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Intelligent Note to Coin Exchanger with Fake Note Detection

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Abstract
Nowadays, people are doing transaction digitally, but still in some rural areas people are using hard cash for transaction .Use of coins has been increased more instead of note in various places like bus station, railway station, shopping malls, temples, coin based water system etc. It is very difficult for common people in getting coins. To provide the solution for above mentioned problem, a system is designed. One mechanical machine that is intelligent note to coin exchanger with fake note detection. In proposed system, where when user enters the note, first it will check whether entered note is real or fake using UV rays, if note is real then it will take inside for further process and camera will take its picture, by calculating number of pixels using image processing; it will calculate the value of note, then according to the value equivalent numbers of coins will be dispensed. In this way, this system will help common people to have easy day to day life.

***Keywords*:** *Image processing, infrared sensor (IR), microcontroller, UV rays.*

INTRODUCTION

In day to day life, we are facing the problem of not getting change at various places like bus station, railway stations, malls, etc., even in rural area where they are still using coin based telephone system [1]. The aim of this project is to provide coins equivalent of the note and to check whether the note is fake or real [2]. The system uses microcontroller to control all the operation and also communicate MATLAB running program. Here, the machine accepts note and checks whether a note is fake or real. If note is fake, the note will be given outside and if a note is real, it will be taken inside then camera will take picture of note and with help of computer having MATLAB program, it will check which note it is (Rs 10 or Rs 20). Once the note is recognized, coins will be dispensed by coin dispensing unit [3].

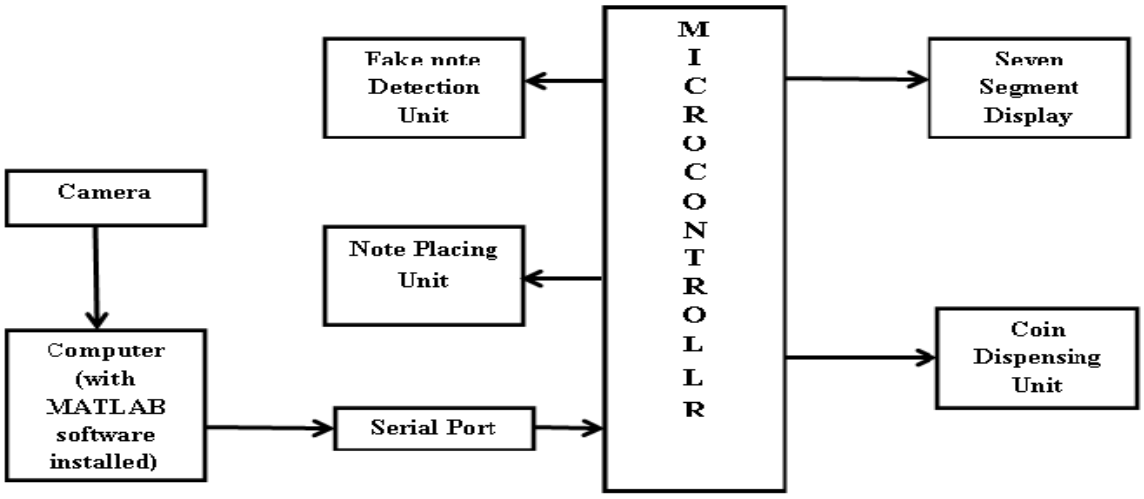


***Figure 1:** Block diagram.*

Note Placing Unit

This is a mechanical structure where user can enter his note [4-6]. After inserting a note, note will be take inside and send for further processing that is nothing but to check whether entered note is fake or real [7-9].

Fake Note Detection Unit

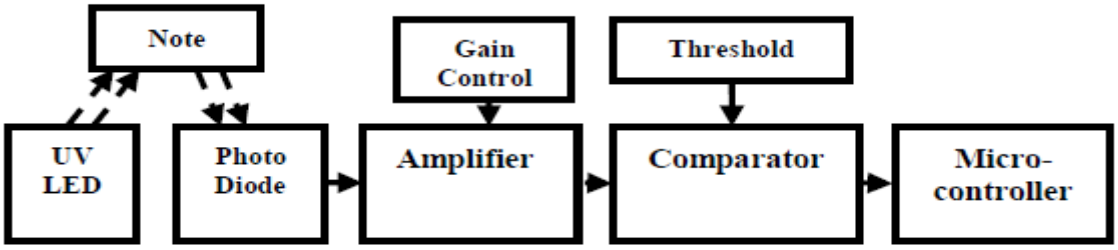


Figure 2: *Fake note detection unit.*

The specialty of Indian currency note is that it absorbs the UV light and a fake note reflects the UV light. Fake note detection unit consist of UV LED, photodiode, amplifier and comparator. The UV LED source transmits the UV rays, if the note is real, it will absorb some amount of UV rays and if the note is fake then all rays will be reflected back towards the photodiode. This output of the UV photodiode is given to amplifier. This output is amplified and then given to comparator. Threshold voltage is applied to comparator. According to threshold voltage, output of the comparator is then given to the microcontroller for further processing [10].

Image Processing Unit

In this unit, it will calculate the value of entered real note by using Edge detection technique in image processing.

Edge detection is an image processing technique for finding the boundaries of objects within images [11]. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision.

Types of Edge detection

- Sobel Operator
- Prewitt Operator
- Robert Operator

Sobel Operator

The Sobel operator is a classic first order edge detection operator computing an approximation of the gradient of the image intensity function [11]. At each point in the image, the result of the Sobel operator is the corresponding norm of this gradient vector. The Sobel operator only considers the two orientations which are 0°and 90° convolution kernels as shown.

-1	0	1
-2	0	2
-1	0	1
G_x		

-1	-2	1
0	0	0
1	2	1
G_y		

Figure 3: *Convolution Kernels in X and Y direction.*

These kernels can then be combined together to find the absolute magnitude of the gradient at each point.
The gradient magnitude is given by:

$$|G| = \sqrt{G_x^2 + G_y^2}$$

Typically an approximate magnitude is computed using:

$$|G| = |G_x| + |G_y|$$

This is much faster to compute.
The Sobel operator has the advantage of simplicity in calculation. But the accuracy is relatively low because it only used two convolution kernels to detect the edge of image.

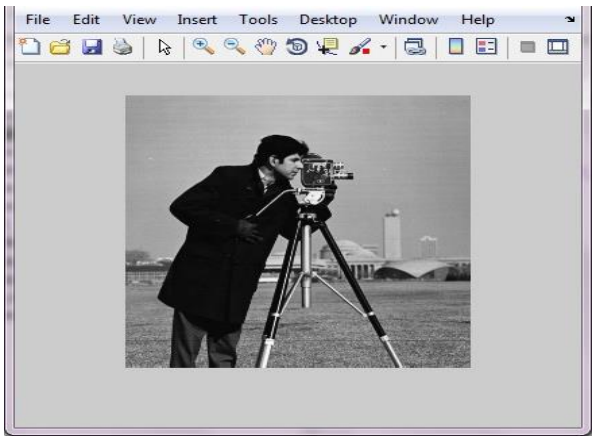


Figure 4: *Original image.*

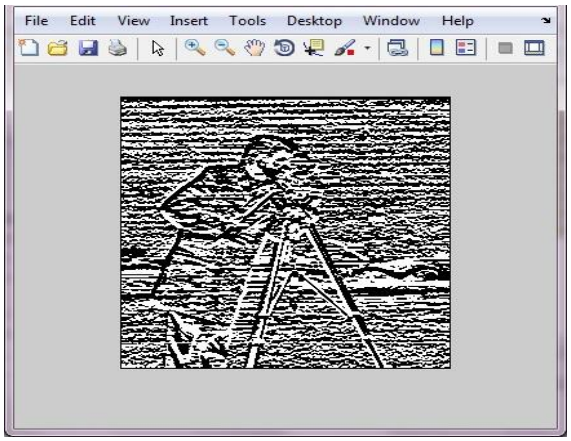


Figure 5: *Gradient in X direction.*

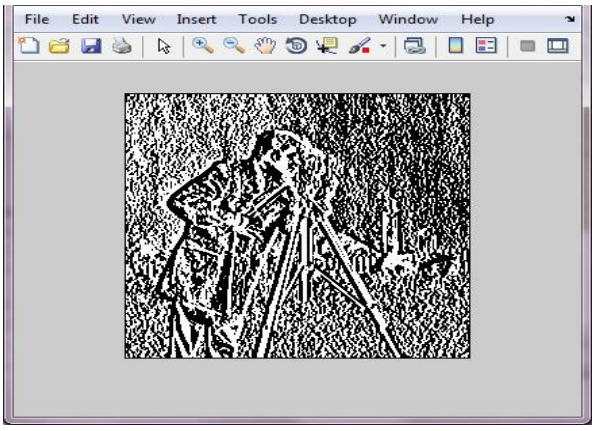


Figure 6: *Gradient in Y direction.*

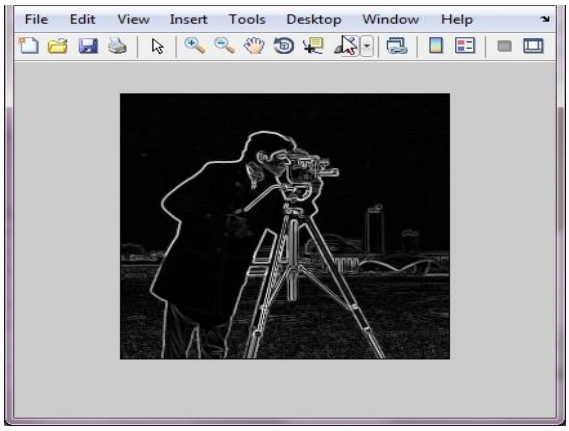


Figure 7: *Segmentated Image.*

In the algorithm, threshold values are accurately and automatically determined for every region [11]. Depending on the image, the width of the region can be set. Above Fig. shows the original histogram and the smoothened histogram to identify the different threshold values for the different regions present in the image. The threshold values are dynamically assigned from the histogram. This also enables the algorithm to segment image with any number of distinct regions. This makes the entire process of segmentation totally automatic.

Coin Dispensing Unit

In this unit after taking the calculated value from MATLAB controller, it will provide the instruction to motor, then motor will start to rotate. In this unit, we are using IR sensor to sense the coins. As the coins are dispensed, the counter will decrement and when counter reached to zero then motor will stop automatically.

FLOWCHART

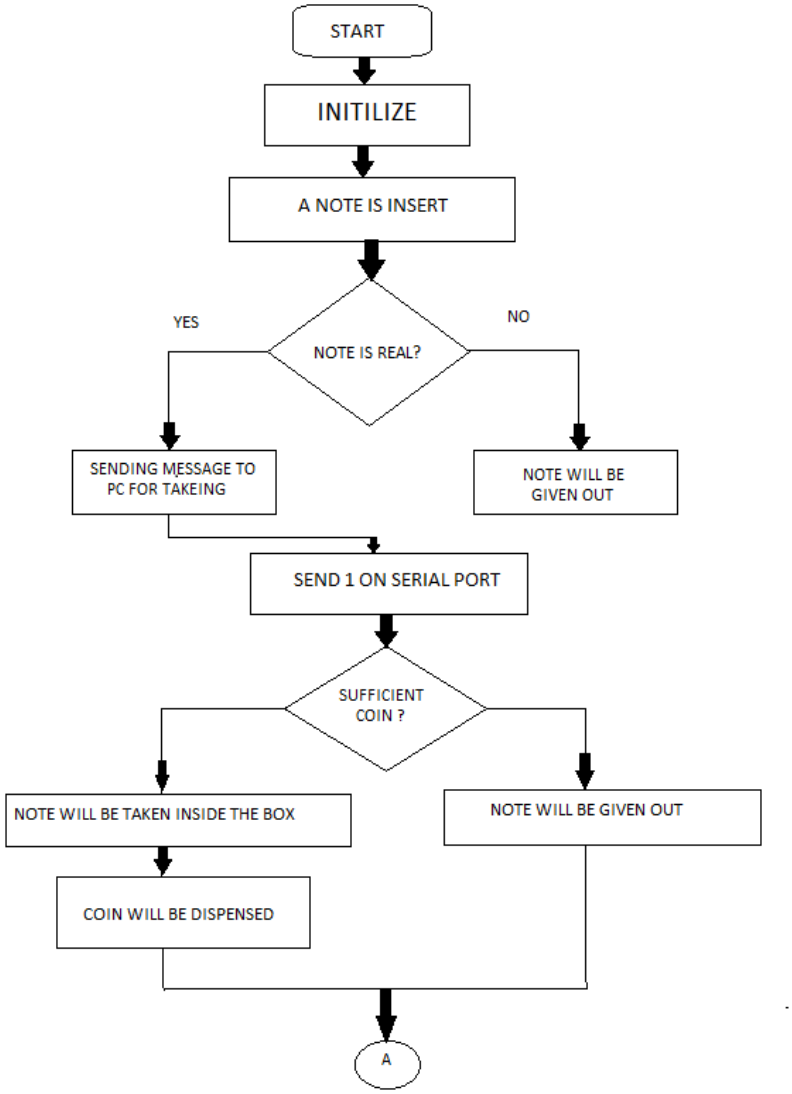


Figure 8: *Flowchart.*

SPECIFICATION

IR Sensor

Principle

An infrared sensor is an electronic instrument which is used to sense certain characteristics of its surroundings by either emitting and/or detecting infrared radiation.

Specifications

Output power: +4 dB mtyp

Single power supply: 1.8 V to 3.6 V

89c51 Microcontroller:

Specifications

Operating Frequency -11.059 MHz
It is 8-bit microcontroller.

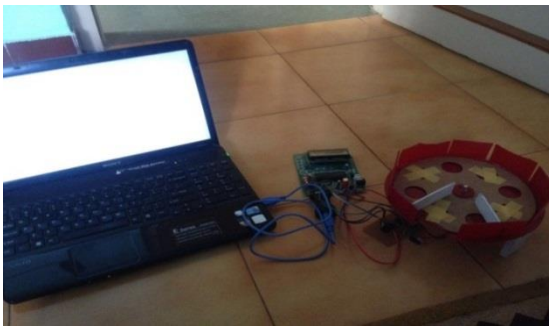
It is having 4Kbytes of program memory (ROM) and 128 Bytes of data memory (RAM)

Table 1: *Comparative study of existing and proposed system.*

Sr. No	Existing Model	Proposed Model
1	Detection of note is not done.	Detection of note is done automatically.
2	Coins are provided by human.	Coins are provided by machine.
3	Takes more time because of manual interference.	Takes less time and no manual interference.

CONCLUSION

This project is a real time application which is much lighter, low power and faster. In the future, this system can also be applied in the buses itself. This will be a relief for the conductors and passengers.



FUTURE SCOPE

- Note coin capacity can be increased.
- GSM security.
- Touch screen based system.

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