

# “QR Codes-The New Buzz”

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**Abstract**—QR Codes (2D bar-codes) are used to encode and decode data at a rapid rate. Using camera phones to read two dimensional bar-codes for various purposes is currently a popular topic in both research and in practical applications. There is a lot of brouhaha about QR codes and they are seen as the next big thing in electronic marketing. These little black-and-white puzzle-like square matrix's originally designed for the automotive industry populate ads and promotional posters, are meant to drive in smart phone users. This paper aims at understanding what these codes are, how they work, what they can do, the security threats posed by them and how to contain these threats.

**Index Terms**— QR Code, Marketing, Modules, Security

## I. INTRODUCTION

Computers are widespread and many everyday-objects come equipped with computer technology. Mobile phones are equipped with high-resolution color displays, wireless access to the Internet, and respectable processing power and memory. Nowadays, different kinds of codes are used in order to store, retrieve and manage information.

Quick response codes popularly known as QR codes are emerging as the next big wave in the e-marketing space, which bridges the gap between print and online marketing. These little black-and-white puzzle-like square matrix's originally designed for the automotive industry hold the key to the future of mobile internet[1]. QR codes can be placed virtually anywhere from a newspaper advertisement to a billboard or in a TV commercial.

A QR-code is a 2-D bar-code that can be scanned by a smart phone's camera and transfer information. Based on the type of code it is, it might direct the viewer to a website, make a phone call, deliver a vCard or more.

QR-codes have become a growing platform for sharing digital information and may quickly become a standardized medium. In 2012, this technology is showing signs to become a standard for business and social interaction[2]

## II. QR CODES

A QR Code is a two-dimensional bar-code introduced by the Japanese company Denso-Wave in 1994. This kind of bar-code was initially used for tracking inventory in vehicle parts manufacturing and is now used in a variety of industries. QR stands for “Quick Response” as the creator intended the code to allow its contents to be decoded at high speed. A great feature of QR Codes is that they do not need to be scanned from one particular angle, as QR Codes can be read regard-less of their positioning. QR codes scanners are capable of determining the correct way to decode the image.



Fig 1. QR Code (QR Codes-The New Buzz)

Information is encoded in both the vertical and horizontal direction, thus holding up to several hundred times more data than a traditional bar code (Figure 2)[3].

Data is accessed by capturing a photograph of the code using a camera (e.g. built into a smartphone) and processing the image with a QR reader.

### A. Technology

QR codes are made up of black squares and white squares. Each of these squares is called a module. In every QR code, there are certain modules that must not be covered or edited, else the code won't scan.

A QR Code is a matrix code developed and released primarily to be a symbol that is easily interpreted by scanner equipment. It contains information in both vertical and horizontal directions, whereas a classical bar-code has only one direction of data (usually the vertical one). Compared to a 1D bar-code, a QR Code can hold a considerably greater volume of information: 7,089 characters for numeric only, 4,296 characters for alphanumeric data, 2,953 bytes of binary (8 bits) and 1,817 characters of Japanese Kanji/Kana symbols. QR Code also has error correction capability. Data can be restored even when substantial parts of the code are distorted or damaged.

In the QR Code standard, corners are marked and estimated so that the inside-code can be scanned [8]. The bar-code recognition process has 5 steps: (1) edge detection, (2) shape detection, (3) identification of bar-code control bar, (4) identification of the bar-code orientation, dimensions and bit density using the control bar, and (5) calculating the value of the bar-code.

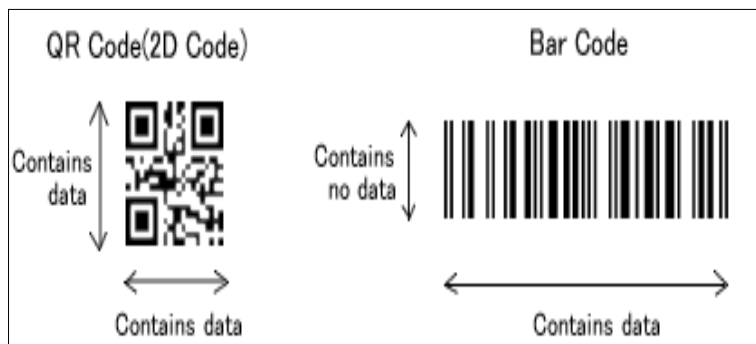


Fig. 2: 2D and 1D Codes

The three large squares highlighted in red are the position markers. These tell the scanner where the edges of the code are. The smaller red square is an alignment marker. This acts as a reference point for the scanner, making sure everything lines up properly. In bigger codes, there are several of these squares. The red strips of alternating black and white modules are called timing patterns. They define the positioning of the rows and columns. The green sections determine the format. This tells the scanner whether it's a website, text message, Chinese symbols, numbers, or any combination of these. The modules highlighted in blue represent the version number. Basically, the more modules in the code, the higher the version (up to v40, which is 177x177 modules). If the code is version 6 or smaller, the version does not need to be defined here because the scanner can literally count the modules and determine the version on its own.

**B. Everything Else**

Having identifies what we can't edit, everything almost else is a free game. All the remaining modules are grouped into sections of 8 modules. These groups (which can be called "bytes" from now on) fit together in the gray area like a jigsaw puzzle as shown in Figure 1.

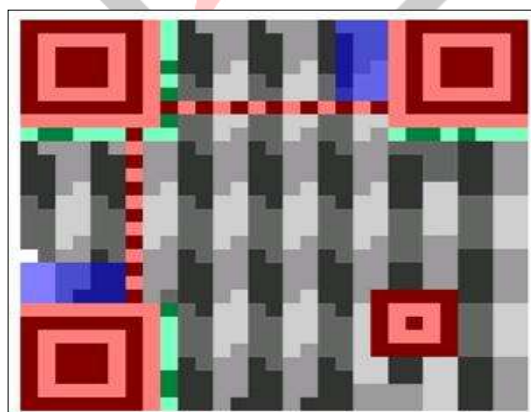
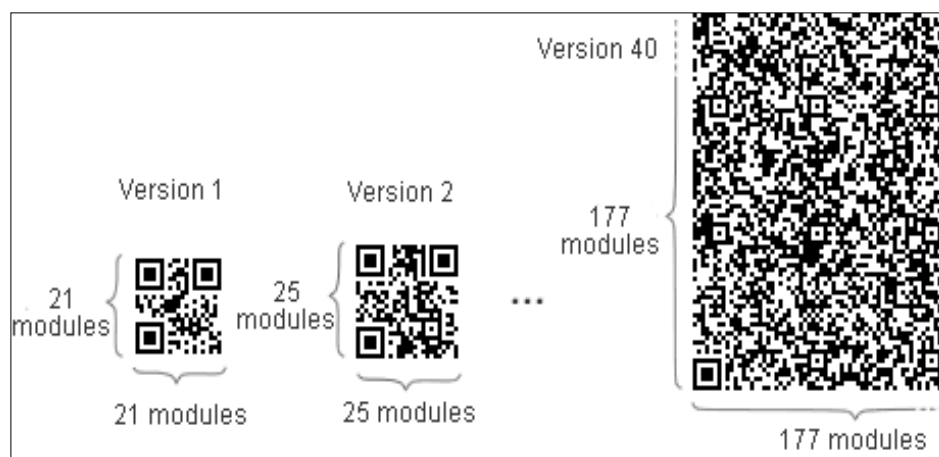


Fig. 3: Structure of QR Code

Now, when a smart-phone or scanner reads a QR code, each byte is determined to be either completely readable or completely un-readable. That means that if you change one single module (e.g. turning a black square into a white square), the entire byte containing that module is rendered un-readable.

Each QR Code symbol version has the maximum data capacity according to the amount of data, character type and error correction level[3]. Refer Figure 4. QR codes are like balloons, They get bigger as you put more information in them and like balloons they do have a data volume limit. Other factors determining the size of a QR code are the selection of error correction as well as the type of data encoding that is used.



**Fig. 4 QR Code Versions**

Although encrypted QR Codes are not very common, there are a few implementations. An Android app, for example, manages encryption and decryption of QR codes using DES algorithm (56 bits). Japanese immigration use encrypted QR Codes when placing visas in passports.

The QR Code is clearly defined and published as an ISO standard. QR codes were originally invented in Japan by Denso for industrial bar codes on packaging for warehousing and production purposes. In their wisdom they realized that this “standard” would be more beneficial if everyone could use it, so they open sourced the technology and now anyone can create, read and implement QR code technology for free with no license fees being required.

### III. QR CODE APPLICATIONS

Since QR codes are placed on paper and other form of physical prints and from their when scanned they can trigger electronic responses complementing the physical media they in a way bridge the gap between print and online media marketing. They also find their applications in storing URLs, addresses, various forms of data on posters, signs, business cards and public transport vehicles[4,5,6]. In-fact, QR Codes have many vast applications in various fields. The most popular applications use QR codes in the following ways-

#### Initiate Browser Session

Most QR marketing codes initiate a browsing session for the phone to a particular website landing page

#### Display Text

They can push an address or some other form of information as text to the handset. e.g. 40% off sale this Thursday to Sunday - our address is 222 InOrbit.

#### Initiate Email Transaction

QR codes can not only initiate an email but pre-populate text into the email

#### Initiate SMS transaction

QR codes are often used to initiate sms. e.g. QR code on a poster to sms Vote for “Radha” in this weeks DID

#### Initiate Audio Stream

You can use a QR code to initiate the download an audio track.

#### Initiate Video Stream

Any phone that allows video to be displayed can use QR codes to initiate playing of a video stream.

#### Mobile operating systems

QR codes can be used on various mobile device operating systems. These devices support URL redirection, which allows QR codes to send metadata to existing applications on the device. Many paid or free apps are available with the ability to scan the codes and hard-link to an external URL.

#### Code payments

QR codes can be used to store bank account information or credit card information, or they can be specifically designed to work with particular payment provider applications. There are several trial applications of QR code payments across the world.

#### Encryption

Japanese visa with a QR code (content is enciphered) Encrypted QR codes, which are not very common, have a few implementations. An Android app, for example, manages encryption and decryption of QR codes using the DES Algorithm (56 bits). The Japanese immigration system uses encrypted QR codes when issuing visa in passports as shown in the figure to the right.

#### IV. SECURITY IN QR CODES

QR codes raise some serious security issues. Simply put they take URL obfuscation to the next level – the large amount of data they can contain as well as their ability to contain binary data opens a new frontier in URL obfuscation for the bad guys.

QR codes are not scanned with desktop computer and its well-equipped browser, but mobile device. Unless a user has purposely added a third party product in his mobile, in all likelihood its browser has no URL filtering capability at all. Compounding the potential for problems is the fact that a QR code is cheap and easy to create, making the field ripe for scammers who use them to create phishing attacks [7]. Such codes don't only appear in expensive advertising campaigns; they can be produced as stickers and adhered illicitly onto legitimate posters and placards.

#### V. CONCLUSION

The usage of QR codes is on the rise. In June 2011, about a year after QR codes first started showing up prominently in the U.S., 14 million Americans scanned a QR code, according to market research firm comScore[8]. These codes can be generated freely by using proprietary software or a lot of free tools available online. Similarly most smart phones have built in QR code readers or users can download reading applications from web. In order to strike a balance between usability and security of this innovative technology these basic points will go a long way in containing the risks:

- Educating users to the risks of malicious QR code scanning most people don't think twice about it.
- Only use QR code readers that allow the user to confirm any action taken by scanning a QR code
- Equipping mobile devices with URL filtering as a second layer of security.

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