QR Code Based Digitized Marksheet System

Kajal P. Chavan, Rupal R. Kamble, Priyanka P. Meshram, Mrs. Kanchan K. Doke

Department of Computer Engineering

Bharati Vidyapeeth College of Engineering,

Mumbai University

Navi Mumbai

India

Abstract:

Now a day, the world is becoming digital and use of digital data is growing. hence, it is very important to optimize these data and secure or preserve them in an eco-friendly manner. In this paper, the auther presents a new method to digitize the academic marksheets, and embed the digital data in the marksheet itself in the form of encrypted QR Code, so that these digital data can not be retrieved by unauthorized person. By using this method , we can save a lot of digital space, which will further necessary to save those digital academic records of each student. In our new marksheet system, the digital data, which is enclosed in the marksheet in form of encrypted QR code, can only be retrieved and decrypted by authorized users using our own web-application, which is hosted in our website.

Keywords: *Digitized mark-sheet, Encryption, Result, QR Code.*

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1. INTRODUCTION

In the modern world, with the evolution of technology and un-ending growth in digital data, there is an essential need of optimization of online data and information present in the digital world. Today, because of ever growing digital data, it is very important to optimize these data and preserve them in an eco-friendly manner.In this paper, we present a method to digitize the educational mark sheet and embed the digital format in the mark-sheet itself in the form of encrypted QR Code[5], so that the digital data cannot be retrieved by any unauthorized user. In this way, we can save a lot of digital space, which was necessary to save those digital academic records of each student. The student Mark sheet or Certificates will now be printed along with a QR Code print. The verifier will be having a application on his android device which will scan the QR Code on the digital certificates. The Android app will decode the QR Code and accordingly contents to the website and downloads the original copy of the certificate along with the student photo registered with the certificate. On receiving the copy of certificate the verifier can easily detect the submitted copy is true or fake.

A QR code (quick response code) is a type of 2-Dimensional barcode(matrix-barcode) that is used to provide easy access to information through smartphones. The QR code system was invented in 1994 by Denso Wave. Its purpose was to track vehicles during manufacture,although initially used for tracking parts in vehicle manufacturing, QR codes now are used in a much broader context.QR codegained popularity because of its large capacity to hold digital data and it can be integrated in any mobile devices. Theuse of QR codes is license-free. A bar code contains data in one direction only but QR Code contains information in both the vertical and horizontal directions therefore QR Code can hold considerably greater information than a bar code. These Quick Response (QR) codes are versatile.

In our new mark-sheet system, we save all the data of every student in the QR Code, like roll number, student's name, registration number, semester and year, marks obtained in different subjects and grades secured. All this data is firstly encrypted, and saved and embedded in QR code, and then QR codes are printed in mark-sheet of the student. So, in future any student or any person want to see their mark-sheet digitallyor want to retrieve their mark-sheet or send their academic information to any university or organization in digital format, then they can just scan the QR code, decrypt the information and send the information.

This system can be easily implemented. Due to QR code, it increases the complexity of the forgery process and hence system is secured as per several security layers to the mark-sheet. Here are some general information about the layout structure of QR code, how they are constructed.

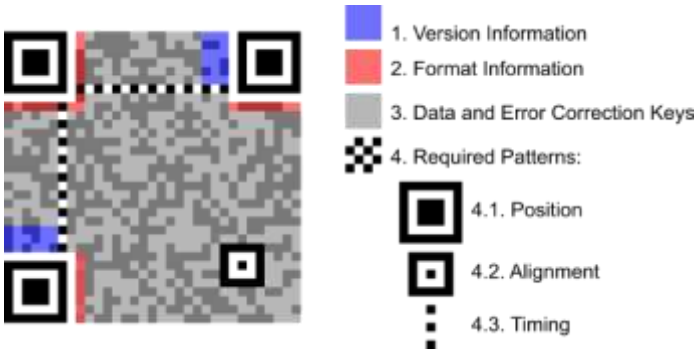

Figure No. 01. QR Code

In the above figure there are various boxes of different size. At the three corners of QR code, these prominent boxes indicate the location of image. Another smaller box at the lower-right corner aligns the image.The rest of the blocks indicate the information specific to the international standards and finally the identifying data contained within the code.

2. SYSTEM ARCHITECTURE

The system architecture is as shown in figure no.2. The College administrator updates and stores the information on the server. This information carries the details of Students, their marks and academic certificates. Official and students on demand can download these digital certificates. The QR CODE patched on digital certificate contains the digital ID

of the certificate and the data is encrypted and encoded in the QR CODE. The server on demand patches the Encoded QR CODE on the digital certificate.

Figure No. 2 System architecture

The official, who must be a registered user of the system, can scan the digital Certificate for getting the right and valid information of the certificate. The android mobile contains an application which can scan the QR CODE on the certificate. The user needs to enter the authentication PIN which is given to him during the registration process. This PIN is send to the Server along with the IMEI (International Mobile Equipment Identification) which the server authenticates the User and check whether the application is running on the same registered Mobile. After validating if found a valid user then the server provides an acknowledgement to the Mobile application which further activates the camera for scanning the QR Code.

The user now captures the QR CODE which is then printed on the certificate. The content of QR CODE is decoded by the mobile application and the Document Digital ID is found. This digital ID is further encrypted using the user PIN and is send to the server. The server then decodes the contents and send the all the required information to the user on his mobile application. The Mobile application shows the information that should be there on the certificate. The user can manually validate the contents. And user can determine the fake information on the certificate. This information help the user to find out the produced certificate is valid or not.

3. SYSTEM IMPLEMENTATION

The major of the system work is mainly focused on QR CODE. For creating a QR Code[3][6][7][8][9], first string of data bits is created. This string includes the characters of the original message (encrypted message in this case) that you are encoding, as well as there are some information bits that will tell a QR decoder the type of QR Code. After generating the aforementioned string of bits, we use it to generate the error correction code words for the QR Code. The error correction technique used by QR code is Reed Solomon error correction technique[4].

The Reed Solomon codes (RS codes) are invented by Irving S. Reed and Gustave Solomon. In coding theory, The Reed Solomon codes are on-binary cyclic error correction codes. After the generation of bit-string and error correction code words, the resultant data is used to generate eight different QR Codes, each of these eight QR code uses a different mask pattern. According to a particular formula,a mask pattern controls and changes the pixels to light or

dark ones. The eight mask pattern formulas are defined in the QR Code specification, further they are referred at the time of mask generation needed for the QR Code generation. Each of the eight QR Codes is then given a penalty score that is based on rules defined in the QR specification.

The purpose of this step is to make sure that the QR Code doesn't contain patterns that might be difficult for a QR decoder to read, like large blocks of same-colored pixels, for example. After determining the best mask pattern, the QR Code, which uses the best mask pattern, is generated and shown as an output. when the size of the encrypted message becomes more than 1,264 characters then the characters appearing after 1,264 characters are used separately and another QR code is generated from those characters. The above mentioned process is repeated until and unless the total encrypted message is converted to QR Code(s).

The method is discussed in details below:

To generate the QR code, the Encrypted file, which is created and is now treated as the input file and the string, is extracted from the file.

Step 1: call function file_read(output_file)

Step 2: call function generateQR Code(str[])

Step 3: call function delete_file(output_file)

From the architectural Point of view, the QR Code which is printed on mark sheet is scanned by user mobile. The user Mobile should be a registered mobile this means that no other QR CODE service will work on our system as the data is encoded and will be decoded only when the Mobile that is used to scan the QR CODE is registered and authenticated. The decoded data is the digital document and is send to the server for information retrieval. The server retrieves the information from the database for the unique Digital ID and the information is synchronized and is send to the user Mobile. The user can now easily detect the data he received and the information printed on the certificate.

4. MOBILE PHONE QR CODE ENCODING AND DECODING SCHEME

A. Encoding and Decoding

QR code encoding and decoding[9][10]steps reference to National standards GB/T 18284-2000 "Quick Response Code" and the minimum encoded version compatible with the data is selected.

B. QR code collection and preprocessing

Decoding data is the inverse process of encoding. Meanwhile, compared with images captured by special barcode reader, images captured in natural environment have shadows and blurring defocus defects. If images are not of high quality, it is impossible to decode the code accurately or completely. Therefore, preprocess the image in the consideration of image problem caused by capture. Preprocessing of mobile phone QR code follows the following steps: convert the colourful image to gray scale image, median filtering, binarization, image location, rotation,

perspective transformation and interpolation. Here conversion is done by weighted mean. After median filtering, bimodal image method is adopted to choose threshold for binarization. Then locate and rotate the image.

5. QR CODE PREPROCESSING SCHEMES

A. image localization

There are lots of methods to extract the edge of QR Code image. Basic idea of edge extraction is to enhance local edge taking advantage of edge enhancement operator and extract edge points using preset threshold. To gain the rotation angle of QR image, horizontal part of Sobel operator is used to convolute with the image. Horizontal edge image is gained using threshold. Edge detection result is shown in Figure 1. To calculate the rotation angle θ, adopt Hough transform to the horizontal edge image.

B. Rotation

Set the centre of QR Code image as reference. To begin with, the axis of centre should be figured out. Since QR Code has position detection patterns located at the three corners of the symbol, search the whole image to find structures which resemble the position detection patterns. Calculate the average length of the QR image and determine the correct coordinates of the four corners. Detect the image edge using sobel operator, obtain the contour of the image and extract QR Code image from the original image removing irrelevant part[1][2]. We assume that the original QR Code's centre is not altered.Then use the rotation angle θ obtained previously and rotate the image applying the universal equation :

$$\begin{bmatrix} x1 \\ y1 \end{bmatrix} = \begin{bmatrix} \cos\theta & \sin\theta \\ -\sin\theta & \cos\theta \end{bmatrix} \begin{bmatrix} x0 \\ y0 \end{bmatrix} \text{ -------- Equation no. 01}$$

while x0 ,y0 are pixel coordinates of the original image, x1 ,y1 are corresponding pixel coordinates after rotation, and rotation angle θ is positive counter-clockwise and negative clockwise.

C. perspective transformation and interpolation

If the plane which the camera lies in is parallel to the QR Code image, bilinear transformation can be adopted. However, real situation can be quite different from this assumption. When acquire QR Code image, the plane in which camera lies may not be parallel to QR image[6-7,9-10] which result in foreshortening effect. Then perspective transformation can be adopted. Since output image pixels are usually mapped to input image in non-integer position, which is located between the four input pixels, interpolation should be applied to decide the pixel value. We can calculate the coefficient of bilinear transformation according to the original and corrected coordinates of the four corners. Then apply the bilinear transformation to the image to correct the image. We adopt the method which map the output image pixel to the input image and calculate the value using bilinear interpolation method. It is simple and easy to implement, meanwhile it avoid the situation in which pixels are mapped out of image boundary.

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