UNOBOT 3.0 SMART ROBOT CAR

ZHIYI智譯

Lesson 5 Line Tracking Car

Points of the Section

In this lesson, we will learn how to control car to move along a runway.

Learning Objectives：

Learn how to use the line tracking module
Learn the line tracking principles
Learn how to implement line tracking via programming

Preparations:

A car (equipped with battery)
A USB cable
Three line tracking modules
A roll of black tape

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Ⅰ. Making runway

Materials: electrical adhesive tape (black tape)

First of all, we need to make a runway on our own. We can make a circuit by pasting black tape on a suitable paper or the ground. Before pasting, you can draw a runway by pen, and then paste it with electrical adhesive tape. It’s better to let the trajectory angle change slowly, not too much at once.. Because the car may run out of the track if the angle of the turn is too big. However if you want to make it more difficult, you can make the angle of the turn bigger. The size of runway is generally not smaller than 40*60 cm.

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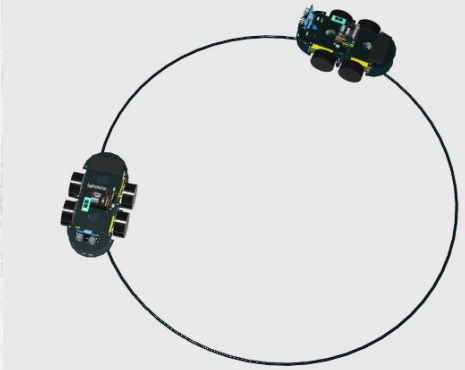
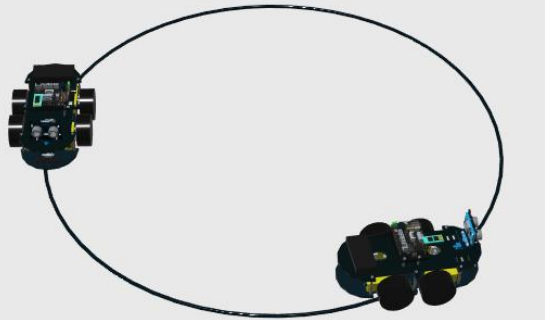
Ⅱ. Connect modules and debug

Tracker Sensor product description:
Tracker Sensor is an infrared tracking sensor, often used to make tracking smart cars.
Tracker Sensor adopts ITR20001/T infrared reflection sensor. The infrared emitting diode of ITR2001/T sensor continuously emits infrared rays.
When the emitted infrared rays are reflected by objects, they are received by the infrared receiver and output analog values.
The output simulation value is related to the object distance and object color. Judge the position of the tracking line by calculating the analog value of 3 outputs.





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Ⅲ. Upload program

After making runway and connecting modules, you just need to open the the code file “\Lesson 3 Line Tracking Car\Line_Tracking_Car\Line_Tracking_Car.ino” and upload the program to the UNO controller board.

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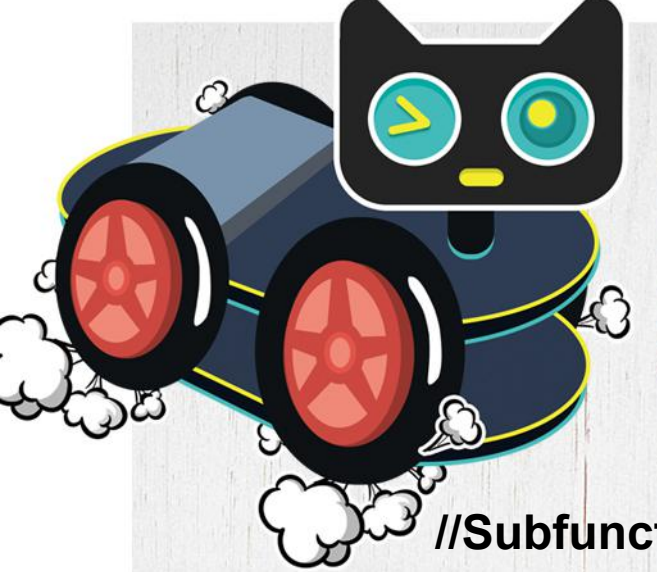
//Control board pin definition

```
int motor_L_ENA = 5; //The left motor control terminal is connected to pins 5, 7, and 8 of the Arduino board
int motor_L_IN1 = 7;
int motor_L_IN2 = 8;
int motor_R_ENB = 6; //The right motor control terminal is connected to pins 6, 9, 11 of the Arduino board
int motor_R_IN3 = 9;
int motor_R_IN4 = 11;
int infrared_L = A0;  //The infrared sensor on the left is connected to the A0 pin of the Arduino board
int infrared_M = A2;  //The mid-side infrared sensor is connected to the A2 pin of the Arduino board
int infrared_R = A3;  //The infrared sensor on the right is connected to the A3 pin of the Arduino board
int sensor_L = 1;  //
int sensor_M = 1;  //
int sensor_R = 1;  //
int low_speed = 200;  //High speed and low speed settings when turning left and right, adjustable
int high_speed = 200;
```



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//Subfunction definition

```
void go_forward_high_speed()   //Trolley forward
{
  analogWrite(motor_L_ENA, high_speed);  //Left motor
forward
  digitalWrite(motor_L_IN1, 1);
  digitalWrite(motor_L_IN2, 0);

  analogWrite(motor_R_ENB,high_speed);   //Right motor
forward
  digitalWrite(motor_R_IN3, 1);
  digitalWrite(motor_R_IN4, 0);
  Serial.println("go forward!");
}
```


```
void stop_with_brake()  //Trolley brake
  {
  digitalWrite(motor_L_ENA, 0);  //Left motor brake
  digitalWrite(motor_L_IN1, 0);
  digitalWrite(motor_L_IN2, 0) ;

  digitalWrite(motor_R_ENB, 0);  //Right motor brake
  digitalWrite(motor_R_IN3, 0);
  digitalWrite(motor_R_IN4, 0) ;
   Serial.println("go stop!");
}
void go_forward_left()  //Turn left
{
  digitalWrite(motor_L_IN1, 1);
  digitalWrite(motor_L_IN2, 0);
  analogWrite(motor_L_ENA,low_speed);  //Revolver low speed
  digitalWrite(motor_R_IN3, 0);
  digitalWrite(motor_R_IN4, 1);
  analogWrite(motor_R_ENB,high_speed); //Right round the
   Serial.println("go Left!");
}
```

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```
void go_forward_right()  //Car turn right
{
  digitalWrite(motor_L_IN1, 0);
  digitalWrite(motor_L_IN2, 1);
  analogWrite(motor_L_ENA,high_speed); //Revolver high speed
digitalWrite(motor_R_IN3, 1);
  digitalWrite(motor_R_IN4, 0);
  analogWrite(motor_R_ENB,low_speed); //Right wheel low speed
   Serial.println("go right!");
}
```

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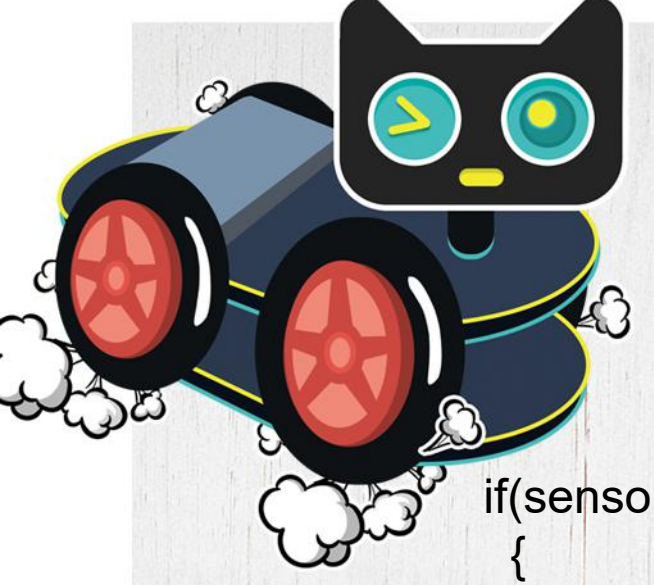
```
void setup()
{
  Serial.begin(9600);
  pinMode(motor_L_ENA, OUTPUT); //Left motor enable and PWM
speed control port
  pinMode(motor_L_IN1, OUTPUT);  //
  pinMode(motor_L_IN2, OUTPUT);  //
  pinMode(motor_R_ENB, OUTPUT); //
  pinMode(motor_R_IN3, OUTPUT);  //
  pinMode(motor_R_IN4, OUTPUT);  //

  pinMode(infrared_L, INPUT);  //Left infrared sensor
pinMode(infrared_M, INPUT);  //  Intermediate infrared sensor
pinMode(infrared_R, INPUT);  //Right infrared sensor
}
```


```
void loop()
{
  sensor_L=digitalRead(infrared_L);
  sensor_M=digitalRead(infrared_M);
  sensor_R=digitalRead(infrared_R);

  if( sensor_M==0)  //The car is on the black line
  {
    go_forward_high_speed(); // go ahead
  }

if(sensor_L==1)  //Car left
  {

    go_forward_left();   //The car turns left for 100 milliseconds, the time can be
adjusted
    delay(100);
  }
```



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```
if(sensor_R==1)  //Car left
  {

    go_forward_right();  //The car turns right for 100 milliseconds,
the time can be adjusted
    delay(100);
  }
if(sensor_R&&sensor_L==1)  //Trolley forward
  {

    go_forward_high_speed();   //go ahead
    delay(100);  }
if(sensor_R&&sensor_M==1)  // Trolley on the right {
     go_forward_right();  //
     delay(100);

  }
```

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```
if(sensor_L&&sensor_M==1)  //Trolley on the left
  {
      go_forward_left();  //The car turns right for 100 milliseconds, the
time can be adjusted
      delay(100);

  }
if(sensor_L&&sensor_M&&sensor_R==1)  //Trolley on the stop line
  {
     stop_with_brake();  //Brake for 2 seconds
     delay(2000);
  }
}
```

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Secondly, Introduction of principle：

tracking module

The tracking sensor is located in front of the car with two parts.The tracking sensor is composed of infrared emission tube and infrared receiving tube. The former is an LED that can transmit infrared light, and the latter is a photoresistor for receiving infrared rays.The light reflectance of the black surface is different from that of the white surface. Therefore, the intensity of reflected infrared light received by the car on the black road is different from that of the white road, and the resistance force will also change. According to the principle of voltage division between series resistance, the motion path can be determined by inferring the color of road below the car from the voltage of the sensor.

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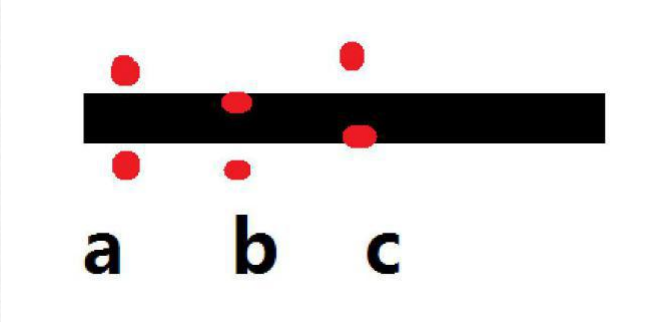

a→The car moves along the black line. One of the tracking modules is on the left side of the line and the other is on the right. The black line could not be detected.

b→The car learn to move to the right. The module on the left can detect the black line, and then it will detect the sending signal to the controller board, and the car will turn left.。

c→The car learn to move to the left. The module on the right can detect the black line, and then it will send a signal to the controller board, and the car will turn right.

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Combining the above information, we can see the principle of tracking cars. After the car starts,

the tracking module only needs to sense the black line on the road and make the corresponding

action according to the need. There are many more complex algorithms, such as PID. Therefore,

after making the tracking function a reality, you can learn more algorithms to control the car

yourself.

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Tips:

(1)The curved part of the line shall be as smooth as possible. If the turning radius is too small, the car is likely to overtake the track.

（2）Line tracking scenes can be made of black and white tape or paper of any color, for differing the path。

（3） Except for line tracking, We can also develop other program line tracking principles.For example, the principle of limiting cars to areas regardless of their movement.

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Thanks for watching!

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