Volume 3, Issue 5, May 2013 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

Congestion Control in Wireless Network for Homogeneous resources using Fuzzy Logic

Saxena Sachin Kumar[*]
Department of IT,
COER, Uttarakhand, India

Kumar Dhaneshwar[**]
Department of IT,
COER, Uttarakhand, India

Agarwal Gaurav[#]**,**
Department of IT,
GRD IMT, Uttarakhand, India

Dua Gaurav[$]
Department of IT,
COER, Uttarakhand, India

Kumar Kundan[@]
Department of IT,
COER, Uttarakhand, India

Abstract: - In wireless networks, we have complex attributes to be considered and heterogeneous resources to deprive the congestion control. Nodes using Internet and other resources are wirelessly connected to each other to communicate. Communication requires less time and good efficiency of network and receiving time. These parameters are affected if network is full of congestion. Once the congestion in communication is diagnosed and reduced by any method, it can improve the entire network performance. The given model in this paper, not only detect the congestion but also predict the congestion control rate and round trip time. In order to counter the effect of congestion control in Wireless network and prove the authenticity of our model, we have implemented it in real world scenario. Entire model is design virtually in MatLab and simulated performances are implemented using Fuzzy Logic and System.

KEYWORDS: WIRELESS NETWORK, FUZZY LOGIC, CONGESTION DETECTION RATE AND PACKET LOSS, TRANSMIT POWER.

1. Introduction

Nowadays wireless networks are the most popular way to connect people to the internet in companies, e-markets, cafes and in homes. Therefore, it must be secured against the malicious users who try to damage the confidentiality, authenticity and privacy of it. Although, wireless networks are protected and powered by encryption technologies such as WEP / WPA encryption, but several tools were developed to analyze and crack the encryption keys by setting the wireless adapter to monitoring mode, where it can gather the packets of the targeted wireless access point from the air and start to analyze them and trying thousands of decryption keys to crack the key, and it works fine. While introducing this paper, we have kept in mind several odds and ends of wireless network [9]. 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 discourse, U, 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 [7]. The thesis then proposed emerged from the study of various thinkers from many different disciplines, who, like him, had a different vision of the problems of traditional logic [4].

2. Methodology

Fuzzy logic technology allows the implementation of real-life rules similar to the way humans would react. For example, humans would react in the following way to control traffic situation at a certain junction: "if the road is loaded on the first and second lanes and the road is less loaded on the third and fourth lanes is less, then the traffic lights should stay green longer for the first and second lanes". Fuzzy logic can easily implement these rules. But enough knowledge is required to prepare knowledge database or rules for a controller. The fuzzy controller has to collect data for the updating of the traffic situation model [5].

2.1. Fuzzy Logic And Application

Fuzzy logic has a lot of applications. The literature review shows that fuzzy controllers, as an application of fuzzy logic, can be found even in things that one would not expect. There are many examples of successfully applied fuzzy theory in practice including: the selection of the most suitable bank for arranging a mortgage, the evaluation of client credibility, the selection of an insurance company, the purchase of a property, the selection of a car, the job selection and many others as depicted in figure 1. These applications serving for decision support are the first large group of applications [2].

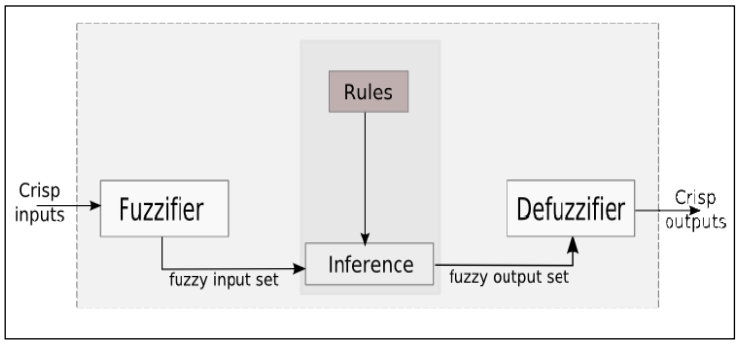

Figure 1. Solving problem using fuzzy logic

2.2. Fuzzyfication

The fuzzificaton means that the real variables are transferred on linguistic variables. The illustration of linguistic language is set up at the variable risk: none, very low, low, medium, high, and very high. Usually there are used from three to seven attributes of variable [1]. The attributes are defined by the so called membership function. Figure 2 clearly defines the membership function graph [6].

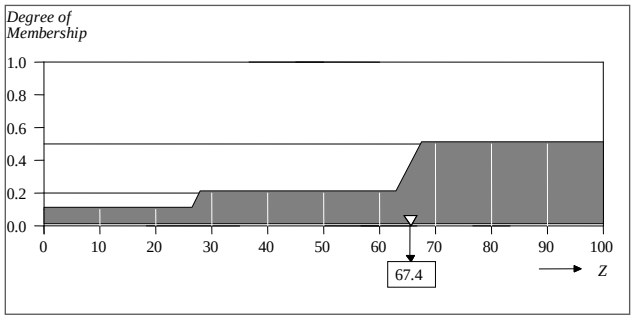

Figure 2. Membership Graph

2.4. MEMBERSHIP FUNCTIONS

Membership functions for the wireless attributes are defined in MatLab simulation and we have tried to implement these functions in simulation model. In order to prove the authentication of these functions we have modeled them in real world also [7].

3. Application Model

On the basis of the existing congestion control, a fuzzy logic based congestion control algorithm for wireless sensor network is presented. This article takes advantage of current buffer occupancy and congestion index, and congestion status for each node is detected by adopting fuzzy logic [5]. Thus, it is able to adjust rate timely and accurately to achieve the purpose to improve network performance. Simulation experiments show that congestion detection programs and rate control strategy in this article can reduce the packet loss rate for the network, improve network throughput effectively, while make the delay performance of the network better.

Rule No.	***Inputs***				***Outputs***		
	Packet Length	**Efficiency**	**Transmit Power**	**Receiver Power**	**Time Taken**	**Packet Loss Rate**	**Congestion Detection Rate**
1	Low	Low	Low	Low	High	Large	Low
2	Medium	Medium	Low	Low	Average	Large	Medium
3	High	Medium	High	Low	Average	Large	Medium
4	High	High	High	High	Less	Few	High
5	Low	High	High	High	High	Large	Medium
6	High	Medium	High	High	Not Less	Not Few	High
7	Medium	Medium	Low	High	High	Few	High
8	High	Low	Low	Low	Average	Not Large	Medium

Table 1. Fuzzy rules for the MatLab simulation

The several model has been introduced in literature but none of them has work concurrently in several attributes such as packet length, efficiency, transmit time and receiver time as well [8]. In addition, we have also emerged the consideration method of congestion detection rate in wireless network which was ignored in several research areas. Rules used in our model are defined in table 1 and recursively tested according the real world scenarios. Once these are verified after improving the error, they are ready to produce output to predict the values. In figure 4, one can clearly determine the values of packet length, efficiency, transmit power and receiver power are given 0.5 each, the outputs are produced as time taken is 0.515, packet loss rate is 0.5 and congestion control detection rate is 0.485. This is MatLab implementation to simulate the entire model and these rules are stemmed from the fact that fuzzy logic work on linguistic values and produces the numerical values.

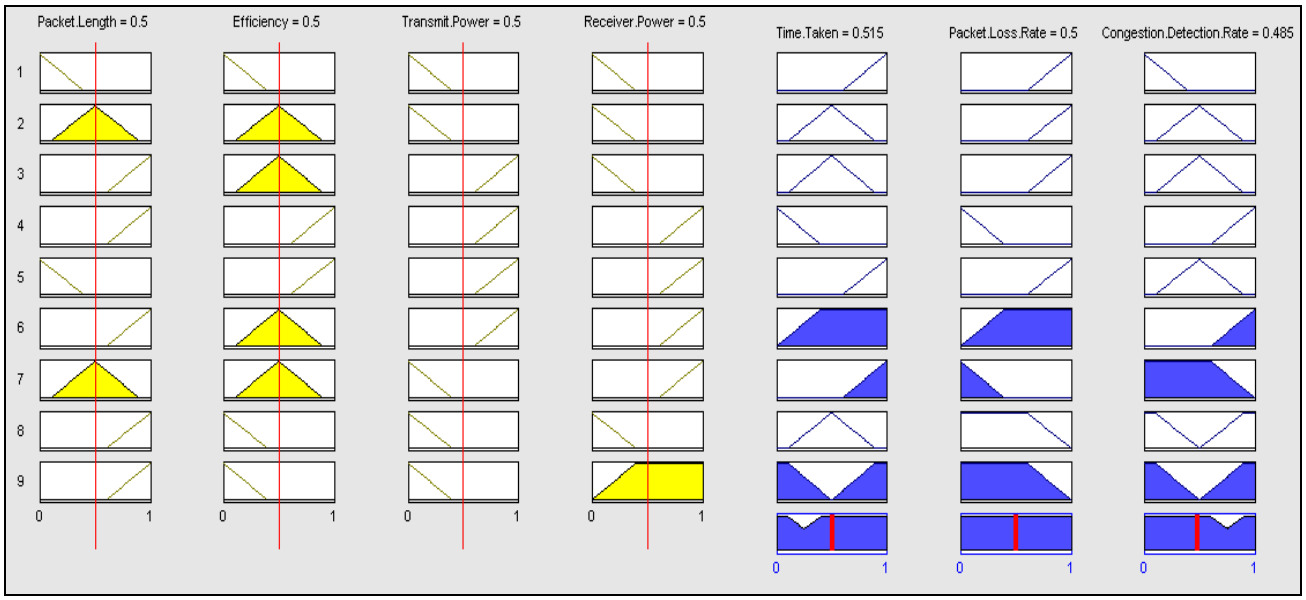

Figure 3. Rules implemented in MatLab Environment

In wireless networks, due to huge amount of packets convergent nature of upstream traffic and limited wireless bandwidth, network congestion happens easy, which is an urgent problem to be solved. The congestion control scheme is necessary to be carried out which can detect congestion precisely and regulate it fairly. To achieve this objective, a fuzzy logic based congestion control is proposed which takes complex attributes as inputs and gives numerical values as an output. In addition, it periodically calculates the congestion degree using fuzzy logic theory. At the same time each upstream traffic rate is adjusted according to the value of congestion degree. Simulations are conducted for the proposal which shows that this implementation efficiently sorts out the traffic and minimizes the packet loss. Our application model of wireless network demonstrated the feasibility of building a strong communication network without any congestion and high throughput [9].

4. Simulation Results

A Network is a group of computing devices communicates with the help of several networking infrastructure. Wireless networks provide an extension to the Internet. Since TCP/IP is the standard network with a protocol on the Internet, therefore attributes such as receiving time and transmitting time are replicated by the Simulation model in MatLab. This model, at some sites gives the glimpse of real field and table 2 compares the Actual values and predicted values while keeping the number of hopes one and two respectively.

S.No.	No. of hopes	Actual Time(sec.)	Predicted Time(sec.)	Error(%)
1.	1	0.654	0.632	0.0336
2.	1	0.567	0.532	0.0617
3.	2	0.768	0.675	0.1215
4.	2	0.845	0.745	0.1183

Table 2. Actual and Predicted values comparison

4.1. SIMULATION ENVIRONMENT

MatLab is the platform where anyone can simulate the real world model; likewise we have simulated our model while considering the rules in table 1. Fuzzy graph is the output of our work which defines the relationship between congestion detection rate and receiver power.

4.1. FUZZY GRAPH

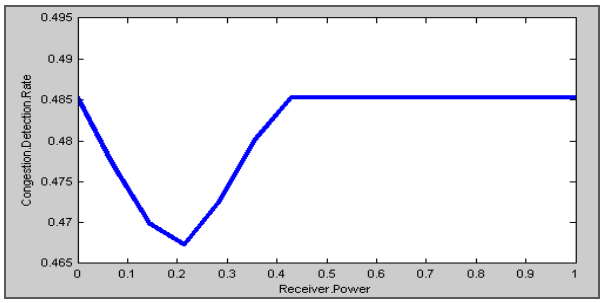

Figure 4. Congestion Detection Rate vs. Receiver Power

The above graph is replica of figure 6, where 3D graph is representing the performance of time taken, packet length and efficiency of the packets in wireless network. One can easily find the value from the graphs for example the value of congestion detection rate is 0.47 % in comparison to 0.1 receiver power. Similarly, other graphs show the relevant dependency among the attributes of parameters of homogeneous resources for wireless network [10].

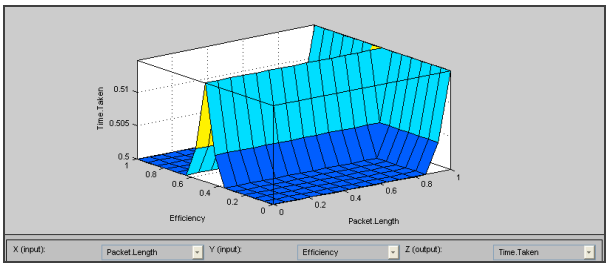

Figure 5. 3D Graph for Packet length, Efficiency and Time taken

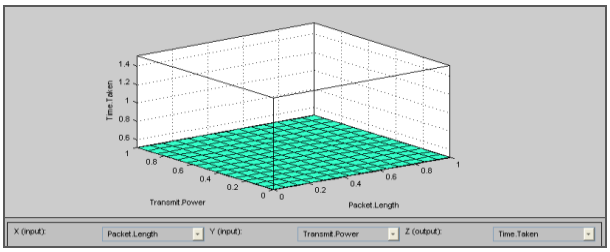

Figure 6. Graph for Packet length, Transmit power and Time taken

5. Conclusion And Future Work

In the view of the worsening congestion situation of freeway and related urban expressway, this paper based on fuzzy metering and neural network theories, a fuzzy control method which chooses d-value of mainline traffic state and expected state and ramp traffic state as input variables, ramp metering rate as output variable was raised., accordingly a ramp metering algorithm was put forward to establish a five layer Fuzzy Neural Network (FNN) model to deepen the ramp metering theory and method.

6. Acknowledgements

These papers is supported by our mentor and guide Sachin Kumar Saxena, Member of Editor Team of International Journal of Advancements in Research & Technology (ISSN 2278-7763), IJOART Publication, USA and has written more than six national and international research papers including different areas. The website reference for it is given here to check http://www.ijoart.org/editorialTeam.shtml and College of Engineering Roorkee, Roorkee for providing the basic resources. The authors would like to thank Dr. Garima Krishna and Dhaneshwar Kumar in order to support in Matlab simulation work and compare this work to real environment.

References

[1] Cagatay Sonmez, Sinan Isik, Mehmet Yunus Donmez, Ozlem Durmaz Incel, Cem Ersoy, "SUIT: A Cross Layer Image Transport Protocolwith Fuzzy Logic Based Congestion Control for Wireless Multimedia Sensor Networks", *IEEE Transactions 9781467302296, 2012*.

[2] Behrouz Safaiezadeh, Amir Masoud Rahmani, Ebrahim Mahdipour, " A New Fuzzy Congestion Control Algorithm in Computer Networks", in *Proceedings International Conference on Future Computer and Communication, 2009*.

[3] Chen Feng, Jia Yuanhua, Li Jian , Yi Huixin, Niu Zhonghai, " Design of Fuzzy Neural Network Control Method for Ramp Metering", *Third International Conference on Measuring Technology and Mechatronics Automation, 2011*.

[4] Parveen Jain, Manoj Sethi, " *Fuzzy Based Real Time Traffic Signal Controller to Optimize Congestion Delays*", *Second International Conference on Advanced Computing & Communication Technologies, 2012*.

[5] M. N. A. Rahim, I. Musirin, Z. A. Hamid, N. A. Mohamed Kamari, " Fuzzy Bee Colony Approach to Mitigate Congestion Problems through TCSC Installation for Voltage Corrective Strategy", IEEE, *International Conference on Innovation, Management and Technology Research (ICIMTR2012), Malacca, Malaysia : 21-22 May, 2012.*

[6] Jutan Wei, Bing Fan , Yi Sun, "A Congestion Control Scheme Based on Fuzzy Logic for Wireless Sensor Networks ", *IEEE 9th International Conference on Fuzzy Systems and Knowledge Discovery (FSKD 2012)*.

[7] Vaibhav Godbole, " Performance Analysis of Clustering Protocol using Fuzzy Logic for Wireless Sensor Network", *IAES International Journal of Artificial Intelligence (IJ-AI) Vol. 1, No. 3, September 2012, pp. 103~111, ISSN: 2252-8938.*

[8] R.-G.Cheng, C.-J.Chang, " Neural-network connection-admission control for ATM networks", *IEEE Proceedings online no. 19971088 Paper first received 18th June and in revised form 20th December 1996*.

[9] Xu Huang and Dharmendra Sharma, " Fuzzy Switching Controller for the Security in 802.11 Networks", *IEEE Transactions First International Conference on Networks & Communications, 2009*.

[10] *Angel Garrido,* " A Brief History of Fuzzy Logic", *Faculty of Sciences, UNED, Madrid, Spai, BRAINotes.*

