Real Time Monitoring and Evaluation of GSM Quality of Service Using Intelligent Agent

[1]Chineke A.H, and [2]Inyiama H.C.,
[1]Computer Engineering Department Michael Okpara University of Agriculture Umudike, Abia State., Nigeria
[2]Electronic and Computer Engineering Department, Nnamdi Azikiwe University Awka, Anambra State, Nigeria

Abstract: The problem of not having free and quality communication network had been a catalogue of problem of not passing piece of information from source to sink in our communication network through GSM.This not having free and quality network which had arisen as a result of not monitoring when there is high bit error rate was overcome in this paper by Real time monitoring and Evaluation of GSM quality of service using intelligent agent. This is done in this manner determining the channel capacity for GSM quality network, determining the bit error rate for the given capacity, designing an intelligent GSM rule that will monitor and reduce the high bit error rate for quality service and designing a Simulink model for real time monitoring and evaluation of GSM quality of service using intelligent agent. The result obtained is10% better than using the conventional techniques like hieratical, proportional integral derivative (PID). Real time monitoring and Evaluation of GSM quality of service using intelligent agent is the best method to have a perfect and free network in our communication network.

Keywords: *Real Time Monitoring And Evaluation Of GSM Quality Of Service, Intelligent Agent*

I. INTRODUCTION

Real time monitoring and Evaluation of GSM quality of service using intelligent agent is the pivot of this paper. With this it is a well-known fact thatWireless mobile communication system has grown from ,the first generation (1G) of analogue system,through the second generation (2G) of digital system to the ever maturing third generation (3G) high speedmultiple service system [1] and has transformed the ease of communication the world over. However, thewidespread use of mobile communications has heightened consumer demand for better quality service. Thus, network operators the world over, face the challenges of improving the quality of service while increasing capacity and rolling out new services as they provide wider coverage at the same time had led to 4G (fourth generation) as the fourthgeneration of mobile telecommunications technology, succeeding 3G and preceding 5G (fifth generation)and 6G (sixth generation). A 4G system support applications like amended mobile web access, IP telephony, gaming services, high-definition mobile TV, video conferencing, 3D television, and cloud computing in addition to the usual voice and other services of 3G. Two 4G candidate systems arePerformance and quality of service (QoS) evaluation are the most important to the mobile operators as therevenue generation and customer satisfaction are directly related to network performance and quality. The Network needs to be under continuous monitoring and control to maintain and improve the performance of the system [2]. Usually, statistics generated from drive tests or network managementsystems are used to unravel network problems and provide useful recommendations to resolve them.This process called radio frequency (RF) optimization is continuously required as the network evolves.Through RF Optimization, the quality of service and usage of the network resources are greatly improved and the balance between coverage and capacity is achieved using existing network resources. In some cases, upgrading of existing resources or additional resources may be required to meet the ever increasing demands for QoS

Drive test trial is the most common way to analyze cellular network performance as it provides

Packet Loss: happens when one or more packets of data being transported across theinternet or a computer network fail to reach their destination. Wireless and IP networkscannot provide a guarantee that packets will be delivered at all, and will fail to deliver(drop) some packets if they arrive when their buffers are already full. This loss ofpackets can be caused by other factors like signal degradation, high loads on networkcommercially deployed: the Mobile WiMAX and LongTerm Evolution (LTE) [8].

Jitter: Jitter is the delay variation and is introduced by the variable transmission ofdelay of the packets over the network. This can occur because of routers' internalqueues behavior in certain circumstances (e.g. flow congestion), routing changes, etc.This parameter can seriously affect the quality of streaming audio and/or video. Tohandle jitter, it is needed to collect packets and hold them long enough until the slowestpackets arrive in time, rearranging them to be played in the correct sequence. Jitterbuffers can be observing when using video or audio streaming websites (e.g. YouTube)and are used to counter jitter introduced by the internet so that a continuous playout ofthe media transmitted over the network can be possible. When clicking in a link to playthe video, buffering starts before the media stream actually does. This procedure causesadditional delay, but is necessary in the case of jitter sensitive applications.links, packets that are corrupted being discarded or defect in network elements.Wireless networks have higher probability of loss that is introduced by the air interface(e.g. interference caused by other systems, multiple obstacles (buildings, environment)in the path, multipath fading, etc.). Some transport protocols such as Transfer ControlProtocol (TCP) make delivery control by receiving acknowledgements of packet receiptfrom the receiver. If packets are lost during transfer, TCP will automatically resend thesegments which were not acknowledged at the cost of decreasing the overall throughputof the connection.

Throughput: Throughput is the amount of data which a network or entity sends orreceives data, or the amount of data processed in one determined time space. It has asbasic units of measures the bits per second (bit/s or bps). The throughput can be lowerthan the input tax due to losses and delays in the system. Throughput is a good measureof the channel capacity of a communications link. A good example of throughputmeasure is performed by a bandwidth meter (which is used for measuring the real transfer rate that a DSL connection has). The Bandwidth Meter estimates the currentthroughput of a DSL connection by calculating the rate at which a test file is deliveredto the computer for a particular Server. Paying for a 1000kbps DSL connection meansthat the bandwidth available for this connection is up to this 1000kbps in the accessnetwork. A bandwidth meter tool reliably measures the speed with which a user candownload information from particular servers. However, it may not reflect users'experience downloading particular pages on the Internet. There are many factors whichaffect the rate at which webpages and files download, regardless of the connection type.

II. MATERIALS AND METHOD

To determine the channel capacity for GSM quality network

To evaluate bit error rate in channel capacity at frequency diversity

The behavior of the network was observed using the proposed mathematical model of equations below. This aided in analyzing the system performance.

What is the channel capacity for a tele printer channel with a100Hz,200Hz 300Hz, 400 Hz,500Hz and 600Hz bandwidth and a signal-to-noise ratio of 3 DB?

Solution:

Using Shannon's equation: $C = B \log_2(1 + SNR)$ we have

B = 100 Hz and SNR =3dB ………. equ. 1

Therefore, SNR = 10^0.3 ………. equ. 2

C1 = 4.76Bps

To calculate the capacity when the frequency is 200Hz

C2 = 200log2(2.995)
C2 = 10^2*0.476
C2 = 47.6bps

To find the value of the capacity when the frequency is 300Hz

B = 300 Hz and SNR (in dB) = 3,

Therefore, $SNR = 10^{0.3}$

$C3 = 300 \log_2(1 + 10^{0.3})$
C3 = 476 bps

To evaluate the channel capacity when the frequency is 400Hz

C4 = 400log2(2.995)
C4 = 4760bps

To solve for the channel capacity when the frequency is 500Hz

C5 = 500log2(2.995)
C5 = 47600bps

To calculate the channel capacity when the frequency is 600Hz

C6 = 600log2(2.995)
C6 = 476000bps

To determine the bit error rate for the given capacity, Let's say that 1,000 bits are transmitted, and a bit, 2 bits, 3 bits, 4 bits, 5 bits, 6 bits, 7 bits and 8 bits received are error because of some kind interference between the transmitter and receiver.

BER in this example is calculated by dividing the number of error bits by the total number of bits transmitted

$BER = \frac{1}{1,000} = 0.001$

To find BER at 2 bit error rate

$\frac{2}{1,000,000} = 0.000002$

To find BER at 3 bit error rate

$BER = \frac{\text{Errored bits received}}{\text{Total number of bits}}$

$\frac{3}{1,000} = 0.003$

To find BER at 4 bit error rate

$BER = \frac{\text{Errored bits received}}{\text{Total number of bits}}$

$BER = \frac{4}{1,000} = 0.004$

To design an intelligent GSM rule that will monitor and reduce the high bit error rate for quality service

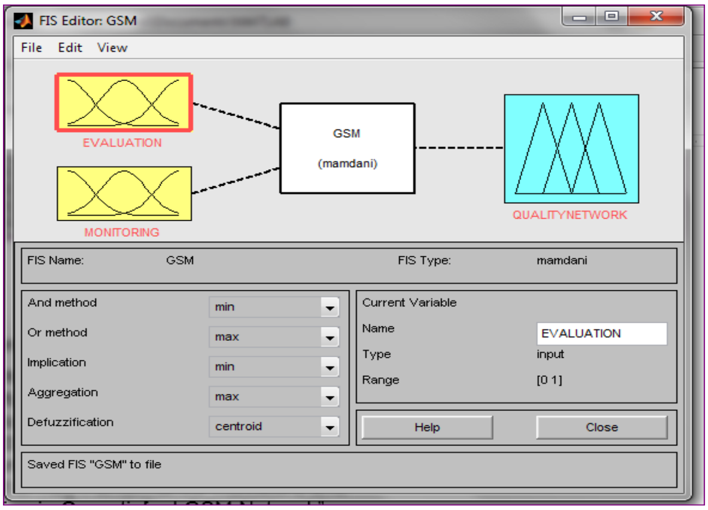

Figure 1: Fuzzy inference system editor for GSM

Fig 1 Shows Fuzzy inference system editor for GSM that has two inputs of evaluation and monitor. It also has an output of quality network.

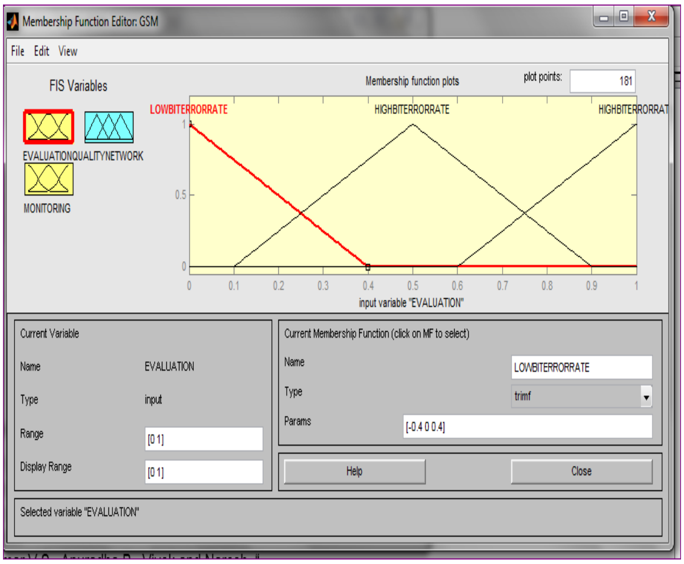

Figure 2: Membership function for GSM evaluation.

Fig 2 Shows membership function for GSM evaluation that analysis the bit error rate.

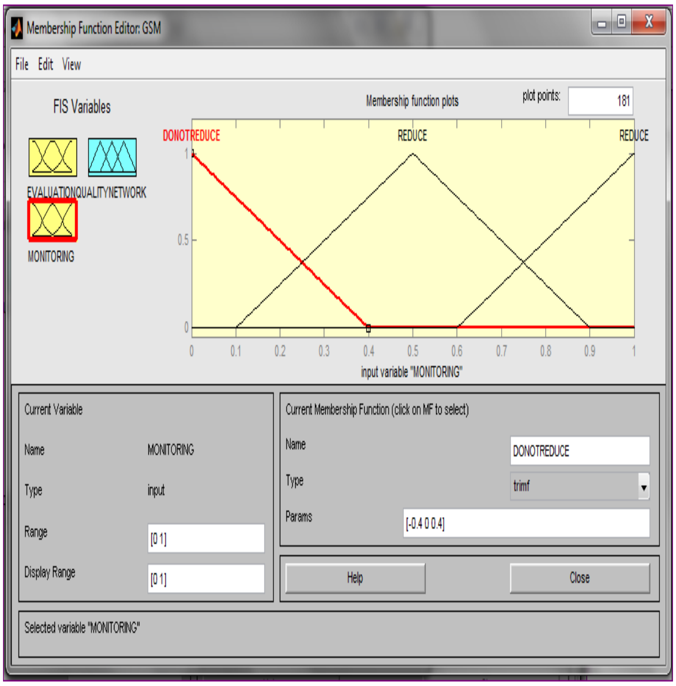

Figure 3: Membership function editor for monitoring

Fig 3 Shows membership function editor for monitoring. This monitors and finds out when the communication network is high and instructs for its reduction.

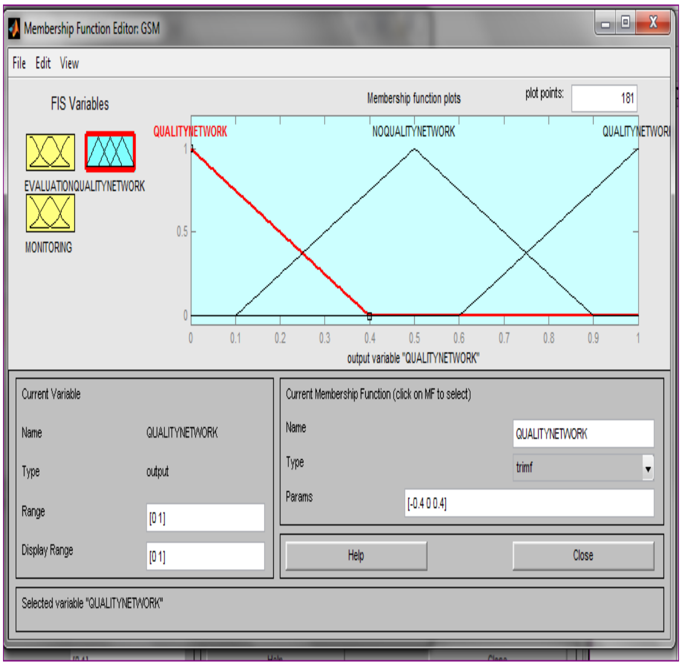

Figure 4: Membership function for quality network

Fig 4 Shows membership function for quality network that identifies if the network is free or not.

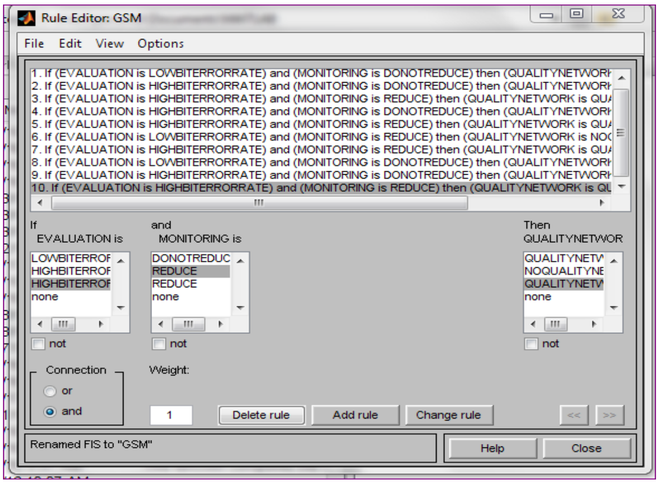

Figure 5: Rule editor for GSM network

Fig 5 Shows rule editor for GSM network that is strictly trained to stick to the rule of reducing the bit error rate when it is high for an efficient and quality network.

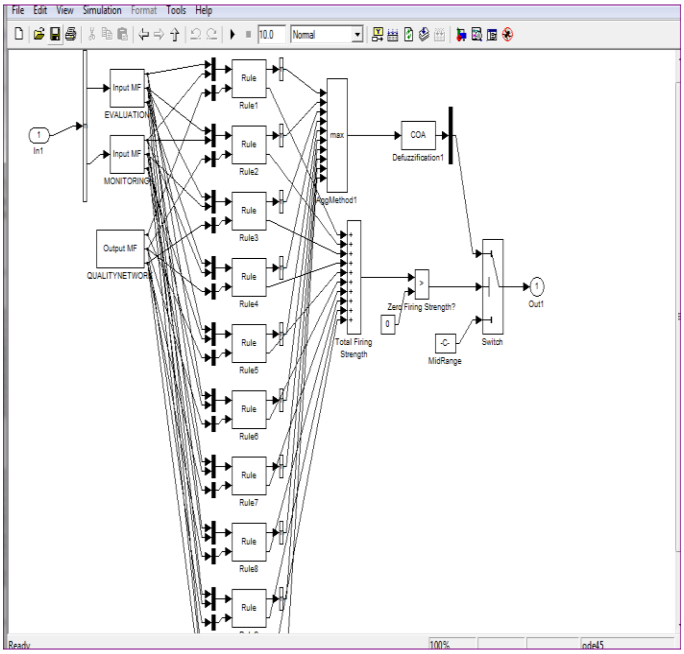

Figure 6: Imbibed rules in the fuzzy logic block

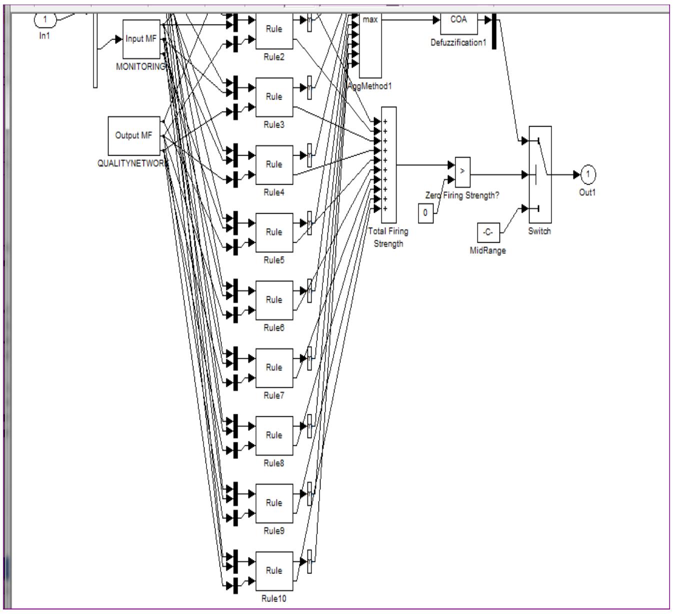

Figure 7: Imbibed GSM rules in the fuzzy logic block

Figures 6 and 7 Show the ten rules of GSM network imbibed in the intelligent agent fuzzy logic control block that enhance the reduction of high for an effective and quality network. To design a Simulink model for real time monitoring and evaluation of GSM quality of service using intelligent agent

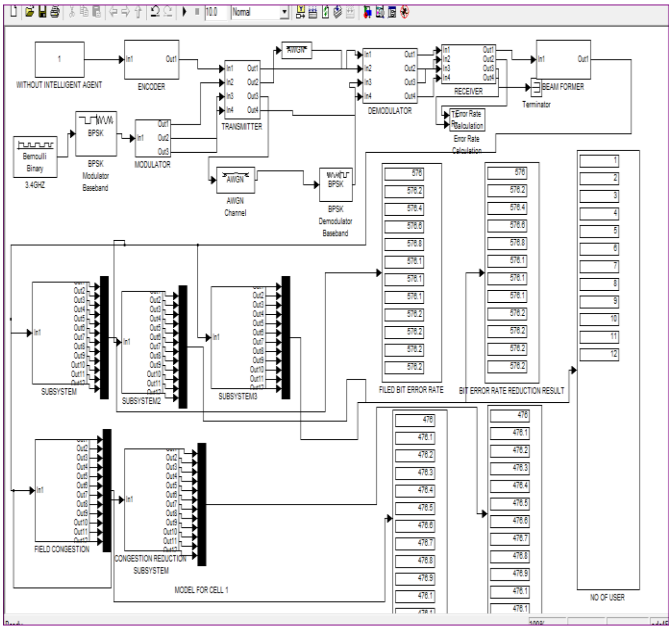

Figure 8: Designed Simulink model for real time monitoring and evaluation of GSM quality of service without using intelligent agent

Fig 8 Shows designed Simulink model for real time monitoring and evaluation of GSM quality of service without using intelligent agent. In this Fig 8 as the bit error rate is high there is an increase in congestion in the communication network thereby leading to low quality or bad network where service will not be experienced.

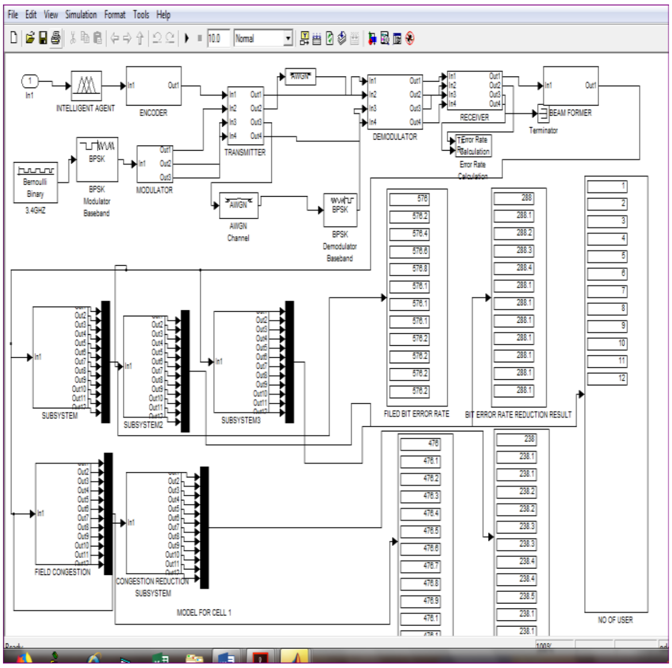

Figure 9: Designed Simulink model for real time monitoring and evaluation of GSM quality of service t using intelligent agent

Fig 9 Shows designed Simulink model for real time monitoring and evaluation of GSM quality of service using intelligent agent. Fig 9 shows that when an intelligent agent monitors and finds out that there is an increase in bit error rate that might cause the network not to be free, the intelligent agent reduces the high bit error rate and the congestion concurrently thereby enhancing quality and free network in communication system.

III. RESULT ANALYSIS

Table 1 Comparing bit error rate without and with intelligent in real time monitoring and evaluation of GSM quality of service

Bit Error Rate Without Intelligent Agent	Bit Error Rate With Intelligent Agent	Time
576	288	1
576.2	288.1	2
576.4	288.2	3
576.6	288.3	4
576.8	288.4	5
576.10	288.1	6
576.12	288.1	7
576.14	288.1	8
576.16	288.1	9
576.18	288.1	10
576.20	288.1	11
576.22	288.1	12

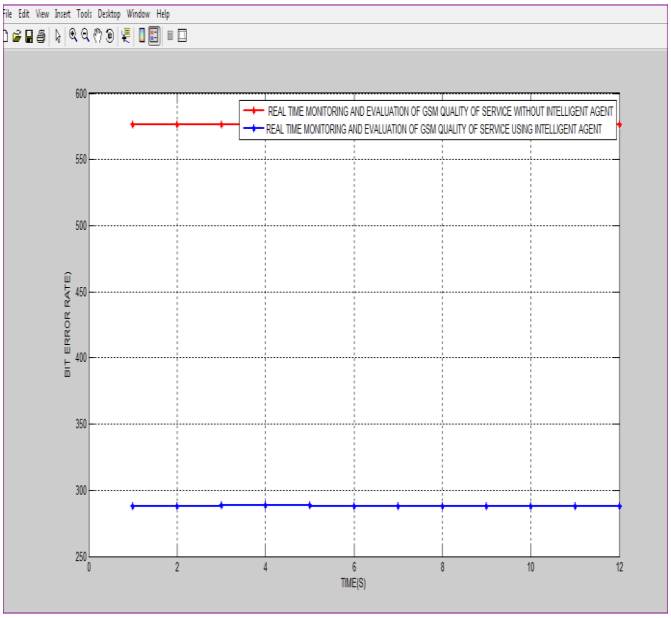

Figure 10: Comparing bit error rate without and with intelligent in real time monitoring and evaluation of GSM quality of service

Fig 10 Shows comparing bit error rate without and with intelligent in real time monitoring and evaluation of GSM quality of service. It shows that the high bit error rate reduces when an intelligent agent is incorporated thereby enhances quality service of free communication network to the subscribers. On the other hand there is no free communication network when an intelligent agent is not introduced in the system thereby causing poor network.

Table 2: Comparing congestion without and with intelligent in real time monitoring and evaluation of GSM quality of service

Congestion Without Intelligent Agent	Congestion With Intelligent Agent	Time
476	238	1
476.1	238.1	2
476.2	238.1	3

476.3	238.2	4
476.4	238.2	5
476.5	238.3	6
476.6	238.3	7
476.7	238.4	8
476.8	238.4	9
476.9	238.1	10
476.10	238.1	11
476.12	238.1	12

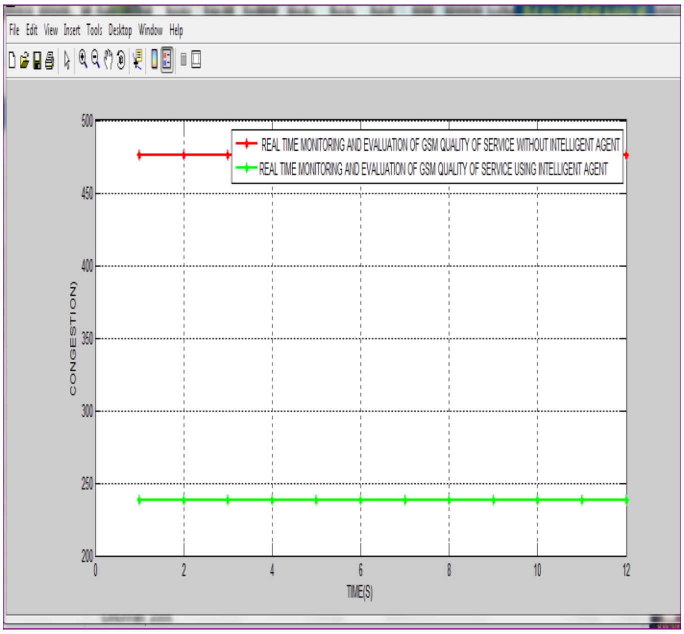

Figure 11: Comparing congestion without and with intelligent agent in real time monitoring and evaluation of GSM quality of service

Fig 11 Shows comparing congestion without and with intelligent agent in real time monitoring and evaluation of GSM quality of service. Fig 11 shows that there is congestion reduction when an intelligent agent is incorporated in the system which increases the quality of the communication network unlike when an intelligent agent is not incorporated in the system.

CONCLUSION

The problem of not having free and quality network in our communication network can be overcome by real time monitoring and evaluation of GSM quality of service using intelligent agent.. This can be done in this way, determining the channel capacity for GSM quality network, determining the bit error rate for the given capacity, designing an intelligent GSM rule that will monitor and reduce the high bit error rate for quality service and designing a Simulink model for real time monitoring and evaluation of GSM quality of service using intelligent agent The result obtained is a free and quality communication network

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