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Rotation Invariable Method for Currency Coin Detection

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***Abstract*—This paper is to detect denominations of Indian coins. Counting the coins manually, collected in large amount, such as coins collected at Indian temples is difficult. This can be made easy with the proposed method of coin detection, where scanning of the coin from both the sides is considered while passing the coin through conveyer belt. By selecting one of the two images acquired, we proceed further with application of segmentation technique. Traversing row wise and column wise through the image acquired, centre and the radius of the coin is obtained. Database image is then selected for comparison based on the radius matching. The methodology proposed here used reduction technique that is the input image is reduced by the database image repeatedly, by rotating it with a fixed angle each time. Next, by plotting the graph of resultant values gives decision whether the coin match found or not, by comparing the minima to the fixed threshold. Denomination of the coin is verified by comparing coin from both the sides. Thus, the method proposed here is rotation invariable, also, by using two way scanning and comparison of coin, method determine the denomination accurately, even if the database is having different coins with same radius.**

***Keywords*- Segmentation, Radius Calculation, Reduction.**

I. INTRODUCTION

Humans can recognize identify and interpret the objects. No matters what size shape or orientation they have. This involves signals in the nervous system, which in turn results from the physical or chemical simulation of sense organs.

This paper proposes a more robust and easier method to give coin identification and interpretation capability to the computer which will be useful for counting coin currency coins where the huge coins are collected like coins collected at Indian temple.

Most of the coin detection methods proposed earlier ware based on testing physical properties like testing radius weight and testing material of coin. Making fool of such machines is easier.

The method proposed here takes two way scanned image of the coin to be detected. One of the two input images is processed further for edge detection and radius calculation. Radius of the input mage is calculated and the database image is selected from the database having same radius .

Image reduction method is used to compare the selected input image and the database image. Database image is reduced by the input image every time by giving rotation to the object image of particular angle (say 15^0) and the graph is plotted of the resultant values. If the minima of the graph is less than the fixed Threshold, we proceed with the acute reduction and plot the graph of result. If the minima is less than the fixed threshold the coin match found.

If coin doesn't matches we proceed again with the reduction technique, but here we will consider the second input image that is other side of the coin to compare with the same database. If the coin match found, we will confirm the coin check by comparing other side of the image selected from database with the second input image. Thus the exact coin match is found reducing false positive rate.

Fig1 Tail side images of some Indian Coins

Fig2. Head side images of Some Indian Coins

II. LITERATURE SURVEY

Counting money involves the coin detection as the first step. Many methods have been proposed for detection of coin such as, Unnikrishnan G Sajith sethu P have proposed[1] a unique way where the abstract image is derived by using the normalized local spatial features of the coin image. A set of compact and effective features is extracted by division of abstract image into concentric circles. The proposed method uses a single gallery image of coin for detection.

Minoru Fukumi, , Sigeru Omatu, Fumiaki Takeda, and Toshihisa Kosaka[2] have propose a neural pattern recognition system. The system is imperceptive to rotation of input pattern by various degrees. The system consists of a fixed invariable network which has many slabs and a trainable multilayered network. R. Bremananth, B. Balaji, M. Sankari and A. Chitra[3] have proposed a method where numeral in the coins are extracted, after acquiring the coin image. Coin edges may not be sharp. Also, gradually it becomes dull by years of usage. This can be done using edge detection process. To reduce the complexity of edge detection process, statistical color threshold method is recommended and carried out in the coin recognition process. Cartesian co ordinates of numeral in the coins are acquired. Sub image of the numeral is then derived from the given coin image. In the method proposed, the character recognition is carried out using this sub image. In this section, with the back propagation network methods and multi channel Gabor filter. C.M.Velu and P.Vivekanandan[4] have proposed a system is to design coin recognition by applying analytical approach, which is based on the coin table of coin . This table is used to save parameters of coins. It is also proposed to apply Hough Transform algorithm. Hough Transform algorithm combines the features of Straight line detection Hough Transform algorithm, Curve detection algorithm and Circle detection Hough Transform algorithm. Edge of the coin is recognized using these three algorithms. The properties of old coins and new coins are considered for differentiating various denominations. Vaibhav Gupta, Rachit Puri, Monir Verma[11] have proposed a coin recognition method, which uses subtraction technique. It has an advantage over the ordinary testimony methods used commonly in slot machines.

This paper proposes reduction based rotation invariant method for currency coin detection.

III. PROPOSED MITIGATION SCHEME

Five steps in proposed accession of coin recognition are

- Image Acquisition
- Radius Calculation
- Edge detection
- Image Reduction
- Coin Verification

The proposed process is shown in Fig. 3. Details of each step are described below.

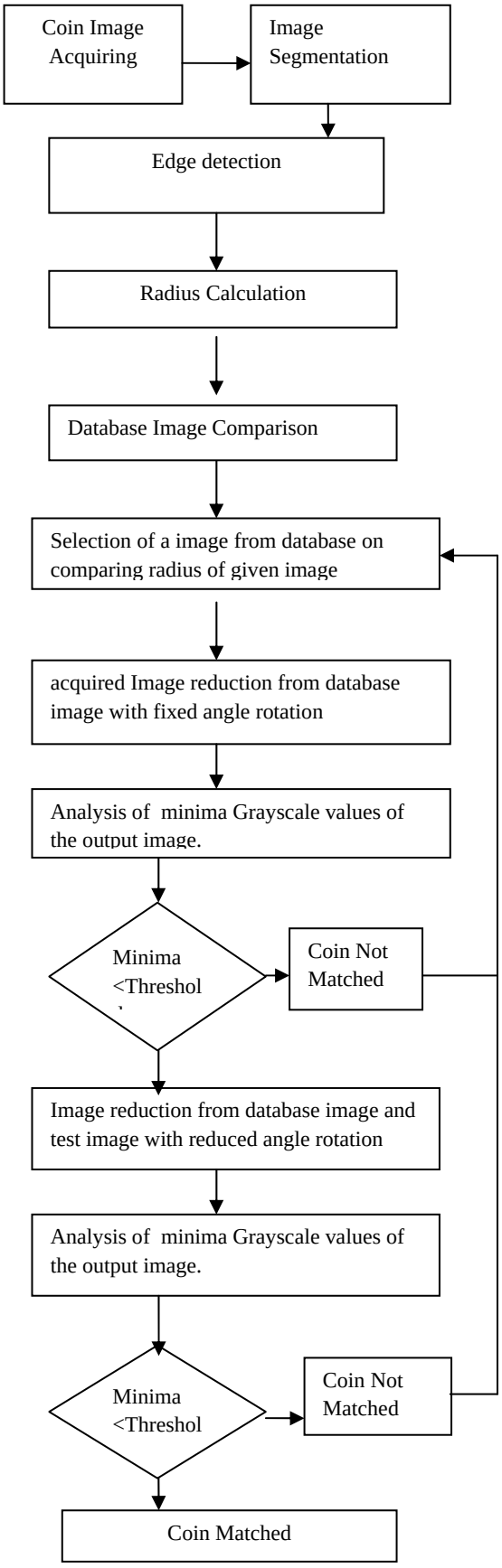

Fig3: Block diagram of the proposed method

A. Image Acquisition

Two way image of a coin is acquired by scanning the coin from both the sides. Or image of both the sides of coin can be acquired perpendicularly, by clicking from a fixed distance, position and lighting condition using good resolution camera.

B. Edge Detection

Acquired image is then undergone the segmentation process to concentrate on the coin image. As we have two input image, we first consider any one as our object image. randomly. One of the Input image is then converted into gray scale image, after which it is to be converted into binary image based on a certain threshold. Binary image is then undergone with the edge detection process

C. Radius Calculation

To get the ends of the diameter, we traverse row wise. Thus we get the horizontal axis. By following same method, traversing column wise we get the vertical axis. The center is the intersection point of the horizontal and vertical axis.

As we get the center point in previous step we find out the radius by subtracting pixel values of center from the end point pixel values of any of the axis. On calculating radius we will select the coin from database by radius matching, as we know Indian coins have distinct radius. This step minimizes the process time and irrelevant data production. A suitable image is get selected for further analysis. Thus we have both the test and object image. Two steps are followed to minimize the complexity of recognition process.

D. Image Reduction

*T*hus we have both the test and object image. Two steps are followed to minimize the complexity of recognition process.

First step is to rotated the test image with the fixed angle say $15^{0.}$ At each rotation instance the image is subtracted from object image. This reduction will produce a third image.

Resultant image = object image – test image[11]

This reduction will produce darker image until it cross the angle of object image. On plotting the graph of the sum of the gray scale values, of the resultant image, minima of the graph can be seen at angle of overlap of two coins.

Next step is acute reduction, which is same as the previous step only the difference is in the angle of rotation. Here in the acute subtraction angle of rotation is minimized for example it can be 1 degree. And the as we get the angle of overlap in previous step we will just test for the particular rotations only. For example If we get the minima at 315 in base reduction we will consider the 300 to 330 angle of rotation in acute reduction. Again by rotating test image by 1 degree, in the range of angle of overlap the reduction of test image form the database image is done. By plotting the graph of sum of the gray scale values and by finding the minima, we will get the exact angle of overlap. If the minima is greater than predefined threshold we can directly say that coin does not match as there will not crossing overlap possibility between object image and test image.

E. Coin Verification

*W*hen a coin match is detected for one side of a coin, the second input image that is other side of the coin is compared with the other side of the coin selected from the database. If the other sides of both the database coin image and input coin image matches then the coin is verified and the denominations become confirm.

IV. CONCLUSION

Coin recognition using reduction is the easy and faster way for coin recognition. The data to be compared become easy as we reduce if in first step accurately. The method also provides the good accuracy of detection of the coin. This can be used in a real time to avoid making fools of machines.

Future work will include method modification by using neural network by removing the need of placing coin in particular position and in particular lighting condition.

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