

BARCODE AND QR CODE SCANNER

A MINI PROJECT REPORT

Submitted by

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BONAFIDE CERTIFICATE

Certified that this project report “**Barcode and QR Code Scanner**” is the bonafide work of “**Cherreddy Sowmya Sri(RA2011026010113)**” of III Year/VI Sem B.tech(CSE) who carried out the mini project work under my supervision for the course 18CSE353T- Digital Image Processing in SRM Institute of Science and Technology during the academic year 2022-2023(Even sem).

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ABSTRACT

Quick Response (QR) codes and Barcodes have become an important component to enable various technical solutions and are being used by millions of people around the world every day. With the tremendous increase in usage of QR codes and the growing number of applications mostly including sensitive tasks such as payment and ticketing, it becomes vital to understand the current state of the technology, its implementation, limitations, and scope for future work. Our project is aimed at fulfilling this purpose and provides an analysis of the latest advancements in QR code detection and pre-processing technologies and also reveals the multi-step process of QR code recognition. This is a great machine learning project using digital image processing techniques. QR codes are frequently used to track information about products in a supply chain, often used in marketing and advertising campaigns. Barcodes are applied to products as a means of quick identification. They are used in retail stores as part of the purchase process, in warehouses to track inventory, and on invoices to assist in accounting.

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CHAPTER 1

INTRODUCTION

This is a great machine learning project using digital image processing techniques. QR codes are frequently used to track information about products in a supply chain, often used in marketing and advertising campaigns. Barcodes are applied to products as a means of quick identification. They are used in retail stores as part of the purchase process, in warehouses to track inventory, and on invoices to assist in accounting.

Barcode is a visual representation of information in the form of bars and spaces on a surface. The bars and spaces are designed with different widths and consist of numbers, characters and symbols such as dot, colon and others. Different combinations of these alphanumeric characters are used to represent information. Today barcodes are widely used on books and at retail stores in order to keep track of the products available and easy checkout of the products.

Quick Response (QR) code is a two-dimensional barcode. A QR code is generated by following certain protocols, the same of which are utilized for its decoding. While generation of a QR code is a straightforward process, the main challenge lies in recognizing it with greater accuracy and speed. Getting information from a QR code in real world environments comprises of three vital steps: localisation, image pre-processing and decoding.

CHAPTER 2

LITERATURE SURVEY

Quick Response code is usually authenticated with the help of the camera of one's mobile phone. QR codes can easily scanned through mediums like Tablets, laptops and personal computer desktops. The system automatically generates the ID of the user and its password. The characteristic which makes QR codes stand out is they can still be scanned even if they are partially damaged. QR codes are a 2-dimensional printing code on a paper or a screen which makes it pretty vulnerable from various type of cyber-attacks. It can harm your device by unknowingly directing you to a virus contaminated page or website. To avoid this, one must verify the origin of a particular QR code and must have a full understanding of the data type of that particular QR code.

There are many attacks involving QR codes as well as their solutions. QR codes are becoming quite popular nowadays because of the rapid increase in smart devices by the normal people around the world. Obviously, 2D QR code is way better and store huge amount of encoded information compared to the old traditional 1D codes. People are using smartphones to do authentications and for this the QR codes are the most ideal way to do it. Many types of QR codes are getting popular nowadays including logo QR code, encrypted QR code, iQR Code etc. QR codes are becoming popular day by day in the upcoming generation as it offers way easier authentication that the traditional old fashioned user id and password. QR codes offers many advantages such as greater storage capacity, fast readability, 360 degree reading, small print size, error correction, support for more languages and durability against soil and damage. Many firms who are relatively new in the online business are tend to use these codes instead of normal login process.

CHAPTER 3

SYSTEM ARCHITECTURE AND DESIGN

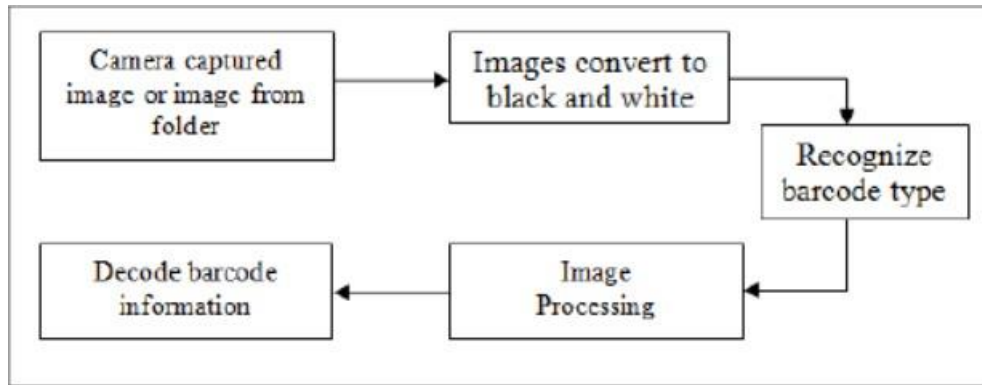


Fig 3.1 Block Diagram

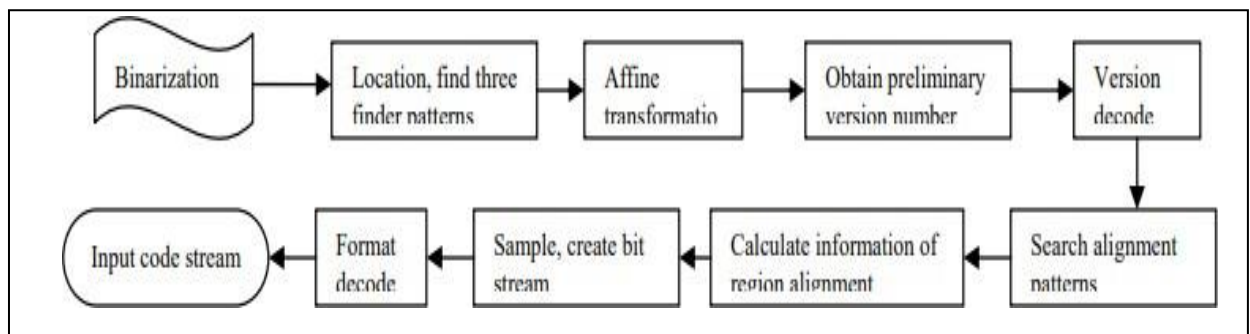


Fig 3.2 Process Flow Diagram

Scientific research has been playing an important role in the progress and enrichment of new age technology. Research is invention or scientific investigation or scientific enquiry to extract truth or invent new concepts by scientific way. Descriptive research consists of fact-finding enquiries and surveys of various kinds. The main motive of descriptive analysis is explanation of the state of affairs as it currently exists. Research can be either applied to study or to fundamental studies. The objective of applied analysis is to find a solution to an instant issue facing a community or an industrial/business organization.

3.1 ARCHITECTURE DIAGRAM

To enable the efficient execution of the subsequent decoding and increase the accuracy of QR code reading, numerous preparation tasks must be completed before QR code decoding. Image capture is the first step in the QR picture recognition process. Next, a number of tasks are carried out, including image pre-processing, barcode identification, information sampling, information error correction, information decoding, and ultimately output results. This architecture displays the typical operating flowchart for recognising QR codes. Image pre-processing is a crucial step in the overall process of recognising QR codes. Information sampling, information error correction, and information decoding all follow set principles.

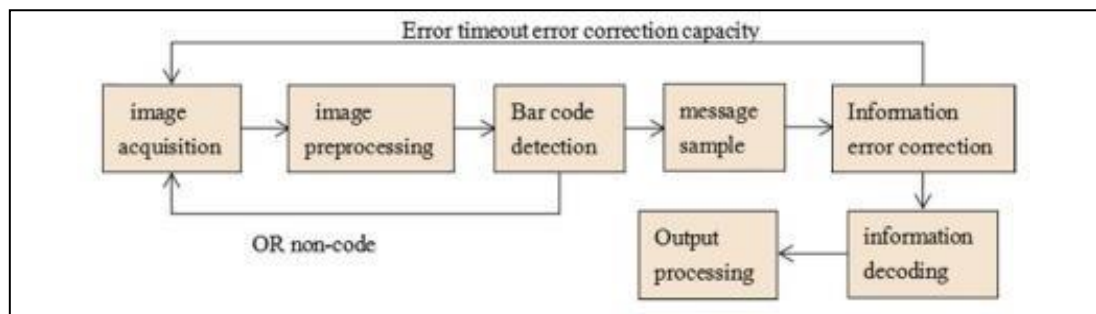


Fig 3.3 Architecture Diagram

CHAPTER 4

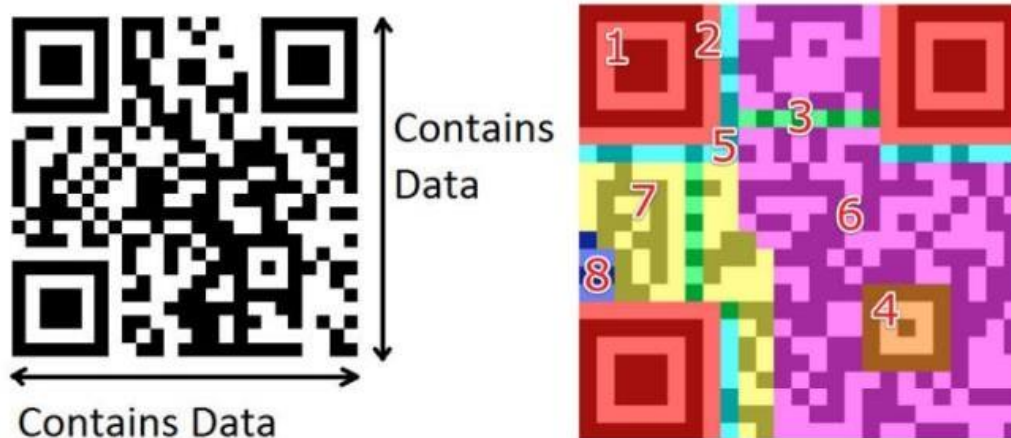
METHODOLOGY

4.1 TECHNIQUE USED

Localization and decode

The barcode reader software scans the entire width of a barcode image to identify a barcode. Once it scans a barcode, it decodes it and presents the encoded information. Also, considering the wide use of mobile devices nowadays, a camera is also used to capture the barcode image for processing and decoding its value.

4.2 PROCEDURE



Finder Pattern (1): The finder pattern comprises 3 identical structures that are situated in all corners of the QR Code except the bottom right one. Each pattern is based on a black module matrix of 3x3 encircled by white modules that are again surrounded by black modules. The Finder Patterns allows the decoder software to identify the QR Code and determine the exact orientation.

Separators (2): The white separators have a width of one pixel and boosts the recognition of the Finder Patterns as they isolate them from the actual data.

Timing Pattern (3): In the Timing Pattern, alternating black and white modules allows the decoder software to determine a single module's width.

Alignment Patterns (4): Alignment Patterns helps to reimburse the decoder software for mild picture deformation. Version 1 QR codes have no Alignment Patterns. With increased code size, more Alignment Patterns are added.

Format Information (5): The Formation Information section is made up of 15 bits next to the separators and stores data about the QR code error correction rate and the masking model selected.

Data (6): Data is converted into a bit stream and then stored in an information segment in 8-bit sections (known as codewords).

Error Correction (7): Similar to the data section, error correction codes are stored in 8 bit long code-words in the error correction section.

Remainder Bits (8): This section consists of empty bits, if data and error correction bits cannot be split into 8 bit codewords without remainder.

CHAPTER 5

DATA SET DESCRIPTION

To understand what information is stored on a barcode, you must first know what a barcode is and how barcodes work. A barcode is an encoded image, usually displayed with black and white lines of varying width that contains vital information easily readable by a machine.

Barcodes store information using symbols that can vary from lines to dots, such as in the matrix barcoding. There are many types of barcodes, such as one dimensional and two-dimensional barcodes, that determine the exact type of data that can be encoded onto it.

When the machine fails to read a barcode, the person can enter the barcode number and get the information required; this is seen frequently in supermarkets and stores.

DATASET - <https://www.kaggle.com/datasets/coledie/qr-codes/code>

CHAPTER 6

IMPLEMENTATION AND RESULTS

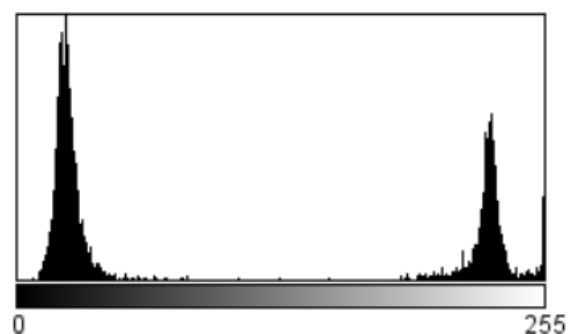
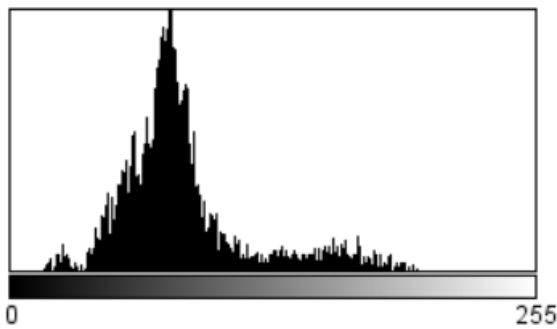
6.1 INPUT IMAGES



Fig 6.1 Image divided into sub – boxes



Fig 6.2 A ref histogram of QR Code



(a) Histogram of sample box without QR CODE (b) Histogram of sample box with QR CODE
Figs a and b present local histograms of sample blocks that do not contain QR code and the corresponding correlation coefficient is very small. For comparison Fig b presents the local histogram of a block that contains QR code.

In Figs a,b it can be seen, that in histograms of blocks without QR code there are no bins around the minimal and maximal intensity. These are clearly visible in the case of a block which contains a QR code.



Fig 6.3 Image with block supposed to contain QR code highlighted in blue



Fig 6.4 Image with a verified histogram



Fig 6.5 Detected QR Code after applying operations with binary mask

6.2 OUTPUTS

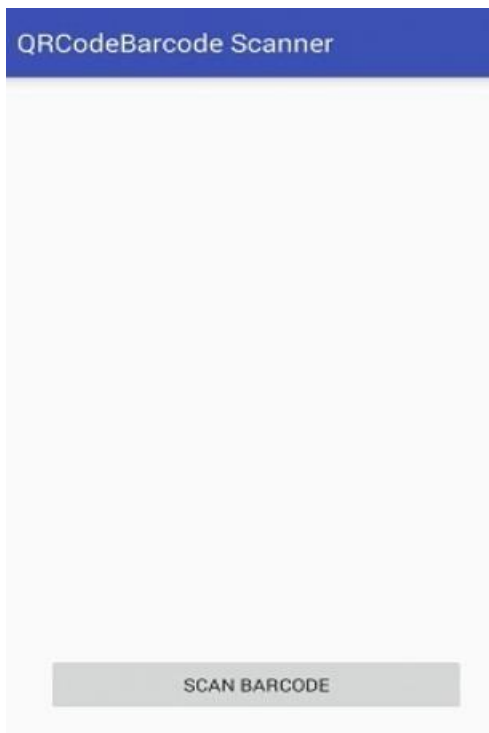


Fig 6.6 Home page

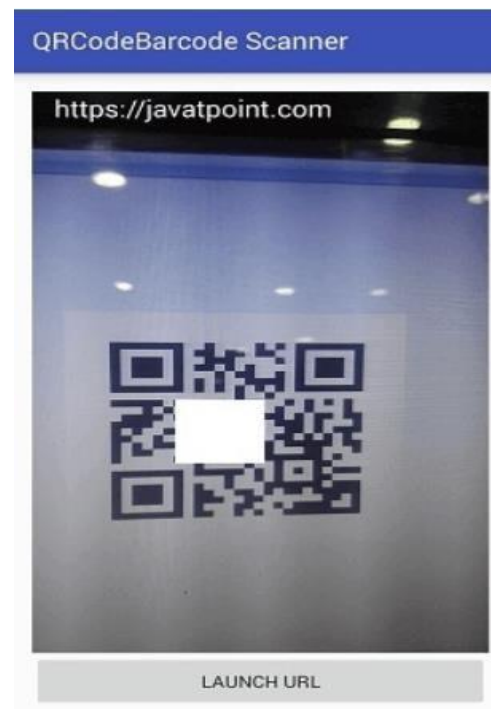


Fig 6.7 Scanner

QR code can be read much faster and within 360 degrees can be scanned from any angle i.e. no need to place the scanner as per the code symbol. The QR Code can handle numerals, alphanumeric characters, Japanese, Chinese or Korean letters and binary data.

6.2 RESULT ACCURACY

The barcode and QR scanner work very close to how we expected. Thanks to efficient image conversion and decoding processes, the entire process runs predictably within reasonable time constraints; roughly a few seconds. As far as resources are concerned, waste is kept low thanks to our pipelined data processing approach. Although decoding often takes up the majority of the process, the time it takes is usually constant. Therefore, the network connection can be considered the major bottleneck since it may produce uncontrollable results.

	Sample processing	Readable	Cannot read	Literacy rate (%)	Increased literacy rate (%)
Direct reading	300	209	91	69.7	0
Proposed algorithm processing	300	251	49	83.7	14

Fig 6.8 Result accuracy

The QR image code reading rate after processing by the system algorithm **increases by 14%**, and the processed images are not recognized by the existing reading software, which proves the effectiveness of the algorithm proposed.

CHAPTER 7

CONCLUSION AND FUTURE ENHANCEMENTS

In this project, we have discussed about the analysis of QR codes as well as their applications. The capacity of these codes to store data is very high plus they are damage resistance which makes them overcome one of the key concerns of security. In the past decade or so, the application of QR codes in public domains like supermarkets and in educational purposes like book scanning or stationary scanning has been increased rapidly and it will continue to thrive in more fields as the awareness will increase. The QR code technique is getting popular day by day and at the same time it is becoming increasingly secure as the technology is enhancing. Once, the awareness about these codes increases, it will get a wide spectrum to evaluate its significance. In near future, this technology will be used in wide public domains. Firstly, QR codes were used to store the information about inventory products but nowadays it is being used in the huge industries like marketing, secure payment systems, advertising, education systems etc.

Many people argue with the fact that QR codes are used as a second fiddle while doing money related transactions. These codes are slowly becoming first preference for many users in the recent times. The main limitation of QR codes is that they are only being used to redirect to a webpage or website but they are not collecting any information on their own. If in this hugely data driven world, if these codes start to collect information and start a two-way transaction then it will surely stabilize in this technology market for future years. Another limitation regarding the application of QR codes is that one must have a QR code reader or scanner installed in their mobile or tablet to be able to scan and read the data held by the QR code.

Instead of this, we can create and integrate the QR code scanners in our smartphone's camera itself so that we don't need any other third party application to scan the QR codes. QR codes have been scrutinized by many of the technology and security pundits but still it has been loved and accepted by the normal people at a high context. They have been literally used everywhere as far as promotional events are concerned like mobile payments, coupons, air ticket coupons, business cards, new business profile promotions etc. There are new technologies launching in the last couple of years who are better or more secure than QR codes, but still QR codes will be there for many more years to come because of the ease of their use and many people in the developing countries already adapting them in the recent past. So it is a rare possibility that they will again turn to a new technology after taking so much years to get used to the QR codes.

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