CSC 615 Assignment 2 – Echo Sensor – Tapeless Ruler

This is an INDIVIDUAL assignment. You can (and should) work in groups to research how to do the assignment, but each person should code their own version and make their own submission.

This is a physical class, so I will want to see what you do in action. Documentation, including short video clips (can use your cell phone) are required as part of the submission. It might be handy to have a friend record while you execute your program.

You will also need to submit hardware drawings. These should be neat (can be either electronic or hand drawn, then scanned) of how the hardware is connected to the Raspberry Pi. This includes which pin (physical and GPIO), positive and negative flow, resisters, etc. I should be able to rebuild your setup from this diagram and then run your program and get the same results. Also see https://www.circuit-diagram.org/editor/# if you want to use that (they have a Raspberry Pi template).

Assignment Description

1. Read the following page "Component Knowledge".

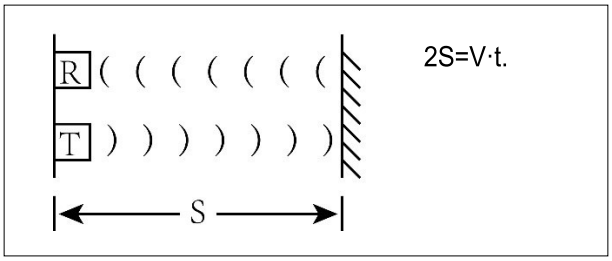
2. You are going to measure distance using the Echo Sensor (HC-SR04). You are to display distance in centimeters in your terminal. Make sure to show the object moving and the distance on the console when you do your video.

3. You are to connect the sensor to the ultrasonic pins on the Motor Shield for hardware mangers. See the motor shield specifications on iLearn to determine the pins and the pin numbers. For the rest of you select two GPIO pins on the pi to connect the Trigger and Echo pins.

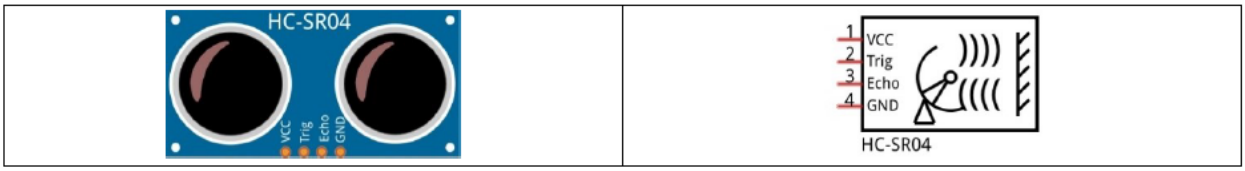
4. Submit your homework in your GitHub Repository and the PDF on iLearn per the submission details below.

Component Knowledge

Ultrasonic ranging module use the principle that ultrasonic will reflect when it encounters obstacles. Start counting the time when ultrasonic is transmitted. And when ultrasonic encounters an obstacle, it will reflect back. The counting will end after ultrasonic is received, and the time difference is the total time of ultrasonic from transmitting to receiving. Because the speed of sound in air is constant, and is about v=340m/s. So we can calculate the distance between the model and the obstacle: s=vt/2.



Ultrasonic module integrates a transmitter and a receiver. The transmitter is used to convert electrical signals (electrical energy) into sound waves (mechanical energy) and the function of the receiver is opposite. The object picture and the diagram of HC SR04 ultrasonic module are shown below:



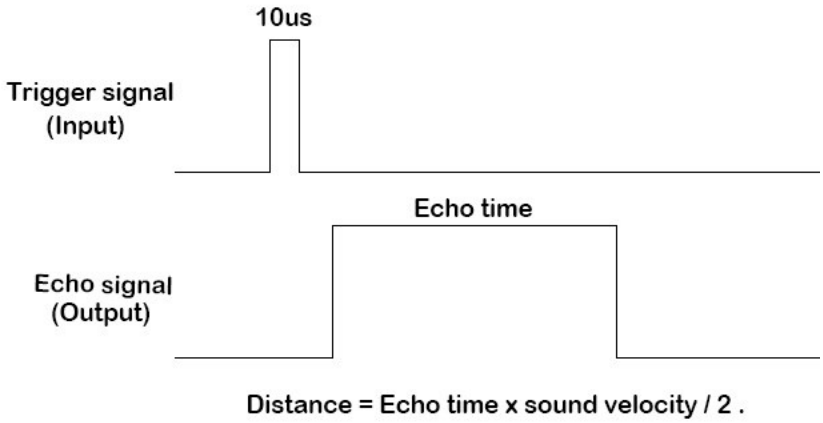
Pin description:

VCC	power supply pin
Trig	trigger pin
Echo	Echo pin
GND	GND

Technical specs:

Working voltage:	5V	Working current:	12mA
Minimum measured distance:	2cm	Maximum measured distance:	200cm

Instructions for use: Output a high-level pulse in Trig pin lasting for least 10uS. Then the module begins to transmit ultrasonic. At the same time, the Echo pin will be pulled up. When the module receives the returned ultrasonic, the Echo pin will be pulled down. The duration of high level in Echo pin is the total time of the ultrasonic from transmitting to receiving, s=vt/2.



Submission Details

You need to submit the following files in your github repository for this assignment:

1. All .c and .h source code files.

2. A makefile file to build your program (the file MUST be called **`makefile`**). The executable output files MUST be called **`assignment2`**.

3. A PDF that is clear and readable with your hardware diagram (make sure to indicate polarity and pin numbers) and a writeup about what you did, strategy, problems and resolutions. This PDF must ALSO be submitted in iLearn.

4. A mp4 file showing your tapeless ruler in action (show both the sensor and the object it is sensing along with the terminal screen showing the measurement).

All parts of the submissions must have your name and student ID number and github user name. For Video's please have at least a 2 second clip at the beginning with your Student ID card clearly visible. (In absence of your student ID card print out your Name and ID number on paper and film that).

Please post questions to the slack channel.

Grading Criteria

Grading criteria will be based on the following:

Completion and success of the assignment	25%
Code well structured, original and well documented	40%
Hardware Diagram and writeup	25%
Video	10%

Instructions followed (this includes submission requirements) This is only a detractor from your grade, i.e. failure to follow the instructions will result in a reduction from the grade calculated from the criteria above.	-50%