

## Note to Coin Exchanger Using PLC

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**Abstract**— Now days, coins are required at lot of places and we have to suffer a lot for the change in various public places in daily life. 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 such applications 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, 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. Color sensor is used which senses the RGB (Red, Green, Blue) colors and 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 or five rupee or mixed and hence in the output we get coins as user requirement.

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### 1. INTRODUCTION OF SYSTEM

At present note to coin converter is being used in various countries including India, but in India such systems are scarce and very few people know about it and also their availability is limited to few banks, but not at public places where the need is more. The systems which are available are also huge and bulky and also with no security other than the banks own security. So our idea is to implement such system at public places which is smaller, lighter and does not require supervision. The basic need of the project arises due to requirement of change at various places. The note to coin converter machine helps to get the change required. The main process of the project is to identify which note is placed in the machine. For detecting which kind of note, the software algorithm runs and the result is given to the controller which will manipulate the coin container through motors, the user can simply press the keypad for which type of change he wants whether one rupee coins or five rupee or mixed and hence in the output we get coins as user requirement.

### 2. IMPLEMENTATION OF NOTE TO COIN CONVERTER

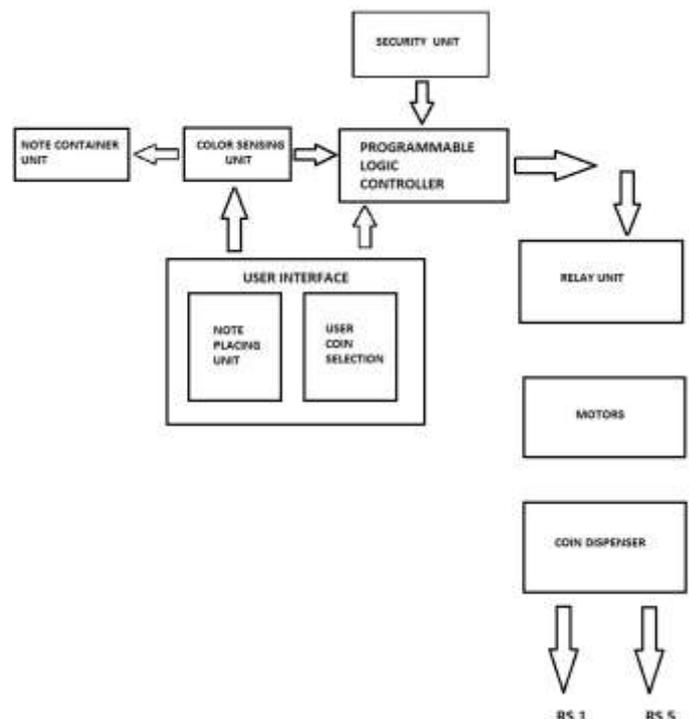
#### A. Note Placing Unit

As the name suggests this unit is meant to take the note from user for further process. It consists of a mechanical note tray to take the respective note from the user. It uses 12v DC motor running at 10RPM. The note should be placed in proper position and should not be folded.

#### B. User Coin Selection (Keypad)

This unit have 4 pushbuttons. These push buttons are used to select operations such as

- Start-To start the operation of the machine.
- Reset -To reset the machine in case of any operation failure.
- Option 1- All Rs 1 Coin.
- Option 2- All Rs 2 Coin.



#### C. Color Sensing Unit

To identify the value of note (Rs 10, Rs 20) is the purpose of this unit. We have used a SUNROM Technologies' color sensor (Model#1185). Any color can be separated or combined into three primary colors Red, Green and Blue using the RGB values. This color sensor identifies color and gives serial output of RGB value. The detected color is identified as amount of three primary color values namely Red, Green & Blue with 8 bit accuracy for each primary color. If this unit fails to identify the color, the note is reverting back to the user via note placing unit.

#### D. Note Container Unit

This unit contains the note after it has been gone through the color sensing unit. The purpose of this unit is to hold

down the note once it has been assigned a value. It has been achieved using a 12v DC motor at 10 RPM.

**E. PLC**

This unit is the soul of the whole machine. It receives input from the color sensing unit and coin selection unit and triggers the relay according to the downloaded ladder program.

**F. Relay Unit**

This Unit consists of total 2 relays. These relays are used to give input to PLC from color sensor. As the output card of PLC is having relay in-built, no relay is used for the operations of motor.

**G. Motors**

These are two 12 V DC motors running at 30 RPM. These two motors are dedicatedly assigned to the dispensing unit which helps to dispense the coin.

**H. Coin Dispensing Unit**

This unit consists of two stacks of coins. One stack of Rs1 Coin and another of Rs5 coin. These coins are dispensed with the help of motor unit.

**I. Security Unit**

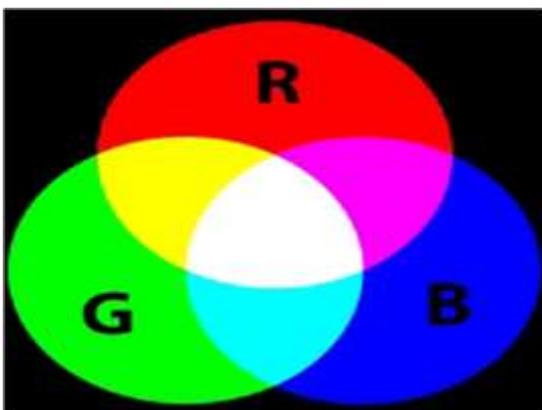
This unit consists of a limit switch and a buzzer which provides the antitheft security. If the machine is disturbed from its position the limit switch below the machine triggers the buzzer giving indication danger.

**3. PROCESS THAT SYSTEM FOLLOWS**

**A. Color Sensing Process**

As there are lots of techniques to detect the Indian currency note, these techniques include texture based, pattern based, checking by the watermarking, checking the micro lettering, color based recognition. The most preferable technique along all these is color based recognition. The principle of color sensing is as follows.

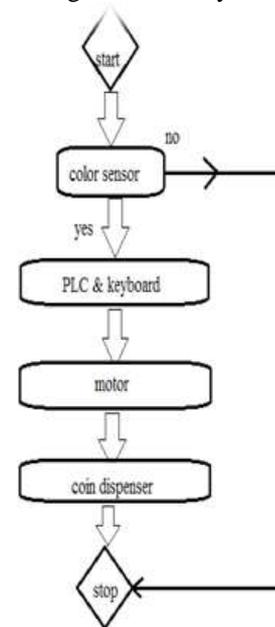
The sensor switches each primary color RGB, one by one and checks what intensity of color is reflected by the surface of detection. This reflected intensity is converted to 8 bit value. For example a RED surface will strongly reflect RED. While a Yellow surface will reflect RED and GREEN both. According to the induction principle of the three primary colors which create various other colors in nature, once the value of three primary colors is confirmed, the color of the tested object is known. Knowing the value of RGB helps people gain the color of the light which is projected onto the sensor since each color correspond to only one value of RGB.



Parameter	Value	Unit
Operating voltage	5VDC	V
Current	20	mA
Color measuring range	350-750	Nm
Luminance range	100	Lux
Response time	500	ms
Output Data baud	9600	Bps
Color Detecting Capacity	16.7 Millions	RGB

**B. Algorithm**

Following is the algorithm that system follows



If the color sensing unit fails to identify the color of the note. The process stops there and the note is returned to the user via note placing unit.

If the color sensor identifies the note color. It sends signal to PLC to collect the note in the note container and according to the denomination choices of the user, the coins are dispensed.

To achieve this we have used a PLC with eight outputs and 6 inputs. The sequence of operations is performed using ladder logic program. The PLC used is DELTA (DVP-14SS211R).

*Specifications*

Parameters	Range
<b>Power</b>	20.4 to 28.8 VDC
<b>Digital Inputs</b>	8 inputs, 24 VDC sink or source <sup>1</sup>
<b>Digital Outputs</b>	6 relay outputs
<b>Output Rating</b>	1.5A each output
<b>Communication Port</b>	RS-232 and RS-485, Modbus ASCII/RTU

	master or slave
<b>Program Capacity</b>	8 k steps
<b>IO Points</b>	Up to 238 via expansion modules
<b>Software Up/Down Counters</b>	Any input, up to 10 kHz on a single input
<b>Software Quadrature Inputs</b>	2 - X4/X5 (5 kHz) and X6/X7 (5 kHz)
<b>Hardware Up/Down Counters</b>	2 - X0 and X2, both 20 kHz
<b>Hardware Quadrature Inputs</b>	2 - X0/X1 and X2/X3, both 10 kHz
<b>Hardware Pulse/PWM Outputs</b>	None

Choosing PLC as a controller in this process because

- PLC has much reliability, Redundancy, Multi-Equipment control and fast communication can be easily achieved.
- PLCs are good at turning outputs on or off based on the state of inputs. (control)
- PLCs are good at bringing together and concentrating a lot of data and status that is uploaded into a computer in a compact form.
- PLCs are more rugged than computers and typically last five, seven, ten years without needing replacement.
- Comparatively very powerful and Easy to use.
- Advanced cure control.
- Multi access using more than one programming or maintenance tools plus visualization stations.
- Cost advantage for simple applications, minimal downtime and large base of maintenance personnel familiar with ladder programming.

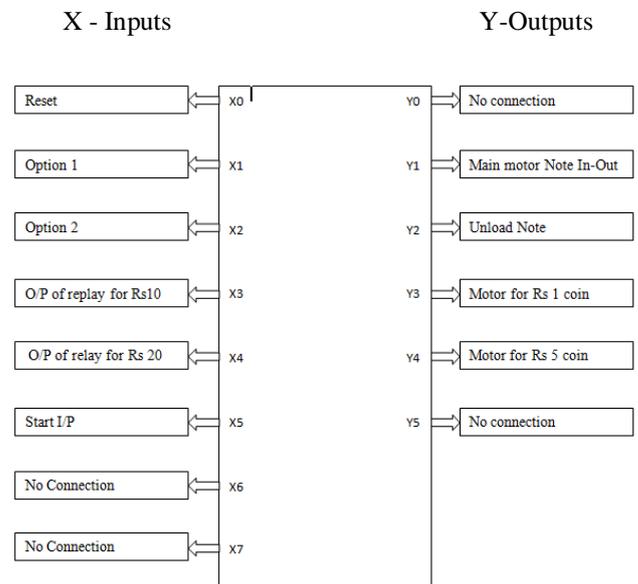
### C. Ladder Logic

To configure ladder for this process we have used DELTA Electronics Inc's WPLsoft. The connections of PLC are as follows. No separate relays were used to fire output as the PLC is having inbuilt relay card for outputs.

#### Sequence of Events

- User has to press start key in order to get started for the process. Pressing start key will push the note placing unit outside.
- Note placing unit (tray) will wait to get a note from user for some time (4 seconds) and it will automatically comes inside.
- Color sensor will process the color of the note and will identify its value. As soon as PLC gets the output from color sensor, note falls in note container.
- Now user has to enter his coin requirement in terms of numbers on keypad. Option 1 will provide all Rs1 denominations; option 2 will provide all Rs5 denominations. If user does not select any option, system will provide all mixed coins by default.

- On the basis of information provided by color sensor and the option selection. PLC will process this data and will generate the output.
- This PLC output is given to 2 motors which dispenses coins by stroking the coins are arranged in a stack in coin dispensing unit.



- Railway Stations where people need change for the tickets.
- Bus stations.
- Malls and parks.
- To make a call from coin box.
- In banks.
- On bill payment stations.

### 5. FUTURE DEVELOPMENTS

In the future we can extend note and coin capacity up to 100 rupee notes and can make provision for the system to recognize the difference between 1 and 2 rupee coin. This will make the system equipped with 2 rupee coin.

### 6. ADVANTAGES

- User friendly.
- Reliable.
- Low maintenance.
- Less time consuming.

### 7. IDEA OF NOTE TO COINVERTER IN SHORT IDENTIFICATION OF COLOUR ON NOTE AND ITS CONVERSION.

Notes

Coins



#### 8. CONCLUSION

This proposed system can be used to replace existing system of exchanging currency. The proposed system will be useful in day to day life of every common man where people have to suffer for change at many public places. As mentioned in the applications this project is an real time application for all real time places.

The system is simple to understand and implement. As it is PLC base we can reduce the manpower as much as possible. We hope that this system can be researched on further to create a better design that can be applied to a larger scale. Besides achieving of the main objective, by using this system it can help to reduce any occurrence of failure. It is very useful and nowadays being applied in many cities of India and also it will prove major benefits.