

Recognition of Indian Currency and Denomination of Coin

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Abstract— The main objective of this project is recognition of Indian currency using the image processing technique and FPGA based coin sorting machine for denomination of coins. Fake currency detection system is used for Indian currency recognition and for finding the forgery currency. In this system first the image is acquired, then apply pre-processing. Pre-processing includes cropping, smoothing and adjusting the image. Convert the RGB image into gray colour. After conversion, apply the image segmentation. The features are extracted. Finally compare the image into original or forgery. If the image is genuine Artificial neural network is used for the denomination of currency. In this project we are also designed a FPGA Based Coin Sorting machine. The operation of this machine is performed by using PMDC motor, DC gun, proximity sensor and camera. The coin sorting process is carried out with help of image processing using MATLAB and FPGA.

Key words: Image pre-processing, Image segmentation, Feature extraction, Denomination

I. INTRODUCTION

Coins are becoming subject to a very large illicit trade. Since, the interest in automatic coin recognition systems within cultural heritage and law enforcement institutions rises rapidly nowadays and there is a need of highly accurate and efficient automatic coin recognition systems in our daily life. Coin recognition systems and sorting machines have become a vital part of our daily life. They are used in banks, supermarkets, grocery stores, vending machines etc. In spite of these uses coin recognition systems can also be used for the research purpose by many institutes or by other organizations that deal with the ancient coins.

Currency can be refer to intermediate of exchange. In our world, there are huge numbers of currencies. The currency of India is Rupee. At present, India is having currency system such as Rs.5, Rs.10, Rs.20, Rs.50, Rs.100, Rs.500, and Rs.1000. These Indian currencies have their own features such as face value of the banknote, shape, colour, quality, texture etc. It is very essential to develop automatic system for recognition of Indian currency as it is useful in most of the areas such as bus station, railway station, shopping malls, banking and ATM machines. Thus this automatic systems would help the people especially visually disabled peoples. In image processing technique using MATLAB, the important features are extracted from Indian currency such as, identification mark and denomination object etc. to identify the denomination of that Indian currency. Automatic methods for currency recognition and coin denomination have become very essential in most of the daily life applications. The system is designed to recognise and verify the denomination of an Indian currency and also to check whether the currency is genuine or counterfeit.

II. LITERATURE SURVEY

- 1) Grid based feature extraction: This approach provides to identify the denomination of an Indian currency note using grid technique. The extraction of features from a 3*3 grid image makes possible to identify the value of a currency based on Rs.500, Rs.1000 are determined using neural network as a classifier.
- 2) Image Processing Technique: This paper mainly provides an image processing technique to extract Indian paper currency denomination. The ROI is extracted and converting it into grayscale and setting up level. The denomination value can be obtained by integrating the sobel edge filter, average filter and laplacian filter. The use of image processing technique to identify specific region of interest and then applying neural network classifier and pattern recognition techniques have been used to identify the denomination.
- 3) Coin recognition approach: In this approach, images of coin are taken from different angles and create a databank. By using this databank, data is provide to the neural network and trained that network.
- 4) Neural pattern recognition system: In this approach, a multilayered neural network and a pre-processor consisting of many slabs of neurons is used to provide rotation invariance. Through this method 100% accuracy for coins was obtained. To design neural network for coin recognition, BP (Back Propagation) and GA (Genetic Algorithm) is used.

III. DESIGN OVER VIEW

A. Fake Currency Detection System:

Overall algorithm:

- 1) Image of Indian currency will be acquired by using a simple scanner or digital camera.
- 2) Apply pre-processing and the image acquired is RGB image and then it will be converted into gray scale.
- 3) Edge detection of the gray scale image will be performed.
- 4) After edge detection, the characteristics of the currency will be cropped and segmented.
- 5) After segmentation, the features of the Indian currency will be extracted.
- 6) The features of test image are compared with the original pre-stored image in the system.
- 7) If it matches with the original image then the currency is genuine otherwise counterfeit.
- 8) If the currency is genuine then the Artificial Neural Network is used for the denomination of the currency.

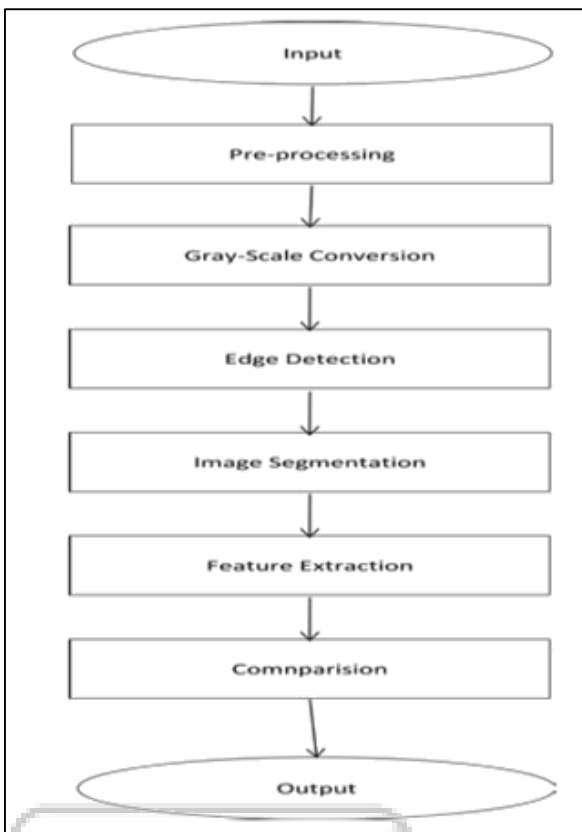


Fig. 1: Block diagram of fake currency detection system

B. Fpga Based Coin Sorting Machine:

The coin sorting machine consists of the following components to full fill the requirements of complete operation of the machine.

1) Pmdc Motor:

DC motor is any of a class of electrical machines that converts direct current electrical power into mechanical power. The most common types rely on the forces produced by magnetic fields. A DC motor's speed can be controlled over a wide range, using either a variable supply voltage or by changing the strength of current in its field windings

2) Proximity Sensor:

A proximity sensor can detect objects without physical contact. It often emits an electromagnetic field or beam and look for change in the field. The object being sensed is often referred to as the proximity sensors target. Different proximity sensor targets demand different sensors. For example, a capacitive or photoelectric sensor might be suitable for a plastic target; an inductive proximity sensor requires a metal target.

3) Dc Gun:

Dc gun consists of copper coil winding and armature shaft. We give 12 v electric supplies as input to this dc gun winding. Now winding can ready to create magnetic flux on its outside area. In this magnetic field area only magnetic field Strength is there and exceed this level no response. Armature comes to approach the winding when 12 v dc supplies came to winding via relay.

4) Camera:

A camera is a device used to capture images, either as still photographs or as sequences of moving images (movies or videos).

5) Fpga:

Field-programmable gate array (FPGA) is an integrated circuit designed to be configured by a customer or a designer after manufacturing – hence "field-programmable". The FPGA configuration is generally specified using a hardware description language (HDL), similar to that used for an application-specific integrated circuit (ASIC). FPGAs contain an array of programmable logic blocks, and a hierarchy of reconfigurable interconnects that allow the blocks to be "wired together", like many logic gates that can be inter-wired in different configurations.

IV. FUCTIONAL DESCRIPTION

A. Fake Currency Detection System:

1) Image Acquisition:

The image can be acquired from a camera or by scanning the image.

2) Image Pre-Processing:

Image preprocessing is done to enhance the visual appearance of the image and to improve the image data and suppresses the unwanted areas. By resizing the image the features can be extracted easily.



Fig. 2: Image pre-processing

3) Gray Scale Conversion:

The image acquired is in RGB color and this RGB image is then converted into gray scale image because it carries only the intensity information which is easy to process instead of processing the other three components such as R(Red), G(Green), B(Blue).



Fig. 3: Gray scale conversion

4) *Edge Detection:*

Edge detection is an image processing technique used for finding the boundaries of objects within images. This works by detecting discontinuities in brightness.



Fig. 4: Edge detection

5) *Image Segmentation:*

In image segmentation, the digital image is partitioned into multiple segments. The aim of this segmentation is to modify or simplify the representation of the image into something that is more meaningful and to analyse easily. This process is also used to locate objects and boundaries in images.



Fig. 5: Image segmentation

6) *Feature Extraction:*

The input data to an algorithm is too large to be processed so that this input data can be transformed into reduced representation set of features called feature extraction. Thus the features of the image can be extracted for the recognition of the Indian currency.



Fig. 6: Feature extraction

B. *Fpga Based Coin Sorting Machine:*

Working principle:

The coin sorting machine relies on FPGA controller which carried out all electronic process. This machine consists of proximity sensor, DC gun, rotating table, PMDC motor and camera. Circular Table is rotated with help of PMDC motor which can rotate forward and reverse direction by FPGA controller. A camera is fixed over the one side of table where image processing is carried out using PC. Purpose of image processing is to check the coin value in order to sort out. First of all a coin is placed under a camera. Using MATLAB software, coin is match with reference image. Once image process is completed table will rotate to the corresponding position according to signal from pc. Afterwards DC gun is actuated to trigger the coin into box. A DC gun is placed on the center of table. Here four proximity sensors is fixed at right angle to each other. Using proximity sensor, table rotation is controlled by PMDC motor.

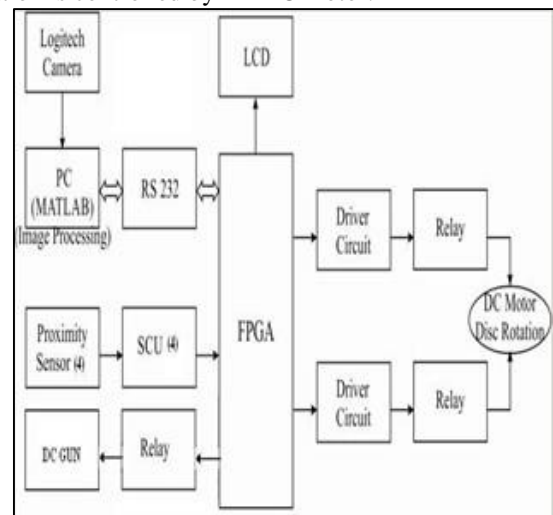


Fig. 7: Block diagram of FPGA based coin sorting machine

V. SOFTWARE DETAILS

The image processing technique is discussed with MATLAB to detect the features of Indian currency. Image processing is done to convert the image into digital form and performs some operations on it to extract some useful information from it. The various techniques for currency recognition involves texture, pattern or colour based.

VI. APPLICATIONS

Assisting visually impaired people: The currency notes are provided with a special identification marks only for blind peoples so that they can easily recognise denomination correctly. Every currency has its denomination engraved at the right end which is sensitive to touch but this mark fades away after the currency goes in circulation for some time. This creates difficulty for the blind people to determine denomination of the currency.

Distinguishing original currency from counterfeit currency is an another important application so that it would be helpful in encountering the counterfeit currency that is flowing throughout the Indian economy.

The system must be also very useful for automatic selling goods. Vendors may get confuse sometimes when there is a huge crowd in the market so there will be a possibility of miscalculation on some of the goods. The system will help the vendors in keeping the records of the amount received and goods sold.

The system is also very helpful in banking applications such as counting notes and its value during transactions, detection of counterfeit currency etc. and the system will make the banking process a reliable process. As the time is an important factor in today's world this system will be helpful in saving the time too.

VII. CONCLUSION

The main purpose of our project was to design a system for easy and quick detection of genuine and fake Indian currency and a coin sorting machine. This system, using effective and efficient image processing techniques and algorithms, provides accurate and reliable results.

VIII. FUTURE SCOPE

In our project we are dealing with denomination of 500 and 100 rupee note. But for a future scope we can add all the details about remaining currency in our software program that will indeed help us to identify remaining counterfeit currency.

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