

Modeling and Designing of Color Detector using Arduino

Shubham Gupta¹, Abhishek Rathee², Abhishek Kathariya³, Ashish⁴, Harpreet Kaur Channi⁵
Student^{1,2,3,4}, Assistant Professor⁵

Electrical Engineering Department, University Institute of Engineering, Chandigarh University, Gharuan, Mohali, Punjab, India

ABSTRACT

The utility model discloses a colour detector and a colour recognition device, wherein the colour detector comprises a luminous source which emits detecting light to to-be measured objects, and a sensor which is used for receiving reflected light to measuring color information, wherein the colour recognition device comprises the color detector, a data processing unit which is used for recognizing colour through collecting data, storing data and comparing data and is used for judging relative cases, and an output unit used for outputting color recognition results. The colour detector and the colour recognition device can be applied in electronic whiteboards, when writing on the whiteboards, the detector and the device can automatically recognize the colour of a writing pen, which is convenient for writers as writing on common blackboards or whiteboards, and the color of the handwritings depends on the color of writing pens. The colour detector and the color recognition device are also can be applied to other situations which need to recognize colors. For the colour recognition we refer to the basic rgb pattern or the hue or colour circle

Keywords: RGB, Hue Circle, Luminous

I. INTRODUCTION

A Color Sensor, as the name suggests, is a device that senses or detects colors. A color sensor will use an external means of emitting light (like an array of white LEDs) and then analyze the reflected light from the object in order to determine its color. Color sensors will give an accurate color of the object. There are a wide range of applications of color sensors like sorting objects by color, quality control systems, printer color enhancement etc. In this project, we have designed a simple Arduino Color Sensor application, which has an ability to detect different colors. We have used TCS3200 color sensors for this purpose. Technically speaking, colors are figments of our imagination. When we see a red apple, it means that it reflects that particular wavelength (~700 nm for Red) of the electromagnetic spectrum. This energy is absorbed by the eye and based on some chemical reaction, the brain says that particular wavelength is red color. For computers, a sensors that differentiates between different colors will help in determining the color of the object. We will see a simple color sensor using a

photoresistor (Light Dependent Resistor – LDR) and two different colored objects, say red and blue. The TCS3200 Color Sensor Module has RGB + Clear Sensor along with 4 bright white LEDs embedded on the board. TCS3200 has an 8 x 8 array of photodiodes, 16 each for Red filters, Blue filters, Green filters and Clear (no filter). The Circuit diagram and connections of the project are shown in the figure below.

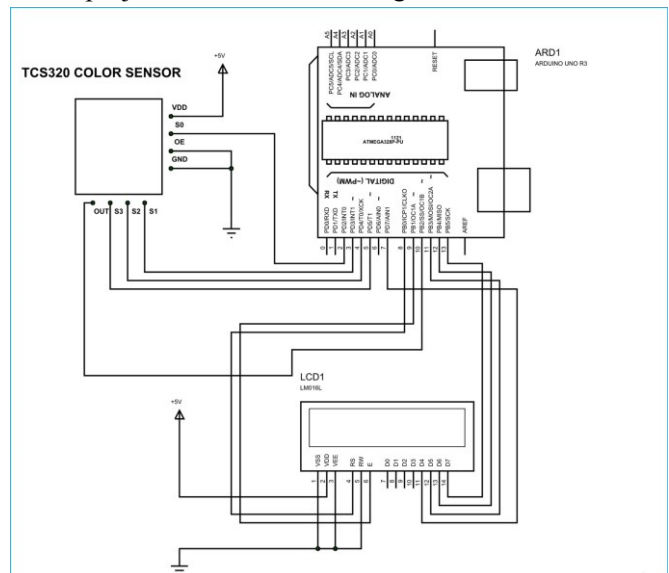


Figure 1: Circuit Diagram and Connections

II. LITERATURE REVIEW

Akriti Kaushik, Aastha Sharama [1] explained that Sensor provide a means for gathering information on manufacturing operations and processes being performed. In a lot of instances sensors are used to transform a physical stimulus into an electrical signal that may be analyzed by the manufacturing system and used for making decisions about the operations being conducted. The purpose of sensors is to inspect work in progress, to observe the work-in-progress edge with the manufacturing utensils, and to permit self monitoring of manufacturing by the manufacturing system's own computer. Color sensors register stuff by contrast, true color, or clear index. True color sensors are based on one of the color models, most commonly the RGB model (red, green, blue). A large percentage of the visible spectrum can be created using these three primary colors. Many color sensors are able to sense more than one color for multiple color sorting applications. Depending on the difficulty of the sensor, it can be programmed to know only one color, or multiple color types or shades for categorization operations. Through this report, the color detection, the basic color theory and the applications of color sensor will be review. In this report will be focusing on the application of color sensor using conveyor system

Tushar G. Gaikar , Soham N. Zadokar, Rajendra S. Bhandari, Sagar S. Patil[2] described that the primary reason for the framework is to separate the item as for their shading code a naturally circulate the item as per their hues. In this anticipate we will distinguish the shade of the item which is put on transport line you need and that question is dispatch to separate box. This can be accomplished effectively by utilizing headway as a part of innovation particularly in the field of inserted frameworks. Presently a day's such a large number of helpful innovations are turning out to make our way of life more solace, extravagant and secure. In this anticipate we are utilizing Arduino (controller) and shading sensor. This shading sensor distinguishes shading and gives serial yield of RBG worth. It can distinguish 16.7 million shading shades giving RGB esteem for the recognized shading. The distinguished shading is recognized as measure of three essential shading values to be specific Red, Green and Blue with 8 bit exactness for every essential shading. Any shading can be isolated or consolidated into three

essential hues Red, Green and Blue utilizing the RBG values.

Mingwei Liu[3] explained that a robot which can follow a black line on a white platform. This can be implemented by using 8 photo resistors array. First, these sensors are set to be output. After delaying for a period of time and setting ports input again, this array will receive light from surroundings and transfers it into digital signal. Since black and white has different reflection coefficient, the robot can use this to distinguish whether it's on a line or not. The delay time is an important parameter because it can determine the sensitivity of the sensor. After experiment several times, I found 200us is the perfect delay time for my robot. Besides tracking the black line, the robot can also detect colors of an object. This can be achieved by using a distance IR sensor and a RGB color detection sensor. The IR sensor can calculate the distance of an obstacle in front. The robot can stop at certain point and use RGB color sensor to read from it. IR sensor can be easily used through ADC port. However, RGB color sensor has to use TWI communication protocol to obtain color because the color sensor contains much more information than IR sensor. For actuation part, at first I used two gear motors and a dual motor driver to control it. However, after changing the platform of my robot, I found the motors were not powerful enough so I replaced them with two servos. The robot and patrol on the map, going through every routine. When it detects object it will distinguish whether this object is red or blue. If the line ends, it will turn around and move on. The destination is a white area. The robot can go back after reaching the destination.

Abhishek Kondhare, Garima Singh, Neha Hiralkar, M.S.Vanjale [4] explained that the project is a smart approach for a real time inspection and selection of objects in continuous flow. Image processing in today's world grabs massive attentions as it leads to possibilities of broaden application in many fields of high technology. The real challenge is how to improve existing sorting system in the modular processing system which consists of four integrated stations of identification, processing, selection and sorting with a new image processing feature. Existing sorting method uses a set of inductive, capacitive and optical sensors which do differentiate object colour. This project presents a mechatronics colour sorting system solution with the application of image processing. Image processing procedure senses the objects in an image

captured in real-time by a webcam and is classified using a decisional algorithm and selected in real time. This information is processed by image processing for pick-and-place mechanism. This project uses an automated material handling system which is widely used in industries.

M. Anil Kumar, Dr. S. A. K. Jilani, Mr. U. Sreenivasulu, Mr. S. Javeed Hussain [5] explained that color plays a vital role in human daily life for recognition. The main objective is to develop a prototype which can detect different colors for visually challenged people. They are expected to be interested in the color of their clothes, the color of toys and the color of pictures etc. This system helps the visually challenged people to recognize the colors without the help of third person, so they can identify the colors independently. This system is implemented on Arduino microcontroller with android device in which color Recognition can be done. After Recognition there will be text to speech conversion so user or visually challenged person can get message from the Android device with the help of Mobile Speaker. The project is based on both hardware and software. This project uses Bluetooth Module that connects the hardware with a Mobile device. The software used in the project is Arduino IDE which is used for coding and as an interface between Arduino microcontroller and Mobile App. This model includes Mobile App with the hardware components such as Arduino microcontroller, Color Sensor, and Bluetooth Module. Arduino microcontroller toolbox are used to implement this project. The proposed system works in standalone mode without the necessity of PC if once programmed. We used the rapid prototype technique approach of a color object for real-time applications using Arduino support package meant for Arduino microcontroller.

III. PROBLEM FORMULATION

The use of arduino for color sensing is modeled as it provides a far more reliable, efficient, easy and quick method than the typical conventional sensing methods such as an RGBW MATRIX method and CYGM method which are described below

A, RGBW MATRIX: An RGBW matrix (from Red, Green, Blue, White) is a CFA that includes "white" or transparent filter elements that allow the photodiode to

respond to all colors of light; that is, some cells are "panchromatic", and more of the light is detected, rather than absorbed, compared to the Bayer matrix

B, CYGM MATRIX: A CYGM matrix (Cyan, Yellow, Green, Magenta) is a CFA that uses mostly secondary colors, again to allow more of the incident light to be detected rather than absorbed. Other variants include CMY and CMYK matrices.

Here we have modeled basic sensor limiting to only few colors but the models potential can be increased as per desire and requirement which also depends upon the use of the sensor or the corresponding application in a device such as display color adjustment, backlight dimmers in liquid crystal displays, and environmental color temperature detection, Brick sorter, Avoids separation of products in manufacturing industries.

IV. MOTIVATION

The motivation behind making this project is to make the life of people easier as much as possible, to solve the complex problems of this world through which we can make this globe a better place for living. This world is full of colors which drives me to make a setup which can tell someone about the color of a particular thing. So this is the driving force which make this imagination turning into reality.

V. OBJECTIVES

- Colour sensors are used to precisely match colours, to identify near colour matches on different surfaces. They can identify invisible markers on products, which is ideal for error proofing package lines.
- Automotive carpet manufacturers use colour sensors to match carpets to car mats, where the naked eye may not be able to see any difference. Using colour sensors in this way ensures high assembly quality and can save money by preventing a colour production error, which would lead to the entire batch being unusable and rejected.
- A colour sensor can be a simple and inexpensive way to detect the presence of markings on a package.

- Various coloured lids on canisters (such as paint) are sorted using a colour sensor to send them to the appropriate packing station.
- Colour sensors can be used to confirm the presence of pills or other products in clear blister packaging and to check their colours. If a pill is missing from a blister pocket, the colour sensor does not see the reflected colour response that was taught, and the package is flagged.

VI. METHODOLOGY

In this project we are going to interface TCS3200 color sensor with Arduino UNO. TCS3200 is a color sensor which can detect any number of colors with right programming. TCS3200 contains RGB (Red Green Blue) arrays. As shown in figure on microscopic level one can see the square boxes inside the eye on sensor. These square boxes are arrays of RGB matrix. Each of these boxes contain Three sensors, One is for sensing RED light intensity, One is for sensing GREEN light intensity and the last in for sensing BLUE light intensity.

Brain of the circuit is Arduino Uno R3 board having ATmega328 or ATmega328P microcontroller (MCU). It has 14 digital input/output (I/O) pins and six analogue input pins, 32k flash memory, 16MHz crystal oscillator, USB connection, power jack, ICSP header and reset button.

Working of the project is simple because this is a basic circuit for interfacing a TCS3200 sensor. When red color is kept near the sensor, it automatically detects the color with the help of photodiode arrays and then RGB color intensity value is displayed in Arduino serial monitor window along with color name. At the same time, a red LED glows in the RGB LED. Similarly, the remaining two colors (green and blue) are shown in Arduino serial monitor window and the respective color LED glows in RGB LED.

VII. SOFTWARE USED

Software is written in Arduino programming language. Arduino Uno Board is programmed using Arduino IDE software. ATmega328P on Arduino Uno board

comes with a pre-programmed bootloader that allows you to upload a new code to it without using an external hardware programmer.

Connect Arduino board to the PC and select the correct COM port in Arduino IDE. Compile the program/sketch (TCS3200.ino). Select the correct board from Tools→Board menu in Arduino IDE and upload the sketch. Load the program to the internal memory of the MCU. The sketch is at the heart of the system and carries out all major functions. It is compiled and uploaded using Arduino IDE 1.6.4.

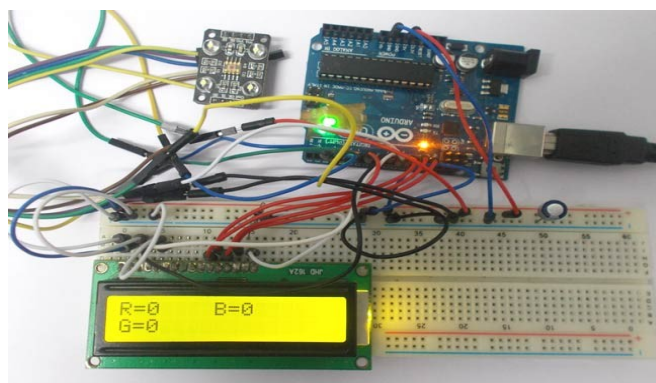


Figure 2 : Hardware structure of Arduino based colour sensor

VIII. CONCLUSION

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IX. ACKNOWLEDGMENT

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