ISIM Final Project - RGB Detector

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1 Description

The goal of our project is to determine the RGB values of a color. We measure the intensities of red, blue, and green by using a photodiode, a RBG LED, and Op-Amps. We did this by measuring the voltage output from the photodiode. Photodiodes release a small current when photons hit its sensor. We converted this current into a measurable voltage with an op-amp and amplified the signal by a gain of 38.23. To reduce noise interference we put the LED and the photodiode through the top of a black cardboard box with a piece of paper acting as a divider between the two components. This black box will prevent outside light from coming in and the paper in the middle will decrease the amount the photodiode is affected by the LED next to it. Additionally, we added another black paper dome on top of the whole setup to completely eliminate outside light pollution. We then calibrated the expected voltage outputs of each individual color by shining them one at a time on white paper and black paper. A white paper should produce the max intensity of each color because white reflects all the colors and black people should be the minimum intensity of each color because it absorbs all the light. Finally, we tested the amount of RBG in six different pieces of colored paper by shining red, green, and blue light one at a time at the paper and comparing the voltage output to our calibration values. Post-processing the data included taking into account the different levels of sensitivity for each color in the photodiode, such as it being more sensitive to red as opposed to blue, and converting our voltage outputs into RBG values. We were able to replicate the color of the colored paper with the RGB values we calculated from the data.

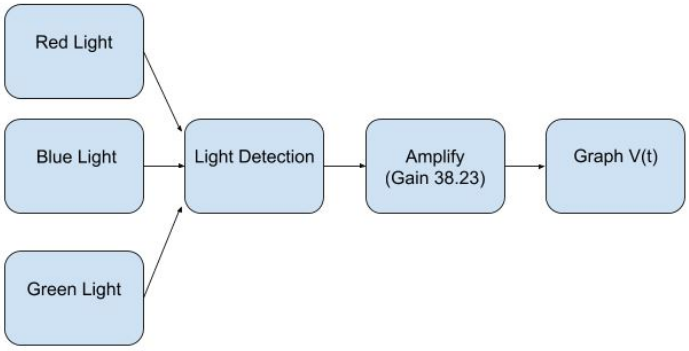

Figure 1: General block diagram of our project

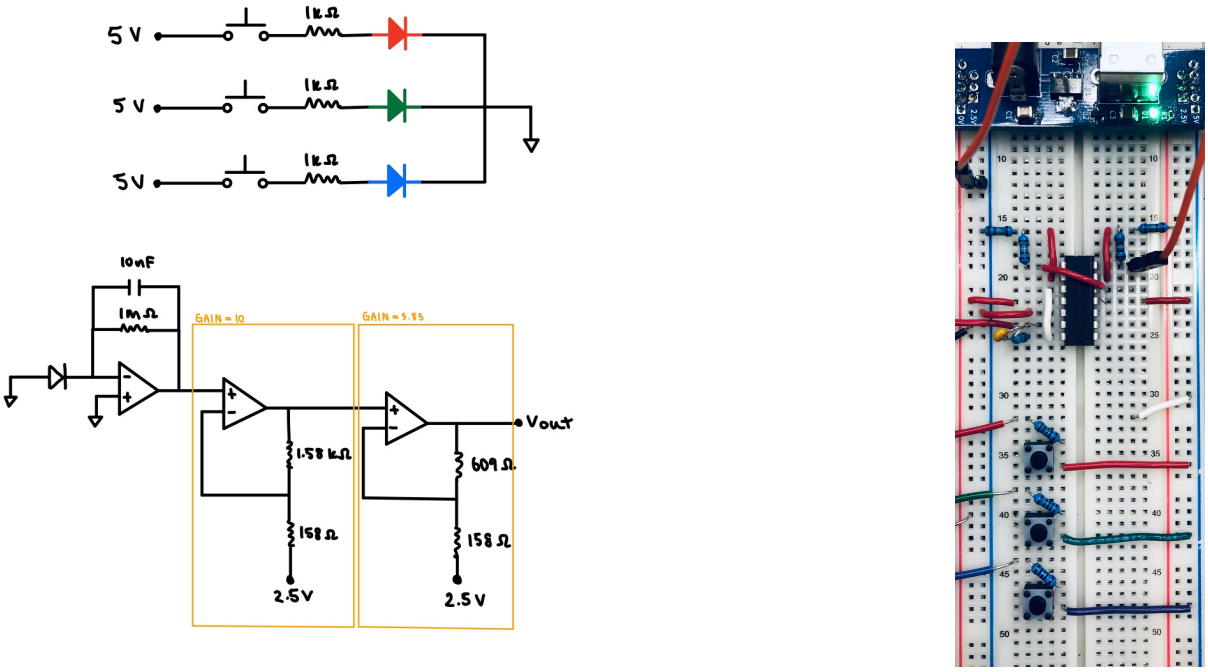

Figure 2: Left: The schematic of the circuit. The total amplification gain is 38.23. Right: final circuit configuration.

Color	R_Voltage	G_Voltage	B_Voltage		R_%	G_%	B_%		R_RBG	G_RBG	B_RBG
White	4.81	3.43	3.61								
Black	2.92	2.77	2.77								
Range	*1.89*	*0.66*	*0.84*								
Light Blue	3.89	3.3	3.66		51.32	80.303	105.952		130.873	204.773	270.179
Salmon	4.81	2.94	3.11		100	25.758	40.4762		255	65.6818	103.214
Pale Yellow	4.81	3.42	3.23		100	98.485	54.7619		255	251.136	139.643
Purple	4.66	3.06	3.46		92.06	43.939	82.1429		234.762	112.045	209.464
Neon Pink	4.81	3.21	3.52		100	66.667	89.2857		255	170	227.679
Muted Green	4.06	3.28	3.12		60.32	77.273	41.6667		153.81	197.045	106.25

Figure 3: Data

2 RGB Intensities of All Colors Measured

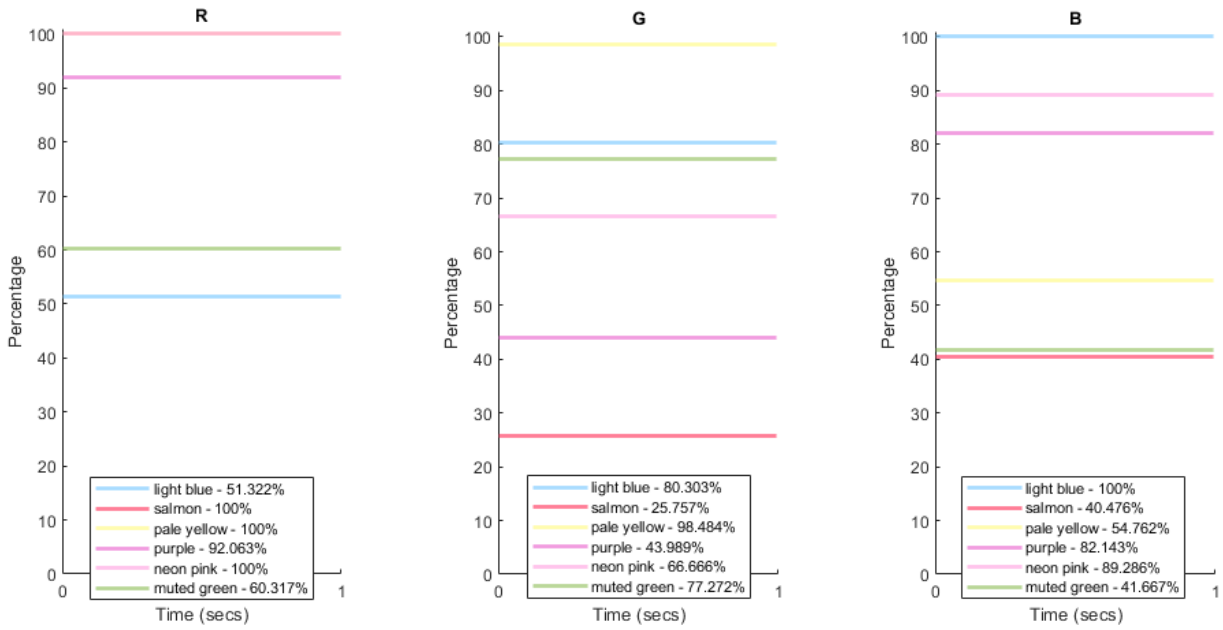

Figure 4: RGB values of all 6 colors we tested plotted. The color of each line corresponds to the actual paper color.

3 RGB Values of Each Color Measured

Figure 5: The first graph shows the intensity of red, green, and blue from a scale of 0-100 for ease of comprehension. The RGB value attained from the data is [130, 204, 270]. The second figure is color obtained from the RGB value. The third figure is the color of the index card.

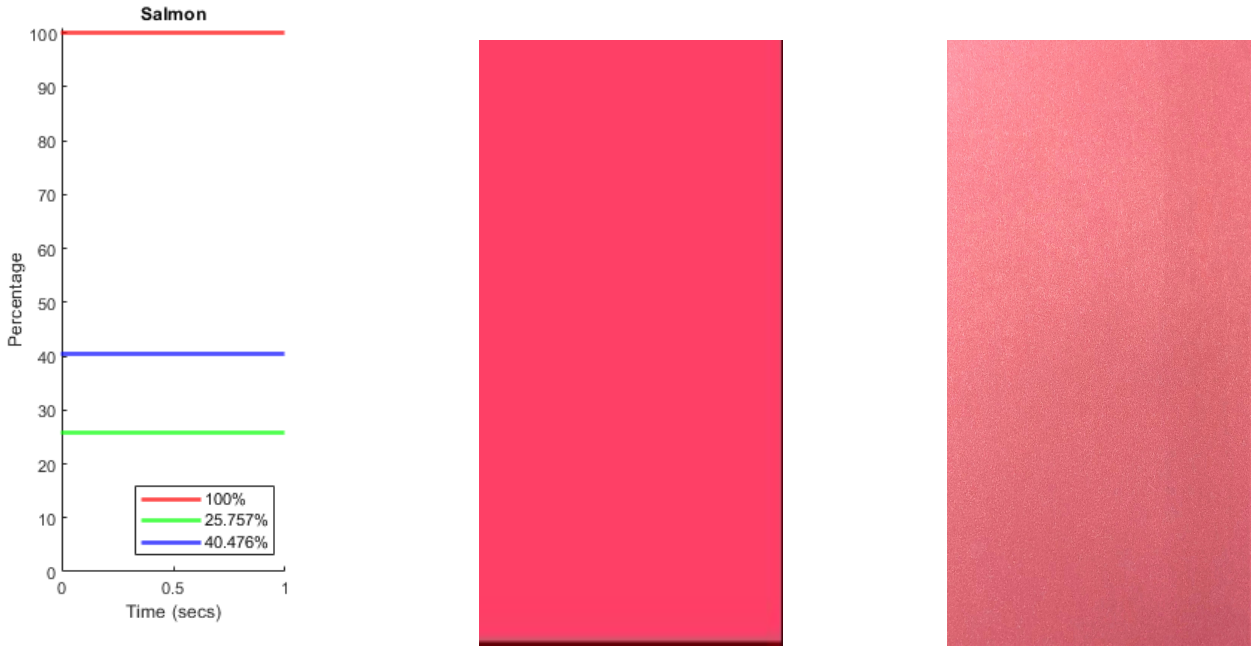

Figure 6: RGB: [255, 66, 103]

Figure 7: RGB: [255, 251, 139]

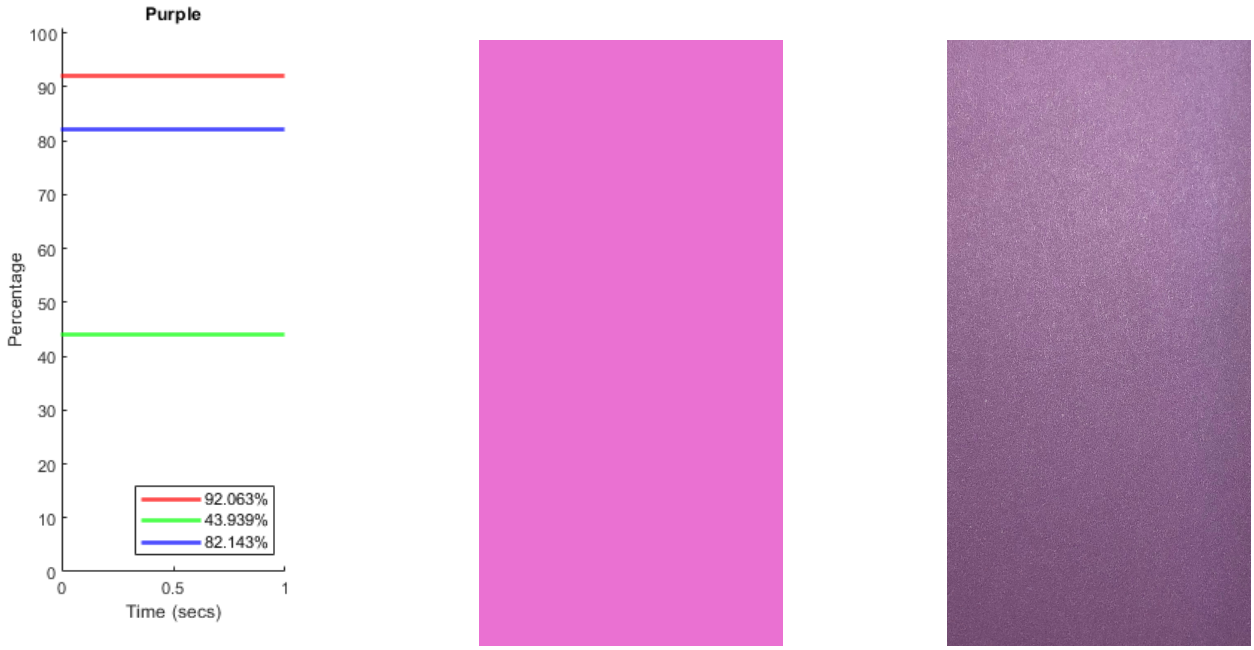

Figure 8: RGB: [234, 112, 209]

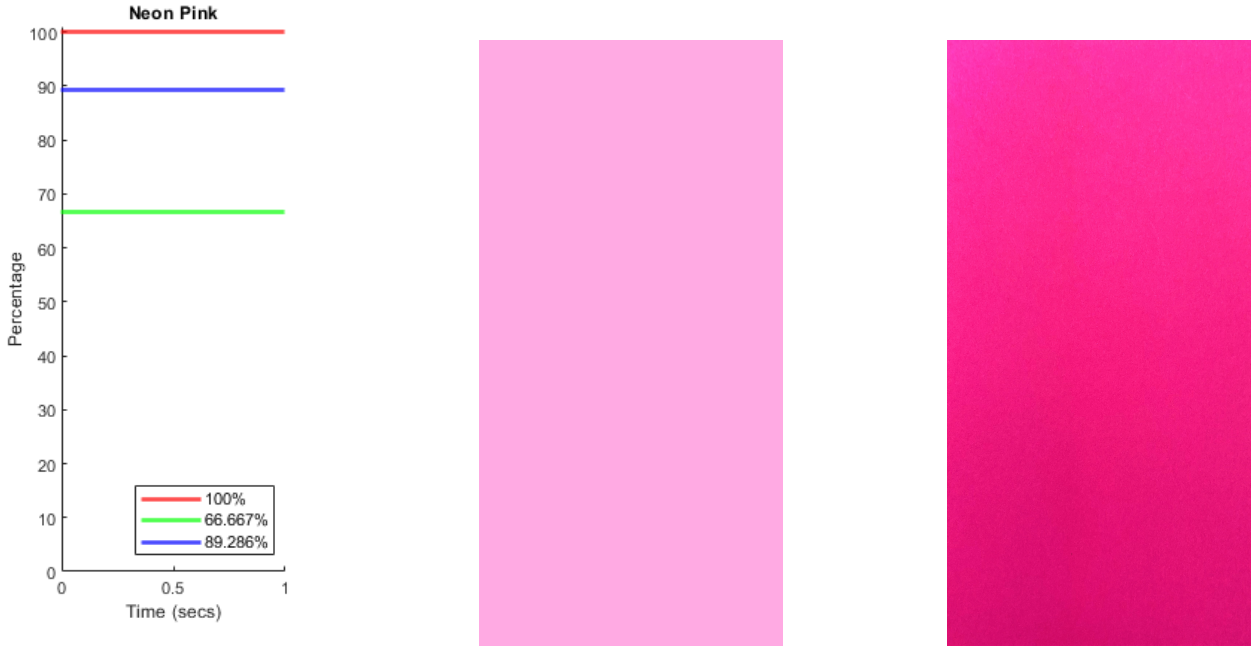

Figure 9: RGB: [255, 170, 227]

Figure 10: RGB: [153, 197, 106]