A new approach in counterfeit note detection using SURF Features

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***ABSTRACT*: Fake Indian Currency Note (FICN) is a term used by officials and media to refer to counterfeit currency notes circulated in the Indian economy. In 2012, while responding to a question in parliament, admitted that there is no confirmed estimate of fake currency in India. The Indian currency recognition is an image processing technology that is used to identify fake Indian note. Indian currency use in day to day life the importance for automatic methods for Indian currency recognition has been increasing and efficient method for currency recognition is used in many sectors such as railway ticket counters, banking system, shopping malls, currency exchange services etc, due to this automatic currency reorganization has been the interest of research .The thesis describe the design of automatic recognition of Indian currency. In this research a software solution which takes the image of an Indian currency from scanner and camera as an input. This combines the surf features characteristic and local features descriptors to design a four level classifier both component are design implemented using matlab.**

***Keywords*: Image processing, currency recogonization, speeded up robust features (SURF) MATLAB, features detect**

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. 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.. Here in this paper I am presenting a method for development of fake currency detection system using SURF features, which is low cost and which will effectively identify the denomination and counterfeit of currency. The approach consists of several steps including image capturing with the help of camera, pre-processing of an image.

II. PROPOSED MODEL

This architecture is unique because it takes two different inputs for the denomination component and the verification component. It takes a scanned image for the denomination component and camera image for the verification component. The other thing that makes the architecture unique is the methods applied in the categorization. The categorization considers four features of the currency, namely dominating colour, the hue value, correlation coefficient and local features. After each feature is extracted, categorization is applied. If the first categorization is successful, it will continue to the second feature extraction and apply the second categorization. Otherwise, the currency is recognized as non-Indian currency. If it passes the second categorization, it will go to the third and the fourth in a similar fashion. A currency image which passes the four iterative extraction and categorization will go through the verification component for validation.

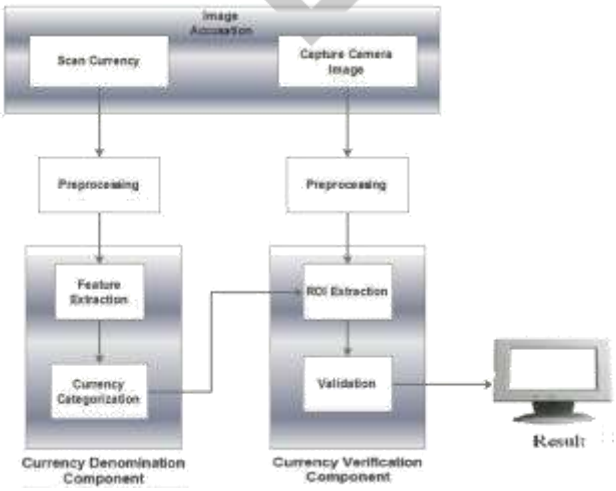

FIG 2.1 Processing Block Diagram

Image Acquisition Device

The image acquisition device is responsible for acquiring the image of the paper currency. This component contains both scanner and photo camera. Each paper currency is scanned as well as its image is captured using a photo camera and both images pass to the image pre-processing component.

Pre-processing

The pre-processing component is responsible for preparing the paper currency image to the main image processing activities. Mainly two tasks are done in pre-processing: Image resizing and image enhancement.

Image Resizing

All the five Indian currencies have different sizes. Since size is not used as a feature for categorization in the proposed design and the size of the image need to be similar for comparing the correlation coefficients of the PGB components among the different currencies, the image sizes of the currencies is brought to a common value

Image enhancement

Old Indian currencies have a degraded image quality. To improve the quality of such input images, the images are filtered using a Gaussian filter of window 3x3 and 3x2.

Feature Extraction and Classification

Feature extraction and classification are the main parts of the first major component of the paper currency recognition system, which is the currency denomination component. For the classification or categorization of the currencies, four different features are selected. These features are dominating color of the image, the distribution of the dominating colour, the hue value of the currency image and SURF features of the currency. Based on these features, the classification into their respective denomination is carried out.

Dominating Color

The image is acquired in PGB format and it has three major components; Pink, grey and blue. The composition of these three components gives the specific color of the currency image. In each image either pink or grey or blue is the dominating color. In other words, either pink, or grey or blue has the maximum pixel occupancy in the image.

Dominating Colour	Pink	Grey	Blue
Currency Name	2000 INR	500INR	50 INR

Table 1. Dominating colour of Indian Paper Currency

2.1 SURF Features

Select Strongest Points or Descriptors

In this step, the feature vectors or descriptors from the selected strongest points are constructed. The MATLAB function extract Features takes the image and points as its argument. It returns extracted feature vectors, also known as descriptors, and their corresponding locations, also known as valid points Therefore valid points, not the input points, are associated to each feature vector. This can be summarized by the MATLAB function: **[features, valid Points] = extract Features(I, points);**

Fig 2.1.1 Feature Vectors of Sample Indian Currencies

III. RESULTS

For evaluating and testing the proposed prototype, different denomination of Indian currencies are collected. Genuine 500 and 2000 note are collected. In these notes new, a currency notes are included. To test the verification capability of the system, counterfeit currency notes are collected. Among these counterfeit notes, previous Indian genuine notes are also included. In addition to these currencies, other countries' currencies are also collected, namely U dollar, Rand, Dirham, and Shilling. Both scanner and camera images of these currencies are acquired and stored for evaluating and testing the system.

The scanner used is HP Scan jet G2710. Each currency is scanned with a resolution of 200dpi, and saved in a jpg image. From the scanned image a standard image is selected from each denomination and stored in an array of size five to be a later reference for comparing the test currency image.

Fig 3.1 Scanned Image of Indian Currency

The camera used to capture the images is Canon Power Shot SD1400 IS Digital ELPH with 14.1 Mega pixels. The images of the currency are taken with a background white light, so that the broken thin golden strip to be straight line. As it is seen in *Figure 5.2*, the golden strip is straight line

Figure 3.2: Camera Image of Indian Currency

For this research work, MATLAB tool is used as a development environment. MATLAB® is a high- level language and interactive environment for numerical computation, visualization, and programming. The version of MATLAB tool used in this research work is MATLAB 2009a. Its language and built- in math functions are used for the implementation

Fig. 3.3: Real 2000 note

Fig. 3.4: Fake 2000 note

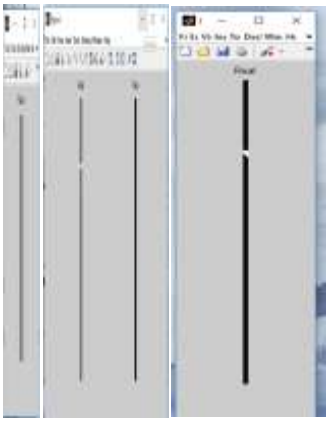

Fig 3.5 Strip of Fake and Real 2000 note

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 and low cost processor .

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