International Journal of Emerging Trends & Technology in Computer Science (IJETTCS)
Web Site: www.ijettcs.org Email: editor@ijettcs.org
Volume 6, Issue 5, September- October 2017 ISSN 2278-6856

Design and Improve AODV Protocol for Congestion Avoidance in MANET Using Neural Network

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Abstract- ***The mobile adhoc networks are the decentralized type of network in which mobile nodes can communicate with each other without the presence of central controller. Due to non-presence of central controller routing, security and quality of service are the three major issues of the network. The congestion is the issue of the mobile adhoc networks which reduce performance of the network in terms of various parameters. In this work, the improvement in the AODV protocol is done for the congestion avoidance in the network. The proposed technique is based on the back propagation algorithm in which error of each path is available from source to destination is calculated. The best path is selected which has minimum error or means that which has least chances of congestion in the network. The proposed and existing algorithms are implemented in NS2 and it has been analyzed that proposed technique performs well in terms of various parameters as compared to existing algorithm.***

Keywords: MANET, AODV, RREQ, RREP, Back Propagation, Ad-hoc.

1. INTRODUCTION

Wireless network is a term refers to any kind of networking that does not necessitate cable. It is a proficiency that helps telecommunications networks to save costs of cables for networking in specific establishment in their installation. The communication system is usually managed and implemented via radio waves where the implementation takes place at physical level [1]. The nodes connected with the internet through the access point in the wireless network. The mobility is the main enhancement feature in wireless network i.e. there is no need to fix at your desktop unlike the wired connection. The network resources can be access from any location within the wireless network coverage area or from any Wi-Fi hotspot. Without the use of wires the implementation and communication is taken place between the different devices. Radio waves and microwaves are used for communicating between devices in wireless networks. Both devices that are communicating to each other, these are lays within the radio range of each other. Ad hoc networks are decentralized type of wireless networks [2]. Based on the network connectivity the data is dynamically forward by nodes as in ad hoc network, by forwarding data to other nodes each node get participated in the routing process. For the mobile hosts, the ad hoc types of networks provide better wireless communication to the users within certain emergency conditions. There is no fixed infrastructure or base station present within these types of networks. Direct communication is possible for nodes that are within the range of each other. Indirect communication is done in cases where the nodes are very far from each other and cannot communicate with each other [3]. Intermediate nodes present within the network help in performing the indirect communication.

The collection of mobile nodes that can help in providing communication amongst each other without the presence of any centralized authority is known as wireless ad hoc network. In order to forward the data gathered from the surroundings, each node acts as a router. The packets are received from the nodes and sent ahead to other nodes such that they can be transmitted from source to destination. The devices present within the MANETs can move freely and are independent in nature.The connections of various nodes amongst each other keep changing at frequent durations in order to transmit and receive information from them. The node needs to act as a router and pass the information received further to the next neighboring nodes. The main purpose here is to transfer the data within the network and handle the complete information that has to be routed within it. The communication is done here with the help of any wireless link such as radio waves [4]. There is a direct communication of the nodes amongst each other if they are directly in range. If the nodes are far from each other they take the help of intermediate nodes. The packets are then routed further with the help of these intermediate nodes. There are huge challenges that arise within these mobile networks mainly due to the decentralized nature. The decentralized nature allows the nodes to move freely across the network which results in making it more prone to attacks. Within MANETs, the route traffic and nodes can be accepted as per the requirement and help in acquiring useful information from the surroundings. The important information is passed to the destination node. The nodes can act both as routers and hosts within these networks and provide the benefits accordingly. An energy constraint is placed on the mobile nodes mainly due to the re-linking of the nodes. The energy efficiency of the nodes is a very important factor mainly due to the limited bandwidth and node mobility of these networks. The major

factors which also cause an affect here are the change in topology, the unreliable communication in the design and the energy consumption of the nodes. In order to control all such factors and enhance the performance of the network, there are various routing protocols used. The amount of energy consumed by the nodes present within the protocols defines the efficiency of the respective routing protocol. The routing of traffic within the network is also an important factor to be computed when selecting a routing protocol.

1.1. Ad-hoc on Demand Vector (AODV)

An on-demand routing protocol which helps in adapting the network as per the changes being made within it is known as the AODV routing protocol. Messages are sent to the affected nodes in the case where a link fails. All the routes are invalidated when the link fails with the help of the information that is gathered. The overhead of memory is lower within the AODV protocol which helps in building the unicast routes across the source and destination. This results in reducing the network utilization. As the routes are built on demand there is less routing traffic within the network. A connection is established amongst the nodes as per the demand. A connection is established amongst the nodes which can help in building multihop routes between the mobile nodes present within it. AODV defines three messages: Route Requests (RREQs), Route Errors (RERRs) and Route Replies (RREPs). In order to discover and control the routing within the network from source to destination, these messages are used. The routes can be identified and handled from source to destination with the help of UDP packets in the network. in order to create a link amongst two nodes, the source node generates a route request packet which is transmitted to the neighboring nodes. A Route Reply message is sent to the source node in case any node is ready to establish a path. The routes are cached from the originator of the RREP to all the nodes to which the message has been sent. A Route request Error message is generated after the route has been established.

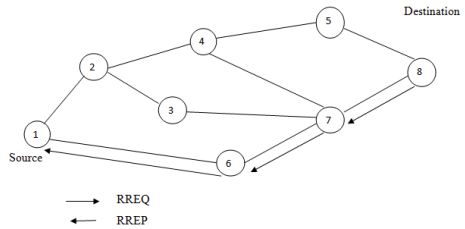


Fig 1: Best path with minimum Hop Count

In the figure 1, the packets are broadcasted to the neighboring nodes with the help of RREQ. Further the table is updated with the information. Till there is an appropriate destination found, the packets are forwarded by the nodes. The sequence number and broadcast ID of each node is maintained by it [5]. The broad cast ID is initiated for each RREQ. An RREQ is identified in a unique manner with the help of IP of the node. The route that contains minimum number of hop counts in chosen to be the final route across which the communication has to be done.

2. LITERATURE REVIEW

In this paper [6], they introduced about congestion control is a key problem in mobile ad-hoc networks. Congestion has a severe impact on the throughput, routing and performance. Identifying the occurrence of congestion in a Mobile Ad-hoc Network (MANET) is a challenging task. The congestion control techniques provided by Transmission Control Protocol (TCP) is specially designed for wired networks. There are several approaches designed over TCP for detecting and overcoming the congestion. This paper considers design of Link-Layer congestion control for ad hoc wireless networks, where the bandwidth and delay measured at each node along the path. Based on the cumulated values, the receiver calculates the new window size and transmits this information to the sender as feedback. The sender behavior is altered appropriately. The proposed technique is also compatible with standard TCP

In this paper [7], they presented the ad hoc connections, which open many opportunities for MANET applications. In ad hoc network nodes are movable and there is no centralized management. Routing is an important factor in mobile ad hoc network which not only works well with a small network, but also it can also work well if network get expanded dynamically. Routing in MANETs is a main factor considered among all the issues. Mobile nodes in MANET have limited transmission capacity; they intercommunicate by multi hop relay. Multi hop routing have many challenges such as limited wireless bandwidth, low device power, dynamically changing network topology, and high vulnerability to Failure. To answer those challenges, many routing algorithms in MANETs were proposed. But one of the problems in routing algorithm is congestion which decreases the overall performance of the network so in this paper we are trying to identify the best routing algorithm which will improve the congestion control mechanism among the entire Multipath routing protocols.

This paper introduced Standard congestion control cannot detect link failure losses which occur due to mobility and power scarcity in multi-hop Ad-Hoc network (MANET). Moreover, successive executions of Back-off algorithm deficiently grow Retransmission Timeout (RTO) exponentially for new route. The importance of detecting and responding link failure losses is to prevent sender from remaining idle unnecessarily and manage number of packet retransmission overhead. In contrast to Cross-layer approaches which require feedback information from lower layers, this paper operates purely in Transport layer. This paper explores an end-to-end threshold-based algorithm which enhances congestion control to address link failure loss in MANET. It consists of two phases. First, threshold-based loss classification algorithm distinguishes losses due to link failure by estimating queue usage based on Relative One-way Trip Time (ROTT). Second phase adjusts RTO for new route by comparing capabilities of new route to the

broken route using available information in Transport layer such as ROTT and number of hops [8].

A Congestion control is a key problem in mobile ad-hoc networks. The standard TCP congestion control mechanism is not able to handle the special properties of a shared wireless channel. Many approaches have been proposed to overcome these difficulties. Ideas and show their interrelations. Mobile agent based congestion control Technique routing is proposed to avoid congestion in ad hoc network. Some mobile agents are added in ad hoc network, which carry routing information and nodes congestion status. When mobile agent travels through the network, it can select a less-loaded neighbor node as its next hop and update the routing table according to the node's congestion status. With the aid of mobile agents, the nodes can get the dynamic network topology in time. In this paper, we give an overview over existing proposals; explain their key ideas, TCP Issues, Reduce the Congestion, delay in mobile ad-hoc network and proposed solution [9].

The ad hoc connections open many opportunities for MANET applications. In ad hoc network nodes are movable and there is no centralized management. Routing is an important factor in mobile ad hoc network which not only works well with a small network, but also it can also work well if network get expanded dynamically. Routing in MANETs is a main factor considered among all the issues. Mobile nodes in MANET have limited transmission capacity; they intercommunicate by multi hop relay. Multi hop routing have many challenges such as limited wireless bandwidth, low device power, dynamically changing network topology, and high vulnerability to Failure. To answer those challenges, many routing algorithms in MANETs were proposed. But one of the problems in routing algorithm is congestion which decreases the overall performance of the network so in this paper we are trying to identify the best routing algorithm which will improve the congestion control mechanism among the entire Multipath routing protocols. Multipath routing can improve network performance in terms of delay, throughput and reliability. Multi path routing protocols also improve load distribution, reliability, delay and energy efficiency. AODVM-PSP (Ad hoc on demand distance vector routing with path selection probability) considers delays along the path while making routing decision. The ability to forward traffic on multiple paths would be useful for customizing paths for different applications, improving reliability, and balancing load [10].

3. PROPOSED METHODOLOGY

The network in which all the mobile nodes are self-configured is known as the mobile ad hoc network. The nodes can join or leave the network and move freely within it as per their requirement which makes the network self-configuring in nature. The path is established as per the AODV routing protocol from source to certain destinationwithin the network. There are some nodes in the path having much movement than other nodes. Due to these nodes congestion problem occurs. So congestion is responsible for performance degradation and low reliability of the network. A novel technique is proposed to overcome problem of congestion in AODV. In present work to overcome congestion problem knowledge based learning will be used. In existing work path were established on the basis of minimum hop count and fresh sequence number. As we discussed earlier there is a problem of congestion in this path. Because there is no knowledge of congestion occur in advance. So to remove this problem a novel technique is proposed, in which path is established on the basis of minimum congestion counter.

There are three conditions which will be followed for the establishment of the path. These are:

1. Minimum Congestion counter
2. Minimum Hop Count
3. Fresh Sequence Number

Minimum Congestion counter has first priority as compare to other conditions. The path which has minimum congestion counter will be followed instead of maximum hop count and least sequence number. As shown in the fig. 3.3, nodes are deployed in the network. Source send route request message to all the nodes. Destination sends route reply message to its previous node with percentage of congestion and so. At the end source receive route reply message with congestion counter. The path which has minimum congestion counter will be selected as final path. In this way with the help of knowledge based technique packet loss problem reduce.

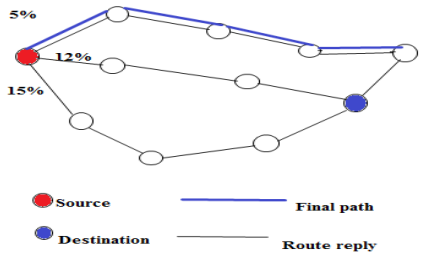


Fig. 2: Final path having less congestion counter

In above figure 2, source sends route request message to the entire nodes up to destination. Then destination reply back to Route reply message to its previous node. At the end it counts congestion count at the source. The path which has minimum congestion will be choosing as the final path.

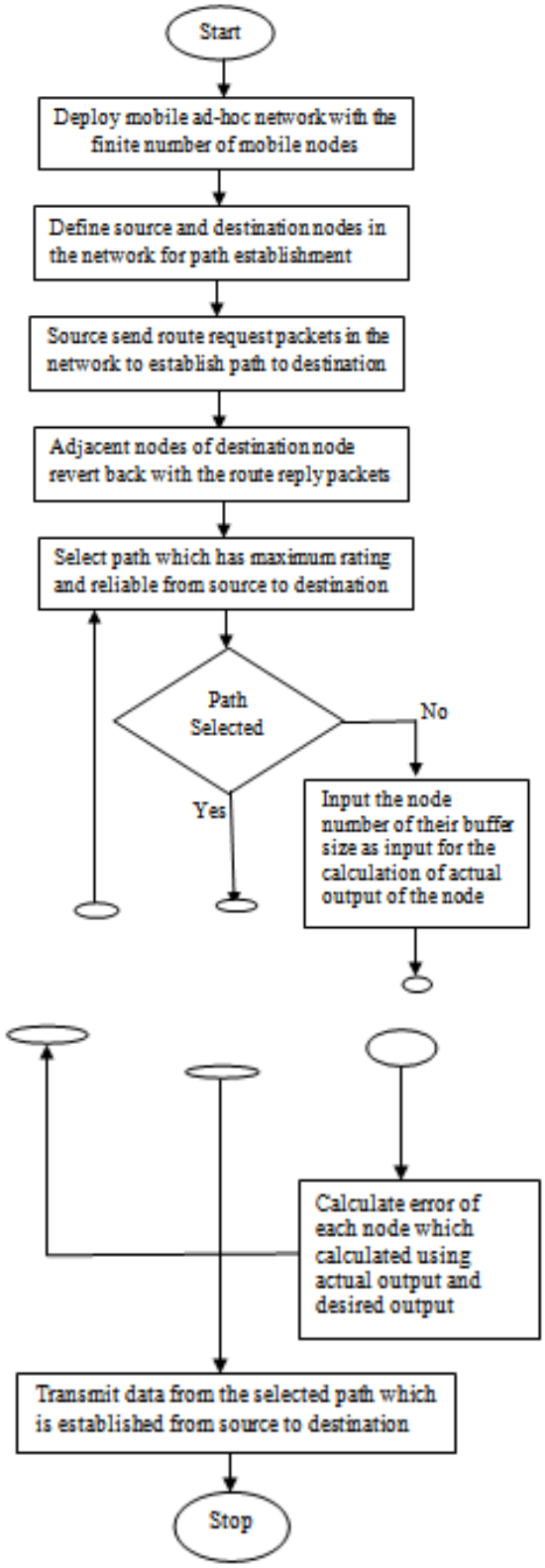
Proposed Algorithm

Input: Network with finite number of nodes

Output: Efficient path from source to destination

1. Define Source and destination in the network for the path establishment
2. Source sends route request packets in the network for the path establishment to destination
3. The adjacent node of destination respond back with the route reply packets
4. Assign rating ()
   4.1. Input the node number as the first input
   4.2. The weight is the buffer size of the node selected in step 4.1

4.3 calculate error=desired output-actual output
5. Calculate average rating value of each path available
6. If (rating of path I > rating of path I+1)
7. Return best Path I
Else
Return best path I+1



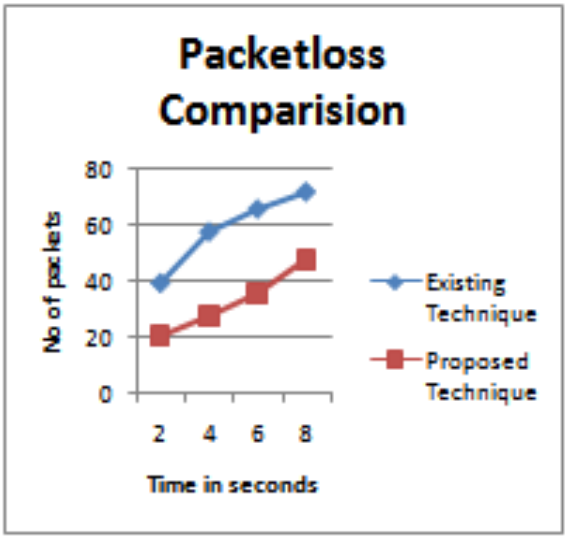
4. RESULTS AND DISCUSSION

The proposed technique will be implemented in NS2 and compared with the basic AODV protocol for the congestion avoidance. The simulation parameters are described in table 1

Table 1: Simulation table

Parameters	Values
Channel	Wireless channel
Antenna type	Omi-directional
No of nodes	24
Area	800*800
Range	18 meter
Frequency	2.4 Ghz

Fig 3: Packetloss Comparison



As shown in figure 3, the comparison of proposed and existing technique is done in terms of packetloss. It has been analyzed that packetloss of proposed technique is less due to congestion avoidance in the network.

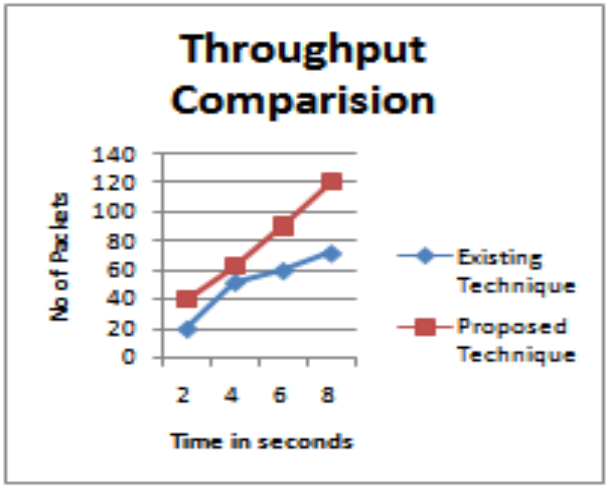


Fig 4: Throughput Comparison

As shown in figure 4, the network throughput of proposed technique is increased at steady rate due to congestion avoidance in the network as compared to existing technique in the network

5. CONCLUSION

In this paper, it has been concluded that AODV is the reactive routing protocol which gather network information for the path establishment from source to destination. The mobile adhoc network is the decentralized type of network due to which quality of service is the major issue in MANETs. The improvement in the AODV protocol is proposed using Boltzmann learning which calculate congestion chances on each path and selects best path which has least chances of congestion in the network

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