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REVIEW ARTICLE

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A MATLAB BASED FAKE NOTE DETECTION AND AN IMPLEMENTATION OF EMBEDDED SYSTEM FOR NOTE TO COIN EXCHANGE

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ABSTRACT

As the requirement of coins at various places like bus station, railway station, malls, parks are increasing day by day. For these various applications there is extreme need of coins. Thus we have developed a note to coin exchanger machine which will give us coins instead of notes. In this project, we have developed mechanical coin dispensing model which takes the note inside and will provide coins for note & also checks whether note is fake or real, if note is real camera takes picture of it. Then the value of note is find out using certain image processing technique and then according to that value required number of coins is dispensed. In this way we are trying to design an efficient machine which will be having low production cost as compared to other existing machines. In this project we have developed a MATLAB algorithm for image binarization to detect the value of note. And a fake note detection section is implemented using UV LED and photodiode.

Keywords -fake note detection, coin dispensing model, Image binarization.

INTRODUCTION

In today's world due to increase in the value of money the term coins or contrarily have a value that it use to have in the earlier days. In the olden days, the value of coin was much more than what it is today. Even a single rupee used to mean a lot. Even we can remember our childhood when our parents use to give a 25 paisa or 50 paisa coins a pocket money.

Due to ever increasing market, growth in production there was a drastic change in the lifestyle of the people of the society. The market saw an increased in value of currency due to the term 'paisa' started losing its self-respect. Nowadays people prefer note over coin just because coins make one's purse a bit bulky. Also one feel uncomfortable will carrying coins. As a matter of fact today people have changed their mentality about coins which is acceptable. This is because

carrying a 10 rupee note is preferable than carrying ten coins of 1 rupee. Also coins tend to make a lot of sound which can be irritating for someone. Such people face problem when they go out in the market. In our day-to-day life people come across with the problem of not getting change at various public places such as railway stations, malls, bus stations etc. People find it very difficult to get denomination at such places. This results in frustration. Suppose you purchased ticket which cost five rupees and you give a 10 or a 20 rupee note at the ticket counter. The person asks for a change and you don't have it, what will you do? Then you go around looking for a change at the station and you don't get it. At that time either you leave the change at that counter or sometimes you are forced to purchase certain things that are unnecessary for you at that time which results in wastage of money.

So in order to help people we are developing an interactive

System that generates currency recognition system using localization and color recognition with the help of MATLAB. The proposed system will be useful in day to day life of every common man where people have to suffer for change at many public places. As mentioned in the applications this project is a real time application for all real time places. In the future this system can also be applied in the buses itself. This will be a relief for the conductors and passengers. A change machine is a machine that accepts large denominations of currency and

Returns an equal amount of currency in smaller bills or coins. Typically these machines are used to provide coins in exchange for paper currency, in which case they are also

Often known as *bill changers.*

I. SYSTEM ARCHITECTURE

Note placing unit: The unit consists of two IR sensors, one DC motor of 15 RPM and rods. The main function of this block is to accept the note inside the machine. Controller will check whether the note is placed or note using IR sensor and according to that it will turn ON and OFF the dc motor. As soon as the note is brought near to the IR sensor the motor starts rotating in clockwise direction to accept the note inside. Once the note is accepted, Controller will send indication to the MATLAB to take a snapshot of the note.

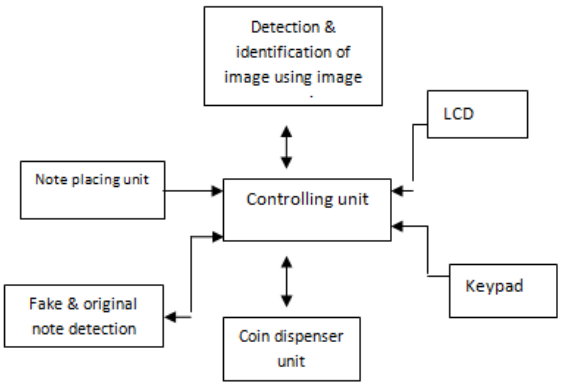


Fig. Basic Block Diagram

Fake and original note detection: The note is checked for its trueness i.e. whether the note is real or fake. We have number of ways to determine whether the note is fake or real. We have used Ultraviolet rays in order to determine so. The rays will be incident on the note using a UV bar whichradiates UV light. If the note is real then the silver strips on the note will illuminate ingreen color and an image of the note will be taken. By using the HSV algorithm only the green components of that note is assigned to one that is white portion and zero is assigned to the rest portion of note. If these green strip which is in white portion are found to be in-between 1 to 8 in numbers then the note is real. The PC MATLAB will send 1 to microcontroller for indication of original note and then the note is taken inside for further processing which is identification of 10 and 20 rupee note which is done by PCMATLAB. If the note is found fake then PC MATLAB will send 0 to the microcontroller and then the motor at the input will rotate in the opposite direction and the note will be thrown outside. Image binarization converts an image of upto 256 gray level to a black & white image.

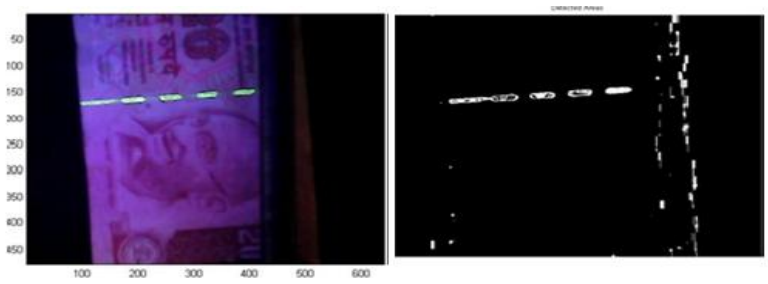


Fig 1.Fake and Original Note Detection

There are different method of identifying the Indian currency note as given below:

i. Watermark: 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.

ii. 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.

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

iv. Microlettering; This feature appears between the vertical band and Mahatma Gandhi portrait. It 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 better under a magnifying glass.

v. Optically Variable Ink: This is a new security feature incorporated 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 colour-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.

vi. 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 one floral design when seen against the light.

vii. Serial Numbers: Every banknote has its own serial number, so it is more important to check whether the number is wrong or repeated.

C.DETECTION AND IDENTIFICATION OF NOTE USING IMAGE PROCESSING: There are different method of identifying the Indian currency note out of all those the most preferable technique is the color based recognition technique.

Histogram Method: Histogram describes the global color distribution in an image. It is easy to compute and is insensitive to small changes in (VP) viewing position. The computation of color histogram just involves counting the number of pixels of specified color. Therefore in an image of resolution m*n, the time complexity of computing color histogram is O (mn). It is quite insensitive to small change in VP. This feature is particularly desired in this project as the VP from which the image of currency note will be acquired can change. Color histogram method will suit when the segregation is to be done between a range of colors and a prominent color. Color histograms describe which colors are present in the image and in what quantities; color histograms provide no spatial information. The color-indexing algorithm uses the back-projection of binary color sets to extract color regions from images

Fig. Detection and Identification of Note

D. **COIN DISPENSER UNIT:** After inserting the note, the note goes through various tests like detection of original or fake note, detection of 10 or 20 rupee note and then controller will ask the user about the choice of coins. Based on user's choice indications are given to the driver IC to drive the respective motors and the motor will rotate in such way that it gives desired no of coins 5, 2, and 1. We have used a switch at the edge in order to give indication to the controller that the exact number of coins is given.

II. MATLAB ALGORITHM& FLOWCHART

ALGORITHM FOR PROCESSING:

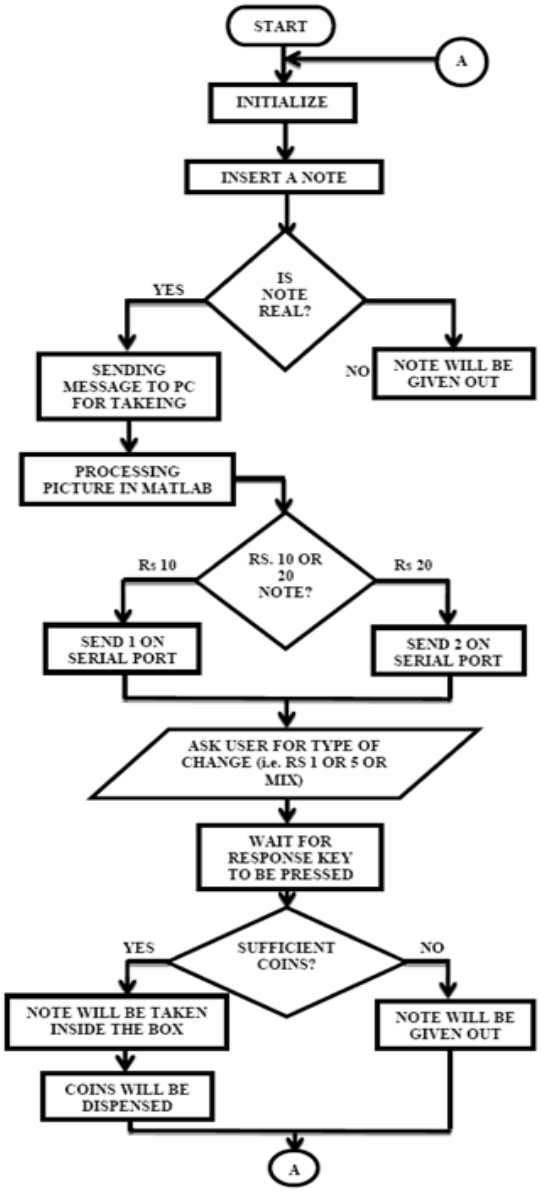
1. Initialize.
2. Set threshold "th".
3. Set COM port for serial communication.
4. Wait for instructions to be received on serial portfrom microcontroller.
5. When arrives, get snapshot of note by using camera.
6. Convert RGB image from camera to HSI image.
7. Separate "S" plane image from HSI image.
8. Cropping the image: Top and Bottom by 40pixels Left and Right by 50 pixels.
9. Set threshold "m" for Binarization of image.
10. Binaries the image.
    If above "m", store 1 in image matrix.
    If below "m", store 0 in image matrix.
11. Calculate percentage of 1 present in the imagematrix.
12. If percentage of 1 is more than threshold "th", send "2" on serial port as denomination for Rs20.
13. Else send "1" on serial port as denomination forRs10.
14. Go to step 3 until counter becomes full.

Processing part:

1. As instruction signal is received on serial port MATLAB started its processing and takes picture of note by camera connected to computer.
2. The original image taken in RGB format is converted into HSI image format.
3. S-Plane image is extracted from HSI image format for calculation and threshold purpose.
4. Then according to MATLAB coding, Output is generated and sent over the serial port.

III. APPLICATIONS

1. At Railway Stations where people need change for the tickets.
2. Similarly at Bus stations.
3. In Mall's and Parks where peoples are to be with change at checkout counters.
4. To make call from the coin box.



IV.CONCLUSION

Our paper provides an interactive system that generates currency recognition system using color model and binarization technique with the help of MATLAB. This system is also interfaced with the Machine having webcam and UV light system to

detect metal strip in the note. This technique is very adaptive to implement in real time world. As per the aim and objective of our project we have successfully developed amodel that will provide change to the user.

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