FUZZY CLOSENESS BASED PRIORITY ROUTING IN MANETS

[1]V.Tejaswini, [2]K.Chinabusi
C.S.E. Department, Kaushik College of Engineering, Visakhapatnam, India.
Email: [1]tejaswini.teja546@gmail.com, [2]koppula33@yahoo.com

Abstract—The de-centralized network with a collection of autonomous wireless mobile devices is a mobile ad hoc network. The mobile node in the network communicates with other devices while moving in their own way. The communication between the devices takes place when they are in range of each other, ignoring the fact how close they are. In real time scenario, the closeness between the devices even they are in the range of each other plays a vital role in the case of performance. In this paper, the fuzzy closeness approach is demonstrated to show the importance of considering the closeness for routing in mobile ad hoc networks. The proposed and existing approaches are evaluated using the popular simulator ns-2.34.

Index Terms—DSR, FUZZY LOGIC, MANETs, PERFORMANCE

I. INTRODUCTION

The infrastructure based and infrastructure-less networks are the main dominating technologies in wireless communication. The Advantages such as decentralization and mobility of the nodes made the infrastructure-less network very popular. One of the famous networks in the infrastructure-less category is Mobile ad hoc network (MANET) [1][2][3][4][5]. Due to the frequent movement of the mobile nodes in the MANET, the route establishment among the nodes is a challenging task[6]. One of the routing protocols[8][9][10] to handle this problem is DSR. The rest of the paper is organized as follows: Reactive routing protocol "DSR" is summarized in section II, Methodology is illustrated in section III, Simulation Environment is presented in section IV, and results is presented in section V and finally concluded with section VI.

II. DYNAMIC SOURCE ROUTING (DSR) PROTOCOL

The reactive routing protocol, Dynamic source routing (DSR)[7][12][23] Protocol works on the principle of source routing. The protocol will find the routes as and when required. The *route discovery* and *route maintenance are th*e key elements during DSR routing. *In Route Discovery process whenever* a mobile node needs to send data to a particular node, a *ROUTE REQUEST* (RREQ) message was flooded. Once the RREP message was received by the sending node, the route has been established and data packets may be forwarded on that route. The broken links in the path are informed to the other nodes through RERR packets.

III. METHODOLOGY

Wireless devices communicate with other devices if they are in range of each other. They ignore the fact that how close they are. For example, the following figures1,2,3 and 4 show importance of the closeness distances between

the two nodes. Therefore, their closeness plays a main role in the means of performance.

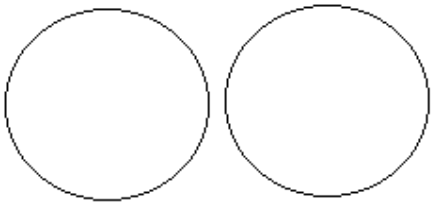

Figure 1: Two nodes out of range

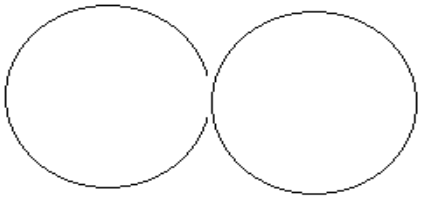

Figure 2: Two nodes just in range

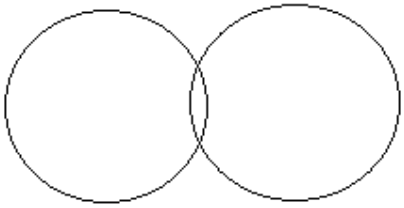

Figure 3 : Two nodes are close in range

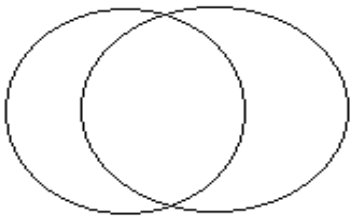

Figure 4: Two nodes are very close in range

The degree of closeness between the nodes i.e., the degree of communication range between the nodes has a major impact on the performance of the network.

IV. FUZZY CLOSENESS BASED PRIORITY ROUTING (FCBPR)

Human experiences can be implemented well through membership functions and fuzzy rules in fuzzy logic[13][14][15] . The proposed method "Fuzzy closeness priority routing model" suggests a priority according to the closeness and speed of the nodes.

The Input variables are distance and speed of the nodes. priority is treated as an output variable. The linguistic variable associated with input variables are very close , close and justclose for distance , and Low , Medium and High for speed and for the output variable these are high, medium and low. Figure 5, Figure 6, Figure 7 shows the membership functions and figure 8 shows fuzzy conditional rules respectively. Triangular shaped membership functions [16] are preferred for output variable. Figure 9 shows rule view for distance 50, speed 10 and the priority is 1.37 respectively. Figure 10 shows the surface view of the model.

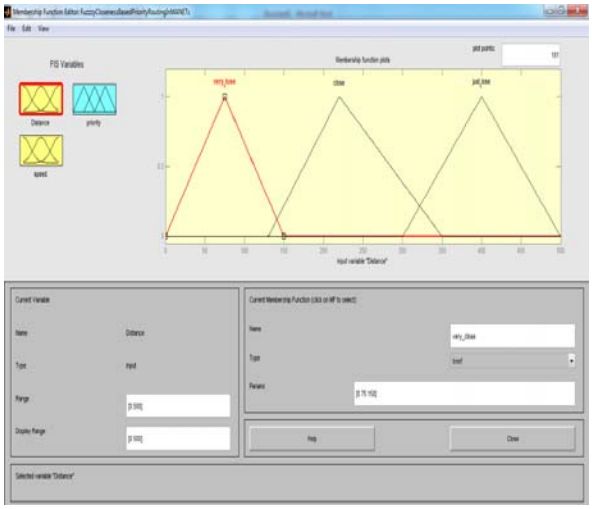

Figure 5: Membership Function For Input Variable Distance

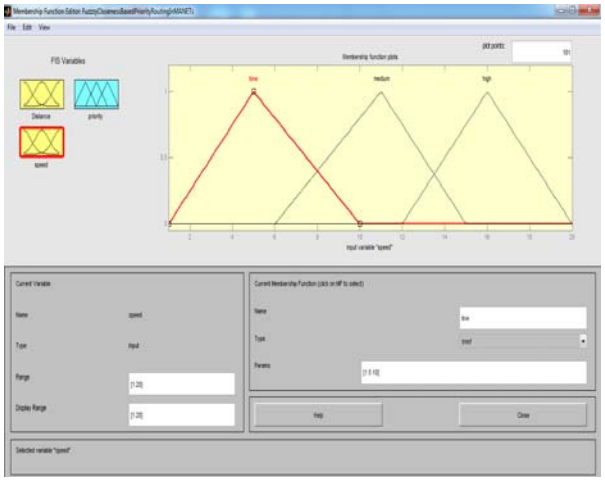

Figure 6: Membership Functions Of The Input Variable "Speed"

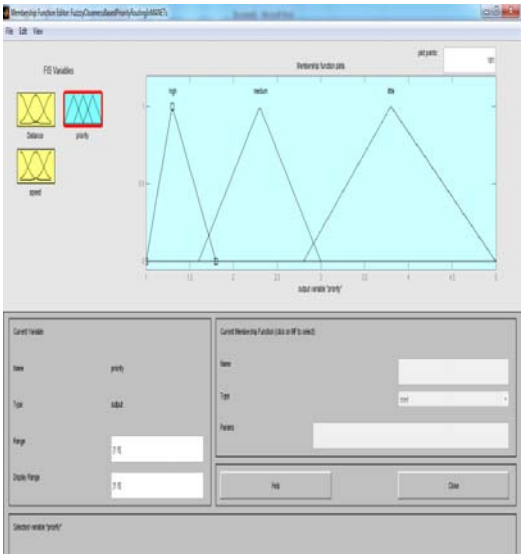

Figure 7: Membership Functions Of The Output Variable "Priority"

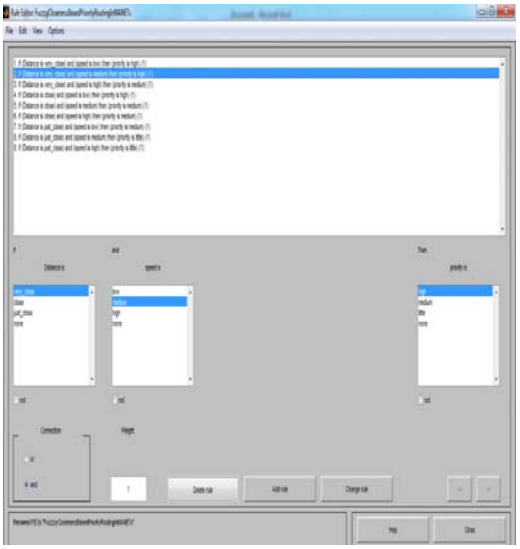

Figure 8 : Fuzzy Rule Base

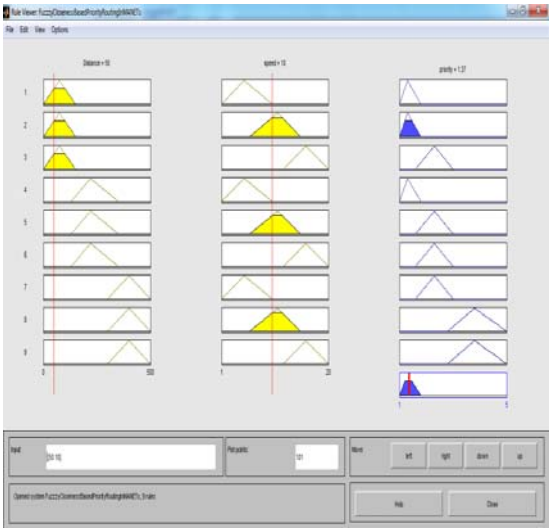

Figure 9 : Rule view for distance , speed and priority

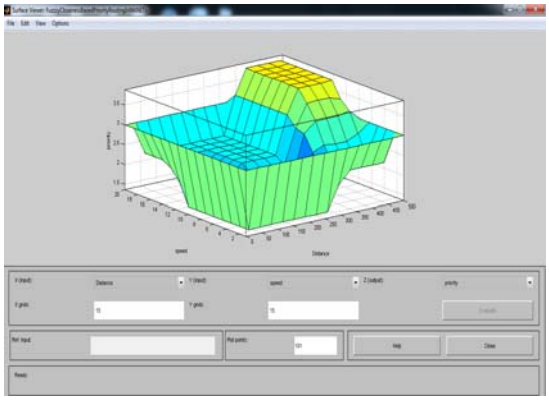

Figure 10: Surface view showing distance, speed and priority

V. SIMULATION ENVIRONMENT

Simulation is an economical and an easy approach to carry out experiments in Mobile Ad hoc Networks. The various simulators[24][25][26] are used to evaluate the mode and in widely used network simulator ns2.34 are preferred to evaluate the performance [17] [18][19][20][21][22] of FCBPR and DSR. Simulation Environment used in the evaluation is presented table 1 below.

Table 1: Scenario Parameters varying number of nodes

Routing Protocols / Approaches	DSR, FCBPR
Simulation Time	360 s
Area (sq.m)	1000 x 1000
Propagation Model	Two Ray
Traffic	CBR
Packet Size	512 bytes
Number of Packets	100
Nodes	20,30,40,50
Antenna Type	Omni directional
Transmission range	250m
Receiver range	250m
Mobility Model	RandomWayPoint
Pause Time	0 s
Speed	10 m/s
Node Deployment Model	Random

RESULTS AND ANALYSIS

The performance metrics namely Packet Delivery ratio , Throughput, End- to-End Delay, Jitter, Routing overhead and Normalized Routing Load are considered to evaluate the proposed approach.

Packet delivery ratio: The Total number of data packets delivered to the destination divided by total number of data packets transmitted by the nodes. Figure 11 presents the Percentage of Packet Delivery ratio for DSR and FCBPR w.r.t number of nodes.

End-to-End Delay: It refers to the amount of time taken by the packet to travel from source to destination. Average End-to-end delay refers to the total amount of time taken by all the packets to travel from source to destination to the total number of packets received. Figure 13 presents the Average End-to-end delay for DSR and FCBPR w.r.t number of nodes

Throughput: It is gives the channel capacity i.e. the rate at which a network can send and receive data. Average Throughput refers to the total amount of data received to the time taken from the first sent to the last packet received. Figure 12 presents the Average throughput for DSR and FCBPR w.r.t number of nodes.

Jitter: It is the variation in latency as measured in the variability over time of the packet latency across a network. Jitter is an important QoS factor in assessment of network performance. Average Jitter is the total variation in delay to the number of variations Figure 16 presents Average Jitter for DSR and FCBPR w.r.t number of nodes.

Routing Overhead: Routing Overhead is the number of routing packets required for network communicatiigure 14 presents the Routing Overhead for DSR and FCBPR w.r.t number of nodes.

Normalized Routing Load: Normalized Routing Load is the number of routing packets per data packets delivered at the destination. Figure 15 presents the Normalized Routing Load for AODV and FCBPR w.r.t number of nodes.

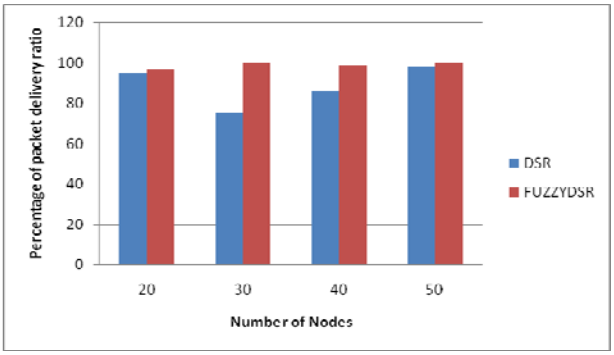

Figure 11: variation of packet delivery ratio with number of nodes

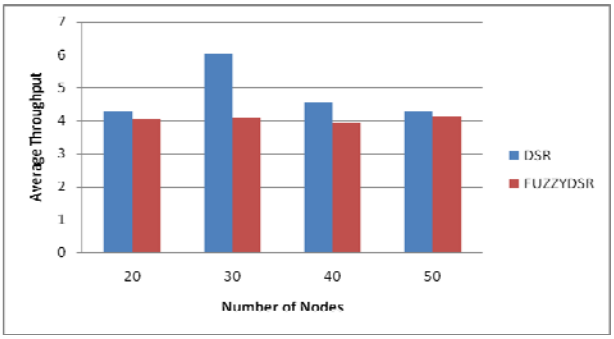

Figure 12: Variation of Throughput with Number of nodes

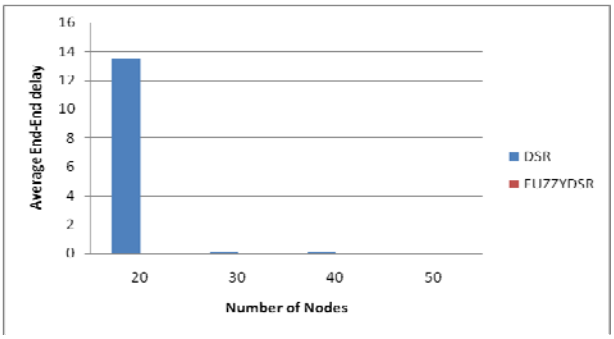

Figure 13: Variation of Average end-end delay with number of nodes

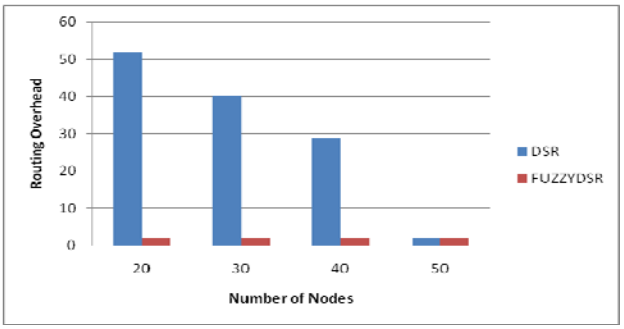

Figure 14: Variation of overheaad with number of nodes

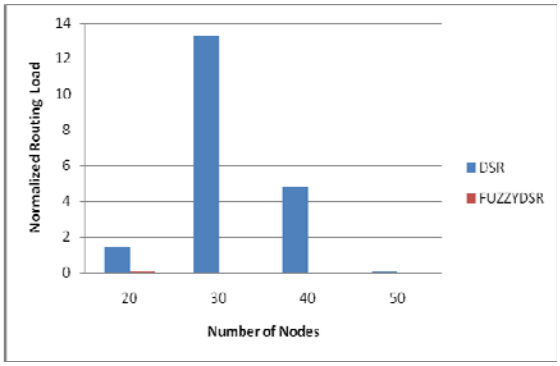

Figure15: variation of normalized routing load with number of nodes

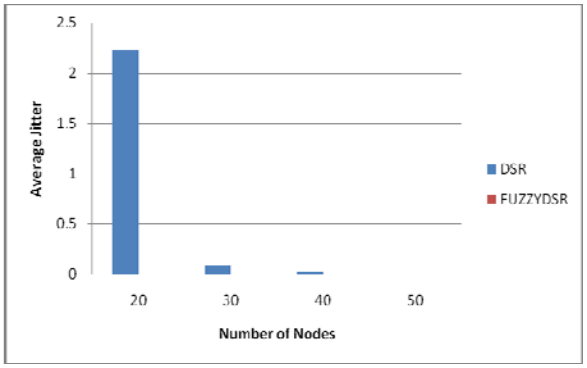

Figure 16: Variation Of Average Jitter With Number Of Nodes

VI. CONCLUSION AND FUTURE SCOPE

Closeness priority with the network size and speed plays a major role for improving the performance in MANETs. From the simulation results, is evident that FCBPR performs better than DSR in the above QOS metrics. The given model with various mobility models can further be studied.

REFERENCES

[1]. D.P.Agrawal and Q-A Zeng, "Introduction to Wireless and Mobile Systems," Brooks/Cole Publishing, ISBN No. 0534-40851-6, 436 pages, 2003.

[2] Perkins C., Ad Hoc Networking, Addison Wesley, 2001.

[3] Iiyas, M., 2003. The Hand Book Of Ad Hoc Networks, CRC Press.

[4] C.-K. Toh, Ad hoc MobileWireless Networks: Protocols and Systems, Prentice-Hall PTR, Englewood Cliffs, NJ, 2002.

[5] Siva, C., R. Murthy and B.S. Manoj, 2004. Ad Hoc Wireless Networks Architectures and Protocols . Prentice Hall.

[6] S. Giordano and W. W. Lu, "Challenges in mobile ad hoc networking," IEEE Communications Magazine, vol. 39, no. 6, pp. 129–181, June 2001.

[7] D.B. Johnson and D.A. Maltz, "Dynamic Source Routing in Ad hoc Wireless Networks", Mobile Computing, Kluwer Academic Publishers, pp. 153-181, 1996.

[8] Hongbo Zhou, "A Survery on Routing Protocols in MANETs," Technical. Note March 2003.

[9] J. Broch, D. Maltz, D. Johnson, Y. Hu, and J. Jetcheva. "Multi-Hop Wireless Ad Hoc Network Routing Protocols." ACM/IEEE International Conference on Mobile Computing and Networking (MOBICOM'98), pages 85-97, 1998

[10] E. M. Royer, and C.-K. Toh, "A review of current routing protocols for ad hoc mobile wireless networks", IEEE Personal Communications, Apr. 1999, pp. 46–55.

[11] F. Baker, "An outsider's view of MANET," Internet
Engineering Task Force document
17 March 2002.

[12] D.Johnson, D.Maltz, and J .Broch. Dsr the dynamic source routing protocol for multihop wireless ad-hoc network ,2001

[13] T. J. Ross, Fuzzy Logic With Engineering Applications. New York: McGraw-Hill, Inc., 1995.

[14] L. A. Zadeh, "fuzzy logic = computing with words", IEEE Transactions on fuzzy systems, vol. 4, no2, pp. 104-111, 1996.

[15] Kosko, B., Fuzzy Thinking, Hyperion, 1993.

[16] Pedrycz W., "Why Triangular Membership Functions?," Fuzzy Sets System, Vol.64, pp.21-30,1994.

[17] A. Nasipuri, R. Castaneda, and S. R. Das, "Performance of multipath routing for on-demand protocols in ad hoc networks,"

Mobile Networks Applicat. (MONET) J., vol. 6, no. 4, pp. 339–349, 2001.

[18] C.-E. Perkins, E.-M. Royer, S.-R. Das, and M.-K. Marina, "Performance comparison of two on-demand routing protocols for ad hoc networks," IEEE Personal Communications, vol. 8, no. 1, pp. 16–28, Feb 2001.

[19] S. -J. Lee, M. Gerla and C. -K. Toh, "A Simulation Study of Table-Driven and On-Demand Routing Protocols for Mobile Ad Hoc Networks," IEEE Network, July-August 1999, Vol. 13, No. 4, pp. 48-54.

[20] S. Corson and J. Macker. Mobile Ad Hoc Networking(MANET) Routing Protocol Performance Issues and Evaluation Considerations. Technical report, Request for Comments : 2501, January 1999.

[21] J. Broch, D. Maltz, D. Johnson, Y.-C. Hu, and J. Jetcheva, "A Performance Comparison of Multihop Wireless Ad Hoc Network Routing Protocols", ACM/IEEE Mobile Computing and Networking, Octobre 1998.

[22] S.P.Setty et.al,"Performance Evaluation of AODV in different Environments", International Journal of Engineering Science and Technology (IJEST), Vol.2(7), 2010 , 2976-2981.

[23] D .Johnson and D. Maltz . Dynamic Source Routing in adhoc Wireless Networks in Computer Communication Review - Proceedings of SIGCOMM 96 Aug-1996

[24] Network simulator -2. http://www.isi.edu/nsnam/ns/

[25] GLOMOSIM http://pcl.cs.ucla.edu/projects/glomosim/

[26] QualNet Network Simulator, Available: http://www.scalable-networks.com