

PLC BASED CHANGE DISPENSING VENDING MACHINE USING IMAGE PROCESSING TECHNIQUE FOR IDENTIFYING AND VERIFYING CURRENCY

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Abstract - Change dispensing vending machines are used to provide change to the user as per the denomination of note given to the machine by the user. Change dispensing vending machine using PLC can be implemented using various devices or techniques such as transistors, transducers, sensors and image processing technique. In this research paper image processing technique is used with PLC for change dispensing machine. Counterfeit currency is the major problem associated with change dispenser machine. To detect the counterfeit note and to identify its denomination image processing technique is used. The output of the image processing is given to the PLC and the operation of PLC is programmed using ladder logic in this paper.

Key Words: Currency, PLC, Sensor, Image processing technique, Change dispensing (vending) machine.

1. INTRODUCTION

A change dispensing vending machine is a machine which is used to dispense change to the user as per the value of the currency inserted in the machine .Once the currency is inserted in the machine image processing technique is used to check its denomination, counterfeit note and sensor is used to check availability of stock however the above process would not be time consuming at all and it also reduces the counterfeiter. The user will get all the details on the screen necessary for the valid transaction. Image processing technique is used for validation and identification of note. Along with it a strain gauge based load sensor can be used for checking the availability of stock in the machine.

2. OBJECTIVE

To design a change dispenser which will accept currency (note) of denomination 10 rupees and 20 rupee and will dispense 5 rupee coin. So, when the user inserts 10 rupee note he/she would get 2Nos 5 of 5 rupee coins and 4Nos of -

5 rupee coins for the 20 rupee note after validation, identification of note and availability of stock.

3. LITERATURE REVIEW

3.1 In 2013 Vipin Kumar Jain and Dr. Ritu Vijay propose method for identifying denomination of currency using image processing technique. First the ROI is extracted than by pattern recognition and Neural Network matching technique is used to match or find the currency.

3.2 In 2014 S.Surya and G.Thilambal propose method to recognize currencies from different countries based on features that is color, texture, size in image processing using filters and Sobel operator.

3.3 In 2014 Binod Prasad Yadav, C.S Patil, R.R Karhe , P.H Patil propose method counterfeit currency detection using MATLAB and feature extraction with HSV color space and other application of image processing technique.

4. FEATURES OF 10 AND 20 RUPEES CURRENCY

Every Indian currency issued by RBI has some special security features.

Some are same for certain currencies while other may vary as shown in table 1.

Table -1: Features of 10 and 20 rupees note



Feature	10 Rupee note	20 Rupee note
Image		
Size	63×137 mm	63×147mm
Seen through register	√	√
Watermark	√	√
Fluorescence	√	√
Security Thread	√	√
Micro lettering	√	√
Year of printing	√	√
Intaglio image	×	√
Latent image	×	√
Identification mark	×	√

TABLE-2: Main demarcation of 10 and 20 rupees note

Feature	10 rupee note	20 rupee note
Size	63×137 mm	63×147 mm
Identification mark	×	√
Intaglio image	×	√

5. HARDWARE REQUIRED

PLC, Camera or Sensor, currency, coin

6. METHODOLOGY

6.1 IMAGE ACQUISITION-

Image acquisition is the first step for identifying denomination and counterfeit currency as image processing technique processes the acquired image. Image can be acquire using scanner or camera. The image captured/ scanned are stored in .jpeg format

6.2 IMAGE PREPROCESSING

The main purpose for preprocessing is to remove noise from the acquired image and to improve its visual appearance. It includes resizing image, removing noise , separating channels, denoising each channels and then restoring channels.

6.3 FEATURE EXTRACTION

It includes the following steps such as-

6.3.1 COLOR FEATURE-

It includes converting rgb to xyz color space and then to luv color space. The image obtained is further processed by separating l,u,v then finding the mean, color variance and color skewness for each channel.

6.3.2 EDGE FEATURE

In edge detecting feature rgb color space is converted into ycbcr color space then y component is extracted, sobel mask is applied and edges are detected.

6.3.3 CONTRAST ENHANCE THE GRAY IMAGE-

After gray scale conversion the image contrast is enhanced to emphasize dark lines in lighter background.

6.4 SEGMENTS

The number of segments obtained depends on currency for real currency there is only one segment while for counterfeit currency there are many segments as shown in figure 1.

7. CHECKING COUNTERFEIT CURRENCY AND DENOMINATION OF CURRENCY

Flowchart for identifying denomination and counterfeit currency is shown in figure 1

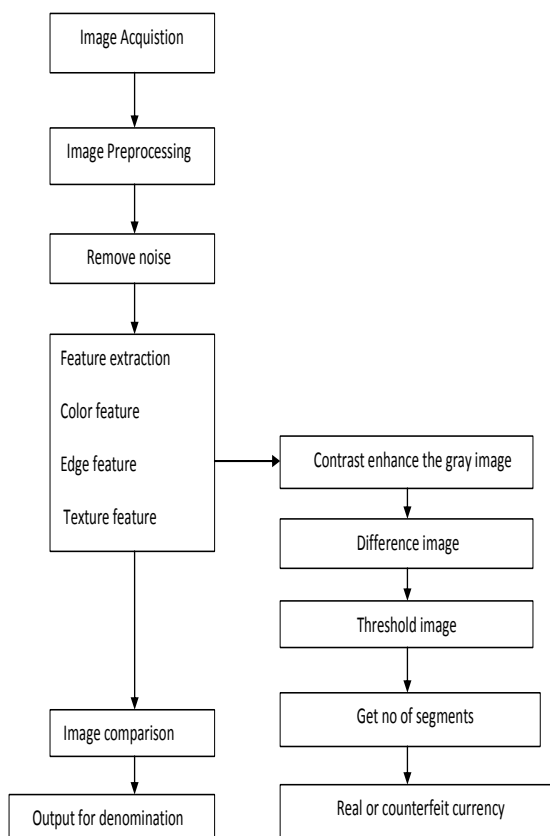


FIGURE 1. Flow chart for identifying and verifying currency using image processing

7.1 OUTPUT FOR DENOMINATION OF CURRENCY

The acquired image is compared with the stored image and accordingly output for denomination is identified if the image matches with the stored image it will shows the denomination otherwise it will show invalid currency.

7.2 OUTPUT FOR REAL OR COUNTERFEIT CURRENCY

The graph obtained for real and counterfeit currency is shown in figure 2.

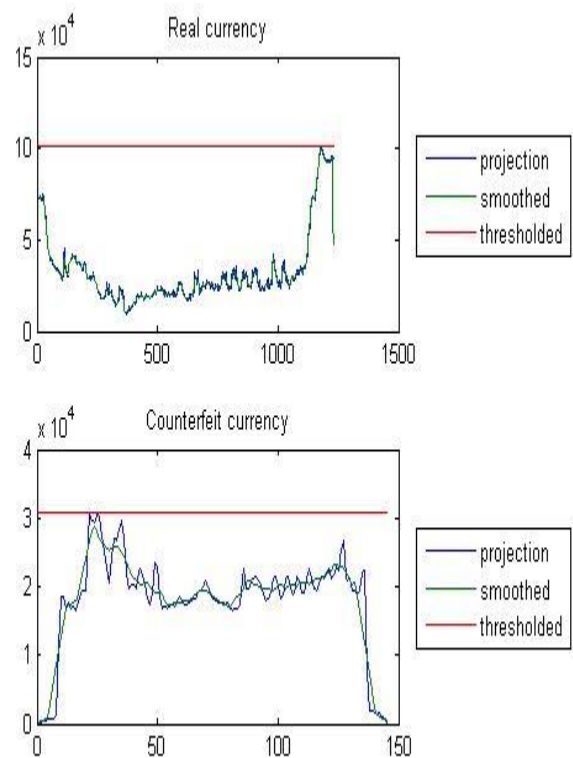


FIGURE 2. Graph for real and counterfeit currency

From the above graph following points are noted they are as follow

TABLE-3: Features of real and counterfeit currency graph

	Real	Counterfeit
Threshold value	10×10^4	3×10^4
projected value at 0	7.5	0
Projected-smoothened	0	.5
Difference between projected value	Very small	Small

8. IMPLEMENTATION

The flowchart of vending machine using PLC is shown in figure 3

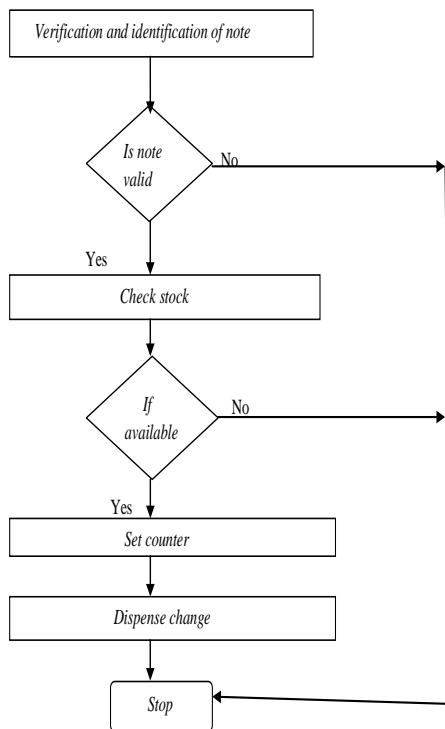


FIGURE 3. Implementation of change dispensing machine using PLC

9. PLC LADDER DIAGRAM

The above flow chart is programmed in PLC as shown in ladder diagram in figure 4

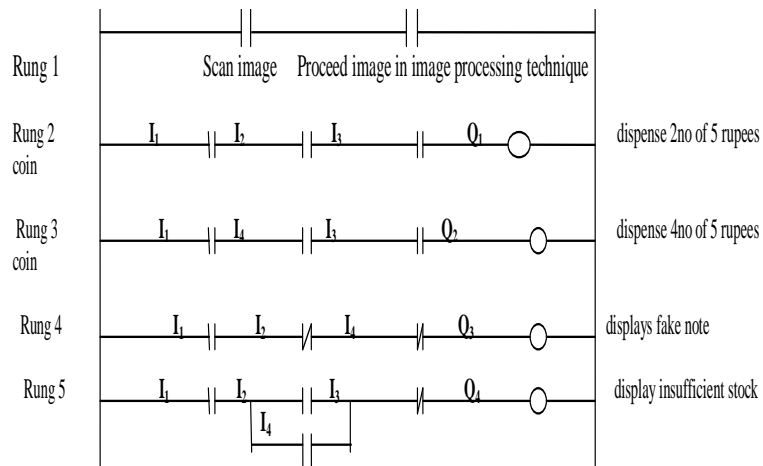


FIGURE4. Ladder diagram of PLC based change dispensing machine

Here,

I₁, I₂, I₃ and I₄ are normally open.

Q₁, Q₂, Q₃ and Q₄ are coils.

I₁- input given to PLC

I₂- 10 rupee note is identified and verified in Image Processing .

I₃ – sufficient stock available.

I₄- 20 rupee note is identified and verified in Image Processing.

Q₁- Dispenses 2 no of 5 rupee coin.

Q₂- Dispenses 4 no of 5 rupee coin.

Q₃- Displays fake note.

Q₄- Displays insufficient stock.

10. WORKING

10.1 RUNG 1- First the image is acquired using scanner or camera and then processed using image processing technique in Matlab.

10.2 RUNG 2- When input is given to machine, Image processing identify and verify 10 rupee note and check for sufficient stock in machine then machine dispenses 2 no of 5 rupees coin.

10.3 RUNG 3- When input is given to machine, Image Processing identify and verify 20 rupee note and sufficient stock is available then machine dispenses 4 no of 5 rupees coin.

10.4 RUNG 4- When input is given to machine and the Image Processing does not identify the inserted note as 10 or 20 rupee note then machine displays fake note.

10.5 RUNG 5- When input is given to machine, Image Processing identify and verify either 10 rupee or 20 rupee note and there is insufficient stock then machine displays insufficient stock.

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11. RESULT

The designed machine successfully give two coins of 5 rupees whenever a currency of Rs 10 is inserted in the machine only after verifying it's correctness and availability of stock in the machine. This machine also gives four 5 rupees coin for Rs 20 as input as explained above.

12. CONCLUSION

It is observed that image processing technique used for identification and verification of currency is faster than sensor in PLC based vending machine.

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