Fuzzy Interference System based Link Failure prediction in MANET

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Abstract. Mobile Ad-Hoc Network (MANET) contains wireless mobile nodes establishing a short-term network lacking the assistance of individual structure. Owing to the nodes mobility, such mobile nodes are auto-configuring also auto-organizing. In MANETs, approaches are essential to discover definite routes among the sender to receiver. One important concern for routing in MANET is how to choose a quality link route that can last longer because mobility may reason links to break regularly. To solve this issue, in this approach, a Fuzzy Interference System based Link quality prediction (FLQP) in MANET is proposed. In this approach, select the intermediate CH using Fuzzy Interference System (FIS) is predicting the sensor link quality by Received Signal Strength (RSS), Communication range (CR), Remaining Energy (RE), packet transmission rate (PTR) parameters. This FIS can be utilized to extend a metric for path selection in terms of link quality that can improve the network performance as to be exposed by the simulation results.
Keywords: Mobile ad hoc networks, Link quality, Fuzzy Interference System, Communication range, packet transmission rate, Simulation Analysis.

1. Introduction

The MANETs are assembling mobile nodes actively shaping as irregular networks lack applying any present structure [1]. The node is liberated to travelling casually, also preparing them-selves randomly; therefore, the network's topography possibly alters quickly. Every node transmits the traffic unconnected to its possess apply [2]. MANETs can own features such as Bandwidth restraint, variables capability associations, Energy-restrained Operations, lacking Security, Dynamics topographies repeated revise, auto organized as well as multi-hop [3]. Nowadays the MANET is applicable for smart agriculture [4], army, disaster area, urban areas. The routing may be capable of describing the procedure of selecting the routes for communicating the network. Routing in communicating is the procedure of choosing the routes to transmit the network traffic [5]. Thus, it necessitates intending a routing approach that effortlessly adjusts to updating network topology.

In MANET Routing is hard because node mobility may reason links to break recurrently. While any path link breaks, this route requirements to be either repaired through discovering another link otherwise substitute with a recently establish path. Self-adaptive proactive routing (SAPR) approach

rely node is selected by node mobility indicator. This mobility indicator is computed by node mobility factor and transmission count. However, this approach increases the link failure in the network [6]..

2. Literature Survey

MRI Mobility Aware Energy Efficient (EE) Clustering concentrates on the difficulty of movement also energy efficiency for formulating a clustering motivated through the multi-agent stochastic parallel search of particle swarm optimization [7]. However, this scheme cannot use the SOM concept. K-Means clustering to minimize the utilization of energy. Thus it raises the packet delivery [8]. Radial Based Function Network (RBFN) uses the SOM method to enhance performance and delay reduction. However, this approach cannot increase the energy efficiency [9].
It partitions the MANET into groups. Next, it identifies the optimal method, for example, energy to be assumed through a flow of data. It computes the energy necessary for every present route also chooses the optimal entrances. Also it is used for cooperative data forwarding [10]. A multi-objective resolution applying multi-objective particle swarm optimization for minimizing energy dissolution as well as minimize the network traffic. This method takes the quantity of nodes, communication energy, also energy expenditure of mobile nodes [11].

A multi-path routing method utilizing helpful neighboring node idea is presented in this paper. Established on the accessibility neighboring nodes energy, multi-path routes are recognized. This approach raises the function such as multi-path recognition delay, lifespan and release ratio [12]. Secure Multipath Routing Algorithm using the k-connectivity threshold constituting the maximum amount of nodes distributed among dual routes in the accomplished routes. This approach established reactive routing, interchanged throughout the route detection to take the threshold also applies a threshold signature.

A delay-aware energy-efficient routing approach is used to minimize the latency also energy utilization. Position based greedy transmitting method altering every node relay packets to a receiver. However, this approach increases the additional communication cost [13]. The energy heterogeneity assists raising the network lifespan and energy efficiency although; this approach enhanced the network delay [14].

3. Fuzzy Interference System based Link Failure prediction in MANET

This In FLQP, the relay node is designated through the link quality (LQ) among all mobile nodes. This LQ is determined by fuzzy interference system that measuring the mobile node Received Signal Strength (RSS), Communication range (CR), Remaining Energy (RE), packet transmission rate (PTR). These parameters are explained below.

Received Signal Strength:

The node Received Signal Strength (RSS) [15] is stated through the transmission energy as well as distance (d). It is compute by the formula is given below.

$$N_{RSS} = \frac{Transmission\ Energy}{4\pi d^2} \tag{1}$$

Node Remaining Energy:

The node remaining energy is measured over its current level of energy and the energy level consumed for previous transmission. The residual energy existing in the mobile node is named as node's remaining energy.

$$N_{RE} = Initial_{Energy} - Consumed_{Energy} \tag{2}$$

Packet Transmission Rate:

Each node calculate the packet Transmission Rate established on the rate of packet transmitting through interval of time. This parameter calculation is given below.

$$N_{PTR} = \frac{Packet\,Transmission\ Rate}{time} \tag{3}$$

Link Failure Prediction:

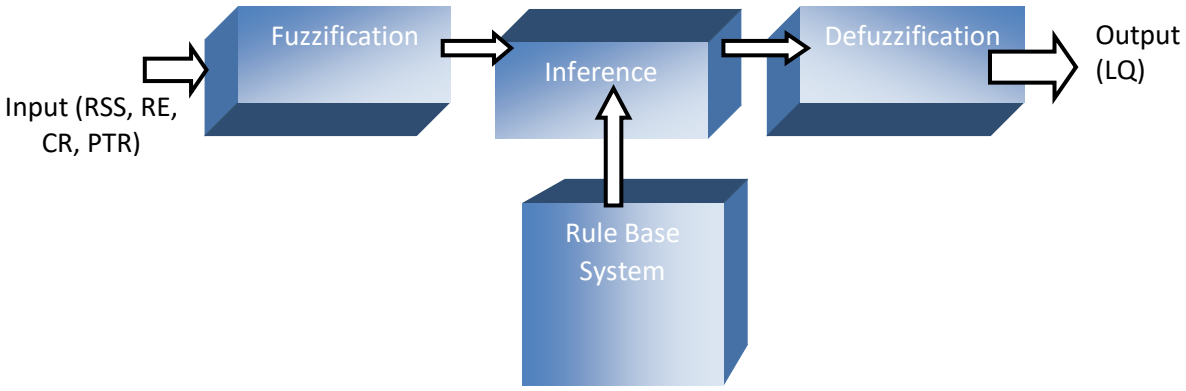

Figure 1: Diagram of FLQP Approach

Here, the quality of the link (LQ) between all mobile nodes are determined by the fuzzy interference system that applies the Received Signal Strength (RSS), Communication range (CR), Remaining Energy (RE), packet transmission rate (PTR) parameters are the input and then produced the LQ as an output is explained in figure 1. The computation of LQ is given below.

$$LQ_{(\forall n)} = Max\left[LQ_{\max} * FIS(RSS, CR, RE, PTR), 1\right] \tag{4}$$

Here, the highest LQ node is selected as a relay node then sender mobile node send the data to the next hop or destination. The lowest link quality node is maximum chances to failure the link. So, send the notification message to the network.

4. Experimental Results

We measure the function of the proposed approach utilizing the Network Simulator (NS-2.35) as well as equate it to the SAPR and FLQP protocol. We have simulated a MANET region with an area of 800*400 metre. The environment in that there are 45 nodes moving arbitrarily and the maximum of mobile nodes transmission range is 300 meters. In this measurement, we have concentrated on the average delay, throughput as well as residual energy of the MANET.

Average delay denotes the time period taken for the packets from sender to receiver, including buffer delays to the period of a path invention, retransmission latency at MAC layer, queuing latency, and time period of propagation. Figure 2 shows the FLQP has a lesser delay than the SAPR approach.

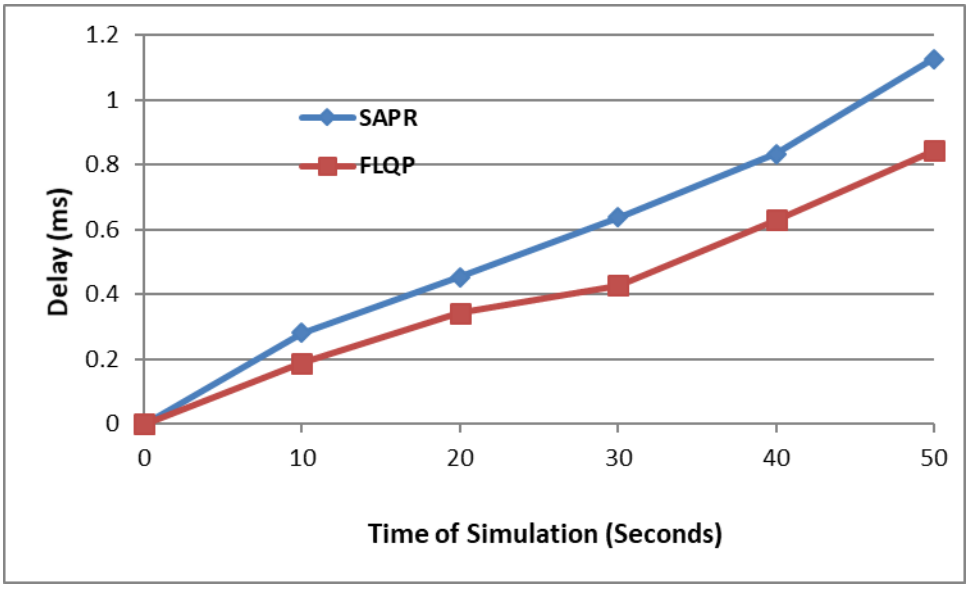

Figure 2: Delay of SAPR and FLQP protocol

Throughput is represented as the part of the total of an effective packet transmitted to the amount of packets. Figure 3 illustrates the FLQP has the highest throughput than the SAPR.

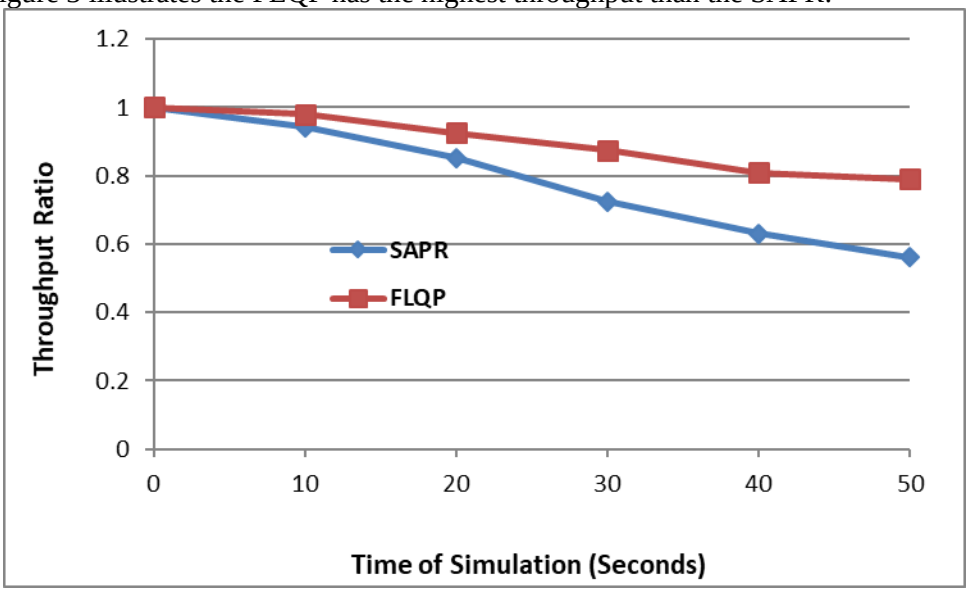

Figure 3: Throughput of SAPR and FLQP protocol

Remaining energy represents the amount of energy remaining in a network is known as Remaining energy.

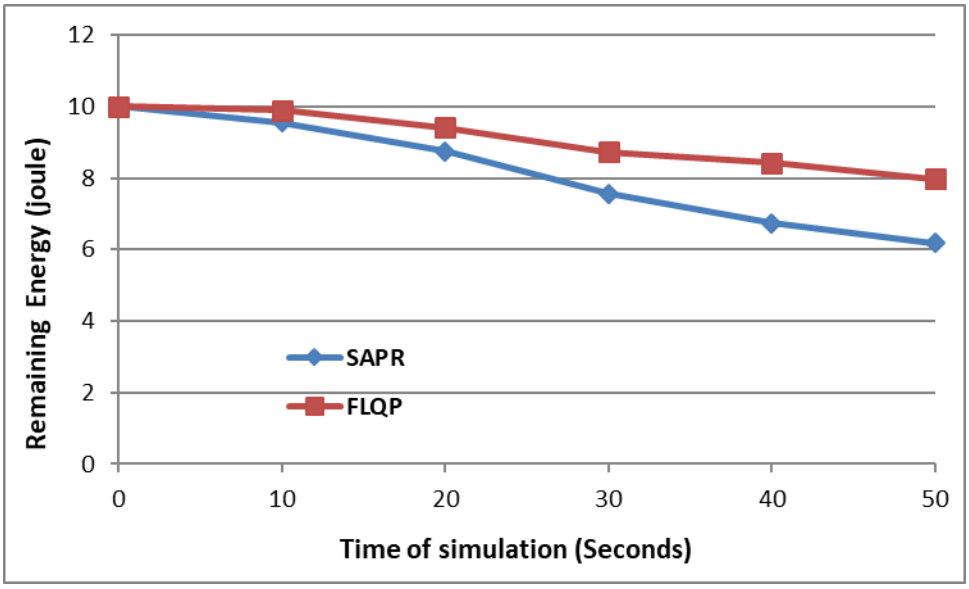

Figure 4: Remaining Energy of SAPR and FLQP protocol

Figure 4 illustrates the Remaining Energy of the SAPR and FLQP protocol. The FLQP scheme equates to the SAPR; the FLQP offers better Remaining energy.

5. Conclusion

In MANET, mobile nodes actively make a network temporary as well as transmitting the information from one mobile node other mobile nodes. In MANETs, approaches are essential to discover definite routes among the sender to receiver. However, the wireless nodes mobility creates the link failure. We have introduced and examined a Fuzzy Interference System based Link quality prediction (FLQP) in MANET. This Fuzzy Interference System is an optimal routing technique. In this approach, select the intermediate CH using FIS method for predicting the sensor link quality by Received Signal Strength (RSS), Communication range (CR), Remaining Energy (RE), and packet transmission rate (PTR) parameters. FIS method select the relay is provide the better packet transmission and raised the balanced energy. This approach minimized the link failure and enhanced the quality of service. Simulation results are done using the network simulator-2.35. The performance metrics are evaluated, and it enhances both the energy efficiency and throughput and minimized the network delay in the MANET.

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