

Application of Barcode Technology as Improved Examination System

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Abstract—The identification of examination papers is most complex and tedious process as number of students and collages increase now days. So, we need to improve traditional examination system for which we can use barcode technology. There are multiple barcode symbologies are available depending upon their area of use. We compare some symbologies such as UPC, Interleaved 2-of-5, Code-39, Code-128, Codebar. Barcode symbologies which are being used widely have been explained with comparison table and its example. The Code-128 is more advanced symbologies, hence we studied the generation of Code-128 symbology. The application of barcodes in general and improved examination system is discussed in detail.

Key words: Barcode Technology, Barcode Generation, Barcode Symbologies, Code-128, Barcode Recognition

I. INTRODUCTION

In traditional examination system human efforts are the main factor which causes some disadvantages to the transparency of the system. As the interaction of the human increases in the examination system, probability of the human errors is also increases. So, we use barcode technology in the examination system for error free identification of examination papers.

Barcode technology were first developed in fifties to help inventory system, rapidly growing super market needs and became the basis for the Universal Product Code System which is used now days. This technology sets standards for unique identification of products and almost used in all manufacturing companies and shops. Barcode technology is an automatic identification method and mostly used for quick data collection. This technology is also called as Auto ID.

Basically, barcode is made up of series of lines and white spaces which varies in various parameters such as width, barcode generation algorithm and correspond to numeric, alphanumeric or multicode configurations which are not in human readable format. They can be recognized by special hardware called as barcode scanner. Barcode scanner uses OCR (Optical Character Recognition) Technology to grab the hidden information in barcodes.

Barcode scanner recognizes bars and white spaces which are encoded using the binary number system. Scanner extracts all information, find actual data and display it with checking integrity of data.

A. Features of Barcode

Features of barcode technology are as follows:

- Improvement in Accuracy of Data: Barcode provides data accuracy over manual data entry. In the survey one thing found that manual data entry has an error rate of 1 for 290 characters entered. Whereas integrated barcode technology gives 99% accuracy in automated system and results in minimization of human errors.

- Quick data input and high data processing capabilities: Computer system quickly captures the data using barcode scanner and provides processing capability in milliseconds.
- Economical benefits: Due to the minimization of human errors and data communication cost the targeted system becomes more cost beneficial.
- Availability: Barcode printers and scanners are widely available in the market so they integration of barcode technology becomes more easy and business friendly.
- Flexibility: It is not mandatory to use barcodes in each and every condition, we have the flexibility to use manual data entry in some worst cases.

II. LITERATURE SURVEY

Nowadays, barcode technology is used in most of businesses over the world. They are used in medical field, manufacturing companies, widely used in electronic industries, inventories, shopping malls for unique and quick identification of the products. In medical field also, barcode technology is famous. The maintaining digital records of each and every medicine are complicated even if we use computer system. These problems are overcome by using the integration of barcode technology in the computerized application of medical organization. Such type of system proposed by the Microscan Systems in white paper [1].

Thota Sriram, discussed in paper [2] that the applications of barcode technology in data storage and retrieval systems. Also they gave the overall idea of how barcodes are useful in business levels. They suggested many other alternatives to the barcode technology such as OCR, RFID, Magnetic stripes, Datacode Technology. But in case of examination system, the barcode technology is best suitable because it provides efficiency in data processing, minimization in the cost of automated system. As mentioned in paper [3], barcode technology is also used in logistic and data warehouse management. Barcode technology enhances the management capability and cost benefits for logistic enterprises.

III. ANALYSIS OF BARCODE SYMBOLOGIES

Many barcode Symbologies are used to create barcodes. The components in barcode are the white spaces and bars. The collection of white spaces and bars makes character which represents alphabets, numbers, punctuation marks or other special characters.

Bars must be enough dark so they do not reflect back a barcode scanner rays while the white spaces must be clear and enough reflective to be differentiable from the bars, to capture by barcode recognizing device. The lots of barcode symbologies are available depending upon their use. We compare some barcode symbologies in table I which are use nowadays. e.g. UPC, Interleaved 2-of-5, Code-39, Code-139 and Codebar.

Characteristics	UPC	Inter leaved 2of5	Code-39	Code-128	Code bar
Characters	numbers from 0 to 9	numbers from 0 to 9	alphanumeric characters from the ASCII character set	alphanumeric characters from the ASCII character set plus any keyboard character	Decimal number digits and several ASCII symbols
Length	Fixed length of 12, 6 digits	EVEN number of digits	Variable	Variable	Variable
Format	Linear, continuous barcode	Linear, continuous bar code	Linear, discrete code	Linear, continuous code	Linear, discrete code
Reading	Bi-directional	Bi-directional	Bi-directional	Bi-directional	Bi-directional
Checking	Self-Checking and Check Digit incorporated into the bar code	Self-Checking and may have a Check Digit incorporated into the bar code	Self-Checking. May have a Check Digit incorporated into the bar code	Self-Checking and may have a Check Digit incorporated into the bar code	Self-Checking and optional Check Digit

Table 1: Comparative Analysis of Barcode Technology

A. Best Suitable Symbology Code-128

Code-128 is a most effective, high-density barcode symbology which allows the encoding of alphabets as well as numeric data. It contains data integrity using checksum digit and byte parity checking methods. This symbology is useful in targeted system where we have to encode the relatively large amount of data in small space. The structure of code-128 barcode symbology supports numeric data to be encoded at double density with efficiency.

B. Sections of Code-128 barcode

Start code, data, checksum value, stop code. The term quiet zone is used before and after these four sections of barcode. The quiet zone is the blank area before and after the bars and spaces, its allows barcode scanners to identify base values for the color and reflectance of the values which they are reading. The start code is a combination of 1's and 0's, in which 1's are used to represent bars and 0's are used to represent white spaces. It is used to indicate starting of barcode.

The code-128 data section is encoded in collection of bars and white spaces. The binary system is used to represent encoding of alphabets, numbers and all other characters. The width of the bar or white space is the main aspect of the barcode generation. If the encoded string is 1101 then the first bar becomes doubles of original width in size that is single bar becomes thicker.

On the basis of character set of 0's and 1's (data), one checksum value is generated. This checksum value is used at the time of barcode recognition to ensure about data integrity. The checksum value is based on a modulo 103 calculation function. The stop code represents the end of data that is end of bars or white spaces space sequences.

C. Steps of Encoding

The steps for calculating encoded string in Code-128 symbology are as follows:

- Take the value of the start code (103 i.e. 11010000100) and make that the starting value of the final checksum.
- Starting with the first data character following the start character, take the value of the character (from 0

to 102, inclusive) multiply it by its character position (1) and add that to the final checksum.

- Take each additional character in the string, take its value, and multiply it by its character position, and add the total to the final checksum.
- Divide the resulting final checksum by 103. The remainder becomes the checksum value which is added to the end of the string.

D. Example

String is CSE370
 START CODE = 11010000100
 STOP CODE = 1100011101011
 C: value is 35 and bar pattern is 10001000110
 S: value is 51 and bar pattern is 11011101000
 E: value is 37 and bar pattern is 10001101000
 3: value is 19 and bar pattern is 11001011100
 0: value is 16 and bar pattern is 10011101100
 CHECKVALUE = (35+51*2+37*3+19*4+23*5+16*6) mod 103 = 20 = 11001001110
 The final encoded string is:
 110100001001000100011011011101000100011010001100110011101101110100111010011101011

E. Barcode Output

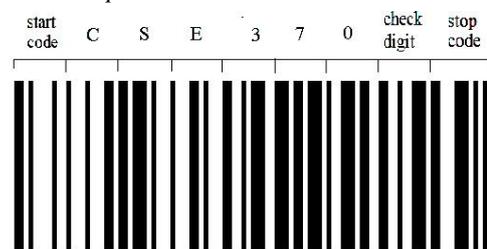


Fig. 1: A sample barcode of the string CSE370 using Code-128 barcode symbology with its all sections.

IV. BARCODE RECOGNITION

The linear imager typically uses only one row of pixels to decode a bar code symbol. It perceives a 1D image, but at a higher resolution than the array imager.

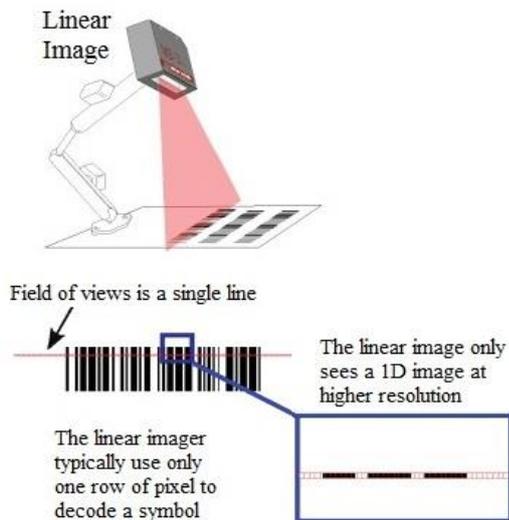


Fig. 2: General working of barcode scanner machine with the linear imager approach.

V. ALTERNATIVE TECHNOLOGY

Another solution for barcode technology is QR code. The QR codes are needed when we required storing more information than barcode technology in very small space. The QR code generation and recognition algorithm are more complicated than the barcode algorithms. It increases cost of implementation of QR code algorithm. So, we found that the use of QR code technology in small scale businesses is not affordable. In the case of improved examination system we have to store single ID of paper. So, we do not required multidimensional information. Hence the barcode technology is performance and cost efficient for improved examination system.

VI. CONCLUSION

Barcode is a technology which is used as information carrier in our day to day life. The barcode technology applying to improved examination system which attached with our computer system and automatic identification technology. There are many barcode symbologies present, in which code-128 symbology is able to encode alphabets, numbers, ASCII character set and all keyboard characters. Hence, this symbology is best suitable for improved examination system which makes the system faster in low cost.

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