# Indian Coin Detection and Sorting using SIFT Algorithm

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## Abstract

Coins form an important part of our daily transactions. We use coins in different places like stores, banks etc. Hence it becomes a compulsion to detect the coin automatically. We have used the SIFT algorithm in order to detect the coin. In this algorithm we have stored the images in a database created called as test image. Then the image called as the training image is compared to the image present in the database. This algorithm detects and describes local features in images. Other applications for sift algorithm also include object recognition, robotic mapping and navigation, image stitching, 3D modeling gesture recognition, video tracking and match moving etc.

**Keywords: Image processing, SIFT algorithm, MATLAB, feature extraction, histogram**

## I. INTRODUCTION

Nowadays, Coin recognition [4-5] has been widely used in real life such as in vending machines, banks supermarkets etc. It is also very useful when classifying a huge amount of collected coins from charity organizations and ancient relics. In-spite of daily uses coin recognition systems can also be used for the research purpose by the institutes or organizations that deal with the ancient coins.

Coin recognition systems began with Mechanical method based systems, Electromagnetic method based systems but this methods could not distinguish between fake coins. Image processing based coin recognition techniques have been able to handle the problem mentioned above. We are using the image processing technique using the sift algorithm. To perform reliable recognition, it is important that the features extracted from the training image must be detectable even under changes in the image scale, noise and illumination. Such points usually lie on high-contrast regions of the image, such as object edges. SIFT[1-3] detects and uses a much larger no. of features from the images, which reduces the contribution of the errors caused by this local variations in the average error of all feature matching errors.

## II. METHODOLOGY

SIFT key points of objects are first extracted from a set of reference images and stored in a database. An object is recognized in a new image by individually comparing each feature from the new image to this. From the full set of matches, subsets of key points that agree on the object and its location, scale, and orientation in the new image are identified to filter out good matches. The determination of consistent cluster is performed rapidly by using an efficient hash table implementation of the generalized Hough transform. Each cluster of 3 or more features that agree on an object and its pose is then subject to further detail model verification and subsequently outliers are discarded. Key locations are defined as maxima and minima of the result of difference of Gaussians (DOG) function applied in scale space to a series of smoothed and resampled images. Dominant locations are assigned to localized key points.

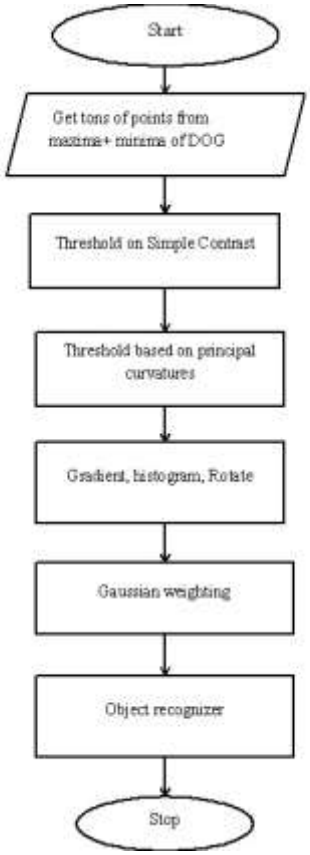


Fig. 1: Flow Chart for SIFT algorithm.

## III. DESIGN AND DESCRIPTION

### *A. Hardware Design:*

As shown in Fig. 2. The hardware consists of servo motors for the sorting mechanism, arduino for controlling the servo motors, IR sensors for detecting and interrupting the computer for triggering the detection algorithm and acrylic for the body parts .

### *B. Software Design:*

The software part involves acquiring the image from the camera and processing the image with MATLAB to determine the type of coin. MATLAB uses SIFT algorithm to identify the features of the coin. The Arduino program involves controlling the servo motors.

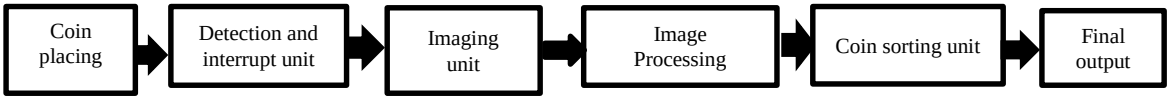


Fig. 2: Hardware design for proposed method.

## IV. IMPLEMENTATION

### *A. Hardware Implementation:*

The hardware part basically consists of arduino and 2 servomotors. The arduino controls the servomotors. One servomotor controls the tray carrying the coin and the other servomotor controls flaps below.

Next IR sensor will get a trigger when coin is dropped in the box which in turn will trigger the arduino and hence the MATLAB. Than MATLAB will capture an image via the camera and process it to determine the feature of the coin and accordingly determine the coin type.

Further the MATLAB will send data to arduino specifying the coin type. Then arduino will accordingly move the tray carrying the coin and drop the coin the respective slots.

Fig. 3: Servo controlled coin sorting mechanism.

### *B. Software Implementation:*

A coin is detected by IR sensors. The output of sensors is given to the arduino UNO board at the input pin. Output from the arduino is processed by the MATLAB using SIFT algorithm for coin recognition.

Fig. 4: Coin feature extraction using SIFT.

## V. CONCLUSION

The coin detection and sorting system will reduce the time consumption and sort the coins efficiently. The SIFT algorithm used is quite useful and formidable in real life applications, giving accurate and efficient results. Further studies are being done to make better use of this algorithm in the future and searching for ways to improve its efficiency.

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