Conceptual Designing of Fuzzy Based Efficient Routing Protocol in AD-Hoc Network to Increase Link Stability

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Abstract: Mobile Ad hoc Network (MANET) is an autonomous system of mobile hosts which are communicated over wireless channels with no central administration or existing infrastructure. In MANET mobile host have dynamic topology where they may join and leave the network randomly and routing is multiple-hop and routes are dynamically formed as mobile hosts join and depart from the network at any time. In contrast to wired networks, wireless ad hoc networks have less stability, longer paths and less bandwidth, all of which arise the need of development of wireless routing protocols for the wireless communication. This paper proposes a fuzzy based routing protocol for MANETS that considers the following parameters as inputs: remaining power and lifetime of path and packet delivery ratio. On the basis of the outputs of Fuzzy modules a best possible routing path is proposed. MATLAB 2016 is used for proposed protocol implementation. The result clearly shows that the proposed protocol outperforms MAODV and ODMRP protocol.

***Keywords*: Ad-hoc Network, residual energy, link stability, Fuzzy**

I. INTRODUCTION

In wireless ad hoc networks bandwidth limitation, mobility, and inadequate power present complex challenges to the architects of a routing strategy. Consumption of network bandwidth and computing resources must be balanced in order to develop a good routing protocol which provides good quality of service (e.g., delay and reliability of packet delivery). In MANETs, in the presence of dynamic connectivity the needs to construct and maintain multi-hop routes are complicated. The deployment of MANETs is gradually growing. MANETs are particularly admired for the locations where lack a fixed communication infrastructure [1] is not possible. MANET is an autonomous and self-configuring multi-hop wireless network. Due to random nodes movement in MANET the network topology changes rapidly and unpredictably. Additionally, some nodes cannot communicate directly with each other because of limited transmission range of mobile hosts. Mobile nodes act not only as a host but also as a router to maintain routes to destination and forwards data packets for other nodes also in the network. Efficiency of routing protocols depends on numerous factors i.e., bandwidth overhead to facilitate proper routing , convergence time after topology changes and power consumption [6]. Based on diverse network structures, applications and mobility scenario various routing protocols have been proposed.

While developing a routing algorithm for MANETs, one of the most challenging peculiarities which developers must consider is the behavior of the proposed algorithm in the presence of node movement. Mobility has a potential to result in dynamic changes to network topology, making the task of routing algorithms more difficult [4]. The routing protocols in MANETs should cope well with dynamically changing topology and nodes should exchange information on the topology of the network in order to establish routes. Routing in ad hoc networks is challenging and several routing protocols have been proposed [5–7]. Hop count is the most commonly used metric when selecting a route from a source to a destination. However, the hop count metric may perform poorly in networks because a route with a minimum hop count may include slow or lossy links, leading to poor end-to-end throughput. In this paper residual energy and transmission power control approach is taken into account.

II. RELATED WORK

Various routing schemes have already been proposed previously for the MANETS. The routing in such an ever dynamic environment is complex task. Some parameters are considered for the route determination in such an environment so that the communication is effectively and valuably achieved. In [2], author proposed a techniques in which on a particular route the intermediate nodes estimate cost based on remaining battery capacity. The intermediary node take into consideration the residual capacity of node to determine whether they can forward RREQ packet or not . This technique protocol improves throughput and packet delivery ratio and energy consumption of nodes is also reduced[3]. In [3], author had proposed a energy aware technique. This scheme is utilizing a new function of the remaining battery capacity of every node on a path and the total number of neighbors of the node. This scheme provides considerable benefits at high traffic but for static scenarios[5]. In [4] author has combined load balancing and transmission power control approach to maximize the life time of MANET. The results of this scheme have reduced the average transmission energy required per packet compared to the conventional AODV. In this paper, we consider both remaining energy capacity and load distribution of nodes for route discovery.

III. PROPOSED ROUTING SCHEME

Using the concepts of Fuzzy logic theory an optimal path from source to destination through the intermediate nodes is determined. The optimal path can be chosen from alternative paths based on remaining energy i.e., it can be shortest path possible, or any other path among all the possible paths between a pair of start and destination [1]. The maximal sets of disjoint paths between two nodes are determined using fuzzy approach and then fuzzy logic controller is used to determine how to use those routes to transmit the data. Fuzzy routing approach is introduced here: Fuzzy Based Routing in Wireless ad-hoc network, which uses the number of residual energy as it's metric. The power requirements of the nodes directly determined through its transmission power of the nodes. Transmission powers required by a node determine the Battery consumption of the nodes. In addition, number of hops is also an vital factor for route determination as longer paths offer larger delays in communication. Path with greater number of nodes will require more resources of intermediate nodes for the communication of data. Hence path length is an indispensable factor in the route determination scheme. Path shall constitute of devices moving with different speeds, the devices moving continuously with higher speeds in the path shall be accountable for early breaking of the path. Similarly the size of data is another such factor that's needed to be examined before deciding the finest route. As larger is the size of data larger will be the transmission time and transmission power required. Again since the devices are constantly in motion the route stability is necessary for the complete data transmission. A new routing model based on concepts of Fuzzy logic theory is proposed that considers the above discussed parameters.

A. Energy Evaluation

It is considered that all nodes initially are fully powered i.e it has full capacity (100%). The host will discard the packets if capacity of nodes falls below 30%.

Fuzzy Logic System

Fuzzy techniques have been extensively used in various fields of computer science and engineering research and provide a very effective approach in routing protocols in wireless networks. The concept of fuzzy logic (FL) was conceived by Lotfi Zadeh(1965), as a way of processing data by allowing partial set membership rather than crisp set membership or non-membership. Fuzzy logic provides a single way to arrive at a definite conclusion based upon vague, ambiguous, imprecise noisy or missing input information. Fuzzy Logic (FL) incorporates a simple rule-based IF X AND Y THEN Z approach to solving a control problem rather than attempting to model a system mathematically. A fuzzy system consists of three parts: fuzzification, inference, composition, defuzzification, and a fuzzy inference engine with IF-THEN-based rules.

Fuzzification: First, the input and output of the system are identified. Fuzzification defines proper rules and use initial data to create a membership function.
Inference: As inputs are received by the system, the member function is used to determines their truth values.
Composition: Combines fuzzy conclusions obtained by inference to determine the optimal path. **Defuzzification**: Converts the fuzzy value obtained from composition into a 'crisp' value.

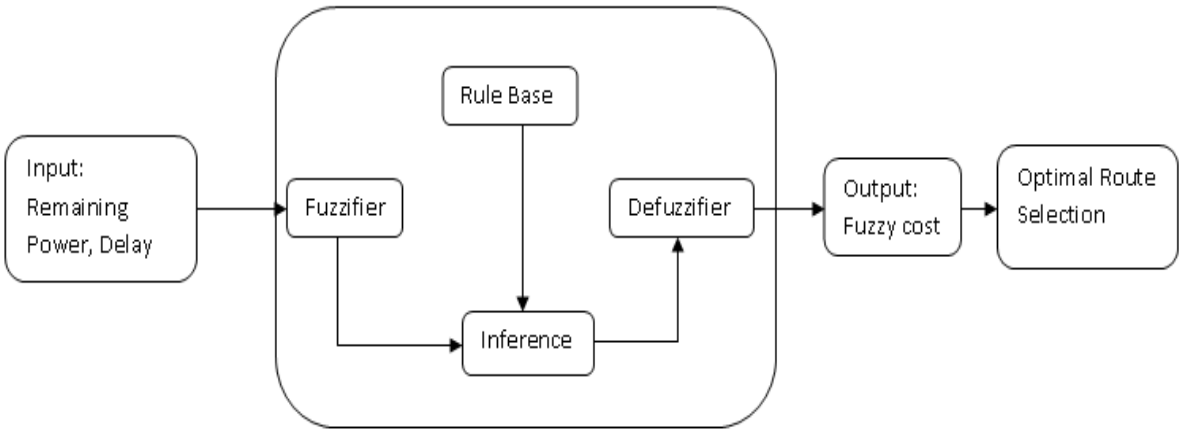

Fig.1: Optimal path selection based on Fuzzy approach

TABLE 1
FUZZY INFERENCE RULES

Input		Output
Transmission Power Required	**Residual Power**	
Low	Low	Low
Low	Low	Medium

Medium	Medium	Medium
Low	Medium	Medium
Low	Medium	Medium
High	Low	Low
High	Medium	Medium
High	Medium	High
High	High	Medium

Results and Discussions

The simulation environment consists an 1000m ×300m area and 60 nodes, distributed over the area . Initial battery energy of each node is 2300mAH which is mapped to 100%. Simulation results have been compared with MAODV and ODMRP .Simulation has been performed for packet delivery ratio and average energy left on a particular path.

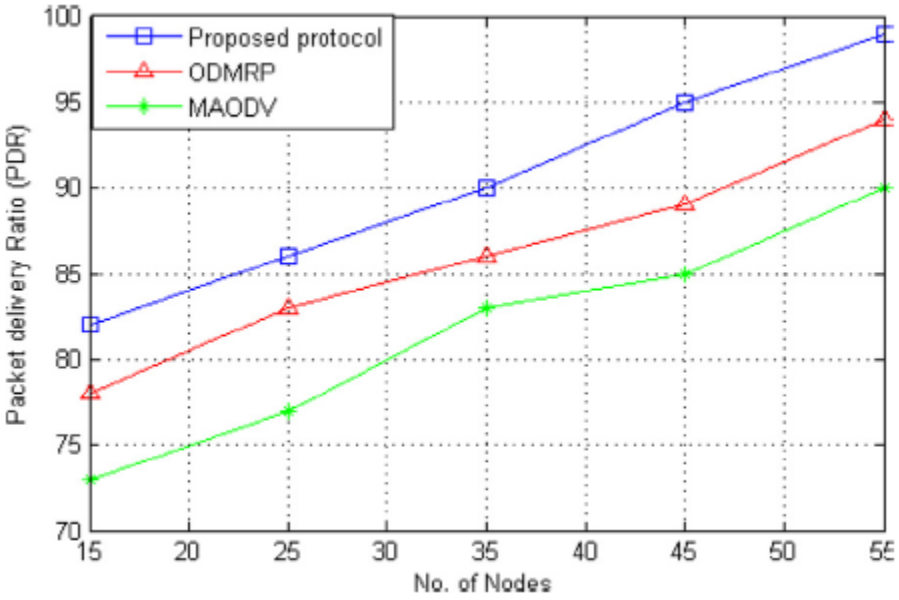

Fig.2: No.of nodes versus PDR

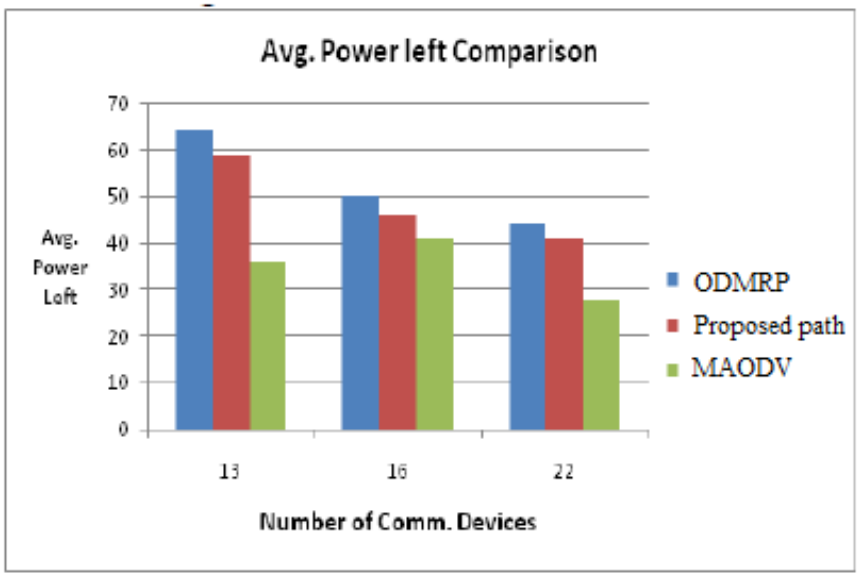

Fig. 3: Remaining power left

IV. CONCLUSION

Since in MANET, mobile nodes are battery powered and nodes behaviors are unpredictable, wireless links may be easily broken. Hence it is important to find a route that is stable for a longer time. In this paper, we have proposed a reliable routing algorithm based on fuzzy logic approach. In this scheme, we determine two parameters: remaining capacity and transmission power required that are used for finding a stable route from source to destination. The simulation results show that the proposed method has significant improvement in comparison with MAODV and ODMRP.

REFERENCES

[1] MANET ROUTING: Optimization by genetic and fuzzy logic approach, " Journal of Theoretical and applied information technology". Dec-2013,Vol.58

[2] R. Patil and A.Damodaram, "Cost Based Power Aware Cross Layer Routing Protocol For Manet", IJCSNS International Journal of Computer Science and Network Security, VOL.8 No.12, December 2008.

[3] G. Nishant and D. Samir, "Energy-aware on-demand routing for mobile Ad Hoc networks," Lecture notes in computer science ISSN: 0302-743, Springer, International workshop in Distributed Computing, 2002.

[4] M. Vijarania, Vivek Jaglan, "Comparative Analysis of Various Energy Efficient Routing Protocols in Adhoc Networks", Vol. 2, No. 1, pp. 60-62, 2015

[5] M.Tamilarasi, T.G Palani Velu, "Integrated Energy-Aware Mechanism for MANETs using On-demand Routing", International Journal of Computer, information, and Systems Science, and Engineering 2;3 © www.waset.org Summer 2008.

[6] M. Pushpalatha, R. Venkataraman, and T. Ramarao, Trust based energy aware reliable reactive protocolin mobile ad hoc networks, World Academy of Science, Engineering and Technology 56 2009

[7] N. Li, B. Gong, and Z. Deng, "A handoff algorithm based on parallel fuzzy neural network in mobile satellite networks," Journal of Communications, vol. 12, no. 7, pp. 395-404, 2017.

[8] W. Duch, "Uncertainty of data, fuzzy membership functions, and multi-layer perceptrons," IEEE Transaction on Neural Networks, vol. 20, pp. 1-12, 2004.

[9] T. P. Hong and C. Y. Leeb, "Induction of fuzzy rules and membership functions from training examples," Fuzzy Sets and Systems, vol. 84, pp. 33-47, 1996.

[10] Meenu, V. Jaglan ,"Optimal Route Selection by predicting Nodes Lifetime in a Homogeneous Wireless Ad-hoc Network using Genetic Algorithm" is published in Journal of Advanced Research in Dynamical & Control Systems, Vol. 10, No. 2, pp. 2216-2225, 2018. (Scopus Indexed)

[11] Meenu, V. Jaglan, "Comparative analysis of power aware routing protocols in mobile ad-hoc network" is International Journal of Engineering & Technology, Vol. 7, No. 2.4, pp. 170-173, 2018. (Scopus Indexed)

[12] Meenu, V. Jaglan ,"Estimation of Network Lifetime Considering Ageing Effect on Battery Capacity of Mobile Devices in Wireless Ad-Hoc Network", IEEE Proceedings (Accepted).

[13] M. Vijarania, "Genetic Algorithm Based Power Aware Multicast Routing Strategies in Wireless Ad-hoc Network", Journal of Emerging Technologies and Innovative Research , Vol. 5, No.6, pp. 531-534