The Design of Color QR Code With Logo

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Abstract. Accommodate the problem of the amount of information for the general black and white two-dimensional bar code is relatively small, and the appearance is monotonous, we propose a color two-dimensional QR barcode with logo. This kind of color QR code achieve   the purpose of improving bar code to accommodate the amount of information by adding color, and solve the ordinary black and white QR code appearance monotonous problem by adding a Logo.

1.   Introduction

At present all kinds of places are covered with two-dimensional code, but it can really lure audiences take out his cell phone to scan two-dimensional code taken is very few, the most important reason is that the current two-dimensional code are made of black colors composition which is so monotonous that the visual attractiveness of produce is relatively small. Under the influence of the trend that media communication environment is developed, whether it is the two-dimensional code appearance design or the improvement of two-dimension code technology are a challenge. This paper designs a color QR code with logo, the color of QR code improve to accommodate the amount of information of the bar code , and increase the beauty of the bar code.

2.   Design Concept of Colored QR Barcode

2.1 Design principles.

Black-and-white QR code symbol character's code flow is made up of eight basic module, each module represents a binary number, so the module QR code which is made up of a binary number is the smallest unit, and the eight smallest module form a codeword unit [1]. Ordinary black and white QR code symbol characters put one bit for each module, in order to increase the amount of information of the QR code, it is easy to think of that put more hexadecimal number binary digits into the QR code symbol characters for each minimal, for example, we can use each module represents two or three binary numbers, even more, so we can make the same version of the QR code to accommodate more information, this is the color of the QR code design thought.

Here we analyze the feasibility of color QR code design, we assume that there are two code word stream, denoted as (a_2, a_1), translate the code word stream into a binary bit stream, denoted as $(b_{16}, b_{15}, \cdots b_2, b_1)$, b_{16} represents the most significant bit, b_1 represents the lowest level, each ordinary black and white QR code's module represent a binary number, in accordance with the above assumptions have shown in the following figure 1 symbol structure, it is assumed that put two binary numbers into each module of the QR code symbols,we can get the symbol structure as figure 2:

b_9	b_{10}		b_1	b_2
b_{11}	b_{12}		b_3	b_4
b_{13}	b_{14}		b_5	b_6
b_{15}	b_{16}		b_7	b_8

b_1 b_2	b_3 b_4
b_5 b_6	b_7 b_8
b_9 b_{10}	b_{11} b_{12}
b_{13} b_{14}	b_{15} b_{16}

Fig 1 Two codewords symbols
tructure of binary numbers
is placed in each module

Fig. 2 Two codewords symbols
tructure of two binary numbers
is placed in each module

By comparing Figure 1-1 and Figure 1-2, it is easy to find that a symbol character in Figure 2 contains 16 bit binary numbers in the two code words, which can achieve the purpose of increasing the information capacity of QR code. There are 2 different combinations of 4 bits in each module in Figure 2, namely 00, 01, 10, and 11. Ordinary black-and-white QR code of each module placed the light and dark representing bit 0 and 1, if a module placed 2 bit binary number, you can use 4 color represents a module in four different combinations 00, 01, 10 and 11. In this paper,we design a four-color QR code based on the principle.

2.2 The color selection.

Color selection is essential to a colored QR code since colors selected can basically determined the effect of recognizing the code, but also has a great influence on the visual effects. For improving the recognition efficiency and beauty of the color QR code, the color must be selected satisfy the following conditions: Firstly,we have selected colors with a high contrast among each other, so that during the reading process a certain color will not be mistakenly recognized as another similar color; At the seam time, selected colors should be able to be effectively read and recognized, to ensure the case that influenced byexternal factors such as light also can be identified; Thirdly, selected colors can give a fresh feeling in the visual senses.

Color QR code is identified by using the method of color image segmentation,.According to the theory of color image segmentation, the most simple and effective segmentation way are and is to directly according to the RGB color space model for image segmentation [2] .As shown in figure 3 is RGB color model figure, it can be seen that model eight vertices of black, white, red, green, blue, yellow, green, magenta, eight kinds of color is the most easy to recognize. But considering the color QR code processing of reading accuracy of equipment is highe, at the same time, if used color is more vulnerable to external factors such as light interference which caused misreading.so in this paper, based on RGB color model selection space diagram we choose black, white, red, blue four colors to design color QR code[3], each color said two binary number, in this paper,we did the following provisions: black (11), white (00), red (01), blue (10), specifically shown in the following Fig. 4.
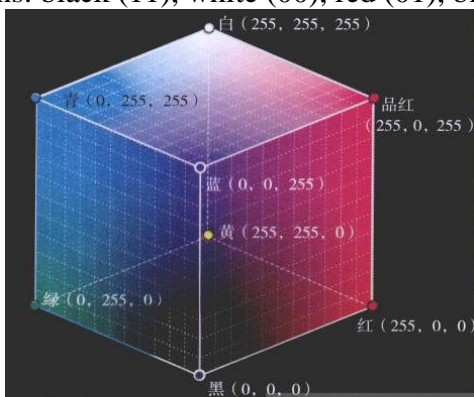

Fig. 3 RGB model space

颜色	黑	白	红	蓝
二进制表示	11	00	01	10
颜色显示	■		■	■

Fig. 4 Bit stream- color corresponding

3.   The Design Principles of color QR code

Disciplinary research ,such as: psychology, physiology, artificial intelligence and computer vision, found that if the outside appears more information, the human visual will be active for the selective information processing, to convey important information to the people of vision and perception, to abandon some of the information what is not important, the information selection process is the human visual selective attention mechanism.According to human visual selective attention mechanism, on the center area information in the visual field of the human eye high density sampling and high resolution processing, instead of the surrounding area of low density of information sampling and low resolution processing [4].In this essay, according to the principle,we place the Logo in the center area of the QR code, and surrounding areas by two-dimensional color coding coding, so as to improve the QR code image visual sense of beauty, but also improve the QR code to accommodate the amount of information.

4.   Design of color QR code with Logo

The symbol structure of the color QR code is similar to that of common black and white QR code, what added the Logo region on the basis of retaining the function pattern region and coding region of the common black and white QR code structure. . The function pattern of the color QR code is also composed of the position detecting figure, the locating figure and the correcting figure. The coding region is the peripheral part of the Logo region.

The version of Color QR code can be adjusted according to the amount of information encoded [5], but we must ensure that the area of the center Logo area larger than the surrounding the coding region,to ensure the beauty of the bar code. The following Figure 5 is the QR color code with Logo which is designed in this paper:

Fig 5 the QR color code

5.   Summary

The appearance of 2D barcode has greatly changed our life, yet the black-and-white 2D code is still of some defects. In view of the small data capacity of the black-and-white 2D code, this paper puts forward a method to design the colored QR code, and described the design principles of color QR codes from design, color selection and Logo use three, and finally a color QR codes were designed show. This design of color QR code with Barcode Logo increased the amount of information and the beauty of the bar code, has great practical value.

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