632	0.023981

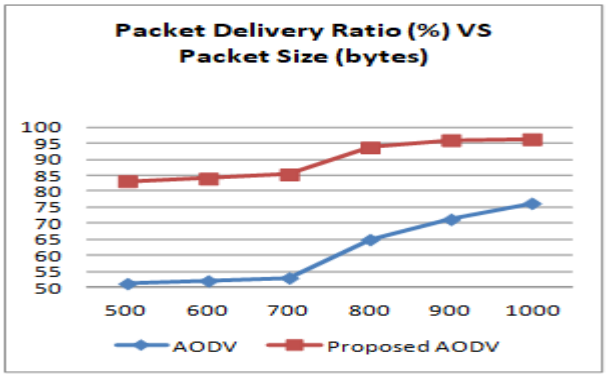

Fig. 3. Packet delivery ratio Vs packet size

Figure 3 shows comparison of packet deliver ratio of AODV and Proposed AODV. It is cleared that with increase in number of nodes the delivery ratio of proposed AODV dominates over standard AODV.

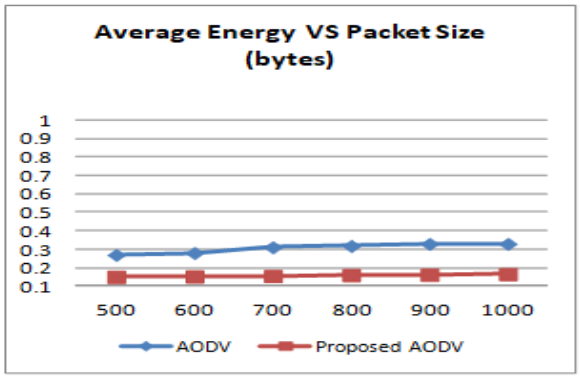

Fig. 4. Average energy Vs packet size

Energy consumption should be low as possible so that intermediate nodes will not run out of energy. Figure 4 shows that the energy consumption is very low in case of proposed AODV protocol in comparison to standard AODV protocol.

Figure 5 shows the average value of end-to-end delay of both protocols. Here proposed algorithm has very low delay in comparison to AODV. It is because AODV chooses route earlier while proposed AODV selects route with load balancing.

In scenario represented in figure 6 the number of nodes is restored at 600 with data sessions 10. Proposed AODV has lower routing overhead in comparison to standard AODV.

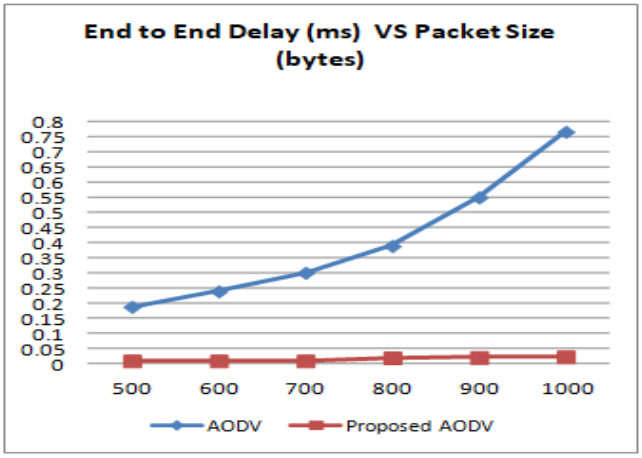

Fig. 5. End to end delay Vs nodes

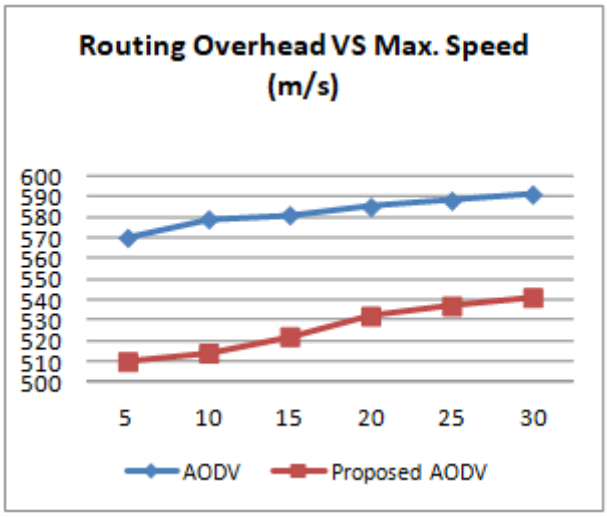

Fig. 6. Route overhead Vs max. speed

From the above results it is cleared that average energy consumption by proposed AODV routing protocol was very less in relative to standard AODV routing protocol. Further Packet delivery ratio is much higher in contrast to standard AODV protocol. Also the end to end delay among nodes is very nominal in contrast to AODV protocol.

VI. CONCLUSION

In this research paper a new energy and time efficient routing strategy using AODV for MANET systems is proposed. The strength of proposed routing algorithm stays in its load balancing strategy as well as its uniqueness send data even when the node power is very less as it uses another route for acknowledgement. Simulation results show that packet delivery ratio of proposed AODV is much higher than standard AODV protocol. Also the other objective parameters routing overhead, average energy consumption and end to end delay is very less for proposed AODV routing protocol. The importance of the proposed AODV protocol is helpful in multipath routing in one scenario as well as energy and time efficient in another scenario. The results of proposed algorithm can be the fundamental steps for the advanced scheme of AODV routing protocol.

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