A Review on QR Code

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Aayushi Mishra
M.Tech Scholar
Dept. of Computer Science
MACERC, Jaipur

Manish Mathuria
Assistant Professor
Dept. of Computer Science
MACERC, Jaipur

ABSTRACT

A QR Code (abbreviated from Quick Response code) is a two-dimensional (2-D) matrix barcode which is the latest variety of barcode in two dimensional form (both the horizontal and vertical direction) being invented by the Japanese corporation Denso Wave and was designed to track the parts of the vehicles during their manufacturing for the automotive industry. It has a very huge information storage facility in comparison with the conventional barcode.

The use of QR code is more captivating than that of the traditional barcodes because of their extendibility and diversity being offered by them. As compared to the conventional barcode, the QR code can hold or signify the same amount of data being symbolized by the barcode in around one tenth of the space of barcode.

Keywords

QR (Quick Response) Code, Traditional Barcode, 2D matrix barcode

1. INTRODUCTION

A Barcode is an optical explanation of evaluating the information generated by the two-dimensional arrangement of parallel black and white lines [2].

There are many varieties of barcode that exist for a wide area of applications:

- **One-Dimensional (1D) Barcode :**

One-dimensional (1D) barcodes, specifically corresponds to the information by altering the width & the spacing of the parallel black and white lines, and this can be described as the linear or one-dimensional barcode[5]. These consist of a few of the classic, and most well identified types of the barcode like the UPC (Universal Product Code) and EAN (International Article Number or European Article Number) code.

- **Two-Dimensional (2D) Barcode :**
Two-dimensional (2D) barcodes, specifically symbolizes the data by the usage of the two-dimensional symbols and shapes. They are analogous to the linear 1D barcodes, though they depict more information per unit area[6]. These comprise of a few of the newer types of barcode like the QR(Quick Response) Code and PDF417 code.

2. QR CODE

A QR (Quick Response) code is the identification name for the 2D barcode system. It make the usage of the four standardized forms of encoding (numeric, alphanumeric, byte / binary, and kanji) to effectively store the information[1].

A QR Code imparts the following characteristics in comparison with the traditional barcodes[3]:

- **High Capacity Encoding of Data**
Though traditional barcodes are capable of gathering an utmost of approximately 20 digits, the QR Code is capable of managing quite a few dozen to more than hundred times more information & data. It manages all forms of the information, for instance numeric and alphabetic characters, binary, Kana, Hiragana, Kanji, symbols and control codes[7]. Around 7,089 characters can be concealed in a particular symbol.

Table1: QR Code Data Capacity

Numeric only	Max. 7,089 characters
Alphanumeric	Max. 4,296 characters
Binary (8 bits)	Max. 2,953 bytes
Kanji, full-width Kana	Max. 1,817 characters

- **Kanji and Kana Capability**
A QR Code is capable of concealing JIS (Japanese Industrial Standard) Level 1 & Level 2 kanji characters[7]. With the QR code, one Kana or Kanji character is conveniently concealed in 13 bits, permitting it to possess more than 20% of the information than the alternative 2D symbology.

- **Dirt and Damage Resistant**
A QR Code has an error correction ability that is the data can be fixed up even if the symbol is dirty or destructed to some extent[10]. A maximum of 30% of the symbol words can be fixed up.

Table 2: QR Error correction levels

Error level	Symbolic constant	Error correction capacity
L	QRCapacity::ErrL	5%
M	QRCapacity::ErrM	15%
Q	QRCapacity::ErrQ	25%
H	QRCapacity::ErrH	30%

- **Readable from any direction in 360°**
A QR Code is competent of Omni-directional reading. It achieves this job by means of the position detection patterns positioned at three corners of the QR code symbol. These patterns ensure constant high speed reading, preventing the unfavourable causes of the background intrusion.

- **Structured Append Feature**

A QR Code can be categorized into several data section. On the contrary, data collected in many QR Code can be reformed as a particular data symbol[10]. A single data symbol can be categorized into 16 symbols, permitting printing in a thin section.

3. STRUCTURE OF QR CODE

QR code consist of the function patterns. These are the shapes which must be positioned in the particular areas of the QR code to make sure that the QR code scanners scan correctly to recognize and adjust the code for deciphering.

- **Quiet Zone**

This is an area 4X broad that is free of all other naming, enclosing the symbol on all four surfaces. The X referenced over indicates to the width of the dark module.

- **Finder pattern**

These are the patterns which appear at the top left, top right, and bottom left in the corners of the QR code and they are the same as each other. The core purpose of this pattern is to precisely describe the position and rotational orientation of the symbol.

- **Timing pattern**

The Finder patterns are being connected by the dotted lines called the timing patterns. In this pattern, to find out the coordinates, white and black modules are organized alternatively.
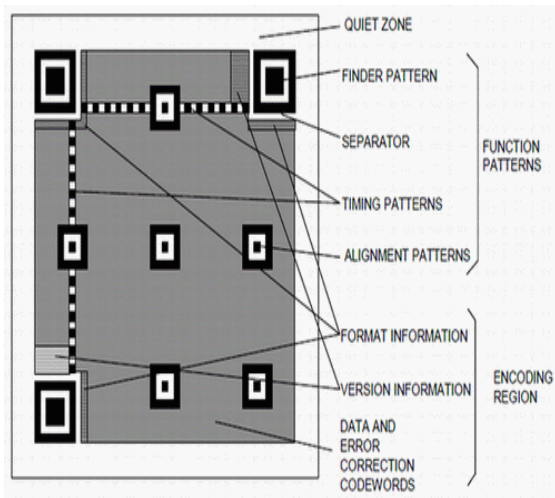

Figure 1: Structure of QR Code

- **Separator :**

These are the sections of whitespace alongside the finder patterns. It comprises of one-module width of the light modules & is positioned between the encoding region and each of the finder patterns. Its core functionality is to separate both of them[8].

- **Alignment pattern**

These are analogous to the finder patterns, on the contrary they are smaller in size. Its position is dependent on the version of the QR code. Due to the movement of modules because of the alteration then this pattern is used for the recognition of the position.

- **Data and error correction codeword :**

Data and Error correction codes are stored in 8 bit parts (called code words) in the data section & in the error correction section respectively.

- **Format information :**

This comprises of 15 bits alongside the separators & it stores the information regarding error rectification level and the selected masking pattern of the QR Code.

- **Version information :**

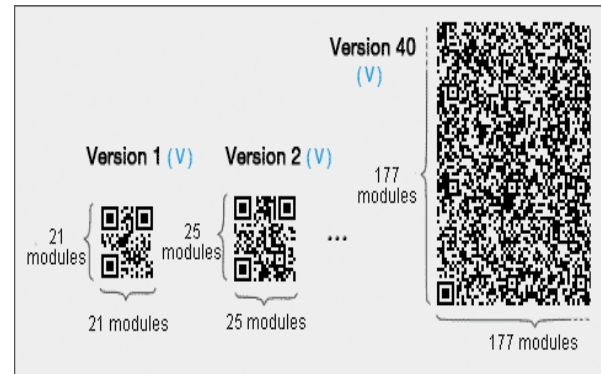QR Code symbols has version 1 to version 40[4].

Figure 2: Version of QR Code

4. TYPES OF QR CODE

The QR Code is categorized into five categories which are as follows[9]:

i. QR Code Model 1 & Model 2 :

As per the AIMI standard, the QR Code Model 1 & Model 2 imparts two alternative on the structure of a QR Code.

The Model 1 is the prototype of the Model 2. It supports up to 14 versions of dimension like 21 * 21 or 25 * 25. Because of the alignment pattern being carried by the Model 2 for the better position alteration which makes it possible for its larger information capacity in comparison to the Model 1. Model 2 supports 1 to 40 versions.

ii. Micro QR Code :

A Micro QR Code has just a single position detection pattern that reduces the size of the QR code. Because of its reduced size, this can be utilized where the area for the barcode is strictly restricted.

iii. iQR Code :

It is a matrix-type 2D code permitting a wide size area of codes than the conventional QR Code and Micro QR Code which can gather more information.

iv. SQRC :

SQRC abbreviated as Secured Quick Response Code & is developed to safeguard the secret and the confidential information from the device which scans the QR Code.

v. Frame QR :

This is a recently developed 2D code & it has blank "canvas area" to hold the design and data.

5. QR CODE V/S BAR CODE

Features	QR Code	Barcode
Capacity	These are 2D codes, capable of holding data & information horizontally and vertically up to 7100 characters.	These are 1D numeric codes capable of holding data up to 20 characters.
Arena of data storage	It store the same amount of data as the barcode, although in only 1/10 of the space the barcode requires.	They store the amount of data and information in more space.
Data restoration	Even if the QR code is damaged, it can restore the data & recover about 30 to 35% of the destructed data.	If the barcodes are damaged, it cannot recover the damaged data & even cannot be scanned.
Speed and precision	Because of the function patterns on the QR codes they can be read with the high speed and precision.	When the barcodes are scanned , the position has to be in ideal position for scanning the code, otherwise it will not scan the code and will slow down the speed.

Figure 3: QR Code v/s Barcode

6. CONCLUSION

This paper presents the blueprint regarding the QR Code. It explain what exactly is the QR code, its structure, the different types of QR Code, how QR code is different from the barcode and its size effectiveness, ease of reading and identifiable format has made it a clear preference for the barcode format.

7. REFERENCES

[1] QR Code features. Denso-Wave. Archived from the original on 2012-09-15. Retrieved 3 October 2011.

[2] Sharu Goel, Ajay Kumar Singh. QR Code Implementation in Photo I-Card for Photo and Text Credentials using .NET. International Journal of Computer Applications (0975 – 8887).

[3] Prof. Sandeep Ponde, Dr. Anand Muley, Dr. R. A. Mankar. QR code and its application in business. NCRD Technical review: e- journal Volume 2, Issue 2. ISSN: 2455-166X.

[4] Kinjal H. Pandya, Hiren J. Galiyawala. A Survey on QR Codes: in context of Research and Application. International Journal of Emerging Technology and Advanced Engineering (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 4, Issue 3, March 2014).

[5] Garcia- Betances , Monica K. Huerta. A review of automatic patient identification options for public health care centers with restricted budgets. Vol. 4, Issue 1, pp. 1-17, 2012.

[6] Jerry Gao, Vijay Kulkarni , Himanshu Ranavat, Lee Chang San Jose State university San Josa, USA. A 2D Barcode based Mobile payment system. pp. 1-10.

[7] Xiaofei Feng, Herong Zheng. Design and Realization of 2D Color Barcode with High Compression Ratio. International Conference On Computer Design And Appliations, Vol. 1, 2010.

[8] Sharu Goel, Ajay Kumar Singh. A Secure and Optimal QR Code. International Journal Of Engineering Research & Management Technology. September- 2014 Volume 1, Issue-5.

[9] Anjali Singh, Dr. Parvinder Singh. A review: QR codes and its image pre-processing method. International Journal of Science, Engineering and Technology Research (IJSETR) Volume 5, Issue 6, June 2016. ISSN: 2278 – 7798.

[10] Abhijeet Booba, Ajinkya Shindeb, Dhiraj Rathodc, Amruta Gaikwad. Qr Code Based Mobile App and Business Process Integration. International Journal of Multidisciplinary and Current Research. Vol.2 (Sept/Oct 2014 issue).