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Analysis of Distributed Packet Receiving in ADHOC Network Using Multicast Routing Protocol

E. N. Ganesh
Professor, Dept. of ECE & Principal, Saveetha Engineering College, Chennai, Tamil Nadu, India
E-mail: enganesh50@gmail.com

***Abstract* - The main purpose multicast routing protocol in MANET is to deliver the data to a group of receivers. Several researchers are proposed various multicast routing protocols to achieve the reliability and scalability in MANET. MANET suffers from high overhead and redundant data transmission due to multicasting. We propose a neural network based multicast routing protocol to overcome the highest overhead and delay thereby network life time and packet delivery ratio (PDR) are improved. This is achieved by identifying the probability of optimum forwarding group node based on the information augmented with the JOIN_QUERY packet. The performance evolution shows the proposed approach ensures the PDR and reducing the control overhead significantly.**
***Keywords:* ODMRP, I-ODMRP, Multicast, MANET, BPN, ANN, Routing**

I. INTRODUCTION

Future information technology will be mainly based on wireless technology. Traditional cellular and mobile networks are still, in some sense limited by their need for infrastructure. For mobile ad hoc networks, this final limitation is eliminated. Ad hoc networks are key to the evolution of wireless networks. Ad hoc networks are typically composed of equal nodes that communicate over wireless links without any central control. Ad hoc wireless networks inherit the traditional problems of wireless and mobile communications, such as bandwidth optimization, power control, and transmission quality enhancement [1]. In addition, the multi hop nature and the lack of fixed infrastructure generate new research problems such as configuration advertising, discovery, and maintenance, as well as ad hoc addressing and self-routing.

Wireless applications, like emergency searches, recues, and military battlefields where sharing of information is mandatory, require rapid deployable and quick reconfigurable routing protocols, because of the reasons here are needs for multicast routing protocols. The objective of a multicast routing protocol for mobile ad hoc networks (MANET) is to support the dissemination of information from a sender to all the receivers of a multicast group while trying to use the available bandwidth efficiently in the presence of frequent topology changes. There are many characteristics and challenges that should be taking into consideration when developing a multicast routing protocol, like the dynamic of the network topology, the constraints energy, limitation of network scalability, and the different characteristics between wireless links and wired links such as limited bandwidth and poor security [2].

Generally there are three types' of multicast routing protocols in wireless networks. They are Tree-based, Mesh-based and Hybrid. In tree-based multicasting, structure can be highly unstable in multicast ad hoc routing protocols, as it needs frequent re-configuration in dynamic networks. Mesh based multicast routing protocols are more than one path may exist between a source receiver pair for example., Core-Assisted Mesh Protocol (CAMP), and On-Demand Multicast Routing Protocol.

II. RELATED WORKS

ODMRP is a source initiated multicast routing protocol in which the source node initiated the JOIN_QUERY packet for route discovery. ODMRP sends the data from a source node to the group of receiver nodes. Source node generate the JOIN_QUERY packet and it floods to all the nodes in the network as shown in Figure 1.The receiver node generates a routing table after it received JOIN_QUERY packet as shown in Figure 2. S1 and S2 are the source node transmits the data to the group of receivers R1, R2, R3, and R4. S1 generates the JOIN_QUERY packet and it floods the packet to other nodes in the network. If any intermediate node receives multiple JOIN_QUERY packets from the other nodes then the recent packet is only accepted and other packets are rejected by the respective intermediate nodes based on the sequence number.

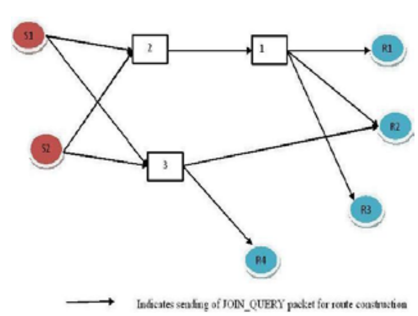

Fig. 1 Flooding of JOIN_QUERY packet

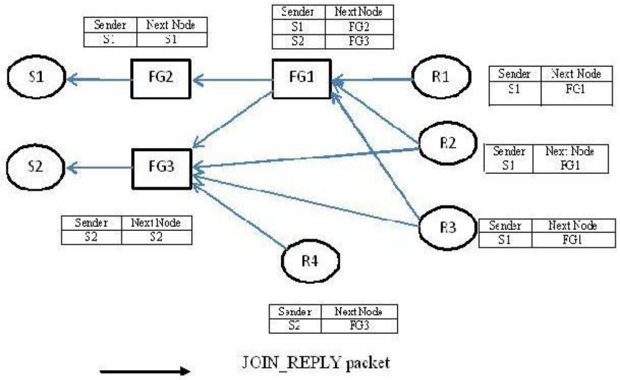

Fig. 2 JOIN_REPLY packet – Routing Table Generation

JOIN_REPLY packet is forwarded back to the source (reverse path mechanism) based on the path travelled by the JOIN_QUERY packet. If the JOIN_REPLY packet is received by the intermediate nodes then, it checks for the availability of its own identity. If the own identity is available then update its information to the join table and enables the forwarding group (FG) flag. Enabling the FG flag denotes that the respective node is available on the path between the source node and the receiver. Thus the JOIN_REPLY is propagated by each FG member until it reaches the multicast source via the shortest path. The process of constructing or updating the routes from source node to receivers and constructing a mesh of nodes with the FG are shown in Figure 3.

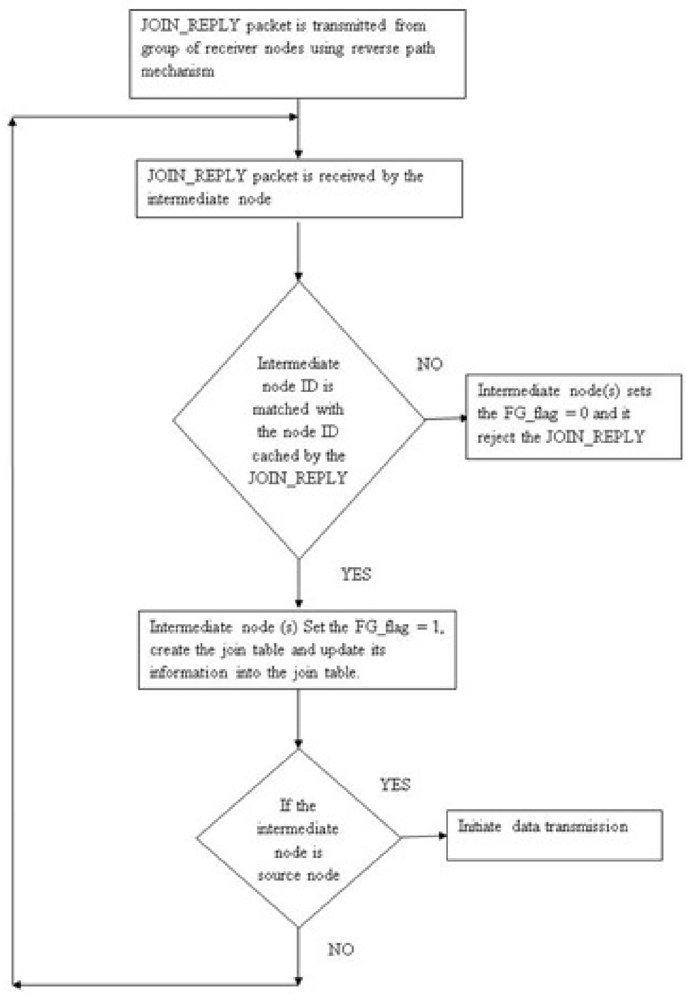

Fig. 3 Mesh and route construction

ODMRP has many advantages but it suffers from high overhead due to the mesh structure and flooding of JOIN_QUERY packets. For large networks the ODMRP suffers with increase in control overhead. ODMRP is modified by several researchers to address these issues. Table 1 shows the existing approaches and modifications made by the researchers with ODMRP protocol.

TABLE 1 EXISTING APPROACHES

Previous System	Methodology
PEODMRP [3]	PEODMRP limits the transmission area of control messages and establishes sparse mesh. It reduces the control overhead and redundant data transmission.
EODMRP [4]	To reduce the packet overhead by up to 50% but maintaining similar packet delivery ratio as the original ODMRP. The approach, the refresh rate adjustment scheme used as a feedback system and apply techniques of Control Theory to use motion adaptive refresh techniques for route local recovery to achieve minimum overhead
PSO-ODMRP [5]	The approach uses nature principle exists in the form of fitness function. It is observed that the performance in the low mobility speed.
ODMRP-LR [6]	The problems in detecting link breakages and local recovery procedure in ODMRP is addressed. The author introduced a new join message for nodes intending to join the multicast group and nodes detecting link breakage. In this approach the packet delivery ratio increases while end-to-end delay remains the same as ODMRP.
SC_ODMRP [7]	In this approach a cluster based on demand multicast routing protocol to the lack of extension of flat multicast routing protocols in large scale ad hoc networks is proposed. SC-ODMRP improves the network performance in terms of end-to-end delay and control packets.
CODMRP [8]	CODMRP refers to the advantages of fitness for high-speed movement of mesh-based ODMRP, and adopts an enhanced weighted clustering algorithm (EWCA) produces low delay, high delivery ratio and good extension compared with the ODMRP.
LF-RDTODMRP [9]	In this paper reduced Data Transmission ODMRP (RDTODMRP) routing algorithm that considers the network conditions such as mobility speed and traffic load to determine the multiple routes. This reduces the unnecessary redundant routes and their data transmissions. It is observed that the RDTODMRP and LF-RDTODMRP reduce the number of data transmission, control overhead, end to end delay and improve the data packet delivery ratio.
Link stability based Multicast Routing in MANET [10]	A mesh based multicast routing scheme that finds stable multicast path from source to receivers is proposed in [25]. The stable paths are found based on selection of stable forwarding nodes that have high stability of link connectivity. The link stability is computed by using the parameters such as received power, distance between neighboring nodes and the link quality that is assessed using bit errors in a packet. The authors observed that the proposed scheme produces better packet delivery ratio, reduced packet delay and reduced overheads (such as control, memory, computation, and message overheads).while compared with ODMRP and EODMRP.
NC-ODMRP [11]	NC-ODMRP classified the nodes into three categories as ordinary node. The categories are distinguished with different weights by a weight table in the nodes. NC-ODMRP chooses the node with the highest weight as FG nodes between different sender and receiver pairs. It is shown that NC-ODMRP can reduce more than 20% FG number of ODMRP, thus enhances nearly 14% data forwarding efficiency and 12% energy consumption efficiency when the number of multicast senders is more than 5.
Developing a Fuzzy Logic Based on Demand Multicast Routing Protocol [12]	The main proposed method tries to find out the high-quality forwarding group node. This is achieved by augmenting the join query packets with additional information such as speed, power level of nodes and link bandwidths. The proposed scheme increases the delivery rate up to 40%, while reducing average end-to-end.

As a summary, the major problem of the existing approaches would be found in their high data and control overhead which might also leads to low packet delivery ratio due to collision. In this paper a novel approach is proposed to reduce the overhead significantly by augmenting JOIN_QUERY packet with the information such as mobility speed, energy, link duration, and route refresh time. To ensure the packet delivery ratio, the fuzzy based control on the selection of forwarding group of node is used.

III.PROPOSED WORK

In our system the Artificial Neural Network (ANN) can be used to improve the routing update mechanism. We used three layered Back Propagation Network (BPN). The BPN can be used to train the multicast network to find a suitable path (Best path) in any dynamic network. We implement the BPN algorithm for training the multicast network. Learning can be done with the help of two parameters such as TIF and NIF. The parameters are used to obtain the best path between the sources to destination. These two parameters are defined as follows.

TIF = Number of Join Request received / Total number of packets received
NIF α 1 / TIF

A.Algorithm

pathdiscovery BPN(TIF, NIF, Target)
{
Initialize weight and input vector as W_{ij} and V_{ij} for input layers; Initialize weight and input vector as W_{0i} and V_{0i} for hidden layers;
Initialize the learning parameter as α;
Do
{
Calculate $Z_{inj} = V_{0j} + \sum X_i V_{ij}$;
Compute $Z_i = f(Z_i)$ where $f(Z_i) = 1 / 1 + e^{-Z\,i}$; Compute $Y_{-ink} = W_{0k} + \sum Z_j W_{jk}$
Calculate $Yi = f(Y\ i)$ where $f(Y_i) = 1 / 1 + e^{-Y\,i}$;
Calculate the target term as $\delta_k = (t_k - Y_k) f'(Y_{-ink})$;
Calculate the error term for hidden layer as $d_{inj} = \sum d_k W_{jk}$; Calculating the error term as $\Delta = \delta_{-inj} f'(Z_{-inj})$;
Where $f'(Z_{-inj}) = f(Z_{-inj}); * (1 - f(Z_{-inj}))$;
Updating the weights and input vectors for main input units as
$\Delta V_{ij} = \alpha \Delta_j X_i$ & V_{ij} new = Vold + ΔV_{ij};
$\Delta W_{0k} = \alpha \delta_k Z_j$ & W_{0k} new = W_{0k} old + ΔW_{0k};
Updating the weights and input vectors for hidden layer units as
$\Delta V_{0j} = \alpha \Delta_j$;
$\Delta W_0 = \alpha \delta_i$;
} While (error rate < 0.05);
Display the values of intermediate iterations from input and hidden units;
}

IV.RESULTS AND DISCUSSION

The simulator is implemented within the NS-2 library with the specifications as shown in Table2.

TABLE 2 ENVIRONMENT SPECIFICATION

Area	1000 m * 1000 m
MAC Protocol	IEEE 802.11 DCF
Wireless Channel	Free Propagation Model
Number of nodes	10, 20, 30, 40, 50
Traffic type	Constant Bit Rate
Mobility Model	Random way point
Mobility Speed	20 ms
Radio range	250 m
Simulation Time	60 ms
Pause Time	0
Initial energy of the node	1500 joules
Transmit power	0.001W
Receive power	0.001W
Packet Size	Default size (512 Bytes)

The metrics that were used for the evaluation of I-ODMRP are:

1. Packet delivery ratio
2. Total packets transmitted per data byte received
3. Control bytes transmitted per data byte delivered

Figure 4 shows the packet delivery ratio based on best path (shortest path) that is used by the nodes for the transmission of the data. The graph shows the comparison between our proposed system I-ODMRP with ODMRP. The result indicates that our proposed system guarantees 95% of packet delivery when compared to ODMRP.

Figure 5 shows the total packet transmitted per data packets delivered. The result as per the comparison shows that I-ODMRP produces better result than ODMRP.

Figure 6 shows the control bytes transmitted per data byte delivered. The result shows that the transmison of control bytes is constant for varied speed.

Figure 7 and 8 shows the packet delivery ratio and control overheads vs number of nodes. The result indicates that the packet delivery ratio is high when compared to ODMRP and the control overhead transmitted is constant for a period of time and decreases as the nodes increases.

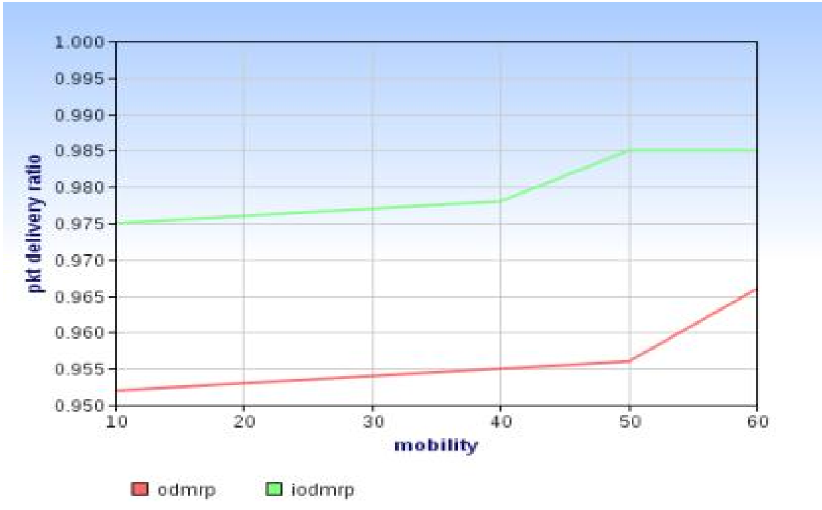

Fig. 4 mobility vs. packet delivery ratio based on best path

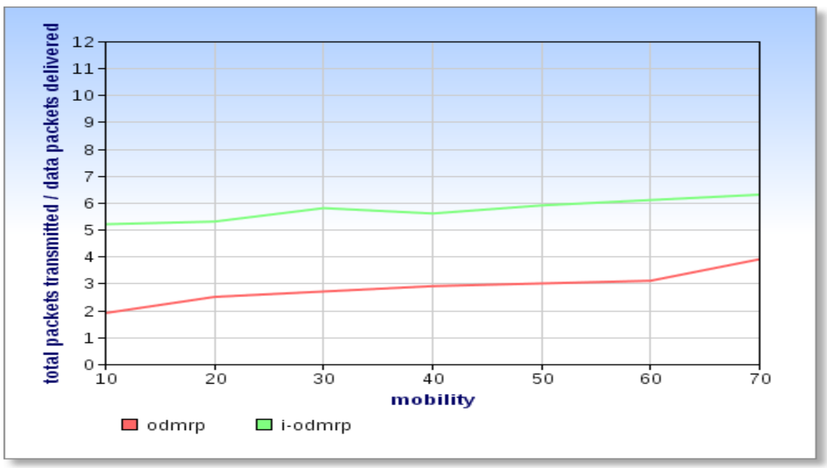

Fig. 5 mobility vs total packets transmitted per data packets delivered

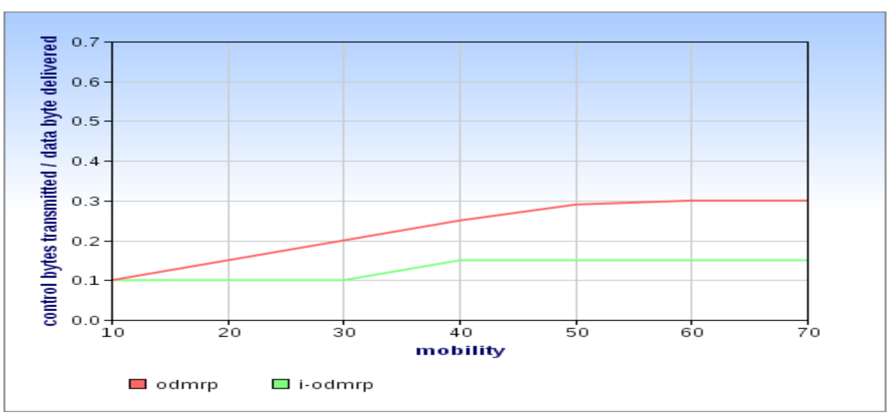

Fig. 6 mobility vs control bytes transmitted per data byte delivered.

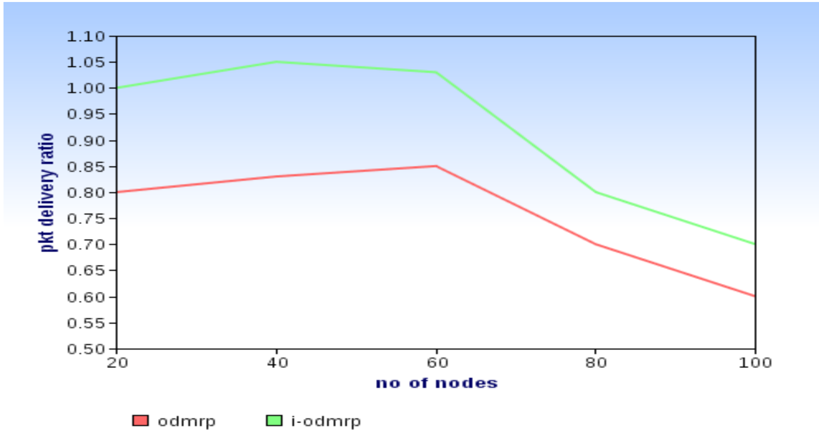

Fig. 7 no of nodes vs. packet delivery ratio

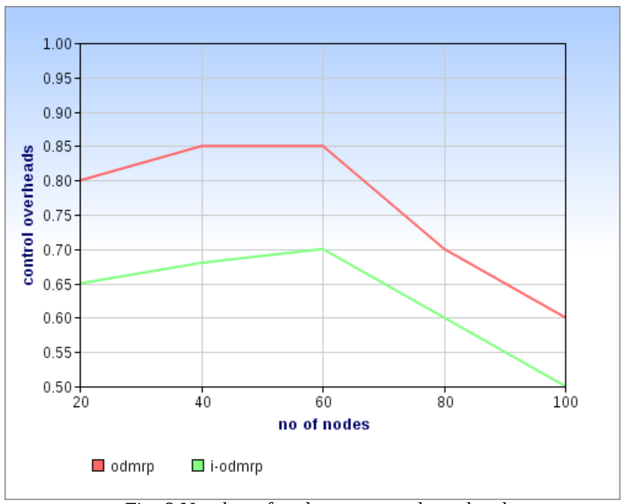

Fig. 8 Number of nodes vs. control overheads

V.CONCLUSION AND FUTURE WORK

We have proposed I-ODMRP (Intelligent-On Demand Multicast Routing Protocol) for mobile ad-hoc network. It applies on demand multicast route construction and membership maintenance. Simulation results show that I-ODMRP is better than ODMRP and effective in dynamic environments even when the number of nodes increases. The simulation results shows that this approach leads to better performance in terms of packet delivery rate, end-to-end delay, control packets and throughput.

Various improvements of the protocol are in progress and will be reported in our future papers. As an extension, the Back Propagation Network activation function can be replaced by Radial Basis Function (RBF). This RBF can be used to optimize multicast network in better way. The RBF can be used to achieve better throughput and to identify a better path in multicast routing protocols.

REFERENCES

[1] Ivan Stojmenovic, “Handbook of Wireless Networks and Mobile Computing”, Wiley Edition, 2002.

[2] Tanu Preet Singh, Neha and Vikrant Das, “Multicast Routing Protocols in MANETs”, International Journal of Advanced Research in Computer Science and Software Engineering (IJARCESE) Vol. 2, Issue 1, January 2012. ISSN: 2277 128X

[3] B. So, H. Jeon, J. Lee,”PEODMRP: Performance Enhanced On Demand Multicast Routing Protocol,” in: Proc. The 8th Joint Conf. on Communications & Informatics, JCCI’ 04, 2004.

[4] Soon. Y. Oh, Joon-Sang Park, Mario Gerla,”E-ODMRP: Enhanced ODMRP with Motion Adaptive Refresh,” International Symposium on Wireless Communication Systems, Sept. 2005, DOI: 10.1109 / ISWCS.2005.154764.1.

[5] E. Baburaj and V. Vasudevan, “ An Intelligent Mesh based Multicast Routing Optimization Algorithm in Mobile Ad Hoc Networks using Particle Swarm Optimization,” International Journal of Computer Scicence and Network Security (IJCSNS), vol.8, no.5, 2008.

[6] Naderan-Tahan, M, Darehshoorzadeh, Dehghan, M,” ODMRP-LR: ODMRP with Link Failure Detection and Local Recovery Mechanism," 8th IEEE / ACIS Int. Conf. on Computer and Information Science, June 2009, pp. 818-823.

[7] MohammadReza EffatParvar, Naser YAzdani, Rarshad LAhooti, and Mahdi EffatParvar,”Link Stability and Scalability method on ODMRP in Ad Hoc Networks,” IEEE 7th Annual Conference on Communication Networks and Services, Research Conference (CNSR’09) 2009, pp.416-421.

[8] Xue-Mei Sun, Wen-Ju Liu, Zhi-Qiang Zhang, You Zhao, “CODMRP: Cluster-Based On Demand Multicast Routing Protocol,” International Conference on Wireless Communications, Networking and Mobile Computing, 2006. WiCOM 2006, 22-24 Sept. 2006.

[9] Ghafouri, R, Fathy, M, “LT-RDTODMRP: A robust and efficient on-demand multicast routing protocol for ad hoc networks,” 14th International CSI Computer Conference, Oct 2009, pp.194-199.

[10] Rajashekar Biradar, Sunilkumar Manvi, Mylara Reddy, ”Link Stability based Multicast Routing Scheme in MANET,” Computer Networks, vol. 54, issue 7, May 2010, pp. 1183-1196.

[11] DENG Xis, SUN Li-min, WANG Jian-xin, LUO Yu-hong, CHEN Jian-er, “On-demand Multicast Rotuign Protocol on node classification in MANET,” J. CENT. SOUTH UNIV. TECHNOL., vol. 13, No. 2, Apr, 2006.

[12] Alireza Shams Shafigh, Kamran Abdollahi, and Marjan Kouchaki, “Devloping a Fuzzy Logic Based on Demand Multicast Routing Protocol,” Journal of Electrical and Computer Engineering, volume 2012. Doi:10.1155/2012/389812.