Camera Based Spectacles for Visually Impaired (Camspects)

Nitu Elza John
Department of Computer Science and Engineering
Saintgits College of Engineering, Kerala, India

Sujin Sam Mathews
Department of Computer Science and Engineering
Saintgits College of Engineering, Kerala, India

Tony M S
Department of Computer Science and Engineering
Saintgits College of Engineering, Kerala, India

Wineeta P Babu
Department of Computer Science and Engineering
Saintgits College of Engineering, Kerala, India

Er.Thomas Joseph
Department of Computer Science and Engineering
Saintgits College of Engineering, Kerala, India

Abstract

Camspects is a camera based portable barcode reader and detection glass for visually impaired people. The idea is to determine the name and price of the product the user held in their hand. The product is held in front of the spectacles and camera attached with the spectacles captures the image. From the image the details of the product is obtained from the database. Thus the details of the hand held product can be obtained and can be distinguished in no time. Hence, it is widely used in their shopping purposes. This product is easy to use, portable and user-friendly. Only simple guidelines are required to use the camspects. The extracted output is given as an audio through the head phones attached with the spectacles.

Keywords- Barcode, Portable, User-Friendly, Spectacles

I. INTRODUCTION

About 285 million people are estimated to be visually impaired worldwide: 39 million are blind and 246 have low vision. And most of them have greater restrictions in their day to day activities, like they have to lean on others for buying the day-to-day necessity, even though highly trained guide dogs are available that can guide their masters with a exacting precisions, they are rendered useless when it comes to basic shopping. In this case, the blind or the visually challenged are at the mercy of others. They will need a human companion with them to identify the objects, mention its price etc.

So we tried to remedy this situation as best as we could and the way forward was through barcodes. Linear 1D barcodes [1] appeared in the 1960s and are now present on the packaging of all consumer products. A barcode consists of a set of dark stripes of varying thickness on a light background encoding an identification number or ID. The store's databases can be propagated with these values to correspond to the price and other relevant data of the product. Many more advanced tagging technologies have emerged in the last decades allowing the storage of more information (e.g. 2D barcodes, QR codes, Radio Frequency ID (RFID) and so on). However, none of them has really taken off in the retail industry as most applications only require a simple label (for billing, tracking, counting, etc).

So here we introduce Camspects, a camera based portable barcode reading spectacles for visually impaired. Our camspects snaps the pictures of whatever is in the peripheral view of the visually challenged person and sends it to the onboard arduino controlling unit, which utilizes the python code to triangulate the position of the barcode within the frame and crops it out. [2]Then another python code is utilized in deciphering the barcode. The deciphered value is then used in identifying the values corresponding to the product from the database.

II. RELATED WORK

The authors EmreBasran, OzgurUlucay and SarpErturk proposed that the technique for barcode interpretation through camera is based on the image processing. Fundamentally, barcode interpretation is achieved through laser readers and it is needed instrument for barcode interpretations. In this paper, the presented approach for barcode interpretation straight from camera pictures and the proposed technique was contained with an edge recognition algorithm to attain barcode borders from the pictures acquired by the camera and also certain threshold mechanism to develop pictures as binary figures and clever edge recognition kernel is needed to determine the barcode part. Throughout the process, edge recognition technique identified the edges in picture and also white parts are allocated to arrays, after that the threshold procedure found the barcode numbers from the white and black areas.

The authors florian hock and douglas are shown an another algorithm to decode and locate EAN-13 barcodes from the pictures taken over the digital cameras in image processing. And this paper presented an algorithm which is accomplished of interpreting a specific barcode from a taken picture. This algorithm categorizes matching line designs on block level for determining location of barcode inside the taken input picture. After the barcode picture area is recognized then decoding progression is passed out conferring to the EAN-13 description and this method could be simply altered to additional one-dimensional barcodes.

The authors Lim Ah Hock, Hiroshi Hanaizumi and Eiasakuohbuchi proposed an algorithm and application of image restructuring for the QR barcode through mobile phones. The mobile handset scheme used here involves of a mobile solicitation processor, display device and camera, digital signal processor (DSP), the basis image which is captured through embedded camera equipment. This algorithm is depended on the code space found via four corner recognition for the 2D barcodes. The taken input picture has a distorted form as it is of being taken from embedded camera equipment, so this paper proposed the procedure is recognized as inverse perception transformation which is used for normalizing the code form.

The authors Ying-Hong Liang and Zhi-Yan presented the robust and speed procedure for skew recognition in 2D barcode pictures and that is based on the least square system. Disparate the approaches depends on Hough deliver that are computationally classy and it quickly achieves skew perspectives building it valid to real-time solicitations and this technique comprises two progressions, first one is segmenting process. It examines for barcode region. Another is the line suitable process. It turns the barcode mark and acquires the skew position. Accordingly the investigational outcomes illustrate this technique decreases the running period. With the use of barcode's borders line information, this technique could examine the border's skew position, even if the identified picture has great noise.

The authors ParastooSadeghi and RamtinSharms proposed the image processing framework to recognition of the single dimensional barcode pictures and the proposed algorithm is mainly designed to identify the barcodes wherever the picture might be having low resolution. And low quality from non-uniform brightness, extensive blurring, noise, hue saturation and de-focusing occurs, where the code compactness might be fewer than dual pixels. This algorithm was mainly implemented for barcodes of EAN-13 type. And it is proven that speed, scalable, accurate and could effortlessly adjusted to find the valid consequence within the indicated time limitation and it was very beneficial for the barcode real-time recognition in the portable hand-held equipment's within the restricted processing abilities, such as mobiles.

Parallel adjacent spaces and bars, were the pattern of barcode generally and it were aligned horizontally. So the barcode region would be obviously conquered with vertical surfaces. The dissimilar sub bands of wavelet picture, the barcode areas coefficients of HL sub bands would be larger than the ones of sub bands of LH or sub bands of HH spread out at corresponding region. Hence, principles defined constructed on the vitality of coefficient pyramid bush which highlights vertical surfaces were functioned for barcode region locality. Concerning the restriction in calculation of mobiles, they used 5/3 symmetric filters and it were used for the picture wavelet decomposition and it is speed and simple. Next mark the vertical surface area in wavelet picture, post processing is required to regulate the limit of barcode region. A morphological handling, initial process is functioned to join vertical surface range. At the end, an object gathering label process was utilized to calculate the extent of the complete object regions in morphological handling outcome. Empirically, the determined categorized region was the barcode space.

III. PROPOSED METHOD

Here these existing systems cannot be easily used by a visually impaired people, or by a blind person. They will not be familiarized with smart phones and cannot use the applications installed in it to recognize the corresponding objects by barcode detection. [3]And the QR code reader is especially for scanning and billing purpose which also cannot be used by visually impaired ones.

In order to overcome the limitations of existing system we proposed a new system, which is, Camspects. Here the visually impaired people have to wear a spectacles and keep the object they wish to purchase in front of the spects. It will recognize the barcode and retrieve the corresponding details of the object from it. The details of this object will be given to them as an audio output through head phones. The details include the prize of the said object alongside the name of the object helping in comparison of same product from different brands.

The proposed system is based on the camera based product identification for blind persons. To solve the common aiming problem for blind users, we have proposed a camera based method to detect the object of interest. Users have to capture image and then system read out the details of product. [4] The proposed system provides effective solution as Compared to most of the existing systems.

The main purpose of the project is to implement a device which is useful for the visually challenged in their shopping purposes. Sometimes when the visually impaired ones pick an object from a rack, they may not be able to identify the exact item, since it have the same physical properties as that of others. So, here, when the object is held in front of the spectacles, it is recognized and the details of the product are read out through head phones. Hence they can recognize the product and its price.

A. Image Capture Module

The image capture module will detect the image captured by the Camera attached to the goggles. This will be easy for the visually impaired person to capture the image as the camera will be situated on the goggles. The image captured will be converted into gray scale.

B. Barcode Detection Module

This module will detect the barcode. This is achieved using computer vision techniques. After detection the scanning and decoding will be done using zbar method.

C. Audio Module

This module will get the product details from database as an input and it will convert it into an audio output. We use text-to-speech technique. Thus they get the output.

D. Architecture

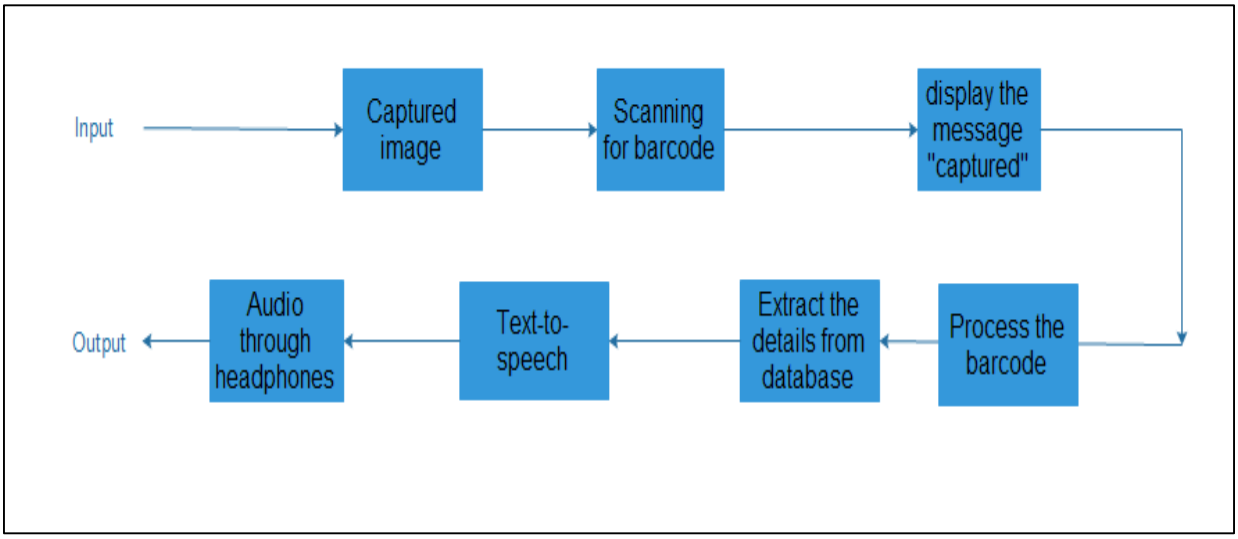

Fig. 1: Block Diagram of Camspects

IV. GENERAL DESCRIPTION

Computer vision [5]tasks includes methods for acquiring, processing, analyzing and understanding digital images, and extraction of high-dimensional data from the real world in order to produce numerical or symbolic information, e.g. in the forms of decisions. Understanding in this context means the transformation of visual images (the input of the retina) into descriptions of the world that can interface with other thought processes and elicit appropriate action. [6]This image understanding can be seen as the disentangling of symbolic information from image data using models constructed with the aid of geometry, physics, statistics, and learning theory.

A. Detecting Barcodes in Images using Python

The steps [7] necessary to detect barcodes in images using computer vision techniques include:

1) Compute the Scharr gradient magnitude representations in both the x and y direction.
2) Subtract the y-gradient from the x-gradient to reveal the barcoded region.
3) Blur and threshold the image.
4) Apply a closing kernel to the threshold image.
5) Perform a series of dilations and erosions.
6) Find the largest contour in the image, which is now presumably the barcode.

B. Example

Fig. 2: Image Containing a Barcode

We load our image off disk and convert it to gray scale. Then, we use the Scharr operator to construct the gradient magnitude representation of the gray scale image in the horizontal and vertical directions .From there, we subtract the y-gradient of the Scharr operator from the x-gradient of the Scharr operator. By performing this subtraction we are left with regions of the image that have high horizontal gradients and low vertical gradients.
Our gradient representation of our original image above looks like:

Fig. 3: The Gradient Representation

The next steps will be to filter out the noise in the image and focus solely on the barcode region. The first thing we'll do is apply an average blur to the gradient image using a 9 x 9 kernel. This will help smooth out high frequency noise in the gradient representation of the image. We'll then threshold the blurred image. Any pixel in the gradient image that is not greater than 225 is set to 0 (black). Otherwise, the pixel is set to 255 (white).

Fig. 4: Thresholding the gradient image

In the threshold image above, there are gaps between the vertical bars of the barcode. In order to close these gaps and make it easier for our algorithm to detect the "blob"-like region of the barcode, we'll need to perform some basic morphological operations. We'll start by constructing a rectangular kernel. This kernel has a width that is larger than the height, thus allowing us to close the gaps between vertical stripes of the barcode. We then perform our morphological operation by applying our kernel to our threshold image, thus attempting to close the the gaps between the bars. Now [9] the gaps are substantially more closed, as compared to the threshold image above:

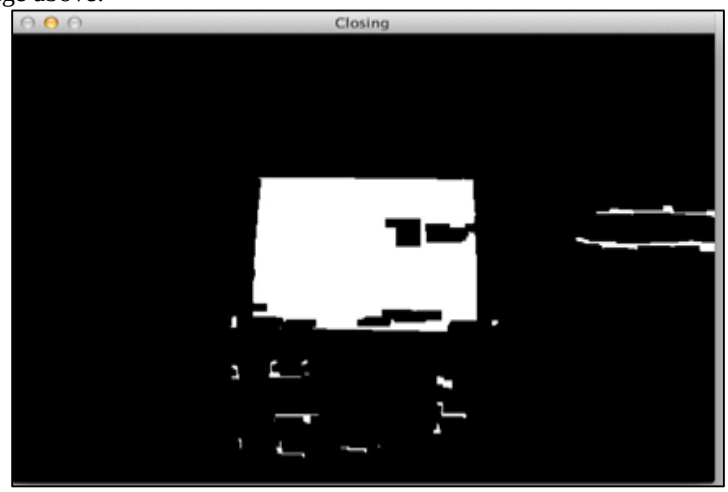

Fig. 5: Applying closing morphological operations

Next we are performing 4 iterations of erosions, followed by 4 iterations of dilations. An erosion will "erode" the white pixels in the image, thus removing the small blobs, whereas a dilation will "dilate" the remaining white pixels and grow the white regions back out. Provided that the small blobs were removed during the erosion, they will not reappear during the dilation. After our series of erosions and dilations you can see that the small blobs have been successfully removed and we are left with the barcode region:

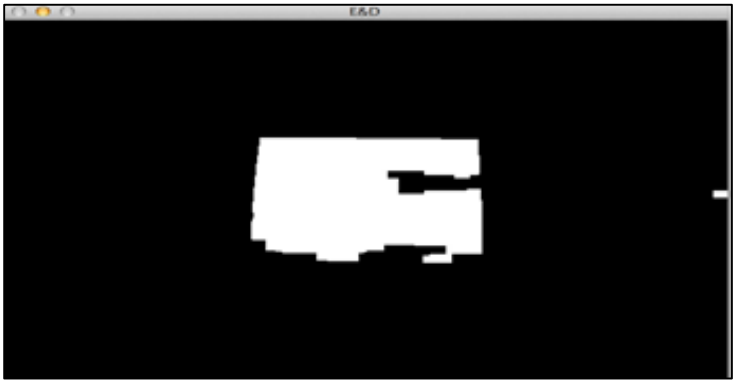

Fig. 6: Removing small, irrelevant blobs

Finally, find the contours of the barcoded region of the image. We simply find the largest contour in the image, which if we have done our image processing steps correctly, should correspond to the barcoded region. We then determine the minimum bounding box for the largest contour and finally display the detected barcode.

Fig. 7: Successfully detecting the barcode

V. CONCLUSION

Camspects is a camera based portable barcode detection glass for visually impaired people. This contains a camera, a raspberry pi module and an audio unit. At first, the person has to hold the object in front of the spectacles. Once the image of the barcode is captured, the corresponding details of the product which include the name and price of the product is given as output to the user through an audio unit. After hearing the audio, the user will get a clear idea about the item they are holding.

Even though there are various equipment's for barcode detection and scanning they are not for suitable for the visually impaired ones. It may be just for billing purposes and so on. But the camspects is a device which of greater use for such people. Sometimes, just by holding an item in hand they cannot correctly recognize what the item is. Items with same weight and texture (e.g., a bottle of jam and a bottle of mayonnaise) cannot be recognized by them.

So in order for the correct identification of objects we introduced camspects. Just by wearing the spects and capturing the image using the camera the exact details of the object is identified and produced. The other advantages include, it is easy to wear and handle. And only simple guidelines are needed to use this. Thus it can overcome many disadvantages the existing systems have.

VI. FUTURE SCOPE

The applications of camspects can be extended by adding more advanced properties to it like the generation of certain instructions. That is, when the barcode is held in wrong way or when it is in a tilted angle, the proper instructions like 'turn right', 'turn left', 'tilt' etc., and should be provided so that the exact image can be captured without any pain. By implementing in malls and shopping complexes, this can be used by any one and thus can reduce the complexity in billing systems. Now, the details of the product

include the name and the price only. So we try to include the entire description of the product like its brand, expiration date etc. since we include a text-to-speech mechanism, this can be again implemented in the field of transportation. That means, by wearing the camspects, it can tell which bus is arriving to the bus stop or bus stand, so it will of greater use for the visually impaired ones in their transportation field. And if there are any obstacles in their way, it will correctly recognize it using ultrasonic technologies and make them aware. Hence it will provide complete security to the user. Thus they can navigate anywhere safely and smoothly.

And in electronic shopping cart facility for blind people in which it gives number of products on trolley and total cost of the products on the spot. Implementing in malls and other shopping complexes, detailed description of the product and capture the image by using a keyword "spects capture". As mentioned earlier, this will reduce the queues in shopping malls to a greater extend.

And the corresponding amounts can be withdrawn from their accounts by integrating the owners account before shopping. Hence its applications can be extended to various fields which include shopping, transportation, navigation, security etc.

REFERENCES

[1] Abinaya, R. Infant, E. Esakkiammal, and Mrs Pushpalatha. "Compact Camera Based Assistive Text Product Label Reading and Image Identification for Hand-Held Objects for Visually Challenged People."
[2] Creusot, Clement, and Asim Munawar. "Real-time barcode detection in the wild." In Applications of Computer Vision (WACV), 2015 IEEE Winter Conference on, pp. 239-245. IEEE, 2015.
[3] PALLAVI, N., and MAYA SPATIL. "An Innovative Product Identification for Blind Persons." (2015).
[4] Kulyukin, Vladimir, Aliasgar Kutiyanawala, and Tanwir Zaman. "Eyes-free barcode detection on smartphones with Niblack's binarization and support vector machines." In Proceedings of the International Conference on Image Processing, Computer Vision, and Pattern Recognition (IPCV), p. 1. The Steering Committee of the World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp), 2012.
[5] Tekin, Ender, and James M. Coughlan. "An algorithm enabling blind users to find and read barcodes." In Applications of Computer Vision (WACV), 2009 Workshop on, pp. 1-8. IEEE, 2009.
[6] Data mining Concepts and Techniques, Jiawei Han and Micheline Kamber.
[7] Jafri, Rabia, Syed Abid Ali, and Hamid R. Arabnia. "Computer vision-based object recognition for the visually impaired using visual tags." In Proceedings of the International Conference on Image Processing, Computer Vision, and Pattern Recognition (IPCV), p. 1. The Steering Committee of the World Congress in Computer Science, Computer Engineering and Applied Computing (WorldComp), 2013.
[8] https://gist.github.com/gyurisc/aa692ad27c2699ec37.Detecting Barcodes in Images with Python.
[9] Jafri, Rabia, Syed Abid Ali, Hamid R. Arabnia, and Shameem Fatima. "Computer vision-based object recognition for the visually impaired in an indoors environment: a survey." The Visual Computer 30, no. 11 (2014): 1197-1222.