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A Novel QR Code Watermarking In Digital Media Using DWT

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ABSTRACT

Due to the extensive use of digital media applications, multimedia security and copyright protection has gained tremendous importance. Digital Watermarking is a technology used for the copyright protection of digital applications. In this project, a comprehensive approach for watermarking digital QR code image is introduced. We propose a hybrid digital media watermarking scheme based on Discrete Wavelet Transform (DWT) for a digital invisible watermarking is to embed binary image in the QR code image. In our method we embed a binary image considered as watermark embedded into one of selected wavelet subband. The proposed algorithm is also implemented on videos which is a novel approach compared to previous works based on the images. The experimental results show that our method has more robustness to attacks in different considerations and it can achieve a viable copyright protection and authentication.

INTRODUCTION

The popularity of digital image based applications is accompanied by the need for copyright protection to prevent illicit copying and distribution of digital image. Copyright protection inserts authentication data such as ownership information and logo in the digital media without affecting its perceptual quality. In case of any dispute, authentication data is extracted from the media and can be used as an authoritative proof to prove the ownership. As a method of copyright protection, digital QR code image watermarking has recently emerged as a significant field of interest and a very active area of research.

Watermarking is the process that embeds data called a watermark or digital signature into a multimedia object such that watermark can be detected or extracted later to make an assertion about the object. The object may be an image or audio. For the purpose of copyright protection digital watermarking techniques must meet the criteria of imperceptibility as well as robustness against all attacks for removal of the watermark. Many digital watermarking schemes have been proposed for still images. Most of them operate on uncompressed images, while others embed watermarks directly into compressed images. Digital watermark is a pattern of bits inserted into a digital image, audio or video that identifies the

copyright and authenticates information. The goals of watermark technique are to embed the secret information seamlessly hidden within into original message, which is robust against attacks. In recent years, some researchers have proposed the adoption of watermark techniques. The watermark can also be inserted in the original spatial domain of the image in the main disadvantage of spatial domain was that it easy to be hacked and attacked.

In the proposed method embedded the copyright image into the original image using (N,N) secret sharing scheme. This method could resist contaminations such as JPEG compression, resize and noise addition. There are many techniques to embed the watermark into frequency domain of the original image. The techniques operating on a frequency domain use transformations such as Discrete Cosine Transform (DCT), Discrete Fourier Transform (DFT) and Discrete Wavelet Transform (DWT). In, a watermark technique of multispectral image is performed in the wavelet transform. In [4], the authors proposed a scheme for color images using wavelet transform based on texture properties and secret sharing.

In this paper, we will propose the blind watermarking algorithm by means of two-level discrete wavelet transform (DWT) embedded in a QR code image. This paper is organized as follows. Some backgrounds on QR code and watermark are presented in section 2. Section 3 describes watermark embedding and extraction. In Section 4, the objective and subjective evaluations are discussed. The last section presents our conclusions code (Quick Response Code) is the trademark for a type of two-dimensional barcode. A barcode is an optically machine-readable label that is attached to an item and that records relevant information. The information encoded by a QR code may be made up of four standardized types ("modes") of data (numeric, alphanumeric, byte / binary, Kanji) or, through supported extensions, virtually any type of Data. The QR Code system has become popular outside the automotive industry due to its fast readability and greater storage capacity compared to standard UPC barcodes. Applications include product tracking, item identification, time tracking, document management, general marketing, and much more.

QR IMAGE:

QR (Quick Response) Codes are 2-dimensional bar codes that encode text strings and were introduced by the Japanese corporation Denso Wave Incorporated [6]. QR codes are considered as the evolution of the one dimensional barcodes. They are able to encode information in both vertical and horizontal direction, thus able to encode several times more information than the one dimensional barcodes. QR codes consist of black and white modules which represent the encoded data.

Fig. QR code

A QR code consists of black modules (square dots) arranged in a square grid on a white background, which can be read by an imaging device, such as a camera or mobile, and 13th International Symposium on Communications and Information Technologies (ISCIT) 791 processed using Reed-Solomon error correction until the image can be appropriately interpreted.

EMBEDDING A LOGO INTO THE QR CODE

A. Watermark Embedding

The following outlined procedure is for the embedding process (Fig.3)

Step of watermark image with secret key

i. The watermark image was produced as a bit sequence of watermark **S**. The data and background values were set to 1 and –1, respectively.

$$\mathbf{S} = \{s_i, 1 \le i \le N\}, \quad s_i \epsilon \{-1,1\} \qquad (1)$$

where *N* is the total number of pixels in the watermark image.

ii. The pseudo-random sequence **(P)** whose each number can take a value either 1 or –1 was randomly generated with a secret key for embedding and extracting of the watermark.

$$\mathrm{P} = \{p_i, 1 \le i \le N\}, p_i \epsilon \{-1,1\} \qquad (2)$$

Steps of QR Code:

I. Apply two-level DWT on QR code image.

II. A watermark was then embedded in subband LH2 or HL2 or HH2. According to the rule:

$$t_i' = t_i + \alpha . p_i . s_i, i = 1,2, \dots, N \qquad (3)$$

where t_i is input image. t_i' is output image with watermark. α is a magnitude factor which is a constant determining the watermark strength.

III. After that, the inverse DWT (IDWT) was then applied to obtain the watermarked image.

B. Watermark Extraction

The watermark extraction algorithm did not use the original QR code image. A prediction of the original value of the pixels is however needed. Thus, a prediction of the original value of the pixels was performed using noise elimination technique. In this paper, we use an averaging3×3mask whose elements were fixed to 1/9. The extraction process are outlined as follows

IV. Apply 2-level DWT on predicted images (as defined above)

V. Apply 2-level DWT on Watermarked image from step VI.

VI. Now select LHF2 or HLF2 or HHF2 from step VIII

VII. Now select LHW2 or HLW2 or HHW2 from step IX

VIII. Now find difference between X and XI i.e., The sign of the difference between the predicted and the actual value is the value of the embedded bit:

$$sgn(\delta_i) = p_i . \hat{s}_i \quad (6)$$

IX. Compute PSNR.

X. Compute NC

The watermark was then estimated by multiplying pseudo- random number to the embedded bit. If an incorrect pseudo random sequence was to be used, the scheme would not work.

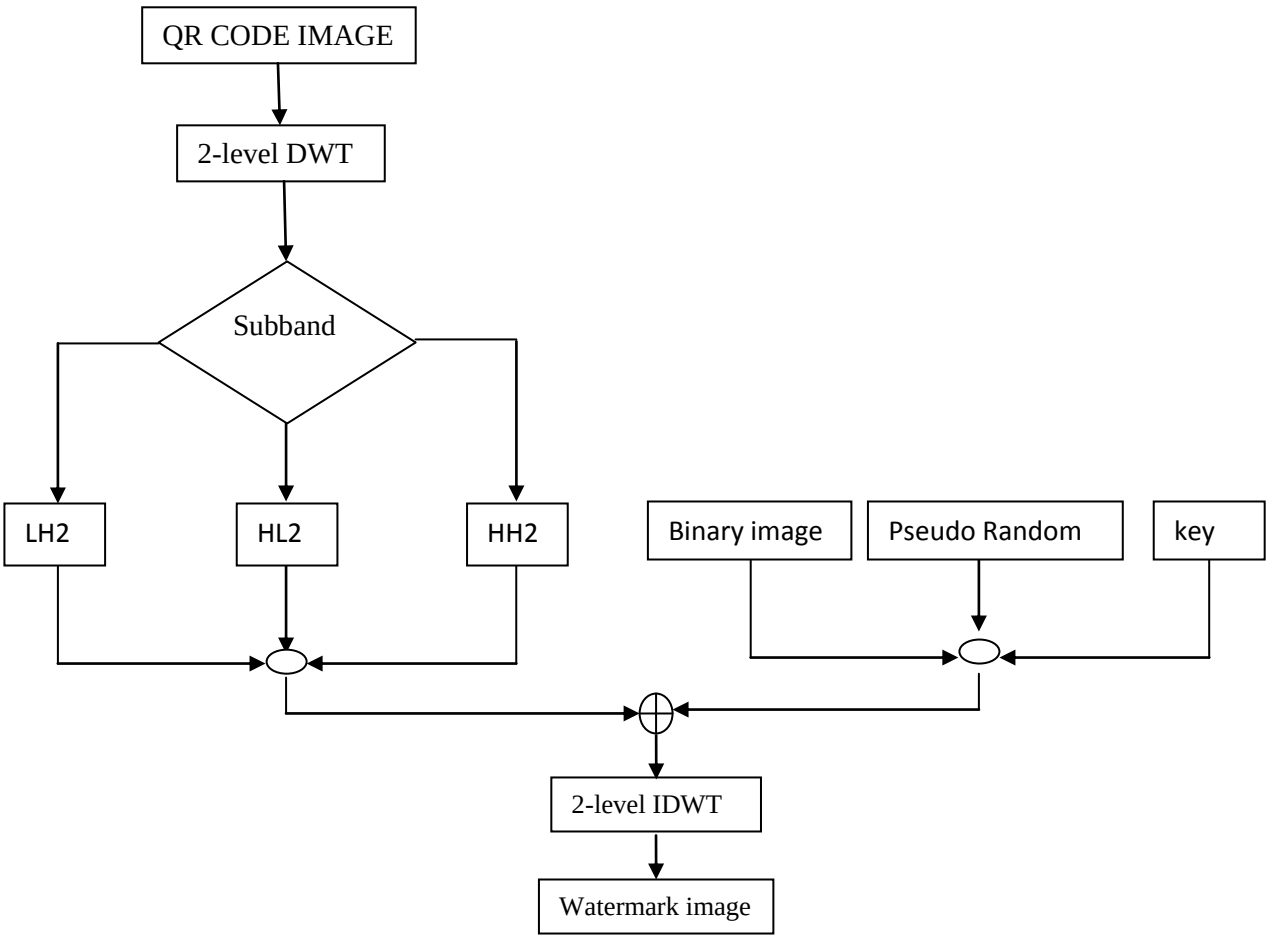

Fig . Watermark Embedding Process

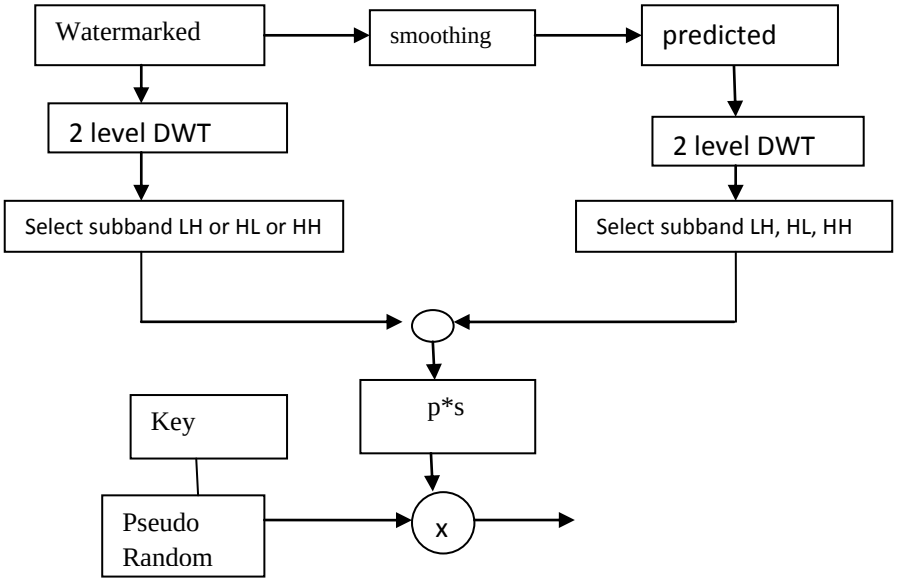

Fig. Watermark Extracting Process

EXTENSION

In this project, a comprehensive approach for watermarking digital video is introduced. We propose a hybrid digital video watermarking scheme based on Discrete Wavelet Transform (DWT) for a digital invisible watermarking is to embed a QR code image in the digital video. In our method we embed a binary image QR image considered as watermark embedded into one of selected wavelet subband.

EMBEDDING QR CODE INTO THE VIDEO

A. Watermark Embedding

The following outlined procedure is for the embedding process (Fig.3)

Step of watermark image with secret key

iii. The watermark QR image was produced as a bit sequence of watermark **S**. The data and background values were set to 1 and –1, respectively.

$$\mathbf{S} = \{s_i, 1 \le i \le N\}, s_i \epsilon \{-1,1\} \qquad (1)$$

where *N* is the total number of pixels in the watermark image.

iv. The pseudo-random sequence **(P)** whose each number can take a value either 1 or –1 was randomly generated with a secret key for embedding and extracting of the watermark.

$$\mathrm{P} = \{p_i, 1 \le i \le N\}, p_i \epsilon \{-1,1\} \qquad (2)$$

Steps of Digital Video

XI. Divide the video (2N × 2N) into distinct frames.

XII. Convert every RGB frame into YCbCr.

XIII. Apply two-level DWT on each frame of digital video.

XIV. A watermark was then embedded in subband LH2 or HL2 or HH2. According to the rule:

$$t_i' = t_i + \alpha . p_i . s_i, i = 1,2, \dots, N \qquad (3)$$

where t_i is input image. t_i' is output image with watermark. α is a magnitude factor which is a constant determining the watermark strength.

XV. After that, apply the inverse 2-level DWT (IDWT)

XVI. Convert every YCbCr frame into RGB

XVII. Combine these frames to obtain the watermarked digital video.

B. Watermark Extraction

The watermark extraction algorithm did not use the original Digital video. A prediction of the original value of the pixels is however needed. Thus, a prediction of the original value of the pixels was performed using noise elimination technique. In this paper, we use an averaging 3×3 mask whose elements were fixed to 1/9. The extraction process is outlined as follows (Fig.4):

XVIII. Apply 2-level DWT on predicted images (as defined above)

XIX. Apply 2-level DWT on Watermarked frames from step VI.

XX. Now select LHF2 or HLF2 or HHF2 from step VIII

XXI. Now select LHW2 or HLW2 or HHW2 from step IX

XXII. Now find difference between X and XI i.e., The sign of the difference between the predicted and the actual value is the value of the embedded bit:

$$sgn(\delta_i) = p_i . \hat{s_i} \qquad (6)$$

XXIII. Compute PSNR.

XXIV. Compute NC

The watermark was then estimated by multiplying pseudo- random number to the embedded bit. If an incorrect pseudo random sequence was to be used, the scheme would not work.

CONCLUSION

This paper presented a digital watermarking technique where by a binary image is watermarked an embedded in a QR code image. The embedding process is presented in a LH, HL or HH sub band based on wavelet transform. The experimental results demonstrated that the algorithm can be recovering the watermark with an acceptable visual quality. As well as we are extended this project video watermarking using dwt. Here we are embedding a binary QR code image into the video. The objective measures such as PSNR and NC are subject to magnitude factor. As the future work, we are trying to find more efficient ways to withstand more severe attacks such as stronger noise, high compression, geometric distortion and occlusion etc.

SIMULATION RESULTS:

Fig: Original QR code image

Fig: watermark image

Fig: Watermarked image

Fig: Extracted Image

Subband	PSNR	NC	Extracted watermark
LH	43.0615	0.9525	
HL	43.1514	0.9611	
HH	44.2675	0.9916	

For Video:

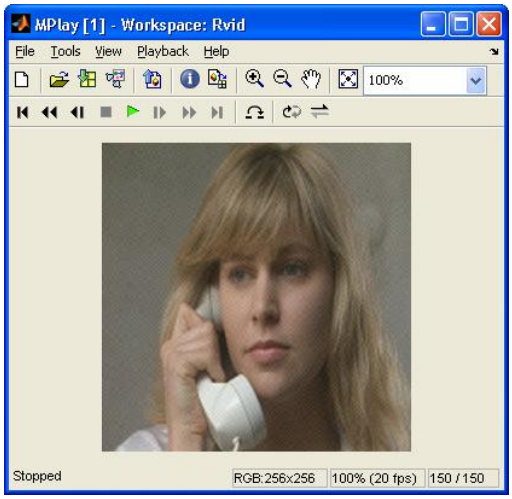

Fig: Original video

Fig: watermark QR code image

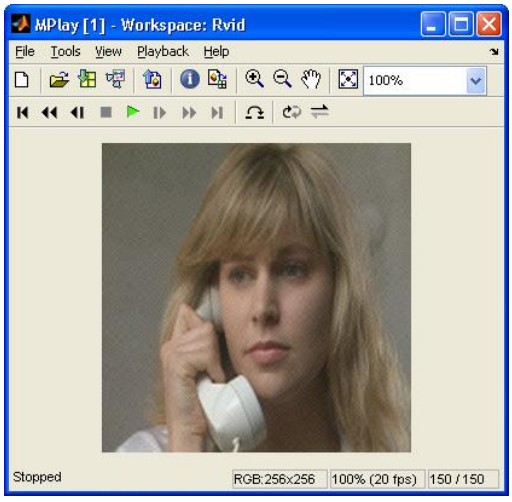

Fig: Watermarked video

Fig: Extract watermark QR code image

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