Study of Techniques on Information Hiding Using QR Barcode

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Abstract: *Nowadays, the information processing system plays crucial part in the internet's. Online information security has become the top priority in all different sectors. Failing to provide online information security may cause loss of critical information or someone may use or distribute such information for malicious for various purpose. Recently QR barcodes have been used as an effective way to securely distributing information. This paper presents the survey on information hiding techniques which can share high security information over network using QR barcode.*

Keywords: QR Barcode, Information Hiding, Online information Security.

1. Introduction

Due to tremendous growth in communication technologies, sharing the information through the communication network has never been so flexible. Nowadays information is processed electronically and conveyed through social networks. Such networks are unsecured and hence sensitive information needs to be protected by all means. Cryptography is the study of techniques that allows us to perform. In order to protect information from various computer attacks as well as network attacks various cryptographic protocols and firewalls are utilized. But no single measure can ensure complete security.

Nowadays, the use of internet and sharing information are growing increasingly across the world, security becomes a vital issue for the societies. Security attacks are classified as passive attacks and active attacks [11, 12]. In passive attacks, attacker monitors network traffic and looks for sensitive information but does not affect system resources in networks. Passive attacks include eavesdropping, traffic analysis, Release of message contents [11, 12]. In active attack, attacker breaks protection features to gain unauthorized access to steal or modify corresponding information. Active attacks include replay, masquerade, and denial of service and modification of messages [11, 12] .Therefore, security threats (such as data modification, eavesdropping, website leaks, phishing etc.) force us to develop new methods to counter among them. Considering QR barcodes as an effective media of distributing information, many researchers have proposed information/data hiding methods [6,7, 8, 9.] as well as online transaction systems [1,2,3,4,5] using QR barcode. In this proposed, we describe different information hiding schemes using QR barcode. This paper is organized as follows: Section 2 gives details about QR barcode and their different features. Section 3 gives details of different information hiding methods using QR barcodes and section 4 compares these methods. Section 5 describes our conclusion at last.2.

2. Background

QR Code is a two dimensional matrix barcode that can store over 1800 characters of text information's. QR Barcodes contain PDF 417 for its high data capacities, Data Matrix for its high density printing and MAXI Code for its high speed reading as shown in fig 1.
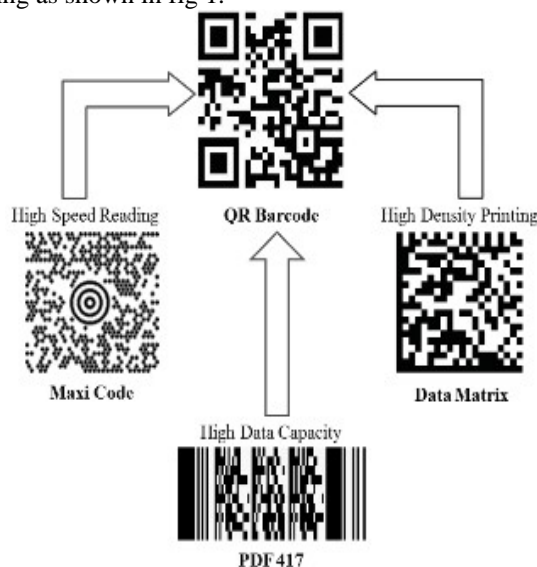
Figure 1: The formation of QR Code

QR Codes are capable of handling of data such as alphanumeric characters, numbers, Kanji, Kana, binary and control codes [10]. A QR code can store information [10] such as:

- Website URL
- SMS
- Text message
- Calendar event
- Contact Information
- Phone number
- Geographic location

2.1 Structure of QR Barcode

QR code consists of the functionality patterns for making it easily decodable in natures. QR code has a position pattern for alignment pattern for correcting distortion, detecting the position of code and timing pattern for identifying the central coordinate of each cell in the Quick Response code.

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Quiet zone is the margin space for reading the QR code and the data area where the data is stored [10].
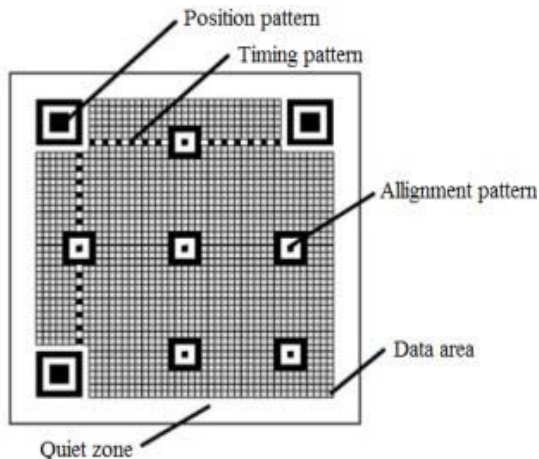

Figure 2: the internal pattern Structure of QR code

2.2. Features of QR Barcode

2.2.1. High Encoding Capacity
QR Barcode is capable of handling hundred times more data than conventional barcode technique. Conventional barcode has capacity to store maximum 20 digits.

2.2.2. Small Size
QR Barcode stores information in both vertical and horizontal fashion. QR Code is capable of storing the same amount of information in one-tenth the space of a conventional barcode [14].

2.2.3. Dirt and Damage resistant capability
QR Code has four different methods error correction levels, detailed as follows [14].

- L - Allows recovery of up to 7% damage.
- M - Allows recovery of up to 15% damage
- Q - Allows recovery of up to 25% damage
- H - Allows recovery of up to 30% damage

The error correction level can be marked by the user when he/she creates the symbol depending on how much damage the QR code is expected to suffer in its usage environment.

2.2.4. Structure Linking Functionality
QR Code has a structure appending functionality which will enable a single QR code to be represented in several symbols by dividing it as shown in fig 3. A single symbol can be divided into up to 16 symbols [14].
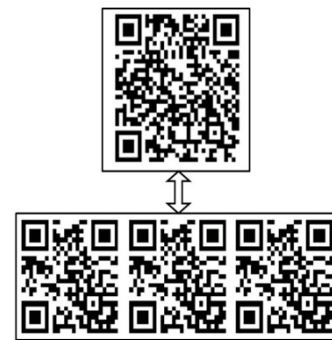

Figure 3: The association of the Symbols

2.2.5. The Confidentiality of the QR Code

The Quick Response code can be easily encrypted and no one will be able to read the data until QR code is deciphered.

3. Information Hiding Methods Using QR Barcode

3.1 Using Hash function

Authors of [6] proposed an information hiding method using Quick Response barcode. In this Method, information which is to be transmitted is first encrypted by using hash function technique, with a secret key K. The key K is known in advance to both receiver as well as sender. After the encryption process; QR code for encrypted information is created and sent over the network for the receiver side. If an intruder were to try to extract the information from QR code technique, he/she would only be able to read the code with a QR code decoder but would not be able to get the secret information from Quick Response code. Only the authorized user with secret key K can retrieve the secret information from QR code technique. The scheme is able to encode large amounts of secret information into a QR code based on selection of the QR version and the error correction levels. The main disadvantage is that the whole secrecy of this scheme depends on their key K. If someone gets the key, this scheme can reveal the secret information by simply decoding the QR code.

3.2 Using TTJSA symmetric key Algorithm

Authors of [7] proposed an encrypted information hiding mechanism using Quick Response barcode. In this method, information which is to be transmitted is first encrypted using TTJSA symmetric key algorithm technology. For encrypted information, QR code is generated by using QR generator [15]. If an intruder tries to extract the information from QR code then he cannot do that because the cryptographic key is unknown to the person. The decryption process is exactly reverse of the encryption process method. TTJSA algorithm is free from attacks such as plain-text attacks, differential attacks or brute force attacks.

3.3 SD-EQR

Author of [8] presents a new technique using QR barcode to transfer information securely through public networks. In this method, the password is entered along with the

information's. The secret key generated from the password which acts as the key for encryption process method. The process of generating secret key is:

- Choose password of any different size, but should consist of only ASCII characters (0-255).
- Finding the length of the entered password denoted by "L".
- Multiply 'L2' with the sum of the ASCII values of each letter of the word entered in the password to get S.
- Each digits of the S is added with each others. The ultimate sum is the secret key.

This secret key will be added to each character in the text entered in the information and complete the first phase of encryption process method. After doing the first level of encryption approach, many other several encryption techniques are used to encrypt the message further to increase the level of securities. At last final encrypted information is encoded into Quick Response code. QR code efficiently handles their 1,264 characters of ASCII text in version 40 with Error correction level H in these approaches. if encrypted information size is larger than capacity of QR code then other QR code is generated containing encrypted information after 1,264 characters respectively. This method is continued until the whole encrypted information is converted into QR codes.

3.4 Using Reversible Data Hiding

Authors of [9] propose a new algorithm for reversible data hiding, with the application associating the QR code. Reversible data hiding is a new technique for hiding data. During encoding process, data is hidden into original image data hidden and original image should be perfectly recovered during decoding process. The secret information which are to be conveyed is first encode to QR code. At the bottom portion of the original image, the pixels in this region are interchanged by QR code. While decoding process, the QR code is first removed from the image and original information can be recovered with reversible data hiding techniques from the rest of the image. During encoding, the information in original image might be lost due to replacement of the corner portion of the original image with the QR code. The author uses reversible data hiding techniques to hide pixels in the corner portion of the original image into the rest of the original image in advance. The detailed process of information extraction by using reversible data hiding techniques is well explained in [10].

4. Conclusion

This paper describes QR barcode and its use in different information hiding method. Such techniques employ traditional information hiding mechanisms like image steganography, hash functions etc. in conjunction with QR barcodes. SD-EQR makes use of user enter password to formulate a private key and generates a QR barcode of the encryption information. Finally the paper compares these techniques.

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