Scientific Journal of Impact Factor (SJIF): 4.14

e-ISSN (O): 2348-4470
p-ISSN (P): 2348-6406

International Journal of Advance Engineering and Research Development

Volume 3, Issue 10, October -2016

PLC based change dispensing machines capable of identifying counterfeit currency using sensors.

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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 sensors are 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 various sensors are used as detector. The outputs of the sensors are given to the PLC and the operation of PLC is programmed using ladder logic in this paper.*

Keywords- *Counterfeit currency, PLC, Sensors, Image processing technique, Change dispensing (vending) machine*.

I. 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 the sensors 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. Along with sensors a strain gauge based load sensor can be used for checking the availability of stock in the machine.

II. 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.

III. LITERATURE REVIEW

In 2013 P.Pradeepa, T.Sudhalavanya, K.Suganthi, N.Suganthi and M. Menagadevi explained the designing of vending machine using Vernilog HDL. Where the vending machine accepts coins as inputs in any sequence and delivers products when required amount is deposited and gives back the change if entered amount is greater than the price of product.

In 2014 Aviral Dua, Chetna Rustagi and Avdesh Bhardawaj describes 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 insights.

IV. 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.

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 1. Specification of 10 and 20 rupees note

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	×	√

Table 2. Demarcation of 10 and 20 rupees note

V. HARDWARE REQUIRED

The hardware required are PLC , sensors, currency ,coin.

VI. *METHOD USED FOR CHECKING COUNTERFEIT CURRENCY AND DENOMINATION OF CURRENCY*

The method used for checking counterfeit currency and is denomination is by using sensors.

6.1 GMR sensor proximity detector-It stands for Giant magneto resistance.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 notes pass over a permanent magnet array they get magnetized along their direction of travel . A magnetic sensor is placed several inches away with its sensitive axis parallel to the direction of travel can detect the remnant field or the ink particles which have ferromagnetic property including some elemental iron .The Magnetic composition comprises carbon nano foam in an amount of from .1 to 45 percent be weight of total composition. The GMR sensor without and with external applied magnetic field is shown in figure 1.

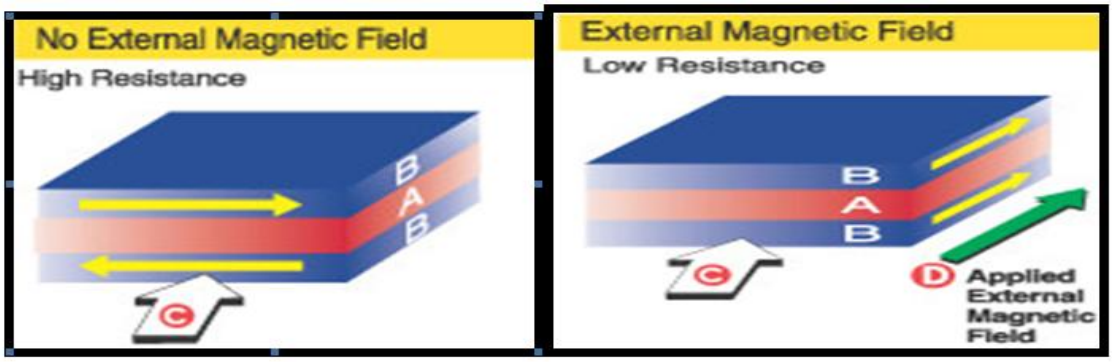

Fig 1. GMR sensor without and with external applied magnetic field (Courtesy GMR Sensors)

6.2 Optical sensor- Optical sensing with a small light detector called a photocell or a miniature digital camera is used. Notes have dots that are spaced differently and have different sizes, depending on note. Notes are fluorescent hence glows when ultraviolet light is shined on it. The sensors used measure the glow to determine the denomination of note.

6.3 Miniature transducer- The thickness and dimensions of a banknote are tested to ensure they are correct and to identify its denomination .Miniature transducers approximately 3/8" diameter offer high accuracy linear measurement in a compact space.

6.4 Load cell sensor-A strain gauge based load cell sensor is used to measure the weight of the available stock which is used to detect the availability of stock whose output is given to the plc. The output of plc is given to the counter and as per the set value of counter change is dispensed accordingly

VII. Implementation

The flowchart of vending machine using PLC is shown in figure 2.

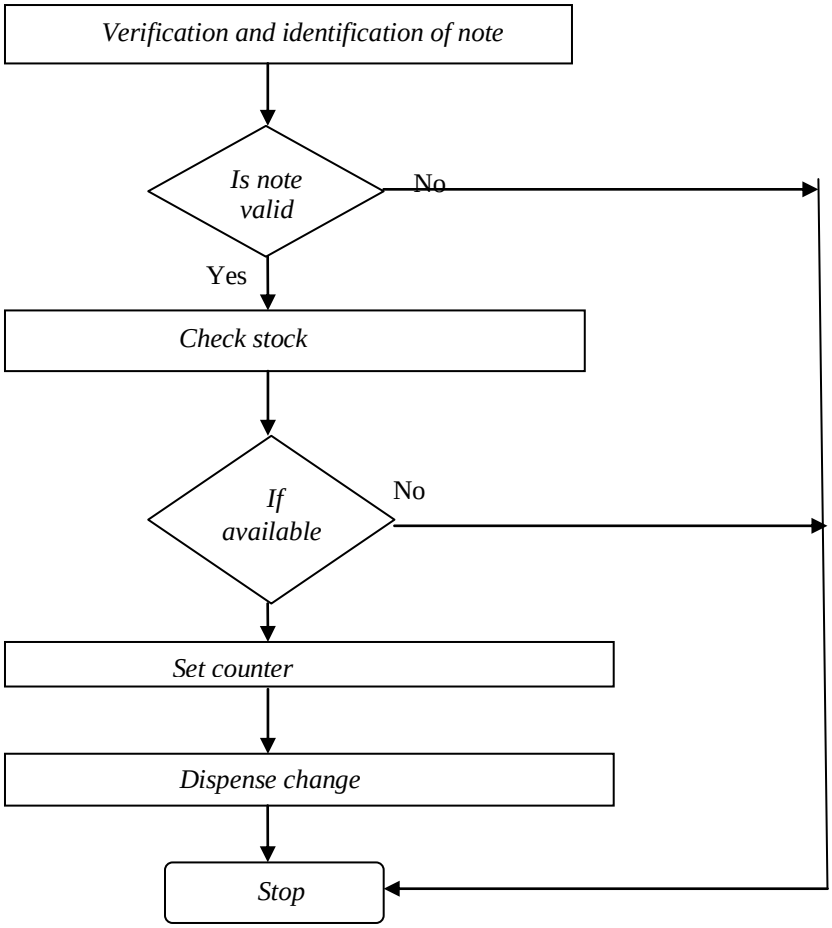

Figure 2. Implementation of change dispensing machine using PLC

VIII. PLC Ladder Diagram

The above flow chart is programmed in PLC as shown in ladder diagram in figure 3.

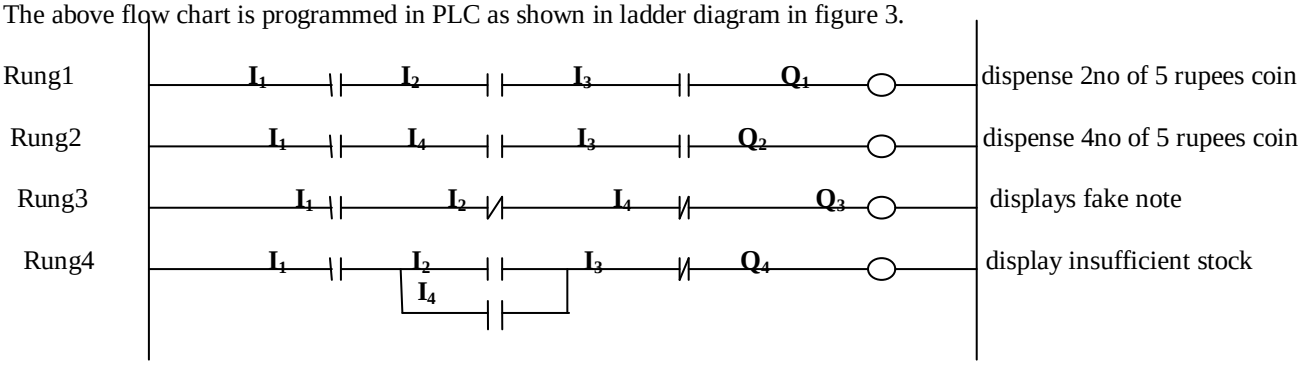

Fig3. Ladder diagram of PLC based change dispensing machine

Here,
I1,I2,I3 and I4 are normally open.
Q1,Q2,Q3 and Q4 are coils.
I1- input given to machine
I2- 10 rupee note is identified and verified by sensors.
I3 – sufficient stock available.
I4- 20 rupee note is identified and verified by sensors.
Q1- Dispenses 2 no of 5 rupee coin.
Q2- Dispenses 4 no of 5 rupee coin.
Q3- Displays fake note.
Q4- Displays insufficient stock.

IX. Working

1. Rung 1- When input is given to machine, sensors identify and verify 10 rupee note and check for sufficient stock in machine then machine dispenses 2 no of 5 rupees coin.
2. Rung 2- When input is given to machine, sensors identify and verify 20 rupee note and sufficient stock is available then machine dispenses 4 no of 5 rupees coin.
3. Rung 3- When input is given to machine and the sensors doesn't identify the inserted note as 10 or 20 rupee note then machine displays fake note.
4. Rung 4- When input is given to machine, sensors identify and verify either 10 rupee or 20 rupee note and there is insufficient stock then machine displays insufficient stock.
5.

X. 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 availabity of stock in the machine. This machine also gives four 5 rupees coin for Rs 20 as input as explained above.

Reference

1. Biplab Roy, and Biswarup Mukherjee , "design of a coffee vending machine using single electron devices" in 2010 International Symposium on Electronic System Design pp-38-43.

2. *Caruso, Michael J.; C.H. Smith; T. Bratland; R. Schneider.* "A New Perspective on Magnetic Field Sensing" *(PDF). Plymouth, MN and Eden Prairie, MN: Honeywell SSEC and Nonvolatile Electronics: 14–15.*

3. NAME (YEAR) A Novel Approach to Designing Intelligent Vending Machines, International Journal in IT and Engineering ,Vol.2 /Issue-12,/(December 2014)

4. Shatrughan Modi, Dr. Seema Bawa, "Automated Coin Recognition System using ANN" in 2011 International Journal of Computer Applications (0975 – 8887), Volume 26– No.4, pp13-17.

5. Suganthi et al.(2013), DESIGN AND IMPLEMENTATION OF VENDING MACHINE USING VERILOG HDL ,International Journal of Advanced Engineering Technology , Vol. IV/ Issue I/, pp /51-53

6. User manual / guidelines from NVE corporation (1998-2008), How gmr works,gmr operation and GMR sensor catalog.pp (79-82)

7. User manual / guidelines from RBI (2005), Counterfeit money detection, 10 Indian rupees note.

8. User manual / guidelines from RBI (2005), Counterfeit money detection, 20 Indian rupees note

9. *Xerox Corporation (2006).* "Magnetic ink composition, magnetic ink character recognition process, and magnetically readable structures" *(EUROPEAN PATENT SPECIFICATION). EP 2 390 292 B1. European Patent Office.*

