

Identification of Counterfeit currency and denomination using Raspberry pi

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Abstract: Advancement in technology leads towards many automated systems which are capable of performing tasks without interference of humans. Money deposit machines, automatic ticket machines are one of such automated systems. In such systems it is necessary to identify the counterfeit and denomination of currency automatically. But available automated currency detection system uses computers and other processors which are bulky in size and cost of the overall system is also more. So it is necessary to develop a system which is capable of identifying the denomination of currency for small scale applications. In this paper, the proposed model will automatically identify the denomination and counterfeit of currency using raspberry pi. Identification of counterfeit and denomination is achieved with the help of basic image processing algorithms such as HSV conversion, template matching, aspect ratio identification, dominant colour and feature extraction.

Keywords: Counterfeit currency, denomination, HSV conversion, dominant colour.

I. INTRODUCTION

In the year of 2011 RBI conducted a survey for counterfeit currency and results of survey shows that there are nearly 69382 million counterfeit notes are in circulation. Counterfeit currency directly affects the financial system of country. To maintain the social harmony and for protection of economic prosperity it is necessary to identify and destroy the fake currency. Normally human brain is capable of identifying the fake currency on the basis of check points printed on the currency. But same task is much more difficult for machine which will identify the originality of currency. At present days, different types of systems are available which identify the fake currency but cost of such systems is much higher. So it is necessary to develop a system which can automatically recognize the denomination of currency and check whether the currency is real or fake. Such type of system is useful for automatic vending machine, automatic mobile currency recharge, and in automatic ticket counter.

Here in this paper I am presenting a method for development of fake currency detection system using raspberry pi which is low cost and which will effectively identify the denomination and counterfeit of currency^[1]. The approach consist of several steps including image capturing with the help of camera, pre-processing of an image and other algorithms to identify originality and denomination^[2].

II. PROPOSED MODEL

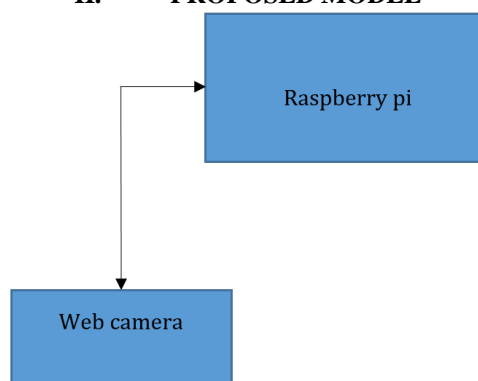


Fig.1. Block diagram of proposed model.

Here raspberry pi is used as a processor which process the image of currency captured by web camera. To check counterfeit and denomination of currency, currency has to be placed under the web camera. Once currency is placed

raspberry pi will enable the web camera and web camera starts capturing the images, web camera can be easily configured to raspberry pi and controlling code for web camera is written and stored in processor. Captured image is send to processor and it is stored in processormemory, now raspberry pi which will process the image to identify the denomination and counterfeit of currency. The processing algorithms and codes are written in MATLAB and converted to Simulink model. The reason behind conversion of MATLAB code to Simulink model is raspberry pi support execution of Simulink model blocks rather than code.

The processing algorithm consist of pre-process of image to reduce the size and noise present in an image, image localization, feature extraction and template matching^[3].

A. Flow Graph

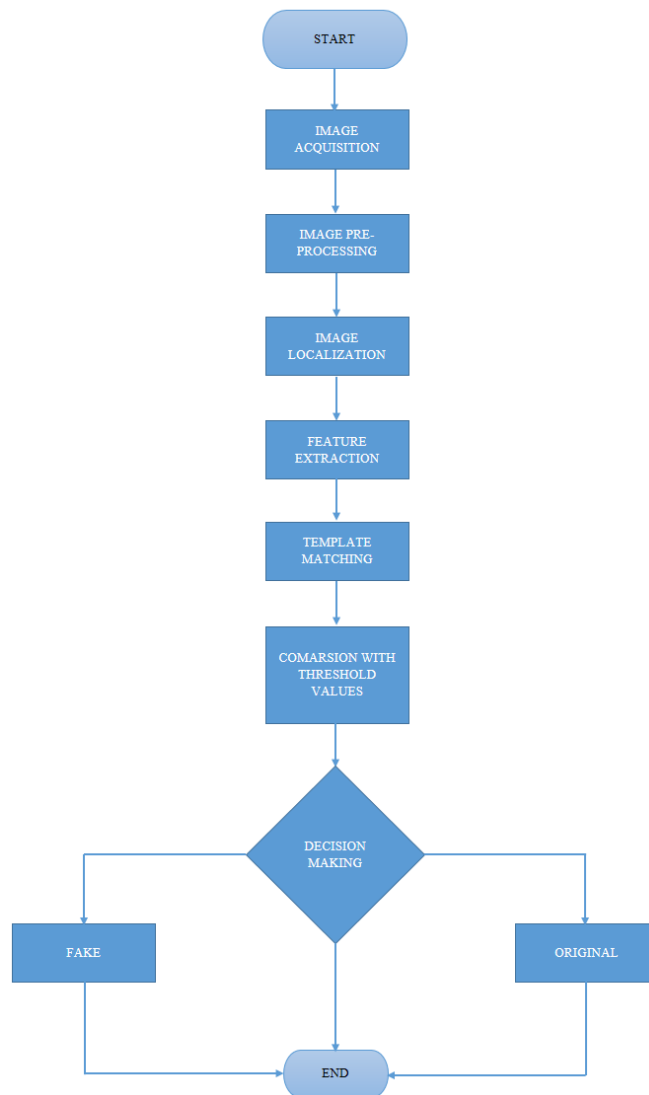


Fig.2. Flow graph of image processing algorithm.

1. Image acquisition:

Image acquisition is a process of acquiring an image with the help of device, the acquired image is stored for further processing. Here the image is acquired with a digital web camera. For image acquisition its necessary to write a functional code for web camera, once the functional code is written the web camera now works according to code and this code can be used to decide the numbers of snaps to be taken of a currency and also it will decide the colour format of image whether it should be colour or grayscale image.

2. Image pre-processing:

Image pre-processing is done to enhance some image features important for further processing and analysis. In image pre-processing size of the image is reduced and noise is removed that may have appeared in the image while capturing.

- **Resizing:** The size of the image is reduced by using MATLAB function ‘imresize’.
- **Removing noise:** When image is captured there are chances that image get blurred and noise may be added to the image and it’s necessary that this should be removed and image should be smoothened.^[4]

3. Image localization:

When web camera capture the image of currency then the image contains background maintained below currency, for processing of an image and to get correct results it is necessary to remove the background and keep the image of currency as it is. This can be achieved by using edge detection and scan line algorithms in MATLAB.

4. Feature extraction:

Using feature extraction technique it is possible to extract the feature of available image and these extracted features are compared with known features to detect counterfeit and denomination of currency^[5].

5. Template matching:

Template matching technique is used to identify denomination of currency. Template matching algorithm will move a template on available image and if template matches with currency then it will return value as true else it value will be false. By this denomination of currency can be easily identified^[6].

6. Comparison with threshold values:

Once all the results obtained from above mentioned algorithms now these obtained results will be compared with threshold values. Threshold is technique where range is set and results will be compared with these values if obtained results lie in the range then true value is returned else false.

III. RESULTS

Image processing algorithms are executed in Matlab using image processing toolbox to detect the denomination and counterfeit of currency.

The results are as below

1. Detection of currency location in an image.

The location of currency in an image containing plain background is identified with the help of feature point matching algorithm. Fig. 3 shows the database image which does not contain any background.

Data base image



Fig. 3. Image without background.

Fig. 4 shows the image of currency with background.



Fig.4. Currency image with background.



Fig.5. Image after applying feature point algorithm.

2. Detection of denomination

Denomination of currency is identified by template matching algorithm using MATLAB.

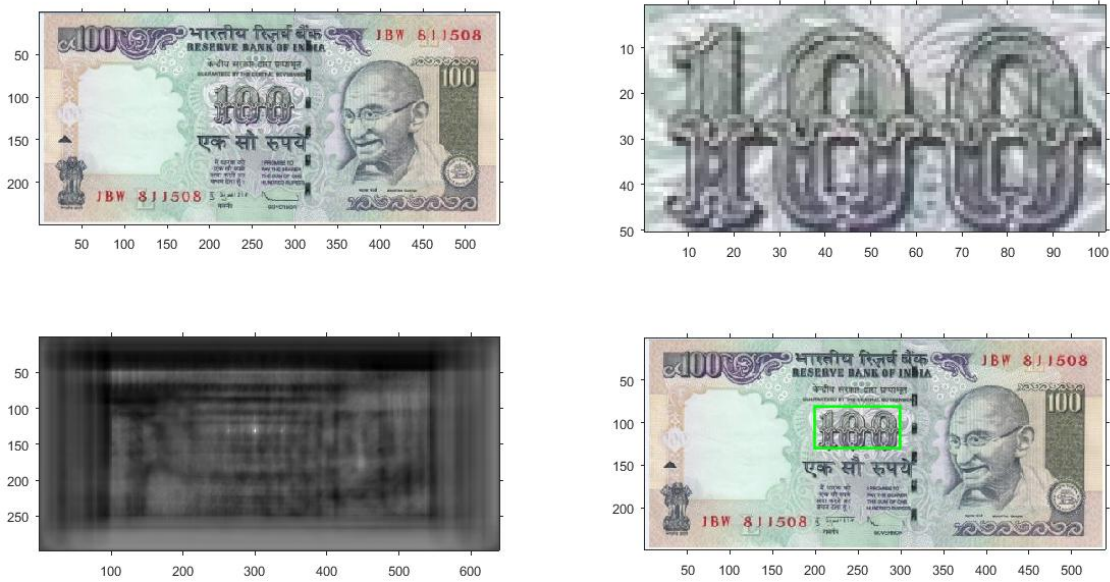


Fig.6. Denomination of currency

3. Detection of strongest feature points of currency:

Strongest feature points of currency are identified with the help of surf feature point detection algorithm in MATLAB.



Fig.7. Strongest feature points of currency.

4. Detection of silver thread in currency:

Silver thread in currency is identified by using HSV transformation algorithm in MATLAB.

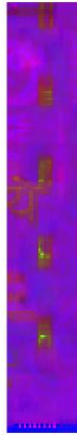


Fig.8. Identification of silver thread.

IV. CONCLUSION

With the help of above proposed method, it is possible to develop a system which will easily detect the denomination of Indian currency and also it checks the originality of Indian currency with the help of basic image processing algorithm. The proposed system can be implemented for real time applications such as automating vending machines, automatic ticket counters. This can be achieved with the help of Matlab Simulink^[7] and low cost processor like Raspberry pi.

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