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Effective Survey On Two-Dimension Color Barcodes For Mobile Applications

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Absract-
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). This paper studies different two dimensional barcodes for mobile applications.

***Index Terms*- 2D barcodes, QR codes, Color barcode, Mobile Devices, Mobile Applications.**

I.INTRODUCTION

Now days two dimensional barcodes have become very popular in mobile applications. Due toe increasingly prevalent camera phones inherently capture 2-D images and directly used with 2-D barcodes and unlike conventional laser-based 1-D barcode scanners that would require hardware modifications for capturing 2-D barcode images. 2-D codes offer high enough rates to provide a viable mechanism for joining the physical world of print and the cyber world of the Internet. The common uses of 2-D barcodes are for the purpose of giving access to online information about products and services advertised in print media such as magazines, posters,and billboards. The universal resource locator (URL) for the online information is embedded within the print as a 2-D barcode, which can be captured with a cell phone camera, and, upon decoding, allow the user to access the information without the tedium of manually entering the URL. Among the various options available for 2-D barcodes, for mobile applications, the (monochrome) quick response (QR) code is used most extensively in practice. The QR code standard defines a flexible solution with competitive data rates, support for multiple character sets, features for rapid and robust synchronization under lighting and orientation variations, multiple data density designs, and built in variable error correction capability for handling differing application requirements. Other popular 2-D barcode designs include the Aztec code which is extensively used in electronic ticketing or the Data Matrix common in industrial component labeling. The majority of color barcodes provide increased data rates compared to 2-D monochrome barcodes by encoding data in the color of small shapes (triangles/rectangles). However, the use of colors for encoding poses challenges in the presence of inevitable tonal variations in the print and capture processes which cause changes in the colors and, to make decoding feasible, usually require part of the barcode real estate to be devoted to estimating parameters associated with the variations.

II. RELATED WORK

M. Querini et al. proposed 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.[3,5,7,13].

Denso Wave invented the QR code system in 1994 to track vehicles during manufacture; it was designed to allow high-speed component scanning. It was initially used for tracking parts in vehicle manufacturing; QR codes now are used in a much broader context, including both commercial tracking applications and convenience-oriented applications aimed at mobile-phone users (termed mobile tagging). QR codes may be used to display text to the user, to add a vCard contact to the user's device, to open a Uniform Resource Identifier (URI), or to compose an e-mail or text message. Users can generate and print their own QR codes for others to scan and use by visiting one of several paid and free QR code generating sites or apps. The technology has since become one of the most-used types of two-dimensional barcode.[4]The only context in which common QR codes can carry executable data is the URL data type. These URLs may host JavaScript code, which can be used to exploit vulnerabilities in applications on the host system, such as the reader, the web browser or the image viewer, since a reader will typically send the data to the application associated with the data type used by the QR code.In the case of no software exploits, malicious QR codes combined with a permissive reader can still put a

computer's contents and user's privacy at risk. This practice is known as "attagging", a portmanteau of "attack tagging".[52] They are easily created and can be affixed over legitimate QR codes.[53] On a smartphone, the reader's permissions may allow use of the camera, full Internet access, read/write contact data, GPS, read browser history, read/write local storage, and global system changes[2,4,8,10].

Barcodes are nothing but the optical machine-readable representations of data which is capable of storing the physical object information in digital form to which they are attached. Barcodes have become ubiquitous in many applications due to their reading speed, functional characteristics, accuracy and their usage in different places. Barcodes are useful in department stores and retail chains to price goods, identify customers through membership cards and to track items .Also it useful in tracking item shipment and movement like express mail, rental cars, airline luggage; in hospitals for patient identification in; in document management systems; in ticketing for sports cinemas, theaters ,events and transportation.
One-dimensional (1D) barcodes represents data by varying the widths and spacing's of parallel lines. In 1D barcodes limited amount of digital information stored and could be easily increased by increasing the barcode digit numbers or by laying out multiple barcodes. This approach has more negative effects, such as enlarged barcode areas, increased printing costs and more complex reading operations[1,6,11].

Fig. 1. Dimension for storing data in (a) 2D and (b) 1D codes.

Due to these reasons, the barcode technology has been deploying geometric patterns (such as , triangles, hexagons ,squares, dots) in two dimensions and referred to as bidimensional (2D) codes. The two Dimension codes increases the data space available by storing information in two dimensions, whereas one dimension codes contains data in one dimension only. Figure 1 shows examples of 1D and 2D barcodes. By repeating a single one dimension barcode over multiple rows to exploiting 2D shapes in order to represent data in available 2D codes span. Figure 2 shows the evolution of 2D barcode technology.

III.BARCODE

Fig. 2. Evolution of barcodes: (a) multiple barcode layout, (b) stacked barcode layout, and (c) matrix barcode layout.

Figure 2 (a) shows a multiple barcode layout. It needs multiple scans in order to get all the information contained in the barcode. Figure 2 (b) shows a stacked barcode layout. In this case a single scan is enough to obtain the stored information but the scanning equipment must be carefully aligned with the barcode orientation. In Figure 2 (c) a matrix barcode layout is
presented. It acquire information in a single scan and does not require the accurate alignment of the scanning equipment. More than 20 types of conventional 2D codes are there.

IV.QUICK RESPONE CODE(QR)

Black and white 2D codes as well as QR codes store the data by using a graphical representation. The base of this core representation is the arrangement of multiple simple geometric shapes over a fixed space. A generic 2D code is necessary to efficiently perform following three functions:
i) The position detection function:-It has capability of identifying the presence of a 2D code in the acquired image;
ii) The alignment function is necessary to synchronize the Scan process on the correct position of a 2D code. This function exploits some alignment patterns placed by the Print process in a well known position. The focus of Scan process is on retrieving these well known patterns in order to position correctly the 2D code.
iii) The data function is necessary to encode the input data in a specific graphical representation. Some more goals may be reached by the data function. Error correction and data masking are examples of these functions for strengthening the 2D code.

For all the required functions the QR codes adopt an arrangement of black and white squares of different sizes. Each module represents a single bit following a simple rule: black squares store 1 and white squares store 0. Features provided by QR codes will be discussed are as follow:

a)High Capacity Encoding of Data:
The 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 than 1D.QR codes can handle a large variety of data, such as numeric and alphabetic characters, binary, Kana, Kanji, and Hiragana (Japanese) symbols and control codes. One symbol can encode up to 7,089 decimal digits if the input is represented by decimal digits.

b)Small Printout Size:
QR codes store information both vertically and horizontally also they are capable of encoding the same amount of data in approximately one-tenth the space of a traditional 1D code.
c) Damage ,Dirt and Distortion Resistant. QR codes have error correction capability.
Even if the symbol is partially dirty and damaged the data can be restored.
30% of the codeword's can be restored in maximally. A codeword is a unit that
constructs the data area. In QR code, one codeword is equal to 8 bits.
d)Readable from any direction in 360 degrees:
QR codes are capable of reading in all 360 degrees (Omni-directional). This task is accomplished through position detection patterns located at the three corners of the symbol. These position detection patterns guarantee stable high-speed reading, circumventing the negative effects of background interference.
e)Structured Append Feature. A splitting function may be applied to obtain smaller QR codes containing the same data if a single QR code is too large for the print space available. One data symbol can be divided into up to 16 codes, which can be printed in smaller areas.
f)Standardization Process. QR codes have become more popular for two reasons:
QR code specifications are clearly defined, made public and the QR codes can be freely usable. QR code is open in the sense that the specification of QR code is disclosed and that the patent right owned by Denso Wave is not exercised[14,15].

Figure 3.represents the QR code in detail. The available space in each symbol may serve as Encoding Region or Function Patterns. The Alignment Patterns, the Position Detection Patterns, , the Timing Patterns, and the Separators for Position Detection Patterns helps the Scan process in detecting the presence, the proper orientation and the correct slope of a QR code into an image.

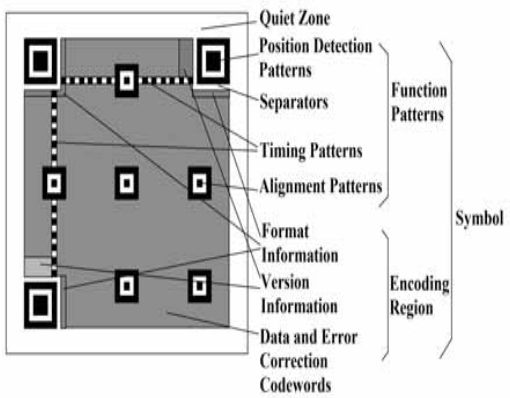

Fig. 3. Structure of a generic QR code.

The error correction level used in the code is described by Format Information. The Data and Error Correction Codeword's contains error correction and input data.

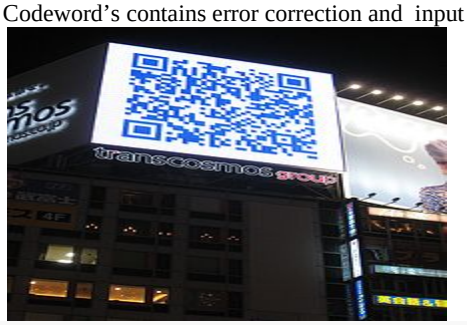

Figure 4.A QR code used on a large billboard in Japan, linking to the sagasou.mobi website

V. HCCB CODE

The HCCB stands for High Capacity Color Barcode. It consists of rows of triangles of
(up to eight) different colors, where successive rows are separated by a white line as shown in Figure 5. The number of rows in a HCCB code may change, the number of modules in each row is always a multiple number of rows. A module represents the basic entity for storing information in a 2D code. Always the HCCB code has a black boundary around it and further surrounded by a thick white band. These patterns are designed to act as visual landmarks in order to locate the barcode in an image. The black boundary at the bottom of HCCB is thicker than the boundaries on the other three sides. The bottom boundary acts as an orientation landmark, as barcodes may be at an arbitrary orientation in the image. The last triangles in the last row are always in a fixed order (2 triangles per color) which used as a color palette during the scan. They are used to reconstruct colors during the detection phase . The detection process of an HCCB code works as below:
It begins from a point at which is supposed to be interior of the code and proceeds on squares of larger sizes until it recognizes the white border around the code; next to the white border has been located, it starts the alignment process by looks for the thick bottom boundary.
One possible disadvantage of HCCB codes is related to their fragility in the detection and alignment process. The automatic recognition of an HCCB code can be problematic, since the position detection could start from any image contained inside a white, thus giving rise to delayed failures. If the distortion is too big, this might result in failures to properly recognize the boundary.

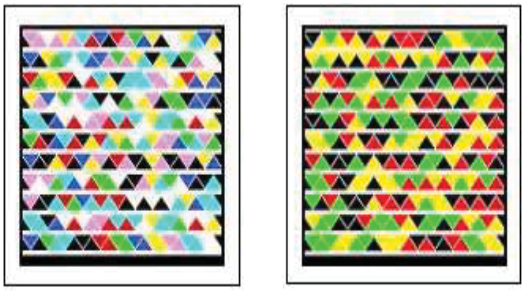

Fig. 5. An example of the Microsoft High Capacity Color Barcode (HCCB) (Viewed better in color).

4. High Capacity Colored 2-Dimensional Code

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 so it is able to maintain fully compatibility with QR. Particularly HCC2D increases the data density by generating each module of the data area with a color selected from a color palette. Figure 6 shows the sample of HCC2D with 4 and 8 colors. The designed the HCC2D code preserving all the Function Patterns, the Format Information and the Version Information defined in the QR code .The space required by all this information is small in size no one did not reduce this space to increase the data density. Any change to such information may led to failures in the recognition process. The most important changes are gathered in the Data and Error Correction Codewords area. The most identify able difference with a QR code is that the modules may be of different colors; in a code with a palette composed by at least 4 colors each module is able to store more than one bit[12].

VI.CONCLUSION

This paper studies the HCC2D, High Capacity Colored 2-Dimensional code, a new 2D barcode technology which aims at increasing the data density and at supporting mobile applications. 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.

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