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# Performance Comparison of MANET, VANET and FANET

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***Abstract*— *A wireless ad hoc network is a decentralized kind of wireless network. It is a kind of temporary Computer-to-Computer connection. It is a spontaneous network which includes mobile ad-hoc network (MANET), vehicular ad-hoc network (VANET) and Flying ad-hoc network (FANET). Mobile Ad Hoc Network (MANET) is a temporary network that can be dynamically formed to exchange information by wireless nodes or routers which may be mobile. A VANET is a sub form of MANET. It is an technology that uses vehicles as nodes in a network to make a mobile network. FANET is an ad-hoc network of flying nodes. They can fly independently or can be operated distantly. In this research paper Fuzzy based 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 as: a) Channel load b) The size of queue within intermediate nodes. These parameters constitute the input to Fuzzy logic controller. The output of Fuzzy logic control (sending rate) derives from the conjunction with Fuzzy Rules Base. The parameter used input channel load, queue length which are produce the sending rate output in fuzzy logic. This fuzzy value has been used to compare the MANET, FANET and VANET in terms of the parameters Throughput, packet loss ratio, end to end delay. The simulation results reveal that usage of Qual Net 6.1 simulator has reduced packet-loss in MANET with comparing of VANET and FANET.***

***Keywords*— *MANET, VANET, FANET, Fuzzy logic, load, Data Rate, Qual net, Membership function.***

## I. INTRODUCTION

A wireless ad hoc network is a collection of wireless nodes without any centralized administration. The network is ad hoc because it does not rely on a pre-existing infrastructure, such as routers in wired networks or access points in managed (infrastructure) wireless networks. That is, in ad hoc mode, you can set up a wireless connection directly to another computer without having to connect to a Wi-Fi access point or router[1]. A MANET is a network that has many free or autonomous nodes often composed of mobile devices that can operate without strict top-down network administration. MANET does not use any existing network infrastructure or centralized administration. The routers are allowed to move randomly and arrange themselves. So, the wireless topology of the network may change frequently and unpredictably. Such a network may operate in a stand-alone fashion, or might be connected with the web. A MANET might be characterized as a network that has many free or autonomous nodes often composed of mobile devices or other mobile pieces that can arrange themselves in different ways and operate without strict top- down network administration. VANET is a subset of mobile ad-hoc networks. It is a recently presented innovation. VANET enables vehicles to communicate with each other and share information in a wireless network if the vehicles are inside the range. VANET has some different characteristics than the manet that makes it unique. There can be two types of VANET **V2V** - when there is no infrastructure required, nodes do vehicle to vehicle communication with each other **V2RSU** - when rode side units are used for routing information exchange with alternate vehicles. FANET is a gathering of unmanned air vehicle (UAVs) communicating with each other with no need to access to point, but at least one of must be connected with a ground base or satellite [2]. UAVs work without human help, similar to autopilot. UAVs can fly independently or can be operated distantly. Earlier, UAVs were simple remotely piloted aircraft and mostly part utilized for military activities/applications. However, in recent years, UAVs are being utilized as a part of expanding number of common applications, for example, policing and putting out fires, non-military security work, and so on. The utilization of single-UAV system is exceptionally normal, yet utilizing a group of little UAVs has turned out to be beneficial. In any case, multi-UAV systems have some selective difficulties and one of the most important design issues is the communication.

 

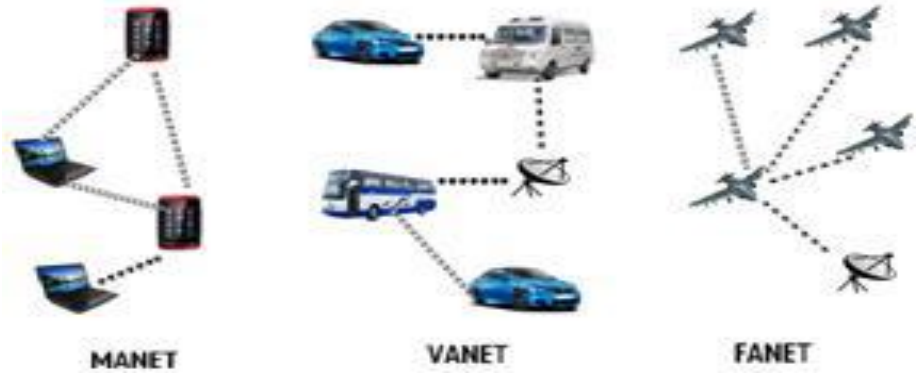


**Fig. 1 Block diagram of MANET, VANET and FANET**

## 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.

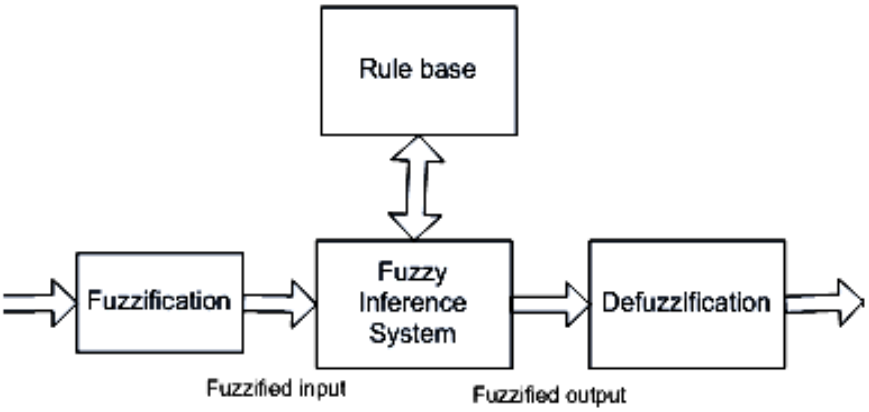


**Fig.2 Block diagram of fuzzy control system**

## 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

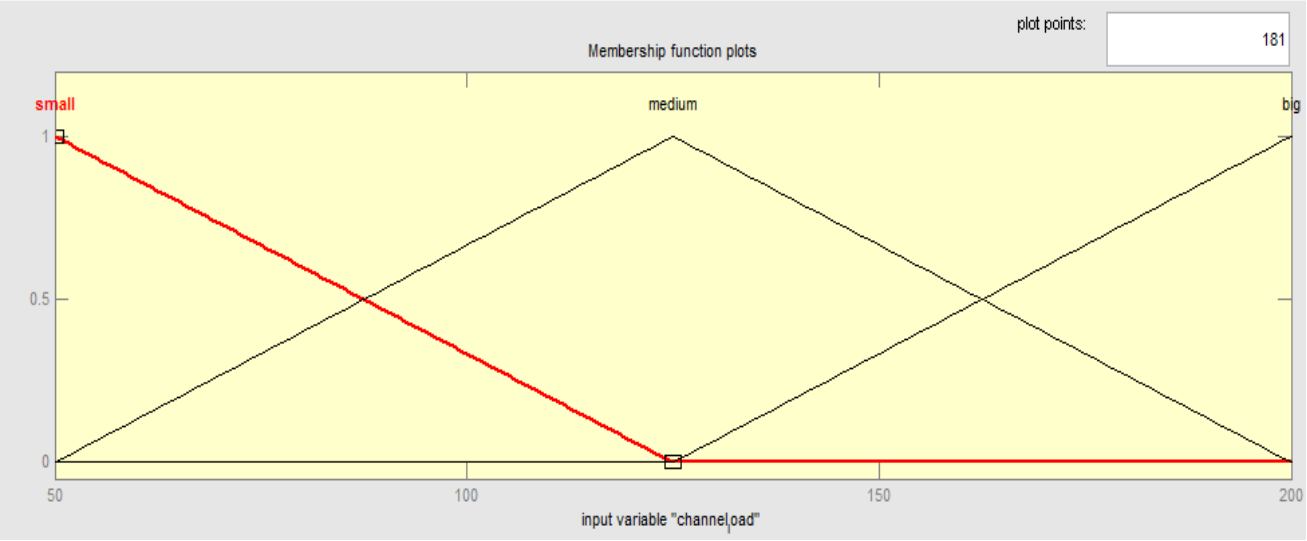


**Fig. 3 Membership function used for input variable**

 

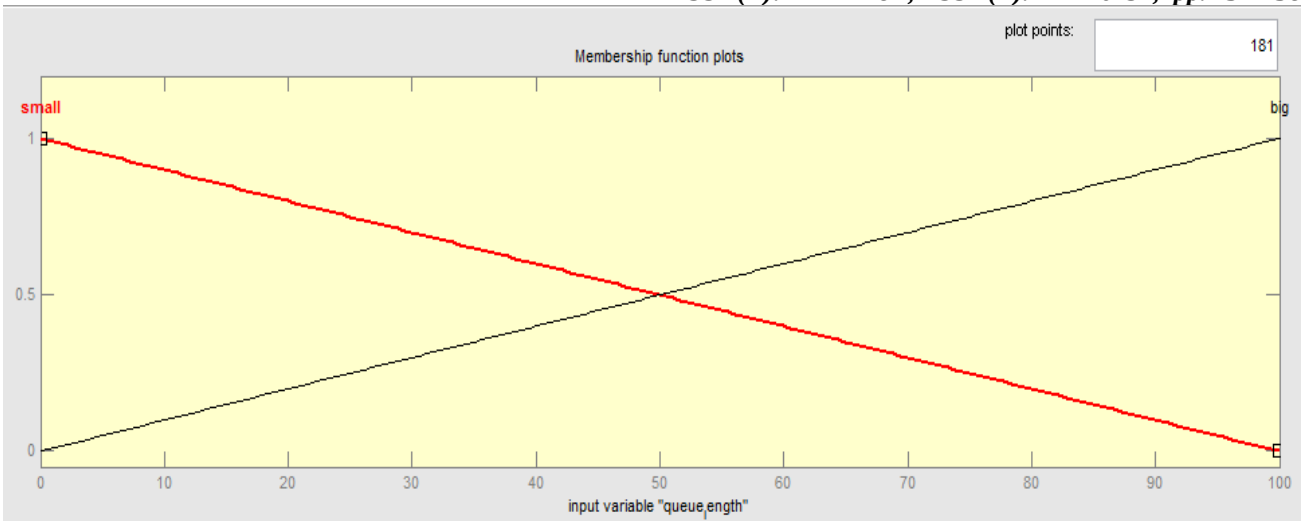


**Fig. 4 Membership function used for input variable**

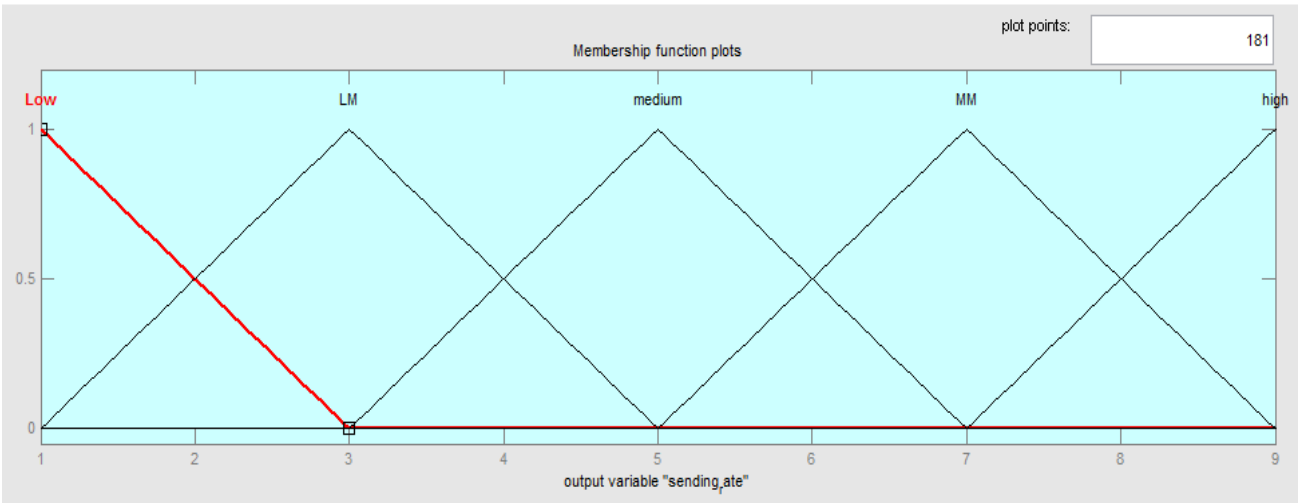


**Fig. 5 Membership function used for output variable**

**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 [3], 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 [3], are shown below in Fig. 4 and Fig. 5, respectively and also shown the numerical value of sending rate, Queue length and channel load.

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

 

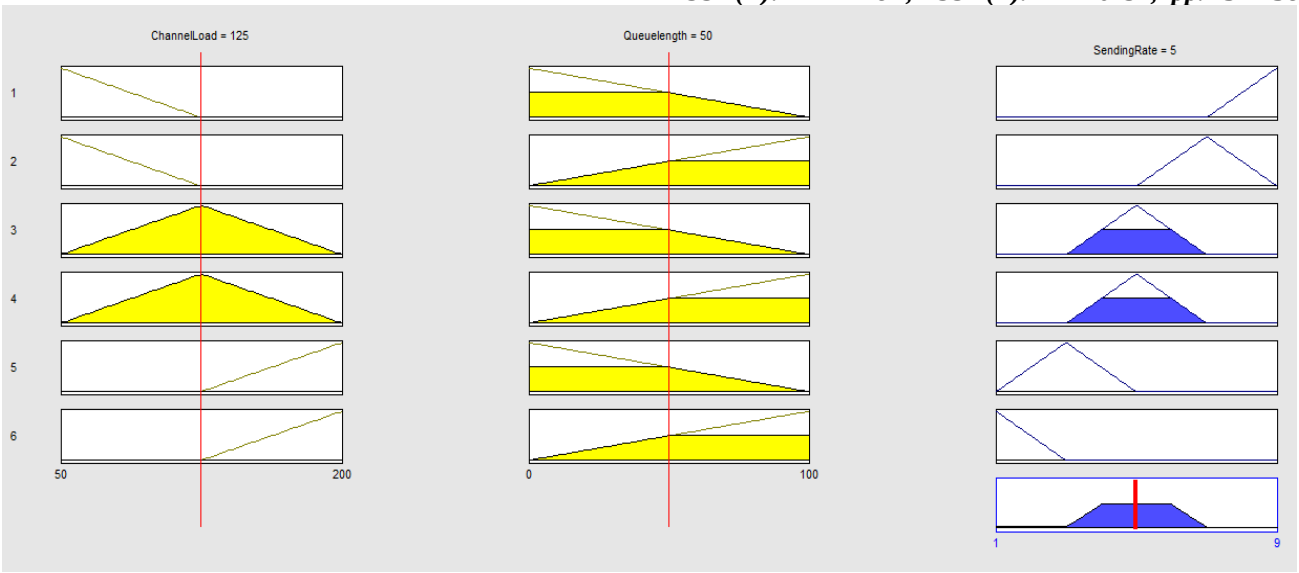


**Fig. 6 Rule view for Channel load, Queue length and Sending rate**

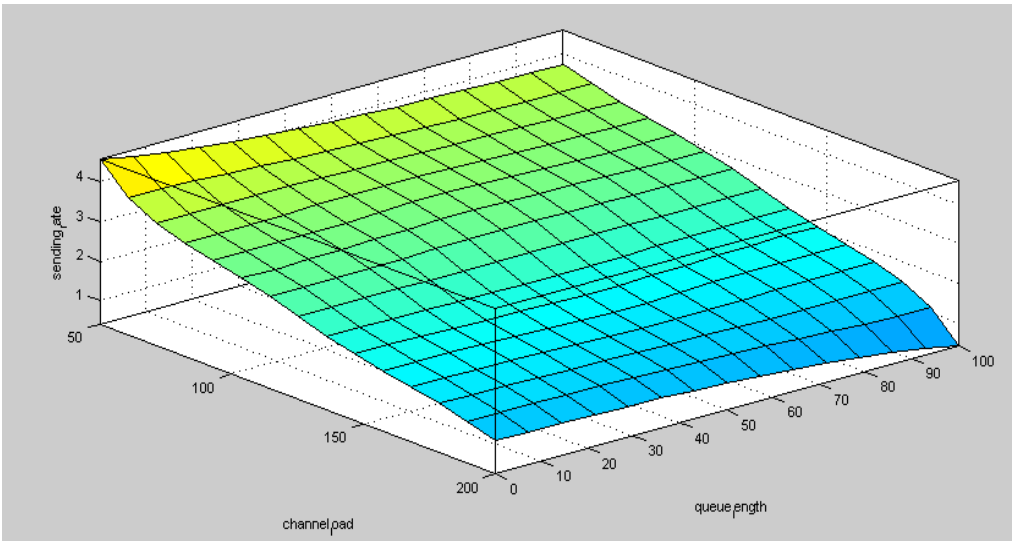


**Fig. 7 Surface view showing channel load, queue length and sending rate**

## IV. SIMULATION PARAMETERS

Qual net 6.1 is quicker, most adaptable system demonstrating platform.[5] 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, MANET, VANET, FANET is utilized for simulation in Qual net 6.1 simulator to assess whether the alteration utilized in the fuzzy parameter, in system, FANET better when contrasted with the Fuzzy value 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**

| **Qual net** | **6.1** |
|---|---|
| Antenna | Omni Directional |
| 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 |

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## V. SIMULATION RESULT ANALYSIS

The performance analyses of Fuzzy value compare in Qual 6.1 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.[4]

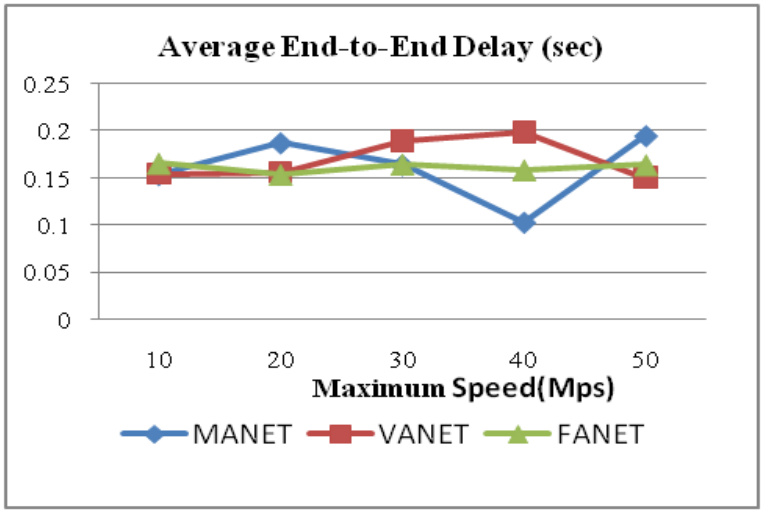


**Fig.8 Average end to end delay with varying maximum speed**

The above figure shows that average end-to-end delay is less in Fuzzy value of MANET as compared to VANET and FANET. Hence, MANET 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 [7]. 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.[6]

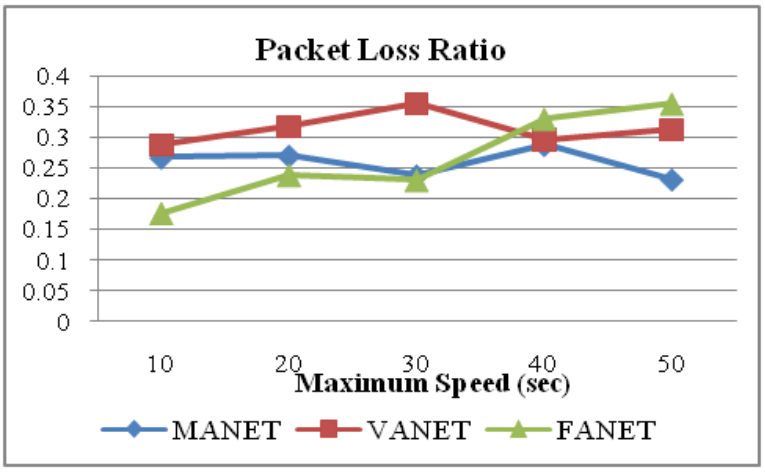


**Fig. 9 Packet loss ratio with varying maximum speed**

The above figure shows that the average Packet Loss ratio is less in Fuzzy value of MANET than that VANET and FANET. Hence, the overall performance of MANET is better than VANET and FANET 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.[6]

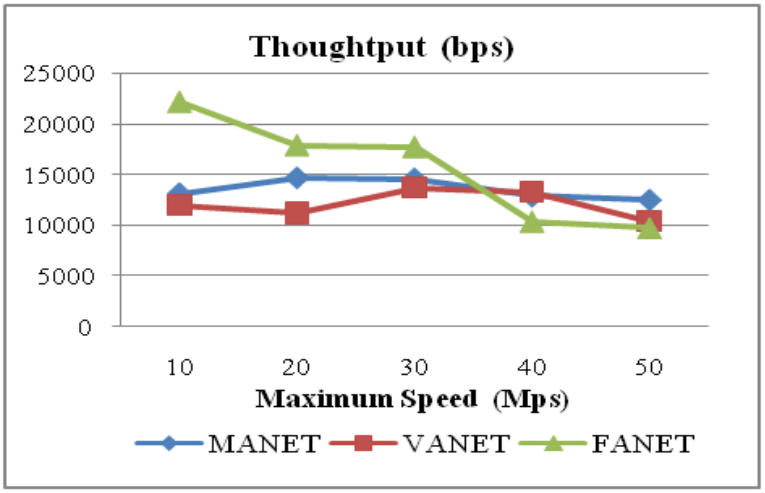


**Fig. 10 Throughput with varying maximum speed**

The above figure shows that overall performance of Fuzzy value of VANET is better than MANET and FANET in terms of Throughput simulation parameter.

## VI. CONCLUSION

In this paper, the performance of MANET, VANET and FANET have been compared in team of throughput, packet loss ratio, end to end delay using fuzzy logic controller from result, it has been observed that performance of FANET is almost better than that MANET and VANET.

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