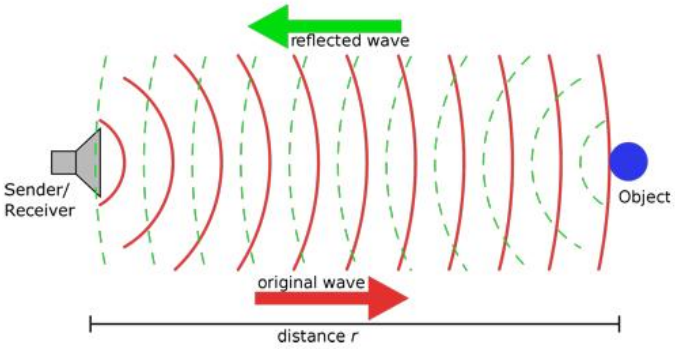
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Project 5 Ultrasonic Sensor

1.Description



The HC-SR04 ultrasonic sensor uses sonar to determine distance to an object like what bats do. It offers excellent non-contact range detection with high accuracy and stable readings in an easy-to-use package. It comes complete with an ultrasonic transmitter and receiver modules.



The HC-SR04 or the ultrasonic sensor is being used in a wide range of electronics projects for creating obstacle detection and distance measuring application as well as various other applications. Here we have brought the simple method to measure the distance with arduino and an ultrasonic sensor and how to use the ultrasonic sensor with Arduino.

2.Specification

Working Voltage :+5V DC

Quiescent Current : <2mA

Working Current: 15mA

Effectual Angle: <15°



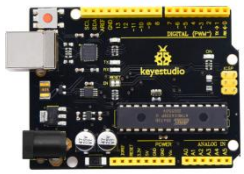
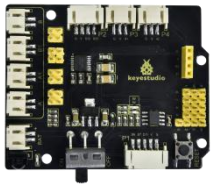
Distance Range : 2cm – 300 cm

Precision : 0.3 cm

Measuring Angle: 30 degree

Trigger Input Pulse width: 10uS

3.Components

Keyestudio 4.0 Development Board *1	Keyestudio 8833 Motor Driver Expansion Board *1		Red LED Module*1
			
4P Dupont Wire*1	USB Cable*1	3P Dupont Wire*1	HC-SR04 Ultrasonic Sensor*1
			

4.Working Principle

As the above picture shown, it is like two eyes. One is transmitting end, the other is receiving end.

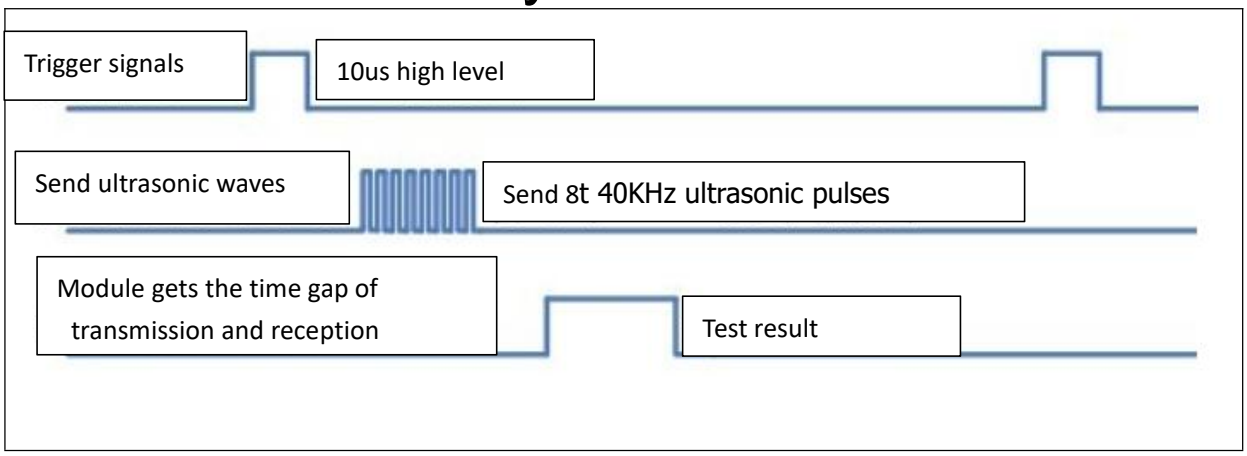
The ultrasonic module will emit the ultrasonic waves after triggering a signal. When the ultrasonic waves encounter the object and are reflected

back, the module outputs an echo signal, so it can determine the distance of the object from the time difference between the trigger signal and the echo signal.

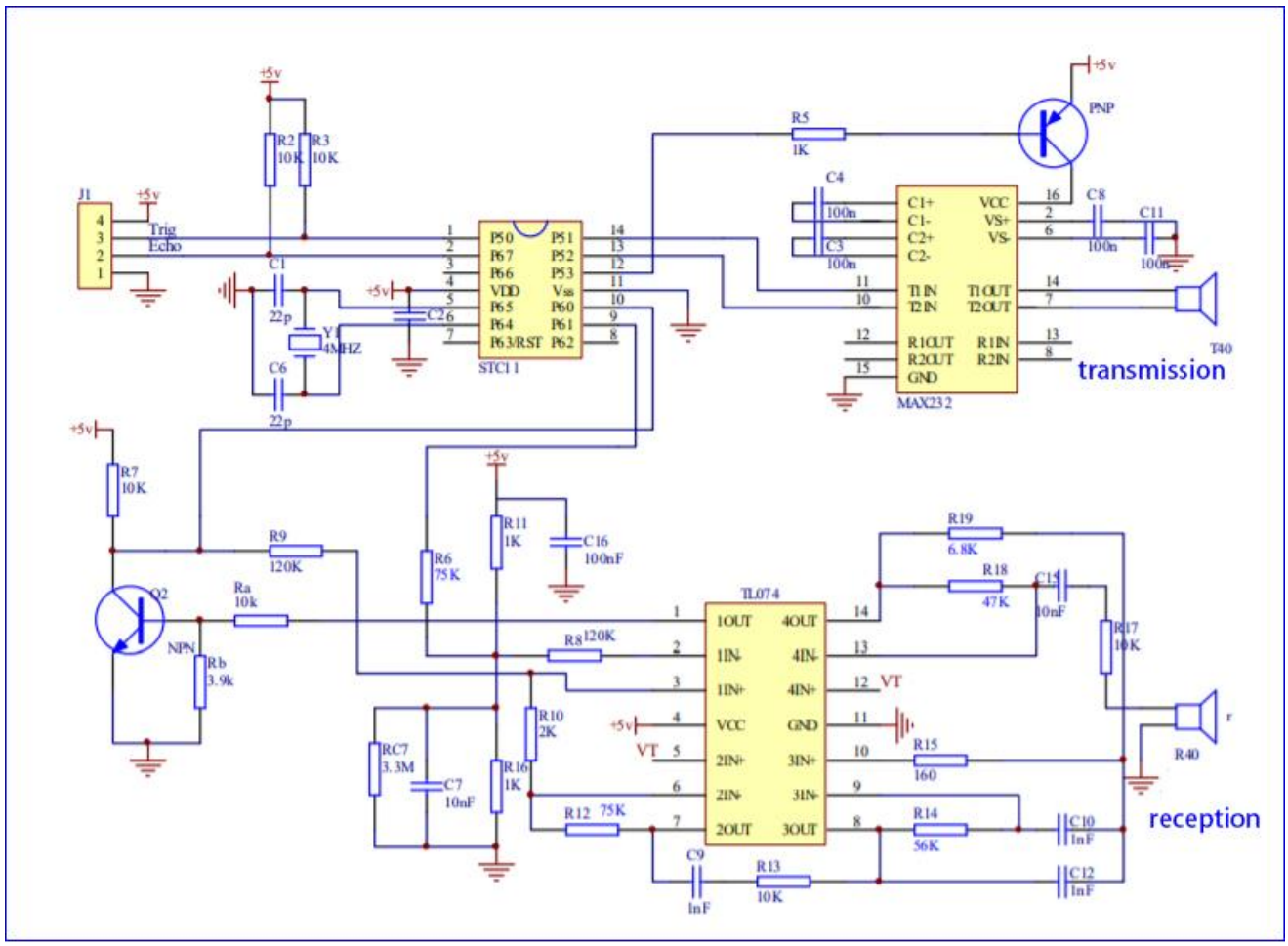
The t is the time that emitting signal meets obstacle and returns. And the propagation speed of sound in the air is about 343m/s, and distance = speed * time. However, the ultrasonic wave emits and comes back, which is 2 times of distance. Therefore, it needs to be divided by 2, the distance measured by ultrasonic wave = (speed * time)/2

Use method and chart of ultrasonic module:

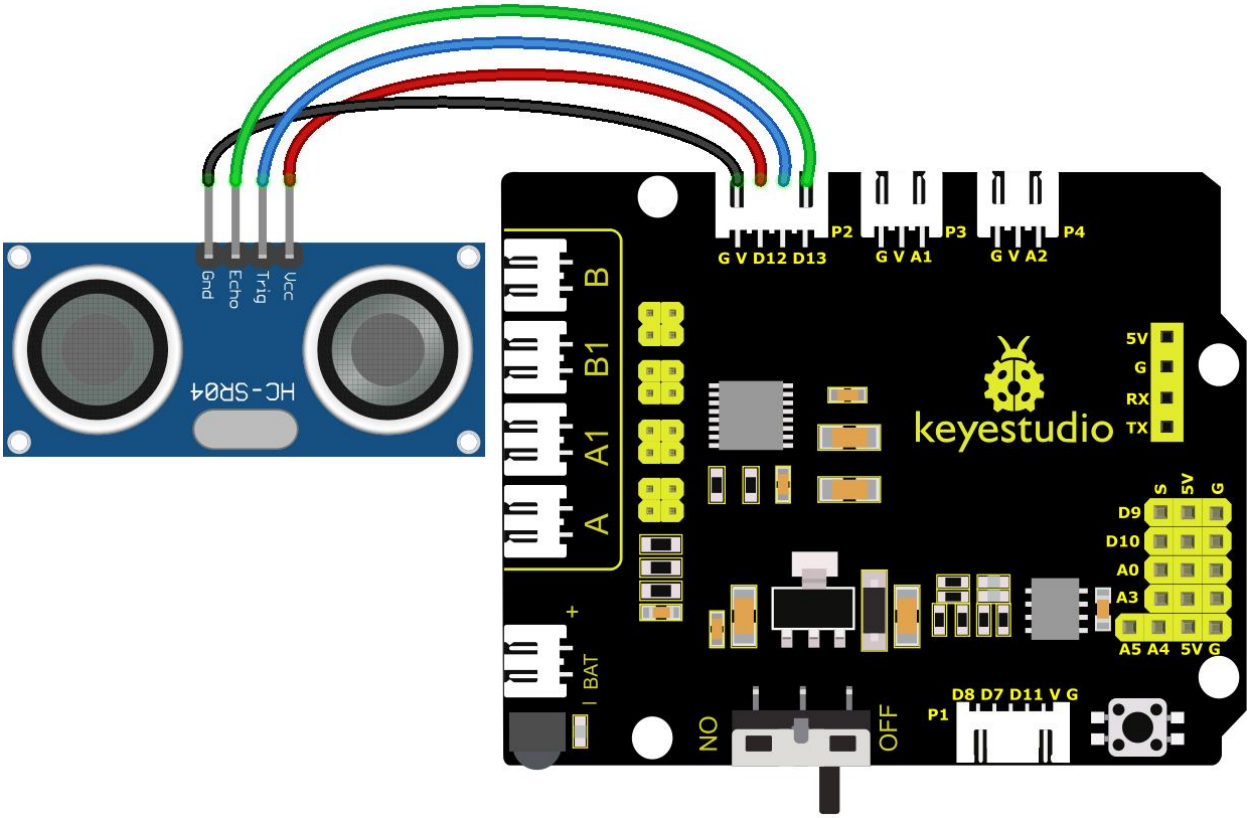
1. Use the GPIO pin to give a high level signal of at least 10μs to the Trig pin of SR04, which can trigger it to detect distance.
2. After triggering, the module will automatically send eight 40KHz ultrasonic pulses and detect whether there is a signal return. This step will be completed automatically by the module.
3. If the signal returns, the Echo pin will output a high level, and the duration of the high level is the time from the transmission of the ultrasonic wave to the return.



Circuit diagram of ultrasonic sensor:



5.Wiring Diagram

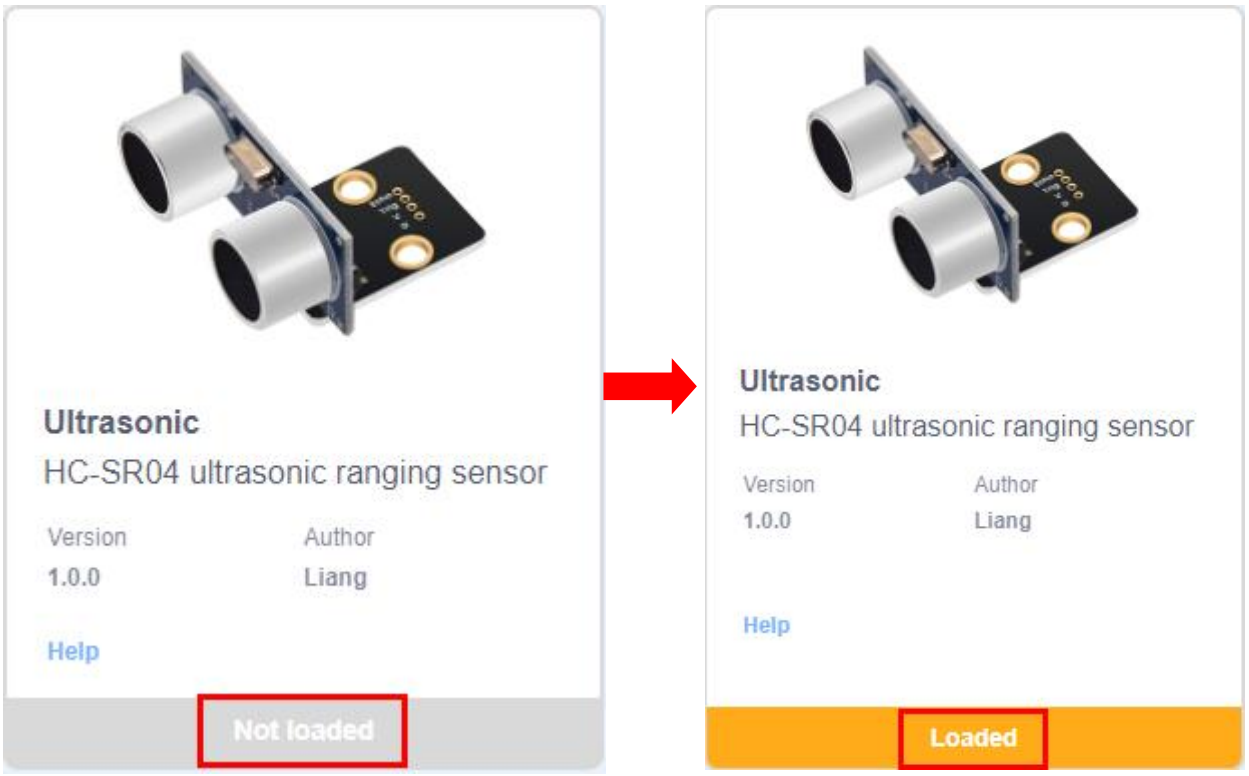


VCC, Trig, Echo and Gnd of the ultrasonic sensor are connected to 5V(V), D12, D13 and Gnd(G)

6.Test Code

Before writing the code, it is necessary to import the library file of the ultrasonic sensor. The specific steps are as follows:

Click  to enter the extension library interface of sensors/modules/components, then search for "Ultrasonic" sensor  and click it. In this way, "Not loaded" changes to "loaded", indicating that "Ultrasonic" sensor was added successfully.



Click  to return to the code editor interface, the instruction block of the added "Ultrasonic" sensor can be seen in the module area.



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You can drag blocks to edit. Blocks listed below are for your reference

（1）

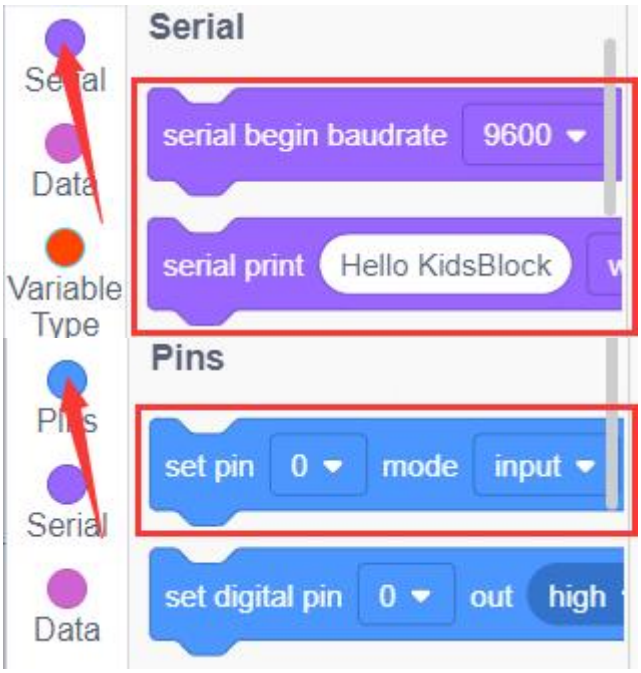


（2）

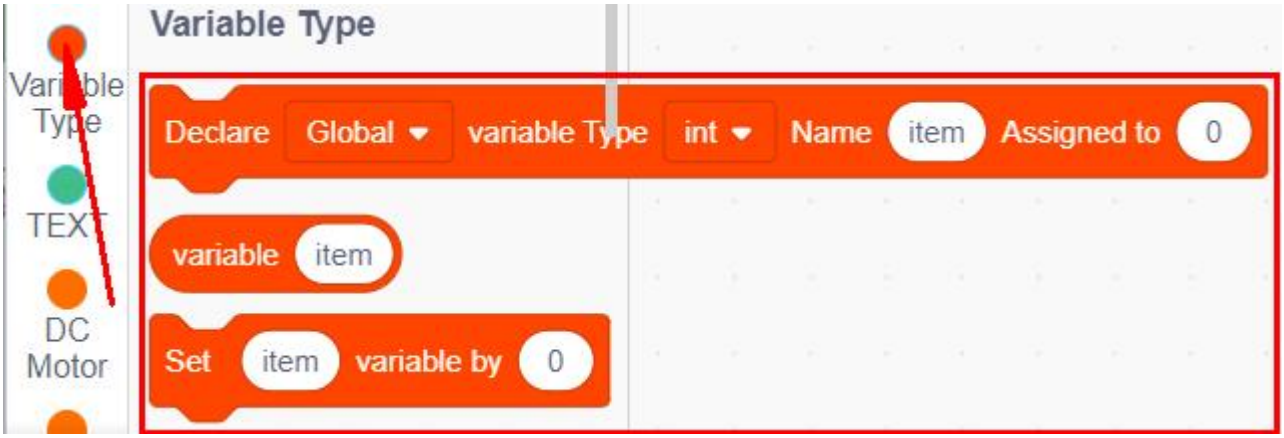


（3）

（4）



（5）


Variable Type
Declare Global variable Type int Name item Assigned to 0
variable item
Set item variable by 0
DC Motor

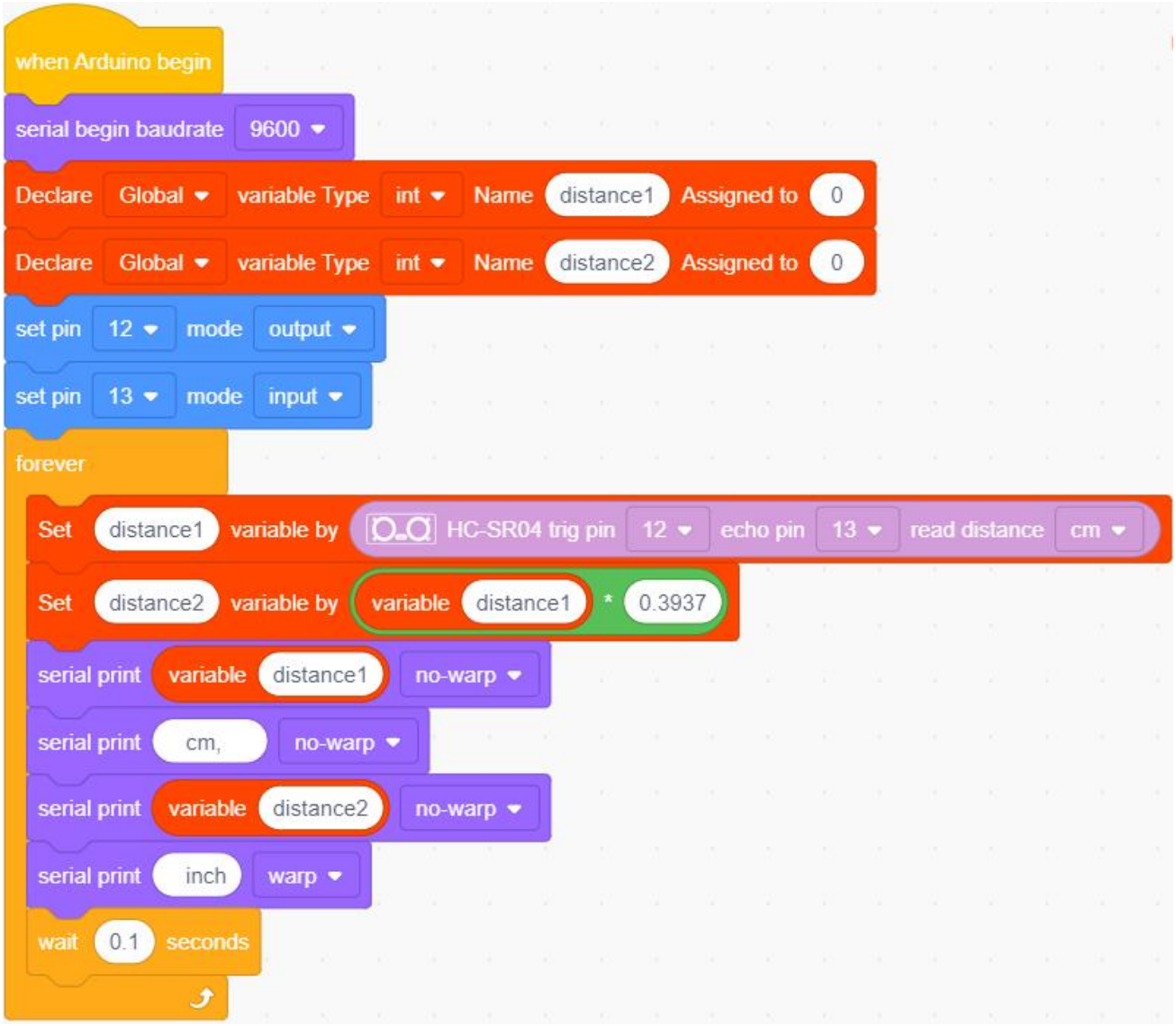
（6）


Operators
Events
Control
0 + 0
0 - 0
0 * 0
0 / 0

（7）


Ultrasonic
HC-SR04 trig pin 12 echo pin 13 read distance cm
Matrix

Complete Test Code

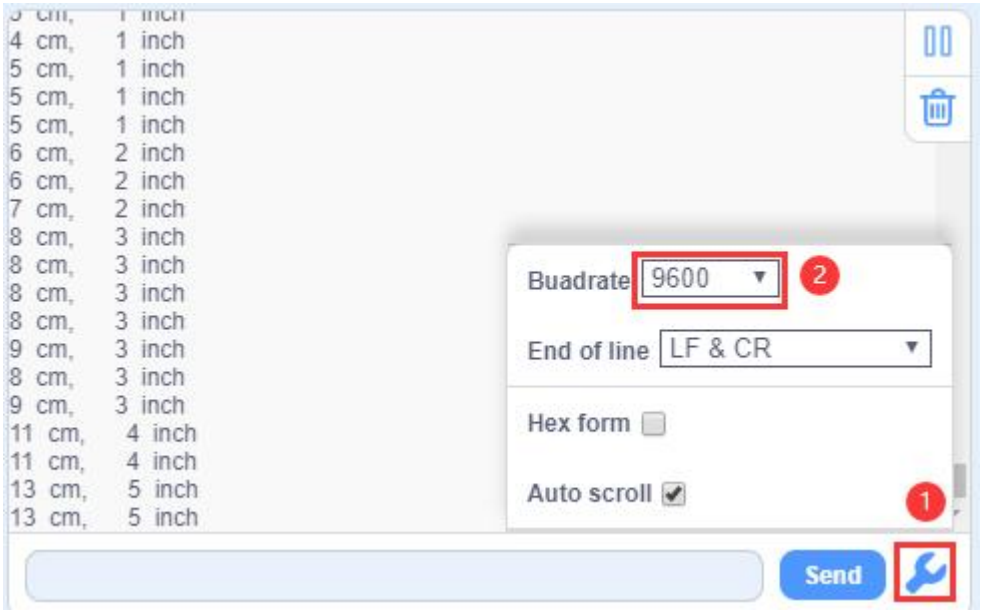


7.Test Result

After successfully uploading the code to the V4.0 board, connect the wirings according to the wiring diagram, then connect the computer via a USB cable to power the board. After powering on, click to set baud rate to 9600.

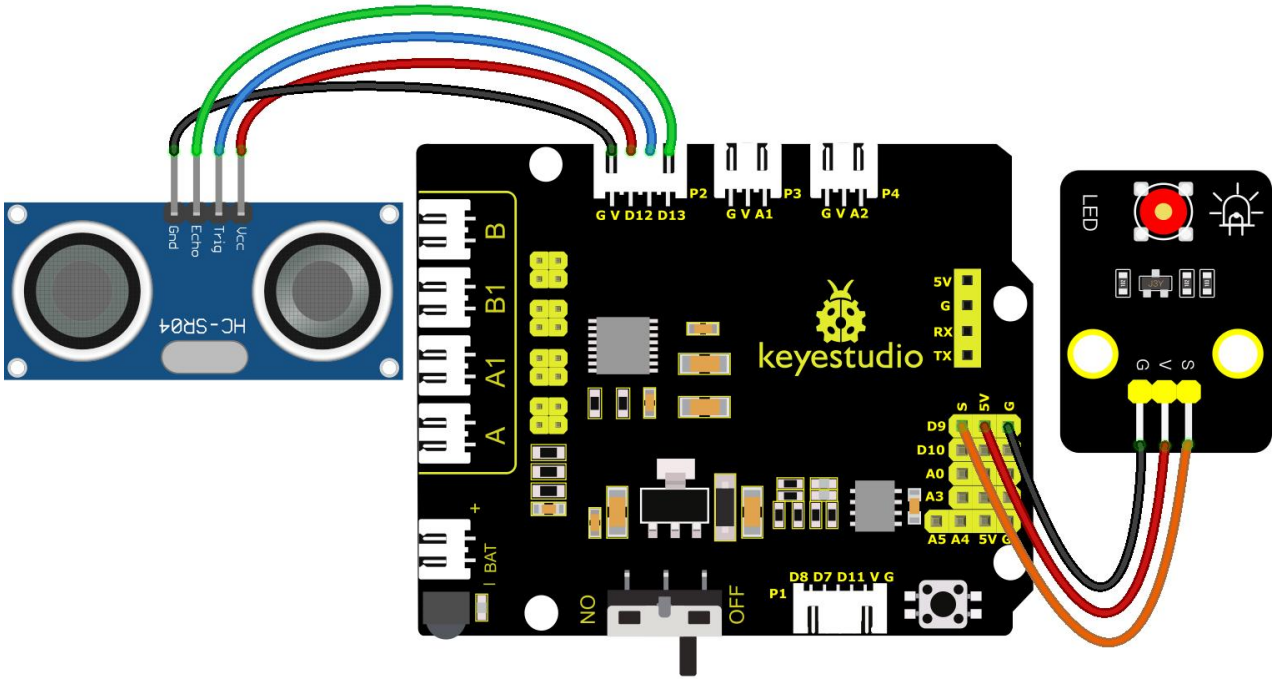
The detected distance will be displayed, and the unit is cm and inch.

Hinder the ultrasonic sensor by hand, the displayed distance value gets smaller.



8.Extension Practice

We have just measured the distance displayed by the ultrasonic. How about controlling the LED with the measured distance? Let's try it and connect an LED light module to the D9 pin.

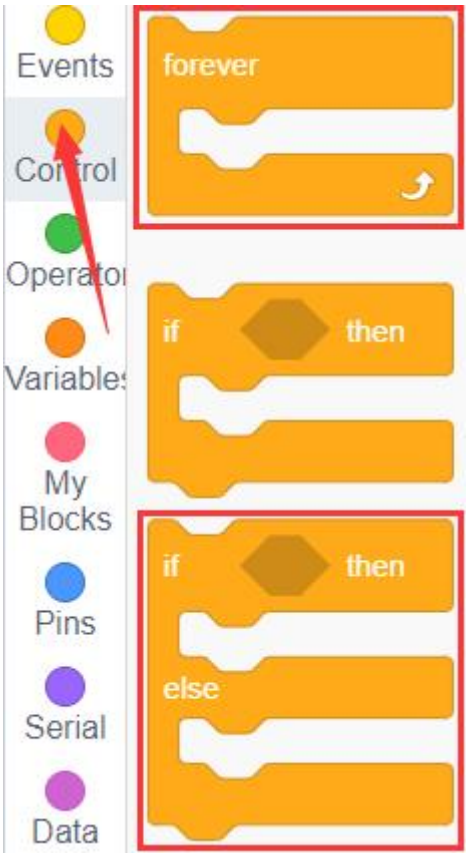


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（1）

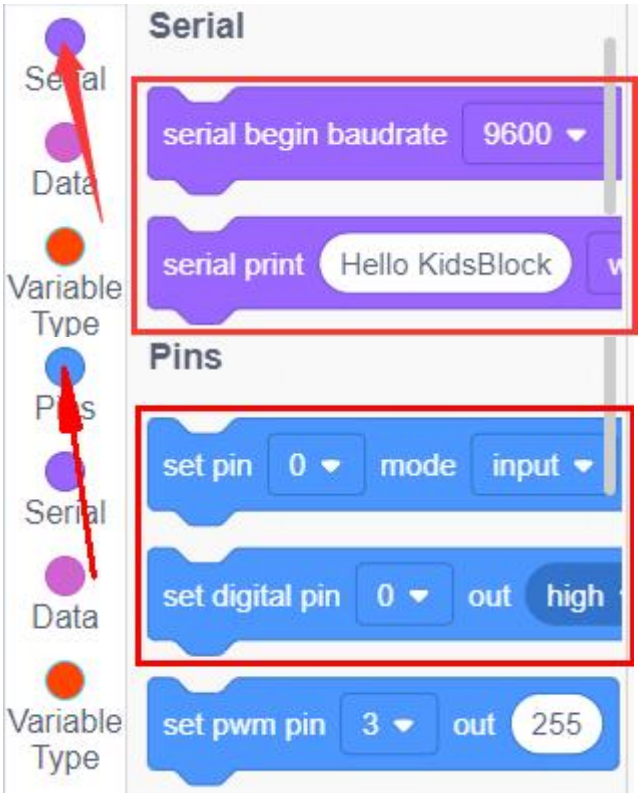


（2）

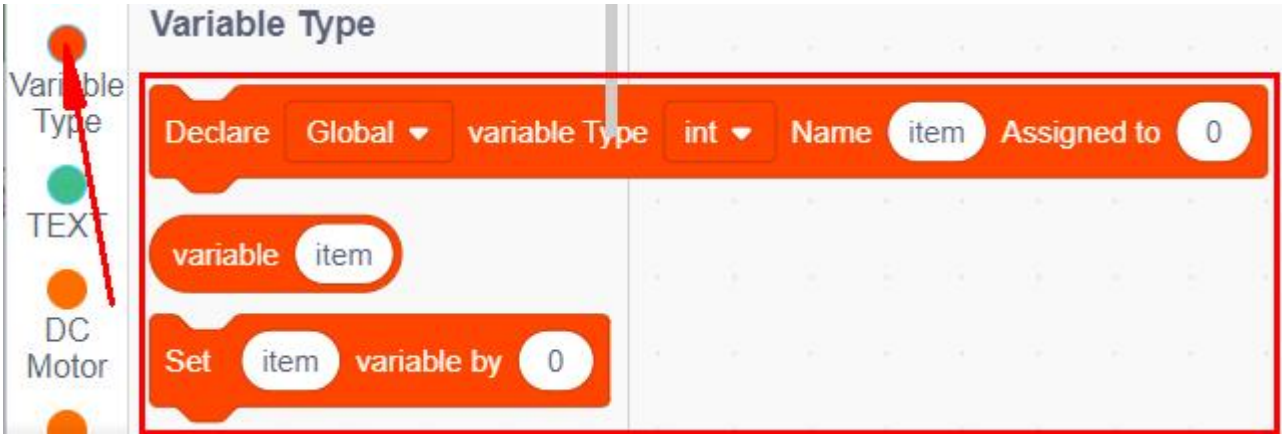

Events
Control
Operator
Variables
My Blocks
Pins
Serial
Data
forever
if then
if then
else

（3）

（4）


Serial
Data
Variable Type
Pins
Serial
Data
Variable Type
Serial
serial begin baudrate 9600
serial print Hello KidsBlock
Pins
set pin 0 mode input
set digital pin 0 out high
set pwm pin 3 out 255

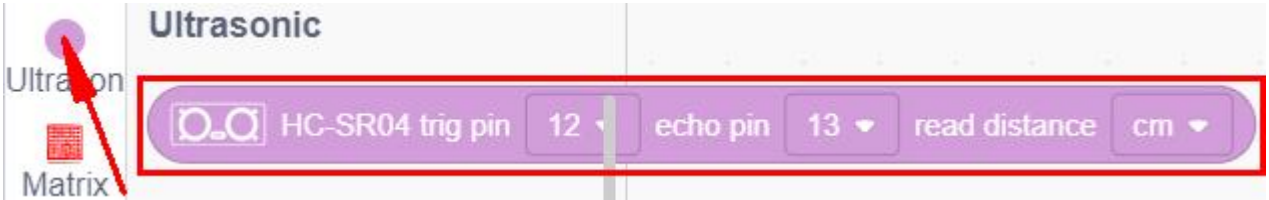
（5）


Variable Type
Declare Global variable Type int Name item Assigned to 0
variable item
Set item variable by 0
DC Motor

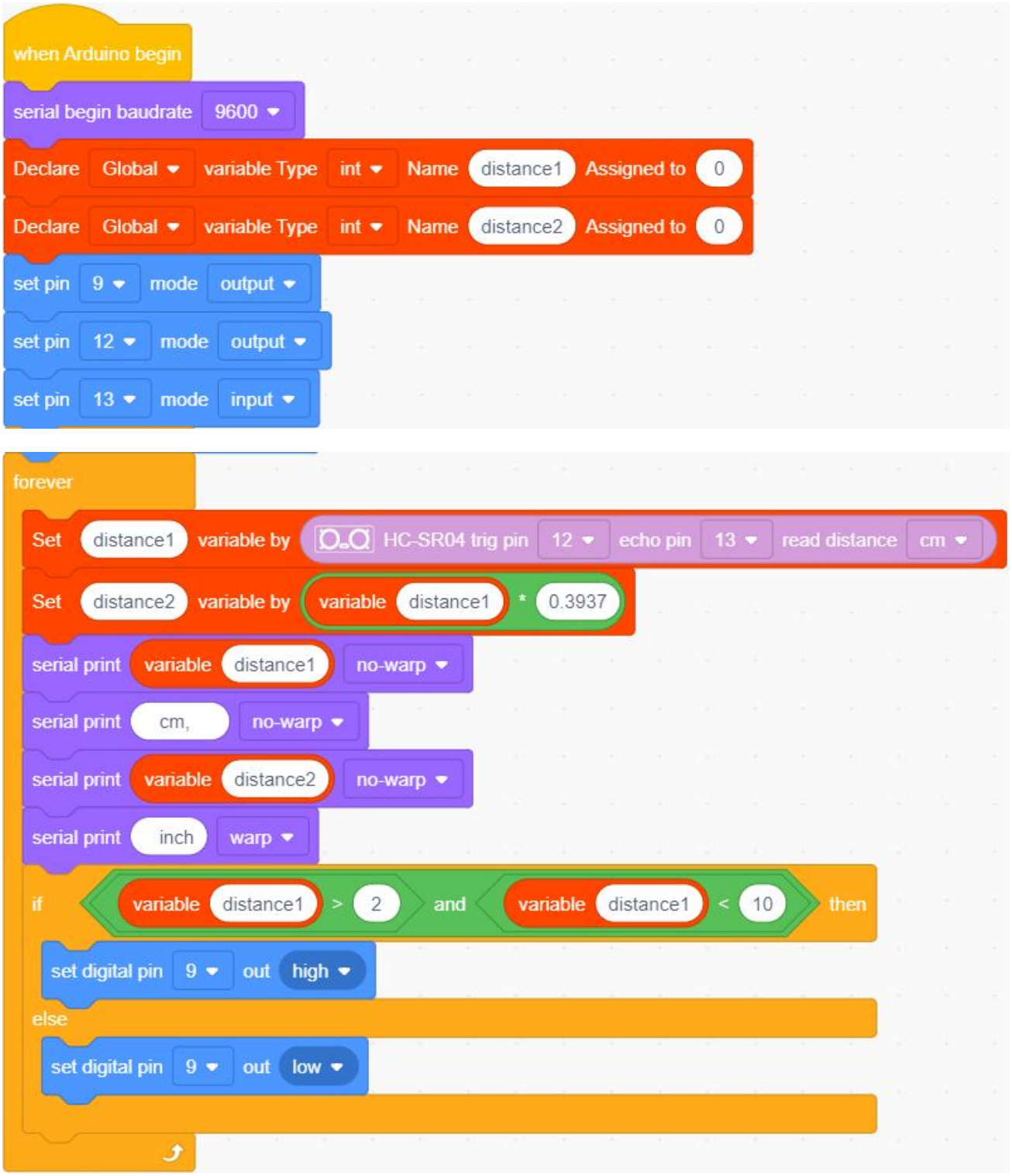
（6）


Events
Control
Operator
Variables
My Blocks
Pins
Serial
Data
0 * 0
0 / 0
pick random 1 to 10
> 50
< 50
= 50
and
or

（7）


Ultrasonic
Matrix
HC-SR04 trig pin 12 echo pin 13 read distance cm

Complete Test Code



After successfully uploading the code to the V4.0 board, connect the wirings according to the wiring diagram, then connect the computer via a

USB cable to power the board. After powering on, block the ultrasonic sensor by hand(the distance is between 2-10cm), then check if the LED is on.