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Note to Coin converter using Digital Image Processing

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Abstract - *Requirement of coins in a day to day transaction has increased; we have to suffer a lot for the change in various public places like bus station, railway station, malls, parks, even in rural areas. 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, we are using fake note detection and digital image processing. A user will place the note and then with the help of image processing the Indian currency note will be identified. We are using MATLAB algorithm for detection of the value of note and we have implemented a fake note detection unit using UV LED and photodiode.*

Key Words: **DIP, Arduino UNO, Fake note, Indian currency**

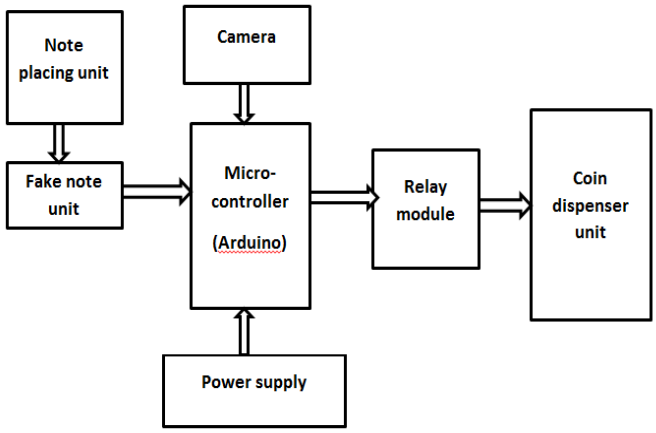
1. INTRODUCTION

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. So our idea is to implement such system at public places which is smaller, lighter and does not require supervision.
The main process of the project is to identify which note is placed in the machine with the help of image processing to identify and detect if the note is real or fake. If note is real camera takes picture of it and find's out its value using image processing technique and then according to the value it gives equivalent number of coins.
For detecting the note the MATLAB algorithm runs 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, two rupee coins or five rupee or mixed and hence in the output we get coins as user requirement.

2. SYSTEM ARCHITECTURE

2.1 Note placing unit:

The note is placed in exact position in the unit and the web camera takes the picture of the currency note placed and then it is sent to the image processing unit for fake note detection. The note should not be folded and nothing should be written on the note.



2.2 Image processing unit:

In image processing various operators are used that are Robert, Sobel, Prewitt, Canny operators, these are edge detection methods. Currently Canny edge detector is known as one of the best edge detectors. Canny edge detector is an edge detection operator that uses multi stage algorithm to detect a wide range of edges in images and it requires less RAM to run on the memory.

2.3 Segmentation Algorithm:

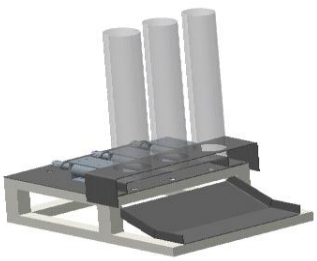
Image segmentation is the process of partitioning a digital image into set of pixels. Image segmentation is typically used to locate objects and boundaries in images. If the object has sufficient contrast from the background it can be easily detected in an image.
The object to be segmented differs in contrast from the background image. Any changes in the contrast will be detected by operators that are used to calculate the gradient of image. The gradient image can be calculated and a threshold can be applied to create a binary mask containing the segmented cell.
The threshold method is based on clip level which turns a grey scale image into binary.
The threshold value only allows 200 to 255 pixel values to pass behind a black background so that the 0 pixel value which is black is not passed and all the other white pixels are passed.

2.3 Viola-Jones Algorithm:

This object detection framework is the first object detection framework to provide as good as object detection rates in real-time proposed in 2001 by Paul Viola and Michael Jones. Despite it can be trained to detect a discrepancy of object classes, it was provoke primarily by the problem of face detection.
The problem to be solved is detection of faces in an image. A human can do this easily, but a computer needs precise instructions and constraints. To make the task more manageable, Viola–Jones requires full view frontal upright faces. Thus in order to be detected, the entire face must point towards the camera and should not be tilted to either side. While it seems these constraints could diminish the algorithm's utility somewhat, because the detection step is most often followed by a recognition step, in practice these limits on pose are quite acceptable.
The characteristics of Viola–Jones algorithm which make it a good detection algorithm are:
Robust – very high detection rate (true-positive rate) & very low false-positive rate always.
Real time – For practical applications at least 2 frames per second must be processed.
Face detection only (not recognition) - The goal is to distinguish faces from non-faces (detection is the first step in the recognition process).

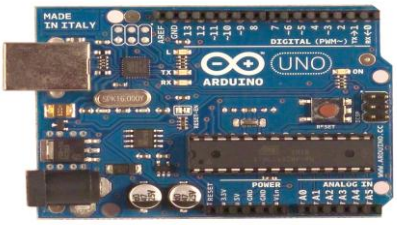
2.4 Coin Dispatching

MATLAB identifies the currency note and assigns a variable the value of the note. The user enters the number of coins he wants using keypad. The total amount of change is compared with the available value and if its accurate the signal is sent to the microcontroller through the serial port. For each set of coins one motor is used. According to user the selected number of coins with the respective motor rotates for a fixed duration to consign a single coin. Therefore N number of coins the motor is rotated for N times for a specific duration.



3. Hardware Description

3.1 Arduino Uno



The Arduino Uno is a microcontroller based on the ATmega328. Which having 14 digital input/output pins out of which 6 can be used as PWM outputs,6 analog inputs and a 16 MHz crystal oscillator, a
USB connection, a power jack, a ICSP header, and a reset button. It contains everything which is needed to support the microcontroller. The Arduino Uno differs from all preceding boards in that it does not use the FTDI.

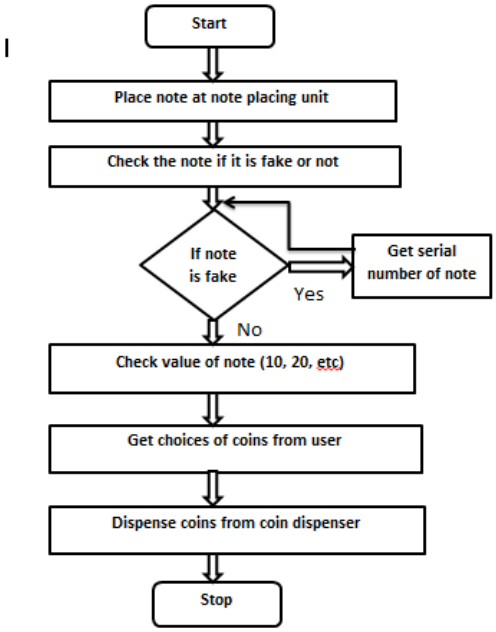
3.2 Relay Module

Relay module is an electrically operated switch that allows to turn on or off a circuit using voltage and/or current which is much higher than a microcontroller could handle. There is no connection established between the low voltage circuit operated by the microcontroller and also high power circuit. In this module each channel has three connections named NC (normally closed), NO (normally open) and COM (common).
When relay contact is NO, there is an open contact when the relay is not energized.
When relay contact is NC, there is an closed contact when the relay is not energized.

3.3 DC Motor

A DC motor is a rotatory electrical machine that converts DC electrical energy to mechanical energy. All type of DC motors have some internal mechanism which is electro-mechanical or electronic, to periodically change the direction of current flow in parts of motor.
The speed of the motor can be controlled over a wide range by using either a variable supply voltage or by changing strength of current in its field windings.

3.4 Flow Chart



4. CONCLUSION

We are develop an interactive system that generates currency recognition system using image processing with the help of MATLAB. In day to day life we are suffering for change of currency at many public places, so this system which is real time application for all real time places i.e. in the buses, railway station, malls are used.

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