

A Survey on Image Embedding In QR Code

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Abstract: Quick response (QR) code is a barcode widely used in many applications such as manufacturing, marketing, product tracking etc. The appearance of QR code can be improved by embedding image in to code. This paper explains the basic concept of QR images, a various exist methods to embed QR codes in to images. These embedding are suitable with standard decoding applications and can be applied to any color images with full area coverage. This insertion takes benefits of the support of QR readers against interruption of image luminance, the important information in QR code bits are transformed in to luminance values of the aimed image which is to be aimed. To minimize the visual distortion of the QR image, the algorithm uses half toning masks for the selection of modified pixels and techniques to locally optimize luminance levels of the QR image. In order to minimize processing time, the optimization technique consider the mechanics of a common binarization method, genetic algorithm etc.

Keywords: QR code, Image embedding, Multi resolution Half toning, half toning, genetic algorithm, DWT.

I. 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.

II. LITERATURE SURVERY

With embedded systems fast expanding its reach, subject matter related to this field is available in tremendous.

While working on this paper I have studied matter from various sources such as books, Online articles and reference manuals From these knowledge gained from this activity has been of great help to us in understanding the basic concepts related to my paper and has inspired further interest in this topic.

This paper explain basic concept of QR code. QR code is two dimensional barcode which encode much information like numbers, binary codes, letters etc. it is a type of matrix barcode which can store information horizontally as well as vertically .there are 40 versions of QR codes available and size varies from 21x 21 modules for version 1 up to 177x177 modules. For calculation of errors QR code uses Reed Solomon code and it consist of 4 types of error correction L,M,Q,H that allow correction up to 7%,15%,20%,30% of codeword's in error respectively. Different types of QR codes are identified by their error correction level and versions of QR code. It has square shape structure and limited color tolerance which is an important difficulty in case of QR code[1][2]. QR code is generated with the insertion of a color image in to it with minimum quantity of error .with standard coding techniques these insertion of important information using QR code in to color images is possible. This insertion takes benefits of the support of QR readers against modification of image luminance. The hide information in QR code bits is transformed in to new luminance value of the image which is colored. Then multi resolution half tone mask is used for selection of modified pixels and nonlinear programming methods with which pixels of the images are transformed in to luminance level, to reduce the visual distortion of the QR image. Here QR code with colored image is proposed with new multi resolution technique to reduce memory requirement and minimize processing time [2]. In this paper new concept of Genetic algorithm for optimization level in process of image

embedding is used. By embedding QR code in to image with full area coverage reflects an increase visual quality and decrease in image distortion and decoding robustness. In it embedding process consist of using halftone technique to generate mask and further apply genetic algorithm at optimization level which reduces processing time required for embedding process[3][4]. In this paper the concept of increasing data security by hiding information in QR code and further embedding in color image is explained. Here half toning technique is used for generation of mask and further process of decoding QR code from color image is given [5]. This paper introduces concept of DWT technique for image embedding in QR code. This technique is a suitable for slandered decoding applications and it solves problem of dot gain generated when embeddings are printed using half toning method [6] [9]. QR code is an optical barcode. In this paper some possible research areas related to QR code such as increase data capacity using color barcode, increase amount of information hide in QR code using multiplexor and demultiplexer, technique for removing scratch or damage exist in QR code etc.[7]. In this paper embedding process consist of converting color image in to gray scale image and after it apply widow extraction ,image embedding and decoding[8][10].

This paper gives basic information of QR code .In next section III-shows procedure for information hiding in QR code, in section IV-existing different techniques for image embedding in QR code, in section V-conclusion and future scope section VII-reference

III. INFORMATION HIDING IN QR CODE

The message to be hiding is divided in smaller parts in a way that it forms a string of characters. Further data is encoded for each part. The steps for information hiding in QR code are shown below.

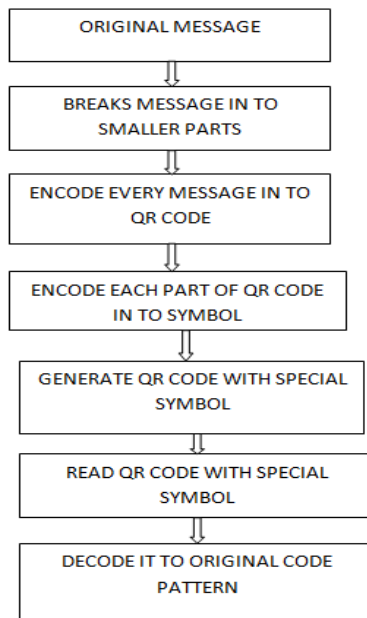


Figure 1.procedure for information hiding in QR code

At the receiver stage, the QR code is decoded to give the number of QR patterns which was encoded in earlier stage. Further it is scanned by an optical device such as scanner or camera and with the help of inbuilt software application data in each QR code pattern is identified to retrieve back the original message which was encoded in QR code.

IV. DIFFERENT METHODS FOR IMAGE EMBEDDING IN QR CODE

A. Image embedding in QR code using half toning technique

In this method a QR code values are transformed in to luminance values of image which is to be embedded in such way that luminance level is increased for light region of code and decreased for dark region of code. Following figure shows block diagram of image embedding in QR code.

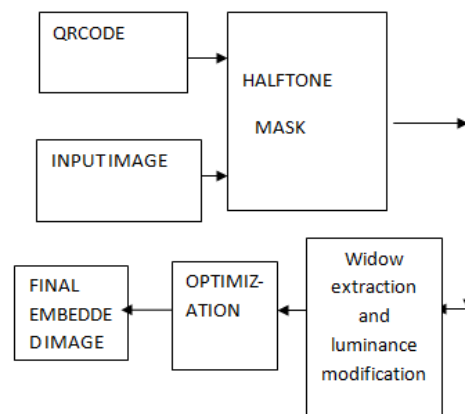


Figure 2. Block diagram of image embedding in QR code

- 1) Input stage: In this method an input to the system is QR code and desired image to be embedded.
- 2) Halftone masking: This method makes use of Halftoning technique for selection of pixels to be modified .Which results in decreasing the appearance of square blocks and retaining high frequency details. Many algorithms available for generation of Halftone mask such as direct binary search, void and cluster, green noise mask etc. every technique have different computation complexity level but as mask design process is offline so speed of pattern not affected.
- 3) Window extraction & luminance modification: Image is further divided in to local window. After selection of pixel to be modified in previous stage luminance is modified to one of four level .the luminance of final embedded image is function of QR cod value and luminance of original image.
- 4) Optimization: Finally optimization is done independently and parallel to give an embedded image in QR code.

B. Image embedding in QR code using multi resolution halftoning technique:
This method differs than other in case of using multi resolution half toning instead of half toning for generation

of masks. Block diagram for this method shown below figure.

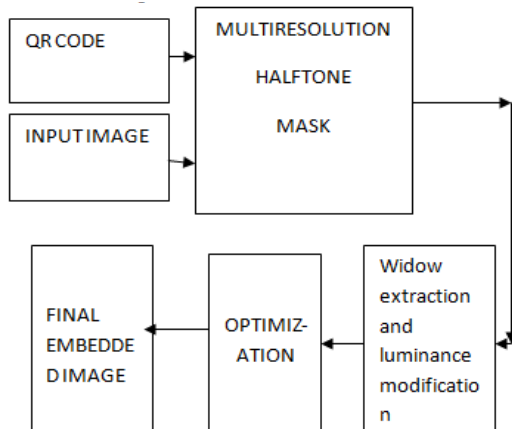


Figure 3. Block diagram of image embedding in QR code

In this method input to the system is QR code and color image. At next stage multi resolution half toning method is used. In this method a gray scale images of gradually increasing resolutions are generated. For storage of image it uses binary display memory so remove need for additional memory for storage of contone image data. So amount of memory required is effectively reduced also obtained halftone images are of improved quality.

C. Image embedding in QR code using genetic algorithm

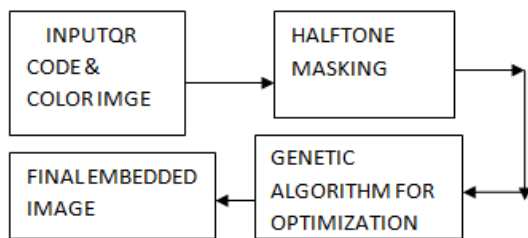


Figure 4. block diagram of image embedding in QR cod

In this technique only difference is using a genetic algorithm at optimization level. This reduces processing time required for the embedding process.

D. Image embedding in QR code using DWT:

Input to the system is color image and color QR code as shown in following figure.

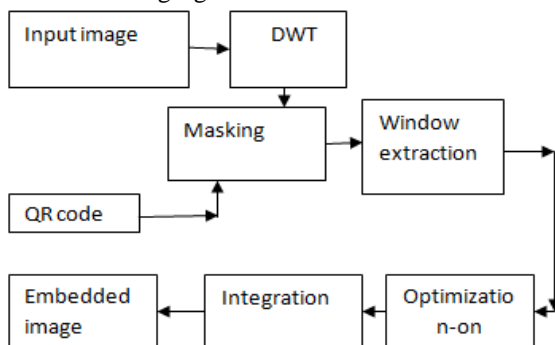


Fig.4: Block diagram of image embedding in QR code

At next stage image is divided in to low frequency and high frequency information. Both low frequency and high frequency information decomposed in to low frequency area and high frequency area that is LL, LH, HL and HH. In it edge is detected using DWT. Then mask is generated with high frequency extraction further it is optimized and integrated to give final embedded image. Quality and visual appearance of final result is improved.

VII. CONCLUSION

This paper, concludes that there are number of possibilities for QR codes in different areas .number of experiments are done with image embedding in QR code in different manners like improve data capacity, increase data security, improve visual appearance, reduce memory requirement for storage, reduce processing time for embedding process. It provides huge platform for researches such as

- 1) Develop automatic FPGA based method for creating QR code for different text size.
- 2) Develop a controller based system which taking lively an image of QR code and image using camera and produce embedded QR code image.

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