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A Survey on Data Security and Confidentiality Using 2D Color Barcodes

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Abstract: ***2D color barcodes have been introduced to obtain larger storage capabilities than traditional black and white barcodes. There is increased interest in the use of color barcodes to encode more information per area unit than regular, black-and-white barcodes. Here a secret message is encrypted with combined cryptographic method and then hide the encrypted data in a color QR Code (Quick Respond Codes). The embedded QR code may be sent to destination or may be saved for future use. Color QR Codes are mainly used to convey or store messages because they have higher or large storage capacity than any other normal conventional 'barcodes'. The data is encryptedusingasymmetrickey, then inserted in color QR code, so that data can not be easily retrievable without adequate authorization / permission.This paper studies two dimensional color barcodes for data confidentiality and security.***

Keywords: QR Codes, 2d Color barcode, Encryption, Hiding, Security

1. Introduction

QR codes (short for Quick Response codes) is a two dimensional barcode were invented in 1994 by the Toyota Motors subsidiary Denso Wave to track vehicles and parts during the manufacturing process. The QR code consists of black modules (square dots) arranged in a square grid on a white background. The information encoded may be made up of data (numeric, alphanumeric, byte / binary, Kanji) or, through supported extensions, virtually any type of data. A QR code can store information [10] such as:

- Website URL
- SMS
- Text message
- Calendar event
- Contact Information
- Phone number
- Geographic location

Now a days instead of barcodes QR codes are widely used because of their increased information storage capacity compared to barcodes. Here the information will be in horizontal and vertical format. Maximum storage capability of QR code using only two colors (black & white) is 4296 characters in version 40. This capacity can be further improved by considering more colors along with black and white i.e, red, blue, green etc.

Considering barcodes as an effective media to share information, at present, the black and white two dimensional barcode technology has developed more mature. American National Standards Institute (ANSI) developed the international standards of two-dimensional bar code, QR codes. However, with the urge of increase in information, expanding the field of bar code applications is thought to be good idea. Barcodes are used to store the high capacity information in less space and thus, stands as a good ideate.

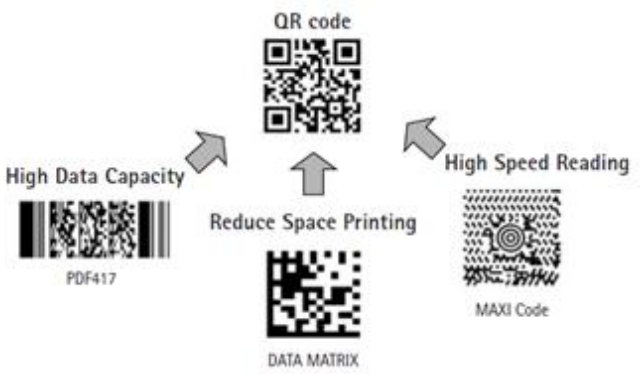

Figure 1: The Development of QR Code.

Recently, many studies have focused on 2D barcodes. Here introduce 2D color barcodes. This paper studies the HCC2D, High Capacity Colored 2-Dimensional code, a new 2D barcode technology which aims at increasing the data density, confidentiality and security. A 2D color barcode has greater capacity then existing 2D barcode. In this paper we have do the survey on previous barcode types and newly introduced 2D color barcode.

2. Literature Survey

Douglas Chai [1] over the past few years, 2D barcodes have gained popularity as one of the key pervasive technologies for mobile applications on smartphones. they will be used as shortcuts to uniform resource locator links; a way to store contact information for simple transfer; admission tickets or boarding passes; and tokens for retrieving digital data, like public transportation timetables or recent produce production information, either directly from the barcode itself or through a networked database server.1. Most mobile applications use black-and-white 2D barcodes (such as QR codes or Data Matrix) that carry only a restricted amount of encoded data. Using 2D Color barcode, the color part is employed additional for its visual value than as a way to encode additional data. Two approaches will increase a 2D barcode's data capacity: increasing data cell density by using

additional cells among a given symbol size or increasing the offered data symbol space by using additional colors.

Vijaya Lakshmi [2] proposes a 2D color barcode can hold much more information in comparison to a binary barcode. 2D barcode is gaining popularity for mobile applications. When used together with camera phones, the 2D barcode can offer a link between the digital and the real world. 2D barcodes have increasing significance as the presence of high-resolution cameras, joined with the availability of variable data printing, drives increasing amounts of "click and connect" applications. Barcodes hence, serve as an more and more vital connection between physical and electronic portions, or versions, of documents itself .

Hiroko Kato [3] proposes camera phones have permeated into our everyday lives, the 2D barcode has attracted researchers and developers as a cost-effective present computing tool. A variety of 2D barcodes and their applications are developed. Nevertheless, they need not been wide used. A possible limitation is their irresponsibility in terms of usability and robustness. Increasing data capability is one of the solutions that address both issues since it helps give a wider type of applications and improve the robustness using further data capability for error detection and correction. A way of achieving this is to use color symbols for encoding data. However, using a larger multitude of colors introduces issues that can negatively have an effect on the robustness of barcode reading. This can be very true when developing a 2D barcode for mobile devices.

Manoj S. Rewatkar and Shital A. Raut [4] proposes the information processing system plays crucial part in the internet. Online information security has become the top priority in all sectors. Failing to provide online information security may cause loss of critical information or someone may use or distribute such information for malicious purpose. Recently QR barcodes have been used as an effective way to securely share information. This paper prese nts the survey on information hiding techniques which can share high security information over network using QR barcode.

M. Querini [5] proposes a new high capacity color barcode, named HCC2D (High Capacity Colored 2- Dimensional), which use colors to increase the barcode data density. They proposed HCC2D, High Capacity Colored 2-Dimensional code, a new 2D barcode technology which aims at increasing the data density and at supporting mobile applications. Their results show that the data density of HCC2D is almost close to the one of HCCB, which is considered to be one of the leading barcodes in data density. HCC2D is built on (and is backward compatible with) QR, and thus inherits from QR its strong robustness and error correction properties. In their experiments, HCC2D shows a reasonably small computational overhead with respect to QR and thus seems amenable to practical applications.

L. Francis and G. Hancke [6] proposes 2D color barcodes have been introduced to obtain larger storage capabilities than traditional black and white barcodes. Unfortunately, the data density of color barcodes is substantially limited by the redundancy needed for correcting errors, which are due not only to geometric but also to chromatic distortions introduced by the printing and scanning process. The higher the expected error rate, the more redundancy is needed for avoiding failures in barcode reading, and thus, the lower the actual data density. Our work addresses this trade-off between reliability and data density in 2D color barcodes and aims at identifying the most effective algorithms, in terms of byte error rate and computational overhead, for decoding 2D color barcodes. In particular, we perform a thorough experimental study to identify the most suitable color classifiers for converting analog barcode cells to digital bit streams.

3. Existing System

In existing system used QR codes. The QR (Quick Response) code is a two-dimensional barcode. The QR code has been widely used due to its good features such as large data capacity, high speed scan, and small printout size.

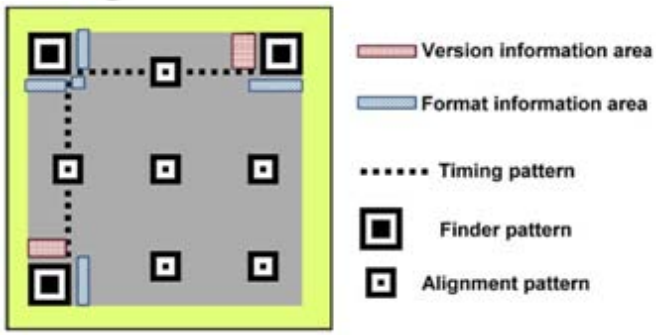

Figure 2: Structure of a QR Code

QR Code (Quick Response Code) There four levels of error correction, and the maximum symbol size can encoding 7089 numeric data or 4296 alphanumeric data [1]. The highest error correction level is upto 30% of code words of the symbol. The advanced features of QR code are:

1) High embedding Capacity.
2) High speed scanning
3) Represented by two bits of data.
4) It can be readable from any direction from 360 degree.

Compared with 1D barcode, the 2D barcodes has a much larger capacity which can hold more data than 1D barcode. A QR code capcity is upto 4296 letters, and 2953 binary code word data and 7089 digits.

3.1 High capacity encoding of data

While conventional 1D codes store up to 20 decimal digits, the QR code is able to store from several dozen to several hundred times more data. QR codes can handle a large variety of data, such as binary, numeric and alphabetic characters, Kanji, Kana and Hiragana (Japanese) symbols, and control codes. If the input is represented by decimal digits, one symbol can encode up to 7,089 decimal digits. QR codes have error correction capability. Data can be restored even if the symbol is partially dirty and damaged. A maximum of 30% of the codewords can be restored. A codeword is a unit that constructs the data area. In the case of a QR code, one codeword is equal to 8 bits. Thanks to their

alignment function, QR codes are resistant to distorted acquisitions.

4. Proposed System

A 2D color barcode can hold much more information than a binary barcode. While a color barcode can hold more information, it makes this vision task unusually challenging because of the varying color balancing in different cameras, poor quality of images taken with current cell phone cameras and webcams, varying lighting conditions, arbitrary rotation of the barcodes in images. They are frequently used in advertising to provide customers with scannable URLs to product websites. In pursuit of increased barcode capacity, novel schemes using color have been proposed.

In this section, describe the HCC2D code, which was designed with the main goal of increasing the data density while preserving the strong robustness and error correction properties of the QR codes. HCC2D defines a superset of the QR code set, and thus it is able to maintain fully compatibility with QR. In particular, HCC2D increases the data density by generating each module of the data area with a color selected from a color palette. The figure shows 2D color barcode.

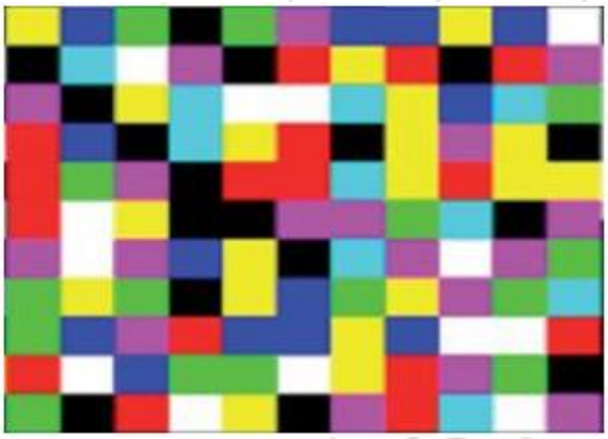

Figure 3: 2D color barcode

To increase the barcode data density by using color this paper studies a new high capacity color barcode, named High Capacity Colored 2-Dimensional. Different colored modules poses some advance and non-trivial computer vision challenges like handling the color distortions introduced by the hardware equipment that realizes the Scan and Print process. Different scheme developed a prototype for generating and reading the HCC2D code format, both on desktops (Linux and Windows platforms) and on mobile phones (Android platforms).

4.1 QR Code Color Chart

The color chart for QR code representation has been given in detail along with the bit pattern generation. The combination of Pixel Values gives different color representation such as black, violet, while, green, blue etc.

Color Name	RGB Value (R,G,B)	Bit Pattern
Black	0,0,0	000
Red	255,0,0	001
Green	0,255,0	010
Yellow	255,255,0	011
Blue	0,0,255	100
Violet	255,0,255	101
Turquoise	0,255,255	110
White	255,255,255	111

Figure 4: Proposed system for color QR code generation.

New 2D color barcodes are designed to increase the capacity. For robust data transmission and secure . The system can be used for private information sharing, secure device pairing and secure mobile payment, etc.

5. Conclusion

A new 2D color barcode technology which aims at increasing the data density and robust data transmission. Color barcodes increases the data embedding capacity than normal 2D barcodes. It provides high level security and data confidentiality prevents eavesdropping and jamming. It is also used for private information sharing. 2D color barcodes have shorter encoding/decoding time and higher data storage capacity. It uses colors for each information block, it can encode more information than 2D barcodes. Encoding/decoding time is less than 20ms and it is faster than 2D barcodes. 2D color barcodes are used to store the high capacity information in less space and thus, stands as a good ideate.

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