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Two Level QR codes Technique for Private Message sharing

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ABSTRACT

QR codes are similar to two dimensional barcodes but having user friendly appearance.In proposed system, we are going to implement the concept of QR images, in which we can hide the secretemessage into QR codes so that it will be difficult for unauthorized person to understand that secret information. We are goingto encode the numeric and alphanumeric characters in the QRcode. In the proposed method we are going to use the 2 levels orNew Rich QR code to carry the secret message mainly to increasethe information security, storage capacity and high-speed readingapplications. The 2 level QR codes will have two storage levels, known as Public level and Private Level in which we are going toencode the public and private message at the same time.

KEYWORDS

QR code, two storage levels, private message,document authentication, pattern recognition, print-and-scanprocess.

I. INTRODUCTION

A. QR codes features:

The QR code was invented for the Japanese automotive industry by Denso Wave Corporation in 1994. A QR code is a two-dimensional (2D) barcode which is a square consisting of black square dots arranged on a white background. It encodes the information in binary form in both horizontal and vertical direction that stores more data than a bar code. The Quick Response (QR) code is designed for storage information and high-speed reading applications. Each information bit is represented by a black or a white module. There are 40 QR code versions can be available having different storage capacities. QR code version (version V1) which is the smallest version has a 21 × 21 module size and can store 152 bits of raw data at the lowest correction level. The biggest version is (version V40) has a 177 × 177 module size with the storage capacity of 7089 bits of raw data at its lowest correction level.

B. Structure of QR codes:

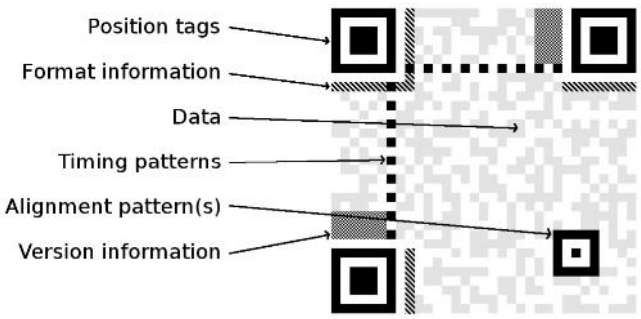


Fig.1 Structure of the QR code [1]-:

Above figure 1 shows the structure of the QR codes. The structure contains the following:

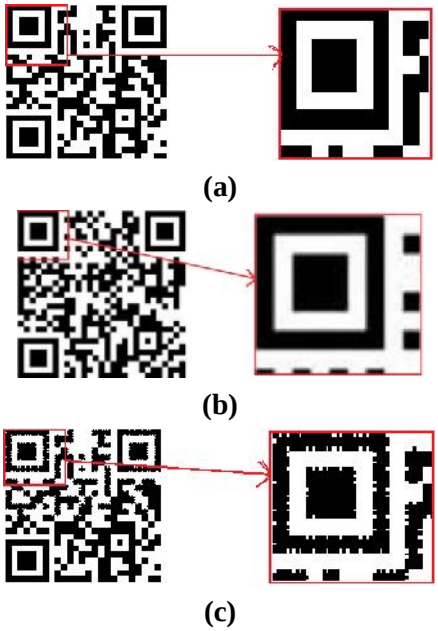
1. Position Tags: 3 position tags are used for QR code detection and orientation correction.
2. Alignment Patterns: One or more alignment patterns are used to code deformation adjustment.
3. Timing Patterns: Timing patterns are used to set module coordinates.
4. Format Information Area: Format information areas contain error correction level and mask pattern.
5. Version Information Area: Version information area is used to store the code version and error correction bits.

II. TWO LEVEL QR CODES

In normal QR codes, the information encoded is always accessible though it is ciphered text and also it is very difficult to distinguish between the original and the copy of the document. To overcome these disadvantages, 2 level QR codes has been introduced which will be having the two levels. In the proposed system we are going to encode the public as well as the private message at the same time which results in increasing the storage capacity of the QR code. The first level i.e. public level is same as the standard QR code which is accessible to any QR code reader and that's why it has the characteristics of the QR codes. In the second level i.e. private level, the black modules are replaced by the custom/proposed code that's why it invisible to standard QR code reader. Only the authorized person or the reader would be able to read the private message in the QR code. This helps to use the QR code for private message sharing and for document authentication.

To encode and decode the public and the private message in the QR code we have used the open source library function from ZXing.ZXing ("zebra crossing") is an open-source, multi-format 1D/2D barcode image processing library implemented in Java, with ports to other languages.

As application perspective, 2LQR code can be suggested as private message sharing scenario and authentication scenario. Private message sharing has to follow the rule of invisible storage and private message transmission into QR code. In authentication scenario, the main aim is to verify if the reader is authorized or not.



(a)

(b)

(c)

Fig 2 (a): Standard QR code, Fig 2 (b) 2LQR code for private message sharing, Fig 2 (c) 2LQR code for authentication.

From the above figures, we can see the standard QR code Fig.(a)and the QR code with the public message

Fig. (b) looks the same. But the QR code encoded with private message Fig.(c) looks different which only the special QR code reader or scanner can decode or read.

The QR code is generated using the standard QR code generator imported from the open source Zxing library function. We enter the message which is the string of alphanumeric characters. We convert this string of ASCII character into equivalent binary bits .This string of bits is then split up into shortest possible string of bits and is then we store the public message Mpub into the QR code using the customized generation method.

III. Process flow of Two Level QR Codes generation

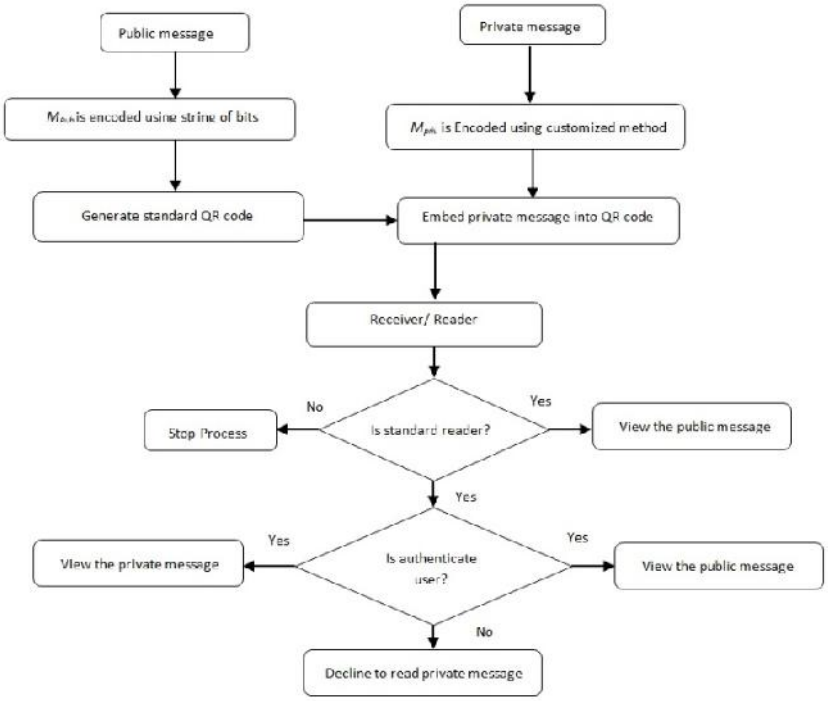


Fig3. 2LQR code generator flow diagram

Above Fig3shows the flow chart of the proposed system. In the first block of the flow chart we check the mode of the entered data or message ex. Numeric, alphanumeric, binary or kanji. In our proposed system we have entered the alphanumeric message which we are going to encode as a public and the private message. We also have to select the version of the QR code. QR code has the different versions from smallest version 1 (V1), version 2 (V2) and so on up to largest version 40 (V40). The size of the QR code is decided according to the version. In our system we are considering version 40 (V40) which is having the size of 177 x177 pixels. The standard formula for calculating the QR code size is as below.

Num = 17+4*N

N = Version of QR code

num = 177 = 17+4*40

QrCodeHeight = 177;

QrCodeWidth = 177;

The capacity of the QR code is depends on the data mode and the version of the QR code. Once we enter the message in the form of string, we calculate the ASCII value of each characters of the string. The ASCII value is then converted to into binary form.

In our proposed system we are going to encode the message at the edges of black modules starting from the top left most pixels in position tag.

The encoded public message can be read by any standard QR reader or the scanner. The public message reader will not know about the contents of the private message in the QR code. However, the encoded private message can be read by only the special QR scanner or reader. In that way we can maintain the privacy of the encoded message without sending any key separately. In the proposed system we are sending or encoding the public and the private message simultaneously which increases the storage capacity.

IV. Private Message Embedding Algorithm

Step 1: After encoding the public message Mpub into the QR code, we get the binary image (IMpubB) of (m * n) size.
Step 2: We take the private message (Mpriv) which is to be encoded in the same QR code. This private message is also the string of alphanumeric characters.
Step 3: We count the total number of characters (Nc) in private message and convert it into the binary format (NCB). This binary format will be the 9 bit binary format.
Step 4: The private message (Mpriv) is then converted into the binary format (MprivB).
Step 5: We count the total number of bits (NcMprivB) of the binary formatted message.
Step 6: With this binary formatted message, we start embedding these binary (MprivB) bits in QR code starting from the top left corner of the code in alternate bit manner.
Step 7: Here, we are using 8- connectivity method to check that pixel (MprivB) should be the edge pixel and we embed (MprivB).
Step 8: At the final stage, we get the binary image (IMprivB) of (m * n) size.

V. Private Message Decoding Algorithm

Step 1: Take private message embedded QR image (IMprivB) of (m * n) size.

Step 2: Get number of characters (NC) from private message in 9 bit binary format (NCB) from upper left corner of (IMprivB) by alternate bit manner.

Step 3: We convert the binary formatted message (NCB) into the decimal format.

Step 4: We calculate the number of bits in private message (NMprivB) by multiplying it by 8 N*8.

Step 5: Get the (PprivB) in QR code from second row and second column in alternate bit manner till we reach the size of (NMprivB).

Step 6: The private message is getting extracted (Mpriv) by converting the private message binary string into the character array.

VI. Storage Capacity Calculation Flow

The following section will describe the data storage capacity ofthe 2 Level QR code.

- The QR image size is 177 x 177 pixels including white area.

177 x 177 =31,329 pixels

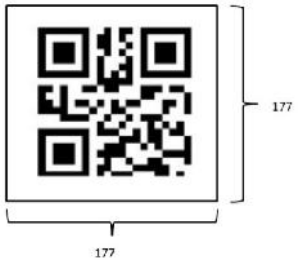


Fig 4. Storage Capacity

- From left 25 pixels and from right 26 pixels are discarded.

Fig 5. Storage Capacity

25+26 = 51
177-51 = 126

- So, the actual QR code matrix becomes, 126 x 126= 15,876
- Again, in the standard QR code structure, 1 pixel from left and 2 pixels from right is discarded, so now the QR code size became
  123 x 123 = 15,129
- In proposed system, we are going to embed data in alternate pixel, so it became
  123/2= 62
- It means, 62 x 62 = 3844 (binary bits) => 3844 /8 = 480 ASCII characters
- Convert it into binary bits => 111100000 (It requires 9 bits to denote binary of 480)
- If we subtract 9 bits from the total binary bits (i.e. 3844)
  3844-9 = 3835 => this will be the actual length if private message.
  3835/8 = 479 ASCII characters
- So we can conclude that the total capacity of the private message that we can encode in the QR code will be 479 characters.

VII. Experimental Results

Currently this proposed system designed to view the public message using the standard QR code reader. The public message isencoded from top left corner of the QR code image using the standard QR code generation algorithm.At the same time we have also encoded the private message in thesame QR code image. We have used the 8 connectivity method toencode the private message into the QR code image.
Following Figure 6 shows the QR image embedded with the public message
Public message: "Welcome to JSPM's RSCOE, Tathawade, Pune"

Fig 6. QR code with public message

Following figure 7 shows the QR image embedded with the private message.
Private message: "mobile no. 4567435022, account no. 545664781235, address.365,Sweet-home,pune."

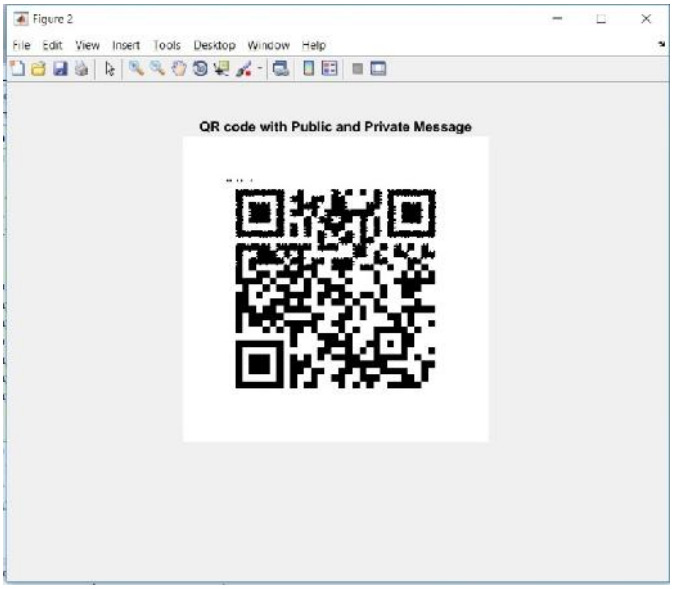


Fig 7. QR code with public and private message

VIII. Conclusion

- We have used the standard QR code reader to view the public message, which is encoded using open source library functions.
- At the same time we have also encoded the private message in the same QR code image. We have used the 8 connectivity method to encode the private message into the QR code image.
- The public and the private message are encoded starting from top left corner of QR image.
- These QR code consist of public and the private message.
- No need to send the key separately with private message.
- 2LQR code can decode the public message without decoding the private message. So, it increases the speed of reading process.
- Storage capacity is increased as the public and the private message is encoded in the same QR code.

REFERENCES

[1] Iuliia Tkachenko, William Puech, Senior Member, IEEE,Christophe Destruel,Olivier Strauss, Jean-Marc Gaudin, andel Christian Guichard “Two-Level QR Code for Private MessageSharing and Document Authentication" .
[2] The thesis "Generation and analysis of graphical codes using textured patterns for printed document authentication"by Iuliia Tkachenko, Submitted on 5 Mar 2016.
[3] R. Vill’an, S. Voloshynovskiy, O. Koval, and T. Pun, “Multilevel 2-D bar codes: Toward high-capacity storage modulesfor multimedia security and management," IEEE Trans. Inf.Forensics Security, vol. 1, no. 4, pp. 405-420, Dec. 2006.
[4] Jaroslaw Duda, Pawe l Korus, Neeraj J. Gadgil, Khalid IEEEtransaction on information forensics and secuirity, VOL. 11,NO. 3, MARCH 2016Tahboub, Member, IEEE, and Edward J. Delp, “Image-Like 2D Barcodes Using Generalizations of the Kuznetsov-Tsybakov problem" IEEE transaction on information forensics and secuirity, VOL. 11, NO. 4, April 2016.
[5] QRStuff. QR Code Error Correction, 2011.QRStuff blog:http://www.qrstu_.Com/blog/2011/12/14/QR-code-error-correction.
[6] P.-Y. Lin, Y.H. Chen, E. J.-L. Lu, and P.-J. Chen, “Secret hiding mechanism using QR barcode," in Proc. IEEE Int. Conf.Signal- mageTechnol. Internet-Based Syst. (SITIS), Dec. 2013, pp. 22-25.

[7] Cl'eo Baras and Franc'ois Cayre, "2D BAR-CODES FOR AUTHENTICATION:A SECURITY APPROACH," 20th European Signal Processing Conference (EUSIPCO 2012).
[8] B. W. Lampson, "A note on the confinment problem," Commun. ACM, vol. 16, no. 10, pp. 613-615, Oct. 1973.
[9] Divya Sharma, Department of Information Technology, Panjab University Swami Sarvanad Giri Regional Center," Steganography of Speech Signal into an Image" Proceedings of 2015 RAECS UIET Panjab University Chandigarh 21-22nd December 2015.
[10] C. Lalengmawia, A. Bhattacharya, Member, IEEE and A. Datta Computer Science and Engineering, NIT Meghalaya, India, "Image Steganography using Advanced Encryption Standard for implantation of Audio/Video Data",2016 Fifth international Conference on recent trends in Information Technology.
[11] M. Querini, A. Grillo, A. Lentini, and G. F. Italiano, "2D color barcodes for mobile phones," Int. J. Comput. Sci. Appl., vol. 8, no. 1, pp. 136-155, 2011.
[12] T. Langlotz and O. Bimber, "Unsynchronized 4D barcodes,"in Proc. 3rd Int. Symp., ISVC 2007, Lake Tahoe, NV, USA,Nov. 26-28, 2007, pp. 363-374.
[13] Denso Wave. [Online]. Available: http://www.qrcode.com, accessed Apr. 20, 2015.
[14] R. C. Gonzalez and R. E.Woods, "Digital Image Processing", 2nd ed.Englewood Cliffs, NJ, USA: Prentice-Hall, 2002, pp. 572-580.
[15] Sayantan Majumdar, Abhishek Maiti, Biswarup Bhattacharyya, Asoke Nath, "New Secured Steganography Algorithm using Encrypted Secret Message inside QRTM Code: System implemented in Android Phone", 2015 International Conference on Computational Intelligence and Communication Networks.
[16] https://github.com/zxing/zxing
[17] http://www.qrcode.com/en/about/version.html
[18] http://www.thonky.com/qr-code-tutorial/module-placement-matrix.