

Review of Types and Analysis of Two Dimensional Bar Codes in Logistics and E-Commerce

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Abstract - Barcodes are visual form of representing data in machine readable form. The Quick Response (QR) codes are machine readable two-dimensional matrix barcodes used for hiding data. These QR codes are increasingly used in e-commerce and day to day logistics for identification of codes. Security of bar codes is becoming a top priority for the concerned organizations carrying out e-commerce businesses. As the QR code is very popular these days, their usability and attacks on QR code are described. Further, different types of barcodes are reviewed with the limitations. The scenarios are identified where a certain barcode is more profoundly used. The future enhancements for making QR codes more secure includes making the codes dynamic i.e. capable of storing changing information.

Key Words: Item, Manifest, Staging Area, Line Haul, Trips, Bar code, QR Code

1. INTRODUCTION

Quick Response codes are used to encode information like website URL, SMS message, vCard information, alphanumeric, numeric etc. The bar codes are designed to simplify the process to retrieve information by scanning the code on the camera. In the case of airlines business, the data leak of 4.5 million customers happened because of low security in the Quick Response codes of users boarding passes. The user's personal data was compromised. QR codes are very popular because of their fast readability and greater storage capacity compared to other types of codes. Bar codes are increasingly used in almost all industries these days. Thus the research on this topic is being conducted by us, to make them more secure and reliable and can be used as per the requirement in different scenarios. In logistics they play a crucial role in transportation of the items and packages. They are widely used in logistics because they are easily generated and easy to read at any stages without affecting the actual package. The Security of Quick Response (QR) codes is becoming a major issue these days, due to technological advancements and rapid growth in the field of media and communication. It is really challenging to keep the data secure in the field of logistics where the items keep moving from one pallet to another in a rapidly fast manner.

2. USABILITY OF QR CODE

Static QR codes are non-modifiable after publishing. These are non expirable. Thus they are generally used to store non changing data. The data is not ingrained in the dynamic QR codes, thus the information stored in QR can be changed after publishing. It takes the user to a location which can be changed. Dynamic QR codes allow tracing the scanning metrics like device, location and time of the scanner. QR codes found special relevance in the Covid Pandemic enabling users to perform touchless retrieval of information.

There are multiple resources businesses can access that will allow them to insert a landing page URL and create a QR code that will direct users to that URL with the click of a button. Nowadays the hotel menus, restaurants booking and entry passes for various events all are done using the scanning of QR codes through their handheld devices. But using this as leverage some attackers falsify the QR and hijack the devices and steal the personal information and use it for bad intentions.

QR codes in the different aspects of business use cases have risk associated with the information stored. In order to tackle the risk, there are multiple algorithms introduced in the improvement of QR codes and better security measures such as digital signatures for watermarking and reduction of duplication of QR codes, Reed Solomon Correction Method algorithm to scan QR for partially visible QR code.

3. TYPES OF ATTACKS ON QR

In the following, we consider the foremost prominent attack scenarios for QR codes and discuss to what extent we are able to prevent them. **Phishing:** during a barcode phishing attack, the attacker tries to urge sensitive information like the login details and also the mastercard number of a user by, e.g., encoding a malicious Web address inside the barcode that redirects the user to a fake online page which appears very just like the legitimate one. **Malware propagation:** it's discussed how QR codes may be utilized by attackers to redirect users to malicious sites that silently install malware by exploiting vulnerable applications on the device. this can be typically done through an exploit kit that fingerprints the device and selects the suitable exploit and malware. **Barcode tampering and counterfeiting:** Since QR codes will be wont to provide information a couple of good,

an attacker can benefit by pasting a fake QR code so as to advertise false products information or false special offers during which the adversary will sell another product to the victims. **SQL and command injections:** The study refers to automated systems using the knowledge encoded within the barcodes to access an on-line database. If the string within the barcode is appended to the query without proper sanitization, the attacker may easily trigger a SQL injection attack. **Cross-site scripting attacks (XSS):** Mobile apps are often supported Web technology and this might allow malicious JavaScript code to be injected into trusted HTML pages, and executed within the app, for instance when the server doesn't sanitize the user data that's rendered in a very page. **Reader applications attacks:** During the installation process, many barcode reader applications enkindle full permissions to access user's resources like the device location, the contact list and therefore the photos. just in case of a vulnerability which will be triggered by an acceptable crafted barcode, the attacker would get access to personal user's data. **Discussion:** Enhancing QR codes with digital signature prevents the above attacks only if it's out of the question for an attacker to perform a legitimate signature. In an open environment this may be hard to attain, since a Public Key Infrastructure (PKI), like the one for the HTTPS protocol, would be at risk of the "HTTPS phishing problem", i.e., attackers that have a sound certificate and use names the same as the one in every of legitimate entities. However, in an exceedingly closed/controlled environment, the reader may be configured to only recognize internal certificates and verifying the signature would prove the trustworthiness of the QR code content. as an example, a supermarket with its own app may well be configured to only use the supermarket's public key for signature verification.

4. PROPOSED USAGE METHOD

In this section we study the usability of QR codes supporting the various scenarios, there are 31 forms of QR codes available. like QR code for websites should be generated for under a span of your time to avoid unnecessary attacks and phishing. The QR reader then analyzes the QR code by breaking the full thing all the way down to a grid. it's at the individual grid squares and assigns all a worth supported whether it's black or white. It then groups grid squares to make larger patterns. In terms of logistics the various QR codes of various colors may be used to support the priority and therefore the security aspect, like using the red color QR code to spot the high risk item during transportation. We will use multiple link QR code to redirect to multiple links and used for various purposes to realize the various tasks. QR chaining will be accustomed avoid the direct access of qr for the attacker, authentication of QR data is extremely tough to realize nowadays, so as to attain we are able to add the digital signature by the assistance of personal key and also the people can access it using the general public keys hence we will assure the authenticity of knowledge of QR. We will

add other cryptography methods to make them safer like using the digital signature and digital fingerprint using the opposite encryption techniques and secure the information forms of QR codes will be used are.

QR code - this refers to the initial version of the qr code created by Denso Wave within the 1990s. it is easy to spot by its three finder patterns within the bottom-left, top-left, and top-right corners. Dynamic QR codes allow for expiration of QR after using for a prespecified number of times.

Aztec code - Similar to QR codes, the Aztec code was developed by Welch Allyn. It has one finder pattern, right within the middle. Aztec code can encode modules in the range from 15 x 15 to an upper limit of 151 to 151 modules. If Aztec code utilizes its maximum storage capacity of 151 x 151 modules it can encode 3000 characters and around 3750 numerical digits. These codes do not support Kana or Kanji characters unlike QR codes which support them. Aztec codes are typically employed for use in airline tickets, travel documents, vehicle registration, in hospitals for patient, medication or sample identification .



Maxi code - This kind of QR code is employed by the US post. It's almost like the Aztec code therein; it places the finder pattern within the middle, but it uses a honeycomb pattern rather than squares. Maxi codes can be scanned accurately in fast motion also(e.g in conveyor belt), and are capable of encoding numbers and letters. It can encode a maximum of 93 characters of data.



PDF417 - Invented in 1991 by Ynjiun Wang of Symbol Technologies, the oddly named PDF417 predates the QR code by three years. It's sort of a mix between a QR code and a barcode and is well recognizable by its rectangular shape. PDF417 consists of a set of linear codes stacked together to give a two dimensional outlook. The name is so because it has 4 bars, each of 17 units length. It can have a maximum of 929 code words out of which 900 words are for data and remaining 29 for functions like shifting between significant modes. These find applications where it's required to store complex data information in a barcode such as images and high graphic data. It takes upto mode space than other two dimensional barcodes. Tilted scanner might not be able to decode correct information form PDF417.



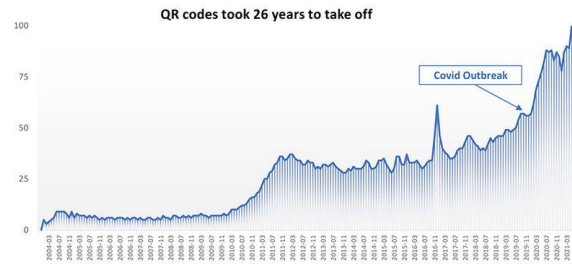
Semacode - Developed by a software company of the identical name, the Semacode may be a data matrix that appears lots like a standard QR code but doesn't have recognizable finder patterns. Data Matrix is 30% to 60% more spatially efficient for encoding the same data compared to QR Codes. Semacode uses Data Matrix for encoding. Semacode tags are put on posters of concerts to direct scanners to the web page to book tickets. Semacode tags and mobile phones used together enable multilingual exhibition systems: Once the tag is scanned, it sets a language cookie on the phone's browser. Subsequently tag scans direct the phone browser to a web page about the item, displayed in the user's language of choice.



We can generate the precise kinds of QR using the open source QR generation libraries, by providing the various parameters like height, width, length, background color, error correction factor, output formats like bitmap, vector, etc, border, version range, masking pattern and error correction level. These differing kinds of QR codes are often employed in the various scenarios like qr codes in sales and marketing, qr codes for coronavirus tracing, qr codes on product packaging, qr codes in industry, QR codes in postal services, qr codes in education, qr codes for sharing contacts, QR codes for wedding invitation, qr for social media handler, QR code for audio file. The more complex the configuration is employed to get the qr makes it safer. The QR codes which store the private information during logistics should be terminated as soon as the operations are going to be over, the qr code should be proper mechanism to handle the QR codes after using it for the particular purpose.

5. ANALYSIS AND RESULT

The outcome can be measured on the basis of readability range, efficiency, security, size, uniqueness, etc. Readability is measured in terms of the maximum distance and minimum distance required to scan the QR code by the scanning device. Nowadays Qr codes are used day to day for payments. The systems are growing complex day by day. These payment QR codes need to be reliable and secure in order to avoid the loss. After the covid outbreak the use of qr codes rapidly increased in all areas across the industries particularly in the field of online payments as shown in the graph below.



The growth of the uses of Qr codes is rapidly increasing because of its advantages. In the field of ecommerce the importance of QR codes is also growing because of high demand in the market. By using the safety measures we can avoid the loss due to Qr code based attacks.

There is a need for uniqueness of QR codes because of multiple items moved on the basis of qr codes and there is very less possibility of failure, to avoid the catastrophic events. These Qr codes are becoming famous because of their high availability and easy readability. The possibilities to enhance QR codes security are by educating users, use of dynamic QR codes, increasing error correction level and usage of softwares for scanning and authenticating the QR codes. Great emphasis needs to be given on securing the code on generation and scanning the code.

6. CONCLUSION

In this research we find that there are various types of barcodes dedicated for use in various situations based on the need, along with the rapid usage the security aspect is also growing rapidly to tackle the technological advancement of today's world. The usage of QR codes in the ecommerce, especially in the payment section has grown more than any other segment's and it also ensures security by using these techniques we have proposed. Same goes for logistics and ecommerce the safety of personal information of customers should be top priority of the organization's using QR codes for day to day activities. Thus this study will help all industries understand the possible usability scenarios of available barcodes and their limitations in certain cases

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