Camryn Shilling PHY 202

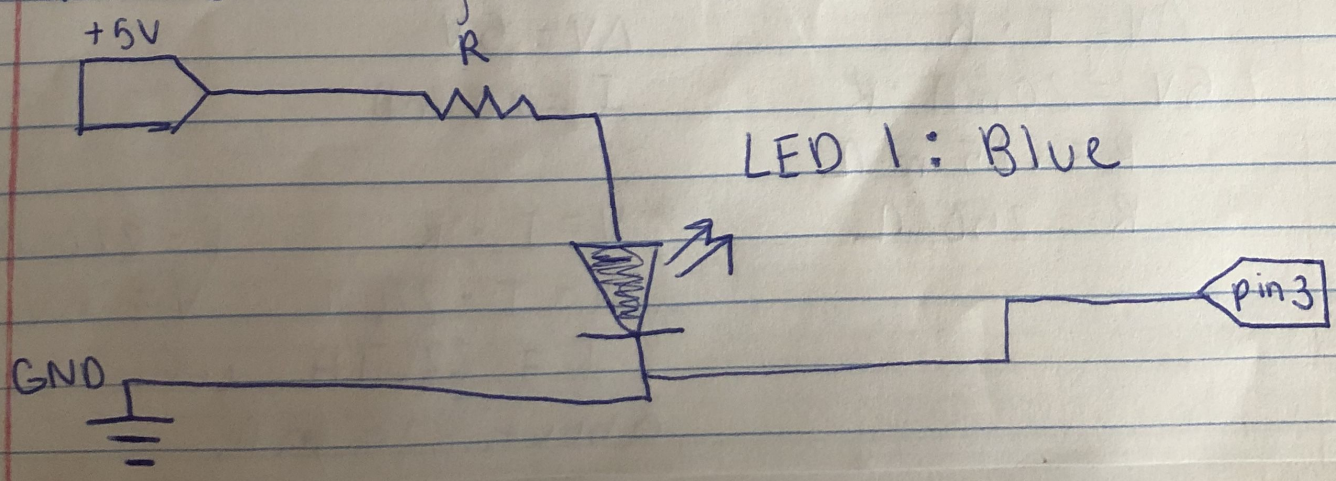
Lab #3: Controlling Circuits with Arduino

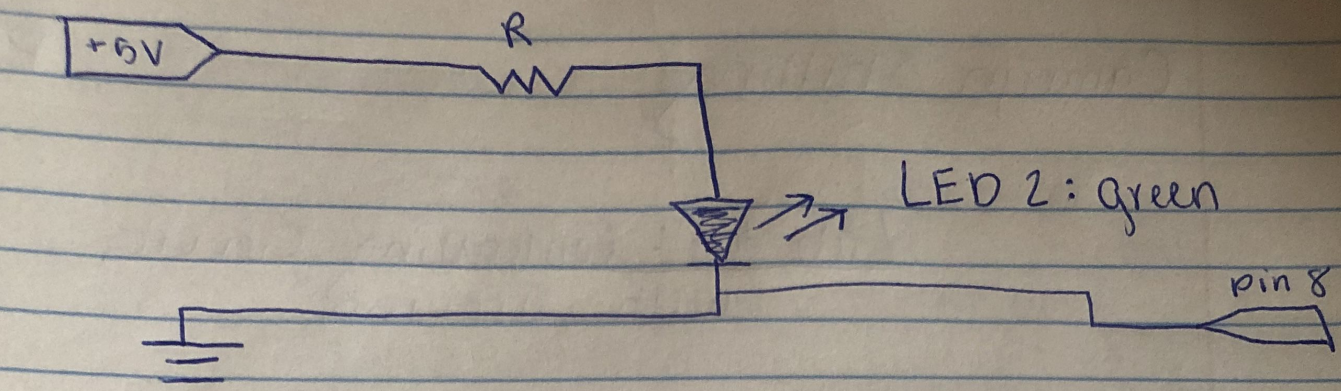
Introduction:

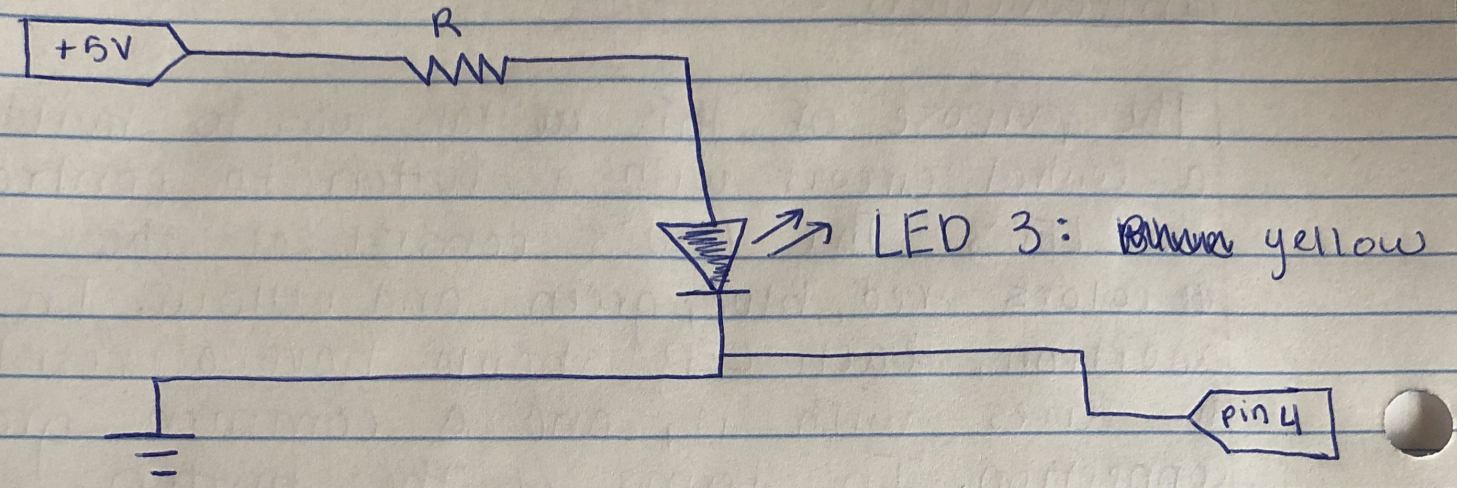
The purpose of this lab was to build a control circuit with a button to control the LED's. The LED's consist of the colors red, blue, green and yellow. In addition, each LED should have a resistor in series with it, and a common ground connection. In terms of the button, pressing it on and off relates to the resistance being allowed. Furthermore, the arduino code that is produced should cause the LED's to blink together in a particular pattern. Lastly, the code will be modified in some way to stop the blink pattern after a period of time.

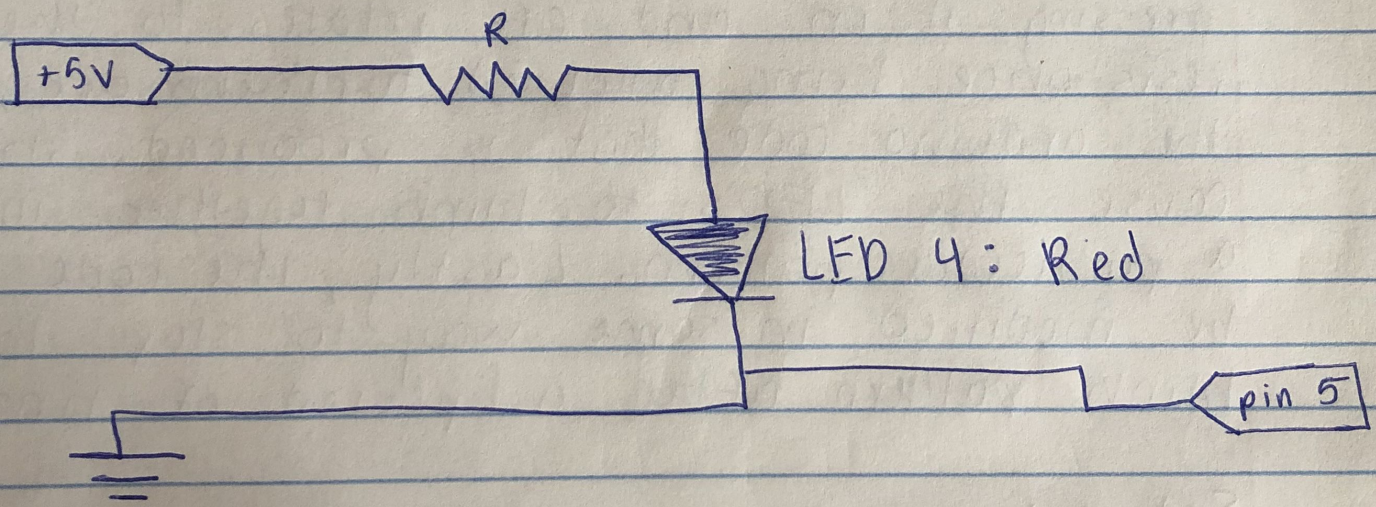
Setup:

1. Circuit Diagrams









2. Justify 220 Ω resistor

$\Delta V = I \cdot R$

$5V = 20mA \cdot R$

$R = .25\ m\Omega$

$R = 250\ \Omega$

$\Delta V = 5V$

$I = 20\ mA$

$V = I \cdot R$

$5V = I \cdot 220\Omega$

$I = 22.7A$ which is about $20\ mA$.

$R = 220\ \Omega$

$V = 5V$

3. Resistance:

$\Delta V = I \cdot R$
$5V = .5mA \cdot R$
$R = 10m\Omega$
$R = 10,000\Omega$

$\Delta V = 5V$
$I = .5mA$

4. Copy of Arduino Code attached here:

Data and Analysis:

1. The basic rules for wiring things correctly using a breadboard include connecting the arduino board and the board using jumper cables. Such that, we bring the +5V source from the arduino board to the positive power strip. In addition, we connect the ground source to the negative power strip. Also, we need to use resistors to prevent too much current from going through the LED. The LED's must be wired so the current flows from the anode to the cathode, however the resistor can be flipped whichever way in the circuit and will act the same. In addition, when adding a button to the breadboard, it should be connected in a way that it will have access to the 5 volt supply and ground.

2. LED stands for Light emitting diode.

3. The two types of materials that are used to make an LED are called N-Type semiconductor and P-type semiconductor. Dislodged electrons leave behind "holes" into adjacent electrons. In addition, these holes act as positive charges and pure semiconductors have equal amounts of positive and negative charge carriers which are holes and electrons. When an electron and a hole combine

it forms a PN junction.

4. Resistors are important to have in series with an LED because it limits the amount of current through the LED so that it does not burn out.

5. ΔV for Blue LED = 2.7 V ΔV for green = 1.7 V

ΔV for yellow LED = 1.8 V

ΔV for red LED = 1.8 V

6. When wiring two LED's of different color parallel to eachother, the voltage is constant. However, the current source increases. Since the LED's are parallel, one LED will recieve more current than the other, thus will be brighter and most likely burn out. As for the other LED, it won't get enough current and will be much dimmer. This is because current is not constant through the resistors in paralle

7. $\Delta V = I \cdot R$

Blue LED:
$2.7V = I \cdot 220\Omega$
$I = .012\ A$

yellow LED:
$1.8V = I \cdot 220\Omega$
$I = .008\ A$

green LED:
$1.7V = I \cdot 220\Omega$
$I = .0077\ A$

red LED:
$1.8V = I \cdot 220\Omega$
$I = .008\ A$

8. When doubling the resistance in series, the current remains constant. Therefore, the LED light will be dimmer because more resistance was added but not more current.

9. The resistor is being used to limit current through the circuit, therefore it can be placed on either side of the LED. However, voltage effects both the LED and resistor. Such that, the LED has forward voltage, and whatever amount of voltage there is will cross the resistor. The current will be the same for both the LED and resistor.

10. When pressing the button, the voltage between the button and the resistor changes because now there is a connection between it's two legs. Meaning, it will now be connected to the voltage source. When the button is pressed, it allows current to pass through and the LED will turn on.

Conclusion:

When splashing a small drop of water on the screen, while using a white background, colors seem to appear. The colors seem to be pixely including colors red, blue, and green.

1080 pixels horizontally by 1920 pixels vertically

refresh rate = 60hz

$(1080 \cdot 60) + (1920 \cdot 60)$

$64800 + 115200 = 180,000$ calculations/sec for one color

red, blue, green = triplet of LED's

$180,000(3) = 540,000$ calculations per second

In order to create a large, full color, LED display system there are a few different things to you can do. One thing in this lab that we added was more LED light circuits. Furthermore, we fixed a code such that it would make the LED's blink on demand. In conclusion, there are multiple ways to create different display systems by editing the code.