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Identify Genuinity of Product using Multiplexed Colored QR Codes

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***Abstract*:- QR code is a two-dimensional version of the barcode, typically made up of black and white pixel patterns. QR stands for "Quick Response". QR codes are capable of storing large amount of information. Colored QR are printed on products to provide detailed information about products. Consumers can scan QR to get this product information very effectively and fast. A prototype has been developed here for various image processing using an open source zXing library. Multiplexed QR codes provides higher encoding capacity than traditional QR codes increasing its performance.**

Keywords: Colored QR code, multiplexing, storage, capacity.

INTRODUCTION

Colored QR codes were introduced to increase the ease in their visibility. In order to be scanned QR codes do not have to be black and white only. Adding colors is the easiest way to make them lively and draw consumer attention. Depending on the goal or content you want to provide, with the help of customized theme, the business brand can be incorporated.

The encoded information in the colored QR code is directly proportional to log2N, Where N is number of colors used. Hence, more the number of colors used more is the encoded information. QR codes are utilized for its higher data storage capacity. QR code provides many advantages like – Reduced space, High data capacity, multilanguage support, 360 degree reading support, soil and damage durability, and many more. And because of these advantages colored QR codes have gained great popularity. Reflectivity and particular illumination source impact the performance of decoding modules, as encoded data into color QR codes are read as color pictures. Also, color interference happens between two encoding modules, which decreases decoding accuracy of color QR codes.

Multiple authors have contributed their work in enhancement of QR codes considering storage capacity and performance. Authors K. D. Gupta, M. Ahsan and S. Andrei[1], have extended storage capacity and researched on noise reduction for faster QR code performance. They have divided the data into two portions, later each is converted to QR code. Second portions are rotated 90 degrees before encoding and then placed on first so that it can form vertical, horizontal and cross shaped black modules.

Authors H. J. Galiyawala and K. H. Pandya [2], have proposed a Multiplexing with color coding to increase storage capacity of QR codes. This technique offered improvement of the data storage capacity up to 24 times that of the QR code of the same version. They have divided the data into n portions, later each is converted to QR code. To generate these n individual QR, 2n distinct encoding color are required. They multiplexed all set of n-bit to corresponding color to form a look up table for encoding.

METHODOLOGY

Different methodology are used for QR code techniques are as follows:

Encoding processes

We have used ZXing library and developed application using Java programming language. For Encoding QR, first image is been generated through core component of the library for the respective data. Depending on the size and length of the data encoding is performed. A custom written java program then reads these codes and applies the color transformation on them separately. This encoding is basically used for product genuinity identification or checking the product for fake branding. The employer will add their branding data into QR code information and that information is encoded into to form QR code. This generated QR code having their brand information is then used on the each selling products.

Multiplexing techniques

Multiplexing techniques involves occupying large information into a single QR code. To achieve this, required information is layered into different sections. Each layer consists of data with bits stored onto it. And after that each layer is placed on bottom layer, while performing some multiplexing techniques like tilting of layer at 90 degrees.

In telecommunications and computer networking, multiplexing (sometimes contracted to muxing) is a method by which multiple analog or digital signals are combined into one signal over a shared medium. The aim is to share a scarce resource.

Decoding processes

For Decoding process, the scanned QR code is decoded for getting the stored information in it. To decode a QR code, we have used core component of a ZXing library. The QR code is scanned through Android application component called as scanner. After scanning, The Encoded multiplexed data is decoded and respective information is displayed. If the displayed information has corrected authenticated brand information, it is accepted as the genuine product, if not then it is rejected and marked as a fake product. If user scans any QR code on a product, and if it is authenticated with the brand, then user will be rewarded with the loyalty and reward point.

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QR coloring

A QR code consists of black squares arranged in a square grid on a white background, which can be read by an imaging device such as a camera, and processed using Reed–Solomon error correction until the image can be appropriately interpreted. The required data is then extracted from patterns that are present in both horizontal and vertical components of the image. The different RGB colours can be applied to QR codes while they are generated. Instead of conventional black QR codes, colored QR codes attract the customers. To form the colored QR codes, different layers of the information are given different color, Each layer brings a unique color, And after completion each layer is collected to form a single colored QR code. To perform this operation core component of a ZXing library is used.

Review Table

Sr No	Title	Techniques	Future scope	Conclusion
1	Improving Performance of the multiplexed colored QR Cod	- Fast Multiplexing Technique - Color coding technique - Encoding process - Decoding process	Future utilization of the proposed technique is to integrate it into a QR scanning system to provide a colored coded QR version with the merit of much bigger capacity and better performance.	The FMT system proved to be very efficient, as it is exponentially faster than the classical MUX technique, yet, possessing the same property of multitude the capacity of the QR code. Its processing time depends, only, on the number of multiplexed QR codes. The FMT technique improved the capacity of QR code up to 24th fold, while preserving its intrinsic property of having Quick Response.
2	Increasing data storage of coloured QR code using compress, multiplexing and multilayered technique	- Multilayers - Multiplexing - Compression - Base64 Encoding/ Decoding	-	As the undertaken experiment produces a positive result and meets the objective of the research. On another hand, it is belief that storing or embedding product description for advertisement purposes would also be successful. Nevertheless, in order to fully utilize the proposed work, there is a need to study the hardware issue such as the capability of the code reader to capture the actual colour produced in the coloured QR Code. Another limitation is the lighting in the environment while reading the code. This will lead to more studies in the area of capacity improvement, security and information hiding in the QR Code.
3	A Simple and Efficient Image Pre-processing for QR Decoder	- low-complexity and practical image pre-processing algorithm - Binarization	The optimization of program codes, and embedding it into mobile terminals, and developing correlative research.	A practical image pre-processing method was proposed for QR barcode recognition. It didn't utilize the traditional methods such as edge detection and line detection, thus the influence by background noise and inhomogeneous light and geometric distortion was minimized.
4	Research on Color Matching Model for Color QR Code	- Color matching model	-	The proposed color matching model offers good performance, based upon wider color gamut and reduced aliasing, for generating color QR codes in the HSV color space. Consumers can scan the printed color QR code on product packaging with their electronic devices to obtain more exhaustive information of product effectively.
5	Robust and Fast Decoding of High-Capacity Color QR Codes for Mobile Applications	- Encoding - Decoding - Modeling chromatic distortion - Color normalization - Local Binarization	In the future, as opposed to current design where error correction is performed layer by layer, a new mechanism will be developed to share correction capacity across layers by constructing error correction codes and performing correction for all layers as a whole, by which we think the robustness of our color QR code system will be further improved.	we have proposed two methods that jointly model different types of chromatic distortion together with newly discovered chromatic distortion, cross-module color interference, for high-density color QR codes. A robust geometric transformation method is developed to address the challenge of geometric distortion
6	Color QR Code Implementation Using Image Processing	- Encoding - Decoding	Efficient methods can be adopted for QR decoding.	Using colors will increase the data rate as well as complexity in its decoding. Although, bit error rates and therefore information capacities vary across the three resulting channels, the error rates are in ranges that are readily handled by the error correction coding options available for monochrome barcodes. Efficient methods can be adopted for its decoding. We have DCT and DWT technologies in association with zing QR API from GitHub to generate QR based in QR parameter.
7	Design and Development of QR Code Recognition from Digital Image	- Tilt correction - Geometric correction - Image Normalization	-	Many algorithms have been proposed for recognizing QR Code Recognize in an image. Each method gives robust results for specified set of

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				images. I used following method of pattern extraction: image pre-processing, Tilt Correction, Geometric Correction , Image Normalization, Segmentation and localization, feature Extraction, and classification.
8	Research on multiplexed colour QR code with direct readability	- Multiplexed color QR code	Future research can focus on halftone colour QR codes and improve the applicability of colour QR codes to accelerate its technology implementation.	In this letter, we provide a novel colour QR code with multi-code composited, which combines colour coding and multiplexing technology to construct colour coding model and algorithm to generate this type of QR code, and we find its readable grayscale redundancy through optimal design. This code solves the compatibility problem of multi-code integration, breaking through the technical matter that existing colour QR codes cannot be read directly
9	Research on QR image code recognition system based on artificial intelligence algorithm	- Backpropagation neural network		Based on standard median filtering and classical adaptive median filtering, this article proposes an improved adaptive median filtering algorithm. The experimental results show that the algorithm has a good filtering and denoising effect even when the image has a high noise density. In addition, the image after filtering and denoising by this algorithm is also slightly prominent in terms of protecting details.
10	Improving Storage Capacity of QR Code: A Survey	- Encoding - Multiplexing - Decoding - Localization - Geometric correction	-	As QR Code provides the structural flexibility, it opens up the huge platform for researchers to explore the possibilities to enhance the performance of QR Code and increase storage capacity.

CONCLUSION

The proposed QR code techniques are best to their presentation. Improved performance and storage capacity for QR codes is proposed in this paper.

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