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Research Article

Improving Data Transmission in a Wireless Communication Network Using Remote Radio Control of Different Noise Channels Technique

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Abstract

Wireless communication networks are increasingly pivotal in modern technology, yet they are frequently hampered by noise interference, which degrades data transmission quality. This paper introduces a novel technique that employs remote radio control to manage and mitigate different noise channels, thereby enhancing data transmission efficiency. By leveraging advanced signal processing algorithms, fuzzy logic, and artificial neural networks (ANNs), the proposed method dynamically adjusts to varying noise conditions, ensuring optimal performance. The consistent decline in data transmission in wireless communication networks has negatively impacted businesses reliant on data for daily operations. This issue arises from interference, low signal-to-noise ratio (SNR), and reduced throughput. To address this, a technique using remote radio control of different noise channels can improve data transmission. The approach involves several steps: characterizing and modeling data communication based on key performance indicators (KPIs), designing a remote-control rule base to facilitate data transmission, training an ANN within this rule base to enhance data transmission efficiency, creating a SIMULINK model for remote radio control sensors, developing an algorithm to implement the process, integrating models, and simulating the integrated model for analysis and validation. Results show that conventional interference in data transmission is 178.6 watt/m², which decreases to 148.8 watt/m² with remote control, marking a 16.7% improvement. The conventional SNR of 0.837 dB improves to 1.004 dB with remote control. Additionally, conventional throughput, which was 66.67 kbps, increases to 80 kbps with remote control, enhancing data transmission. Moreover, the conventional packet reception in April was 185 kbps, increasing to 188 kbps with remote control, reflecting a 1.62% improvement. In summary, using remote radio control of different noise channels significantly enhances data transmission in wireless communication networks, reducing interference, and increasing both SNR and throughput. This method offers a practical solution to the challenges faced by businesses relying on stable data communication.

Keywords: Data Transmission; Wireless Communication Network; Remote Radio Control; Different Noise Channels Technique

Introduction

Wireless data communication transmits signals through the atmosphere utilizing the radio spectrum. This technology is applicable to both Local Area Networks (LANs) and Wide Area Networks (WANs) in either one-way or two-way configurations, and it supports both analog and digital signals (Zhou et al., 2014). Different segments of the radio spectrum, ranging from 30 Hz to 300 GHz, are employed by various wireless data communication applications and technologies to facilitate communication (Baek et al., 2009).

Broadband wireless technologies cater to a wide array of devices, including personal computers, smartphones, laptops, netbooks, ultra books, tablets, handheld devices, and other consumer gadgets such as music players and digital cameras, all of which are configured to operate over wireless broadband networks. These technologies enable the most efficient and effective wireless data transmission for specific applications (Shi et al., 2022). Common methods of wireless data transmission include infrared, 802.11-based, and 802.15-based technologies. The transmitted data can be in the form of digital messages originating from data sources, such as accessing data from an external hard disk on a computer. Alternatively, it can be analog signals, such as phone calls or video signals, that are digitized into a bit-stream using techniques like pulse code modulation (PCM). Establishing a wireless network involves adding a new network layer on top of the existing GSM network, forming a logical entity. This new layer represents a novel packet data bearer service built on the foundation of the existing GSM infrastructure. Key properties of wireless networks suitable for remote data collection are summarized as follows (Hong and Huang, 2021). Generally speaking, poor communication network is usually due to high bit rate causing interference, congestion; this stresses the transmission packet from one point to the other (Ngang et al.,2021)

Literature Review

Noise in Wireless Communication

Noise in wireless communication can originate from various sources, including environmental factors, electronic interference, and signal fading. Previous studies have explored various noise mitigation techniques such as error correction codes, spread spectrum methods, and adaptive filtering. However, these methods often lack the flexibility to adapt to rapidly changing noise conditions (Goldsmith, 2005; Proakis & Salehi, 2008; Sklar, 2001).

Remote Radio Control Techniques

Remote radio control techniques have been used in various applications to improve signal quality and manage interference. Recent advancements in this field have shown promise in enhancing wireless communication performance by dynamically adjusting signal parameters in real-time (Haykin, 2008; Tse & Viswanath, 2005; Wang & Poor, 2004).

Adaptive Control Mechanisms

Adaptive control mechanisms involve algorithms that automatically adjust system parameters to optimize performance. In wireless communication, these mechanisms can be used to adjust transmission power, frequency, and modulation schemes based on real-time noise conditions (Goldsmith, 2005; Rappaport, 2014; Zeng & Zhang, 2017).

Fuzzy Logic in Wireless Communication

Fuzzy logic has been used in wireless communication to handle uncertainties and imprecise information. It provides a robust framework for decision-making in complex environments where traditional binary logic fails (Zadeh, 1965).

Artificial Neural Networks in Wireless Communication

Artificial neural networks (ANNs) are effective in pattern recognition and adaptive learning. They have been applied in wireless communication for channel estimation, noise reduction, and signal prediction (Haykin, 1999).

Methodology

The proposed technique integrates remote radio control with adaptive control mechanisms using fuzzy logic and ANNs to manage different noise channels effectively. The system architecture includes:

Noise Detection Module: Continuously monitors the communication environment to detect and classify different types of noise.

Fuzzy Inference System: Processes the classified noise data to determine the degree of interference and necessary control actions.

ANN-Based Control Algorithm: Utilizes advanced signal processing techniques to analyze noise patterns and optimize control actions.

Remote Radio Control Unit: Implements control actions by adjusting transmission parameters such as power, frequency, and modulation schemes.

The methodology involves the following steps:

i. **Noise Monitoring**: Continuous monitoring of the wireless communication environment to detect noise interference.
ii. **Noise Classification:** Using machine learning algorithms to classify detected noise into predefined categories.
iii. **Fuzzy Inference**: Applying fuzzy logic to process classified noise data and determine the degree of interference.
iv. **ANN-Based Control:** Dynamically adjusting transmission parameters using an ANN-based control algorithm to minimize interference and maximize data throughput.

Characterization and System Design

Noise Detection Module

The noise detection module employs sensors and signal processing techniques to continuously monitor the wireless communication environment. Detected noise is classified using machine learning algorithms, providing input to the fuzzy inference system

Fuzzy Inference System

The fuzzy inference system processes the classified noise data, determining the degree of interference based on fuzzy rules. For instance, if noise level is high and signal quality is low, the fuzzy system may suggest increasing transmission power or changing the frequency.

ANN-Based Control Algorithm

The ANN-based control algorithm receives input from the fuzzy inference system and historical data. It adjusts transmission parameters such as power, frequency, and modulation schemes to optimize data transmission. The ANN is trained using historical noise patterns and network performance data to predict the best control actions.

Remote Radio Control Unit

The remote radio control unit implements the control actions determined by the ANN-based algorithm. It dynamically adjusts transmission parameters in real-time, responding to changing noise conditions.

Characterizing and modeling the data communication in a wireless communication network with respect to relevant key performance indicators (KPIs).

The following Key Performance Indicators (KPLs) are characterized. This is done from the point of view of the quality of service (QoS) of the network under study, the Nigerian Communication Commission (NCC) threshold values and international standard given by 3GPP and ITU regulations. To this effect, the KPIs are as follows:

(i) Reference Signal Received Power (RSRP).
(ii) Reference Signal Received Quality (RSRQ).
(iii) Received Signal Strength Indicator (RSSI).
(iv) Single User's Throughput.

When these KPIs are known, it is then possible to progress in the research by carrying out a modeling of the wireless network thereby confirming the data integrity of the KPIs. This leads to the implementation of other objectives and generation of results as expected

Table 1: Data collection in MTN on packet transmitted, received and time of transmission

TIME	*PACKET TRANSMITTED or FILE SIZE (kbps)*	*PACKET RECEIVED (kbps)*	*TRANSMISSION TIME (s)*
NOVEMBER	200	170	3
DECEMBER	200	140	5
JANUARY	200	150	5
FEBUARY	200	160	3
MARCH	200	180	2
APRIL	200	185	2
MAY	200	185	2

MTN cellular network operating on 4G network platform at a signal power of 32dBm

Let desired signal power or P_{signal} = -95dBm

Let typical noise power value P_{noise} = -115dBm

Characterization is classification of finding out the core causes of poor quality of service in transmission of data in data transmission in a wireless communication network. The core causes of poor quality of service in a wireless communication network are low throughput, interference and low signal to noise ratio. These factors that cause delay in transmission of data in wireless communication network are computed from the characterized collected data as shown from equations 1 through 4.

Applying formula to find SNR = $10Log_{10}(P_{signal/}\ P_{noise})$

$$SNR = 10\ Log_{10}(\ -95dBm/-115dBm) \quad (1)$$

$$SNR = 10\ Log_{10}0.8261$$

$$SNR = 10 \times -0.0837$$

$$SNR = 0.837dB$$

To find the packet loss in November

Packet loss = transmitted data – received data = 200 – 170= 30**(kbps)** **(2)**

Solving for packet loss in December

Packet loss = transmitted data – received data = 200 – 140= 60**(kbps)**

To find the packet loss in January

Packet loss = transmitted data – received data = 200 – 150= 50**(kbps)**

Solving for packet loss in February

Packet loss = transmitted data – received data = 200 – 160= 40**(kbps)**

To find the packet loss in March

Packet loss = transmitted data – received data = 200 – 180= 20**(kbps)**

Solving for packet loss in April

Packet loss = transmitted data – received data = 200 – 185= 15**(kbps)**

Solving for packet loss in May

Packet loss = transmitted data – received data = 200 – 185= 15**(kbps)**

To analytically solve for throughput

$$Throughput = File\ sie \div Transmission\ time \quad (3)$$

Solving for November throughput

$Throughput = 200 \div 3$

$Throughput = 66.67$**(kbps)**

Solving for December throughput

$Throughput = 200 \div 5$

$Throughput = 40$**(kbps)**

Solving for January throughput

$Throughput = 200 \div 5$

$Throughput = 40$**(kbps)**

Solving for February throughput

$Throughput = 200 \div 3$

$Throughput = 66.67$**(kbps)**

Solving for March throughput

$Throughput = 200 \div 2$

$Throughput = 100$**(kbps)**

Solving for April throughput

$Throughput = 200 \div 2$

$Throughput = 100$ (kbps)

Solving for May throughput

$Throughput = 200 \div 2$

$Throughput = 100$(kbps)

To compute the interference

Formula for two-point interference in waves that is from the transmitting point to the receiving point.

$I = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos(\sigma)$ (4)

Where I_1 and I_2 are intensities of the individual waves, σ is the phase difference between them

41vpm 900MH or 100 is to 1. Watt/

Where

$I_1 = 200$ watt/m^2

$I_2 = 2$watt/m^2

$\sigma = I_1 - I_2$

$\sigma = 200 - 2$

$\sigma = 198^0$

Then, apply formula to find the interference from the transmitting point to the receiving point in data transmission in a wireless communication network

$I = I_1 + I_2 + 2\sqrt{I_1 I_2}\cos(\sigma)$

$I = 200 + 2 + 2\sqrt{200 \text{x} 2}\cos 198^0$

$I = 202 + 2\sqrt{400}\cos 198^0$

$I = 202 + 2\sqrt{400 \text{ x} -0.34202}$

$I = 202 + 2\sqrt{-136.808}$

$I = 202 + 2\text{x} -11.7$

$I = 202 - 23.4$

$I = 178.6$watt/m^2

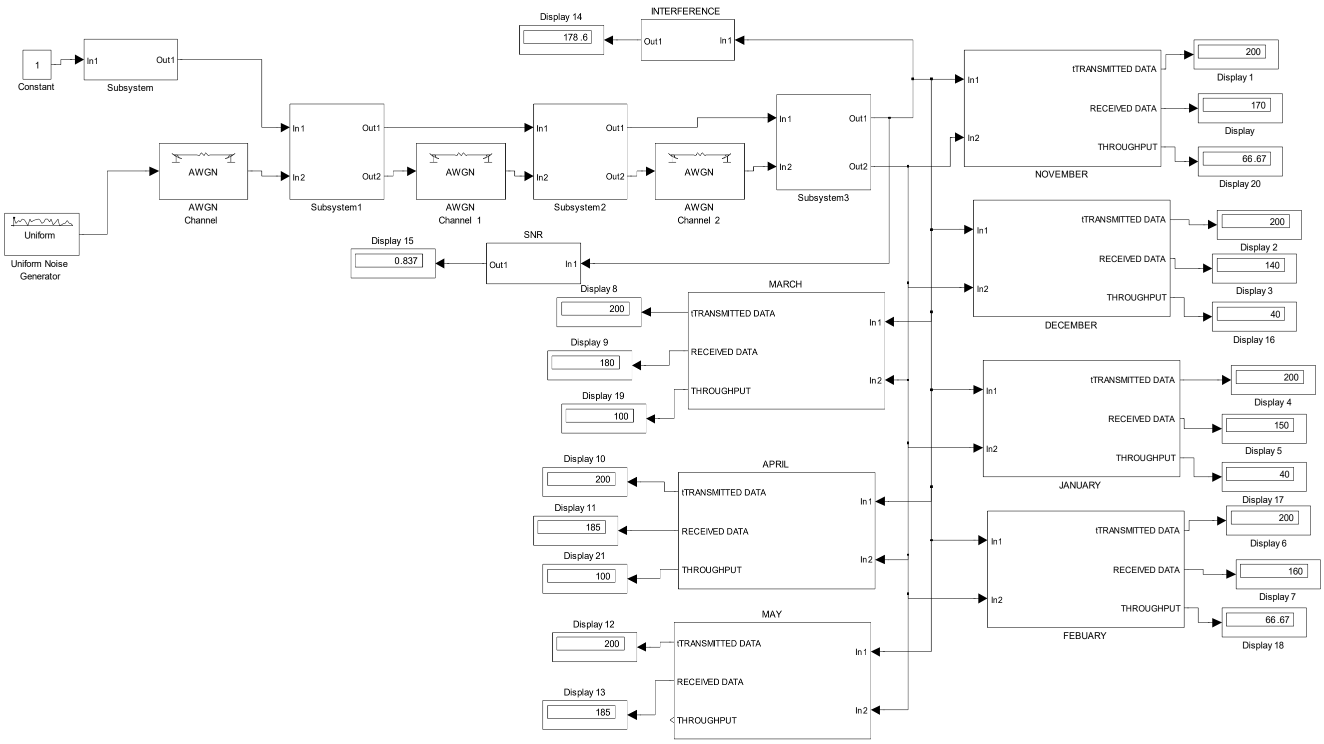

Fig. 1 conventional SIMULINK model for data transmission in a wireless communication network.

Designing a remote-control rule base that will facilitate data transmission from source to destination in a wireless network

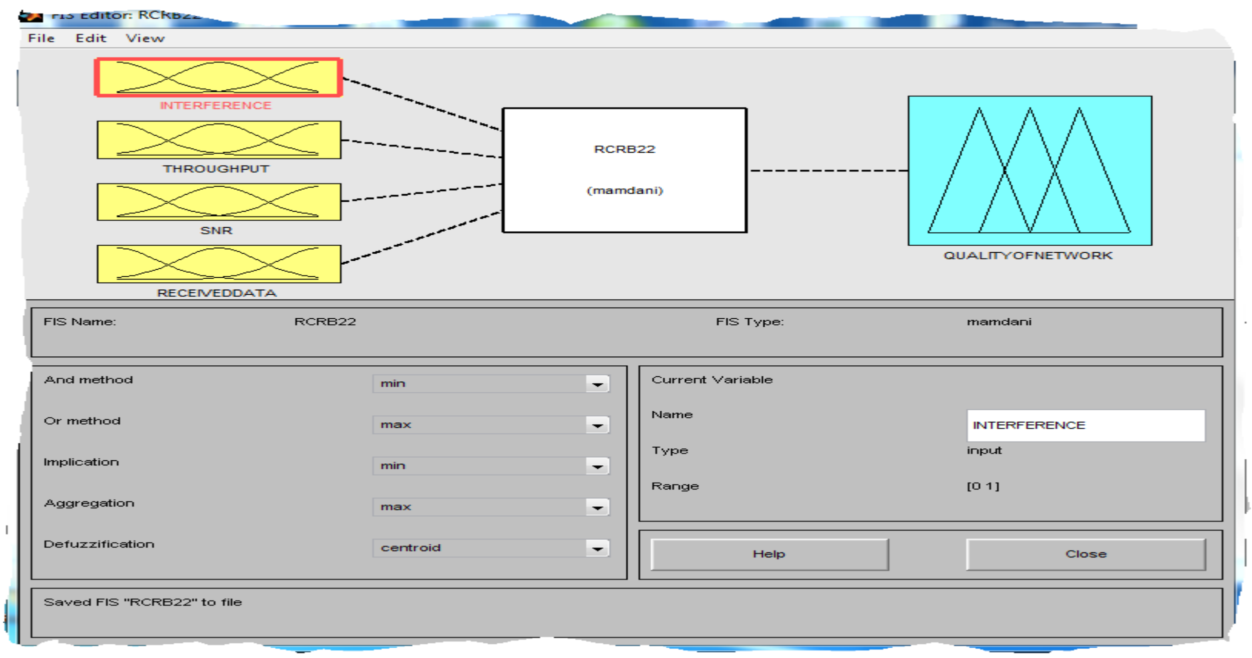

Fig. 2: Design a Remote Control Fuzzy inference system (FIS) that will facilitate data transmission from source to destination in a wireless network

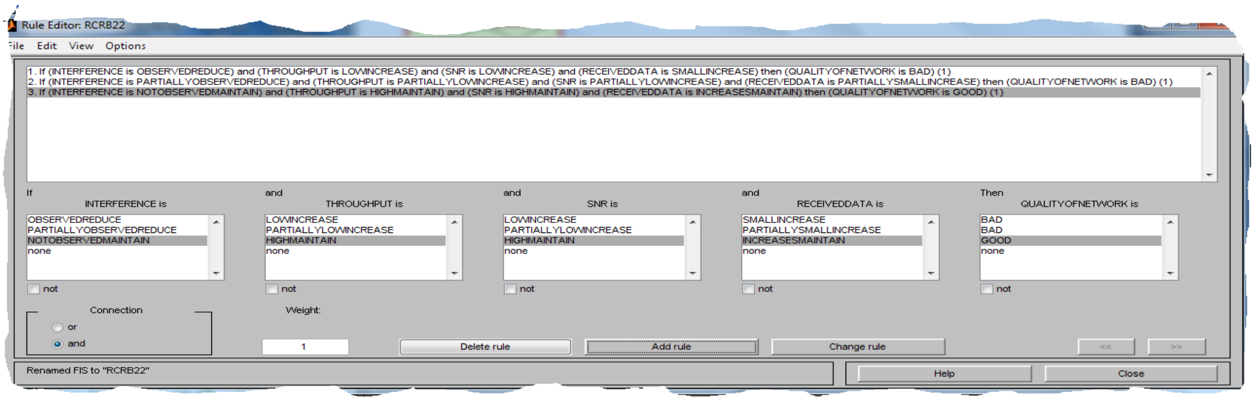

Fig. 3: Designed remote control rule base that will facilitate data transmission from source to destination in a wireless network

Table 2 Comprehensive Detail of Remote Control Rule Base that will Facilitate Data Transmission from Source to Destination in a Wireless Network

1	IF INTERFERENCE IS OBSERVED REDUCE	AND THROUGHPUT IS LOW INCREASE	AND SNR IS LOW INCREASE	AND RECEIVED DATA IS SMALL INCREASE	THEN QUALITY OF SERVICE IS BAD
2	IF INTERFERENCE IS PARTIALLY OBSERVED REDUCE	AND THROUGHPUT IS PARTIALLY LOW INCREASE	AND SNR IS PARTIALLY LOW INCREASE	AND RECEIVED DATA ISPARTIALLY SMALL INCREASE	THEN QUALITY OF SERVICE IS BAD
3	IF INTERFERENCE IS NOT OBSERVED MAINTAIN	AND THROUGHPUT IS HIGH MAINTAIN	AND SNR IS HIGH MAINTAIN	AND RECEIVED DATA IS MANY MAINTAIN	THEN QUALITY OF SERVICE IS GOOD

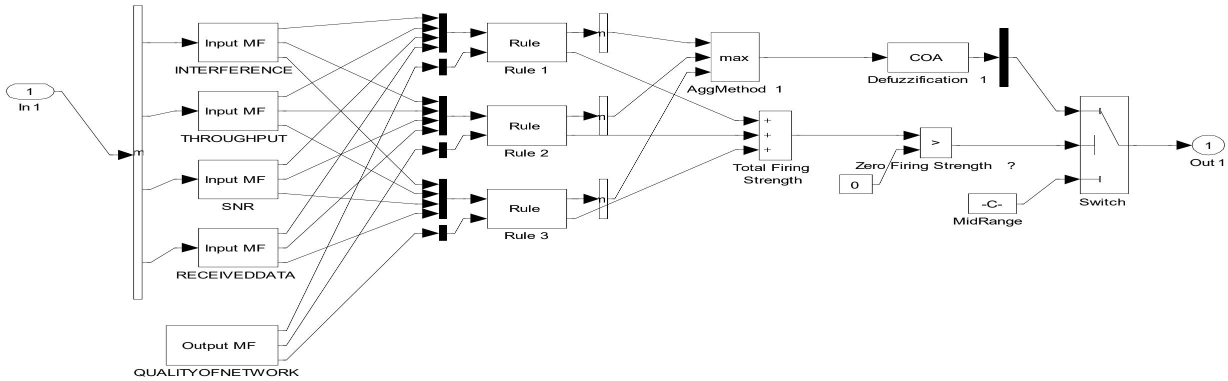

Fig 4: Result obtained when the three rules are incorporated in the designed SIMULINK model for remote radio control sensor

Training Artificial Neural Network (ANN) in the designed rule base to enhance the alertness of data transmission from source to destination.

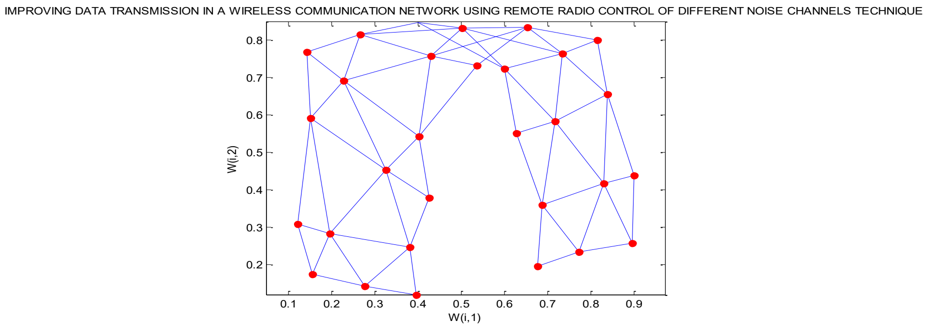

Fig 5: Trained Artificial Neural Network (ANN) in the designed rule base to enhance the alertness of data transmission from source to destination.

The three rules were trained ten times 3 x 10 = 30 to have thirty neurons that looks like human brain and which abide strictly to the rules. The result obtained during the training is as shown in fig 6

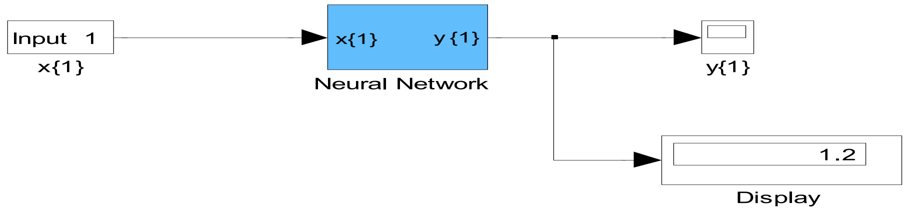

Fig 6: Result of the trained rules

Designing a SIMULINK Model for Remote Radio Control Sensor

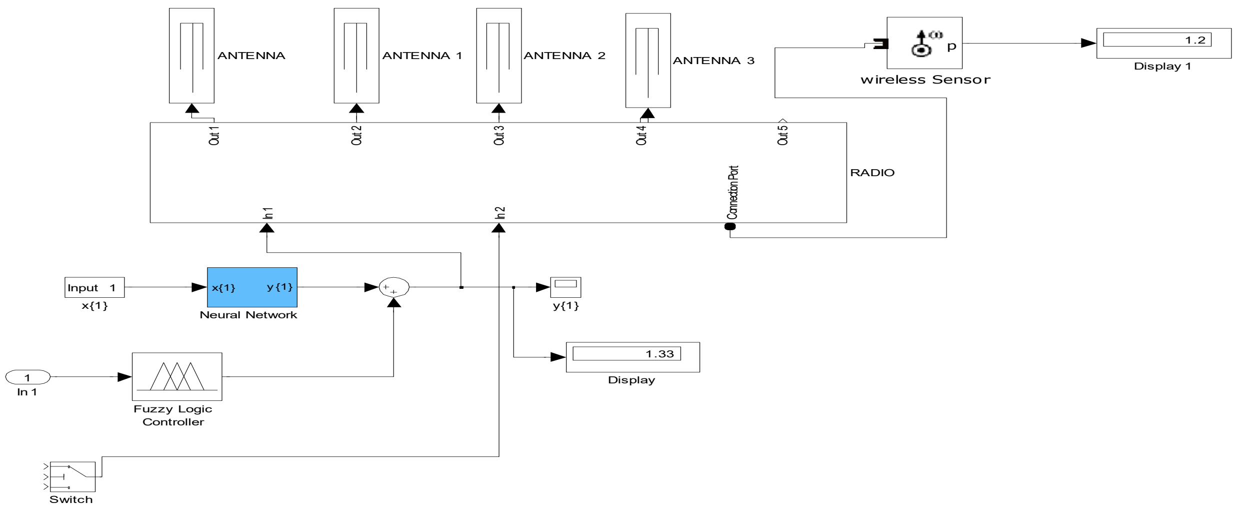

Fig 7: Designed SIMULINK model for remote radio control sensor

Proposing an algorithm for implementing objectives 2, 3 and 4

1. Identify low throughput that cause poor quality network
2. Identify low SNR that cause poor quality network
3. Identify interference observed that cause poor quality network
4. Identify small quantity of data received
5. Design a conventional SIMULINK model for data transmission in a wireless communication network and integrate 1, 2, 3 and 4.

6. Design a remote control rule base that will facilitate data transmission from source to destination in a wireless network
7. Train Artificial Neural Network (ANN) in the designed rule base to enhance the alertness of data transmission from source to destination
8. Design a SIMULINK model for remote radio control sensor
9. Integrate 6, 7 and 8
10. Integrate 9 in 5
11. Do data transmitted and received improved when 9 is integrated in 5.
12. If No go to 10
13. If yes go to 14
14. Improved data transmitted and received in a wireless communication network.
15. Stop.
16. End

Integrating models 1 and 4 and simulate the integrated model to generate results for further analysis

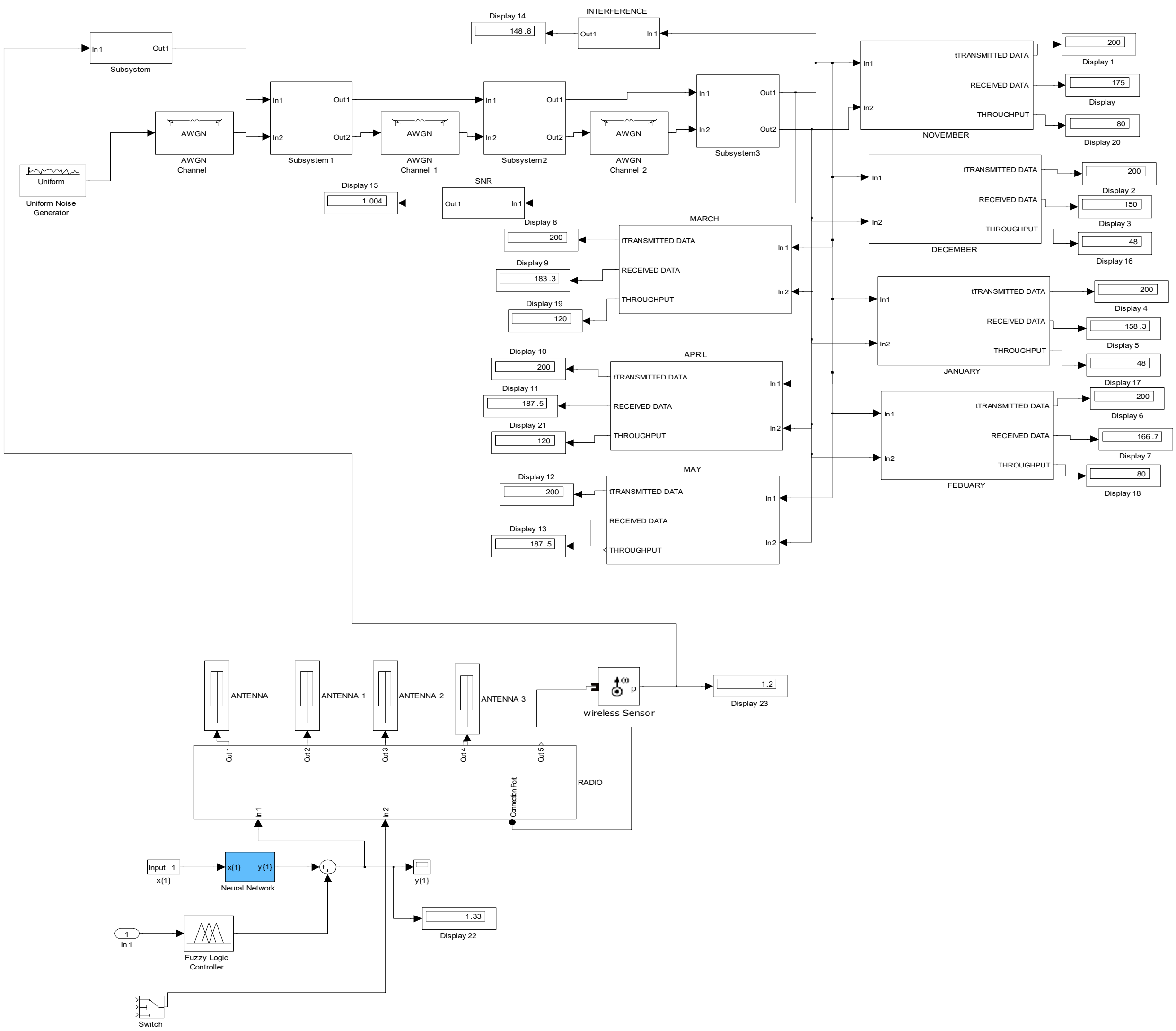

Fig 8: Integrated Model of the Conventional with Designed SIMULINK model for Remote Radio Control Sensor

Validating the results obtained in objectives 1 and 6 in order to justify the research by calculating the percentages of improvement in data transmission in a wireless communication network with and without remote radio control sensor

To find percentage improvement in throughput in MAY in data transmission in a wireless communication network using Remote radio control of different noise channels technique
Conventional throughput in MAY =100(kbps)
Remote radio control of different noise channels technique Throughput in May =120 (kbps)

% improvement in MAY throughput in data transmission in a wireless communication network using Remote radio control of different noise channels technique =

$$\frac{\text{Remote radio control throughput in May} - \text{Conventional throughput in May}}{\text{Conventional in May}} \times \frac{100\%}{1}$$

% improvement in throughput in May in data transmission in a wireless communication network using Remote radio control of different noise channels technique =

$$\frac{120 - 100}{100} \times 100\%$$

% improvement in SNR in data transmission in a wireless communication network using Remote radio control of different noise channels technique =20%

To find percentage improvement in SNR in data transmission in a wireless communication network using Remote radio control of different noise channels technique
Conventional SNR =0.837dB
Remote radio control of different noise channels technique SNR =1.004

% improvement in SNR in data transmission in a wireless communication network using Remote radio control of different noise channels technique =

$$\frac{\text{Remote radio control SNR} - \text{Conventional SNR}}{\text{Conventional SNR}} \times \frac{100\%}{1}$$

% improvement in SNR in data transmission in a wireless communication network using Remote radio control of different noise channels technique = $\frac{1.004 - 0.837}{0.837} \times \frac{100\%}{1}$

% improvement in SNR in data transmission in a wireless communication network using Remote radio control of different noise channels technique

To find percentage improvement in reduction of interference in data transmission in a wireless communication network using Remote radio control of different noise channels technique
Conventional interference =178.6watt/m^2

Remote radio control of different noise channels technique interference =148.8

% improvement in reduction of interference in data transmission in a wireless communication network using Remote radio control of different noise channels technique=

$$\frac{\text{Conventional interference - Remote radio control interference}}{\text{Conventional interference}} \times \frac{100\%}{1}$$

% improvement in reduction of interference in data transmission in a wireless communication network using Remote radio control of different noise channels technique = $\frac{178.6 - 148.8}{178.6} \times \frac{100\%}{1}$

% improvement in reduction of interference in data transmission in a wireless communication network using Remote radio control of different noise channels technique=16.7%

To find percentage improvement in the data received in November in data transmission in a wireless communication network using Remote radio control of different noise channels technique
Conventional data received =170
Remote radio control of different noise channels technique data received =175
% improvement in the data received in November in data transmission in a wireless communication network using Remote radio control of different noise channels technique =

$$\frac{\text{Remote radio control data received in November} - \text{conventional data received}}{\text{conventional data received in November}} \times \frac{100\%}{1}$$

% improvement in the data received in November in data transmission in a wireless communication network using Remote radio control of different noise channels technique= $\frac{175-170}{170} \times \frac{100\%}{1}$

% improvement in the data received in November in data transmission in a wireless communication network using Remote radio control of different noise channels technique=2.9%

To find percentage improvement in the data received in December in data transmission in a wireless communication network using Remote radio control of different noise channels technique
Conventional data received in December = 140
Remote control data received in December = 150
% improvement in the data received in December in data transmission in a wireless communication network using Remote radio control of different noise channels technique =

$$\frac{\text{Remote radio control data received in December} - \text{conventional data received}}{\text{conventional data received in December}} \times \frac{100\%}{1}$$

% improvement in the data received in December in data transmission in a wireless communication network using Remote radio control of different noise channels technique =

$$\frac{150-140}{140} \times \frac{100\%}{1}$$

% improvement in the data received in December in data transmission in a wireless communication network using Remote radio control of different noise channels technique =7.14%

To find percentage improvement in the data received in January in data transmission in a wireless communication network using Remote radio control of different noise channels technique
Conventional data received in January = 150
Remote control data received in January = 158
% improvement in the data received in January in data transmission in a wireless communication network using Remote radio control of different noise channels technique =

$$\frac{\text{Remote radio control data received in January} - \text{conventional data received}}{\text{Conventional data received in January}} \times \frac{100\%}{1}$$

% improvement in the data received in January in data transmission in a wireless communication network using Remote radio control of different noise channels technique = $\frac{158-150}{150} \times \frac{100\%}{1}$

% improvement in the data received in January in data transmission in a wireless communication network using Remote radio control of different noise channels technique =5.3%

To find percentage improvement in the data received in April in data transmission in a wireless communication network using Remote radio control of different noise channels technique
Conventional data received in April = 185
Remote control data received in April = 188

% improvement in the data received in April in data transmission in a wireless communication network using Remote radio control of different noise channels technique =

$$\frac{\text{Remote radio control data received in April} - \text{conventional data received}}{\text{Conventional data received in April}} \times \frac{100\%}{1}$$

% improvement in the data received in April in data transmission in a wireless communication network using Remote radio control of different noise channels technique = $\frac{188 - 185}{185} \times \frac{100\%}{1}$

% improvement in the data received in April in data transmission in a wireless communication network using Remote radio control of different noise channels technique =1.62%

Results and Discussion

Conventional SIMULINK Model

Figure 1 presents the conventional SIMULINK model for data transmission in a wireless communication network.

Inputs and Quality of Service

Figure 2 illustrates the four key inputs: interference, throughput, SNR (Signal-to-Noise Ratio), and data received. The output, Quality of Service (QoS), is significantly affected by these inputs. Poor QoS in wireless networks is primarily due to high interference, low throughput, low SNR, and minimal data reception. Addressing these issues requires a remote-control rule base designed to minimize interference, enhance throughput, and improve SNR, thereby boosting data transmission quality.

Remote Control Rule Base

Figure 3 shows the designed remote control rule base aimed at facilitating data transmission from source to destination in a wireless network, with comprehensive details provided in Table 2.

Rule Performance

Figure 4 demonstrates the effective performance of three stipulated rules in enhancing data transmission by reducing interference, increasing SNR, and boosting throughput within the SIMULINK model for remote radio control.

Artificial Neural Network Training

Figure 5 displays the trained Artificial Neural Network (ANN) within the rule base, designed to enhance data transmission alertness. The three rules were trained ten times each (3 x 10 = 30), resulting in thirty neurons resembling a human brain and adhering strictly to the rules. The training results are shown in Figure 6.

SIMULINK Model Integration

Figure 7 presents the SIMULINK model for the remote radio control sensor, integrated into the conventional model to simulate significant improvements in data transmission. This integration, shown in Figure 8, aims to reduce interference, increase SNR and throughput, and boost data reception without obstructions.

Detailed Results and Comparisons

Figures 9 to 17 and Table 12 detail the comprehensive results and validations:

1. **Interference Reduction**: Figure 9 compares conventional and remote-control interference, showing a reduction from 178.6 W/m² to 148.8 W/m², a 16.7% improvement.
2. **SNR Improvement**: Figure 10 shows the conventional SNR at 0.837 dB, improved to 1.004 dB with remote control.
3. **Throughput Enhancement**: Figure 11 illustrates an increase in throughput from 66.67 kbps to 80 kbps with remote control.
4. **Packet Reception Improvements**:

    a. Figure 12: November packets increased from 170 to 175.
    b. Figure 13: December packets increased from 140 to 150, a 7.14% improvement.
    c. Figure 14: January packets increased from 150 kbps to 158 kbps.
    d. Figure 15: February packets increased from 160 kbps to 167 kbps.
    e. Figure 16: March packets increased from 180 kbps to 183 kbps.
    f. Figure 17: April packets increased from 185 kbps to 188 kbps, a 1.62% improvement. Table 12 provides a detailed comparison of conventional and remote-control packet reception across these months, highlighting the effectiveness of the integrated remote-control system in enhancing data transmission in wireless communication networks.

Table 3: Comparison of Conventional and Remote-Control Interference in Data Transmission in a Wireless Communication Network

Time (s)	*Conventional interference in data transmission in a wireless communication network (watt/m²)*	*Remote control interference in data transmission in a wireless communication network (watt/m²)*
0	178.6	148.8
1	178.6	148.8
2	178.6	148.8
3	178.6	148.8
4	178.6	148.8
10	178.6	148.8

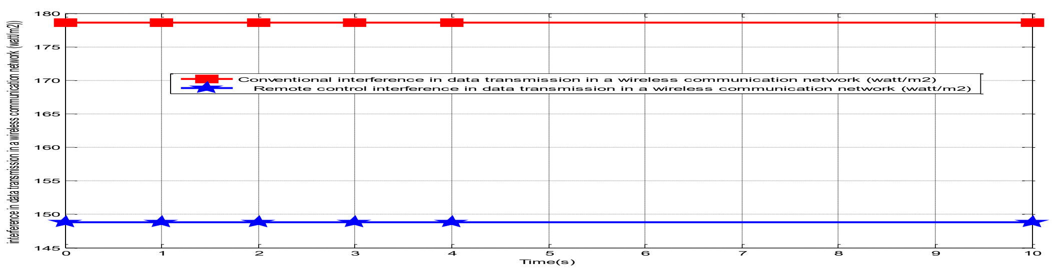

Fig. 9: Comparison of conventional and remote-control interference in data transmission in a wireless communication network

Table 4: Comparison of Conventional and Remote Control SNR in Data Transmission in a Wireless Communication Network

Time (s)	*Conventional SNR in data transmission in a wireless communication network (dB)*	*Remote control SNR in data transmission in a wireless communication network (dB)*
0	0.837	1.004
1	0.837	1.004
2	0.837	1.004
3	0.837	1.004
4	0.837	1.004
10	0.837	1.004

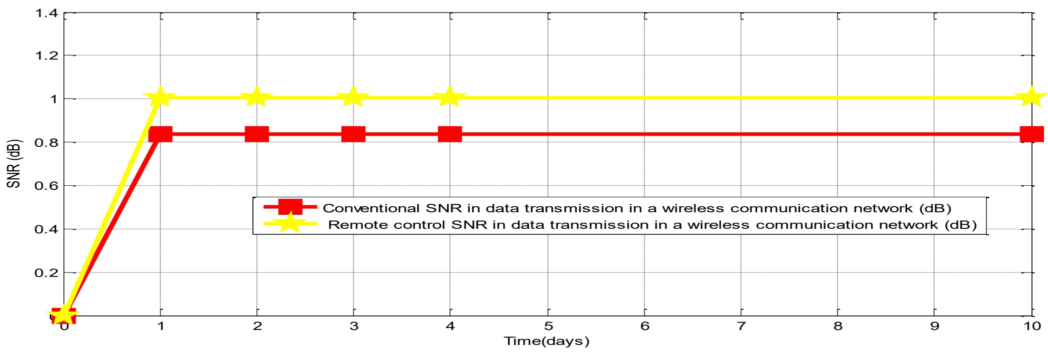

Fig 10: Comparison of conventional and remote-control SNR in data transmission in a wireless communication network

Table 5: Comparison Of Conventional and Remote-Control Throughput on November in Data Transmission in a Wireless Communication Network

Time (s)	*Conventional throughput on November in data transmission in a wireless communication network **(kbps)***	*Remote control throughput on November in data transmission in a wireless communication network **(kbps)***
0	66.67	80
1	66.67	80
2	66.67	80
3	66.67	80
4	66.67	80
10	66.67	80

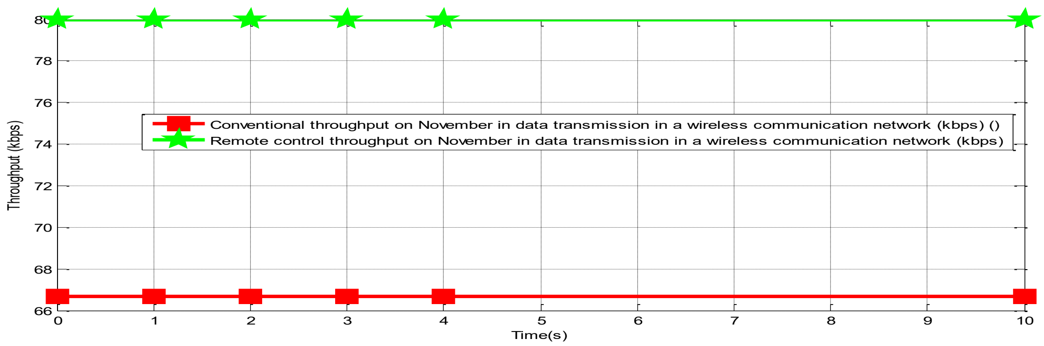

Fig 11: comparison of conventional and remote-control throughput on November in data transmission in a wireless communication network

Table 6: Comparison of Conventional and Remote-Control Packet Received on November in Data Transmission in a Wireless Communication Network

Time (s)	*Conventional packet received on November in data transmission in a wireless communication network (**kbps)***	*Remote control packet received on November in data transmission in a wireless communication network (**kbps)***
0	170	175
1	170	175
2	170	175
3	170	175
4	170	175
10	170	175

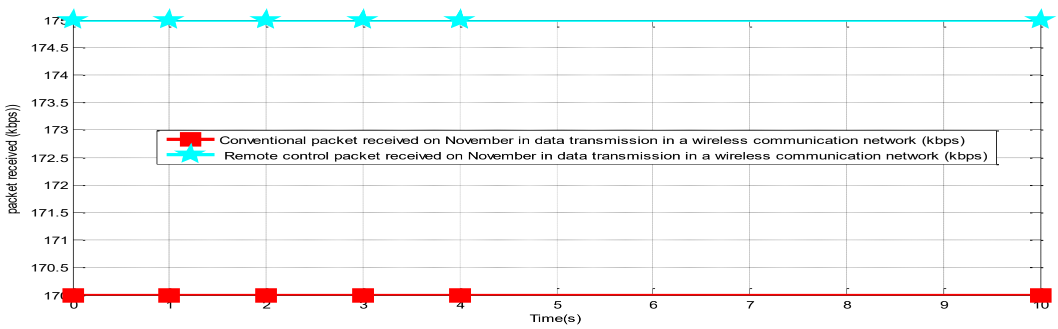

Fig 12: Comparison of conventional and remote-control packet received on November in data transmission in a wireless communication network

Table 7: Comparison of Conventional and Remote-Control Packet Received on December in Data Transmission in a Wireless Communication Network

Time (s)	*Conventional packet received on December in data transmission in a wireless communication network **(kbps)***	*Remote control packet received on December in data transmission in a wireless communication network **(kbps)***
0	140	150
1	140	150
2	140	150
3	140	150
4	140	150
10	140	150

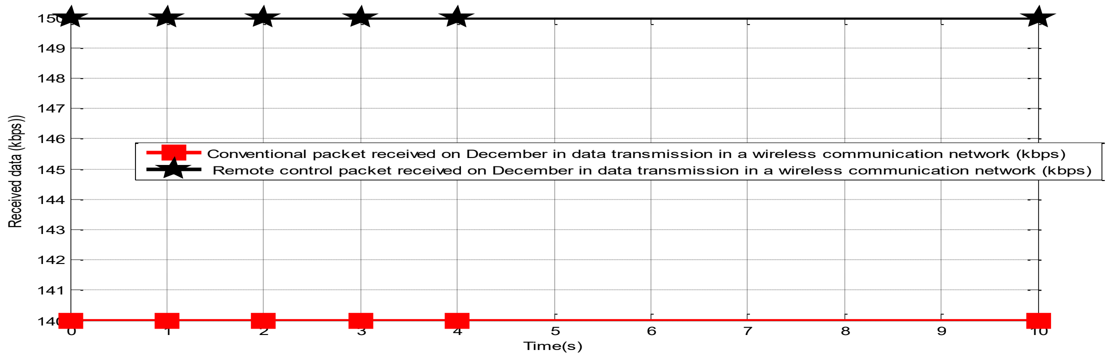

Fig 13: comparison of conventional and remote-control packet received on December in data transmission in a wireless communication network

Table 8: Comparison of Conventional and Remote-Control Packet Received on January In Data Transmission in a Wireless Communication Network

Time (s)	*Conventional packet received on January in data transmission in a wireless communication network **(kbps)***	*Remote control packet received on January in data transmission in a wireless communication network **(kbps)***
0	150	158
1	150	158
2	150	158
3	150	158
4	150	158
10	150	158

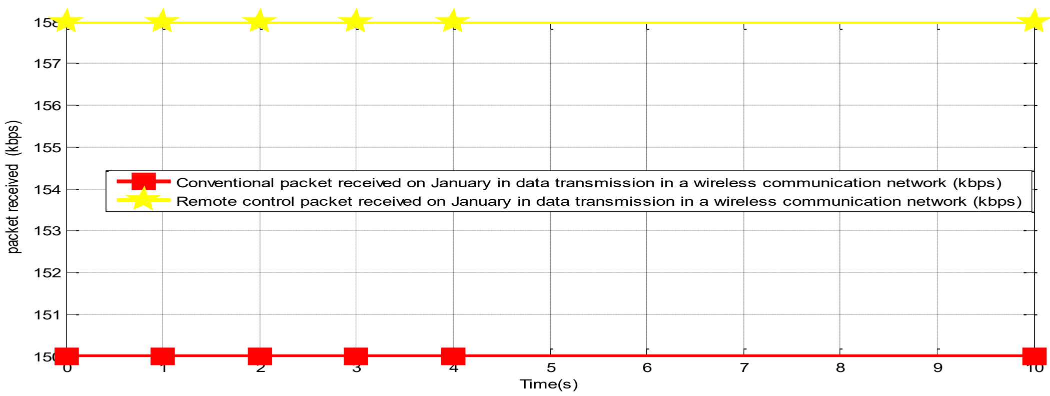

Fig 14: Comparison of Conventional and Remote-Control Packet Received on January in Data Transmission in a Wireless Communication Network

Table 9: Comparison of Conventional and Remote-Control Packet Received on February in Data Transmission in a Wireless Communication Network

Time (s)	*Conventional packet received on February in data transmission in a wireless communication network (kbps)*	*Remote control packet received on February in data transmission in a wireless communication network (kbps)*
0	160	167
1	160	167
2	160	167
3	160	167
4	160	167
10	160	167

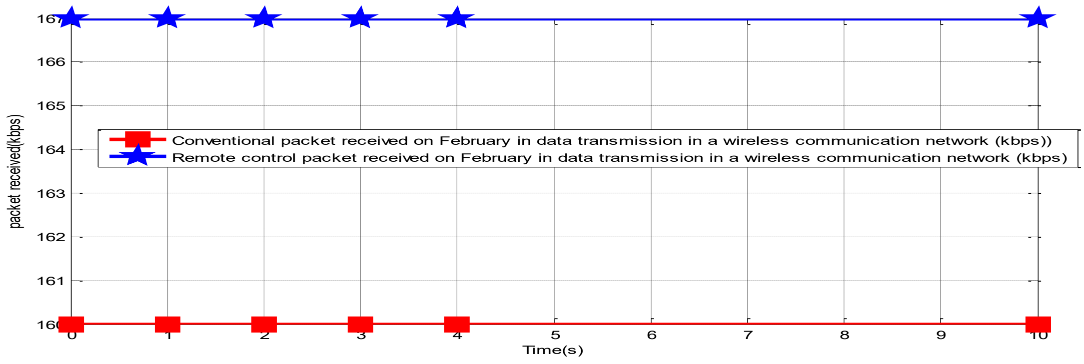

Fig 15: Comparison of Conventional and Remote Control Packet Received on February in Data Transmission in a Wireless Communication Network

Table 10: Comparison of Conventional and Remote-Control Packet Received on March in Data Transmission in a Wireless Communication Network

Time (s)	*Conventional packet received on March in data transmission in a wireless communication network **(kbps)***	*Remote control packet received on March in data transmission in a wireless communication network **(kbps)***
0	180	183
1	180	183
2	180	183
3	180	183
4	180	183
10	180	183

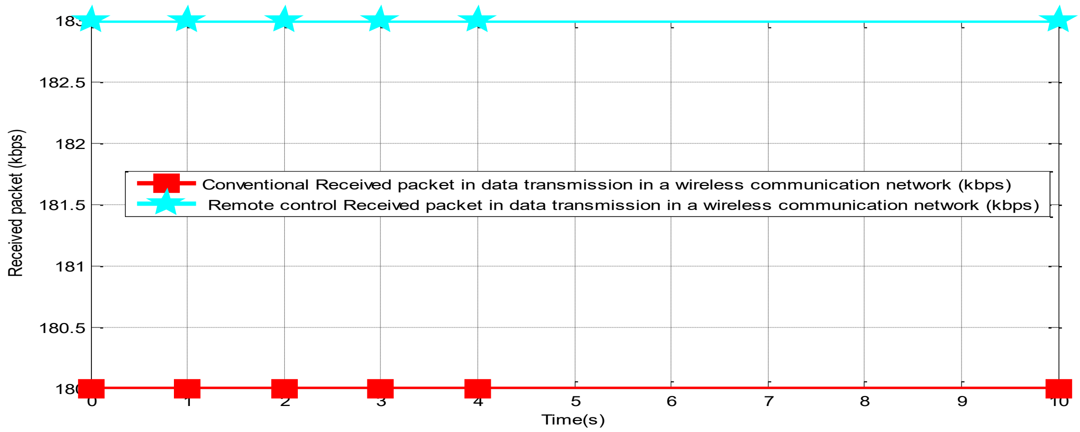

Fig 16: Comparison of Conventional and Remote-Control Packet Received on March In Data Transmission in a Wireless Communication Network

Table 11: Conventional Packet Received and Remote Control Packet Received on the Month of April In Data Communication Network

Time (s)	*Conventional packet received on April in data transmission in a wireless communication network (kbps)*	*Remote control packet received on April in data transmission in a wireless communication network (kbps)*
0	185	188
1	185	188
2	185	188
3	185	188
4	185	188
10	185	188

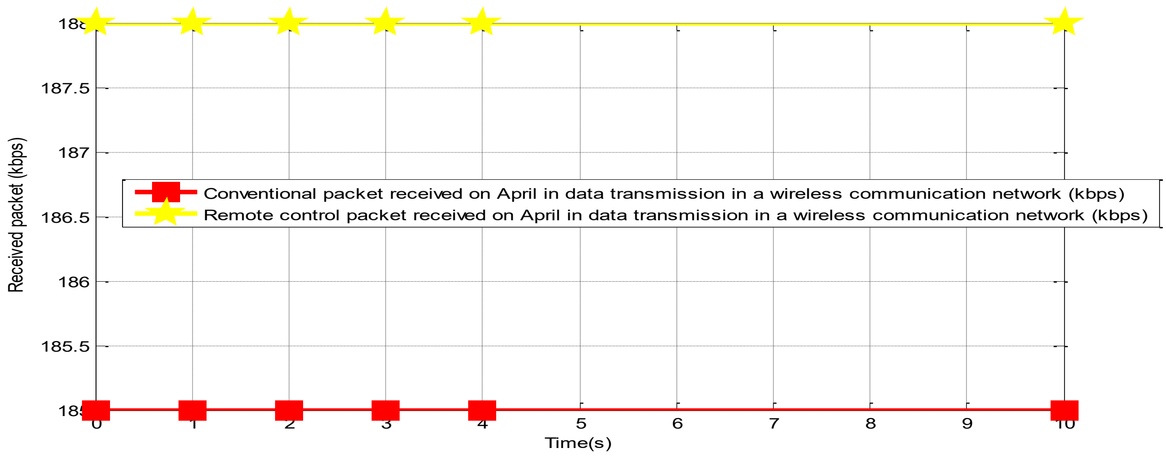

Fig 17: Comparison of conventional and remote control packet received on April in data transmission in a wireless communication network

Conclusion

The study concludes that the implementation of remote radio control for different noise channels effectively enhances data transmission in wireless communication networks. By reducing interference, improving SNR, and increasing throughput, this technique provides a practical solution to the challenges faced by businesses reliant on stable data communication. The integration of fuzzy logic and ANNs within the remote-control framework allows for dynamic adjustment to noise conditions, ensuring consistent performance improvements. This method not only addresses the current issues in wireless communication but also offers a scalable approach for future advancements in the field. This paper addresses the prevalent issue of noise interference in wireless communication networks, which adversely affects data transmission quality. It presents a novel technique that employs remote radio control to manage different noise channels, enhancing data transmission efficiency. By utilizing advanced signal processing algorithms, fuzzy logic, and artificial neural networks (ANNs), the proposed method adapts dynamically to varying noise conditions, ensuring optimal performance. The approach involves characterizing and modeling data communication based on key performance indicators (KPIs), designing a remote-control rule base, training an ANN within this rule base, creating a SIMULINK model for remote radio control sensors, and developing an algorithm to implement the process. Results from simulations show a significant reduction in conventional interference, improvement in signal-to-noise ratio (SNR), and increase in throughput and packet reception, demonstrating the efficacy of the technique in enhancing data transmission in wireless communication networks

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