Embed the HC2D Barcode Reader in Android Mobile Phone

C.Keerthika[1] S. Sindhu Meenakshi[2]
[1]Master of Engineering [2]Assistant Professor
[1,2]Department of Electronics and Communication Engineering
[1,2]Velalar College of Engineering and Technology Erode.

Abstract— Barcodes are capable of storing the information with the help of black and white bars, dots and lines. Based on the data related to the object, the barcodes can create a unique pattern. This barcode data's are retrieved with the optical readable machine. Basically, barcodes are three different types called as One Dimensional, Two Dimensional, and Three Dimensional. HC2D is a "High Capacity Two Dimensional" barcode can carry the information in two directions that is in vertical and horizontal. In existing system, this barcodes are scanned by using a mobile phone with Android Operating System. But, the accuracy rate is reduced because large amount of data stored in small place. In this technique, by adding the wiener filter in Barcode Recognition Algorithm the recognition rate is improved up to 95%.

***Key words*:** HC2D Barcode, Android4.4 version, Filter

I. INTRODUCTION

Nowadays, barcodes plays an important role in many places based on their application. There are different software are available to print a barcode. But, to recognition the barcode image several technique are available like laser scanner, camera based readers, CCD readers, etc. Based on the technique, the accuracy and cost will vary. In this technique, High Capacity Two Dimensional (HC2D) barcodes are used to hold the data and this barcode is recognized using the mobile phone with high accuracy. Here HC2D barcode is focused because large amount can encode and [1] popular in communication field like [2] QR code, [3] [4] PDF417 barcode, [5] Data-matrix barcode. In this HC2D barcodes data compression [6] is also possible to enhance the data capacity. Also, there is no need to interface any symbol recognition to the mobile phones [7]. So, this is possible to implement in the real time process with low cost.

II. DATA RETEIVAL TECHNIQUE

A. HC2D Barcodes

HC2D is a High Capacity Two Dimensional barcode, it can store large amount of data compared to other 2D barcodes, while it occupies a small area.

Fig. 1: HC2D Barcode

The maximum capacity of HC2D barcode is 10,100 ASCII character and 7250 numeric character that is we can hold both text and binary data. Actually, the HC2D barcode can hold pixel up to 28,224 which consists of data and Reed-Solomon error correcting code [8]. Because of this barcode size is small we can place it in a documents and posters. The HC2D barcode consists of vertical line, horizontal line and dash line. This line is used to find the detection point while reading and dash line is used here to separate the column sampling. The data compression also possible in HC2D barcodes, nearly 60 to 70 percent will be reduced for English language.

When the data are encoded [9] to the barcode format there is a protocol for a proper encryption. That is HC2D barcode has a unique header format for the data encryption. The header format is

Version	DT	Z	Checksum	Length
Data				

Fig. 2: HC2D Header Format

- The current version '1' because still now there is no new version is available.
- DT is Data Field that indicates what type of data is to be encoded like numeric or ASCII characters.
- Z is to indicate that either compression technique is used or not.
- Checksum is to indicate the error correction level.
- Length field indicates the size of the data.
- Data field is nothing but an original data.

B. Barcode reader

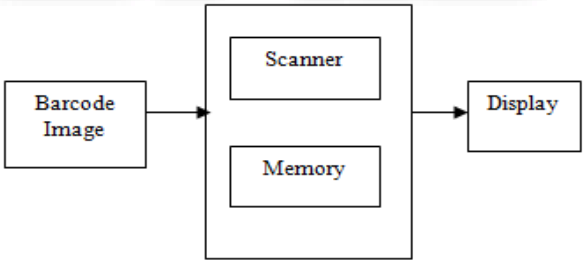

Fig. 3: HC2D Barcode Reader

There is a lot of technique to read a data from the barcode [10] [11]. Barcode image consists of black and white bars, squares dots and space. The lights are shine into the barcode image from the mobile [12] in terms of flash and capture the reflected light back from the barcode. Then by using the reflected light the black and white bars, dots are replaced by 0 and 1. It is possible by represent that white as'1' and black as '0'. So, the original data's can be recognized using mobile reader technique. Then the data which are attached to the barcode image are viewed using the display screen.

C. Data compression

Data compression [13] is at technique in which the data's are encoded to reduce the number of bits. This technique is used while storing the data and transmitting/receiving the

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data. Due to transmitting the compressed data bandwidth is also reduced. This leads to reduce the time and traffic too. The original data also retrieved from the uncompress ion technique [14].

III. ERROR DETECTION AND CORRECTION

When the data's are decoded from the barcode image, some error may occur due to damaged parts and while scanning the barcode some recognized bits may differ from the original data. Reed-Solomon error correction and detection technique [15] [16] is used to reduce the error while storing the data and when decoding from compressed format. Because it is an easier code, an efficient one and it can detect and correct multiple bits. But, this error correction code cannot detect any noise present in the barcode while reading.HC2D barcode can hold pixel up to 28,224 which consists of data and Reed-Solomon code. In Reed-Solomon algorithm, there are two different levels of error correction.

1. Low level error correction
2. High level error correction

In low level process, HC2D barcodes pixel forms many groups and each group pixel consists of 109 byte data and 17 byte error correction code. In high level process, each pixel group consists of 25 byte data and 17 byte error correction code. Based on the required data capacity the error correction level may vary.

IV. BARCODE RECOGNITION ALGORITHM

It is the process of recovering the original data which is attached to the barcode using the following steps,

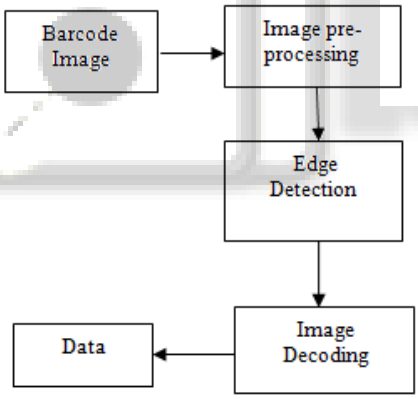

Fig. 4: Processing in Data Retrieval

A. *Image pre-processing*

In a barcode reading process, the original data which is attached to the barcode should not be lost. This is possible only when the image quality is improved. To improve the image quality the following technique should be carefully done in the design process. They are

1) Grey scale processing

Image may be a color or colorless while capturing. This captured image appearances should be changed by applying grey scale process. The image contains a unique intensity value for each pixel based on the image. That value will vary from 0 (black) to 255 (white), the in-between is a grey color. So, based on the intensity level, the color will vary like black, grey and white.

a) Image sharpening

It is an important technique to improve the contrast level. Almost all the pixel should be sharpened to improve the contrast. Sharpening makes the edges appear more defined by darkening the dark pixel and brightening the bright pixel. It will not recover the lost data that is if the image is taken in an out of focus, the fine pixel values are not recovered.

b) Image binarization

Nowadays most of the applications can handle only binary values. Bi-level takes the value of either '0' or '1'. In this application mobile phone are used for reading the barcode and the mobile phone contain the processor for their normal operation. This processor accepts only '0' and '1' values. So, convert each pixel value into bi-level based on the mean value of the entire pixel that is, if the pixel value is above the average means the value is '1' else '0'.

c) Median filtering

Median is a non-linear filter and it is an efficient filter to reduce the salt and pepper noise. There is a lot of noise other than the salt and pepper may occur in the binary image, because the intensity value of the pixel will vary for background image and the main (barcode) image. In Median filtering, the neighboring pixel is arranged based on the intensity value, and then median value is a new intensity value for the centre pixel.

d) Wiener filter

After performing the Median filter, salt and pepper noise is reduced. But the noise due to blurred image is not rectified by the median filtering. If the image is captured by the camera with an unfocussed condition, blurred noise may occur. This noise can be removed by using the Wiener filter. For example: The HC2D barcode with and without filters

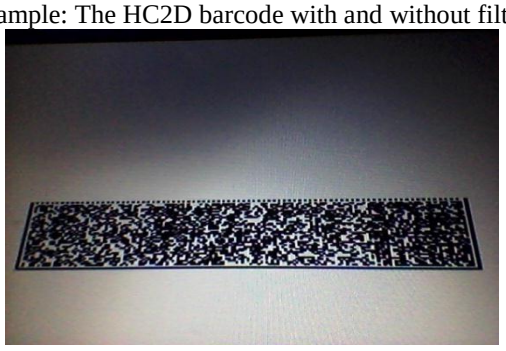

Fig. 5: Without Wiener filter

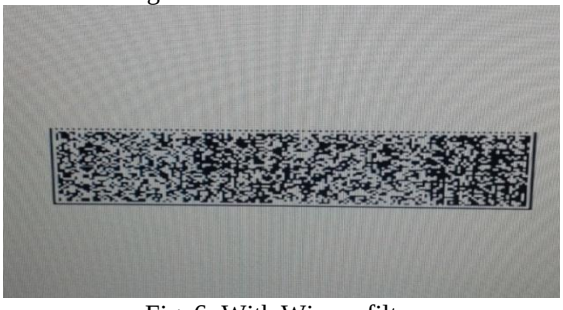

Fig. 6: With Wiener filter

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B. Edge detection

An edge in an image is a boundary at which a significant change occurs in some physical aspect of an image such as discontinuity in depth and/or surface color and texture, direct reflection of light, such as mirror. It takes four steps such as smoothing, enhancement, detection, localization.

C. Image decoding

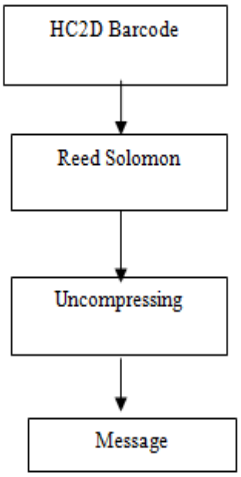

Fig. 7: Processing in Data Decoding

Decoding the data from the barcode through the mobile phone so, that the original data's are retrieved from the barcode and the error correction process is done to eliminate any error occurs in the transmitting process. Then perform the uncompressing technique to obtain the original data from compressed format.

V. EXPERIMENTAL RESULT

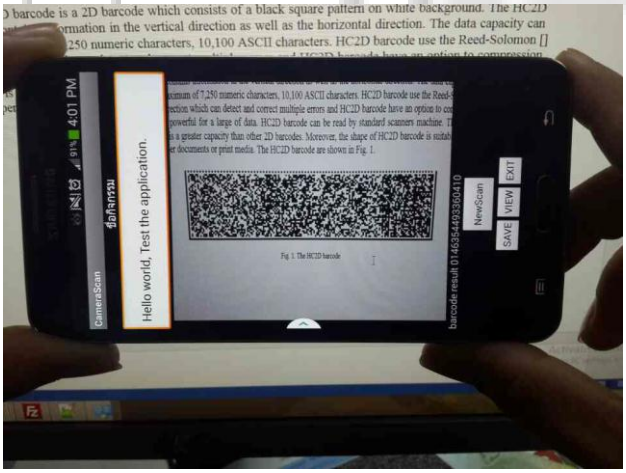

Fig. 8: Experimental setup

This technique is a kind of application to read a barcode image. Android version 4.4 operating system is used to activate the components in the mobile phone after completing the developing parts of application, log in to that and capture the barcode image using camera in mobile phone. The data regarding to the object which is attached to the barcode is displayed in the mobile screen.

This is the data which is attached to the above HC2D barcode. While reading this barcode through the mobile phone the output is displayed as follows.

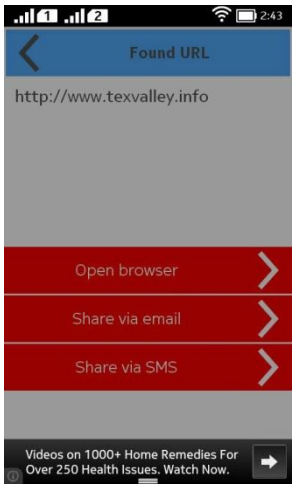

Fig. 9: Data retrieved from barcode

VI. CONCLUSION

This paper presents a real time application to read High Capacity Two Dimensional barcode through the mobile phone. By using, the Barcode Recognition Algorithm the recognition rate is improved while reading the barcode. In the next, the researcher will improve the HC2D recognition rate even at the damaged condition.

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