QR codes are the upgraded versions of barcodes, they can hold and transfer much more information. The QR stands for quick response, because of the information's ease of access through the lens of a smartphone. Thus, they are plastered in an assortment of visible surfaces, such as business cards, posters to sign up or reserve an activity, or restaurant tables to access their menus, becoming used frequently now more than ever, due to the pandemic. Scanning and entering a QR code's link can lead to anywhere on the internet, giving this access point another reason for its popularity.

A QR code is a type of Matrix barcode, also known as a 2D code. Matrix barcodes are codes made of black and white cells and are most commonly found in a square pattern. As these codes hold more information, the number of rows and columns of the black and white cells grows. Several unique patterns help a scanner determine each cell location, which then leads to the decoding of the code.

QR Code Origins

QR codes were created due to the expanding commodity market in Japan in the 1960s, where a cashier would have to manually input the price of the product. Eventually, this led to the creation of the Point of Sales system, which involved the barcodes seen in today's markets, to alleviate the cashiers' large workload. The idea of barcodes was pushed even further, where DENSO WAVE and the lead developer Masahiro Hara announced QR codes in 1994. They held even more information than a barcode and could be used to relay information at a faster pace. In 2000,

the International Organization for Standardization added QR codes to global standards, pushing QR codes to be used in daily life.

QR Code Structure

A QR code is composed of 7 different parts that work in conjunction to provide data to the scanner. The first and most notable part of the QR code are the position detection markers, which are located at three corners of every code, and allows the scanner to recognize it is a QR code and the orientation in which the code should be scanned.

Assisting in the orientation of the QR code are alignment markings, which are smaller position detection markers found throughout the code. This helps the QR code straighten itself if found on a curved surface. The more information stored in a QR code, the more alignment markings it will need. Timing patterns alternate between black and white cells, they help the scanner know how large the data matrix is.

Version information is found in varying patterns and helps the scanner know what QR code version is being scanned, as there are 40 versions available. Format information is also found in varying line formations, giving information about the error tolerance and data mask pattern; fewer mistakes are made while scanning.

All the data is then contained in the data and error correction keys. The error-correcting mechanism is in the same area as the data, where the error correction blocks allow up to 30% of the code to be damaged. This way, the data being conveyed is safe even after minimal damage.

Lastly, The quiet zone is found outside of all these components, where there is only white space. This allows scanning programs to find the QR code even in noisy environments. Noisy environments refer to the visual environment surrounding a QR code. For instance, if a QR code were surrounded by drawings or stickers, which makes it difficult to spot the QR code, the quiet zone separates the data that needs to be scanned from this "noise". The QR code then remains scannable and the information can still be transferred.

Creating QR Codes

QR codes can be generated simply or become automatically generated available through an app or online. It can be paid for or free, with the paid versions having more features, such as customization and data analytics attached to the code. There are two types of QR codes: static and dynamic. Static codes contain information that can not be edited once created. On the other hand, dynamic codes allow information to be changed constantly to fit the code's needs. Thus, QR codes continue to be future-proof, being one of the main methods of providing quick information to scanners.

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