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IHIQ: Information Hide InImage Using QR-Code

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Abstract: *Quick Response (QR) code is a two dimensional barcode widely used in many applications such as manufacturing, advertising, retailing etc. QR code looks like a noisy structure. The appearance of QR code can be improved by embedding an image into the code. This work proposed a method where the appearance of QR code is composed of visually meaningful patterns selected by users. This work makes QR code from machine read only to a personalized form with human visual pleasing appearance. The image embedding in the QR code is not an easy task because embedded result should be de-codable by standard Decoding applications and can be applied to any color image with full area coverage.*

Keywords: *QR-Code, Hide, image, barcode, embedding, de-embedding*

I. INTRODUCTION

Quick response (QR) codes have rapidly emerged as a widely used inventory tracking and identification method in transport, manufacturing, and retail industries. Their popularity is due to the proliferation of smart phones, capable of decoding and accessing on line resources as well as its high storage capacity and speed of decoding. QR codes are used in a variety of applications, such as accessing websites, download personal card information, post information to social networks, initiate phone calls, reproduce videos or open text documents. This versatility makes them a valuable tool in any industry that seeks to engage mobile users from printed materials. Not surprisingly QR codes have been widely adopted in the marketing and publicity industry thanks to the advantage they provide in tracking the performance of publicity campaigns. An important problem of QR codes is its impact on the aesthetics of publicity designs. The square shapes and limited color tolerance, severely impairs their integration into billboard designs or printed materials. This challenge has generated great interest for algorithms capable of embedding QR codes into images without losing decoding robustness. There have been several efforts to improve the appearance of such embeddings which can be classified in two categories, methods that modify the luminance or color of image pixels and methods that replace QR modules.

II. RELATED WORKS

Awdeshkumar[1]In this paper QR Codes have already overtaken the conventional 1-D bar codes because of the capacity of data that can be stored by a 2-D barcode(QR Code) is much greater than that of conventional 1-D bar code. QR Code contains data both in horizontal and vertical directions. This stems in many cases from the fact that a typical 1-D barcode can only hold a maximum of 20 characters, whereas as QR Code can hold up to 7,089 characters [3]. QR Codes are capable of encoding the same amount of data in approximately one tenth the space of a traditional 1-D bar code. A great feature of QR Codes is that they do not need to be scanned from one particular angle, as QR Codes can be read regardless of their positioning. The data can be read successfully even if QR code is tampered while 1-D barcode can't. QR Codes can be easily decoded with a smart phone with appropriate barcode reader software (for example:,Kaywa Reader, QRafter and I-Nigma etc.) Secure communication can also be established using QR Encoding techniques.

2.1 Structure of QR Codes

QR Codes are actually black modules in square patterns on white background but many researchers have been working for collared QR code. It consists of the following areas having specific significance. □ Finder Pattern □Alignment Pattern□ TimingPattern QuietZone □ Data Area

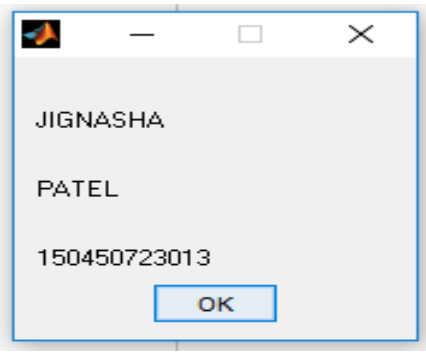
Fig.1 shows the structure of QR Code. The significance of each area is as described as follows: Each QR Code symbol consists of mainly two regions: an encoding region and function patterns. Function patterns consist of finder, timing and alignment patterns which does not encode any data. The symbol is surrounded on all the four sides by a quiet zone border. A QR Code can be read even if it is tilted or distorted. The size of a QR Code can vary from 21 x 21 cells to 177 x 177 cells by four cell increments in both horizontal and vertical direction.

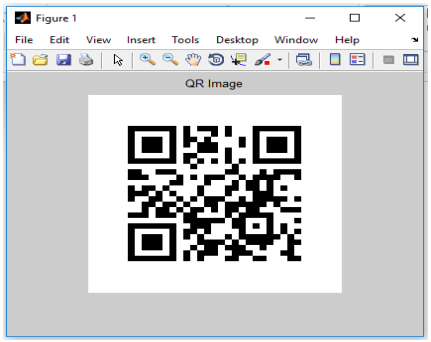
2.1.1 Finder Pattern This pattern can be used for detecting the position, size and angle of the QR Code. These can be determined with the help of the three position detection patterns (Finder Patterns) which are arranged at the upper left, upper right and lower left corners of the symbol as shown in Fig. 1.

2.1.2 Alignment Pattern The alignment pattern consists of dark 5x5 modules, light 3x3 modules and a single central dark module. This pattern is actually used for correcting the distortion of the symbol. The central coordinate of the alignment pattern will be identified to correct the distortion of the symbol.
2.1.3 Timing Pattern the timing patterns are arranged both in horizontal and vertical directions. These are actually having size similar to one module of the QR Code symbol. This pattern is actually used for identifying the central co-ordinate of each cell with black and white patterns arranged alternately.
2.1.4 Quiet Zone this region is actuallyfree of all the markings. The margin space is necessary for reading the bar code accurately. This zone is mainly meant for keeping the QR Code symbol separated from the external area. This area is usually 4 modules wide.
2.1.5 Data Area it consists of both data and error correction code words. According to the encoding rule, the data will be converted into 0's and 1's. Then these binary numbers will be converted into black and white cells and will be arranged accordingly. Reed-Solomon error correction is also used here.
Congouxu[2] in this paper, with the increasing effectiveness of text-based spam filtering technologies like Bayesian filters which has done an excellent job, almost all junk mails can be detected and blocked. However, the image spam, in which the message text of the spam is presented as pictures in an image file coupled with adding noises in the pictures and using obfuscating technique, is invented to circumvent those filtering software dedicated to text-based space filtering. Image spam first appeared at the end of 2005, and is now accounting for roughly 40% of all spam traffic and is still on the rise [1]. Typically, the size of an image spam email is about 3 to 4 times larger than a corresponding plain text-based email. This feature brings with several direct harms two of which that can be immediately perceived by intuition are the contention of bandwidth when transferring image spam over the Internet and the extra requirement for storage space.
Nancy Victor[3] in this paper, Bar codes have become widely popular because of their reading speed, accuracy, and superior functionality characteristics. Barcodes can be divided as 1D and 2D. 1D barcodes can express information in horizontal direction only. Also, the data capacity is limited. 2D barcodes can hold data both in horizontal and vertical direction. As a result, the data capacity is 100 times more than the 1D barcode [1]. As bar codes became popular and their convenience universally recognized, the market began to call for codes capable of storing more information, more character types, and that could be printed in a smaller space. 2D Code emerged in response to these needs and problems [2]. QR Code is a kind of 2-D (two-dimensional) semiology developed by Denso Wave and released in 1994 with the primary aim of being a symbol that is interpreted by scanning equipment. 2D bar codes can act like identifier (like in 1D) but takes less space. Alternatively, it can function as a database itself.

III. Methodology:

QR-code generation:





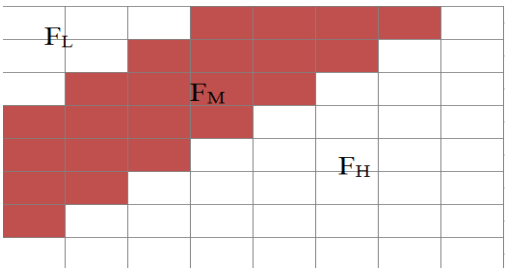
- QR-code generated from simple text.

1. Compression Method:

In the history of computer science, data compression, source coding or bit-rate reduction includes encoding information using fewer bits than the original representation. There are two kinds of data compression: loss and lossless. Loss compression reduces bits by identifying marginally important information and removing it. Lossless compression reduces bits by identifying and eliminating statistical redundancy. No information is lost in lossless compression.
Data Compression is very useful due to reducing the consumption of resources such as data space or transmission capacity. Because compressed data must be decompressed to be used, this extra processing imposes computational or other costs through decompression. The design of data compression schemes involve trade-offs among various factors, including the degree of compression, the amount of distortion introduced and the computational resources required to compress and uncompress the data. Lossless data compression algorithms usually exploit statistical redundancy to represent data more concisely without losing information. Lossless compression is possible because most real-world data has statistical redundancy.

Discrete Cosine Transform (DCT):

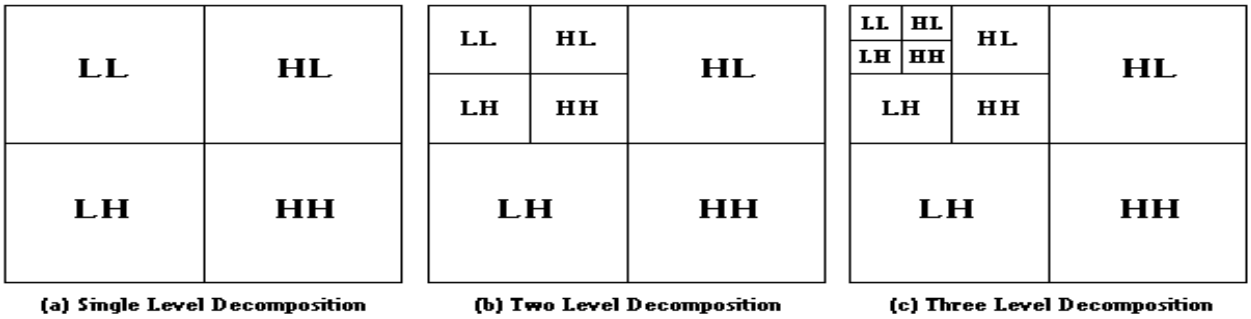
DCT block is composed of three Frequency bands; Low frequency components of the block(FL), High frequency components of the block(FH) and Middle frequency components of the block(FM). FM are chosen for embedding the watermark in figure:



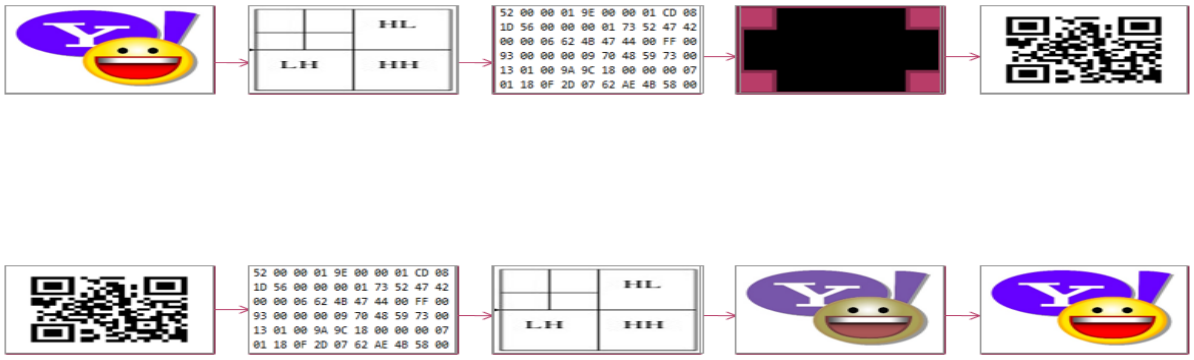
- Region of DCT

ii) Desecrate Wavelength Transform(DWT):

The DWT separates an images into a lower resolution approximation image (LL) as well as horizontal (HL), vertical (LH) and diagonal (HH) detail components. The process can be repeated to computes multiple "scale" wavelet decomposition, as in the 2 scale wavelet transform shown below in figure.



Proposed work:



(i) Pre-Processing:

The input image will be enhance in this phase; means a set of operations to an Encoder that given desired bit-rate will enhance the image.

IMAGE -TO-DOUBLE

↓

RESIZE

(ii)Compress image Using DWT-SVD(Discrete Wavelet Transformation)(Singular value Decomposition)

- Image to string transfer
- 0 to 255 pixel value convert character
- For example for 00-aa

11-ab

255-pp...

Embedding:

Data hiding modules in that write down text into QR embedding.

QR-code generator: Using java library we are here to generate the QR-code. The 4 standard modes of data for creating QR-code is numeric, alphanumeric, Java API for QR code and we will be using the 'core' for QR-code generation.

Decoder:

In decoder as we input the QR-code, the reverse process of an Encoder will be done. There are also mainly 3 phases, after which the information that is hidden in the image will be shown to the receiver.

QR code to string convert using JAVA library

QR-code

↓

Image

↓

JAVA Library

Input string from above block

Image Encoder:

An Image Encoder translates the data in an image into a designated format. An Image Encoder will write image data to a stream; Encoder can compress, encrypt, and write the image pixels in a number of ways prior to writing them to the stream.

De-Embedding:

In this phase first of all the QR-code which is embedded will be De-Embed and will be transform into the image form.

Image De-Encoder**:** By using image De-encoder you can load images from disk into memory. The decoder translates the data in a disk file to the format required by the image. In image encoding Decompress image Using IDWT-SVD(Inverse Discrete Wavelet Transformation)(Singular value Decomposition)

1st step is string to number generation.

2nd is mapping number in array for image formation

Image Enhancement:

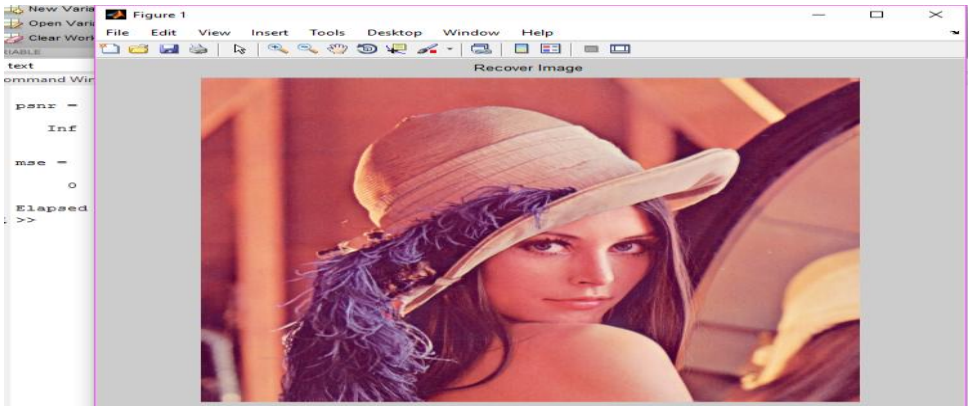
Enhancement means image resize and noise removal and contrast adjustment task; in which the noise will be removed and the text format of information will generate.

Image Formation: In this phase the receiver will get the information which is hide in Image.

Experimental Results:

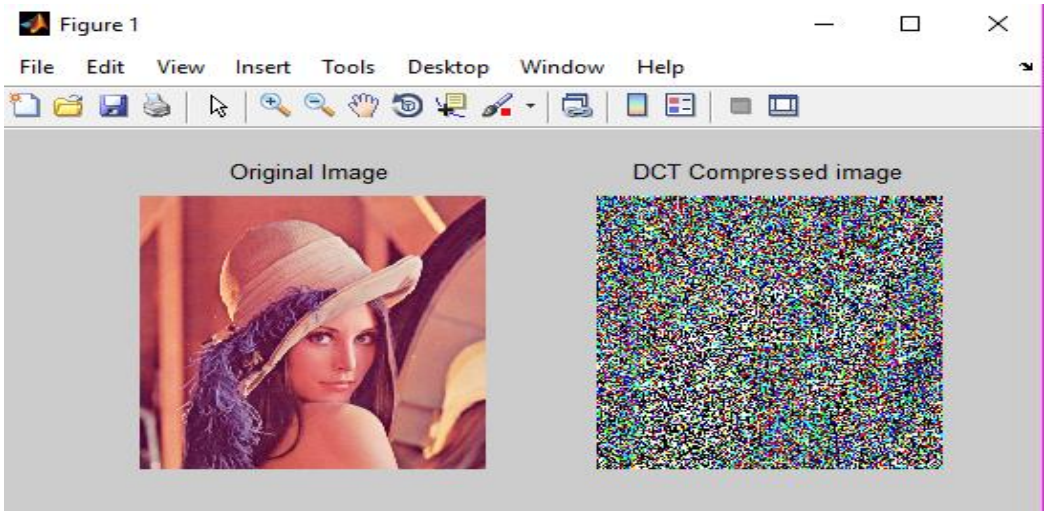
The highly secure Image QR Codes which this paper focuses on consists of mainly four steps for encoding. In the first step, an image. The second step maps these 0's and 1's by grouping it into four digits and by converting these into the alphabets from 'a' to 'p'. In the third step, these will be further compressed and encrypted to get a new text file. This file will be then converted to its corresponding QR Code.

i) Text-To-Image

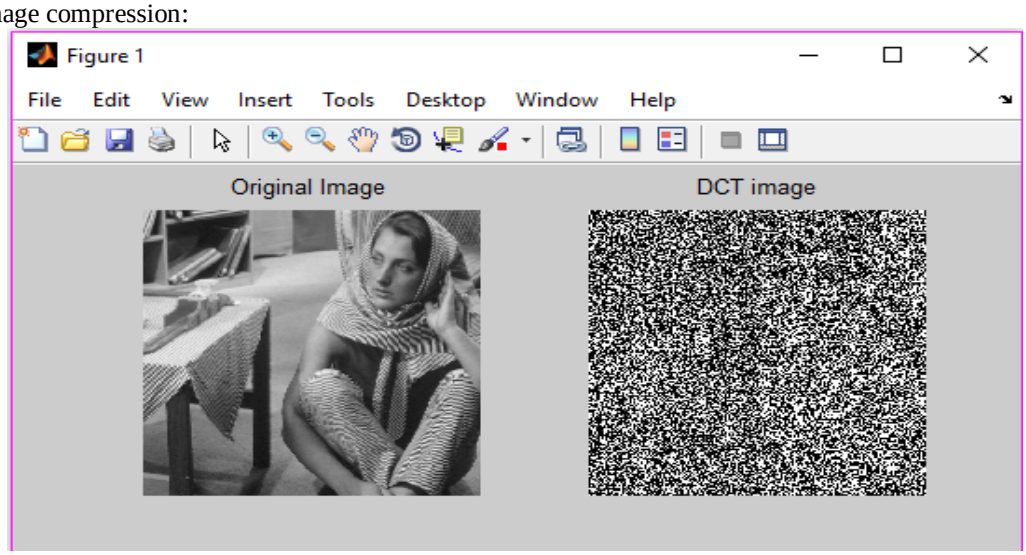


ii)DCT compression:

1.) DCT colour image compression:

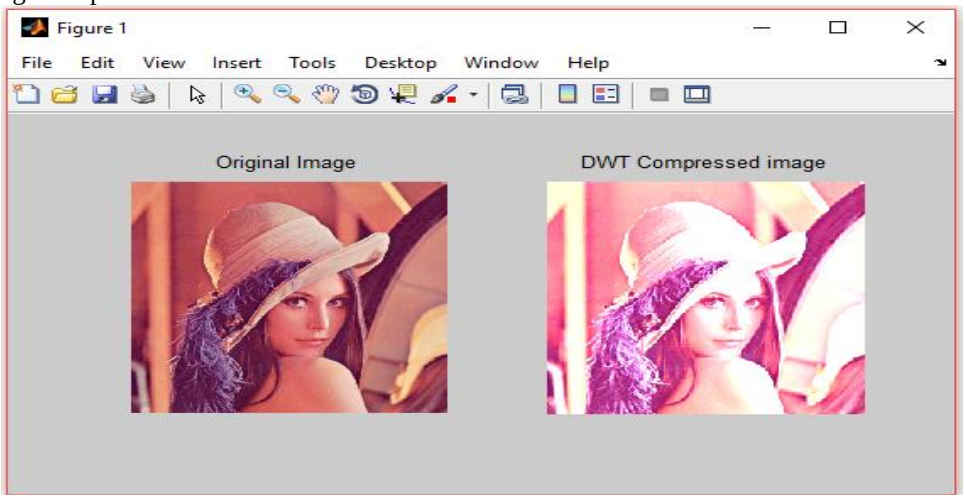


2.) DCT grey image compression:

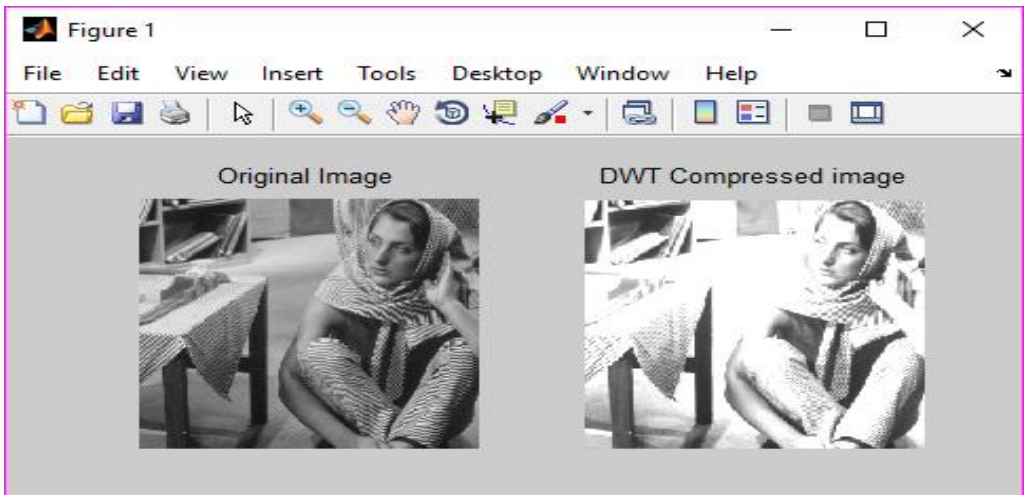


iii)DWT compression:

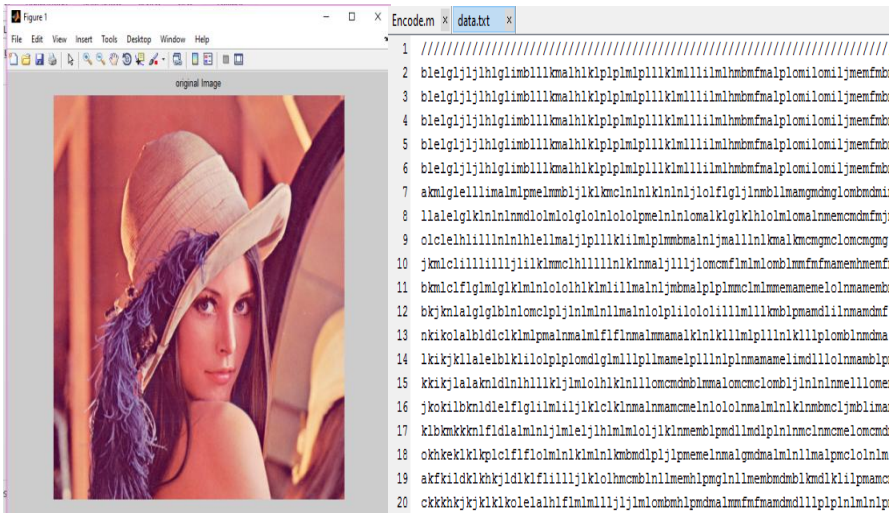
1.) DWT colour image compression:



2.) DWT grey image compression:

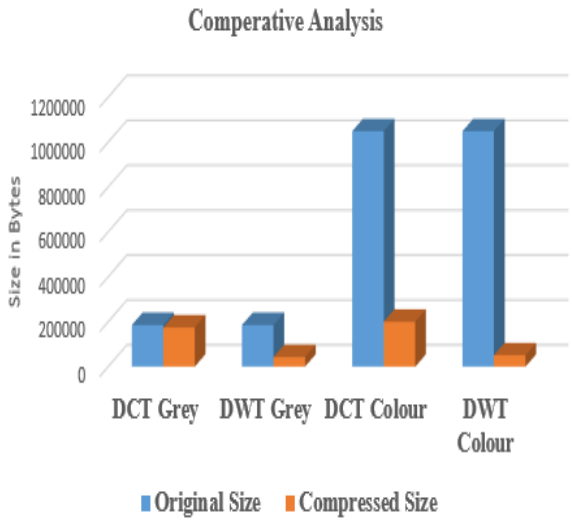


iv.) Image-To-Text



Compression table:

Analysis:



Compression Type	Original Size	Compressed Size	PSNR	MSE
DCT Grey	185727	174499	∞	0
DCT Colour	1048714	199826	∞	0
DWT Grey	185727	42695	∞	0
DWT Colour	1048714	50523	∞	0

IV FUTURE WORK:

The main goal of our proposed work is try to increase security for image transfer and store the data into less storage space. So try to produce new approach for generating QR code from image.

Here we have done compression using DWT & DCT but DWT gives better results and more Compression. And also done image to text conversation using simple method which generate large amount of text which text is not support to generate QR code. So need to reduce size of text by using proposed base64 algorithm, so infuture we can generate QR-code of image.

V. CONCLUSION:

The main goal of this research is storage less with high security image transfer. We have proposed new approach to embed color image into QR-codes. For that we have converted image into text and then combining the character with novel approach and generate QR-code. These methods allow to secure and efficient embedding with less probability of detection error. So here produce new approach based on image hiding in QR-code.

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