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New Secure Image Transmission Technique via Secret-Fragment-Visible Mosaic Image with Improved Visual Quality

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Abstract:Image transmission is one of the important parts in our day to day life. Basically in the internet, images are transmitting for various applications, such as online personal photograph albums, confidential enterprise archives, document storage systems, medical imaging systems and military image databases etc. All these images contain some secrecy so to protect this secrecy we want to provide some techniques that makes the images secret. Mosaic image transmission is a new image transmission technique, which transforms a given large-volume secret image into a so-called secret-fragment-visible mosaic image of the same size. But there are issue related to clarity and time take for producing mosaic image is very large. Here talented techniques are designed to conduct the color transformation process so that the secret frame may be recovered nearly lossless.Here I propose a new technique for producing mosaic image and the experimental results shows good visual clarity and less time taken for producing result as compare to the conventional algorithms. Performance evaluation has been increased a in significant way.

Keywords: Terms—Color transformation, data hiding, image encryption, mosaic image, secure image transmission..

I. INTRODUCTION

Image transmission is one of the important parts in our day to day life. Basically in the internet, images are transmitting for various applications, such as online personal photograph albums, confidential enterprise archives, document storage systems, medical imaging systems and military image databases etc. All these images contain some secrecy so to protect this secrecy we want to provide some techniques that makes the images secret. Nowadays, many many methods have been developed for securing image transmission, for which two common approaches are image encryption and data hiding. Image encryption is a technique that makes use of the natural property of an image, and algorithms that convert one image to another unreadable form called encrypted format. Main drawback of this technique is encrypted image is a meaningless file, so that it cannot provide an additional information before decryption and this may cause an attacker's attention during transmission because of its randomness. An alternate solution to this problem is data hiding. Data hiding, is a form of steganography, which embeds data into digital media for the purpose of identification, annotation, and copyright. Several constraints affect this process, some of them are the quantity of data to be hidden, the need for invariance of these data under conditions where a "host" signal is subject to distortions, e.g., lossy compression, and the degree to which the data must be immune to interception, modification, or removal by a third party. Thus, a main issue of this method for hiding data in images is the difficulty to embed a large amount of message data into a single image. Specifically, if one wants to hide a secret image into a cover image with the same size, the secret image must be want to highly compress.By minimizing draw backs of above methods a new technique for secure image transmission is proposed, which transforms a secret image into a meaningful mosaic image with the same size and looking like a preselected target image. The transformation process is controlled by a secret key, and only with that key a person can recover the secret image nearly losslessly from the mosaic image. The mosaic image is obtained as a result of rearrangement of the fragments of secret image in disguise of another image called the target image freely select his/her favourite image. The aim of this project is to develop a method to improve the visual quality of produced mosaic image.Chapter 2 contain Literature survey and chapter 3 includes design of the proposed system. Implementation details are organized in chapter 4. Chapter 5 contains evaluation. Finally concluded in chapter

II. EXISTING SYSTEM

Mosaic image is a new technique for secure image transmission which transforms a secret image into a meaningful mosaic image with the same size and looking like a preselected target image. Mosaic image is the result of rearrangement of the fragments of a secret image in disguise of another image called the target image.

Santosh Bandak Vaneeta Sunil Phand proposed that, Image steganography and watermarking techniques are commonly been for multimedia data security. Wavelet and LSB are most common steganography methods. These two methods do not require any external information for decoding as the data is hidden in the image it can be interpreted with steganolysis tools. In his work we have proposed a unique mosaic based technique which extracts texture block from payload and embeds it in the usual similar texture block of the carrier. it results in visible steganography which looks

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like a normal mosaic image. The source block to the carrier block mapping is saved in a table this is the partial information required for reconstruction therefore it is impossible by steganolysis tools to assume a steganographic method by analyzing the image. Another reason being that there is no embedding data but rather a substitution of blocks this result is better security for the data and also the result shows that the proposed system performs better than both LSB and wavelet steganography in terms of visual and quantitative methods

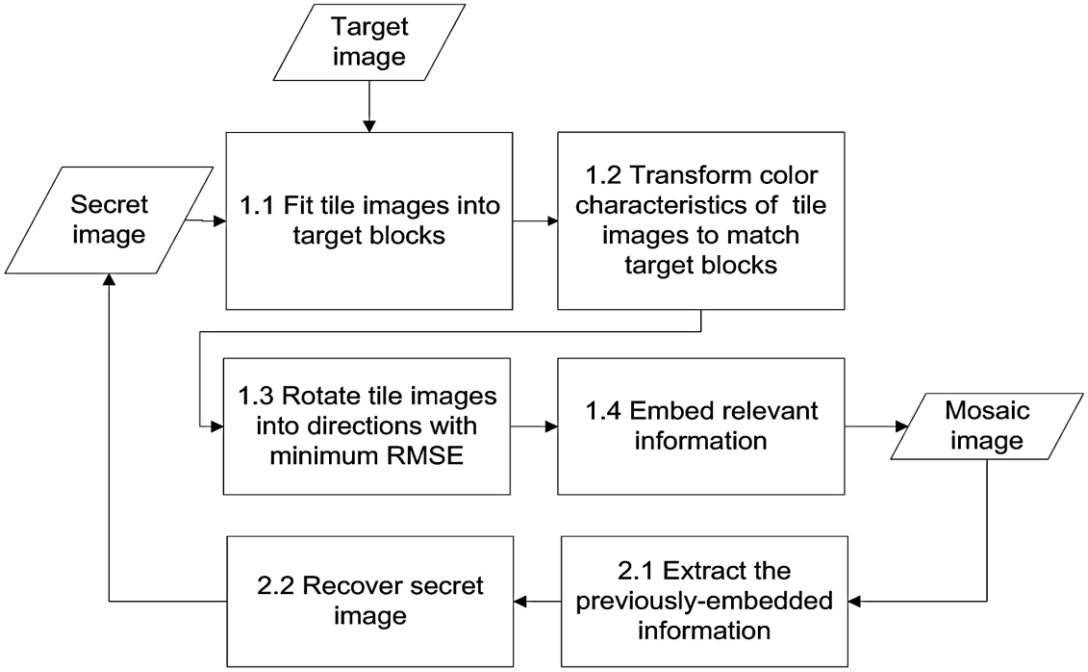

Fig 2.2: Block Diagram of Existing System

Mosaic image is a new technique for secure image transmission which transforms a secret image into a meaningful mosaic image with the same size and looking like a preselected target image. Mosaic image is the result of rearrangement of the fragments of a secret image in disguise of another image called the target image

III. MOSAIC IMAGE CONSTRUCTION

a) Fitting Tile Images

The secret image selected first. Then it is divided into tile blocks. The target image can be selected from given video according to the user's interest. Then it is also divided into target blocks. The size of each tile and target block should be equal. Then find out the standard deviation of each block in secret and target image by using the equation

I. $$\alpha_{c'} = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(c'_i - \bar{c}_{c'})^2}$$

$$\alpha_c = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(c_i - \bar{c}_c)^2}$$

Where

$\alpha_{c'}$ Standard deviation of target image

α_c Standard deviation of secret image

$\bar{c}_{c'}$ Mean of target image

$\bar{c}_c$ Mean of Secret image

Then perform a mapping between secret image block and target block based on the similarity in standard deviation.

b) Color Transformation

The color characteristics of the secret image should be converted into the color characteristics of target image using the mean and standard deviation values using the equation and the new colour value can be calculated by using the formula

$c_i'' = q_c(c_i - \bar{c}_c) + \bar{c}_{c'}$.

Where,

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Where q_c is the quotient can be calculated by using the formula

$$q_c = \frac{\alpha'_c}{\alpha_c}$$

And mean of secret and target can be calculated by using

$$\bar{c'} = \frac{1}{n}\sum_{i=1}^{n} c'_i$$

$$\bar{c} = \frac{1}{n}\sum_{i=1}^{n} c_i$$

We are considering the RGB colour space here. Because of that, there will be three component values for each pixel in the image.

c) Image Rotation

It consists of rotating blocks to fit better with smaller RMSE value. RMSE stands for root mean square error. After a target block B is chosen to fit a tile image T and after the color characteristic of T is transformed, we conduct a further improvement on the color similarity between the resulting tile image T' and the target block B by rotating T' into one of the four directions zero, ninety, one hundred and eighty and two hundred and seventy degrees, which yields a rotated version of T' with the minimum RMSE value with respect to B among the four directions for final use to fit T into B.

d) Embedding Information

For the secret image retrieval from the receiver side, we need to embed some information into the mosaic image. The information to be embedded are mean values, std deviations and rotation angle. For the embedding purpose, we can use LSB embedding. ie, the informations are embedded into the least significant bits of the pixels in the random blocks.

IV. SECRET IMAGE RECOVERING

a) Extraction of Recovery Information

The information's which are embedded in the mosaic image to be retrieved for the secret image retrieval. The embedding technique can be reversed for the extraction purpose. A lossless extraction leads to the efficient recovery of secret image which was sent.

b) Secret Image Retrieval

After extraction of recovery information, the secret image can be retrived using the reverse processes of mosaic image construction. The mosaic image provides transmission facility for the image data when it sent through the network.

V. PROPOSED SYSTEM AND DESIGN

In the digital world, security is an important issue. There are many digital images are present in digital communication system which being sent over computer networks. There is one of the obvious way to ensure security is Image encryption. This technique is try to convert original image to another image which is hard to understand and to keeps the image confidential between users, in other word, its important that without decryption key no one can access the content. Image encryption has applications in internet communication, multimedia systems, medical imaging. telemedicine, military communication etc. For privacy protection of digital images, encrypted databases is an important technological capability in multiparty information management.

Steganography means covered writing. Data should be hidden in cover object in such a manner that is just by viewing or listening you can't even judge that there is any data or not. Changing the image in a way that only the sender and the intended recipient is able to detect the message sent through it. it is invisible, and thus the detection is not easy. It is a better way of sending secret messages than encoded messages or cryptography as it does not attract attention to itself

VI. FEASIBILITY STUDY

A feasibility study is defined as an evolution or analysis of the potential impact of a proposed project. The main objective of this study is to determine whether the proposed system is feasible or not. Mainly there are three types of feasibility studies to which the proposed system is subjected. They are Economical Feasibility, Technical Feasibility and Behavioural Feasibility. The proposed system is evaluated from technical view point first and if technically feasible, its impact on the organization must be accessed. If compatible , the behaviour of the system can be devised. Then those must be tested for economical feasibility.

a) ECONOMICAL FEASIBILITY

Economic analysis is used for the cost effectiveness of a proposed system. More commonly known as cost/benefit analysis, the procedure is to determine the benefits and savings that are expected from a proposed system and compare with the costs. If benefits outweigh the costs, a decision is taken to design and implement the system. Otherwise, further justification or alternative in the proposed system will have to be made if it so to have a chance of being approved. Financial benefits must equal or exceed the cost.

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b) TECHNICAL FEASIBILITY

The question is to answered is whether the organization is technically sound to operate the system. The necessary hardware and software must be installed in the organization. Technical needs of the system may vary considerably, but might include Facility to produce outputs in a given time and Response time under certain condition.

c) BEHAVIOURAL FEASIBILITY

Operational behavioural feasibility shows up to what extend the user accept the system. It is mainly related to human organizational and political aspects.

VII. PROPOSED SCHEME

The main drawback of existing system is

- More time needed for mosaic image creation
- Complex mapping strategy
- Minimum visual quality for mosaic image

In this paper, I propose a New Secure Image Transmission Technique via SECRET-FRAGMENT-VISIBLE MOSAIC IMAGE with Improved Visual Quality, reduce mapping complexity and also reduce time needed for execution

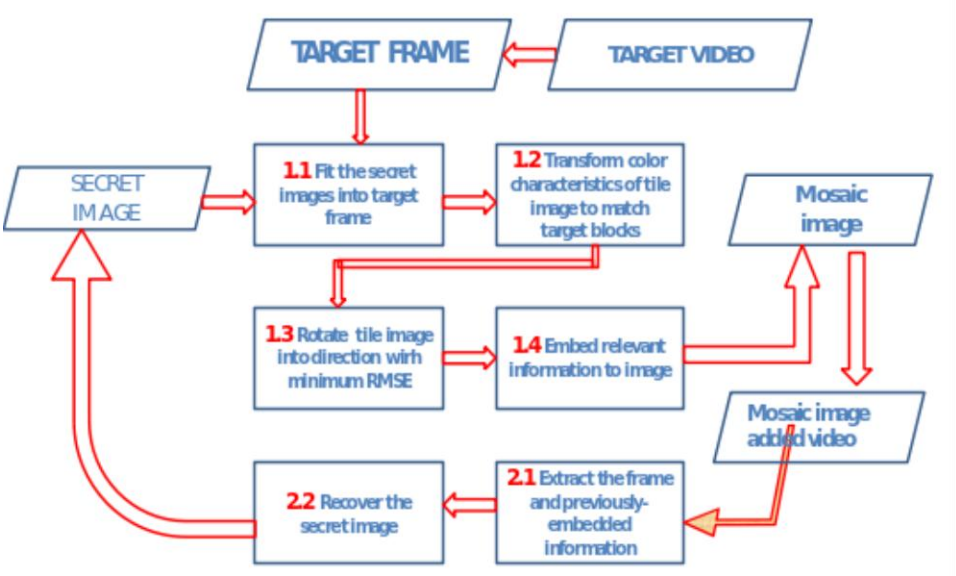

Fig 3.1: Block Diagram Of Proposed System

Mosaic image is a new technique for secure image transmission which transforms
a secret image into a meaningful mosaic image with the same size and looking like a preselected target image. Mosaic image is the result of rearrangement of the fragments of a secret image in disguise of another image called the target image.

1. Mosaic Image Construction

a) Fitting Tile Images

The secret image selected first. Then it is divided into tile blocks. The target image can be selected from given video according to the user's interest. Then it is also divided into target blocks. The size of each tile and target block should be equal. Then generate a random matrix whose size is equal to the no of blocks in the secret image then perform a mapping between secret image block and random matrix values. Perform a sorting on random matrix then perform direct mapping between sorted random matrix block and target image block.

b) Color Transformation

The color characteristics of the secret image should be converted into the color characteristics of target image using the mean and standard deviation values using the equation

$c_i'' = c_i + \Delta$,

where $\Delta = \sigma_{c'} - \sigma_c$.

We are considering the RGB colour space here. Because of that, there will be three component value for each pixel in the image.

c) Image Rotation

It consist of rotating blocks to fit better with smaller RMSE value. RMSE stands for root mean square error. After a target block B is chosen to fit a tile image T and after the color characteristic of T is transformed, we conduct a further

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improvement on the color similarity between the resulting tile image T' and the target block B by rotating T' into one of the four directions zero,ninety,one hundred and eighty and two hundred and seventy degrees, which yields a rotated version of T' with the minimum RMSE value with respect to B among the four directions for final use to fit T into B.

d) Embedding Information

For the secret image retrieval from the receiver side, we need to embed some information into the mosaic image. The information to be embedded mean values and rotation angle. For the embedding purpose, we can use LSB embedding. ie, the informations are embedded into the least significant bits of the pixels in the random blocks. For retrieving the actual image we have to send the our seed value for generating random matrix, frame number of the video used as the target frame. Here by using AES encryption technique we encrypt the data and send over the internet

2) SECRET IMAGE RECOVERING

a) Extraction of Recovery Information

The information's which are embedded in the mosaic image to be retrieved for the secret image retrieval. The embedding technique can be reversed for the extraction purpose. A lossless extraction leads to the efficient recovery of secret image which was sent.

b) Secret Image Retrieval

After extraction of recovery information, the secret image can be retrieved using the reverse processes of mosaic image construction. The mosaic image provides transmission facility for the image data when it sent through the network.

VIII. RESULT ANALYSIS

A series of experiments have been conducted to test the proposed method using many secret and target images with different sizes. To show that the retrieved secret image is nearly lossless, six performance metrics are used.They are

- Mosaic Structural similarity
- Structural similarity
- Visual quality
- psnr value checking
- Mean square error
- time elapsed for mosaic image creation

The test images used for the experiments are given below.

Table 6.1: Image name with Id

Image	**Reference id**
Red rose	1
Rose	2
A painting	3
Cup	4
Violet colour	5
Green colour	6
Romantic scene	7
Sunset	8
Yellow colour	9
Red colour	10

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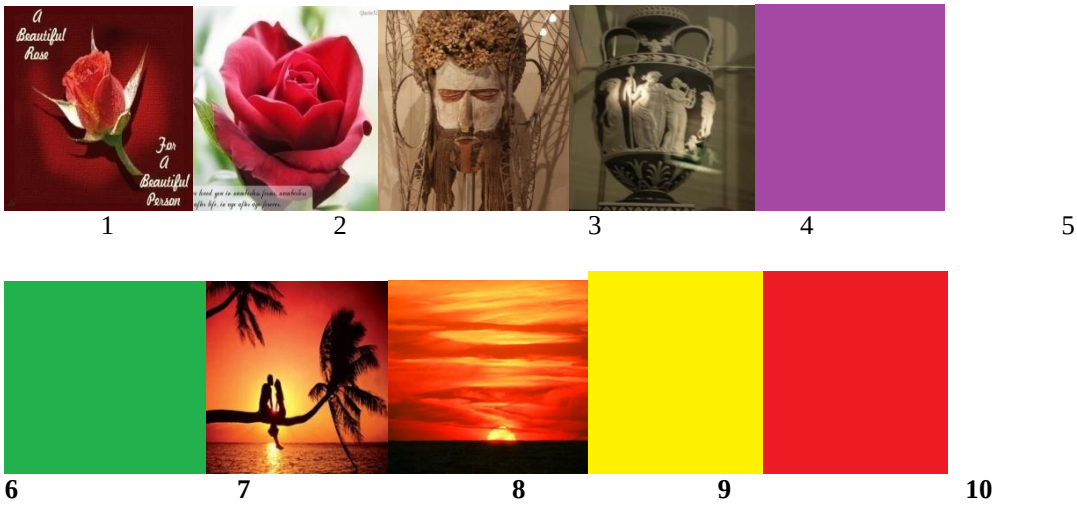

Fig 6.1 : Test Images

IX. EVALUATION

- SSIM : The structural similarity index is a method for predicting the perceived quality of digital television and cinematic pictures, as well as other kinds of digital images and videos.
- PSNR : PSNR is most commonly used to measure the quality of reconstruction of lossy compression codecs (e.g., for image compression). The signal in this case is the original data, and the noise is the error introduced by compression. When comparing compression codecs, PSNR is an *approximation* to human perception of reconstruction quality. Although a higher PSNR generally indicates that the reconstruction is of higher quality, in some cases it may not. One has to be extremely careful with the range of validity of this metric; it is only conclusively valid when it is used to compare results from the same codec (or codec type) and same content
- Mean square error : mean squared error (MSE) or mean squared deviation (MSD) of an estimator measures the average of the squares of the errors or deviations, that is, the difference between the estimator and what is estimated. Like the variance, MSE has the same units of measurement as the square of the quantity being estimated. In an analogy to standard deviation, taking the square root of MSE yields the root-mean-square error or root-mean-square deviation (RMSE or RMSD), which has the same units as the quantity being estimated; for an unbiased estimator, the RMSE is the square root of the variance known as the standard deviation
- MOSAIC SSIM : check the similarity in structure between created mosaic image and existing target image . The structural similarity index is a method for predicting the perceived quality of digital television and cinematic pictures, as well as other kinds of digital images and videos
- Time needed for mosaic image creation and visual quality of mosaic images are also be checked

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X. VISUAL QUALITY

SECRET IMAGE TARGET IMAGE

Fig 7.1: Secret and Target Image

MOSAIC IMAGE (BASE PAPER) MOSAIC IMAGE (MODIFIED)

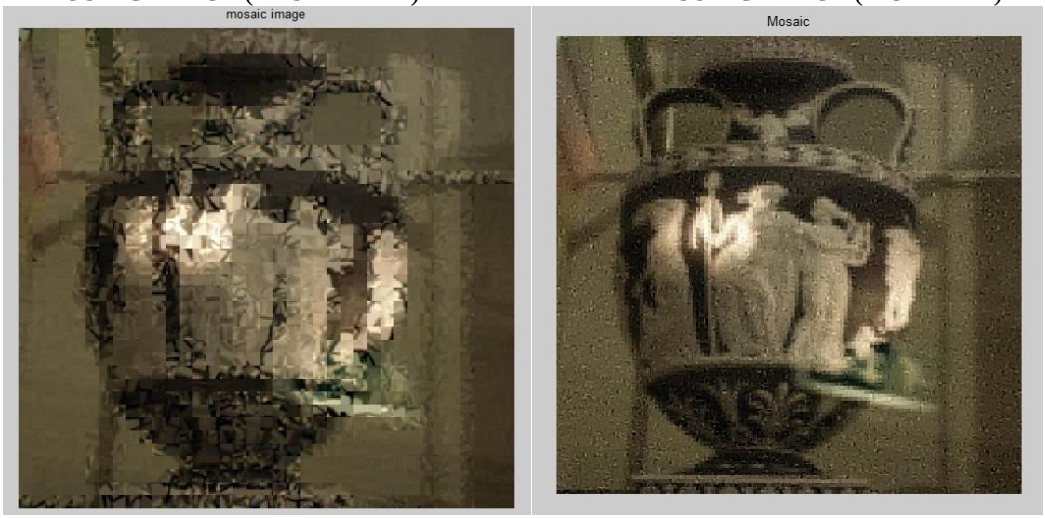

Fig 7.2: Comparison

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XI. COMPARISON OF EXISTING AND PROPOSED METHOD

Table 7.1: Comparison

SECRET IMAGE	TARGET IMAGE	EXISTING METHOD				PROPOSED METHOD			
		PSNR	TIME In sec	MSSIM	MSE	PSNR	TIME In sec	MSSIM	MSE
1	2	35	75	.4	2.2	39	60	.9	.98
3	4	43.7	89	.32	1.4	48.441	62	93	1.1
5	6	37	100	.45	2.25	61	70	.99	2
7	8	40	124	.76	3.6	52.1	85	.89	2.4
8	10	38.6	120	.82	.96	50.56	80	.97	1.6

Performance is measured through both existing and proposed methods. They give absolutely dominate our proposed method. Hence the proposed method maintains the image quality as good than existing one and time needed for producing mosaic image is less as compared to the existing one and also the value of psnr is little bit higher than the existing one . Security aspects can be said based on the AES encryption.

XII. CONCLUSION

A new secure image hiding and transmission technique via secret-fragment-visible mosaic image by nearly reversible color transformation has been proposed with ,more visual clarity.

It consume less time as related to existing one ,which can create a meaningful mosaic images and also can transform a secret image into a mosaic one with the same data size for use as a camouflage of the secret image. By the use of proper pixel color transformations as well as a skilful scheme for handling overflows and underflows in the converted values of the pixels' colors, secret-fragment visible mosaic images with very high visual similarities to arbitrarily-selected target images can be created with no need of a target image database. Also, the original secret images can be recovered nearly lossless from the created mosaic images. Good experimental results have shown the feasibility of the proposed method.

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