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Universal Currency Identifier and Fake Note Detection for Indian Currencies

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Abstract:- Universal currency identifier is a system used for recognition of currency. In today's world of automation this systems play an important role. It has various scope like banking application, currency monitoring systems, ATM machine, money exchange machines, visually impaired people and so on. This paper proposes a system with image processing techniques for identification as well as fake note detection of Indian currencies like 10, 20, 50, 100, 200, 500, 2000 rupees. First we acquire the image using camera. The system use different methods for Indian currency identification like color recognition, feature extraction and digit recognition. The feature extraction is performed on the given images of the currency and it is compared with the real image. Image processing involves the changing of nature of an image in order to improve its quality of information for human interpretation. The result will be the identification of Indian currency and fake note detection as well.

Keywords:- *Paper Currency, Image Acquisition With Camera, Pre-Processing, Feature Extraction, Classifier.*

I. INTRODUCTION

Paper currency identification is one of the most widely researched area of interest in image processing because of demonetization. To recognize denomination accurately and efficiently in applications like ticket vending machines, food and beverage dispensers, Automated Teller machine, banking, currency monitoring systems, money exchange machines and so on. On the other hand, identification of various paper currencies is not an easy task for visually impaired people, even though there are several special symbols embossed on different currencies, still this is very tedious for blind people so it is an attempt to help them.

This system consist of main stages as image acquisition, pre-processing, feature extraction is nothing but the segmentation and then the classification where the comparison will be done for identification.

In this paper we will capture the real time image with the help of camera and will perform preprocessing like resizing, filtering, extract features like mean standard deviation, skewness, gray level, color, edges on the currency that is texture and we will do comparison with classifier in this proposed system we use Euclidean distance method, it will match the input image with the database and accordingly shows result which currency is this and as well as show whether the currency is real or fake.

II. RELATED WORK

Several researchers have done the work for currency recognition or we can say identification and fake note detection over the years. The author's research was based on different algorithms, methods and approaches such as [1] for the detection of fake banknotes the adaptive Neuro Fuzzy interface system and digital image processing are designed by the M.Thakur and A. kaur.

One another system [2] designed by the W.Q.Yan was an empirical approach for currency identification in this system they designed Feed forward Neural network (FNN) to extract monetary features such as color and texture. [3] the novel approach by Jong k wang was designed to recognize Korean bank note with the help of RGB color and UV information as feature of currency. This method involves the RGB color information to classify the bank note, size is one of the parameter improved the accuracy. Training overhead of back propagation neural network is because of its slow convergence speed and indeterminate initial weights. Training of neural network require more time because of the rigorous need of samples. Since training time for a back propagation neural network is exceedingly high they are not considered for a real time system. [4] Sign B.K proposed a method currency recognition by texture feature for this system he used five different features extracted from input image that is Indian currency, the feature were extracted on the basis of ROI region of interest from these different feature the best feature was used for classification.[5] Er-hu Zhang introduced a method this method follows the addition of all non masked pixel values are computed an used as processing input to the neural network(NN) detection is performed on the basis of pattern of edges on the currency. [6]Hamid Hassanpour in his paper introduced the method in which currency is vertically divided in to number of subparts and based on this the number of pixels are found which were representing the edge the next stage was the back propagation neural network which took the pixels of each edge as input. In this method he make use of the Hidden Markov Model(HMM) in which the textures are modeled as a random process.

Sr. No	Article and Author	Method or algorithm used	Feature extracted
1	Detection of fake note by M.thakur	Adaptive neuro fuzzy interface system	Local region
2	Empirical approach for currency identification by W.Q.Yan	FNN	Color texture
3	A study on Korean bank note recognition using RGB and UV information	Back propagation neural network	RGB and UV information
4	Indian currency recognition based on texture analysis by Sign B.K	Neural network	Based on ROI
5	Research on paper currency recognition by Er-hu zhang	Neural network	Non-masked pixels
6	Using hidden mark ov model for paper currency recognition by Hamid hauuanpour	Back propagation neural network, HMM	Divide the image and take pixel of each edge

Table 1:- Overview of Related Work

III. PROPOSED SYSTEM WORKING

By going through the related work previously done observing the drawbacks of those systems it is an attempt to overcome few of them and to give more accurate result in less time and using somewhat different methodologies.

The system proposed in this paper is used to identify the paper currency that is 10,20,50,100,200,500,2000 rupees note. Basically this system is captures the image from the input device like camera then performs certain actions like pre-processing, and extract the particular feature of the image like mean, standard deviation, skewness these are nothing but luv parameters as well it will compare the histogram value with the database, gray occurrence matrix is also one the feature after that the classifier is used to compare the data with the data base. Figure 2 shows the block diagram of the universal currency identifier for Indian currency which consist of block points.

A. Input image

The very first step in this system is that the image acquisition the image is captured with the help of camera or we can access the already stored image for this system the jpeg or jpg images are used o process.

B. Pre-processing

Here we perform certain actions like:-

- *Image resizing*

It is the geometric transformation for each pixel. It is the mapping of corresponding pixel between input image and output image. For this interpolation is used to resolve the remapping. There are several methods of interpolation that is bilinear interpolation it uses 4 pixels and bicubic interpolation which uses 16 pixels.

- *Median filter*

When we capture the image some noise get added to the image one of the most occurred noise is salt and paper noise to remove this noise we use median filter. Median filter perform the filtering on image in two dimensions. Each output pixel contains the median value in 3 by 3 neighborhoods around the corresponding pixel in the image with zeros on the edges.

C. Feature extraction

In this stage the various feature of the image is extracted the proposed system uses the features like mean, standard deviation, skewness, converting the image into other colour spaces for luminance, chrominance, and edge detection.

- *Mean*

Mean of a colour is obtained by taking average value of all of the colour component of the colour space used. The formulation for mean is

$$\mu = \frac{1}{MN} \sum_{i=1}^{M} \quad \sum_{j=1}^{N} p\text{ij}$$

where, M,N= dimension and total number of pixels in image pij = color values of column i and row j.

- *Standard deviation*

It is a quality that express the how much the member of color channel differ from mean value for channel.

$$\sigma = \sqrt{\frac{1}{MN} \sum_{i=1}^{M} \quad \sum_{j=1}^{N} (p\text{ ij} - \mu)^2}$$

➢ *Skewness*

It is used to measures the degree and direction of symmetry or asymmetry of distribution

$$\frac{1}{MN}\sum_{i=1}^{M} \quad \sum_{j=1}^{N}(p\,\mathrm{ij} - \mu)^3 \div \mathrm{MN}$$

➢ Canny edge detector is used in this system for the edge detection.

D. Classifier

For this system we use knn classifier that is nearest neighbor classifier it allows to find the closest point to the set point means it compare the test data with the data base.

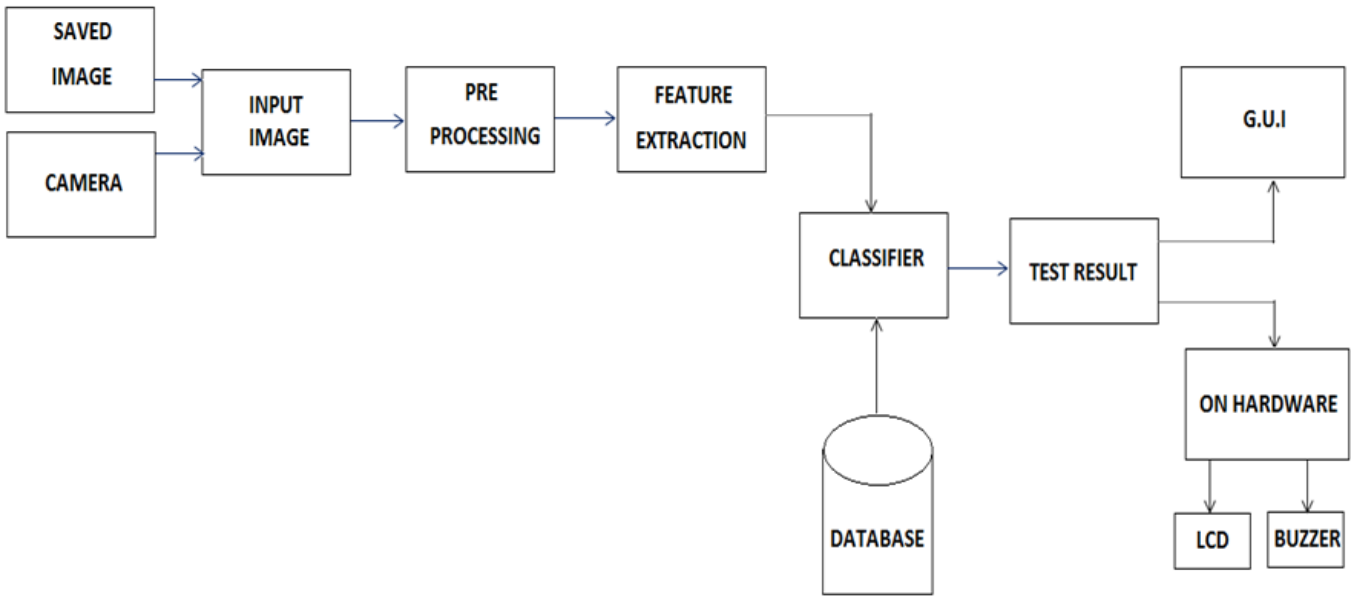


Fig 1:- Block diagram of universal currency identifier for indian currency

IV. EXPERIMENTAL RESULTS

To experiment the proposed system we used the USB camera connected to the laptop with installed software MATLAB R15 version, and hardware like LCD connected through AVR controller and buzzer as output device.

When we execute the code the Graphical User Interface will help us to choose the input method that is select already stored image or capture real time image after running code output will appear on screen of GUI as well as LCD and if the currency is fake buzzer will energize.

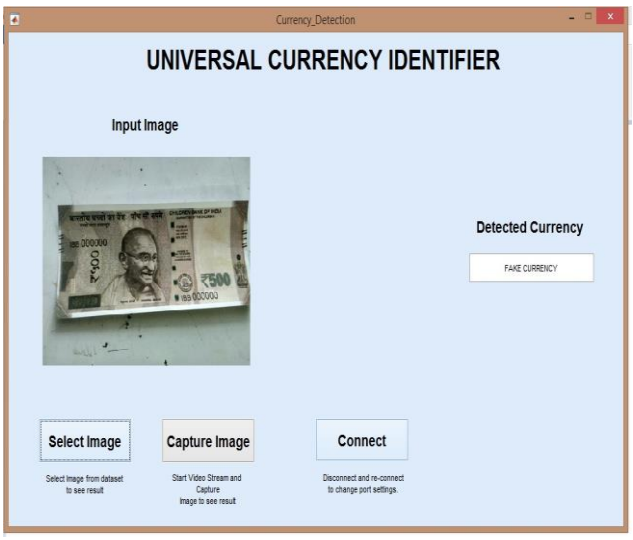


Fig 2:- Output of 500 Rupees Currency

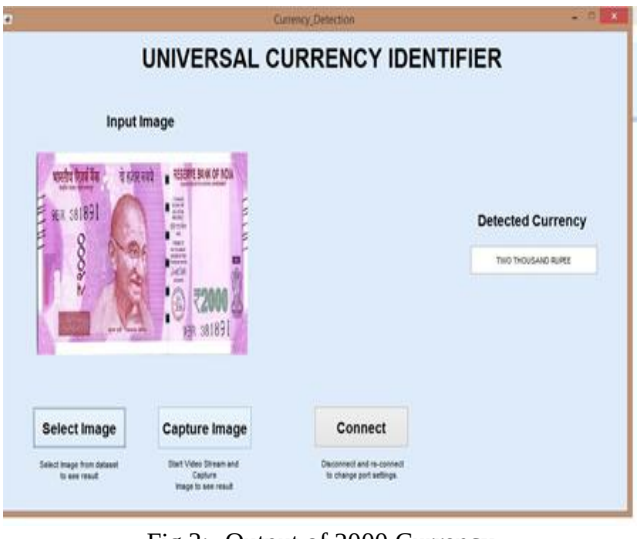


Fig 3:- Output of 2000 Currency

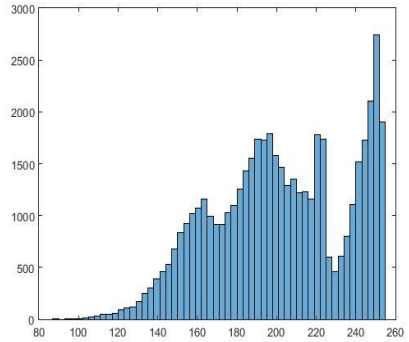
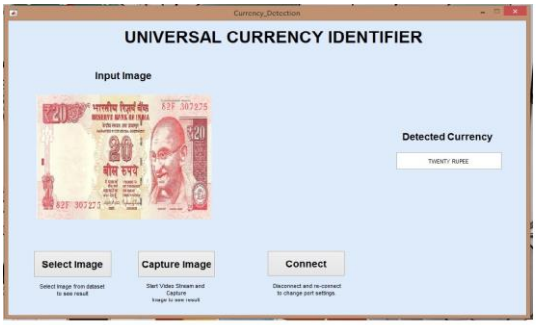
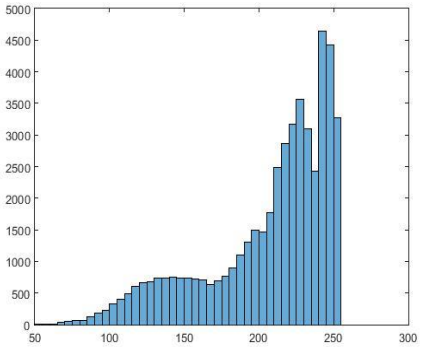
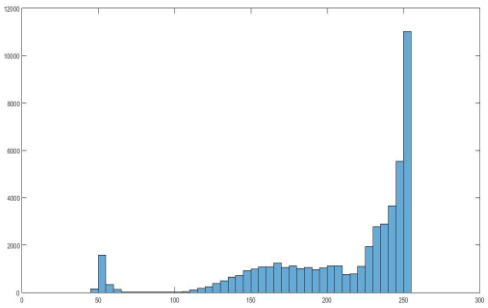
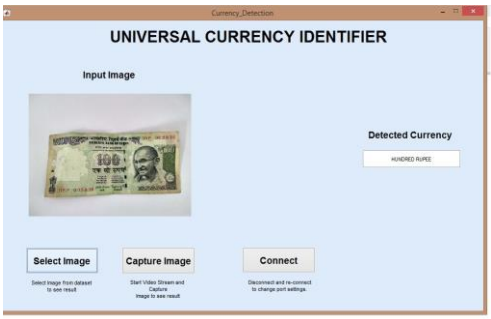
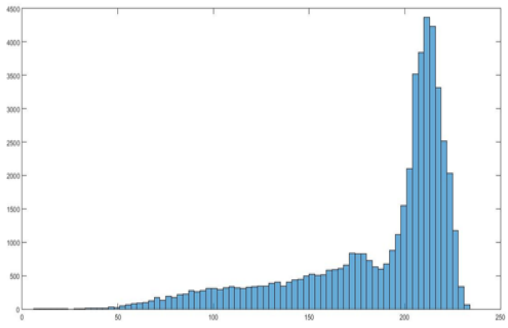
Sr. No.	Input image currency	Output on MATLAB	Histogram
1	Real 10 rupees		
2	Real 20 rupees		
3	Real 50 rupees		
4	Real 100 rupees		

Table 2:- Result of Currency of 10,20,50,100,200 Rupees

FUTURE ENHANCEMENT

In this paper all the currency are cover but if any currency demonetization happens and new currencies come in market that time those new currencies can be added to database by doing appropriate changes of feature.

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