An automatic recognition of fake Indian paper currency note using MATLAB

Binod Prasad Yadav, C. S. Patil, R. R. Karhe, P.H Patil

Abstract— Counterfeit notes are one of the biggest problem occurring in cash transactions. For country like India, it is becoming big hurdle. Because of the advances in printing, scanning technologies it is easily possible for a person to print fake notes with use of latest hardware tools. Detecting fake notes manually becomes time-consuming and untidy process hence there is need of automation techniques with which currency recognition process can be efficiently done. Many techniques have been proposed with the use of MATLAB, feature extraction with HSV color space and other applications of image processing. We have implemented a fake note detection unit with MATLAB algorithm. This paper is a based on the same project to give solution for fake currency problem.

Index Terms— Counterfeit notes, feature extraction, image processing, MATLAB algorithm.

I. INTRODUCTION

Manual testing of all notes in transactions is very time consuming and untidy process and also there is a chance of tearing while handing notes. Therefore Automatic methods for bank note recognition are required in many applications such as automatic selling-goods and vending machines. Extracting sufficient monetary characteristics from the currency image is essential for accuracy and robustness of the automated system. This is a challenging issue to system designers. Every year RBI (Reserve bank of India) face the counterfeit currency notes or destroyed notes. Handling of large volume of counterfeit notes imposes additional problems. Therefore, involving machines (independently or as assistance to the human experts) makes notes recognition process simpler and efficient.

Automatic method for detection of fake currency note is very important in every country. In this project we have made fake currency note detection technique using *MATLAB and feature extraction with HSV color space and other applications of image processing*. In the project setup, note is placed in front of camera to check whether it is fake or genuine. The camera pictures of notes are analyzed by MATLAB program installed on computer. The project is meant to check Indian currency notes of *100, 500 and 1000 rupees*. If the note is genuine, the respective message is appeared on the screen and vice-versa.
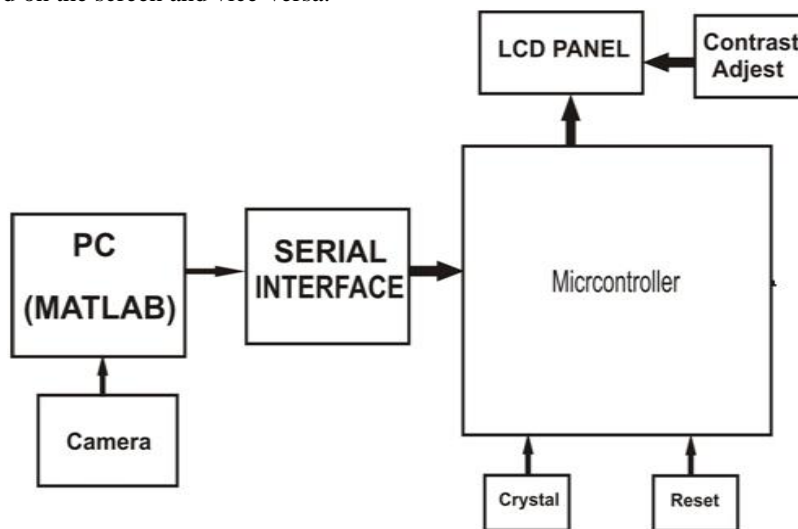

Fig. 1 Block diagram for automatic recognition of genuine and fake Indian notes
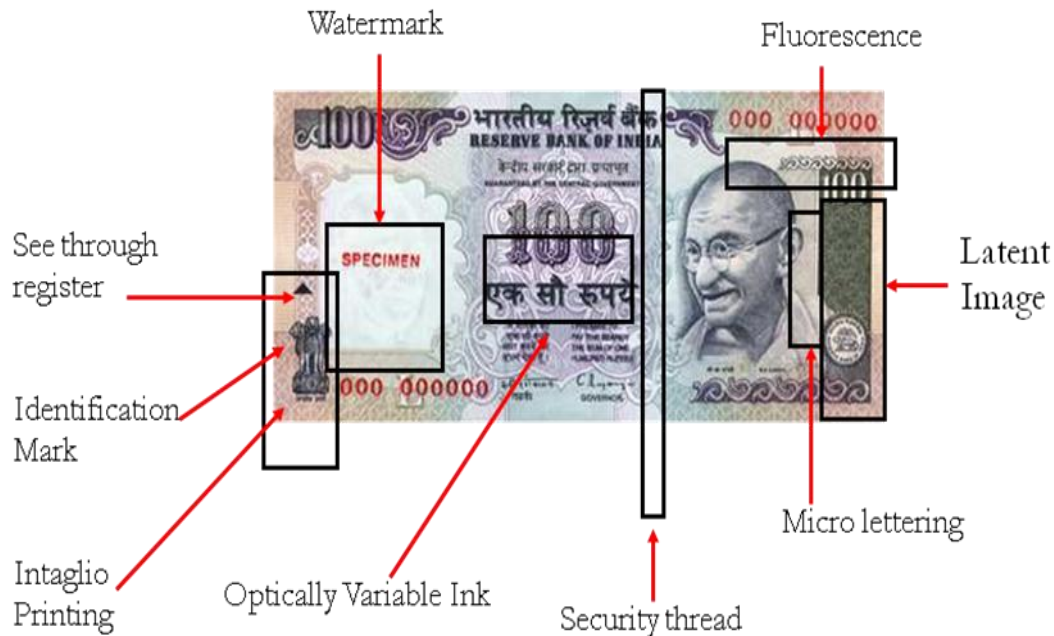
COMMONLY USED METHODS TO DETECT FAKE NOTES [1]: -

Fig. 2 Security features of indian curency notes [3][4]

1. See through register

The small floral design printed both on the front (hollow) and back (filled up) of the note in the middle of the vertical band next to the Watermark has an accurate back to back registration. The design will appear as floral design when seen against the light.

2. Water marking

The Mahatma Gandhi Series of banknotes contain the Mahatma Gandhi watermark with a light and shade effect and multi-directional lines in the watermark window.

3. Optically variable ink

This is a new feature included in the Rs.1000 and Rs.500 notes with revised color scheme introduced in November 2000. The numeral 1000 and 500 on the obverse of Rs.1000 and Rs.500 notes respectively is printed in optically variable ink viz., a color-shifting ink. The colour of the numeral 1000/500 appears green when the note is held flat but would change to blue when the note is held at an angle.

4. Fluorescence

Number panels of the notes are printed in fluorescent ink. The notes also have optical fibers. Both can be seen when the notes are exposed to ultra-violet lamp.

5. Security thread

The Rs.500 and Rs.100 notes have a security thread with similar visible features and inscription 'Bharat' (in Hindi), and 'RBI'. When held against the light, the security thread on Rs.1000, Rs.500 and Rs.100 can be seen as one continuous line. The Rs.5, Rs.10, Rs.20 and Rs.50 notes contain a readable, fully embedded windowed security thread with the inscription 'Bharat' (in Hindi), and 'RBI'. The security thread appears to the left of the Mahatma's portrait.

6. Intaglio printing

The portrait of Mahatma Gandhi, the Reserve Bank seal, guarantee and promise clause, Ashoka Pillar Emblem on the left, RBI Governor's signature are printed in intaglio i.e. in raised prints, which can be felt by touch, in Rs.20, Rs.50, Rs.100, Rs.500 and Rs.1000 notes.

7. Latent image

On the obverse side of Rs.1000, Rs.500, Rs.100, Rs.50 and Rs.20 notes, a vertical band on the right side of the Mahatma Gandhi's portrait contains a latent image showing the respective denominational value in numeral. The latent image is visible only when the note is held horizontally at eye level.

8. Micro lettering

This feature appears between the vertical band and Mahatma Gandhi portrait. It always contains the word 'RBI' in Rs.5 and Rs.10. The notes of Rs.20 and above also contain the denominational value of the notes in micro letters. This feature can be seen well under a magnifying glass.

9. Identification mark

Each note has an unique mark of it. A special feature in intaglio has been introduced on the left of the watermark window. This feature is in different shapes for various denominations (100-Triangle, Rs.500-Circle, and Rs.1000-Diamond) and helps the visually impaired to identify the denomination.

II. DESIGN FLOW OF AUTOMATIC RECOGNITION OF GENUINE AND FAKE INDIAN NOTES

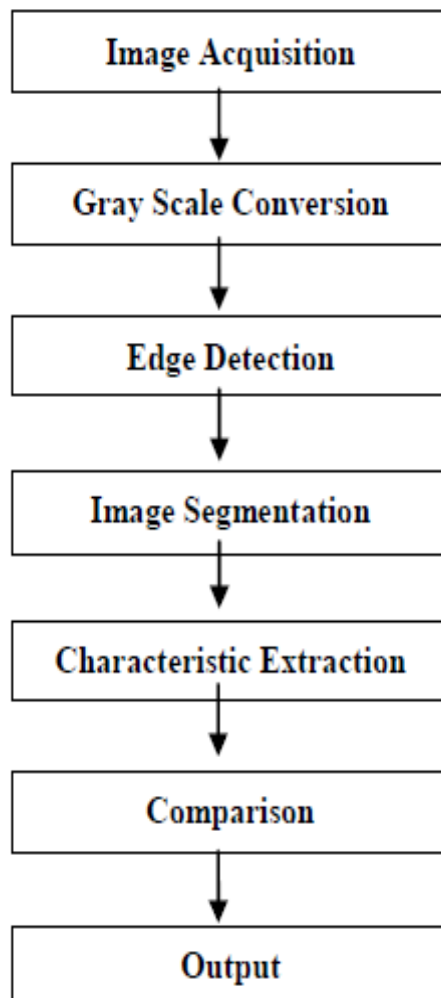The below diagram shows step-by-step process of this paper currency verification system

Fig. 3 Design flow of automatic paper currency verification system
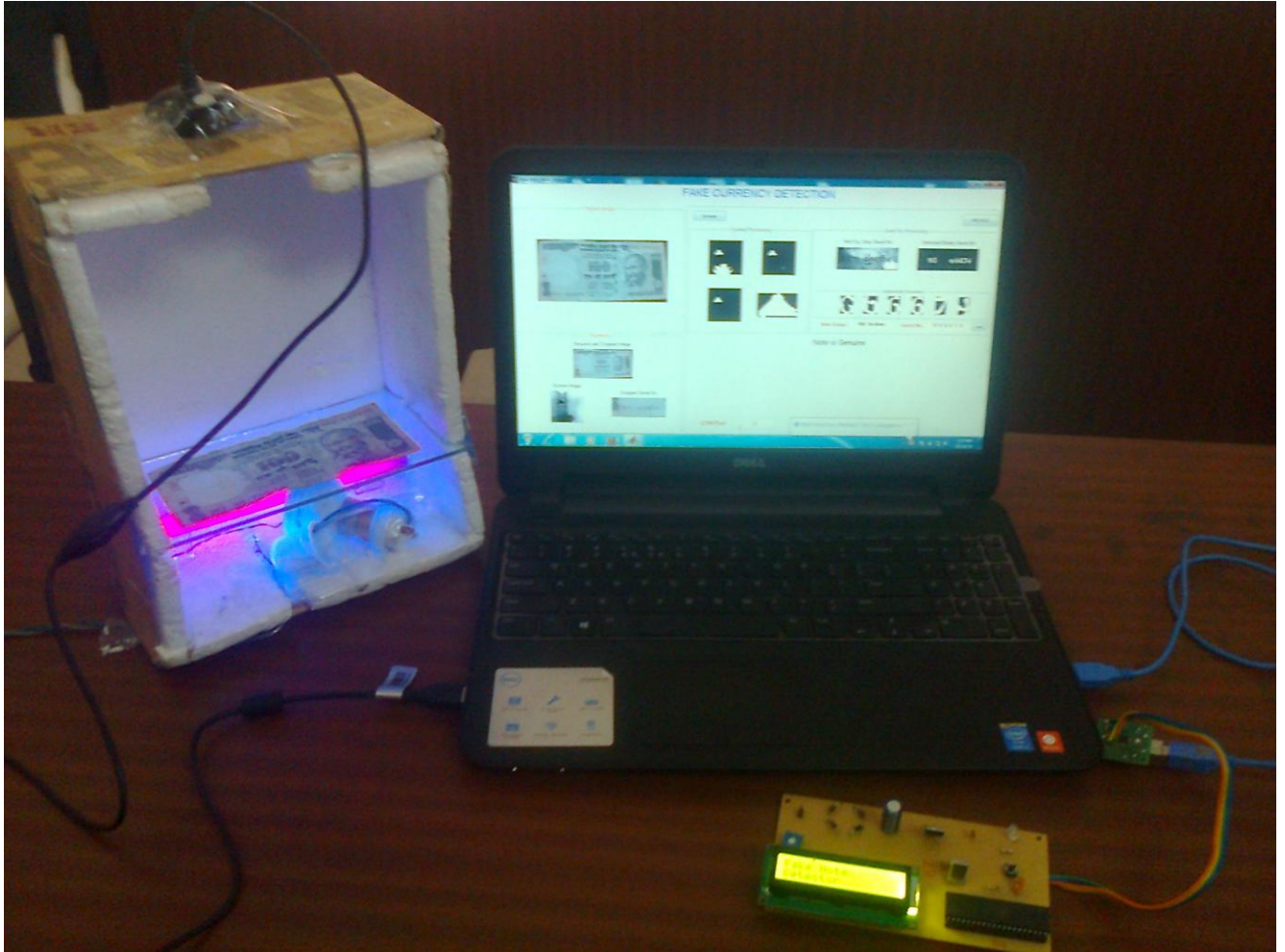
III. EXPERIMENTAL SETUP

Fig. 4 Image of experimental setup

IV. EXPERIMENTAL RESULTS
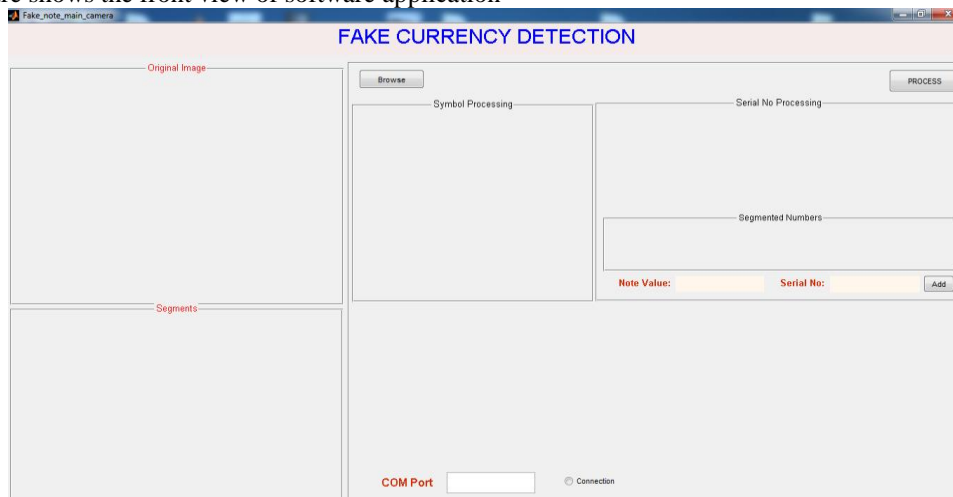
Below figure shows the front view of software application
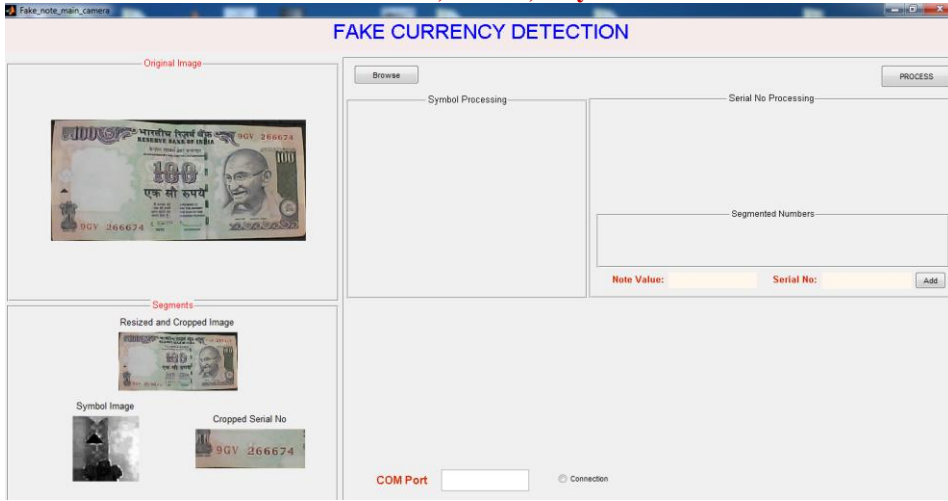

Fig. 5 Front panel of software application

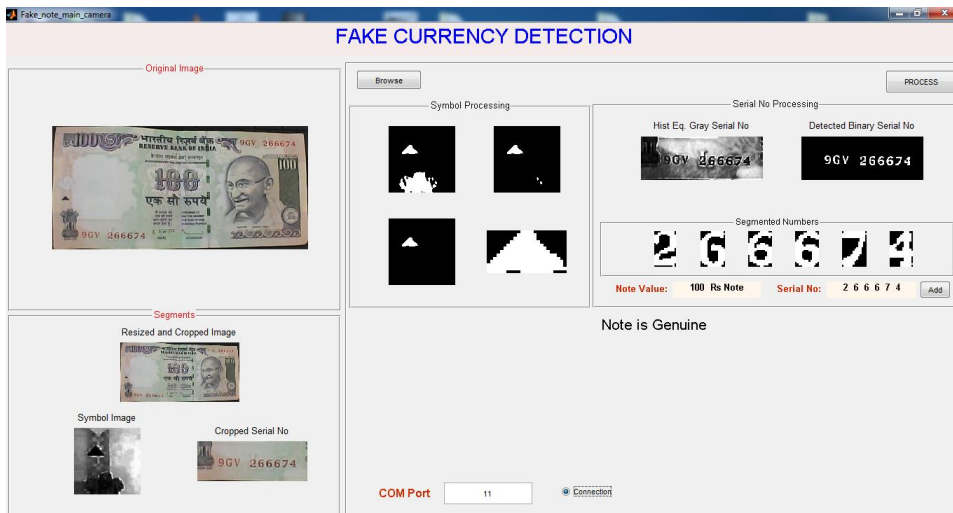**Fig. 6 Front panel of software after image is selected**

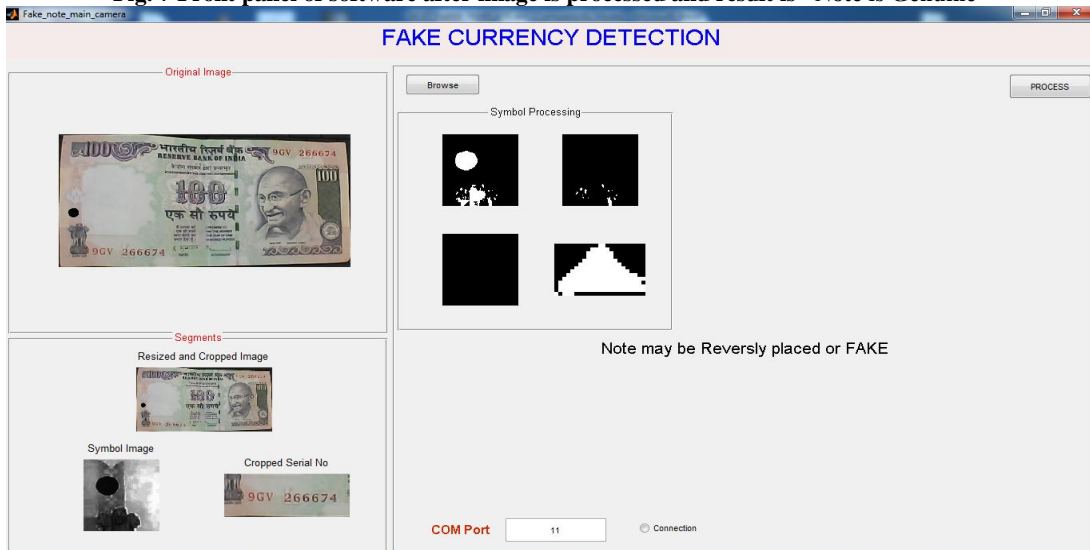**Fig. 7 Front panel of software after image is processed and result is "Note is Genuine"**

Fig. 8 Front panel of software after image is processed and result is "Note may be reversal placed or fake"

V. CONCLUSION

The main motivation behind development of this project was to make a system for easy and quick detection of genuine and fake Indian currency notes. This is a MATLAB based system for automatic recognition of security features of Indian currency. The low cost system, using effective and efficient image processing techniques and algorithms, provide accurate and reliable results at good throughput as shown by experimental results. The developed algorithm works for Indian denomination 100, 500, 1000. The system is also interfaced with input device CCD camera and output device LCD display.

ACKNOWLEDGMENT

REFERENCES

[1] Sanjana, Manoj Diwakar, Anand Sharma, "An Automated recognition of Fake or Destroyed Indian currency notes in Machine vision", IJCSMS, Vol. 12, April 2012.

[2] Hanish Agarwal, Padam Kumar, "Indian currency note denomination recognition in color images", IJACEC, Vol. 1, ISSN 2278–5140.

[3] http://www.rbi.org.in/currency/

[4] http://www.rbi.org.in/currency/Security%20Features.html

[5] Foresti G.L, Regazzoni C,"A hierarchical approach to feature extraction and grouping" IEEE Trans Image Processing, 2000; 9(6):1056-74.

[6] Euisun Choi, Jongseok Lee and Joonhyun Yoon,"Feature Extraction for Bank Note Classification Using Wavelet Transform"2006 @ISBN ISSN: 1051-4651, 0-7695-2521-0, IEEE.

[7] Peng Wang and Peng Liu, "Invariant Features Extraction for Banknote Classification "Proceedings of the 11th Joint Conference on Information Sciences@2008.

[8] Ahmadi and S.Omatu," A Methodology to Evaluate and Improve Reliability in Paper Currency Neuro-Classifiers" Proceedings 2003 IEEE International Symposium on Computational intelligence in Robotics and Automation July 16-20,2003, Kobe, Japan.

[9] E.H.Zhang, B. Jiang, J. H. Duan, Z. Z. Bian," Research on Paper Currency Recognition by Neural Networks", Proceedings of the 2nd Int. Conference on Machine Learning and Cybernetics, 2003

[10] Jae-Kang Lee and Hwan Kim,"New Recognition Algorithm for Various Kinds of Euro Banknotes" 0-7803-7906-3/03/ 2003 IEEE.

[11] F.H Kong, J.Quab Ma , J.Feng Liu,"Paper Currency Recognition Using Gaussian Mixture Models based on Structural Risk Minimization" Proceedings of the Fifth International Conference on Machine Learning and Cybernetics, Dalian, 13-16 August 2006.

[12] Ji Qian,Dongping Qian,Mengjie Zhang,"A Digit Recognition System for Paper Currency Identification Based on Virtual Instruments"1-4244-0555-6/06 © 2006 IEEE.

[13] Nadim Jahangir and Ahsan Raja Chowdhury,"Bangladeshi Banknote Recognition by Neural Network with Axis Symmetrical Masks" 1-4244-1551-9/07/$25.00 ©2007 IEEE.

[14] H.Hassanpouri, A.Yaseri, G.Ardeshiri, "Feature Extraction for Paper Currency Recognition" 1-4244-0779-6/07/2007 IEEE.

[15] Dr.Kenji Yoshida, Mohammed Kamruzzaman, Faruq Ahmed Jewel, Raihan Ferdous Sajal,"Design and Implementation of a Machine Vision Based but Low Cost Stand Alone System for Real Time Counterfeit Bangladeshi Bank Notes Detection" 1-4244-1551-9/07/2007 IEEE.

AUTHOR BIOGRAPHY

Binod Prasad Yadav, He is B.E. (E&TC) and P.G. (Communication engineering) appeared in SGD College of engineering, North Maharashtra University, Jalgaon, Maharashtra, India.

C. S. Patil, He is H.O.D. (E&TC Department) in SGD College of engineering, North Maharashtra University, Jalgaon, Maharashtra, India.

R. R. Karhe, He is Associate Professor (E&TC Department) in SGD College of engineering, North Maharashtra University, Jalgaon, and Maharashtra, India.

P.H.Patil, She is Assistant Professor (E&TC Department) in SGD College of engineering, North Maharashtra University, Jalgaon, Maharashtra, India.