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QR Codes and Security Solutions

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Abstract– Identification of objects and places in the real world is important, and 2-D printing code is useful to store identifiers of them. Any camera mobile device with capture function can read content from a barcode tag directly. When a barcode contains important data or privacy information, the risk of security becomes an important problem. Because QR codes simply feature a square barcode with a unique pattern, people have no idea whether the code will take them to reputable information or a site loaded with malware. In this paper, discusses QR codes different data types, attack via QR codes and security solutions. However, since it is easy to modify the content stored in the 2-D code, we must verify whether the identifier written in the 2-D code is indeed issued by the authorized organization.

Index Terms– QR Codes, Barcode, Security and Smartphone

I. INTRODUCTION

A QR Code is a Matrix code; the QR codes were developed in Japan in 1994 by Toyota subsidiary, Denso Wave to help track automobile parts throughout production. This technology has been around for over a decade but has since become popular as a medium for marketers to reach smart phone users. Quick Response Codes, or QR Codes, are nothing new. In fact, in Japan and Europe they have been used in marketing as well as inventory control and manufacturing for the last 10 years. The security of one-dimensional (1D) barcodes is lower than 2D barcodes. 1D barcodes are very easy to read by scanning the lines and the spaces. However, 2D barcodes are not easy to read a symbol pattern by human eyes. With regard to readability, 1D barcodes must scan along a single directional. If the angle of a scan line does not fit within a range, the data would not be read correctly. However, 2D barcodes get wide ranges of angles for scanning. Thus, 2D barcodes are readability [3].

The key difference between the two is the amount of data they can hold or share. Bar codes are linear one-dimensional codes and can only hold up to 20 numerical digits, whereas QR codes are two-dimensional (2D) matrix barcodes that can hold 7,089 numeric characters and 4,296 alphanumeric characters, and 1,817 kanji characters of information [3]. Their ability to hold more information and their ease of use makes them practical for small businesses. When you scan or read a QR code with your iPhone, Android or other camera-

enabled Smartphone, you can link to digital content on the web; activate a number of phone functions including email, IM and SMS; and connect the mobile device to a web browser. Any of these desired functions are easily achieved by properly creating your QR code. It's a simple process of entering the appropriate data into the QR code generators [20]. It can be read by the camera of a Smartphone, and once read it may instantly redirect the Smartphone user to a webpage. QR Codes are only to be machine readable. This means that a human looking at the code is unable to determine its content. QR Codes can be used in a variety of ways to market a business, to provide further information on a product or service by encoding general text, URL, phone number, business card and even provide Wi-Fi access.

In the Philippines, the National Bureau of Investigation uses QR codes in their NBI clearances. A recent implementation of QR codes is India's 'Aadhar' project that gives a unique identification number to the citizens of India much like the Social Security Number (SSN) in USA. Another first in Indian aviation (Jet Airways) uses QR codes in their products and services.

II. QR CODES

Bar codes have become widely popular because of their reading speed, accuracy, and superior functionality characteristics and their convenience universally recognized, the market began to call for codes capable of storing more information, more character types, and that could be printed in a smaller space. As a result, various efforts were made to increase the amount of information stored by bar codes, such as increasing the number of bar code digits or layout multiple bar codes. However, these improvements also caused

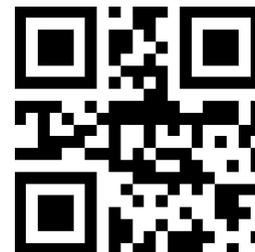


Fig.1: A Sample QR code containing the text "Hello World"

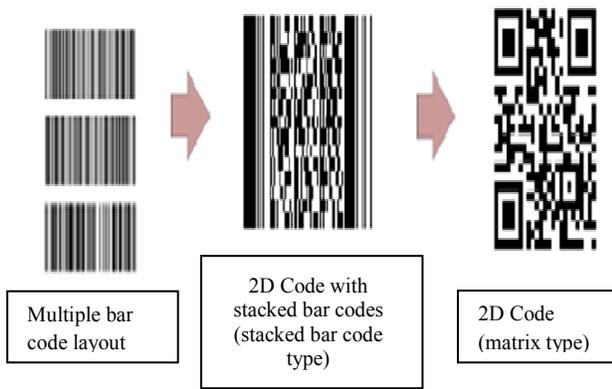


Fig. 2: Multiple bar code to 2D code [25]

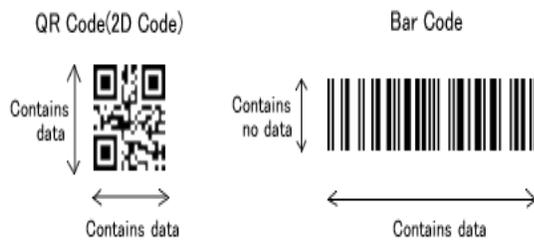


Fig. 3: QR Code and Bar Code (Contains Data) [25]



Fig. 4: Some examples of QR Codes (business solutions, marketing, personal information) [22]

problems such as enlarging the bar code area, complicating reading operations, and increasing printing cost. 2D Code emerged in response to these needs and problems [25].

QR Code is a kind of 2-D (two-dimensional) symbology developed by Denso Wave the primary aim of being a symbol that is easily interpreted by scanner equipment.

QR Code (2D Code) contains information in both the vertical and horizontal directions, whereas a bar code contains data in one direction only. QR Code holds a considerably greater volume of information than a bar code.

A. QR codes data types

QR codes can contain many different types of information. Different app readers on Smartphone are able to act and read

this data. Think of it as an alternative way of getting data into your phone (as opposed to typing it in manually). Here are some of the possibilities.

- a) *Contact information:* QR codes can contain contact information so someone can easily scan a QR code, view your contact details, and add you on their phone. You can input your name, phone number, e-mail, address, website, memo, and more.
- b) *Calendar event:* If you have an event you want to promote, you can create a QR code containing info for that event. QR codes containing event info can contain event title, start and end date/time, time zone, location, and description. This could work well on an event flyer or possibly even on a website promoting.
- c) *E-mail address:* A QR code can contain your e-mail address so someone can scan the code, see your e-mail, and then open an e-mail on their phones. If your call to action is mostly to have someone e-mail you, this would be great.
- d) *Phone number:* Maybe e-mail isn't immediate enough and you want someone to call. Link them up to a phone number.
- e) *Geo location:* If you have an event you want to promote, you might want to stick a QR code linking someone to a Google Maps location. This will allow someone to scan your QR code and get directions so they don't have to manually type in an address. Although some may prefer to type it in, it doesn't hurt to give them another option.
- f) *SMS:* QR codes can populate a text message with a number and message. You can have your QR code send you a text saying "Tell me more about XYZ," for instance.
- g) *Text:* You can also just have a sentence or a paragraph of text. This could be fun for having some type of QR code based game where you can leave hints in QR codes.
- h) *Wifi network:* Do you hate telling someone a long WEP wireless key that's a pain to type out on a mobile phone? Set it up so someone can scan a QR code and automatically configure wifi on their phones.
- i) *URL:* The possibilities of encoding URL into barcode are endless. You can use a link that takes someone to your Facebook fan page, LinkedIn or Twitter profile. You can also link someone to a YouTube video. Check in to some place via check in link. Encoding android market or iPhone app store link allows promoting and downloading you mobile application anywhere. Or maybe you want someone to pay for something via PayPal.

III. ATTACK VIA QR CODES

In September 2011, Kaspersky Lab detected a first-of-its-kind malicious QR code. The attack method used in the QR code was that when a user scans the code he is directed towards a website and then a malicious file downloads in the user's device without the knowledge of the user. Till now,

this is the only method of attack known about malicious QR codes. They detected several malicious websites containing QR codes for mobile apps (e.g. Jimm and Opera Mini) which included a Trojan capable of sending text messages to premium-rate short numbers [28].

IV. SECURITY SOLUTIONS

- QR codes are tricky because you cannot weed out the bad from the good by simply looking at the code. Because the vulnerability is practically part of the design, consider downloading an app on your phone which provides a preview to each code before it opens a webpage (eg: I-nigma) reader. This way, you will have right to refuse the QR code is corrupted.
- Scan a code and get directed to a login form, always remember never to fill it in for it may be a trap used by criminals to get access to personal information. Legitimate QR codes never ask for personal info.
- Include signage telling the user what the code does. Otherwise the user has no way of knowing if the code should point to a URL, phone number, or SMS.
- Print the URL near to the code. This way if the code is hijacked and pointed to <http://evilsite.xxx/> the user can see they're not visiting the correct site.
- Include https in the URL. Get users used to checking for https before they interact with you.
- If possible, use a short domain. Not only will it reduce the size of the QR code, it will give your users confidence if they can see the full domain in their phone's URL bar.
- Don't ask a user to get their credit card out on a busy street. Use a mobile payment solution which charges to the user's phone bill or deducts it from their credit.
- Every time you put out a QR Code in a public area, you should know where it is. If a code is on a billboard, on a storefront, or anywhere else it can be accessed by the public, it could be at risk. But you'll know your code is working correctly when you see "normal" traffic through it. If the traffic suddenly stops, check up to make sure that the code is still there and hasn't been tampered with.
- Distinctive, branded QR Codes with special colors or other design features are far more likely to get attention, so you should be using them anyway. But what's more, it'll help people to know that they're dealing with a legitimate link to your brand and not a counterfeit code. It'll be much more difficult for a hacker to simulate a highly designed and colorful code than a plain one.

V. CONCLUSION

In general, we believe that QR codes have great potential in business media. Some possibilities are discussed in this paper and there are many creative ideas waiting for us to explore. Also, this paper can be served as the first step for the readers to investigate this exciting topic of mobile learning. In this paper examine outlined the dangers of possible malicious

attacks utilizing manipulated QR Codes. Since QR Codes gain increasing popularity through their use for marketing purposes, we expect that this kind of attack will receive more and more attention by the hacking community in the future. This paper will present some security conscious of the mobile phones users.

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