

Lesson6. Obstacle Avoidance



Key Points

Avoiding obstacle sometimes means avoiding danger. We have learned how to make a robot that follows the line, and in this lesson, you'll tech it to avoid obstacles themselves.

Key Points

1. Learn how to use infrared transmitter and receiver
2. Get to know how to avoid the obstacle
3. Program your robot
4. Equipment needed: Micro USB Cable, miniQ v2.0

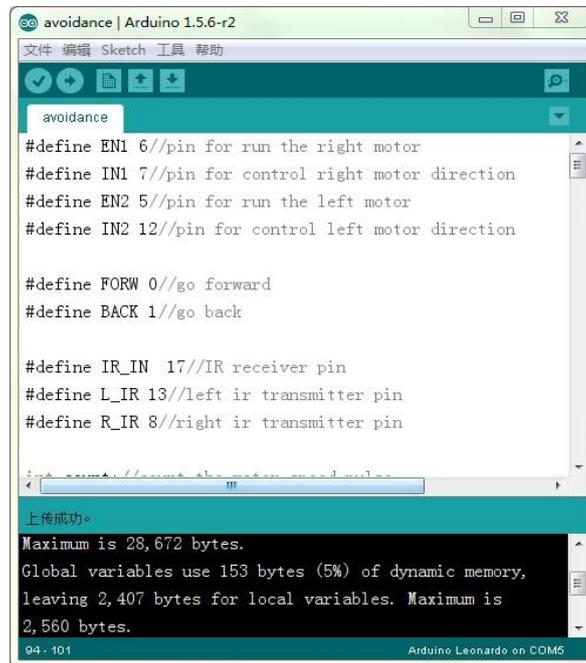
Upload the Code

- Open the folder and find “avoidance”,

| Name | Date modified | Type | Size |
|-------------------|----------------|-------------|------|
| avoidance | 2014/6/3 17:10 | File folder | |
| buzzer | 2014/6/3 17:14 | File folder | |
| control | 2014/6/3 17:10 | File folder | |
| Eat_Beans | 2014/6/3 17:10 | File folder | |
| hmc | 2014/6/3 17:10 | File folder | |
| key | 2014/6/3 17:10 | File folder | |
| lcd | 2014/6/3 17:10 | File folder | |
| light | 2014/6/4 10:15 | File folder | |
| line | 2014/6/3 17:10 | File folder | |
| line_hunt | 2014/6/3 17:10 | File folder | |
| miniQIII | 2014/6/3 17:10 | File folder | |
| ObstacleAvoidance | 2014/6/3 17:10 | File folder | |
| remote | 2014/6/3 17:10 | File folder | |
| rgb | 2014/6/3 17:10 | File folder | |
| song | 2014/6/3 17:36 | File folder | |
| speed | 2014/6/3 17:10 | File folder | |

1) Find the code we use

- Upload the code, and then put your robot on the ground, use your hands as obstacle to test the robot.



```
avoidance | Arduino 1.5.6-r2
文件 编辑 Sketch 工具 帮助

avoidance
#define EN1 6//pin for run the right motor
#define IN1 7//pin for control right motor direction
#define EN2 5//pin for run the left motor
#define IN2 12//pin for control left motor direction

#define FORW 0//go forward
#define BACK 1//go back

#define IR_IN 17//IR receiver pin
#define L_IR 13//left ir transmitter pin
#define R_IR 8//right ir transmitter pin

上传成功
Maximum is 28,672 bytes.
Global variables use 153 bytes (5%) of dynamic memory,
leaving 2,407 bytes for local variables. Maximum is
2,560 bytes.
94 - 101 Arduino Leonardo on COM5
```

2) The code

Code Analysis

- ◇ Define which pin to control the motor
 - #define EN1 6//pin for run the right motor
 - #define IN1 7//pin for control right motor direction
 - #define EN2 5//pin for run the left motor
 - #define IN2 12//pin for control left motor direction
- ◇ Define the pin which connect with the sensor
 - #define IR_IN 17//IR receiver pin
 - #define L_IR 13//left ir transmitter pin
 - #define R_IR 8//right ir transmitter pin
- ◇ Function to send pulse of 40KHz
 - void L_Send40KHZ(void)//left ir transmitter sends 40kHz pulse
 - {
 - int i;
 - for(i=0;i<24;i++)
 - {
 - digitalWrite(L_IR,LOW);
 - delayMicroseconds(8);
 - digitalWrite(L_IR,HIGH);
 - delayMicroseconds(8);
 - }
 - }

- ✧ Interrupt init:
 - `void pcint0_init(void)//init the interrupt`
 - `{`
 - `PCICR = 0X01;//`
 - `PCMSK0 = 0X01;//`
 - `}`
 -
 - `ISR(PCINT0_vect)//motor encoder interrupt`
 - `{`
 - `count++;`
 - `}`
- ✧ Transmit→Judge→Operate
 - `for(i=0;i<20;i++)//left transmitter sends 20 pulses`
 - `{`
 - `L_Send40KHZ();`
 - `delayMicroseconds(600);`
 - `}`
 - `if(count>20)//if recieved a lot pulse , it means there's a obstacle`
 - `{`
 - `Motor_Control(BACK,100,BACK,100);`
 - `delay(300);`
 - `Motor_Control(BACK,100,FORW,100);`
 - `delay(500);`
 - `}`

Principle Analysis

1. Infrared receiver

The receiver on the robot consist of receiver, amplification and demodulation. The infrared signal will be demodulated after being received, then the receiver will gives a high level voltage or low level voltage. And for the users, we often connect the output pin to the interrupt pin of Arduino thus to get the data.

2. The concept if interrupt

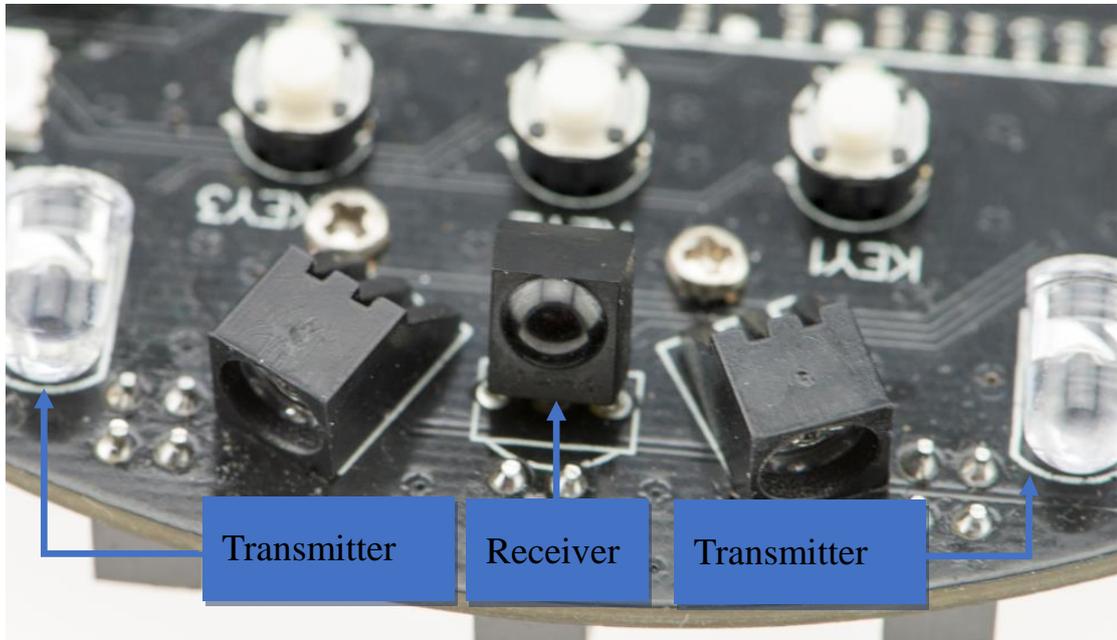
Interrupt is the action the MCU will memorize where the code runs and jump to run a special function at the same time when it meets special situation or request, and it will jump back when the MCU finish the function for acting the request or the situation.

Take a simple example, if you were eating, and you hear it was raining, you would go and close the window, and then went back to eat your meal. The rain was the interrupt signal, you do the action of closing the window. The continue eating.

3. Principle of avoiding obstacle

We use infrared sensor to help us finish the task of avoiding obstacle. The left

transmitter will give 40KHz pulse and then the right one does the same work. If the robot can receive the pulse be reflected, the interrupt function will work to count how many time it receives the signal. When the time is more than 20, we can consider that there must be something in front, then we just need to change the route.

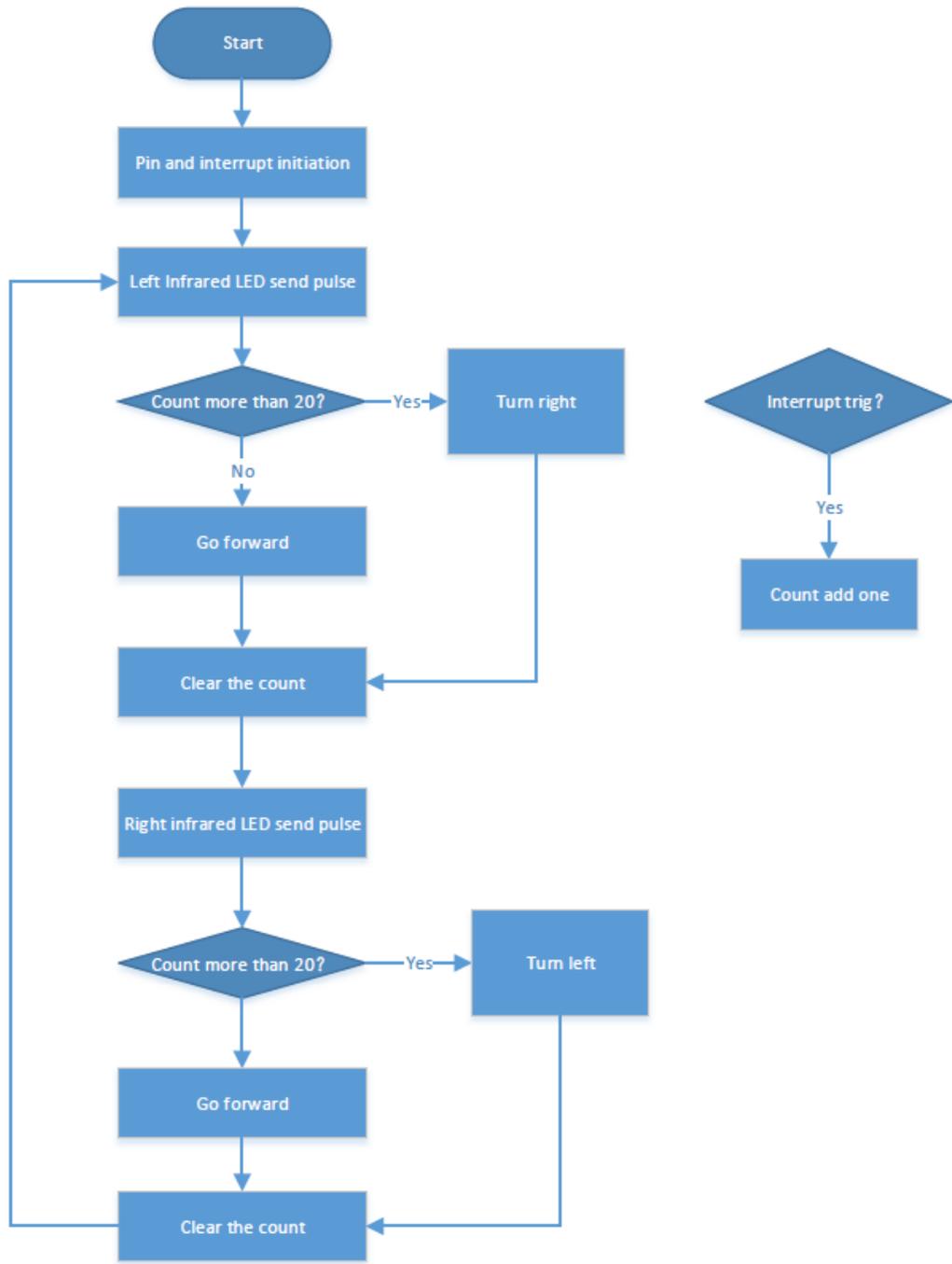


3) Obstacle Avoiding Modules

In the flow chart below, we can see that we just need to check that how many times the receiver can receive the signal when the transmitter is working. After finish the simple way to avoid the obstacle, it is very nice to make your own opinion to have fun with your robot like let your robot follow your hand or something else.

And you can also use line tracking sensors and obstacle avoiding sensor together to let your robot can stop when he have a line follow work. And we also put an electronic compass sensor, so you can let your robot runs more straightly.

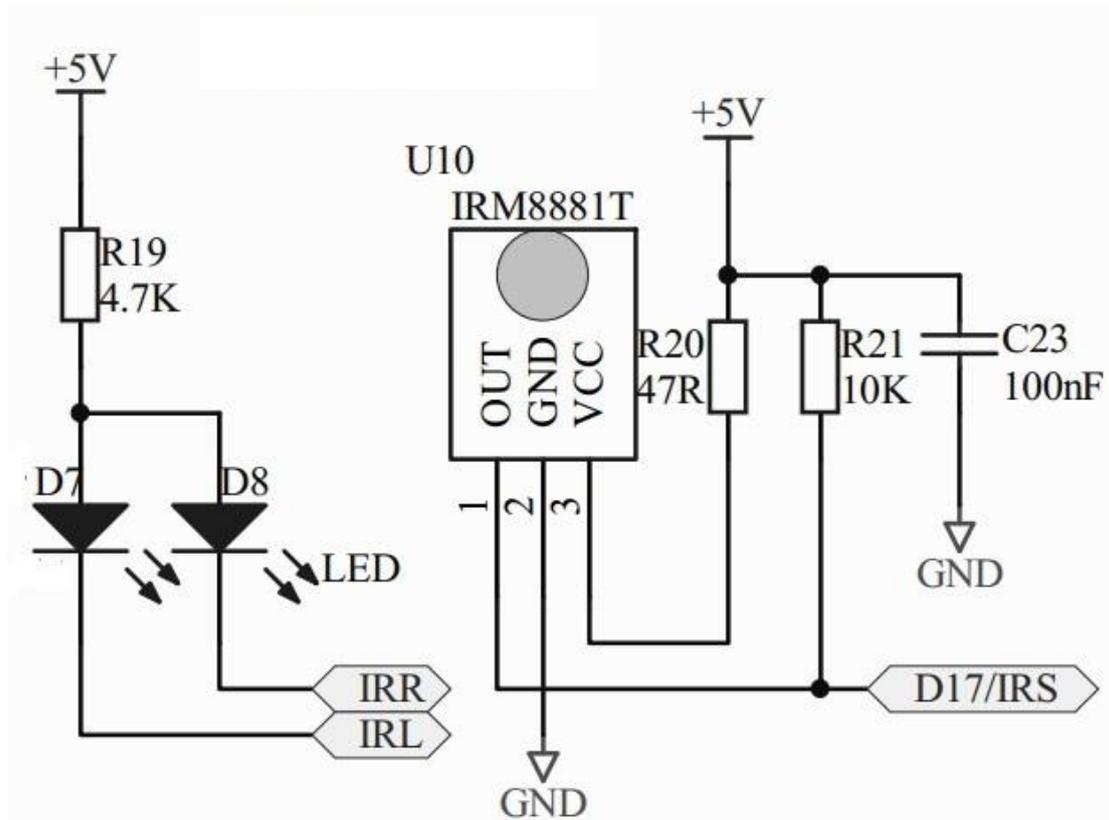
o



4) Flow chart about the code

✚ Because if we just turn on the infrared LED, the distance we can detect will be very short, that is not enough for using, and now we use pulse about 38KHz, we can detect longer. This is an interesting point that we change the way of transmitting, and it gives different feedback.

Circuit Design



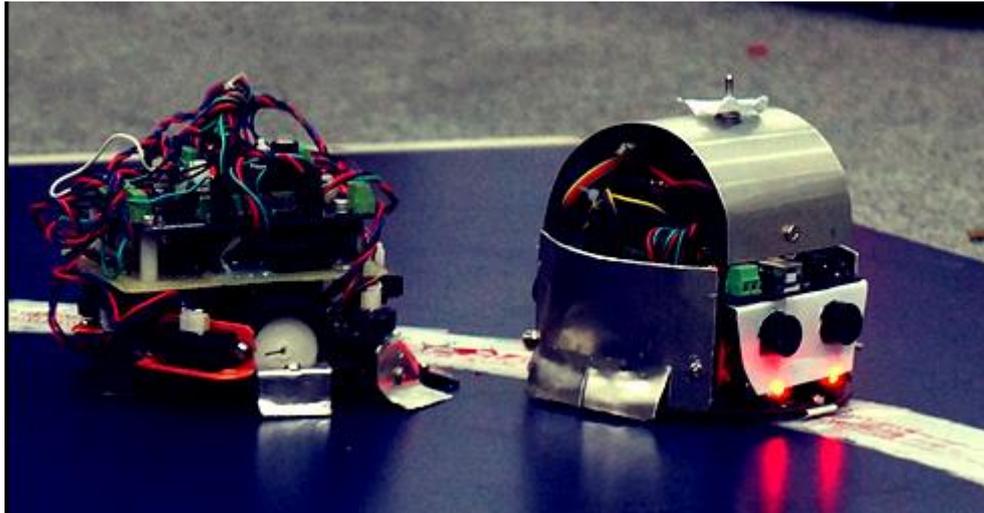
5) Obstacle Avoidance Circuit

See the schematic upon, C23 is used for smoothing, that means ignore the affection by the noise of the circuit. IRR means infrared led in the right and if this pin is given a low voltage, D8 will work. The infrared light reflected will be received by U10, the infrared receiver, and if it receives the right signal, it will change voltage of pin2 to make the MCU run its interrupt function. D17 means digital pin 17 of Arduino.

Now you can do something else with these sensors, just go ahead your idea.

Continue Reading

There is a kind of game named sumo robot which is based on obstacle avoiding strategies, so would you have a try?



6) SumoRobot

Link:

[http://www.dfrobot.com/index.php?route=product/product&filter_name=sumo
&product_id=1037#.U4gAE43diHA](http://www.dfrobot.com/index.php?route=product/product&filter_name=sumo&product_id=1037#.U4gAE43diHA)