Note to Coin Exchanger

Pranjali Badhe, Pradnya Jamadhade, Vasanta Kamble, Prof. S. M. Jagdale

Abstract— **The need of coin currency change has been increased with the present scenario. It has become more difficult for the common man to fight against the increasing rates of daily requirements rounding off to the nearest values in the multiple of 10's. Rather coins are used more instead of note in various places like bus station, railway station, malls, parks, even in rural areas where nowadays also coin telephone system is used. For these many application places coins are used extremely, so we thought to develop an exchanger machine which will give us coins instead of notes. As there are lots of techniques to detect the Indian currency note, the most preferable technique along all these is color based recognition. It is constructed by counting the number of pixels of each color. The result is given to the controller which will manipulate the coin container through relays and motors, the user simply press the keypad for which type of change he wants whether one rupee coins, two rupee or five rupee or mixed and hence in the output we get coins as user requirement.**

Index Terms— **Currency, Micro Lettering, Texture, Watermarking.**

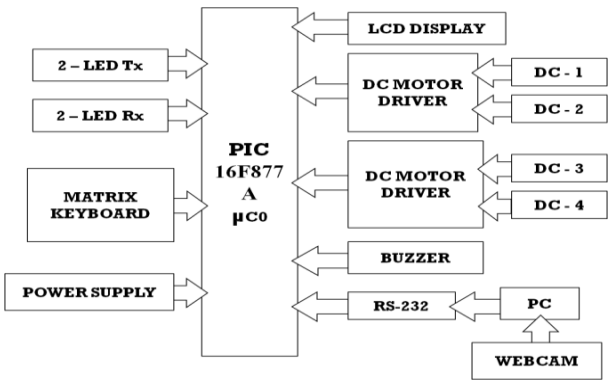
I. INTRODUCTION

To develop an exchanger machine which will give us coins along with fake note detection, currency localization and currency note recognition, this is the basic idea behind this project.

The aim of this project is to provide coins equivalent to note. The circuit uses microcontroller with mechanical structure which have motors to perform requested tasks. Here the machine accepts note and checks whether a note is fake or real. If a note is real, camera takes picture of note and with help of computer having MATLAB program checks which note it is (Rs 10 or Rs 20). Once the note is recognized coins will be dispensed by coin dispensing unit.

The specialty of Indian currency note is that it absorbs the UV light and a fake note reflects the UV light. Fake note detection unit consist of UV LED, photodiode, amplifier and comparator. The UV LED source transmits the UV rays, if the note is real it will absorb some amount of UV rays and if the note is fake then the all rays will be reflected back towards the photodiode. This output of the UV Photodiode is given to amplifier. This output is amplified and then given to comparator. Threshold voltage is applied to comparator. According to threshold voltage output of the comparator is then given to the microcontroller for further processing.

II. BLOCK DIAGRAM



A. Note placing unit

It will accept note from the user. It consists of mechanical Design of relays to take the respective

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note from the user. It takes 12v to drive the DC motor of 10RPM. There will be 3 relays and 2 DC motors at the user side to take the note inside the machine. This information is sent to the microcontroller for further processing.

B. Signal conditioning unit

When to identify whether the note is fake or real, specialty of real currency note is to absorb the UV light and a fake note reflects the UV light. This work is done by the UV LED transmitter and UV receiver or detector. The UV LED source transmits the UV rays. If the note is real it will absorb the UV rays. If the note is fake then the rays will be reflected towards the receiver or the detectorBPW34.This output of the UV detector is given to the inverting transconductance amplifier CA314.This output is amplified and then given to the single supply comparator LM 311.The output of the comparator is then given to the micro-controller for further processing Fake note detection, currency note localization and currency note.

C. Note recognition using Image Processing

In Image processing there are lots of technique to detect a note. The most preferable technique along all these is color based recognition. It is based on counting the number of pixels of each color. Histogram describes the global color distribution in an image.

Color of fake note detection is performed under UV light because UV pattern is not reflected under general LED illumination. To inspect paper, the paper money image must be separated into a pattern and a background. There is a method of separating an image into a pattern and a background using a threshold value. Histogram-based threshold value decision methods exist such as Otsu's method and Huang and Wang's method. These methods are used in separating an image into 2 objects. The method using Gaussian mixture model (GMM) can segment an image into many objects. This method synthesizes n of normal-Gaussian PDF to segment the image. First, we obtained a UV-image of the paper money using UV-LED illumination. The UV image is separated into the RGB value and we selected the G value. Next, find the gray-histogram of the G value and then find optimum mixture component number selection by using Brain Image Centre (BIC) and standard deviation. Then, UV image segmentation by using Gaussian mixture model (GMM) is segmented into four parts. Then, it is classified as the background from the first part until the second part. And the third part and the fourth part are classified in the ultraviolet pattern. Therefore, in order to segment the UV pattern using Gaussian Mixture Model (GMM), we have to choice the part from segmented UV-image. This judgment is performed according to the characteristic of the paper money. Color detection algorithms scan every frame for pixels of a particular quality. To recognize a pixel as part of a valid object, it's Y, U and V components must fall within the ranges defined in the Thresholds section of the color definition file. It defines an RGB color triplet, a merge parameter (0 … 1), a color identifier (0 … 31) and a color label (text). Every entry in colors must have a corresponding entry in Thresholds. The latter defines ranges for a pixel's Y-component (brightness), its U-component (first color attribute) as well as its V-component (second color attribute). A suitable choice of these ranges can easily be made using the camera training utilities train Camera (working of live images). A video camera is designed to capture an image – either a single "frame," or a series of frames, over a period of time. Modern solid-state cameras can capture images in a broad range of light conditions. It is possible to produce an image using a shutter speed of less than 1/800,000 second, or to leave a shutter open for many seconds to accumulate necessary light.

HSI color model:

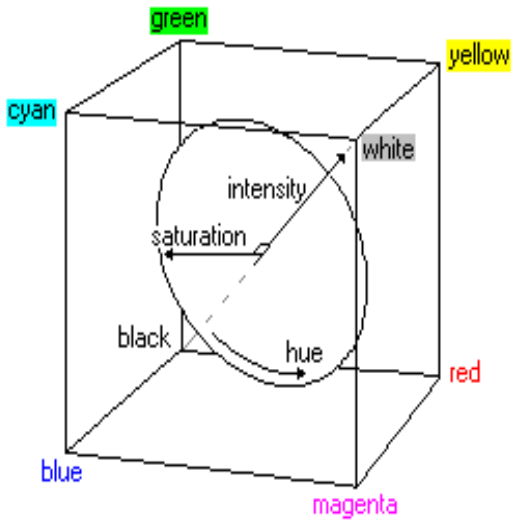

Fig. 1, HSI color model cube

I denote the light intensity, H denotes the hue that indicates the measure of the color purity and S is the saturation (the degree of a color permeated the white color). If a color is with high saturation

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value, it means the color is with the low white color. HSI describe colors as points in a cylinder whose central axis ranges from black at the bottom to white at the top with neutral colors between them, where angle around the axis corresponds to "hue", distance from the axis corresponds to "saturation", and distance along the axis corresponds to "intensity", "value", or "brightness."

For recognizing currency note of rupees 10 or 20 we are setting threshold values of H, S, I components for specific color. When webcam captures image of original note, this image is send to MATLAB algorithm. It will compare the detected values of color components with defined values of these components and based on the predefined tolerance it will recognize the note whether it is of 10 or 20 rupee.

RGB color model: The three primary colors (red, green, and blue) and their combination in visible light spectrum describe this model. With different weights, (R, G, B), their combination can indicate different colors. After normalizing the values of R, G, B, we can get the color cube. The colors on the diagonal line, from the origin to the coordinate (1, 1, 1) of the cube, means the grey- level values.

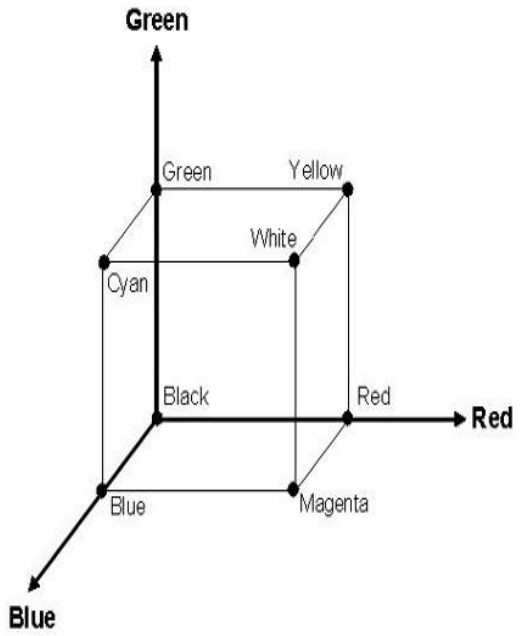

Fig. 2, RGB color cube

The image is taken by a webcam and this image is stored in a 3D array. The coordinate of the pixel in 2D image is given by the first and second index of the array and the third index stores the RGB (Red-Green-Blue) intensities for each coordinate. Each element of array stores an unsigned 8 bit integer (0-255).First two indices of array determines the resolution of the image. This limit is set to be 640 for the first index and 480 for the second index. The images are taken considering following assumptions. Image is taken in a clear environment. Resolution of the image is fixed to be 640 X 480 so that we can use any basic camera for taking image. Distance of camera is nearly fixed from the object. The currency notes are of good quality. The orientation of the currency note should be such that the sufficient amount of data required for further processing is visible.

D. Controller PIC-16F877A

The work of controller is to identify the data sent by the PC MATLAB in the form of 2's and 1's.The controller knows that a.1 = 10 rupee note. b.2 = 20 rupee note. The controller knows that now it has to generate coins in the multiples of 5 and 1 or mix coins.

*E. Matrix keypad (4*4)*

Keypad is the user interface. There are 4 keys on keypad:

1) Start
2) 1rupee coins
3) 2rupee coins
4) 5rupee coins
5) Mix coins
6) The user can select the combination in the form of 5's, 2's & 1's.

F. Coin container

This unit consists of 2 DC MOTOR DRIVER.

I. Relay 4: Relay 4 is used to drive the motor 3
II. Relay 5: Relay 5 is used to drive the motor 4

Motor 3 will let out the 1 rupee coins to the user and motor 4 will let out the 5 rupee coins to the coins to the user. In case of mix coins, the controller will check for availability of coins in the coin container and then as per the wants of the user from the keypad, the mix coins will be let out to the user. If the coins as per the need of the user are not present in the coin container then a message will be displayed on the LCD "INSUFFICIENT COINS".

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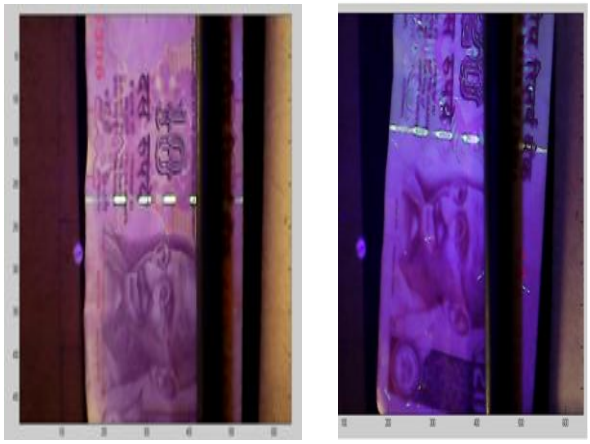
III. MATLAB RESULTS AND ANALYSIS

The Matlab algorithm results in following steps:

1. RGB image captured by webcam as soon as note inserted in note placing unit.



(a) (b)

Fig. 3, RGB image captured by webcam

a*) 10 rupees note, b) 20 rupees note*

2. RGB image values captured in presence of UV light are converted into HSV values of its gray image pixels.

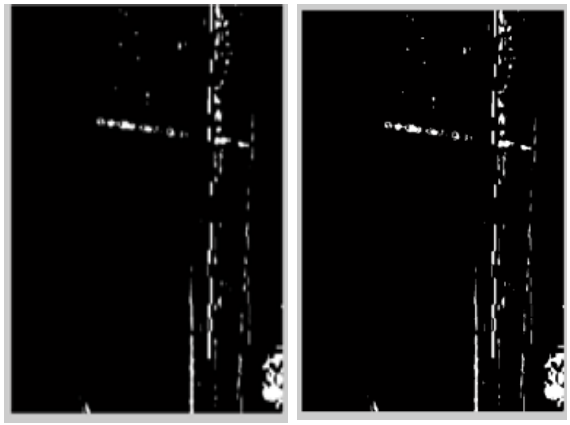
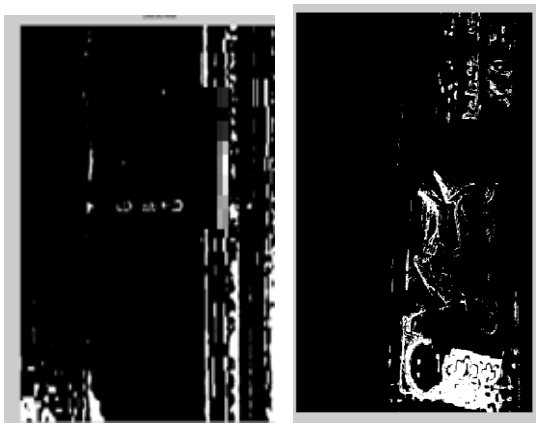


Fig. 2, HSV image of frame captured under UV light

a*) 10 rupees note, b) 20 rupees note*

3. After note is detected as real note it then undergoes through processing to detect whether it is 10 or 20 rupees note.



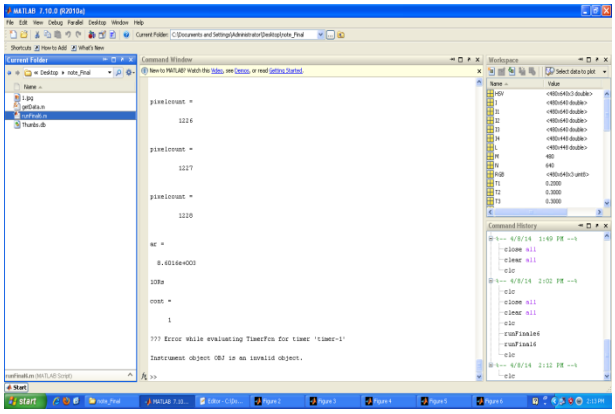
(a) *(b)*

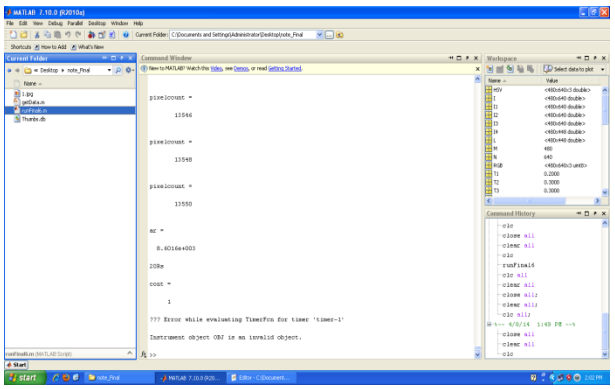
Fig. 5, detected area (pixel count: white color amount in detected area is amount of light color converted into gray levels)

a) 10 rupees note, b) 20 rupees note

An Indian currency note of 10 rupees has maximum number of dark color pixels while 20 rupees note has brighter pixels.

4. Pixels count in Matlab windows for 10 and 20 rupees note respectively.





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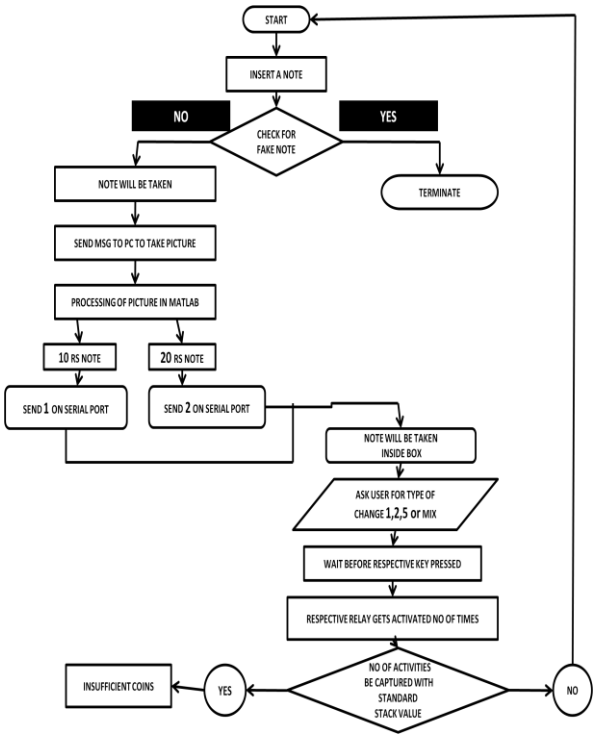
The above results are obtained in Matlab are then given to microcontroller and then microcontroller asks for number of coin change required to the user. When user gives desired input on keypad microcontroller instructs driver ICs to drive the respective DC motors. As each motor is assigned to respective coin containers, the desired number of coins in exchange of currency notes 10 and 20 are obtained.

IV. FUTURE DEVELOPMENTS

1) As we are developing a note to coin exchanger model only for 10 Rupee and 20 Rupee note but we can also develop it for a 50 Rupee note with addition of 10 Rupee coin.
2) We can develop a machine which will give us change of 100 Rupee, 500 Rupee and 1000 Rupee notes. This machine can consist of note as well as coin. As we know that its not possible to provide 500 Rupee or 1000 Rupee coins. So the expected future machine can provide some coin and notes as change.
3) When we are providing change of 500 Rupee or 1000 Rupee, we can use 100 Rupee coin also, which is expected to be in market soon.

V. FLOWCHART



VI. CONCLUSION

The basic idea of developing a machine to exchange currency coins instead of notes is very adaptive in implementation. It's a fully automated system. This system can be placed at railway stations, bus stations, malls and parks, etc.

Further it may be developed to exchange 1000rupee, 500 rupee notes with various Indian currency coins, such as 10 rupees coins which will be available henceforth. Simultaneously, fake note identification will be easily known to all.

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REFERENCES

1) Angelo Frosini, Marco Gori, "A Neural Network-Based Model for Paper Currency Recognition and Verification," IEEE Transaction on NN Vol.7 No. 6
2) Otsu N, "A Threshold Selection method from Gray-Level Histograms," IEEE Transaction on System Man and Cybernetics. (9), 62-66(1979).
3) Farid García-Lamont, Jair Cervantes, Asdrúbal López, "Recognition of Mexican banknotes via their color and texture features," F. García-Lamont et al. / Expert Systems with Applications 39 (2012) 9651–9660.
4) Hanish Aggarwal, Padam Kumar, "Indian Currency Note Denomination Recognition in Color Images," International Journal on Advanced Computer Engineering and Communication Technology Vol-1 Issue: 1: ISSN 2278 – 5140.
5) Prof. M.E.Ingale, Akash Deore, Rahul Sambre, Rakesh Karad, "International Journal of Advanced Research in Electronics and Communication Engineering (IJARECE) Volume 4, Issue 3, March 2015.

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