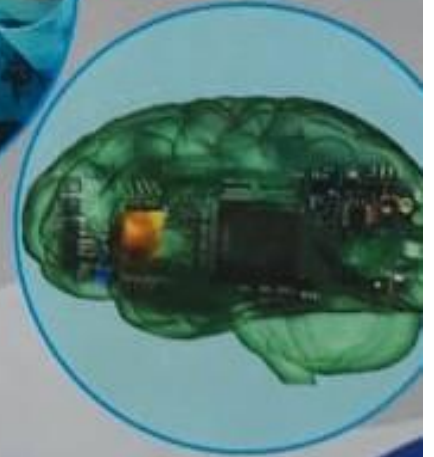


New Horizons in ***Computational Intelligence*** ***and Information Systems***

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NCNHCIIS - 2015

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Enhancing Data Security by Merging QR Codes and Steganography

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Abstract

In recent years data communication has been increased dramatically and the Internet has become effective and fast media for digital data communication. At the same time, communication over the Internet has become susceptible to copyright, infringement, eavesdropping, hacking etc. So it is necessary to secure data in a secured way. Cryptography and Steganography play major role for secured data communication. Steganography stands for concealed writing; it hides the message inside a cover medium. Cryptography conceals the content of a message by encryption. QR (Quick Response) Codes are 2-dimensional bar codes that encode text strings. They are able to encode information in both vertical and horizontal directions and are able to encode more information. In this paper a novel approach is proposed for secret communication by combining the concepts of Steganography and QR codes. Experimental result shows that the proposed method has high imperceptibility, integrity and robustness.

Keywords: Steganography, QR code, BER

1. INTRODUCTION

Cryptography, Steganography and Watermarking techniques can be used to obtain data security, secrecy, privacy and authenticity of data. Cryptography scrambles the data and makes it unreadable and unintelligent form called cipher. Steganography hides the data in a medium and conceals the very existence of the message in the medium. QR code is a two dimensional bar code capable of encoding different types of data like binary, numeric, alphanumeric, Kanji and control code. A piece of long multilingual text, a linked URL, an automated SMS message, a business card or just about any information can be embedded into the QR code.

QR codes (Quick Response codes) were introduced in 1994 by Denso-Wave, a Japanese company subsidiary of Toyota. Initially, these codes were conceived as a quick way to keep track of vehicle parts, but they are now extremely popular in Asian countries like Japan, South Korea, China or Taiwan and becoming more and more popular in western countries by the day. [1] QR codes are capable of encoding the data both in horizontal and vertical direction, thus able to encode several times more data than the barcodes. The following table shows the maximum number of characters encoded in a QR code (version 40) with and without minimum error correcting level L:

Table 1: Capacity of QR Codes

Sl. No.	Data Type	Characters
1	Numeric data	7,089
2	Alphanumeric data	4,296
3	8-bit byte data	2,953
4	Kanji data	1,817

Figure 1 shows a QR code and Error Correction (EC) levels. [2] The technology of QR codes has proved out to be successful even if the code is damaged. This is feasible due to the error correction capability of QR codes, which is based on the Reed-Solomon code. There are four levels of error correction: Low (L) which can tolerate up to 7% damage, Medium (M) can tolerate up to 15% damage, Quartile (Q) can tolerate up to 25% damage and High (H) can tolerate up to 30% damage. The reason why the Low error correction level is preferred is that the higher error correction levels raise the percentage of data that can be stored in the QR code. The amount of data that can be stored in the black and white modules of the QR code is reduced by the encoded data. This information is not in human readable form hence an individual cannot anticipate the information. Any smart phone with built-in camera can capture the image of the QR Code and then decode the data present in it.



Fig. 1: QR Code and EC Level

The advantages of steganography are taken into consideration for the proposed algorithm to enhance data security.