

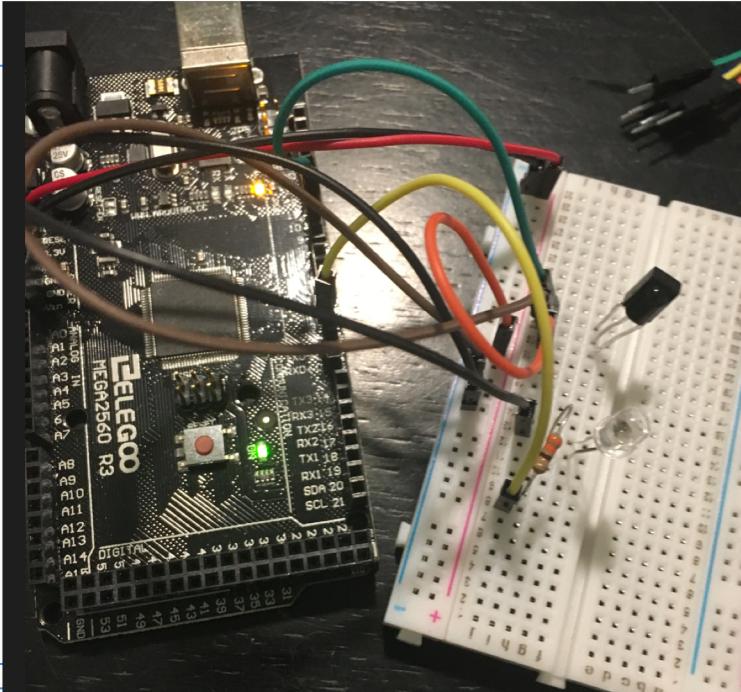
Lab 1: Communication

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Objective

The objective of this lab is to learn how to use IR LEDs and IR receivers, and use a remote to communicate with them. And also use a remote to change the color of an RGB led.

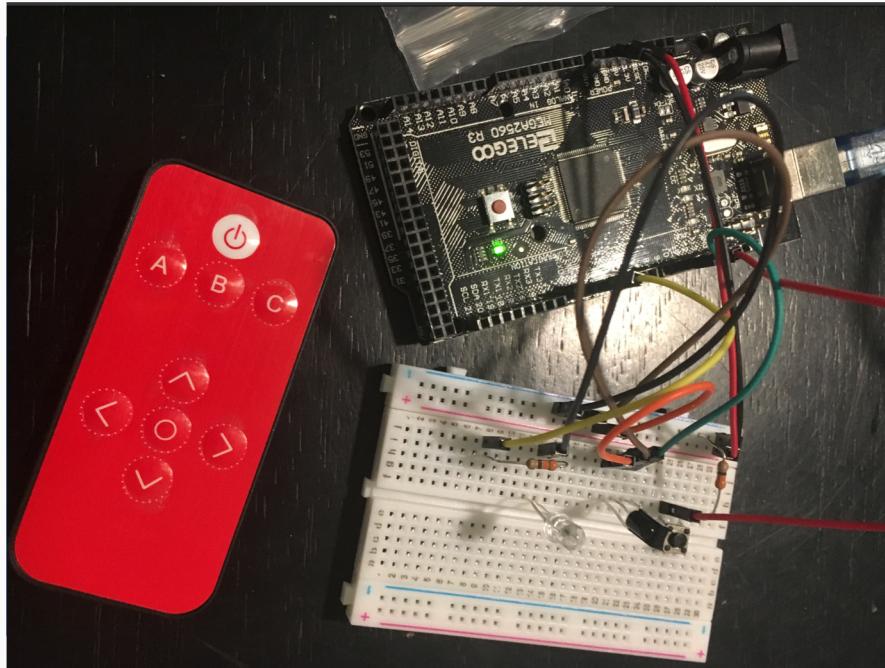
Lab 1: Challenge #1



```
1 #include <TimerOne.h>
2
3 const int ledPin = 3;
4 const int sensorPin = 11;
5 int lightLevel;
6 void setup() {
7   Serial.begin(9600);
8   pinMode(sensorPin, INPUT); // Input to Arduino
9   pinMode(ledPin, OUTPUT); // Output from Arduino
10  Timer1.initialize(26); // set a timer of length 26 microseconds (or 38kHz)
11  Timer1.attachInterrupt(callback); // attach the routine that will happen at the i
12 }
13
14 void loop(){
15   lightLevel = digitalRead(sensorPin);
16   Serial.print("The IR Sensor is reading:");
17   if (lightLevel == 0) {
18     Serial.println("IR Communication ON");
19   }
20   else {
21     Serial.println("IR Communication OFF");
22   }
23   delay(500); // delay to slow serial monitor output
24 }
25 void callback() // time sensitive function to toggle the IR LED
26 {
27   digitalWrite(ledPin, digitalRead(ledPin) ^ 1); //Toggle the IR LED
28 }
```

The setup shows an IR led connected through a resistor to a PWM pin, and the receiver connected to another pin for reading. The code reads the IR sensor every 500ms and toggles the LED every 26us. I toggled the IR led at 38kHz by interrupting it every 26 microseconds which corresponds to a frequency of 38kHz ($1/26\mu s = 38\text{kHz}$). This is important because IR communication is standardized to that frequency so it reads at that frequency.

Lab 1: Challenge #2



This setup has an IR led and a receiver with a button. Each button press on the remote sends a hex code to the Arduino and when the button is pressed it sends that signal on the IR led that can be used to control other electronics.

Lab 1: Challenge #2



Paste HEX Code Recorded
(Choose 6 buttons)

Example: 0x10EF0E0F

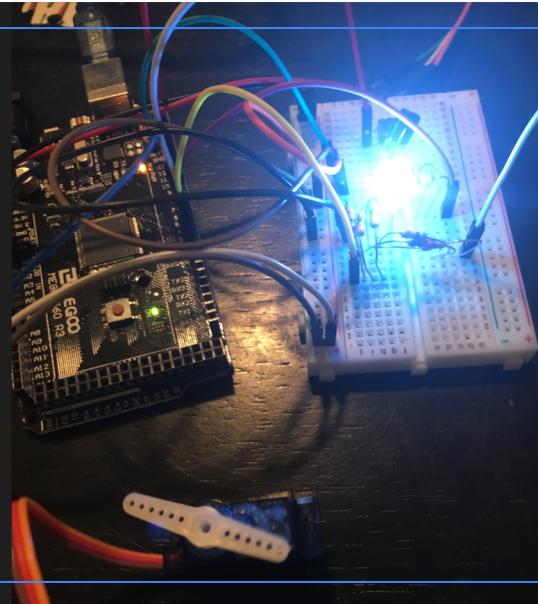
- | | |
|--|----------|
| | 0xFF629D |
| | 0xFF22DD |
| | 0xFF02FD |
| | 0xFFC23D |
| | 0xFF9867 |
| | 0xFF30CF |
| | 0xFF18E7 |
| | 0xFF7A85 |
| | 0xFF38C7 |

Lab 1: Challenge #3

```
#define ON_OFF_KEY 0xFF629D
#define TOGGLE_COLOR_KEY 0xFF22DD
#define BRIGHTNESS_UP_KEY 0xFF9867
#define BRIGHTNESS_DOWN_KEY 0xFF38C7
#define CIRCLE_KEY 0xFF18E7
#define CUSTOM_FUNCTION_KEY 0xFFC23D
```

```
void rainbow(){
    red=0;
    green=0;
    blue=0;
    Serial.println("Party time");
    for(int i=0; i<255; i++){
        for(int j=0; j<255; j++){
            for(int k=0;k<255; k++){
                red=random(255);
                green=random(255);
                blue=random(255);
                setColor(red,green,blue);
                servoSpeed = (red+green+blue)/3;
                analogWrite(servoPin, servoSpeed);
                delay(500);
            }
        }
    }
}
```

Challenge #3



This figure shows the RGB led lit to a shade of blue and the servo is in a specific position. The servo moves a specific amount depending on the average of the RGB values.

What did you learn? Most was stuff I had learned in previous classes, but I had never learned how to work with a servo but it was pretty simple to use.

How does an RGB LED work? What is Pulse Width Modulation? RGB led works by setting a specific voltage on each pin that correlates to 0-255 for RGB scale. PWM is varying the period of a square wave to create a signal that parts can react to using the duty cycle.

Explain why an IR LED and receiver work much more effectively than a visible light (LEDs) receiver and transmitter? An IR led is better because it is invisible light so it is not affected by ambient lighting.

Experience

The most valuable part of this lab was getting to play with a remote, those are always fun and I remember in ECE 25 my favorite lab was the one with the remote. I didn't try extending anything I learned in this lab but I am planning on it due to my other project classes this quarter.

I did not take any other pictures for this lab. Another idea to continue on with this is to create functions that could send a specific set of commands to something like a TV using a single button on the remote. I.e. turn the tv on, set the volume to a specific level, set the input to a specific one all at once.