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High Resolution Image Encryption and Reconstruction Using Scalable Codes

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ABSTRACT: In today's connected world, the protection of digital data and image compression has arisen as a major concern for the general public, and an important topic of research. This paper proposes a unique scheme of scalable coding of transmitting and receiving images in an extreme protected way using Wavelet transform. In the encryptionphase, the original pixel values are masked by a modulo-256 addition with nonrandom numbers that are derivedfrom a secret key. Then, the encrypted data are decomposed into several parts, and each part is compressed as a bit stream. After decomposing the encrypted datainto a down sampled subimage and several data sets witha multiple-resolution construction, an encoder calculatesthe subimage and the Wavelet coefficients of each dataset to condense the data quantity. Then, the data calculates subimage and coefficients are observed as a set of bitstreams. Because of the hierarchical coding mechanismat the receiver side with the cryptographic key, the principal content with higher resolution can be reconstructed when more bit streams are received. The efficiency of output image is calculated on the basis of two factors PSNR and MSE. If we get more number of bits that means more clear image is obtained.

KEYWORDS: Bitsreams, Wavelet Transform, Image encryption, Image Compression, Quantization Scalable coding.

I.INTRODUCTION

As the world has been totally digitized, along with digitalism, use of multimedia has also rapidly increased. But with sudden increase in use of multimedia has raised an important issue of securing the multimedia data as these data prone to being getting hacked or leaked due to its availability. As the multimedia data is transmitted over networks on large scale, we need to have a reliable technique to prevent data getting leaked or attacked. In todays connected world for sending and receiving the images the most important thing is security. In recent years, encrypted signal processing has attracted considerable research interests. Earlier the technique used for sending and receiving images was different but as the day passes new technology had invented and it has provided more security to the data.

Along with this increasing use of digital images comes the serious issue of storing and transferring the huge volume of data. For this compression techniques are used. Image encryption and Image compression plays an important role between sender and receiver. The goal of image encryption is that the attacker or hacker or intruder should not obtain the statistical information. Various Cryptographic techniques are developed to secure the data between transmission and reception. The images have to be encrypted before compression to give high level security. We design a highly efficient image encryption –the-compression system using lossless and lossy compression. The frequency domain and adaptive filtering can be engaged in the encrypted area based on the homomorphic properties of a cryptography and a complex signal representation method can be used to decrease the size of encrypted information and computation difficulty

The compatibility of image depends on two factors i.e. PSNR and MSE. This both terms are inversely proportional to each other. If PSNR is 100% then the compression is known as lossless as the image can be reconstructed exactly. If any values are changes then PSNR will be lost and is known as lossy compression. For this we use wavelet transform and Lossless Compression. The most important feature of wavelet transform is it allows multiresolution decomposition. An image that is decomposed by wavelet transform can be reconstructed with desired resolution. The procedure for this is a low pass filter and a high pass filter is chosen, such that they exactly halve the frequency range between themselves. This filter pair is called the Analysis Filter pair. First of all, the low pass filter is applied for each row of data, and then we obtain low frequency components of the row. As the LPF is a half band filter, the output data consists of frequencies only in the first half of the original frequency range.

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So in order to help people we had developed an interactive system that will help in reconstruction of image with the help of MATLAB. The proposed system will be useful in day to day life. As mentioned in the applications this project is a real time application for all real time places.

II.SYSTEM MODEL AND ASSUMPTIONS

It consist of main two phase Encryption and compression phase. The general concept of our project is first we take i/p image after that we do encryption process on that image. Some coding is applied which is known as encoding process. After that image is compressed which is known as Encryption then compression technique. For that SPHIT coder is used. And for encryption compression technique wavelet transform is used. After completing all this process we get reconstructed image which is highly secure. And we can measure the efficiency on the basis of two factors PSNR andMSE. These two terms are related to each other. The value of MSE must be low to get the better output.

III.PROPOSED SCHEME

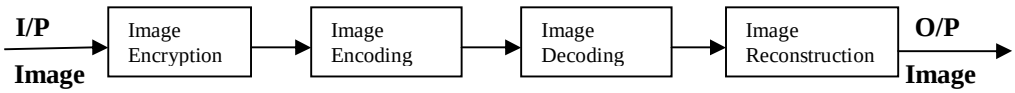

Fig.1: General Block Diagram

General block diagram of the system is shown above.

1. Take I/P image: Take the i/p image in BMP image format.
2. Image Encryption: In the below diagram plainimage is referred as a normal image. Then it undergoes an encryption process. And after that the plainimage is converted into cipherimage. Cipherimage means in some proper code which no one can easily read. Encryption is the process of encoding message or information in such a way only authorized persons can see it. Encryption is the most effective way to achieve data security.
   PlainimageCipherimage

Fig.2: Encryption Phase

3. Image Encoding: Encoder is used to convert the one form of data into another form. Here, the encoder decomposes the encrypted image into a series of sub images and data sets with a multiple resolution construction.

Fig.3: Encoded Phase

4. Image Decoding: It is totally opposite to Encoder. Decryption is the process of converting encrypted data back into its original form. Unencrypted data is called plaintext, Encrypted data is refers to as cipher text. When it undergoes the process of decryption the cipherimage is converted into plaintext.
5.

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Fig.4:Decryption Phase

6. Image Reconstruction: With the bitstreams and the secret key a receiver can reconstruct the principal content of the original image, and the resolution of the reconstruct image is dependent on the number of received bitstreams. If we get more number of bits that means image retrieval is more.

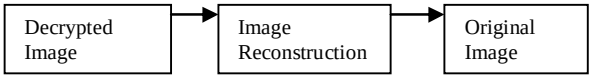

Fig.5: Reconstructed Phase

7. Output Image: In this the output image is obtained. Which is highly secured.

IV.SECURITY

When we use any system the more important issue is security. In our project the main concentration is given to security. The image we get after reconstruction is highly secured.

V. RESULT AND DISCUSSION

In the fig 1, it shows the pop window when we do the encryption and decryption process:

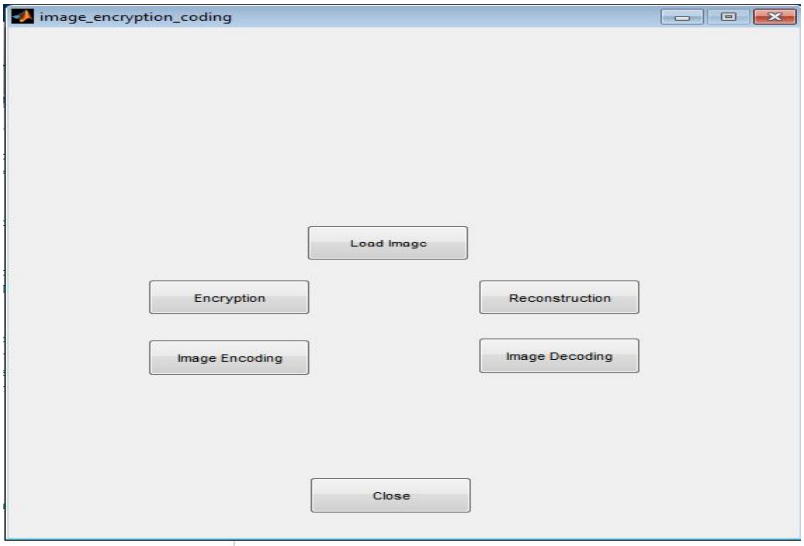

Fig.6:Image Encryption Coding

The function of the buttons are as follows:

1. Load Image: In this we take the image of BMP format.
2. Encryption: If we click on this button encryption process gets started.
3. Image Encoding: If we click on this button the process of Encoding gets started.
4. Image Decoding: If we click on this button the process of decoding gets started.
5. Reconstruction: If we click on this button we get back the original image which is known as Reconstructed Image.
6. Close: After we get back the original image it get closed.

PERFORMANCE ANALYSIS:

Performance analysis depends on two factor:

1. PSNR(Peak Signal To Noise Ratio):
2. MSE(Mean Square Error):

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1. PSNR: PSNR represents a measure of the peak error.To calculate the PSNR valuethe block first calculates the mean squared error using the following equation.

   $PSNR=10log_2\left(\frac{R^2}{MSE}\right)$

   R is the maximum fluctuation in the input image data type. For example, if the input image has a double precision floating point data type, then *R* is 1. If it has an 8bit unsigned integer data type, *R* is 255, etc.
2. MSE: The MSE represents the cumulative squared error between the compressed and the original image. The lower the value of MSE, the lower the error.

$$MSE = \frac{\sum_{M,N}[I_1(m,n) - I_2(m,n)]^2}{M * N}$$

M and *N* are the number of rows and columns in the input images, respectively.
On the basis of above two factor we have taken some images into input side and get the reconstructed image and also calculated the PSNR value and MSE value. Results are shown below:

Fig.7. Snapshot Of Images

Input Image	Output Image	PSNR Value	MSE Value
		**32.36 dB**	**37.72**
		**39.85 dB**	**6.7242**

VI. CONCLUSION

We have tried to obtainmore clear image with high resolution. Firstly the image is encrypted then. For encryption and compression purpose SPHIT encoder and decoder is used. In order to achieve the final goal first we have generalized the image encryption schemes related to scalable coding, i.e., wavelet based algorithms. After receiving the image we have calculated the PSNR and MSE value. PSNR and MSE are inversely related to each other. If PSNR is low MSE will be high and vice-versa. There are two types of Compression techniques namely loseless and lossy compression. If the value of PSNR is 100% then the compression is known as losseless as the image can be reconstructed exactly. If any values are changes then it is known as lossy compression.

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