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COLORIMETER

CSE3442 Embedded Systems I – Spring 2019

General Overview:
This device is capable of measuring, learning, and recognizing the color of a target over the visible portion of the light spectrum. It communicates over a serial connection with a computer using a terminal.

Hardware:
The project will consist of a single board containing a socket for the M4F board, drivers and an RGB LED that is used to illuminate the target, and a TEPT5600 ambient light sensor and conditioning circuitry that will be used to measure the relative intensity of the reflected light.
The system measures color by measuring the intensity of the reflected light from the target when each of three illuminators (red ~630nm, green ~525nm, and blue ~465nm) are on.

Part Quantity	Quantity
EK-TM4C123GXL (rs-232 receiver/driver)	1
TEPT5600 (light sensor)	1
WP154A4SUREQBFZGC (RGB LED)	1
0.192” ID / 0.3125” OD / 0.5” L aluminum spacers	2
2N3906 PNP transistor	4
680 ohm resistor (red led current limiter)	1
2.7k ohm resistor (green/blue led current limiter)	2
1kohm resistor (sensor PNP collector sink)	1
10k resistor (sensor PNP base pull-up, LED base)	4
4.7k resistor (LED PNP base pull-up)	3
47k resistor	1
0.1uF capacitor (integrator)	1
10x2 100mil pitch unshrouded header	2
Wire (22-24 AWG solid wire, 3 colors) Red for 3.3V or 5V, black for GND, other color for other signals	1
PC board (3x5 size recommended)	1

Table 1. Parts list

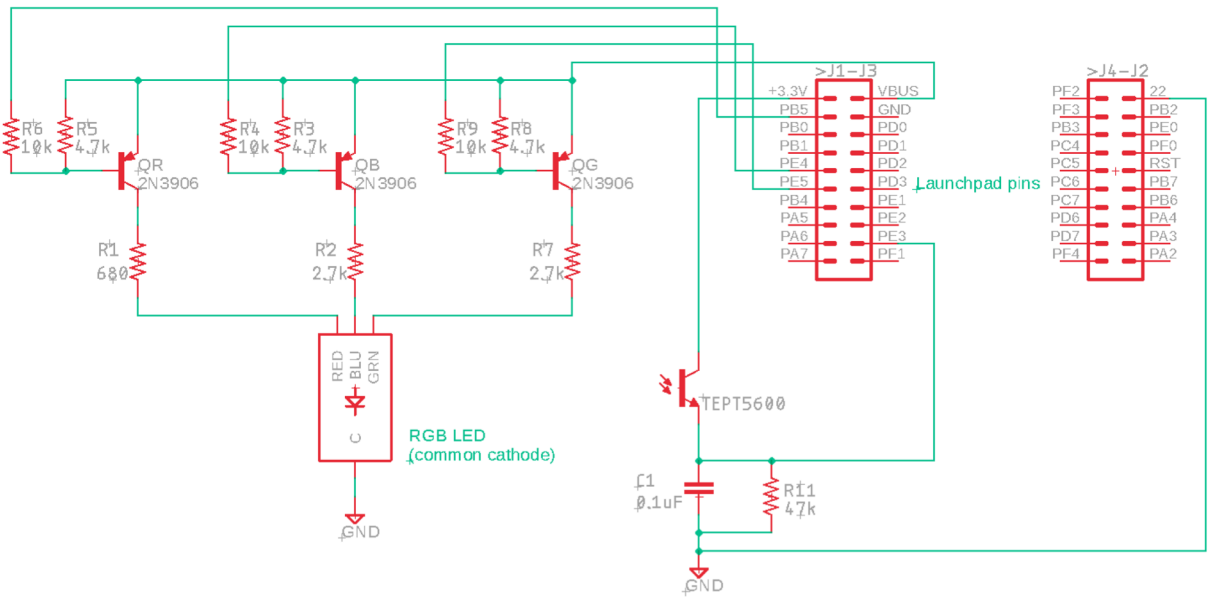

Figure 1. Eagle schematic of device

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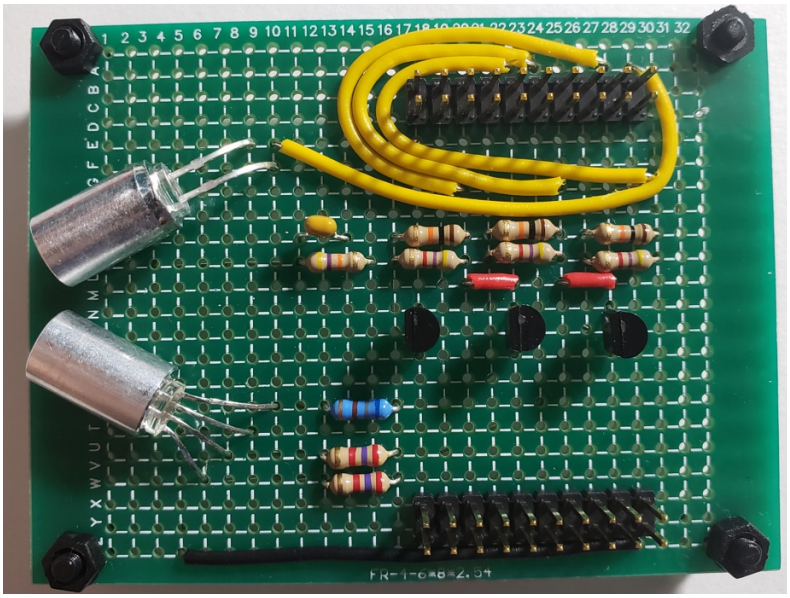

Figure 2. Soldered PCB

Software:

Calibration Functions	
calibrate	Instructs the hardware to calibrate the white color balance and displays the duty cycle information when complete
color N	Stores the current color as color reference N (N = 0..31)
erase N	Erases color reference N (N = 0..31)
Sampling Functions	
periodic T	Configures the hardware to send an RGB triplet in 8-bit calibrated format
delta D	Configures the hardware to send an RGB triplet when the RMS average of the RGB triplet vs the long-term average (IIR filtered, alpha = 0.9) changes by more than D, where D = 0..255 or off
match E	Configures the hardware to send an RGB triplet when the Euclidean distance (error) between a sample and one of the color reference (R,G,B) is less than E, where E = 0..255 or off
trigger	Configures the hardware to send an RGB triplet immediately
button	Configures the hardware to send an RGB triplet when the SW1 is pressed
User Interface functions	
Menu	Shows main menu listing functions
showColors	Shows saved color in current running program
show N	RGB LED will light color N's rgb values
led off	Disable the green status LED
led on	Enables the green status LED
led sample	Blinks the green status LED for each sample taken
Test	Drives up the LED from a DC of 0 to 255 on red, green, and blue LEDs separately and outputs the uncalibrated 12-bit light intensity in tabular form
EEPROM Functions (hidden)	
promMenu	Shows EEPROM hidden menu listing commands
promShowColors	Lists colors currently saved in EEPROM. Displays rgb values and index numbers.
promShowCalibration	Displays calibration values currently in EEPROM
promErase	Erases everything saved in EEPROM to factory default

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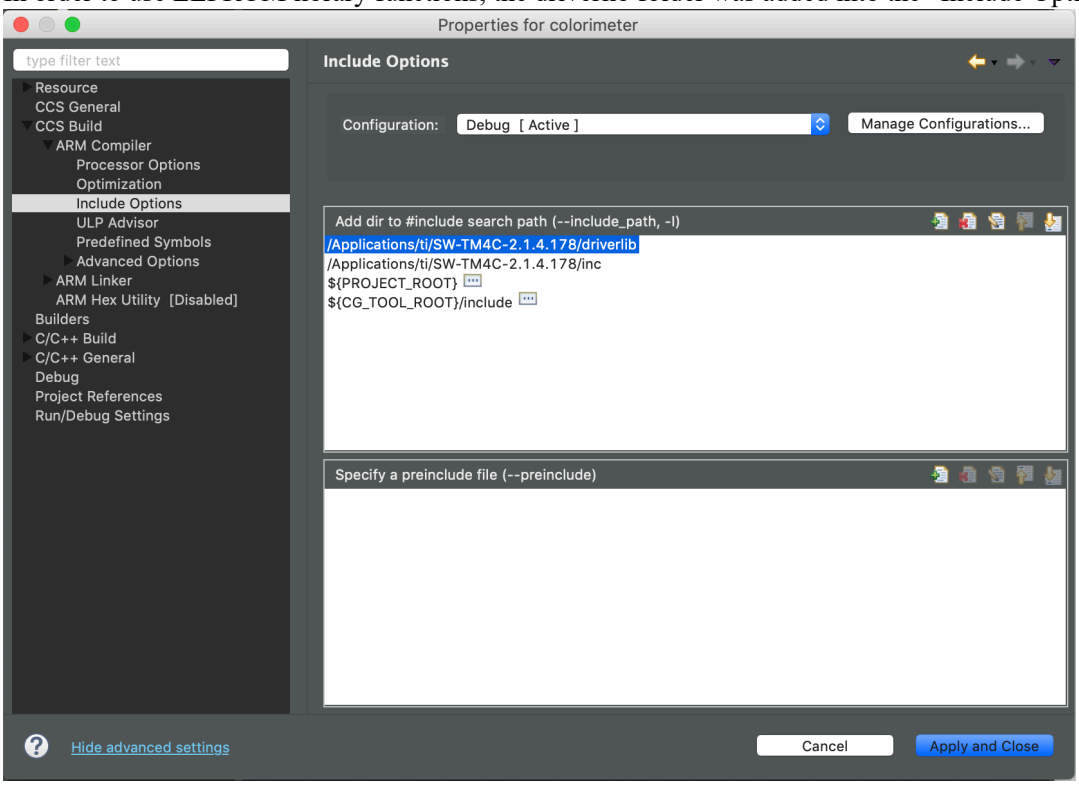
In order to use EEPROM library functions, the driverlib folder was added into the “Include Options”.



In addition, the “driverlib.lib” was also added into the “File Search Path” option.