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A Novel Method for Encryption of Images based on Displacement of RGB Pixels

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***Abstract*—** In today's world, security of information has become a crucial part of every aspect of human-life, when data is transferred through internet. Due to the transmission of information through network, unauthorized access is possible. Image Encryption is one of the techniques to protect the images over the internet. This can be possible by displacement of RGB pixels of an image. Encryption can prevent a third party from understanding the data during the transmission. This paper sets out to contribute to the general body of knowledge in the area of cryptography application and by developing a RD algorithm for image encryption by shifting the RGB pixel values. The algorithm ultimately makes it possible for encryption and decryption of the images based on the RGB pixel. The algorithm was implemented using JAVA.

Keywords—*Image, Encryption, Decryption, Cryptography, Image Security, algorithm, Pixel shifting, RD algorithm*

I. INTRODUCTION

In cryptography, encryption is the process of encoding information using an algorithm to make it illegible to anyone except those possessing particular knowledge, usually referred to as a key. In the present era not only the business but almost all aspects of human life are driven by the information, so it is become imperative to protect the information from malicious activities such as attacks. Now days everyone has the access to the internet for the purpose of transferring the data and this data may be in the form of textual or multimedia[2]. For this purpose security of information is a major concern. Information is passed on through the internet in which it is very easy to divulge vital information from pilfering, thus encryption methods be used [3]. Encryption is the process of encoding messages or information in such a way that only authorized parties can access it by applying numerical algorithms and keys to convert data into cipher code earlier than they are broad cast. Decryption involves the use of numerical algorithms and keys to get back the original data from cipher code[8]. In today's world images are widely used to represent information in various domains [1]. The image encryption is to transmit the image securely over the network so that no unauthorized user can able to decrypt the image[9]. Decryption is the reverse process of encryption where in cipher image is converted into original image by providing the key which is used in encryption [7]. Cryptography provides us the major objectives like Authentication, Secrecy of information, integrity and non reputation.

Image Encryption can be done in two ways Symmetric and Asymmetric.. Symmetric methods uses single key for encryption and decryption. In asymmetric encryption two keys are used one is public key and the other is private key for encryption and decryption [13]. This paper mainly focuses on a method, symmetric algorithm which uses single key is used for encrypting the plain image and decrypting the encrypted image [6].

Numerous approaches and methods for image encryption are approaching. Several methods consider the image as blocks of data or streams that can be encrypted either block by block or stream by stream[4]. Some traditional encryption techniques Data Encryption Standard (DES) and Advanced Encryption Standard (AES) both show poor error detection and high computational time [8].

RGB pixel displacement is the method to encrypt the color images. In this method the image is used as a key for both encryption and decryption. This method is suitable for encrypting the color images[5]. The image is split into three planes in color image. After encryption cipher image is generated, which is not understandable by any one[11]. The same image is used for decrypting the cipher image then the input image will be generated [14].

In this paper a new technique for encrypting color images using the RGB pixel displacement is proposed. The section II contains the Problem Definition. The section III contains reviews on related work. Section IV contains Methodology. Flowchart is in section V. Results of the work done on color images is shown in the VI section. Conclusion is given in section VII.

II. PROBLEM DEFINITION

In today's world, the security of information transmission mainly transmission of images is becoming a trivial deliberation since the network is going rapidly. And the image security is a hot research area in multiple areas like information security, secure transmission and copyright laws. Image encryption technique should be designed to augment the effectiveness of the transmission and it should be protected from susceptible attacks by the illicit access. So that, Image encryption using RGB pixel displacement technique is proposed to enhance the security.

III. REVIEWS ON RELATED WORK

Navita Agarwal proposed a novel approach for efficient shuffling technique on RGB pixels for image encryption. This technique involves, firstly extract the values from the input image and then managed to get the cipher image. For this technique there is no need to increase the pixel size and change the bit values. Numerical values are displaced, rearranged and mix with the RGB values and they are moving from their respective positions. Then the RGB values are swapped to obtain the cipher image. In this approach the the numerical values of an image is rearranged and displaced and finally they swapped with RGB values to get encrypted image. Kester proposed a approach image encryption based on the RGB pixel transposition and shuffling. In this method there was no change of bit values of the images.

And at the end of the encryption decryption process there is no pixel displacement. The change in their values in the image is zero. Input image numerical values are displaced and rearranged with rgb values cipher image was generated. RGB

pixel values are shifted to native pixel positions and interchanged within the image boundaries. Finally the shuffling image is displacing by the RGB values and also interchanging the RGB pixel values. Some techniques are proposed using image as key [10,12]. Kamboji, presents an algorithm that extracts the edge information of color images in RGB color space with fixed threshold value.

In this paper a new technique for encrypting color images is proposed. In image encryption using RGB technique the single image is used as a key for both encryption and decryption. Encryption and decryption algorithms are used for encryption and decryption.

IV. METHODOLOGY

Traditional Encryption techniques (DES, RSA) uses single key for encryption and decryption. These methods are used only for encrypting the text messages. Now a days images are widely used for data transfer. So it is important to encrypt an image before sending to anyone. RGB pixel displacement is the best method to encrypt the color images. In RGB technique the input image is encrypted by using another color image is used as a key. And the key image is of the same size(256×256). Key generation process involves the splitting of key image into three components (RED,GREEN,BLUE). The bit plane of each of three components is selected. This act as the key. The original image is also split into RGB components. Original image components are XORed with the selected bit planes of the key image. Intermediate cipher image will be generated, which further undergoes scrambling of RGB and gives the required Cipher Image. That means the original image is encrypted with the key image. Encrypted image is accessible by one who are having the same key image. Decryption of the image is the reverse process of Encryption. This method is well suitable for encrypting the color images and 3D images.

RGB technique is used to encrypt color images and 3D images. An image is the combination pixels. Color model consist of three component images, one for each primary color. These three images combine on the screen to produce a composite color image, When fed into an RGB monitor. The number of bit used to signify each pixel in the RGB space is called pixel depth . RGB technique is used to encrypt color images and 3D images. In the RGB model each color appears in the primary spectral components of red, green, blue. This model is based on a Cartesian coordinate system. space is called pixel depth. The RGB model is an preservative color model in which each pixel is represented as three numerical values. The first numerical value is red, second value is green and third one is blue. These values are used to represent color on the screen. Each other mix of values gives the different color. For example R+G+B= White, R+G= Yellow, R+B= Magenta, G+B= Cyan. Each pixel in the image has an intensity value that is represented with a digital number. Figure 4 shows the original image, this image is combined with the key image that is showed in figure 5 then encrypted image is generated. The encrypted image should be the same size as original image.

Decryption is the reverse way of encryption. Encrypted image is combined with the key image then the original image is generated with the same size. Color variations in RGB are represented in a scale of values ranges from 0 to 255 with 0 having the low intensity value and 255 having the high intensity value.

When the 3 components are combined 256×256×256 probable combinations for a color image. Original image is split into three components RED,GREEN,BLUE components these three components are mix with the key image it produces different color then encrypted image will be generated.

V. SYSTEM ARCHITECTURE

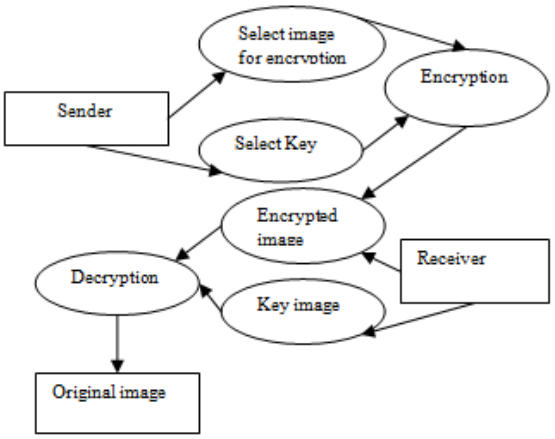

Figure 1: Image encryption using image as key

A. Algorithm for Encryption

1. Select the Input image and Key image.
2. Split RGB components of input image and Key image.
3. Then do XOR operation of input image and Key image.
4. Intermediate image will be generated.
5. Shift bits of input image
6. Encrypted image will be generated.

B. Algorithm for Decryption

1. Select the Encrypted image and Key image.
2. Split RGB components of Encrypted image and Key image.
3. Shift bits of encrypted image.
4. Intermediate image will be generated.
5. Then do XOR operation of encrypted image and Key image.
6. Input image will be generated

C. Flowchart

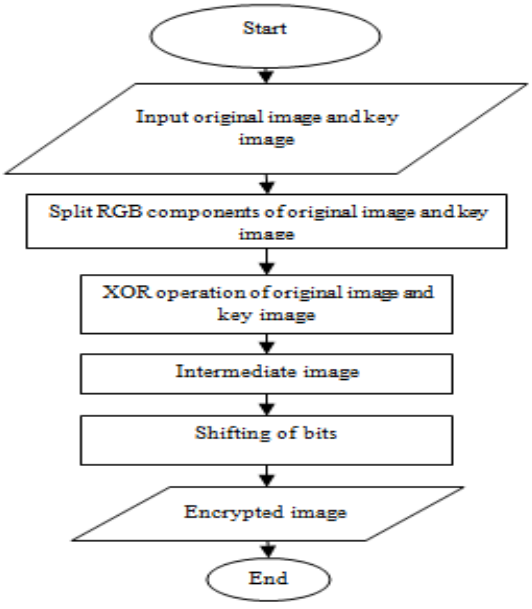

Figure 2: Flowchart for RGB pixel displacement Encryption

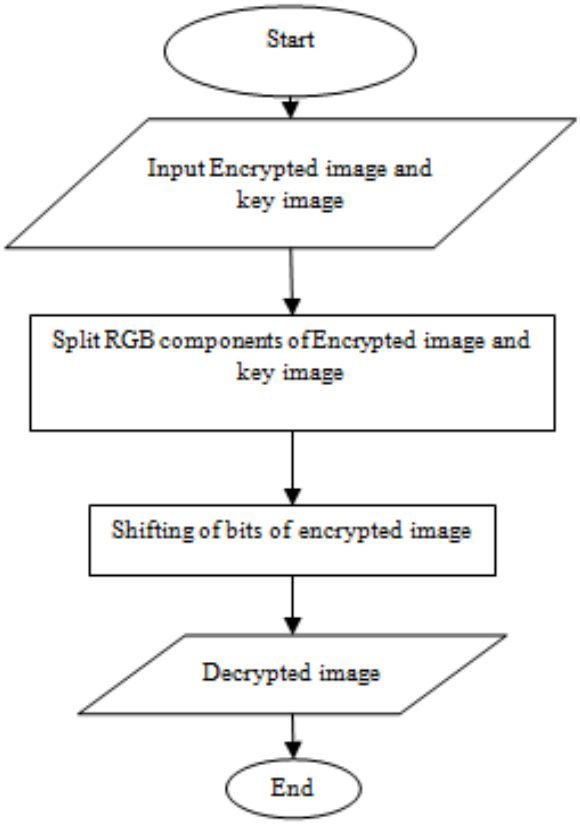

Figure 3: Flowchart for RGB pixel displacement Decryption

V. EXPERIMENTAL RESULTS

Figure 4: Original image Tulips.jpg

Figure 5: Key image Ship.jpg

Figure 6: Encrypted image

Figure 7: Decrypted image Tulips.jpg

CONCLUSION

The proposed method of encryption of color images using RGB pixel displacement is well suitable for encrypting 3D images or color images. In this approach the encrypted is obtained by doing some operations like XOR operation and shifting the bits of an image is done. It is very easy and simple technique for encrypting color images using the RGB components i.e., RED,GREEN,BLUE and scrambling by just performing some transpose operations on image with the displacement of components. In this approach the single key is used for both encryption and decryption. This method is suitable for encrypting images which are of different types and sizes and that are used for different applications.

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