Topic : QR code

Môn học : Introduction to computing(CSI104)

Giảng viên : Thầy TruongLV2

Student group: SE1637

Team1:

1.Nguyễn Đình Thành

2.Nguyễn Lê Hồng Nhi

3.Nguyễn Mạnh Lực

4.Bùi Quốc Khánh

5.Phạm Tuấn Anh

6 .Nguyễn Hoàng Anh Tuấn

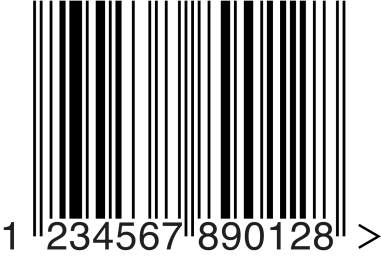
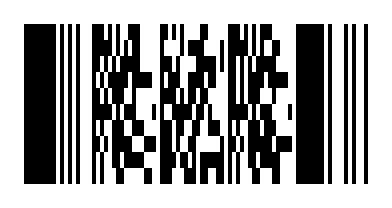
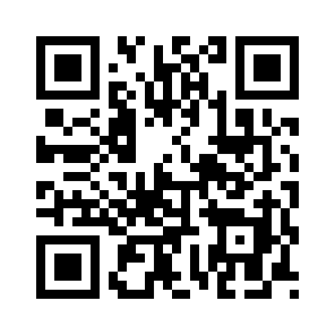
I.Introduction :

1. What is QR code?

QR code is a matrix code or "two-dimensional code" developed by Denso Wave (Japan) in 1994. QR is an acronym for Quick Response (roughly translated "Quick Response Code") ). This is a matrix of barcodes that can be read by a barcode reader or by a smartphone (smartphone) that has an image capture function with a specialized application for scanning barcodes. The QR code consists of black modules arranged randomly in a square with a white background. This combination of modules encodes any online data including: links to websites, images, information, product details, advertisements for products, etc.

2. Development history:

QRcode's stub is "Barcode" a type of barcode invented in 1973 and widely used in many areas of the world.Barcode boomed and developed quite strongly until now due to its reading speed and accuracy. However, with limitations in many aspects, especially in terms of the amount of information that Barcode can store (only about 20 numbers or digits), 2-D codes have been was born to solve those problems.

2D code (Matrix type)

2D Code with stacked bar codes

Barcode

2D (Two-Dimensional) codes are originally actually stacked Barcodes (stacked Barcodes) and then evolved into various 2D codes with matrix method to store more information. There are many types of codes that are popular today in the fields of scientific technology such as PDF417, DataMatrix, Maxi code, ... but the most common is QR code.

The QR code system was invented in 1994 by Denso Wase. Its main purpose is to track vehicles during production, it is designed to allow high-speed scanning of parts. Although the initial applications were only for tracking vehicle parts, QR codes are now used in a variety of contexts including commercial tracking applications and convenience-oriented applications. for mobile phone users QR codes can be used to display text to the user, the time of an event, to add a vCard to the user's device, to open a URI, to write an E-Mail or message. even geolocation information .Users can generate and print their own QR code for others to scan and use to visit one of the paid and free sites via QR code .It is now becoming one of the most used styles in the two-dimensional bar code group.

II. Key features of QR codes:

1. Important features:

-QR code can store information containing several tens to several thousand characters and digits much superior to traditional Barcode which can only store about 2o characters. Up to 7,089 characters can be encoded in a single .



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-QR code is capable of handling a variety of complex data, such as alphanumeric characters, Kanji, Hiragana, Khmer characters, Chinese characters, Hebrew characters, ....... binary code symbols and control codes.

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QR code's data storage capacity:

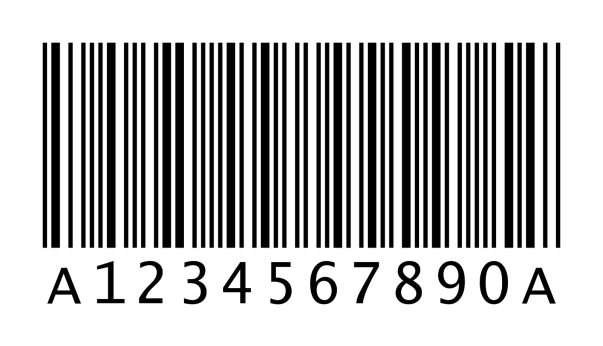
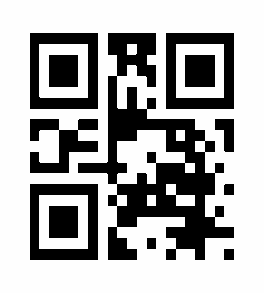
-Pure numbers: Up to 7,089 characters

-Numbers and letters: Up to 4,296 characters

-Binary number (8bit): Up to 2,953 bytes

-Kanji/Kana: up to 1,817 characters.

- Compact size is more convenient than BarCode: Because QR Code carries information both horizontally and vertically, QR Code is capable of encoding the same amount of data in about a tenth of the size of BarCode. QR code also has the form of Micro QR code (Micro QRcode) with very small and convenient size.

-Another outstanding feature of QR codes is that when our code is dirty, slightly damaged, we can still read the data. Because each QR code will have a certain error correction level (using the algorithm). Read-solomon error correction algorithm) to ensure that data is not lost, the higher this level, the less information contained on the QR code. From there, users can customize and edit their QR codes for many different purposes.

\* Troubleshooting capabilities:

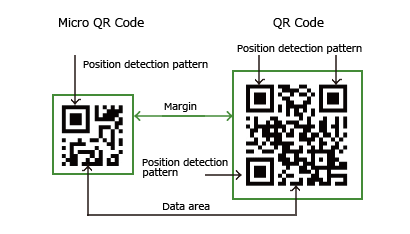
- Level L: 7% of codewords can be recovered.

\_Level M: 15% of the codewords can be recovered.

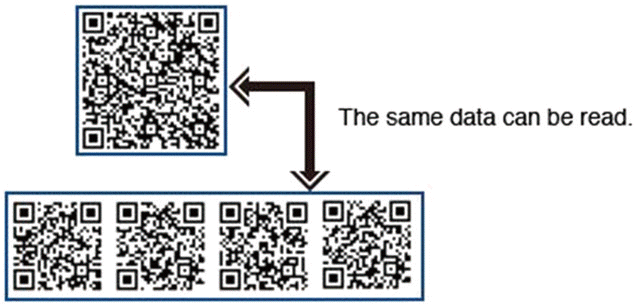
-Q level: 25% of the codewords can be recovered

-Level H: 30% of the codewords can be recovered

-No matter where it is located, whether it is upside-down - forward - horizontal - vertical, reading the code is still very easy without having to rotate the reading device or code to the correct format. This ability is mainly due to the structure of the QR code with positioning patterns, so the QR code can be read at 360 degrees.



-Structured Append: This feature allows a QR code to be divided into multiple data areas. Conversely, information stored in multiple QR code symbols can be reconstructed as single data symbols.



- In addition, QR code has also been developed into many types with many separate applications being used in many fields through specific features such as Micro QR code, IQR Code, SQR code, Frame QR,.... .

2. Limitations:

Besides the extremely useful features QR codes also have a few very small limitations as follows:

-Must have a QR code reader or smartphone with QR code scanning software.

-The level of popularity in practice is much lower than Barcode, on the other hand, businesses, organizations and individuals are quite satisfied with Barcode, so they will not be ready to spend money on reading devices QR code.

III. How to generate QR code:

1. Basic steps in QR code generation algorithm:

Step 1: Data Analysis:

-The QR standard has four text encoding modes: numeric, alphanumeric, binary, and Kanji. Each mode encodes text as a binary string (1 and 0), but uses a different method. to convert the text to a binary string , and each encryption method is optimized to encode the data with the shortest possible string . Therefore , our first step is to perform the product of the data to determine . see if our text can be encoded in numeric , alphanumeric , binary or kanji mode , then choose the optimal mode for our text .

Step 2: Data Encoding.

-Now that we have selected the cooperative encryption mode for our text, the next step is the cipher text. The result of this step is a bit string divided into words whose data length is 8 bits.

Step3:Error Correction Coding:

-The QR code uses the Reed-Solomon error corrector. This means that after we create a binary string of data representing our text, we must use these strings to generate the error correction code. using a process called Read-Solomon error correction.

-The QR scanner reads both the data code and the error correction encoding word. By comparing the two, the scanner can determine if it reads the data correctly, and it can correct the error if it reads the data. incorrect .

Step 4: Structure Final Message.

-The encryption and error correction data generated in the previous steps must be arranged in the appropriate order. For large QR codes, error correction data and codes are generated in blocks and these blocks must be interleaved according to the QR code specifications.

Step 5:Module Placement in Matrix:

After generating the data codes and error correction codes and arranging them in the correct order, we have to place the bits in the QR code matrix. The codewords are arranged in the matrix specifically. In this step, we will also place patterns for all QR codes, such as the boxes in the three corners.

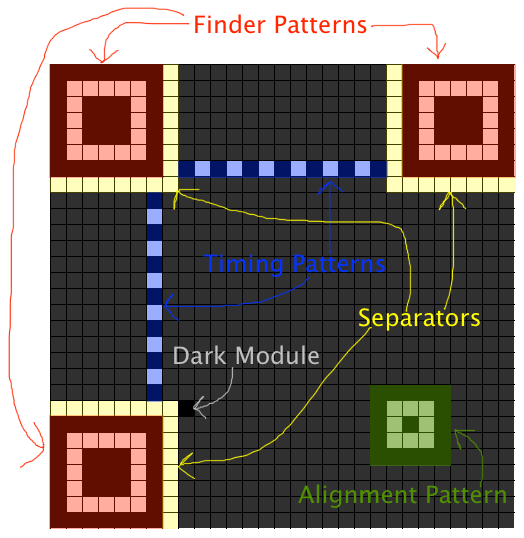
\*Finder patterns(FP): Are the three blocks in the corners of the QR code at the top left, top right, and bottom left.

\*Separators: are spaces next to FPT.

\*Alignment patterns: Similar to FPs, but smaller and transparent.

\*Timing patterns: are the dotted lines connecting the FP.

\* Dark module: are the black modules.



Step 6: Data Masking .

Some patterns in the QR code matrix can make it difficult for the QR code scanner to read the code correctly. To combat this, the QR Code Specification has defined 8 mask patterns, each of which will change the QR code according to a particular pattern. We have to determine which of the mask patterns. We have to define which pattern in This number of mask patterns will result in a QR code with few unwanted features. This is done by evaluating each masked matrix based on four penalty rules. Your final QR code must use the mask pattern that results in the lowest penalty score.

Step 7: Format and Version Information.

The final step is to add formatting and version information to the QR code by adding pixels in particular areas of the code that were left blank in the previous steps. The format pixels determine the level of error correction and mask pattern used in this QR code.

IV. Advantages and Disadvantages:

\*\*Advantages:

• Easy to craft. All you really need is a free QR code generator, and there are plenty of them floating around the Internet.

• Cost-effective. Since most QR code generators are free, the actual code generation is inexpensive. The cost of printing materials can also be relatively low, as they can be used on business cards or stickers. Stores can print their QR codes in the ads they've invested money in.

• Anyone can generate a QR code.

• Save paper. People can scan QR codes to do things like enter contact information or store coupons on mobile phones. Instead of having to carry paper coupons, people can scan QR coupons and have it available in their phones. No specialized equipment is required, just a smartphone can be used to scan QR codes.

• Transfer information very quickly. Since the advent of DSL Internet and now the 4G network for mobile phones, people are used to receiving information very quickly. Massive amount of stored information and extremely diverse information, from text, images, videos, to WiFi access, etc.

• Relatively small size. This makes the code great to place on business cards, in a corner of an advertisement, somewhere on a coupon or anywhere.

- There is a little bit of space. These codes can be made much smaller than the information they contain. So instead of putting a long, ugly URL, on an ad or resume, just put a small QR code.

\*\*Disavantages:

-When scanning the qr code, it can only be read when there is a network

-Difficulty for first-timers, especially for the elderly or those who have not been exposed to the Internet much.

-Not yet popular because Qr code is only available in big and modern cities, but in rural areas, it's almost impossible for us to come across many.

-To be able to scan a QR code, it is necessary to ensure two conditions, one is to have a network connection, the other is to capture the entire image of the code, so where to place the QR code is very important.

-If you place the code in places where 3G or wifi is poor, such as on banners in the basement, around high-rise buildings, etc., it will make it difficult for users to scan the qr code.

• Anyone can generate a QR code So it's easy to get scammed

•Security issues. Transferring data between two devices can always lead to security issues. Also, before scanning codes, the scanner never really knows where the codes will lead them.

V. Application:

1, Search for the necessary applications.

-Suppose you buy a certain technology device such as a drone or a smart watch and need to install a corresponding software for it, you will find it difficult to find the right one. application to install for your device.

-However, in many manuals that come with this device, the manufacturer has printed QR codes to help you find the application you need right away. This method both saves time and gives the most accurate results.

2. Help you buy things:

-On many online sales sites today, in the display information about the product, along with the traditional information and the user rating scale, you will see a QR code displayed next to it.

-Accordingly, you just need to use this QR code scanning application, and you will immediately be provided with the most specific and rich information about the product to buy.

3. Grant wifi access to guests:

-In case you want to share your private wifi network with other people coming to your home, your router may have pre-printed a QR code right at the bottom.

-In case you don't have one, you can consider creating a QR code containing the SSID information of your home wifi network (simply the name of your Wifi network), password and other necessary information.

4. Marketing at offline touchpoints:

-No need to go to the website to look for genuine sales channels, users only need to scan the QR code placed at public places such as bus stations, outdoor billboards, ads in elevators, etc. to get direct navigation. Go to your online store or purchase website. Marketers can place an attractive billboard about the new product of the business, with a QR Code for customers who are interested in learning and buying immediately to optimize the order conversion rate.

5. QR Code in Marketing on product packaging:

-Product packaging is an interesting touch point that few businesses have really paid attention to. Especially, for businesses that produce and distribute mainly through agents, packaging seems to become the only touch point for consumers. Attaching a QR code on product packaging can bring many unexpected advantages to businesses because of its novelty and convenience. Consumers will ask themselves what awaits them behind this code, which is a decisive factor for successful packaging marketing.

VI.Reference:

https://vi.wikipedia.org/wiki/M%C3%A3\_QR