

# QR Codes

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## Application Note

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This application note is a reference on how to generate and use QR codes. This document explains how QR codes are made and several common applications in which they may be found and recommends many new uses for using QR codes to ensure successful relevance when using.

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## Introduction

The introduction of the common bar code, found on virtually all retail items today, has undoubtedly made life easier for businesses as well as the consumer. They address the following categories: speed, accuracy, and functionality. However, there is one downfall to today's version of the barcode. It almost always relies on a database to store the key information of the product being scanned<sup>2</sup>. The barcode only acts as the intermediate, eliminating the user from having to manually type in information. This application works well when access to a database is handy and on-site, such as a grocery store. Limits become apparent however, when applying to different applications. Like all technology today, there is always a desire to obtain and store *more* information. QR Codes have addressed this issue by offering the same functionality and ease-of-use as the typical barcode but offering over 300 times the storage. Capacity is notably the key feature of QR codes but without accessibility, the technology is useless. QR Codes initially became popular in Japan<sup>1</sup> often found on billboards, magazine ads, and food labels. In fact, the QR Code on the cover page of this document leads to the ECE480, Team 2's website. The United States' smartphone market and wireless service provider's network speeds have greatly evolved recently. With access to a camera equipped smartphone comes access to a QR Code scanner. Now, additional equipment for use does not need to be distributed and the user-base may increase exponentially. With larger capacity coupled with large accessibility, QR Codes' uses and applications will continue to expand.

## Technology

QR Codes offer a large amount of advantages that make their applications limitless. Specifically, a QR code is a two dimensional barcode that stores data both vertically and horizontally<sup>3</sup> as shown in Figure 1. A typical bar code can store a maximum of 20 digits<sup>3</sup>. Today's QR Codes can store up to 7,089 characters<sup>3</sup>. In addition to high capacity, the codes may be printed in very small sizes and their area consumes much less than a conventional barcode while holding several times the amount of data.

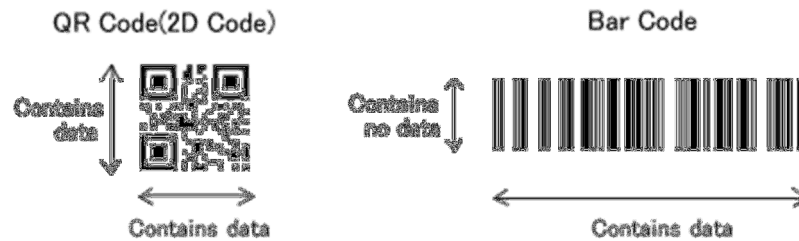


Figure 1: Illustration of Increased Capacity

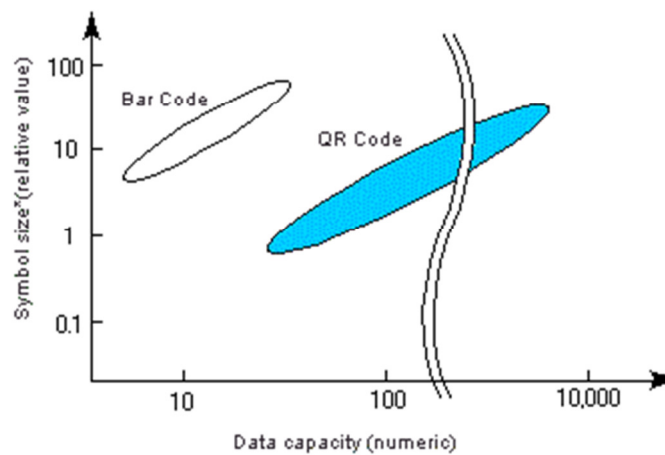


Figure 2: Illustration of Potential Size Comparison

In parallel to the physical advantages of QR Codes, these codes offer error correction capability. If a code happens to become ripped or dirty, a mathematical error method may be implemented, in the same manner that music CDs deal with error correction. Finally, QR Codes are readable by their scanners from  $180^\circ$  on a flat surface<sup>3</sup>. All of the mentioned features enhance the usability of QR Codes and will continue to make their applications endless.

## Implementation

In order to use conventional barcodes, specialized software must be used to generate the barcode and correlate the code to a database. With QR Codes, however, the actual data is stored within the image code so the need for a database is eliminated. Secondly, QR codes may be generated for free online. Websites such as Kaywa QR-Code, found through a web search, along with hundreds of other websites allow users to generate QR Codes for free. A variety of options may be selected for the type of data in which the code contains such as a URL, a text message, a phone number, or simply customized text. Specialized, pricey software is now eliminated, too. After the desired codes are generated, a reading device needs to be established. As mentioned, with the expansion of the smartphone market today, users may now use their mobile, camera-equipped devices, as the QR Reader. Several smartphones come with the software preinstalled. If not, free applications are available through the respective devices' application store. For example, iPhone users may download an app called RedLaser. After launching the app, the user simply points the camera at a QR Code and the end result is displayed. Taking action with the result requires the user's permission<sup>1</sup> illustrated in Figure 3. It is very easy to create QR Codes and use them as desired. The main components are a laptop to generate the code and a smartphone to read and execute the code.



Figure 3: RedLaser Demonstration on iPhone

## Application

As previously mentioned, the applications of QR Codes are virtually limitless. The most mainstream application so far has been marketing and advertising. Process control in warehouses and retail stockrooms has also been implemented. People have gone as far as adding them to business cards. Perhaps one of the most interesting applications is giving location information within or around buildings. These applications are all discussed below.

## Marketing

While QR Codes initially started in Japan, their most typical use was on billboards and magazine ads. As seen in Figure 4, an advertisement billboard for Calvin Klein Jeans is displayed stating the words, “Get It Uncensored.” The main object in the picture is not a model wearing the company’s products, nor even the companies name or logo. It is the QR Code. Although this is a dramatic example, it undoubtedly will spark viewer’s interest to see more. All they have to do is scan the code with their smartphone to launch the URL.



Figure 4: Billboard Ad for Calvin Klein Jeans



Figure 5: Magazine Ad QR Code

Magazines followed a similar trend, offering more, even exclusive, information by pointing a reader's smartphone to the QR code on the page<sup>4</sup>. This will lead the reader to the website and potentially lead to product sales.

## Process Control

A common application in the automotive industry is to place QR codes on shipping slips. In this manner, receipts may be distributed with customer data, shipping data, product numbers, and quantity. This can dramatically increase process control efficiency by eliminating the need for a database to store all this information, as a barcode would do<sup>3</sup>.

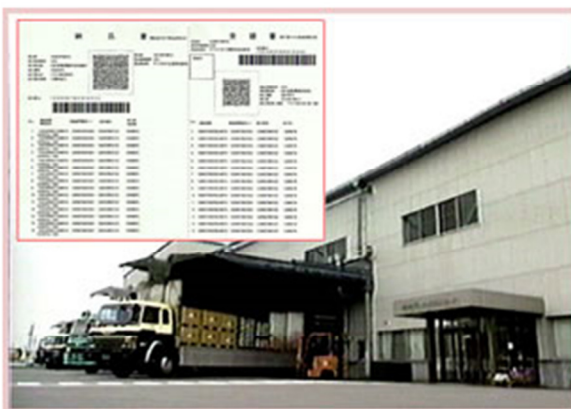


Figure 6: Product Scanning for Auto Parts

## Business Cards

A company entitled Raised Connections has taken all the benefits of QR Codes and applied them to the business world. By imprinting a QR Code on a business card, a user may quickly scan the card and automatically add the contact information to the address book of a smartphone. This eliminates the need to keep track of dozens of small paper cards. In this manner, information such as name, phone number, fax, email, and company website can all be seamlessly stored<sup>4</sup>.



Figure 7: Connection Card by Raised Connections

## Site Information

One of the most interesting methods of applying QR Codes to everyday life is using them in or around public buildings to supply information about an item or location. In England, Bath University put QR Codes inside of checked out books which contained due date information and the phone number to renew the check out<sup>1</sup>. In addition, codes were placed outside labs giving data on the research or work being conducted. Codes were also placed on instruments inside of labs linking to user manuals and calibration dates. The possibilities are again nearly endless.



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