

Digital Image Watermarking Using QR Code

^[1]Sumedha Nishane, ^[2]Prof. V. M. Umale

^{[1][2]}SSGMCE Shegaon

^[1]sumedha.nishane@gmail.com, ^[1]vmumale@rediffmail.com

Abstract: In this science era with the development of technology and internet, the protection and authentication of data is essential. Watermarking techniques provide solution to this problem. QR code being so versatile because of its structural flexibility that it leads to so many diverse field for research such as increasing data capacity, security applications such as different kinds of watermarking . We have used QR code as cover image and as secret image to protect it from other users. This paper is representing a new watermarking technique with QR code to protect the secret image. In the method described here the image is first encrypted in random matrix, then it is invisibly watermarked in cover image and no information about the secret image and cover image is needed for extraction of secret image, so it more secure.

Key words- DWT, QR Code, Watermarking

I. INTRODUCTION

Increase in use of Digital Media, raises the problem of data protection and authentication. Data can be easily copied. Digital Watermarking Technique gives the best solution to protect data.

In this technique the data is hidden within the cover image so stranger cannot get it without having proper guidance. Many methods used for the invisible Digital Watermarking required some information about the cover image. But we do not require it for secret image extraction, so it is more secure. We are using QR code which itself hide the information but which can be easily scanned .We can use this method to hide image in QR code and to hide QR code in an image. In both the cases the information is detectable under the influence of various attacks.

- **Discrete Wavelet Transform**

It decomposes the image into different frequency ranges such as low frequency, middle frequency and high frequency. In same way the image can further be decomposed into n levels. Here we are using 3level decomposition for better result.

In two dimensional applications, for each level of decomposition, we first perform the DWT in the vertical direction, followed by the DWT in the horizontal direction. After the first level of decomposition, there are 4 sub-bands: LL, LH, HL, and HH. For each successive level of decomposition, the LL sub-band of the previous level is used as the input. To perform second level decomposition, the DWT is applied to LL and so on.

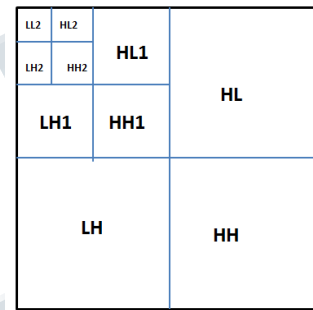


Fig.1 DWT decomposition

- **Quick Response Code**

It is two dimensional barcode consists of black modules arranged in white background. It can store large alphanumeric information and easily readable by scanner. A QR code is capable of being read in 360 degree from any direction thus eliminating interference. The QR Code system has become admired outside the automotive industry due to its fast readability and greater storage capacity than that of the UPC barcode.

- It has higher information density.
- It is small in size than that of Barcode.
- Data can be restored even if the symbol is partially dirty or damaged.

Some features that describe how QR code is better in comparison with conventional barcodes have been listed out in following table

Table I: Comparison of QR code and Barcode

| QR Code | Barcode |
|--|---|
|  |  |

| | |
|-------------------------------------|---------------------------------------|
| Upto 7089 numeric digits | 10-20 digits |
| 40 digits Numeric (approx 5 mm 5mm) | 10 digits numeric (approx.50 mm 20mm) |
| Supports 360 d reading | Horizontal reading |

QR code is used for Advertising, Business cards, Social networking, Branding, registration.

II. PROPOSED TECHNIQUE

The process of image embedding and image extraction is given as follows:

Image Embedding

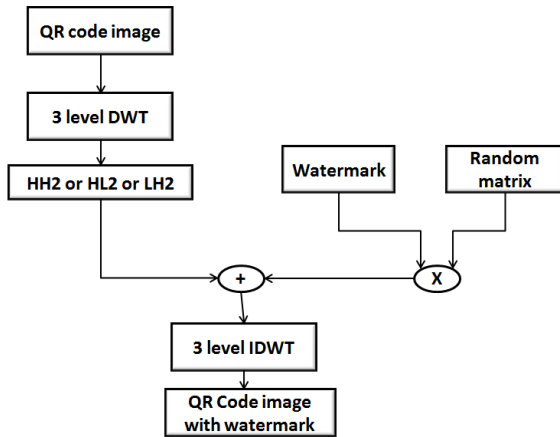


Fig.2 Watermark embedding technique

- The cover image is 3 level DWT decomposed into HH3, HL3, LH3, LL3
- Select HH3 for image embedding
- Secret image (which is watermark) is encrypted with random matrix
- Encrypted secret image(watermark) is now embedded within the HH3
- Apply inverse DWT, to get cover image

Image Extraction

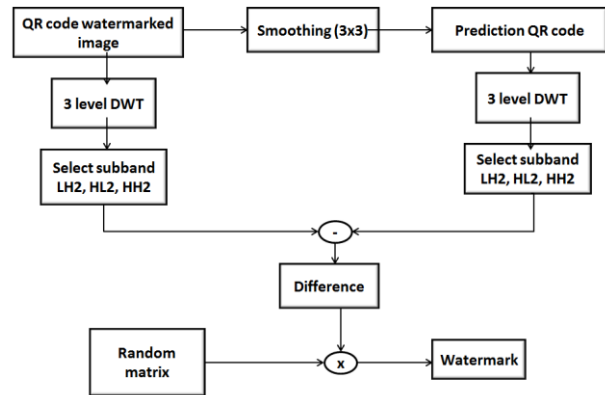


Fig.3 Watermark Extraction Technique

- Apply 3 level DWT to watermarked cover image, image is decomposed into HHW, HLW, LHW, LLW
- Predicted cover image is obtained by smoothing watermarked cover image
- Apply 3 level DWT to this predicted image, image is decomposed into HHP, HLP, LHP, LLP
- Subtract HHP from HHW
- Decrypt the image by using random matrix

III. EXPERIMENTAL RESULTS

The above algorithm is implemented in MATLAB and the results are checked for various attacks.

In first case we use QR code as a cover image and logo as a secret image. In second case we are using QR code as a secret image. The results are compared for various attacks with their PSNR (Peak Signal to Noise Ratio) and MSE (Mean Square Error). PSNR is calculated by using formula given below,

$$PSNR = 10 \log_{10} \left(\frac{255^2}{MSE} \right)$$

$$MSE = \frac{1}{M \times N} \sum_{i=1}^M \sum_{j=1}^N [f(i,j) - f'(i,j)]^2$$

The similarity between the original watermark and the extracted watermark is calculated using normalized correlation (NC):

$$NC = \frac{\sum_{i=1}^M f(i) \times f'(i)}{\sum_{i=1}^M f(i)^2}$$

Table II. Results for various noises

| Type of noise | Extracted image |
|---------------|-----------------|
|---------------|-----------------|

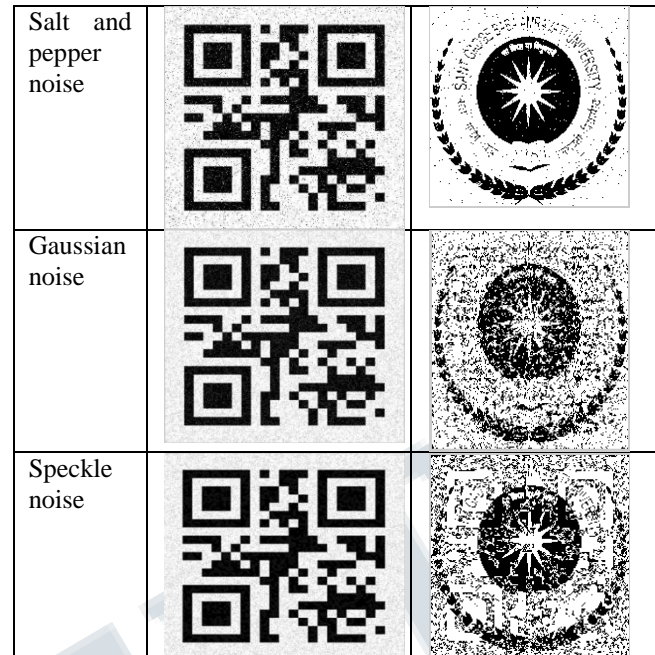
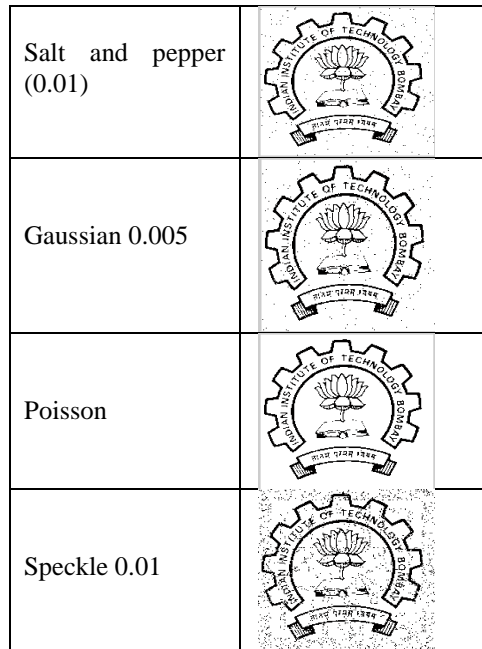


Table III. Results comparison with MSE, PSNR, NC

| Type of noise | MSE | PSNR | NC |
|-----------------------|------|-------|-------|
| Salt and pepper(0.01) | 2.92 | 43.51 | 0.96 |
| Gaussian (0.005) | 4.34 | 41.79 | 0.97 |
| Poisson | 2.86 | 43.60 | 0.99 |
| Speckle (0.01) | 5.20 | 41.01 | 0.831 |

Table IV. Results for QR code as cover image and logo as a secret image

| | Cover image with watermark | Extracted watermark |
|-----------------|----------------------------|---------------------|
| Original images | | |
| Without noise | | |

Table V. PSNR for noise attacks

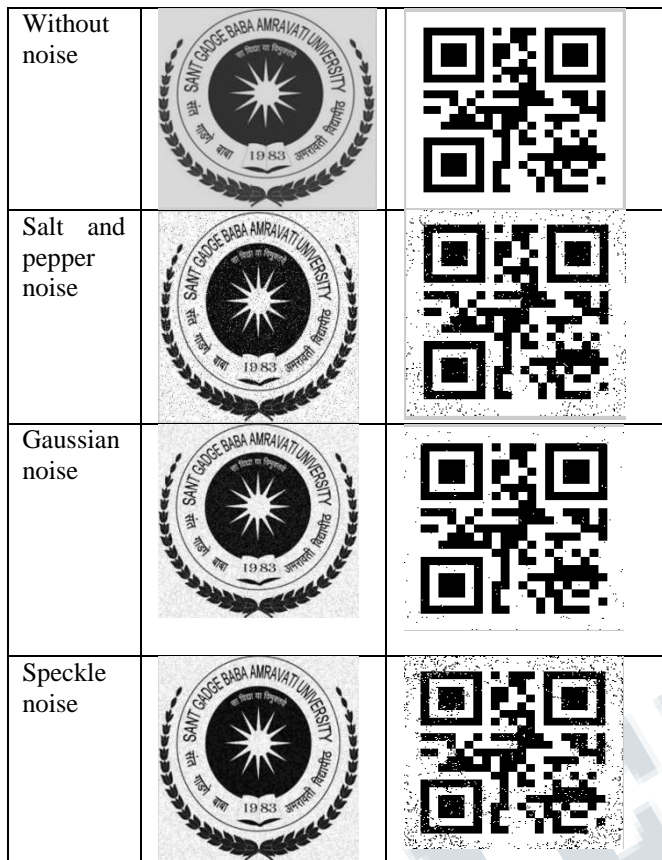
| Noise type | PSNR |
|-----------------------|-------|
| Salt and pepper noise | 68.27 |
| Gaussian noise | 55.65 |
| Speckle noise | 55.37 |

QR code can store large amount of data but it can be easily scanned by anyone so if you want to transfer or store important information it is better to hide it in the other image. In next case we are going to watermark QR code in the logo. And from the result it is observed that extracted QR code is decodable under different attacks.

The results observed are as follows:

Table VI. Results for logo as cover image and QR code as secret image

| | Cover image with watermark | Extracted watermark |
|-----------------|----------------------------|---------------------|
| Original images | | |



Sushma Yalamanchili, M.Kameswara Rao “Copyright Protection of Gray Scale Images by Watermarking Technique Using (N, N) Secret Sharing Scheme” JOURNAL OF EMERGING TECHNOLOGIES IN WEB INTELLIGENCE, VOL. 2, NO. 2, MAY 2010

Jantana Panyavaraporn, Paramate Horkaew, Wannaree Wongtrairat “QR Code Watermarking Algorithm based on Wavelet Transform” 2013 13th International Symposium on Communications and Information Technologies (ISCIT) 978-1-4673-5580-3/13/\$31.00 © 2013 IEEE

Suraj Kumar Sahu ,Mr. Sandeep Kumar Gonnade “Encryption in QR Code Using Steganography” (IJERA) ISSN: 2248-9622 www.ijera.com Vol. 3, Issue 4, Jul-Aug 2013, pp.1738-1741

Sankara Narayanan,” QR Codes and Security Solutions”, International Journal of Computer Science and Telecommunications [Volume 3, Issue 7, July 2012]

Nikita Kashyap, G. R. SINHA, “Image Watermarking Using 3-Level Discrete Wavelet Transform (DWT)”, *I.J.Modern Education and Computer Science*, 2012, 3, 50-56

Namita Chandrakar, Jaspal Bagga, “Performance Comparison of Digital Image Watermarking Techniques: A Survey”, International Journal of Computer Applications Technology and Research ,Volume 2– Issue 2, 126 - 130, 2013

Kinjal H. Pandya1, Hiren J. Galiyawala2, “A Survey on QR Codes: in context of Research and Application”, International Journal of Emerging Technology and Advanced Engineering Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 3, March 2014)

Table VII. PSNR for noise attacks

| Noise type | PSNR |
|-----------------------|-------|
| Salt and pepper noise | 72 |
| Gaussian noise | 64.67 |
| Speckle noise | 61.79 |

CONCLUSIONS

The algorithm presented here gives us more secure watermarking for an image and the important data can be kept secure in watermarked QR code. It works under various noise attacks. It satisfies all the properties of the watermarking such as robustness, fidelity, computational cost, data Payload. In this way we can make QR code secure. With help of this one can make transmission more secure. This can be used for keeping organizational record secure and one can keep his personal information safe in QR code. For future work, further encryption can be added to the QR code so that it cannot scan by anyone without key.

REFERENCES

Mei Jiansheng, Li Sukang and Tan Xiaomei “A Digital Watermarking Algorithm Based On DCT and DWT” Proceedings of the 2009 International Symposium on We Information Systems and Applications (WISA’09) Nanchang, P. R. China, May 22-24, 2009, pp. 104-107