





## Lesson 6 Reading the Value of the Ultrasonic Distance Sensor

In this lesson, we will learn how to read the distance of an ultrasonic distance sensor.

### 6.1 Components used in this course

Components	Quantity	Picture
AdeptPixie Drive Board	1	
Micro USB Cable	1	
3 pin jumper wire	1	
Ultrasonic Distance Sensor	1	

### 6.2 The application of the Ultrasonic Distance Sensor

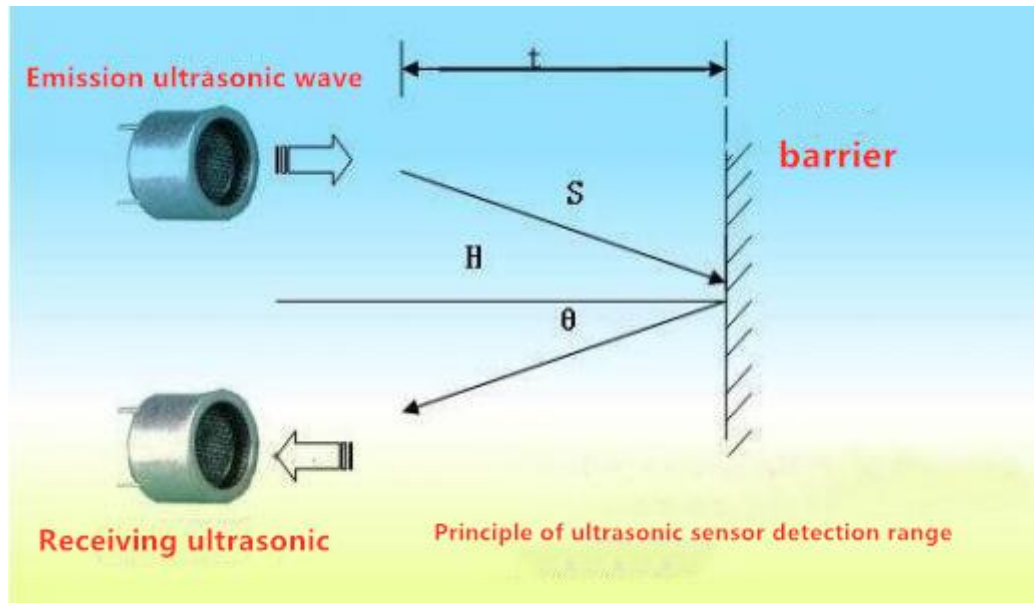
#### 6.2.1 Ultrasonic Distance Sensor

The model of the ultrasonic distance sensor we use is hc-sr04, it is mainly composed of two left and right probes, looking like our human eyes. One probe is responsible for transmitting sound waves for detection, and the other probe is responsible for receiving sound waves for return. It has 4 pins, which are VCC; Trig (control end - trigger signal input); Echo (receiver - recovery signal output); Gnd(ground).



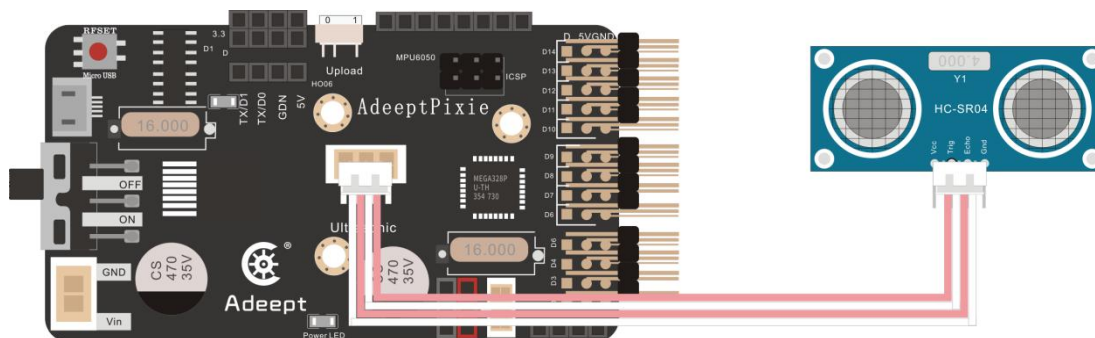
### 6.2.2 The working principle of the Ultrasonic Distance Sensor

The method of detecting distance of ultrasonic wave is called echo detection method, which ultrasonic emitter emits to a certain direction, in the moment of timer timing starts at the same time, the ultrasonic wave in air, run into obstacles on the way your face (objects) block was reflected immediately, ultrasonic receiver received the ultrasonic reflected back to immediately stop timing. The propagation speed of ultrasonic wave in the air is 340m/s. According to the time  $t$  recorded by the timer, the distance  $s$  from the launch point to the obstacle surface can be calculated, that is,  $s=340t/2$ . Under this principle of ultrasound, ultrasonic ranging module is widely used in practical applications, such as car reversing radar, uav, and intelligent car.



## 6.3 Wiring diagram (Circuit diagram)

Before the experiment, we connected the components used in this lesson to the circuit as shown in the figure below. The Ultrasonic Distance Sensor module was connected to the Ultrasonic port on the AdeptPixie Drive Board, as shown in the figure below:

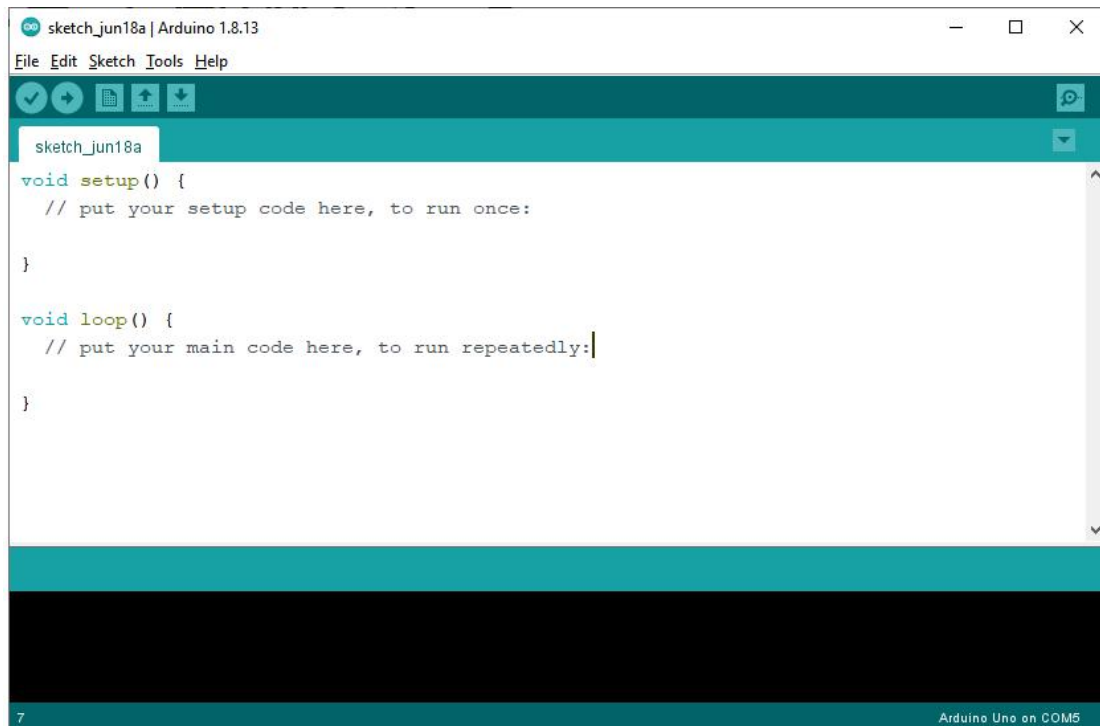


## 6.4 How to read the value of the ultrasonic distance sensor

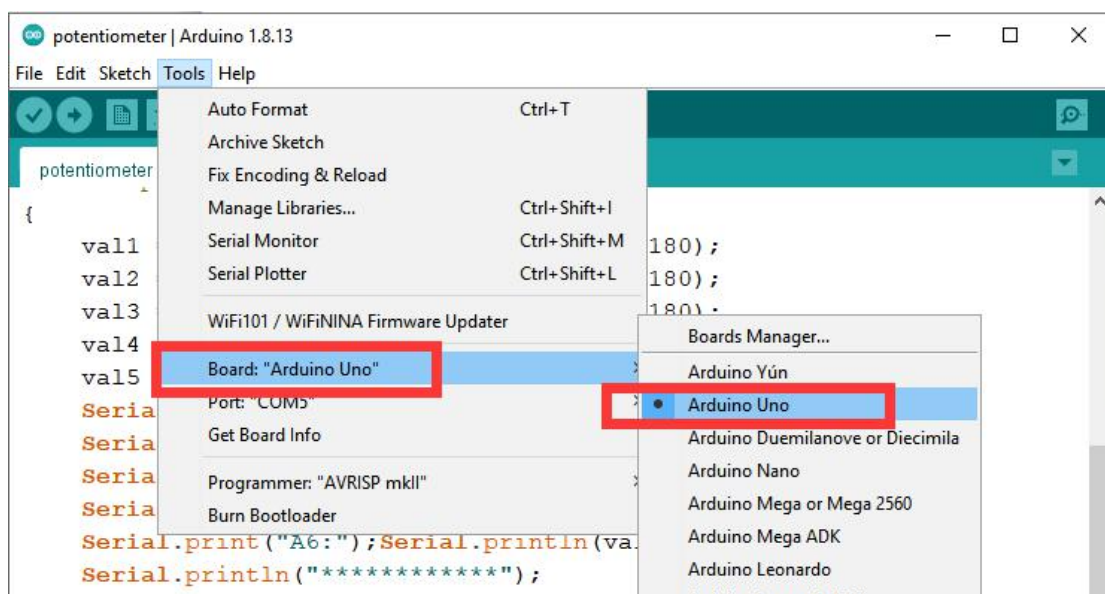
We use the Arduino IDE to use the C language to program and read the value of the ultrasonic distance sensor on the AdeptPixie Drive Board. You need to master the C language. Let's learn how to read the value of the ultrasonic distance sensor. ◦

### 6.4.1 Running the code program of this lesson

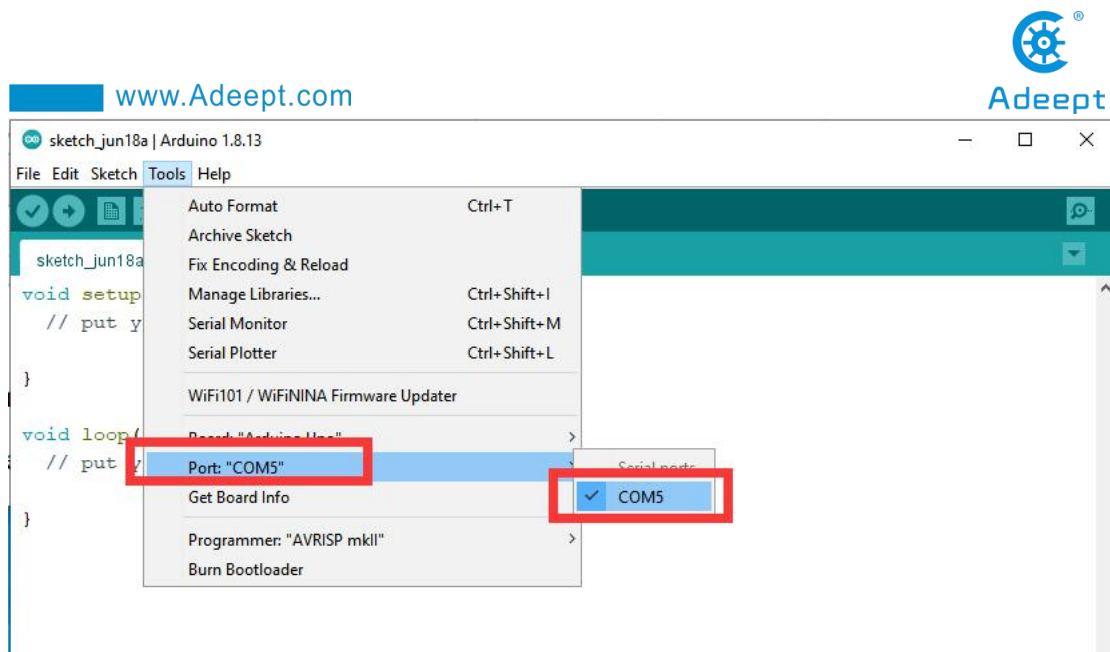
1. You need to use Micro USB Cable to connect AdeeptPixie Drive Board to your computer, and then open the Arduino IDE, as shown below:



2. In the Tools toolbar, find Board and select Arduino Uno, as shown below:



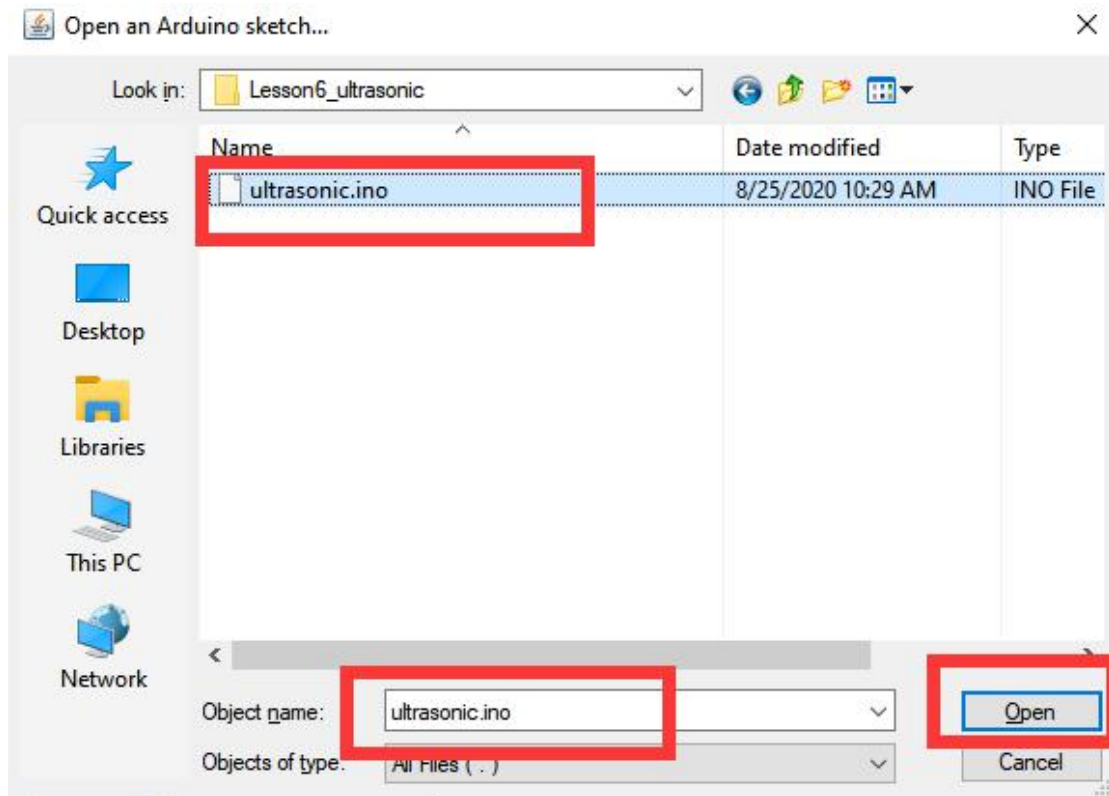
3. Click "Tools" and select the port number of the connected AdeeptPixie Drive Board in "Port": COM5, as shown in the figure below:




4. You need to open the code program of this lesson. In the File in the upper left corner, click Open, as shown below:

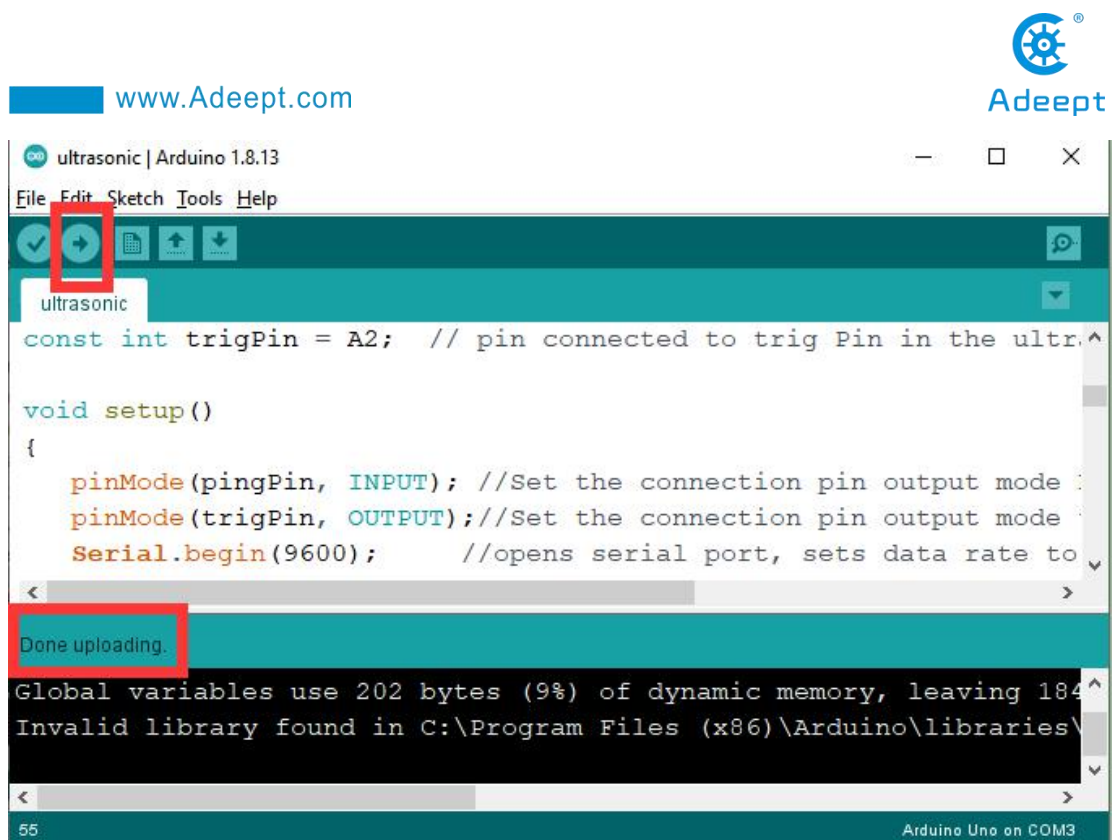



5. Find the file information provided by Adept: Hexapod 6 Legs Spider Robot Kit for Arduino\03Course code, open the Lesson6\_ultrasonic folder, select ultrasonic.ino, this file is the code program we need to use in this lesson, and then click Open.

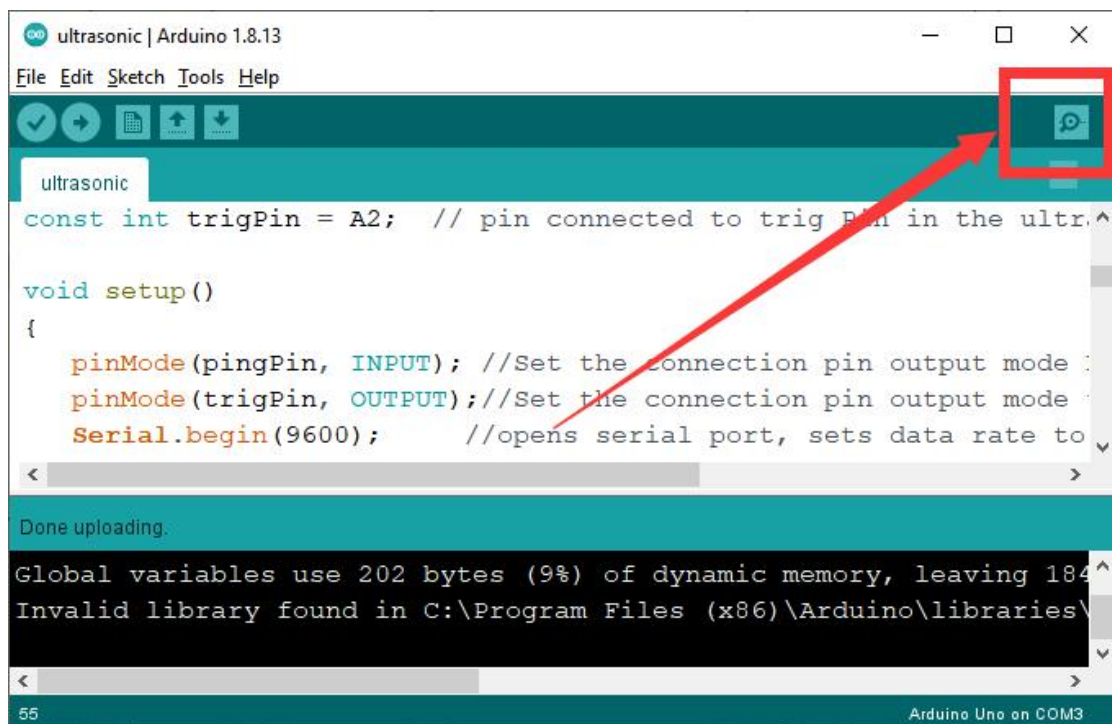



6. After successfully opening the file, you need to click the button  to upload the code program to the AdeeptPixie Drive Board. After the upload is successful, the console will not appear a red warning, and the prompt text "Done uploading" appears in the upper left corner, as shown in the figure below:

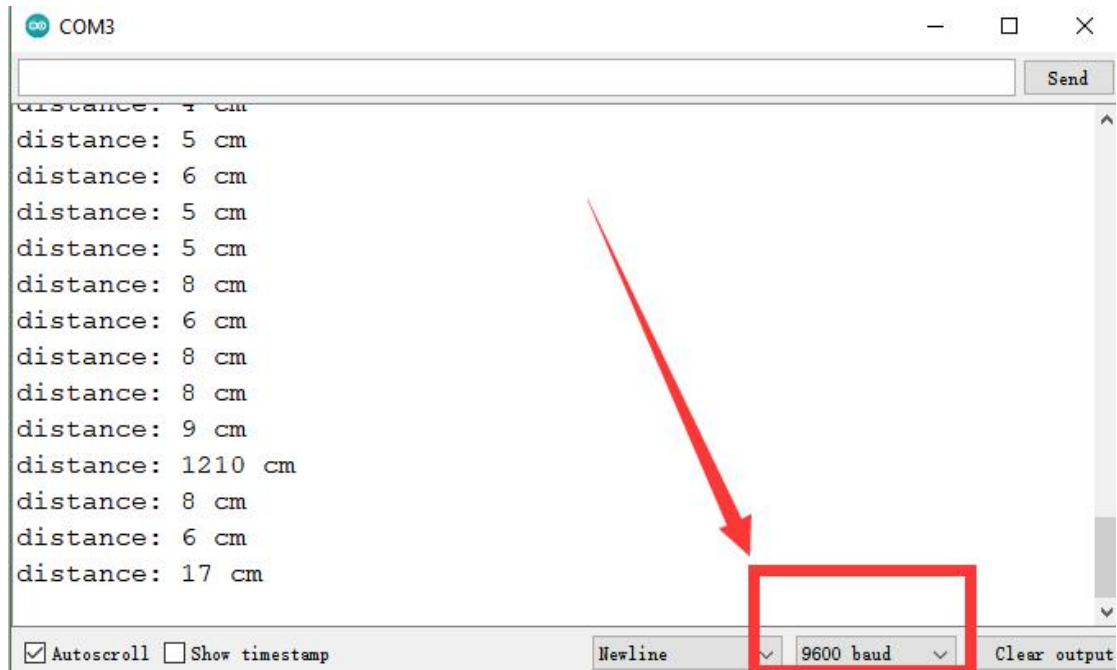




7. After successfully running the program, we need to open the serial monitor on the Arduino IDE and observe the acquired data with the serial monitor. How to open the serial monitor? You need to click the "Serial Monitor" button  in the upper right corner, as shown below:



8. After clicking , the serial monitor window will pop up, and the obstacle distance data detected by Ultrasonic Sensor will be observed. Note that 9600 baud is selected, as shown below:



## 6.4.2 Main code program

After the above practical operation, you must be very curious to know how we use C language to program and read Ultrasonic Sensor module data on AdeeptPixie Drive Board. Below we will introduce how the main code program is implemented.

In the `setup()` function, initialize the serial monitor with `Serial.begin(9600)`.

```
void setup()
{
  pinMode(pingPin, INPUT); //Set the connection pin output mode Echo pin
  pinMode(trigPin, OUTPUT); //Set the connection pin output mode trog pin
  Serial.begin(9600);      //opens serial port, sets data rate to 9600 bps
}
```

In the `loop()` function, the `ping(pingPin)` function reads the data of the Ultrasonic Sensor module, and prints out the acquired data to the serial monitor with `Serial.println()`. The detailed calculation process can be viewed in the `ping (pingPin)` function in the source code.



```
void loop()
{
    int cm = ping(pingPin);
    Serial.print("distance: "); // Print a message of "Temp: " to the serial monitor.
    Serial.print(cm);           // Print a centigrade temperature to the serial monitor.
    Serial.println(" cm");      // Print the unit of the centigrade temperature to the s
    delay(500);
}
```