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QR CODE: A BRIEF OVERVIEW

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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.
Index Terms: QR Barcode, Information Hiding, Online information Security

1. INTRODUCTION

There is a tremendous growth in communication technology and due to this sharing the information through the communication network has not been so convenient. Nowadays information is processed and conveyed electronically through the public networks. But these networks are not secured and therefore the sensitive information needs to be protected. Cryptography is the study of techniques that allows us to protect information from various computer and network attacks. Various cryptographic firewalls and protocols are used but no measure can ensure complete security.

The use of internet and sharing information is growing increasingly and security has becomes a vital issue for the society. Security attacks are mainly of two types: passive attacks and active attacks [11, 12]. In passive attacks, attacker monitors the network traffic and looks for sensitive information but the attacker does not affect system resources. Passive attacks include traffic analysis, eavesdropping, Release of message contents [11, 12]. In active attack, attacker breaks the protection features such as passwords to gain unauthorized access and then steals or modifies the information. Active attacks include masquerade, replay, modification of messages, and denial of service [11, 12]. This security threats such as eavesdropping, data modification, and website leaks, etc. force us to develop new methods to counter them. Considering QR codes as an effective media of sharing information, many researchers have proposed information/data hiding methods [6,7, 8, 9.]using QR code. In this paper, we have discussed the different information hiding methods using QR code and described the effective use of QR code as a marketing tool.

2. BACKGROUND

QR Code also known as "Quick Response" [10] code is a 2 dimensional matrix barcode that can store over 1800 characters of text information. QR codes contain data matrix for its high density printing, PDF 417 for its high data capacity and MAXI Codes for its high speed reading.
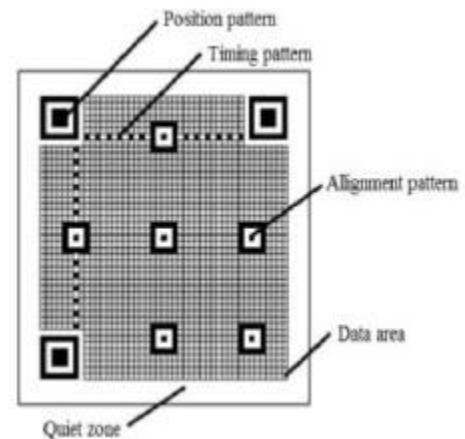

Fig 1: Internal pattern of QR code

QR code consists of the an alignment pattern for correcting distortion, functionality patterns for making it easily decode able, timing pattern for identifying the central coordinate of each cell in the QR code and a position pattern for detecting the position of the code. Quiet zone is the margin space for reading the QR code and the data area where the data is stored [10].

3. FEATURES OF QR CODE

3.1. High Encoding Capacity

QR code has a very high encoding capacity. It is capable of handling hundred times more data than conventional barcode. Conventional barcode has the capacity to store maximum 20 digits [14]. QR code stores up to 7,089 Numeric, 4,296 Alphanumeric, 2,953 Binary/byte, 1,817

kanji/kana characters and this can be encoded in one symbol.

3.2. Small Size
QR code 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].

3.3. Dirt and Damage resistant capability
QR Code has four different error correction levels which are detailed as follows:

a.   L - Allows recovery of up to 7% damage.
b.   M - Allows recovery of up to 15% damage
c.   Q - Allows recovery of up to 25% damage
d.   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.

3.4. 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 2. A single symbol can be divided into up to 16 symbols
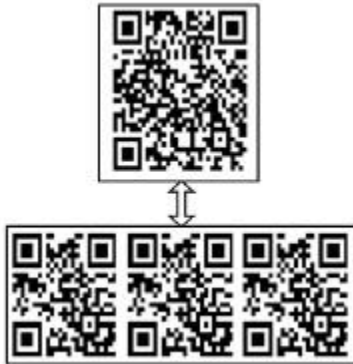

Fig 2: Association of Symbol

3.5. 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 converted. Some QR Code contains all the information in the code itself, but other need to be connected to internet to retrieve the information.

4. INFORMATION HIDING METHODS USING QR CODE

4.1. Using Hash function
Some authors proposed an information hiding method using the QR code. In this Method, a secret key K is generated. The information which is to be transmitted is first encrypted by using hash function. The key K is known in advance to both sender as well as receiver. After the encryption process is completed a QR code for encrypted information is created and then this code is sent over the network for the receiver. If an intruder were to try to extract the information from QR code, he/she would not be able to get the secret information

from the QR code. He/she would only be able to read the code with a QR code decoder. Only the authorized user with secret key K can retrieve the secret information from QR code. The main disadvantage of using Hash Function is that the whole secrecy of this scheme depends on the key K. If the key get hacked, then the secret information is revealed by simply decoding the QR code.

4.2. Using TTJSA symmetric key Algorithm
Authors [7] proposed an encrypted information hiding mechanism using QR code. In this method, information which is to be transmitted is first encrypted using TTJSA symmetric key algorithm. QR generator is used to generate the QR code for encrypted information. 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.

4.3. SD-EQR
Author of [8] presents a new technique using QR code 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:

a.   Choose password of any size, but should consist of only ASCII characters (0-255).
b.   Find the length of the entered password denoted by "L".
c.   Multiply 'L2' with the sum of the ASCII values of each letter of the word entered in the password to get S.
d.   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.

4.4. 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 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]

5. EFFECTIVE USE OF QR CODE AS A MARKETING TOOL

The six vital factors that should be considered and referred to while effectively implementing QR codes are: Five W's and H. They are Who, What, Why, When, Where and How.

5.1. WHY? Objective

Brands or companies seeking to implement a QR code campaign should first clearly define the goals and objectives. Why has the company decided to use this technology? Is the company just trying to keep up with trend to portray a "technological innovative impression" to both consumers and competitors? Or it has a well-defined objective like to boost lunch time sales that could be achieved by using QR code. Setting a clear objective will aid guide the campaign development and effectively design creative use of QR codes.

5.2. WHO? Consumer

Consumers are end-users of goods and services. Understanding the behaviour, perceptions and judgments of the consumers is very important. QR code is a product of technological advancement and will be well received among consumers who are more inclined to technology. Consumer's behaviours vary depending on factors such as demographics, technology literacy and experience level. The company needs to know the demographics and psychographics of their market prior to undertaking any marketing activities. Companies/brands with a higher proportion of young people are highly likely to succeed with QR code campaigns. QR codes have the image of youthfulness and the young generation is reported to have a high reliance on technology and it has become a major core part of their lives. Nevertheless, there exist a small percentage of the older generation population who are tech-savvy. Also since QR code is a form of mobile, a potential user needs his/her smart phone equipped with scanning application (app) to perform this task. The younger generation dominates in this context as well.

5.3. WHAT? Content

QR codes are mainly use as a link to online content when they are scanned by consumers. Consumers want to know more about the products they purchase and this can be achieved through QR codes. However this information should be relevant and it should provide added value to the consumer. If the consumers are satisfied with the content then the re-scanning of QR codes in the future is highly possible. QR codes are particularly prevalent on advertising materials for several purposes ranging from providing voucher codes for money in supermarkets to connecting to further information on all sorts of products via the web.

Technology Acceptance Model (TAM) proposes that decision of a user to use a technology depends on two factors: perceived ease of use and perceived usefulness. QR code can be easily created and encoded data can be easily decoded by simply scanning it. The second factor-perceived usefulness is what consumers are not getting from most of these QR code campaigns. Consumers want something of value when they scan a code.

5.4. WHERE? Location/Placement

QR codes are continually growing in popularity and constantly being used in more creative and interesting ways. Marketers are placing QR codes on almost everything. Many companies are placing their QR codes at very appropriate and advantageous places whiles others are getting it wrong. The product or service involved plays a vital role in where you want to place your QR code. McDonald's wrappers have QR codes on them, where the code can be scanned for ingredients or nutritional contents. The McDonalds example shows how the placement is really important. The code should also be in locations that will be easy to scan. I came across QR codes placed on moving targets and highway billboards and was wondering how such a code can be scanned. A difficult place to scan will discourage consumers from scanning your QR code. It should also be in locations with internet access coverage. Importantly, the code should be place in a location for consumers to take a moment to scan.

5.5. WHEN? Business Plan/Strategy

QR code campaign needs to be carefully researched into and well thought out by marketers. A QR code marketing campaign can be solely done on its own or integrated with other traditional media. Deciding to opt for a QR code campaign will differ from one company's strategy to the other. Is it to aid in market growth or product growth? QR codes can be use when targeting new geographic markets or new customer segments. It can also be used when competing for market share

growth by engaging more with consumers and creating added value.

Furthermore, it can also be used to assist with product development strategies

5.6. HOW? Execution of QR Codes

Creativity is really vital in designing the QR code. QR codes can be boring – nothing special to look at: black and white squares. Emphasis should be placed on creativity when executing a QR code campaign. A more good looking code could be the difference between someone scanning your code or not. It is important to make your QR code stand out from the crowd. There exist a lot of brilliant designs created for companies of all sizes and markets. Such designs draw more attention than the standard black dots on a white background.

6. CONCLUSION

This paper describes QR code, features of QR code and its use in different information hiding techniques. Such techniques employ traditional information hiding mechanisms like hash functions, symmetric key algorithms, etc. in conjunction with QR codes. .The paper also focuses on how QR code can be used as a marketing tool.

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