Note to Coin Exchanger Using Image Processing

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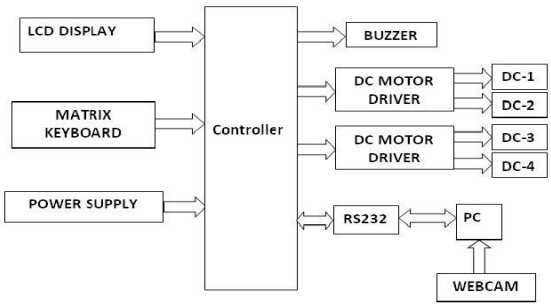
Abstract:

The need of change has been increased now a day. We suffer a lot for the change at various public places in daily life like bus station, railway station, malls, parks. Even in rural areas where now a days coin telephone system is used. Use of coins has been increased more instead of note in various places. So we thought to develop a system which will give us coins against notes and also it will check the originality of note. There are lots of techniques to detect the Indian currency note these are pattern based, watermark checking, texture based, color based recognition technique

.The most preferable technique along all these is color based recognition. This method work by counting the number of pixels of each color. The detection of note is done by MATLAB algorithm and the result is given to the controller which will turn on the respective relays and motors of coin container, the user simply press the keypad for which type of change he wants whether one rupee coins, two rupee coins, five rupee or mixed and hence at the output we get coins as per requirement of user.

Introduction:

Block Diagram:



1. Note Placing Unit :

It will accept note from the user. It consists. of mechanical design of relays to take the note from the user. DC motor of 10RPM is used at the user side to take the note inside the machine .

2. Note Identification:

To identify whether the note is fake or real: We are using the metal strip in the currency note to detect whether it is fake or real. Using UV light metal strip in the note is highlighted. When UV light falls on the metal strip in the note it appears partially green. Image of this part of the note is captured by webcam placed in the system. This image is processed in the MATLAB. MATLAB algorithm will detect whether the note is fake or real.

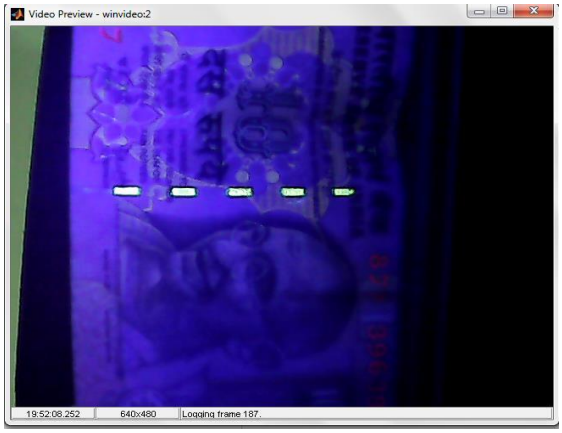


Fig (a). Image of metal strip in UV light taken by webcam.

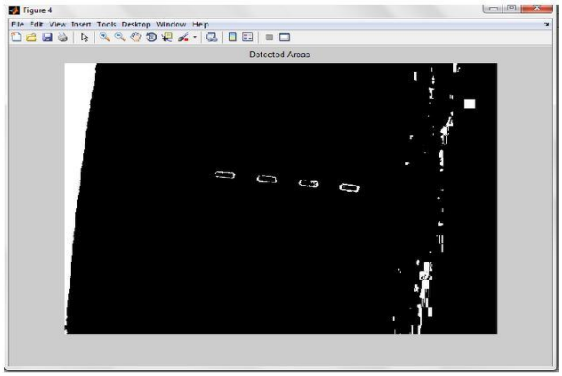


Fig (b).Image after localization.

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3. Currency note Recognition using image processing:

Image processing technique is a vast in this there are lots of technique to detect a note these are texture based, pattern based, checking by the watermarking, checking the micro lettering, color based recognition technique .The most preferable technique along all these is color based recognition

. It is constructed by counting the number of pixels of each color. We use the color model to represent the color information of digital images. Since we need three parameters to represent a color, those color models must be with a three dimensional format

The models use some mathematical functions to represent a point position (in the three dimensional space) that is assigned to a color. Some color models (RGB, CMY, HSI) are summarized as follows.

a. 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 (Fig.1).

The colors on the diagonal line, from the origin to the coordinate (1,1,1) of the cube, means the grey-level values.

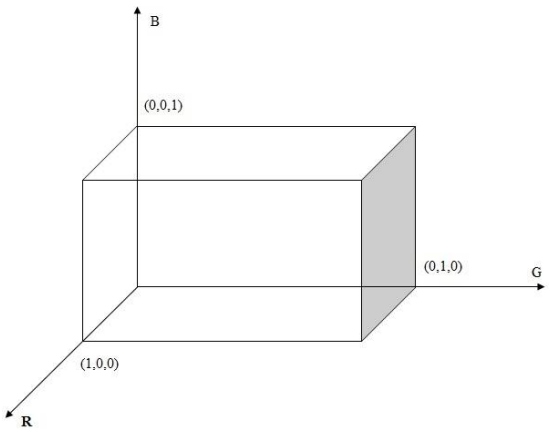

Fig. (1). RGB primary color cube.

b. HSI color model:

The HSI color model is also based on the characteristics of the human's visual system.

I denotes the light intensity, *H* denotes the hue that indicates the measure of the color purity, *S* is the saturation (the degree of a color permeated the white color). If a color is with high saturation value, it means the color is with the low white color. As shown in fig(2) 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”.

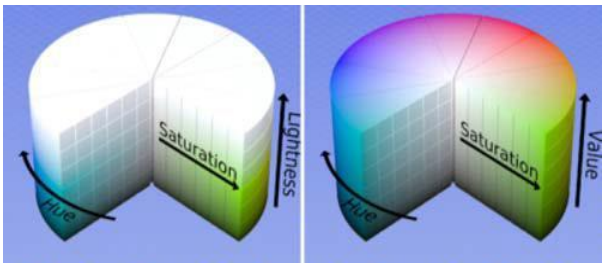

Fig (2).

The relationship between HSI and RGB can be described as

$$I = \frac{1}{3}(R+G+B),$$

$$H = COS^{-1}\{\frac{\frac{1}{2}[(R-G)+(R-B)]}{[(R-G)^2+(R-B)(G-B)]^{\frac{1}{2}}}\}$$

$$S = 1 - \frac{3}{(R+G+B)}[\min(R,G,B)]$$

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.

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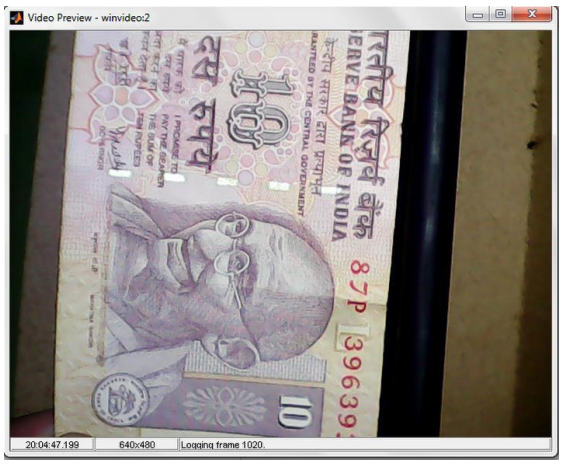
The image is taken by a webcam and this image is stored in a 3D array. The coordinate of the pixel in 2D image is given by the first and second index of the array and the third index stores the RGB (Red-Green-Blue) intensities for each coordinate. Each element of array stores an unsigned 8 bit integer (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.

Steps performed by MATLAB algorithm are as shown below in fig c,d &e :



Fig(c).Image of original note taken by webcam

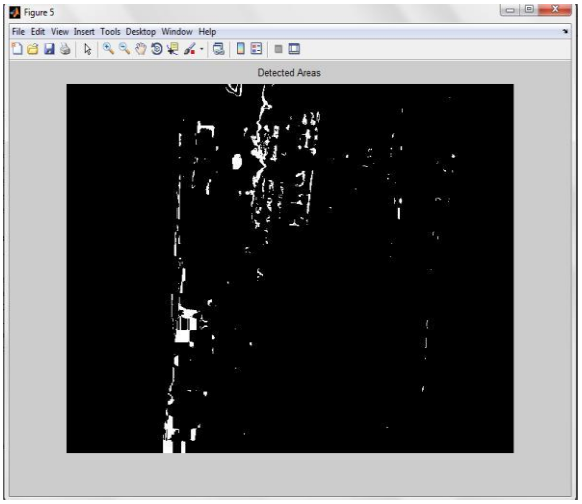


Fig (d).Image of original note after localization

Fig (e).Output window in MATLAB showing note is of Rs. 10

4. Controller PIC-16F877A:

The work of controller is to identify the data sent by the MATLAB in the form of 2's and 1's.

As shown in above result window the controller knows that count = 1 = 10 rupee note. & count = 2 = 20 rupee note.

Then controller will generate coins in the multiple of 5 , 2 or 1 or mix coins as user requirement.

5. Matrix Keypad:

Keypad is the user interface (4x4 matrix). There are 4 keys on keypad:

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

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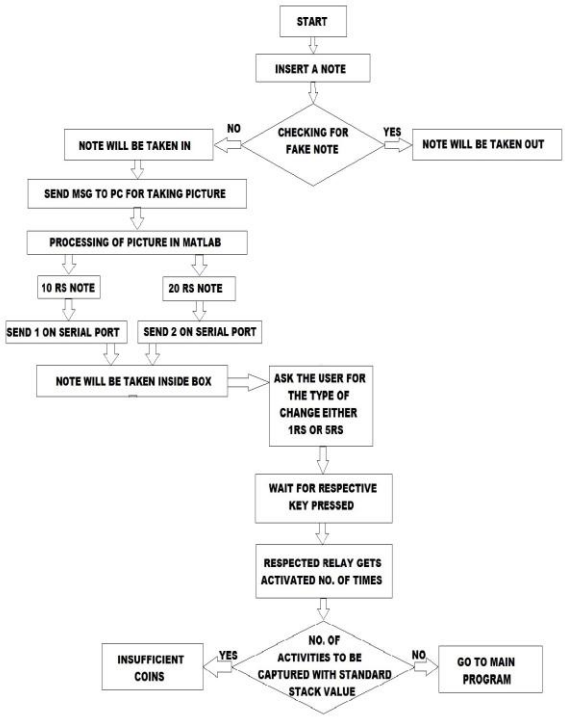
5. Coin Container:

This unit consists of 3 DC motors.

We prefer to use motor driver IC L293d. Motor 2 will let out the 1 rupee coins to the user, Motor 3 will let out the 2 rupee coins to the user and motor 4 will let out the 5 rupee coins to the user. As per the requirement 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".

Flowchart:



Application:

- Railway stations where people need change for ticket.
- To make call from the coin box.
- At the parking site.
- At the bus stand.

Future Development:

In the future we can extend note and coin capacity upto 50 rupee notes and can make provision for the system to sort 10 & 20 rupees notes.

Conclusion:

Our main motive is to present the system which generates currency recognition system using localization and color recognition 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. Not only in banks, such type of appliances could also be used in shops or some other places. It will be quite beneficial for the person to check their banknotes and avoid to being fool.

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