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Money Detection System for Blind People with Color Sensor and Ultraviolet

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Abstract

Money is a tool used to make buying and selling transactions and has been used by all people in every corner of the world. This certainly makes money a staple item for everyone, even for people with disabilities as well as blind people. The weakness of the blind in seeing and identifying money can cause money to be exchanged, wrongly taken, or even deceived when buying and selling activities. Referring to this, it is necessary to have tools that can facilitate the blind to identify the nominal value and authenticity of money. This tool usea TCS3200-DB color sensor to detect the color of banknotes, and ultraviolet sensors to detect the authenticity of money and then by the microcontroller is converted into RGB data and issued in the form of sound. fake looks brighter with the appearance of green in addition to blue, while the real money will only be found in blue. The green and blue colors are also produced from the separation of the three basic colors. Basically, this tool is capable of detecting money from 2000. Only in the program, has the RGB value been set for the 2018 emission of rupiah banknotes.

Keywords: Color sensors, UV sensors, banknotes, blind people

1. Introduction

Rupiah banknotes are money in the form of sheets made of paper or other materials (which resemble paper) issued by the Indonesian government, and legally used as a means of payment in the territory of the Republic of Indonesia. The authenticity of Rupiah can be recognized through the characteristics found in both the material used to make money (paper, plastic, or metal), the design and color of each of the money pieces and the printing techniques. Some of the characteristics contained in the Rupiah, in addition to functioning as a feature to distinguish between one fraction and another, can serve as a safeguard against the threat of money fraud.

The safety device consists of invisible safety equipment, tangible, and new security is seen by using aids in the form of ultraviolet rays, infrared rays, magnifying glass, and certain plastic tools to see scramble images. In plain view, we can distinguish original banknotes with counterfeit paper money by way of being seen, touched and exposed. Original banknotes have security threads, watermarks, glossy prints, and embossed prints that feel rough when touched (Jalil, 2014). But this is not the case with blind people who have physical limitations in distinguishing original and fake banknotes. So far, blind people use conventional methods such as making nominal banknotes or making folds of money to distinguish the nominal money. However, it still has some weaknesses, namely in terms of blind memory, physical condition of money and lack of honesty determinants that when dealing in the sale and purchase of goods and services, the person invited to transact gives money in accordance with the nominal value and directs the tuna blind to arranging the money correctly. According to a survey of the Senses of Sight and Hearing in 1993 - 1996, the highest number of blindness in Indonesia was 1.5% in Asia, compared to Bangladesh 1%, India

0,7%, dan Thailand 0,3%. This means that if there are 12 world population blind in every 1 hour, four of them come from Southeast Asia and one person is confirmed from Indonesia. (Porbadi, 2014).

2. Methodology

Arduino Uno functions as a microcontroller that regulates the workflow of a tool by entering commands into the microprocessor (Zarkasyi, 2013). The color sensor detects the color of money to find out the nominal value and Ultraviolet Sensor as a reader of ultraviolet light released from the lamp. to find out the authenticity of money, a microcontroller is a digital electronic device that has input and output as well as control with programs that can be written and deleted in a special way.DFPlayer Mini functions as a sound storage and the speaker as the output of the sound.

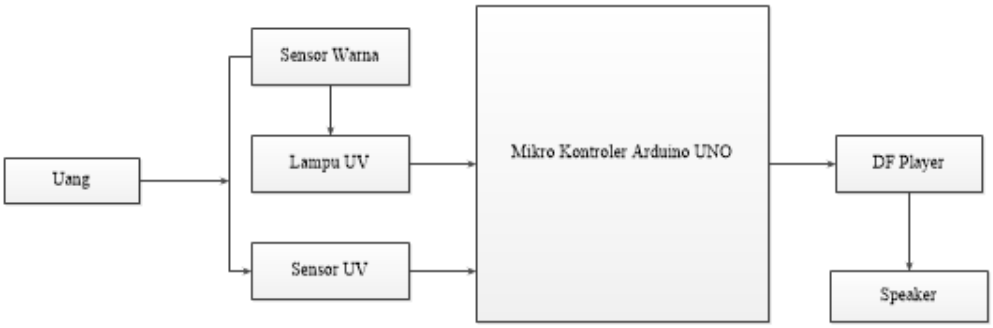

Figure 1. Overall tool scheme.

A. Hardware Design

1. Color Sensor circuit

   Color sensors can be interpreted as a particular spectrum contained in perfect/white light (Aidil, 2016). Color is divided into 2, namely primary color and secondary color. The primary color is the color of the base color, while the secondary color is the color produced from a mixture of two primary colors in a color space. Examples are as below. In graphics equipment, there are three primary colors of light: (R = Red) red, (G = Green) green (B = Blue) blue or more familiar with RGB which when combined in certain compositions will produce a variety of colors.

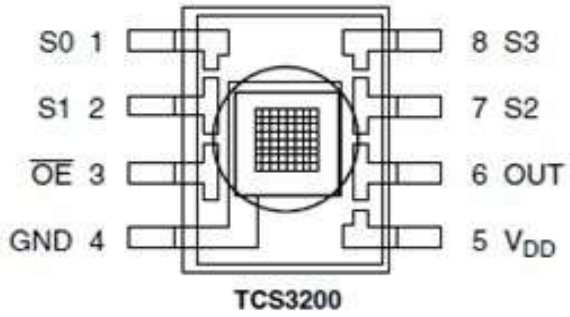

Figure 2. Color sensor series

2. Arduino Uno circuit

   Arduino is an open-source platform for both hardware and software. Arduino consists of megaAVR microcontrollers such as ATmega8, ATmega168, ATmega328, ATmega1280, and ATmega 2560 using 16 MHz oscillator crystals, but there are several types of Arduino using 8 MHz crystal oscillator Sulaiman (2012: 1). The power supply needed for the minimum supply of the Arduino system is enough with a voltage of 5 VDC. The Arduino Atmega series port consists of 20 pins which include 14 digital I / O pins with 6 pins that can function as PWM (Pulse Width Modulation) outputs and 6 analogs I / O pins.

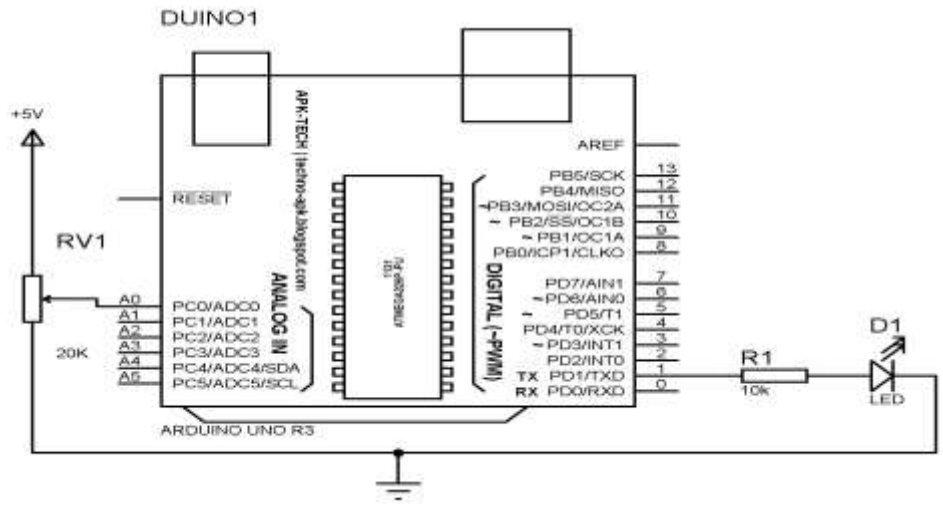

Figure3. Arduino uno series

3. DFPlayer Mini circuit

DFPlayer Mini is a player module for audio/module sound player music files with audio format support such as .mp3 files which are commonly known by the general public (Nugroho, 2014). The physical form of the mini DFPlayer is square in shape with a size of 20 x 20 mm which has 16 feet of the pin. The output on this mini mp3 module can be directly connected to the mini speaker or amplifier as the loudspeaker.

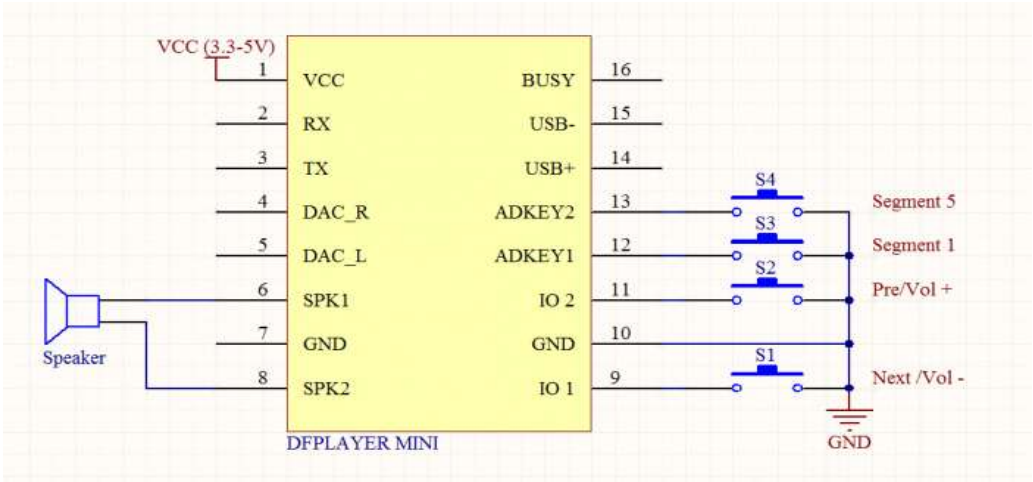

Figure 4.DFPlayer Mini series

4. Ultraviolet Sensor

The ultraviolet sensor is a display of RGB output from the sensor whose data has been processed by a microcontroller and also as a display of the nominal value of money (Adi, 2013). Audio amplifiers are used to amplify the output voltage of the DF player to 20 times. Speaker, a device that is used as an output from the DF player's sound storage.

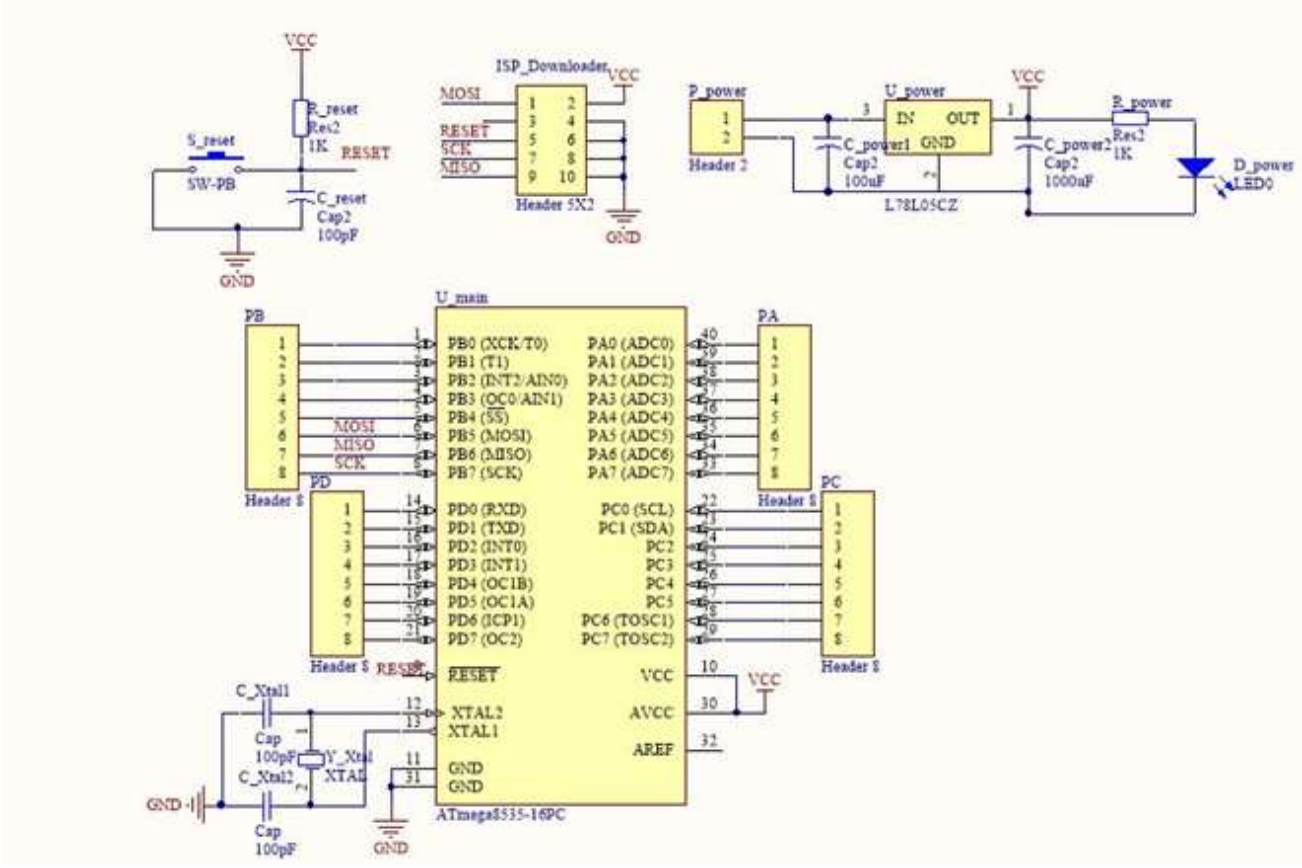

Figure 5. UV Sensor Series

3. Results

The system testing used is Black Box. Black Box testing is testing the device in terms of functional specifications without testing the design and program code. The test is intended to find out whether the functions and outputs have been running as desired. In testing, the steps that are carried out for the first time are testing the input device, which is testing the color sensor that will detect nominal money. Then continued testing of the ultraviolet sensor to detect the authenticity of money. Which then results from the detection of color sensors and ultraviolet sensors as for the stages in testing the authenticity and nominal money detection system, Testing the TCS 3200 color sensor is done by inserting money into the last box with the help of a UV sensor to detect the nominal and authenticity of the money. This tool also has a success rate of 80% because of the outside light coming in so that it easily affects the RGB value that has been specified in the Black Box, therefore the Black box must be closed with a Sticker so that the RGB value that has been set in Arduino can remain stable and money can be easily recognized.

Limit (In thousands)	Side	Good money				Medium money				Bad Money			
		R	G	B	Result	R	G	B	Result	R	G	B	Result
100	Top	220	320	320	90%	240	302	302	80%	205	240	302	70%
	Bottom	239	344	345	90%	190	344	282	80%	191	282	282	70%
50	Top	220	300	300	90%	204	260	260	80%	205	230	230	70%
	Bottom	215	300	300	90%	200	250	250	80%	201	230	225	70%
20	Top	81	109	113	90%	74	107	121	80%	85	116	122	70%
	Bottom	96	134	137	90%	84	125	133	80%	81	109	113	70%

Testing the original banknotes is done by placing the banknotes over the detection system to find out the nominal value and authenticity of the money. Seen from the picture above the money has two parts to scan, namely the top and bottom, the top and bottom of the money has a different RGB value but the value is not much different, then the value of RGB is strongly influenced by the condition of the money itself. The purpose of good money is money that is still new or there is no stain or stick and then the meaning of medium money is money that is still pretty good and has a little bend and still pretty clean from stains and bad money is money with dirty conditions and lots of bending so that the RGB value that will be generated from bad money is difficult to detect by the color sensor After the color sensor matches the RGB value with the program that has been made, the first test is done by placing a nominal banknote of Rp. 100,000, Rp. 50,000, Rp. 20,000, Rp. 10,000, Rp. 5,000, Rp. 2,000 Rp. 1,000, above the detection system, After the color sensor matches the RGB value with the program that has been made, then SPEAKER will issue a currency sound along with a statement stating that the money is fake.

Figure 6. The whole tool making process

4. Conclusions

1. TCS3200-DB sensor can be applied as a detector of banknote nominal by forming the RGB range pattern for each banknote from the sensor output in the form of frequency.

2. The effect of gradation and good and bad physical condition of banknotes greatly affect the frequency reading by color sensors. The better the physical condition of the money, the more physical color of money will appear. Whereas for money with gradations and poor physical conditions will lead to an RGB color overlap with each other so that the reading of the data experiences an error.

3. From the results of testing the tool for reading paper money objects, it was found that the application of TCS 3200-DB color sensor to the nominal detection of banknotes resulted in a percentage of success in reading different instruments for each paper currency.

4. To get the authenticity of banknotes, it is necessary to help with ultraviolet lights that will make the color of counterfeit money look brighter with the appearance of green than blue, while the real money will only be found in blue. The green and blue colors are also produced from the separation of three basic colors.

5. Basically this tool is capable of detecting money from 2000. Only in the program, has the RGB value been set for the 2018 rupiah banknotes.

6. The condition of money will greatly affect the RGB value of the money for example, new money will produce a more stable RGB value then the money will produce the value of RGB which is still said to be fairly stable and money is not good will produce a value of RGB which is far from the value that has been set on the color sensor.

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