Review of a 2D embedded QRcode System

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Abstract— Nowadays, 2D barcodes have been widely used as an interface to connect potential customers and advertisement contents. However, the appearance of a conventional 2D barcode pattern is often too obtrusive for integrating into an aesthetically designed advertisement. Besides, no human readable information is provided before the barcode is successfully decoded. This paper proposes a new picture-embedding 2D barcode, called PiCode, which mitigates these two limitations by equipping a scannable 2D barcode with a picturesque appearance. PiCode is designed with careful considerations on both the perceptual quality of the embedded image and the decoding robustness of the encoded message. Comparisons with the existing beautified 2D barcodes show that PiCode achieves one of the best perceptual qualities for the embedded image, and maintains a better tradeoff between image quality and decoding robustness in various application conditions

Index Terms—*2D barcode, embedded picture, perceptual quality, decoding robustness.*

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I. INTRODUCTION[1]

NOWADAYS, two-dimensional (2D) barcodes are widely used in the advertisement business as a bridge to link the offline and online contents. In such a application, a 2D barcode encoding a product promotion web link is often attached to an advertisement to engage customers and the mobile phone with ever increasing computational power and imaging capability is employed as a 2D barcode capturing and decoding device.

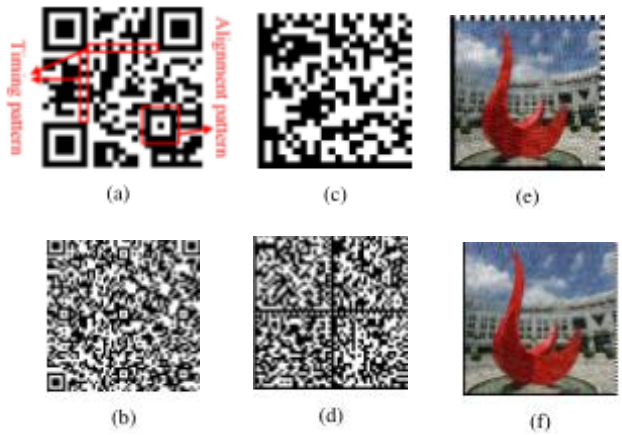

Fig 1.1.The low and high capacity versions of the conventional 2D barcode

Therefore, designing a superior picture-embedding 2D barcode for the customer engaging applications is a problem of practical significance. In this paper, a novel picture-embedding 2D barcode, called PiCode (c.f. Fig.(e)-(f)), and the corresponding decoding algorithm is proposed. The key novel aspects of the proposed PiCode system, compared with existing 2D barcode designs, are summarized as follows.

1) Major encoder enhancements for maintaining a high perceptual quality of the embedded image

a) A novel adaptive modulation1 scheme which adapts modulation energy to the local image intensity, is proposed. Compared with the binary modulation scheme in conventional 2D barcodes, the adaptive modulation reduces the image distortion introduced by the data modulation operation. b) Unlike QR code and Data Matrix code in Fig. 1 (b) and (d), in the case of high capacity versions, no fixed pattern is inserted in the interior area of a PiCode so as to avoid the obtrusive pattern which degrades the appearance of the embedded image. Since these fixed patterns help locate each module2 in the so-called module alignment process for performing demodulation. This modification imposes a challenge in the decoder implementation.

2) Major decoder enhancements for achieving high decoding robustness in the presence of image embedding

a) In the absence of fixed patterns in the interior area of a PiCode, the module alignment accuracy is sensitive to the performance of corner detection, which aims to locate the four corners of a barcode image making use of some fixed pattern in the exterior area of the barcode. We propose a coarse fine corner detection algorithm and a module alignment scheme that exploits prior information on the PiCode structure to accurately locate each module for demodulation.

b) The conventional demodulation algorithm first binarizes the barcode image and then samples the central pixel of each binarized module to obtain the demodulated bit decision. We propose a demodulation scheme that utilizes

the intensity of (almost) all pixels of each module for decision and does not involve a binarization operation. The latter is known to be sensitive to the embedded image.

Fig.1.2 Picode with embedded image

II. Literature Review

1)Homayoun Bagherinia, Roberto Manduchi,had praposed the for,University of California, Santa Cruz"A novel approach for color barcode decoding using smartphones"

The use of colors increases the information storage capacities in barcodes. Increasing the number of color stolen code information makes the decoding a challenging task due to the dependency of the surface color on the illuminant spectrum, viewing parameters, printing device and material, color fading in addition to other nuisance parameters. A popular solution is the use of a color palette of reference colors printed with barcode.

The decoding becomes more challenging if a mobile phone as a decoding device is used due to the capture of images from different distances as well as angles. In addition, the barcode images are often blurry because of incorrect focus or camera shake. We present an iterative decoding algorithm that decodes the colors of all barcode patches across the barcode by minimizing the overall observation error. Our method is able to decode colors in presence of blur using a small number of colors yet ensuring high information density.

2) Rinju Alice John and Kaamran Raahemifar Ryerson University, Toronto, Ontario, Canada had praposed the work for "designing a 2d color barcode "

The barcode technology has undergone many dramatic changes during the past few years. This is due to the increased need for encoding more data into the barcode. One of the latest developments in the barcode technology is color barcode, developed by Microsoft's High Capacity Color Barcode (HCCB). With four or eight colors, color barcodes are now used extensively in certain areas such as airports, print advertising and mobile phones compared to the 2D black and white barcodes such as Quick Response (QR) code and data matrix.

This paper provides an overview of six papers related to color barcode and later introduces an algorithm developed to encode data using binarization and grouping of bits to form a color barcode and also to decode data from color barcode.

3) Clement Creusot and Asim Munawar IBM Research Tokyo "low-computation egocentric barcode detector for the blind"

Linear barcodes are the principal labeling system for retail products. Barcode reader apps found on smartphones always assume that the localization and framing of the barcode is performed manually by a sighted human operator. This is problematic for visually-impaired people since they don't know where to position the camera to scan the barcode. To solve this problem we propose a hand-free interface to detect barcode using a wearable camera. The user rotate a query product in front of him/her and is informed when and where the barcode is visible. The challenge is to detects mall barcodes at arm's length in a video with potentially large motion blur. In this paper we propose a novel technique for barcode detection using very little computation (adapted to wearable systems), presenting very good robustness to blur and size variations, and able to run on HD video streams. The proposed system perform significantly better than the state-of-the-art methods on existing public datasets, while being much faster. A new and challenging egocentric product video dataset is also provided with this paper.

4) Aliakbar Akbari, Shiva Mirshahi, and Majid Hashemipour had praposed the work for "Comparison of RFID System and Barcode Reader for Manufacturing Processes"

Recently, automated identification system has been playing an important role in industry for different types of process and there are different ways, ex. applying Radio Frequency Identification (RFID) or barcode scanner to detect tagged items. This study is going to evaluate significant difference of RFID system and barcode scanner for the manufacturing process. The main aim is to show the efficient process which is performed by applying RFID instead of barcode system to enhance productivity and decrease idle time of workstations.

5) Amin Motahari , Member, IEEE, and Malek Adjouadi , Member, IEEE had Praposed the work for "Barcode Modulation Method for Data Transmission in Mobile Devices"

The concept of 2-D barcodes is of great relevance for use in wireless data transmission between handheld electronic devices. In a typical setup, any file on a cell phone, for example, can be transferred to a second cell phone through a series of image son the LCD which are then captured and decoded through the camera of the second cell phone. In this study, a new approach for data modulation in 2-D barcodes is introduced, and its performance is evaluated in comparison to other standard method of barcode

modulation. In this new approach, orthogonal frequency-division multiplexing (OFDM) modulation is used together with differential phase shift keying (DPSK) over adjacent frequency domain elements. A specific aim of this study is to establish a system that is proven tolerant to camera movements, picture blur, and light leakage within neighboring pixels of an LCD.

VI.CONCLUSION

This paper has designed a novel picturesque 2D bar-code, that named picode is very efficient technique for E-commerce system. Comparing with existing QR codes, it provides one of the best perceptual quality in preserving the aesthetic appearance of the embedded image, while maintains the decoding robustness.It is acheived by the desgin of barcode pattern and better decoding algorithm. The Picode is design with less obtrusive fix patterns to avoid distoration on the embedded image, and a modulation scheme which represents the data bit value adaptively with the embedded image intensity.

On the other hand, some key steps of the decoding process have also been develop to guarantee the decoding robustness including the coarse-fine corner detection, module alignment with barcode structural information and demodulation with information from all pixels in each module.

Comparision with existing beautified QR codes by experimental result shows that picode has maintain a better trade-of between the perceptual quality and the decoding robustness.

To evaluate its practicality, the picode system has been implemented in MATLAB on a PC, and as mobile application software in android and iOS platforms.

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