



Short Review Paper

Identification of counterfeit currency in ATM using PLC

Dimple Thakwani* and N. Tripathi

Dept. of Electrical Engg, BIT, Durg, CG, India
dimplethakwani@gmail.com

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Abstract

Automatic teller machine (ATM) is used to provide money to the user as per the amount inserted by the user. ATM using PLC can be implemented using various devices or techniques for identification and verification of currency such as transistors, transducers, sensors and image processing technique. The present ATM's already use PLC for programming but the machines are not capable of identifying counterfeit currency and its denomination hence changes with programming are needed along with some hardwares. In this research paper sensors and image processing technique are compared for identification and verification of currency. Identification of counterfeit currency is the major problem associated with ATM. The outputs of the sensors or image processing technique are given to the PLC and the operation of PLC is programmed to dispense money.

Keywords: Counterfeit currency, ATM, PLC (programmable logic controller), Sensors, Image processing technique.

Introduction

A ATM is a machine which is used to dispense money to the user as per the amount inserted in the machine by the user. Once the amount is inserted in the machine the sensors or image processing technique used in the machine check its denomination, counterfeit note and 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. GMR sensor, proximity detector, optical sensor and miniature transducer are used for validation and identification of note using sensors¹, and image processing technique is used for validation and identification of note in MATLAB. Along with this a strain gauge based load sensor can be used for checking the availability of stock in the machine².

Objective

To identify the features of currency which can be used to check counterfeit currency and denomination of currency also, to identify counterfeit currency and denomination of currency in ATM using sensors and image processing technique. And to compare the above mentioned methods with respect to processing time, accuracy and cost.

Literature review

Vipin Kumar Jain and Dr. Ritu Vijay in 2013 proposed 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 currency³.

S. Surya and G. Thilambal in 2014 propose method to recognize currencies from different countries based on features that is color, texture, size in image processing using filters and Sobel operator⁴.

Binod Prasad Yadav, C.S Patil, R.R Karhe, P.H Pati lin 2014 proposed method of counterfeit currency detection using MATLAB and feature extraction with HSV color space and other application of image processing technique⁵.

P. Pradeepa, T. Sudhalavanya, K. Suganthi, N. Suganthi and M. Menagadevi in 2013 explained the designing of vending machine using Vernilog HDL. Where the designed vending machine is capable of accepting coins of any denomination and the vender selects the product that he wants the machine delivers the product to the vender and return back Change if the inserted amount was greater than the product cost⁶.

Aviral Dua, Chetna Rustagi and Avdesh Bhardawaj in 2014 described a novel approach to design a intelligent vending machine, which covers various factors, including a design of an intelligent vending machine market forecast, key drivers, restraints and geography-focused insights⁷.

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.

Table-1: Specification 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	×	√

Main demarcation of 10 and 20 rupees note.

Table-2: 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	×	√

On the basis of above features identification and verification of inserted currency is done^{8,9}.

Hardware required: The hardware required are PLC, sensors, currency, coin, camera or scanner.

Methods used for checking counterfeit currency and denomination of currency

The method used for checking counterfeit currency and is denomination are by using sensors and Image processing technique.

Using sensors: The functioning of sensors used for identification and validation of currency is described below -

GMR sensor proximity detector-It stands for Giant magneto resistive. GMR structures are ferromagnetic alloys sandwiched around an ultrathin nonmagnetic conducting middle layer. When an external magnetic field (D) is applied it overcomes anti ferromagnetic coupling, which aligns magnetic moments in alloy (B) layers. When the currency passes over a permanent magnetic field array along its direction of travel it gets magnetized. At some distance of several inches a magnetic sensor is placed with its sensitive axis parallel to the direction of travel as the ink particles contain the ferromagnetic property including some elemental iron which is able to detect the remnant field. The Magnetic composition of ink particle of the inserted currency comprises of carbon in nano foam in an amount of from .1 to 45 percent be weight of total composition¹⁰. The GMR sensor without and with external applied magnetic field is shown in Figure-1.

Optical sensor: Optical sensing of inserted currency is done with the help of a small light detector called a photocell or a miniature digital camera is used. Each and every Indian currency note have dots depending upon the denomination of the currency that dots are spaced differently and are of different size. The printing on the currency is done with a fluorescent ink hence when an ultra violet light is shined on currency the currency starts glowing. The sensors used measure the glow to determine the denomination of note.

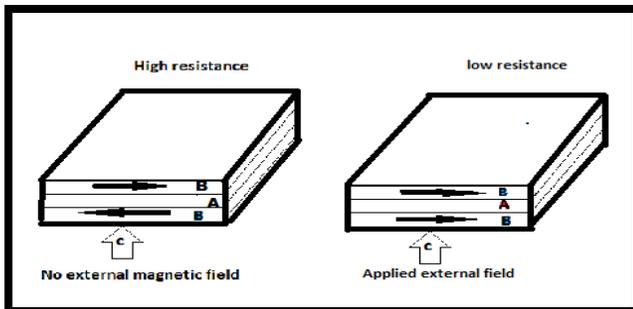


Figure-1: GMR sensor without and with external applied magnetic field.

Miniature transducer: The physical properties of the inserted currency is checked which includes the thickness and dimensions of the currency inserted are tested to ensure they are correct and to identify its denomination since the size of the currency varies with the dimension hence to check this a miniature transducers is used which offers higher currency and linear measurement in a compact space¹¹.

Using Image processing technique: The method used for validation and identification of note using Image processing technique includes the below steps.

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.

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.

Feature extraction: It includes the following steps such as - i. Color feature, ii. Edge Feature, iii. Contrast enhance the gray image.

Segments: The number of segments obtained depends on currency for real currency there is only one segment while for counterfeit currency there are many segments¹² as shown in Figure-2.

Results

The key features of the currencies have been studied and verified through PLC programming physically found correct as per the guidelines of Ministry of Finance a, Government of India and the Reserve Banks of India who are responsible of the circulation of currency in our country.

Conclusion

PLC programming with sensors as well as Image processing technique as basic sensing element can used to detect counterfeit notes.

Most of the ATMs used in our country does not have any inbuilt feature for detection of counterfeit currency.

On comparing two methods Image processing technique gives better result because of digital filters.

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