

# Synesthesia Glove Tutorial

*Goal:* To build a synesthesia glove that takes in inputs from the visible spectrum (RGB inputs) as well as infrared and ultraviolet light inputs, and outputs pitches based on the light wavelengths and intensities. In other words, the glove converts light into sound.

## *What is Arduino?*

Arduino is a hardware and software platform used for building DIY electronics projects. Arduino boards can be programmed through the Arduino IDE (download here: <https://www.arduino.cc/en/Main/Software>). Arduino boards can be programmed to take various real-world inputs (like sensing light and/or color) and create outputs (like turning on an LED or playing sounds).

Optional Links to Learn More:

Introduction: <https://www.arduino.cc/en/Guide/Introduction>

Arduino Programming Language: <http://www.arduino.org/learning/reference>

Arduino IDE examples: <http://www.arduino.org/learning/tutorials/ide-examples>

## **Steps for building the Synesthesia Glove**

1. Test and connect the color sensor and test the neoPixel.
2. Test and connect the audio driver
3. Test audio driver with the color sensor
4. Test the color sensor and the IR/UV sensor (optional)
5. Attach all the components to the glove.

## Test and connect the color sensor

1. Install the necessary drivers for the arduino sensors. Go to the “Synesthesia Libraries” folder:

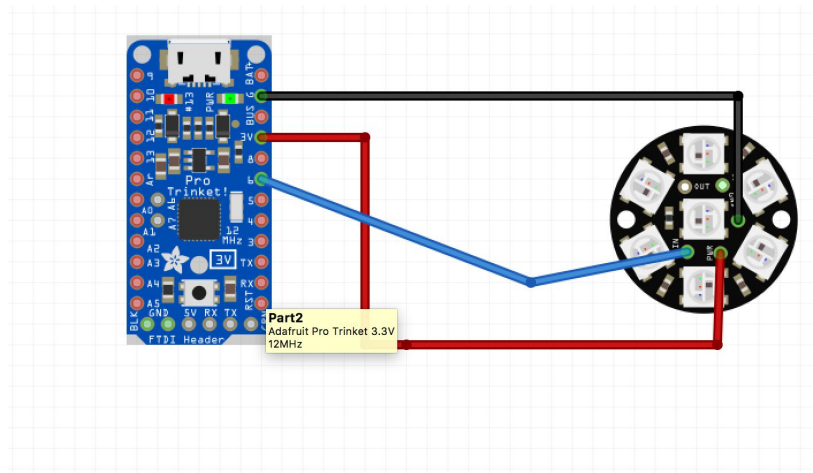
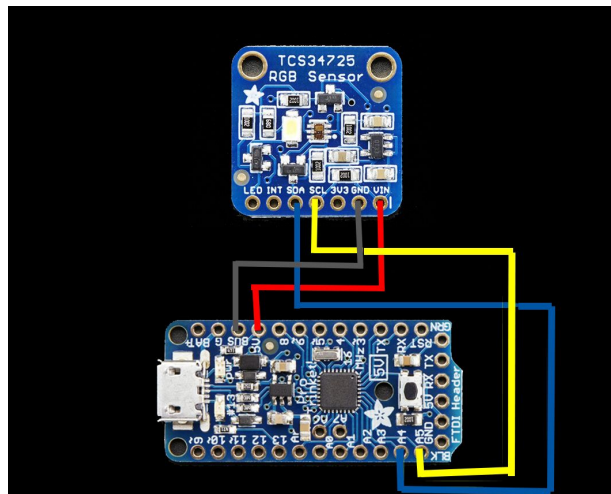
(Dropbox → ASU Course → Hardware → Glove → Arduino → Synesthesia Libraries)

Copy all the subfolders into your own ‘libraries’ folder within your ‘Arduino’ folder.

2. Solder each arduino, following the guidelines and safety tips taught:

- Take the line of solder in one hand and the hot wand in the other
- Touch the tip of the solder and the tip of the hot wand onto each pin on the arduino. The solder should melt onto the tip.
- Hold the hot wand on each tip so that the melted solder lowers on each pin and is neatly wrapped around.

3. Follow the circuit diagram to connect and complete the components:



4. Open colorview code on arduino:

(Dropbox → ASU Course → Hardware → Glove → Arduino → RGBsensorsTest → RGBsensorsTest.ino)

The code The code should look like this:

A screenshot of the Arduino IDE interface. The title bar reads "colorview | Arduino 1.6.12". The menu bar includes "File", "Edit", "Sketch", "Tools", and "Help". The toolbar contains icons for a checkmark, a circular arrow, a document, an upload button, and a download button. The main text area shows the following code:

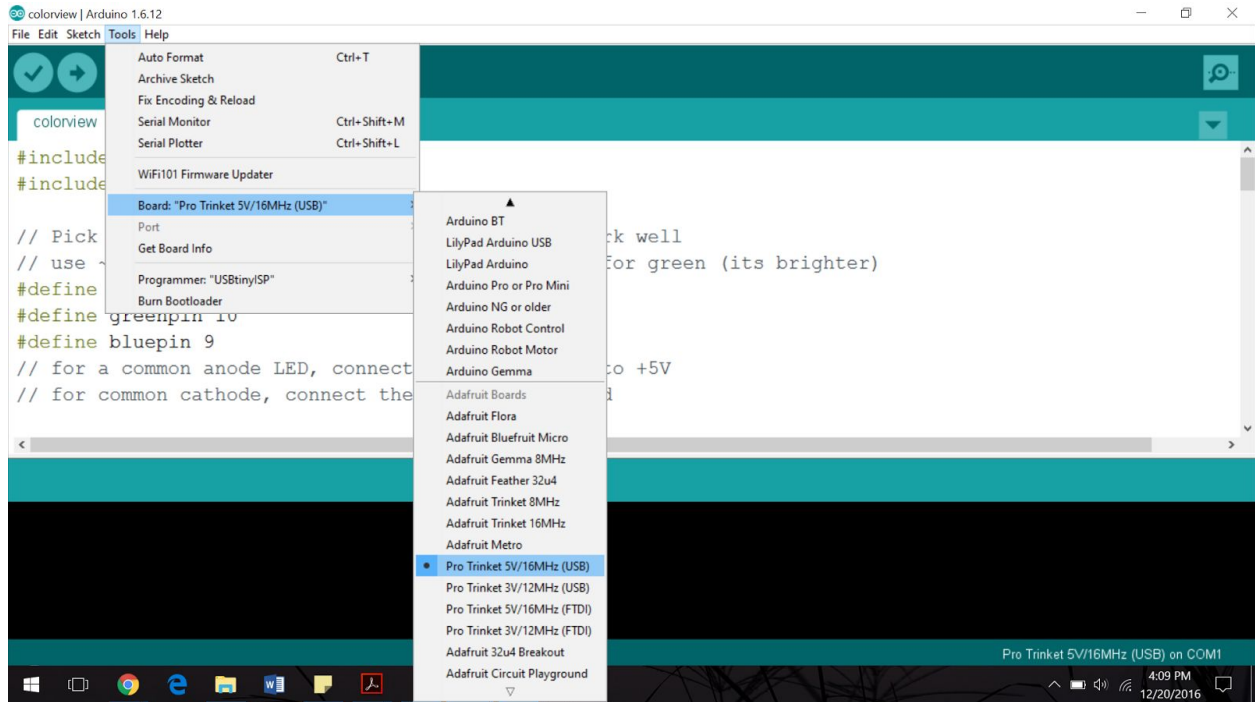
```
#include <Wire.h>
#include "Adafruit_TCS34725.h"

// Pick analog outputs, for the UNO these three work well
// use ~560 ohm resistor between Red & Blue, ~1K for green (its brighter)
#define redpin 11
#define greenpin 10
#define bluepin 9
// for a common anode LED, connect the common pin to +5V
// for common cathode, connect the common to ground
```

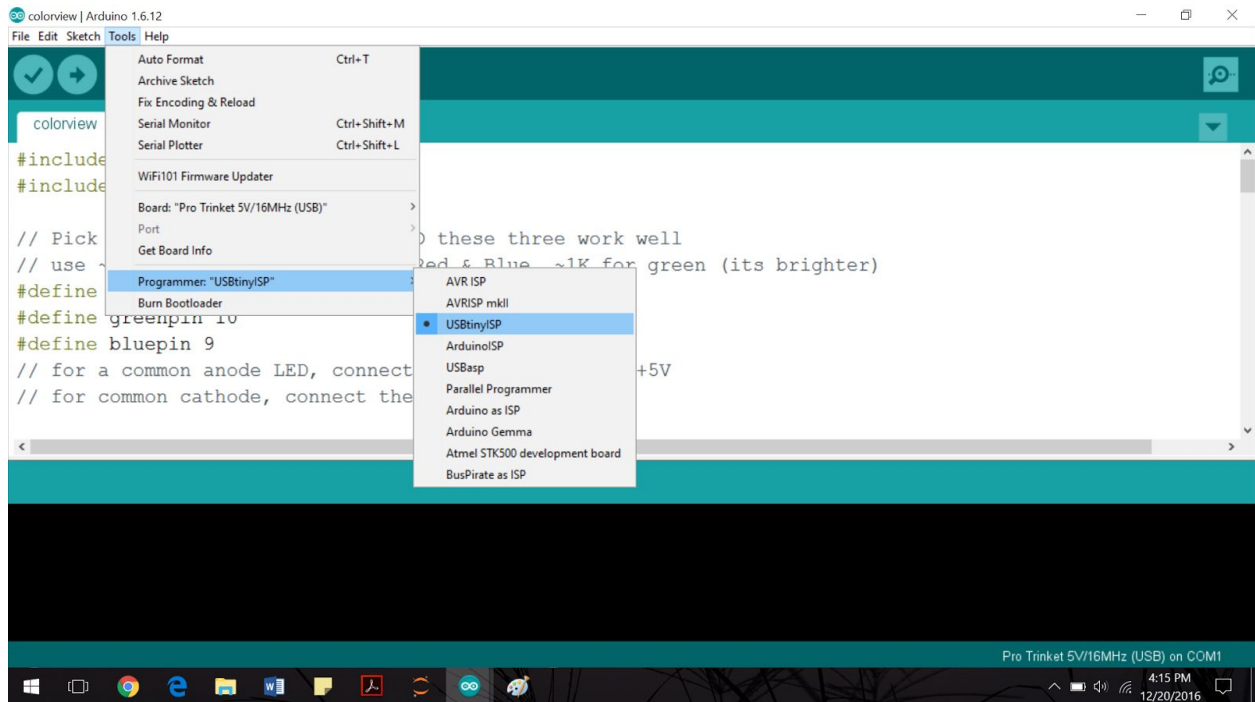
The bottom status bar indicates "Pro Trinket 5V/16MHz (USB) on COM1".

5. Upload the code onto the arduino:

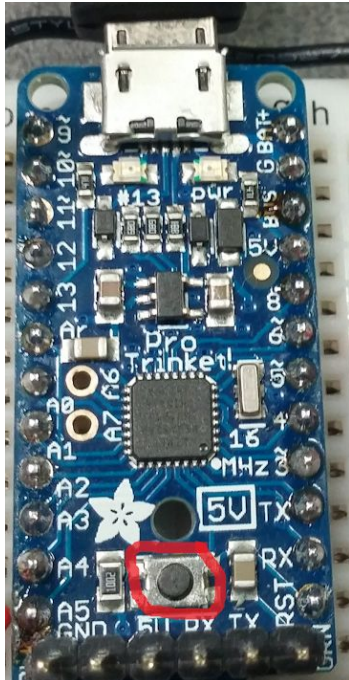
- Plug the USB wire connecting the arduino to your computer
- In the arduino console, go to Tools, then change the board to the **“Pro Trinket 5V/16MHz (USB)”**



- Also under Tools, Change the Programmer selection to “USBtinyISP”



- Press the button at the end of the arduino at the opposite end of the connection port (circled in red below).



- Press the upload button (a right-arrow that's the 2nd button from the left at the top bar)

```
colorview | Arduino 1.6.12
File Edit Sketch Tools Help

[Checkmark] [Right Arrow] [Sketch] [Upload] [Download] Upload

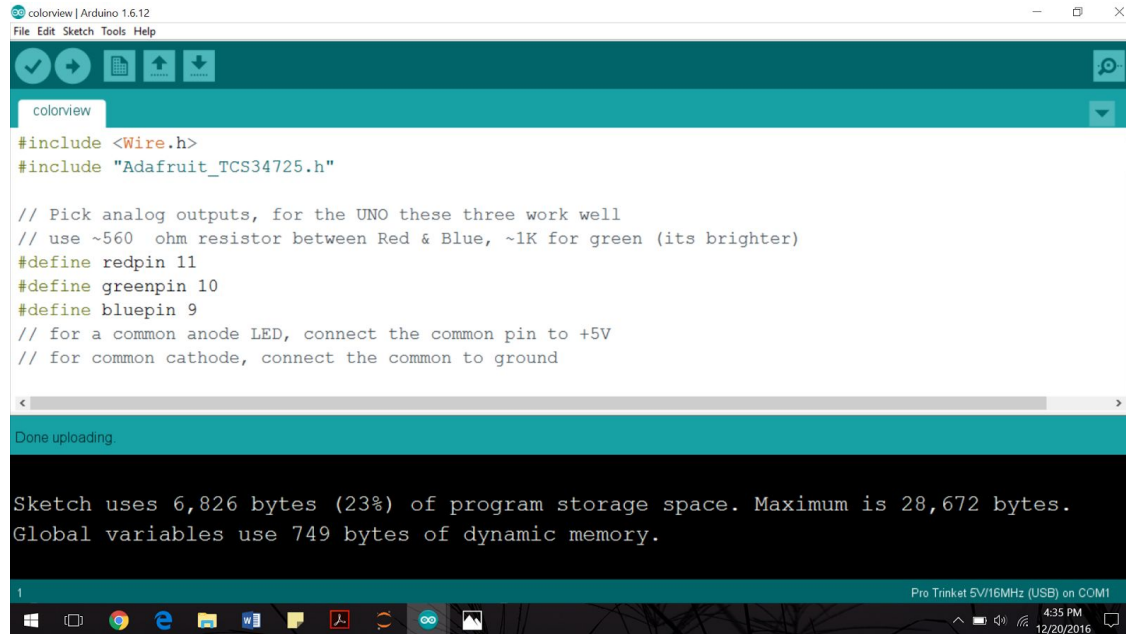
colorview

#include <Wire.h>
#include "Adafruit_TCS34725.h"

// Pick analog outputs, for the UNO these three work well
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Pro Trinket 5V/16MHz (USB) on COM1
4:34 PM
12/20/2016
```

After uploading, your screen should look like:



**Test the Neopixel LED** with the 'simplified' file from the library folder.

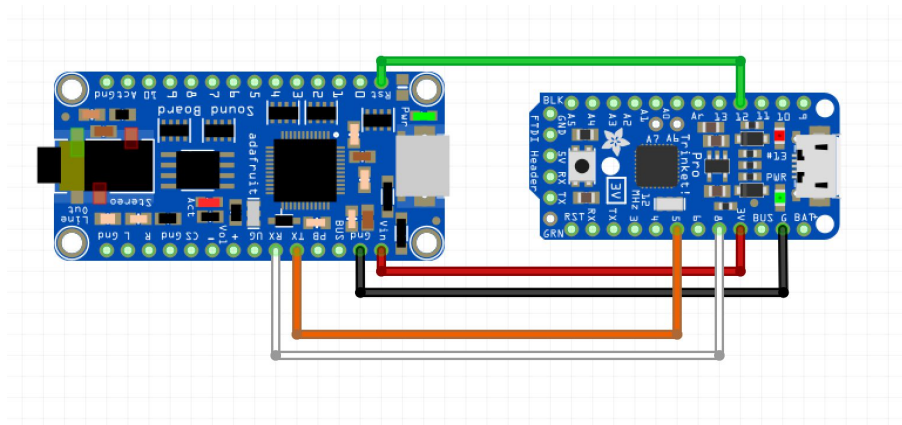
Upload it and watch the led turn on! You can play around with the code and change the color as well (look for the line `pixels.setPixelColor(i, pixels.Color(0,75,75))`)

## Test and connect the audio driver

Copy the audio files to the sound driver. Piano folder.

Plug the sound board to the computer and copy the following files to <https://learn.adafruit.com/adafruit-audio-fx-sound-board/copying-audio-files>

T00.wav -> R  
T01.wav -> G  
T02.wav -> B  
T03.wav -> IR  
T04.wav -> UV



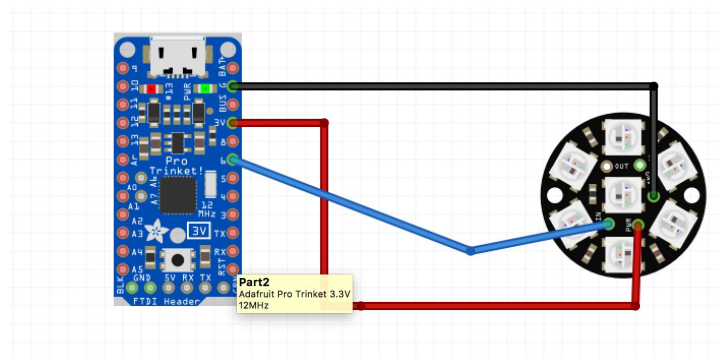
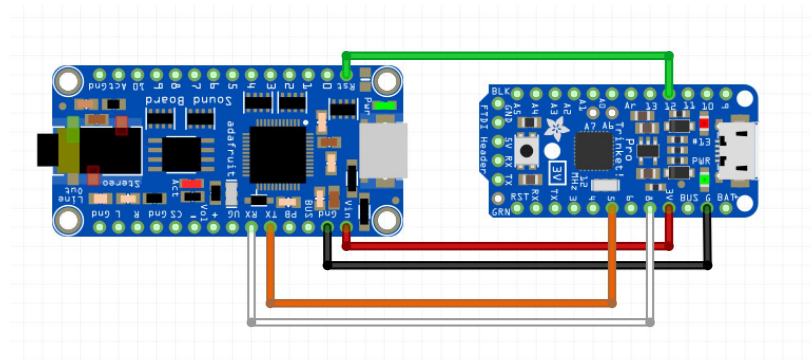
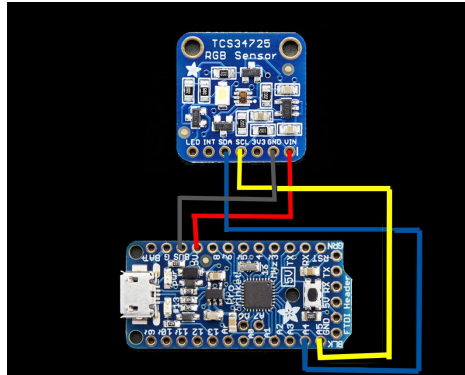
Test the Audio Driver with the code. **SoundBoardTest**

Listen for a sound. "Track Two" should be heard.

You can press the button on the arduino (the reset button) to hear it again.

## Test audio driver with the color sensor

Connected components



Use code **colorview\_music**

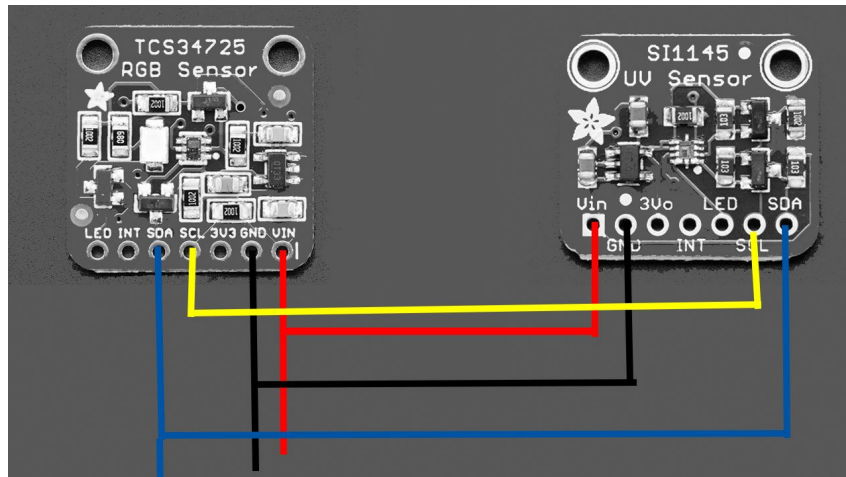
Upload `colorview_music` onto the arduino board. Then, test out the software by placing various-colored objects on the sensor and listening for sounds.



## Test the Infrared/Ultraviolet sensor.

Open up the IR/UV code

(Dropbox → ASU Course → Hardware → Glove → Arduino → UV\_IR\_TestSensor → UV\_IR\_TestSensor.ino) and upload it onto the arduino board.



*IR/UV Circuit components:*

```
UV_IR_TestSensor | Arduino 1.6.12
File Edit Sketch Tools Help
UV_IR_TestSensor
Upload

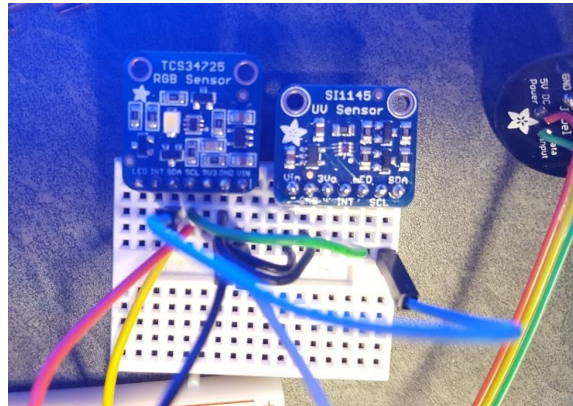
/*****
 * This is a library for the SI1145 UV/IR/Visible Light Sensor
 *
 * Designed specifically to work with the SI1145 sensor in the
 * adafruit shop
 * ----> https://www.adafruit.com/products/1777
 *
 * These sensors use I2C to communicate, 2 pins are required to
 * interface
 * Adafruit invests time and resources providing this open source code,
 * please support Adafruit and open-source hardware by purchasing
 * products from Adafruit!
 *
 * Written by Limor Fried/Ladyada for Adafruit Industries.
 * BSD license, all text above must be included in any redistribution
 *****/

#include <Wire.h>
#include "Adafruit_SI1145.h"

Adafruit_SI1145 uv = Adafruit_SI1145();

void setup() {
  Serial.begin(9600);
}
```

Connect the arduino with an FTDI cable to your computer -- this connects the UV sensor to your console and you can see the amount of UV sensed. Try lighting the flashlight from your phone onto the sensor. You can also use the UV light strips and test those on the sensor as well:



(RGB and UV Sensors)

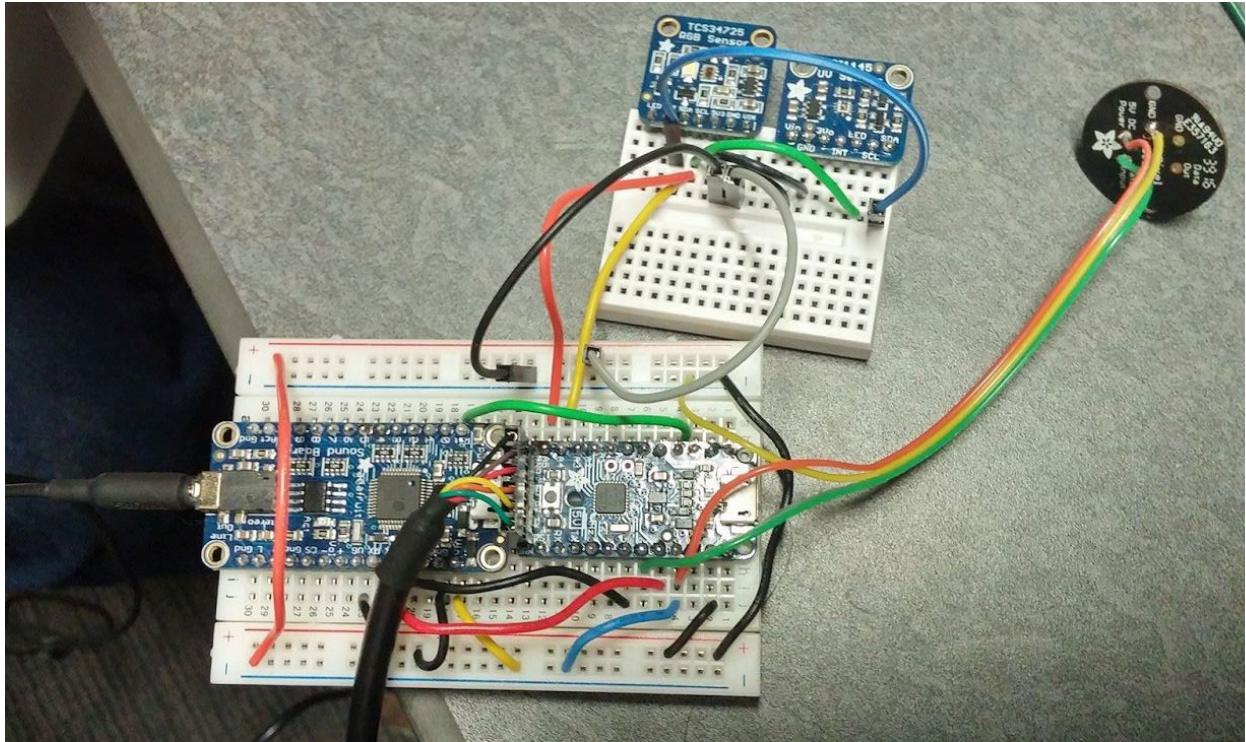


(UV Light Strips)

Then, upload the colorview file again and place various colored objects near the color sensor to watch the LED change color!

## Build the glove

All the components connected correctly.



Feel free to take a look at the PianoGlove, which has a similar design:

<https://learn.adafruit.com/pianoglove/what-youll-need>. Here's a sample glove design as well:

