An Efficient Investigation Of A Wireless Network Using OPNET Modeler In Radio Communication

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Abstract : With Wireless functionality, we can model both terrestrial and satellite radio Systems. Radio communication is used to implement and administrate the Telecommunication networks. Usually this implementation will takes place at the physical level of the OSI model network. We create a radio network by using modeler and wireless modeling. Also we will observe the quality variations in the received signal. This quality variation arises from radio interference at the accepting node in a powerful system topology. In a wireless system, the obstruction can diminish the sign to commotion proportion (SNR). The SNR in a system can be improved utilizing various sorts of reception apparatuses, for example, directional receiving wires and by expanding the compelling sign quality at the beneficiary. To analyze the performance of the network with jammer device, we will structure a straight forward radio system with a portable jammer hub and two stationary correspondences hubs, and afterward the distinctions in the SNR of the system has been broke down when the stationary hubs utilize a directional receiving wire versus an isotropic reception apparatus. The OPNET Modeler, a network performance analysis software tool is used to create a network model. In this paper we evaluated the receiver BER, received power, and throughput with two antenna patterns. Also a timer controller is designed to compare the situation of the jammer with BER.

Index Terms :SNR, OPNET modeler, OSI model, Bit Error Rate, Throughput, Jammer device.

1. INTRODUCTION

A Wireless computer network has been created using the remote information associations between arrange hubs. By using this methodology, we shall avoid the telecommunications network and business installations cost as well as connection between various equipment locations. Radio communication has been used to implement and administered the Telecommunications networks [5] [6]. Radio correspondence requires the utilization of both transmitting and accepting hardware. The transmitting gear incorporates a radio transmitter and an antenna to transmit the signal, and it is introduced at the position from where the messages are ready to be transmitted [3]. The accepting hardware incorporates a radio beneficiary and an antenna to receive the signal, and it is introduced at the place at where the information is ready to be received. Here we are having Transmitter node and a receiver node. They are stationary nodes, along with that one mobile jammer is designed. In this paper we compare the performance like bit error rate, received power in both receiver and jammer and throughput using isotropic and directional antenna. Also we analyze the performance when jammer is moving with timer controller.

2 RELATED WORKS

2.1 OPNET (Optimized Network Engineering Tools)

OPNET Modeler 14.5 is being used for the simulation analysis. This simulation software is one of the extensive and powerful software used to simulate entire heterogeneous networks with various protocols with wide variety of possibilities [1]. It is preferred network simulation environment for network modeling. And we can manage the network with several hundreds of nodes. By using this simulator we can place various network elements like nodes, routers, gateways, servers, and links[1][2]. OPNET gives four various leveled editors to build up a demonstrated framework. Among the four levels node is a basic editor, which is a fundamental model [2]. Examples for nodes are personal computer, Transmitter, receiver, file server, printer, router, etc. It simulates and exhibits the analysis graphically, and its graphical representation is exactly same as that of actual networks. It defines various events like packets created, destroyed, packets received etc. It provides several numbers of solutions for network operations also we can view the animated results [1]. The various technologies like Mobile Adhoc Network, 802.11, 3G, 4G, Ultra Wide Band, WiMAX, Bluetooth, and ZigBee can be replicated using this tool.

3. PROPOSED WORK

3.1 NETWORK TOPOLOGY

It contains three nodes: A Mobile jammer node, Transmitter node, and a Receiver node.Transmission has been done using the transmitter node at uniform strength in all the direction [3][6]. This node consists of three modules named as packet generator, transmitter, Antenna. The quality of the received signal can be measured by receiver node. This node also consists three modules like transmitting node along with that it contains processor module. The node model for receiver side is shown in Fig 2.For radiating and receiving power, directional and isotrophic antenna is used in both the transmitter and receiver node [4]. Isotrophic antenna radiates power equally in all the directions.so the radiation pattern will be sphere. Directional antenna radiates or receives greater power in specific direction.so the maximum radiation occurs in a particular direction. We designed an antenna with a gain of 200 dB. It is shown in Fig 1.

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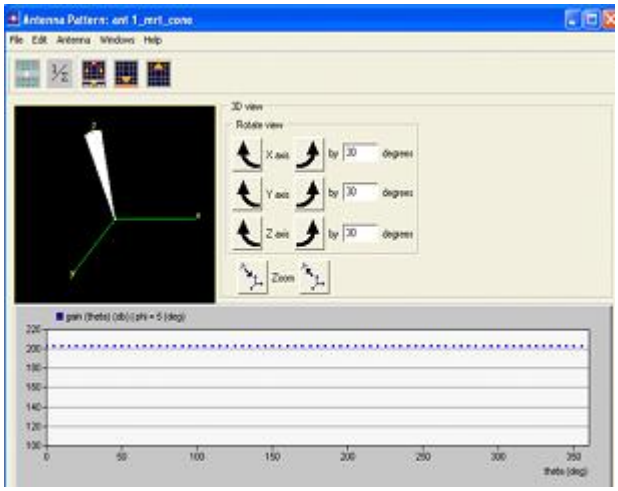

Fig 1 *Antenna pattern*

In the transmitter node model, 1024-bit packets can be generated by packet generator that arrive at the rate of 1.0 packet per second with a steady inter arrival time [5]. Once the packets created, it moves to the radio transmitter module through a packet stream, per second 1024 bits can be transmitted by the packet stream which utilizes the channel bandwidth 100 percent effectively. They are passing from the sender to the antenna module through another packet stream.

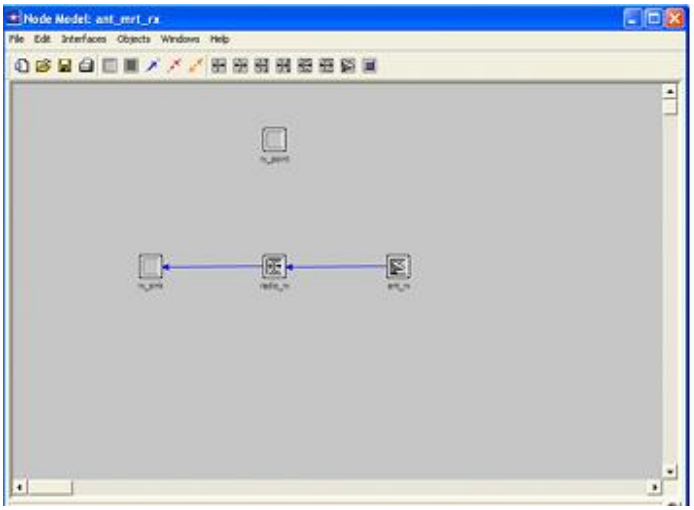

Fig 2 *Node model*

The interferences have been introduced in the network by the jammer node. It is also having three modules like stationary transmitter node. The power of the channel and the type of modulation is different in jammer node when compared with sender [5]. Since the properties of the jammer node are different, it introduces some noise in the receiver. The directional antenna can be focused towards the transmitter using the pointing processor module in the receiver node. In behavior of wireless communications, the important criterion is exact position of nodes. Fig 3 shows that the movement of node can be analyzed using the term called trajectory. Table 1 shows the Coordinates of each node. It can be chosen that, for transmitter node (3, 2), Receiver node (4,2) and jammer node(0.5,1.5) in the workspace. Along the trajectory the jammer can be moved with a speed of 10 m/s.

Node name	X position	Y position
Transmitter	3	2
Receiver	4	2
jammer	0.5	1.5

Table 1 *Position of each node in workspace*

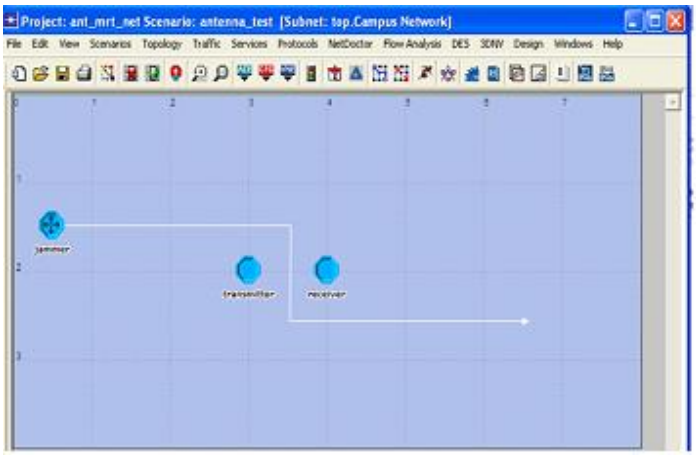

Fig 3 *Network topology with jammer trajectory*

4 SIMULATION AND RESULTS

Fig 4 shows that there were 1,420 packets created during the simulation. The sender node creates one packet per second. Also the jammer creates same packets per second. So from simulation time 10 seconds to 12 minutes each creates (12 x 60) - 10 = 710 packets.

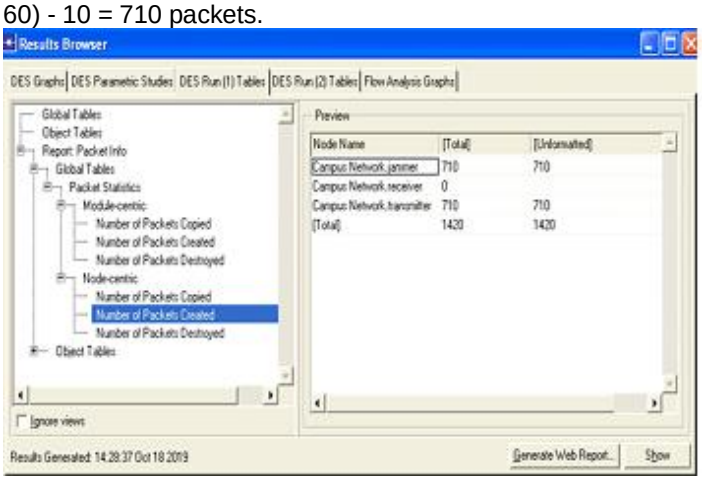

Fig 4 *Packets creation*

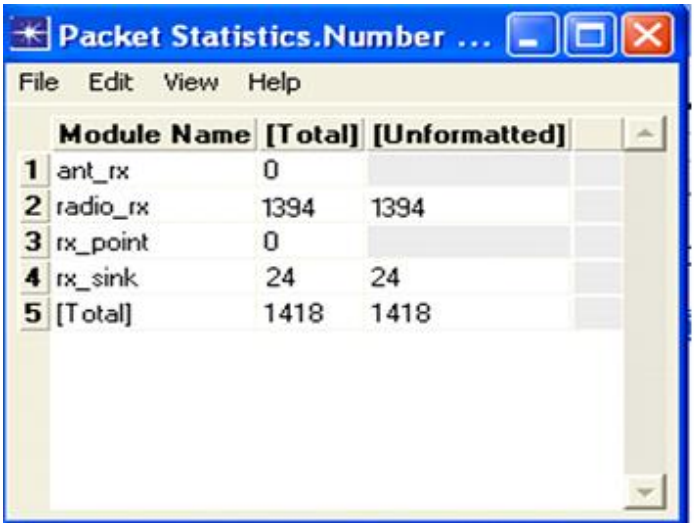

Fig 5 *Packets destroyed with isotropic antenna*

From Fig 5 and 6 by using isotropic antenna almost all packets were destroyed. The same packets were destroyed using directional antenna, but almost half of the packets were successfully received.

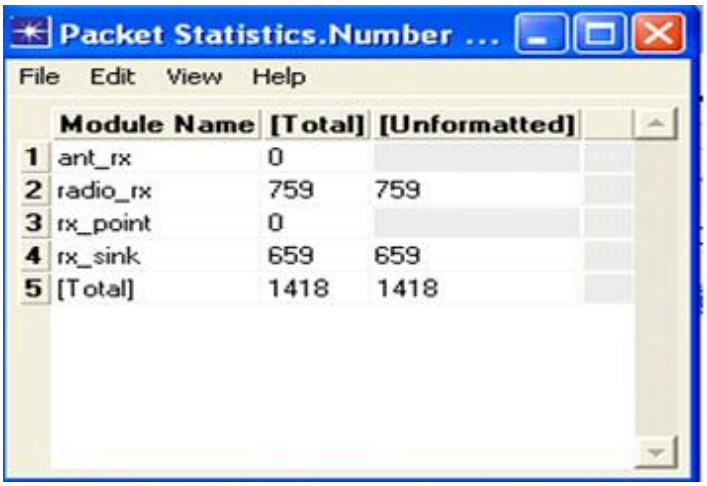

Fig 6 *Packets destroyed with directional antenna*

4 RESULT COMPARISON

The result has been analyzed for two patterns-one for the isotropic antenna pattern and one for the directional antenna pattern. Bit Error Rate (BER): It is the quantity of bit mistakes per unit time [7]. Likewise determined as the level of bits that have mistaken comparative with the complete number of bits got in a transmission. Throughput: It is a measure of how many units of information in a given time, a system can process.Received power: It is the total amount of power that has been received from some transmitter section.

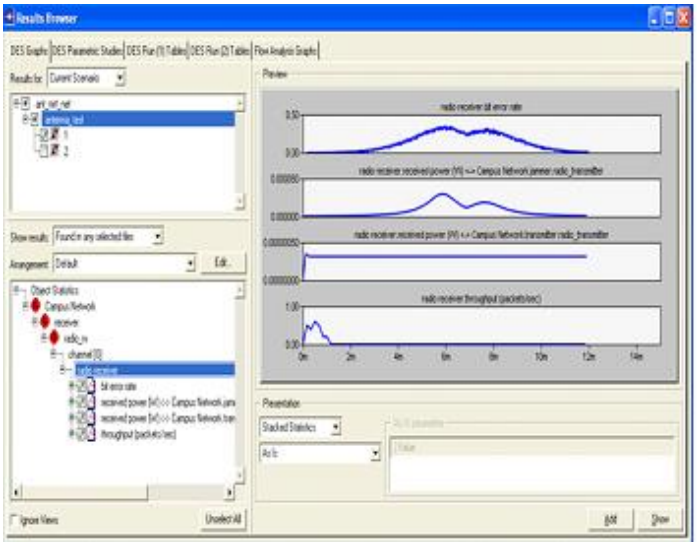

Fig 7 *Bit Error Rate, Throughput, and Received Power Statistics of the Isotropic Antenna*

The fig 7 shows that, in the receiver side initially the bit error rate is less and it is slowly increased when the separation between the jammer and receiver nodes diminishes, and vice-versa. The bit error rate arrives at a level of about 0.4 errors / bit when the separation is very small. The two "humps" coordinate the two areas when the jammer is nearest to the recipient. During entire simulation, the jammer noise can be received by isotropic receiver. Received power from the transmitter is constant, which is expected since both transmitter and receiver are fixed nodes. The received power from the jammer follows a similar pattern as the bit error rate.

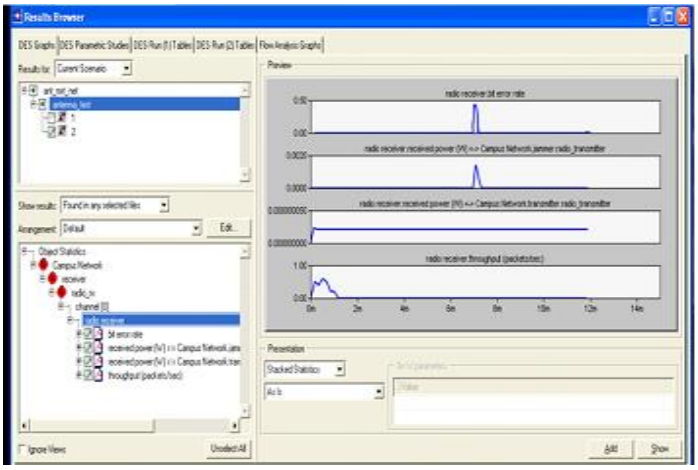

Fig 8 *Bit Error Rate, Throughput, and Received power Statistics of directional Antenna*

The BER graph which has been drawn from directional antenna conceals that BER at receiver node is non-zero initially because distance between Jammer and receiver node reduces. However, after one minute, while the jammer antenna moves towards sender or receiver node, the BER becomes zero. It has been shown in Fig 8.Therefore, this drop has rapidly hiked the numbers of received packets from stationary node which is transmitted after about 6 minutes, the jammer returns back to its antenna's range, at which point the bit error

rate increases and the number of packets received first drops then increases again. If the jammer moves from the antenna, the bit error rate reduces to 0. Unlike Isotropic antenna here the BER is maximum at only one point where the jammer is very close to sender and receiver.

5 TIMER CONTROLLER

To compare the jammer's position with BER, we used timer Controller. By using this we can set the start time and end time. There is a play button in timer controller. When we press this button the jammer starts moving along the trajectory.

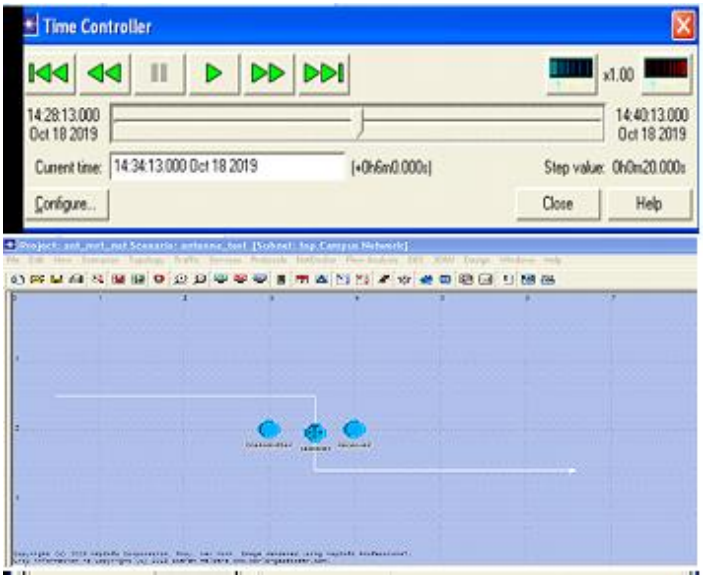

Fig 9 *Jammer movement along the trajectory using timer controller*

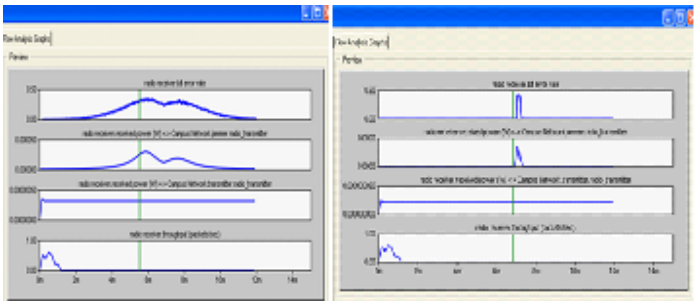

Fig 10 *Performance comparison*

6 CONCLUSION

The evaluation of wireless network with different antenna patterns has been proposed in this paper. The main impartial of our paper is comparing the performance of wireless network with different antenna patterns. Also a jammer is designed and it is moving along the trajectory using timer controller. The parameters like Bit error rate, Received power and Throughput have been analyzed with the movement of jammer. It can be evaluated that using Directional antenna, the BER is maximum at only one point and all other places it is zero. But in Isotropic the BER is gradually increases and it has two humps after that gradually reduces. From the result analysis it can be shown that directional antenna is better than Isotropic antenna.

REFERENCES

[1] OPNET Modeler [Online]. Available: http://www.opnet.com/products/modeler/home.

[2] OPNET product documentation v.11.0.A, OPNET Technologies,Inc., Bethesda, MD, 2004.

[3] S.K.Sarkar, T.G.Basavaraju and C.Puttamadappa; Ad hoc mobile wireless networks: Principles, protocols and applications,‖ Auerbach Publications, 2008.

[4] A.ElGamal, J. Mammen, B.Prabhakar, and D.Shah, Throughput delay trade-off in wireless networks II in Proc. 23rd Annual Joint Conference of the IEEE Computer and Communications Societies, vol.1, pp.475, March 7 to 11, 2004.

[5] C.Balanis," Antenna theory analysis and design," third edition by John wiley and sons, Inc., United States of America, 2005.

[6] Y. Zhang, S. Wang, Z.Liu,W. Zhou and D.Liu, "Performance Analysis of Wireless Sensor Network Based on NS-2" IEEE International Conference on Systems and Informatics 2012, pp. 1445-1448.

[7] Yi Sun, Yue Sun, Peng Xu, Haocheng Liu Performance Analysis of Wireless Sensor Network Based on OPNET, Communications and Network, 2013, 5, 512-516, 2013.