Currency Recognition and Fake Note Detection

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ABSTRACT: The use of counterfeit currency is one of the major issues faced throughout the world nowadays .The counterfeiters are becoming harder to track down because of their use of highly advanced technology. One of the most effective methods to stop counterfeiting can be the outspread use of various counterfeit detection tools/software that are easily available and are efficient .The implemented project would recognize Indian currency notes using a real time image obtained from a webcam .This is a java based application which will help recognize a bank-note based on its denomination on an application window. The method will be based on image pre-processing followed by a classification of note. The application will be trained with samples of note denomination in Indian currency before testing.

KEYWORDS: Fake Currency; Image Pre-Processing; Feature Extraction; Recognition; Text-to-Speech.

I. INTRODUCTION

Modernization of the financial system is a milestone in protecting the economic prosperity, and maintaining social harmony. The Reserve Bank of India is only one which has the full authority to issue bank notes in India. But some unsocial group of people is prone to make these fake currencies. Fake Indian Currency of 100, 500 and 1000 seems to have flooded the system and there is no proper way to deal with them for a common person. Common Person fall prey to this currencies.

The value of money is increasing and Rs. 1000 and Rs. 500 is the highest value currency existing till date and maximum fake is done in them. From few years, along with the original currency, Fake Currency is also circulating in the society and unbalancing the social harmony of the society. Many of the transaction are also carried out with it.

Fake currency detection means finding fake currency from the currencies. With the advancement of the modern banking services, automatic methods for paper currency detection has become important in most of the applications such as in automated teller machines and automatic goods seller machines. Images are processed by using various techniques of image processing and further various features are extracted from the images. Automatic methods of banknotes recognition are required in many applications, such as automatic selling goods and vending machines, among others. The approach consists of a number of components including image processing, image segmentation, characteristic extraction, comparing images[10]. The basic thing of approach is that we extract the features on the basis of which we are going to classify the fake note. [5][6]

II. RELATED WORK

In [1] authors proposed the problem of Detecting fake Currency using MATLAB technique. In this technique, they used the RGB components of two images: one was the original currency note(r1,g1,b1) and other was the note to be tested(r2,g2,b2). Then a new image with components as r1, g2, b1 or r2, g1, b1 or b2, g1, b1 was constructed. But r1,g2,b1 combination was most preferred because human eye is sensitive to green component and most of our images contains maximum green component so that our output image will be much easier to identify the fake note more efficiently. In [2] the authors presented an extensive survey of research on various developments in recent years in identification of currency denomination and it also focused primarily on currency detection system including various steps involved in it like image acquisition, feature extraction and classification system using various algorithm. Various classification techniques had been mentioned in the paper, they were as follows: i) Artificial Neural Network. ii) Image

histogram iii) Money detector. In [3] the author presented the various fake currency detection techniques which were as follows: i) Commonly Used Methods to Detect Fake Currency ii) Digital Image Processing Method To Detect Fake Currency iii) MATLAB technique iv) Counterfeit Detection Pen and v) Ultraviolet counterfeit detection scanner. In [4] the author proposed to help and improve the detection of counterfeit currency, for which a series of tests of performance were designed to explore the contributions of note quality, sensory modality, training, security features and demographic variables to the accuracy of counterfeit detection with three different note types. When the security features were tested individually, the Optical Security Device (OSD) was the best feature, the hidden number was the worst, and the portrait, maple leaves, fluorescence and micro-printing were intermediate. Accuracy was higher with notes that could be seen but not touched than vice versa. Cash handlers were 74% correct with touch alone and adding touch to vision significantly improved counterfeit detection. In [5] the authors proposed intrinsic features that are used for detecting Indian currency. Principal Component Analysis (PCA) was applied on each feature individually. Normalized weight vector was generated for all images in training set and distance measure of these weight vectors are determined using Mahalanobis distance. Based on the distance measure the class to which the currency belongs was determined. The proposed system consisted of: i) Dataset Preparation ii) Feature Extraction iii) Principal Component Analysis.

III. IMPLEMENTED SYSTEM

The aim is to design a robust prototype that can perform efficient and reliable recognition of the Indian currency notes. The problem identifications of the proposed study are as follows: Presence of noise while capturing the image of currency note and mitigating them. Computing extent of the threshold to be used for color matching for different type of denomination under challenging physical condition of notes (skewed, variable illumination etc.)

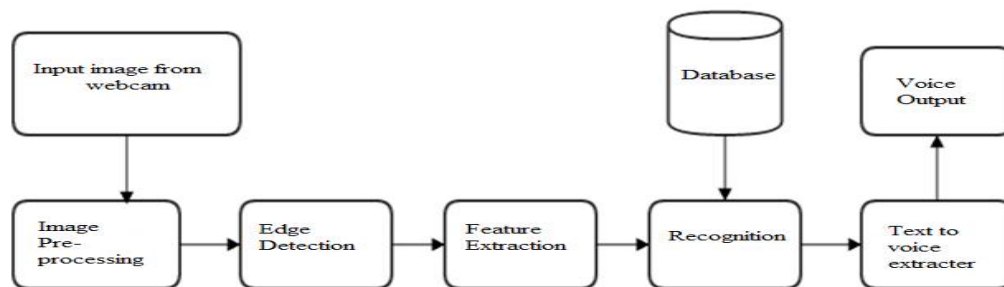*A.   System Block Diagram:*

Fig.1. System Block Diagram[5][6]

B.   Steps of implemented system:
Image processing based currency recognition technique consists of few basic steps like image acquisition, its pre-processing and finally recognition of the currency. Image processing generally involves three steps:
Step 1. Image Aquisition: Importing an image with an optical scanner or directly through digital photography or webcam.
Step 2. Performing Image pre-processing techniques such as:
    i.   Image Adjusting: Reduces the calculations and complexity of the size of the image and used for rotating, zooming, shrinking and for geometric corrections.
    ii.   Image Smoothening: Reduces the noise introduced in the image.
Step 3. Detect the edges of the note and partition it from the surrounding background of the image.
Step 4. Perform Feature Extraction on the note to detect whether the note is real or fake by comparing the features of the note with the stored database. There are two databases, one consisting of fake serial no.s, so when the image is captured, the captured image's serial no. is compared with the fake serial no's database and the result is

displayed and the other database consist of the images of the features except for serial no.
Step 5. After Feature Extraction the application will detect and recognize the note.
Step 6. The final result will be an audio output.

IV. PSEUDO CODE

Step 1: Capture image through a webcam.
Step 2: Perform image pre-processing techniques on the captured image in the following way:

    a) Image Adjusting using Bilinear Image Interpolation technique[5][6]

    Where, (x , y) denotes coordinates of the location where we want to assign an intensity value and $Z(x , y)$ denote that intensity value, so to evaluate assigned value we use equation,
    $Z (x,y) = ax + by + cxy + d$
    Where, four coefficients can be obtained from the four equations from the four unknown nearest neighbours of the point.

    b) Image Smoothening using Median Filter (Non-Linear Algorithm) [9]

```
allocate outputPixelValue[image width][image height]
  allocate window[window width * window height]
  edgex := (window width / 2) rounded down
  edgey := (window height / 2) rounded down
  for x from edgex to image width - edgex
     for y from edgey to image height - edgey
        i = 0
        for fx from 0 to window width
           for fy from 0 to window height
              window[i] := inputPixelValue[x + fx - edgex][y + fy - edgey]
              i := i + 1
        sort entries in window[]
     outputPixelValue[x][y] := window[window width * window height / 2]
```

Step 3: Perform Edge Detection

Step 4: Analyze Extracted Features:
    (a) Security Thread
    (b) Intaglio Print
    (c) Serial No.
    (d) Floral Design
    (e) Emblem Of India
    (f) Latent Image
    (g) Optically Variable Ink

Step 5: Provide Text to Speech Output
Step 6: End (The note will be recognized and detected)

V. RESULTS AND ANALYSIS

Some of the results of the system are given below:

A. LOGIN FORM
In the application, First the Login Form is opened. Enter valid Username and Password, click on Submit as shown in Fig.2. The appropriate test page will be opened.
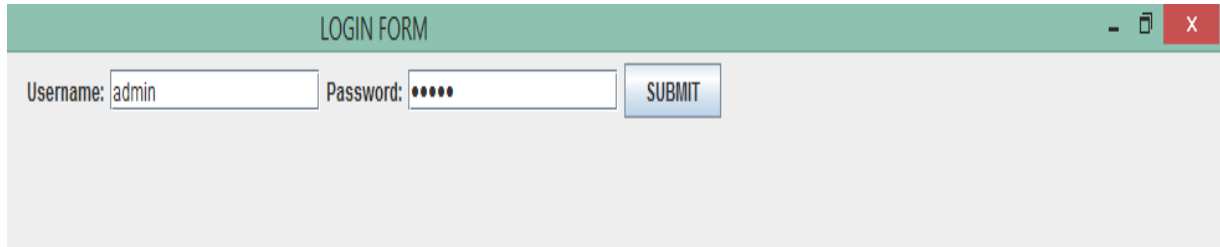
Fig.2. Login Form

B. TEST PAGE

In Fig.3, the test page includes features of Indian Currency which we are going to test such as Check serial no., Emblem of India, Flower test, Optical variable Ink, Latent matching, Security thread.
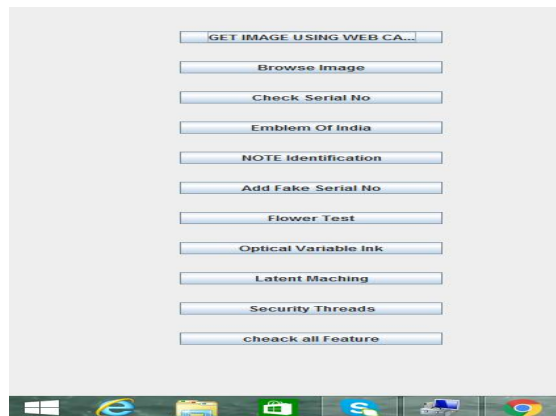

Fig.3. Test Page

C. GET IMAGE USING WEBCAM

As shown in Fig. 4, click on 'Get image using Webcam'. Webcam will be started, take a snapshot of currency and click the stop button. The image will be stored in the database which can be used for further processing.
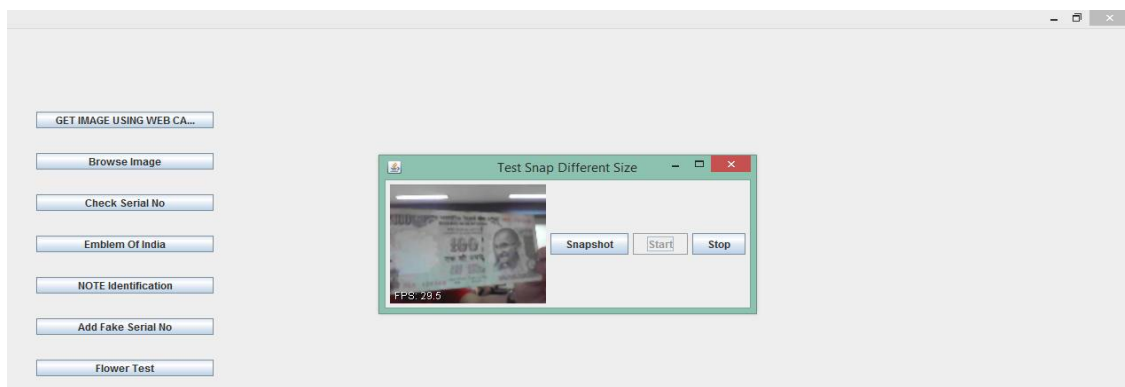

Fig.4. Get Image using Webcam

D. BROWSE IMAGE

Browse image button is used to take image from database. This will open browse window, select image from the folder or file where the image is stored as shown in Fig.5. Open the image, the image will upload successfully, which is shown in Fig.6.
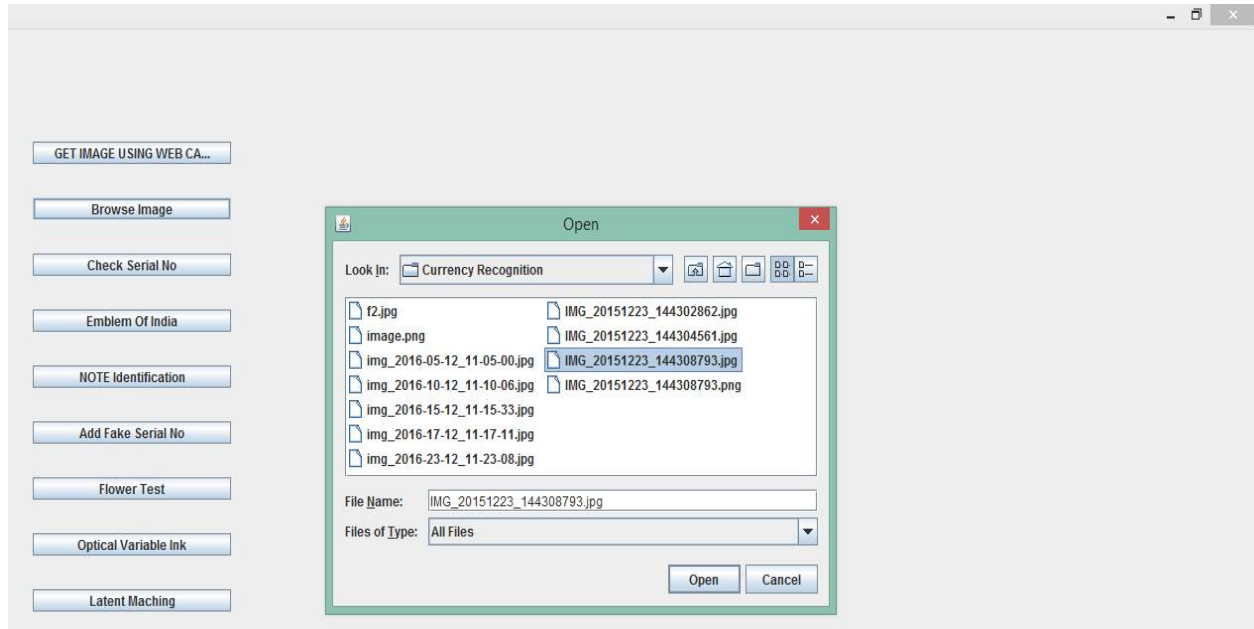
Fig.5. Browse Image

Fig.6. File Uploaded Successfully

E. **ADD FAKE SERIAL NO.**

Add fake serial No. will add fake serial No. in the database. In Fig.7 enter the fake serial No. in the textbox and click 'submit'. A window page should be displayed indicating fake serial No. added successfully or fake serial No. not added successfully as shown in Fig.8.
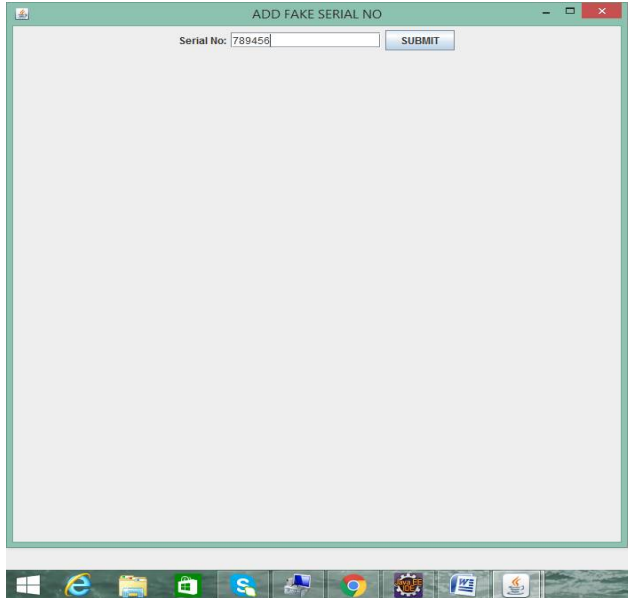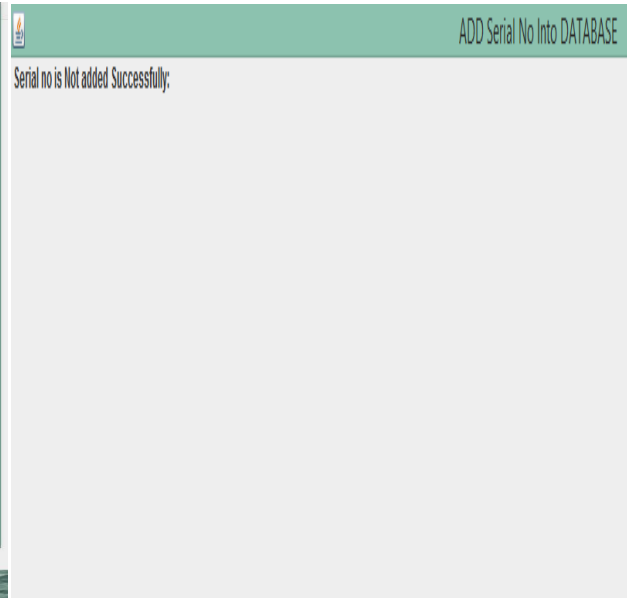
Fig.7. Add Fake Serial No.

Fig.8. Result of Serial No.

F. FLOWER TEST

Click on 'Flower Test' It should display a page Grab image and crop the Flower area, match with training dataset and pop-up should display Flower Test is matched or Flower Test is not matched as shown in Fig.8 and Fig.9 respectively.
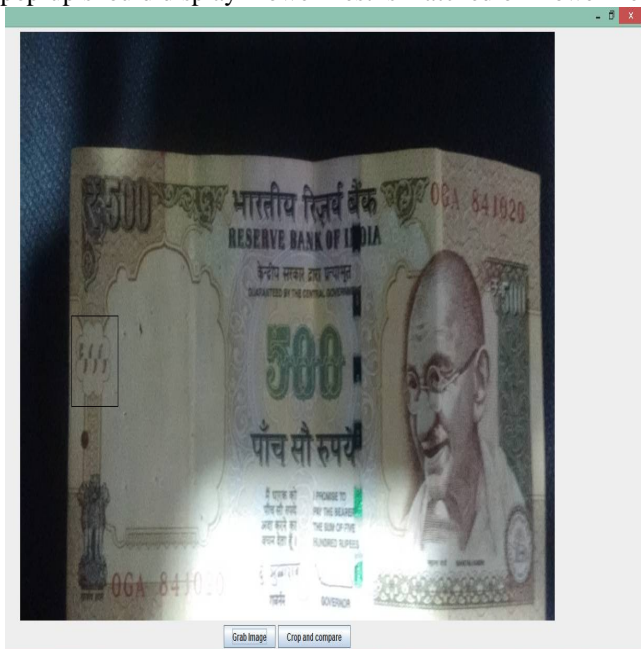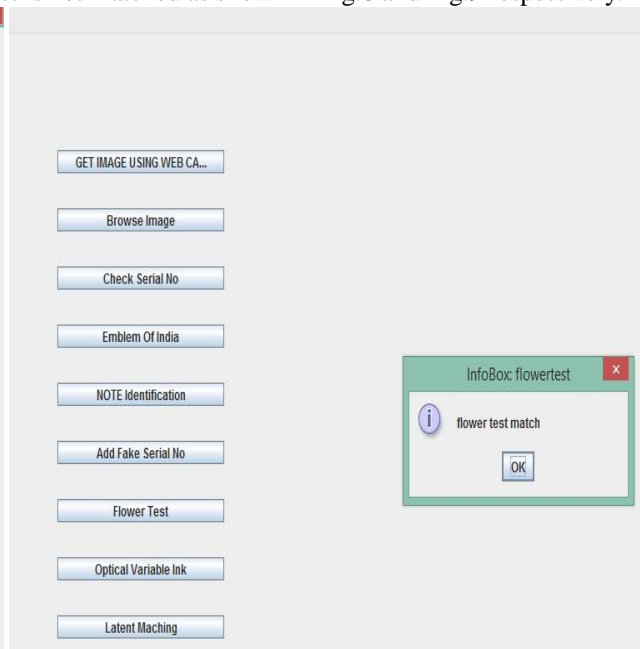

Fig.8 Flower test

Fig.9 Result of Flower Test

G. SECURITY THREAD

As shown in Fig.9, click on 'Security Thread' It should display a page, Grab image and crop the security thread part, match with training dataset and pop-up should display Security thread is matched or Security thread is not matched, which is shown in Fig.10.

Fig.9. Security Thread test

Fig.10. Result for Security Thread

VI. CONCLUSION AND FUTURE WORK

This project discussed a technique for verifying Indian paper currency. This project is an effort to suggest an approach for extracting characteristic of Indian paper currency. Approach suggested from the beginning of image acquisition to converting it to gray scale image and up to the word segmentation has been stated. The work will surely be very useful for minimizing the counterfeit currency. In Future, Mobile app can be developed which would be useful for normal as well as visually impaired persons, the same system can be developed for the remaining Indian currency notes and other country's currency notes. Also the app's interface can be further modified as per the user requirements.

REFERENCES

[1] D.Alekhya, G.DeviSuryaPrabha and G.VenkataDurgaRao, "Fake Currency Detection Using Image Processing and Other Standard Methods" International Journal of Research in Computer and Communication Technology, Vol 3, Issue 1, pp.128-131, January- 2014

[2] Kishan Chakraborty, Jordan Basumatary, Debasmita Dasgupta, Subra Mukherjee, Jagadish Chandra Kalita "RECENT DEVELOPMENTS IN PAPER CURRENCY RECOGNITION SYSTEM" IJRET: International Journal of Research in Engineering and Technology, Vol.2, Issue 11, pp.222-226, Nov-2013

[3]. Megha Thakur, Amrit Kaur, "VARIOUS FAKE CURRENCY DETECTION TECHNIQUES" International Journal For Technological Research In Engineering Volume 1, Issue 11, pp.1309-1313, July-2014

[4] Raymond M. Klein, Simon Gadbois, John J. Christie, "Perception and Detection of Counterfeit Currency in Canada: Note Quality, Training and Security Features" IS&T/SPIE 16th International Symposium Electronic Imaging: Science and Technology, session on Optical Security and Counterfeit Deterrence Techniques V. Volume 5310 (January, 2004 San Jose, Ca)

[5] Vishnu R, Bini Omman, "Principal component Analysis on Indian Currency Recognition" 2014 5th International Conference on Computer and Communication Technology 978-1-4799-6758-2/14/$31.00 ©2014 IEEE 291, pp.291-296, 2014

[6] Prof. Sowmyashree, ShreyaShetty, TruptiGhotkar, ChirayuYadav, SurajKanojia, "Currency Recognition and Fake Note Detection." IJREAT: International Journal of Research in Engineering & Advanced Technology, Volume 3, Issue 5, pp.179-182, ISSN: 2320-8791, , Oct-Nov, 2015

[7] ShreyaShetty, TruptiGhotkar, ChirayuYadav, SurajKanojia, Prof. Sowmyshree, "Currency Denomination", IJSRD, NCTAA-2016, January-2016

[8] http://searchmobilecomputing.techtarget.com/definition/text-to-speech

[9] https://en.wikipedia.org/wiki/Median_filter

[10] http://www.oalib.com/paper/2090901#.VvlxrHpRJdg/

BIOGRAPHY

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