Instructions
Wearable system for exposure sensing and feedback

Overview:
In this project you will be provided with a microcontroller, 3 sensors (ambient light, UV, and temperature) and two feedback devices (light and sound) and be asked to integrate them into a wearable computing system that gives users feedback as to whether they should go inside due to extended exposure to either sunlight or temperature or go outside if they have had little or no exposure for an extended period of time.

Goals and Expectations:
Your wearable system should make use of each sensor and provide intuitive feedback to the user with the two output devices. You are not required, but encouraged to use both light and sound as a feedback mechanism. Each team will need to provide a piece of clothing to use for the project, this can be anything from a shirt to a fanny-pack. One member of each team will be asked to wear and demonstrate their wearable device on the due date. We will have a UV light source to simulate sunlight and a heat source to simulate heat exposure. The wearable should be practical, meaning that the placement of the sensors and output devices should be strategic and robust. While this isn't a fashion competition, creativity is important. While this is a prototype, you should strive to make something that you would wear yourself.

Week 1:
You will given paper versions of the microcontroller and sensors you will be using and fabric to prototype with.

The goal during this week is to download and install the IDE and successfully communicate with the microprocessor and get familiar with the connections between the microprocessor and sensors/components.

By the end of week 1, you should have successfully completed a mockup of your wearable and checked it with one of the instructors to confirm that all of the connections are correct.

After you have completed this you will been given the rest of the parts needed to complete your wearables project.

Week 2:
By now you should have received the remaining components needed for your project:
- Conductive thread
- Microcontroller
- Piezo Buzzer
- PhotoResistor
- 10k Resistor

- Needle set
- Fabric to prototype with
- UV Sensor
- 2-3 Neopixel RGB LED's
- Temperature sensor

Notes:
- You should **NEVER** have both a Battery and USB cable plugged into the Microprocessor at the same time**!!!**
- **All Ground (GND) pins are interconnected, you can use the same for multiple components or just the closest one, this goes for the Power (3.3V) pins as well**
- **"+" is the same as power, "-" is the same as ground, and "s" stands for output signal**
- **You must use the 10kOhm Resistor with the photoresistor to read the signal, refer to the example projects below**
- **Refer to the Pinout link for the Flora and make sure that you are using the right type of pin for the given component**
- **Refer to the sample projects and sample code in the links at the bottom of this page to troubleshoot**

You will need to have one article of clothing with you in the lab, this should have been decided on between you and your partner during the previous week. During class you should be working on the design of your wearable and start to determine how you will distribute the work between you and your partner.

You should have a wearable prototype completed and have demoed it to the instructors by the due date listed on BlackBoard.

In the demo, you will be asked to wear your wearable and explain your design choices. We will test the different sensors with UV and Visible light as well as a heat gun to see how you handled the input and output of your wearable. We will grade on functionality, practicality, creativity, and wearability.

Software
Arduino IDE Download: https://www.arduino.cc/en/Main/Software

Adafruit Flora software installation:
https://learn.adafruit.com/adafruit-arduino-ide-setup/arduino-1-dot-6-x-ide

Neopixel Library: can be istalled directly through the IDE (as shown in pictures below) or downloaded here https://learn.adafruit.com/adafruit-neopixel-uberguide/arduino-library
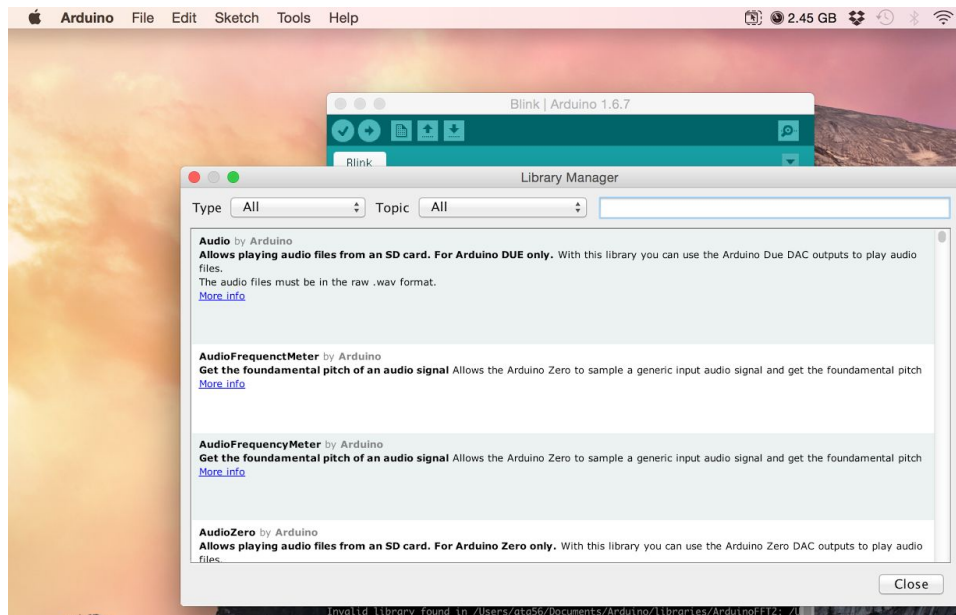
Adding and Using Libraries in arduino

Open the Arduino IDE and go to the **Sketch** menu

Select **Include Library** in the **Sketch** Menu then choose the **Manage Libraries** option
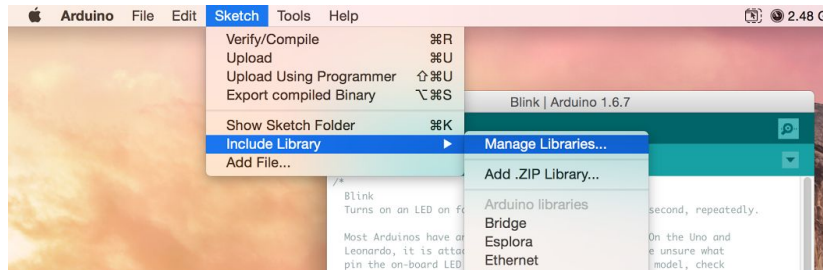

Sketch -> Include Library ->Manage Libraries

In the **Library manager** you can install a variety of very useful libraries and example projects.

To use the NeoPixel RGB LEDs install the Adafruit NeoPixel Library (type Neo in the filter to find it). The installed libraries will appear below the **Manage Libraries** option. New example projects associated with the newly installed library may also be added to the **Examples** option in the **File** menu.
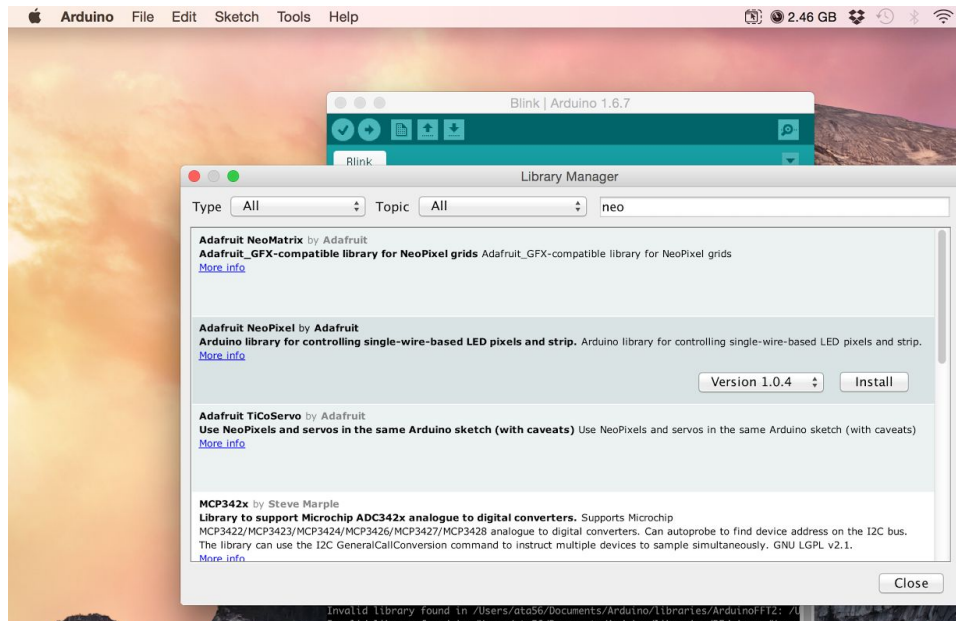
Materials

Wearable Platform (Adafruit Flora or Arduino Lilypad)
UV Sensor
Photoresistor
10k Resistor
Piezo Transducer (can be use to capture and/or create sound)
RGB LED
Analog Temperature sensor
Conductive Thread
Sewing kit

Grading Rubric

50 pts: Project is complete with working input and output in the form of a wearable
20 pts: Wearable is robust. Devices are secure and placed so that they perform optimally
20 pts: Practicality of application and design
10 pts: Creativity

Extra Credit:

25 pts: After demonstrating your wearable, incorporate an 9 DOF sensor (3 axis accelerometer, 3 axis gyroscope, and 3 axis magnetometer) and demonstrate a creative use of the additional sensing modalities.

Useful Reference Projects and Tutorials

General:

https://learn.adafruit.com

https://learn.sparkfun.com/tutorials/e-textile-basics

https://learn.sparkfun.com/tutorials

http://www.learningelectronics.net

https://learn.sparkfun.com/tutorials/how-to-read-a-schematic

http://www.learnelectronicsonline.com

http://www.learnabout-electronics.org

https://blog.arduino.cc/category/wearable-computing/

http://inventtolearn.com/resources-project-collections-tutorials-and-inspiration/

https://www.arduino.cc/en/Tutorial/HomePage

http://www.instructables.com

http://sewelectric.org/diy-projects/

Wearable platform:

https://www.arduino.cc/en/Main/ArduinoBoardLilyPad

https://www.arduino.cc/en/Guide/ArduinoLilyPad

http://lilypadarduino.org/?page_id=147

http://lilypadarduino.org/?page_id=192

https://www.sparkfun.com/tutorials/312

Piezo transducer:

https://www.arduino.cc/en/Tutorial/PlayMelody

https://learn.adafruit.com/adafruit-arduino-lesson-10-making-sounds/playing-a-scale

https://www.arduino.cc/en/Tutorial/KnockSensor

https://www.arduino.cc/en/Tutorial/Knock

Temperature Sensor:

https://www.sparkfun.com/products/8777

PhotoResistor:

http://playground.arduino.cc/Learning/PhotoResistor

https://learn.sparkfun.com/tutorials/sik-experiment-guide-for-arduino---v32/experiment-6-reading
-a-photoresistor

https://blog.udemy.com/arduino-ldr/

RGB LEDS

https://learn.adafruit.com/adafruit-neopixel-uberguide

https://learn.adafruit.com/firewalker-led-sneakers