Enhancement throughput and increase security of image transmitted over wireless network using (DNC)

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ABSTRACT: This paper diagnose the problem of exchanging images among multiple nodes of wireless networks through using DNC (digital network coding). Our algorithm is introduced new technique in simple design to transmitting image with more security through relay nodes. We used DNC technique for enhancing the throughput, efficiency and scalability, as well as reliance to attacks and eavesdropping of the wireless network. The relay node of the proposed algorithm network receiving and combining the two images of two transceiver nodes that need for exchanging the data using XOR MATLAB function and retransmit it over AWGN channel with different values. We using (512*512) RGB-JPEG images. The modulation scheme that used in the proposing algorithm 64-QAM, the receivers applying Median filter to improve the received data. Many standers are used to testing the algorithm such as PSNR, MSE, BER, the entropy and SSIM. The algorithm was simulated by MATLAB 2015a.

KEY WORDS: Digital network coding, RGB image, throughput, security

1- Introduction.

Networks coding are a system of improvement the flow of digital data in a network by transmitting digital guide about information. The "digital guide" is, itself, a complex of many messages. When the digital guide bits reach at the end, the information of transmitted is deduced replace directly aggregation [1].

Coding of network, switches and routers are substituted by tools depict coders. The programmers are transforming information in the form of digital guide about the information along multi-paths in the same time, instead of guidance of the switches and packets forward. The data are reaching from multi sources can be composited into a one packet. These apportionment methods can rise the efficient ability of a network by decreasing the number and intensity of suffocations When traffic volume of network is near the maximum ability which can be got lead to clear enhancement of network traffic. The original data are getting during if the received digital guidance is enough. Even if part of packets is lost or mutilated on some of the paths which compute the designed message/packet [2].

Digital Network coding (DNC) have multi definition. One of this definition, is network of packet (which data is dividing into many packets and network coding is applied to the packets contents). Generally, the physical layer is interested with the coding. Network coding can improve many things as throughput, durability, complexity, and security. The signals in wireless access are received as their superposition, the simple way of forwarding signals (without decoding them first) enables analog network coding in the physical layer [1,3].

The simplest example for networks with and without coding demonstrates in figure below. The repeater C can save one sent data by sending the composited data of A and B, then A and B can calculate the data which they want to receive it by split up their transmitted message.
Another type of network coding shows in figure 2, the X-topology, in this type the two sets of nodes can communicated through the same relay:

As shown on above figure, Nodes C and D both receive the same packet network coded, and they both use the overheard packet (from Node A and Node B, respectively) for decoding the received packet.

The most-important utility coding of network – and the simple to illustrate – is maximize of throughput. The throughput useful is performed by using package. The butterfly network, which explain network coding for multicast in the wire network can increase throughput. The nine packet that are used in the butterfly network that transfer the contents of two packets as shown in figure 3. Without coding, this transmission cannot be to transfer many data, and they must be complemented with extra sending process (as example, an extra transmission from node 3 to node 4). Whilst network coding can grow throughput for multi broadcast in wire network, and throughput useful are not restricted to multi broadcast or wire networks.[3]

Digital Network coding can increase the realizable throughput average for single-source multi broadcast connection in wire mesh. The expansion to wireless networks includes the linked styling the network codes with medium access control (MAC) under the extra features of multidirectional sending, interference impact [5].

To obtain visions on the open trouble of multiple source coding of network, we assume a simple wireless mesh with multi-sources interchange broadcast packets during a single node of relay [4].

All can see this intelligently mixing packet maximize throughput of network. Some paper was exhibited new architecture which basically improves the wireless networks throughput. This architecture include insertion a coding chips between the MAG and IP layers, which useful from them by redirection multi-packages in a single sending [6]. The new architecture for networks of wireless aim to increase the throughput, also redirection the packets. Summary of this technical is mix packets from different sources to maximize the data content of each sending [1,4]

The exchange of images among relay nodes during coding channel. The channel coding is introduced some repetition into the basically data to permit decomposition of the damaged blocks at the reception. However, transmission operation of image is exposed to the noises during coding channel. The digital images have been tested by the noise effect on it’s the features [7]. Since most of the communication systems are exposed for one of noise types as Gaussian noise that may issue from normal sources. It is also known as ‘electronic
noise’ because it emerges in detectors or amplifiers. Gaussian noise is affected on the digital images. Therefore, the images are processed upon receipt by many types of filters for the more clearly [8].

In simplest case Digital Network Coding can sum many packets into a one transmission through a relay node [3], so less broadcast time, as we proposed the transceiver Relay nodes are detecting the data of two neighbors’ nodes demodulated it and combine these data in to one packet by applying XOR function then retransmitted it over AWGN channel ,the resulting data will be mixing of two nodes packets or two transmitters data cannot be understandable to any attackers only the desired node able to decryption which encrypted packets will be its own transmitted data . These are obtained through temporary storage to transmissions, thus retransmission. In other words, the message is receiving from more than one source it will send the message one after one to destination [4].

2- Methodology

This study has employed the exchange of image in coding network with enhancement the throughput and high security. The image exchange is designed to complies with requirements market requirement and coding network technology.

This paper explains the Scheme of Image Transmission Over DNC (SITODNC), the scenario of exchanging (512*512) RGB images among relay nodes via channel coding in digital network coding as well as the security lineaments used to protect the application images.

The way that an images transmitted from two transceivers for exchanging its data between them after applying 64-QAM modulation over AWGN channel using digital network coding by the relay node or third transceiver applying XOR function that results new data image different from image of transmitted nodes cannot be understandable to any undesired nodes only the desired node or transmitted node can know the data or image of the other node by applying also XOR function between the received image and its own original image , so more security without interference in data and enhancement throughput. However, usually the data required to pass through one or more intermediate nodes before reach to its desired station in all network as well as it contains on two transmissions and receivers represented in each destination. Each one must have address so the data arrive to destination according to this address [9,10].These addresses are used in image transmission dependent on topology of the network, as follows topology:

1- Star: All data will be routed during the Co-Ordinator. All addresses are desired and the “following hop” address is which of the Co-Ordinator.

2- Tree: A data are orientated up the tree even it reaches at a node which can route it back down to the end node of the tree in this case required. All addresses are and the “first hop” address is which acting as transmitting node. and this node sends back the data back to the other nodes until it reaches its desired destination.

3- Mesh: the path of transmission in this topology depended on whether the required node is included range. If the required node is within range, only the “final destination” uses the address. Otherwise, the address of “next hop” is representing that of the first node in the orientate to the final destination. The data transmission continues in this case even it reaches at the target point [11].

Network encrypting is beneficial in wireless, messaging, storage, broadcast streaming, file-sharing peer to peer networks, and other networks which the same information needs to be transmitted to a many receive nodes. The programmers are needing long processing time to decrypt the data therefore the change of uniform the structure of peer-to-peer network is representing large challenge to technique of network coding due it contracts synchronization of network Overall, the network coding increases their efficiency [5,12].
3. Scheme of Image transmission over DNC (SITODNC)

The scheme for transmission of two colored images (RGB-JPEJ) with size of (512*512) over DNC, node A to node B by relay DF with noisy channel. The system of SITODNC included two stages, the sender and receiver of image systems at two nodes as illustrated in flowchart in figure below.

1-Sender system: -

It is represented by two points as transmitters (node A and node B) transmitted to (node C). It explains by the following steps:

- Node A is transmitted a color image (512*512 pixel) JPEG to node B, also node B will be transmitted image to node A.
- Read images in both nodes A and B, (512*512*3) char.
- Fetch the image and separate it to (R, G and B layers) each layer with size 512*512, (rr, cc) will be the size of each layer.
- Convert the images in to binary form (512*512*8 bits) for characters.
Convert the characters to logical then to vector of binary form (1, rr*cc)

The data then modulated using 64-QAM modulation, transfer through noisy channel (AWGN) to the relay node C.

Node C is received the noisy data from nodes A & B.

Rearrangements the binary bits of data for A&B nodes after demodulate the information by 64-QAM through node C.

Convert the characters to logical for A&B data bits stream.

The aspect of security is very important for all communication network; the security of our work is done by XOR MATAB function between data of A and B nodes, resulting new data that different from the data of A&B understandable to any attackers only the desired node able to decryption which encrypted packets will be its own transmitted data.

The new data (AB) is obtained from XOR A and B in security process in logical form convert to char, then Re-modulate the data after convert the char to vector of binary data (1, rr*cc).

Transmit the data which include the data result from execute XOR process between A and B through AWGN channel with different value (5,10,15, and 20 dB).

The Previous procedures done in node C that represented the relay (Df)

2- Receiver System:
The second part of transmit image over DNC scheme that was proposed in this study. The message is received by nodes A and B, these data are included mix information of A and B(AB). Many steps of processing to obtain the original data for each node as explain in figure (4). The system is illustrated by following steps:

Receiving the information (AB) read it, demodulated by 64-QAM, rearrangement the binary data, and convert AB in vector form.

Convert the data from char to logical

To get the B data at node A, node A will XOR the received information with its original data, also the node B make XOR between the received information with its original data to get A data.

Convert the data at each node to char and then to binary form.

Rearranging the binary (rr*cc,8) at nodes A & B, after that converting to decimal.

Reconstruction the received image by reshape to (512*512*3) pixel at each node and filtered it using median filter.

We can summary above the scheme by simple diagram explain the procedure of sender and receiver:

![DNC transmitter and receiver diagram](image)

4. The results and discussion:

In this section we explain the results of our algorithm that tested by 2015-a MATLAB with different standards such as BER, PSNR, MSE, entropy and SSIM under AWGN channel with different SNR from 0 to 35 dB we obtain a good values as shown on table (2), figures 6 and 7, the MSE and BER reach to zero in bout 30dB also PSNR goes to infinity.
As the proposed algorithm with RGB images of size 512*512-pixel table (1) explain number of bits that can be transmitted through the channel with and without DNC as show we can increase the throughput of channel by using DNC.

| Table (1) | The number of transmitted bits over channel |
|-----------|------------------------------------------|
| Without DNC | (512*512*3*8*4) = 25165824 |
| With DNC   | (512*512*3*8*3) = 18874368 |

Also, Table (3) explain the entropy and SSIM of image. The entropy near to ideal value (8), and low values of SSIM approximately zero that’s mean there is no similarity between AB(AB=A\(\oplus\)B) and A or B. We used median filter that can be enhanced the received image with high noisy channel less than 20dB but not good choice for low noise channel.

| Table (2) | PSNR, MSE and BER of received image with variance channel condition (0-30dB) |
|-----------|------------------------------------------|
| SNR of channel (dB) | BER | PSNR(dB) | MSE | BER | PSNR(dB) | MSE |
| 0         | 0.3911 | 7.4419 | 1.1719e+04 | 0.2022 | 9.4195 | 7.2010e+03 |
| 5         | 0.2874 | 8.2201 | 9.7965e+03 | 0.1274 | 11.0198 | 5.0613e+03 |
| 10        | 0.2192 | 9.3699 | 7.4833e+03 | 0.0472 | 21.1695 | 496.7396 |
| 15        | 0.0173 | 19.5038 | 728.9564 | 0.0103 | 30.8526 | 70.4406 |
| 20        | 1.1460e-04 | 42.1978 | 3.9201 | 0.0068 | 30.1209 | 63.2403 |
| 25        | 2.2252e-06 | 59.8118 | 0.0679 | 0.1717 | 32.1209 | 63.2399 |
| 30        | 6.3578e-07 | 84.2544 | 2.4414e-04 | 0.1717 | 33.1212 | 63.2358 |
| 35        | Inf | Inf | Inf | 0.1717 | 33.1212 | 63.2358 |

| Table (3) | The entropy and SSIM of AB data and A or B over variance channel condition (0-30dB) |
|-----------|------------------------------------------|
| SNR       | Entropy | SSIM |
| 0         | 7.9582 | -0.0051 |
| 5         | 7.9228 | -0.0113 |
| 10        | 7.8637 | -0.0172 |
| 15        | 7.7463 | -0.0230 |
| 20        | 7.5481 | -0.0084 |
| 25        | 7.4948 | 0.0295 |
| 30        | 7.4945 | 0.0298 |
Fig. 6. The transmitted and received images
5-Conclusion
This research study an algorithm for exchanging images between two transmitted nodes through relay node of noisy wireless network using digital network coding. We enhanced the throughput of wireless channel by
decreasing number of transmitted data through XORed the information of transmitted nodes in relay node and retransmitted again in the same time to these nodes. We also increase the security because the transmitted information cannot be known by attack only the desired distention can know the information or extract it by XORed the received data with its original data. We obtain a good value of entropy and SSIM under different SNR channel value. Also, a good value of PSNR, MSE and BER. PSNR of the received images reach to infinity in about 30dB. Median filter can be a good choice for high noise channel near 20dB above this value its degradation the received image.

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