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IMPROVING THE PERFORMANCE OF WAVELENGTH MULTIPLEXER USING INTELLIGENT OPTICAL BANDPASS FILTER

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Abstract: *The low performance of wavelength multiplexer has liquidated a lot of companies or establishments that depend on data for their day-to-day businesses. This can be done by introducing improving the performance of wavelength multiplexers using an intelligent optical bandpass filter. To achieve this, it is done in this manner, characterizing the network under study, determining the hitches of wavelength multiplexer performance such as congestion and bit error rate from the characterized data, designing optical bandpass rule base that will reduce the hitches of wavelength multiplexer performance, training ANN in these rule base to enhance the efficacy of reducing the hitches of wavelength multiplexer performance and designing a SIMULINK model for improving the performance of wavelength multiplexer using intelligent optical bandpass filter The results obtained are the highest conventional congestion is 5.67bits/s in 6hours time while when intelligent optical bandpass filter is incorporated in the system the congestion reduced to 5.31bits/s thereby enhanced the efficacy of wavelength multiplexer performance and the highest conventional bit error rate in improving the performance of wavelength multiplexer is 0.000084 bits while that when an intelligent optical bandpass filter is incorporated in the system is reduced to 0.000079 bits. This vehemently catalyzed the improved performance of the wavelength multiplexer to 6.3%.*

1.0 Introduction

In this work, we review the implementation details of bidirectional PON system architecture. Firstly, it describes three proposed system models, the first system does not include AWGs, the second system includes AWG at RN and the final system includes two cascaded AWGs at both CO and RN. It explains the implementation

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environment and then the final results are discussed. As well as, we compare main measurements such as BER versus received power for each system model.

The delay in transmitting data from transmission to receiver in our communication network has become a very big problem in our society and the country at large. This singular reason for late transmission of data from the receiver to transmission has motivated the researcher to source for a means of averting it**.** Wireless networking is becoming increasingly important and a popular way of providing global information access to users on the move. Various popular protocols such as IEEE 802.11/16/21 (Sharif & Maeda, 2011; Wong *et al.*, 2009), and technologies such as; WLAN, WiMAX, GPRS, Long Term Evolution (LTE), and 3G/4G Cellular wireless networks provide mobile users universal and seamless mobility for all kinds of traffic. Worldwide Interoperability for Microwave Access (WiMAX) is a recent wireless broadband standard that has promised high bandwidth overlong-range transmission (Mohammed *et al.*, 2010). WiMax is one of the technologies that is being used for 4G networks and can be used in both point-to-point and the typical WAN type configurations that are also used by 2G and 3G mobile network carriers. Its formal name is IEEE standard 802.16 (Rogers & Edwards, 2003).

2.0 Methodology

'To characterize the network understudy

Table 1: Results of Packet transmitted and Packet received in GLO network

TIME	PACKET TRANSMITTED	PACKET RECEIVED	Packet loss
12.00 AM	30	25	0.8
1.00 AM	28	24	0.833
2.00 AM	26	20	0.7
3.00 AM	26	18	0.556
4.00 AM	24	16	0.5
5.00 AM	24	14	0.2858

The empirical data of packet transmitted, a packet received and packet loss was measured by an instrument known as J perf. This instrument is used in a communication network to get an accurate measurement of the packet received, a packet transmitted, and packet loss in a communication network. This hourly data was collected in the GLO office in the Enugu metropolis.

To determine the hitches of wavelength multiplexer performance such as congestion and bit error rate from the characterized data.

The empirical data of packet received, a packet transmitted and packet loss collected from the GLO network was used to form the mathematical model for the development of an intelligent routing algorithm for the improvement of throughput in data networks as shown in equation 3.1. This equation was used analytically

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to solve the congestion experienced in these hourly packet losses collected. The congestion in table 3.2 was analytically calculated.

The mathematical model for improving the performance of WDM using the routing technique is as shown in equation 2

L = 8/ 3W^2 ---1

Where L is packet loss

W is the network congestion

Then, make W the subject formula in equation 1

The mathematical model for congestion in the network is as shown in equation 2

W = Square root of 8/3L^2----------------------------------2

To find the network congestion in 12.00 AM

W_1 = square root 8/ 3 x 0.8^2

W_1 = square root 8 /3 x 0.64 = 8/1.92

W_1 =√ 4.17

W_1 =2.04

To find the network congestion in 1.00 AM

W_2 = square root 8/3 x 0.833^2

W_2 = 8 / 3 x 0.833^2 = 8/2.081667

W_2 =√ 3.84

W_2 = 1.96

To find the network congestion in 2.00 AM

W_3 = Square root of 8/ 3 x 0.7^2

W_3 = square root of 8/ 1.47 = 5.442

W_3 = √5.442

W_3 = 2.33

To find the network congestion in 3.00 AM

W_4 = Square root of 8/ 3 x0.556^2

W_4 = square root of 8/ 0.927

W_4 = √8.63

W_4 = 2.94

To find the network congestion in 4.00 AM

W_5 = square root of 8/3 x 0.5^2

W_5 = Square root of 8/ 0.75 =10.67

W_5 = √10.67

W_5 = 3.266

To find the network congestion in 5.00 AM

W_6 = Square root 8 / 3 x 0.2858^2

W_6 = Square root 8 / 0.25

W_6 = √32

W_6 = 5.67

To determine the bit error rate of the network

From the worst-case scenario, the linear relationship between BER and packet error rate (PER) is expressed as:

PER= 8 × BER ×MTU ×66/64---3

Where the MTU is the maximum transmission unit and using the Ethernet standards it is set to 1500 bytes for the simulations and then the MTU is increased to improve performance. Conversion from 8 bits to 1 byte is shown,

Recall 1 byte = 8bits

1500bytes = 8 x 1500 = 12000bits

MTU = 12000bits

PER is packet loss and BER is a bit error rate

To evaluate the bit error rate at 12 A.M when the packet loss is.

Make BER the subject formula in equation 3.3

BER_1 = PER/8 × MTU × 1.03125 -------------------------------4

BER_1 = 0.8/8 x 12000 x1.03125

BER_1 = 0.8/9900

BER_1 = 0.000081bits

To evaluate the bit error rate at 1.00 AM when the packet loss is 0.833.

BER_2 = 0.833/9900

BER_2 = 0.000084bits

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To evaluate the bit error rate at 2.00 AM when the packet loss is
BER3 = 0.7/9900
BER3 = 0.000071bits
To evaluate the bit error rate at 3.00 AM when the packet loss is 0.556.
BER4 = 0.556/9900
BER4 = 0.0000562bits
To evaluate the bit error rate at 4.00 AM when the packet loss is 0.5.
BER5 = 0.5/9900
BER5 = 0.000051 bits
To evaluate the bit error rate at 5.00 AM when the packet loss is 0.2858.
BER6 = 0.2858/9900
BER6 = 0.000030 bits

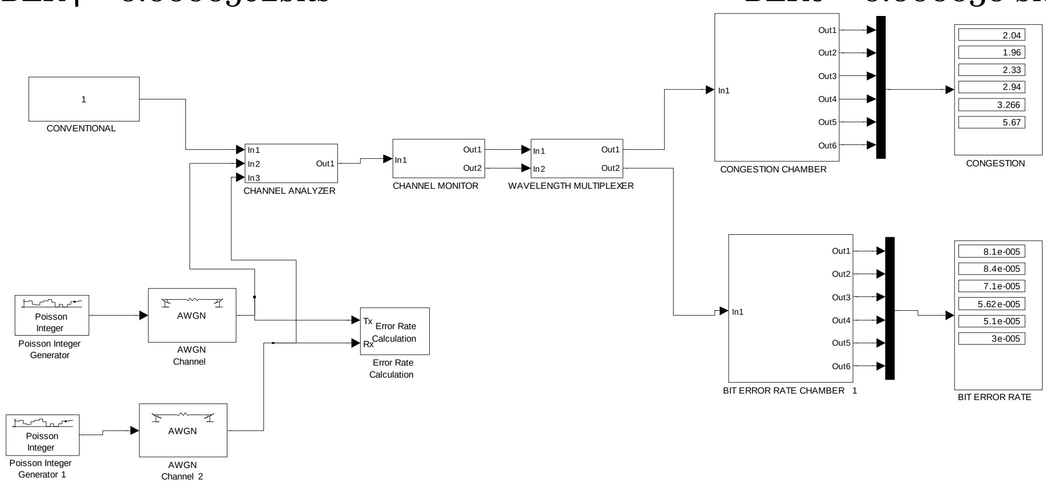

Fig 1 conventional SIMULINK model for improving the performance of wavelength multiplexer

Fig 1 shows the conventional SIMULINK model for improving the performance of the wavelength multiplexer. The results obtained after the simulation is as shown in figures 7 and 8.

To design an optical bandpass rule base that will reduce the hitches of wavelength multiplexer performance

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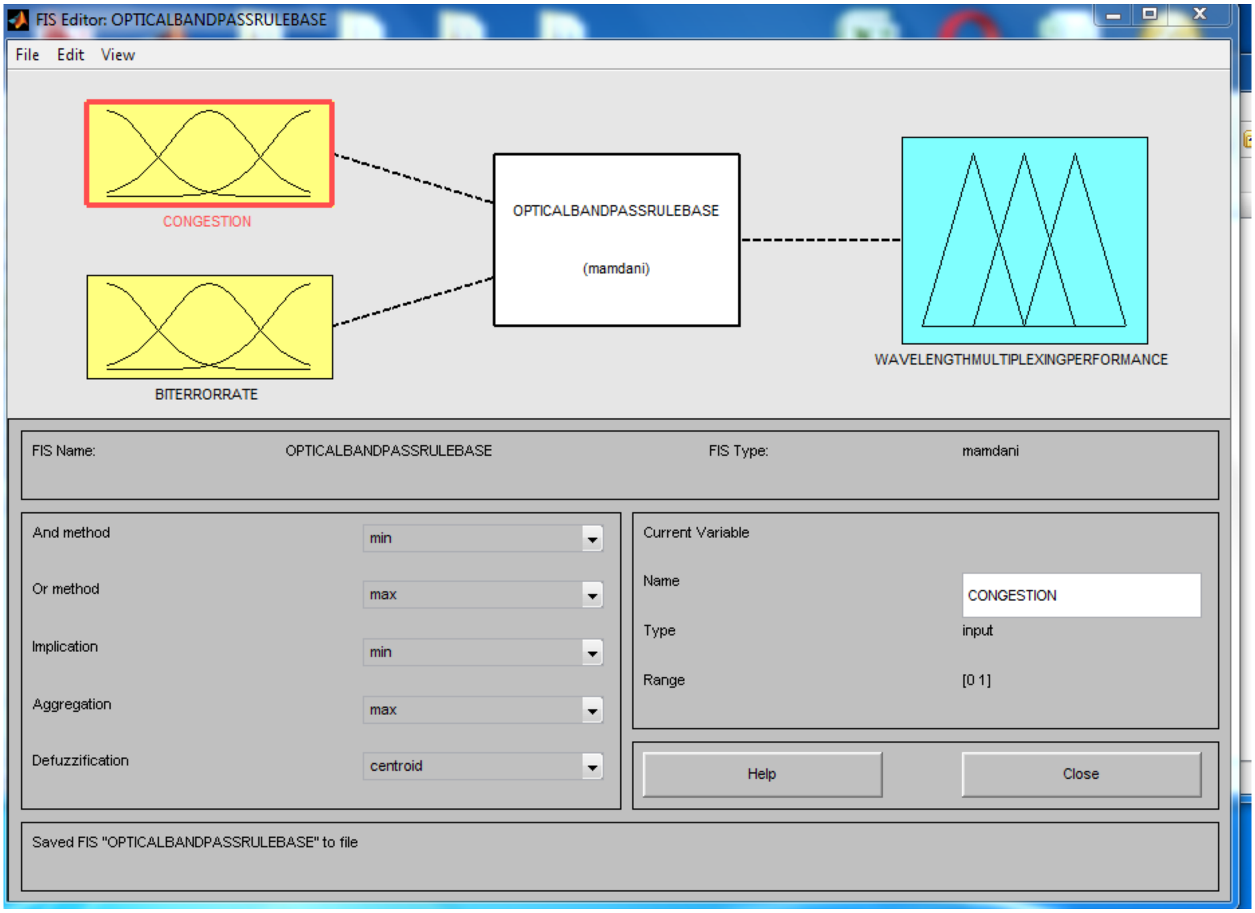

Fig 2 designs a fuzzy inference system for optical bandpass that will reduce the hitches of wavelength multiplexer performance. Fig 2 has two inputs of congestion and bit error rate. It also has an output of wavelength multiplexing performance.

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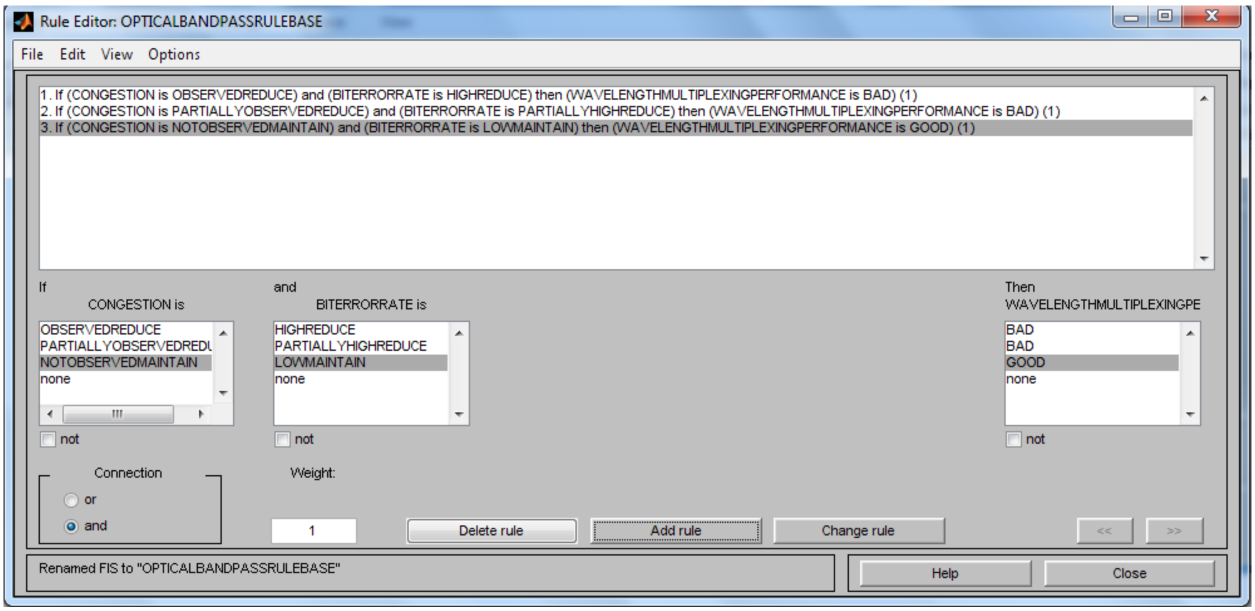

Fig 3 designed optical bandpass rule base that will reduce the hitches of wavelength multiplexer performance

Fig 3 shows **a** designed optical bandpass rule base that will reduce the hitches of wavelength multiplexer performance. The comprehensive detail of the rule base is shown in table 2.

Table 2 designed optical bandpass rule base that will reduce the hitches of wavelength multiplexer performance

1	IF CONGESTION IS OBSERVED REDUCE	AND BIT ERROR RATE IS HIGH REDUCE	THEN WAVELENGTH MULTIPLEXING PERFORMANCE IS BAD
2	IF CONGESTION IS PARTIALLY OBSERVED REDUCE	AND BIT ERROR RATE IS PARTIALLY HIGH REDUCE	THEN WAVELENGTH MULTIPLEXING PERFORMANCE IS BAD
3	IF CONGESTION IS NOT OBSERVED MAINTAIN	AND BIT ERROR RATE IS LOW MAINTAIN	THEN WAVELENGTH MULTIPLEXING PERFORMANCE IS GOOD

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To train ANN in these rule bases to enhance the efficacy of reducing the hitches of wavelength multiplexer performance.

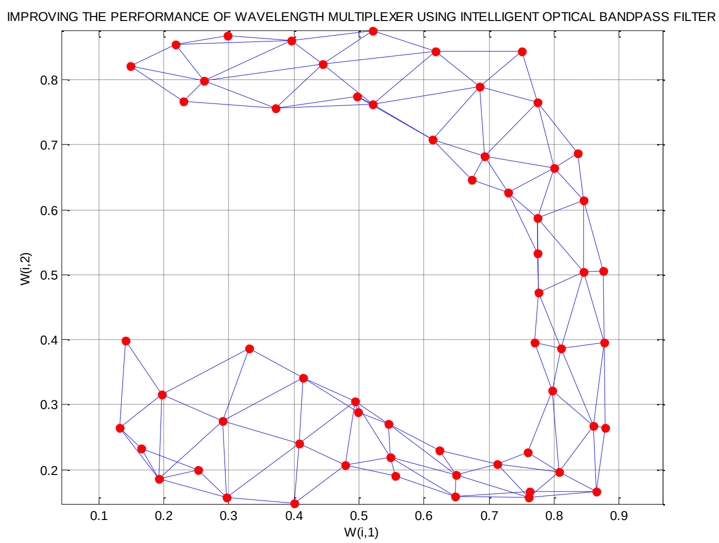

Fig4 trained ANN in this rule base to enhance the efficacy of reducing the hitches of wavelength multiplexer performance. Fig 4 shows that the three rules were trained twenty times to give sixty neurons 3 x 20 = 60 that mimics human intelligence.

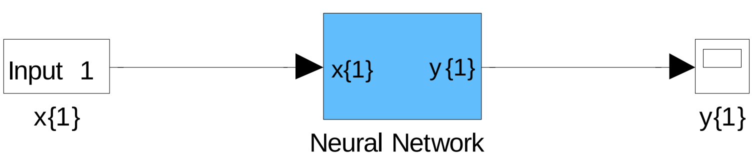

Fig 5 Result for trained ANN in rule base to enhance the efficacy of reducing the hitches of wavelength multiplexer performance. Fig 5 will be integrated into the conventional model for improving the performance of the wavelength multiplexer.
To train ANN in these rule bases to enhance the efficacy of reducing the hitches of wavelength multiplexer performance

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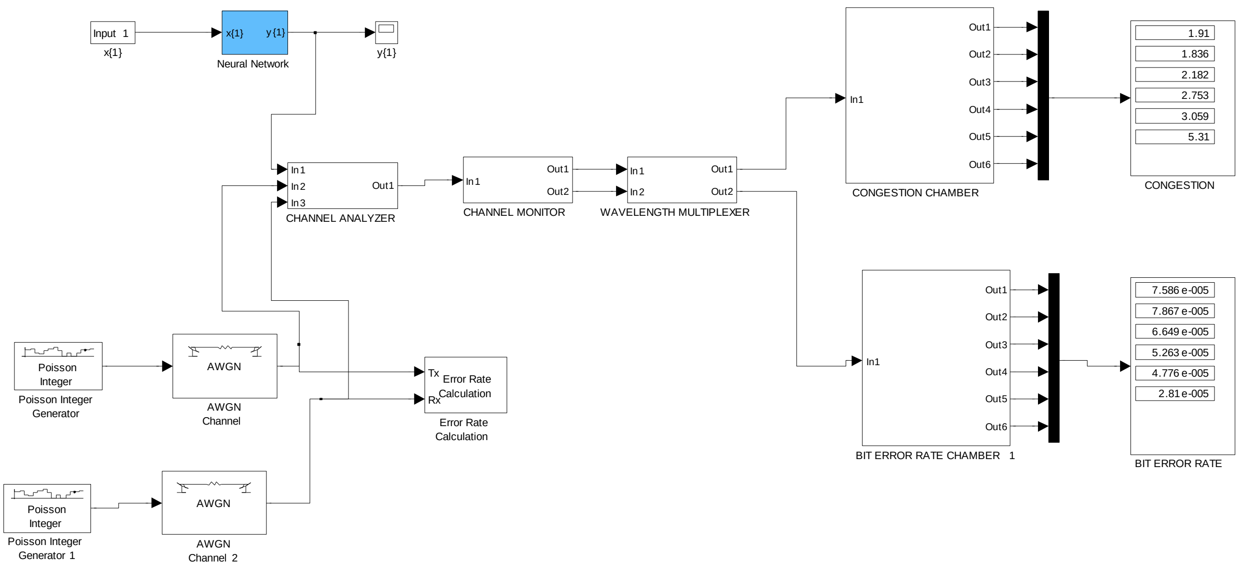

Fig 6 trained ANN in this rule base to enhance the efficacy of reducing the hitches of wavelength multiplexer performance. The results obtained are as shown in figures 7 and 8.

3.0 Discussion of Result

Table 2 compares conventional and intelligent optical bandpass filter congestion in improving the performance of wavelength multiplexer

Time(h)	Conventional congestion in improving the performance of wavelength multiplexer	Intelligent optical bandpass filter congestion in improving the performance of wavelength multiplexer
1	2.04	1.91
2	1.96	1.836
3	2.33	2.182
4	2.94	2.753
5	3.266	3.059
6	5.67	5.31

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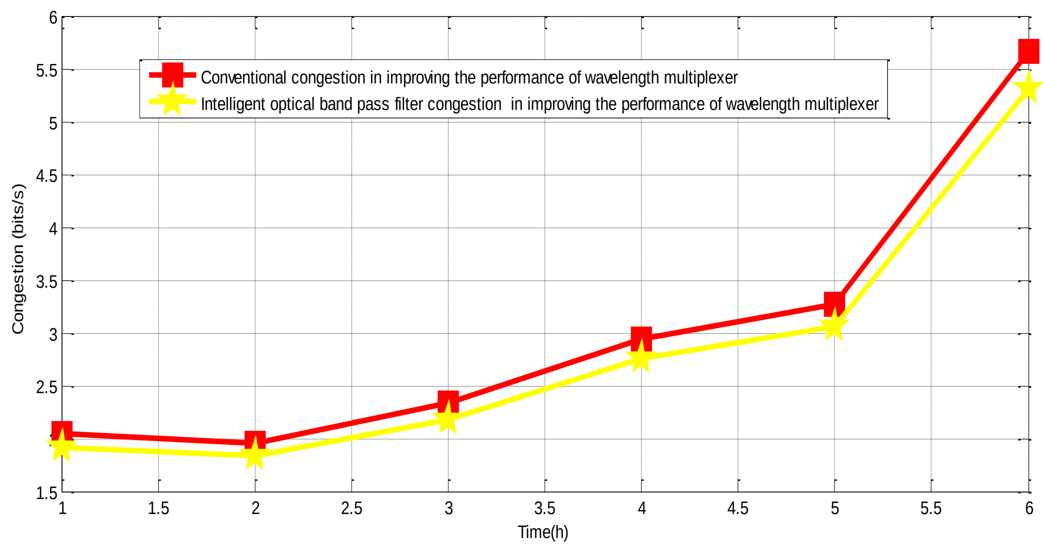

Fig 7 compares conventional and intelligent optical bandpass filter congestion in improving the performance of wavelength multiplexer

In fig 7 the highest conventional congestion is 5.67bits/s in 6hours of time while when an intelligent optical bandpass filter is incorporated into the system the congestion is reduced to 5.31bits/s thereby enhancing the efficacy of wavelength multiplexer performance.

Table 3 compares conventional and intelligent optical bandpass filter bit error rates in improving the performance of wavelength multiplexer

Time(h)	The conventional bit error rate in improving the performance of wavelength multiplexer	Intelligent optical bandpass filter bit error rate in improving the performance of wavelength multiplexer
1	0.000081	0.000075
2	0.000084	0.000079
3	0.000071	0.000065
4	0.0000562	0.000053
5	0.000051	0.000048
6	0.000030	0.000028

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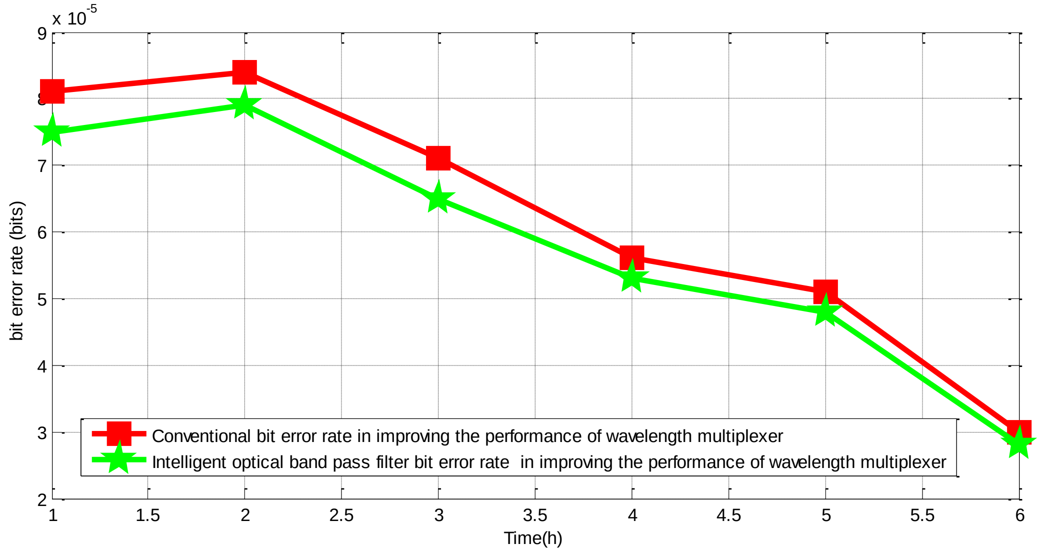

Fig 4 compares conventional and intelligent optical bandpass filter bit error rates in improving the performance of wavelength multiplexer. Fig 4 shows that the highest conventional bit error rate in improving the performance of wavelength multiplexer is 0.000084 bits while when an intelligent optical bandpass filter is incorporated in the system is reduced to 0.000079 bits. This vehemently catalyzed the improved performance of the wavelength multiplexer to 6.3%.

4.0 Conclusion

The low performance of wavelength multiplexer has solely liquidated some establishment that depends on the piece of information for their routine businesses. This is surmounted by introducing improving the performance of the wavelength multiplexer using an intelligent optical bandpass filter. To achieve this, it is done in this manner, characterizing the network under study, determining the hitches of wavelength multiplexer performance such as congestion and bit error rate from the characterized data, designing optical bandpass rule base that will reduce the hitches of wavelength multiplexer performance, training ANN in these rule base to enhance the efficacy of reducing the hitches of wavelength multiplexer performance and designing a SIMULINK model for improving the performance of wavelength multiplexer using intelligent optical bandpass filter The results obtained are the highest conventional congestion is 5.67bits/s in 6hours time while when intelligent optical bandpass filter is incorporated in the system the congestion reduced to 5.31bits/s thereby enhanced the efficacy of wavelength multiplexer performance and the highest conventional bit error rate in improving the performance of wavelength multiplexer is 0.000084 bits while that when an intelligent optical bandpass filter is incorporated in the system is reduced to 0.000079 bits. This vehemently catalyzed the improved performance of the wavelength multiplexer to 6.3%.

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