Neural Networks Approach for Congestion Avoidance in Mobile Ad hoc Networks

Kumari Shambhavi, Rajnesh Singh

ABSTRACT---The mobile ad hoc network is the decentralized type of network in which mobile nodes can join or leave the network. Due to such type of network quality of service is the major issue of this network. In this research work, AODV routing protocol is modified for congestion avoidance in the network. In the modification neural networks are applied for the congestion avoidance. The proposed technique is implemented in NS2 and results are analyzed in terms of certain parameters. The proposed technique shows high performance than existing AODV protocol in terms of throughput and packetloss

KEYWORDSAODV, Neural Networks, Back propagation

I. INTRODUCTION

A mobile ad-hoc network is the network in which all the present nodes are mobile in nature as randomly distributed. There is no central controller within the network and it is the infrastructure less due to the mobility of the nodes. The network is established here in a completely different manner. There is no infrastructure within these networks and the cost of these networks is very genuine. The low level ad hoc network related facilities can be provided within this network with the help of IEEE 802.11 Wi-Fi protocol. These networks can operate either alone or can combine with the larger networks in order to provide connection [1]. A user can make it possible for the user to be connected anywhere all around the world. There are numerous applications in which these networks are deployed amongst which the disaster recovery and military operations are some of them. These are the networks using which devices can be connected anywhere at any time without requiring any fixed infrastructure.

II. PROBLEMS IN ROUTING WITH MOBILE AD HOC NETWORKS

i) Asymmetric links: In case of the ad-hoc networks nodes are distributed randomly and moving freely within the network instead of the wired networks where nodes are fixed on the symmetric links [2].

ii) Routing Overhead: In this network, there is change in the location of nodes due to which old routes are generated in the routing table that increase the routing overhead within the network.

iii)Interference: It is the major issues faced by the mobile ad-hoc networks as on the basis of transmission characteristics there is change in links due to which there is interference between nodes [3]. This leads to damage of the total transmission.

iv)DynamicTopology: There is change in the position of the nodes leads to change in characteristics since the topology is not constant. These changes are reflected in the routing table with change in the topology that must be adapted by routing algorithms.

III. ROUTING IN MANET

Mobile Ad-hoc is the networks which can configure it and has no central controller in it, as there is dynamic change in the network topology [4]. All the nodes in the network are distributed randomly in the network due to this is infrastructure less network. The same random access wireless channel has been utilized by the nodes of the network by which it engage itself in the multihop forwarding. The nodes in the network act as both the router as well as host. In this network, there is no particular infrastructure for the nodes as there is no destination node is out of the range of the source node, hence it requires routing protocols to transfer data packets. These protocols help to find out the optimal path between the source and destination. There is no need of routing protocols within the cell as base station can easily reach all mobile nodes. In MANETs, all nodes must be able to forward the data packets to the nodes. Some of the routing protocols are discussed here given below:

Proactive Routing protocol: These protocols are also called as time table-driven protocols as the routing information is maintained by these protocols even it is not required [5]. With the help of this protocol, routing information is maintained in the network for each and every node. All the routing information is maintained in the routing tables and with the change in the topology, it is also updated. With the help of the link state routing, there are various routing protocols have been established under this category, there are different types of protocols in which routing information is updated in each routing table. A different number of tables is maintained by these routing protocols. These protocols are not suitable for the larger networks, as it is required to maintain entry of each and every node in the routing table to update the upcoming entries [6]. Due to this process, there is more consumption of the bandwidth in the network that causes overhead in the routing table.

Reactive routing protocols: Reactive routing protocols are also known as the On Demand protocols as if there is no communication at the network nodes, these protocols do not maintain the routing information or routing activity [7]. If

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there is need to send packets from one node to another node, a route is found out using this protocol in an on-demand manner that establishes the connection between the nodes in order to transfer packets from source to destination. An appropriate route is discovered throughout the network by forwarding the route request packets.

Hybrid protocol: Hybrid protocol is defined as the combination of both the proactive and reactive routing protocols. It contains the feature of both protocols. Zone routing protocol is the most commonly used hybrid routing protocol. The working capability of both these methods proactive and reactive protocols is optimal in the network. The balance between the two protocols is maintained by this protocol hence, it is called the enhanced version of both. The distance-vectors method has been utilized by this protocol in order to determine the optimal path to the destination. In case, there is a change in the network topology this protocol inform all the changes happen in the routing information. In order to transfer data packets from source node to its destination, this routing requires less processing power and memory [8].

IV. AD HOC ON-DEMAND DISTANCE-VECTOR ROUTING (AODV)

Ad hoc On-Demand Distance Vector routing protocol has been utilized for the mobile ad hoc networks and other wireless ad-hoc networks [9].It is the protocol, in which a route is established only on demand from a destination as it is an on-demand and distance-vector routing protocol. Using this protocol both unicast and multicast routing can be performed. These routes are present in the protocol until they are demanded by the source. A tree is created by this protocol by which 14 multicast group members can be connected easily. The group members are present in the trees and for connecting the member's nodes are required [10]. AODV utilizes the sequence numbers in order to ensure the freshness of routes. This protocol provides the large numbers of mobile nodes as it is loop-free and self-starting. AODV consists of two processes- Route Discovery and Route Maintenance.

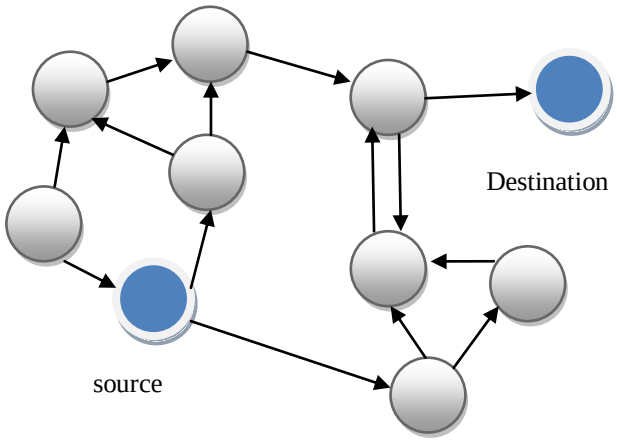

Fig 3.2: RREQ

When there is a requirement of the packets at the destination, the source needs to send packets for which it broadcasts an (RREQ) route request packet to its neighbors when there is no route is available [11]. In order to ensure loop-free routing, each node in the network maintains the sequence in increasing order to surpass old route cache. In the RREQ packet, the known sequence number of the destination is included by the source node.

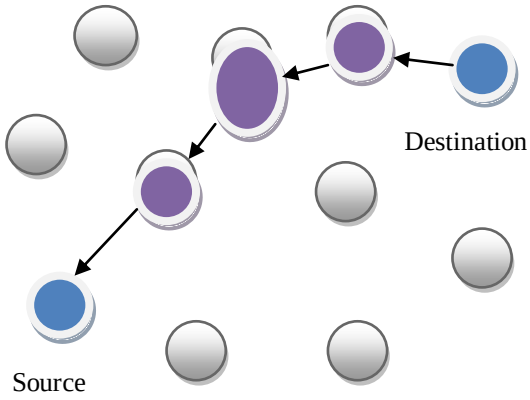

Fig 3.3: RREP

The nodesends the RREP packet message back to the source, this node can be either destination node or contains a valid route to the destination. The source of the request is the unicast RREP along the reverse path. The received RREQ packets are rebroadcasted by each neighboring node until a route is established. For the source, this RREP is unicast in a hop-by-hop fashion. A route is created by each intermediate node to the destination with the propagation of RREP [12]. The route to the destination is recorded by the source when it receives the RREP and starts sending data. A Route Error (RERR) request is sent to the source in case of detecting a link break. The route to the destination is invalidated by each intermediate node when the RERR propagates towards the source. When the RERR us received by the source, the route is invalidated and new route discovery is initiated if required. Hello, messages provide the information about the neighborhood. A hello message is broadcasted to its neighbor by each node at regular interval of time. Only for one hop hello messages are propagated for the neighborhood of a node.

V. ADVANTAGES AND DISADVANTAGES

AODV protocol has been utilized for the establishment of the routes on demand for which a destination sequence number is utilized in order to find out the most recent route to the destination. There is less delay in setting up connection. There is no network overhead as routes maintenance supported by the HELLO message is limited in range.

The contradictory routes are leaded by the intermediate nodes which is one of the major disadvantages of this protocol [13]. This happens as source sequence number is very aged and intermediate nodes not have latest destination sequence number but higher due to which it has sale entries. There is heavy control overhead due to the multiple Route Reply packets when connecting with the Route Request packet. Unnecessary bandwidth consumption is the

other disadvantage of this protocol.

VI. LITERATURE REVIEW

Saurabh Sharma, et.al (2017) presented the detailed study of congestion issue and congestion control techniques in wireless networks are the major concern of this paper [14]. Due to the mobility of the nodes, these networks can be termed as the simple networks or ad hoc network or most typical Mobile Ad hoc network. Hence, congestion is the major issue faced by the MANETs. Various challenges have been posed by the change in the network topology and shared nature of the wireless channel as it becomes difficult to deal with congestion in the network. In this paper, for the control of the congestion and to overcome this comparative analysis between the clustering; queuing and cross-layer protocols were presented.

Ashish Kumar Mourya, et.al (2013)presented the main reason behind the occurrence of congestion in the mobile ad-hoc networks are the limited resources. The special properties of a shared wireless channel are not handled by the standard TCP congestion control mechanism. On the internet the working of the TCP congestion control is optimal. There are some unique properties present in the mobile ad-hoc network that affects the design of appropriate protocols and protocol stacks in general. Hence, in the difference in the environment is a problem to the standard TCP. Therefore, various methods have been proposed to overcome this issue [15]. In order to avoid congestion in the ad-hoc network, they proposed a mobile agent based congestion control Technique in this paper. A mobile agent can select the neighbor node having less-load as its next hop while traveling through the network. After which it can update the routing table as per obtained node's congestion status. There is dynamic network topology of the nodes due to which help is provided to the mobile agents. They also presented a mobile agent based congestion control mechanism in this paper.

Som Kant Tiwari, et.al (2013)presented it becomes a monotonous task to proposed or design efficient protocols by which congestion problems can be handled effectively due to highly dynamic nature of Mobile ad hoc networks [16]. It is required to design a network by which source in the network is notified using congestion control mechanism by which the transmission rate is minimized. In the existing methods, the information about congestion issue is provided to the source as TCP has been utilized by them. But in case of MANETs, there is packet loss due to link failure as packet losses occur due to congestion and in the snapshot of a timeout, backing-off its RTO. Due to this, there is a reduction in the transmission speed by which throughput of the whole network is degraded.

Heena Gupta, et.al (2014)presented an essential role is played by the mobile network communication in the field of wireless network communication. Nodes are randomly distributed in the MANETs which are temporary network and infrastructure less. In this network, over the wireless link nodes are communicating with each other and due to the movement of the node, there isachange in the network topology [17]. Due to the absence of router in between source and destination, routing issues are faced in the MANETs due to nodes act as a router. Hence, controlling congestion is the major issue faced by this network. The network becomes congested when transmission of a number of packets across the network is greater than the capacity of the network. This leads to reducing the performance of the network as congestion drop all the required packets. Therefore, the author used a fuzzy based algorithm in this paper for the avoidance of the congestion issue in this network.

Abinasha Mohan Borah, et.al (2015)presented there is no central controller in the network, and mobile nodes are distributed randomly this network is known as mobile ad-hoc networks. These networks are infrastructure less in which nodes act as both routers as well as hosts. This property of the network faces major challenges such as network overhead and loss of packets [18]. The congestion in the network occurs due to the increase in the size of the data packets by which loss of packets occurred. So far, various congestion control algorithms are introduced by various researchers so that congestion in the network can be detected easily. In this paper, the author discussed all the aspects that cause the congestion in the network and also various congestion control algorithms. In order to reduce the amount of congestion and its effect on the network, the main objective of this paper is to design an effective and efficient method.

GurmeenKaur, et.al (2016)presented mobile ad-hoc network that establishesacommunication link between nodes in which interference of an external device is not allowed. This network is the branch of networking [19]. The performance of the network is degraded due to various issues within the network. Among all these issues, network congestion is major which occur in peer to peer communication. It is not necessary that bulk of nodes can carry a large amount of data sometimes a single node can carry huge quantity to the destination. Due to the presence of the congestion on the node, there is a loss in the data. There are various algorithms was proposed so far for minimizing the effects of congestion in MANET but due to their complexity, network overload and consumption of time they are not utilized currently.

Vandana, et.al (2017)presented the number of active flows and the total storage in the network is the main reason behind the congestion loss in the bust network [20]. Buffer memory and packets are the routers present in the total storage for the long links in flight. In this paper, a simple flow counting algorithm is proposed. In this algorithm, one bit of state per flow was utilized in which few instructions per sender were transferred. By changing the number of packets per sender in proportion to the queue length, this algorithm provides the congestion feedback. The queuing delay has been reduced using this algorithm and provide favorable results due to which there is an increase in a loss when a number of flows increases. This results in the long and unfair timeout delays that degrade the performance.

VII. PROPOSED METHODOLOGY

The mobile ad-hoc network is the decentralized type of network in which mobile nodes can join or leave the network when they want. Due dynamic nature of the network, quality of service is the major issue of the network. In this research work, neural network based technique is proposed for the congestion avoidance in the network. In this research work, back propagation algorithm is proposed for the congestion avoidance. In back propagation algorithm learns from the previous experience and drive new values. The back propagation algorithm takes input node number and their buffer size. It will calculate the actual value of the congestion on a particular node.

$$\text{Actual value}=\sum_{\substack{w=0\\x=0}}^{\substack{w=n\\x=n}} x_n w_n + bais \quad (1)$$

The actual value of congestion is calculated with the equation number 1. The error is calculated with subtracting desired value from the actual value

$$\text{Error} = \text{Desired Value} - \text{Actual Value} \quad (2)$$

The mobile node on which error is least is selected as the best node for the path establishment. The proposed improvement is the AODV protocol for the congestion avoidance in mobile ad hoc network. The AODV protocol establishesapath through the nodes which havetheleast error, minimum hop count,and maximum sequence number.

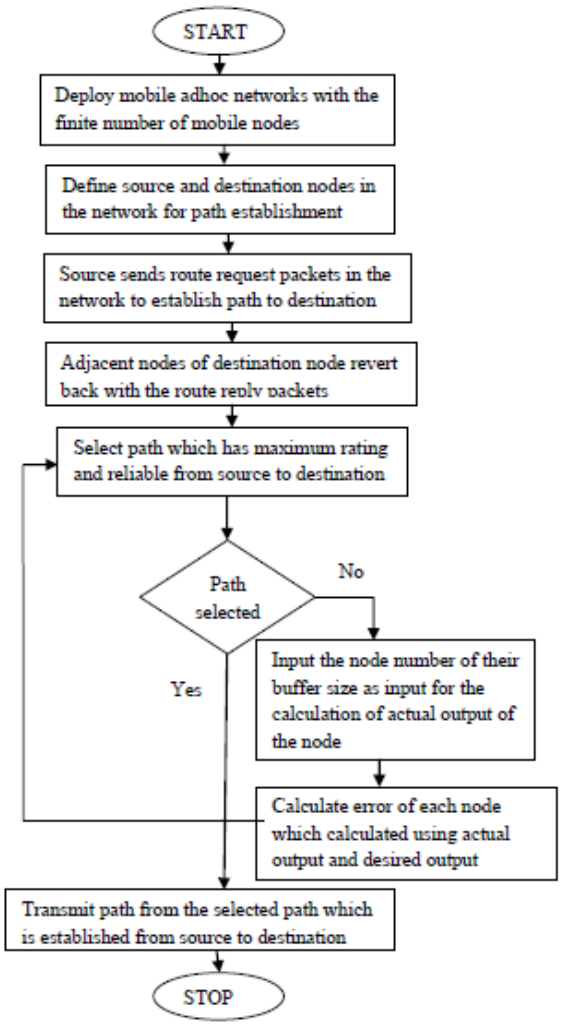

Fig 1: Proposed Flowchart

VIII. RESULT AND DISCUSSION

This research work is based on congestion avoidance in mobile ad hoc networks. The AODV routing protocol will be improved using neural networks. The performance of proposed AODV protocol is compared with the existing AODV routing protocol for path establishment. To simulation parameters are described in table 1

Parameters	Values
Propagation Model	Two Ray
Antenna type	Omi directional
Number of nodes	28
Queue	Priority Queue
Area	800*800 meters
Standard	802.11

Table 1: Simulation parameters

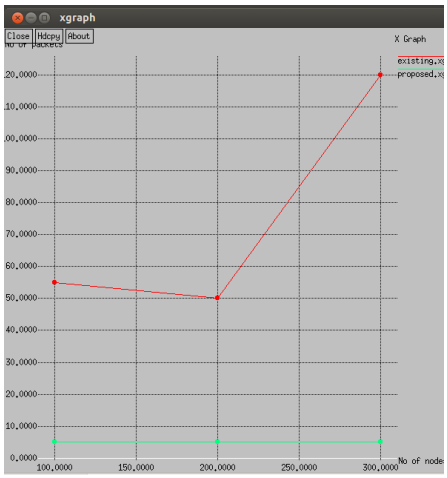

Fig 2: Packet loss Comparison

As shown in figure 2, the packetloss of proposed AODV protocol and existing AODV protocol is compared. It is analyzed that packetloss is reduced in proposed technique due to congestion avoidance in the network. The x-axis of the graph define number of nodes and on the y-axis the number of packets.

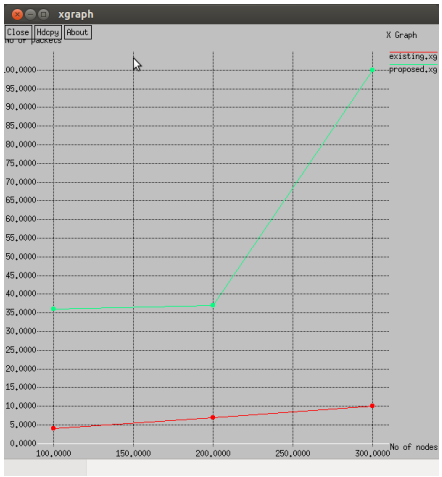

Fig 3: Throughput Comparison

As shown in figure 3, the throughput of the proposed and existing protocol is compared. In the proposed technique neural networks are used with the AODV protocol which reduces chances of congestion due to which throughput is increased at a steady rate

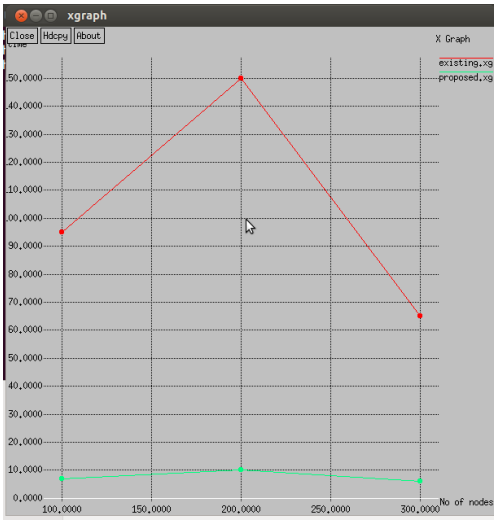

Fig 4: Average End to End Delay Comparison

As shown in figure 4, the end to end delay of the proposed and existing algorithm is compared for the performance analysis. It is analyzed that delay of proposed algorithm is less as compared to existing algorithm

IX. CONCLUSION

In this work, it is concluded that mobile ad-hoc network is decentralized in nature due to which it has high chances of congestion in the network. In this research work, neural network approach is proposed for the congestion avoidance in the network. The back propagation approach calculates the future possibilities from the current information for the congestion avoidance. The proposed technique is implemented in NS2 and simulation results showanincrease in throughput, reduction in packetloss.

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