Fuzzy Logic Based DSR Routing Protocol Design For Mobile Adhoc Network(Manet)

Engineering

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ABSTRACT   *Wireless networks are increasingly becoming popular and have enabled communication between mobile devices using standard network protocols. In ad hoc networks, nodes communicate directly with each other without any special access point equipment. Because of its infrastructure less characteristic, MANETs (Mobile Adhoc Networks) can be used when the mobile devices are on the move even in places where access points are not feasible. In an ad hoc network connectivity is achieved in the form of a multihop graph between the nodes. The QoS of the network depends on the workstation position, coverage sample and transmission power and interference level. This paper propose a novel approach called fuzzy based dynamic source routing to evaluate the performance metrics such as delay, throughput and packet delivery ratio depending on hop count and mobility of the nodes.*

I. INTRODUCTION

MANET finds wide applications in military, business and academia due to its infrastructure less, sparkling character and the ease of use [1]. A MANET either operates as a standalone or as a remnant network. The mobile nodes act as host and router, each node acts as a router to forward packets between two or more nodes. The nodes are free to move and organize themselves in arbitrary manner, new nodes get included in the network, existing nodes may move out of the network thus the topology of the network keeps changing. Due to this dynamic nature of the MANET, it is a challenge to maintain the correct routes. The routing protocol used should be able to relay the traffic dynamically and be capable of adjusting to high/low mobility with high/low bandwidth.

Destination Sequenced Distance Vector (DSDV), Optimized Link State Routing (OLSR), Topology Dissemination Based on Reverse Path Forwarding (TBRPF) are some of the proactive routing protocols. Reactive protocols are more efficient than proactive protocols as reactive protocols minimize control overhead and power consumption, as routes are discovered only on demand. In the paper, an extension to DSR is proposed which uses no. of hops, route expiry time and mobility of the node for route selection. Fuzzy logic is incorporated to form rules for selection of links on the basis of the fuzzy cost computed from the above parameters.

II. DSR ROUTE DISCOVERY

When some originator node originates a new packet addressed to some destination node, the originator node spaces in the header of the packet a "source route" giving the sequence of hops that the packet is to follow on its way to the destination [1]. In general, the dispatcher will obtain a suitable source path by searching its "Route Cache" of routes previously learned; if no route is found in its cache, it will start on the Route Discovery protocol to animatedly find a new path to this destination node. In this case, we term the originator node the "initiator" and the destination node the "target" of the Route Discovery. To begin Route Discovery, originator node transmits a "Route Request" as a single local broadcast packet, which is received by (approximately) all nodes currently within wireless transmission range of initiator.When another node obtain this Route Request, if it is the target of the Route Discovery, it returns a "Route Reply" to the initiator of the Route Discovery, giving a copy of the accumulated route record from the Route Request; when the initiator receives this Route Reply, it caches this route in its Route Cache for use in sending subsequent packets to this destination.

III. DSR ROUTE MAINTENANCE

When originating or forwarding a packet using a source route, each node transmit the packet is liable for confirming that data can flow over the link from that node to the next hop. If any link or node failure in the route means the intermediate node which detects it will send the Route Error packet to the source node. When source node receives this packet it will start the alternative route to the destination by initiating another route discovery phase.

IV. FUZZY LOGIC DSR

Fuzzy Logic (FL) was introduced by Prof. Zadeh in 1965.Basically; FL is a multi-valued logic allowing in-between values to be defined between predictable valuations like true/false, yes/no, high/low, etc. Ideas like rather tall, very fast are expressed mathematically and processed by computers, to put on a more gentle way of thinking in computer programming [2]. Fuzzy systems are an alternative to conventional ideas of membership and logic that originated in ancient Greek philosophy. Mathematical precision owes its success largely to the efforts of Aristotle and philosophers who preceded him. In a bid to devise a concise logic theory and later mathematics, the so-called "Laws of Thought", were stated. Of these, the "Law of the Excluded Middle", states that every proposition must be either true or false. Fuzzy Logic is a tool for controlling of systems and complex industrial processes, as also household and entertainment electronics and other expert systems. FL is a problem-solving control system method that is applied in systems from simple, small, embedded micro-controllers to large, networked, multi-channel PC-based data acquisition and control systems. The FL is applied in hardware, software, or in a combination of both. FL gives an easy way to arrive at specific conclusions based on imprecise, unclear, inaccurate, piercing, or absent input information. FL's approach to control problems imitates a person making decisions, but quicker. FL includes a simple, rule-based IF X AND Y THEN Z approach to solving control problems rather than attempting to model systems mathematically. It is empirically-based and relies on an operator's experience rather than technical knowledge and understanding of such systems. The simplest fuzzy model consists of a set of rules with an "if – then" structure: where condition i is a statement of type "xi is Lij". In this statement xi represents actual value of some ith real world variable meanwhile Lij is a flexible predicate naming the jth linguistic term of corresponding i^{th} Linguistic Variable. L_{ij} is given by a fuzzy set that represents use of a flexible predicate on x_i domain. Such statements are known as "premises". The conclusion is a fuzzy set, representing a linguistic term expressing a flexible predicate, characterizing system output behavior when all con-

ditions are met. Notice that "if – then" rules are used to model the state of a system and to decide to control it (Claudio 2005). In DSR protocol, source routing approach is followed to route the packet to the destination. Here the route selection is made by considering the no.of hops between the source and the destination. But in MANET due to nodal mobility and infrastructure less nature of node hop count alone will not help to find optimum path. In this proposed protocol we use the hop count and mobility of the node to compute the optimum path. These parameters are used in fuzzy logic to compute the fuzzy cost, based on which optimum path is computed [3][4].

The membership functions are used to signify inputs and output, with three verbal variables to the inputs: Low, Medium, and High, and three for the output: Low, Medium, High, while the fuzzy rule base is shown in Table 1.

TABLE – 1 RULE BASE

	Mobility			
		Low	Medium	High
No.of Hops	Low	High	Medium	Low
	Medium	Medium	Low	Low
	High	Medium	Medium	Low

The input membership functions along with the output membership functions are shown in the Figure1.
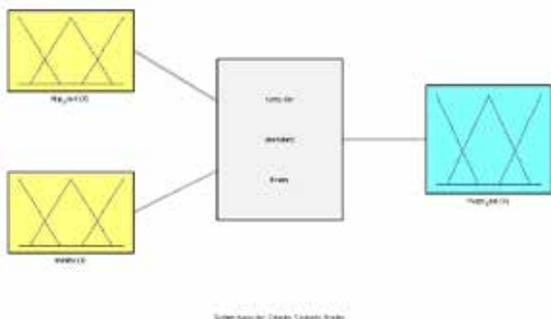

Figure 1: Fuzzy Inference System

V. SIMULATION
To verify the efficiency of the proposed mechanism, the proposed methodology was simulated using OPNET with the following parameters. In this scenario the nodes are considered to move at different speeds and travel in different trajectories.

TABLE – 2 SIMULATION SETUP

Total area of the network	25sq.km
Number of nodes	20
Mobility of the node	Nodes moving randomly in the network with varying speed
Data rate	1 Mbps

VI. RESULTS AND DISCUSSION
Simulations were run for the planned protocol and the outputs recorded. The trials were conducted for two scenarios, in the first scenario the nodes move in continuous speeds. In the second scenario, trials are conducted with 8 nodes moving at an average speed of 75 Kmph in a predefined round route, 4 nodes moving at an average speed of 50 Kmph in a predefined square route. Balance nodes moving arbitrarily about the network. The following figure 2, 3 and 4 gives the result for end-to-end delay, Traffic send and Traffic received respectively.
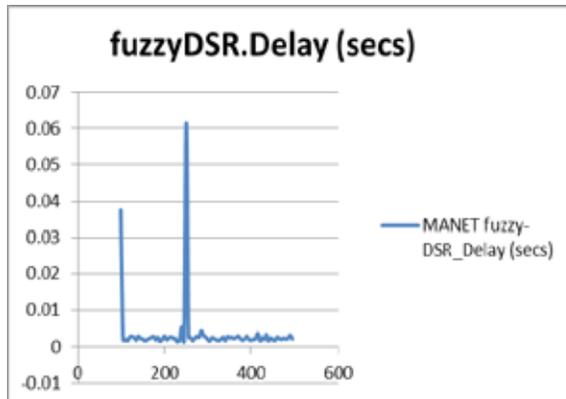

Figure 2: End-to-end delay when nodes moving in varying speed

It is seen from the Figure 2 that with increase in node speed, the End to End delay increases. When the nodes are moving at constant speed, the End to End delay is Low
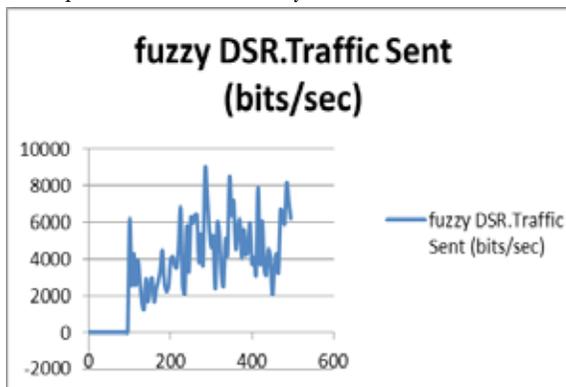

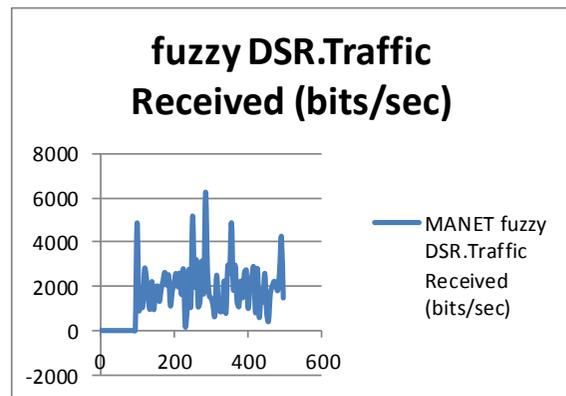**Figure 3: Traffic sent when nodes moving in varying speed**

Figure 4: Traffic Received when nodes moving in varying speed.

VII. CONCLUSIONS
In this study, it was proposed to implement a novel dynamic routing algorithm based on DSR. The proposed algorithm uses fuzzy inference to dynamically vary the parameters of DSR and hence improve the performance of the network. The proposed methodology was tried in a network covering nodes moving in continual speed and also with unlike mobility speeds. The outputs obtained in network performance are hopeful. Further work needs to be carried out for high volume data like video conferencing.

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