

QR Code Steganography Using Encryption

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Abstract – This paper focuses on providing a secured method of sending data using cryptography, steganography and QR Code. Internet is prone to all kinds of malicious activities like stealing of information, destroying the integrity of data, unauthorized authentication etc. We develop a system, which helps to send information in the form of an image to the receiver. The message sent is encoded into the QR code. The message is encrypted using DES algorithm for providing additional security to the QR Code. Data Encryption Algorithm is a block cipher algorithm, used in encryption. DWT technique hides the QR Code into the image. Compression of QR Code provides storage capacity and robustness. The Peak Signal-to- Noise Ratio calculates the efficiency of system.

Keywords: Steganography, Cryptography, QR Code, DWT, DES algorithm.

I INTRODUCTION

Data is more precious these days. As the network has become vast, the usage of data over the network has rapidly increased. Transactions, business deals, communication, data transmissions are all done over internet. There is threat of data manipulation, hacking, fraud transactions, copyright issues etc due to its vast usage. To protect data from intruders we need our network to be free from vulnerability for transaction. Steganography and cryptography helps us to achieve a secured transmission. Steganography is hiding of data inside a cover image. The intruder will never suspect there is secret data inside the image. Thus, steganography can be used in sending confidential data to the receiver. The most common technique used for hiding the data into the image is the LSB technique. The message that is converted into the binary format is embedded into the least significant bits of the image.

Discrete Wavelet Transformation is a frequency domain technique where high pass and low pass filters when passed in to the time domain generates high and low pass wavelets. DWT is the most secure and high capacity technique compared to the standard LSB technique. QR code is a two dimensional barcode that is used to store information like text, URL's etc. High storage capacity and fast readability makes it widely used in the digital market for advertisement, transport, transactions etc. They are very much easy to use and the interesting part is our smart phones can also scan them. Scanning QR code is very much easy so the information is not protected from intruders. Thus, cryptography helps us to make our messages more secretive by converting the plaintext into the cipher text with the help of secret keys. The message encoded in QR

code is encrypted using DES algorithm. This system will help big organizations to transfer their data through the internet without being misled by their enemies. Government and intelligence agencies can store critical information and can fearlessly transmit information over the network.

QR code stores information in x and y-axis of the plane. It is in the shape of square represented with black and white pixels. Inside QR, there are three-square boxes, which are usually bigger than others used for pattern separators and for detecting positions. There are six smaller squares in alignment pattern. The outer space is called the silent zone. The modes in which we can store information are bytes, numeric, alphanumeric and kanji. Versions of QR code ranges from Version 1 (21x21) to Version 40 (177x177). They have error correction levels and can completely restore codeword. They can be read and scanned in any direction. We can easily create QR code using the zxing library which is an open source tool written in java language. Our smart phones can scan them thus making it free resource for peoples. QR codes can store data's like URL, text, contact, email-address, pdf, business cards etc. The processor can lose data at any time, QR code can protect secret message inside it because it has the ability of error correction. The secret message can be easily restored in QR code. QR code has good robustness and provides maximum security to the message.

II LITERATURE SURVEY

The main purpose of this paper enhances the image quality and security through compression using DWT technique. The secret message is embedded in QR code. The

embedding and extraction phase provides security and speeds up the transmission of steno image. In embedding phase QR code with the secret message is embedded into the pre-processed cover image. The extraction phase extracts the source image and QR code separately within less computation time. The proposed system gives average PSNR value, which maintains the quality of stego image [1]. This paper combines steganography and cryptography for transmission of secured data over the network. In this paper Discrete Wavelet Transform- Singular Value Decomposition (DWT-SVD), steganographic methodology is used for hiding QR code into the image. Here the QR code generated is converted into one-dimensional vector with a sequence of 1's and 0's. The message is encrypted using AES algorithm and is hidden into the LL DWT sub division of the cover image. To achieve another level of security the QR code is scrambled before embedding into the cover image[2]. In this paper steganography is achieved by embedding the secret message into the image by DWT technique and through color space models(RGB and $YCbCr$). The cover image in the RGB model is replaced into the $YCbCr$ model. DWT is applied on the chrominance component C_b . The LSB bits in the HH band replace the secret message in the ASCII code encrypted by AES. In the extraction process the stego image obtained is applied DWT and then there is decomposition of HH band and the embedded secret message in the LSB bit. These bits are converted into decimal values and then decrypted using AES [6]. This paper gives the concept of hiding data into the QR code and hiding the QR code into the colour images. The two main concepts used in this method is the half toning technique to reduce the square structure of QR code and the second method is to modify the luminance level of QR code with the luminance level of colour image such that it is invisible to the human eye. In the extraction process the binarization of QR code image is done to obtain black and white pixels. Code words from the binary image are sampled on the grid and are estimated by finder and alignment pattern. The QR code is extracted after binarization and grid sampling [3].

III PROPOSED SYSTEM

The system takes input message and a cover image from the user. The text is encrypted using DES algorithm and then is encoded into the QR code. Encrypted QR code is then embedded into the cover image using DWT technique. The image is the received by the receiver. We make sure that the cover image and the stego image looks similar. In the receiver side the inverse procedure is applied to get the QR code. Receiver scans the QR code and the decryption key is provided to get the secret message.

1. DES Algorithm: DES algorithm is a symmetric block cipher algorithm used for encryption and decryption of messages. The 64-bit plain text gets converted into 64 bit cipher text. It uses 16 round structures. The 64-bit key structure is used out of which 56-bit keys are used and the

rest 8 bits are used for padding. Des uses following structure:

- Initial permutation
- Round function
- Key structure
- Final permutation

1.1 Initial and Final permutation: Initial and Final permutation are straight permutation boxes that are inverse of each other.

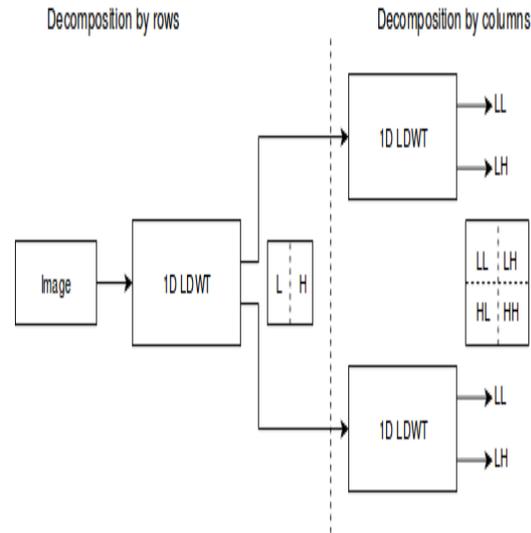


Fig 1. Discrete Wavelet Transformation

1.2 Round function: DES function uses f function which uses 48 bit key on the rightmost to produce 32 bit output. In expansion p-box the 32 bit rightmost key is expanded to 48 bit output. The XOR operation is performed on expanded output along with the key. There are 8 s-boxes in DES for which 6 bit is input and 4 bit output. The output of this s-box is 32-bit. The output of 32 bit s box is then permuted to give 32 bit output.

1.3 Key structure: In 16 rounds 48 bit keys are generated of 56bit cipher text.

2. DWT transformation: Discrete wavelet transformation is used for compression of the image in frequency domain. The lifting scheme of DWT and IDWT provides lower computational complexity, reduced memory requirement and lossless information of data

3. DWT in one dimension: In one dimensional DWT vector x gets filtered through high pass and low pass filters. In the first part the vector x gets filtered through low pass filter and is store into the first eight elements of transformed vector w . In the second part the vector gets filtered through the high pass filter and is stored into the last eight elements in the vector w .

4. DWT in two dimensions: In two-dimensional DWT, there is first decomposition of rows, which gives high pass and low passes regions as shown in fig 1, then there is decomposition of columns to form four sub regions. DWT

converts the cover image into four sub bands LL, LH, HL, and HH. The inverse of DWT is the reverse procedure of DWT.

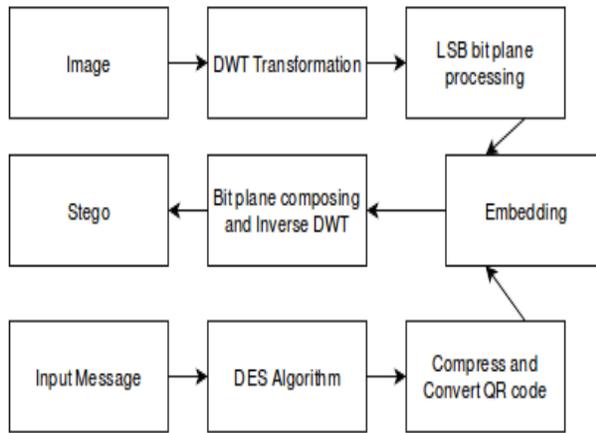


Fig 2. Block diagram of proposed system

5. Embedding process: The embedding process of the proposed system shown in fig 2 has following steps:

- Input QR code, message and cover image.
- Verify QR code size.
- Crop the white space (four bits from every side). The adjacent module in the QR code are replaced by specific value to achieve compression. The user decides the module.
- The cropped QR code size is inserted into transformation coefficient of image.
- Input image undergoes wavelet transformation to form HH, HL, LH, LL sub regions.
- Find the size of HH image where the message is embedded.
- Store the sign of transformation coefficient in sign matrix.
- The signs are removed and HH image is converted into eight-bit plane. The message is embedded into the LSB bit.
- The embedding of QR code is performed on the LSB bit of HH sub image, wherein encrypted QR code bits will be embedded in the LSB bits. The bit substitution is done on the second column and third row of HH matrix to preserve statistical feature of image.
- LSB bit plane is composed of HH image.
- HH image undergoes IDWT to get the original LH, HL, LL images back.

The stego image is obtained in the final step, which has secret message and QR code in it.

6. Extraction process: The extraction procedure is the reverse of embedding process. The secret message from QR code is obtained through the extraction process on the stego

image. The QR code is scanned and the decryption key is given to get the back the original message.

VI CONCLUSION

The QR code gives high embedding capacity and DWT technique gives lossless information of data. Additional security is given to the text by DES algorithm. The stego image and the cover image look similar. The transmission cost is less as we are using QR code for transmission of large amount of data. Two levels of security are provided by encryption and compression of QR code. Transmission of data along the network thus becomes secure and loss of data is preserved in this system. Performance analysis is done by the two parameters PSNR and MSE values. In future we can improve the quality of the embedded image using the intelligent optimization technique.

REFERENCES

- [1]. Poonam Survase "QR code based Image Steganography with Enhanced Image Quality and Compression" International Journal for Innovative Research in Science & Technology | Volume 2 | Issue 05 | October 2015.
- [2]. Dr. V. R. Sasikumar, Dr. R. Vijayanandh, "Secured Steganography Methodology Using Combined Encryption And Quick Response Codes," International Journal of Latest Trends in Engineering and Technology, Vol.(8)Issue(1), pp.486-493.
- [3]. A. Gaikwad and K.R.Singh, "Information Hiding using Image Embedding in QR Codes for Color Images: A Review," International Journal of Computer Science and Information Technologies, Vol. 6 (1) , 2015.
- [4]. B. Padmavathi, S. Ranjitha Kumari " A Survey on Performance Analysis of DES, AES and RSA Algorithm along with LSB Substitution", International Journal of Science and Research (IJSR), India Online ISSN: 2319-7064.
- [5]. Shanjun, Zhang Kazuyoshi, Yoshino, "DWT-Based Watermarking Using QR Code", Science Journal of Kanagawa University, 2008, pp. 3-6.
- [6]. M. Broda, V. Hajduk, D. Levický, "Image steganography based on combination of YCbCr color model and DWT," in ELMAR, 2015 57th International Symposium, pp. 201-204, 28-30 Sept. 2015.
- [7]. V.Hajduk , M.Broda , O.Kováč and D.Levický, "Image steganography with using QR code and cryptography," 26th Conference Radioelektronika, IEEE pp. 978-15090-1674-7, 2016
- [8]. Luo, Z. Chen, M. Chen, X. Zeng and Z. Xiong, "Reversible image watermarking using interpolation techniques", IEEE Transactions on

- Information Forensics and Security, vol 5, no 1, Mar 2010, pp. 187–193
- [9]. H. C. Huang, F. C. Chang and W. C. Fang, "Reversible data hiding with histogram-based difference expansion for QR Code applications," IEEE Transactions on Consumer Electronics, vol. 57, no. 2, pp. 779-787, 2011
- [10]. Garateguy, G.J.; Arce, G.R.; Lau, D.L.; Villarreal, O.P., "QR Images: Optimized Image Embedding in QR Codes," Image Processing, IEEE Transactions on , vol.23, no.7, pp.2842,2853, July 2014.