PSC-103 - Spring 2018 - Arduino Introduction

Introduction

An "Arduino" is a small, credit-card sized computer. It is extremely popular in K12 STEM education initiatives (robotics, clubs, etc.). This work will give you some exposure to it (perhaps to use it in your own class someday). Our goal over the next few classes, is to create gadgets that will take weather (i.e. earth) related data for us. Below is a "warm up" to using the Arduino. Everything you will use costs about $30 (it's cheap enough so you can get your school's PTA to buy you a class set someday).

Note!

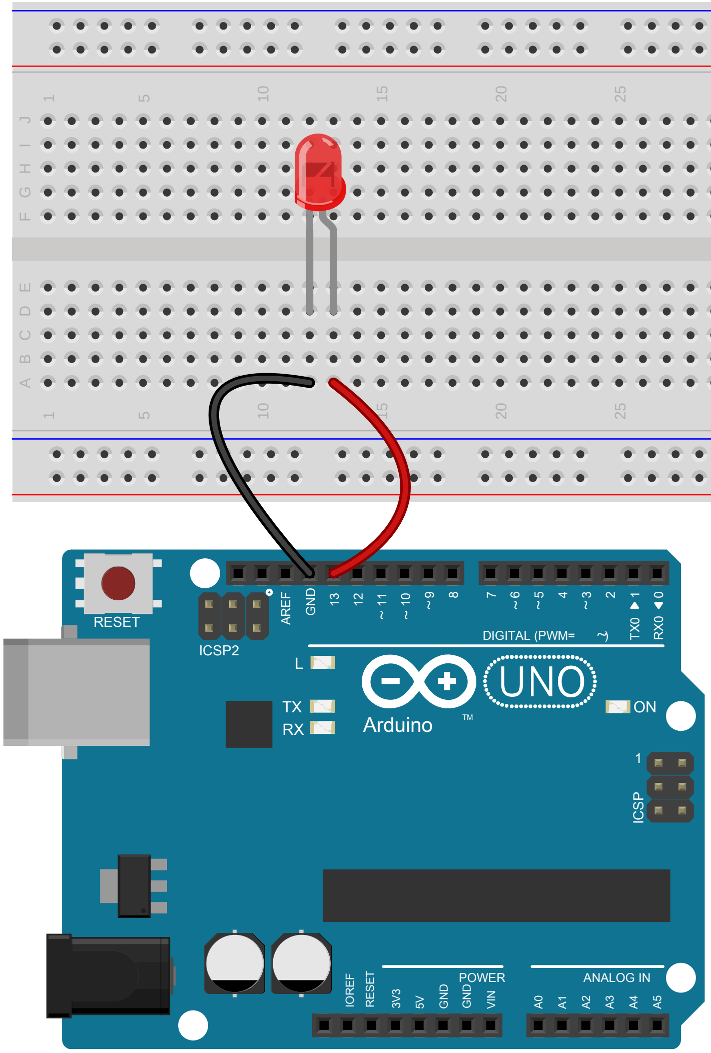
Today's work will culminate with your group giving a presentation on the last day of class. The presentation will be the first 25 points of your final exam.

Materials needed

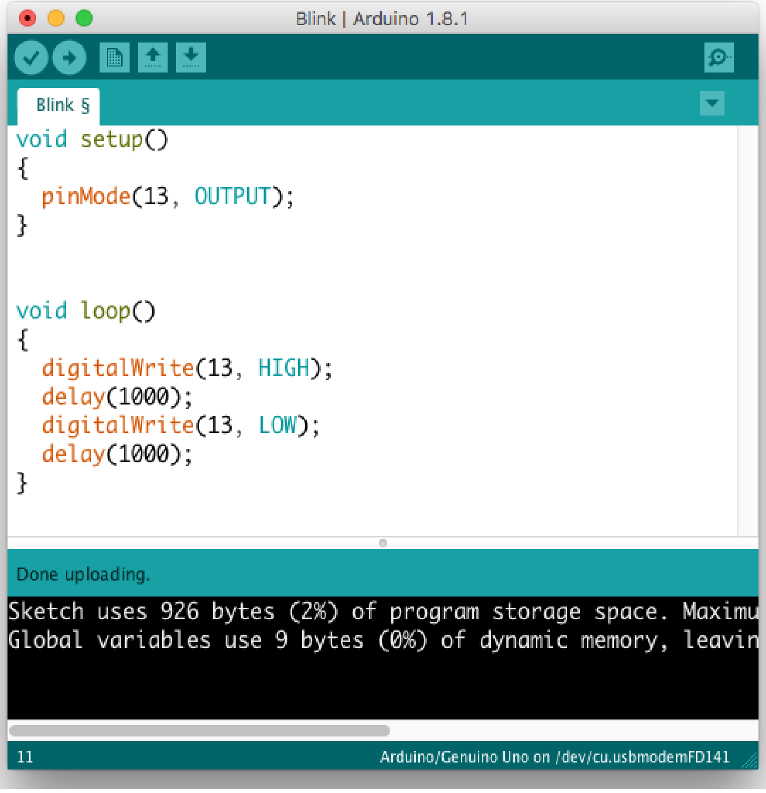
1. Arduino and breadboard
2. USB cable
3. 2 LEDs
4. 4 strands of wire
5. Potentiometer

Make a light flash

Using an Arduino requires two actions, 1) wiring it up and 2) coding the Arduino to make it "do what you want." To start, let's make a light (an LED actually) flash on and off. Here's the wiring (be sure the <u>flat edge</u> on the plastic of the LED is connected to GND):



Now, connect the Arduino to your computer using a USB cable. Here's the code that will flash your light. Type it into the "Arduino" software you can find in the "ClassFiles" folder:



```
void setup()
{
  pinMode(13, OUTPUT);
}


void loop()
{
  digitalWrite(13, HIGH);
  delay(1000);
  digitalWrite(13, LOW);
  delay(1000);
}
```

Done uploading.

```
Sketch uses 926 bytes (2%) of program storage space. Maximu
Global variables use 9 bytes (0%) of dynamic memory, leavin
```

When done, click the → button, to send (upload) your code to the Arduino. If everything went OK, the LED should begin to flash.

Questions
(OMG! If you got it to work, that's awesome!)

1. What pin on the Arduino is the black wire connected to? __________

2. "GND" stands for "ground" and is the return point for all current in a circuit (nothing will work without it). Find one fact about "electrical ground" online:

____

3. What pin number on the Arduino is the red wire connected to? _____

4. Do you see this pin number in the code? Yes or no.

5. Describe what you think each line of the code that uses this pin number does (I see 3 such lines.)

____

____

6. What do you think the words HIGH and LOW do in the code?

____

7.What do you think the "`delay(1000)`" lines do? ____

8. Ok, so in light of your answers to #6 and #7, describe what the lines of code do in the `loop()` block above:

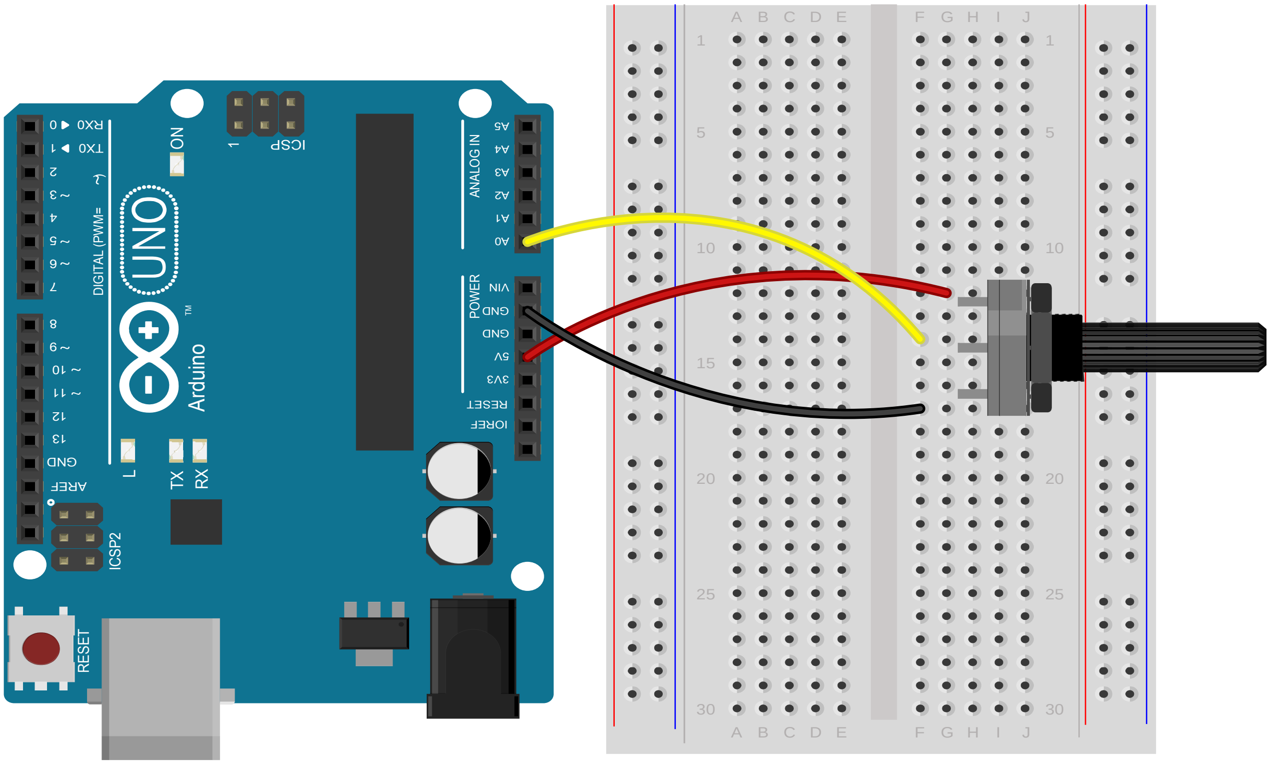
9. What does your LED do if the 1000 is changed to 100? ________________________________

10. Make your LED go on for 5 seconds and off for 2 seconds. Jot down the delay lines that you used to do this.

<u>* STOP! Show your circuit and answers to your instructor. ***</u>**

Inputs to the Arduino

Clear your breadboard and build this circuit below. The big thing on the breadboard is called a "potentiometer." You can turn the knob on it (they are sometimes used as "volume control" knobs in home sound systems).



Put in this code (be sure to save all of your older code).

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


void loop()
{
  int x;

  x = analogRead(A0);
  Serial.println(x);
}
```

Click the upload arrow to send it to the Arduino. When it runs, pull down the menu "Tools->Serial Monitor..." option. Turn the knob as you watch the numbers scroll by. Also, be sure to try the "Tools->Serial Plotter..." option for a more visual output.

Questions

1. When you turned the knob, the numbers on the screen changed. For the potentiometer, does this sound like an INPUT to or OUTPUT from the Arduino?

2. What do you think the "A" stands for in "A0?" What about the "0?"

____

3. What do you think the "analogRead(A0)" does?

____

4. Suppose the potentiometer could be replaced with a "thing" that measured pressure. How could the Arduino take pressure measurements for you?

***** STOP! Show your circuit and answers to your instructor. *****

Challenges for you

1. Connect two LEDs to your Arduino. Use any two empty pins you like (0-13). The flat edge of both LEDs must also be connected to GND. Write some code that will make both LEDs flash on/off, one twice as often as the second.

2. Change the code above so that when one LED blink on, the other blinks off.

Ultra-challenge

Wire up a circuit and write code that will turn an LED on if the number input from the potentiometer is above 600, and off if below 600. Hint:

```
if (x > 600)
{
   blah blah
}

if (x < 600)
{
  blah blah
}
```