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Performance Comparison of MANET based on Data Rate using Fuzzy Logic Controller

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ABSTRACT

Mobile ad-hoc network consist of mobile nodes. These nodes does not follow any particularly topology. Now, days many humans dependent on internet for their daily chores. But congestion is one of the major issue, which effect the data network. Real time multimedia application have came into existence like audio, video etc. So the congestion problem is also increasing . Thus, in order of control congestion, various schemes have developed. In this research paper Fuzzy based Congestion control approaches in wireless network detects & avoids congestion by developing the ad-hoc fuzzy rules as well as membership functions. The output of this FCC (sending rate).The congestion is controlled by sending rate. The parameter used input channel load, queue length which are produce the sending rate output in fuzzy logic.

Index Terms: *Congestion Control, Fuzzy logic, load, Qual net, Membership function***.**

INTRODUCTION

In this era the world has become wireless network. A wireless network includes several nodes. One or more nodes can also be considered as source. The networks have a few loads in normal conditions, but when they receive an occurrence, they become active in order to detect the occurrence and control it. In this condition, the network load increases and congestion happens in intermediate nodes. Congestion control in the wireless networks is the foremost problem in this world. Modern Telecommunication, Computer Networks and both wired and wireless communications including the Internet, are being intended for fast transmission of large amount of data, for which Congestion Control is very important. Without proper Congestion control mechanism the congestion downfall of such networks would become extremely complex and is a real possibility. Congestion is caused by saturation of network resources (communication links, buffers, network switches, etc.).Congestion will occur, if the resources are not managed effectively. The optimal control of networks of queues is a well-known, much studied, and notoriously difficult problem, even for the simplest of cases. Congestion may become unmanageable unless effective, robust, and efficient methods of congestion control are developed.

FUZZY LOGIC:

A fuzzy system are consist of three step 1) fuzzification 2) interference 3) defuzzication. Fuzzy logic controller may be viewed as alternative, non-conventional way of designing feedback controllers. Fuzzy logic controllers, like expert system can be used to model human decision making behaviours. In fuzzy logic controller input and output relations can be expressed as a set of linguistics rule (If-then rules), to model a particular system. Many of the fuzzy control application have an input data which has a crisp value, so a fuzzification is

necessary to convert a input crisp data into a suitable set of linguistic value that is needed in the inference engine. Singleton fuzzifier is the general fuzzification method which is used to map the crisp input to a singleton fuzzy set. In the rule base of fuzzy logic controller, a set of fuzzy control rules, which characterize the dynamic behaviour of the system.

HOW TO DEFINE CONGESTION CONTROL

Congestion is a complex process to define. It is felt by a degradation of performance. Despite the many years of research efforts in congestion control, there is no unique approved, by the network research community, definition of congestion. Currently, there is an ongoing discussion between the active members of the networking community as to give the right definition for congestion [1]. However, it cannot be argued that the effect of network congestion is a degradation in the network performance. The user experiences long delays in the delivery of data, perhaps with heavy losses caused by buffer overflows. Thus, there is degradation in the quality of the delivered service, with the need for retransmissions of packets (for services intolerant to loss). In the event of retransmissions, there is a drop in the throughput, which leads to a collapse of network throughput, when a substantial part of the carried traffic is due to retransmissions.

FUZZY LOGIC APPLICATION FOR CONGESTION CONTROL

Human experiences can be implemented well through membership functions and fuzzy rules in fuzzy logic[1][2][3] .MANET is capable of forming a large and complex network, comprises of Default value of Qual net and Fuzzy value. Which is provided efficiently by the fuzzy logic controller [4].

MEMBERSHIP FUNCTIONS FOR FUZZY VARIABLES

The MFs that are used for the fuzzy input is channel load, queue length and output is sending rate are illustrated in fig. 1

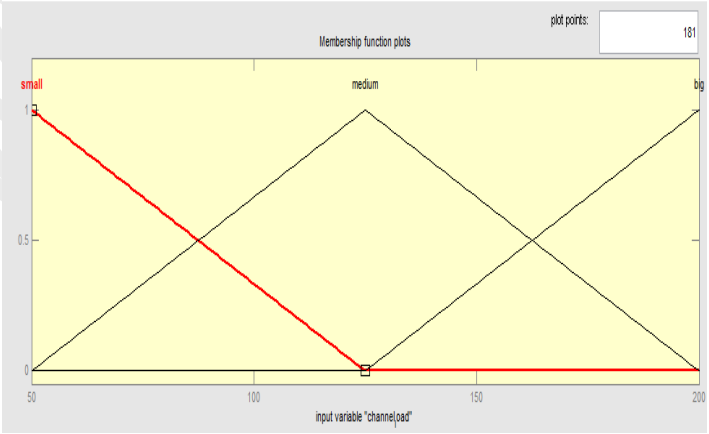

Fig. 1 Membership function used for input variable

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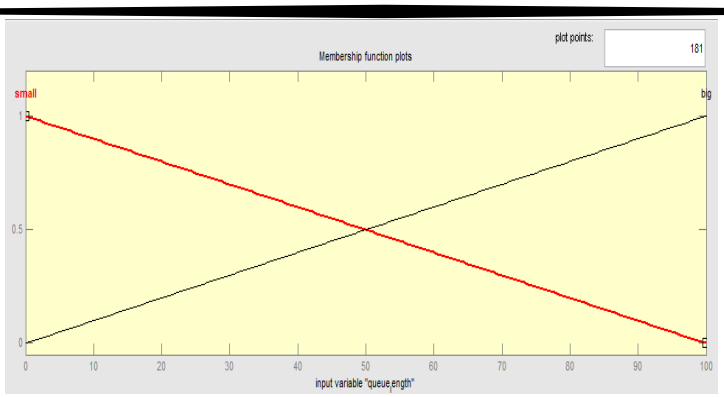

Fig. 2 Membership function used for input variable

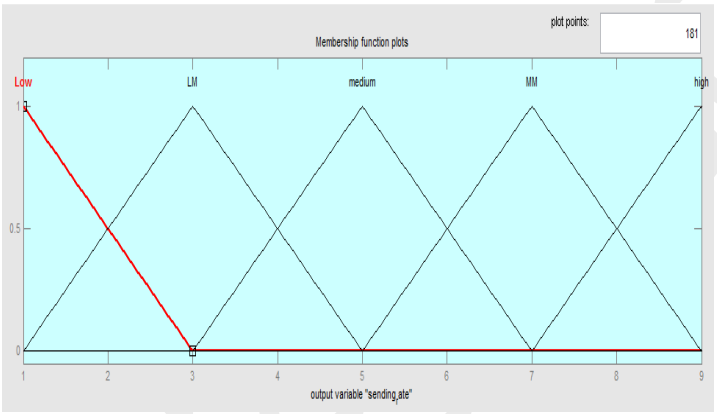

Fig. 3 Membership function used for output variable

TABLE 1 Fuzzy based rule are used

	INPUT		OUTPUT
S. No.	Channel load	Queue length	Sending rate
1.	Small	Small	High
2.	Small	Big	More than medium
3.	Medium	Small	Medium
4.	Medium	Big	Medium
5.	Big	Small	Less than medium
6.	Big	Big	Low

According to [5], The rule viewer, which is an inbuilt MATLAB fuzzy logic tool for computing the output based on the set of given inputs, and surface viewer, which is also an inbuilt MATLAB fuzzy logic tool for graphical representation of relationship between membership functions [5], are shown below in Fig. 4 and Fig. 5, respectively:

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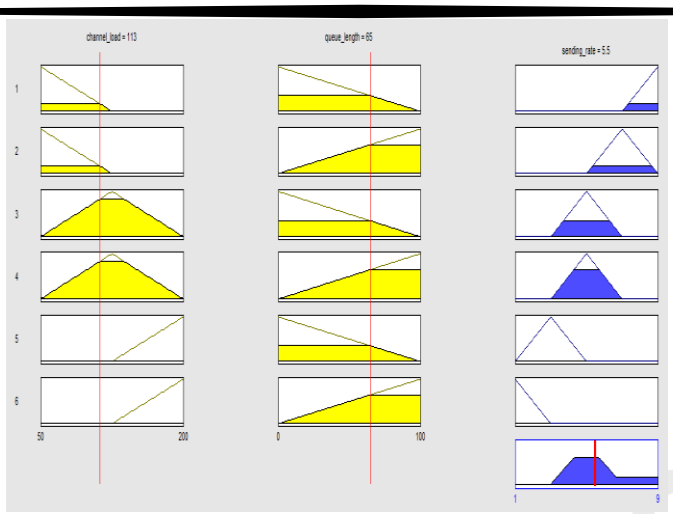

Fig. 5 Rule view for Channel load, Queue length and Sending rate

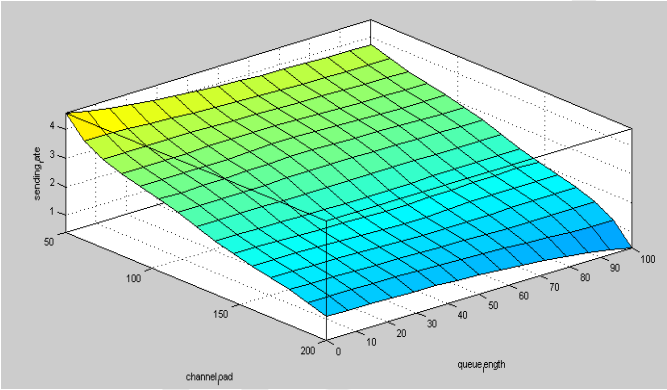

Fig. 6 Surface view showing channel load, queue length and sending rate

SIMULATION PARAMETERS

Qual net 6.1 is quicker, most adaptable system demonstrating platform.[6] In this exploration paper, QualNet 6.1 system test system is utilized for performing simulation . Qualnet is a commercial simulator which is very effect solution to study the performance of a communication network through simulation process and can also be used to design network which provides optimum performance by varying various simulation parameter. This simulator is typically favoured for wireless network because of faster simulation and more noteworthy adaptability. Thus, it can easily analyze the behaviour of any real communication network by virtual simulation on the software [4]. In this research paper, MANET is utilized for simulation in Qual net 6.1 simulator to assess whether the alteration utilized in the fuzzy parameter, in system, control congestion better when contrasted with the default estimation of parameter in Qual net 6.1. In this paper execution by changing maximum speed 10,20,30,40,50 mbps and all parameter depicting in taking after Table 1.

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Table 1 simulation parameters

Antenna	Omni Directional
Qual net	6.1
Node placement model	Random
Mobility Pattern	Random Waypoint
MAC	802.11
Number of nodes	50
Routing protocol	AODV
CBR	10
Seed	1
Pause Time (in sec)	5
Maximum Speed (in mps)	10,20,30,40,50
Traffic Type	CBR
Simulation Area	1500×1500
Data Rate	5.5 Mbps
Packet Size	512 Bytes
Queue length	65
Channel load	113

SIMULATION RESULT ANALYSIS

The performance analyses of Fuzzy and Qual net 6.1 in term of packet delivery ratio, average end to end delay, throughput, packet loss and jitter is done on the premise of recreation result in Qual net 6.1.

Packet Delivery Ratio (PDR) Packet delivery ratio signifies the total number of packets successfully delivered to the destination. [7]

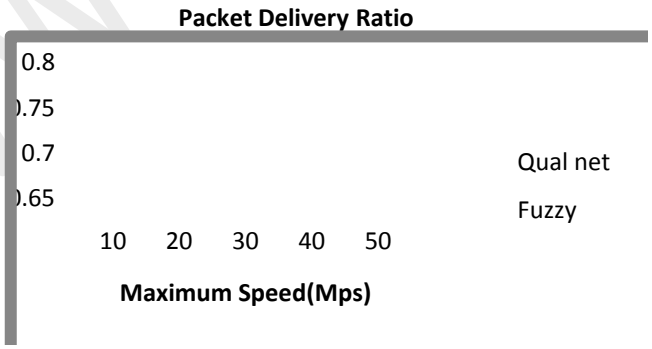

Fig.7 Packet delivery ratio with varying maximum speed

The above fig demonstrate that the general packet delivery ratio in the event of fuzzy is increment look at then Qual net In this way, Fuzzy execution proficiency as far as packet. delivery ratio.

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Average End-to-End Delay: The average time interval between the generation of packet in a source node and successfully delivery of the packet at the destinations node. The queuing time can be caused by network congestion or unavailability of valid routes.[7]

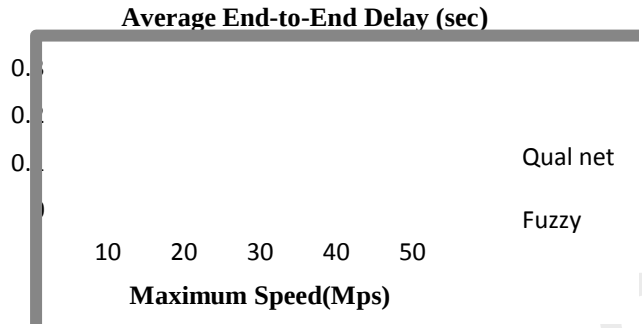

Fig.8 Average end to end delay with varying maximum speed

The above figure shows that average end-to-end delay is less in Fuzzy as compared to that of default value of Qual net . Hence, Fuzzy better in case of average end-to-end delay**.**

Average jitter : Jitter could be named as the variety in deferral or packet delay variation. The estimation of jitter is ascertained from the end to end delay. Measuring jitter is basic component to deciding the execution of system and the QoS the system offers. It is the variety in the time between packet arriving. Jitter is usually utilized as a marker of consistency and strength of a network.[7]

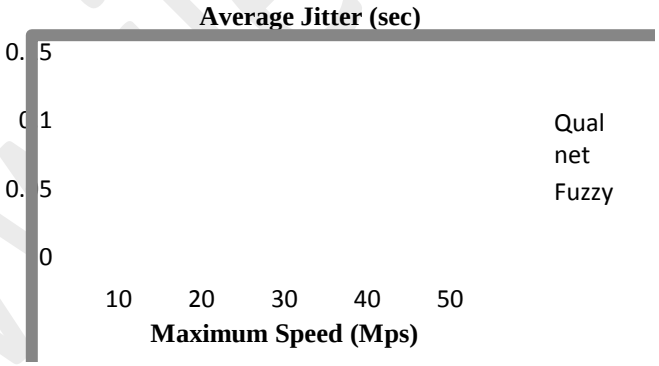

Fig 9 Average jitter with varying maximum speed

The above figure show that the average Jitter is less in Fuzzy than that default estimation of Qual net .Thus, the general execution of Fuzzy is superior to anything default estimation of Qual net as far as average Jitter simulation parameter.

Packet loss ratio : Packet loss influences the apparent nature of the application. A few reasons for packet loss or debasement would be bit mistakes in an incorrect remote system or inadequate buffers because of system congestion when the channel ends up plainly over-loaded [8]. A portion of the Packet are lost because of network congestion or due to noise. Packet loss proportion ought to be least, in order to keep the effective conveyance of high QoS.[7]

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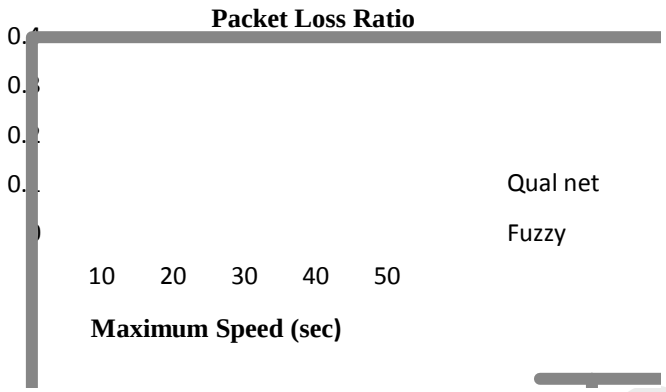

Fig.10 Packet loss ratio with varying maximum speed

The above figure shows that the average Packet Loss ratio is less in Fuzzy than that Default value of Qual net. Hence, the overall performance of Fuzzy is better than Qual net in terms of Packet Loss ratio simulation parameter.

Throughput - Throughput is measure of number of Packet effectively conveyed in a network. It is measured in term of packets/second. The estimation of throughput ought to be high.[7]

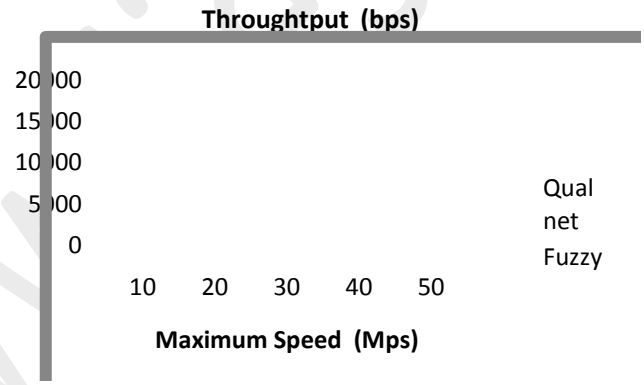

Fig 11 Throughput with varying maximum speed

The above figure shows that overall performance of Fuzzy is better than Qual net in terms of Throughput simulation parameter.

CONCLUSION

In this paper , It has observed that a fuzzy controller can reduce the packet loss and average end to end delay. It has also increased throughput and packet delivery ratio. As a result, the fuzzy controller can control congestion in wireless network.

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