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FUZZY BASED NODE TRAVERSAL TIME AODV FOR IMPROVING THE PERFORMANCE IN MANETs

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ABSTRACT

In this paper, an attempt has been made to calculate the Node Traversal Time (NTT) values dynamically by taking input variables Network Size and Speed based on fuzzy. Comparison of the performance of AODV protocol with and without applying fuzzy is made. QOS metrics such as Throughput, Delay, Traffic load, Route discovery time are compared. Using OPNET, simulation is performed after applying fuzzy and improvement in results is observed.

Keywords: Mobile Ad Hoc Network, AODV, OPNET, Fuzzy logic, FBNTTAODV

I.INTRODUCTION

A mobile ad hoc network (MANET) is an independent group of mobile users which communicate over unstable wireless links. Because of mobility of nodes, the network topology may change rapidly and unpredictably over time. All network activity, including delivering messages and discovering the topology must be executed by the nodes themselves. Therefore routing functionality, the act of moving information from source to a destination, will have to be incorporated into the mobile nodes .Hence routing is one of the most important issue in MANET. The routing protocols can be proactive, reactive, and hybrid.

Simulation is performed using defacto values. As per International Engineering Task Force (IETF) standards, in the dynamic environment we are not supposed to take static values. So fine tuning of defacto values of Node Traversal Time is made by applying fuzzy rules on the input variables Network size, Speed. Performance of AODV protocol after application of Fuzzy based approach is assessed.

The rest of the paper is organized as follows: Reactive routing protocol "AODV" is summarized in section 2, Methodology is illustrated in section 3, Simulation Environment is presented in section 4, and results is presented in section 5 and finally concluded with section 6.

II.AD-HOC ON DEMAND DISTANCE VECTOR ROUTING

The On demand routing protocol, Ad Hoc On-Demand Distance Vector (AODV) Protocol finds the routes as and when required. The route discovery and route maintenance are the key elements during AODV routing. If a sender wants to find a route to the destination, it broadcasts a RREQ message and then waits for NET

TRAVERSAL TIME (NETT) to receive RREP message. Once the source node received the RREP message, the route has been established and data packets may be forwarded to the destination. Route Maintenance is to provide feedback to the sender in case of router or link failure through RERR message.

2.1 Characteristics of AODV

- Unicast, Broadcast, and Multicast communication.
- On demand route establishment with small delay.
- Multicast trees connecting group members maintained for lifetime of multicast group.
- Link breakages in active routes efficiently repaired.
- All routes are loop-free through use of sequence numbers.
- Use of Sequence numbers to track accuracy of information.
- Only keeps track of next hop for a route instead of the entire route.
- Use of periodic HELLO messages to track neighbours.

III.METHODOLOGY

3.1 Fuzzy Logic

Fuzzy Logic Toolbox provides MATLAB functions, apps, and a Simulink block for analyzing, designing, and simulating systems based on fuzzy logic. The product guides you through the steps of designing fuzzy inference systems. You can create a fuzzy system to match any set of input-output data. This process is made particularly easy by adaptive techniques like Adaptive Neuro-Fuzzy Inference Systems (ANFIS), which are available in Fuzzy Logic Toolbox software.

Fuzzy inference is the process of formulating the mapping from a given input to an output using fuzzy logic. The mapping then provides a basis from which decisions can be made, or patterns discerned. Fuzzy inference process comprises of five parts:

- Fuzzification of the input variables
- Application of the fuzzy operator (AND or OR) in the antecedent Fuzzy Inference Process
- Implication from the antecedent to the consequent
- Aggregation of the consequents across the rules
- Defuzzification

3.2 Fuzzy Logic based Node Traversal Time AODV

AODV is further extended to a new method for very larger networks. This new method Fuzzy Logic Based Node Traversal Time Performance Enhanced AODV is strengthened by its large number of fuzzy logic rules and behavior of membership functions. This method calculates Node Traversal Time value associated with the network size and speed. The Input variables are network size and speed. Node Traversal Time is treated as an output variable. The linguistic variable associated with input variables are Low (L), Medium (M), High (H) Very High (VH) for network size, Low (L), Medium (M), High (H) and Very High (VH) for Speed and for the NTT output variable these are Low (L), Medium (M), High (H) and Very High (VH).

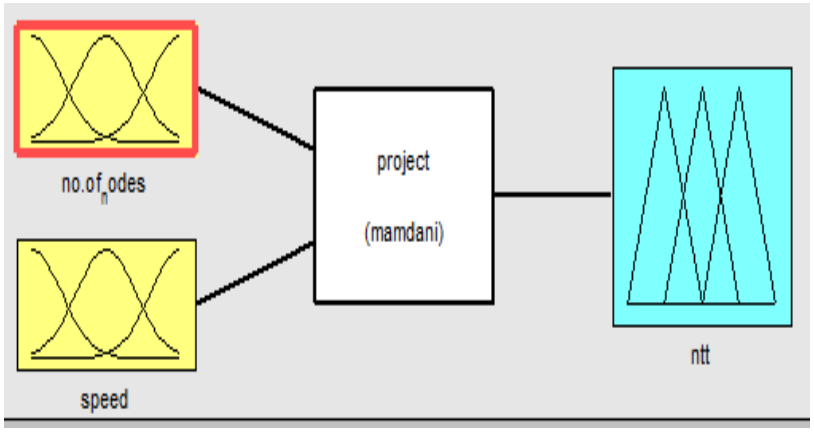

Figure 1: Fuzzy Inference System of NTTAODV

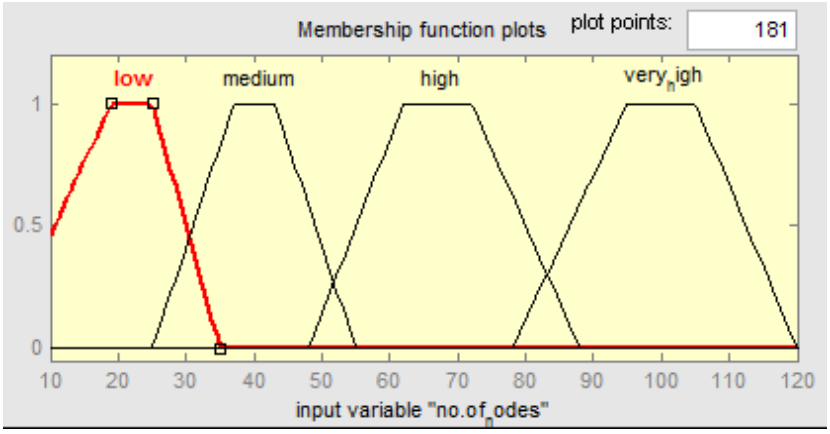

Figure 2: Membership function for the input variables 'Network Size'

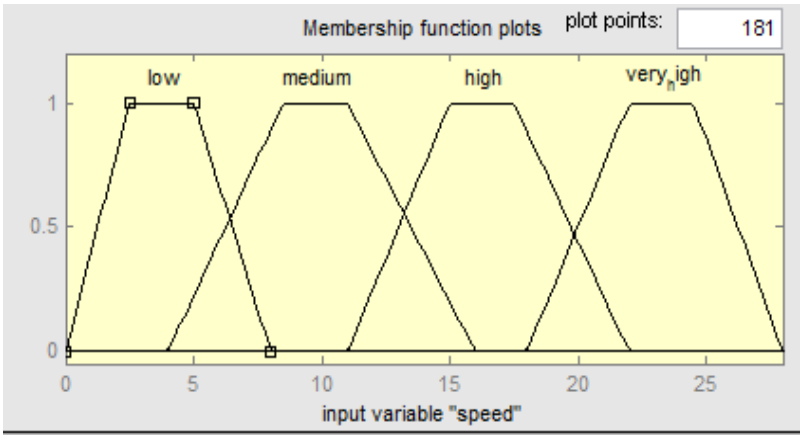

Figure 3: Membership function for the input variables 'Speed'

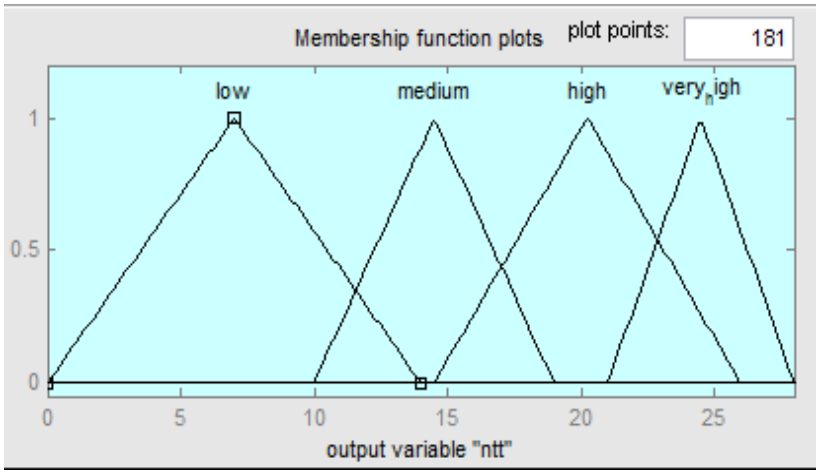

Figure 4: Membership function for the output variable 'Node Traversal Time'

Table.1 Fuzzy Rule Base

No. of Nodes	Speed	Node Traversal Time
Low	Low	High
Low	Medium	Very High
Low	High	Low
Low	Very High	Medium
Medium	Low	Low
Medium	Medium	Medium
Medium	High	Very High
Medium	Very High	Medium
High	Low	Medium
High	Medium	Low
High	High	Very High
High	Very High	Low
Very High	Low	Low
Very High	Medium	Very High
Very High	High	Medium
Very High	Very High	Very High

Table 1 shows different rules given by taking input variables as Network Size and Speed, output variable as Node Traversal Time.

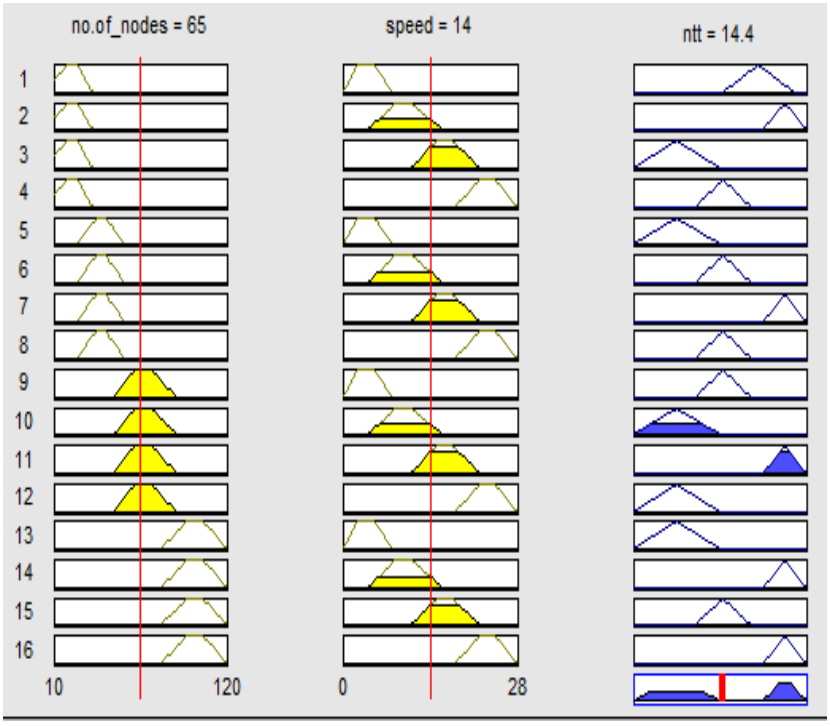

Figure 5: Rule viewer

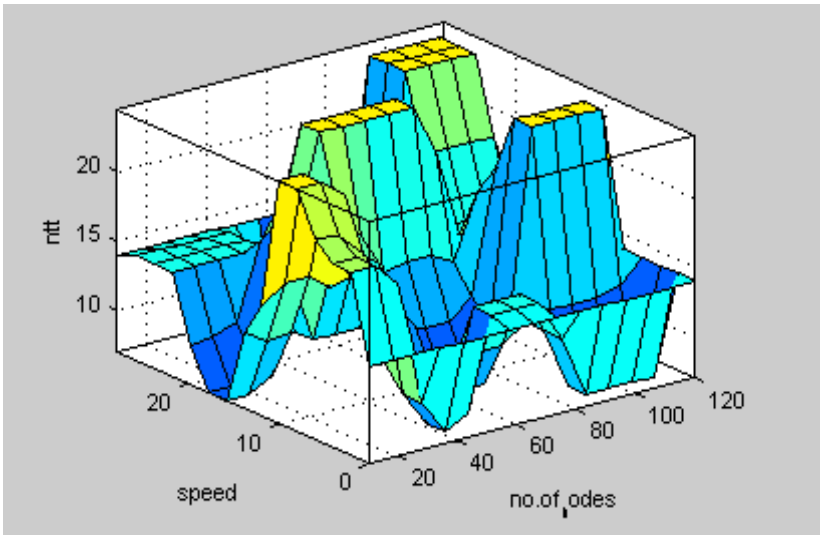

Figure 6: Surface viewer of FBNTTAODV

IV. SIMULATION ENVIRONMENT

Simulators like NS2, Glomosim, Opnet and Qualnet etc., were developed to evaluate the performance of routing protocols. The experiments for evaluating the FBNTTAODV model were implemented within the OPNET. OPNET is a network simulator that provides virtual network communication environment. It is prominent for the research studies, network modeling and engineering, R & D Operation and performance analysis. It is extensive and powerful simulation software with wide variety of possibilities and Enables the possibility to simulate entire heterogeneous networks with various protocols. The simulation parameters used in the method was given in table below.

Table.2 Simulation parameters for aodv

Parameters	Value
Routing Protocol	AODV
Simulation Time	900sec
Area	1500m X 1500m
Packet Size	512bytes
Nodes	10,30,50,70,100

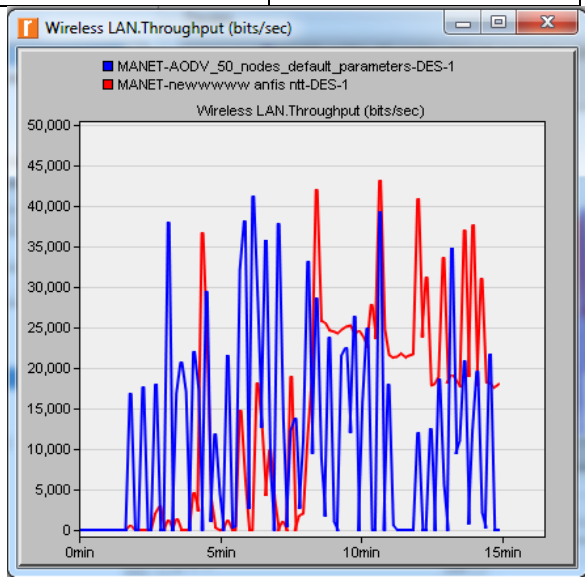

Figure 7: Variation of Average Throughput in AODV and FBNTTAODV Protocols

VI. RESULTS

The performance of AODV and FBNTTAODV were analyzed with the metric Average throughput. Average Throughput elaborates the total amount of data received by the particular receiver during the simulation time.

Average Throughput of AODV and FBNTTAODV

	Node Traversal Time(NTT)	Average Throughput
AODV	0.04s	41265
FBNTTAODV	0.037s	43178

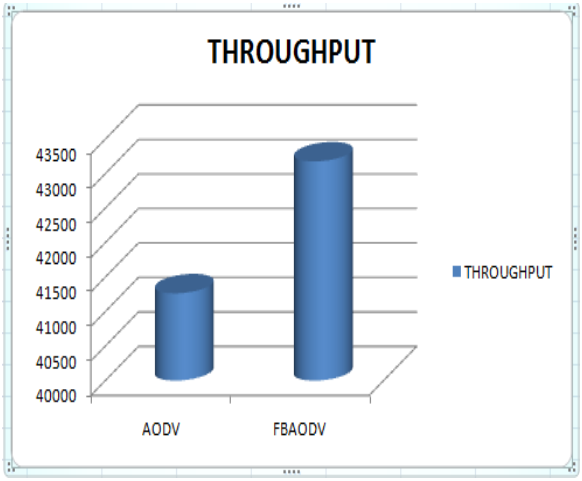

Figure 8: Histograms generated on Throughput in AODV and FBNTTAODV

VII. CONCLUSION AND FUTURE SCOPE

Varying node traversal time with the network size and Speed plays a major role for improving the performance. From the simulation results, it was observed that at 50 nodes, the average Throughput for AODV and FBNTTAODV was 41265 and 43178 respectively. From the results, it is evident that FBNTTAODV performs better than AODV. The given model with various mobility models can further be studied.

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