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Detecting and Decoding Algorithm for 2D Barcode

Mr. Nachiket A Rathod, Dr. Siddharth A. Ladhake

Mr.Nachiket A. Rathod, Sipna's college of Engineering, Amravati
Dr. Siddhartha A. Ladhake, Principal, Sipna's college of Engineering, Amravati

***Abstract* — 2D Barcode can be classified mainly in two types which are stacked 2Dbarcode and matrix 2D barcode. This paper discusses structure of types of 2D barcode in brief. This paper will propose flowchart of detecting 2D barcode and also decoding the 2D barcode.**

***Keywords* — 2D barcode, stacked 2D barcode, matrix 2D barcode.**

I. INTRODUCTION

The barcodes have been spread from supermarkets to department stores, factory floor, the military, the health industry and many more. Recent years have also seen demand to increase the density of information in barcodes. Traditional 1 dimensional barcode are getting replaced by 2D barcodes worldwide. Linear barcodes are created by translating supported characters that should be displayed into combination of narrow and wide bars which are combined into a barcode. The barcode symbology refers to the protocol that defines standards for arranging the bars and spaces that comprise the particular type of barcode such as UPC-A and EAN. It defines technical details of particular barcode type including the width of bars, character set, method of encoding, checksum specification. To identify the start and end of a barcode special pattern are used to indicate to scanner that the barcode starts and identify what type of symbolgy is used.

In 2Dimensional barcodes many thousand alphanumeric characters can be placed in single symbol. One of the most important advantages of 2D barcode is that large amount of data can be read easily and writes accurately. The durability 2D barcode is much better that of 1Dimensional barcode. The 2D barcode is generally mainly classified into three types of barcode which are data Matrix, QR code and PDF 417 barcodes. The data Matrix is 2D matrix barcode consisting of black and white cells arranged in either square or rectangular pattern. The information to be encoded can be text or numeric data. Usual data size is from few bytes up to 1556 bytes. The length of encoded data depends on number of cells in matrix. Error correction code are often used to increase the reliability, even if one or more cells are damaged it is unreadable message can still be read.

A data Matrix symbol can store up to 2335alphanumeric characters.

QR code is trademark for type of matrix barcode it consist of black modules arranged in square pattern on white background. The information encoded in can be made up of four standardized kind of data i.e. numeric's, alphanumeric, byte, kanji (logographic Chinese character) or through supported extension virtually any kind of data.PDF 417 is stacked linear barcode symbol format used in variety of application, primarily transport, identification cards and inventory management.PDF stands for portable data file.417 signifies that each pattern in code consist of 4 bars and space and each pattern is 17 units long.

Current mobile phones implement various kinds of application such as taking photos, movie shooting by camera embedded devices. In this paper we will discuss about the algorithm implemented to decode the 2D barcode with the help of camera embedded mobile device.

II. TYPES OF 2D BARCODE

In general the 2D barcode are classified in two groups which are stacked 2D barcode, such as code 49 and PDF 417 and matrix 2D barcode, such as data matrix barcode and QR code barcode.

A. Stacked 2D Barcode

The Code 49 is stacked type of barcode which is also known as USS-49.Code 49 can encode 128 characters ASCII. Input can consist of any ASCII data. Code 49 is developed to fill a need to pack a lot of data in very small symbol. Code 49 accomplishes this by using series of barcode symbols stacked one on top of another. Each symbol can have between two to eight rows. Each row consists of a leading quite area a starting pattern four data words encoding eight characters, with last symbol a row check symbol, a stop pattern and trailing quiet area. Each row encodes the information in exactly 18 bars and 17 spaces and each module is separated by a one-module high separator bar. The code is continuous variable length symbology that can encode complete ASCII 128 code.

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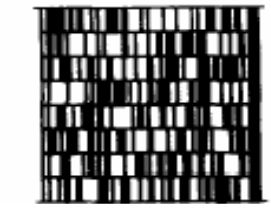

Figure 1.1

PDF 417 capabilities include symbol can link to others symbols which are scanned in sequence allowing even more data to be scored. The user can decide how wide the narrowest vertical bar(x dimension) is and how tall the rows are(y dimension). The PDF 417 barcode has 3 to 90 rows each of which is small linear barcode. A quiet zone is minimum amount of white space before the barcode begins. The start pattern identifies the format as PDF 417. A row left codeword containing information about the row. 1-30 data codeword's are group or bars and spaces representing one or more numbers, letters and other symbols. A row right codeword has more information about the row. Each codeword represent a number between 0 and 928.

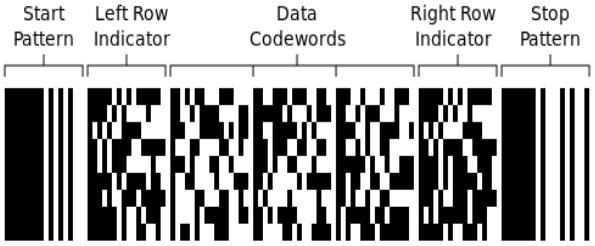

Figure 1.2

B. Matrix 2D Barcode

The data matrix 2D barcode and QR code are example of matrix 2D barcode. The data matrix barcode is high-density, two dimensional symbology that encodes the number, files, and actual data bytes. It was developed by RSVI Acuity Cimatrixfor space shuttle program and then enhanced by NASA and Symbology research center. Data Matrix is very effective 2D barcode symbology that uses a small area of square modules with unique perimeter pattern which help the barcode scanner cell allocation and decode symbol. The characters, numbers, text, and actual bytes of data may be encoded including Unicode characters and photos. The encoding and decoding process of data matrix is very complex. Several methods have been used for error correction in the past.

All current implementation have been standardized on the ECC200 error correction method, which is approved by ANSI/AIM BC11 and ISO /IEC 16022 specification.

The valid characters for data matrix barcode are ASCII 0 to 255.

Figure 1.3

The QR code is 2 dimensional symbols. It was invented in 1994 in Denso, major of Toyota group of companies. Several characteristics superior to liner barcode much higher data density support kanji/Chinese character. Data structure standards are not prerequisite for current usage. Most mobile phones in Japan equipped with cameras that enable reading of QR code can access internet addresses automatically by simply reading URL encoded in QR code. The QR code is a matrix symbol which has been developed as the one enabling all of high capacity PDF 417, high density printing of data matrix, high speed reading of maxi code based on research made on their characteristics. Two dimensional symbols generally contain much more data amount when compared with linear symbol (approx. 100 times more) and therefore require much longer data processing time and more complex process.

Figure 1.4

III. Detecting 2D Barcode

The 2D barcode should be detected before it is processed for decoding. The detected 2D barcode is further decoded i.e. the information which is encoded within the barcode is carried out in user understandable form which is called decoding.

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As there is different type of 2D barcode we know in this section we are proposing an algorithm flowchart which will show us the proper sequence for detecting a particular 2D barcode. The flowchart given below will illustrate the idea for detecting a 2D barcode:

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After all four steps the type of barcode is detected which is forwarded for decoding. The image is acquired through highly sophisticated camera device or camera embedded mobile devices. Acquired image is converted to bitmap. In computer graphics, when the domain is rectangle, a bitmap gives a way to store a binary image. Image consists of pixels 1 bit image consist of on and off bits. The entire Image can be thought of as two dimensional arrays of pixel values. We refer to such array as a bitmap. In next step the bitmap is converted to image histogram which is type of histogram that acts as graphical representation of the tonal distribution in a digital image. It plots the number of pixel for tonal value. Histogram can be useful tool for thresholding. Threshold value can be used for edge detection, image segmentation and co-occurrence matrix.

Hough transformation technique is used to detect particular shape in within image. Edge detection technique aims to identify points in digital image at which brightness changes sharply. Histogram works with these two techniques and converts the image into Byte Array. At last the image which is acquired by camera is step by step converted to from bitmap then to image histogram it is further converted to byte array which will help to detect the type of 2D barcode in final step as depicted by algorithm. This detected 2D barcode is next Decoded according to type of barcode detected.

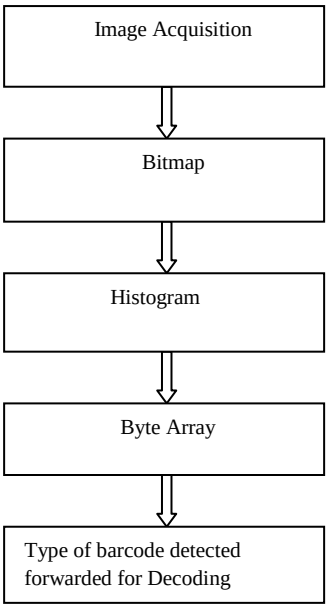

Figure 2.1

IV. 2D BARCODE DECODING

The earlier section illustrate the steps of detecting 2D barcode in this section we will propose a decoding flowchart for 2D barcode. The flowchart proposed in Figure 3.1 diagram depicts that 2D code is located at by corner detection and then segmented from background.

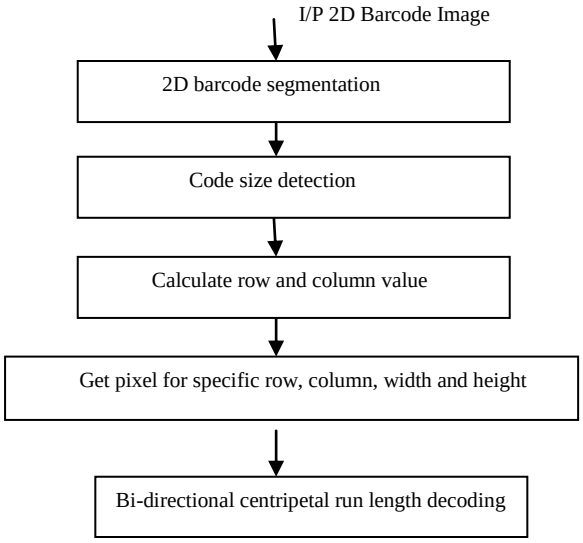

Figure 3.1

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Code size is detected based on the periodic edge information of first column. Then the code image is scanned by Bi-directional centripetal run length method where mixed model is applied to perform decoding bit by bit Normally barcode region contain special texture information in background, there are many approaches using texture analysis to locate barcode area from image. Considering the case that barcode region always occupies a large area in barcode image captured. We use Hough transform to locate four corner of barcode region. It is easy to compute size of barcode based periodic edge information after it has been located. After code segmentation and size detection we obtain coordinates of four corners of code and side length. We just keep the circumscribed rectangle of code quadrilateral and scale it to normal size. It is found that modules placed close to sides of code are comparatively easier to identify that their central peer. The code region is divided into four quarters. In each quarter scan is performed from outer to inner along the columns and rows and previous scan are used to predict parameters of successive ones.

After scans of all four quarters are finished bit-by-bit decoding result is naturally obtained. Thus this section illustrates the proposed flowchart of the image decoding after it is detected.

V. CONCLUSION

This paper discusses the different type of 2D barcode used in application in recent days, in the field of m-commerce. The paper first review structure of popular 2D barcode like stacked 2D barcode and matrix barcode. The detecting and decoding of 2D barcode is illustrated in paper with help of flowchart. Future work of this review paper can be implementing this decoding algorithm in mobile application or m-commerce.

REFERENCES

[1] Hao Wang and yanming zao "2D Barcode reading: solutions for camera phones", World Academy of science, Engineering and Technology 6 2007

[2] Ovidiu parvu and Andrei G. balan "A method for fast detecting and decoding of specific 2D barcodes" 17 Th telecommunication forum TELFOR 2009

[3] Romulus terebes and Otmane lahlou "Camera phone based barcode decoding system" ACTA TECHNICA NAPOCENSIS,

[4] Jiejing Zhou, Yunfei liu and Amit kumar, "Research on distortion correction of QR code image" IJCST VOL 3 ISSUE 1, 2012

[5] Jerry Zeyu, Lekshmi prakash and Rajini jagatesan, "Understanding 2D barcode technology and application in m-commerce-Design and application and implementation of 2D barcode processing solution" COMPSAC 2007

[6] Hee IL Hahn and Joung Koo Joung, "Implementation of algorithm to decode Two- dimensional barcode PDF-417" ICSP'02 Proceedings