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Reducing Transmission Risk Using Diverse Image Media

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***Abstract*— In the previous visual secret sharing schemes which can hide secret images in image shares and the used image may be printed on transparencies or encoded and also stored in a digital form. The shares of the image can appear like noise pixels or as meaningful images; but it will suspicion and increase interception risk during transmission of the shares. Hence, VSS schemes have limitation that it suffers from a transmission risk problem for the secret itself and for the participants who are involved in the VSS scheme. To avoid the problem i.e. transmission risk, a natural image based VSS scheme (NVSS scheme) which can shares secret images via different carrier media to protect the secret and the participants during the transmission phase. This proposed (*n*, *n*) - NVSS scheme can share digital secret image over *n*-1 arbitrary selected natural images (called natural shares) and one noise-like share. The natural shares or natural images can be photos or hand-painted pictures in digital form or in printed form. The shares that look like noisy share can be generated based on these natural shares and the secret image. The unaltered natural shares are various and inoffensive, thus considerably reducing the transmission risk problem.**

***Keywords*— Visual Cryptography scheme, extended visual cryptography, natural images, transmission risk, Visual secret sharing.**

INTRODUCTION

In traditional visual cryptography scheme, shares are created as random patterns of pixel. These shares look like a noise. Noise-like shares arouse the attention of hackers, as hacker may suspect that some data is encrypted in these noise-like images. So it becomes prone to security related issues. It also becomes difficult to manage noise-like shares, as all shares look alike. Nakajima, M. and Yamaguchi, Y. developed Extended visual cryptography scheme (EVS). An extended visual cryptography (EVC) provide techniques to create meaningful shares instead of random shares of traditional visual cryptography and help to avoid the possible problems, which may arise by noise-like shares in traditional visual cryptography.

Traditional visual cryptography schemes were based on pixels in the input image. The limitation of pixel based visual cryptography scheme is loss in contrast of their constructed image, which is directly proportional to pixel expansion. Visual cryptography (VC) is a technique that encrypts a secret image into *n* shares, with each participant holding one or more shares. There are different types of Secret images such as : images, handwritten documents, photographs etc. An important purpose of the VC is to provide security to the secret image or message. In traditional VC's thy suffer from a problem of a) Share management, b) Pixel expansion, c) Transmission Risk problems, d) Quality of recovered image[1].

Sharing and delivering secret images is also known as a visual secret sharing (VSS) scheme. VSS schemes play an important role in the visual cryptography, because it use images and text messages to hide secrets and provide secure communication. Carrier is the medium that used to transfer the message e.g. digital media, printed media, and transparency. Another important thing is that the appearance of the image which can be used to display the image in different formats such as noise like image, meaningful image, stego image and natural image. These various types of images are used to hide secrete message and make the communication secure.

I. LITERATURE SURVEY

Visual cryptography concept came into focus to hide the secret text or image behind another image also this concept used by M. Naor and A. Shamir. These can be done by generating the different shares of the image. Then apply the process of encryption to encrypt that image and send to the proper destination. Other side that received shares can be merged to get the original image. But it suffers from the problem of share management, because they generate more than one share to hide the secret image [2].

The problem occurred in the VC scheme that can be overcome by the extended visual cryptography scheme. This VC schemes work on the Share management problem. To get the better solution Kai-Hui Lee and Pei-Ling Chiu uses a meaningful cover image concept. This type of VC scheme uses binary images. For the purpose of managing shares this technique first construct the meaningful share using an optimization technique. And in the next step it will uses cover images that can be added in each share directly by a by using the stamping algorithm. As this VC scheme uses binary image they are not able to maintain the quality of recovered image [3].

The purpose of such schemes to generate noise-like random pixels on shares to hide secret images which can be done in the conventional visual secret sharing. But it suffers a management problem, because of which dealers cannot visually identify each share. This management problem is solved by the extended visual cryptography scheme (EVCS), which adds a meaningful cover image in each share. However, the previous approaches involving the EVCS for general access structures suffer from a pixel expansion problem [4].

A construction of EVCS which is realized by embedding random shares into meaningful covering shares, and we call it the embedded extended visual cryptography scheme (embedded EVCS). A construction of EVCS which was realized by embedding the random shares into the meaningful covering shares. A method to improve the visual quality of the share images. Embedded EVCS has many specific advantages

against different well-known schemes, such as can deal with grey-scale input images, has smaller pixel expansion, always unconditionally secure, does not require complementary share images, one participant only needs to carry one share and can be applied for general access structure [5].

Extended VCS is that where hyper graph colourings are used in constructing meaningful binary shares. Since hyper graph colourings are constructed by random distributed pixels, the resultant binary share contains strong white noise leading to inadequate results. An encryption method to construct color EVCS with VIP (Visual information pixel) synchronization and error diffusion for visual quality improvement. [6].

Gray level visual cryptography is invented to provide the better quality image in the VC scheme. Here they applying adaptive order dither technique as well as existing visual cryptography scheme for binary image to construct the shares. This method reduces the size of decrypted images. The quality of decrypted image will be improved than the ECVS scheme. But this technique suffers from the pixel expansion problem [7].

Pixel expansion problem can be further considered in the Halftone VC scheme. This technique uses Halftone error diffusion method to convert secret image and the visible image in to the halftone image. Halftone shares are generated, because the secret information is embedded into the halftone shares and it will give the result as recovered good quality of image. This technique can avoid the transmission risk problem [8].

Technique used for halftone technique is error diffusion method. Which take one gray scale image and convert it into binary image by applying halftone technique? In this binary share images, put secret image pixel in to each share image by applying void and cluster algorithm. The reconstructed image is obtained by superimposing two share images. It is a very good method but still there is a trade off between pixel expansion and contrast loss of original image. this method size of pixel is same as original image pixel size. That means relieved secret image size and original image size is same so it reduces the problem of pixel expansion. In this method random grid R is defined as a two dimensional array of pixels. Each pixel is either transparent (white) or opaque (black) by a coin flip procedure The numbers of transparent pixels and opaque pixels are probabilistically same and the average opacity of a random grid is 50% [9-11].

Color image with natural shadow visual cryptography scheme Use the natural image to hide the secret information and one noise-like share image. For the encryption process its need to alter the natural image. So that this type of VC scheme suffers from texture problem i.e. original texture of the image will be lost [12].

In order to guarantee the secret image that transmits through the network will not be stolen, the secret images must be encrypted, the concept of this process is called secret image encryption. The random grid algorithm to encrypt the secret image. The scheme can adjust distortion to infinitesimal it also improve on the problems of decoding. The secret image consists of a collection of pixels, where to each pixel is associated a grey level ranging from white to black and each pixel is handled separately. Any set of qualified participants stack their transparencies they can correctly recover the image shared by the dealer. The security of the scheme, since it implies that, even by inspecting all their shares, any set of forbidden participants cannot gain any information on the value of the grey level of the shared pixel. [13-15].

II. PROPOSED NVSS METHODOLOGY

In the below diagram it gives the brief information about the architecture of the proposed NVSS scheme and the whole process of encryption can be displayed in different steps. In this process it only extracts features from the natural shares; but without altering the natural shares. In the image preparation and pixel swapping processes are used for pre-processing printed images and for post-processing the feature matrices that are extracted from the printed images. Image preparation process contains three small operations on printed image such as acquire image, crop image, resize image.

The feature extraction process is used to extract feature from the natural image by doing the three operations namely binarization, stabilization, chaos. Binarization process used to extract feature matrix from natural image. Balancing the occurrence frequency of values 1 and 0 in the obtained feature matrix can be done in the process of stabilization. The process named chaos is used to eliminate the texture of the extracted feature images and the generated share. In this process, the original feature matrix will be disordered by adding noise in the matrix.

Image distortion caused by the image preparation process can be tolerated in the pixel swapping process. The image distortions were introduced in the image preparation process was spread in a feature matrix, and the noise also is distributed in the recovered image without clustering together. Lots of the image distortions result in noise that appears in the recovered

images and if there is large amount of noise clusters together, then the image is severely disrupted which may cause a bad effect on recovered image that it makes impossible task for the naked eye to identify it. The pixel swapping process is the solution for this problem.

XOR operation used to do the encryption process. Before applying the XOR operation the stacking process of input image S and feature images FI1,…, FI*n*--1 can be done after that the XOR operation can be apply on in each color plane.

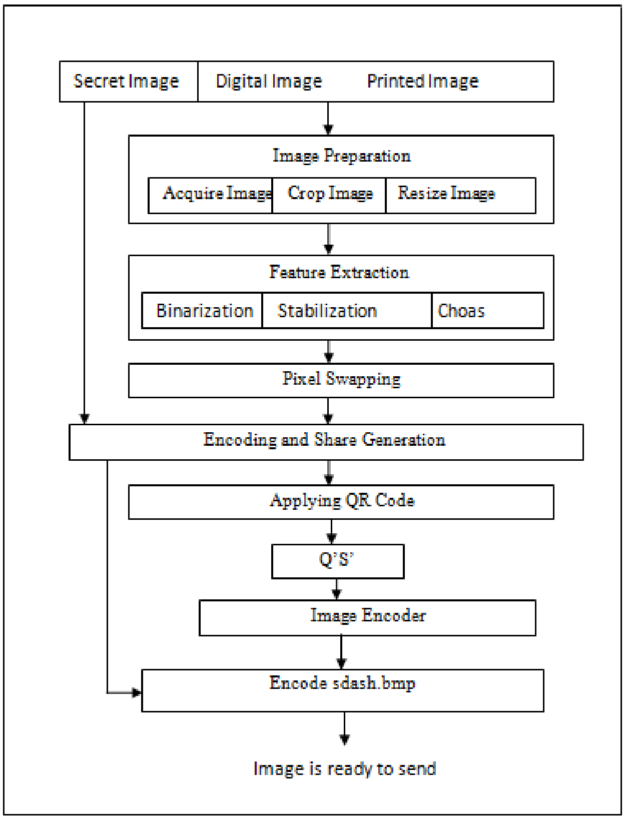


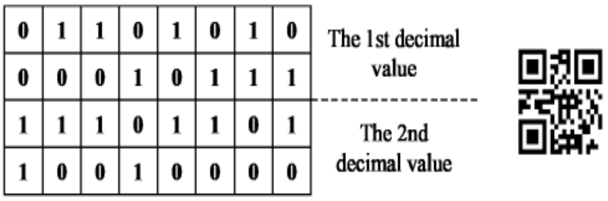
Fig 1 Architecture flow

Then the resultant image S is the share image ready to send to the destination place. This generated share is secure because the share was generated by stacking a secret image and *n*-1 feature images as well as the pixel values in each feature image are distributed randomly and uniformly. These feature images (FI) can be used as *n*-1 one-time pads (OTP). An important OTP system used which is difficult to break. The length of each one-time pad is equal to the length of the secret image. The encryption operation uses the logical XOR operator. By using these different methods the generated share must be secure.

By applying the feature extraction algorithm the generated shares of image have the properties like the new generated share is secure along with the pixel expansion free.

A. QR Code

The Quick-Response Code (QR code) techniques are introduced to conceal the noise-like share and further reduce intercepted risk for the share during the transmission phase. In the proposed NVSS scheme, a dealer can hide the generated share by using existing steganography. The amount of information that can be hidden in a cover image is limited and depends on the hiding method. To embed the generated share in a cover image, generally the dimension of the cover image must be larger than that of the secret image. If the share can be hidden in the cover image and then can be retrieved totally, the secret image can be recovered without distortion. We leave the details of using steganography to hide shares to the reader; our focus is on how to hide the share in printed media using QR code technology.



0	1	1	0	1	0	1	0
0	0	0	1	0	1	1	1
1	1	1	0	1	1	0	1
1	0	0	1	0	0	0	0

Fig 2 QR code

B. Feature Extraction from Image

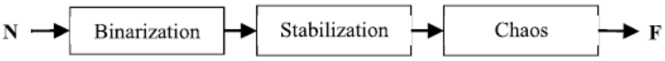


Fig.3 The block diagram of the feature extraction.

The feature extraction module consists of three processes Binarization, stabilization, and chaos processes. First, task is a binary feature matrix is extracted from natural image N via the Binarization process. Then, the stabilization balances the occurrence frequency of values 1 and 0 in the matrix. At last, the chaos process scatters the clustered feature values in the matrix.

C. Image Processing and Pixel Swapping

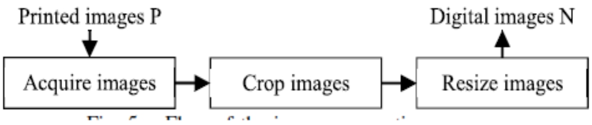


Fig. 4 flow of image preparation process

The image preparation and pixel swapping processes are used for pre-processing printed images and for post-processing the feature matrices that are extracted from the printed images. The printed images were selected for sharing secret images, but the contents of the printed images must be acquired by computational devices and then be transformed into digital data [1].

D. Encryption/Decryption Process

Encryption: Input images include *n* -1 natural shares and one secret image. The output image is look like a noise-like share image. Decryption: Input images include *n* -1 natural shares and one noise-like share. The output image is a recovered image i.e. image with secrete message [1].

III. Proposed Algorithms

A. The feature extraction algorithm (FE)

Step 1. Extracts one binary feature matrix F from each input natural image N.

Step 2. Determine the feature values of each pixel in a block.

Step 3. The stabilization process is performed and the noise can be added based on a given parameter Pnoise.

Step 4. Finally feature matrix ***F*** can be generated as an output.

B. *Encryption and Decryption Algorithm*

Step 1. Initializes random number generator G and this function G is used for the feature extraction and pixel swapping processes.
Step 2. Initializes all feature images.
Step 3. Extracts a binary feature matrix from a natural share by calling the feature extraction algorithm.
Step 4. Also adds the extracted matrix to corresponding bit and color planes of a feature image.
Step 5. The pixel-swapping process for each feature image extracted from the printed images. For each feature image, the pixel-swapping process randomly selects a pair of pixels in a feature image.
Step 6. Stacks input image $\bar{S}$ and feature images $FI_{1.....}$ FI_{n-1} by applying the XOR operation in each color plane.
Step 7. Finally, the resultant image S is the output.

C. *Share Hiding Algorithm*

Step 1. Initialize the parameters.
Step 2. Reduce the amount of information in the feature matrix F to fit within the capacity of the hiding media.
Step 3. Decides the value of stego bit s_b by majority. Function H(S) represents the Hamming weight of bit string S. Then, the stego-bit is appended to bit string F_{QR} .
Step 4. Convert F_{QR} to the numeric string S_{QR}. And finally the S_{QR} is output share image with QR code.

D. *Share Extraction Algorithm*

Step 1. Retrieves the related parameters from S_{QR}.
Step 2. Transform 5 numeric characters into binary form, then removes 5 consecutive numeric characters from the front of number string S_{QR} by calling procedure *remove*().
Step 3. Converts string S to its integer value by procedure *str2int* ().
Step 4. Transforms the value to a corresponding binary bit string and appends it to bit string $F_{QR.}$
Step 5. Converts F_{QR} to the resultant feature matrix F.
Step 6. Outputs feature matrix ***F***.

IV. NVSS SCHEMES

A. Hide the Secret Noise-Like Share

The Quick-Response Code (QR code) technique is used to hide the secrete image. The QR code is a two-dimensional barcode. A QR code uses four standardized encoding modes i.e. numeric, alphanumeric, byte / binary, and kanji to efficiently store data. A barcode is a machine-readable optical label that contains information about the item to which it is attached. This QR code encodes meaningful information. The noise-like share as the numeric type of the QR code. The encoding process consists of two steps: 1) Transform pixels on the share into binary values and represent the values in a decimal format. 2) Encode the decimal values into QR code format. Also the multiple QR can be used to encode more data bits.

The QR code generator is used to encode the secrete image in the QR code i. e. stego share. The QR code can be read by using QR cod scanner and smart phone devices. It is necessary to provide security to the QR code also so that no one can easily read that particular QR code. That's why the concept of applying digital signature to the QR code is most important to provide security to QR code.

Digital signatures employ a type of asymmetric cryptography. For messages sent through a nonsecure channel, a properly implemented digital signature gives the receiver reason to believe the message was sent by the claimer sender. In other word we can say that a Digital signature is a mathematical scheme for demonstrating the authenticity of a digital message or document.

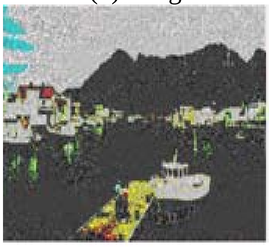
V. RESULT ANALYSIS

In the traditional visual cryptography schemes suffers from share management, quality of shares, quality of recovered image, pixel expansion, transmission risk, texture of image. These problems can be overcome in this proposed NVSS schemes. Here in this scheme it will produce only one share that's why it cannot face the share management problem. This proposed NVSS scheme uses the natural images so that the problem of quality maintenance can be overcome. By using the digital images, hand printed pictures, scan photos etc these are high quality images so that they can avoid the image or share quality problems. The amount of information required for the generated share is the same as for the secret image. So that the generated share is expansion free. Next is the texture problem of the image as the proposed NVSS scheme uses or work on natural images there will be no any texture problem occurs.

(a) Image 1

(b) Image 2

(c) Image 3



(d) Image 4

(e) Image 5

Here Image a, b, and c are the three images are used to hide the secrete data. Image d is the generated share used to have the secret data. Final Image e is the QR code to transfer for the security purpose. The final QR code is used to transmute the secret data.

VI. CONCLUSION

The proposed VSS scheme, (*n*, *n*)-NVSS scheme, that can share a digital image using diverse image media. The media that include *n*-1 randomly chosen images are unaltered in the encryption phase. Therefore, they are totally innocuous. Regardless of the number of participant's *n* increases, the NVSS scheme uses only one noise share for sharing the secret image. Compared with existing VSS schemes, the proposed NVSS scheme can effectively reduce transmission risk and provide the highest level of user friendliness, both for shares and for participants. This provides four major contributions.

1) This is the first attempt to share images via heterogeneous carriers in a VSS scheme.
2) Successfully introduce hand-printed images for images-haring schemes.
3) This proposes a useful concept and method for using unaltered images as shares in a VSS scheme.
4) Develop a method to store the noise share as the QR code with digital signature.

FUTURE ENHANCEMENT

There are an approach is invented that can use the video for hiding the secret in it and send it safely. This dissertation focuses on the reducing transmission risk, pixel expansion problem, maintaining the quality of image. Still there are more features related to image which can be considered in future enhancement. Video can be used as a media to hide secret. And also use image with the large size or with high resolution.

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