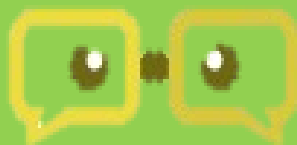


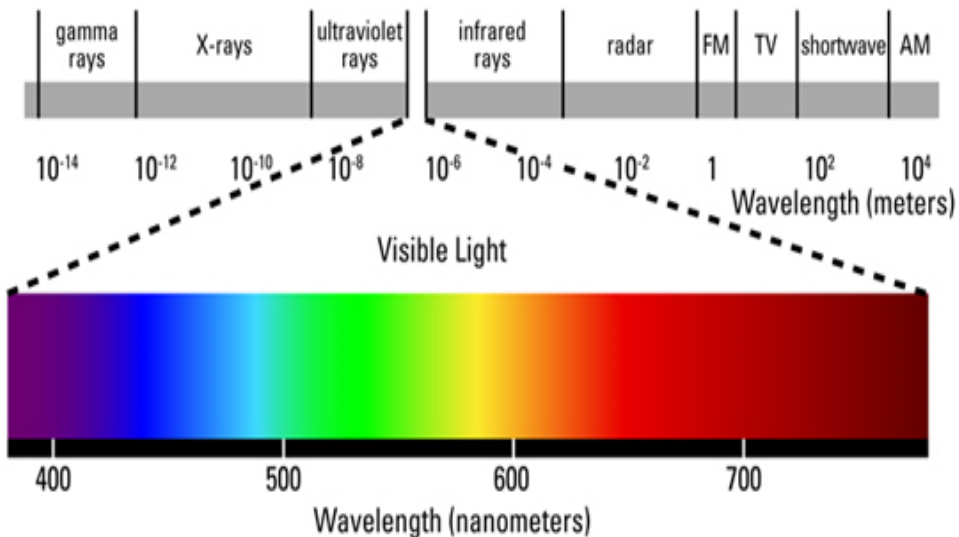
RainbowCam

FUNWITHOPTICS KIT



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Optical Principle Colors



Color	Wavelength
violet	380–450 nm
blue	450–495 nm
green	495–570 nm
yellow	570–590 nm
orange	590–620 nm
red	620–750 nm

Newton showed that white light is made up of colors (VIBGYOR). Different colors can be constructed by addition of these basic colors. Light was then classed as waves with the visible range having a wavelength from 380 -780 nm. Each different wavelength within the visible spectrum can be linked to a different color. In the digital age, the color gamut as it is called, can be formed by mixing of 3 basic colors – Red, Green and Blue. All digital devices such as CCD/CMOS cameras, Monitors and Displays and Light Emitting Diodes(LEDs) use the color gamut to describe colors. THE CIE1931 color space was setup to link the physical colors (wavelengths) to colors perceived by human vision.

LED

Light Emitting Diodes (LED) are a new breed of light sources which are rapidly replacing conventional sources for their efficiency and tunability. LEDs are commonly available as Red, Green and Blue colors with typical wavelengths centred at 625 , 525 and 470 nm. Addition of these different RGB values provide the range of visible light colors. While each LED is identified by its wavelength, the addition of different LED wavelegths while giving the visual perception of a particular color does not show the single spectrum of that color. **Hence the need to better understand wavelength and color.**

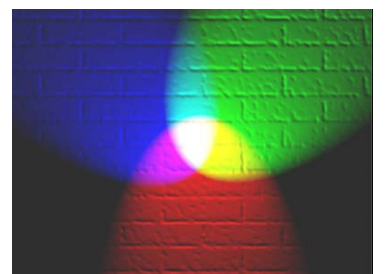
RGB Color Model

A frequent way of referring to colour on computer screens is by using the RGB colour model.

The RGB color model describes a color by using 3 variables, Red, Green and Blue. These variables can be compared to the strength of the signals from the 3 types of color receptors in the nerves and can make each type brighter or darker independently, exciting the correct receptors of the eye to create the desired color.

The RGB color model is an additive color model in which red, green, and blue light are added together in various ways to reproduce a broad array of colors.

Computer perceive a 24-bit color wherein each of the 3 components R, G and B is an 8-bit variable that can be an integer number between 0 and 255, giving a total value of 16.7 million possible colors. 0 means the color component is off (black), while 255 means it's at its full intensity. 127 is half intensity.

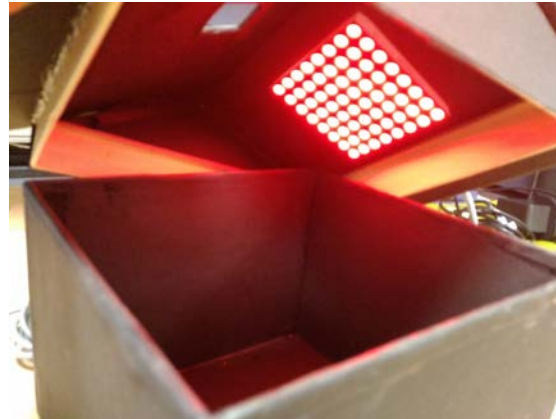


Experiment Setup and Procedures

The RainbowCam is based on the RGB color model. It consists of 64 LEDs which display colors over the entire range of the visible spectrum by changing its RGB values.

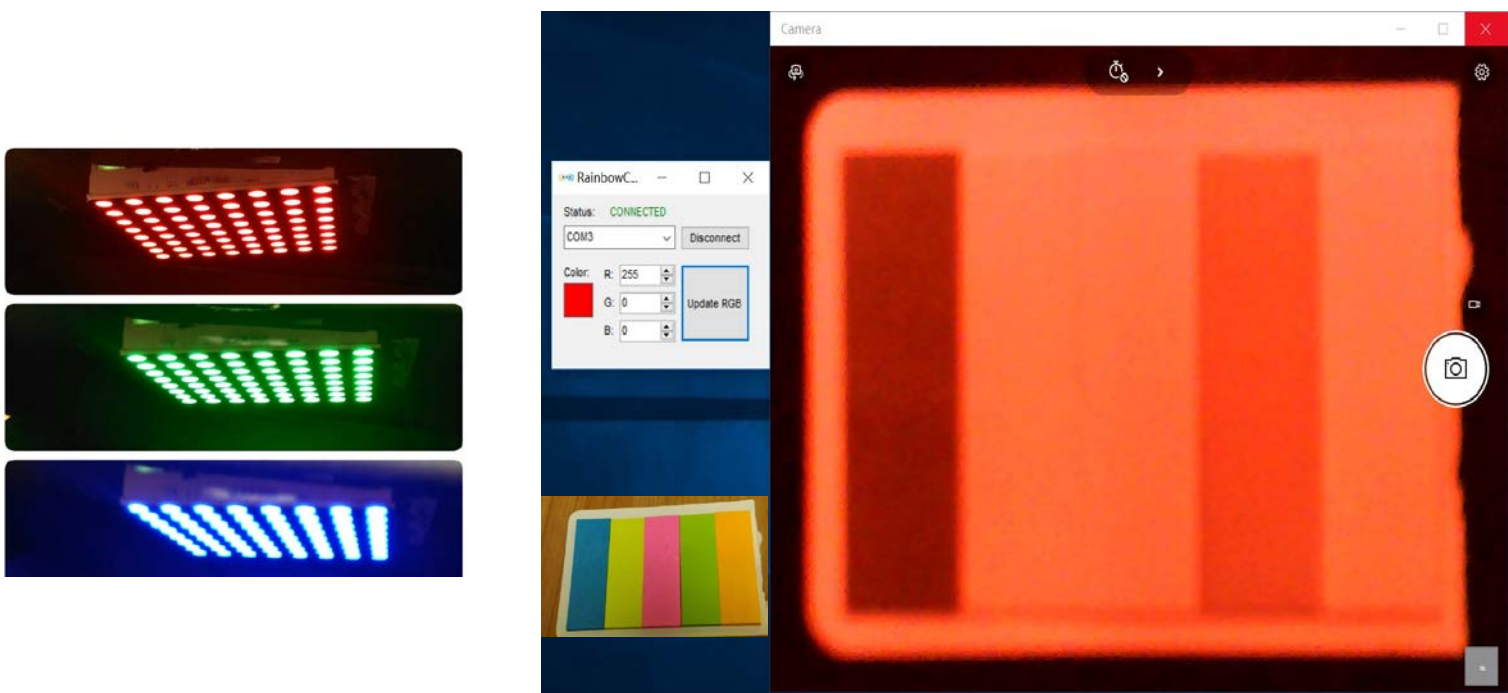
Experiment

As we have learnt, different colors have different wavelengths and combination of RGB Values. In this experiment, we will change the RGB values in the program to obtain different colors.



Steps

1. Connect the LED matrix and the camera to the computer
2. Launch the RainbowCam program, select the port and click on connect
3. Enter the RGB values for a particular color (eg. For red, R=255, G=0, B=0)
4. Click on 'update RGB' after each change of RGB values to run the program
5. The RainbowCam will light up with the corresponding color once uploading is completed
6. Insert a sample of a pure color in the box.
7. Capture the image on the camera software and save it.
8. Complete the table in the logsheet by trying out different RGB combinations and verifying them on RainbowCam
9. Repeat step 6 to 8 for different objects



Camera and color control interface

Discussion

Discussion and Additional projects

1. How to convert wavelength to RGB values?
2. Based on your observations of Experiment 2,
How do Red, Green and Blue interact with different color on the rubric cube?
Why are some parts of the rubric cube darker than others when the RainbowCam is shining on it?
3. A color model is simply a way to define colors. Name 3 color models, besides RGB color model, and describe how they define colors.
4. What are the characteristics of color?
5. How can we reproduce color?
6. A project to design an experiment that mimic the theory of color and light, using the RainbowCam.

Write a report comprising:

1. Experimental data and interpretation
2. Literature and web research
3. Personal discoveries and reflection

Reading References

Lode Vandevenne. (2004). Light and Color
Retrieved from <http://lodev.org/cgtutor/color.html>

Wikibook. (2016). Color Models: RGB, HSV, HSL
Retrieved from https://en.wikibooks.org/wiki/Color_Models:_RGB,_HSV,_HSL
The Muser, Physics and Psychology of Color. (2016). The characteristics of Color
Retrieved from
<http://www.greatreality.com/color/ColorHVC.htm>

Pantone. (2016). What are other ways to define color
Retrieved from
<https://www.pantone.com/what-are-other-ways-to-define-color>

Pantone. (2016). How can we reproduce color
Retrieved from
<https://www.pantone.com/how-can-we-reproduce-color>

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