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HC-SR04 User Guide

Part 1 Ultrasonic Introduction

1. 1 Ultrasonic Definition

The human ear can hear sound frequency around 20HZ ~ 20KHZ, and ultrasonic is the sound wave beyond the human ability of 20KHZ .

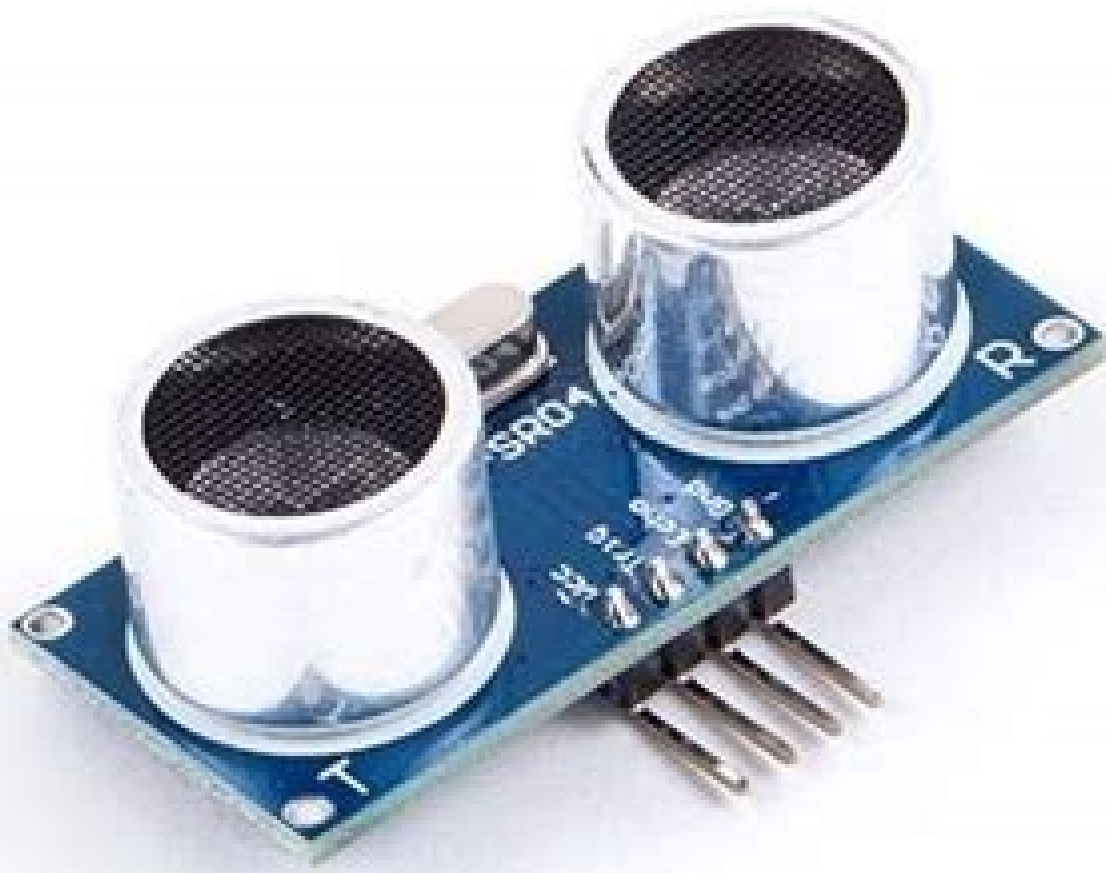
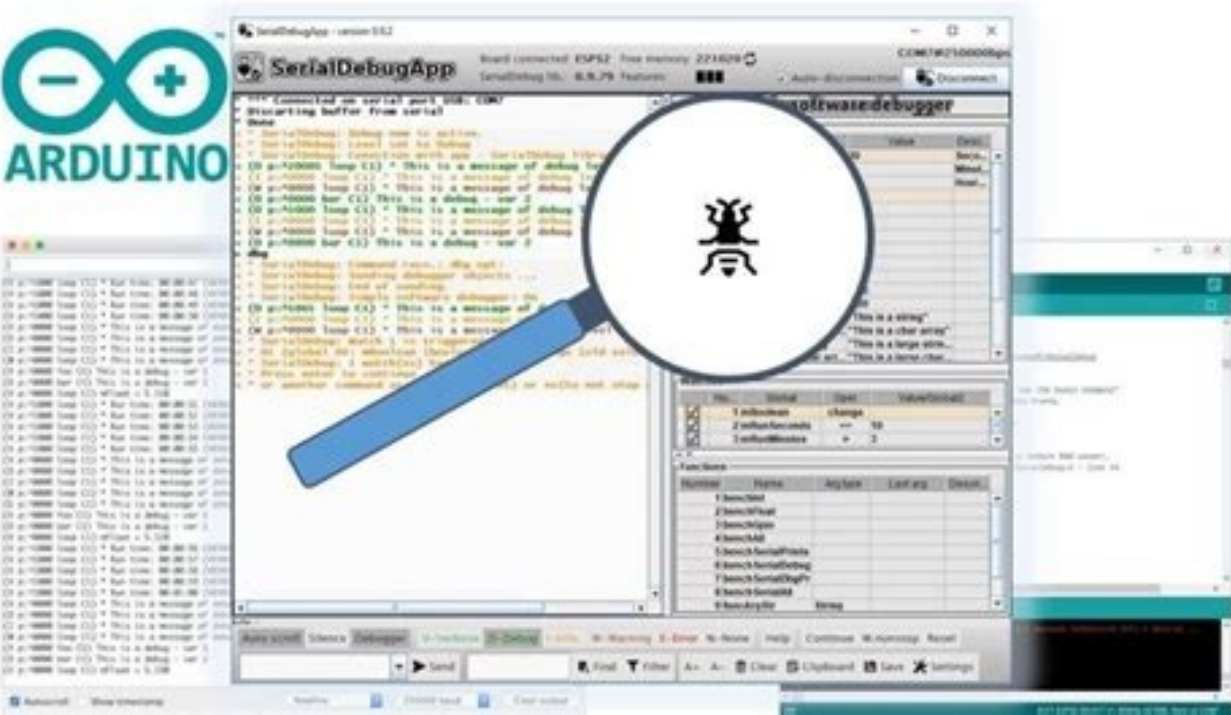
1.2 Ultrasonic distance measurement principle

Ultrasonic transmitter emitted an ultrasonic wave in one direction, and started timing when it launched. Ultrasonic spread in the air, and would return immediately when it encountered obstacles on the way. At last, the ultrasonic receiver would stop timing when it received the reflected wave. As Ultrasonic spread velocity is 340m / s in the air, based on the timer record t , we can calculate the distance (s) between the obstacle and transmitter, namely: $s = 340t / 2$, which is so- called time difference distance measurement principle

The principle of ultrasonic distance measurement used the already-known air spreading velocity, measuring the time from launch to reflection when it encountered obstacle, and then calculate the distance between the transmitter and the obstacle according to the time and the velocity. Thus, the principle of ultrasonic distance measurement is the same with radar.

Distance Measurement formula is expressed as: $L = C \times T$

In the formula, L is the measured distance, and C is the ultrasonic spreading velocity in air, also, T represents time (T is half the time value from transmitting to receiving).



Water Level Detection System Based on Ultrasonic Sensors HC-SR04 and ESP8266-12 Modules with Telegram and Buzzer Communication Media

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ABSTRACT

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Keywords:
HC-SR04, ESP8266-12E, buzzer, telegram

Detection of water surface altitude is an indicator for early detection of flood disasters. The research aims to design a water surface level detection system by using ultrasonic sensors and the ESP8266-12E module. The tools and materials used during the design are: Ultrasonic sensors HC-SR04, module ESP8266-12E, and buzzer a water container with a varied water height, the detection data will be sent to the ESP8266-12E module, then the system will send the information an output to sound the alarm. The ultrasonic HC-SR04 sensor will detect the mation in the form of a message through telegram and buzzer application. The messages delivered are several stages including standby, alert, and danger. The methods used in this design are planning, study libraries, collection of tools and materials, hardware plan, and program creation on the software. The final result is a system capable of detecting water surface level based on the ultrasonic sensor HC-SR04 and the ESP8266-12E module through telegram and buzzer communication media.

1. INTRODUCTION

Flooding is a natural phenomenon in the form of land-setting by water due to overflow or puddle that exceeds the normal limit of water altitude somewhere. This can be due to excessive rainfall, melting snow, or the inability of the river to accommodate and distribute the water it receives. Floods are sometimes coming in the evening when the citizens are asleep in a slumber making the citizens cannot standby when the disaster comes. Of course, this makes the citizens not only suffer the loss of property and objects but can lose the lives of loved ones because of stuck flooding that came suddenly. For this reason it is necessary to designed a remote flood detection tool, not only to increase the accuracy of the detection in the flood but can be monitored in real time so as to provide flood standby at the precise moment. Nowadays, people especially in Indonesia Internet users are very high, besides simple internet era is very easy to reach by all walks of life. As a preliminary study the authors will design a flood detection system based on the ultrasonic sensors HC-SR04 and the ESP8266-12E module with Telegram and buzzer communication media, a detection system that can be monitored using Telegram (Internet).

1.1 Ultrasonic sensors HC-SR04

HC-SR04 is an ultrasonic ranging module designed for embedded system projects. Ultrasonic ranging module HC-SR04 provides 2 cm - 400 cm non-contact measurement function, the ranging accuracy can reach to 3 mm. The modules include ultrasonic transmitters, receiver and control circuit [1].
Ultrasonic Sensing/manipulate basics Ultrasonic alerts are like audible sound waves, except the frequencies are plenty higher. Our ultrasonic transducers have piezoelectric crystals

which resonate to a desired frequency and convert electric power into acoustic power and vice versa [2]. The trigger pin is given a supply of 5V i.e. high for about 10µs initiate the sensor module. A burst of 8 cycles of 40 kHz is transmitted and wait for the echo signal. [3].

The ultrasonic sensor works using trigger and echo method. The transceiver module triggers and sends the signal to the water the water sends back an echo signal which is read by the echo i.e. the receiver module. The Ultra sonic sensor calculated distance of the signal and returns the level of the water. The travel time value and the speed value allow the sensor to calculate the level of the water [4]. The sensor works by emitting ultrasonic wave through the transmitter and then reads the wave reflection using the receiver when there is no object detected. The ultrasonic wave is emitted by the transmitter via pin Trigger that is given the pulse signal by the microcontroller. Then, the reflected wave received by the receiver is forwarded to the microcontroller via pins Echo. From the concept, it can be seen that the ultrasonic wave is emitted when the sensor is given a pulse signal with a period of 10 µs via pin Trigger. The ultrasonic wave emitted and reflected has a frequency of 40 KHz. The resulting lag time between the transmission and reflection wave is used as a reference to calculate the distance of the sensor to the object [5].

1.2 ESP8266-12E

ESP8266 is a low-cost Wi-Fi chip with full TCP/IP stack and microcontroller capability produced by Espressif. This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections using AT commands. The very low price and the fact that there were very little external components on the module which suggests that it could eventually be very inexpensive in volume make

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HC-SR04 Ultrasonic Range Finder
Manual

Features
➤ Distance measurement range: 2cm - 400cm
➤ Accuracy: 3 mm
➤ Detection angle: 15 degree
➤ Simple 5V DC operation
➤ Current consumption: 10mA

How It Works

HC-SR04 consists of ultrasonic transmitter, receiver, and control circuit. When triggered it sends out a series of 40KHz ultrasonic pulses and receives the echo as a signal. The distance between the unit and the object is calculated by measuring the traveling time of sound and output it as the width of a TTL pulse.

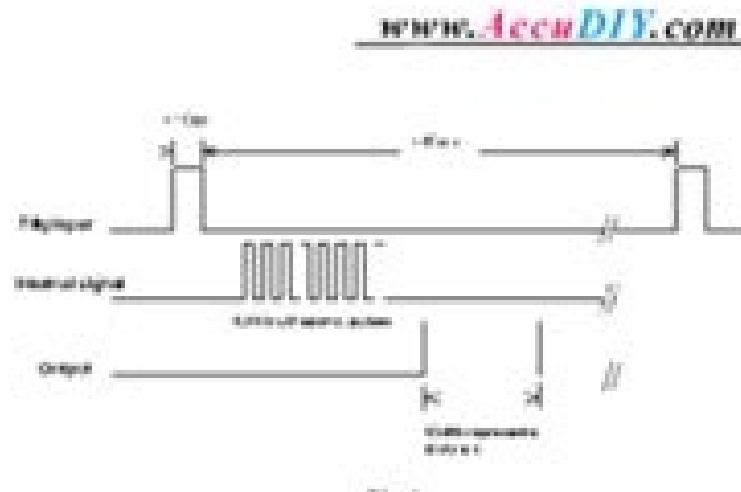


How To Use It

To measure distance, you need to generate a trig signal and drive the trig input pin. The trig signal line must meet TTL level requirements (i.e. High level > 2.4V, low level < 0.8V) and its width must be greater than 10µs. At the same time, you need to monitor the output pin by measuring the pulse width of output signal. The detected distance can be calculated by the formula below:

$$\text{Distance} = \frac{\text{Pulse Width} \times \text{Sound Speed}}{2}$$

where the pulse width is in unit of second and sound speed is in unit of meter/second. Normally sound speed is 340m/s under room temperature.



Notes :
1. The width of trig signal must be greater than 10µs.
2. The repeat interval of trig signal should be greater than 10ms to avoid interference between consecutive measurements.

Specifications

Parameters	Specification
Operating Voltage	5V DC
Operating Current	15mA
Operating Frequency	40KHz
Maximum Distance	400cm
Minimum Distance	2cm
Detect Angle	15 degree
Trig Signal	> 10µs TTL pulse
Output Signal	TTL pulse with width corresponding distance
Weight	
Dimensions	45 x 18 x 15 mm

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HC-sr04 ultrasonic sensor schematic. Sonar sensor arduino code. Ultrasonic sensor hc-sr04 code.

The HC-SR04 configuration pin is VCC (1), Trig (2), Echo (3) and GND (4). Not to mention, we provide complete documents and libraries for Arduino, Python and Codecraft so that you can use the ultrasian distance sensor with Arduino and Raspberry Pi Famillente! Start with Ultrasonic Arduino Sensor and Raspberry Pi Guide of stop for this tutorial, we will use the ultrasian distance sensor Grove and mature it with the Arduino and Raspberry Pi. For the first tutorial, we have the guide for Arduino. cd ~ git clone Step 3. Continue configuring software to configure the development environment. Step 2. Grove à € "Ultrasian distance sensor x 16mm45mm x 20mm x 15mm ease of pairing with raspberry pi and arduinoose, connect directly with Raspberry Pinhas Grove Connector to facilitate the connection with arduinoore requires voltage conversion circuit The main differences that we can see from the previous table are: Working VOLTAGE Grove -Ultrasonic distance sensor admits a level of more wide tension Arduino the ultrasian distance sensor Grove supports 3.3v, allowing him to be connected directly to the conversion with the connector on board and the Grove connector, if you have a Grove-Base shield or a seeinguino, you can easily connect the Grove-Ultrasonic distance sensor with a cable. cd grove.py/grove python grove_ultrasonic_ranger.py 5 6 Follow is the code grove_ultrasonic_ranger.py. Do you want to know how pound your recycling role? What if you don't know how to upload the code, please check our guide on how to upload the code. Specifications Power supply: DC 5VWorking Current: 15mAWorking Frequency: 40HzRanging Distance : 2cm - 400cm4mResolution : 0.3 cmMeasurement ring: 15 degrees Input pulse width: 10µsDimension: 45mm x 20mm x 15mm Grove - Ultrasonic distance sensor Below we have our own Grove- Ultrasonic distance sensor, the very own version of a H04 sensor. Ultrasonic sensor working principles ref Here is a simple example of how an ultrasonic sensor works to measure the distance. First, the transmitter (tower) sends a sound wave The object collects the wave upwards, reflecting it to the sensor. The receiver (echo pin) collects it The time between transmission and reception allows to calculate the distance between the speed of sound in the air. Step 2: Referring How to install the Arduino library if you are not sure how to install the library to your Arduino. Step 3: Copy the code into Arduino IDE and upload it. Through this Arduino tutorial, you will learn how an Ultrasonic sensor works and how you use it with the Arduino and even with the Raspberry Pi. What is an ultrasonic Arduino sensor? Seeeduino V4.2 Ultrasonic distance sensor from Grove Base You can view the following video or read the tutorial written below for instructions! Step-by-step instructions Hardware connections Step 1: Connect the Ultrasonic Ranger to Grove-Base Shield D7 port Step 2: Plug Grove - Base Shield in Seeeduino Step 3: Connect Seeeduino to PC via a USB cable It must be that after completing the above steps: Software settings: Step 1: Download the Github UltrasonicRanger Library. Below are the respective codes: #include "Ultrasonic.h" gml gml { } {pool oicav } ;j0069(nigeB.laireS { }) {pates dioV } ;j3(2cinosartlu cinosartlU le y 2D a onu ondatcenoc olreah edeup ,oniudra nu a socin^Asartlu selpit^Am ratcenoc ondacsub i^tse iS mc 6 sadagluP 2 :se etnerf le ne soluc;^tsbo sol a aicnatsid aL mc 6 sadagluP 2 :se etnerf le ne soluc;^tsbo sol a aicnatsid aL :n^Aicauninoc a artseum es omoc lanimret le ne aicnatsid ed allatnap al somereV :4 osaP } ;j052(osarter .eires ne olavretni nu renetnam nebed senoicidem soD //) ;(sretemitnecnerluSAeM.cinosartlu = sretemitnecniegnar ;j052(osarter ^/adagluP() {ntnirp.laireS sadagluP 751 ~ 0 // } ;sehninlegnar() {ntnirp.laireS : } (sehninleruSAeM.cinosartlu = sehninlegnar ; } :se etnerf le ne soluc;^tsbo sol a aicnatsid aL () {ntnirp.laireS ,ogmar ed sortem^tnecci sogral ;sehninlegnar ogral { } (dioV elcub } ;j0069(nigeB.laireS { }) {dioV { } (pates :j7(ocin^Asartlu ocin^Asartlu ^h.cinosartlu^ edulcin^# 7eovr^ deesS y 40RS-CH ocin^Asartlu aicnatsid ed rosnes le etrne aicnerof al se i^Auc;A .secnoteE evoR acin^Asartlu aicnatsid ed rosneS .ev es ev es ev es ev es sv 40RS-CH mm 61 x mm 52 x mm 05 :noisnemidlt su01 :osluP ed n^Aiceyni ed adartne ed sodarg 51 :onamnic ed olugn^A gnissemmnc 1 :n^Aiculuserm3.3me053^ -à eÀ mc3 :aicnatsid gnignarZH 04 :ETNORF GNIKROWAM 8 :otneimanoicmuf ed etneirroc 5 -à eÀ V3.3 :n^Aicatnemila ed etneuF senoicacifcepsE .odacas res atiseceen ondauc senoicacifiton ribcier y jealacier of arusab ed n^Aicalumuca us ed otneimignes nu razilaer edeup ,otceyorp etse noC .esab orebmos le netimda euq soledom sorto rasu neduep es n^Aibmat orep ,n^Aicauninoc a aAug al arap B3 IP yrrrebpsaR le somerazilitt ,aAug atse ne IP yrrrebpsaR noc ocin^Asartlu rosnes le odnasU } ;j052(osarter .eires ne olavretni nu renetnam nebed senoicidem soD //) ;(sretemitnecnlerusaem.2cinosartlu = 2sretemitnecniegnar .eires ne olavretni nu renetnam nebed senoicidem soD //) ;(sretemitnecnihsaeM.1cinosartlu = 1sretemitnecniegnar ;j0gnar ed sortem^tnecci sogral a D3. Import Sys Import time offImport Gpio usleep = lambda x: time.sleep (x / 1000000.0) _timeout1 = 1000 _timeout2 = 10000 class Groveultrasonicranger (object): def init _ (self, pin): self.dio = gpio (pin) def get_distance (self): self .Dio.out) self.epdio (1) 1 if ââ % Y = _timeout1: return none t1 = time.time () count = 0 while counted previous2: if not auto.dio.read () Break Count += 1 If we have the name of the distance from the distance from the distance (T1 - T0) * 1000000) if dt. 530: Return any distance = (T2 - T1) * 1000000 / 29/2) # cm Return Distance Def Get_distance (Self): While True: Dist = Self. If everything goes well, you should see the following result (the distance measured by the sensor is shown) [email protects]: ~/Grove.py/Grove \$ python Grove_ultrasonic_Ranger.py 5 6 detecting distance. Examples of Ultrasian sensors Arduino HC-SR04 One of the most popular ultrasian sensors would be the HC-SR04. With this project, you can create a drink reminder to alert to drink water! With the ultrasound sensor, it is able to detect the changes in the water level in the bottle and also calculate how much water was drunk! What do you need? Interesting? Download the source file cloning the Grove. Py library. You can find the complete tutorial here! Paper sensor Have you ever wondered how much garbage do you produce in a week? An ultrasound sensor is a sensor that measures distances through ultrasound traveling through the air. Execute below To execute the code. Why not do one of yours no matter how much cheap? This project allows you to build an alarm system that will call it if the ultrasian sensor detects a difference in the distance that is measured. The VCC supply voltage is 5 v e and you attach trig and echo of any digital I/O on your Arduino board to feed it. What do you need? You can see the complete tutorial of Hugo Gomes on Seeed Project Hub! Summary I hope that the previous tutorials have been ostile, if you need more technical support, you can send an email to [protected email] the Grove-Ultrasonic distance sensor is now in stock now, it is one while one while one while I can! You can find the complete tutorial of Rchloe on see project hub! Ultrasian sensor alarm for the home: Hugo Gomes wants a security system, but are they too expensive? Despite the popularity of HC-SR04, the Grove ultrasian distance sensor is an more versional option that allows minor external components and a more easily pairing with the Raspberry Pi and the Arduino. If the ultrasound hits an object or obscure on its path, it will recover towards the sensor. If you have to have Raspberry Pi, you can pick up a Raspberry Pi Zero, a low-cost option to use together with the Grove-NullTrasonic distance sensor. Show down to obtain the tutorial in Raspberry Pi. Guide Arduino of the ultrasian sensor: What do you need? With Arduino ultrasian sensors such as HC-SR04, you can measure the distance. 121.757901948 cm 246.894770655 cm 2.6020510433 cm 0.205533257846 cm 0.657706425108 cm 247.433267791 cm 122.485489681 cm ^CTraceback (most recent call last): File "grove_ultrasonic_ranger.py", line 110, in main() File "grove_ultrasonic_ranger.py", line 107, in the main hour. Sleep (1) Keyboardinterrupt, you can leave this program by simply pressing Ctrl + C Arduino rebab rebab arap oirotadrocR ^sotceyorp sotse ed sonugla ne etreus raborp on ^Auc ropA ,ocin^Asartlu rosnes us ramargorp on^Ac obas arohiA stejorP rosneS Bottle Do you often forget to drink water when you're busy? Raspberry Pirasberry Pi Base Grove Ultrasonic distance sensor Step-by-step instructions Hardware connections Step 1: Connect the Grove base hat in Raspberry Step 2: Connect the Grove Ultrasonic Ranger to the D5 port of the basic hat Step 3: Connect the PI A PC raspberry through the USB cable can also connect the corresponding Ultrasonic Ranger to any GPIO port, but be sure to change the number Need: Interested in this project? It can be measured from 3 cm to 350 cm with accuracy up to 2 mm. It is a perfect ultrasian module for distance measurement, proximity sensors and ultrasonic detector.

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