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Performance Analysis of FANET Data Rate and Drop Probability

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Abstract— In recent year, the capacity and part of Mobile Ad hoc Networks has quickly developed. Their utilization in the situations of emergency, in the case of natural disaster, military battle fields and UAVs is getting extremely main stream because of cutting edge Technologies in networking and communication. Taking the MANET technology as the base has helped in the evolvement of new technologies like FANET and VANET. FANET (Flying A-hoc Networks) is another concept if contrasted with MANET with the capacities to handle situations where traditional MANET can't do as such. And furthermore we will discuss about the comparison and design consideration of FANET. In this research paper based fuzzy logic control approaches in wireless network detects & avoids congestion by developing the ad-hoc fuzzy rules as well as membership functions.In this concept, two parameters have been used : a) Channel load b) The size of queue within intermediate nodes. These parameters constitute the input to Fuzzy logic controller (FLC). The output of this FLC (sending rate, Drop probability) derives from the conjunction with Fuzzy Rules Base. The parameter used input channel load, queue length which are produce the sending rate and Drop probability output in fuzzy logic.The simulation results reveal that usage of Qual Net 6.1 simulator has reduced packet-loss comparing with fuzzy logic controller.

Keywords— Fuzzy logic Controller, load, drop Probability Qual net, Membership function.

I. INTRODUCTION

Fanet is the short form of Flying ad-hoc network which can be thought of as a sub class of mobile ad-hoc network. FANET may consist of homogeneous or heterogeneous flying specialists that can speak with each other in the region, and furthermore cooperates with their surroundings to acquire some sort of valuable information. FANET technology does not use central controlled system [1]. Although mobile ad-hoc network have flexible application yet there is a need of an alternate technology which can overcome the disadvantages of MANET, such as, disaster situations like drowning or military combat field [2]. It isn't desirable to install moving hubs (which precede onward surface) in such a correspondence region.

Have a considered random waypoint mobility model which RWP (Random Way Point Model) is a straight trajectories. Each UAV nodes select a random destination moves with a random speed and pause time at the destination. When the pause time expire node choose another random position and moves with another speed value at this location. UAVs decide on their action according to fixed probabilities [3]. This paper present fuzzy rule based Fuzzy logic controller and compare with default value of Qual net. In this paper describe the two sections – first section is describing the output of sending rate and second section is describing the output of drop probability.

II. FUZZY LOGIC CONTROLLER

A fuzzy system consists 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.

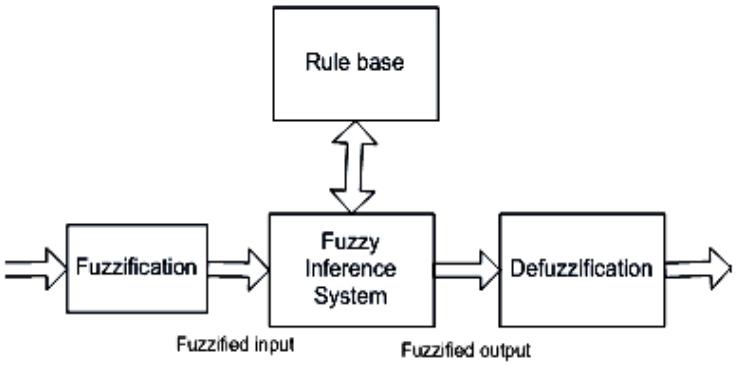

Fig.1 Block diagram of fuzzy logic controller system

Human experiences can be implemented well through membership functions and fuzzy rules in fuzzy logic[4][5][6] . FANET is capable of forming a large and complex network, comprises of Default value of Qualnet and Fuzzy value which is provided efficiently by the fuzzy logic controller [5]. In this research paper, we have described two result output of sending rate and Drop Probability.
Firstly we have described section A the output of sending rate then we have describe output of Drop Probability in section B.

SECTION A

III. 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

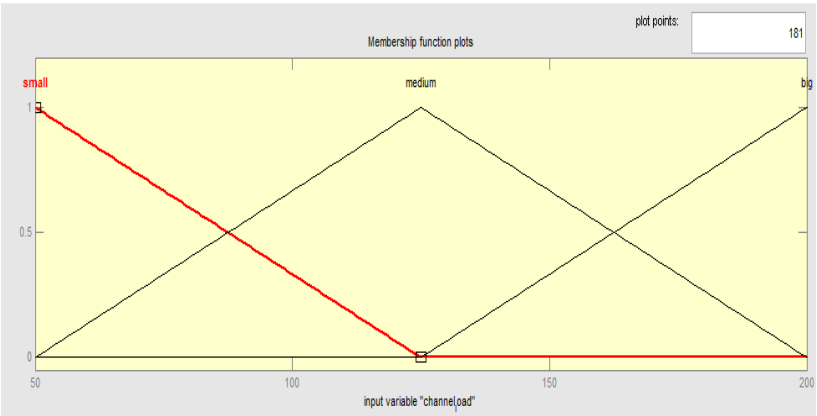

Fig. 2 Membership function used for input variable

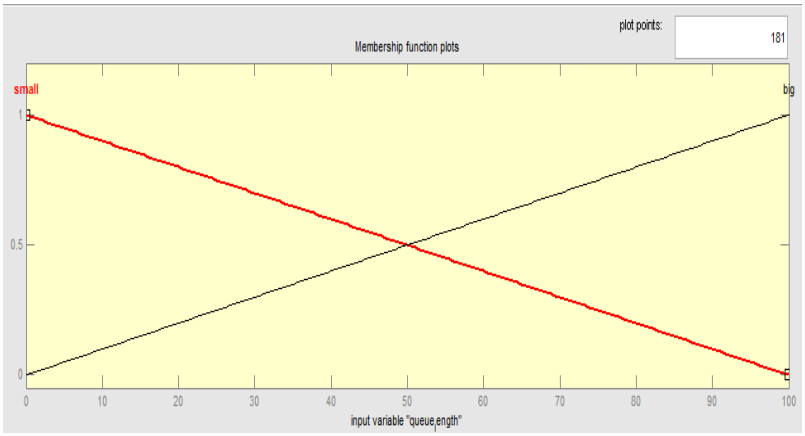

Fig. 3 Membership function used for input variable

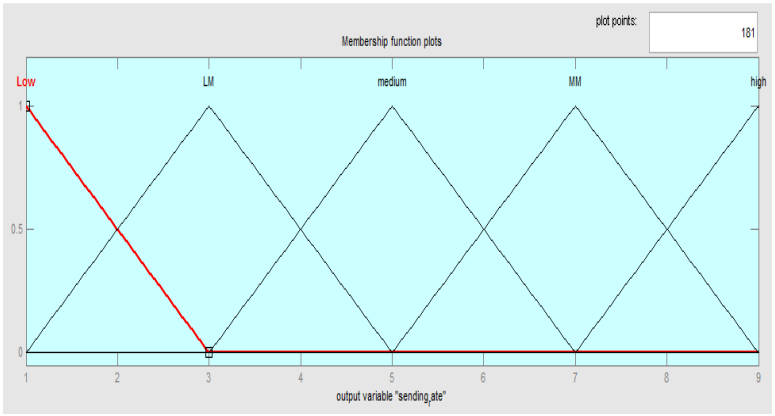

Fig. 4 Membership function used for output variable

TABLE 1
Fuzzy based rule are used

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 [8], 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 [8], are shown below in Fig. 4 and Fig. 5, respectively and also the numerical value of sending rate, queue length and channel load.

Fuzzy Value	
Sending Rate	5 Mbps
Queue length	65
Channel load	113

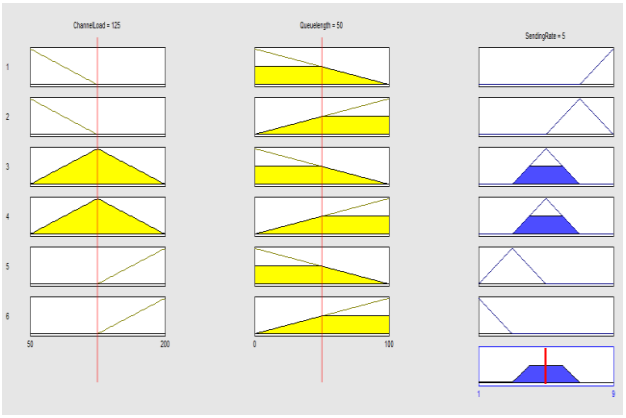

Fig. 5 Rule view for Channel load, Queue length and Sending rate

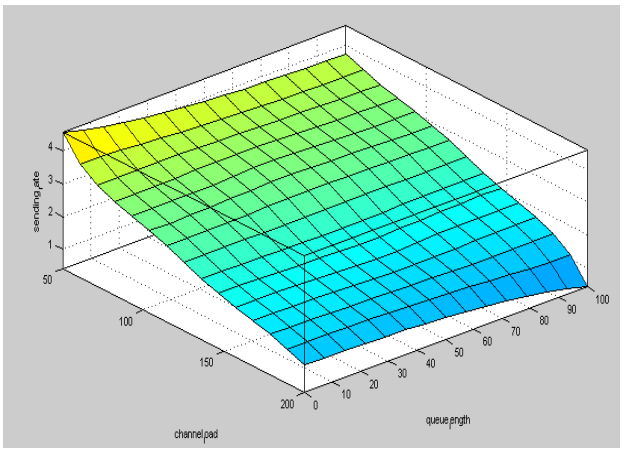

Fig. 6 Surface view showing channel load, queue length and sending rate

IV. SIMULATION PARAMETERS

Qual net 6.1 is quicker, most adaptable system demonstrating platform.[8] 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 analyse the behaviour of any real communication network by virtual simulation on the software [5]. In this research paper, FANET is utilized for simulation in Qual net 6.1 simulator to assess whether the alteration utilized in the fuzzy parameter, in system, Fuzzy less 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 2.

TABLE 2
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
Packet size	512Bytes

V. SIMULATION RESULT ANALYSIS

The performance analyses of with Fuzzy and without Fuzzy value in term of average end to end delay, throughput and packet loss is done on the premise of recreation result in Qual net 6.1.

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.[9]

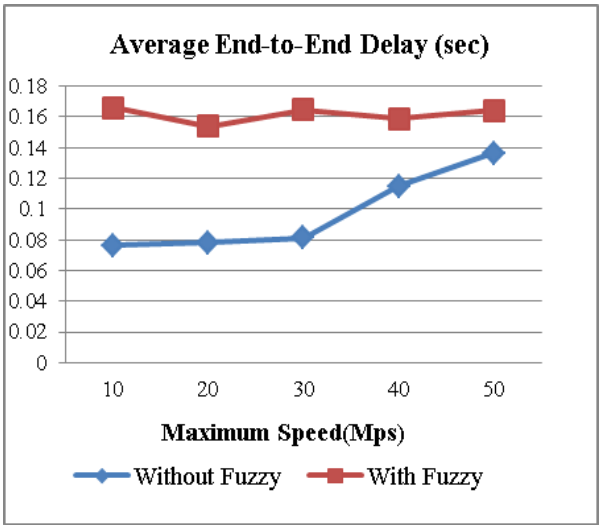

Fig.7 Average end to end delay with varying maximum speed

The above figure shows that average end-to-end delay is less in without fuzzy value of Qual net as compared to that of with Fuzzy value. Hence, without fuzzy better in case of average end-to-end delay**.**

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 [10]. A portion of the Packet is 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.[9].

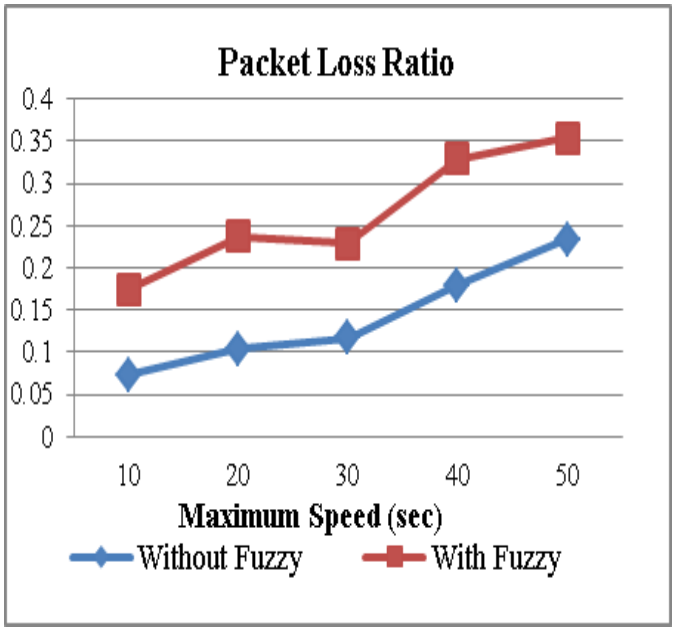

Fig.8 Packet loss ratio with varying maximum speed

The above figure shows that the average Packet Loss ratio is less in without fuzzy value of Qual net than that with Fuzzy value. Hence, the overall performance of without fuzzy is better than with Fuzzy value 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.[9].

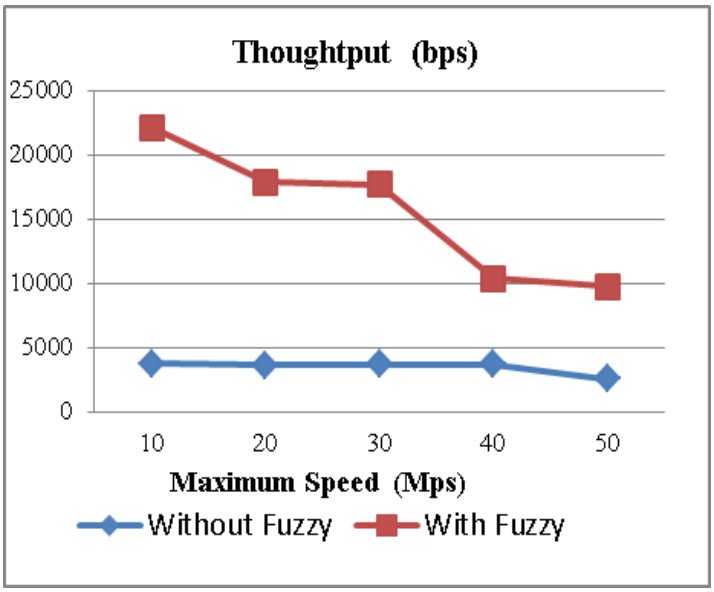

Fig 9 Throughput with varying maximum speed

The above figure shows that overall performance of with Fuzzy is better than without fuzzy in terms of Throughput simulation parameter.

SECTION B

VI. MEMBERSHIP FUNCTIONS FOR FUZZY VARIABLES

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

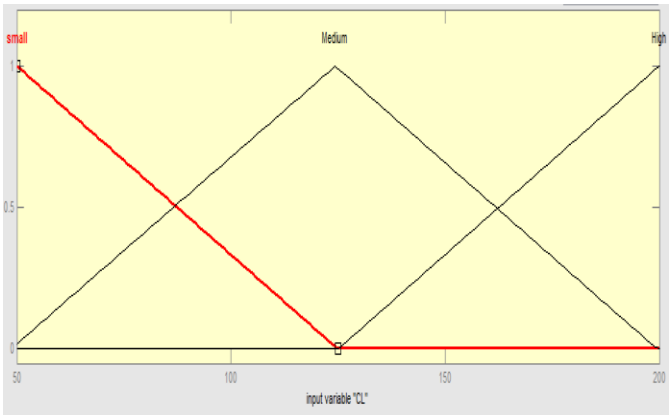

Fig.10 Membership function used for input variable

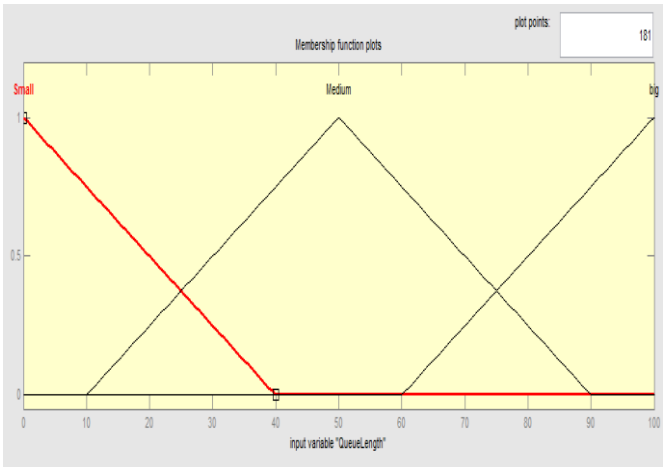

Fig.11 Membership function used for input variable

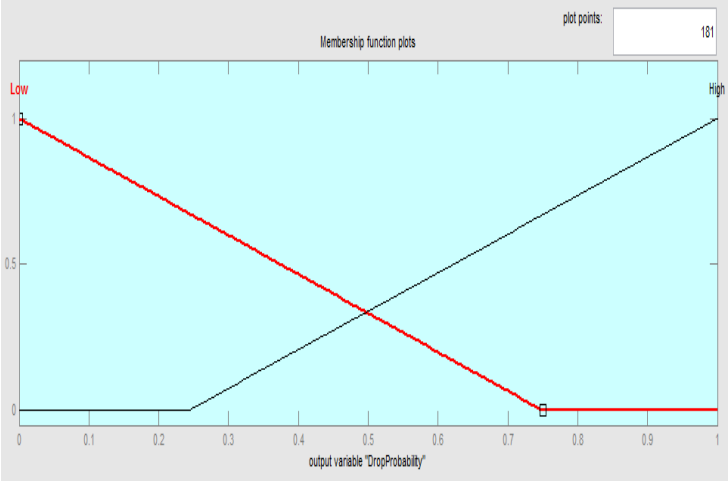

Fig.12 Membership function used for output variable

TABLE 3
Fuzzy based rules used

S. No.	Channel load	Queue length	Drop Probability
1.	Small	Small	High
2.	Medium	Small	Low
3.	Small	Big	High
4.	Medium	Big	Low
5.	Big	Small	Low
6.	Big	Big	Low
7.	Medium	Small	High
8.	Medium	Big	High

According to [19], 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 function and numerical value of Drop probability, queue length and channel load.

Fuzzy Value	
Queue length	50
Channel load	122
Drop probability	0.5

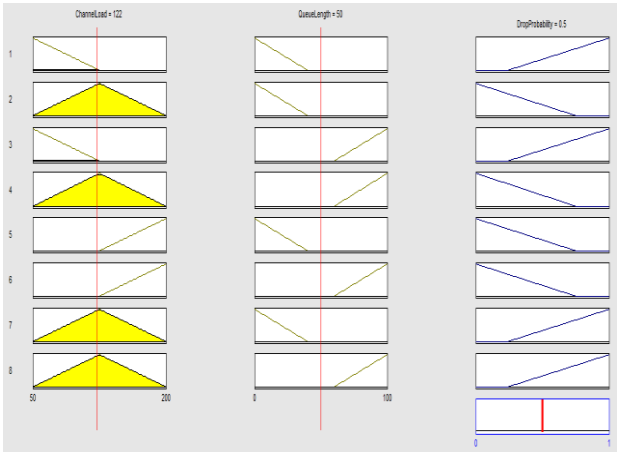

Fig. 13 Rule view for Channel load, Queue length and Drop Probability

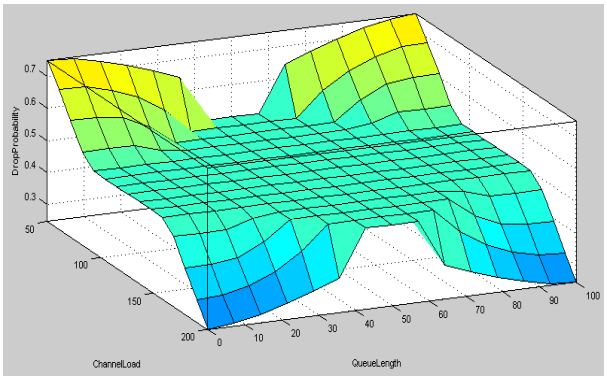

Fig. 14 Surface view showing channel load, queue length and Drop probability

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Table 4
simulation parameters

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Pause Time (in sec)	5
Maximum Speed (in mbps)	10,20,30,40,50
Traffic Type	CBR
Simulation Area	1500×1500
Data Rate	2 Mbps
Packet Size	512 Bytes

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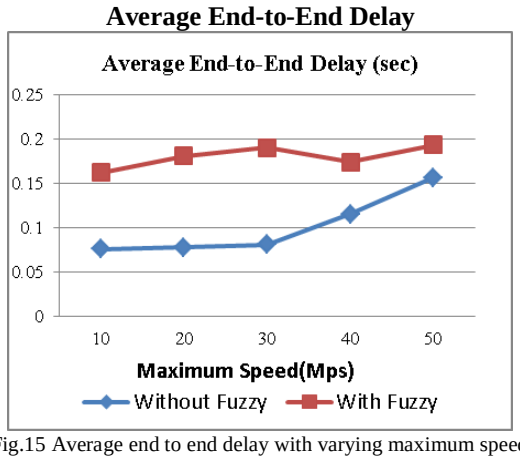

Fig.15 Average end to end delay with varying maximum speed

It can be observed that the overall average end-to-end delay in case of without fuzzy value is lower than that of with Fuzzy value, which ensures that Qual net case performs better than that of Fuzzy, thus helping in improving the performance of the network.

Packet loss ratio

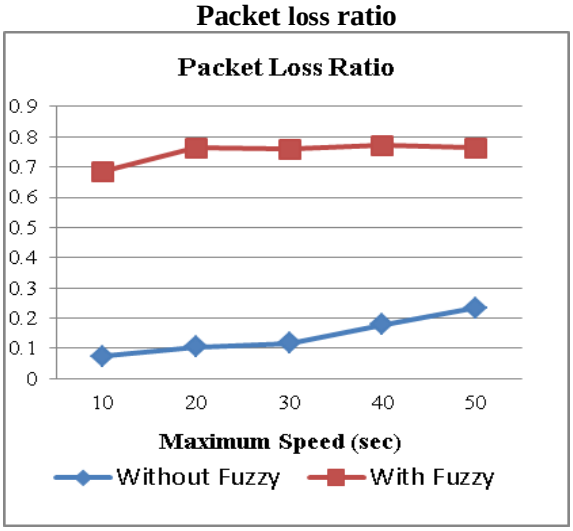

Fig.16 Packet loss ratio with varying maximum speed

It can be observed that the overall packet loss ratio in case of with Fuzzy value is higher than that without fuzzy value of Qualnet, which ensures that Fuzzy case performs poor than that of Qualnet, thus helping in improving the performance of the network.

Throughput

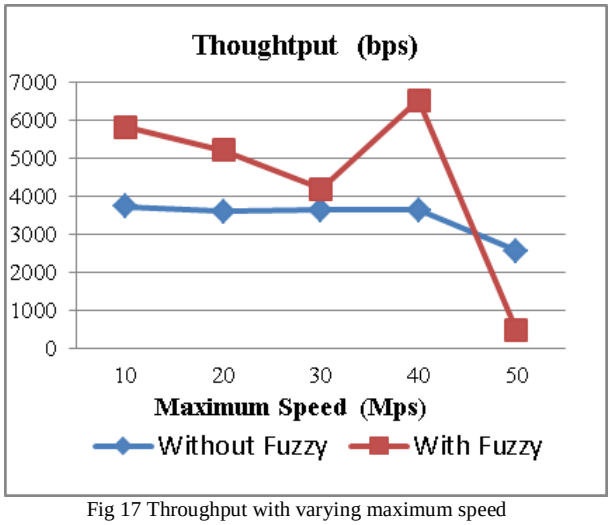

Fig 17 Throughput with varying maximum speed

It can be observed that the overall throughput in case of with Fuzzy value is higher than that of without fuzzy value, which ensures that with Fuzzy case performs better than that of without fuzzy.

IX. CONCLUSION

In this research paper, the performance of FANET have been compared of fuzzy value of result from fuzzy logic controller and without fuzzy value from default value of Qualnet it has observed that without fuzzy value almost better than that fuzzy value in term of throughput, end to end delay and packet loss ratio in output of sending rate and drop probability.

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