Aryan Gupta
Partner: Anthony Samagaio

Video Link: https://youtu.be/BoFbs03vxjQ

Objective: The video will demonstrate a program to measure the distance to an object by measuring the distance from an ultrasonic sensor five times with a delay of one seconds between each measurement. The final distance was calculated to be the median of the five data points. This process was repeated after 5 seconds.

Commentary:

- 0:01: Behold… My box… (Insert Thor: Ragnarok meme here)
- 0:03: Needed to use a level converter since my sensor wouldn't run off of 3.3V
- 0:07: The output from the MSP432
- 0:13: Placed hand in front of sensor to simulate errors
- 0:16: Median of dataset was successfully able to remove errors
- 0:27: One more run without hand in front of sensor

Reflection: The biggest problem encountered in this lab was that my ultrasonic sensor would not work on the 3.3V rail. Looking through the datasheet, none of the pins on the MSP432 were 5V tolerant so I needed a voltage divider or a level converter. I left my electronics kits back in my apartment near campus so I needed to buy a resistor kit or a level converter. Decided to go with the level converter as they are cheaper and they come in handy pretty often. An oscilloscope came in handy to troubleshoot this. These labs have been pretty easy so no major lesson learned other than hot glue makes good filler material to fill in space and mount things.

Code:

```
/*
HC-SR04 Ultrasonic Distance Sensor Example
Demonstrates sensing distance with the HC-SR04 using Texas Instruments
LaunchPads.

Created by Frank Milburn 5 Jun 2015
Released into the public domain.

Modified by James Conrad 8 Jun 2020
Modified by Aryan Gupta 12 Jun 2020
*/

//another reason why I hate arduino
//https://arduinojson.org/v6/error/macro-min-passed-3-arguments-but-takes-just-2/
```

```
#undef min
#undef max
#include <algorithm>

const int trigPin = 32; //This is Port Pin 3.5 on the MSP432 Launchpad
const int echoPin = 33; //This is Port Pin 5.1 on the MSP432 Launchpad

constexpr size_t NUM_SAMPLES = 5;

void setup() {
  pinMode(trigPin, OUTPUT);
  pinMode(echoPin, INPUT);

  Serial.begin(9600);
  Serial.println("Starting HC-SR04 Test...");
}

long get_sonar_val() {
  long samples[NUM_SAMPLES];
  long inches;
  long centimeters;

  for (int i = 0; i < NUM_SAMPLES; ++i) {
    digitalWrite(trigPin, LOW);     // send low to get a clean pulse
    delayMicroseconds(5);           // let it settle
    digitalWrite(trigPin, HIGH);    // send high to trigger device
    delayMicroseconds(10);          // let it settle

    samples[i] = pulseIn(echoPin, HIGH);

    inches = samples[i] / 148;
    centimeters = samples[i] / 58;

    Serial.print("Distance = ");
    Serial.print(inches);
    Serial.print(" inches");
    Serial.print("       ");
    Serial.print(centimeters);
    Serial.println(" centimeters");

    delay(1000);
  }
```

```
  std::sort(samples, samples + NUM_SAMPLES);

  return samples[(NUM_SAMPLES / 2) + 1];
}

void loop() {
  long pulseLength;
  long inches;
  long centimeters;

  pulseLength = get_sonar_val();
  inches = pulseLength / 148;
  centimeters = pulseLength / 58;

  Serial.print("Median distance = ");
  Serial.print(inches);
  Serial.print(" inches");
  Serial.print("       ");
  Serial.print(centimeters);
  Serial.println(" centimeters");
  delay(5000);
}
```