# A Review on Congestion Control in A Wireless Network using Fuzzy Logic

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*Abstract*— In wireless networks, we have multifaceted characteristics to be considered and diverse resources are used for controlling the congestion. Nodes making use of Internet are wirelessly associated to each other to interconnect. An important subject rising in mobile networks is the selection of the ideal path between any two nodes. Fuzzy logic is a logical field studies evaluating the accuracy of the results based on the approximation of the components involved, make decisions based on many factors relative accuracy based on experimental or mathematical proof. In this review paper, some basic parameters are considered which are necessary for the congestion control in wireless networks. These are: Transmission energy, queue size, distance from receiver, transmission rate, cost assigned. On evaluating these parameters using fuzzy logic, a preferred output for congestion control can be determined.

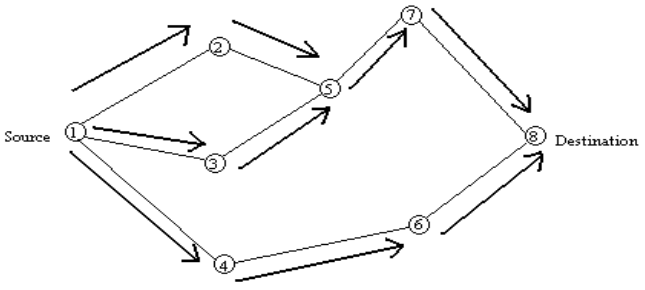
***Key words:*** wireless network, fuzzy logic, transmission energy, transmission rate, cost assigned, congestion

## I. INTRODUCTION

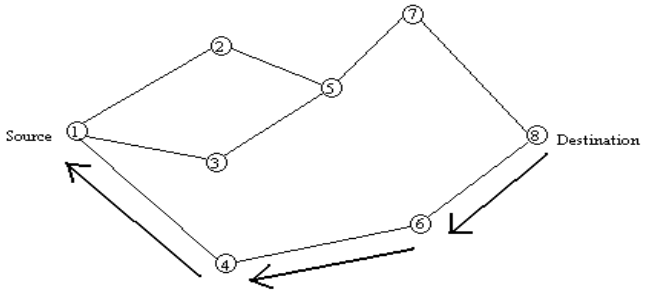
Nowadays wireless networks are the most popular way to connect people to the internet in companies, e-markets, in homes and cafes. Therefore, it must be secured against the malicious users who try to damage the confidentiality, privacy and authenticity of it. Although, wireless networks are protected and powered by encryption technologies such as WEP / WPA encryption, but several tools were developed to analyse and crash the encryption keys by setting the wireless adapter to observing mode, where it can gather the packets of the targeted wireless access point from the air and start to analyse them and trying thousands of decryption keys to crash the key, and it works fine. While introducing this paper, we have kept in mind several odds and ends of wireless network [1]. To support this theory, we have a transfer function in Fuzzy Logic which is derived from the characteristic function usually called the "membership function", which runs from the universe of dissertation, until the unit closed interval of 0 and 1. Not so in the sets "classic" or "crisp sets", where the range of the function is reduced to a set consisting of only two elements, namely was the {0, 1}. Therefore, fuzzy set theory is a generalization of classical set theory [2]. Addition to the waste of communication and energy that it creates; congestion negatively affects the reliability due to the packet losses and degrades the overall performance of the network and quality-of-service of application[3]. Congestion control is a difficult task for wireless networks because identifying the occurrence of congestion is not as simple as in wired networks. The first criterion in wireless medium is to discover the available routes and establish them before transferring. The selection of path for data transmission is done based on the availability of the nodes in the region using the ad-hoc on demand distance vector routing procedure[4]. By using the network on Demand Distance Vector routing protocol, the routes are created on demand that is only when a route is needed for which there is no "new" record in the routing table.

## II. ROUTE AND DATA MAINTENANCE

In the wireless networks, the nodes are inclined to to experience change in their locations. Hence the source should be constantly tracking their points. By implementing the protocol in the simulation scenario it transfers the first part of the data through the allowed path. After few seconds the nodes move to other positions. The succeeding step is the conservation of these routes which is equally important. The source has to continually monitor the location of the nodes to make sure that the data is being conceded through the route to the endpoint without harm[5]. In all the cases, if the position of the nodes modifies and the source doesn't make a note of it then the packets will be absent and eventually have to be resent. The path range, conservation and data transmission are successive processes. Hence the paths assigned prior are used for data transmission. The first path assigned previously is now used for data transmission. The data is shifted through this highlighted path. The second path carefully chosen is now used for data transmission. The data is transferred through this emphasised path. The third path carefully chosen is used for data transmission. The data is shifted through this highlighted path.




(a) Propogation of Route Request (RREQ) Packet




(b) Path taken by the Route Reply (RREP) Packet

Fig. 1: Route path

## III. FUZZY OPTIMIZATION ON ROUTING WIRELESS NETWORKS

A fuzzy system, which includes the scheme rule where the input membership functions to
fuzzify the input variables and the output variable de-fuzzification procedure. Fuzzification is a process where crisp inputs values are signified in terms of the membership function. The fuzzy logic switches the membership's resolutions, which describes over the range of the fuzzy response values. In Dynamic Source Routing the route call is engulfed through the network nodes add on their own addresses to the route record and if needed rebroadcast the request. It is proposed here that nodes that appear in this route record should determine whether to continue with the route discovery process or not. Route metrics that are used to make this conclusion are linked to strength, energy available at a link vertex, and number of hops currently in a path. Current routing protocols are typically optimized with regard to one of these metrics. DSR selects the paths that consist of the small number of hops [5] and the Associativity-Based Long-Lived Routing protocol [6] selects the paths that show long-lived connectivity between nodes, with nodes periodically transmitting instances as a means of identifying themselves.

### *A. Fuzzy Logic:*

Fuzzy logic is an approach to computer science that mimics the way a human brain thinks and solves problems. The idea of fuzzy logic is to approximate human decision making using natural language terms instead of quantitative terms. It is formally defined as a form of knowledge representation suitable for notions that cannot be defined precisely, but which depend upon their contexts. It enables computerized devices to reason more like humans.

## IV. FUZZY INFERENCE SYSTEMS

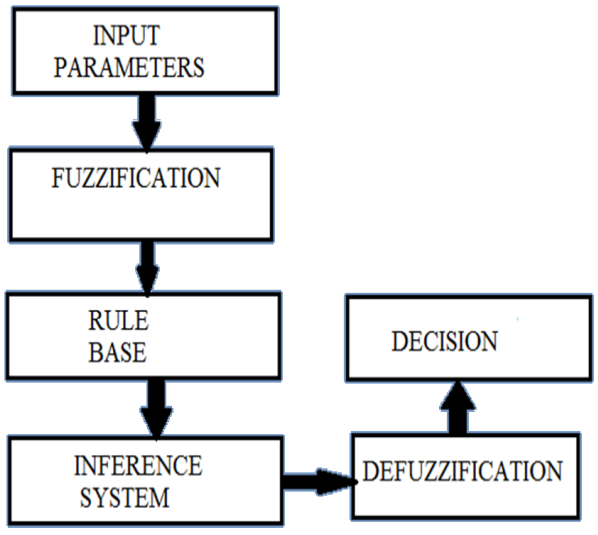



Fig. 2: Fuzzy Inference System

Fuzzy inference systems (FISs) are also known as fuzzy rule-based systems, fuzzy model, fuzzy expert system, and fuzzy associative memory [7, 8]. This is a major unit of a fuzzy logic system. The decision-making is an important part in the entire system. The basic blocks diagram of an FIS is given below.

### *A. Fuzzifier:*

Which transforms the crisp inputs into degrees of match with linguistic values. Membership functions are used in the fuzzication and defuzzication steps of a FLS, to map the non-fuzzy input values to fuzzy linguistic terms and vice versa. A membership function is used to quantify a linguistic term.

### *B. Fuzzy Rule Base:*

Which Contains A Number Of Fuzzy If-Then Rules.

### *C. Fuzzy Inference System:*

Which performs the inference operations on the fuzzy rule.

### *D. Defuzzifier:*

Which transforms the fuzzy results of the inference into a crisp output.

Parameters to be considered for congestion control in wireless networks [9,10,11]:

*1) Transmission Energy:*

This energy is readily used to transmit packets over a wireless link in WSN. The main key observation is that the energy required to transmit a packet can be significantly reduced and this parameter is lowering the transmission power and transmitting the packet over a longer period of time. "Transmission energy" represents the energy needed to transmit a data packet from node one to another node. Lower value of transmission energy leads to lower congestion.

*2) Data Transmission Rate:*

When transmit and receive stations have been interconnected by a call, a training sequence for the modem is executed and, also, a test signal transmission sequence is affected to set up a data transmission rate before delivery of information. Training on the transmission rates which a modem can use is executed satisfying a predetermined protocol and without increasing the protocol time. Data transmission rate should be fast so that delivery of packets at the destination will be received on time. Fast data transmission rate are assigned as lower link cost.

*3) Distance between Transmitter and Receiver:*

The fuzzy input variable "Distance from the gateway" enables selection of routes with minimum hops. Nodes nearer to the gateway are thus assigned lower link cost. Minimum number of hops provides an efficient way for transmission of packets at destination and it also reduces the complexity of sensor networks.

*4) Queue Size:*

The input fuzzy variable "queue size" indicates the buffer capacity at any node. This parameter helps avoid packet drops due to congestion at the receiver. Congestion leads to great trouble for efficient transmission of data packets at receiver end in networks. This queue size of packets should be small so that there will be less waiting time for execution.

*5) Cost Assigned To Each Path:*

Each sensor node is assigned a dynamic weight depending upon its current status. An in-active node that is neither sensing nor relaying is assigned a highest value whereas a node that is performing both these tasks is assigned a least weight. This parameter helps in selecting nodes which are either inactive or are only in the sensing state. Thus, a high value of weight makes the node favorable for next-hop, resulting in a lower value of link cost.

## V. CONCLUSION

In the opinion of the failing congestion state of limited-access highway and linked city expressway. The fuzzy logic can make use of the above given parameters to calculate the congestion or shortest path and can give efficient results which can be helpful in path calculation.

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