4 - Reading Sensors -- Fun o Meter

# Getting Started

In the last activity, you used the button to trigger the LEDs to turn on, in this activity, we will use a couple of the sensors on the Digital Sandbox to see if we can make a “Fun-o-Meter.” Compare the push button to the slider on the digital sandbox. These are both inputs to the digital sandbox, but how are they different?

Example code on codebender: [https://codebender.cc/sketch:342867](https://codebender.cc/sketch%3A342867)

## Analog vs. Digital

Notice that the button has only one of two *states* that it can be in. The button is either pushed down or it is up. This is what we call a digital sensor - it can only be one of two values. The slider, on the other hand, can be in a nearly infinite number of positions from all the way to the left to all the way to the right! This is an analog sensor. All of the analog sensors are marked with numbers “A0”, “A1”, “A2”, or “A3”.

# Code Example

Let’s start with this simple piece of code. Start a new sketch, copy this code, and upload it to your digital sandbox. You’ll notice that this code looks a lot like the last example.

|  |
| --- |
| void setup() { **pinMode(4, OUTPUT);**}void loop() { **if ( analogRead(A3) > 500 ) {** **digitalWrite(4, HIGH);** **}** **else {** **digitalWrite(4, LOW);** **}**} |

# Reading inputs from the analog Sensors

Recall that in the last activity, we used the digitalRead() function to read the state of the button. To read the state of an analog sensor, we use the analogRead() function. This returns a value from 0 to 1023 based on the voltage that the sensor is providing to the digital sandbox. There are a lot of different sensors on the digital sandbox. We’re going to first use the slider (A3) because it’s easy to control!

# if() statement -- review

Here, we’re using the if() statement again. Remember those boolean “inequality” expressions? This one is checking to see if the analogRead(A3) value is greater than 500.

**if ( analogRead(A3) > 500 )**

If it is, it turns the LED on, otherwise (else), it turns the LED off. Now change this to one of the other sensors like the light sensor (A1) or the sound sensor (A2) and play around with the threshold value or sensitivity -- that’s the 500 number.

Play around with this. Can you make this into a night-light? Or a whisper sound detector?

# Seeing the values -- Introducing the serial monitor

The slider is a nice sensor because it has numbers below it (0 on the left, and 1023 on the right). So, when the slider is halfway, we know that the value is going to be somewhere near 511. But, how do we know what value the light sensor is seeing?

Let’s add a few new lines of code so that we can use what is called the Serial Monitor in Arduino.

## Add this line to the setup():

Serial.begin(9600);

## Add this line to the loop():

Serial.println( analogRead(A2) ); // prints out the sound sensor value

Upload the code and then click on the Serial Monitor icon or click (CTRL+SHIFT+M). You will see a series of numbers scrolling across the screen. Move your hand up and down above the light sensor. What is the range of values that you see? Write these down in the table.

Now, change the A1 to the other two sensors and record your values below. This is a useful trick to print out values that are being used in the program. It’s what we call “debugging” our code.

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Temperature\* (A0)** | **Light (A1)** | **Sound (A2)** |
| **Minimum Value** |  |  |  |
| **Nominal Value** |  |  |  |
| **Maximum Value** |  |  |  |

\* - Note: You will probably only be able to manipulate the temperature in one direction. What do you have that is warmer than room temperature?

# Things to try

Now, you’ve played around with the analogRead() function, the Serial Monitor, and the if() statements, see if you can build one of these projects:

## Adjustable sensitivity

Re-write the code so that all of the LEDs light up when the sound is above the level of the slider. Is that confusing?? Well -- take a minute to think about what this says and see if you can do it! Try it with just one LED and then add the others.

Now, you get to set the sensitivity of the sound detector with the slider. Walk around the library and see who’s being too loud!

## Sound bar graph

The if() statement is a really useful tool. In fact, you can stack if() statements together into what is called an if()-else if() statement. This is useful if you want to compare the value against multiple conditions. Here is a skeleton of an if()-else if() statement:

|  |
| --- |
| if(analogRead(A2) > 800){ // turn on 5 LEDs}else if(analogRead(A2) > 600){ // turn on 4 LEDs}else if(analogRead(A2) > 400){ // turn on 3 LEDs} |

Can you use this example to create a sound bar graph? Or a light bar graph that shows a different number of LEDs based on the amount of light in the room?

