RGB Color Mixing Toy

Introduction:

This project is a simple red, green, and blue light emitting diode toy intended for beginners in electrical and computer engineering. In this mini-project you can create a simple RGB color mixer with the parts found in your ECE master or mini kit. Any spare parts can be picked up in the Electrical Engineering building's ECE shop room EE162. This simple toy will help you understand the foundation of color mixing at a rudimentary level. These concepts can be applied to many other LED applications.

Procedure:

Using the parts list described in the RGB Color Mixing Toy tab in the ECE projects webpage; use the following instructions to build the toy.

The RGB LED used in this example is a common anode, meaning that of the four pins that are leading off of it one pin will go directly to a power supply for the entire LED and the other 3 pins will sink the current running through the LED itself. Because of this configuration it is important to supply the LED with the right amount of voltage and forward current as described on the datasheet. If too much is supplied the diode will not be able to dissipate the energy and will break. A simple 5V supply is given in your ECE lab kit. It should produce more than enough current necessary for the simple circuit. The first step is to create a voltage divider to supply the correct 3V to the LED from our 5V supply.

- If you have not already, cut and strip the end DC adapter off of the supply and power the rails of your breadboard with it. Binding posts that are given to you in your lab kit are a good way to attach the supply wire. In our example alligator leads were used.
- Obtain a near 3V node from the supply. The simple voltage divider comes in handy here. The equation used below is the design we chose for the circuit. Since the data sheet specifies max voltage for G and B pins is 3V and the R pin is 2V.

Voltage Divider Equation:

$$Vout = Vin * (R2 / (R1 + R2)) \Longrightarrow 5V * (560\Omega / (330\Omega + 560\Omega)) = 3.146\ V$$

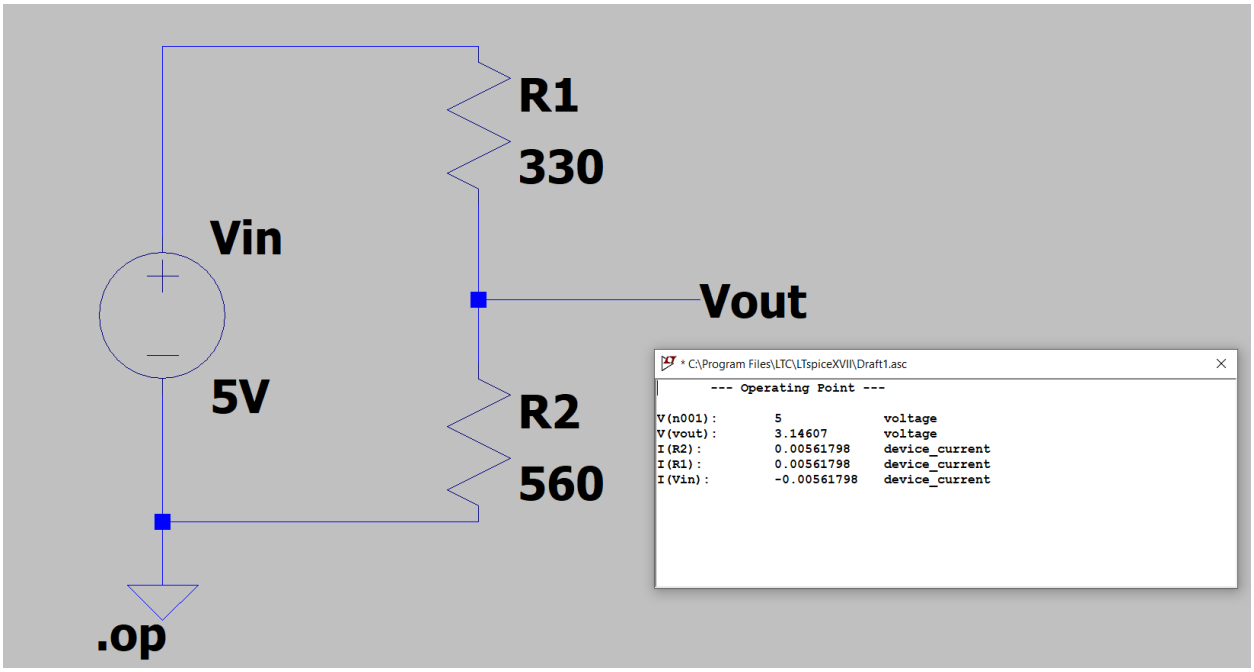

Figure 1: Simple voltage divider

Now that we are supplying the correct voltage we can move on to wiring the rest of the circuit. The amount of current flowing through a light emitting diode determines its brightness; using this principle, an RGB diode has 3 different diodes in one unit, adjusting the current going through each one can produce almost any color in the spectrum of our visible light. In this toy we will be using 3x 10k potentiometers found in your ECE kit to adjust the amount of current we are sinking through each individual diode in the component.

- Begin by placing the LED into the breadboard. The longest lead on the LED is the supply pin. This should go into the middle node in the voltage divider circuit.
- The remaining three pins should each go onto a separate node in the breadboard so 4 adjacent lines are taken up by the diode unit. These remaining pins are the RGB channels.
- Wire the RGB channels over to three separate 10k potentiometers. The current going in to the potentiometer should go into one of the potentiometers outermost pins, since there are three.
- For each potentiometer another wire should then get places from the center pin of the potentiometer and be linked to ground. (Ground rails should all be connected to the 5V supply.)

Plugging the circuit in you should now see the LED light up! Adjust the potentiometers and play around with the device to see what colors you can make!

By changing the energy potential drop across the variable resistor the energy sunk through each diode can change. If you're having a hard time seeing the differences hold a white piece of paper over the LED to better diffuse the light. The farther away you hold the paper you can also see the separation of the colors.

If you are having any trouble be sure to check the overview video of the RGB color mixing toy attached to this section of the ECE projects page.

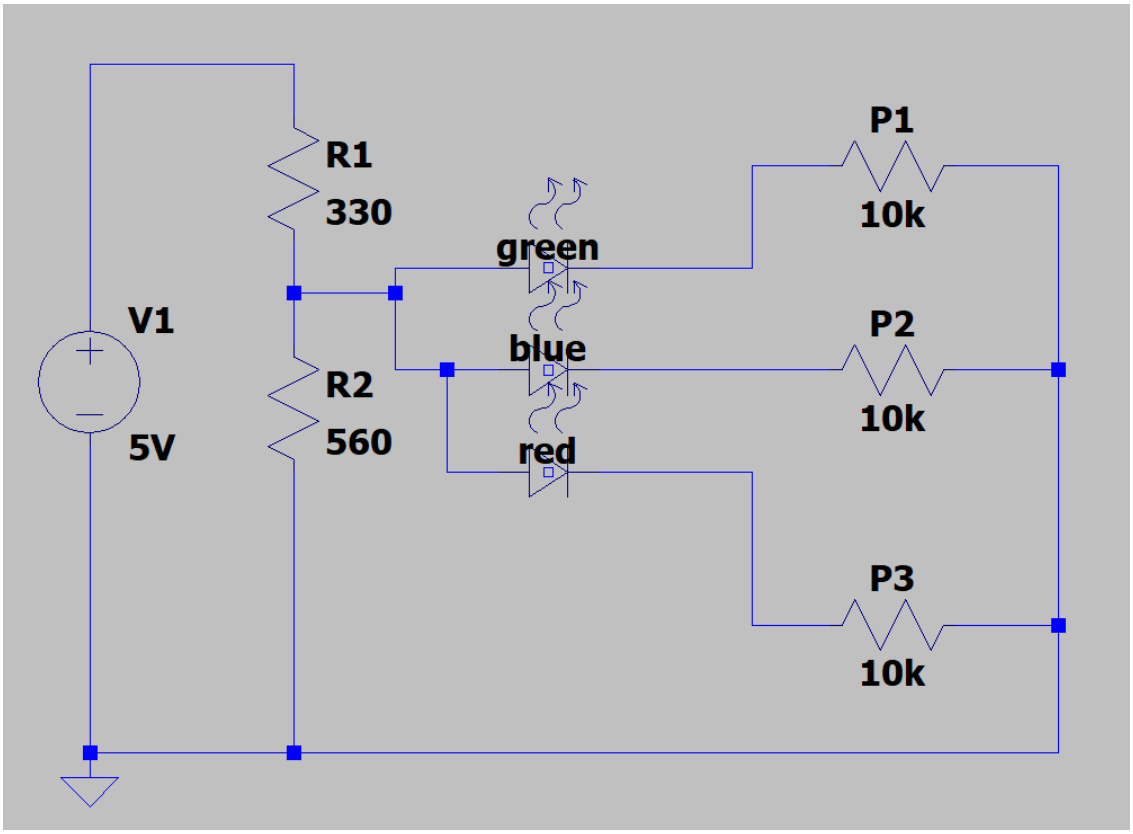

Figure 2: Completed circuit LT spice model

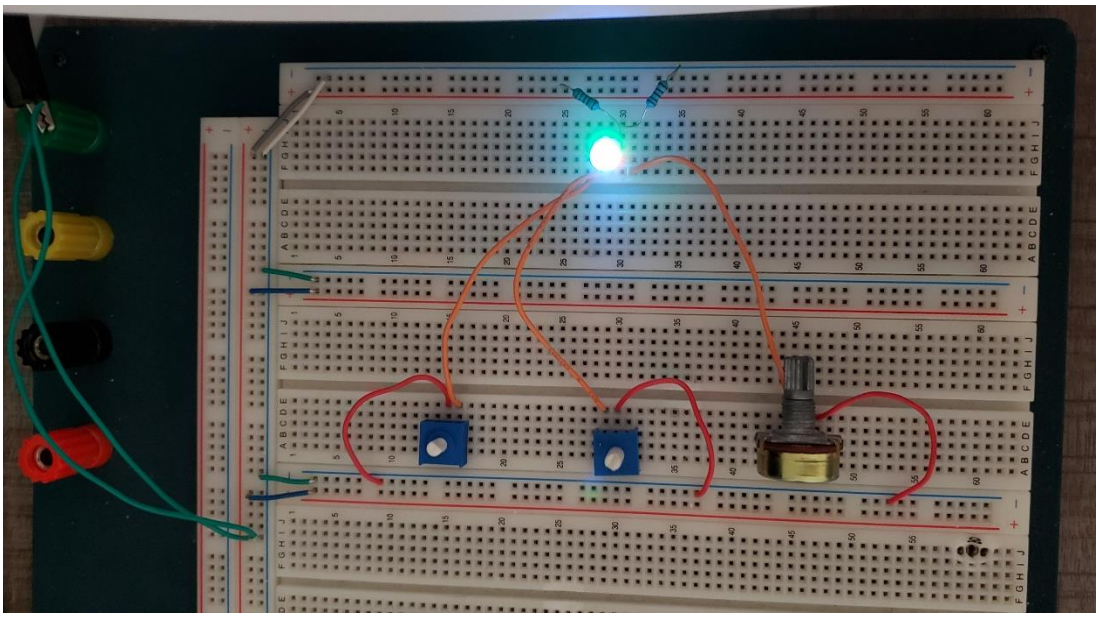
Figure 3: Example (3 different potentiometers are used but they are all rated for 10k Ω)