SURVEY ON INFORMATION HIDING TECHNIQUES USING QR BARCODE

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ABSTRACT

Nowadays, the information processing system plays crucial part in the internet. Online information security has become the top priority in all sectors. Failing to provide online information security may cause loss of critical information or someone may use or distribute such information for malicious purpose. Recently QR barcodes have been used as an effective way to securely share 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 technology, sharing the information through the communication network has never been so convenient. Nowadays information is processed electronically and conveyed through public networks. Such networks are unsecured and hence sensitive information needs to be protected by some means. Cryptography is the study of techniques that allows us to do this. In order to protect information from various computer attacks as well as network attacks various cryptographic protocols and firewalls are used. But no single measure can ensure complete security.

Nowadays, the use of internet and sharing information are growing increasingly across the globe, security becomes a vital issue for the society. 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. Passive attacks include traffic analysis, eavesdropping, Release of message contents [11, 12]. In active attack, attacker breaks protection features to gain unauthorized access to steal or modify information. Active attacks include masquerade, replay, modification of messages, and denial of service [11, 12].Therefore, security threats (such as eavesdropping, data modification, phishing, website leaks etc.) force us to develop new methods to counter them. Considering QR barcodes as an effective media of sharing 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 paper, we describe different information hiding schemes using QR barcode.

This paper is organized as follows: Section 2 gives details about QR barcode and their features. Section 3 gives details of different information hiding methods using QR barcodes and section 4 compares these methods. Section 5 presents our conclusion.

2. BACKGROUND

QR Code, also known as "Quick Response" [10] code, is a two dimensional matrix barcode that can store over 1800 characters of text information. QR Barcodes contain PDF 417 for its high data capacity, Data Matrix for its high density printing and MAXI Code for its high speed reading as shown in fig 1.
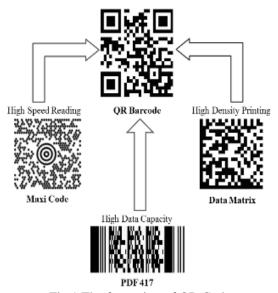

Fig.1.The formation of QR Code

QR Codes are capable of handling of data such as numbers, alphanumeric characters, 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. QR code has a position pattern for detecting the position of code, alignment pattern for correcting distortion, and timing pattern for identifying the central coordinate of each cell in the QR code. Quiet zone is the margin space for reading the QR code and the data area where the data is stored [10].
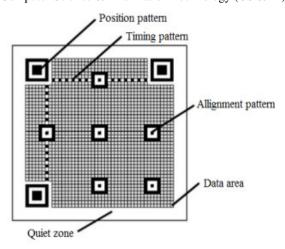
Fig.2. the internal pattern Structure of QR code

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. Conventional barcode has capacity to store maximum 20 digits [14]. While for QR code, up to 7,089(Numeric),4,296(Alphanumeric),2,953(Binary/byte),1,817(kanji/kana)characters can be encoded in one symbol.

2.2.2. Small Size

QR Barcode stores information in both horizontal and vertical 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 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 selected 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 presented in fig 3. A single symbol can be divided into up to 16 symbols [14].
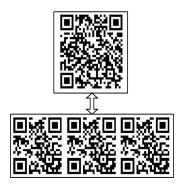
Fig 3.The association of the Symbols

2.2.5. The Confidentiality of the QR Code

The QR 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 QR barcode. In this Method, information which is to be transmitted is first encrypted by using hash function, with a secret key K. The key K is known in advance to both sender as well as receiver. After the encryption process; QR code for encrypted information is created and sent over the network for the receiver. If an intruder were to try to extract the information from QR code, 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 QR code. Only the authorized user with secret key K can retrieve the secret information from QR code. 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 level. The main disadvantage is that the whole secrecy of this scheme depends on 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 QR barcode. In this method, information which is to be transmitted is first encrypted using TTJSA symmetric key algorithm. 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 him. The decryption process is exactly reverse of the encryption process. TTJSA algorithm is free from attacks such as differential attacks, plain-text 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 network. In this method, the password is entered along with the information. The secret key generated from the password which acts as the key for encryption process. The process of generating secret key is:

- Choose password of any size, but should consist of only ASCII characters (0-255).
- Find 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 digit of the S is added with each other. 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. After doing the first level of encryption, many other several encryption techniques are used to encrypt the message further to increase the level of security. At last final encrypted information is encoded into QR code. QR code efficiently handles the 1,264 characters of ASCII text in version 40 with Error correction level H. if encrypted information size is larger than capacity of QR code then other QR code is generated containing encrypted information after 1,264 characters. This method is continued until the whole encrypted information is converted into QR codes. Decryption is actually the reverse process of the encryption.

3.4. Using reversible data hiding

Authors of [9] propose a new algorithm in reversible data hiding, with the application associated with the QR code. Reversible data hiding is a new technique to hide data. During encoding process, data is hidden into original image. Hidden data and original image should be perfectly recovered during decoding process. The secret information which is to be conveyed is first encoded into QR code. At the lower portion of the original image, the pixels in this region are replaced by QR code. While decoding, 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 process, the information in original image might be lost due to replacement of the corner portion of the original image with the QR code. The authors used 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 embedding and extraction by using reversible data hiding techniques is well explained in [10].

4. COMPARISON CHART

Table1. Comparison between Different Information Hiding Methods

Methods	Using Hash function	Using TTJSA symmetric key Algorithm	SD-EQR	Using reversible data hiding
Basic Application	Secret hiding	Secret hiding	Secret hiding	Image hiding
Computational Complexity	Low	Low	High	Low
Processing On QR code	No	No	No	No
Utilizing the error correction capability	Yes	Yes	Yes	No

Encryption on Data before embedding into QR code	Yes	Yes	Yes	No
Hiding Mechanism	Encrypted data embedded into QR Barcode			QR barcode of data embedded into cover image

5. CONCLUSION

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

6. ACKNOWLEDGEMENTS

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