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Two Way Securities in QR Code Image by Using Steganography

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Abstract: QR (Quick Response) Codes, is a kind of barcode, are Initiating to make inroads in the United States. It is upcoming technology which is adopted in higher education and non rural areas. A QR code is a matrix barcode readable by smart phones and mobile phones with cameras and android operating system. This can be refereed as 2D code, 2D bar code and Matrix code. This technique is more convenient to hiding data in simple manner, but there is no security, which lead to information leakage. To avoid such cases, need security in QR Code. In this paper we are using QR Code as Image and providing (TWS) two ways security (QR Code Image Security and stenography which is used by new technology is called DWT) to secure data, which is more convenient to hold sensible as well as highly valuable data, used in army force and keeping patient's information securely and thwart from third party attacks while sending it through internet.

Keywords: QR, DCT, DWT, IDWT, TWS, Steganography.

I. INTRODUCTION

Two dimensional (2D) barcodes, such as QR Code[1] are becoming a persistent interface for mobile devices with camera phones and android Software. The monochrome 2D-barcodes are used to their robustness in an uncontrolled operating environment of camera phones. Most camera phones capture 2D-barcode images and store it. Recently, QR barcodes have become used and getting popular f or the identification of products or items and are especially used in trading markets.

An Internet usage becomes tremendously popular, exchange the data in online becomes very easy as well. Even though the users gain benefits by utilizing an internet, they also are facing different kind's problems with it. Security in private data is one of the good examples[2]. There is a way to set right the problems in data communication via internet, to avoiding such cases, proposed a variety of data security techniques. Steganography is a proper method used for protecting text data and nontext data.

II. QR BARCODE

A. *QR Barcode Structure:*

The QR barcode7 is a 2-D symbology developed by DensoWave in 1994. The code contains information in both the x and y-axis, whereas traditional single barcodes contain data in one direction only. The QR barcode therefore stores a considerably greater volume of information than a normal bar code[3].

The main structure of the QR barcode is the outer range is the quiet zone. The upper-left, upper right, and left-bottom square areas are used for position detection and pattern separators for positioning[4]. There are

The QR code is a kind of matrix symbol, which was developed by the Japanese company Denson-Wave in 1994. Fig 1 shows the basic structure of QR code. They are quiet zone, position detection patterns, separators for position detection patterns, timing patterns, alignment patterns, format information, version information, data, and error correction code words. They are shown in Fig 1. Some details of QR code can be refereed to [5].

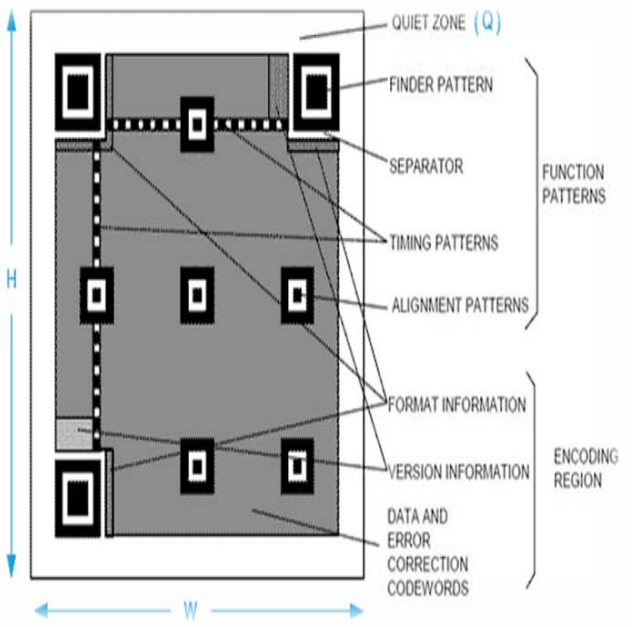

Figure 1. Structure of QR Code

B. *EncodingSize:*

The QR barcode can be generated by English, Chinese, or Japanese text. The text data shown in Figs. 2a are used for input. The generated QR barcode, as Figs. 2b show are the QR encoding output. Because the size of QR barcode is varied by encoding input data, larger text data will generate a larger size QR code. In Fig. 2b, the size of the QR barcode is 159 and it is encoding from Fig. 2a. It is a part of the secret data in our scheme and will be embedded into a cover image. Figure 4 shows a bigger QR barcode pattern. Figure 4a is the encoding text, and Fig. 4b is the corresponding QR barcode pattern of 279 x 279 size[6].

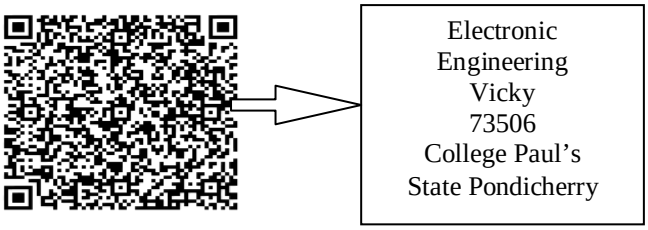

Figure 2. Hidding a text data

2a: Generated QR Barcode 2**b**: the text data

C. Flow of QR Bar Code:

In QR Bar Code, the working flow is divided into three parts as Fig. 3 shows. The upper path is the text data encoding flow; it first transfers the text into a 2-D barcode pattern QR code and then embeds it into the cover image. The middle path is the face image embedding flow[7]. The lower path is preparing the cover image for secret data embedding.

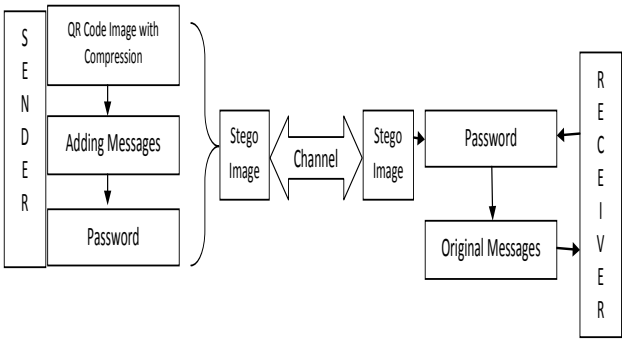

Figure 3. Flow of QR Bar Code

III. TECHINIQUES USED

QR barcodes image-processing techniques were used to construct a steganography scheme. Then the QR barcode pattern and a face image serve as the secret data which are embedded into the cover image without degradation of quality[8,1].

In the embedding process, the working flow is divided into three parts as Fig. 5 shows. The upper path is the text data encoding flow; it first transfers the text into a 2-D barcode pattern QR code and then embeds it into the cover image. The middle path is the face image embedding flow. The lower path is preparing the cover image for secret data embedding. At the beginning, the text data is used generate a QR barcode pattern at the barcode encoding BCE stage[9]. Because the QR barcode is a regular format of data blocks, it can be eliminated for decreasing the secret data. Thus, the regular area moving RAM is designed for moving the redundancy. For enhancing the security, a chaotic mechanism CM provides hashing of the secret data. Furthermore, the dimension reduction DR stage is used to map 2-D barcode patterns into 1-D data for convenient secret data embedding. A lower nibble byte discarding LNBD stage is used to keep the kernel data of the face image and eliminate the unimportant message[10]. However, the key and a pseudorandom number sequence PRNS generator are used to generate the pseudorandom sequences. On the cover image, a discrete wavelet transform DWT is adopted to convert the image from the spatial domain to frequency domain for robustness. Simultaneously, a block selection BS and coefficient selection CS are used to hash the order, thereby increasing the security. Once all of these processes have been prepared, the secret bits embedding SBE step is used to hide the secret data into the cover image. After all the secret data is embedded, an inverse discrete wavelet transform IDWT returns the cover image to the spatial domain from the frequency domain. Then the secret data embedding is complete[11].

IV. EMBEDDING ALGORITHM

A. Secured Design for QR Code Image:

The work flow is divided into three parts in the embedding process, as Fig. 4 shows. The text data encoding flow is in upper path, it convert the text as image which is called QR code. The image embedding flow is in middle path[12]. The secret data is embedding in the lower path.

In the first step, the text data is used to generate a QR barcode pattern at the barcode encoding BCE stage[13]. QR barcode has a proper data blocks format, which can be eliminated for decreasing the secret data. Thus, the standard or usual area which used to moving RAM is designed for shifting the redundancy. For the security enhancement, a chaotic mechanism (CM) provides hashing of the secret data. Additionally, for convenient secret data embedding, the dimension reduction (DR) level is used to map 2D barcode patterns into 1D data. LNBD (Lower Nibble Byte Discarding) phase is mainly used to carry on the kernel data of the image and eliminate the message which is not important. Then the key and PRNS(Pseudorandom number sequence)[14] generator are used to produce the sequences of pseudorandom.

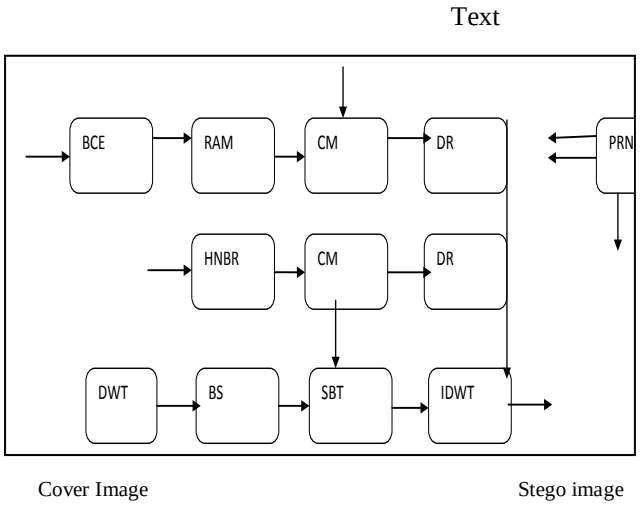

Figure 4. Embedding algorithm procedure

BCE: Bar Code encoding-- PSNR: Pseudo Random Number Sequence

HNBR: High Nibble Byte Reserving CM: Chaotic Mechanism

RAM: Regular Area Moving DM: Dimension Reduction

DWT: Discrete Wavelet Transform SBE: Secret Bits Embedding

IDWT: Inverse Discrete Wavelet Transform BS: Block Selection

For the robustness, DWT (Discrete Wavelet Transform) is adopted to convert the image from the spatial domain to frequency domain on the cover image[15].

At the same time, to hash the order, thereby increasing the security, BS (block selection) and CS (coefficient selection) are used. All these processes have been prepared, SBE (Secret Bits Embedding) is used to hide the secret data into the cover image.

The secret data embedding is completed, when an inverse discrete wavelet transform (IDWT) returns the cover image to the spatial domain from the frequency domain

B. Design Secured QR Code Image with additional data and Password:

After generating secured QR Code Image, this is used as cover image to adding more information which is an important secret message, which is not easily revealed one. Cover image is used to compresses for easy transmission via network. JPEG2000[16] Image compression techniques are used to reduce the size of image which is more convenient to transfer through internet.

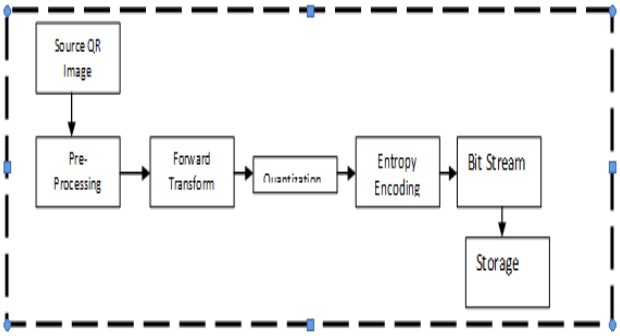

Figure 5. Encode Technique

Monochrome 2 dimensional (2D) barcodes, such as QR Code and Data Matrix are becoming a pervasive interface for mobile devices, especially for camera phones. Most camera phones store captured barcode images in the baseline JPEG format. This is especially true for mobile devices, where their low-end hardware and software required a low complexity codec. Furthermore, as a lossy compression scheme, JPEG2000 does introduce a fair amount of error in the decoding of captured 2D-barcode images. Fortunately, there is still some control on the parameters of the JPEG2000 algorithm to adapt it for different image types. Compression of images with different contents by varying these parameters has received significant attention in the recent past.

Discrete Wavelet Transformation (DWT) transforms discrete signal from the time domain into time frequency domain. The transformation product is set of coefficient organized in the way that enables not only spectrum analysis of the signal but also spectral behavior of the signal in time. The wavelet transform has emerged as a cutting edge technology, within the field of image compression. Wavelet-based coding provides substantial improvements in picture quality at higher compression ratios.

Wavelet based coding on the other hand provides substantial improvement in picture quality at low bit rates because of overlapping basis functions and better energy compaction property of wavelet transforms. The aim of our project is to compress QR barcode images using DWT and convert the image into stego –image.

V. EXTRACTING ALGORITHM

In the extracting process, the inverse of the concealing process is used to extract the secret image. A flow chart of the extracting process is shown in Fig. 6. The stego-image R is transferred to R ˆ by DWT. The locations are exactly the same as were used in the embedding and were selected by means of the BS, CS, and the PN3, PN4 sequence with its private key. Once the locations are determined, a bit capture is used to extract the secret data. When the secret bits are all extracted, they are immediately concatenated into two bit sequences m1 and m2 by a rearranging operation. Then m1 is contracted by an inverse chaotic mechanism ICM.

Furthermore, the regular area padding of the extracted QR code is used to reconstruct the complete QR code. Then a QR decoder is used to extract the original text. Additionally, m2 is contracted by ICM[17,9]. Following execution, low nibble byte padding the recovered face image is obtained. Because the extracted face image includes noise, a median filter is used to filter out the noise and output an acceptable face image.

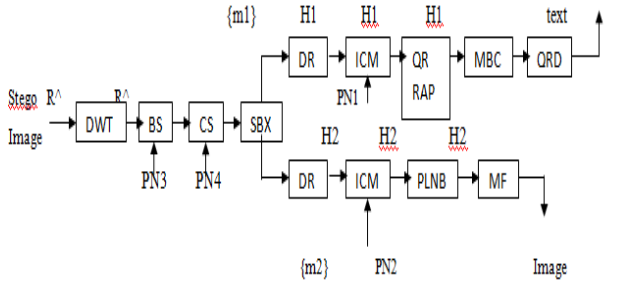

Figure 6. Extracting Algorithm structured procedure

SBX- Secret Bit Extracting	BCE: Bar Code encoding
PSNR: Pseudo Random Number Sequence	CM: Chaotic Mechanism
HNBR: High Nibble Byte Reserving	DM: Dimension Reduction
RAM: Regular Area Moving	DWT: Discrete Wavelet Transform
SBE: Secret Bits Embedding	BS: Block Selection
IDWT: Inverse Discrete Wavelet Transform	DR- Dimension Recovery
ICM- Inverse Chaotic Mechanism	QR RAP- QR Regular Area Padding
MBC- Majority Bit Check	QRD- QR Decoding
PLNB- Padding Lower Nibble Byte	MF- Median Filter

A. Median Filter:

The median filter, a nonlinear spatial filter, is a powerful tool for removing outlying-type noise. It is not suitable for preserving the edges of an image. The filter mask simply defines what pixels must be included in the median calculation. The computation of the median filter starts by ordering those n pixels defined by the filter mask, in the order from minimum to maximum value of the pixels, as given below.

$$F_0 \leqslant F_1 \leqslant F_2 \cdots \leqslant F_{n-2} \leqslant F_{n-1},$$

Where, F0 denotes the minimum and Fn-1 is the maximum value of all the pixels in the filter calculation. The output of the median filter is the median of these values and is given by

$$F_{\text{med}} = \begin{cases} \dfrac{F_{n/2} + F_{n/2-1}}{2} & \text{for even } n \\ F_{n/2} & \text{for odd } n \end{cases}.$$

Typically, an odd number of filter elements is chosen to avoid the additional step in averaging the middle two pixels of the order set when the number of elements is even. In this scheme, we select a mask with size 3x3 used to filter out the noise.

VI. EXPERIMENTAL RESULT

A. Data & qualitative Result:

The size > 0.02mb input data are load as test image. If it is a normal image its convert into the format of jpg or if it is QR Barcode image it is convert into bmp image. Both the images are possible to compress using jpeg2000 compressor. Add a key file to the compressed image and embedded the data into the image, it is possible to add a data in the form of text or image. Final output data obtained is in the form of high quality super resolution image with the embedded data.

One main techniques are used in jpeg2000 compressor known DWT[Discrete Wavelet Transform] instead of DCT[Discrete Cosine Technique] because wavelet based coding provides substantial improvement in picture quality at low bit rates because of overlapping basis functions and better energy compaction property of wavelet transforms. Because of the inherent multi resolution nature, wavelet-based coders facilitate progressive transmission of images thereby allowing variable bit rates.

B. Quantitative Result:

While qualitative analysis is a good first step for determining whether an image processing technique has succeeded or not, quantification of the results is necessary.

Quantification allows for a more exact measurement of improvement, and more importantly, allows for comparison between the efficacies of different methods. In this instance, quantification was performed by finding the mean pixel intensity value over a region, the standard deviation of the pixel values over that same region, and then determining the image contrast ratio; the ratio of standard deviation to the mean. This ratio normalizes the standard deviation so that any changes to the mean intensity caused by our filtering technique would not influence determination of filter quality, and acts as a direct measure of image contrast. Contrast ratio for a restored image should be higher than that of the original image.

The reason for this is that an image causes the pixels surrounding a moving edge, the area where motion occurs, to become washed out and all take on similar intensity values. This leads to a low standard deviation relative to the mean. Once the image is filtered, however, contrast between the edge and the object should be restored and this contrast will cause a higher value for the standard deviation to mean ratio. Comparisons between normal and compressed images were made using a parameter of percent improvement.

C. Performance Result:

The following are the assumptions of our QR Code image compression with embedded data approaches are to be made to achieve better performance which is involved in size of the image and different type of the data.

VII. CONCLUSION

We propose that the two way security in QR barcode and image-processing techniques by using steganography scheme in JPEG2000. In our approach, two types of data text and image serve as the secret data which are embedded into a cover image. To demonstrate the robustness, a JPEG2000 compression is used to attack the stego-image. However, the extracted text data cannot have any distortion compared to the original. From the experimental results, it is evident that combining the image-processing techniques and QR barcode can achieve an excellent in steganography scheme using JPEG2000, even when encountering JPEG2000 attacks.

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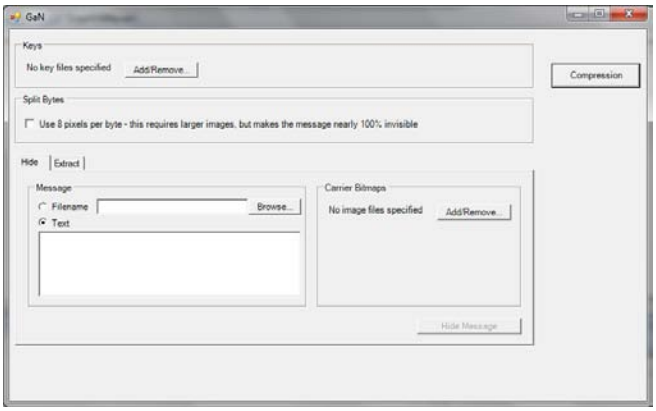
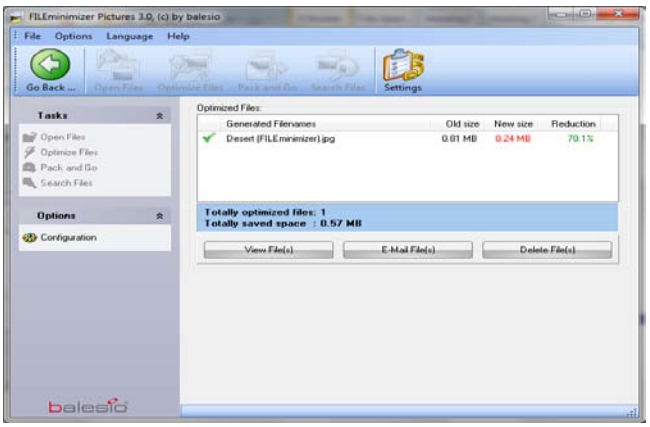
IX. APPENDIX

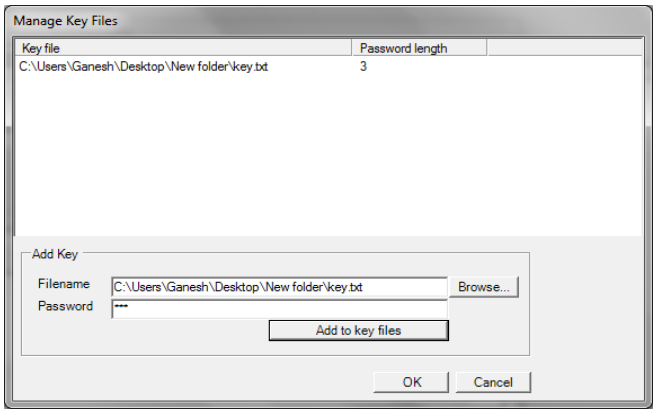
After generating GR Code Image, the first module design appearance.



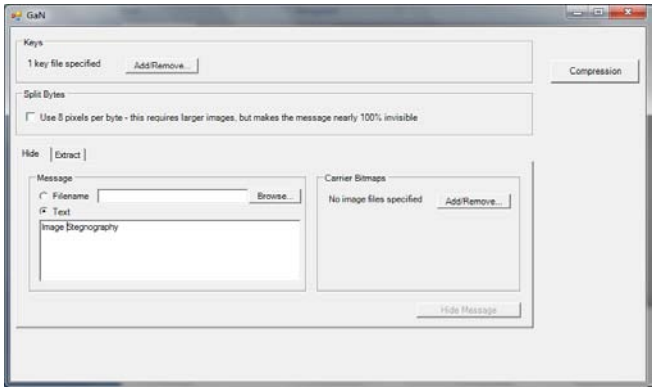
This module is used to compress the QR code image



This module is used to know the password length



This module is used to add text into the image



This module is used to extract the image and secret text.