

Secured E-Commerce Transactions Using QR-Code

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Abstract— Expeditionary growth in E-Commerce trade has led to various user centric applications throughout the world. The ever-growing popularity of online shopping has shown new dimensions of technology two new approaches are proposed for the purpose of E-payment transaction. The first method requires customer has limited personal information that is necessary for fund transfer during online shopping. This safeguards the customer data, which indeed increases customer confidence and prevents identity theft. Second method is generating new QR code for product and replacing Barcode with New QR code.

Keywords— QR code, Ecommerce, barcode, Scanning, Smartphones, Payment, Customer, Encoding, Decoding.

1. INTRODUCTION

E-COMMERCE shopping refers to the retrieval of product related information from the vendor's site and purchase of products via Internet through fund transfer. The main concern of purchase order through electronic is the filling of credit or debit card information, which may end up in the hands of criminals or hackers. Identity theft, phishing and pharming are the common issues in E-COMMERCE shopping. There exist diverse supporting technologies for electronic shopping, such as NFC or RFID, but they require specialized terminal hardware. Instead, visual QR-Codes (Quick Response Codes) are used for displaying the transaction information.



Fig:1 QR-code

Using Encoding and decoding process are used to encode and

decode the information from single QR code with special symbols and split the data back to their QR Code pattern where these QR Code pattern can be read by Android mobile phones. Standard image codes like one-dimensional barcodes and two-dimensional codes with black and white patterns identify a product for its value and basic features but does not authenticate it, moreover not ever product that is identified, is used for authenticating manufacturer's warranty. So QR code verify the products by capturing it through the smart phone, then decodes and sends it to the server for authentication. In particular mainly, we focus on minimizing the number of input clues needed to retrieve information with small uncertainty and present good construction some of which are optimal. The customer forwards the selected product list to the server that enables the consumers to decide based on the products authenticity. Customer does once the shopping Finally Payment will be done through online using newly one time generated QR code.

2. LITREATURE REVIEW

Even though e-commerce is not all about fund relocate, electronic payment (or e-payment), such as credit-card payment over the Internet, is at rest one of the most popular ecommerce applications. In other words, e-payment is one of the essential parts of an e-commerce transaction in that the ecommerce transaction cannot complete with no of it. For instance, an online shopping store which provides both electronic with physical shopping to its customers must have a behind payment system available for its customers to transfer money to it. Therefore, each customer can complete the buy which includes goods relief (or commitment of goods delivery) and payment by the store in one transaction. Without the payment system provided, the customers are required to perform two sessions separately: one for the goods purchase

and the other for the payment business. In particular, the fee transaction has to be performed by transferring cash to the store's bank account straight [1].

A barcode is an optical machine-readable representation of data related to the object to which it is attached. Originally, barcodes systematically represented data by varying the width and space of parallel lines, and may be referred to as linear or one-dimensional (1D). Bar codes consist of bars and spaces that vary in width. The bars and spaces on a bar code correspond to numbers and letters that represent descriptive data. In 1994, Denso Wave started using a type of bar code for their robots industry. We never really saw the potential that had QR Code technology. Unlike the standard bar code system in use today, QR codes are far more powerful and can contain much more information. While our current bar-coding system holds information only one-way, QR Code holds into both vertically and horizontally [2].

QR-code payment sounds like a very new technology; in fact, QR-code payment technology has existed since the early 90s, beginning in South Korea and Japan. While this paying method accounts for up to 95 percent of their markets, QR-code also started launching in China. Its popularity is by no means accidental; users can install QR-code recognition software, where a simple brush can complete the transaction. QR-code stores a lot of information making it a good choice in mobile payment. QR code technology could help to improve the consumers' experience especially in retail shopping. Findings showed that in order to allow access to the real-time information about products (online catalog system) QR code was a simple and effective system in terms of providing consumers faster and more efficient shopping experience.

3. IMPLEMENTATIONS

E Commerce is a form of doing business that is performed online or over the internet. In simple terms, when you buy or sell something online or via an electronic medium, it is referred as electronic commerce, popularly known as e Commerce. E Commerce business models can be divided into six major types, such as:

- **Business-to-Business (B2B),**
- **Business-to-Consumer (B2C),**
- **Consumer-to-Consumer (C2C),**
- **Consumer-to-Business (C2B)**
- **Business-to-Administration (B2A)**
- **Consumer-to-Administration (C2A)**

In this mainly focusing on **Business-to-Consumer (B2C)**: The Business-to-Consumer e Commerce is related to the transactions and relationship between businesses and the end customers. This is mainly to do with the retail e Commerce trade that takes place online. With the inception of the internet, B2C e Commerce has evolved largely. Today, we find scores of electronic shopping sites and virtual stores on the web, that sell myriad products, ranging from computers, fashion items to even necessities.

The QR code is a matrix code designed and developed primarily to be a symbol that is easily scanned and interpreted (Rouillard, 2008), consisting of a number of black and white squares, formally defined as modules, arranged in a grid pattern. Each module encodes data. The traditional codes (bar codes) can carry maximum 20 characters, while QR code has a much higher capacity because can encode 7 089 numeric data or 4 296 alphanumeric data. QR codes are categorized into 40 versions depending on the number of modules contained by its two dimensions (version 1 contains 21x21 modules and version 40 contains 177x177 modules, each version having with four modules more than the previous). Currently, the version 6 of QR code (41x41 modules) is mainly used because it can be easily read by most mobile applications and can store enough data. The modules in QR code can be separated into two categories, namely: function patterns and encoding regions. The function patterns enable smartphones or cameras to recognize the QR code and the encoding region contains modules that represent data, error correction code words, and information on the version and format of the code. Furthermore, QR code has the ability to correct errors due to deterioration and there are four levels of correction possible using the Reed-Solomon algorithm (non-binary cyclic error correcting codes invented by Reed and Solomon (1960) that have described a systematic way of building codes that could detect and correct multiple random errors). According to this algorithm, QR codes contain validation data of the stored information to allow correct reading of the code although maximum 7%, 15%, 25% or 30% of the code image is missing, is damaged or contains incorrect information.

3.1 QR code creation

The first step is to go to a website, which generates QR Codes, e.g. www.qr-code-generator.com. There you can choose the type of the Code you want to create and then enter the appropriate data. Simply click on "Create QR Code" and your personal QR Code is ready. Now you just decide, in which image format you want to use the Code and download the file easily.



Fig 3.1: Creation of QR-code

various services that can recognize the authenticity of any product. QR code verifies products by capturing it through the smart phone, then decodes and sends it to the server for authentication. The customer forwards the selected product list to the server that enables the consumer to decide based on the products authenticity.

3.3 Encoding

The format information records two things: the error correction level and the mask pattern used for the symbol. Masking is used to break up patterns in the data area that might confuse a scanner, such as large blank areas misleading features that look like the locator marks. The mask patterns are defined on a grid that is repeated as necessary to cover the whole symbol. Modules corresponding to the dark areas of the mask are inverted. The format information is protected from errors with a BCH code, and two complete copies are included in each QR symbol that is shown in figure (1). BCH code is the abbreviation for (Bose-Chaudhuri-Hocquenghem) code. A multi-level, cyclic, error correcting, variable-length digital code used to correct errors up to approximately 25% of the total number of digits. Note: BCH codes are not limited to binary codes, but may be used with multilevel phase-shift keying whenever the number of levels is a prime number or a power of a prime number, such as 2, 3, 4, 5, 7, 8, 11, and 13. A BCH code in 11 levels has been used to represent the 10 decimal digits plus a sign digit. The message dataset is placed from right to left in a zigzag pattern, as shown in figure (2). In larger symbols, this is complicated by the presence of the alignment patterns and the use of multiple interleaved error-correction blocks, as shown in figure (3). Four-bit indicators are used to select the encoding mode and convey other information as shown in table (3). Encoding modes can be mixed as needed within a QR symbol.

Step 1: type of QR code you need.

We have over 20 QR code data types to choose from including website URL, video, Facebook, map location, SMS or email message, contact details, etc.

Step 2 Add the QR code content.

Depending on the data type, you have chosen; enter the content for the QR code e.g.; the website URL, the Facebook page, the map location, the email message details, etc.

Step 3 Dynamic or Static QR code?

You can choose whether to make your QR code dynamic or static. Dynamic QR codes are editable and has analytics available.

Step 4 Style your QR code.

Change the colour of your QR code using our handy colour picker. If you are a paid subscriber, you can change the appearance of your QR code or add a logo.

Step 5 Download your QR code.

Download your completed QR code image. A range of vector and raster file formats are available for paid subscribers.

3.2 Security for QR code

We are using Encryption and decryption algorithm for recognizes QR code image using smart phones to provide

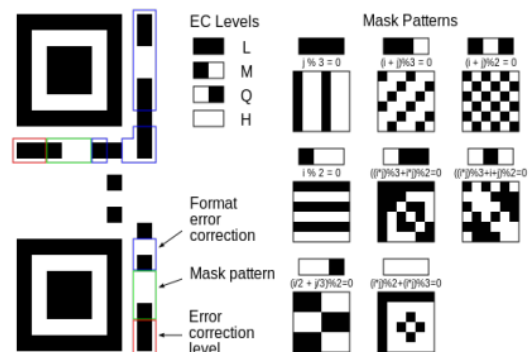


Fig:1 format information

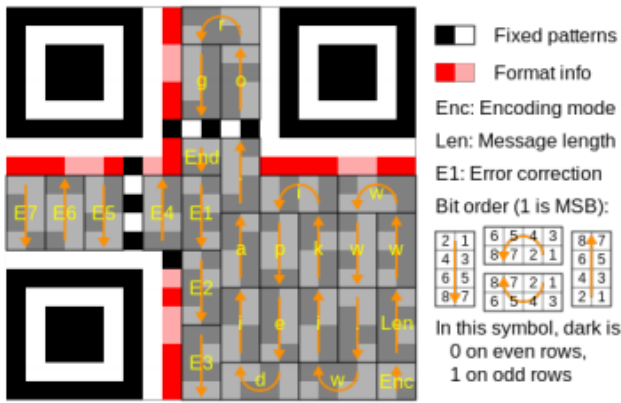


Fig:1.1 Format information

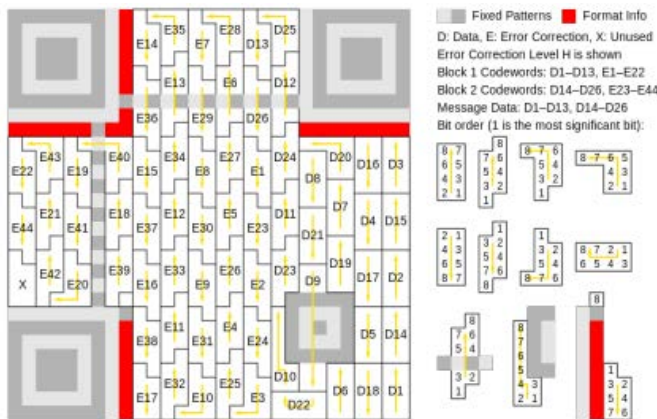


Fig:2 data encoded

3.3.1. Algorithm of Convert Plaintext to QR code

- Step 1: write message (text).
- Step 2: generate QR code for the message.
- Step 3: save QR image as P.

3.3.2. Algorithm of Convert Key to QR code

- Step 1: write key as numbers or text.
- Step 2: generate QR code for the key.
- Step 3: save QR image as K.

3.3.3 Algorithm of get Begin Indies of Data Area in QR

- Step 1: start.
- Step 2: Do loop to get beginning of data area in plain.bmp with width i as height j.
- Step 3: end.

3.3.4Algorithm of Encryption

- Step 1: start.

- Step 2: load QR image P.
- Step 3: load QR image k.
- Step 4: define cipher as bitmap file with dimensions width (wd) & height (hg).
- Step 5: Call function to put P(0)(0) to P(i)(j) in cipher(0)(0) to cipher(i)(j).
- Step 6: loop statement x=i
loop statement y=j
cipher(x)(y)=P(x)(y) XOR k(x)(y)
next y,x.
- Step 7: end.

3.3.5. Algorithm of Putting Key in Cipher Bitmap File

- Step 1: start.
- Step 2: binarization each character or number in key as 8bit.
- Step 3: loop statement l<key (length)

If (key(l)=255)

Key(l)=254;
Else
Key(l)=1;
End if.
Next l

Step 4: if statement

If (key(l)=255)
Key(l)=253;
Else
Key(l)=2;
End if.

Step 5: end.

4.3.6. Algorithm of Getting Key from Cipher Bitmap File

- Step 1: start.
- Step 2: loop statement until key(l)=253 or 2
If (key(l)=254 or 1)
Str=concat(str,'1');

Else
Str=concat(str,'0');

End if
Next l

Step 4: collect each 8bit in str and get character of this collection.

3.3.7. Algorithm of Decryption

- Step 1: start.
- Step 2: load QR image c.
- Step 3: get width (wd) & height (hg) of c.
- Step 4: define plain as bitmap file with dimensions width (wd) & height (hg).
- Step 5: Call function to put cipher(0)(0) to cipher(i)(j) in

plain(0)(0) to plain(i)(j).

Step 6: loop statement x=i

loop statement y=j

plain(x)(y)=cipher(x)(y) XOR key(x)(y)

next y,x.

Step 7: end.

Encryption Process

For example, choose a message “book” and a key “1”. Figure (5) illustrates the QRs for message, key & the resulted QR or final QR image. The final QR is unreadable.



Fig:5 Encryption process

Encryption and decryptions process as shown in the fig4.

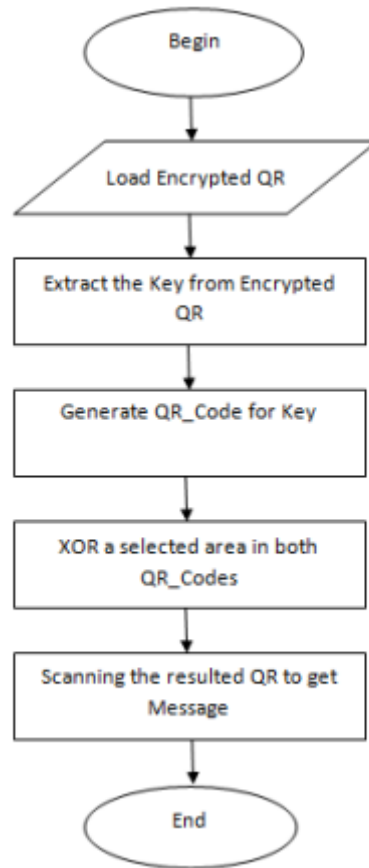
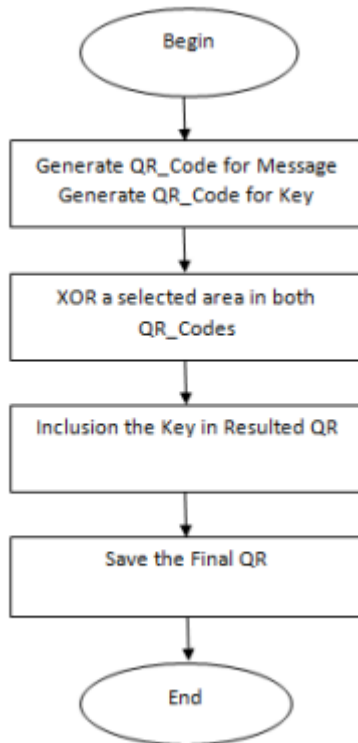


Fig 4: Encryption and decryptions process

Decryption Process

The previous example is used for the inverse operation (decryption). Figure (6) shows the QR codes for resulted QR, key & Message.



Fig:6 Decryption process

4.4.1. TRANSACTION PAYMENT USING QRCODES

In this transaction payment model, information submitted by the customer to the online merchant is minimized by providing

the minimal information. Verification of the payment made by the customer is done at the bank. This is achieved in the proposed model by the introduction of QR-codes and application of visual encoding and decoding algorithm. During online shopping, after selection of desired items and adding them to the cart, preferred payment system of the merchant directs the customer to the payment system. At this point, in the usual method of online transactions, the details like, customer name, card number, the customer gives CVV and expiry date. However, in the proposed method, a QR code is generated in the customer side with all the necessary details like, customer name, card number, and CVV and expiry date along with the transaction amount. The details to be send for online purchase is in the encrypted form as shown in Fig. 3(a). QR code is used with banking details instead of giving debit or credit card details directly.

In an alternate method, this QR code is generated dynamically at the customer side which has all the necessary details for transactions without the transaction amount. The QR code is updated with the specified amount of the purchasing item to be finally submit in the payment system at the transaction payment gateway. In case of insufficient transaction amount, the transaction is declined by the gateway. This makes the customer in using the generated QR code for single purpose. When an attack like, man-in-the-middle is performed against the customer, then the subsequent use of the QR code is deemed to be invalid or using the same QR code for different amount other than the specified transaction amount is also considered as invalid. After receiving the customer authentication card details, the bank matches the information with its own database for verifying whether the user is a legitimate customer. Once the customer is confirmed as account holder and necessary fund is available in the customer’s account, the fund is transferred from the customer account to the submitted merchant account as shown in Fig. 4. QR code is used for transaction purpose while online shopping and even in payment at retail shops.

The proposed QR based transaction payment also be used in retail shops without any modifications. In retail shops, once the customer finishes the purchase, he is directed to the billing section for payment. The usage of debit or credit card at the retail shops suffer from the problems like, cards can be duplicated, pin number can be exposed, and cards may be misplaced or forgotten after the transactions. But the proposed model helps in generating a one-time usage QR code using the details like, customer name, card number, CVV and expiry date that are already stored in the smart phone along with the transaction amount. The customer is free from carrying his

credit or debit cards, instead the details are stored in his smart phone. The one-time QR code is generated at the retail shop payment section by just entering the amount of purchase. The program to generate QR code and the customer details are securely saved in the customer’s smart phone through appropriate security mechanisms like, password, biometric or patterns. The generated QR code with encrypted customer card details is shown at the retail shop transaction gateway which is then transmitted to the bank for appropriate verification. The results of encrypted and decrypted banking details for online payment section is shown in Fig. 4.

Architecture Diagram

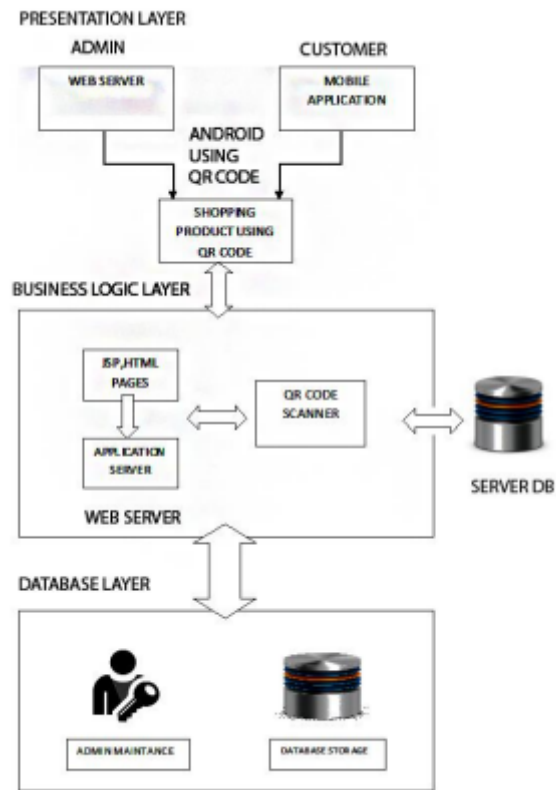


Fig. 4: Transaction payment using QR code

4.4.2 BILLING & PAYMENT.

Once the scanned product are confirmed the details of the product are send to database for update the remaining quantity of product. If any modification required in list of products, the customer can modify. Otherwise the customer can pay the billing amount into shop authority.

4.4.3 SHOP DATABASE MAINTENANCE.

The shop authority can add or update the products details to server. The QR code image automatically generate for all products. Each Query given by the user will be processed by the server and update the changes in the database. The results produced by the database will be displayed to the user with an help of user interface.

5. RESULT ANALYSIS

This project will benefit small & medium business to adopt new technology and increase the consumer traffic. It is cost effective solution to medium sized business as compared to the individual hosted solution. This application establishes that the use of QR code in shopping malls can greatly influence fast and efficient shopping. Here enables the customers to access online real time information (online catalog system) about products by simply scanning product QR code. In addition, the system will enable accurate statistical data report and reliable data mining for the shopping mall on both consumer and product information. Customers also want the opportunity to explore the capabilities of their smart phones.

CONCLUSION

Consumers find QR barcode in each products cashier has scan each and every product using barcode reader it take longer time and inefficient a new way of getting information about the products and services and gain information before they visit the store is replacing barcode with QR code customer can scan product using smartphones and payment is also can be done by QR code. It is recommended that virtual shopping process should be simple and short, captures shopper's interests effectively and ensure the security of virtual shopping by offering safety payment methods. To incorporate an enhanced security feature on the QR codes so that customers can securely scan codes and comfortably perform financial transactions using their mobile phones

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