Lab 4-Sensors

## Learning Outcomes:

* Learn how to work a sensor
* Learn about the ultrasonic sensor

### Background:

Electrical engineers use all kinds of sensors for a variety of applications. It could be a LIDAR module on a self-driving car or a thermocouple in an indoor air conditioning system. Regardless, the purpose of sensors is to record some measurement from the outside world, turn it into an electrical signal, which is then analyzed by a device. [Different Types of Sensors and their Uses (ie Electrical Sensors)](https://www.thomasnet.com/articles/instruments-controls/sensors/#applications)

Sensors first use an electro-mechanical device to measure something in the real world. The sensor then converts the data into a digital or analog signal. A digital signal is composed of low voltage 0’s, and high voltage 1’s, like your computer. An analog signal can exist in a range of voltages. Regardless, this signal is typically sent to a controller which then processes that signal and will then act on the world.

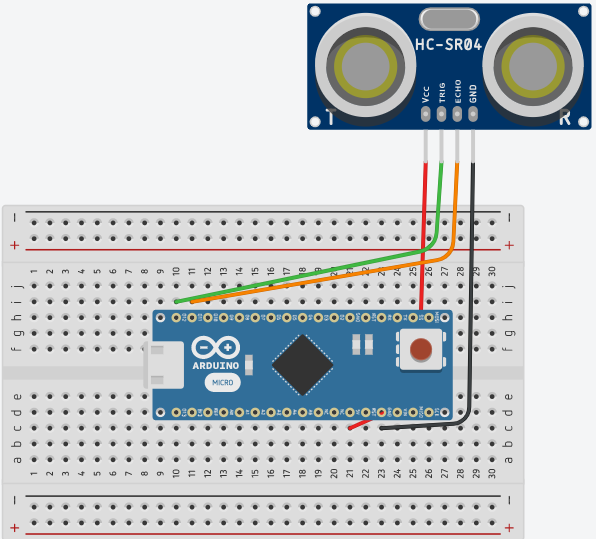
With the advent of the internet of things ([Internet of things](https://en.wikipedia.org/wiki/Internet_of_things)) sensors are more important than ever. It’s very important to understand how they work and use them effectively. When using a sensor that you’re unfamiliar with it is useful to refer to its datasheet. You can find all sorts of useful information there. For our AutonoMouse we will be using HC-SR04 which is an ultrasonic sensor. Read more about it here: [How HC-SR04 Ultrasonic Sensor Works & How to Interface It With Arduino](https://lastminuteengineers.com/arduino-sr04-ultrasonic-sensor-tutorial/)

The project objectives for today’s lab are to 1) read data from an ultrasonic sensor (HC-SR04), and 2) read the data using arduino’s Serial monitor.

### Part 1 Ultrasonic Sensor Circuit:

Build the following circuit.

1. Put Arduino Nano into the center of the breadboard
2. Put wires connect the following pins
   1. 5V and VCC
   2. Pin 12 and TRIG
   3. Pin 11 and ECHO
   4. Gnd and Gnd



*Ultrasonic Sensor Circuit from Tinkercad*

### Part 2 Reading via Serial Monitor:

Copy and upload the code provided with this lab to the Arduino. Once the code is successfully uploaded, open a serial monitor through Arduino IDE by clicking the serial monitor button in the top right corner. You should see another window open that provides data from the ultrasonic sensor. **Make sure that the baud rate is set to 9600 or else you will see nothing in the serial monitor.** Try moving the sensor around and get a feel for the range and how accurate it is. Make sure it works correctly or else your car will not be able to stop in the next lab.

