International Journal of Emerging Technology and Advanced Engineering
Website: www.ijetae.com (ISSN 2250-2459, ISO 9001:2008 Certified Journal, Volume 6, Issue 7, July 2016)

Design of HSV Mechanism for Detection of Fake Currency

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***Abstract*— The process of recognizing real currency from the group of different currencies is called currency recognition system. The currency recognition system arises because the features of currencies of different countries are different. The persons who work in the currency transaction have to identify features of all types of currencies. The aim of our system is to help the persons who need to perform money transaction to identify different currencies perfectly and quickly. Fake notes are a problem of almost every country & it effects the development of the any country. Therefore every country demands an effective way to tackle the problem of fake currencies.**

The countries needed a currency identification system that can quickly recognize fake currency from the bunch of currencies. In this paper we propose a new HSV (Hue Saturation & Intensity Value) feature extraction approach of currency note to recognize fake and real currency.

***Keywords*— Security Features, Currency Recognition & Converter, Image Processing**

I. Introduction

In the last few years a huge technological advances within colour printing, duplicating and scanning, counterfeiting problems have become more serious. In earlier period only authorized printing house has the ability to make currency paper, but now a days it is possible for anyone to print fake bank note with the help of up to date technology such as computer, laser printer. The currency recognition system arises because the features of currencies of different countries are different. The persons who work in the currency transaction have to identify features of all types of currencies. Fake notes are a problem of almost every country & it effects the development of the any country. The aim of our system is to help the persons who need to perform money transaction to identify different currencies perfectly and quickly.

The currencies of different countries are different from each other with some specific features. For example paper size may be different, colour and pattern of the currency may be different. The image shown on the currency note may be different. Therefore the persons who work at places of currency transaction need to differentiate these features for proper money exchange. This is not an easy job because they have to remember the unique feature of each currency.

This may result into false recognition, so they need an effective and simple currency recognition system that helps them to identify the unique characteristics of different currencies quickly and efficiently [1].

The aim of our system is to help the persons who need to perform money transaction to identify different currencies perfectly and quickly. This paper proposes HSV (Hue Saturation & Intensity Value) feature extraction approach of currency note.

II. Applications Of Currency Recognition

Recent years have seen an improved concern in currency recognition system worldwide. And this is because of the variety of potential applications it has [2].

Distinguishing original note from counterfeit currency- One important application is to distinguish original note from fake currency so that it would be very helpful in encountering the counterfeit note that is flowing throughout economy.

Shopping by machines-The system must be very helpful for shopping via machines. Sellers may sometimes get distract when there is a huge crowd of customer in a market. He may perform miscalculation on some of the products. So the machine will help sellers in keeping records of products sold and the currency received.

Used in Banking Applications- The currency recognition system proved to be very helpful in banking application. It helps in counting of notes and its value during currency transactions, detection of fake or duplicate notes, etc. Hence it saves time and also it is trustworthy.

III. Problem Formulation

Automatic methods for paper currency recognition become important in many applications such as automatic cashier machine and automated goods seller machines. This system is designed to recognize and verify the paper currency of any country. The approach consists of a number of steps including image acquisition, gray scale conversion, edge detection, feature extraction, image segmentation and comparison of images as shown in figure 1 [3].

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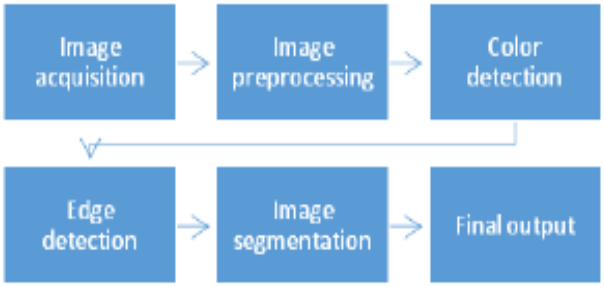

Figure 1: Block diagram of currency identification system

1. Image Acquisition

Figure is taken from digital camera by applying the white backlighting aligned with the paper currency so that the unseen attributes are able to move toward the image of the currency.

2. Gray-scale conversion

The picture acquired is in RGB color. It is converted keen on gray scale because it carries just the intensity information which is easy to process in its place of processing three components i.e. R (Red), G (Green), B (Blue). Image is acquired in step 1 is huge to continue process and colour information is not wanted, except the colour index. First, RGB image is converted to pixel values and next into gray scale [4].

3. Edge detection

Once conversion to gray scale we detect the edge so that we aim at identifying points in digital image at which the image brightness changes sharply. Edge detection is performed by Sobel operator. The Sobel operator smoothes the image and calculate the gradient of the figure.

4. Image segmentation

It is the procedure of partitioning a digital image into multiple segments. It is usually used to distinguish objects from backgrounds. Here edge based segmentation is performed on the image. It divides the image to multiple regions [5].

5. Feature extraction

After segmenting the image we can extract the features using edge based segmentation. It is a challenging work in digital image processing. In several currency recognition systems, feature extraction is one of the most challenging tasks. Here, the aim is to examine and identify the unique and distinguishing features of each denomination under various challenging conditions such as previous notes, worn out notes, also under different illumination and background.

6. Comparison

Lastly the extracted features are compared with the extracted features of unique currency by calculating the number of black pixels of segmented image. Depending upon the similarities and differences of pixels of segmented image we can determine whether the currency is original or fake.

7. Output

The output will be currency denomination and also "The note is concrete" or "The note is fake" at a time anyone will be put on view.

IV. Proposed Algorithm

The aim of our system is to help people who want to be familiar with different currencies, and work with convenience and efficiency. This thesis proposes an image processing method for paper currency recognition. The image processing approach is discussed through MATLAB to detect the features of paper currency. We can improve the pictorial information of an image using Image Processing technique.

The proposed system will accept an image of any note and then it performs HSV feature extraction of the note to determine whether note is fake or not. The main focus of HSV is on the security thread area of the note. If there is one line in thread then it is original but if there are multiple lines or no line in the security thread then the note is fake. The proposed algorithm works for currency of any country.

Algorithm:

▪ Obtain the image of the currency note whose authentication need to be checked using Camera, Scanner etc.

- Execute image preprocessing operations i.e. blurring, grayscale conversion, thresholding, noise elimination using filters
- Detect the boundaries and extract the ROI (Region of Interest) using cropping.
- Extract the desired features using HSV technique.
- Compare the extracted feature values with ideal feature values of real note.
- Display the result for note authentication.

Description of the Proposed Algorithm:

The aim of our system is to help the persons who need to perform money transaction to identify different currencies perfectly and quickly.

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Step 1: Obtaining the Image:

Picture can be obtained with the number of different equipments, such as cameras or Scanner.

Step 2: Pre processing Operations:

Pre processing operations are essential to alter the nature of the image, which makes removal of features easier. In this particular case, pre processing operations involve, blurring, grayscale conversion, thresholding, noise deletion using filters, color blurring RGB to HSV conversion. These operations help us in detecting borders, cropping the ROI and Calculating color features.

Step 3: Boundary Detection and cropping:

For boundary detection, we need a binary image, which has only 2 colors, black and white. All we do in this process is simply, separate the background and the center, and separate the ROI.

Step 4: Feature extraction:

From the cropped Region of Interest we can extract required information. From the binary image we find out the dimensions of the currency and find out the aspect ratio, aspect ratio remains similar in all light conditions, so it becomes an important feature for recognizing image. Then we compare the aspect ratio of the objective image with the ideal aspect ratios of all the denominations of that exacting currency. The other features we extract are H, S and V of particular blocks of the notes. We separate the currency in numeral of blocks. We extract the HSV values of all the pixels and take average of their H, S, V features and once more compare them with the values from the database. We use Euclidian distance equation for finding out the average values of the differences among the target and Ideal HSV features [6]

$$d(p, q) = \sqrt{(h2 - h1)^2 + (S2 - S1)^2 + (V2 - V1)^2}$$

Where,

(H1, S1, V1) = Target image feature set
(H2, S2, V2) = Ideal feature set.

HSV stands for to Hue, Saturation and Value. Hue is pure color and is calculated by degrees or percentage. Saturation is the radius in the circle. Value corresponds to pure white.

Step 5: Displaying results:

To display the results, we have built a graphical User Interface (GUI); where we are providing a various graph to identify fake currency according to extracted feature.

A block diagram is given below in figure 2 below that represents the processes is done for our currency recognition system for identifying fake and real currency of different countries..

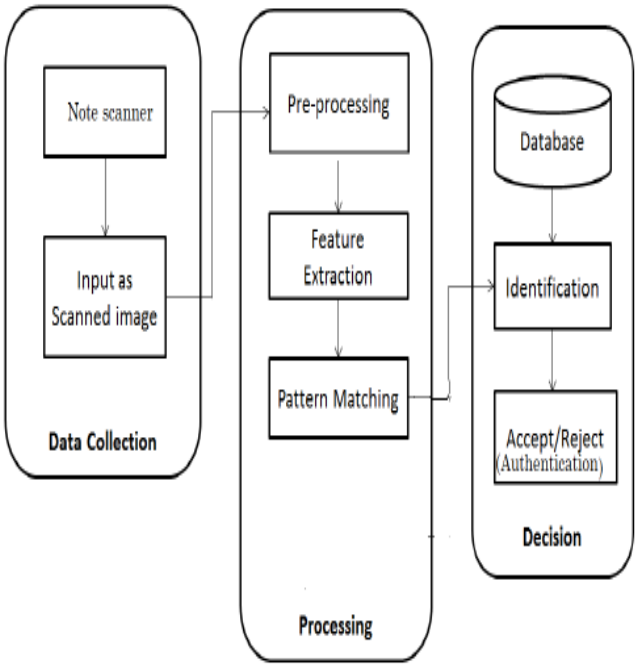

Figure 2: Block diagram of identifying fake and real currency of different country

V. Implementation & Results

In a paper currency we want to check the strip is broken or solid line. For that we took a picture with the background a strong light. We cropped the image at the position where the strip (security thread) exist and finally count the black pixels.

The security thread is a security feature of many currency notes of different countries to protect against duplication. It consists of a thin ribbon that is threaded through the paper notes. It has characters imprinted on it. Threads are embedded within the paper fiber and can be completely invisible or have a star burst out an effect, where the thread appears to weave in and out of the paper when viewed from one side.

Implementation steps are listed below:

Step 1: Read in the Image

Step 2: Decompose image into HSV and analyse

Step 3: Threshold the saturation and rate planes to create a binary image

Step 4: Do some minor closings

Step 5: Final cleanup

Step 6: Count the number of black lines

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Figure 3 to 8 shows the results of my implementation.

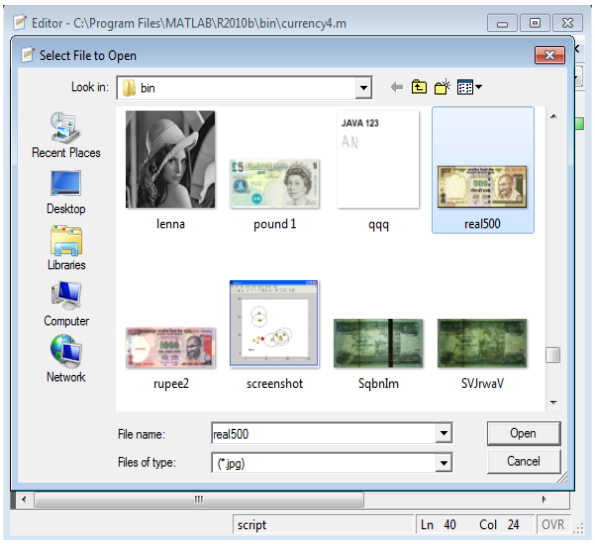

Figure 3: Selecting image of note for testing

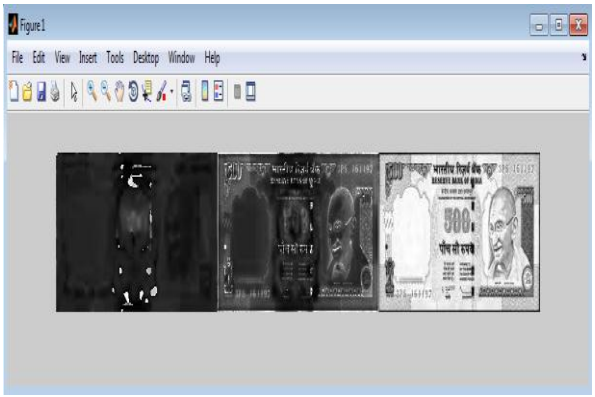

Figure 4: Decomposition of image into HSV

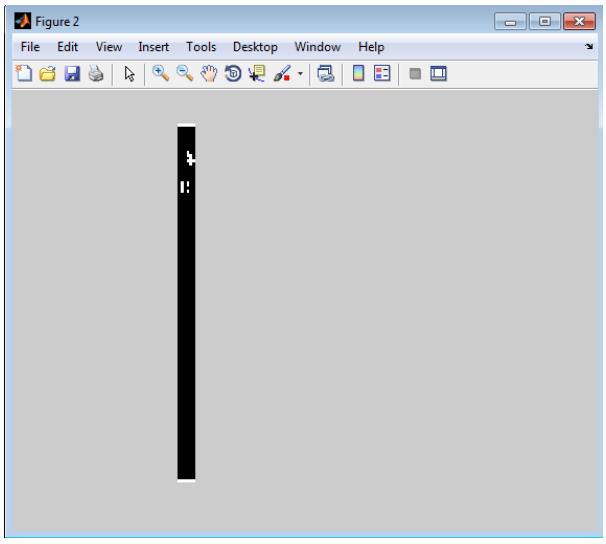

Figure 5: Threshold the saturation and value planes of note Image

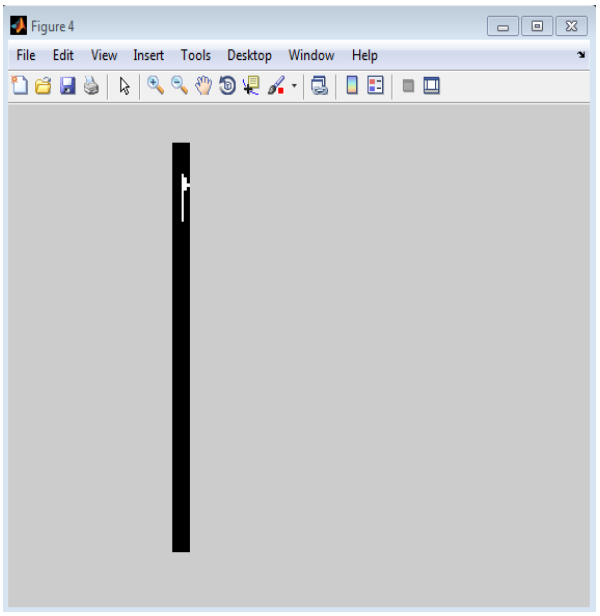

Figure 6: Minor Closing of note Image

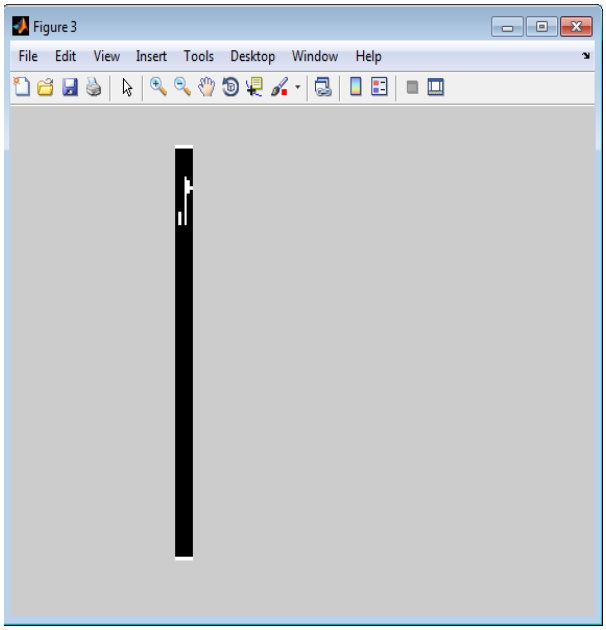

Figure 7: Final Cleanup of noisy area of note Image

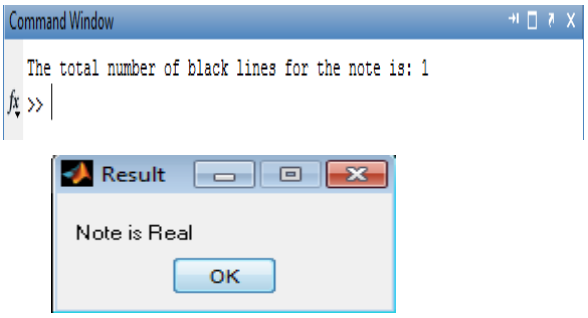

Figure 8: Displaying the final result

VI. CONCLUSION

In this paper we proposed HSV (Hue Saturation & Intensity Value) feature extraction approach of currency note. The proposed system will accept an image of any note and then it performs HSV feature extraction of the note to determine whether note is fake or not. The main focus of HSV is on the security thread area of the note. If there is one line in thread then it is original but if there are multiple lines or no line in the security thread then the note is fake. The proposed algorithm works for currency of any country.

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