Smart Textiles Techniques

Week 3: Hello Analog!

Analog Signals

Analog signals are multi-state, continuous signals which can be read by and created by* the Arduino.

*Analog output is actually digital output!

Analog signals are represented as a range:

0V ~ 5V (actual voltage)
0 ~ 1023 (numeric representation)

No pinMode necessary!

Setting a pin as INPUT or OUTPUT is only necessary with digital signals.

Analog Input is handled through a set of pins which only do Analog Input.

Tonight's Code

We'll be relying on examples which come with the Arduino software tonight.

These can be found in:

File > Examples > 03. Analog > AnalogInput

and

File > Examples > 03. Analog > AnalogInOutSerial

Additional Code

Additional code can be found on the class Github repository.

Check the class site for a link.

Circuit Diagrams

Connecting a potentiometer (“pot”).

Connecting a CdS photocell.

DIY “lie detector”

Potentiometer (“pot”)

Ground

Wiper (Output)

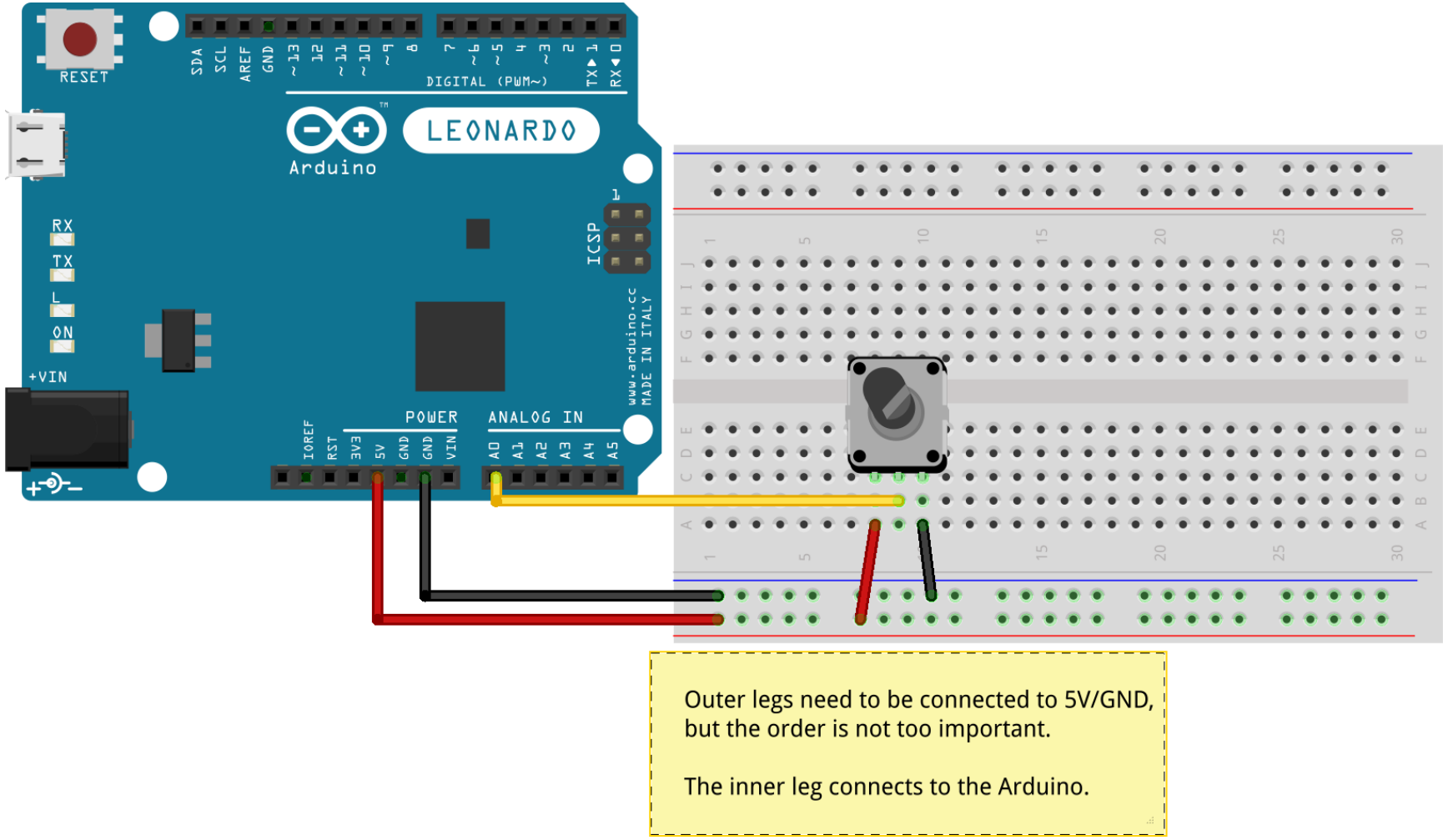
Power

A potentiometer is a type of variable resistor.

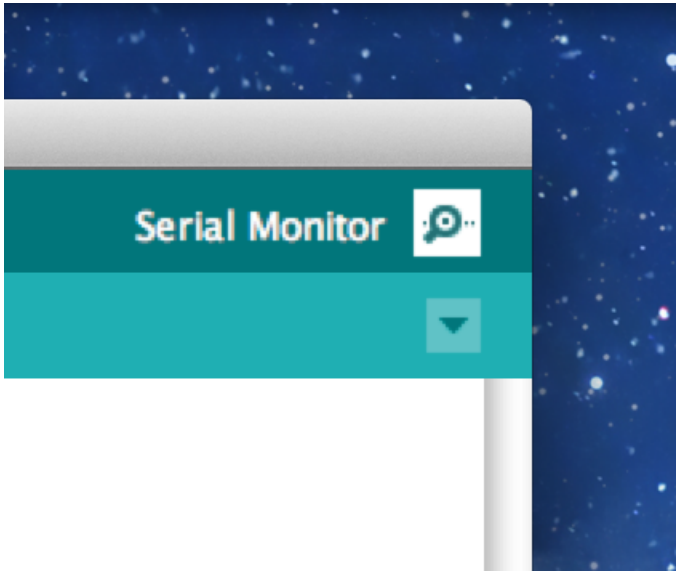
As we turn the shaft, we are adjusting the balance of resistance inside. This changes the level of voltage exiting through the wiper.

Always use a linear potentiometer with the Arduino.

Connecting a Potentiometer



Serial Monitor



The Serial Monitor is used to display messages sent from the Arduino using Serial.print(); or Serial.println();

Slow response from Serial Monitor?

If running the Serial Monitor feels slow or starts to hang your computer, add the following line after the last `println()`:

```
delay(10);
```

This will slow communication down just enough to make everything run more smoothly.

Variables

Data goes in here.

Variables are containers for data. They allow us to use the same data over and over again.

Variables can also act like labels, making it easier for us to keep track of things in our code.

Declaring variables

```
int potPin1 = 0;
int potValue1 = 0;
int ledPin1 = 13;
```

- Creating a variable is referred to as “declaring a variable”.
- Variables are declared before void setup() so they can be used anywhere in our sketch.
- A variable can only hold one type of data, but you can choose what that is (and create as many variables as you’d like!)
- A variable name cannot contain any spaces.

Data types

- Computers store information as data.
- There are specific types of data for storing different kinds of information.
- We'll commonly use one called `int` (integer).

*An `int` is a whole number (no decimals) between -32,768 & 32,767

Using variables

To use a variable we just refer to it by name:

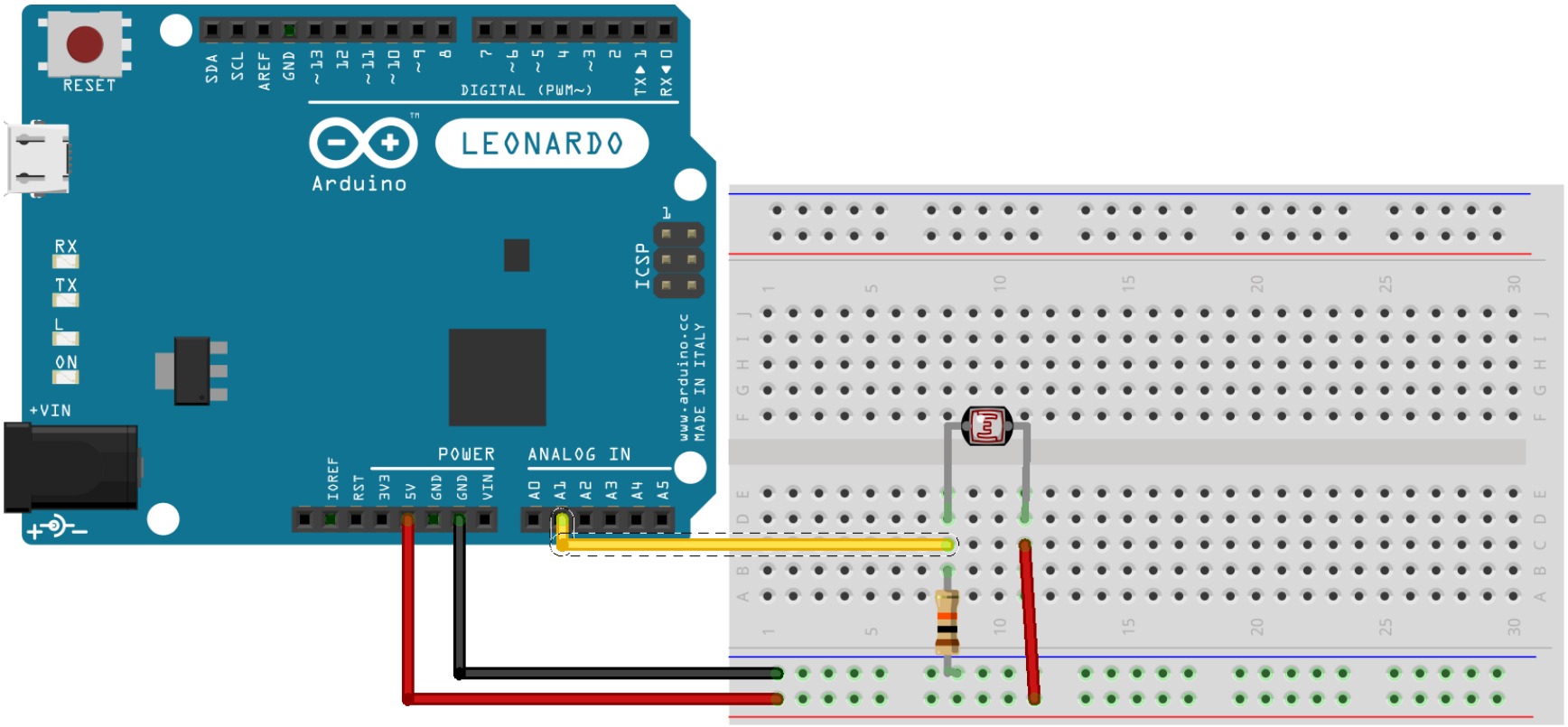
```
potValue1 = analogRead(potPin1);

digitalWrite(ledPin1, HIGH);
```

*HIGH and LOW are actually variables which are used to store 1 and 0.

Connecting a CdS Photocell

Cadmium Sulfide



Be sure to also connect the leg going to Arduino to GND with a 10KΩ resistor.

Better conditional logic (else if)

```
potValue1 = analogRead(potPin1);

if (potValue1 > 1000){
   digitalWrite(ledPin1, HIGH);
}
else if (potValue < 100){
   digitalWrite(ledPin1, HIGH);
   delay(1000);
   digitalWrite(ledPin1, LOW);
   delay(1000);
}
else {
   digitalWrite(ledPin1, LOW);
}
```

Combining conditional logic (&& ||)

```
potValue1 = analogRead(potPin1);

OR (||):
if (potValue1 > 1000 || potValue1 < 100){
    digitalWrite(ledPin1, HIGH);
}
else{
    digitalWrite(ledPin1, HIGH);
}

AND (&&):
if (potValue1 < 1000 && potValue1 > 500){
    digitalWrite(ledPin1, HIGH);
}
else{
```

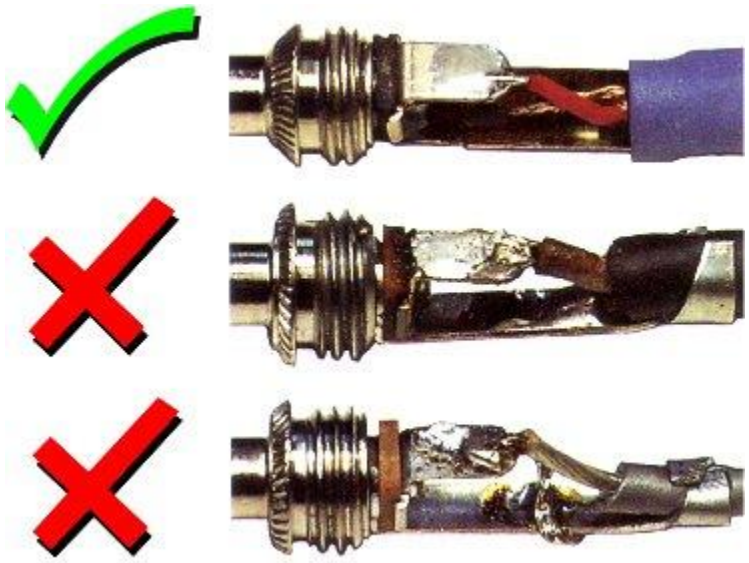
Soldering introduction (Safety)

- Never leave a hot soldering iron unsupervised.
- Put soldering iron in stand when not in use.
- Use “helping hands” to hold components and wire while soldering.
- Work in a well ventilated space and/or use a fume extractor
- Always wash your hands after handling solder.
- Keep your workspace clean and clutter free.
- Wear eye protection as an extra precautionary measure.

Soldering introduction (Technique)

- Set temperature to roughly 600 degrees for leaded solder (Higher for lead free solder)
- A good solder joint should take no longer than 2-3 seconds to form. If it takes longer, raise the temperature.
- Keep the soldering tip clean and “tinned” (thin coat of solder).
- Apply heat to the joint and allow the solder to flow over it.

Good Job! Bad Job!



Good solder joint: bright silver with a smooth texture. (Lead free solder will not be bright silver.)

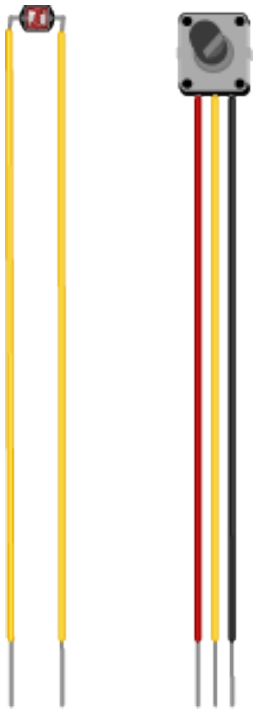
Bad solder joint: dull gray color with a gritty texture. Too much solder!

Hands on: Soldering components

Solder 2 wires to your photocell.

Trim legs of photocell to reduce chance of a short circuit.

Same color wire is OK.



Solder 3 wires to your photocell.

Use different colors for each leg.