QR Code Multi-Layer Encryption System Based On Image Geometric Processing

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Abstract - *Taking advantage of the unique image characteristics of the QR code, the geometric processing method of the image is employed to hold out the ordered quadratic processing of the two-dimension code through the principle of equivalence class, and therefore the encryption effect of the two-dimension code is achieved. The special generated QR code can only be read by a specific code sweeper, but the overall reading mode cannot read the effective information of the precise content within the QR code. It's expected to be applied to precise company customer information insurance secret, solving the shared bicycle QR code vulnerabilities and commodity anti-counterfeiting and other civilian areas. It also has high application value within the field of non-civil tip transmission.*

***Key Words*: QR Code, Multi-Layer Encryption, Image Geometric Processing, Image Processing, Scanning.**

1. INTRODUCTION

QR barcode or two-dimension code (QR codes) may be a black and white pattern which is employed to record data symbol information and is distributed in plane (QR direction) by certain geometry. Using the concepts of "0" and "1" bit stream, which forms the logical basis of the interior logic of the pc, several geometric objects like binary systems are used.

Automatic information science is realized by image data input device or photoelectric scanning device. It's characteristics like high density and enormous capacity, in order that often want to represent the data. QR codes are widely utilized in many fields of social life and have become one among the foremost powerful tools to bridge reality and virtual world.

At present, the commercial design of comparable functions within the domestic market is to cover the knowledge by the way of database retrieval, that is, to hold a bit of string through the QR code. The primary level user, that is, the user side recognizes the QR code, can only recognize the string. The secondary user, that is, the enterprise end, searches the pre-established information database through the address string. The aim of encrypting the user information is achieved by using the private information of the user. This approach doesn't essentially encrypt any information. This suggests that as long the database is accessed; the private

information of all users is actually completely public. The news that several personal information has been leaked proved that there's an enormous defect within the security of this manner.

The two dimensional code processing method only applies its image feature, and therefore the process doesn't keep up the 2 dimensional code reading code work. It not only guarantees the data security, but also reduces the time cost of the encryption algorithm.

1.1 Existing System

The QR code is widely used and has low technical threshold. The knowledge within the existing QR code is essentially open and therefore the user information is leaked or may be maliciously trafficked. Due to this problem, a replacement QR code encryption system is proposed. As QR Code may be a new leaf within the world of bar codes so it's numerous aspects during which researchers can work like enhancing error correction or increasing data capacity or providing good security or better and fast recognition.

1.2 Basic Structure of QR Code

The common QR code is QR Code, QR full name Quick Response. It's a well-liked encoding method on mobile devices in recent years. It can save quite the normal Universal Product Code barcode. Information also can indicate more data types. Each code system has its own specific character set; each character occupies a particular width; it's a particular check function. At an equivalent time, it also has automatic recognition function for various rows of data, and handles the rotation change point of the graphic.

1.3 Overview of Steganography

The steganography technique might be a secret electronic transmission, while the water marking is used for the copyright protection of the electronic products. The aim of steganography is to send data secretly through hiding the existence of that data in another media. The content accustomed hide the data named cover object, while the hidden data is named stego object. The steganography may be a well-known technology that has many applications in various fields. It's the art and science of hiding secret data within the duvet object in some way that, only the intended recipient has knowledge about the key data and thus the

extraction of it at its destination. The word "steganography" comes from the Greek word "steganos" which means "covered" and "graphie" which suggests "writing", so steganography means "covered writing". The stego-image is passing through a channel to the destination point. At the receiver side, the key text is extracted from the received stego-image.

2. METHODOLOGY

The un-located region of the QR code is randomly divided into m blocks and equal area quadrilateral consistent with 2nh2n, and therefore the equivalent point of the segmented region, that is, the relative center point, is decided. Consistent with the principle of Equivalence class, The m block equi-product quadrilateral is calibrated by 2n assignment consistent with the arc distance between its position and therefore the equivalent point. Each group of quadrilateral with an equivalent value has four blocks. The equal quadrilateral position is interchanged to make a replacement image. The encryption process only applies its image features, and therefore the processing process doesn't perform QR code reading.

The algorithm detection library is employed to match the key recognition with the encryption method and retrieve the decoding mode like the encryption mode of the encrypted image. It's used to detect and distinguish the local secret key, after the key matching, the decoding mode is extracted and transmitted to the image processing unit, the image is restored so on to decode and restore the upper layer information of the QR code, and therefore the upper application data is extracted.

Fig -1: Division of 4×4 regions of Equivalence class principle

The mathematical model applied to the present principle is shown in Figure 1, and therefore the algorithm of equivalent class is applied. Within the graph, P point is that at the center, A, B, C and D occupies four squares, the equivalent one is equivalent, but the situation is different. The random selection of a group of A, B, C and D are often used to encrypt, but the camouflage image generated by different selection principle is different. The amount of scheme selections increases exponentially for every additional row of the

matrix. The amount of encryption schemes increases to 4096 when the image is split into 6 x 6 matrices. Two dimensional code, as simple two value image, split selection tends to infinity. Within the case of the utilization of empirical cracking, if the pc tries to decrypt, the computation are going to be very large. It'll be very difficult to use the pc to undertake to decrypt the image.

According to the principle of Equivalence class, the four groups of A1-A4, B1-B4, C1-C4 and D1-D4 are respectively equivalent at the image level. The differences of various user systems are selected like A1-A4, B1-B4, C1-C4and D1-D4, like A1, B3, C4 and D4 is chosen. The D4 region is employed because the reading area, which may be read out fourfold by a particular rule (usually left-handed or right-handed), and every region is rearranged within the order of reading, it's a rearranged image.

Fig -2: Extension of Equivalence class principles 6×6
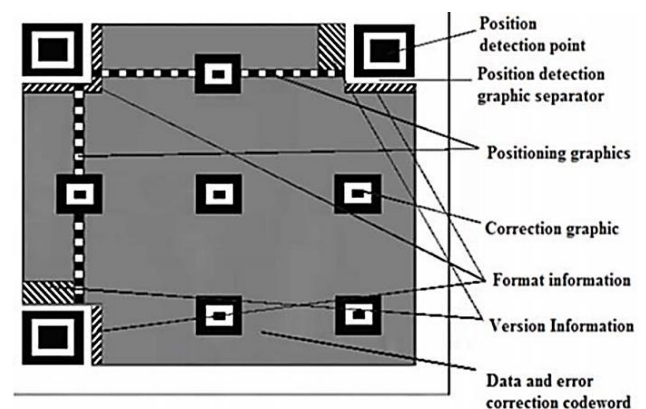
3. PROPOSED MODEL

Fig -3: QR code basic structure diagram

The multi-layer encryption are often obtained by image superposition processing, the QR code encryption information are often obtained consistent with the key matching. Consistent with the built-in secret key, the QR code images are often encrypted several times, and if it's the primary layer encryption, the region is going to be directly divided. The corresponding decoding method is employed to revive the QR code image. If it's multi-layer encryption, the

region of multi-layer disorder is delineated. Consistent with the corresponding decoding mode, the local disorder is firstly restored, and then the general recovery is administered.

The corresponding encryption algorithm is retrieved within the encryption algorithm library, and therefore the local physical information is input to get the key, which is matched and retrieved by the decoding device. Consistent with the encryption algorithm, the region of disorder is calculated and therefore the mode of disorder is decided. The QR code image is rearranged in reverse order, and the carrying information is read in the normal way.

In the actual application process, the two-dimensional code encryption system is split into two parts: the generating end and identifying end. The generating end is liable for masquerading and encrypting the two-dimensional code that needs to transmit information, and the identifying end is responsible for restoring the two-dimensional code image consistent with the previously set secret key, and parsing the encrypted two dimensional codes. So as to finish the above functions, it's necessary to determine an algorithm database beforehand, allocate corresponding keys to users of various terminals, and complete decoding by system key matching.

Fig -4: QR code basic structure diagram

Fig -5: Decrypted QR code

4. CONCLUSIONS

The implementation of a special QR code encryption algorithm supported national standard code system. A replacement idea, combining image geometric processing

with QR code information encryption which is novel and practical, and features a profound influence and high practical value.

The encryption level of the algorithm is often changed flexibly consistent with the user's own requirements. The essential function is that only a selected scanning reading system can read the valid information within the camouflage two-dimension code, and therefore the conventional reading system can only obtain the disguised camouflage information. The algorithm is ingenious, rich in variation and satisfies the range and non-repeatability of encryption methods to the best extent. It belongs to the secondary processing supporting the QR code technology and may be further developed with the event of the QR code technology. Good ability to resist elimination and adapt to market.

At the appliance level, the key is allocated to different users through the built-in closed algorithm library, and therefore secret key is not shared among the various users within the system. The algorithm diversity and therefore the uniqueness of the interface are guaranteed while preventing the information leakage between users.

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