Identification and Enumeration of Indian Coins Value Using Morphological Operation

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Abstract— The main purpose of the paper is to apply computer vision techniques to develop a program which should identify the coins in an image and enumerate their total value. That is to have a computer to read the image and calculates the total value of the coins which are on the image. There are several techniques involved such as image colour segmentation, edge enhancement, noise reduction, dilation, edge detection, Hough transform. The key to accomplish this paper is grouping of coins based on its feature. Feature used here are radius and colour. Once the radius is calculated, total value of the coins are calculated. MATLAB simulation is used to obtain results.

Keywords— edge enhancement, noise reduction, dilation, edge detection, Hough transforms.

I. INTRODUCTION

Nowadays banks use the bill counting machines to enumerate the money they have received, however when the customer wants to pay a large number of cash into the bank, then still have to wait for a quite a while. Particularly when there is large number of coins inside bank, staff may committee mistakes in counting, since some coins looks similar in shape so sometimes it is difficult to distinguish them by human eyes, especially for large number of coins. Minoru Fukumi et al. presented a rotational invariant neural pattern recognition system for coin recognition[1].Minoru Fukumi et al. tried to achieve 100% accuracy for coins.in this work he used back propagation and genetic algorithm for coin recognition[2]. paul Davidson presented an approach for coin classification using learning characteristics decision trees[3].Michal nolle et al. developed a coin recognition and sorting system called Dagobut[4].Seth Mc Nell et al. presented a coin recognition system to recognise US coins using rector quantization and histogram modelling[5].

This paper presents morphological operation for coin detection and enumeration of total value of the coins. The program working conditions should be set up to improve the efficiency and effectiveness of the program. Because there are hundreds conditions about how the coins display on an image. For instance, the size and shape of the same coin could also vary according to the position of the camera that captures the coins. If the camera is placed just above the coin, the shape of the coin will be a circle. Otherwise, the shape of the coin will be ellipse. And also if the camera placed near the coins, the size of the coin on the image captured by the camera will be relatively bigger than the size of coins captured by the camera which placed far from the coins. Although these two problems can be solved by using scale, the time of this project is restricted. Following fig.1 shows some Indian coins used in this paper.

Fig. 1 Original image

II. ASSUMPTION

This paper is developed under the following physical conditions.
1. The camera should be placed just above the coins.
2. The distance between the camera and the coins should be fixed.
3. The coins should be placed on the clear background.
4. The coins should be placed lying flat.

III.   PROPOSED METHOD

The proposed method of coin identification and calculating the total value includes image reading colour segmentation, edge enhancement, edge detection and Hough transform.

A. *Image Reading and Converting Image to Grey Scale.*

Image is captured by good resolution camera and store the image in the database. Once the image is captured, the image must be converted to grey scale image. Then segmentation is done.

B. *Segmentation*

In this step image is separated from the background. The output image should be coin belonging to the same group on the input as shown in fig.2

Fig. 2 Output image after segmentation

C. *Edge enhancement*

In this step once the segmentation is done, lots of non-edge pixels would be found. To remove the non-edge pixel and to   obtain clear edge of the coins, edge enhancement is done. Edge enhancement is performed in two steps.
1.   Reduce noisy
2.   Fill the region

1)   Reduce the noisy: In this step, random and isolate pixels which are formed during segmentation are removed. Random and isolate pixels are called noisy here.Fig.3 shows output image after applying noise reduction.
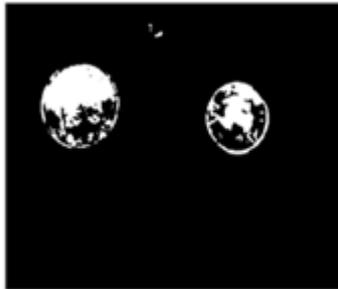

Fig. 3 Output image after applying noise reduction

2)   Fill the region: In this step fill the gaps within the coins in order to recover the pixels that are lost in segmentation. Here Dilation operation is used to fill the space between the isolate pixels of the coins. After dilation clear edges are obtained as shown in fig.4

Fig. 4 Output image after applying dilation operation

D. *Edge detection*

Once the clear edges of the coins is obtained, Use edge detector to find the edges of the coins.in this paper canny edge detector is used to find the edges of the coins as shown in fig.5

Fig. 5 Output image after applying canny edge detector

E. Blob measurements

In this steps once the clear edges of the coins are obtained, Hough transform algorithm is applied to all the edge points to get the shape and location of the coins. And then accordingly radius and centre of the coins are obtained.

F. calculate the total value of the coins

Once the radius and centre is obtained, value of the coins in each group is calculated. Finally all the values add together to get the total value of the coins. Here strcat is used to get the total value.Fig.6 shows the flowchart of methodology.
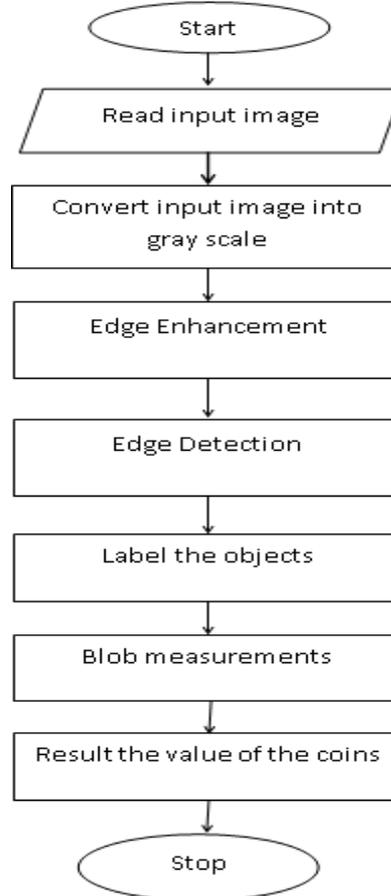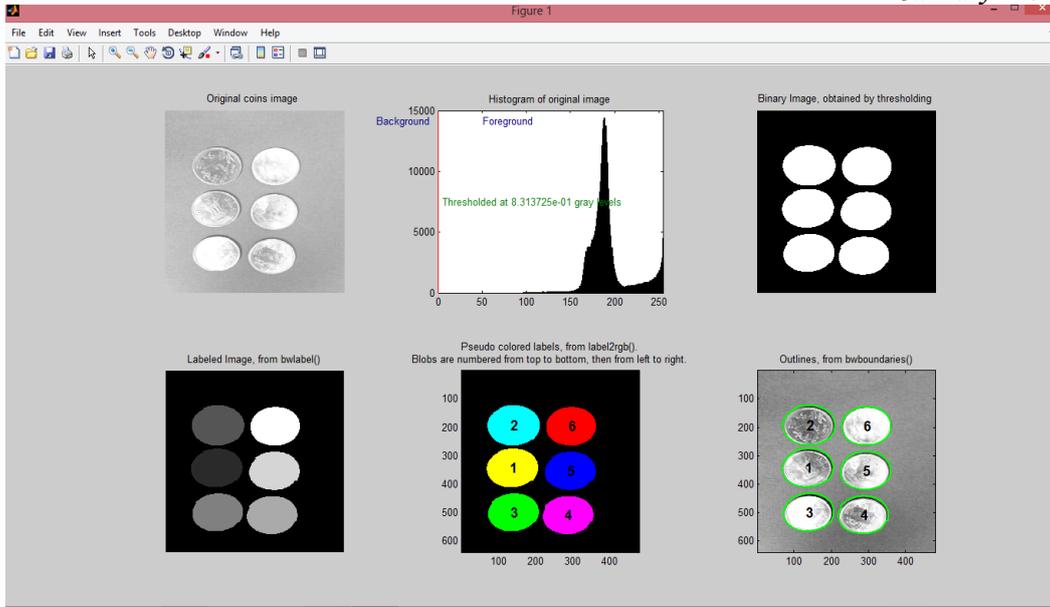

Fig. 6 Flowchart of methodology

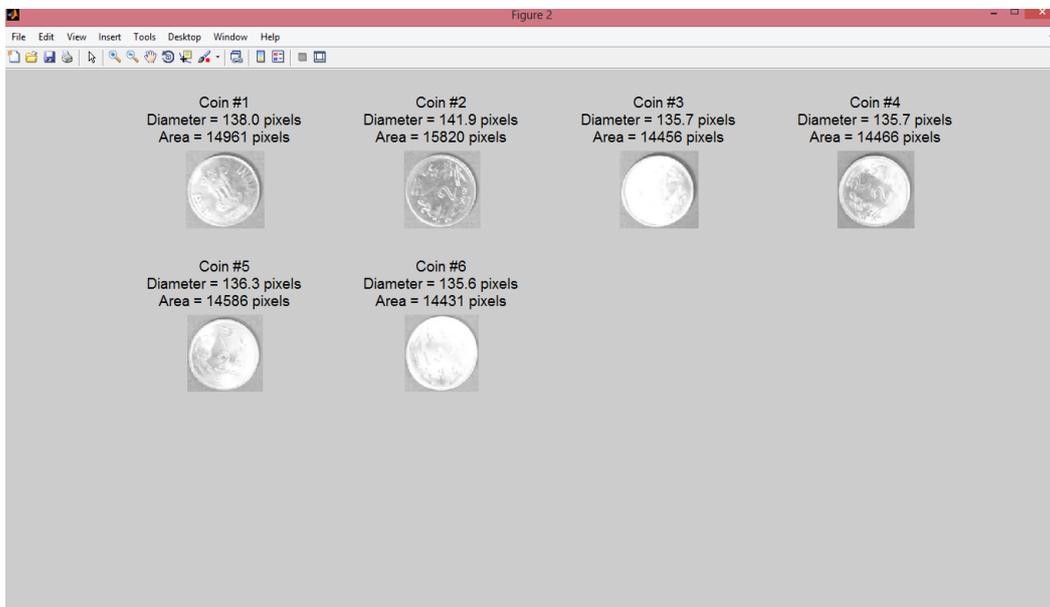## IV. RESULTS AND SNAPSHOTS

The proposed method is implemented using MATLAB 2013. Results are analysed. Following snapshot illustrate the result of this paper

Programmed GUI to select image

Output Background Image

Detected coins of input image

Resulted coin value produced in GUI

Values produced after blob measurements are tabulated (table 1).

Table I

Blob #	Mean	Intensity	Area	Perimeter	Centroid	Diameter
# 1	209.9	14961.0	458.7	137.9	343.4	138.0
# 2	186.2	15820.0	470.4	141.0	193.3	141.9
# 3	232.6	14456.0	449.3	140.3	499.9	135.7
# 4	212.2	14466.0	451.5	286.9	509.3	135.7
# 5	225.0	14586.0	458.5	293.3	353.5	136.3
# 6	240.4	14431.0	445.1	295.4	196.5	135.6

V. CONCLUSION

Morphological operation shows positive sign for coin identification. Edge enhancement provides the clear edges of the coins to improve accuracy for coin detection. Also blob measurements provide better results.

Future work includes introducing new technique of image processing such as neural network for coin edge detection. Also considering other properties of coins like size, weight and material used.

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REFERENCES

[1]   M. Fukumi, S. Omatu, "Rotation-Invariant Neural Patten   Recognition System with Application to Coin Recognition", IEEE Trans. Neural Networks, Vol.3, No. 2, pp. 272-279, March, 1992
[2]   In 1993 Minoru Fukumi et al. tried to achieve 100% accuracy for coins.
[3]   Paul Davidsson in 1996 presented an approach for coin classification using learning characteristic decision trees.
[4]   M. N¨olle, P. Harald, R. Michael, K. Mayer, I. Holl¨ander, and R.Granec, .Dagobert - a new coin recognition and sorting system,. in Proc. DICTA Digital image computing techniques and applications, 2003, vol.1, pp. 329.338.
[5]   In 2004 Seth McNeill et al. presented a coin recognition system to recognize US coins using vector quantization and histogram modeling.