© 2014 IJIRT | Volume 1 Issue 11 | ISSN: 2349-6002

ENERGY PROFICIENT BARCODE IDENTIFICATION FROM UNFOCUSED IMAGES

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***Abstract*- Many cell phones cameras in the market are equipped with low grade lenses which produce blurred images, so most of the barcode scanning technologies are not capable of handling out-of-focus blurred images. To tackle this problem, an energy efficient template matching scheme is proposed. It is capable of reading linear barcodes from low resolution images containing OOF image blur. Finally, the barcode value is retrieved and its efficiency in energy is calculated which is the rate at which the work is done upon a blurred barcode image.**

***Index Terms*- out-of-focus, energy efficient template matching, blurred barcode.**

I. INTRODUCTION

Barcode technology uses a variety of different symbols to encode the data in different forms. Barcodes are used widely in business environment which take account of the description about the product and its price information. In this paper, the proposed scheme works specifically for the widely used standards such as UPC/EAN-13.

A. Barcode

Barcode is a visual representation of data of varying widths of black bars and white spaces that holds alpha numeric information to be easily accessed by computers (reading device). It is referred as linear or 1-D barcode.

B. Out-Of-Focus Barcode

An image point is the point where light rays originating from a point converges from the object, is also called as focus. Out of focus is the light which is not well converged. Many cell phone cameras are often equipped with low grade lenses, generally lacking focusing capability which produces blurred images.

The barcode images taken by this kind of cell phones produce out-of-focus blurred images. Therefore, the scanned barcode symbol is not focus to be read without error. To deal with out-of-focus barcode images, an energy efficient template matching scheme is proposed.

C. General Barcode Format

The energy efficient template matching scheme is specifically applied to EAN-13/UPC barcodes. The EAN-13 barcode is a superset of UPC barcode because EAN-13 contains a 13 digit number while UPC barcode includes 12 digit numbers.

The 12 digit numbers can be divided into four parts. The first digit describes the object type. The second part includes the next five digits which describes the object manufacturer. The third part includes the next following five digits which describes the manufacturer individual object. The fourth part contains the last digit called the check digit used to verify whether the barcode has been scanned correctly.

II. RELATED WORKS

Barcode plays an important role in our day-to-day life. It is necessary that the barcode symbols should be in focus to be read by the scanner. If the barcode symbols is not in focus, the scanner will not able to decode the barcode value efficiently. The barcode scanning system proposed in many of the works are not capable of handling severe OOF blur because the features used for barcode localization or symbol character segmentation are not invariant towards image blur. The Newton's method approach [1] is discussed to decode the blurry barcode. The barcode value is obtained in about six minutes. This approach is promising and proves useful for applications if speed is not an important factor. This is too slow to be practical. The performance of this method is usually dependent on initial settings of the parameters such as the variance of the blurring kernel. The blur level handle by this method is still limited. The novel approach [2] is discussed to detection of one dimensional barcode images. This approach is particularly designed to recognize barcodes, where the resolution and the quality of the barcode image may be low due to noise and illumination. The novel approach is fast and scalable and can be adjusted to search for applicable outcome within a particular period of time. It is hard to implement because the features used for barcode localization or symbol character segmentation are not invariant towards image blur. An approach using total variation based energy minimisation [4] to address the recovery of a blurred one dimensional (1D) bar code. This process is stable with respect to changes in the input signal. The energy methods are robust for significant blurring. The size of the blurring kernel pertains to the so-called spot diameter of the laser beam at impact with the bar code. This spot diameter is a function of the laser beam and the distance from the scanner to the bar code. Most scanners can successfully read a bar code if the spot diameter is no greater than square root times the x dimension. Iterative procedures were used to reconstruct the barcode signal. Additionally, the iterative nature of these categories of methods makes computation very time consuming, which may take seconds or even minutes for processing, and is not feasible for real-time barcode scanning in real-world situations.

III. PROPOSED SYSTEM

The OOF blur barcode images are handled by using iterative procedures. This increases the computational time to handle these images. It limits the robustness of the barcode scanning systems towards blur. To tackle this problem, an energy efficient template matching scheme is proposed to improve the computational time and improve the efficiency of the barcode scanning systems.

IV. SYSTEM MODEL

The Energy efficient template matching scheme for linear barcode scanning is proposed to handle the Out-of-focus (OOF) barcode images. The OOF blur barcode image is given as input in the client system. The deformed scanline is extracted based on the blur level estimation of the barcode image. The sequences of waveform are generated for each and every scanline extracted from the blurred barcode. The scanline of the barcode is also represented graphically. The Energy efficient template matching scheme reconstruct the barcode template by comparing the waveform sequence and the graphical representation of the barcode. Finally the reconstructed template value is retrieved from the server. The energy value for the barcode image is then calculated by examining how fast the work is done on the barcode object by using this scheme.

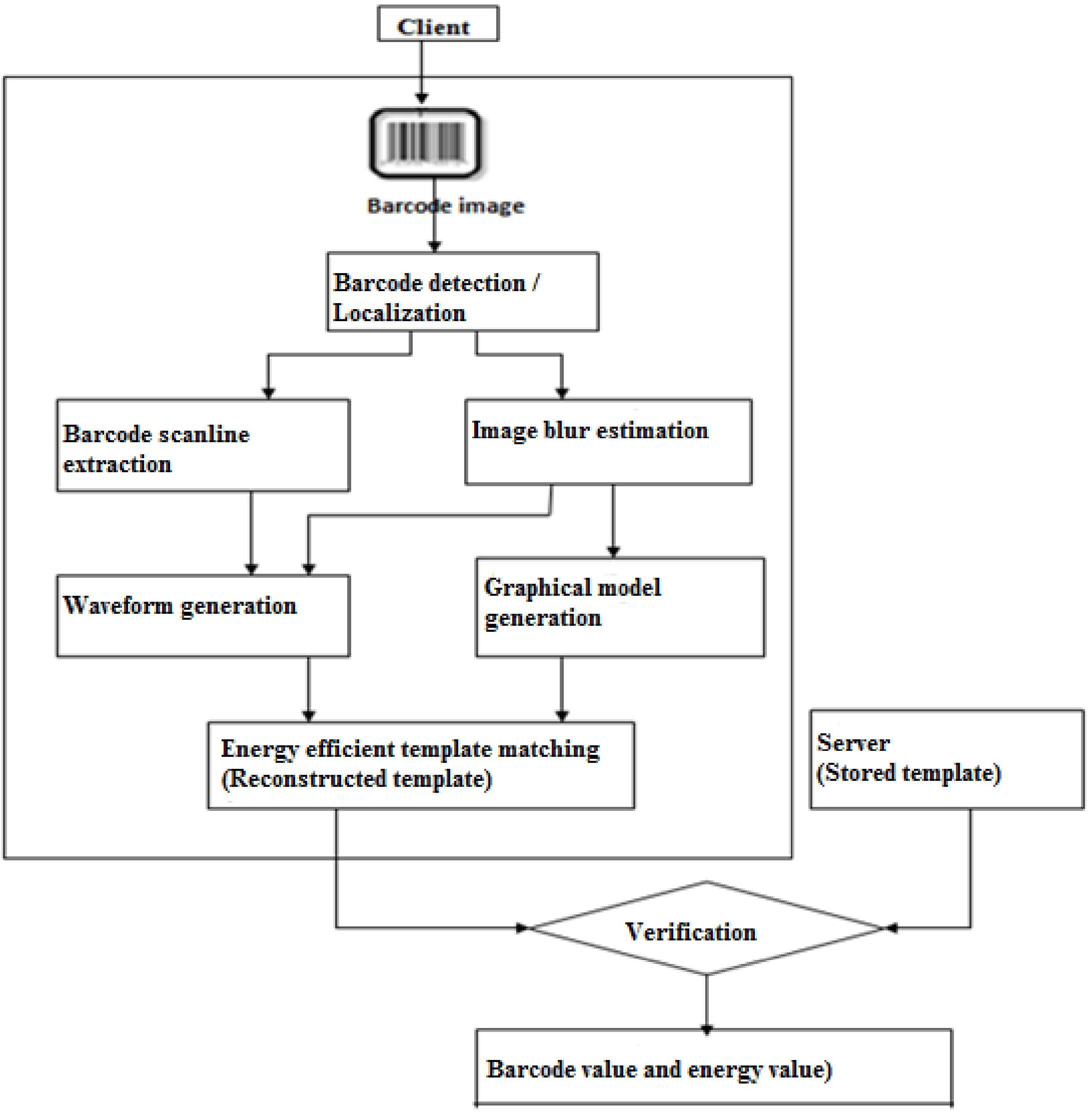

Fig.1 System Architecture

V. IMPLEMENTATION

A. Getting an Input Image

The original barcode image is given as an input. Then the barcode image is degraded by adding noise. Then the original barcode image becomes blurred and out-of-focus.

B. Barcode Detection and Localization

Barcode is detected by removing the unwanted spaces.

C. Barcode Scan Line Extraction

A linear regression is used to compute the regression coefficient of the points in the line segment. All points with regression coefficient below a threshold are scanned in the segment and the point that gives the largest error will generate a new breakpoint.

D. Image Blur Estimation

Parameters of image degradation can be extracted based on the position of border guard bars. When the parameter changes the border guard bar pattern has a convex parabolic curve.

E. Waveform Generation

The extracted scanline can be chosen to decompose the extracted scanline into waveform segments.

F. Graphical Model Generation

The graphical model is generated by considering the height and width of the extracted scanline. This model illustrates the relationship between the waveform of the blurred barcode and the template value of the barcode.

G. Energy Efficient Template Matching

The template matching scheme compares the portions of an image against one another. The template is obtained by comparing the waveform and graphical representation of the extracted scanline.

H. Barcode Verification

Barcode verification is to check barcode quality. It is a bridge between printing and scanning of barcodes. It is something more than scanning. The reference waveform most similar to the observed barcode waveform is found through dynamic template matching. Then the barcode is verified.

I. Barcode Value and Energy Calculation

After the barcode is verified, the found reference waveform's corresponding barcode value is treated as the output of the barcode scanning system. Then the energy efficiency rate for the retrieved barcode is also calculated.

VI. RESULTS

The screenshots of the proposed system is described as below

Fig.2 scanline extraction

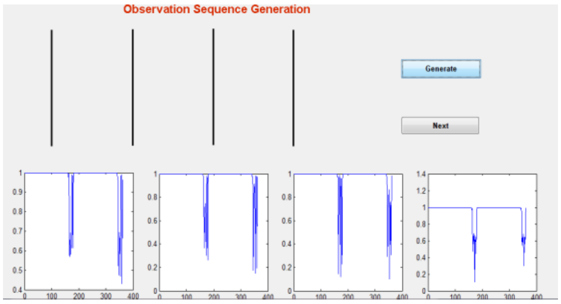

Fig.3 Waveform generation

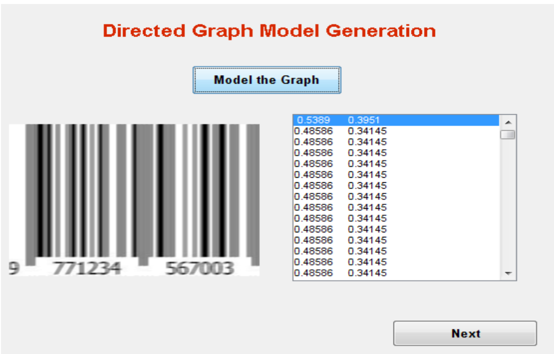

Fig.4 Graphical model generation

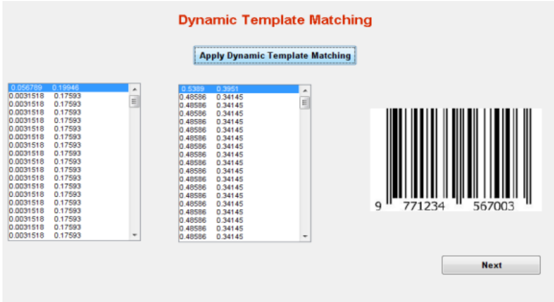

Fig.5 Template matching

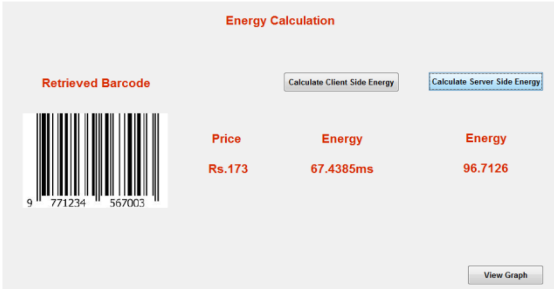

Fig.6 Barcode value and energy value

VII. CONCLUSION

The proposed disciplined and efficient dynamic template matching approach is capable of retrieving barcode value from out-of-focus blurred images and finally calculating the energy efficiency, which is the rate at which work is done upon a blurred barcode images. The proposed system is specifically applied to EAN-13/UPC barcode scanning.

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