**A Project Report**

**on**

**Barcode/QR Code Reader**

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**CERTIFICATE**

Certified that **Aayush Singh, Abhinav Kishore & Ankit Kumar** has carried out the Project work presented in this project entitled **“****Barcode/QR code Reader”** for the award of **Bachelor of Technology** from Dr. A.P.J. Abdul Kalam Technical University, Uttar Pradesh, Lucknow under my supervision. The Project embodies the result of original work and studies carried out by the students themselves and the contents of the Project do not form the basis for the award of any other degree to the candidate or to anybody else.

**Dr. VRINDA SACHDEVA** **DR. ASHISH KUMAR**

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**ABSTRACT:**

* This project provides a clear concept about the working of QR and Barcode scanners.
* It serves as both QR code scanner and Barcode scanner.
* The rapid increment of daily usage of scanners made us think about building our own scanner and thus this project.
* QR and Barcode are a big commercial tool and people need to know more about it.
* Project includes work in the Python programming language completely.
* This program can be used to scan any sort of QR or Barcode.

**ACKNOWLEDGEMENT**

It gives us a great sense of pleasure to present the Report of the Project “**Barcode/QR code Reader**” undertaken during B. Tech 2nd Year. First and foremost, we wish to thank our Guide Prof. **DR. VIRNDA SACHDEVA,**

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We also do not like to miss the opportunity to acknowledge the contribution of all faculty members of the Department for their kind assistance and cooperation during the development of our project.

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**INTRODUCTION**

**QR CODE:**

A QR code simply consists of a black square and dots (yeah). That, essentially, is what a QR code looks like. The pattern on QR codes can be alphanumeric, numeric or binary.

QR codes stand for Quick-response codes, which are two-dimensional barcodes containing data that point to a website or application.

The idea behind a QR code is to create an image that any mobile device can read (or scan) with a certain QR code scan application and transfer it to something meaningful.

You can store a great amount of information. The most popular information they contain are website addresses and links which provide multimedia content like music, image galleries, etc.

**BAR CODE:**

A barcode is “A machine-readable code in the form of numbers and a pattern of parallel lines of varying widths, printed on and identifying a product.” But in truth a barcode is so much more. Barcode systems help businesses and organizations track products, prices, and stock levels for centralized management in a computer software system allowing for incredible increases in productivity and efficiency. The lines and patterns on a barcode are actually representations of numbers and data and their development allowed basic information about a product to be easily read by an optical scanning device, a barcode scanner, and automatically entered into a computer system.

**ALL ABOUT QR CODES:**

I think Barcodes/QR codes are very cool and interesting because they store information in a different format. The fun part about them is we can’t really tell what they are storing until we scan them. It’s like playing a puzzle game. And one more thing that I like about them is they can be part of the physical world and still connects us to the internet world. Isn’t that really cool?

**QR CODES PROS:**

**Easy to produce**

As mentioned above, you can easily create a QR code for your brand within 5 minutes. This helps you to spend your time solving other important questions such as where to print the code on or how to distribute it.

**Can be placed anywhere**

QR codes provide endless placement opportunities. They can be printed on different material such as paper, cloth or displayed digitally.

If you place an advertising banner somewhere on the internet, you can add the QR code there so your customers can visit your homepage, discount page, etc.

If you own a home furniture brand with an app, showcase your code outside the store to let busy customers visit your app simply by scanning it.

**Appeal to curiosity**

QR codes are tricky because you can’t see what you get until you scan it. You can use this mystery to ignite people’ curiosity and create excitement.

**Easily Trackable**

The tracking of QR codes is straightforward. Once a dynamic QR code is completed, it can be recorded.

You can track QR code usage data such as location, operating system (window, android, ios, ect.), traffic coming from the code, etc.

Some QR codes generators provide you with these kinds of data, however, you still need a more trustable source, we recommend you to use Google Analytics.

To see QR code visit information via Google Analytics, you just need Google Analytics code snippets added to your sites and the Google UTM string parameters added to your site URL.

**QR CODES CONS:**

**Scanning can be inconvenient**

While scanning can be exciting, it’s not completely convenient and intuitive.

Some people find it a lot more convenient to directly click on links stored in other digital forms or basically google the brand name instead of using the QR code.

**The Tiring Process**

One more thing is not everyone has smartphones as well as the QR code scanner app, also, the process can be long and frustrating if the QR code doesn’t work.

**SPICE UP MARKETING CAMPAIGNS WITH QR CODES:**

Despite some disadvantages, you still can use QR codes for your marketing campaign with certain tactics.

Let we walk you through some amazing ideas to boost your marketing performance and drive sales!

Take advantage of one-time customers

Let’s say if someone randomly saw your product on the supermarket shelf and decided to buy it. Then they became your one-time buyer.

However, the chance that they become repeat customers is low. Consumers have lots of choices and the nearest competitor is just a click away.

What if you want to offer your first-time customers some incentives through discounts or special offers, what will you do?

A QR code can help you. Just include your sign-up page on the QR and place it on the package**.** Your new customers can notice the code and visit the page, in the most prominent case, they sign up and become your member, or at least, they will have a look at your offer on the website.

**INCREASE YOUR WEBSITES AND SOCIAL MEDIA PAGES TRAFFIC:**

If you are wondering how to increase your website’s visitors number, let’s try QR codes.

For example, if you have a brick-and-mortar store that already attracts a certain number of customers, however, you want to increase the online visitors. So, we recommend you to place the QR code at your store to lead the physical to online visitors as you want. Don’t forget to include the appealing message in the code.

Perhaps they are not convinced by the image or content in the ad banner, a QR code may be a viable option because it has a mystery that people can’t know what’s behind until scanning it.

So, you can store the link to your website or social page in the QR codes, craft an enticing CTA, design an attractive QR code then wait for traffic to come.

**ENHANCE SHOPPING EXPERIENCES BY AR:**

So you may ask “what do QR codes do with AR for my store”

As mentioned above, QR codes can draw customer’s attention whenever you place them on your content.

While AR is an undeniable digital trend and its footprint has been expanding to e-commerce, as a store owner, you can stay outside the game. If you are considering adopting AR in your online store, think about letting customers scan the QR code to view your products through AR.

Let’s say if you are running a furniture store and you want to provide the AR experiences for your customers. So, just include the QR code with CTA “Does this fit my real place”, you will be surprised by the scanning times of the QR codes.

**MAKE QR CODES STAND OUT:**

Please keep in mind that if you can’t make QR code stand out, you fail. Your customer will ignore the QR code and don’t make further action if they’re not convinced that scanning the code will benefit them. To increase the QR codes scan rate, here are some advices:

* **Custom your QR code:** add a colour palette to your QR codes. You can use your brand’s colour palette to trigger the sense of brand archetype and make it more interesting.
* **Always include a Call-to-action** in your QR codes design to entice your customers to scan it, for example “Scan me”, “Get the deal”, “See us”.
* Embed your QR codes on marketing materials as well as collaterals to encourage them to scan it and receive the valuable information.
* Include your QR code on any kind of outdoor areas that suitable to grab the customer’s attention.

**TYPES OF QR CODES:**

In the development of QR codes, there are two types which were created:

**Static QR Code:**

A static QR code is a QR code with fixed information. The information a static QR code delivers upon being scanned is encoded directly in the QR code itself. QR codes are made up of scannable patterns of white and black blocks, all aligned in various ways. The information in a static QR code is contained within this pattern and alignment. The more (and more complex) information communicated through the static QR code, the larger and more complex the QR code is. This has implications for how small a QR code can be. Though, more often than not, the information encoded in static QR codes is a URL. Most folks want to go from URL to QR code.

And if that information (again, a URL typically) needs to change, the pattern and alignment of the QR code needs to change. Which makes any previously printed QR code obsolete. With static QR codes, more information means a bigger code, and new or updated information means a new or updated QR code.

**Dynamic QR Codes:**

A dynamic QR code is a QR code with a short redirection URL encoded in it. The information you’re trying to communicate isn’t encoded in the QR code itself, like a static QR code. Instead, the information you’re trying to communicate is on a website, and a dynamic QR code redirects to that website. The best part? That redirection URL can change. Unlike a static QR code, the information in a dynamic QR code can change without needing a new code. When evaluating a QR code vs barcode, this is one of the biggest draws.

**Dynamic QR Codes or Static QR Codes?**

QR codes are finally assuming their rightful role in a world that newly values contactless commerce. Just look at the QR code statistics. And the short, simple answer is that if you’re a business, use dynamic QR codes. If you’re using QR codes for personal reasons, you can use static QR codes.

There is no downside to using a dynamic QR code if you’re doing it for personal or one-time use. In fact, there is a benefit. You leave yourself the option of editing or updating the content associated with your QR code down the line.

There is, however, a massive downside to using a static QR code if you’re a business. First, your business will be boxed in to the first version you publish. Second, your business won’t be able to fix mistakes or update anything. And finally, you’ll be in the dark about how successful your QR codes are because you’ll have no data about their scanning or usage.

|  | **Dynamic QR Code** | **Static QR Code** |
| --- | --- | --- |
| **Size** | Small, lightweight | Large, dense |
| **Editing Ability** | Can edit and update | Cannot edit and update |
| **Usage Metrics** | Can track usage and scan data | Cannot track usage and scan data |
| **Ideal Use Cases** | Menus, hospitality, marketing, business, government | Personal use, one-time use |

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**ALL ABOUT BARCODE:**

The barcode has a long and interesting history from its initial development nearly 70 years ago through today. It is an ever-changing story, as the technology behind the barcode is constantly evolving, and we discover ways to put more and more information into these “machine-readable” codes. It all started in 1949 on a beach when Joseph Woodland, a mechanical engineer at Drexel University, drew a set of parallel lines in the sand that “represented a kind of ‘long form’ of dots and dashes” or Morse code. Woodland had been thinking about the ways Morse code might be used to solve a problem his colleague Bernard Silver had presented to him. Months earlier, Silver had overheard the president of a grocery chain appeal to the dean of Drexel University to help him devise a system to automate the grocery checkout process. On October 20, 1949, Woodland and Silver filed a patent application for a “Classifying Apparatus and Method” -- the first barcode concept. They finally received their patent in October 1952, and while the idea was intriguing to a number of companies and industries, the scanning technology, which would eventually allow the barcode to become one of the most ubiquitous symbols in the world did not yet exist.

In the 1950s and 1960s various companies and industries tried to develop the barcode technology. The first implementation was the KarTrak system developed by David Collins for the Boston and Maine Railroad company. It was subsequently selected as the standard by the Association of American Railroads (AAR) and by 1974, 95% of the AAR fleet was labelled with the KarTrak system. However, the system was never fully functional and its use was discontinued by the late 1970s. The breakthrough that would lead to the global spread of barcodes was the development of the Universal Product Code (UPC). In 1966 the National Association of Food Chains (NAFC) began to discuss the idea of automated checkout systems. At the time, RCA owned the rights to Woodland and Silver’s original patent and began an internal project to develop an effective system. Then, in the mid-1970s, the NAFC established the U.S. Supermarket Ad Hoc Committee on a Uniform Grocery Product Code, to create basic guidelines for barcode development and an effective coding system. This led to the creation of a standardized 11-digit code to identify any product. At the time, IBM employed George Lauer and had him begin work on what would become the standard UPC linear 1D barcode. The critical moment came in 1974 on June 26th when the first barcode was scanned in a supermarket in Troy, Ohio. It was a 10-pack of Wrigley’s Juicy Fruit gum. Over time the barcode has expanded from simple lines to complicated designs and helps people track everything from a can of soda to top secret assets in the Department of Défense.

**TYPES OF BARCODES:**

* 1D Barcode
* 2D Barcode

**1D Barcode:**

It is the most visually recognizable, the UPC (Universal Product Code) linear 1D barcode. It is made up of two parts: the barcode and the 12-digit UPC number. The first six numbers of the barcode are the manufacturer’s identification number. The next five digits represent the item’s number. The last number is called a check digit which enables the scanner to determine if the barcode was scanned correctly. A linear barcode typically holds any type of text information.

**2D Barcode:**

2D barcode is more complex and can include more information in the code: price, quantity, web address or image. A linear barcode scanner cannot read a 2D barcode, requiring the use of an image scanner for reading the information embedded in a 2D barcode. Mobile phones with cameras, like iPhones and Android phones, and many other devices can read 2D barcodes through their integrated cameras. The development of the 2D barcode greatly expanded the application of barcodes. Now that they could contain more information and are easily readable by consumers (via their mobile phones) the 2D barcode could do much more than just keep track of assets and inventory. Today, 2D codes, especially QR codes, which can hold as much as 7,000 digits or 4,000 characters of text, are used by companies to share information or websites and videos with consumers, or by healthcare facilities to monitor medication, and even to integrate data with programs like MS Office, MS SQL Servers, and other databases and files.

**HOW DO BARCODES WORK?**

Barcodes work through the combination of a symbology (the barcode) and a scanner that can read the symbols and convert them into useful information, often information about an item’s origin, price, type, and location. The scanner reads the barcode and automatically enters the information stored in it into a system - often some type of database. This tool has provided many, many benefits for businesses. It paved the way for the globally connected distribution channels we now have and it is what allows big corporations like Walmart to ensure they have products properly stocked and priced around the world. It has also become a crucial tool to help small and medium businesses, as well as hospitals and government groups, keep track of assets and improve their efficiencies. Some of the ways businesses use barcodes include:

1. Keeping track of inventory. A basic inventory tracking system consists of software and a barcode scanner or mobile computer. Inventory items (like products you sell, supplies, or raw materials) will all have barcode labels, so when you remove an item from stock, you just scan the barcode to reduce the available count in your inventory tracking software, instead of having to type in a SKU.
2. Keeping track of assets. Any business, no matter how large or small, has IT assets and fixed assets. Barcoded asset tags are attached to each individual asset, and can be scanned to check items in or out in your asset tracking software. It’s a great way to improve accountability and makes audits much easier.
3. Use barcodes in return mail. Add a barcode to the return-mail registration postcard that matches the product’s serial number, and then you can instantly track which serial numbers are registered, and which aren’t. Plus, your customers won’t have to locate and transcribe a lengthy serial number.
4. Include barcodes in a mail merge. If your company is hosting an event, you can add barcodes to an RSVP card so you can track who has responded – without trying to translate anyone’s handwriting.
5. Add barcodes to invoices. Add a barcode that represents the customer number or the individual invoice number so when it’s returned with payment, you can easily locate the customer account or invoice number. This will prevent problems like applying payments to the incorrect customer account or invoice.

**How Do Barcodes Help Businesses?**

How can barcodes help your business’s bottom line? Strictly speaking it isn’t the existence of barcodes themselves that help businesses save and make more money; it’s the systems behind them.

Take the Arizona Cardinals scoreboard crew for example, they recently implemented an asset tracking system (leveraging barcode technology) in order to track all of the parts involved in a flawless game day experience. As a result, they were able to save over 500 hours per year. How’s that for improving efficiency! Just because you’re not an NFL team doesn’t mean that barcodes can’t help to improve how your small business works. In fact, whether you make and sell physical products or you just can never seem to figure out where your projector is when you need to give a presentation, labelling and tracking your assets with barcodes can save your business time and money.

**GETTING STARTED:**

In this project, I will show you how to build a barcode and QR code reader using Python. This is a great machine learning project to get started with computer vision. If you are wondering how barcode and QR code readers work, let’s do a quick real-life practice. Turn on your phone’s camera and show the featured image of this article. You will see a link show up, it’s very simple to use. Today, we will create our own reader, without losing any time let’s get started!

We will start by installing the libraries that we will need for this project and then we will start programming.

**LIBRARIES:**

In this step, we will install the following three libraries: Pillow, OpenCV and Pyzbar. Pillow library is also known as PIL, which stands for Python Image Library. OpenCV is a well-known library, especially when working with computer vision projects. And lastly Pyzbar, a python library that will help us read the barcode and QR codes. Let’s start installing them.

**Pillow:**

Pillow is the friendly PIL fork by Alex Clark and Contributors. PIL is the Python Imaging Library by Fredrik Lundh and Contributors. As of 2019, Pillow development is supported by Tidelift.

pip install Pillow

**OpenCV:**

OpenCV (Open-Source Computer Vision Library) is an open-source computer vision and machine learning software library. OpenCV was built to provide a common infrastructure for computer vision applications and to accelerate the use of machine perception in commercial products*.*

pip install opencv-python

**Pyzbar:**

Installation of Pyzbar library is different depending on the computer you are using. I will show both Mac OS and Windows installation lines.

# Mac OS version  
brew install zbar

# Windows OS version  
pip install pyzbar

# **DECODING FUNCTION:**

In this step, we write the decoding function, where most of the cool things will be happening. The decoding function will be doing mainly three things, and can be listed as follows:

* Recognizing and decoding the barcode/QR code that we will be showing to the camera.
* Adding the stored information as a text on the recognized barcode/QR code.
* And lastly, exporting the stored information as a text document.

Let’s import the libraries we installed before we write to the function:

#import libraries

import cv2

from pyzbar import pyzbar

Now, let’s write the function. Instead of adding part by part, I will share the whole function with you. Since, indentation matters when writing in python, I don’t want to disorganize things by ruining the structure of the code. I will add my comments below the code.

def read\_barcodes(frame):  
 barcodes = pyzbar.decode(frame)  
 for barcode in barcodes:  
 x, y , w, h = barcode.rect #1  
 barcode\_info = barcode.data.decode('utf-8')  
 cv2.rectangle(frame, (x, y),(x+w, y+h), (0, 255, 0), 2)  
   
 #2  
 font = cv2.FONT\_HERSHEY\_DUPLEX  
 cv2.putText(frame, barcode\_info, (x + 6, y - 6), font, 2.0, (255, 255, 255), 1) #3  
 with open("barcode\_result.txt", mode ='w') as file:  
 file.write("Recognized Barcode:" + barcode\_info) return frame

# **MAIN FUNCTION:**

In this step, we will write the main function, where the application is prompt to work. The main function will turn on the video camera of the computer, and the then call the decoding function. Here is the code:

def main(): #1  
 camera = cv2.VideoCapture(0)  
 ret, frame = camera.read() #2  
 while ret:  
 ret, frame = camera.read()  
 frame = read\_barcodes(frame)  
 cv2.imshow('Barcode/QR code reader', frame)  
 if cv2.waitKey(1) & 0xFF == 27:  
 break #3  
 camera.release()  
 cv2.destroyAllWindows()#4  
if \_\_name\_\_ == '\_\_main\_\_':  
 main()

Perfect! We are done with the programming part.

**CONCLUSION:**

* Our knowledge in Python grew exponentially during this project.
* We got to learn about libraries that support projects in the Computer Vision field.
* Our coding skills took a boost while working on this project.
* We worked as a team, and successfully completed the project before due time.
* Our knowledge about the QR and Barcode advanced.
* We got to learn almost everything about QR and Barcode.
* Now, whenever in our life we will scan any QR or Barcode, it will remind us of this project.
* The code is tested very well and errors are properly debugged.
* Further enhancements can be made to the code, so that the program functions very attractive and in useful manner than the present one.
* It is concluded as the code works well and satisfy the purpose.
* We as a team, look forward to many such projects in our further academic as well as professional future.

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