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sensor (ultrasonic sensor HC-SR04)

For many (outdoor) projects a distance measurement is necessary or advantageous. These small modules are available starting at 1-2 bucks and can measure the distance up to 4-5 meters by ultrasound and are surprisingly accurate. This tutorial shows the connection and control.

Hardware

- HC-SR04 Module ([US](#) / [UK](#))
- Resistors: 330Ω and 470Ω ([US](#) / [UK](#))
- Jumper wire ([US](#) / [UK](#))

Wiring

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- VCC to Pin 2 (VCC)
- GND to Pin 6 (GND)
- TRIG to Pin 12 (GPIO18)
- connect the 330 Ω resistor to ECHO. On its end you connect it to Pin 18 (GPIO24) and through a 470 Ω resistor you connect it also to Pin6 (GND).

We do this because the GPIO pins only tolerate maximal 3.3V. The connection to GND is to have a obvious signal on GPIO24. If no pulse is sent, the signal is 0 (through the connection with GND), else it is 1. If there would be no connection to GND, the input would be undefined if no signal is sent (randomly 0 or 1), so ambiguous.

Here is the structure as a circuit diagram:

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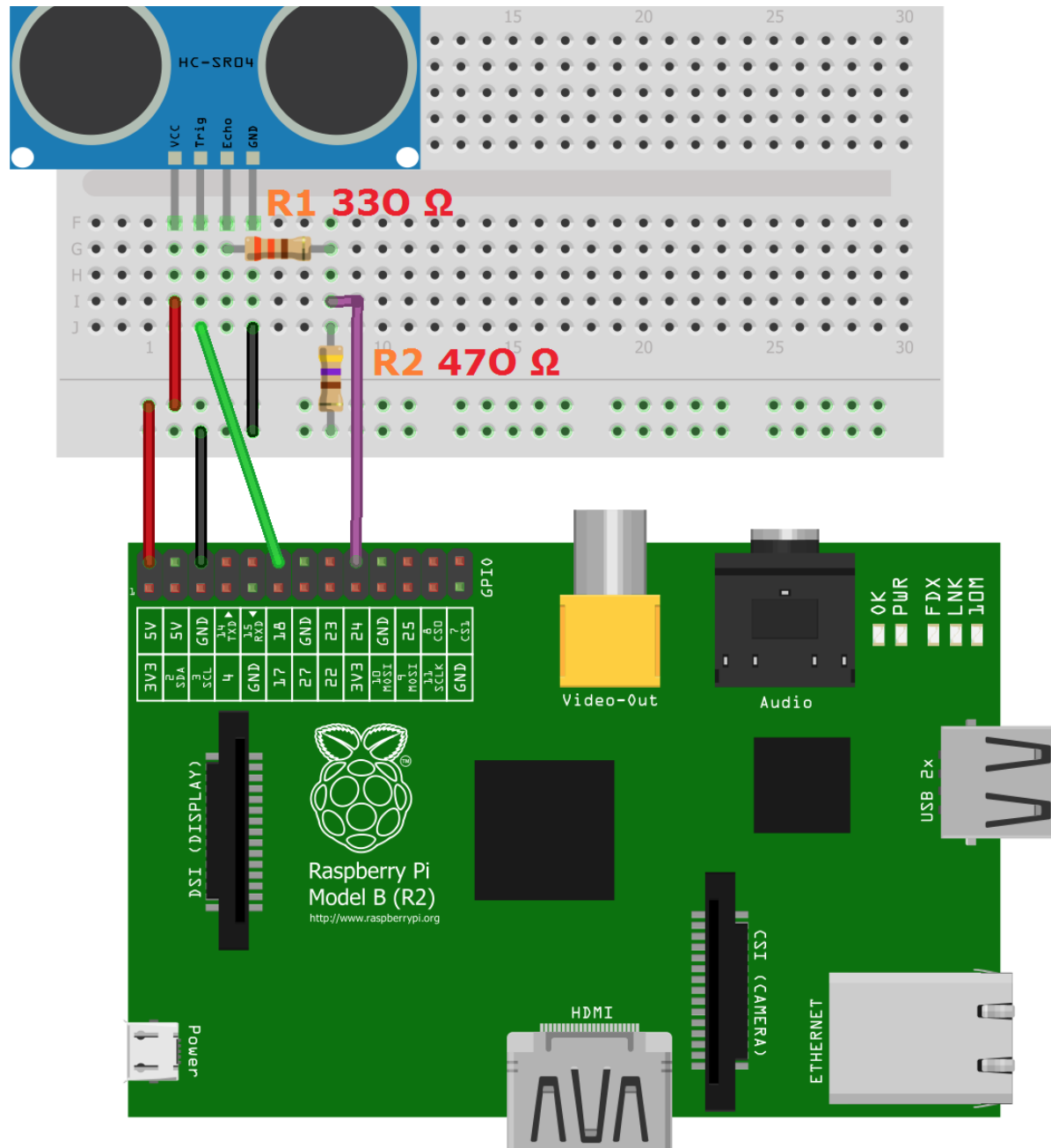
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Script for controlling

First of all, the Python GPIO library should be installed

To use the module, we create a new script

```
sudo nano ultrasonic_distance.py
```

with the following content:

```
1  #Libraries
2  import RPi.GPIO as GPIO
3  import time
4
5  #GPIO Mode (BOARD / BCM)
6  GPIO.setmode(GPIO.BCM)
7
8  #set GPIO Pins
9  GPIO_TRIGGER = 18
10 GPIO_ECHO = 24
11
12 #set GPIO direction (IN / OUT)
13 GPIO.setup(GPIO_TRIGGER, GPIO.OUT)
14 GPIO.setup(GPIO_ECHO, GPIO.IN)
15
16 def distance():
17     # set Trigger to HIGH
18     GPIO.output(GPIO_TRIGGER, True)
19
20     # set Trigger after 0.01ms to LOW
21     time.sleep(0.00001)
22     GPIO.output(GPIO_TRIGGER, False)
23
```

Python

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```

27 # save start time
28 while GPIO.input(GPIO_ECHO) == 0:
29     StartTime = time.time()
30
31 # save time of arrival
32 while GPIO.input(GPIO_ECHO) == 1:
33     StopTime = time.time()
34
35 # time difference between start and arrival
36 TimeElapsed = StopTime - StartTime
37 # multiply with the sonic speed (34300 cm/s)
38 # and divide by 2, because there and back
39 distance = (TimeElapsed * 34300) / 2
40
41 return distance
42
43 if __name__ == '__main__':
44     try:
45         while True:
46             dist = distance()
47             print ("Measured Distance = %.1f cm" % dist)
48             time.sleep(1)
49
50         # Reset by pressing CTRL + C
51     except KeyboardInterrupt:
52         print("Measurement stopped by User")
53         GPIO.cleanup()

```

After that we run:

```
sudo python ultrasonic_distance.py
```

So every second, the distance will be measured until the script is cancelled by pressing CTRL + C.

That's it. You can use it many fields, but who still want to measure larger distances would have to rely on laser measuring devices, which, however, are much more expensive.

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