

SMOKE COLOUR DETECTION SYSTEM

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ABSTRACT

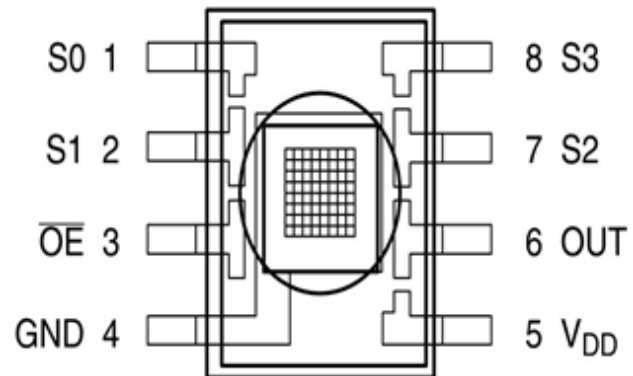
In marine industry, time is very crucial during troubleshooting & rectification. Every delayed of this action will cause severe loss for the business. So, the idea of this whole project is to shorten the time period in rectify and troubleshoot when excessive smoke produces by every machines/engine that powered by combustion system such as Main Diesel Engine, Auxiliary Diesel Engine, Boiler & Incinerator. Nowadays different smoke color produced are caused by different type of problem in the combustion system. So, by recognizing what color of this smoke, engineers can shorten the time to rectify the problems and take necessary action to bring back the system in normal state. This paper will offer a development of smoke color detection system that informs duty engineer what color of excessive smoke produced such as in boiler during cargo discharge operation in oil tanker.

NOMENCLATURE

<i>LED</i>	Light Emitting Diode
<i>MARPOL</i>	Marine Pollution
<i>MHz</i>	Mega Hertz
<i>MCU</i>	Microcontroller Unit
<i>HD</i>	High Definition
<i>AC</i>	Alternate Current
<i>DC</i>	Direct Current

1.0 INTRODUCTION

In this project, we are using 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 below 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.

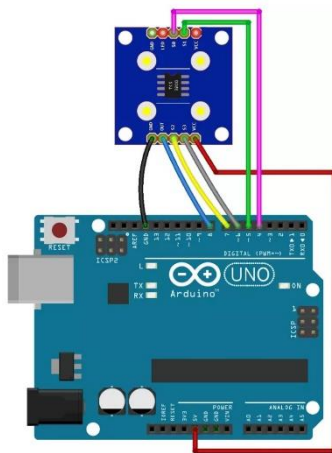


2.0 METHODOLOGY

Basic example. See how to detect colors with this TCS3200 chip with photodiodes filters for red green and blue. We will detect the frequency response of each color using the Arduino. The TCS2300 senses color light with the help of an 8 x 8 array of photodiodes. Then using a Current-to-Frequency Converter the readings from the photodiodes are converted into a square wave with a frequency directly proportional to the light intensity. Finally, using the Arduino Board we can read the square wave output and get the results for the color.

2.1 COMPONENTS

In this project we are using 16x2 LCD display, TCS 3200 color sensor, 10k variable resistor, breadboard, male to male jumper wires, female to female jumper wires.

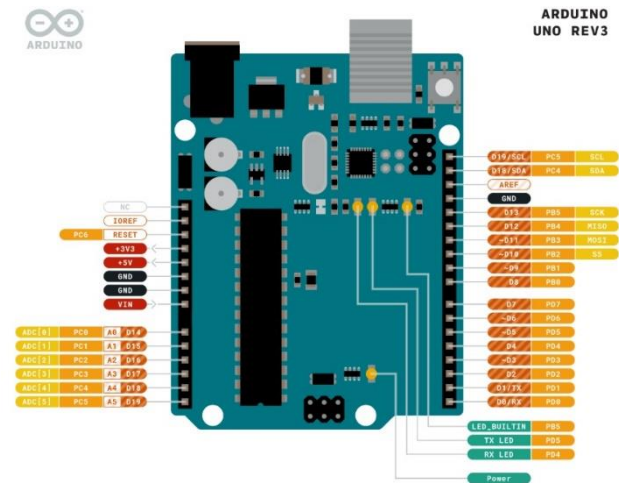


2.2 Operation

In example, during cargo discharge operation, when a boiler in firing mode, if any problems happen in automatic combustion control system, it will affect the combustion and will produced excessive smoke either black or white smoke. TCS 3200 senses color light with the help of 8x8 array of photodiodes. Then using a current-to-frequency converter the readings from the photodiodes are converted into a square wave with a frequency directly proportional to the light intensity. This sensor will be connected to a PC or Computer and gives information to duty engineers on what color of excessive smoke produced so that they can acknowledge and rectify the problems accordingly. In example, when black smoke produced, this is due to excessive fuel compared to air in combustion system and when a white smoke produced, this is due to excessive air was introduce compared to fuel in combustion chamber. In internal combustion engine such as Main and Auxiliary Diesel engine, there is possibility of blue smoke produced due to mixed of lubrication oil in combustion chamber.

2.3 Microcontroller

Arduino Uno is a microcontroller board based on the ATmega328P. it has 14 digital input/output pins (of which 6 can be used as PWM outputs) 6 analog inputs, a 16 MHz ceramic resonator (CSTCE16MOV53-R0) a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with a AC to DC adapter or battery to get started.



3.0 Schematic Diagram

The sensor has two more control pins, S0 and S1 which are used for scaling the output frequency. The frequency can be scaled to three different preset values of 100 %, 20 % or 2%. This frequency-scaling function allows the output of the sensor to be optimized for various frequency counters or microcontrollers. Below you have the schematic used with this sensor. Make the connections and then upload the code.

3.1 Code With Serial Pin

First, we need to define the pins to which the sensor is connected and define a variable for reading the frequency. In the setup section we need to define the four control pins as outputs and the sensor output as an Arduino input. Here we also need to set the frequency-scaling, for this example I will set it to 20%, and start the serial communication for displaying the results in the Serial Monitor.

In the loop section, we will start with reading the red filtered photodiodes. For that purpose, we will set the two control pins S2 and S3 to low logic level. Then using the “pulseIn()” function we will read the output frequency and put it into the variable “frequency”. Using the Serial.print() function we will print the result on the serial monitor. The same procedure goes for the two other colors, we just need to adjust the control pins for the appropriate color.

4.0 RECOMMENDATIONS

In this presentation, the author tells a color detection system which differentiate between 3 different color of excessive smoke produced in the event of the failure from combustion control system. In addition, the MCU can be reprogrammed to suit the advance needs such as it can be connected directly to the machinery safety system in example, when black smoke produced in boiler during cargo discharge operation, boiler safety system will directly

trip the boiler without any delay.

5.0 CONCLUSION

This project basically is to enhanced safety culture onboard of marine vessel. As per Marpol Annex VI, stated that it limits the main air pollutants contained in ships exhaust gas, including Sulphur Oxides (SO_x) and Nitrous Oxides (NO_x). Thus, fast action has to be taken in the event of any excessive smoke produced to reduced air pollution. By recognizing what color of smoke, engineers can tackle the problem faster without to do a lookout from the ships funnel. In near future, the system could be further improved by enhancing a visual aid such as HD live camera that directly connected between alarm and monitoring system and combustion control system either in boiler or main diesel engine.

ACKNOWLEDGEMENTS

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