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Colour Detector Tool Using TCS3200 and Arduino Uno for Blind and Child

Mohammad Habib Hasan, Arief Marwanto, Agus Suprajitno
Electrical Engineering Post Graduated Program, Sultan Agung Islamic University
Jl. Raya Kaligawe KM 4 Semarang 50112, Indonesia
e-mail: habb82@gmail.com

Abstract

Color detector using TCS3200 that can help the independence of the blind category of low vision in daily life and help improve children's enthusiasm for learning colors early age. Creation tool TCS3200 color detection is based on the large number of persons with special needs, so this tool can be independent again in everyday life, esppecially on matters relating to the colors. The method used is a model of research and development, starting from planing concept and manufacture of hardware product design to final testing tools as well as the customization tools. The results show that the prototype device is able to conduct perform color detector recognize by voice. For the blind peoples, the prototype of color detection is able perform well by expresse the statement of 80%, whenever the juvenile has state that prototype is able to perform color detection is 70%.

Keywords*: Sensor TCS3200, Arduino Uno, Speaker, SD Card*

1. Introduction

Technology development in electronic field give an impact on increasing to easier human activity as the subject executor. Technology advances also have an impact on modern techniques measurement. The color can be detected using the tools. In the physics, there primary and secondary colors. The basic color is RGB (Red, Green, Blue). The parameter color has different waves light. Based on the shown file in the BadanPusatStatistik stated that blind people in Indonesia about 3,75 million people. It does not mean the physical limitations preclude any independent individual. Early childhood in the ability to recognize colors is one aspect from some aspects of cognitive ability aspects skills. This childhood capability is something important to their brain development, since the color introduction to early childhood can increase the sense brain sight.

Blind children problem in color learning and children study spirit need special treatment. So, in order that can happen so we intend to create a technological product that works to help people with disabilities, especially to the blind and early childhood. This product is a product that have form color sensor that is combine with LCD and speaker. This product can also this person with disabilities especially the blind in complete their daily needs. Detected color tool TC3200 have purpose disabilities specially blind people with category low vision be independent giving positive impact to study motivation childhood to knowing color.

2. Related Study

2.1 Color Sensor TCS3200

A sensor color module base TAOS TCS3200 that use in color measuring RGB (*Red, Green, Blue*) from one object. This sensor module have facility record to 25 colors file that will be save in EEPROM. This sensor module completed by UART TTL and 12C. Basicay Color Sensor TCS3200 is a light sensor completed by light filter base color RGB (*Red, Green, Blue*). Photo diode in color sensor TCS3200 arranged to *array* 8x8 with internal sensor photo diodes configuration is 16 photo diodes to light sensor with light filter red color. 16 photo diodes to light sensor with light filter green color 16 photo diodes from light sensor with light filter blue light. And 16 photo diodes to light sensor without color filter.

Figure 1. TCS 3200 Sensor

DT-SENSE Color Sensor has the following specifications:

1. Able to measure RGB color components from a colored object.
2. TAOS TCS3200D based sensor.
3. There are 2 white Leds to help read the color file on the object.
4. Input / Output pins are compatible with TTL and CMOS voltage levels.
5. Equipped with UART TTL and I2C interface.
6. The serial communication configuration is: baud rate 9600 bps, 8 file bits, 1 stop bit, no parity, and no flow control.
7. The power supply source uses a voltage of 4.8 - 5.4 VDC.
8. I2C interface supports bit rate file up to 50 kHz.

Characteristics TCS230 color sensor IC TCS230 can be operated with a voltage supply at Vdc ranging from 2.7Volt - 5.5 volts, in operation the sensor can be done in two ways:

1. With the maximum voltage supply mode, that is by supplying the voltage ranging from 2.7volt - 5.5 volts on the TCS230 color sensor.
2. The minimum supply voltage mode, ie by supplying a voltage of 0 to 0.8.

The TCS230 color sensor consists of 4 groups of photo diodes, each group having a different sensitivity to each other in the photo diode response to the wavelengths of the readable light, the photo diode that detects red and clear has a high sensitivity value when it detects light intensity with wavelengths 715 nm, while at 1100 nm wavelengths the photo diode has the lowest sensitivity value, it indicates that the TCS230 sensor is not linearity and has a changed sensitivity to the measured wavelengths, Figure 2.2 shows the photo diode characteristics of the wavelengths of the light.

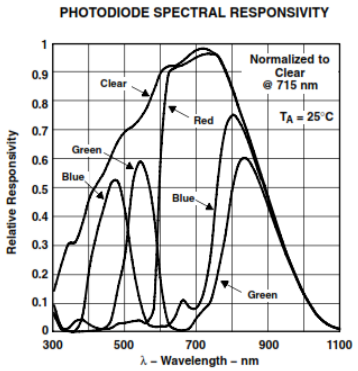

Figure 2. Characteristics of photo diode sensitivity and linearity to the wavelengths of light.

The greater the temperature coefficient obtained from the photo diode, the greater the wavelengths produced by the sensor, where the magnitude or magnitude of the coefficient coefficient is affected by the state of wavelengths or illumination, indicating that the TCS230 sensor has a linear wavelength characteristic.

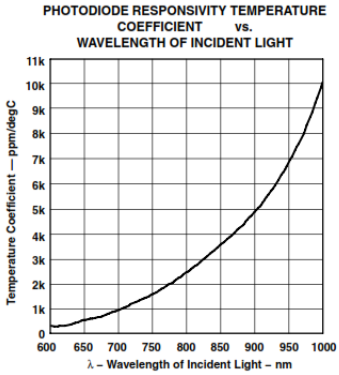

Figure 3. Indicates the characteristic comparison between the coefficient temperature to wavelengths.

2.2 Arduino Uno

Arduino UNO is a micro controller board to Atmega328. Arduino UNO have 14 digital pin input/output (6 from then used as PWM output), 6 analog input,aosilator Kristal 16 MHz, a USB connection, a power jack, a ICSP header, and a reset tune. Arduino UNO accommodate all need to support micro controller, easy connect to computer with USB cable or supply it with AC to DC adaptor or use bat to begin.

Figure 4. arduino Board

The arduino function in this tool, which is the center of the color sensor management controller and performs the input processing which produces the output of Liquid Crystal Display (LCD).

2.3 Mini speaker 8 Ohm 0,5 Watt

This speaker have a function to you that want to try a sound series with Arduino. With 0,5 watt, it's enough to give a loudly sound. Speaker 0,5W 8Ohm, diameter 5,5 cm, 1.7cm tall.

2.4 SD Card reader write Module

This module is module card reader micro SD for Arduino consist of 6 pins.

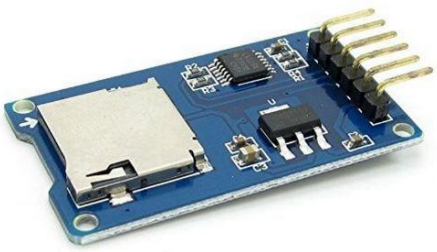

Figure 2.5 SD Card Module

SD Card reader write Module has Features:
1. Supports Micro SD Card, Micro SDHC card (high-speed card)
2. On board level conversion circuit, can be 5V or 3.3V
3. Power supply 4.5V ~ 5.5V, 3.3V voltage regulator circuit-board
4. Communication interface using standard SPI interface
5. Has 4 hole bolts M2 for easy installation

2.5 Led 16x2

LCD is one of the electronic components that serves file display, character, letter or chart. LCD (Liquid Cristal Display) is one kind of electronic display that created with CMOS technology logic that works with a does not produce light but light sensor reflect around them to front-lit or light transmission back-lit. LCD (Liquid Cristal Display) have function as a file viewer in character, letter, number or chart.

Figure 6. Liquid Cristal Display 16 x2

LMB162A is an LCD matrix module with 16 character configurations and 2 lines with each character formed by 8 lines pixels and 5 columns pixels (1 the last line is the cursor). The LCD memory consists of 9,920 CGROM beers, 64 bytes of CGRAM and 80x8 bits DDRAM addressed by addressing, address Counter and file access (reading and writing of file yes) right through register file. In LMB162A there is file register and register p order. Access process file to or from registers file will access to CGRAM, DDRAM or CGROM depends on the conditions address Counter, while the file access process to or from register p the government will access Instruction Decoder (decoder instructions) that will determine the command-command to be performed by LCD.

Classification LED Display 16x2 Character :
a. 16 characters x 2 lines
b. 5x7 point Matrix character + cursor
c. HD44780 Equivalent LCD controller / driver Built –In
d. 4 bit or 8 bit MPU Interface
e. Standard type
f. Works almost with all Micro controllers

3. Research Method

The time begin November 2016 begin to March 2017. Through many steps that consist planning step to evaluation step. Research Stages In this Chapter, the research stages are as follows:
1. Designing tools, namely designing the number of colors that will be detected and design the tool design. In the color determination using RGB value parameters obtained from the calibration process against the existing color. In TCS3200 color sensor there are 4 LEDs each, there is a function of determining the value of red, green and blue and 1 LED lights serve as clear[1-3].
2. Conducting instrumentation testing, ie testing tool done by black box method, where the test is done by detecting the color that later results from the process in the arduino must be in accordance with the input[4].

3. Testing the object, ie testing the tool directly to the object by using 9 color papers as test materials. The color determination parameters used are based on the value of red, green, blue (RGB).
4. Analysis of test results, that is analyzing the results of the test results of the tool against the object that later results will be compared with other methods to see the superiority of the tool under study.

The method used is the research and development model, namely (1) design concept and manufacture of hardware product design; (2) Conducting an experiment based on existing theory; (3) Modify based on the results obtained. At this stage of implementation of this type of file used are qualitative and quantitative file. Qualitative file obtained from the validation and trial results in the form of suggestions and comments. While the quantitative file obtained from the validation questionnaire and limited trial of the value of ADC (Analog Digital Converter) color detection. The ADC value is a value derived from RGB color reading in the form of a digital output [5]. The analysis technique used is the calculation of the range of values of each color. So that obtained a precise result and no fatal error when doing color detection.

3.1. Design concept and product design

Designed the design as the application of color and software. The designed concepts include [7]:

1. Concept of Color detecting device;
2. The concept of hardware
3. Concept of hardware framework
4. Prototype design that includes hardware
5. Study of theoretical analysis of the tools produced

In the design-making section refers to the design of the product concept that has been appropriate. Meanwhile, the finished design will be conducted experiments and revisions to minimize losses that occur.

This tool will only detect nine colors, which are red, green, yellow, black, white, light green, blue, purple, and brown where the object can be detected only objects that can reflect light from the color sensor LED [6].

The working system concept of the tool can be seen in the chart below:

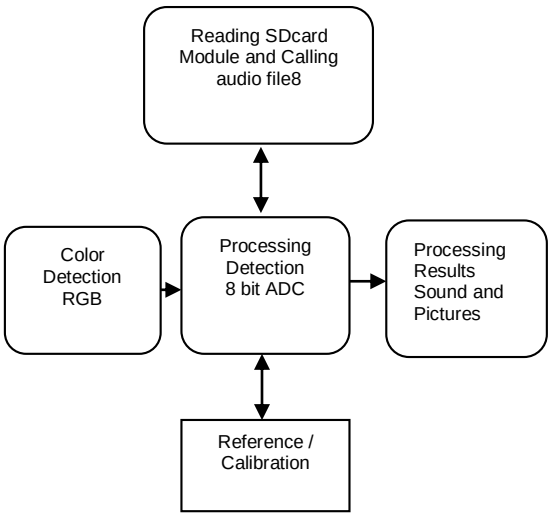

Figure 7. Concept of Tool planning

3.2. Conducting experiments based on theoretical studies

The theoretical study used in the experiments of the theory of reading the tool through the hardware micro controller ArduinoUno combined with color sensors. The micro controller system reads and stores the values of each color. A prototype experiment was conducted to obtain quantitative file in the form of ADC values of each color[4]. Then from the file that has been

obtained will be made as a basic modification of the prototype of the more precise in the color detection.

3.4. Modifications based on the results obtained

The results of the file obtained from the experiment are used as the basis for modification of the prototype. The process of using RGB color reading system in the Arduino Uno program script. So the results of the detection is more accurate than the previous results. Hardware modification is the addition of components to focus the intensity of color detection. developed prototype made attractive by providing ease of operation and 2 outputs in the form of audio and visual it.

4. Results and Analysis

The research system in order to have obtain desired result, so in this study have to some testing on the system as whole. The result of the survey and interview from several sources help in repair process to tool produce according to destination. Then also do steps evaluation to the maximal step.

Testing perfomed to prove the tool work as planned. Each test conducted to hardware analyze on the test tool close to color detector tool to the object color that the color choose appropiate to the configuration color in the tool.

Table 1. Evaluation Test Result

No	Object color	Value Calibration Value Color Intensity			Value detector Valueresult color intensity			The color detection
		R	G	B	R	G	B	
1	White	3 – 6	5 – 6	4 – 5	5	6	4	White
2	Yellow	3 – 4	5 – 7	9 – 14	4	6	12	Yellow
3	Red	5 – 9	15 – 36	14 - 30	8	34	27	Red
4	Black	14 – 53	17 – 60	13 – 49	46	50	39	Black
5	Green	17 - 31	10 – 14	14 – 22	26	12	20	Green
6	Brown	28 – 30	48 – 55	45 – 52	29	52	47	Brown
7	Blue	14 – 35	12 – 25	5 – 8	33	24	7	Blue
8	Purple	5 – 8	11 – 23	6 – 8	5	20	7	Purple
9	Light Green	7 – 11	5 – 7	8 – 13	9	6	10	Light Green

From each evaluation result that have gotten, have to do perfection. This Prototype Product Perfection done perfection to prototype that include casing hardware and adding color. Perfection have done to get perfectness in prototype. So that make the user specially blind and childhood more easily to use. So include on color adding to reach nine color that able to tool detection.

The system illustration more specific can be read in the program flowchart in this picture.

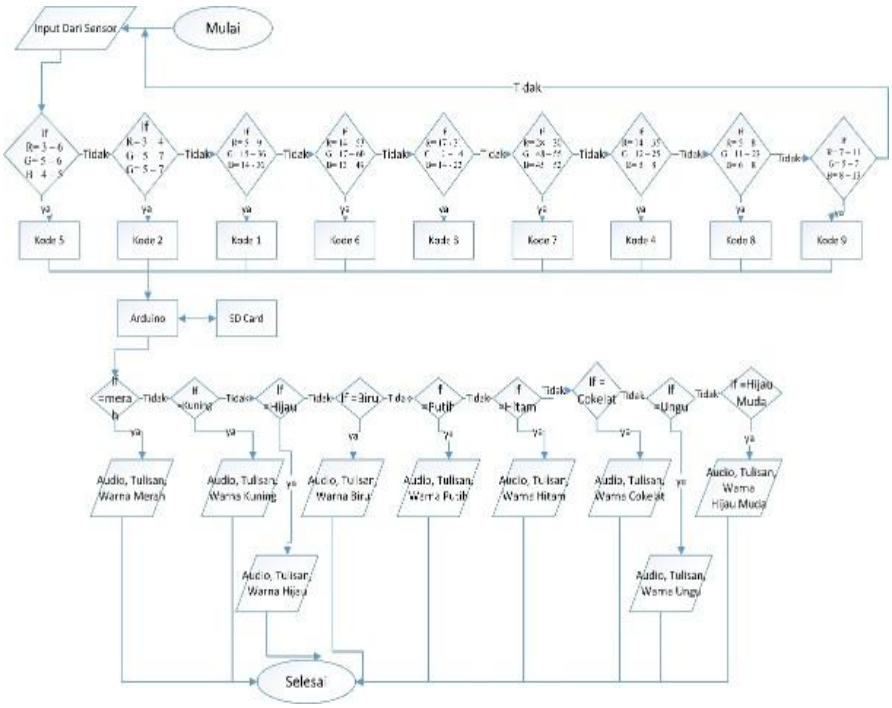

Figure 8. Flowchart color detection tool

Analysis of Test Results. Testing is done by testing directly against the color object. In the LED sensor will emit light to the color object that will reflect the color will be captured color sensor, then will be processed that results in the value of the pulse. So the signal detected by the TCS3200 sensor will be sampled and quantified at the ADC pin in the arduino to be changed in an 8 bits value [9]. The bit value to produce a measurable digital signal, will be used later to determine the range of each color used.

The results of the tool testing analysis of early childhood and visual impairment can be seen in the following table:

Table 2. Evaluation Test Result

No	Sensor Detected Color	Color Detection Results	Votes
1	Red	Red	Red sound
2	White	White	White sound
3	Yellow	Yellow	Yellow sound
4	Black	Black	Black sound
5	Light green	Light green	Light green sound
6	Purple	Purple	Purple sound
7	Blue	Blue	Blue sound
8	Green	Green	Green sound
9	Brown	Brown	Brown sound

5. Conclusion

Based on the obtained file expected to get quantitative file sawing prototype escap able detect nine object color. “So that” this tool can help disability can help independent disabilities blind and childhood. The independent in this case one of them to make object differences appropiate with the color that needed by blind related nine detected color.

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