Optimizing the Efficiency of MANETs Through an ANFIS-Based DSR Routing Protocol for MANETS.

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Abstract:

MANETs are baseless networks without infrastructure, consisting of nodes with mobility which are dynamic in nature. Routing protocols are available for helping node to node communication. In this context, Performance of the network by increasing QoS parameters like throughput and minimizing delay and network load has become essential factor. This paper emphasizes on the execution of ANFIS approach for enhancing the performance of the DSR routing protocol in MANETs. The suggested adopts Fuzzy Inference System in optimizing the QoS parameters. Experimental results acquired from MATLAB and OPNET 14.5 simulator specifies that ANFIS based DSR showed better performance by increase in Throughput 10.69%, decrease in Network Load by 11.43% and decrease in delay by 6.30%.

Keywords: DSR, ANFIS, Fuzzy DSR

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1. Introduction:

Mobile-Ad-Hoc-Network is a regionalize type of Ad Hoc network typically mobile in nature. It doesn't have a proper topology due to its dynamic in nature and has no access point. MANETs are dynamic by its inbuilt characteristic features, frequent routing changes due to its mobility and low energy resources. Unlike other networks, these networks though they are demanding and portable in nature the routing has become challenging issue. This routing according to the requirement, the related protocol selection has become crucial point.

MANET protocols are classified as Pro-active (Table-Driven), Re-active (On-Demand) and amalgam of routing Protocols (Hybrid-Model) as shown in the Figure1

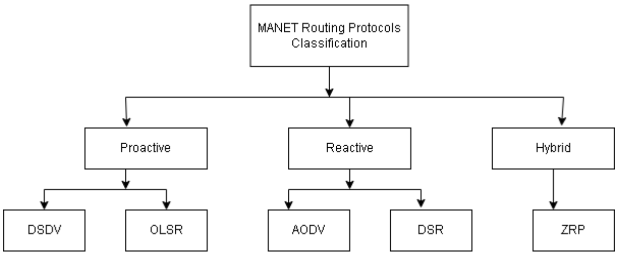

Figure1: MANET Routing Protocols Taxonomy

In Pro-active Protocols for routing, network of nodes conserves the routing information in the table and updates at time interval. This continuous activity results in more overhead. DSDV, OLSR, WRP, etc. are the examples of Proactive Routing Protocols. In Reactive Routing Protocol, the routing table is updated only when it required. That is whenever sender wants to send data to receiver, it broadcasts RREQ packets or destination route and sends accordingly. This results to less overhead. AODV, DSR are the examples of Reactive Routing Protocols. Hybrid Routing Protocol is a combination of both Proactive and Reactive Routing Protocol. ZRP is an example to Hybrid Routing Protocol.

2. Literature Review:

Sabina Barakovic, et al [1] in their paper showed comparative performance evaluation of reactive routing protocol in MANETs. AODV and DSR routing protocol are simulated and analyzed using NS-2 and proved that DSR outperforms AODV and DSDV protocol under high mobility.

Vivek Sharma et al [2] proposed an algorithm using Adaptive Fuzzy Inference System (ANFIS) by taking inputs hop count, energy and delay to select the optimal route such that improve performance of DSR routing protocol is improved.

Sunaina Sharma et al [4] in their paper, discussed different approaches in improvising DSR routing protocol. The main objective is to minimize packet loss and attaining route stability and this is achieved by MDSR by comparing them.

H.Martinez-Alfaro, et al [5] in this paper, observed that network size has great impact on performance of DSR routing protocol. Using ANFIS, this the problem is overcome. The results are obtained using MATLAB and NS simulator.

P.Srikanth et al [6] mainly focused on the execution of ANFIS based ICMP-RPL for enhancing the performance and network lifetime in IOT. Experiment results obtained with the help of COOJA and MATLAB simulator presented better performance as per QoS metrics.

3. DSR Routing Protocol:

DSR routing Protocol is a Reactive Routing Protocol based on Source Routing principle. There are two mechanisms called Route Discovery and Route Maintenance followed by DSR Routing Protocol.

Route Discovery mechanism in DSR routing protocol is used to find the route from source to destination using Route Request (RREQ) packet. That means whenever the source-node need to transmits the data to destination, firstly it identifies in its cache for the route and if it is not available the source node broadcasts RREQ packet to all the nodes within the network. Meantime if any intermediate node contains route details it sends route details as Route Reply (RREP) to the sender else the intermediate nodes further broadcasts for route requests and adds its own identity in the header of the route request packet until the destination address is obtained.

Route Mechanism in DSR is used to maintain the failed routes. When the current paths or links are failed this route mechanism concept helps in finding the alternative routes to destination. Here, Source node receives Route Error (RERR) packet when it encounters failed route. It immediately deletes the expired or failed route from cache and sends new broadcast request for new route to the destination.

4. ANFIS Based DSR:

The defacto parameter values of broadcast jitter in DSR routing protocol is not suitable for real world scenario. A soft computing approach ANFIS is used for calculating dynamic Broadcast Jitter by training the data set obtained from Fuzzy Logic as shown in Figure2

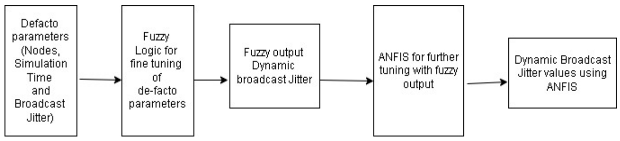

Figure2: Block Diagram of ANFIS

The below flowchart demonstrates the implementation of ANFIS modelling on the data set generated with FIS is shown in Figure 3

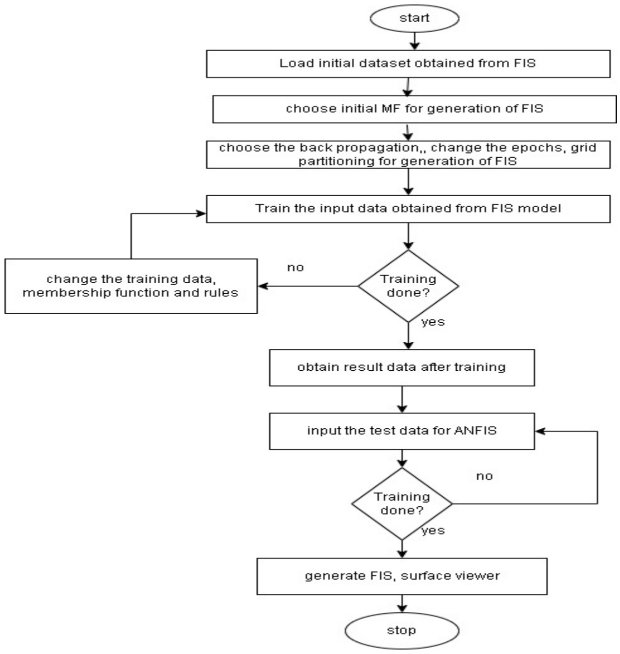

Figure3: Flowchart of ANFIS

Adaptive Neuro Learning is similar to Neural Network training the data is fed as input for the neurons by assigning the weights for the links between the input layer to hidden layer and hidden layer to output layer. The summation function is applied at outer layer and bias function in applied for changing of weights is done in back propagation algorithm.

The data set from FIS is done by loading the data from workspace consisting of inputs number of nodes, simulation time and broadcast jitter.

For the given inputs, the obtained output design using ANFIS is shown in Figure 4.

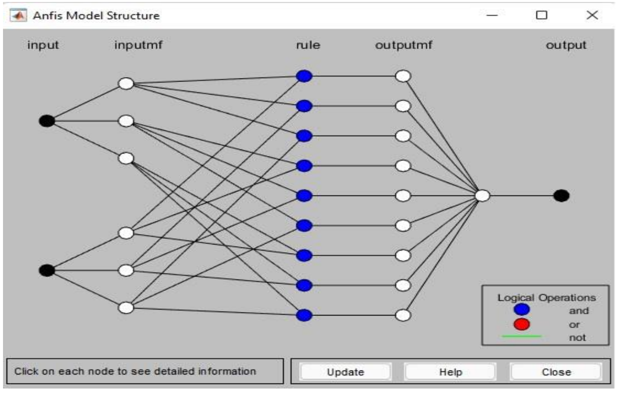

Figure4: ANFIS model structure

The data given as input is trained by Adaptive Neural Networks by minimizing error, epoch value with 1000 and error tolerance is shown in the Figure5

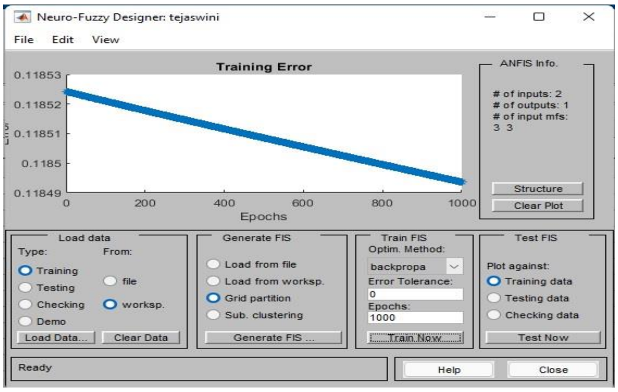

Figure5: Training the network by minimizing the network

The Adaptive Neural Network will generate the FIS Rule viewer to obtain ANFIS outputs by further tuning of the dataset obtained by using Fuzzy Logic as shown in the Figure6

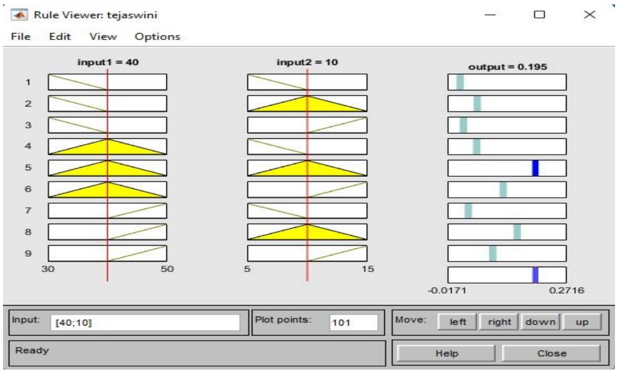

Figure6: Rule Viewer for the ANFIS

The 3D Surface viewer input1(nodes), input2(Simulation Time) and Output (Broadcast Jitter) is shown in Figure7.

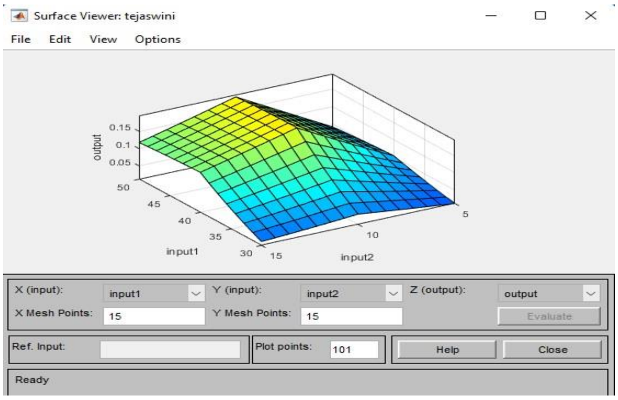

Figure7: 3D Surface viewer for ANFIS

5. Experimental Setup:

OPNET 14.5 simulator is designed for modeling communication devices, technologies, protocols, and to simulate performance of them. In this simulation experiment, DSR routing protocol is used as part of the study.

Simulation Parameters

Routing Protocol	DSR
Simulation Time	5, 10 and 15 in minutes
Area of Simulation	1000m X 1000m
Traffic	Exponential
Node Used	MANET
Size of Each Packet	1024 Byte
Network Speed	15 mts/sec
Network Size Variations	30, 40 and 50 Nodes

Range of Transmission Node	250meters
Range of Reception	250m
Minimum& Maximum speed of Nodes	0mts/sec& 12 mts/sec
Time for Pause	0 mts/sec
Model of Mobility	Random-way-Point
Node Placement Model	Random
Jitter Broadcast time in Seconds	0.01,0.009,0.007,0.005,0.003,0.001
Mode of Addressing Used	IPV4

Table 1: Simulation Parameters

6. Results and Analysis:

Network-Throughput: Network – Throughput identifies the count of bits or bytes transferred from the source to the destination over a period of time in the seconds.(bits/Sec (or) bytes/Sec)

Throughput variation for 30 nodes, 40 nodes and 50 nodes are depicted as below:

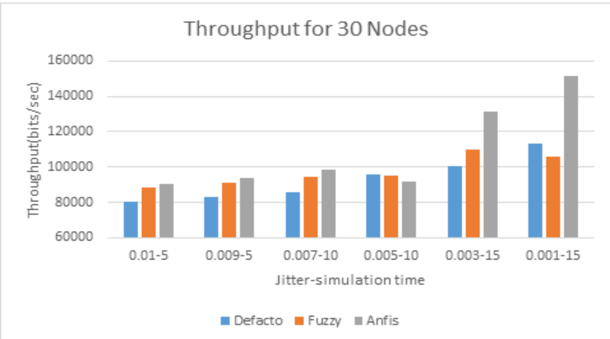

Figure 8(a): Throughput for 30 nodes

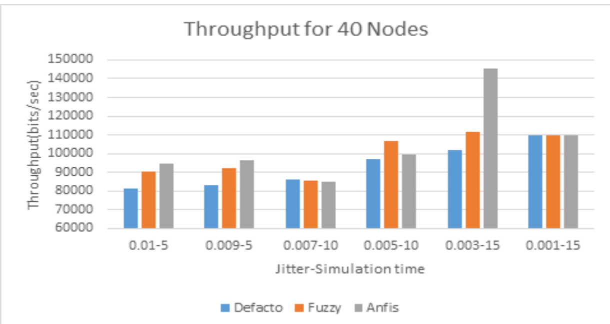

Figure 8(b): Throughput for 40 nodes

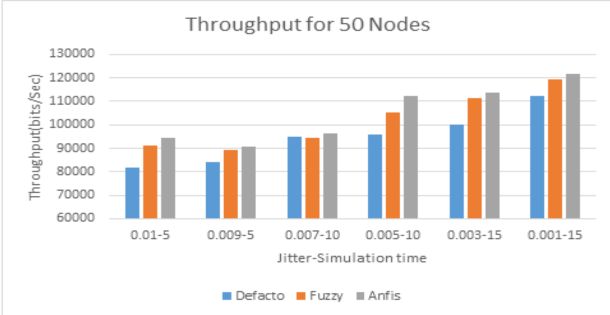

Figure 8(c): Throughput for 50 nodes

Network Load: It is the total load measured in bits/sec.

Network Load variation for 30 nodes, 40 nodes and 50 nodes are shown below

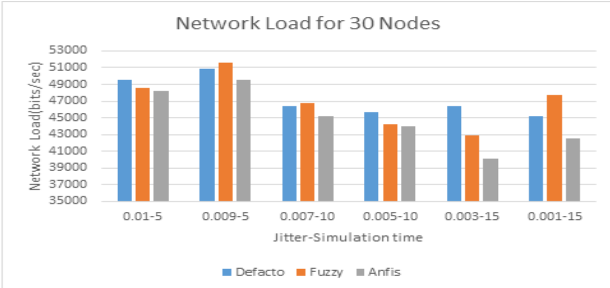

Figure 9(a): Network Load for 30 nodes

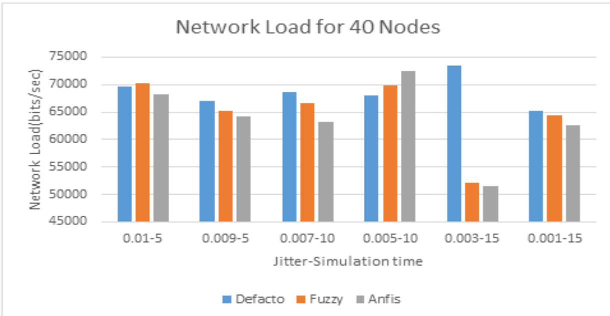

Figure 9(b): Network Load for 40 nodes

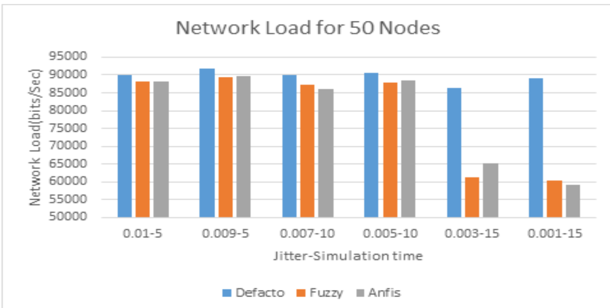

Figure 9(c): Network Load for 50 nodes

Delay: Delay is the sum of processing, computational and transmission delay other than the QDelay.

QoS Parameter Delay variation for 30 nodes, 40 nodes and 50 nodes are shown below:

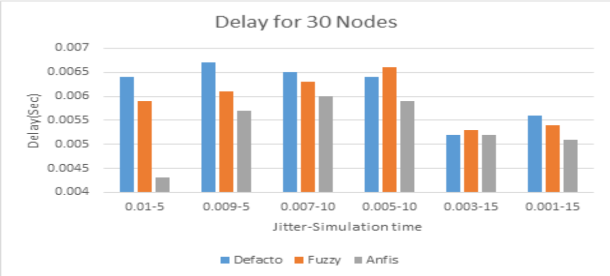

Figure 10(a): Delay for 30 nodes

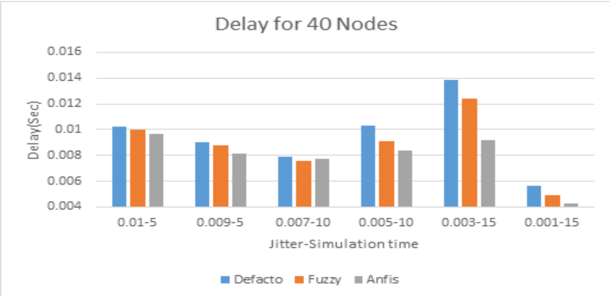

Figure 10(b): Delay for 40 nodes

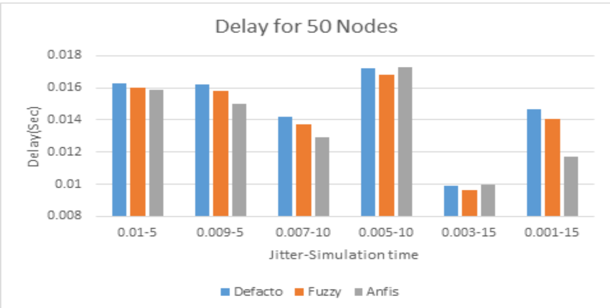

Figure 10(c): Delay for 50 nodes

7. Conclusion:

In this paper, an attempt has made to implement is made to tuning of the DeFacto parameter Broadcast Jitter using Adaptive Neural Network (ANFIS). Experimental results showed that the suggested has improved the performance than the traditional DSR by increasing Throughput 10.69%, decrease in Network Load by 11.43% and delay by 6.30% when compared to DeFacto and ANFIS based Fuzzy-DSR.

8. References:

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