QR Images: an Automatic Method to Embed QR codes in to Color Images

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***Abstract*— A way to introduce the concept of QR images, it is an automatic method to embed the QR codes into color images. This technique can be applied to any color images. The QR information bits are put into the codes over the luminance values. To make it unpleasant the visual perversion of the QR image, the algorithm uses halftoning mask for selection of modified pixels and nonlinear programming techniques to locally optimize luminance levels. A docile model for the probability of error is developed and human visual system model are considered in the quality metric used to minimize the luminance value of the QR image. To minimize the processing time optimization technique is used to consider the common binarization method. It is acceptable for parallel implementations. Results of this project experiment shows graceful disgrace of decoding rate.**
A visual comparison between the existing and proposed system is shown.

***Keywords*— QR code, luminance value, embedding decoding, Halftoning.**

INTRODUCTION

The QR code was released in 1994 by Japanese Denso wave. The main use of QR
code is in large areas like industries, manufacturing, healthcare, Life sciences, office automation, etc. It is mostly used in mobile marketing and advertising campaigns as a fast connecting to the customer and end user. The QR code is two dimensional matrix code used to identify the product. That include machine readable codes [2].The capacity of QR code to hold the information is maximum as compare to barcode. It gives us good speed as compare to barcode. Whereas Barcode are visual representation of information which contains information only in horizontal fashion [6]. On the other hand QR code contains both fashions horizontal as well as vertical. More advantage of QR code is it has unique design and its scanning is fast The QR code looks like so small but it contains large amount of data as barcode in one tenth space. QR code can also read damage as well as dirty data such as numerical, alphanumeric, binarydata, etc.The main problem of QR code is the beauty of the advertisement [3]. The square of QR code can form only in minimum color into billboard format. These challenges create best interest for algorithm to embed QR code into QR image without loss their best performance.
The QR code has many methods divided into two formats:-
1) Change the luminance
2) Change the QR module
1st Method: It is to change luminance in that we have to select the mid pixel of each module and change luminanance it is generally sampled by decoder. In this method of binary embedding we divide QR module into set of (3 by 3 pixels).
2nd Method: It includes the way to finding the correct group of QR module and
place the image or logo in the QR code [7].A collision of change code module with image pixel was introduced in first method of QR code. The authors concluded that to get high rate of decidability the ratio between image & code is approximately proportional to the correction capacity of the code. Some methods are not applicable but Reed Solomon encoding is used in large area amount.

QR CODE

QR code is nothing but **Quick Response Code.** It is the type of two-dimensional barcode that can be directly scan or read using smartphones [2][5].
After scanning the QR code,that link directly to text encoded into that QR code. That text may be anything like emails, websites, phone numbers and more which are encoded in that QR code. You may have even reached to this site by scanning a QR code.
QR Codes have the ability to have a major effect upon society and particularly in advertising, marketing and customer service with a quality of product information just one scan away.
There a number of different barcode scanner applications such as red laser,barcode scanner,QR scanner are available. If you have a smartphone like an iPhone, Android or Blackberry then that can read and decode data from a QR code. The majority of these are completely free.you need to install that once and then by using your phone camera you can easily scan that particular QR code. It will then automatically fetch the encoded data for you.

STRUCTURE OF QR CODE

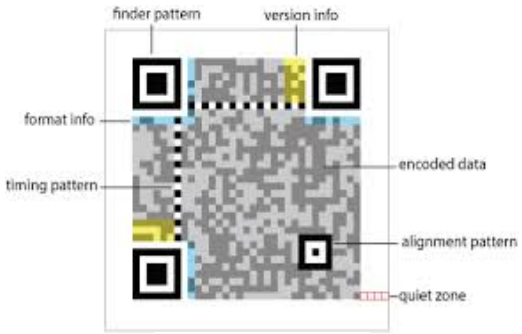

Fig. 1 Regions of QR code

A.Finder Pattern Region

In this paper, there is essential to locate, rotate and align the finder and alignment structure of QR code. The former ones are designed to have the same ratio of black and white pixels in a way when intersected by a line at any angle, allowing easily detecting, rotating or inverting the codes.

B.Encoding Region

The encoding region is that area in which we set the limit to the code area by finder pattern where data, parity modules and decoding information is stored. This area is divided into codeword consisting of blocks of 8 QR modules. Shape of this codeword is two dimensional and it is depends on version of the code and are designed to optimized the area coverage.

C.Data capacity and Error Correction

The probability of binarization error is known as the probability of sampling the incorrect binary value for any pixel in the QR module.

Probability of detection error: The probability of error for central pixels of each QR module which are sampled accurately is given by:

PDerr = P(decide qc = 1-qc = 0) p0 + P(decide qc = 0-qc = 1)p1

Where qc is the value of the QR code module at its center and p0= P(qc = 1), p1= P(qc1) are the probabilities of having the corresponding QR module inside the local window. This is an enough requirement since only the mean value of non-central pixels is important.

In order to take the advantages of local correlation between the luminance of the image and the value of the QR code, using local overlapping windows the optimization of the transformation parameters is performed independently. In this paper we choose to set the size of the windows to 40*40 pixels centered around each image block of 8*8 pixels. The experimental test gives a good tradeoff between robustness and quality for typical scanning distances.

ARCHITECTURE OF QR IMAGE

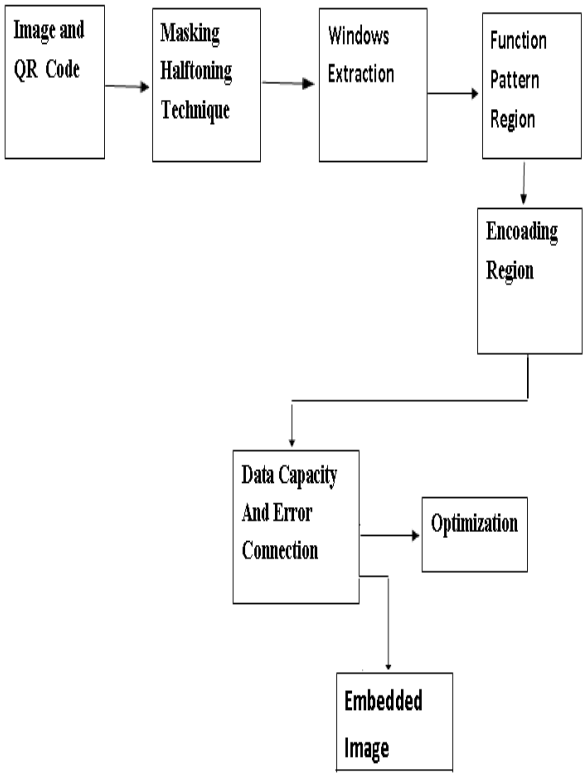

Fig. 1 Architecture showing embedded QR code into image

EMBEDDING OF QR CODE INTO COLOR IMAGE

A. Embedding

In this paper, the system takes QR code and image as an input. By using halftoning masking binarization is performed. Then the window area is divided and extracted. Function pattern region of QR code is selected. Then in the encoding region the image is embedded. Optimization is also performed.

The embedding of image pixels introduces changes in the luminance of the code. However increases error probability. The second challenge is to find out the entire area of the code in which is to be embedded by image or logo. This cannot be got by replacing information modules which is proportional to the correction capacity of the code.

B.Halftoning Techniques

The method used to select modified pixels based on the halftoning techniques in order to minimize the appearance of blocks. The visual impact of the embedding is minimized when modified pixels are randomly but uniformly distributed in space because these patterns concentrate their energy at higher frequencies where the human visual system is less sensitive.

Halftoning is a color optimization technique which is frequently used in digital printing and imaging industry. It gives a grayscale or color image with minimum number of paints while preserving a close visual impact to original image. Halftoning algorithm are designed to deal with uniform textureless regions. The method introduced for the selection of modified pixels is based on halftoning technique. This method

is used to decrease the appearance of blocks and at the same time it preserves high frequency details. If modified pixels are casually but uniformly distributed in space,the visual appearance of embedding is minimized because these patterns concentrate most of their energy at higher frequencies where human nacked system is less sensitive. This
effect is mostly used in digital halftoning where different algorithms are used to develop equal distribution of points with particular spectral properties have been proposed.

C.Embedded Image

Each modules of the embedding is compared with their corresponding counterparts. For this embedding different center sizes and halftone masks are used. The advantage of the proposed embedding method is the possibility to generating pseudo random cluster of dots. This feature of embedding also allows to solve the problem of dot gain generated when the embedding are printed simply by using appropriate halftoning masks.

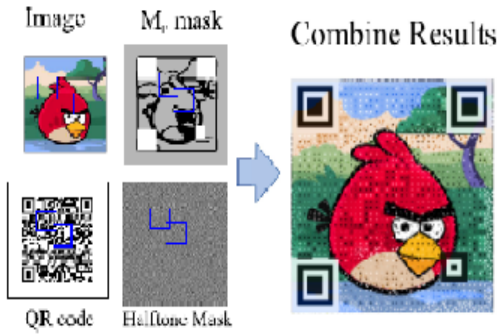

Fig. 3 Embedded image

DECODING OF QR IMAGE

The decoding process continues with three basic steps: binarization, detection and decoding of bit stream. In binarization step, the gray scale image segmented into black and white pixel. This binary image is used to find out the center of QR module and sampling grid in that code word extracted. After this process detected code word are make in right form by using reed Solomon algorithm and then decoded as per their order in which it is arranged and particular form. In below,in decoding block diagram the embedded QR image is the inputs of reader application .Reader further process it by calculating threshold. Then mean block binarization method is used to convert image into binary format. Then the required sample is selected by calculating its luminance. Then the codeword is extracted through sampling grid information. The code is corrected retrieved.

A. Binarization

1) Threshold Measuring For Binarization:

In decoding process used the decoding speed for binarizaion it is important feature of QR code.Thresholding is the method of image segmentation. The simplest thresholding methods replace each pixel in an image with a black pixel if the image intensity $I_{i,j}$ is less than some fixed constant T (that is, $YB=I_{i,j} < T_{i,j}$), or a white pixel if the image intensity is greater than that constant. Binary image are getting by thresholding the grayscale image. Where I is captured image, t[i,j] is the threshold assigned to pixel [i,j] and YB is the output. In QR code does not define any specific binarization method this are usually selected between speed and quality.therholds can be calculated globally by using whole pixel in the image or locally reduced windows.

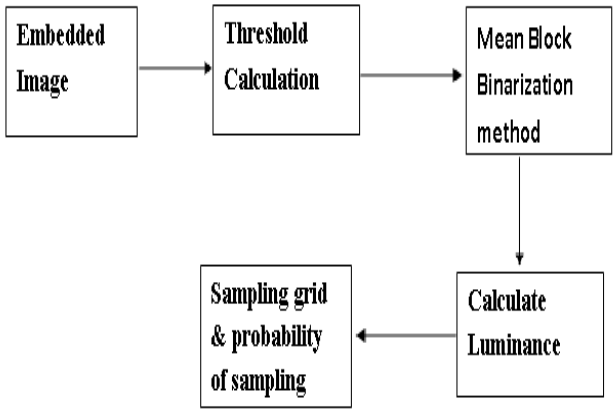

Fig. 4 Decoding of QR image

2) Mean Block Binarization Method:

In QR code generation and reading open source Zxing library is the most popular library. In that library threshold used in the sbinarization function and they are calculated through a hybrid method that use average luminance set of overlapping square windows. In mean block binarization method in that captured image is divided into non overlapping block 8 by 8 pixel and then the average luminance in overlapping sub window of 5 by 5 block calculated.

3) Probability Of Sampling Error And Sampling Grid:

In that when the binary image YB is getting then the code words are extracted by sampling on a grid by using finder and alignment patterns. The points in that grid are created by drawing same lines in between corner of finder and alignment pattern. For big size code required multiple sampling grids are used to remove local geometric distortion. When we are clearly defined the luminance around the center of QR module then the binary value safely detects. if we define a region of size da by da pixels centered in QR module then the outside this region can be getting by considering a Gaussian distribution of the sampling point around the center.

RESULT ANALYSIS

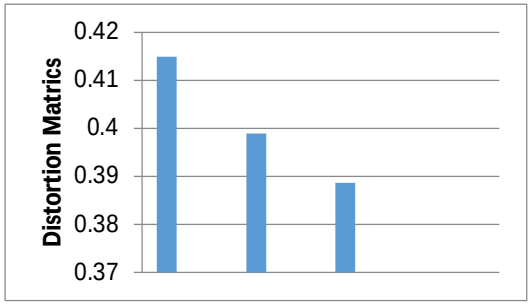

Fig. 4 Result showing graceful degredation of decoding rate

CONCLUSION AND FUTURE SCOPE

A way to embedding color images and QR code permit to directly create embedding with probability of discovering error for noise power which is provided.

Our technique contributes various component parts with the technique which are previously used. Our method allows reducing the brightness value of each and every pixel found at position determined by halftone method. Further it will be fixed at center of QR module which having a specific value. By using halftone, the darkness of visual distortion can be reduced which is created due to embedding in our algorithm we must have to do various mathematical calculation related to parameters of image.

Our method has also some boundary conditions. Main important and tedious task is to select every single pixel in QR code to resolve it from image. It restricts the resolution of image.

Uptil today, scanner is not developed. In future we can develop standard scanner for such type of embedded QR code which can scan fastly.

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