



UNOBOT 3.0 SMART ROBOT CAR



Lesson 4 Infrared Controlling Car

The Points of Section

Infrared remote control is a widely used method for remote control. The car has been equipped with infrared receiver and thus allows it to be controlled using the infrared remote controller.

Learning Objectives:

Understand the infrared remote controller and the receiver

Understand the remote control principles

Preparations:

A car (with battery)

A USB cable

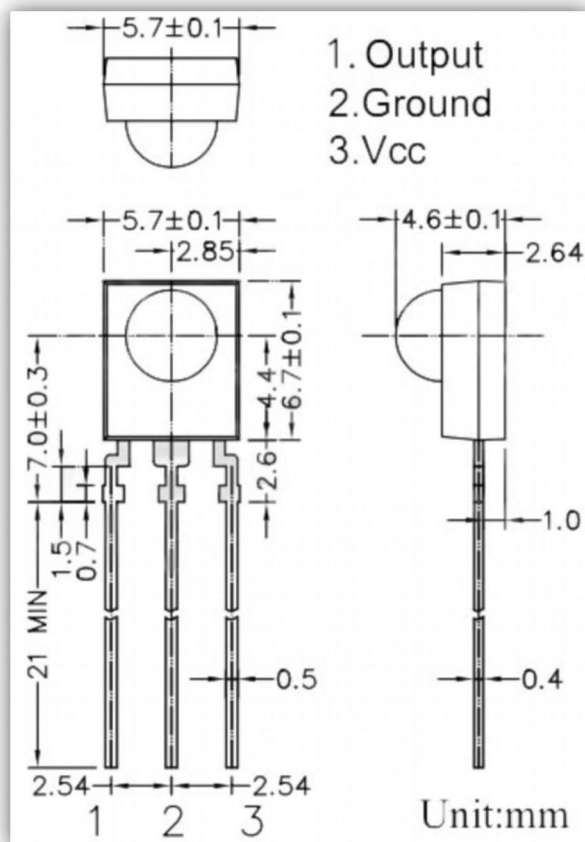
IR receiving module and IR remote



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I . IR Receiving Module and IR Remote
The data of IR receiver sensor is as below:

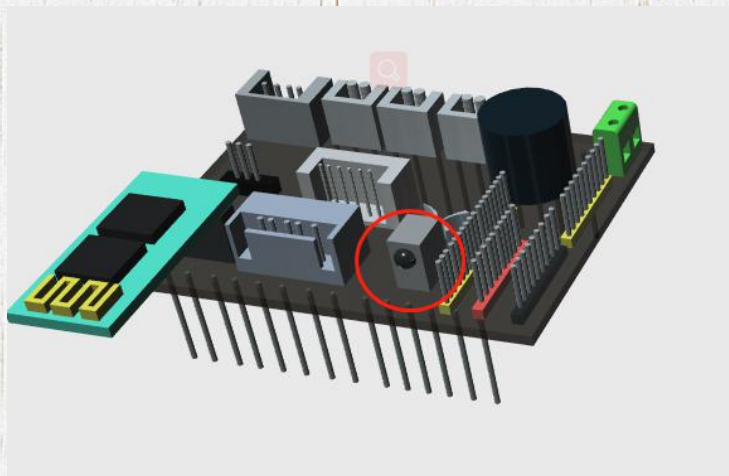




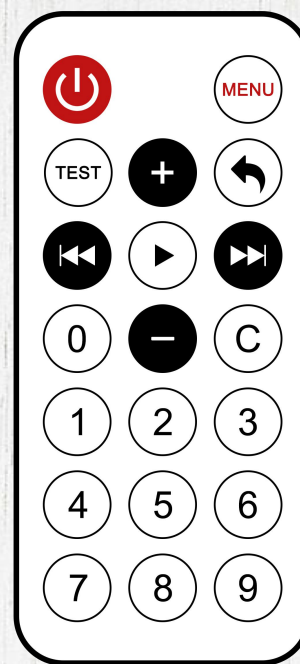
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The connection of receiver module is as below:



This is IR remote:





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II. Testing program

In this program, we need to use the library so that we need to add library file first. Connect the UNO to the computer and open the Arduino IDE.

```
sketch_dec25a | Arduino 1.8.13
File Edit Sketch Tools Help

[Icons]

sketch_dec25a
void setup() {
  // put your setup code here, to run once
}

void loop() {
  // put your main code here, to run repeatedly
}

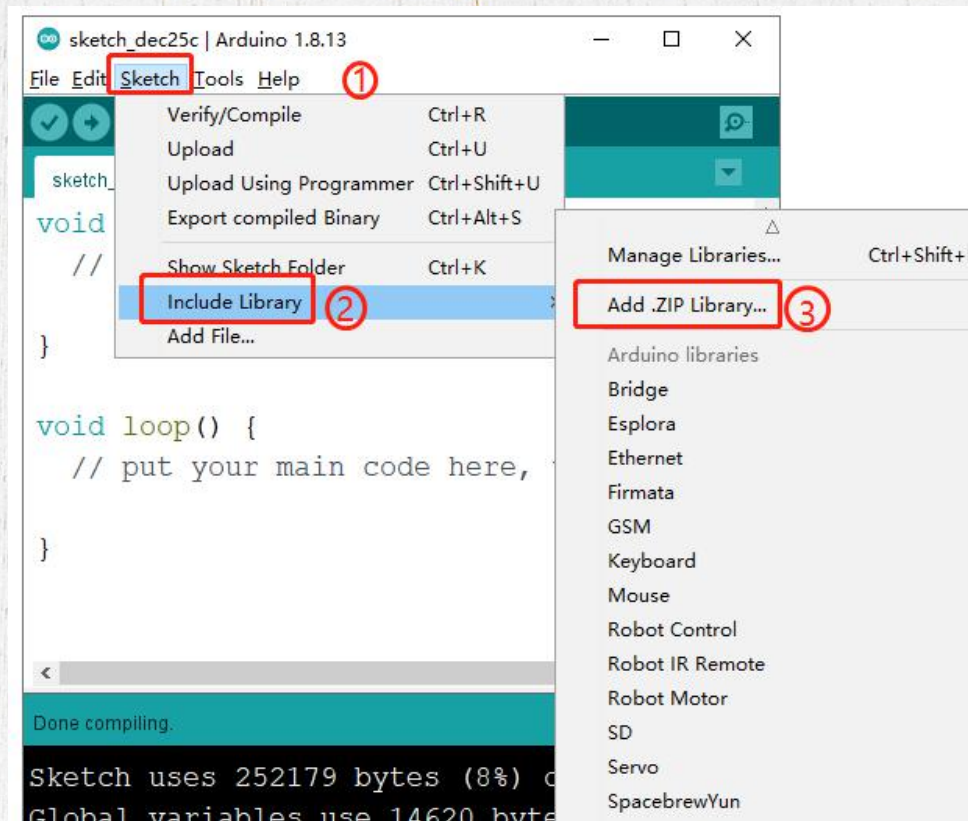
[Serial Monitor]
21Wrover Module, Huge APP (3MB No OTA/1MB SPIFFS), QIO, 80MHz, 921600, None on COM14
```




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Click Sketch --> Include Library --> Add .ZIP Library... --> then select the library as below.





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The file name of ZIP library must be IRremote.



Open zip file of tutorial materials: Lesson 4 Car Infrared Remote Control Mode-Infrared_remote_control_car——IRremote. And add it.



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III. Introduction of principle

1. Working principle

The universal infrared remote controlling system consists of two parts: sending and receiving. The sending part consists of an IR remote controller, the receiving part consists of an infrared receiving tube. The signals that sent by IR remote controlling is a serial of binary pulse code. In order to be free from distraction of other infrared signals during wireless transportation, it's general to modulate it at given carrier frequency, and then launch it through infrared emitted phototransistor. Infrared receiving tube filters out other noise waves, only receives signals of given frequency and restores them to binary pulse code that is demodulation. Built-in receiving tube transform light signals that are sent from infrared light-emitting diode to weak electric signals, signals are enlarged through amplifier inside IC, and through automatic gain controlling, band-pass filtering, demodulation, wave shaping and be restored to original encoding sent by remote control, recognize the circuit by coding that is input to electric appliance through signal output pin of infrared receiving module.



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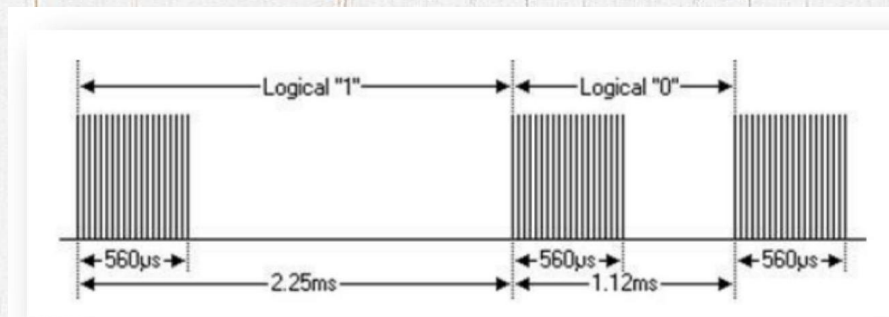


2. Protocol of infrared remote controlling

The coding scheme of matched IR remote controlling is: NEC protocol.
Next, let's learn what NEC protocol is.

Features:

- (1) 8 address bit, 8 order bit
- (2) Address bit and order bit are transmitted twice in order to guarantee reliability
- (3) Pulse position modulation
- (4) Carrier frequency is 38kHz
- (5) Time of every bit is 1.125ms or 2.25ms





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Definitions of logical 0 and 1 are as below:

The protocol is as below:

Press instant loosen transmission pulse:



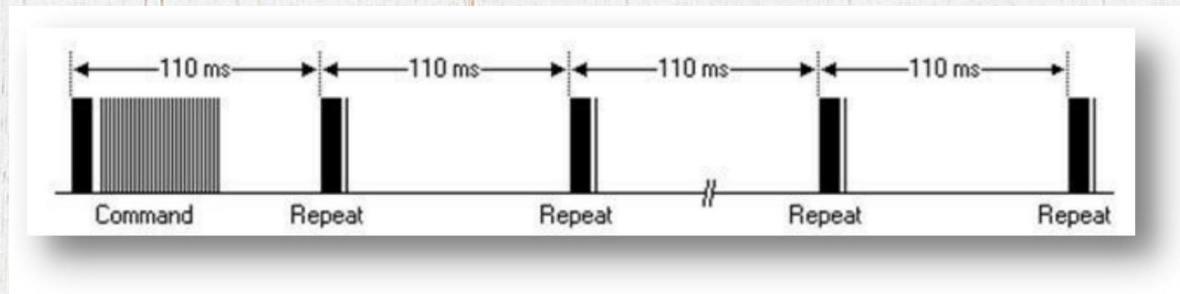
Note: This is protocol of sending LSB (least-significant bit) firstly. Transport address of the above pulse is 0x59, order is 0x16. One message starts from a high level of 9ms, the follow is a low level of 4.5ms, (Two level forms guidance code) and through address code and order code. Address and order are transmitted twice. In the second time, all bits are inverted the opposite, can be used to confirm the receiving messages to be used. Total sending time is fixed, if you are not interested in it, you can ignore reliability of invert, and can expand address and order at 16 bit! Because the fact that length repeat if every bit is opposite.



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Press transmitted pulse loosened after a time.



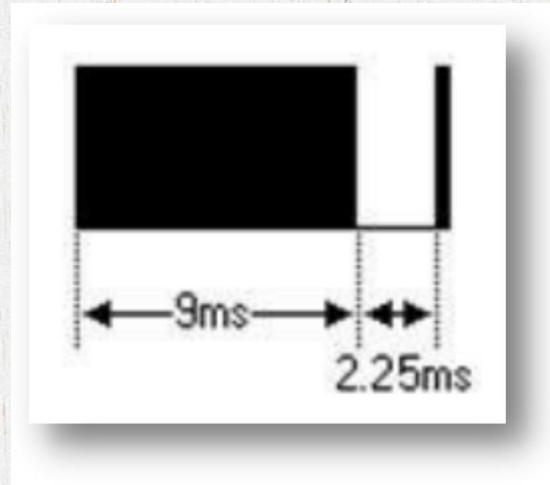
Once a command was sent, even if the button of remote controlling is pressed, when the button is still pressed, the pulse of first 110ms is different from above, duplicated code is transmitted after every 110ms. Duplicated code is made up of a high level pulse of 9ms and a low level of 2.25 and a high level of 560 μ s.



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Repeat pulse:



Note: After impulse waveform enters into integration of sensor, owing to the fact that integration of sensor should be decoded, signal magnified and plastic, you should note the time when there are no infrared signals, its output terminal is high level, and is low level when there are signals. So the level of output signal is opposite to transmitting terminal. Everybody can see receiver pulse through oscilloscope, understand program with wave form seen.



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1. The idea of programming remote control car

According to the characteristic of NEC code and wave of receiving-end, this experiment divides wave of receiving-end into five parts: leading code (Pulse of 9ms and 4.5ms)、 address code (including 8-bit address code and 8-bit address fetch)、 16-bit address code (including 8-bit address code and 8-bit address fetch)、 16-bit order code(including 8-bit order code and 8-bit order fetch)、 repeat code(be made up of pulse of 9ms、 2.25ms、 560us).







Exploit the timer to test high level and low level of wave received, being distinguished according to the time tested: logical“01”、 logical”1”、 leading pulse、 repeat pulse. Leading code and address code are judged whether correct, not be stored, owing to the fact that order code of each key is different, action is carried out by order code.

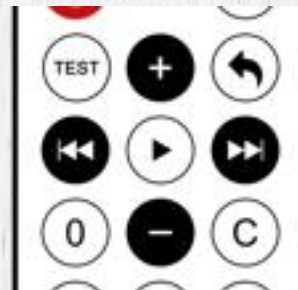


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During car experiment, we just need to control the car to go forward and backward, turn left and right, and stop ,which means we would need 5 keys and the value of them are as below:

Remote control character	key value
Middle(Stop) button 	0xFFA857
FORWARD button 	0xFF02FD
BACK button 	0xFF9867
LEFT button 	0xFFE01F
Right button 	0xFF906F
Buzzer button 	0xFF7A85





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IV. Make a remote controlling car

Open the code file in the path “\UNObot Car Kit V3.0

Plus\Infrared_remote_control_car\

Infrared_remote_control_car.ino” and then upload the program as below to the car.

Lesson 4 Car Infrared Remote Control Mode > Infrared_remote_control_car			
名称	修改日期	类型	
 Infrared_remote_control_car	2020-12-28 14:21	Arduino file	
 IRremote	2020-10-16 19:46	360压缩 ZIP 文件	

Select the Arduino Uno Board and Serial port.

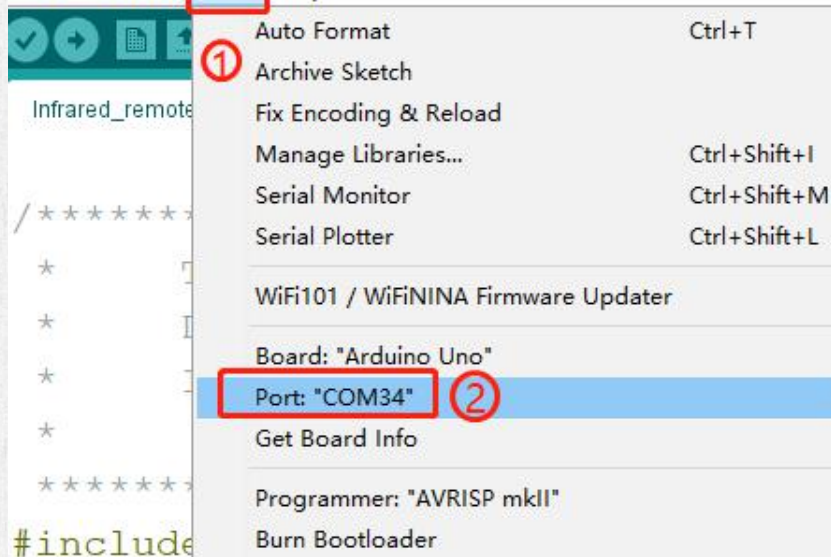


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Infrared_remote_control_car | Arduino 1.8.13

File Edit Sketch **Tools** Help



```
//----- IR REMOTE CODES -----//  
#define FORWARD 0xFF02FD //16718055  
#define BACK 0xFF9867 //16730805  
#define LEFT 0xFFE01F //16716015  
#define RIGHT 0xFF906F //16734885  
#define STOP 0xFFA857 //16726215  
#define Buzzer 0xFF7A85 //16738455
```



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Press the upload button

```
Infrared_remote_control_car | Arduino 1.8.13
File Edit Sketch Tools Help
[Icons: Checkmark, Upload, Serial Monitor, USB, Download]
Infrared_remote_control_car

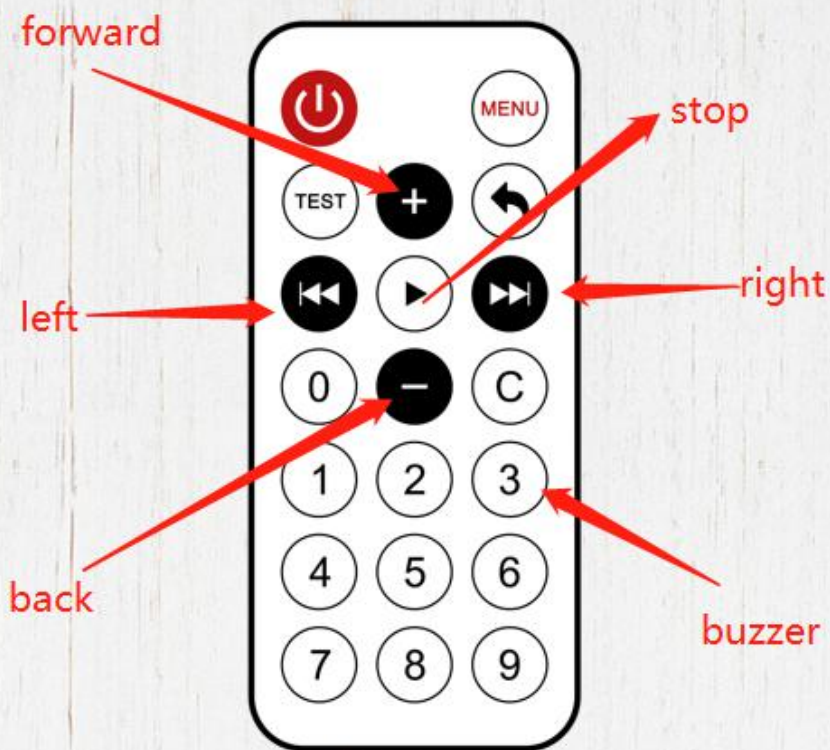
/*****
 *      TIME:2020.10.29
 *      Development Team: Zhiyi Technology Co., Ltd.
 *      INFRARED REMOTE CONTROL
 * *****/
```




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When done uploading, disconnecting the car to the computer. Then turn on the power switch and put the car on the ground. Press the button on the remote control and you can see the car move accordingly as you command.



Voila, now you can play with the IR controlling car happily.



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Thanks for watching!

