A Modified Fuzzy Logic Routing for Wireless Mesh Network

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ABSTRACT

To make routing decisions based on more than one check, buffer residency, node energy and hop count and to provide an efficient routing method for wireless mesh networks, a fuzzy based oblivious routing is proposed in this paper. Simulation results in ns-2 verify that they perform better than multiple restriction routing. The AP need not be in the reach of all the nodes in the network. Nodes around the AP forward the packets from the neighbor nodes to the AP. If there are an important number of nodes in the network, neighbor nodes can transfer data with the AP in a few hop. In this wireless mesh network to used for oblivious routing fuzzy logic to perform high level data to reach the destination, any traffic occurred in this network it's to be cleared and data to be send on efficiently on their network

Keywords: Wireless Mesh Network, Fuzzy Logic, AODV, Access Point, Constant Bit Rate, Oblivious Routing,

1. INTRODUCTION

Wireless mesh networks are becoming a promising communication technology for broadband wireless access by providing wireless backbone to mobile devices over multi-hop wireless communication systems. This emerging technology has a great skill that it can be accessed anywhere and anytime. A number of wireless networking and communication technology is used everywhere, wireless services and applications are widely used on the network [1]. Wireless Mesh Networks (WMNs) are dynamically self organized and self-configured, with the nodes in the network automatically establishing an ad hoc network and maintaining the mesh connectivity [2]. The inbuilt characteristics of WMN enable the nodes to find out automatically and route dynamically. The fundamental features of WMN are large in capacity, wide area coverage and high transmission speed. The drawbacks found in WMN include the frequent topological variations, unbalanced link and multiple external interferences on the network. And also it causes packet loss, connectivity problem and slow response of the source to destination on their network [2].

AODV is another routing algorithm used in ad hoc networks, it does not use source routing, but it is on-demand [2]. In AODV, each node maintains a routing table which is used to store destination and next hop IP addresses as well as destination sequence numbers [13]. Each entry in the direction-finding table has a destination talk to, next hop, procedural nodes list, lifetime, and distance to destination. We defined a console as the set of sensors that will be required to route high priority packets from the data sources to the sink. Our solution does not require active queue organization, maintenance of multiple queues or preparation algorithms, or the use of specialized MAC protocols of the network. Our wide simulations show that as compared to AODV, CAR increase the fraction of high priority data delivery, decreases delay and jitter for such delivery while using energy uniformly in the deployment [5]. By discovering the required canzone and using differentiate routing we can free the canzone from most of the low priority traffic traveling through the network. This will help nodes on the canzone to provide better service to high priority data.

The concepts of AODV that make it desirable for MANETs with limited bandwidth include the following: Minimal space complexity. The algorithm makes sure that the nodes that are not in the active path do not maintain information about this route. After a node receives the RREQ and sets a reverse path in its routing table and propagates the RREQ to its neighbors, if it does not receive any RREP from its neighbors for this request, it deletes the routing info that it has recorded [4]. It is simple with each node behaving as a router, maintaining a simple routing table, and the source node initiating path discovery request, making the network self-starting. Most effective routing info, after working in a network, node should be find and receives the internal with smaller network, it updates its direction-finding info with this superior path solution and propagation on their wireless mesh network topology.

When a node S needs a route to some destination D, it broadcasts a route request message to its neighbors, including the last known sequence number for that destination. The route request is busy in a controlled manner through the network awaiting it reaches a node that has a route to the destination. Each node that forwards the route request creates a reverse route for itself back to node S. When the request route reaches a node with a route to D, that node generates a request reply that contains the number of hops necessary to reach D and the sequence number for D most recently seen by the node generating the reply [2]. Each node that participates in forwarding this back toward the originator of the request route (node S) creates a forward route to D.

Fuzzy Logic introduced by Zadeh [12] allows a computer to model the same way that people do, not always precise. People think and reason using their terms such as "hot" and "fast", rather than in exact numerical terms 90 degrees and 200 km/hours respectively. The fuzzy set theory models the understanding of rough and incomplete sensory information as clear by human brain. It's represents and numerically manipulates such uniform information in a natural way via membership functions and fuzzy rules. Some advantages of fuzzy logic are conceptually easy to understand, flexible, and tolerant of free data. It can model nonlinear functions of difficulty, and also can be built on top of the experience of

2. RELATED WORK

Fuzzification is a data regarding topology information is transformed into logic variables that are used in the available system of inference. Inference System or Inference Engine: the logic variables coming from the fuzzification process are applied to a specified set of rules and produce a set of linguistic variables related to the inference output. Defuzzification: uses the linguistic variables coming from the inference system and converts them into crisp values according to the defuzzification strategy being used.

The function of the fuzzification is to determine the degree of membership to an unbreakable input in a fuzzy set. The fuzzy rule base is used to present the fuzzy relationship between the input output fuzzy variables. The output of the fuzzy rule base is determined and based on the degree of membership specified by the fusilier. The defuzzification is used to convert outputs to the fuzzy rule base into true values. We presented the standard routing in mesh, the thermal field approach and fundamental fuzzy logic technique [15]. The next section will explain how the fuzzy logic works to find an optimal routes by considering relative distances in grid and buffer usage level.

Ad hoc On-Demand Distance Vector (AODV) routing is a oblivious routing protocol for mesh networks and other wireless ad-hoc networks. The same protocol used in AODV is used for fuzzy logic but it performs differently on the mesh network. It is jointly developed by zedeh [9]. It is an on-demand and distance-vector routing protocol, meaning that a route is established by AODV from a destination only on demand AODV protocol Route Discovery When a source node S wishes to send a packet to the destination node D, it obtains a route to D. This is called Route Discovery. Fuzzy logic is used only to AP when S attempts to send a packet to D and has no information of a route to D.AODV protocol oblivious Route Maintenance of the network. The AP fuzzy logic to be indicated for the T. fuzzy sets and fuzzy traffic occurs means the packets are to be loosed. When there is a change in the network topology, the existing routes can no longer be used [5]. In such a scenario, the source S can be used as an alternative route to the destination D rom the AP. This is called fuzzy logic on the mesh network.

An efficient network congestion control has to prevent the packets losses, which are caused by unexpected traffic bursts. Thus, it has to estimate the dynamic behavior of the traffic in the nodes buffers and to send sources the congestion notifications early enough. Therefore, due to the dynamic nature of buffer occupancy and congestion at a node, it is expected that by applying a fuzzy logic control seems to be a very interesting issue [11].

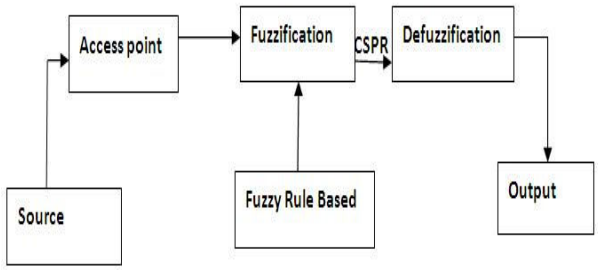

Fig1: Fuzzy logic Routing

The protocol starts route discovery when Access Point needs a route to destination. During route Discovery, source node broadcast the packets through neighboring nodes. Packets are transmitted from Source node to destination node. In Normal AODV the losses of data's are more compared to the Fuzzy logic Routing.

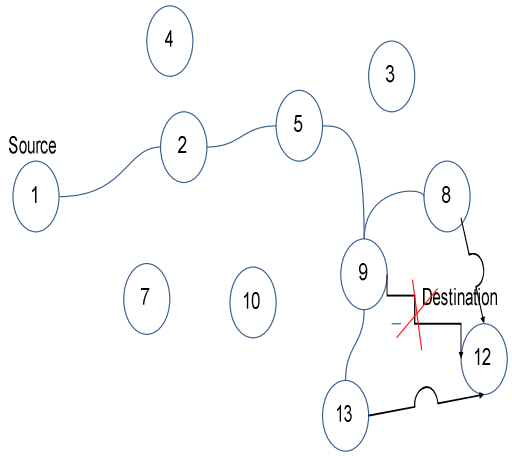

Fig. 2 Conditional Shortest Path Algorithm

Here, node1 is a source node and then node12 is a destination node. During the data ransmisssion process ifany atack or traffic occurred in the way it will find out the shortest path. In orde to save time it is selecting the nearest shortest path to reach the neighbouring node and then sends the data through that way. Here the link failure between the node9 and node 12 so it has found node 8 or node13 to transmit the data.

3. PROPOSED APPROACH

In this paper the fuzzy logic routing algorithm is proposed to provide the optimal best case performance on all possible traffic demands faced by users may in the wireless mesh network, the goal is to minimize the maximum traffic aware of oblivious intrusion sets in the network over all properly work demand patterns. It is a maiden attempt that investigates the fuzzy logical oblivious routing issue in the context of wireless mesh networks. A trace of simulation study demonstrates that our fuzzy based oblivious routing solution can effectively perform in the dynamics in mesh network routing.

Wireless mesh networks have many logical functions on the network which are increasing attention and used as a high-performance and low-cost resolution to last broadband Internet access. In a wireless mesh network, local access points and stationary wireless mesh routers communicate with each other and form a backbone structure which forwards the attacks between mobile clients and the Internet. We simulate existing Oblivious Routing (OBR), Oracle Routing (OR), and Shortest-Path Routing (SPR) strategies respectively over the network configuration with gateways and we have proposed for fuzzy based on the wireless mesh network [14]. In this Fuzzy based on the wireless mesh network work on access point to send the data from source to destination on the network. During this process it is minimizing the packet loss compared to the OR which used to loss many data and not resolving.

Here, shortest path routing (SPR) protocol in which average conditional intermeeting times are used as link costs rather than standard intermeeting times and the messages are routed over the network. A comparison is made between SPR protocol with the existing shortest path (SP) based routing protocol through real trace- driven simulations. The results demonstrate that SPR achieves higher delivery rate and lower end-to-end delay compared to the shortest path based routing protocols. This shows how well the conditional intermeeting time represents internodes' link costs and helps making effective forwarding decisions while routing a message. Routing algorithms utilize a paradigm called store-carry-and-forward. it generates the multiple messages from a random source node to a random destination node at each seconds.

The concepts of AODV that make it attractive for MANETs with limited bandwidth include the following: Minimal space difficulty. The algorithm makes sure that the nodes that are not in the lively path do not keep information about this route. following a node receives the route and sets a reverse path in its routing table and propagate the RREQ to its neighbors, if it does not receive any RREP from its neighbors for this request, it deletes the direction-finding info that it has recorded. Simple: It is simple with each node behave as a router, maintaining a simple routing table, and the source node initiating path discovery ask for, making the network self-starting.

The performance ratio of fuzzy oblivious routing is better than oblivious routing it is plotted for each hour since the beginning of the trace collection. The ratio generally remains in the range, high on the other performance, with irregular conditions on the network [12]. This result shows that our fuzzy oblivious routing strategy performs competitively against the oracle routing strategy even without the knowledge of attack based demand on this wireless network. In this performance level are so high and data loss level is low in condition, this is the main advantage of these work.

3.1 Fuzzy Logic Routing Algorithm:

```
if S message D received then
source A from neighbor list
  compute the network topology
    if source(p) = T(Traffic) then
        Reset parent ( A ←Received)
        Reset Data
  Broadcast FUZZY-LOGIC message
  Enter neighbor discovery phase
  End if
  End if
  if CSPR message AP received then
    if source (p) = D(Destination)then
 Reset parent ( p ←Received)
Packet received
 Broadcast FUSSY-SET logic
 Enter Route discovery
        else
 if P = loss then
        Broadcast FUZZY-Operator
 logic
 end if
 end if
  end if
  if P ≠ loss then
        Broadcast set Defuzzification Logic
 end if
```

3.2 Various steps involved in the proposed Fuzzy Logic protocol

1. The data are sending by wireless mesh network from source (S) to destination (D) on this network topology.
2. Source node collects the neighbor node list and source to transmit the data to destination intermediately work through AP (Access Point).
3. AP has to gather the data sending and receiving process on the network. The traffic conditions to be checked on this Access Point.
4. Fuzzy logic can be applied on this level to the AP and if there are any traffic Occurred in this Network path the fuzzy logic will select alternate shortest path route to send the data. It's mainly work on conditional shortest path routing in its function on the network.
5. It is the more secured method because it is reducing the packet's delay and number of loss packets in this wireless mesh network. The fuzzification is work properly in this time of the traffic.
6. If Fuzzy-set logic is applied in some conditions the data loss can be retrieved from C++ file.
7. If fuzzy operator is executed the packet loss at a time will not be equal to loss the when defuzzification is executed.
8. When data are send from source to destination, this is the network which finds the shortest path to check and then send the data through the alternative path to the destination.

4. RESULTS AND DISCUSSIONS

The goal of our simulation is to analyze the behavior of the AODV by deploying mesh Networks. The simulation environment is created in NS-2, a network simulator that provides support for simulating mesh wireless networks. NS-2 was written using C++ language and it uses the Object Oriented Tool Command Language (OTCL). It came as an extension of Tool Command Language (TCL). The simulations were carried out using a MESH environment consisting of 71 wireless mobile nodes roaming over a simulation area of 1200 meters x 1200 meters flat space operating for 10 seconds of simulation time. The radio and IEEE 802.11 MAC layer models were used. Nodes in our simulation move according to Random Waypoint mobility model, which is in random direction with maximum speed from 0 m/s to 20 m/s. A free space propagation channel is assumed for the simulation. Hence, the simulation experiments do not account for the overhead produced when a multicast members leaves a group. Multicast sources start and stop sending packets; each

packet has a constant size of 512 bytes. Each mobile node

in the network starts its journey from a random location to a random destination with a randomly chosen speed. In a IEEE 802.11 based wireless mesh network there are significant problems in maintaining fairness and low delay for long-hop flows. Express forwarding, which has been proposed to the IEEE 802.11 Task Group, is a possible strategy for solving these problems.

The proposed system consists of a well-organized tree construction scheme which manages to decrease data overhead compared to customary ad hoc routing protocols. To do that, it takes full advantage of the broadcast nature of the wireless medium. We also expand that routing protocol with group association functionalities well-matched with those currently used in the Internet, allow for the ready deployment of the solution in existing networks with current equipments. In addition, we also use an auto-configuration protocol which provides nodes with topologically correct IP addresses and reduces system overhead by the use of prefix permanence. That is, all wireless routers using the same Internet gateway are configured with addresses on the same prefix. Our imitation and experiential results in a real tested show that the proposed scheme is able to offer a good performance, while being fully well-suited with standardized multicast solutions of their mesh networks.

The simulation scenario is designed specifically to assess the impact of network concentration on the performance of the protocols. The impact of network density is assessed by deploying 30 –71 nodes over a fixed square topology area of 1200m x 1200m using 5m/s node speed and 3 identical source-destination connections. AODV have a number of quantitative metrics that can be used for evaluating the performance of mesh network. The following metrics for evaluating the performance is given in Table 2.

Table 1: Values for simulation

Parameters	value
Version	Ns-allinone 2.28
Protocols	AODV
Area	1500m x 1500m
Transmission Range	250 m
Traffic model	UDP,VBR
Packet size	512 bytes

TABLE 2 : Metrics for evaluating the performance

S.No	No Of Nodes	Protocol	Throughput	Average Delay	Pdf
1.	61	Aodv	0.28	18.28	95.2
2.	61	Aodv	0.29	11.01	98.0

Throughput is the ratio of throughput performance overall network performance improve network performance and packet delivery ratio and minimize packet delay.

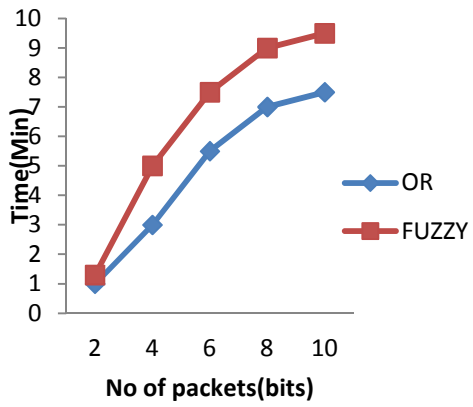

Fig. 3a Performance of fuzzy logic

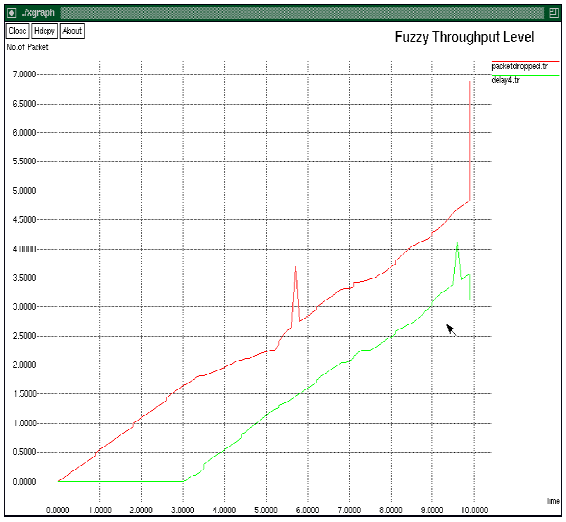

Fig. 3b Screen Snap shot for the performance of throughput for the fuzzy based routing

The performance of the throughput for oblivious routing and the proposed fuzzy logic routing is depicted in Fig. 3a. The performance of fuzzy logic based routing throughput level is higher than oblivious routing of the network. It is calculating the performance of throughput level and high accuracy of the data transferring on source to destination of the method. The higher in performance is due to the fuzzy logic engine is presented as an intelligent technique for discriminating packet loss due to congestion from packet loss by wireless induced errors. The results have shown that the fuzzy engine may distinguish congestion from channel error conditions on this time .This graph is to distinguish between the oblivious routing and then fuzzy logic performance of the networks. X and Y are to mention the number of packets sending and receiving level.

The screen shot of the results are presented in Fig. 3b. It is desirable to implement a wireless routing protocol with the maximum probability of data delivery, minimum probability of data loss. So, in wireless networks, the attempt has always been to its calculating the packet dropped and delay of the data transmission on the network performed. If they have any packets to be dropping means to delay on the network. Time based to intimate on the delay performing on the whole network performing of process. A new model is to investigate the use of fuzzy logic theory for assisting the routing error detection mechanism in an ad hoc network. An elementary fuzzy logic engine was presented as an intelligent technique for discriminating packet loss due to congestion from packet loss by wireless induced errors. The results have shown that the fuzzy engine may distinguish congestion from channel error conditions on this time. Here we are using the packets to be drooped at a time the data to be reached the destination to take several times on the network. At the same time delay to be taken a high level perform on this graph.

Packet delivery fraction is the ratio of data packets delivered to the destination to those generated by the sources. It is calculated by dividing the number of packet received by destination through the number packet originated from source.

$$PDF = (Pr/Ps)*100$$

where, Pr is total Packet received & Ps is the total Packet sent.

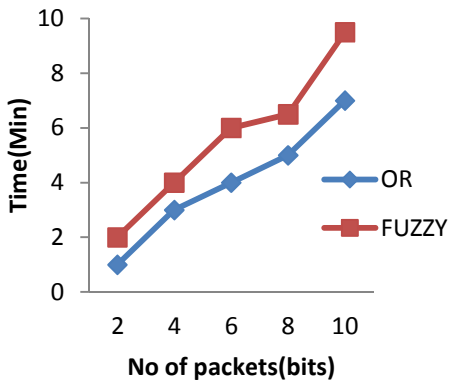

Fig. 4a: Packet deliver ratio for the proposed fuzzy based routing algorithm with oblivious routing

Delivery fraction is calculating the data transmission between the one node to another node of the network. The performance of the packet delivery fraction for the proposed routing and the oblivious routing based on manual calculation is presented in Fig. 4a. Fuzzy Logic has been used for routing and management of an ad hoc wireless network. The fuzzy logic based routing algorithm takes into account input variables, delay, throughput and energy consumption. It is differentiating performance between the existing and fuzzy performance on the network. It is stating that at a time of process how many packets send and received during the process on the transmission and intermediately showing the difference in calculating the time take by packets to reach the destination.

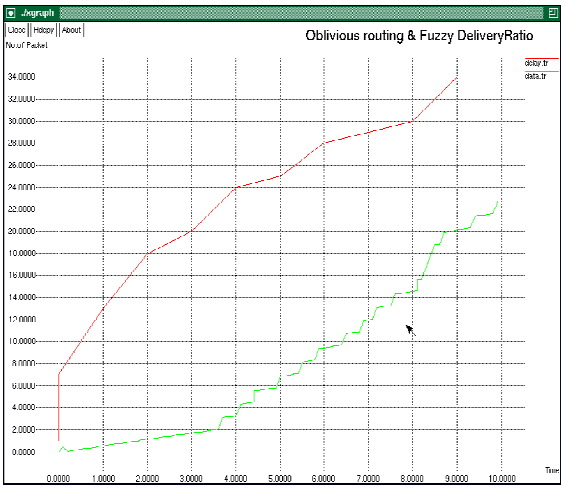

Fig. 4b: Screen snap shot of Packet deliver ratio for the proposed fuzzy based routing algorithm

The simulation output of the packet delivery ratio of the proposed fuzzy routing protocol is shown in Fig. 4b. The optimal performance in the network is guaranteed a controlled randomized routing strategy which can be viewed as cost of exploration. The cost of exploration is proportional to the total number of packets whose route deviates from the optimal path. To increases sub linearly with the number of delivered packets hence the per packet exploration cost are the numbers of delivered packets grow. It represents the number of control packets divided by the total number of received data packets. For this computation, every time a control packet is retransmitted, it is considered as a new control packet from

the oblivious routing on the total area network performance of the process.

Average end to end delay includes all possible delay caused by buffering during route discovery latency, queuing at the interface queue, retransmission delay at the MAC, propagation and transfer time. It is defined as the time taken for a data packet to be transmitted across an MESH network from source to destination. Average end-to-end delay is written as

$$D = (Tr - Ts)$$

where, Tr is receive Time and Ts is sent Time.

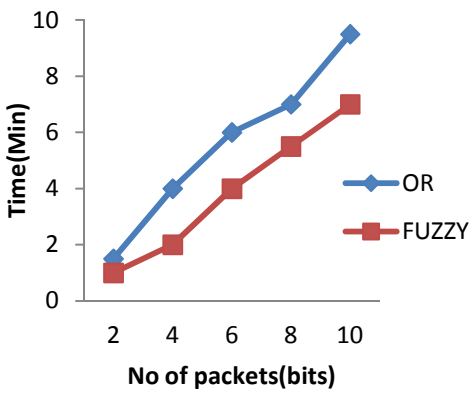

Fig. 5a Comparision of delay for the proposed routing protocol with oblivious routing protocol

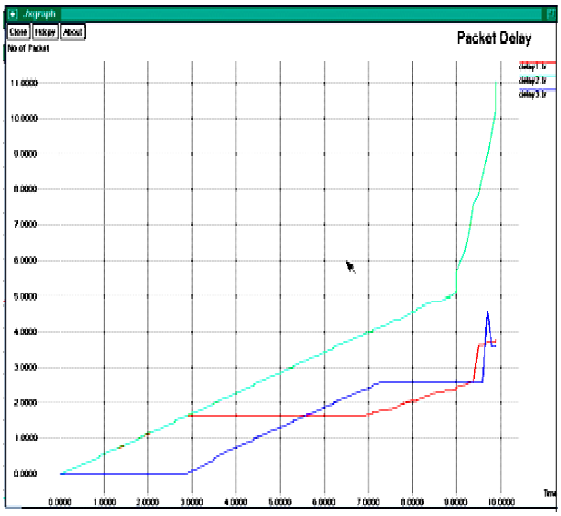

Fig. 5b Screen snap shot of delay for the proposed routing protocol for various nodes

The performance of delay for the proposed routing protocol with the oblivious routing protocol is depicted in Fig. 5a. and also a comparison of delay for different nodes for the proposed fuzzy based routing protocol and the real time output is depicted in Fig. 5b. Delay is used to calculate the packet droping level of the networks and then if data are dropped means the time taken by fuzzy logic routing is very low but oblivious routing is delaying to send and receive the data processing of the networks. The route discovery process can take some time and this delay can be increased due to problems in the medium access, such as busy channel and collisions. If they have any problem in transmitting the data to route fuzzy logic is discovering the neighbour node to get active and send the data quickly when compred to oblivious routing which delays its process.

5. CONCLUSION

This paper presents an analysis and performance evaluation of fuzzy logic controller design by using ns2. The simulation results for the first type prove that the fuzzy logic controller performance of the specifications that belong to the existing one of oblivious routing. In this traffic aware routing of fuzzy logic, throughput and packet delivery ratio provides better performance than the existing in the network. The ratio generally remains in the range of, with occasional spikes. In their existing one of the oblivious routing to packets delay over lapped so we are using the fuzzy logic method and then using the conditional shortest path routing method of the system. Fuzzy logic controller is implemented to find the path for transfer of data from source to destination easily and efficiently. In this paper to future work can be done on implementing to performance to reducing the existing packet dropping level of the network during the data transfer. The same fuzzy logic can be used to increase the performance of the networks.

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