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ROBUST BARCODE RECOGNITION USING TEMPLATE MATCHING

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ABSTRACT

*Nowadays, barcodes are used in almost every single business. Many different Applications such as access control, price calculation **uses** barcodes for pricing. It is very informative in business environment. This barcode reading/recognizing task can be done by using traditional scanners but in other environments where the volume of information is very high and time is critical, hardware scanners are not the best choice. In such situations the proposed powerful software robust barcode reorganization can be used to read the critical / blurred images barcodes very accurately. In this paper we present an image processing procedure for barcode detection in image. The goal of our method is to improve the quality of the input image. The implementation details and the results obtained with the proposed method on real images are discussed .Implement an image processing based barcode recognition toolkit that can be used to eliminate the need for external proprietary hardware required to recognize barcode. The challenge in this paper is to be able to detect a barcode on an image and we have to account for the following situations: blurriness, slanted barcodes, light intensity of images, noise in images. There are many techniques that can be used in image processing and our group has invested in the Image Processing Toolbox in Java so that we will be able to use special function of template matching to identify our barcodes.*

KEYWORDS: *1D-1 Dimensional, 2D-2 Dimensional, UPC-Universal Product Code, EAN-European Article Number*

I. INTRODUCTION

Barcodes are ubiquitously used to identify products, goods or deliveries. Devices to read barcodes are all-around, in the form of pen type readers, laser scanners, or LED scanners. Camera-based readers, as a new kind of barcode reader, have recently gained much attention. The interest in camera-based barcode recognitions build on the fact that numerous mobile devices are already in use, which provide the capability to take images of a fair quality.
Efforts concerning the recognition of 1D barcodes using camera phones have already been made. Adelman net al. [1] has presented two prototypical applications: the display of literature information about scanned books, and the display of ingredient information about scanned food for allergic persons. They did not report recognition performances, but showed proof of concept for new applications.
Barcode technologies become widely used nowadays. For example, in the supermarket, there are many hand-held scanners that automatically read the barcodes in the merchandises. Barcode reading via dedicated scanners is a mature technology. Commercial laser-based, hand-held barcode scanners achieve robust reading with a reasonable price tag. Recently, however, there has been growing interest in accessing barcodes with regular cell phones rather than with dedicated devices. Unfortunately, some images taken by cameras are often of low quality. Which frequently produce blurred images.

Only few cameras have flashes so motion blur and noise are an extremely common problem for pictures taken in low light conditions. All of these factors, possibly combined with low image resolution, make barcode reading difficult in certain situations. Indeed, all existing image-based barcode readers have limited performance when it comes to images taken in difficult light conditions [1].

With the binary string, you can then use the encoding rules to get the EAN / UPC number.

In this paper, we present an algorithm to recognize1D barcodes, which works for the widely used standards UPC-A, EAN-13. Our algorithm uses image analysis and pattern recognition methods which rely on knowledge about structure and appearance of 1D barcodes. Given the computational power and the image quality of today's camera, our contribution is an algorithm which is both fast and robust. Our proposed work will contain three major sections 1. Threshold Selection 2. Template Matching and 3. Encoding .

II. RELATED WORK

Barcode decoding has been studied and optimized for decades and it now represents a consolidated industrial standard. Until recently, however, barcode reading was performed almost exclusively with dedicated, generally expensive hardware. Despite the rapid growth of interest in camera-based readers, most of the challenges posed by this new approach are yet to be solved. Commercial scanners, such as those used in supermarkets, shine a light on the code and measure the intensity of its reflection, thus being virtually insensitive to ambient illumination. As a consequence, the extracted scan lines are of very high quality. Camera-based methods generally produce much lower quality scan lines. Moreover, the barcode generally does not completely fill the image; the first step to barcode interpretation is therefore its localization. We argue that this stage is intrinsically more robust to noise than the actual decoding, for it requires a lower accuracy. Existing methods for this step apply to the Binaries image methods. Other approaches simplify the problem assuming that the center of the image falls within the barcode area [2,3].

Decoding can be performed by estimating the width of all the bars in the barcode from the binaries image [6]. Wachenfeld et al., instead, use an adaptive thresholding.They then model the different digits and find the combination that best explains the scan line.Previous work can be analyzed through a diagram

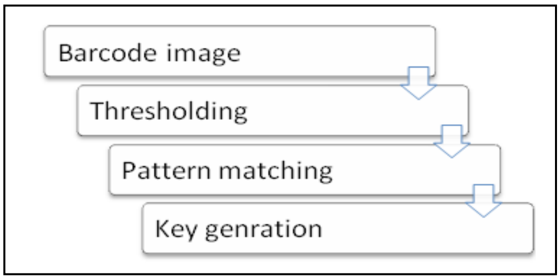

Figure 1 Traditional Method

III. PROPOSED SYSTEM

In proposed system we are building a system which processes an image to remove noise in it to get a perfect result. After capturing image if it is color image we are converting it to the grayscale image and performing filtration operation on it. Then with thresholding algorithm and post filtering process we are generating a bit-pattern for template matching.

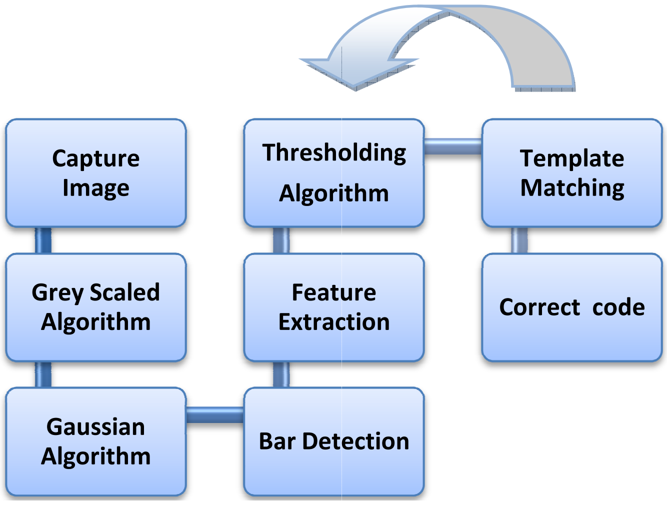

Figure 2 Detection Process

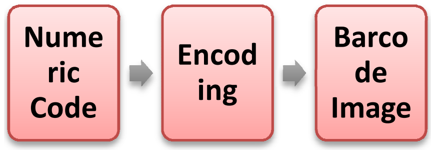

Figure 3 Generation Process

Gray scale:

Color images are often built of several stacked color channels, each of them representing value levels of the given channel. For example, RGB images are composed of three independent channels for red, green and blue primary color components.[2]

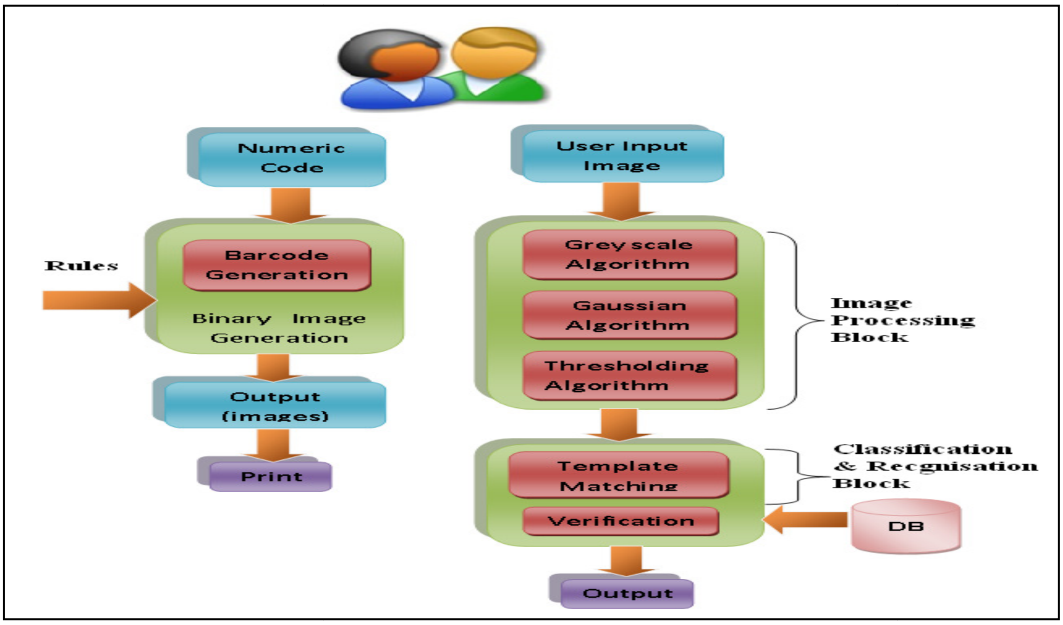

Figure 4 System Architecture

Gaussian blur:

A Gaussian blur is the result of blurring an image by a Gaussian function. The visual effect of this blurring technique is a smooth blur resembling that of viewing the image through a translucent screen, which is different from the broken effect produced by an out-of-focus lens or the shadow of an object under usual illumination

1. **Threshold selection:**

The key parameter in the thresholding process is the choice of the threshold value. A method which is robust against image noise is the following iterative method

1. An initial threshold (T) is chosen, this can be done randomly or according to any other method desired.
2. The image is segmented into object and background pixels as described above, creating two sets:
   a. $G_1 = \{f(m,n):f(m,n)>T\}$ (object pixels)
   b. $G_2 = \{f(m,n):f(m,n) \leq T\}$ (background pixels) (note, f(m,n) is the value of the pixel located in the m^{th} column, n^{th} row)
3. The average of each set is computed.
   a. m_1 = average value of G_1
   b. m_2 = average value of G_2
4. A new threshold is created that is the average of m_1 and m_2
   a. $T' = (m_1 + m_2)/2$
5. Go back to step two, now using the new threshold computed in step four, keep repeating until the new threshold matches the one before it.[5]

2. **Template Matching:**

Technique used in classifying objects. Template matching techniques compare portions of images against one another. Sample image may be used to recognize similar objects in source image. If standard deviation of the template image compared to the source image is small enough, template matching may be used. Templates are most often used to identify printed characters, numbers, and other small, simple objects. The matching process moves the template image to all possible positions in a larger source image and computes a numerical index that indicates how well the template matches the image in that position. Match is done on a pixel-by-pixel basis.

3. **Encoding**

In a barcode, each digit of an encoding is represented by seven black or white bars of equal size. Visually, two or more adjacent black bars appear as a single wide bar; white bars appear as space separators (also of varying size) between the black bars. If we call such wide (black or white) bars *generalized bars*, then, as a rule, a digit's representation always consists of four such generalized bars, which by necessity, interlace: either white-black-white-black or black-white-black-white. Possible variants of 7-bar representation are shown in the diagram below.

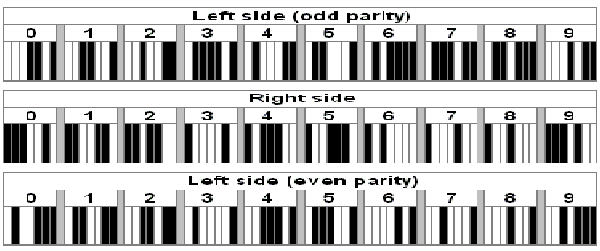

Figure 5 Upc-A Encoding

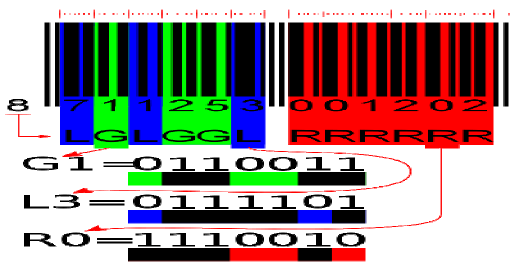

Figure: 6 EAN-13 Encoding

Barcode Boundary Detection

In the following, we use some knowledge about the UPC-A/EAN-13/ISBN-13 barcode. These barcodes consists of 13 digits. The last digit is a checksum which is computed from the first 12 digits.

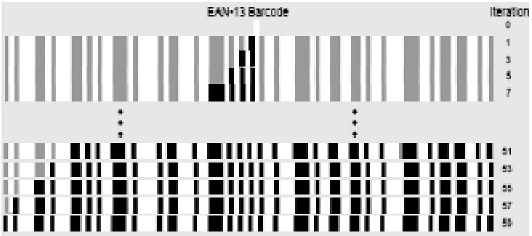

Figure: 7 Barcode Detection

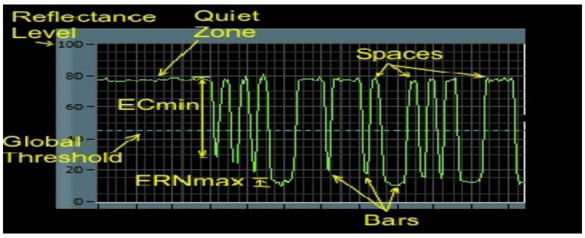

Figure: 8 Boundary Detection

The barcode starts by a left-hand guard bar A (black white- black) and ends with a right-hand guard bar E (black-white-black). Between the guard bars, there are two blocks B and D of 6 encoded digits each, separated by a center bar C (white-black-white-black-white).A module is the smallest unit. Bars and spaces can cover one to four modules of the same color. Each digit is encoded using seven modules (two bars and two spaces with a total width of 7 modules). The width of a complete EAN-13 barcode is 59 black and white areas (3+6 _ 4+5+6 _ 4+3) which consist of 95 modules(3 + 6 _ 7 + 5 + 6 _ 7 + 3).etc

IV. RESULT & DISCUSSION

1. Blur image

Blurring is present, to some extent, in all imaging processes, including vision, photography, and medical imaging methods An image is a visual representation of a specific physical object, such as a patient's body. In an ideal situation, each small point within the object would be represented by a small, well-defined point within the image. In reality, the "image" of each object point is spread, or blurred, within the image.

2. BlurShape

The blur of a small object point can have a variety of shapes, as shown below. The shape generally depends on the source of blur. Some x-ray system components, such as intensifying screens and image intensifier tubes, generally produce round blur patterns. Most imaging methods that produce digital images (digital radiography and fluoroscopy, CT, MRI, etc.) produce square or 3D blur patterns that correspond to the dimensions of the image pixel or tissue voxel. Motion during the imaging process typically produces an elongated blur pattern. X-ray tube focal spots produce a variety of blur shapes.

3. Slanted Image

This barcode detection algorithm can also detect if the barcode is slanted and readjust the barcode so that it is straight. Actually very simple maths is behind this part of the algorithm! Using the Bounding Box property of Region props this will output the upper-left x and y coordinates, the width and the height of each area found in the image (i.e. the bars in the barcode). From this if we take the x and y values of the first and last bar and calculate their gradient, if this is not zero then the barcode must be slanted. Since we have the gradient we can then calculate the degree to rotate the image, one trick is that we had to convert from radians to degrees. This part of the code happens right near the end of the algorithm since we want to make sure that we only have barcode bars in the image, otherwise this will distort the output. The only major disadvantage is that it will work for barcodes that are rotated -90 to 90 degrees, if the barcode is rotated more than this the resultant barcode will be upside down (i.e. the barcode will still be straightened but it will be upside down). Below shows this part of the algorithm in action.

V. CONCLUSION

Using our proposed model we can recognition Barcode highly accurate. It also uses powerful developer library which recognizes barcodes from digital images. Recognizes barcode's orientation from 0° to 360°. Detects multiple barcodes from black & white, grayscale, palletized and color images. Returns the type of each barcode recognized. Detects nearly 11 industrial barcode types. It is fast, accurate & easy to use hence it is very beneficial in current business market. Barcode recognition is a highly accurate and powerful developer library which recognizes barcodes from digital images hence it is fast , accurate and reduces manual work our proposed model will capable to read blurred image so it is helpful to read barcode on old objects like old book in the Digital Book Library.

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