Lab Report

Course number: EE101	**Lab Section: A04**
Student Name: Helen Wang	**Student ID: hwang2**
Lab GTA:	**Lab TA: Hannah, Artur**

TA ONLY

Lab Objectives	OK	NOK	**Points Earned**	0 - Wholly inadequate. 1 - An attempt, but missing many pieces, unprofessional parts, missed the point. 2 – More than one unsatisfactory section. 3- One unsatisfactory section. 4 - Spot on. All sections delivered as required. Professional
Materials	OK	NOK		
Exercise Req/Proc	OK	NOK		
Conclusions	OK	NOK		

Lab Title: Arduino digital input/output

Section A: Lab Objectives

In your own words list the objectives of this lab.

In this lab, the objectives are to process distance information from a smart ultrasonic ranging sensor and use the I2C communications protocol to talk to display information on an LCD device. Interface the ultrasonic sensor to your RoboRed microcomputer given a schematic. Interface the LCD (Liquid Crystal Display) module to the RoboRed microcomputer given a schematic. Learn about the I2C communications protocol. Continually display distance from the Ultrasonic sensor to object in millimeters or inches on LCD. Units are selectable via serial monitor input.

Section B: Equipment and component materials used

Electronics measurement equipment, power supply, electronics components, etc. Only what you used for this lab.

- Arduino Programming book (Blum)
- Makerspace Kit
    - HC-SR04 Ultrasonic sensor, also called a “ping” sensor
    - LCD-Blue-I2C

Optional

- O-scope
- Power Supply.

Section C: Reference works and soft materials used

Text book sections, Datasheets, On-line sources, Code snippets, etc. Be thorough and give credit where due.

Dr.Gallagher(.n.d), Arduino digital input/output. Department of Electrical Engineering. Accessed 02/28/2020

Section D: Exercises

Exercises have unique requirements that are met by your "unique" solutions. Multiple exercises fulfill our lab objectives. List the lab exercise requirements here.

Requirements:

Procedure:

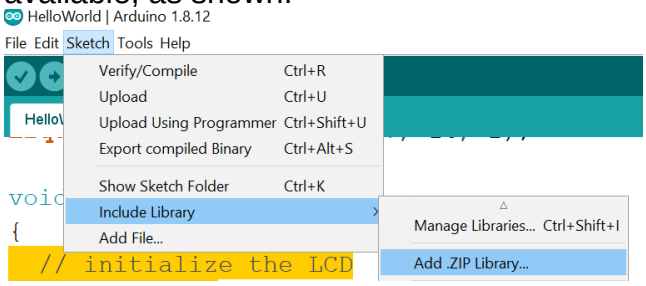
Part1:

Build circuit

build the circuit shown in Figure 3. Use the schematic below to construct serial to parallel converter LED light bar.

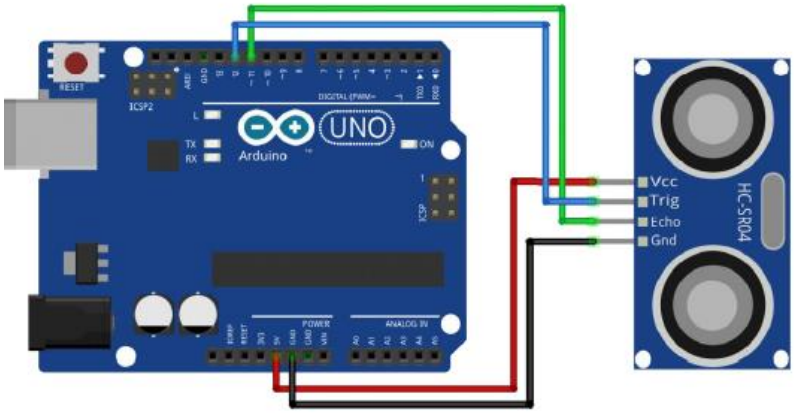
Download

from Bb the two zipped libraries for the LCD and the ping sensor. Use the sketch/include library/add .zip to make the libraries available, as shown.



NewPing-1.9.1.zip
Arduino-LiquidCrystal-I2C-library-master.zip

Write code to display sensor to object distance on the serial monitor. Create a command to display distance in either inches or millimeters. Consider using the Arduino "NewPing" library to help construct your software.

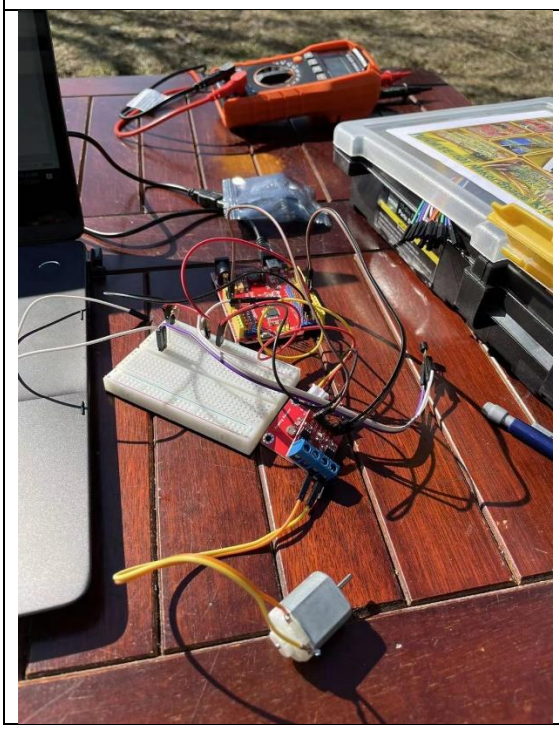


Layout of ultrasonic sensor / Arduino

In order to generate the ultrasound we need to set the **Trigger Pin** on a **High** State for **10 µs**. That will send out an 8 cycle sonic burst which will travel at the speed sound and it will be received in the Echo Pin. The Echo Pin will **output** the **time** in microseconds the sound wave traveled.

Part 2. Integrate the LCD

Demonstrate a single illuminated LED "ping-ponging" across the 8 LED string. Use an input from the serial monitor input to vary the rate at which the ping pongs (4Hz - .25 Hz).



Solution/Procedure:

What did you do to fulfill the exercise requirements?

Code:

```
#include <NewPing.h>

#define TRIGGER_PIN 12 // pin tied to trigger pin on the ultrasonic sensor.
#define ECHO_PIN 11 // pin tied to echo pin on the ultrasonic sensor.
#define MAX_DISTANCE 500 // Maximum distance we want to ping for (in centimeters). Maximum sensor distance is rated at 400-500cm.
const int ledpin = 4;
NewPing sonar(TRIGGER_PIN, ECHO_PIN, MAX_DISTANCE); // NewPing setup of pins and maximum distance.

char unit;

void setup() {
pinMode(ledpin, OUTPUT);
Serial.begin(9600); // set baud rate at 9600 baud to see ping results
}
void loop()
{
int dist = sonar.ping_median(5); //median off 5 values


if (Serial.available()) {
unit = Serial.read();
}
Serial.println(unit);

switch (unit) {
case 'i':
dist = sonar.convert_in(dist); //convert that to cm, replace "cm" with "in" for inches
Serial.print("Ping: ");
Serial.print(dist); // //print value to screen so we can see it.
Serial.println(" inches");
break;

case 'm':
dist = sonar.convert_cm(dist); //convert that to cm, replace "cm" with "in" for inches
Serial.print("Ping: ");
Serial.print(dist); // //print value to screen so we can see it.
Serial.println(" cm");
break;
```

```
default:
break;
}
}
```

Section E: Lab Conclusion

In this lab, we process the distance information from a smart ultrasonice ranging sensor and use the I2C communications protocol to talk to display information on an LCD device. The switch case function in the code helped with the unit convert. In order to generate the ultrasound we need to set the Trigger Pin on a High State for 10us.