

Educational Application of QR (Quick Response) Code

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Abstract

Our general purpose is to identify the level of security awareness that people have, concerning the security issues of QR Codes. QR code being so versatile because of its structural flexibility that it leads to many diverse field for research such as increasing data capacity, security applications such as different kinds of watermarking and steganography as well. QR codes contain information such as text, URL links, automatic SMS messages, or any other information that can be embedded in a two-dimensional barcode. This encoded data can be decoded by scanning the barcode with a mobile device that is equipped with a camera and QR reader software. One of the applications of QR code is in the school library. QR code are created for specific books, linking to reviews, trailers or additional resources assisting students to scan & learn more about the book before they choose to read it. The tool that we use to collect all this information is an on-line survey. In order for a user to reach this survey, he/she has to scan one of the QR Code stickers deployed by us in one of the selected locations. QR codes, or quick response codes, are two-dimensional codes that direct users to sites where they can read data and media available through the code. The paper describes about QR code, how QR code is different from barcode, its formation, capacity, security and error correction code.

Keywords

QR Code, Data Hiding, Code generation, watermarking, security, data capacity

I. Introduction

QR code, a new Jargon in today's world, stands for Quick Response code, is now becomes a trademark for business and all purpose use is a kind of two-dimensional matrix first designed to be used for automotive industry in Japan. With increased use, the concept of designer QR Codes – QR Codes that have been graphically altered to make them more graphically appealing – has taken root. QR codes, or quick response codes, are two-dimensional codes that direct users to sites where they can read data and media available through the code. Reason of the widespread use of QR Codes is its ability to use all programs of software system. Those are; web page applications, computer software's, smart phones and tablet computers. Everyone using this kind of devices has ability to instantly access the material to be shared by using QR Codes.

If we detailedly put QR Code products and services in order:

- Phone numbers
- Address Data
- Web links
- e-mail addresses
- e-mail messages
- SMS/MMS messages
- vCard/meCard business card data
- vCalendar calendar data
- Person/company introductory info
- Curriculum Vitae Data
- Geographical Coordinates
- Detailed Product Info
- Catalogue Pages
- Campaigns
- Mottos
- Advertisements

Decoding software on camera phones interprets the codes that can be found on product labels, billboards, and buildings inviting passersby to pull out their mobile phones and uncover the encoded information. In this paper, we explore how QR codes can be used in education. The low technical barrier of creating and reading QR codes allows innovative educators to incorporate them into their educational endeavors. The operations to retrieve or store QR codes are incredibly simple and quick, and with mobile devices, make

them the ideal educational tools for teaching and learning.



QR codes are similar to the barcodes used by retailers to track inventory and price products at point of sale. The key difference between the two is the amount of data they can hold or share. Bar codes can only hold up to 20 numerical digits, whereas QR codes are two-dimensional and can hold thousands of alphanumeric characters of information.

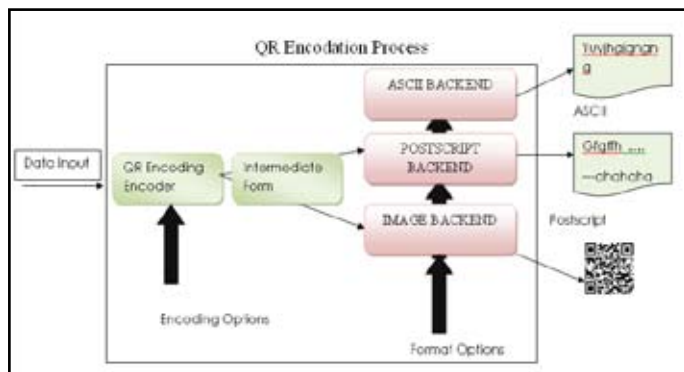
II. The basic QR algorithm

The QR algorithm consists of two separate stages. First, by means of a similarity transformation, the original matrix is transformed in a finite number of steps to Hessenberg form or – in the Hermitian/symmetric case – to real tridiagonal form. This first stage of the algorithm prepares its second stage, the actual QR iterations that are applied to the Hessenberg or tridiagonal matrix. The algorithm is based on the LR factorization, i.e., based on Gaussian elimination without pivoting.

Algorithm Basic QR algorithm

- 1: Let $A \in \mathbb{C}^{n \times n}$. This algorithm computes an upper triangular matrix T and a unitary matrix U such that $A = UTU^*$ is the Schur decomposition of A .
- 2: Set $A_0 := A$ and $U_0 = I$.
- 3: for $k = 1, 2, \dots$ do

- 4: $A_{k-1} := Q_k R_k$; /* QR factorization */
- 5: $A_k := R_k Q_k$;
- 6: $U_k := U_{k-1} Q_k$; /* Update transformation matrix */
- 7: end for
- 8: Set $T := A_\infty$ and $U := U_\infty$.



III. Security of QR Codes Security of QR Codes

Concerning the security issues of QR codes, the first approach to this matter that can be found in the literature examines how a QR Code can be used as an attack vector. In simple words, if someone just scans a random QR code which an attacker has created and which includes one of the attack methods, that we just described then the unwitting user will generate the attack on behalf on the attacker. As QR Codes are a standardized way of encoding information we strongly believe that the majority of software developers do not treat the encoded information as possibly insecure input. QR Code could be manipulated in order to change the encoded information. Depending on the programs that process the encoded information, whether this would be in logistics, public transportation or in a fully automated assembly line, attacks on the reader software as well as the backend are theoretically possible.

Authentication system

Once the requirements to implement this prototype have been described, we need to explain how the actual authentication will take place. For this, we need to understand first how the registration process would work. Then, the authentication method will be described.

- (a) Registration: This part is not implemented as the paper is only intended to present an authentication method. The following steps are a suggestion on how to complete the registration process:

The user would go into the registration section in the QRP web application and would submit her username, password and IMEI number of the phone she intends to use to authenticate.

1. After validating the data entered (correct IMEI, password complex enough, etc.), the server would store this information on the database.
2. Next, the server would generate a private and public pair of keys unique to the user that would be stored on the server.
3. After this, the user would proceed to download and install the application on her phone.
4. The first time the mobile application is run, the user will need to enter her username and password (the IMEI can be verified by the mobile application) and the credentials (user/password) would be validated against the database through a https request to the application server.
5. If successful, three files would be imported and stored in the

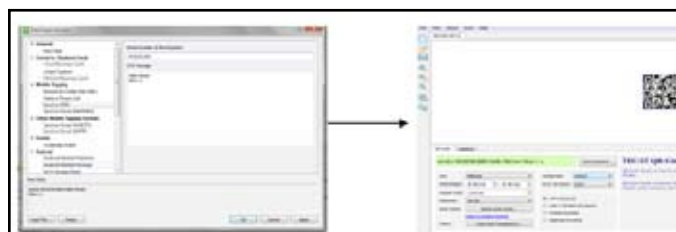
user's phone internal storage: the server's public key, the user's private key and a user data file, containing the user's encrypted credentials. The server's public key will be used to decrypt the credentials file. The user's private key will be used to authenticate in the server.

- (b) Authentication: When the authentication page in the web application is opened, a QR code containing a random number rn between 1 and 999999999 is shown. In the background, a row is created in the transactions table, containing the current timestamp ts and the random number rn .

IV. The potential uses for QR codes in Education

Book Reviews

One of the best ideas heard for using QR codes is in the school library. QR codes are created for specific books, linking to reviews, trailers or additional resources. The QR codes are then printed on to stickers and stuck inside the cover of the book. This is great as students can scan and learn more about the book before they choose to read it.



V. Examination

Examinations generally fall into two categories: objective and subjective. Our product will set up of automated examination systems to process, mark, score, grade and report on these assessments. Objective examinations are suited to this automated process, as there is little or no room for interpretation or conjecture over the outcome. Within objective examinations there are also several categories, such as the commonly known Multiple Choice Questions (MCQ), True/False and Extended Matching variety. Other variations such as Single Correct Answer (SCA) and Multiple Correct Answers (MCA) can complicate the picture further. Our product will generate a QR-Code of each question paper and students will scan the code to generate the question on their mobile screen.

Example:

1. For each catalogue search at the library. of the college, a QR code will also be displayed automatically to summarize the key information, the title, the author, and the shelf location.
2. Student assignment submission to the Faculty to accompany with a coversheet bearing the relevant QR code.
3. QR codes are automatically added. The QR code contains the URL of the page on that particular course.
4. QR codes can also be found on posters around campus, on Websites and service blogs for bookmarking, in handbooks linking to activities, and in marketing materials from departments.

VI. Conclusions

In this paper we outlined the QR Code, it's structure, working and it's various possible application and it's implementation in Education. Our experiments showed that it is important to take the

pedagogical aspect into account when planning QR activities. The focus should be more on the learners than on the technologies used. When the focus is too much on technology and the activity is not well-planned, it fails to motivate the students and their attention may be diverted to something else. As QR code provides the structural flexibility, it opens up the huge platform for researchers to explore the possibilities to enhance the performance of QR code or to merge QR code with different technologies, like -

1. Experiments can be done to improve data capacity of QR codes.
2. To find out the possibility of the use of coding techniques other than RS coding.

Use encryption to encode data first, and then encode it to QR code for better security solutions.

VII. AcknowledgEment

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Author's Profile

