Secure Watermarking through Optimized Embedding of Images in QR Codes

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Abstract - *Speedy reaction (QR) code is a standardized identification generally utilized in numerous applications, for example, producing, advertising, and item following and so on. The presence of QR code can be enhanced by implanting picture in to code. This paper clarifies the fundamental idea of QR pictures, a different exist techniques to insert QR codes in to pictures. These inserting are appropriate with standard interpreting applications and can be connected to any shading pictures with full territory inclusion. This addition takes advantages of the help of QR per users against intrusion of picture luminance, the vital data in QR code bits are changed in to luminance estimations of the pointed picture which is to be pointed. To limit the visual mutilation of the QR picture, the calculation utilizes half conditioning veils for the determination of altered pixels and systems to locally streamline luminance dimensions of the QR picture. So as to limit preparing time, the streamlining system thinks about the mechanics of a typical linearization strategy, hereditary calculation and so forth.*

***Key Words*: component, formatting, style, styling, insert**

1. INTRODUCTION

QR code means quick response code, which is type of the matrix barcode which was invented first by the Japanese corporation Denso Wawe. QR code has overtaken the popularity of traditional barcode in many fields due to number of advantages such as large data capacity, dirt and damage resistant, high speed decoding, small size, it can read at any angle and structural flexibility of applications. The QR code system has become popular due to its fast readability and greater storage capacity than standard UPC barcodes. With the increment trend to use technology of smart mobile phones s ,QR codes seems to be an important tool to quickly and effectively convert URLs to users. .This also allows using offline media such as magazines, newspapers, business cards, public transports vehicles, and any other medium that can carry the print of a QR code to be used as carrier for advertisements for online products. QR codes are capable for representing same amount of data in small space compared to traditional barcode. Information such as URL, SMS, contact information and plain text can be embedded in to 2D matrix barcode. An important problem in QR code is square shapes and limited color tolerance. This difficulty has generated great interest for algorithms able of hiding information in QR codes and embedding QR code in to color images. The embedding process introduces change in the luminance of the pixel of desired image. The second challenge is the problem of using entire area of the code in which the image to be embedded. This cannot be done directly placing information module with the desired image. An effective embedding method should decrease the number of corrupted modules and increase and uses the larger area.

2. RELATED WORK

Daniel L. Lau, Senior Member, IEEE, and Ofelia P. Villarreal, Member, IEEE "QR Images: Optimized Image Embedding in QR Codes" saying introduces the concept of QR images, an automatic method to embed QR codes into color images with bounded probability of detection error. These embedding are compatible with standard decoding applications and can be applied to any color image with full area coverage.[1]

The QR information bits are encoded into the luminance values of the Image, taking advantage of the immunity of QR readers against local luminance disturbances. To mitigate the visual distortion of the QR image, the algorithm utilizes halftoning masks for the selection of modified pixels and nonlinear programming techniques to locally optimize luminance levels.

Hung-Kuo Chu1 Chia-Sheng Chang1 Ruen-Rone Lee1 Niloy J. Mitra2 "Halftone QR Codes" says that propose an approach to produce high quality visual QR codes, which we call halftone QR codes, that are still machine-readable. First, we build a pattern readability function wherein we learn a probability distribution of what modules can be replaced by which other modules. Then, given a text tag, we express the input image in terms of the learned dictionary to encode the source text. We demonstrate that our approach produces high quality results on a range of inputs and under different distortion effects.

Qingbo Kang(1), Ke Li(2), Jichun Yang(2) "A Digital Watermarking Approach Based on DCT Domain Combining QR Code and Chaotic Theory " This paper proposes a robust watermarking approach based on Discrete Cosine Transform (DCT) domain that combines Quick Response (QR) Code and chaotic system. When embed the watermark, the high error correction performance and the strong decoding capability of

QR Code are utilized to decode the text watermark information which improves the robustness of the watermarking algorithm.

2.1 STRUCTURE OF QR CODE

The styles and structures inside a QR code have properly defined capabilities which consist of error correction, sampling grid dedication, and symbol alignment. These patterns are used in the interpreting process, to extract the QR code image [7,8]. The information is encoded in rectangular black and white modules of several pixels. Finder patterns play a principal role inside the speed and achievement of decoding and are located in 3 corners of the symbol as proven in determine 1. QR readers use binary images ensuing from thresholding the captured gray scale photo with neighborhood or international thresholds. This particular function simplifies the computations and decreases the processing requirements for QR interpreting. Function pattern shows the principle regions in the QR symbol and their patterns. The modules in a QR code may be categorized in predominant categories: function pattern vicinity and encoding area. The feature sample vicinity includes the finder and alignment patterns in addition to the timing styles. The encoding region includes the statistics code words, the mistake correction code words and the modules used for the willpower of the model and kind of encoded records.

A. Function Pattern Region

This location incorporates all the necessary facts to correctly come across and pattern the facts bits of the code. Finder and alignment patterns are the most essential modules within the area and are key to locate, rotate and align the QR code as well as to accurate for deformations inside the printing surface [7]. In addition to finder and alignment patterns, timing styles additionally aid inside the determination of the sampling grid specifically for big code sizes.

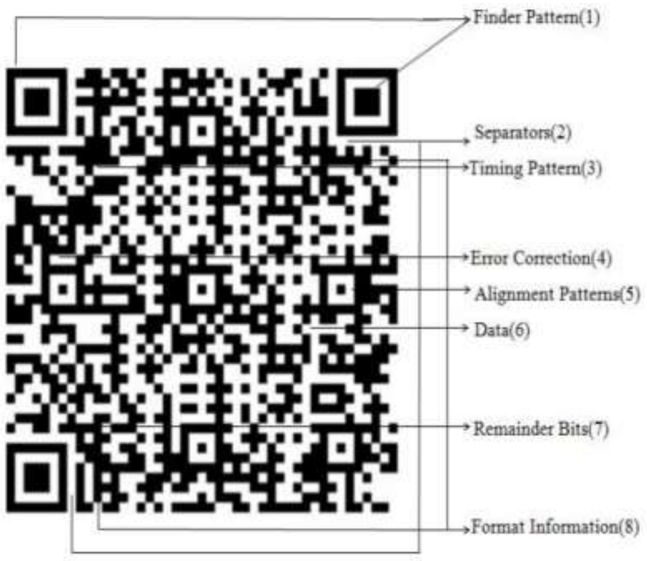

Figure 1. Structure of QR code [2]

Finder Patterns

Finder patterns are easily identifiable as 3 concentric square structures inside the corners of the code. They are designed to have the same ratio of black and white pixels when intersected by using a line at any angle, allowing figuring out its centre although the code is scanned at arbitrary angles. Finder styles are surrounded through two shield zones of 1 QR 10 module wide referred to as the separators [8,9]. These zones aid inside the separation of finder patterns from the encoding area and in the identification of the right series of black and white pixels further enhancing the place accuracy.

1) Separators

The white separators have a width of one pixel and enhance the recognizability of the finder patters as they separate them from the actual facts.

2) Error Correction

Similar to the facts section, blunders correction codes are saved in 8 bits lengthy code words within the blunders correction section.

3) Alignment Patterns

Alignment patterns on the other hand are used to decide the sampling grids from which codewords are extracted and to correct for feasible deformation of the printing surface [9].

4) Timing Patterns

The popular also defines zones consisting on one row and one column of alternating black and white QR modules, denoted as the timing zones and placed between finder patterns.

B. Encoding Region

The code place delimited by way of finder patterns is denoted because the encoding location [9], where statistics, parity modules and interpreting facts is saved. This vicinity is divided into codewords along with blocks of 8 QR modules. Two dimensional shapes of this code words depend upon the model of the code and are designed to optimize vicinity coverage.

2.2 ENCODING PROCEDURE

The input message is given as per user requirement. The QR code is generated according to the input message. The input message is divided into smaller parts then qr code pattern is formed. The code territory of QR code is delimited by discoverer examples and it is meant by the encoding district, where information, equality modules and unraveling data is put away. The focal territory of QR code is separated into codewords comprising of squares of 8 QR modules. Two dimensional states of these codewords rely upon the rendition of the code and are intended to upgrade full region inclusion.

1) Input Image

To install QR code into shading picture, the initial step is to peruse input picture that is QR code and its adjusted pixels is chosen utilizing halftoning cover and

2) Halftoning

The strategy proposed to choose altered pixels is in light of halftoning methods so as to limit the appearance of squares while saving the high recurrence subtleties. Whenever changed pixels are haphazardly yet consistently conveyed in space, the visual effect of the inserting is limited since these examples concentrate the majority of their vitality at higher frequencies where the human visual framework is less touchy.

3) Embedding

In the wake of halftoning, QR code is implant into shading

Picture with its luminance level of modifications and mistake adjustment code is utilized in the QR code picture and afterward show the implanted picture.

The flow chat shown in figure 2 shows the step by step procedure to generate QR code and decoding is done by inverse the procedure. The extraction of QR code is also done by use of android software or by use of QR reader.

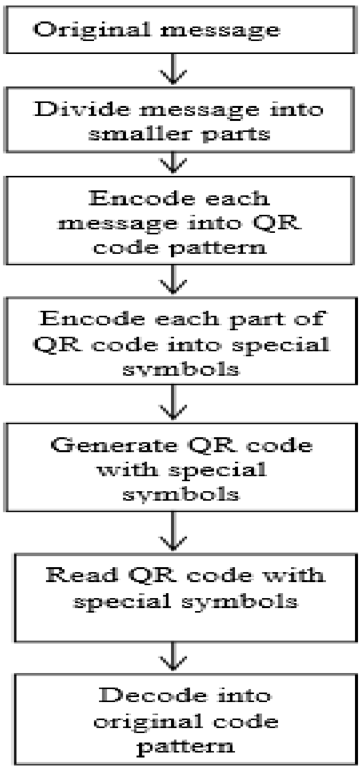

Figure: 2 Flow chart of QR based

Figure :3 a) QR code b) Boundary elimination of QR code

The result of QR code and its boundary eliminated QR code is shown in figure 3. The input message is generated into QR code.Figure 4 depicts the halftone QR code.The embedding input image shown in figure 5a) and halftone embedding image is shown in 5b).The encoding of input image with QR code is shon in figure 6.The output of QR Embedded color image shown in figure 7.

Figure : 4 Halftone QR code

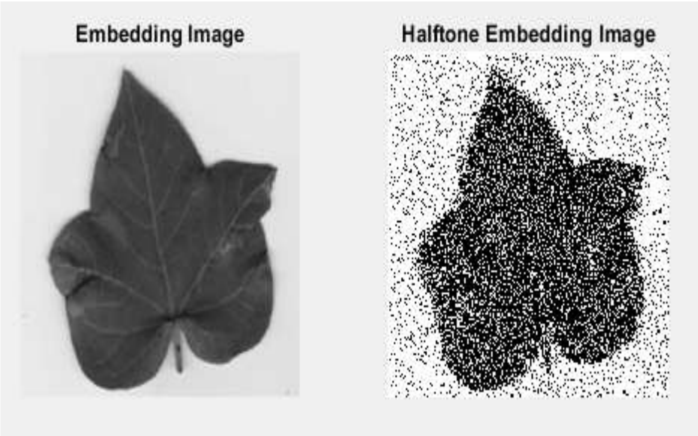

Figure:5 a)Input Embedding image b) Halftone Embedding Image

Figure: 6 Result of Embedded Halftoned QR image

Figure:7 QR Embedded Colour Image

3. CONCLUSIONS

In the QR code implanting process, the code picture will be influenced in the wake of choosing the QR code and makes an issue while utilizing the whole region of the code wherein the picture or then again logo is to be implanted. The fundamental test of any installing strategy is that they ought to be decodable by the standard applications. A decent inserting strategy ought to limit the quantity of debased modules and utilize the most prominent conceivable zone. The focal point of this paper is to acquaint a novel method with convey changed pixels in light of halftoning techniques which help to diminish the visual effect of the change and to accomplish above objectives. QR encoding is successful in both color and gray scale images. The image is easily decoded by using any QR reader.

The system is used in future instead of barcode QR code pattern is available in most of the product and goods .The mobile application easily decode the QR code and gets the information. The system can be useful and implemented in shopping malls, purchasing goods daily needs, grocery.

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