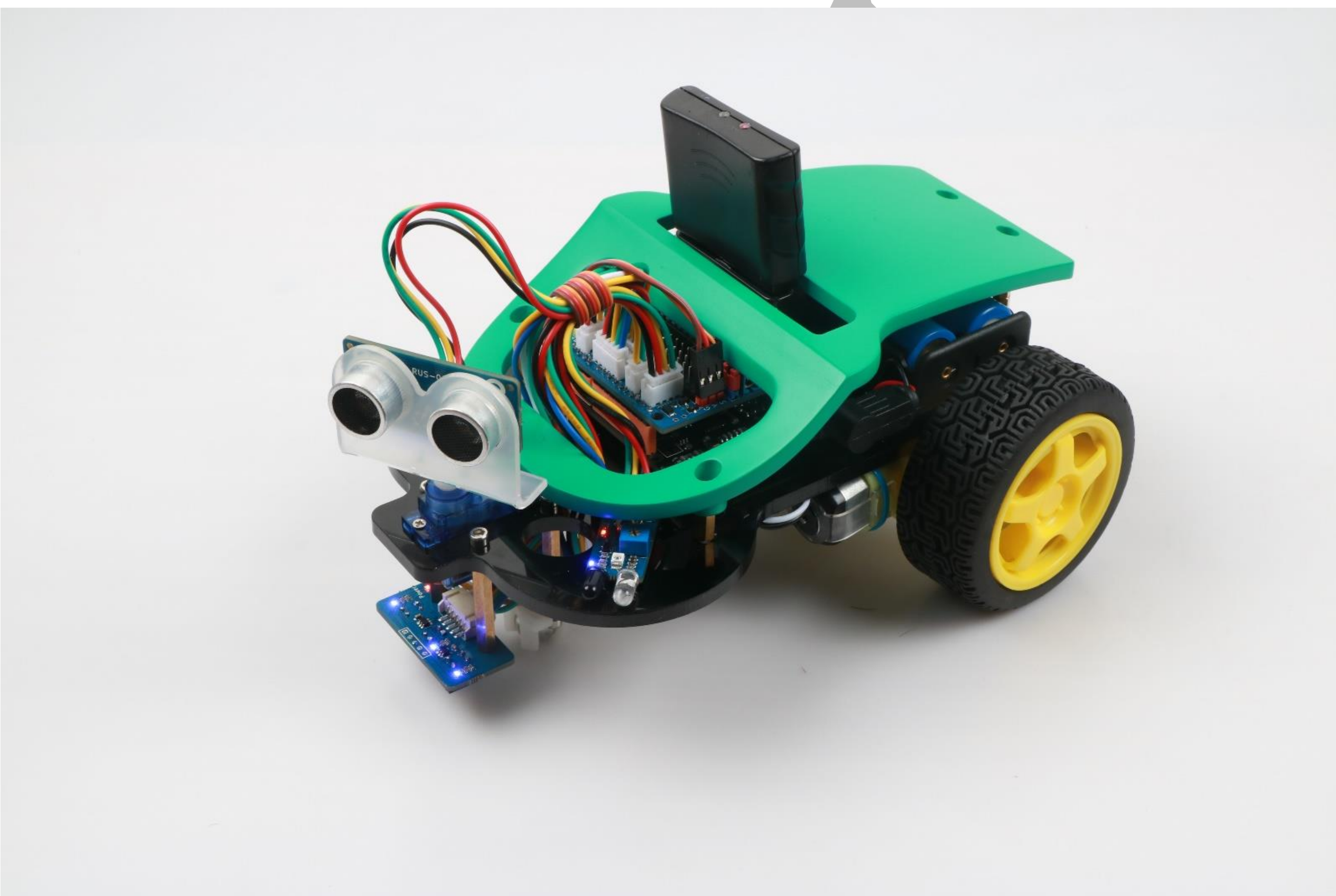
Starter-bot
Mixly Graphical
Programming Course
V.1.0



Revision of edition

date	version number	description	author
2019-5-17	V.1.0	created documents	Twisted

content

Chapter 1

Understanding Starter-bot and Its Programming Environment

1.1 Introduction of life

Hello, everyone. Welcome to the world of Starter-bot robots!

What is a robot? Robots don't necessarily have to be long as human beings call them robots. Generally, robots can perform their work automatically. They can be commanded by human beings and run pre-programmed programs. Such things can be called robots.

What are the responsibilities of robots? Robot, originally Robo, means slave, that is, human servant, so the duty of robot is to help human work.

1.2 Summary

1.2.1 Starter-bot introduction

Through the study of this tutorial, we will experience the interactivity of the physical world and software. Starter-bot consists of three components: Starter-bot smart car, Arduino UNO master board and MagicBlock graphical programming software. MagicBlock is a graphical programming learning software for STEAM education, which is developed based on Scratch 2.0. It not only enables users to create interesting stories, games, animations and other works, but also supports Arduino hardware programming. We can use this software to control the Arduino UNO motherboard on Starter-bot, so that Starter-bot can issue various commands and control it. In this software, programming is no longer tedious code, using graphical representation and drag-and-drop interaction to complete the core logic of programming. The whole programming is like building an interesting building block toy. Through Magic Block's stage area or Starter-bot's behavior, we can intuitively see the actual effect of various script designs.

1.2.2 Starterbot Function list

1) Obstacle avoidance function of ultrasound
2) Ultrasound + Infrared Barrier Avoidance Function
3) Automatic Tracking Function
4) Infrared remote control function
5) Bluetooth remote control function
6) PS2 remote control function
7) Bluetooth Remote Mode Switching Function
8) Ligh Finding Function

9) Rgb Light Function

1.3 Starter-bot Hardware introduction

1.3.1 Introduction to analogy

The hardware part of the Starter-bot robot we use is a Starter-bot robot, which consists of a body model built by acrylic board, various sensors, motor wheels, control panel and power supply battery, as shown in Figure 1-3-1-1.

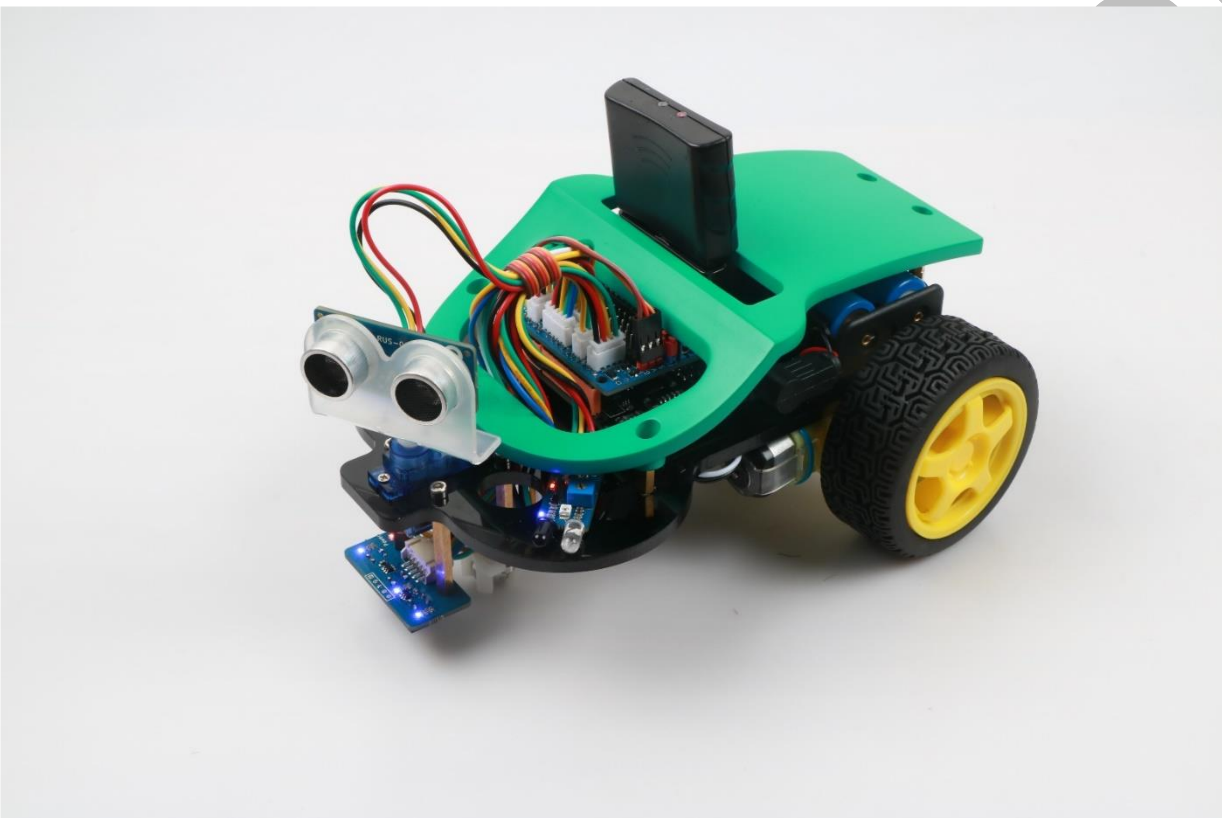


Figure 1-3-1-1

In this robot, every part of it is similar to the structure of our human body and plays a vital role. It is similar to human beings, as shown in Table 1-3-1-2.

Robot	Human	Function
Control panel	Brain	Accept instructions, process information, and give instructions to control limbs and organs
Motors and wheels	limb	Responsible for limb movements
Battery	heart	Provide motivation
sensor	Facial features	Acceptance of perceived information
electronic	nerve	Connect each part of the limb to form a whole.

circuit		

Table 1-3-1-2

1.3.2 Introduction of Main Control Board

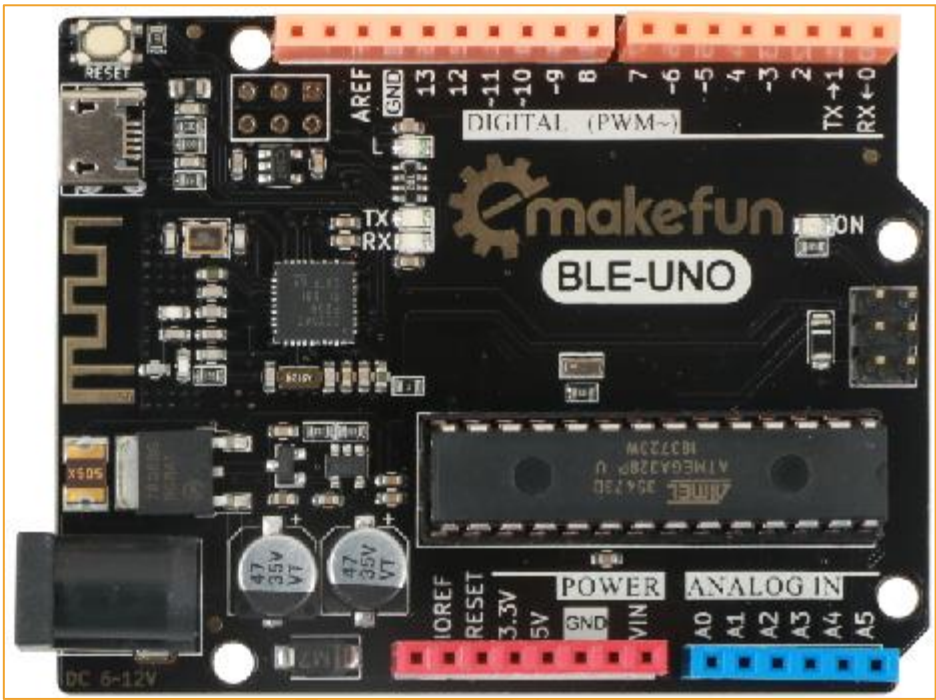


Figure 1-3-2-1

1.3.3 Introduction to Extension Board

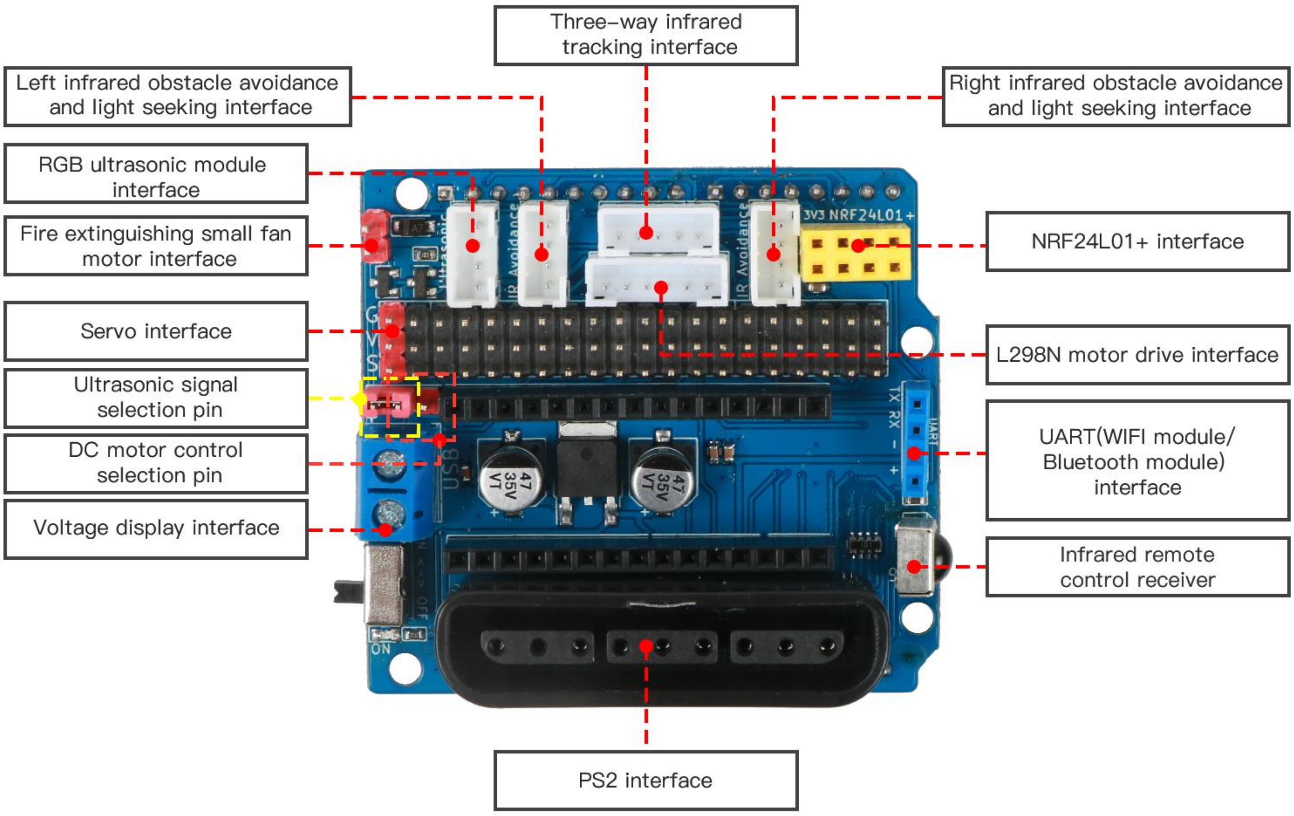


Figure 1-3-3-1

1.4.1 Software and Driver Installation

Installation Procedures of Windows Version Mixly Software

Figure 1-4-1-1

After downloading and decompressing the Windows version, double-click Mixly.exe to open the Mixly software

Figure 1-4-1-2

Figure 1-4-1-3

Installation Procedures of Mac Version Mischi Software

The Mac version of Missy software installation steps include three steps:

1. nstall JDK

   Mac version mainly runs in Java environment, so when installing, you need to install JDK. In this disk, you can directly install jdk-8u71-macosx-x64.dmg file, or according to your own system, you can choose the corresponding JDK in Oracle official website.

2. Download Missy Software Compression Package

   At present, the official website only supports the download of Mischi Mac software on Baidu Disk. Without Baidu Disk, Baidu can search for Mischi Mac version to download. After downloading, decompression, and running Mixly.jar file, Mischi software can be opened on Mac. If the software can not run, please select "General" page in "Preference Settings" - "Security and Privacy", and allow the software to use.

3. Installation driver

   If the Mixly software is installed, we write the code. If we want to run on the device, we need to install the serial driver. The serial driver is CH341SER_MAC for the download file. The software can be installed directly. After successful installation, we can see the new device in the "About the Native Machine" - "Overview" page - "System Report" - "USB". At this point, the basic installation is completed.

Figure 1-4-1-4

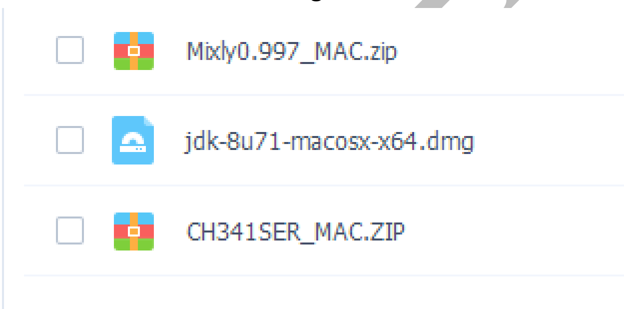


Figure 1-4-1-5

The interface of the Mac version of Missy software is shown in Figure 1-4-1-5.

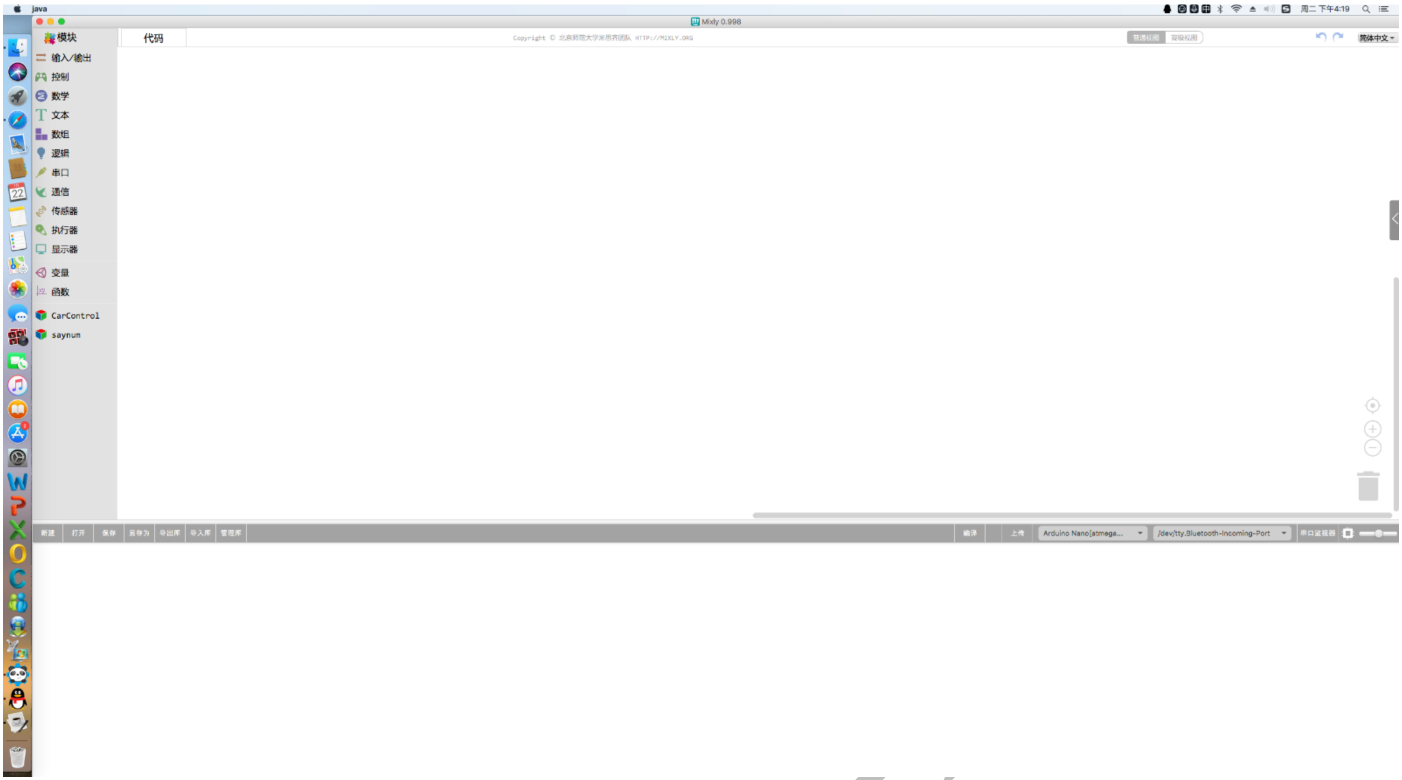


Figure 1-4-1-5

1.4.2 Introduction to Compiler Environment

We know that in order for a robot to move, besides the hardware cooperation, the more important thing is to write a program for it. We already know the hardware part of the robot, and then we will know its software part. Starter-bot's software part is programmed on the graphical programming software Mixly. With this software, we can control the robot by writing various commands that we want it to execute. Mixly's software interface is shown in Figure 1-4-2-1.

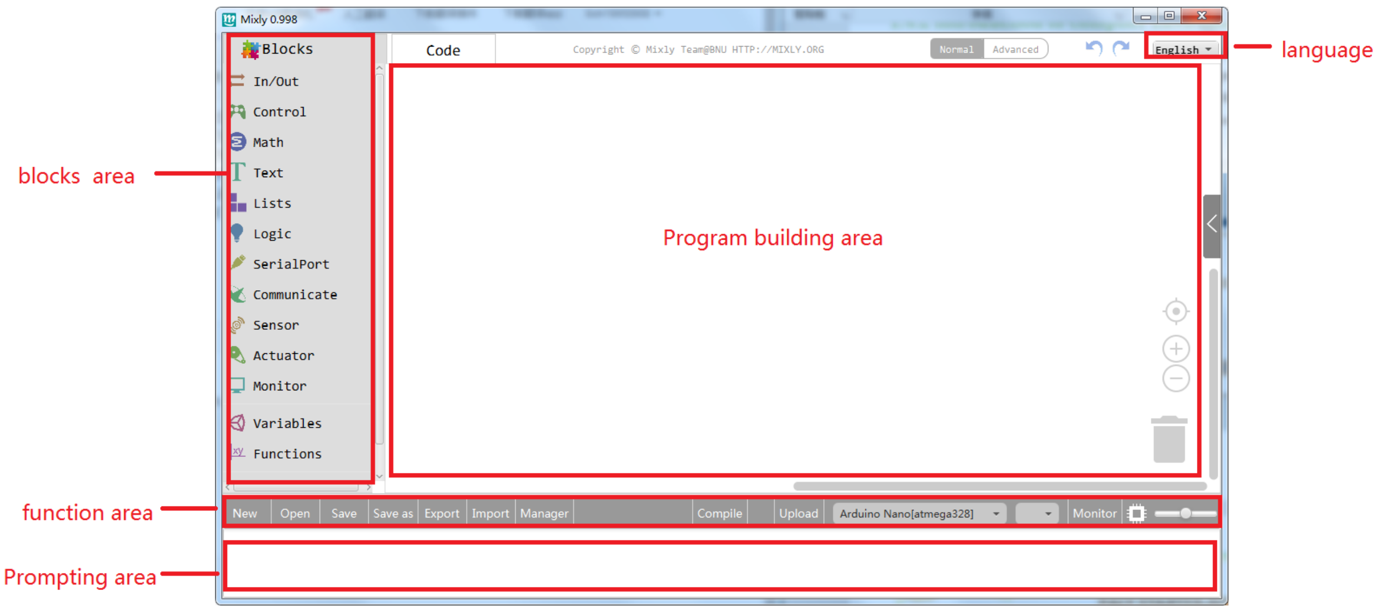


Figure 1-4-2-1

- **blocks area:** The same type of building blocks are divided into the same module and given the same color. Each building block represents a control instruction.
- **function area:** Create and save project files, import, export and manage libraries, connect and upload programs through serial ports, and select the area for operation by the control board.
- **program building area:** Place the building blocks pulled out of the base module area and the reservoir module area.
- **language switching buton:** You can switch between simplified Chinese, traditional Chinese, English and Spanish.

1.5 Introduction Of Blocks Area

Mixly's blocks area are divided into some building blocks brought by Mixly software and the library building blocks imported by Mixly itself. These blocks can correspond to C language code one by one. We can write our favorite program by splicing different blocks. We don't even need to know what code each block corresponds to. Because when we drag and pull out the blocks, the program is written by us. We can see these C language codes by clicking on the "code" field. Figures 1-5-1 and 1-5-2 are modules and codes, respectively.

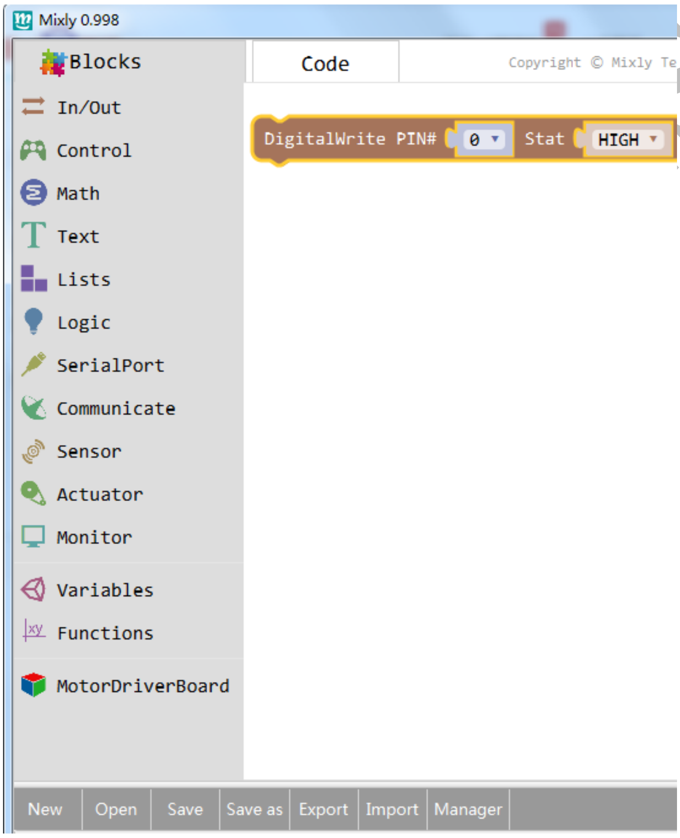


Figure 1-5-1

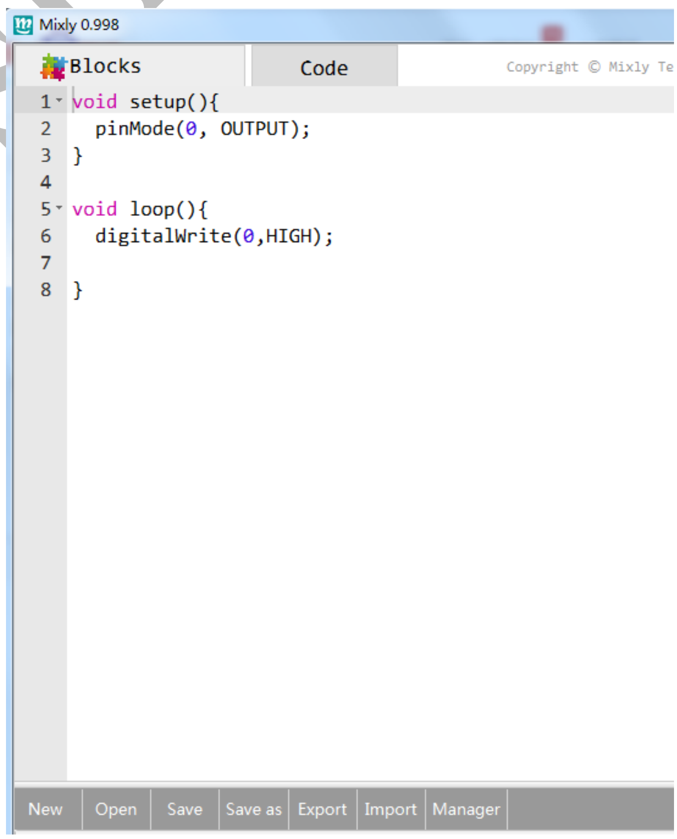


Figure 1-5-2

1.6 Introduction of building blocks

Mixly's script label has many types of building blocks, such as input/output, control, mathematics, text, array, serial port, communication, etc. If you are interested in it, you can try it out by yourself. Let's not go into details here. We mainly know four types of building blocks: control, mathematics, serial port and logic.

1) Control building blocks are the building blocks that control the execution process of the program. The main program is shown in Fig. 1-6-1.

Figure 1-6-1

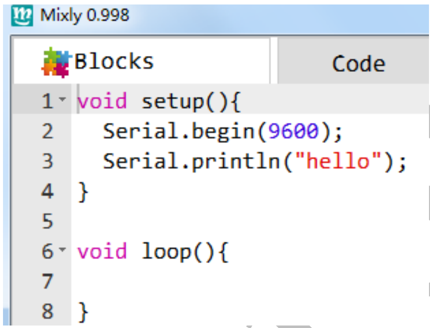


Figure 1-6-2

Initialize the setup function in the corresponding code of building blocks, dragging some building blocks into the initial building blocks means that the dragged building blocks program will run once. If the building blocks are dragged outside the initial building blocks, then these programs will enter the loop function, and then they will execute these programs in a loop. As shown in figure 1-6-2

2) The main function of building blocks of digital and logical operation types is to do mathematical operation, which is used as the condition of judgment, to compare size and logical judgment with, or with, or without, as shown in Figure 1-6-3.

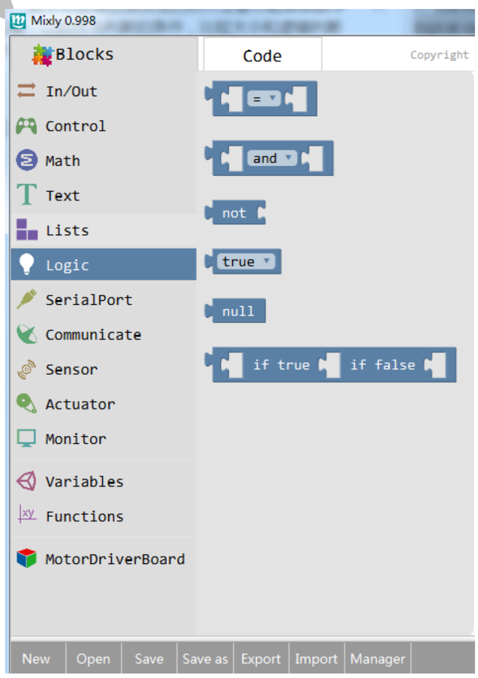


Figure 1-6-3

Be careful! The "variables" building block of Mischi software is a little imperfect. Unlike other building blocks, it is automatically put into the setup function. If you need to use this building block and do not want it to enter the setup function, but into our usual loop function (such as writing the program of ultrasonic obstacle avoidance), then we need to build the built-up Library of Mischi software. The modifications are as follows:

Open the Mixly software installation directory, enter blockly/generators/arduino/and open the variables.js file with the editor. Change lines 30 to 35 to the following figure: Save in the open Missy software and complete.

```
7
8   Blockly.Arduino.variables_get = function() {
9     // Variable getter.
10    var code = Blockly.Arduino.variableDB_.getName(this.getFieldValue('VAR'),
11        Blockly.Variables.NAME_TYPE);
12    return [code, Blockly.Arduino.ORDER_ATOMIC];
13  };
14
15  Blockly.Arduino.variables_declare = function() {
16    var dropdown_type = this.getFieldValue('TYPE');
17    var argument0;
18    //TODO: settype to variable
19    if(dropdown_type=='String'){
20      argument0 = Blockly.Arduino.valueToCode(this, 'VALUE',Blockly.Arduino.ORDER_ASSIGNMENT) || '""';
21    }else{
22      argument0 = Blockly.Arduino.valueToCode(this, 'VALUE',Blockly.Arduino.ORDER_ASSIGNMENT) || '0';
23    }
24    var varName = Blockly.Arduino.variableDB_.getName(this.getFieldValue('VAR'),
25        Blockly.Variables.NAME_TYPE);
26    if (dropdown_type != 'String')
27        Blockly.Arduino.definitions_['var_declare' + varName] = 'volatile ' + dropdown_type + ' ' + varName +
28    else
29        Blockly.Arduino.definitions_['var_declare' + varName] = dropdown_type + ' ' + varName + ';';
30    //Blockly.Arduino.setups_['setup_var'+varName] = varName + ' = ' + argument0 + ';';
31    var code = varName + ' = ' + argument0 + ';\n';
32    return code;
33    //Blockly.Arduino.variableTypes_[varName] = dropdown_type;//处理变量类型
34    //return '';
35  };
```

1.6.1 Introduction of Starterbot Building Block

Starterbot is a library we wrote for Starterbot. After importing the library, it will appear in the library module area below the basic module area. Click on it and it will appear various small building blocks, as shown in Figure 1-6-1-1. Next, we will learn how to write programs for Starterbot by assembling these modules.

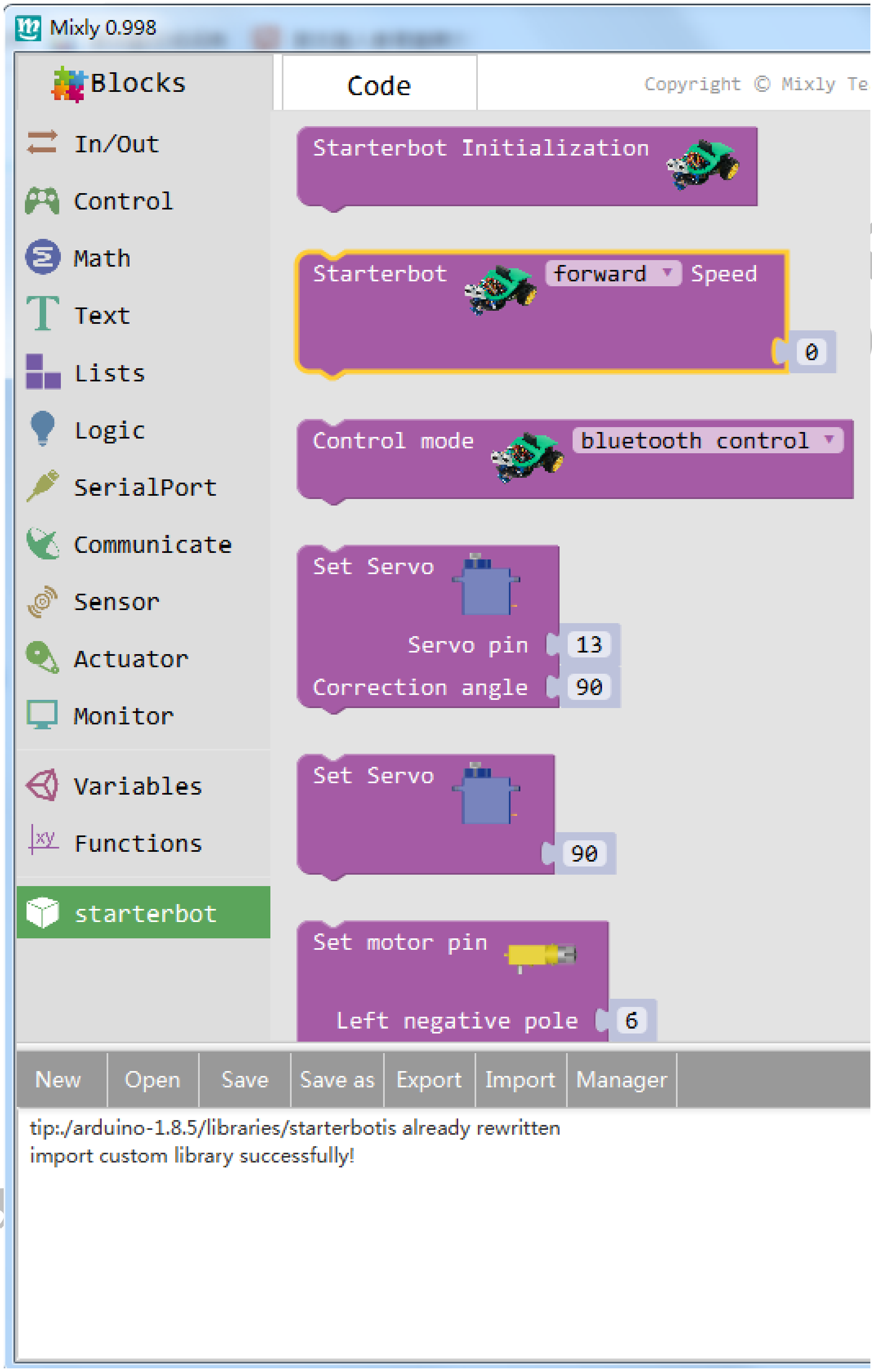

Mixly 0.998
Blocks
Code
Copyright © Mixly Te
In/Out
Control
Math
Text
Lists
Logic
SerialPort
Communicate
Sensor
Actuator
Monitor
Variables
Functions
starterbot
Starterbot Initialization
Starterbot forward Speed
0
Control mode bluetooth control
Set Servo
Servo pin 13
Correction angle 90
Set Servo
90
Set motor pin
Left negative pole 6
New
Open
Save
Save as
Export
Import
Manager
tip:./arduino-1.8.5/libraries/starterbotis already rewritten
import custom library successfully!

Figure 1-6 -1-1

Chapter 2 Initial Knowledge Programming

2.1 Hello word

If we want the Starter-bot robot to move, we need to store instructions (programs) in its brain (control board) beforehand for the Starter-bot robot. How to compile instructions for the Starter-bot robot? Now let's take you through the experience of writing a Starter-bot robot print Hello word program.

2.1.1 Add Starterbot Library

Before programming, we need to add the Starterbot library. The steps are as follows:

1) Download Starter-bot library and save it on your computer
2) Open the Mixly software and click "Import Library", as shown in Figure 2-1-1-1;
3) Click on the Starterbot.xml file and then click Open, as shown in Figure 2-1-1-2.

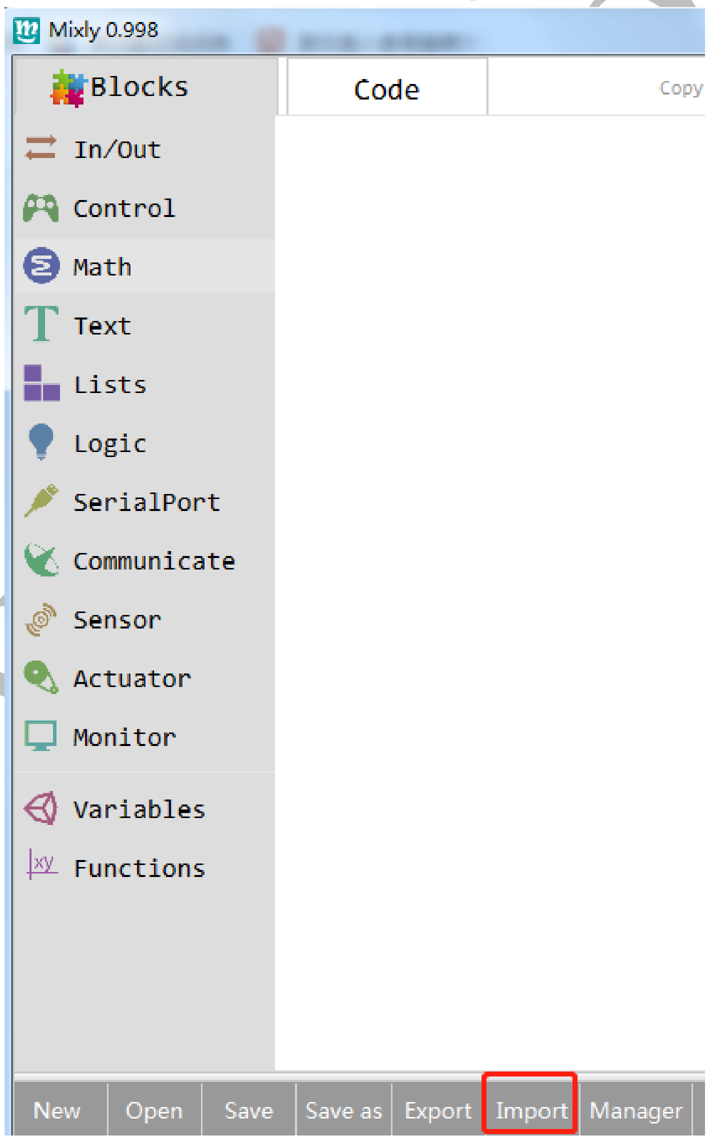


Figure 2-1-1-1

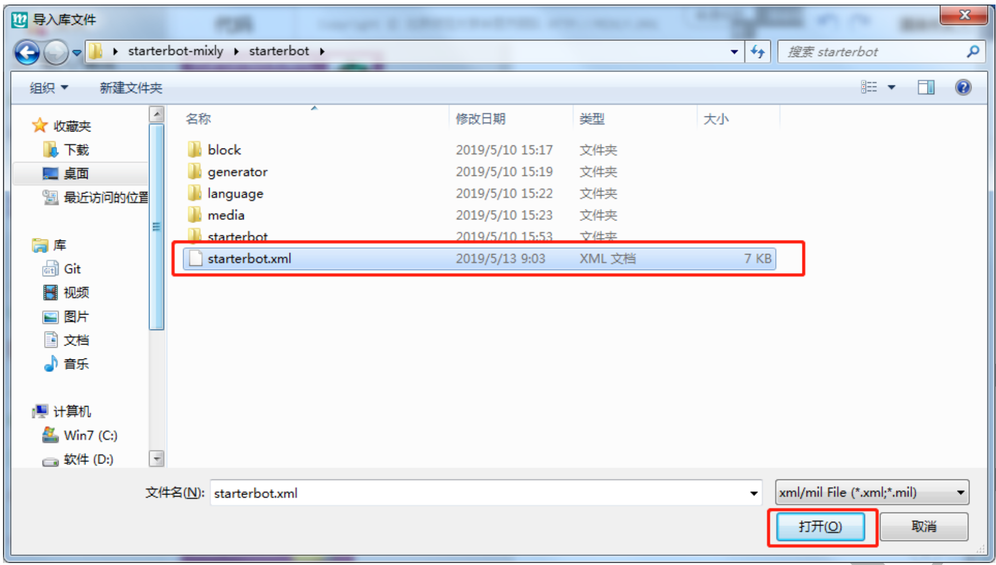


Figure 2-1-1-2

4) After successful import, the prompt area will show that the import of custom library is successful! In the library module area, you can see the Starterbot library module as shown in Figure 2-1-1-3.

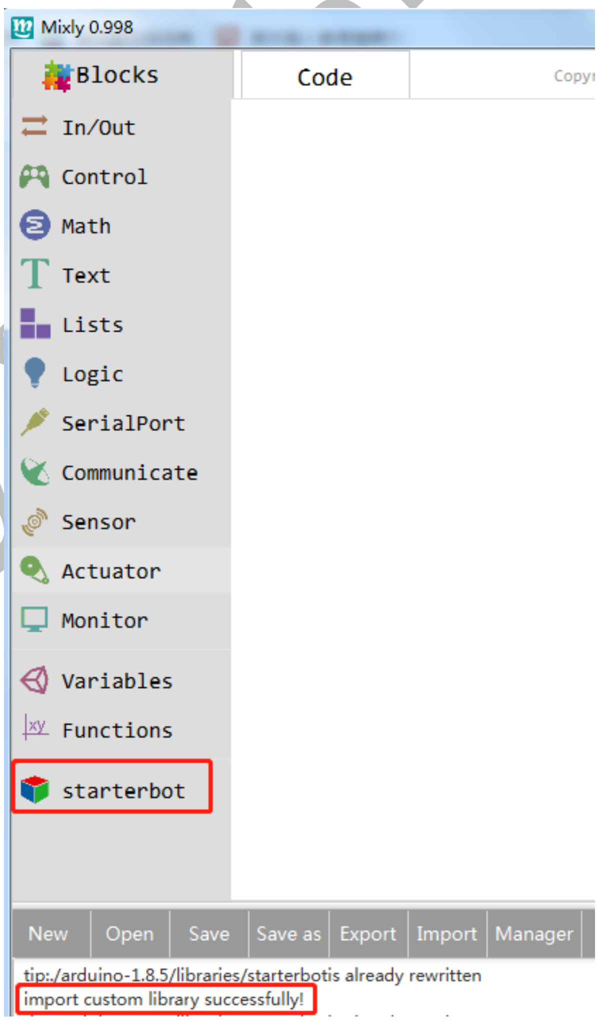


Figure 2-1-1-3

5) Click on "Starterbot" to display the Starterbot building block graphics programming block, as shown in Figure 2-1-1-4.

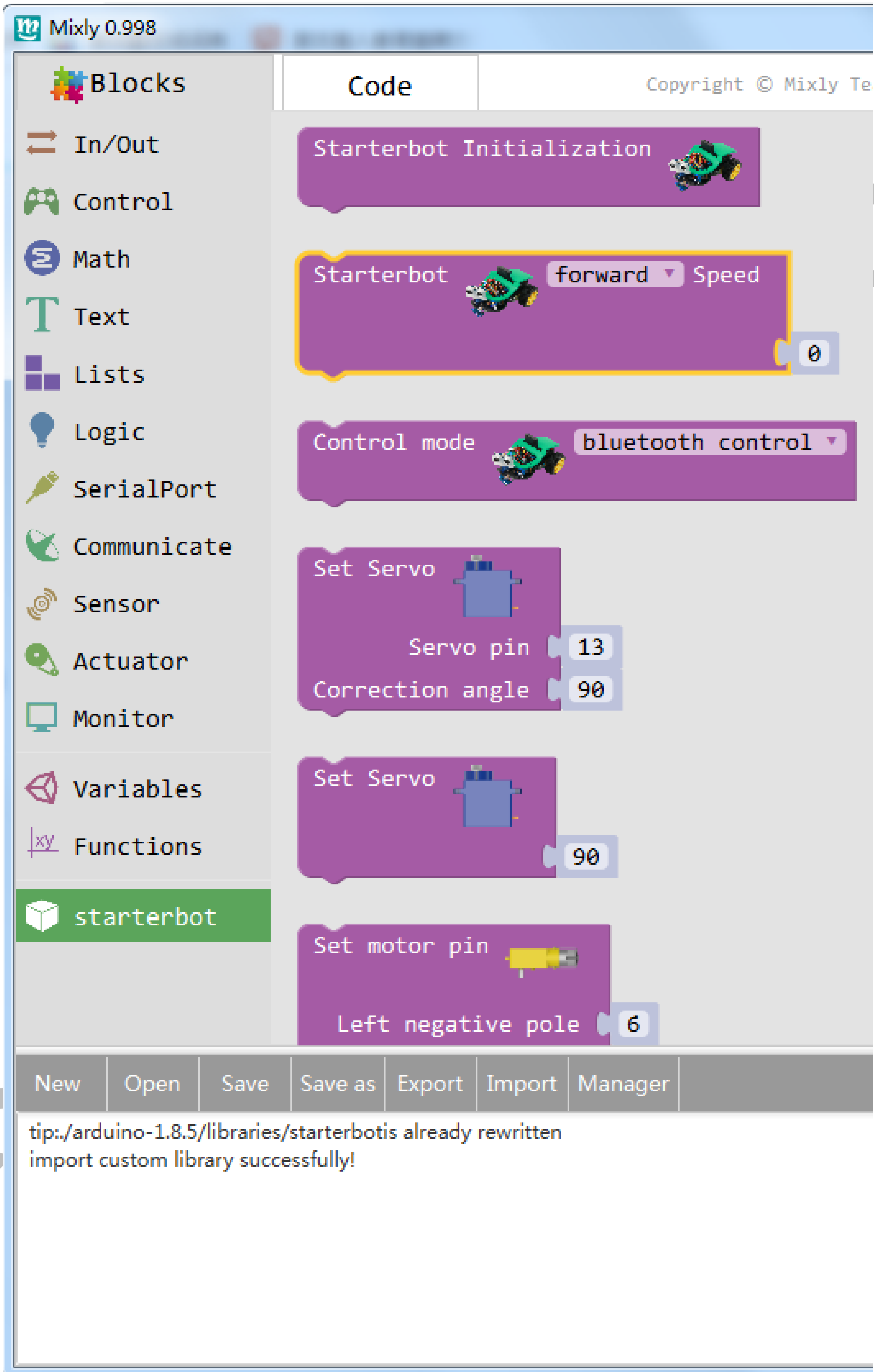


Figure 2-1-1-4

2.1.2 First Experience of Programming

After adding the Starterbot library, let's experience Starterbot programming. Let's first write a program for Starterbot robot to print Hello word.

1) First, the "Hummer Initialization" in the building block area is dragged to the program architecture area with the mouse, and then the "Serial Baud Rate 9600" is dragged to the bottom of the "Hummer Initialization" building block, as shown in Figure 2-1-2-1.

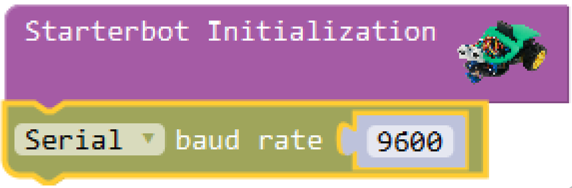


Figure 2-1-2-1

2) Drag the "Serial Printing (Automatic Line Breaking) building block under the"Serial Baud Rate 9600"in the serial module, as shown in Figure 2-1-2-2.

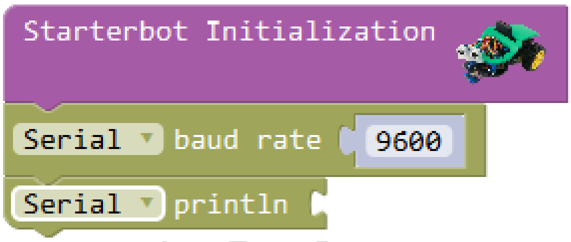


Figure 2-1-2-2

3) In the text module, drag the building blocks of "hello" to the right of Serial Printing (automatic line breaking) and enter "Hello word" as shown in Figure 2-1-2-3.

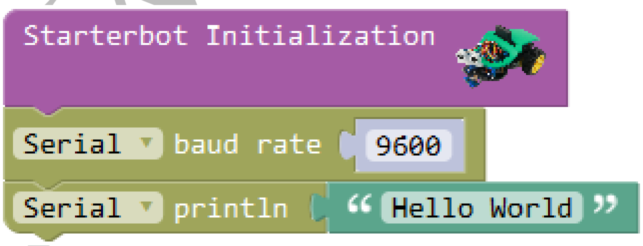


Figure 2-1-2-3

This is the Starterbot Robot Printing Hello Word program. After the program is written, we need to transfer the program to the brain of the Starterbot robot (control motherboard) to do the desired action according to the program we wrote. How to transfer the program to the brain of the Starterbot robot (control motherboard)? Only when Mixly is connected to the robot motherboard, can we transfer the written program from the computer to the brain of the Starterbot robot (control motherboard). Here's how Mixly connects to the robot motherboard.

2.2 Connect Mixly With Starter-bot

1) Using a USB data line, one end is inserted into the computer, and the other end is inserted into the robot master board, which connects the robot master board with the computer.
2) Click the drop-down box on the right of "Upload" to select the model of the main console, and then click the second drop-down box on the right to select the USB serial port, as shown in Figure 2-2-1. When the selection is completed, Mixly and Starter-box are successfully connected.

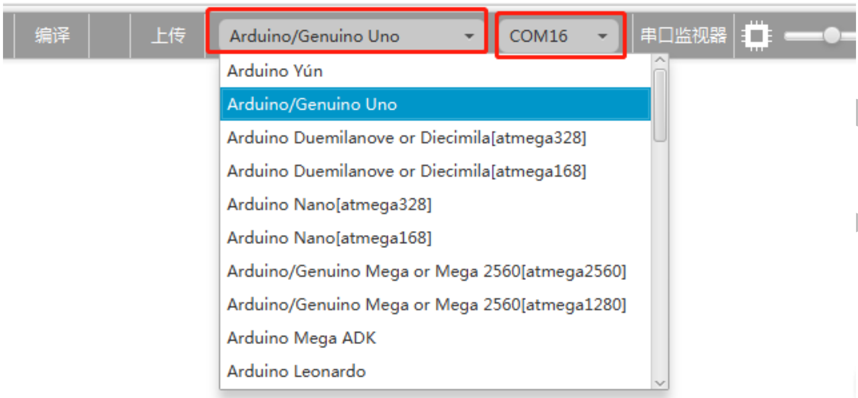


Figure 2-2-1

2.3 Upload program to Starter-bot robot

When the program is finished and Mixly and Starterbot robots are connected correctly, we can transmit the program to the brain of Starterbot robots (main control board). The specific steps are as follows:

1) Click on upload, and the building blocks in the program architecture area begin to upload to the control board. We need to wait for a while. After the upload is completed, we will prompt "upload completed", as shown in Figure 2-3-1.

After completing the above steps, the Starterbot robot's brain (main control board) already has the program we wrote. If the upload succeeds, it will be prompted to upload successfully. Of course, we can click on "code" at any time to see the program that is actually uploaded to the control board. These are the C language codes corresponding to building block graphics, as shown in Figure 2-3-2.

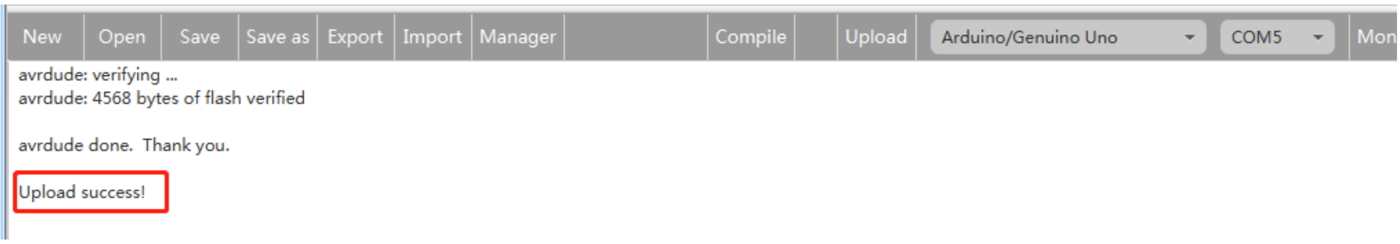


Figure 2-3-1

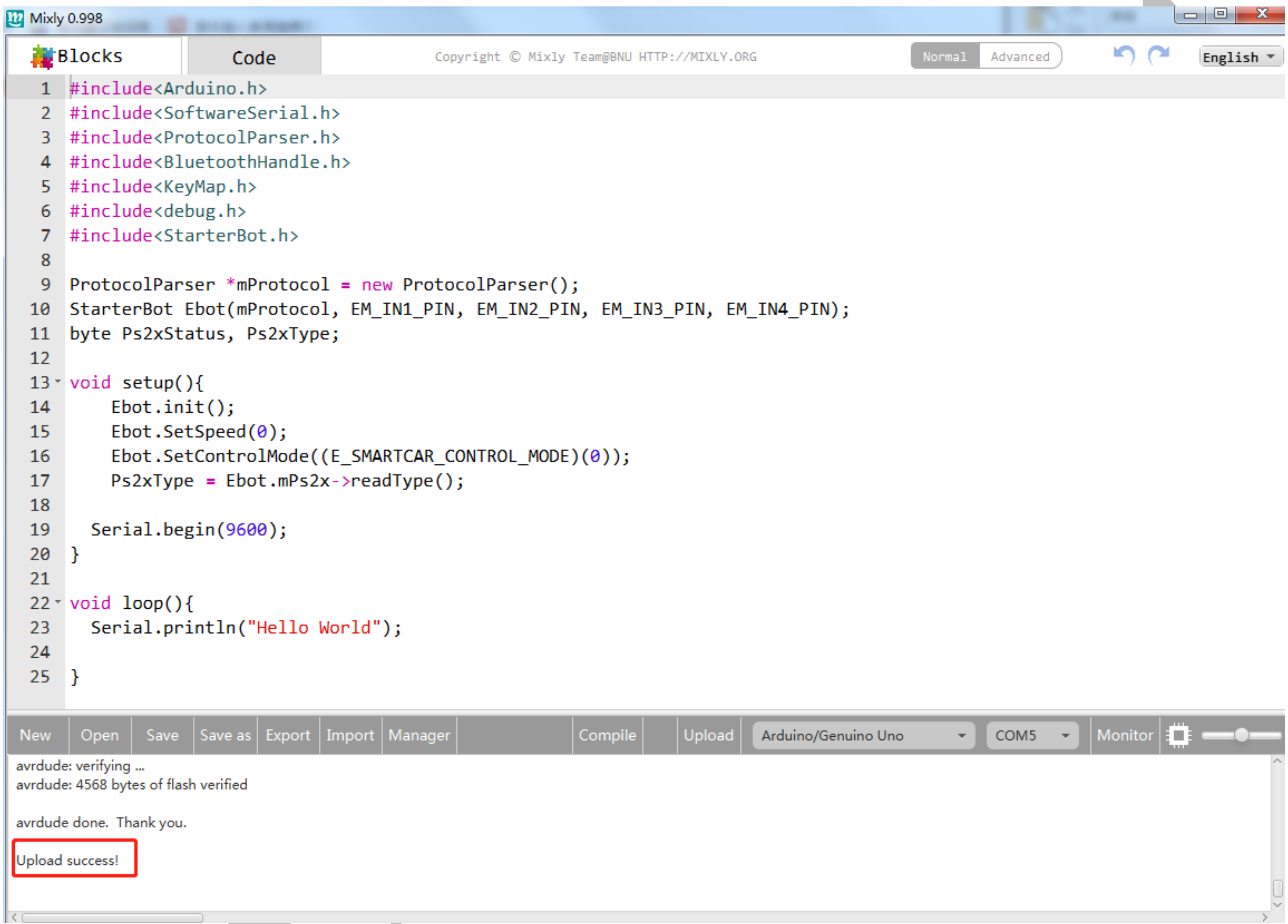


Figure 2-3-2

Turn on the serial monitor and we will see Hello Word printing continuously on the serial monitor, as shown in Figure 2-3-3.

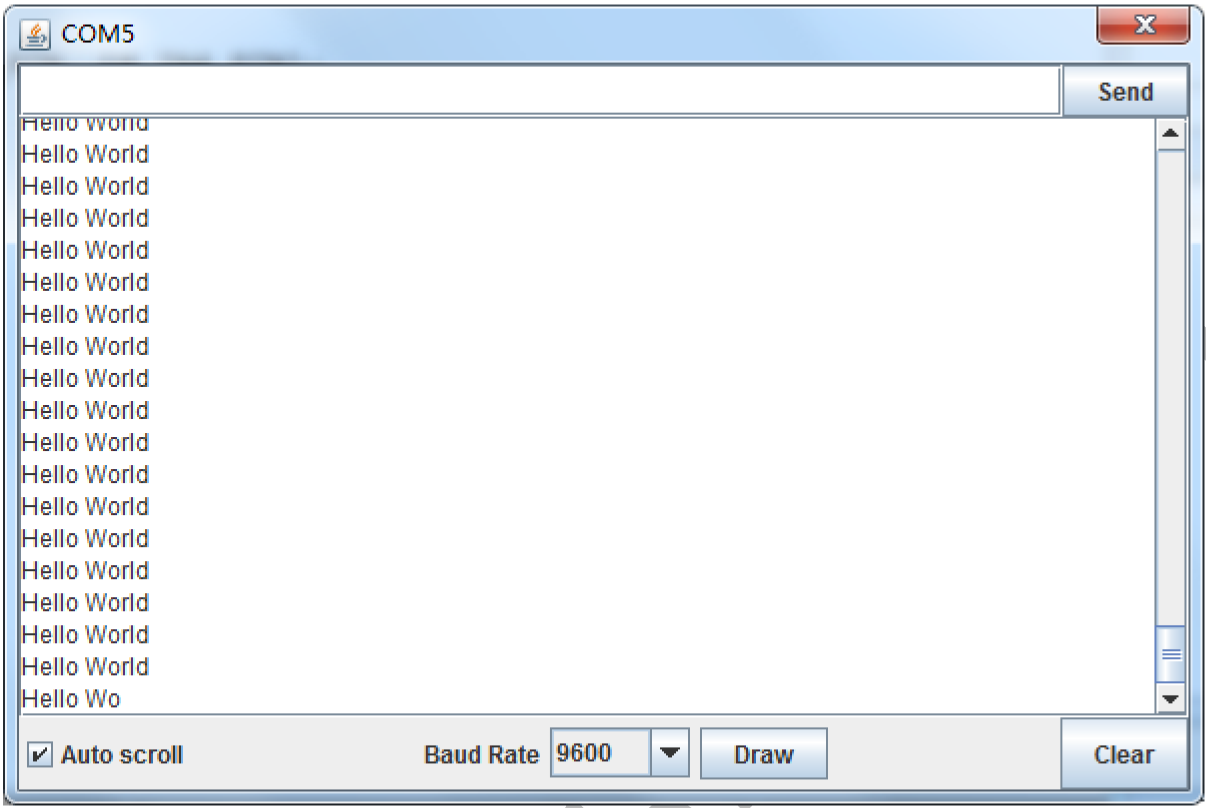


Figure 2-3-3

Chapter Three Robots Move

3.1 DC motor

3.1.1 Principle of DC Motor

The reason why cars are active is that they have engines to power them. Robots also have DC motor modules that allow them to move, so what is a motor? In our science textbook, there is an introduction of electromagnetic induction. The motor is rotated by electromagnetic induction. It has an iron core winding copper wire inside and a rotor outside. When the iron core is electrified, there is electromagnetic induction to make the rotor move. This is the motor.

Starter-bot robot has two DC motors. We can use DC motors to control building blocks to make DC motors turn, thus driving Starter-bot robot to move.

3.1.2 DC motor test

In the robot module, we can find three control blocks of DC motor module, which are motor pin building blocks, direction setting, speed building blocks, turning angle setting and speed building blocks, as shown in Figure 3-1-2-1.

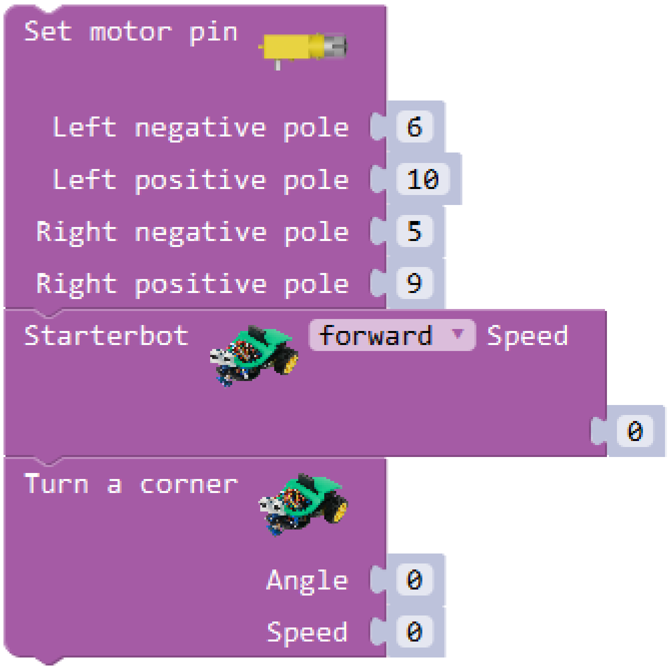


Figure 3-2-2-1

- Setting up the motor pin building blocks: Used to set the pins connecting the two motors of the control robot to the main control board. The default pins are selected in this tutorial.
- Set the direction and speed, speed building blocks: Set the direction of the robot movement and the speed in that direction;
- Set the turning angle and speed: Set the turning angle and speed when the robot moves.

Write the following program on Mixly. They can control the motor forward and reverse respectively, and then let the robot move forward, backward, left and right directions. They run the program separately and observe carefully the direction of two DC motors when the robot moves in each direction. The programming of the four directions is shown in Figure 3-2-2.

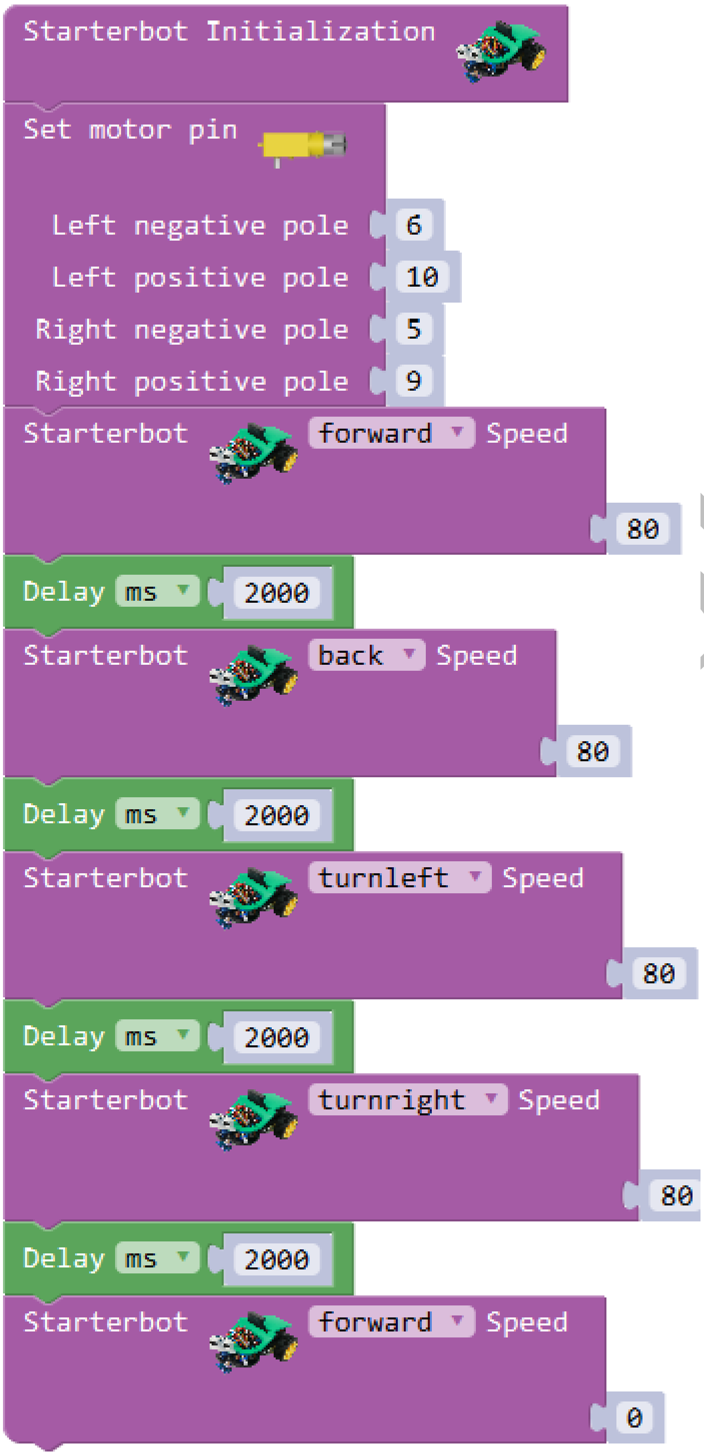


Figure 3-2-2-2

Through the above practical operation, we should have understood the programming method of letting the robot move in a single direction by controlling the motor. Now let's explore the programming method of letting the robot walk in a square.

3.1.3 Programming control and debugging the robot to take the square route.

The way the robot moves in a square is to go forward, turn left, move forward, turn left, move forward, turn left, turn left (reverse can also be done). The path of the robot is shown in Figure 3-1-3-1, and the reference program is shown in Figure 3-1-3-2.

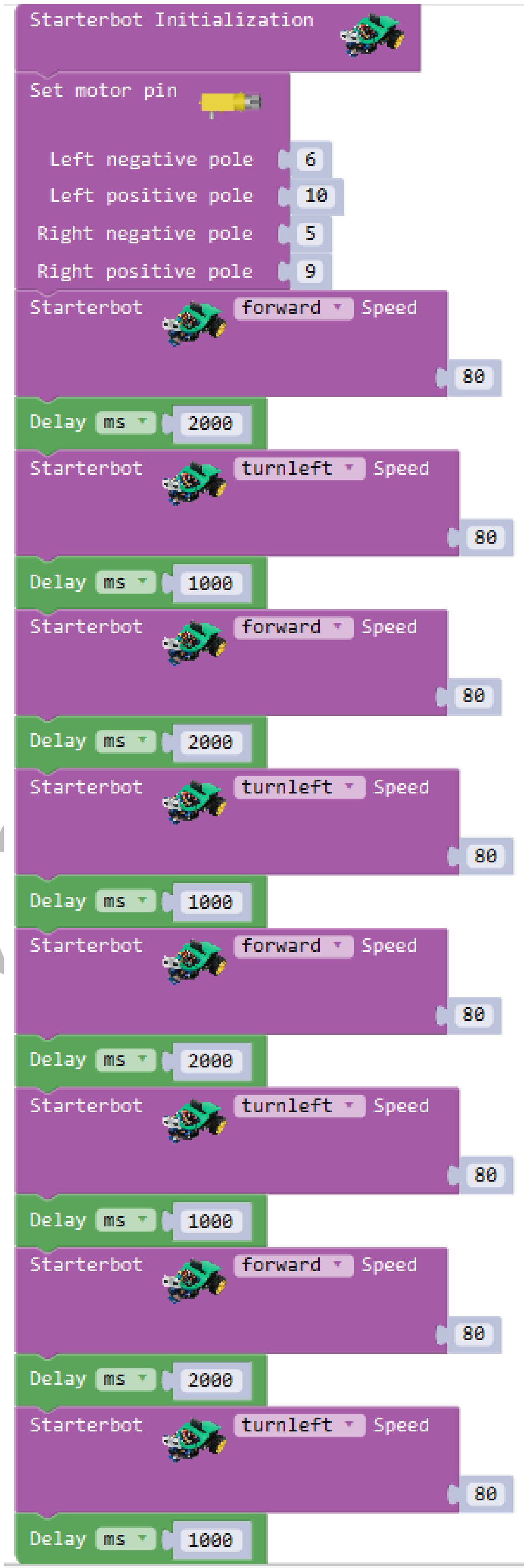

Starterbot Initialization
Set motor pin
Left negative pole 6
Left positive pole 10
Right negative pole 5
Right positive pole 9
Starterbot forward Speed 80
Delay ms 2000
Starterbot turnleft Speed 80
Delay ms 1000
Starterbot forward Speed 80
Delay ms 2000
Starterbot turnleft Speed 80
Delay ms 1000
Starterbot forward Speed 80
Delay ms 2000
Starterbot turnleft Speed 80
Delay ms 1000
Starterbot forward Speed 80
Delay ms 2000
Starterbot turnleft Speed 80
Delay ms 1000

Figure 3-3-3-1 Figure 3-1-3-2

note:

1) The delay blocks under the "forward" building blocks are to control the forward distance of the robot, while the delay blocks under the left turn are to control the turning angle of the robot. When writing the program, the delay time should be modified according to the actual walking condition of the robot.
2) At the end of the program, the motor must stop turning, otherwise the robot will remain in its original state of motion and turn left all the time.

3.1.4 Discover the Rule of Program and Optimize Program

By observing the program of Figure 3-1-3-2, we can find that the path of the robot walking square is actually to control the wheel to repeat four times forward and turn left 90 degrees. The optimization program is shown in Figure 3-1-4-1.

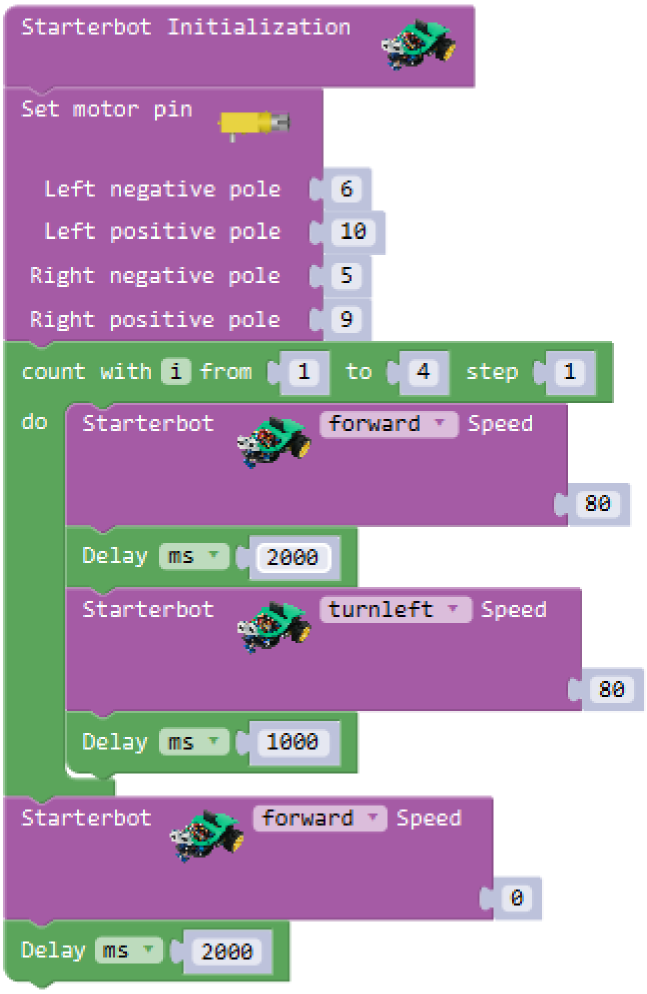


Figure 3-1-4-1

3.2 Ultrasound module

3.2.1 Principle of Ultrasound

Ultrasound sensor (Figure 3-2-1-1) is a device that detects distance by transmitting ultrasound. Ultrasound is an inaudible sound wave, which has the characteristics of returning when it touches an object. Ultrasound sensor has two "eyes", one of which emits ultrasound, and the other "eyes" receives the ultrasound emitted from obstacles. When one eye emits ultrasound, it begins to time, and when the other eye receives the returned ultrasound, it stops the time. Mathematically, we have learned that distance = speed * time, then the distance is measured by ultrasound.= The speed of the ultrasonic wave (2) so that the distance can be calculated.

Figure 3-2-1-1

3.2.2 Usage of Ultrasound Module

We find the control building blocks of the ultrasonic module in the control module of the robot. As shown in Figure 3-2-2-1, the building blocks can detect the distance between the robot and the obstacle in front. Note: In order to use the ultrasonic module, we should first choose the mode to control the building blocks and set the mode to the ultrasonic obstacle avoidance mode. When the obstacles completely block the ultrasonic module or face the ultrasonic module to the distant place, the ultrasonic wave emitted by the ultrasonic module can not be received, so the distance between the robot and the obstacle can not be measured. The ultrasonic module installed on the robot can not be detected. The detection range is 5CM ~ 400CM.

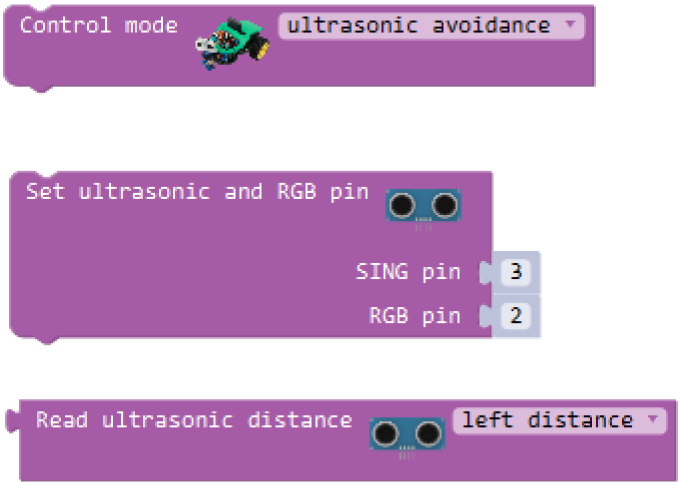


Figure 3-2-2-1

3.2.3 Testing of the Ultrasound Obstacle Avoidance Module

We can first write a program to test the ultrasonic obstacle avoidance module, using serial port printing. When we hand close to the ultrasonic obstacle avoidance module and far away from the ultrasonic obstacle avoidance module, we can observe the ultrasonic distance measured by serial port printing, and we can more intuitively see the process of measuring the distance of the ultrasonic obstacle avoidance module. Now we first write a test program.

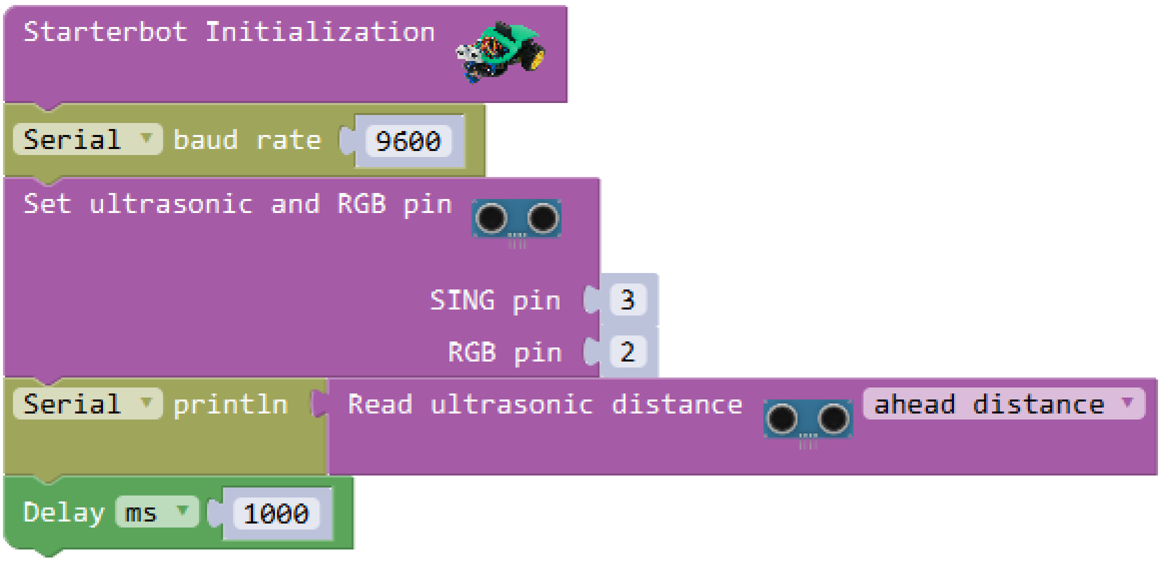


Figure 3-2-2-2

We write the program as shown in Figure 3-2-2, then upload the program successfully, open the serial port, and then close or far from the ultrasonic module, the serial port will print the corresponding distance.

3.2.4 Writing Robot Program for Tango Dance

Tango dance is a kind of double dance. The dance step is to let the robot dance with our palms when one person is close. If the hand is close to it and the hand moves away from it, the distance between the hand and the robot should be measured by the ultrasonic module to determine whether the robot moves forward or backward. The larger the measuring distance of ultrasound means that the hand is far away from the robot, and after a certain distance, the robot moves forward; the smaller the measuring distance of ultrasound means that the hand is close to the robot, and after a certain distance, the robot retreats; let's set the median value to 15CM first, then let's start programming.

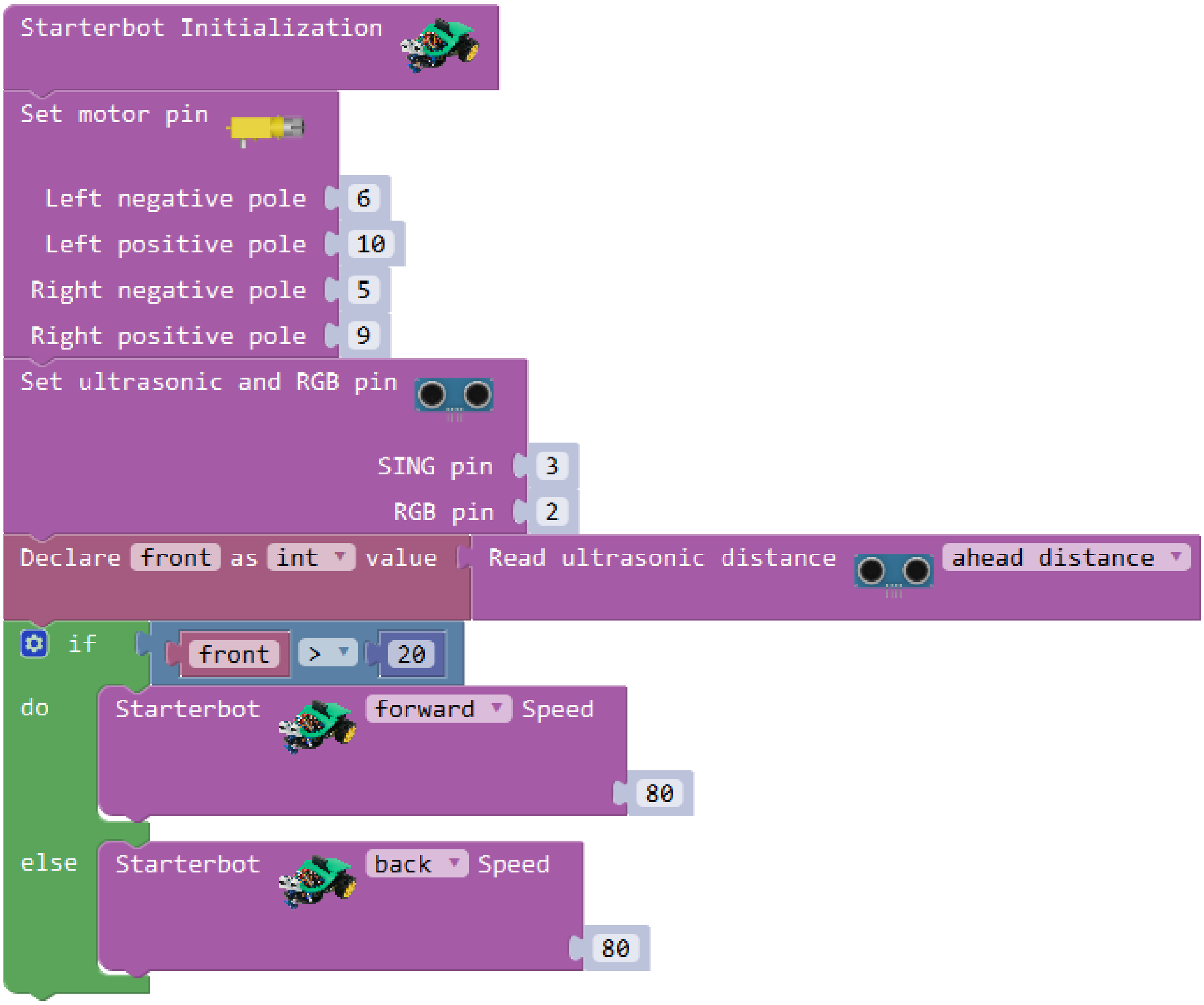


Figure 3-2-4-1

Run the program shown in Figure 3-2-4-1 above. When the hand is far away, the robot moves forward; when the hand is near, the robot retreats. But when the hand is still, the robot will move back and forth repeatedly, because we did not set a stop motion interval for the robot. How to stop the robot in an interval?

The Value Measured by the Ultrasound Module	Motion State of Robot
Greater than 20	Forward
Between 12~20	Stop
Less than 12	Back off

Table 3-2-4-2

As shown in Table 3-2-4-2 above, a new judgment statement is needed for this situation between 12 and 20. As shown in Figure 3-2-4-3, when the distance measured by ultrasound is greater than 12CM and less than 20CM, the robot stops.

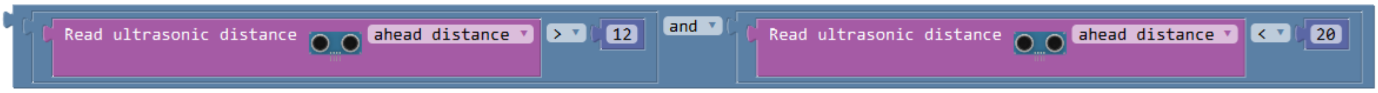


Figure 3-2-4-3

3.2.5 Optimizing Dancing Robot Program

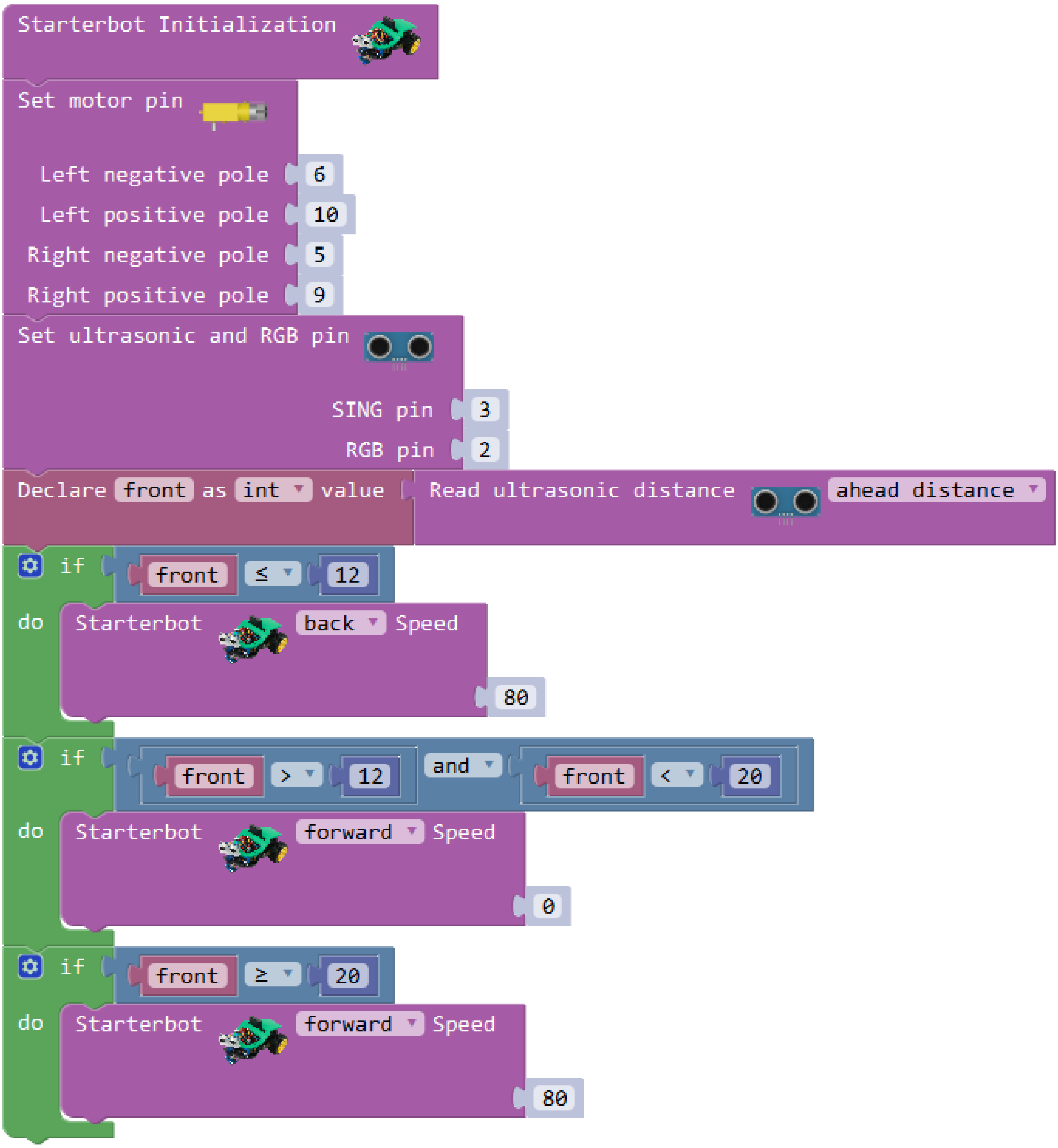


Figure 3-2-5-1

3.3 Ultrasonic obstacle avoidance robot

We've learned the roles of robots in moving forward, backward, left, right and ultrasonic modules. Now let's explore how robots use ultrasound to avoid obstacles in motion. The so-called obstacle avoidance of robots is to let robots move around obstacles (left or right or backward) if there are obstacles in front of them. If the object continues to move, the robot needs to turn left and right and judge the distance between left and right directions, then the ultrasonic module needs to rotate left and right to "explore the way". At this time, the steering gear is used to realize the left and right turn of the ultrasonic module. How does the steering gear work? Next we will introduce the use of the steering gear.

3.3.1 Operating Principle of Steering Engine

The steering gear is mainly composed of the following parts: steering wheel, deceleration gear set, position feedback potentiometer, DC motor, control circuit and so on, as shown in Figure 3-3-1-1. The Bumblebee and Optimus Prime joints we see in the movies need to be controlled by the steering gear. Especially when the robot is walking, the mechanical sound of clicking and clicking is generated by the steering gear rotating on the robot body. Figure 3-3-1-2 is the most commonly used SG90 steering gear physical diagram at this stage.

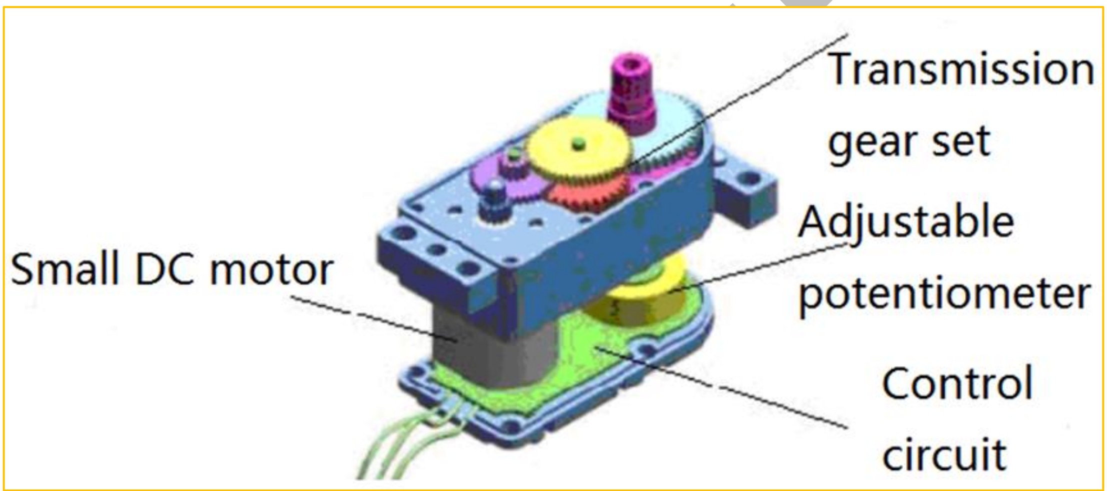


Figure 3-3-1-1

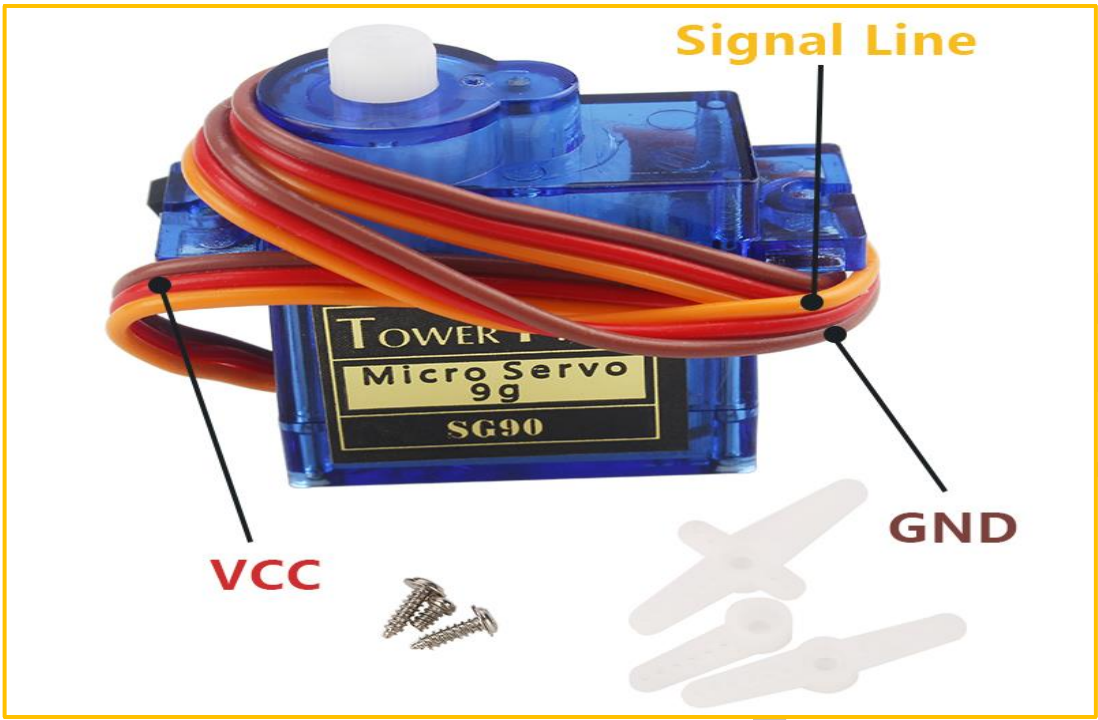


Figure 3-3-1-2 SG90

When the control circuit board receives the control signal of the self-confidence signal line, it controls the motor to rotate, and the motor drives a series of gears, then reduces the speed and drives them to the output steering wheel. Its work flow is: control signal control circuit board motor rotation gear set deceleration steering wheel rotation position feedback potentiometer control circuit board feedback.

3.3.2 Steering gear test

The steering gear on the Starterbot robot is installed in the front, and the ultrasonic module is fixed on the steering gear. When the ultrasonic module is to measure the distance between the robot and the front obstacle, the steering gear is 90 degrees. When the ultrasonic module measures the distance between the robot and the left obstacle, the steering gear rotates 90 degrees to the left. When the ultrasonic module measures the distance between the robot and the right obstacle, the steering gear rotates 90 degrees to the left. The steering gear rotates 90 degrees to the right. Next, we write a program to test the steering gear by using the steering gear to make the ultrasonic wave move forward, then left and then right.

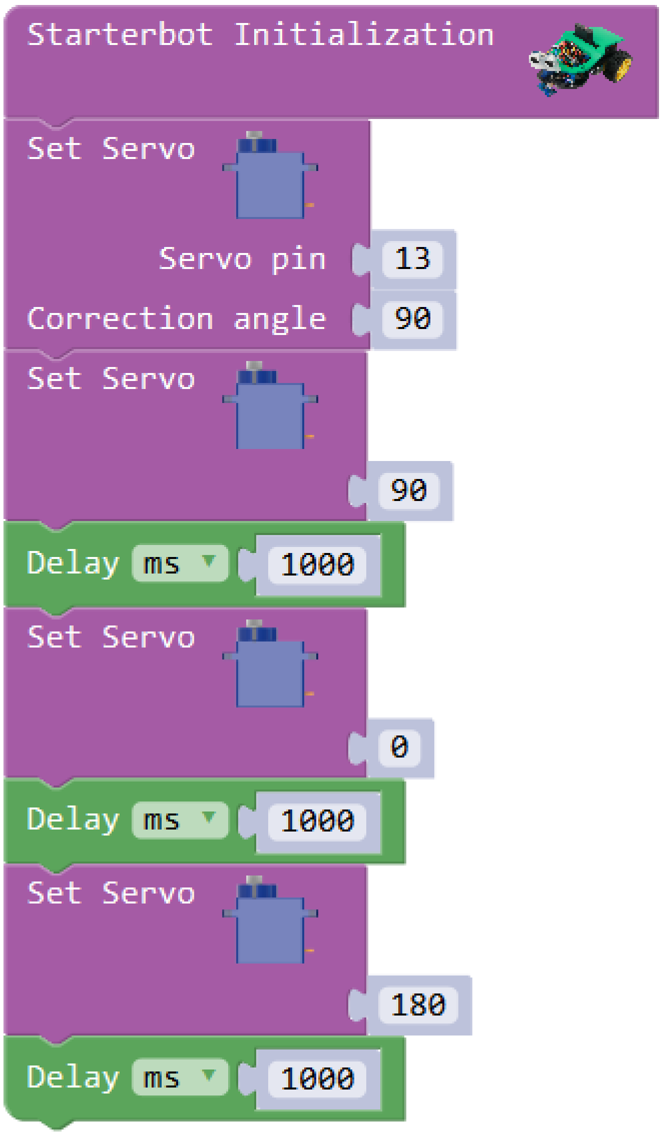


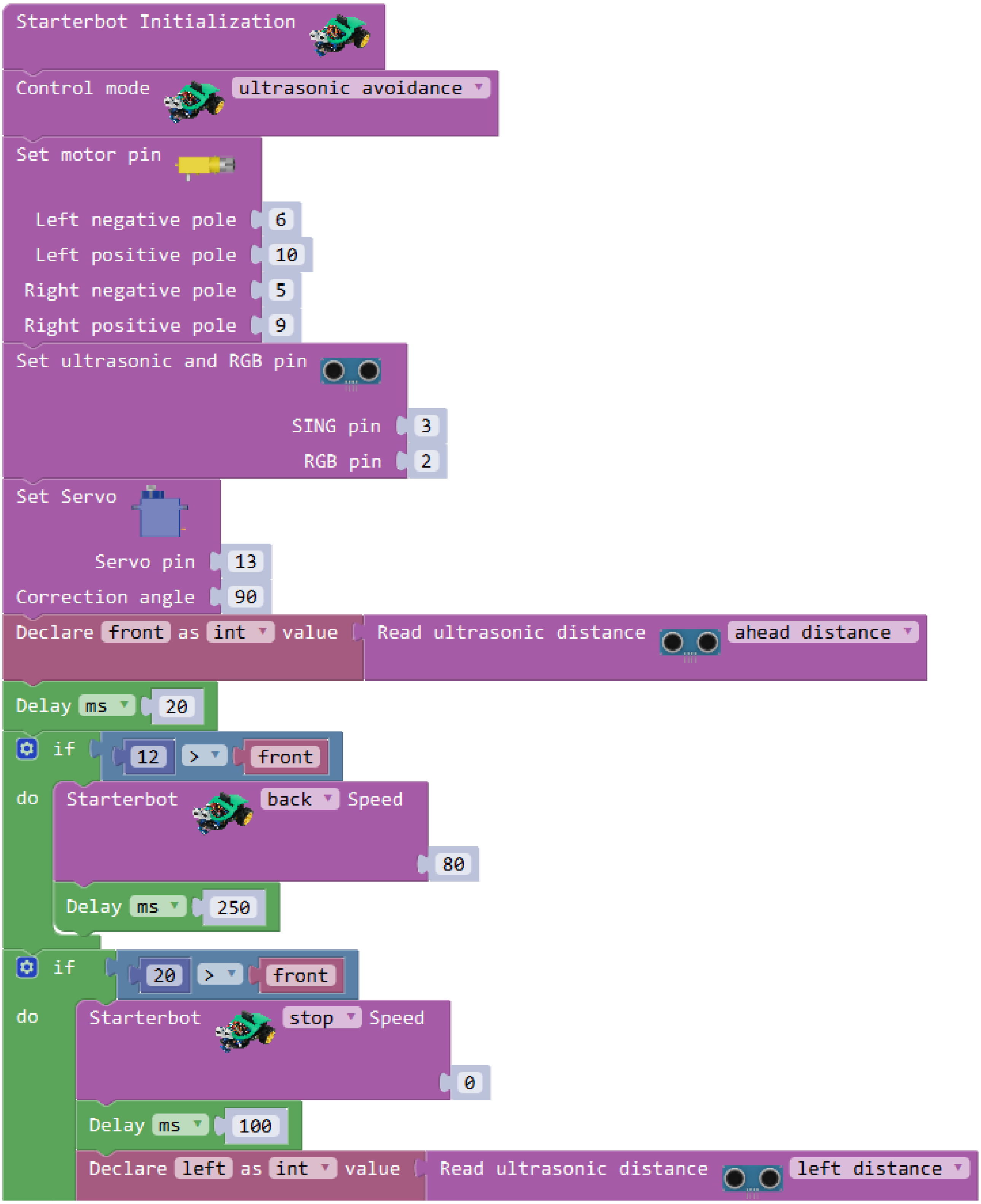
Figure 3-3-2-1

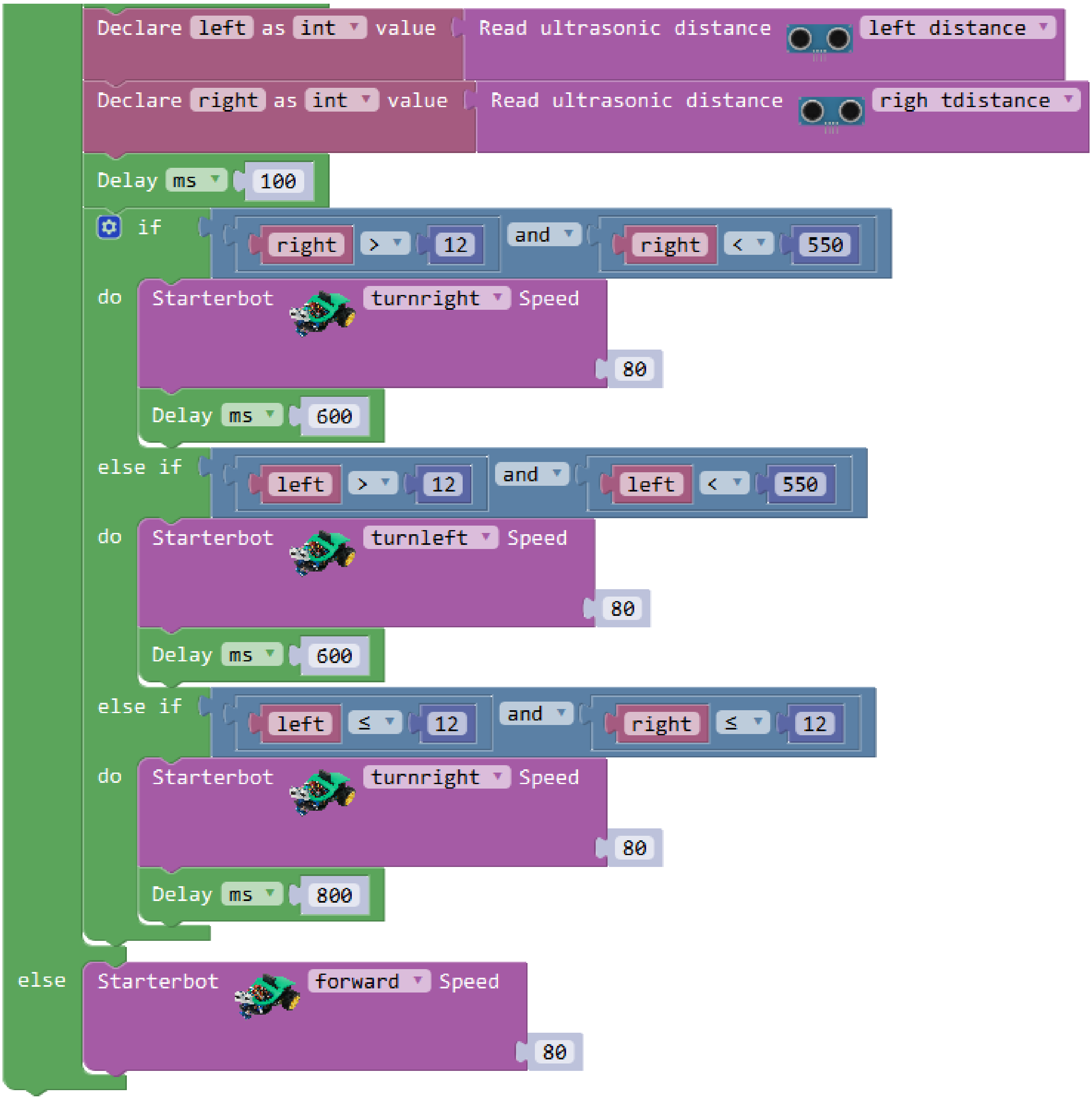
Above is the testing procedure of the steering gear. After uploading the program to the robot, turning on the power supply, we can see that the steering gear makes the ultrasonic module turn forward, then left, and then right.

3.3.3 Programming of Obstacle Avoidance Robot

The main work flow of the ultrasonic obstacle avoidance robot is as follows: after power-on, the steering gear makes the ultrasonic module automatically turn to 90 degrees (alignment in front of the robot). The ultrasonic module measures the distance of the obstacle in front. If the value is larger than the set safe distance (12CM), the robot continues to move forward, otherwise stops. At this time, the steering gear makes the ultrasound rotate 90 degrees to the right first, and the ultrasonic mode. The distance between the block and the right obstacle is measured. Then the steering gear rotates the ultrasonic wave 180 degrees to the left. The ultrasonic module measures the distance between the ultrasonic module and the left obstacle.

Then the steering gear lets the ultrasonic module return to 90 degrees. The robot compares the two measured distances. If the left is larger than the right, the robot turns left, then drives, then turns right, and vice versa. When the distance is less than the safe distance, the robot will turn around and walk. Following this train of thought, let's start to write the program of obstacle avoidance robot.


Starterbot Initialization
Control mode ultrasonic avoidance
Set motor pin
Left negative pole 6
Left positive pole 10
Right negative pole 5
Right positive pole 9
Set ultrasonic and RGB pin
SING pin 3
RGB pin 2
Set Servo
Servo pin 13
Correction angle 90
Declare front as int value Read ultrasonic distance ahead distance
Delay ms 20
if 12 > front
do Starterbot back Speed 80
Delay ms 250
if 20 > front
do Starterbot stop Speed 0
Delay ms 100
Declare left as int value Read ultrasonic distance left distance



3.4 Infrared Barrier Avoidance Robot

3.4.1 Principle of Infrared Obstacle Avoidance Module

The principle of the infrared obstacle avoidance module is similar to that of the ultrasonic module. The difference is that the ultrasonic module measures the distance by transmitting ultrasonic wave. The infrared obstacle avoidance module measures the distance by transmitting infrared ray. The infrared obstacle avoidance module has a pair of infrared emission and receiving tubes, which emits infrared ray. When the emitted infrared ray meets the obstacle (reflecting surface), the infrared ray is reflected back and received. Receiving and receiving, the green indicator lights up. After the infrared signal is processed by the control motherboard of the robot, the detection distance is calculated. The infrared obstacle avoidance module is shown in Figure 3-4-1-1.

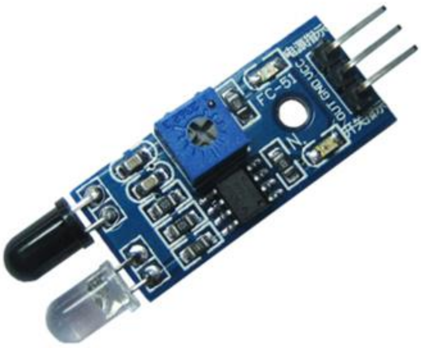
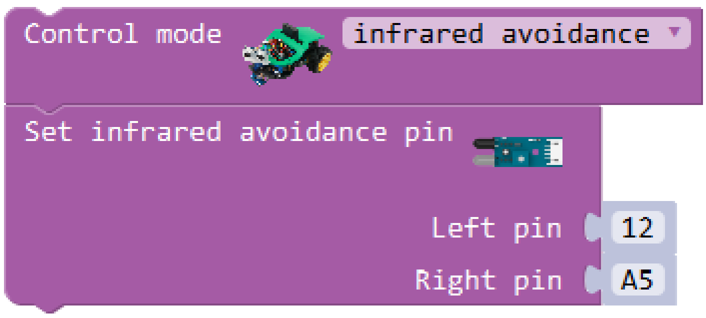


Figure 3-4-1-1

3.4.2 Usage of Infrared Obstacle Avoidance Module

In the control module of the robot, we find the control building blocks of the infrared obstacle avoidance module. As shown in Figure 3-4-2-1, the building blocks can detect the distance between the robot and the left and right obstacles. Note: In order to use the infrared obstacle avoidance module, we first need to choose the mode to control the building blocks and set the mode to the infrared obstacle avoidance mode. When the obstacles completely block the ultrasonic module or face the ultrasonic module to the distance, the infrared radiation emitted by the infrared obstacle avoidance module can not be received because it is too far or too close to detect the distance between the robot and the obstacle, so it is used. When infrared obstacle avoidance module ranging, it is appropriate to keep the distance between the obstacle and the infrared obstacle avoidance module between 5 and 15.



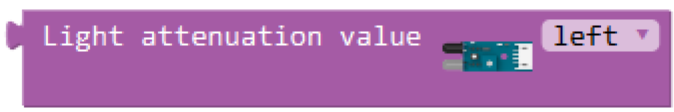


Figure 3-4-2-1

3.4.2 Test of Infrared Obstacle Avoidance Module

We can first write a program to test the infrared obstacle avoidance module, using serial port printing, when we hand close to the infrared obstacle avoidance module and far away from the infrared obstacle avoidance module, we can observe the contents of serial port printing, we can more intuitively see the infrared obstacle avoidance module measuring distance process, below we first write a test program.

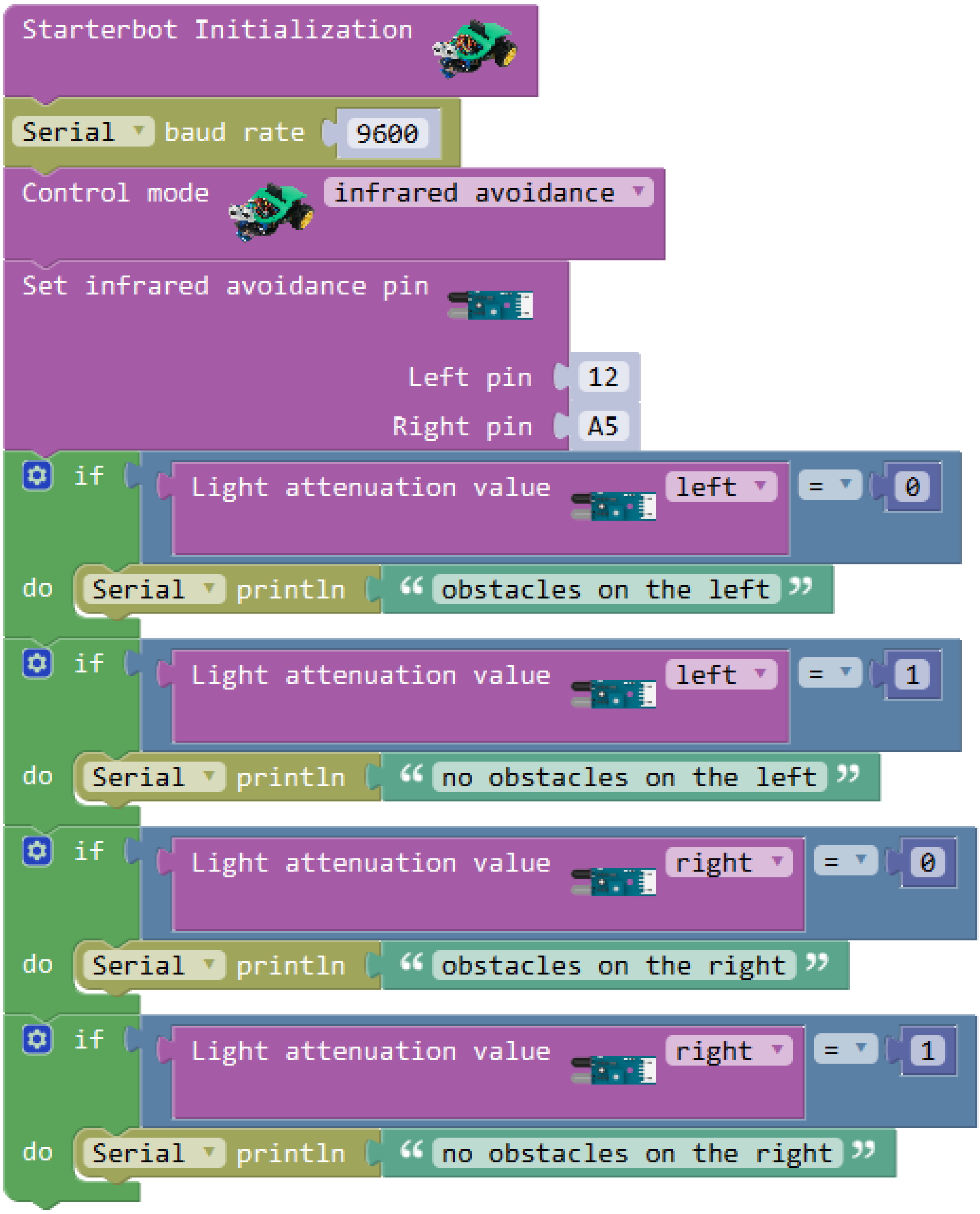


Figure 3-4-2-1

We write the program as shown in Figure 3-4-2-1, then upload the program successfully, open the serial port, and then close or far from the infrared obstacle avoidance module, the serial port will print the corresponding text.

3.4.3 Robot Writing Runway

If we want to let the robot run smoothly on the track to avoid encountering the track, we need to keep a certain distance between the robot and both sides of the track at all times. At this time, we can use the infrared obstacle avoidance module to achieve this effect. The basic idea is to set the safe distance of the infrared obstacle avoidance module first, the robot moves forward, and the infrared obstacle avoidance module measures it with the right track. The distance between the edge and the left side of the track is measured by the infrared obstacle avoidance module. Then the robot compares the distance measured twice. If the left is larger than the right, the robot turns left, then drives, and vice versa. If the distance measured on both sides is less than the safe distance, the robot will stop walking. Follow this train of thought to learn how to write a racetrack robot.

Figure 3-4-3-1

Run the program shown in Figure 3-4-3-1 above, and the robot moves forward; when the robot's left side is near the edge of the runway, the robot turns right. When the right side of the robot is close to the edge of the runway, the robot turns left. When the left and right sides of the robot are close to obstacles, the robot stops.

3.5 Ultrasound+Infrared Barrier Avoidance Robot

We have already known the use and programming of the ultrasonic module and the infrared obstacle avoidance module separately. Next, we will combine the ultrasonic module and the infrared obstacle avoidance module to use together. The programming idea is to set the mode as the ultrasonic infrared obstacle avoidance mode first, then set the ultrasonic module, the safe distance of the infrared obstacle avoidance module, and then detect the obstacle in front of the robot by ultrasonic. Obstacles, infrared obstacle avoidance module detects whether there are obstacles on the left and right sides of the robot. Now let's write the program of the ultrasonic infrared obstacle avoidance robot.

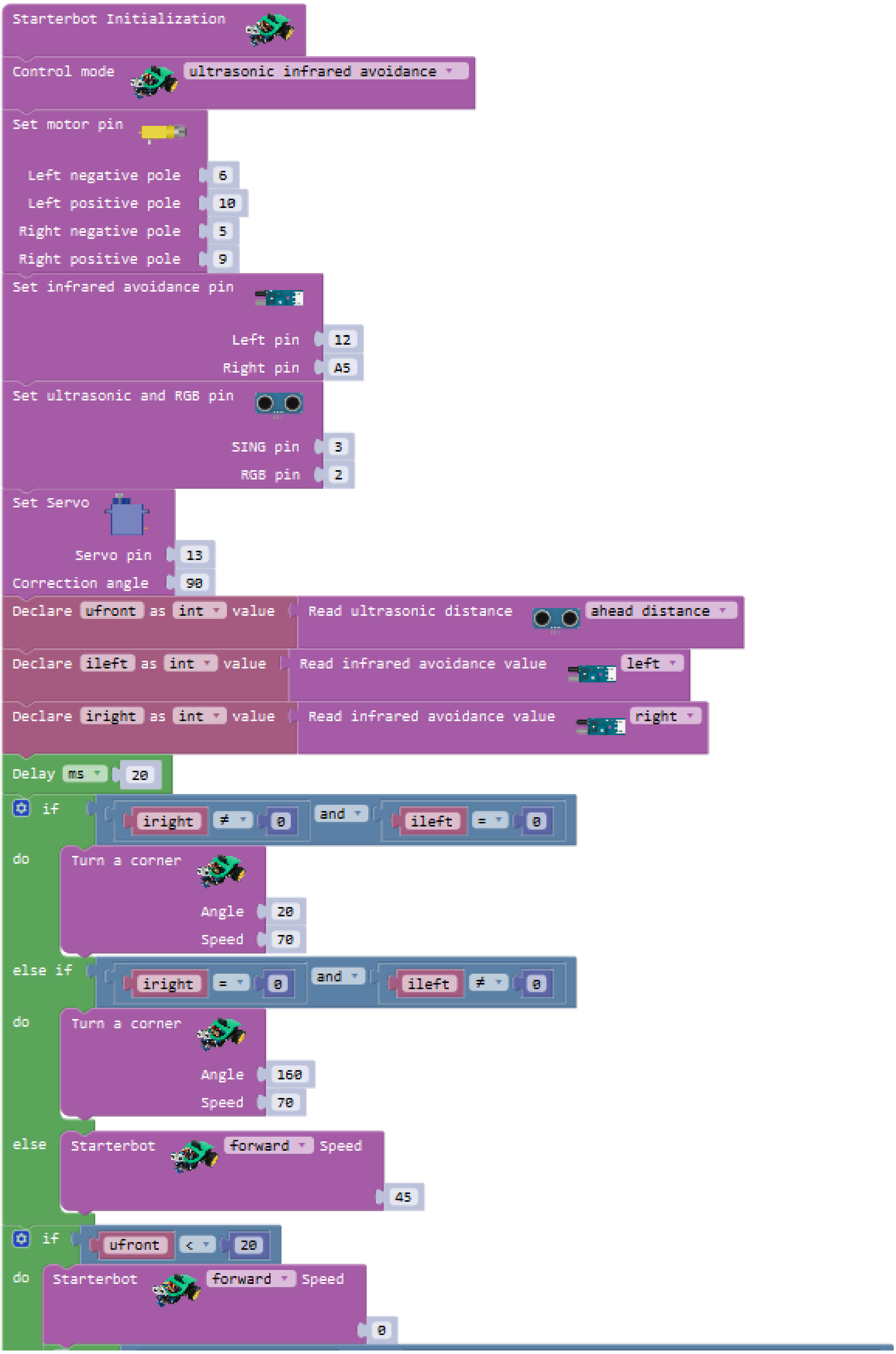

Starterbot Initialization
Control mode ultrasonic infrared avoidance
Set motor pin
Left negative pole 6
Left positive pole 10
Right negative pole 5
Right positive pole 9
Set infrared avoidance pin
Left pin 12
Right pin A5
Set ultrasonic and RGB pin
SING pin 3
RGB pin 2
Set Servo
Servo pin 13
Correction angle 90
Declare ufront as int value Read ultrasonic distance ahead distance
Declare ileft as int value Read infrared avoidance value left
Declare iright as int value Read infrared avoidance value right
Delay ms 20
if iright ≠ 0 and ileft = 0
do Turn a corner
Angle 20
Speed 70
else if iright = 0 and ileft ≠ 0
do Turn a corner
Angle 160
Speed 70
else Starterbot forward Speed
45
if ufront < 20
do Starterbot forward Speed
0

Figure 3-5-1

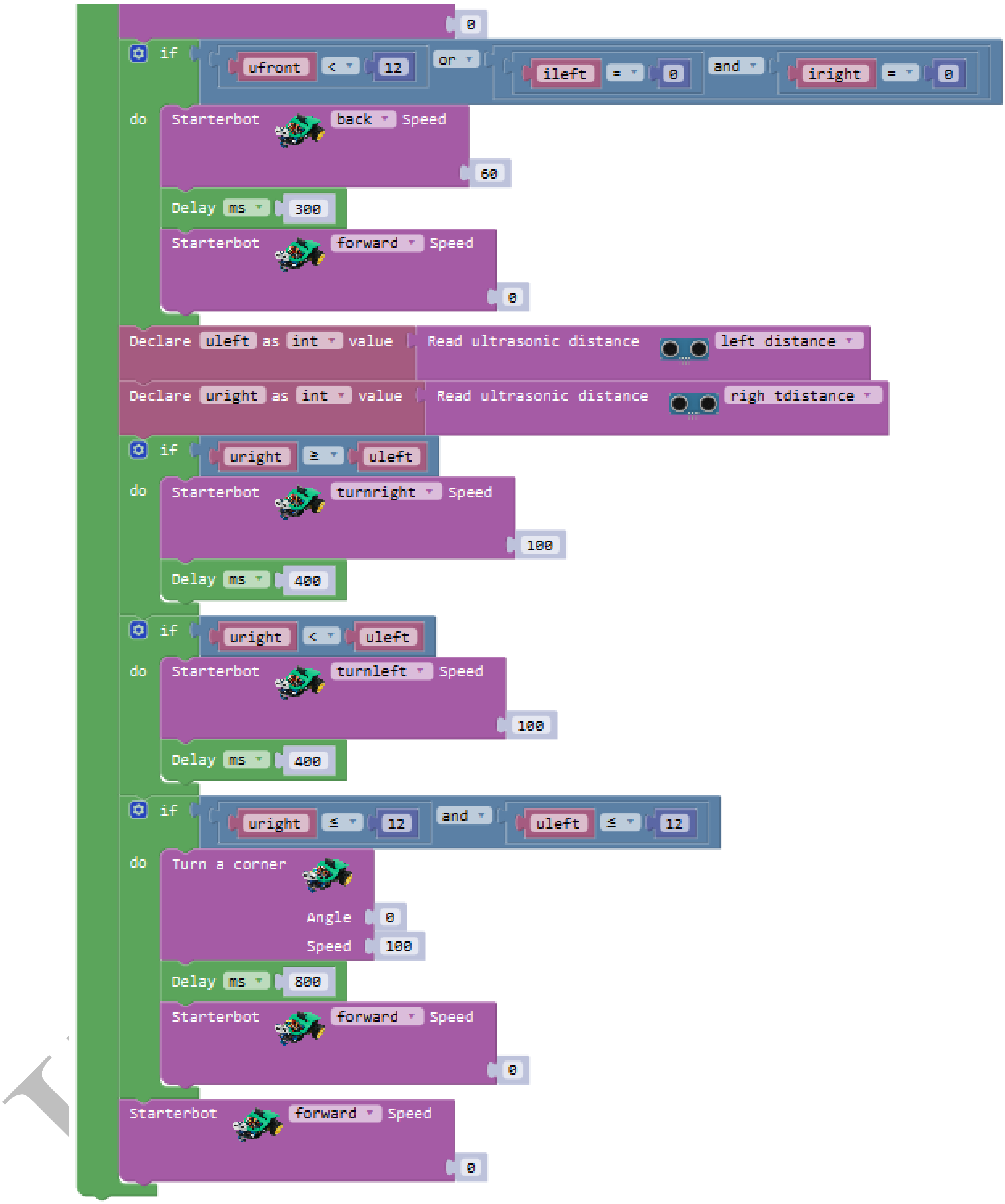


Figure 3-5-2

Fig. 3-5-1 and Fig. 3-5-2 are the procedures of the ultrasonic infrared obstacle avoidance robot. In the above procedures, the delay time after turning should be adjusted according to the speed of the robot, which should be paid attention to when programming.

Chapter IV Tracking Robot

4.1 Principle of Tracking Module

Tracking module works by using the characteristics of different reflective properties of infrared rays on the surface of objects with different colors. During the movement of the robot, infrared light is continuously emitted to the ground. When the emitted infrared rays are not reflected back or reflected back, but the intensity is not high enough, the robot thinks that the area is the route it is going to take; when the infrared light is reflected back to the machine, the robot thinks that the area is the route it is going to take. Man recognizes that the robot thinks the area is not the route it takes. The robot is based on the reflected infrared light to determine the position of the black line and its walking path. The Starterbot robot is equipped with three tracking modules, one on the left, one on the right, and the principle of tracking is shown in Figure 4-1-1.

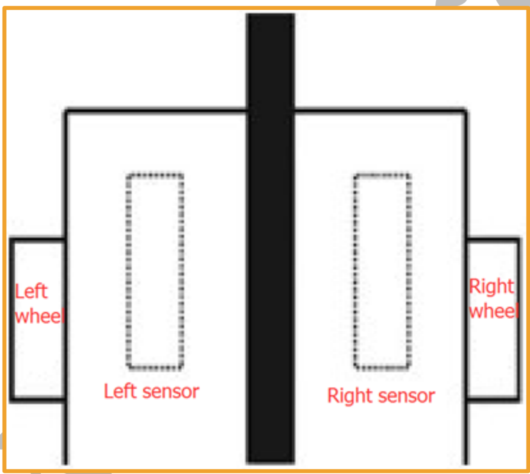


Figure 4-1-1

4.2 Use of Trace Module

In the control module of the robot, the control building blocks of the infrared tracking module are found. As shown in Figure 4-2-1, using the building blocks, the robot can automatically run along its own track. Note: In order to use the infrared tracking module, we first need to select the mode to control the building blocks, and set the mode to the infrared tracking mode. Besides the mode setting, we need to define a variable to save the values read by each infrared tracking, so that when the robot runs off, it can correct the direction according to the values read last time and find the route again. Read the trace value building blocks, the drop-down menu has all black, all white, left 1, left 2, center, right 1, right 2 options, their interpretation is as follows:

- All black: black lines were detected in all three tracking modules.
- Whiteness: None of the three tracking modules detected black lines.
- Left 1: The black line was detected by the tracking module on the left.

- Left 2: Black lines were detected in the left and middle tracing module.
- Center: The black line was detected by the tracing module in the middle.
- Right 1: The black line was detected by the tracking module on the right.
- Right 2: The black line was detected by the tracing module on the right and in the middle.

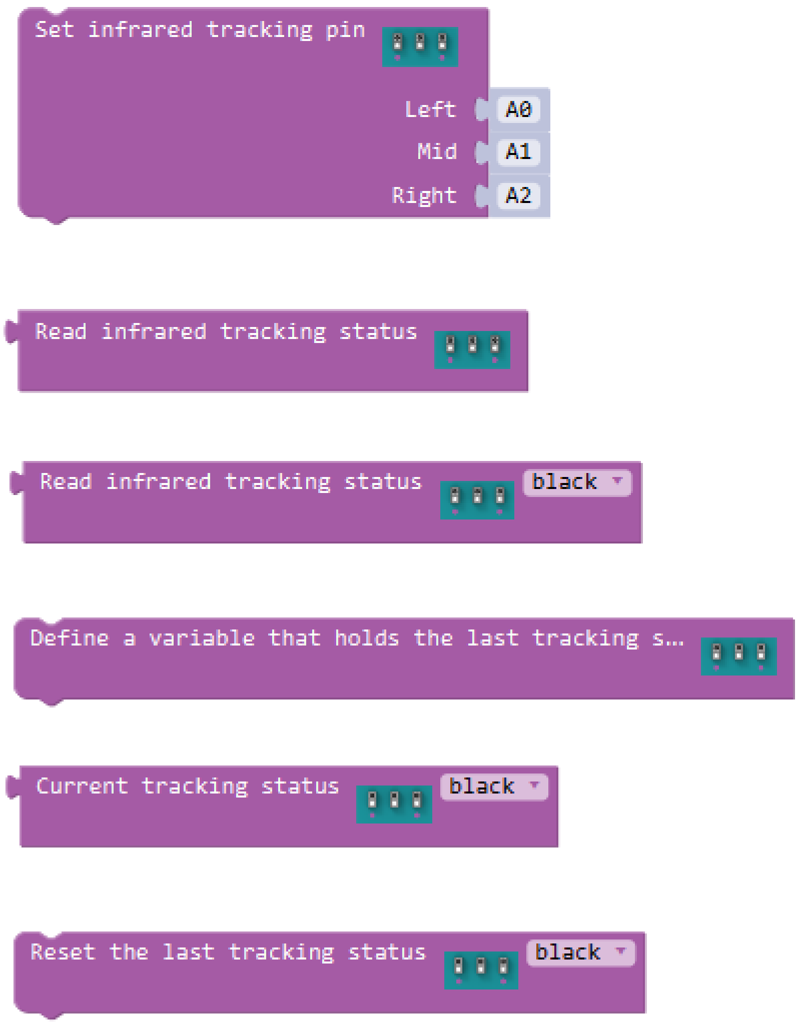


Figure 4-2-1

4.3 Testing of Infrared Tracking Module

We can first write a program to test the infrared tracing module, using serial port printing, using black tape near the infrared tracing module and far away from the infrared tracing module, we can observe the contents of serial port printing, we can more intuitively see the tracing effect of each module when the infrared tracing module tracks. Now we first write a test program.

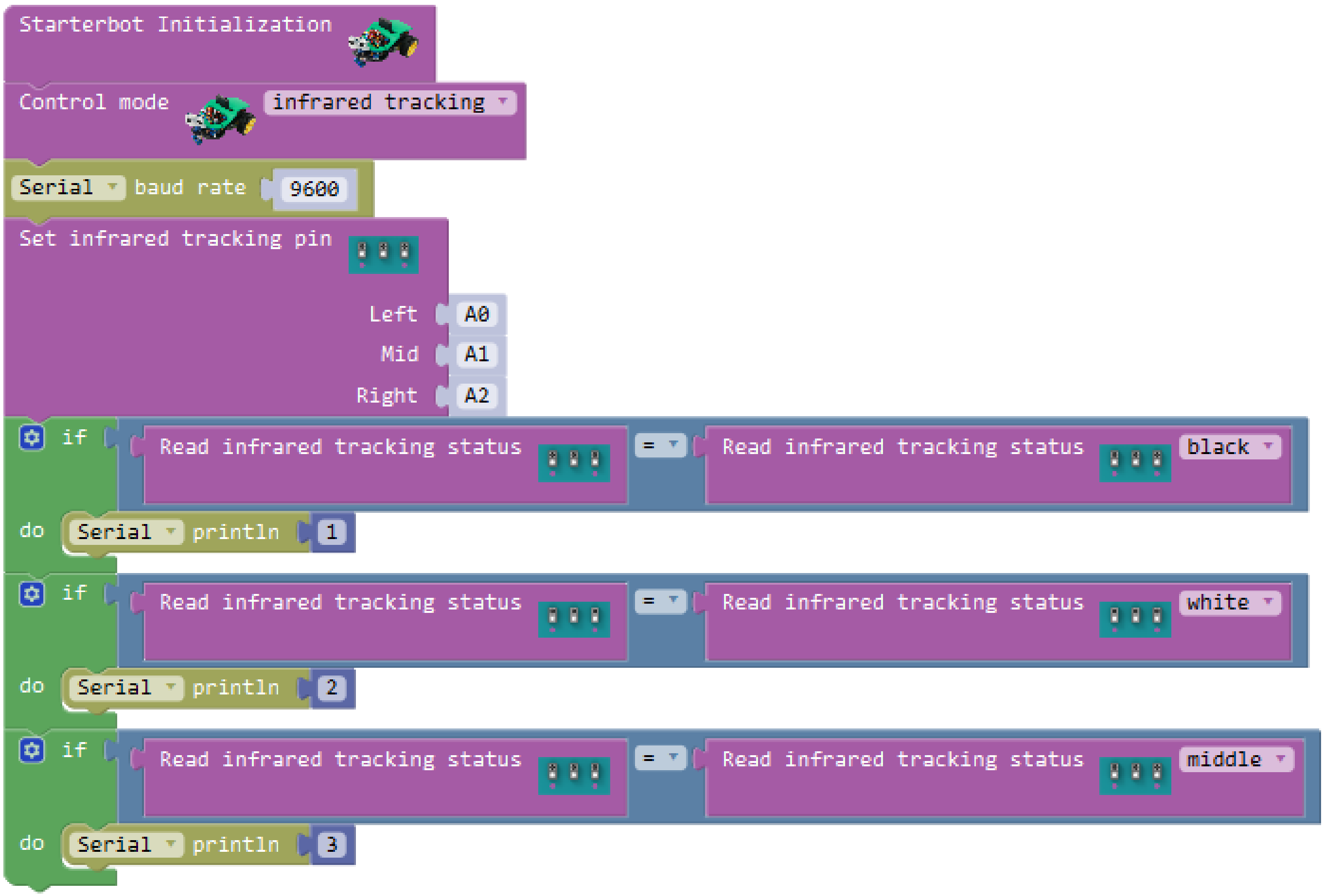
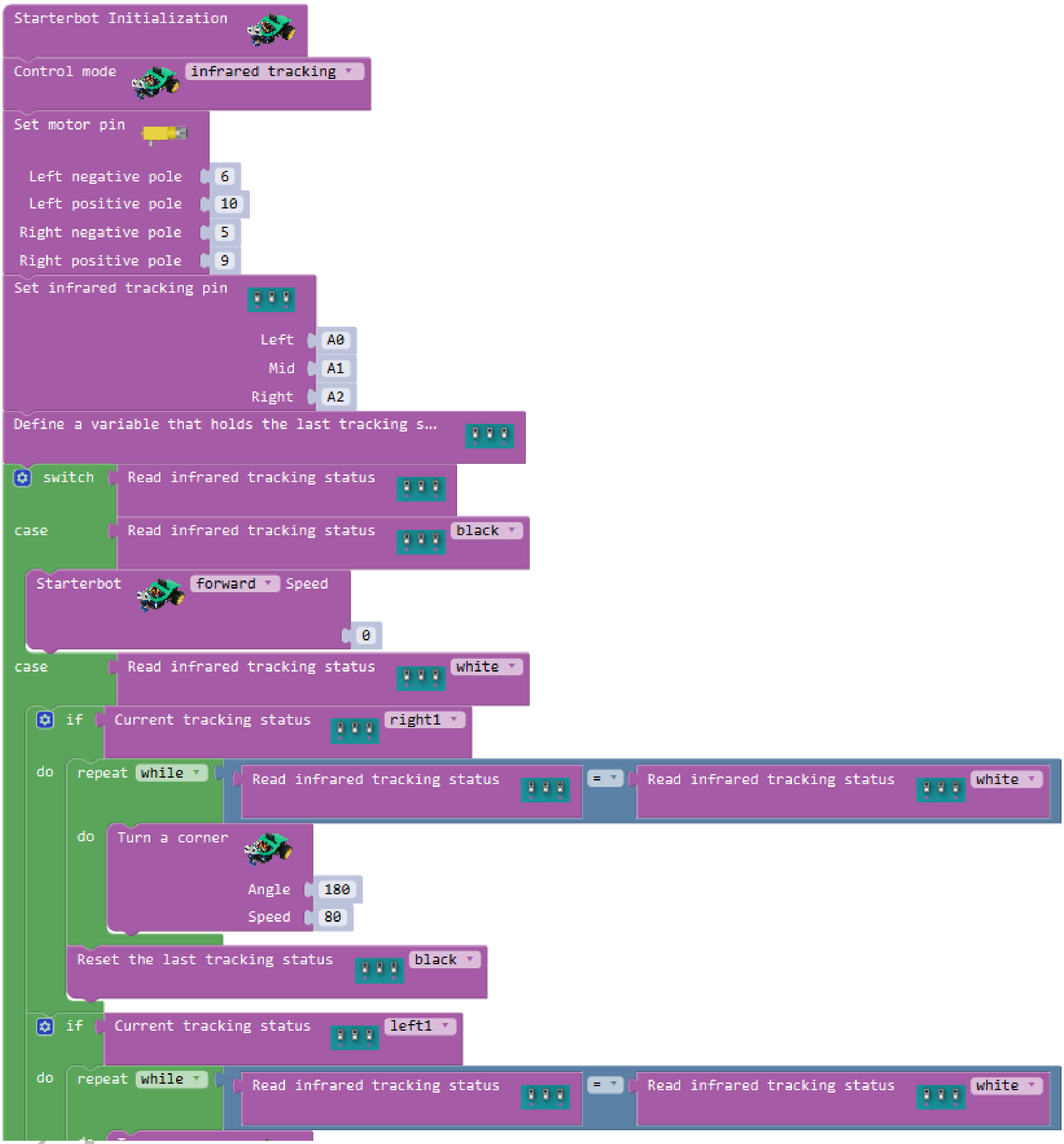


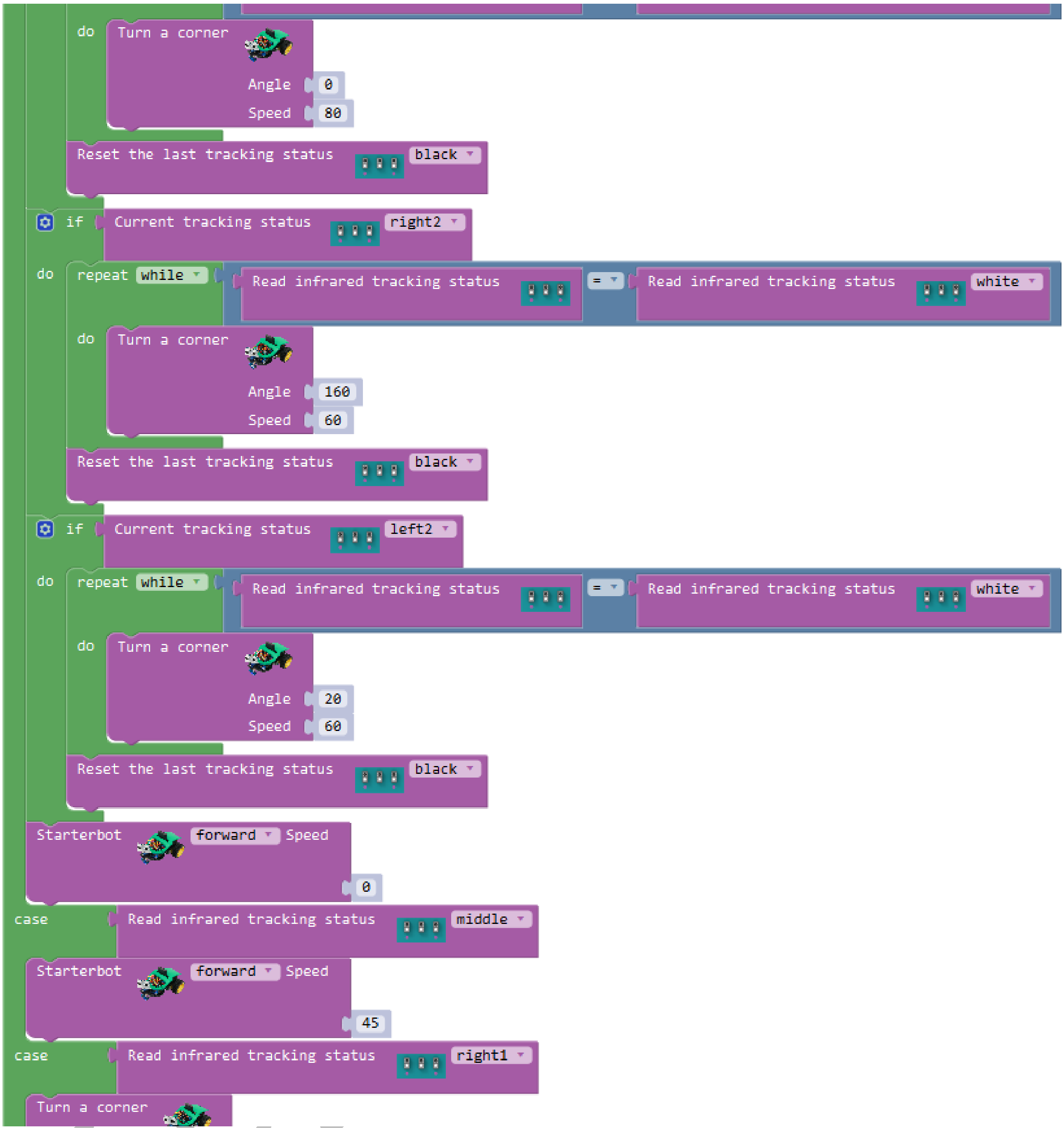
Figure 4-3-1

As shown in Figure 4-3-1 above, when we open the serial port, we close the black strip to any one of the tracking modules, and the serial port will print the corresponding number.

4.4 Writing Tracking Robot Program

The programming idea of the tracking robot is to set the infrared tracking mode first, and then set the connecting pins of the infrared tracking module according to its actual wiring mode. Then the robot executes the corresponding left-to-left, forward and right-to-right movement according to the detection results of the left-to-center and right-to-right tracking modules. Let's write the program of the tracking robot together.


Starterbot Initialization
Control mode
infrared tracking
Set motor pin
Left negative pole
6
Left positive pole
10
Right negative pole
5
Right positive pole
9
Set infrared tracking pin
Left
A0
Mid
A1
Right
A2
Define a variable that holds the last tracking s...
switch
Read infrared tracking status
case
Read infrared tracking status
black
Starterbot
forward
Speed
0
case
Read infrared tracking status
white
if
Current tracking status
right1
do
repeat
while
Read infrared tracking status
=
Read infrared tracking status
white
do
Turn a corner
Angle
180
Speed
80
Reset the last tracking status
black
if
Current tracking status
left1
do
repeat
while
Read infrared tracking status
=
Read infrared tracking status
white


do
Turn a corner
Angle 0
Speed 80
Reset the last tracking status black
if Current tracking status right2
do repeat while
Read infrared tracking status = Read infrared tracking status white
do
Turn a corner
Angle 160
Speed 60
Reset the last tracking status black
if Current tracking status left2
do repeat while
Read infrared tracking status = Read infrared tracking status white
do
Turn a corner
Angle 20
Speed 60
Reset the last tracking status black
Starterbot forward Speed
0
case Read infrared tracking status middle
Starterbot forward Speed
45
case Read infrared tracking status right1
Turn a corner

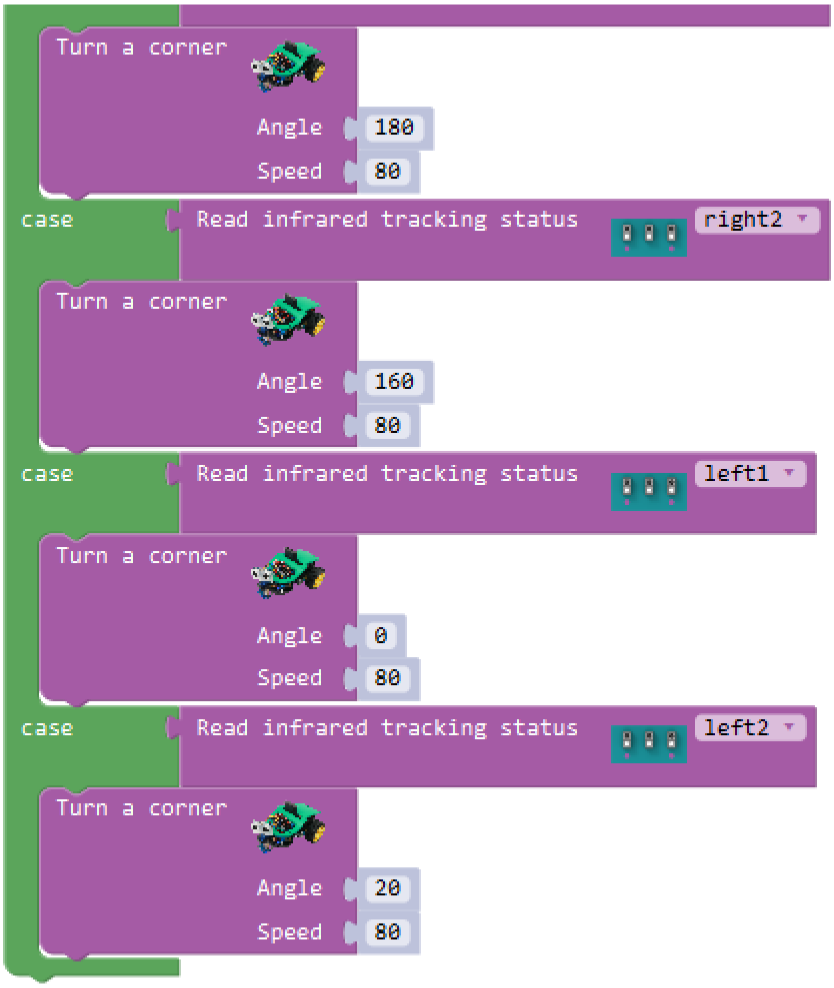


Figure 4-4-1

Chapter 5 Infrared Telecontrol Robot

5.1 Principle of Infrared Remote Control

The remote control system is generally composed of a remote controller (transmitter) and a receiver. When you press any key on the remote controller, the remote controller will issue an instruction. After receiving the instruction from the remote controller, the receiver will transmit the instruction to the robot's brain. The robot will think about what kind of action to do according to the remote control instruction, and then control its limbs (four wheels) to do the corresponding. Actions, remote controls and receivers are shown in Fig. 5-1-1.

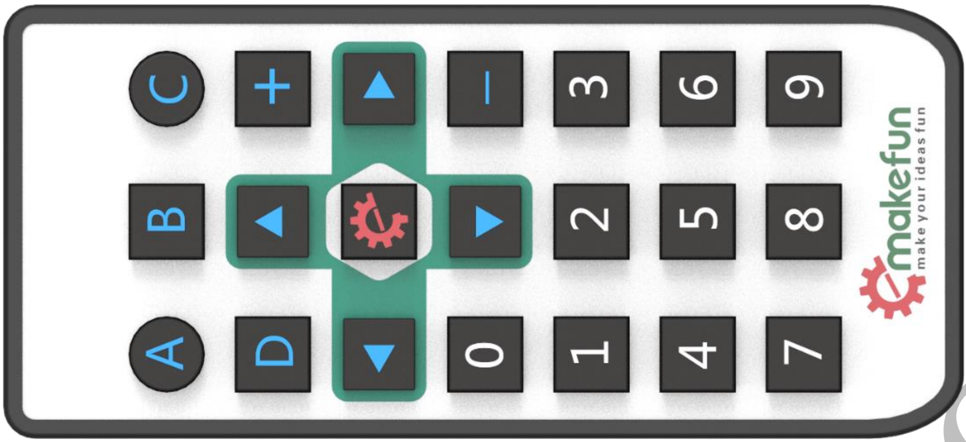


Figure 5-1-1

5.2 The Use of Remote Controller

To control the robot through the remote controller, we first set the operation mode to infrared remote control mode, and set the infrared remote control receiving pin according to the actual connection port, then define the effect of each key press of the remote controller, so that when we press the key of the remote controller, the robot will do the action defined in our program.

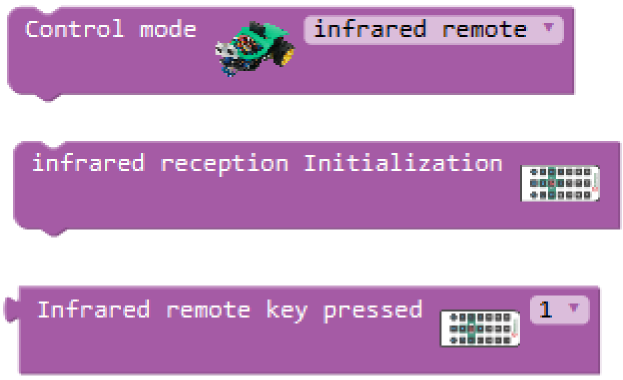


Figure 5-2-1

5.3 Infrared remote control test

We can first write a program to test infrared remote control, using serial port printing, when the remote control button is pressed, the serial port prints the corresponding key values, we observe the contents of serial port printing, we can see which key of the infrared remote control is pressed. Now we first write a test program.

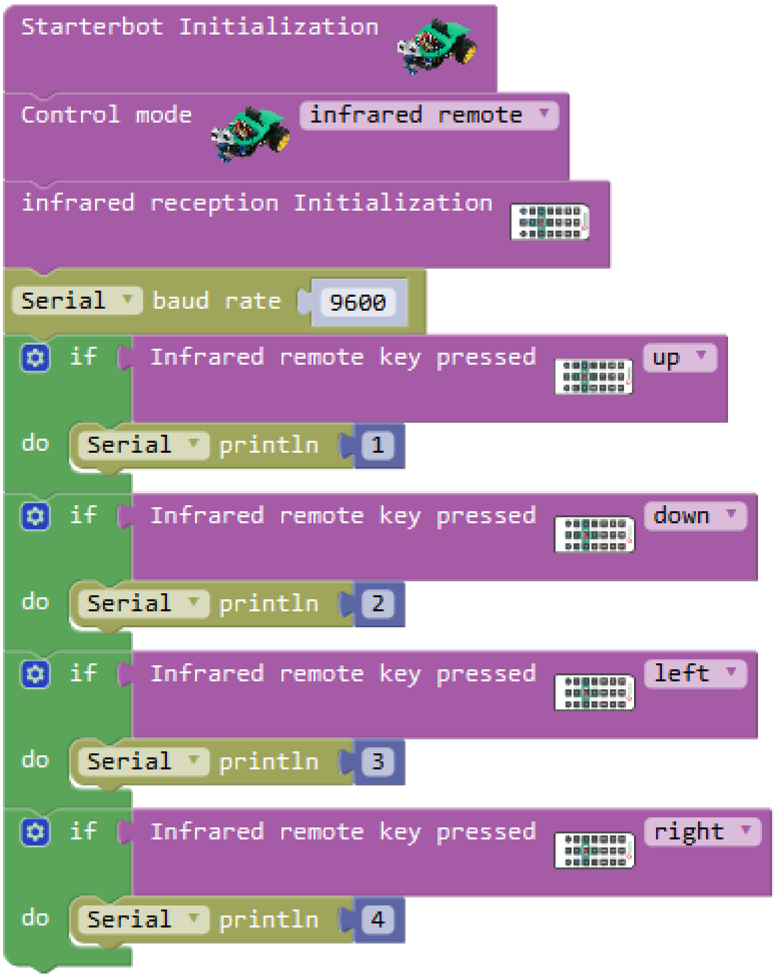


Figure 5-3-1

We write the program as shown in Fig. 5-3-1, then upload the program successfully, open the serial port, then hold the remote control to the robot, press up, down left, right, the serial port will print the corresponding key numbers.

5.4 Programming of Remote Control Robot

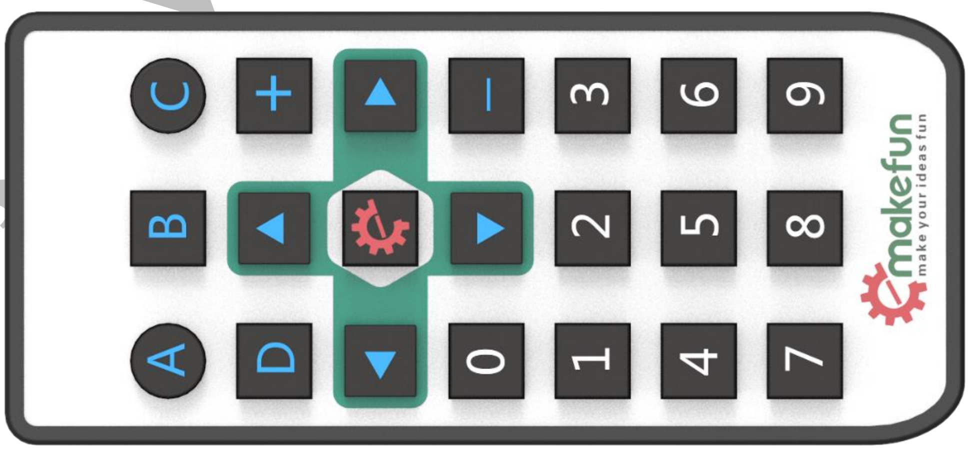


Figure 5-4-1

We write a remote control key function as defined in Fig. 5-4-1, and set the speed regulation 1 (+) for acceleration and the speed regulation 2 (-) for deceleration. We have to do a 0.12S delay after the acceleration and deceleration procedures, which is to make the robot accelerate and decelerate a little bit more smoothly. Without the delay, the speed will directly change to the maximum or minimum.

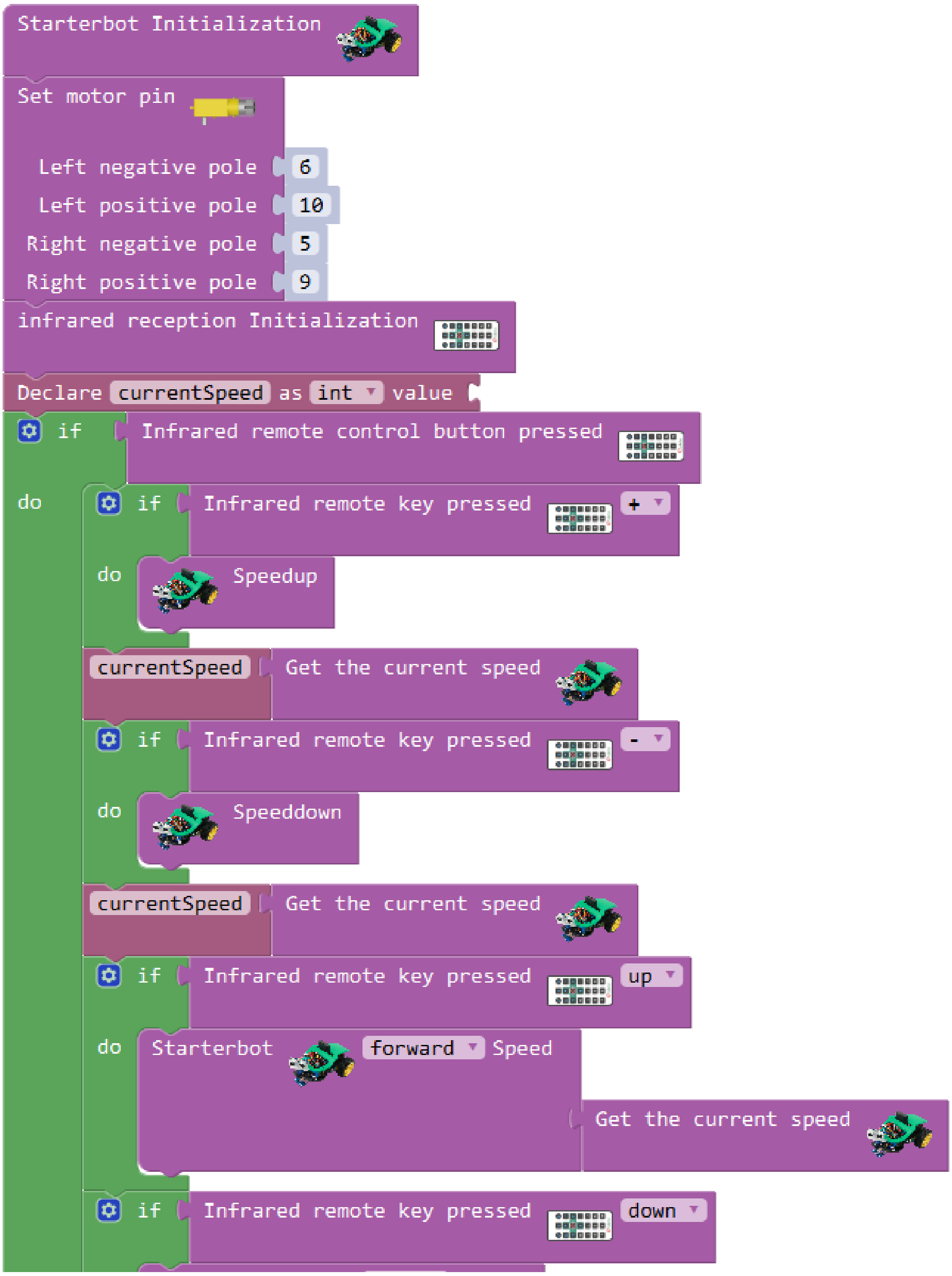


Figure 5-4-2

Note: When setting the steering speed, the speed value can not be set too small, otherwise the robot will not be strong enough when turning, and will be stuck in place. Therefore, the best setting speed value is above 40.

Chapter 6 Bluetooth Remote Control Robot

6.1 Bluetooth Control Principle

Bluetooth is a kind of long-distance communication mode. We send the instructions to the Bluetooth module on the robot from the APP end of the mobile phone through the Bluetooth of the mobile phone. Then the Bluetooth module on the robot sends the instructions to the robot brain (main control board). The robot controls its limbs (four wheels) to do the corresponding actions. At the same time, the robot will also install Bluetooth through itself. The module sends the action being done to the mobile app, so that the mobile app can be remotely controlled by Bluetooth.

6.2 Bluetooth Module and Starterbot Robot APP KeywishBot Connection Method

The Starterbot robot is equipped with a Bluetooth module (as shown in Figure 6-2-1). The blue light on the Bluetooth module flickers when the power is turned on. After turning on the APP, select Starterbot , Bluetooth module and the Starterbot robot APP KeywishBot on the mobile phone (as shown in Figure 6-2-3) and connect via Bluetooth. When the connection is successful, the blue light will be on for a long time, and then select "remote". The control interface enters the gravity induction control interface (Fig. 6-2-5). Handle control mode can also be switched as shown in Figure 6-2-6.

Figure 6-2-1

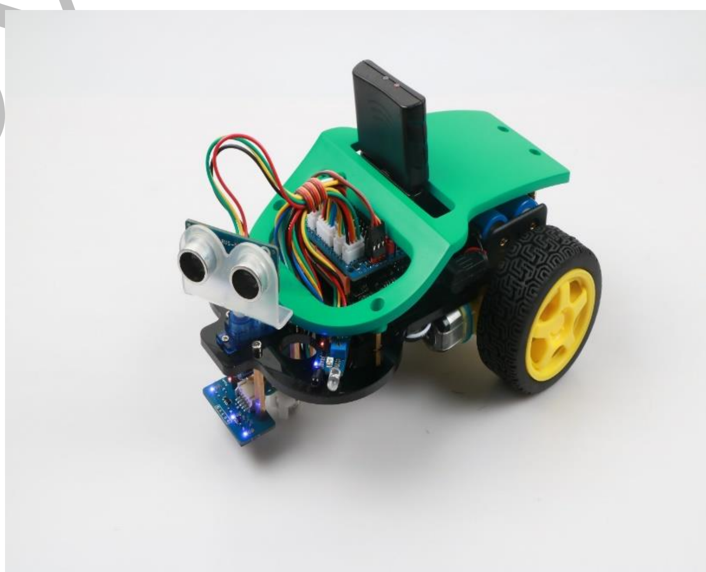


Figure 6-2-3

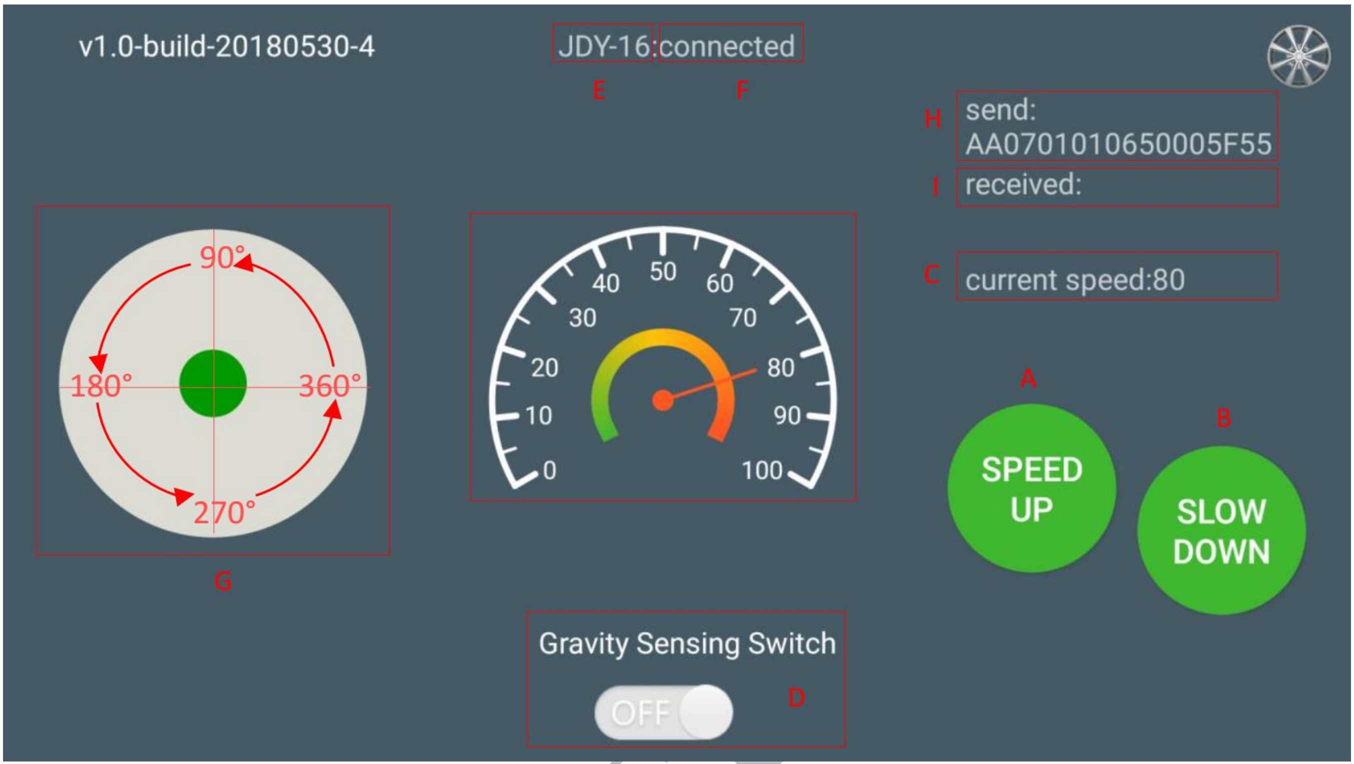


Figure 6-2-5

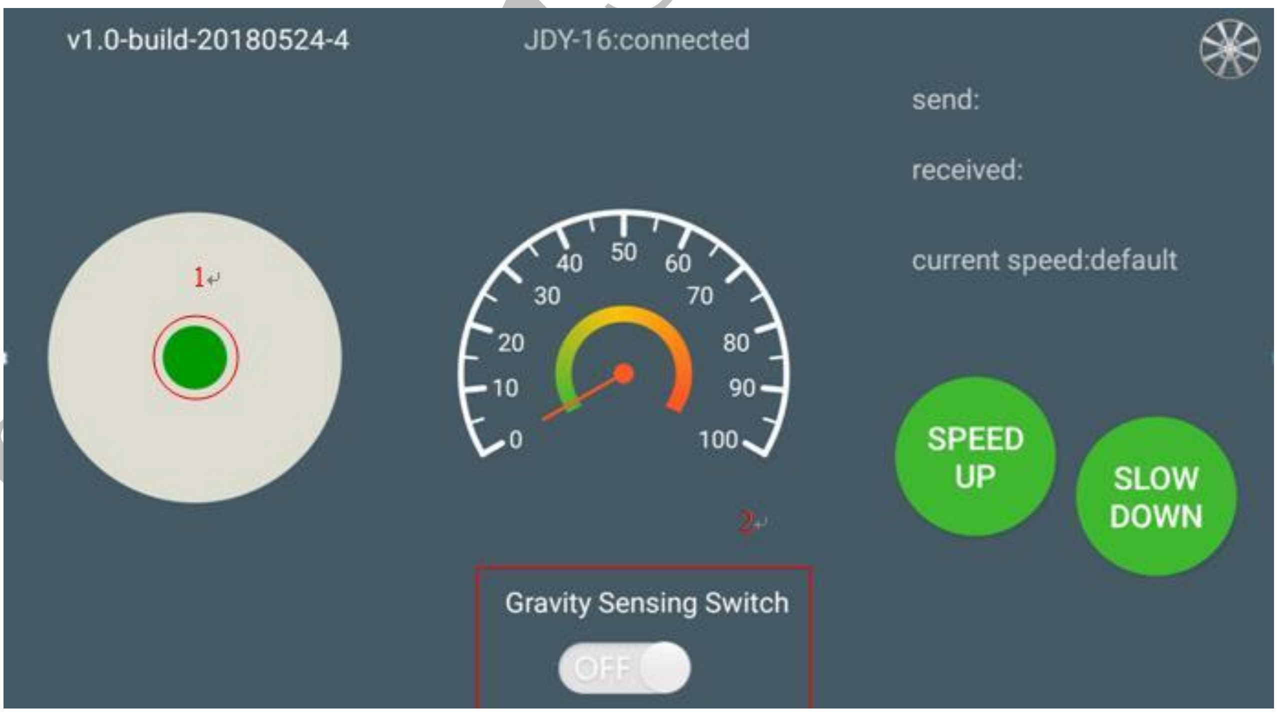


Figure 6-2-6

6.3 Bluetooth module testing

We can first write a program to test Bluetooth module, using serial port printing. When the Bluetooth module of the robot receives data and the serial port prints the data received by Bluetooth, we can see the effect of Bluetooth data transmission by observing the content sent by Bluetooth and the content printed by serial port. Here we write a test program.

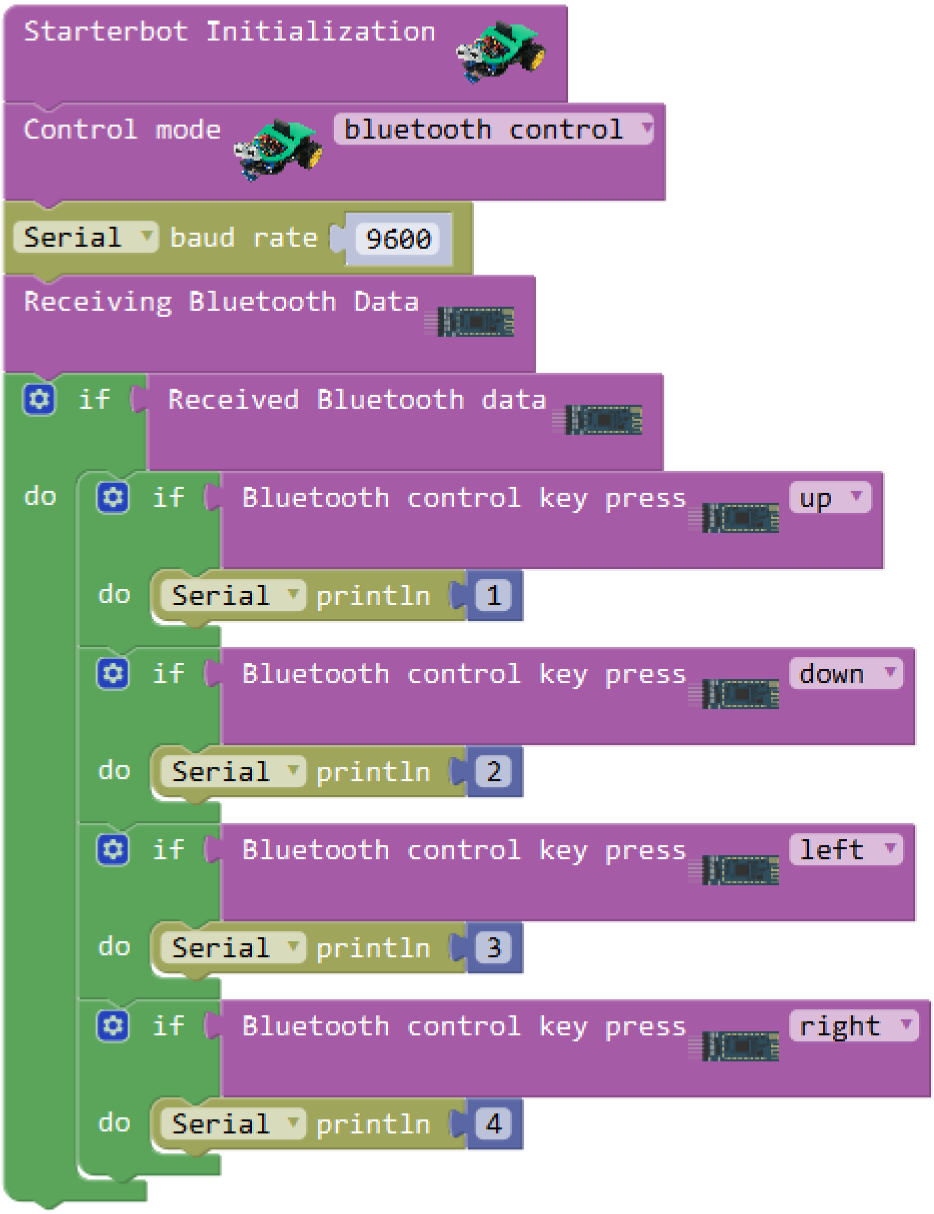


Figure 6-3-1

We have written the program as shown in Figure 6-3-1. After uploading the program successfully, we open the serial port, then connect it with the robot Bluetooth using mobile APP, press the left and right buttons, and the serial port will print the corresponding key numbers.

6.4 Programming Thought of Bluetooth Remote Control Robot

The programming idea of Bluetooth remote control robot is to set the mode as Bluetooth operation mode, initialize the serial port, and then the Bluetooth module of the program waits to receive the instructions from the mobile phone APP. The robot will act accordingly according to the instructions. Now we will write the program of Bluetooth remote control robot together.

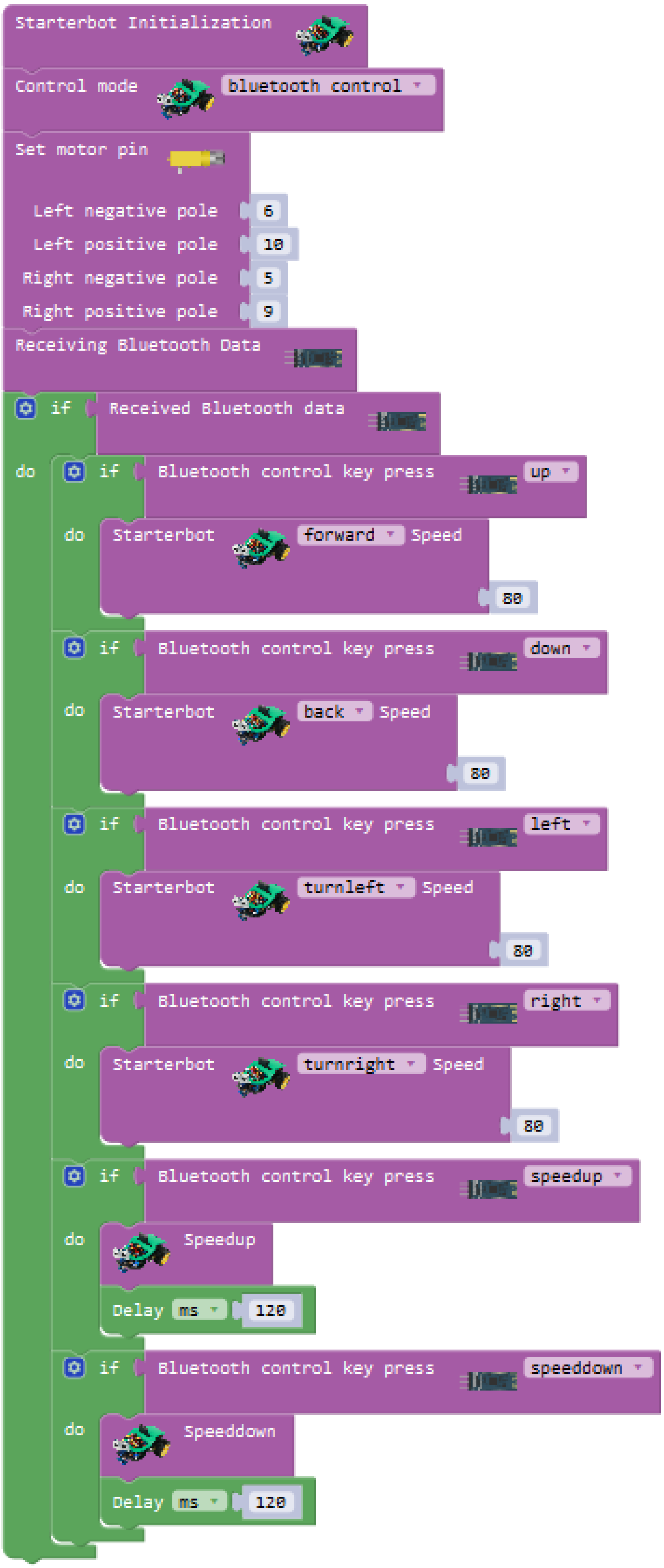

Starterbot Initialization
Control mode
bluetooth control
Set motor pin
Left negative pole
6
Left positive pole
10
Right negative pole
5
Right positive pole
9
Receiving Bluetooth Data
if
Received Bluetooth data
do
if
Bluetooth control key press
up
do
Starterbot
forward
Speed
80
if
Bluetooth control key press
down
do
Starterbot
back
Speed
80
if
Bluetooth control key press
left
do
Starterbot
turnleft
Speed
80
if
Bluetooth control key press
right
do
Starterbot
turnright
Speed
80
if
Bluetooth control key press
speedup
do
Speedup
Delay
ms
120
if
Bluetooth control key press
speeddown
do
Speeddown
Delay
ms
120

Figure 6-4-1

In the above programming, notice that we have made a 0.12S delay after the acceleration and deceleration program. This is to make the acceleration and deceleration of the robot a little more smooth. If there is no delay, the speed will directly change to the maximum or minimum.

Chapter 7 PS2 Telecontrol Robot

7.1 Principle of PS2 remote control handle

The PS2 handle is composed of a handle and a receiver (as shown in Figure 7-1-1). The handle needs two sections of 7 1.5V power supply. Put the handle switch on ON. Without searching for the receiver, the light on the handle will flash continuously. For a certain period of time, before searching for the receiver, the handle will enter standby mode, and the light on the handle will go out. At this time, press START. ” Key, wake up handle.

The working power supply of the receiver is 3 ~ 5V, so it can not be connected back or overvoltage, otherwise the receiver will burn out.

After normal power-on, the handle and the receiver are automatically paired and connected. In the unsuccessful state, the green light of the receiver flashes, and the light on the handle also flickers. When the pairing is successful, the green light on the receiver is always on, the light on the handle is always on, and the button "MODE" (with different batches of the handle, the above logo may be "AnalyOG", but it will not affect the use), so the "red light mode" can be selected. "Green light mode".

Figure 7-1-1

When the handle is connected to the receiver, we can use the handle to send button commands. When the receiver receives these button commands, the robot's brain (main control board) will let his limbs (four wheels, steering gear) act accordingly according to the received commands.

7.2 PS2 remote control test

We can first write a program to test the PS2 remote control, using serial port printing, when the PS2 remote control keys press, serial port printing the corresponding key values, we observe the contents of serial port printing, you can see which keys of the PS2 remote control are pressed, next we first write a test program.

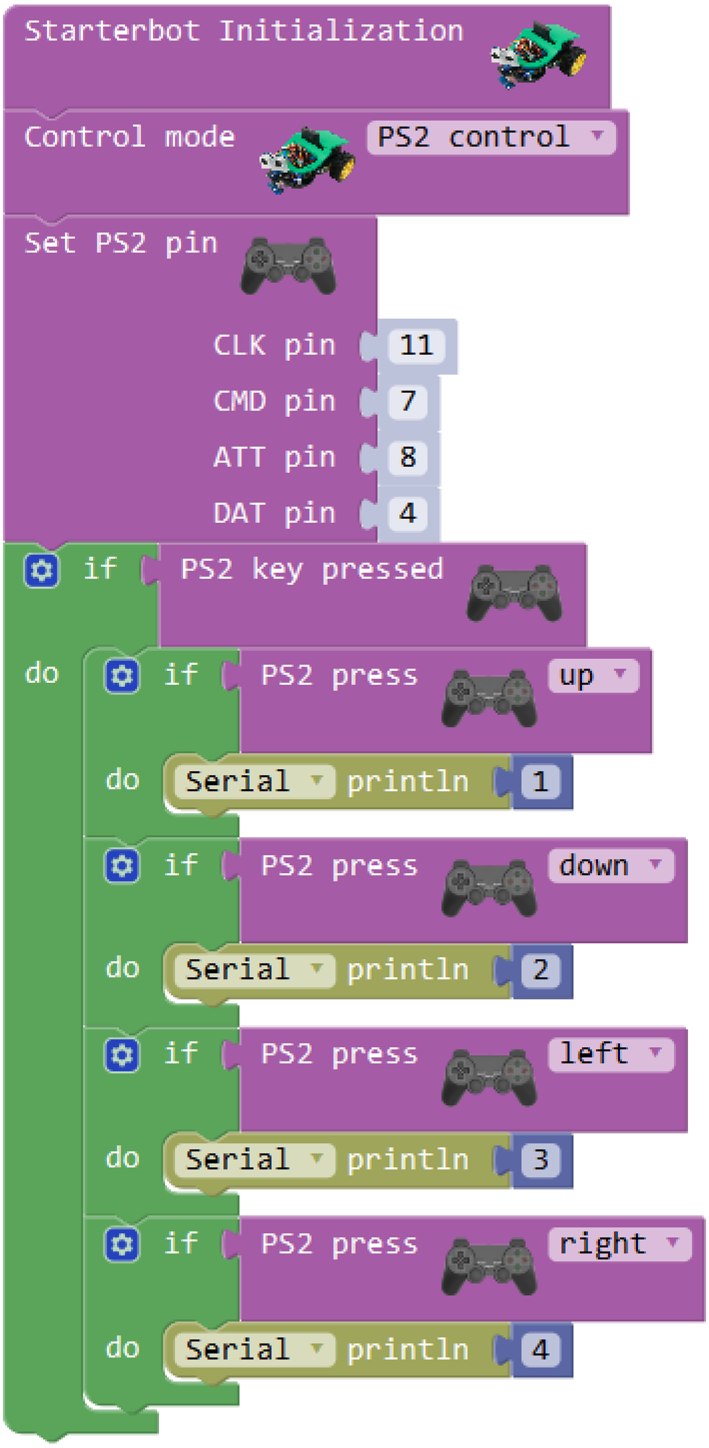


Figure 7-2-1

Fig. 7-2-1 bit PS2 test program, after uploading the program to the robot, open the serial port monitor, press the buttons around PS2, and the serial port will print the corresponding number.

7.3 Programming Thought of PS2 Remote Control Robot

The programming idea of PS2 remote control robot is to set the mode as PS2 control mode first, then define the key function on the PS2 handle according to its own needs. Our next programming is programmed according to the key definition shown in Figure 7-3-1. Then the robot executes the corresponding left, forward, right movement according to the received key value of the handle, or accelerates, decelerates, operates the steering gear, etc., PS2 handle. The remote control car defines all key functions as shown in Figure 7-3.

Figure 7-3-1

- Sign UP: Forward
- Sign DOWN: Back
- Sign LEFT: Turn left
- Sign RIGHT: Turn right
- Sign A: Acceleration
- Sign B: Left turn of steering gear
- Sign C: Deceleration
- Sign D: steering gear right turn

Now let's write the program of PS2 remote control robot.

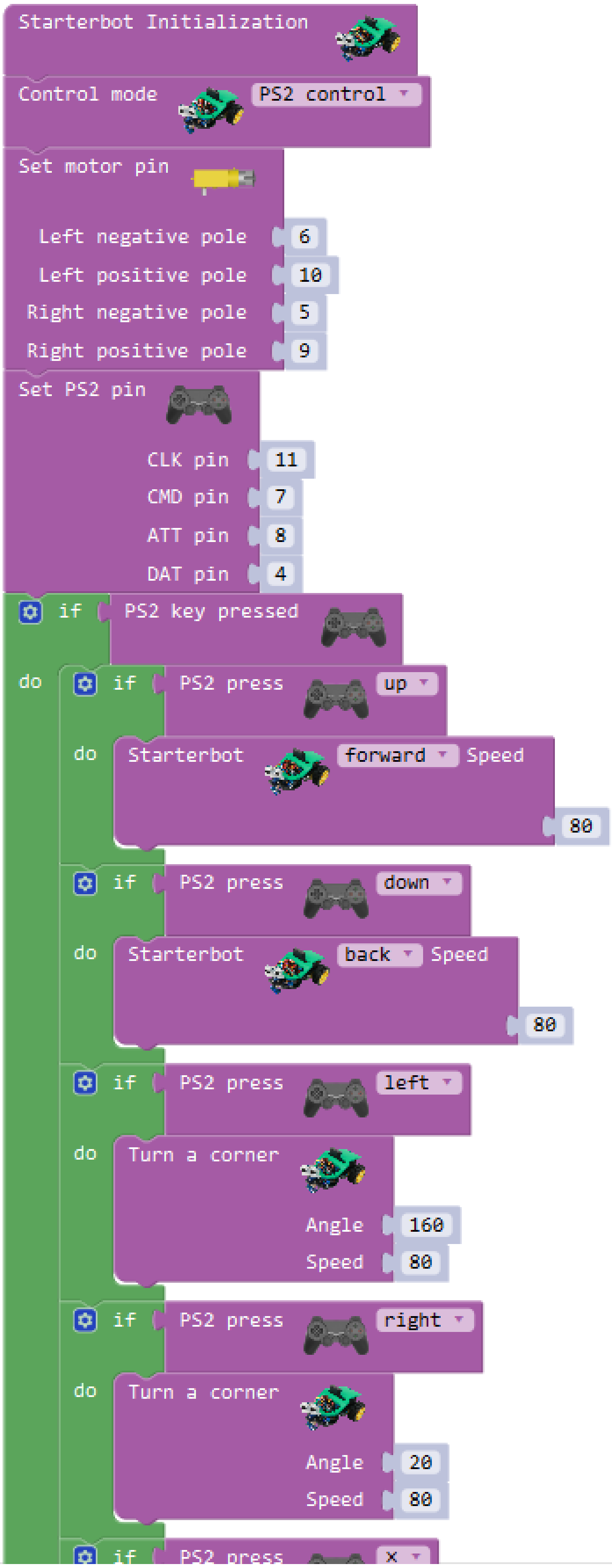

Starterbot Initialization
Control mode
PS2 control
Set motor pin
Left negative pole
6
Left positive pole
10
Right negative pole
5
Right positive pole
9
Set PS2 pin
CLK pin
11
CMD pin
7
ATT pin
8
DAT pin
4
if
PS2 key pressed
do
if
PS2 press
up
do
Starterbot
forward
Speed
80
if
PS2 press
down
do
Starterbot
back
Speed
80
if
PS2 press
left
do
Turn a corner
Angle
160
Speed
80
if
PS2 press
right
do
Turn a corner
Angle
20
Speed
80
if
PS2 press
x

Figure 7-3-2

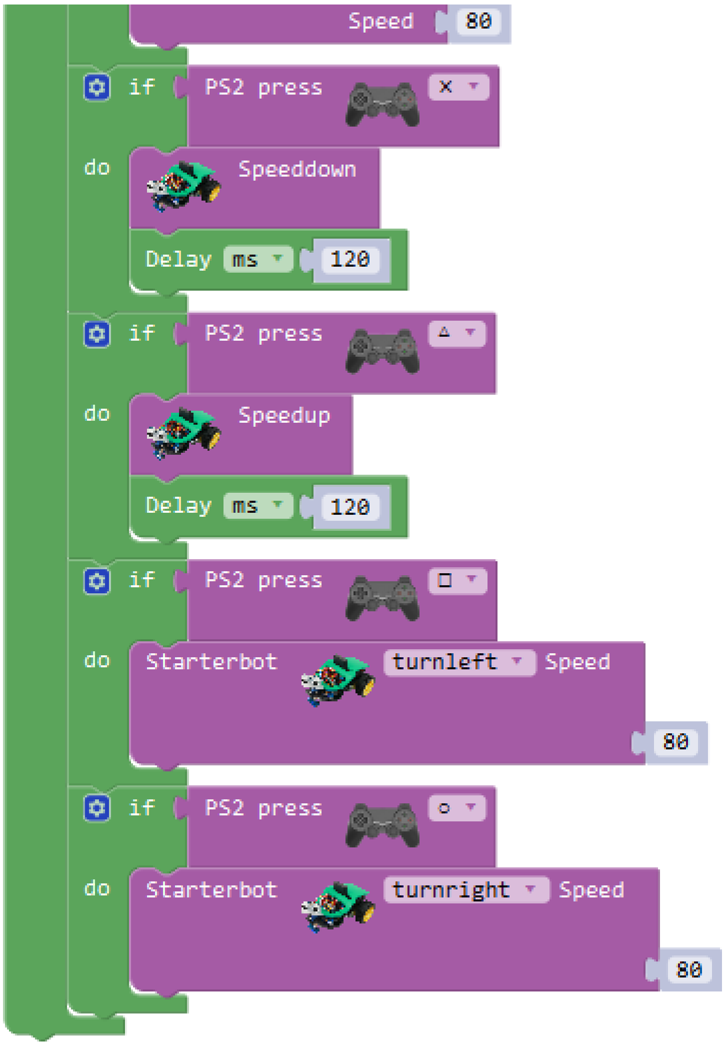


Figure 7-3-3

Transfer the program of Figure 7-3-2 and Figure 7-3-3 to the robot. We turn on the power of the robot, connect the PS2 handle to the receiver, press the button on the PS2 handle, and the robot will perform the corresponding action.

Chapter 8 Rgb Robots

8.1 RGB lamp

We usually see some colorful lights in the evening. The colorful lights are very gorgeous. There are also two colorful lights on Starterbot. They are installed on the ultrasonic module. These two LED lights can emit colorful light. Why can one light emit colorful light? This is related to the three primary colors of light we have learned in physics. The three primary colors of light are red, green and blue, which is why? Three colors can be mixed together to show different colors, which is the principle of Starterbot RGB LED lamp. The program building blocks in Starterbot are shown in Figure 8-1 below.

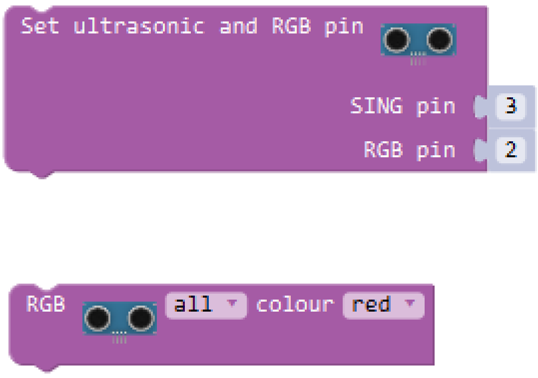


Figure 8-1

After recognizing the building blocks of LED lights, let's write a simple program to make the two lights light up.

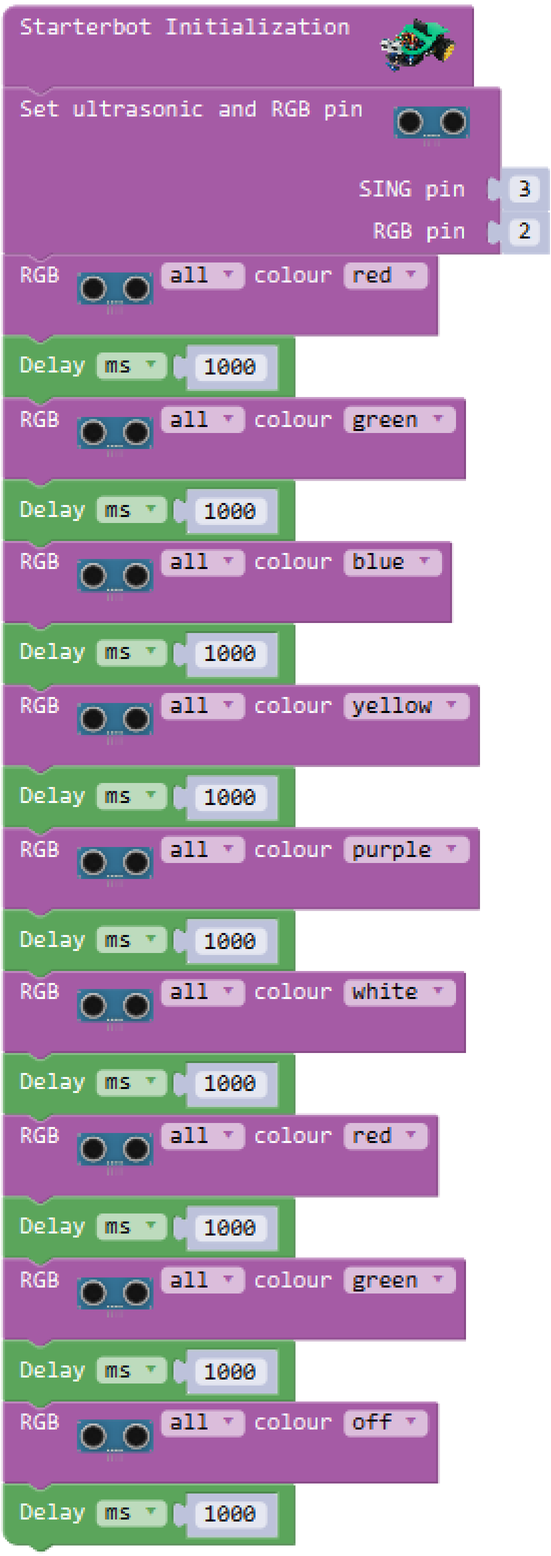


Figure 8-2

By running the program shown in Figure 8-2 above, we can see that when we turn on the Starterbot power supply, the two lights will turn on, and the color will be changed every second. The color can be set by ourselves.

Chapter 9: Light-finding Robots

9.1 Light-finding Module and Principle

The light-finding function of the light-finding module is to output analog signals by judging the light intensity of the surrounding environment through the photodiode. When the photoresistor is illuminated by strong light, its resistance value drops rapidly, the passing current increases, the resistance value of the photoresistor increases rapidly in the dark environment, and the passing current decreases. The main control board judges whether there is a light source. The tracking module and program building blocks are shown in Figures 9-1-1 and 9-1-2.

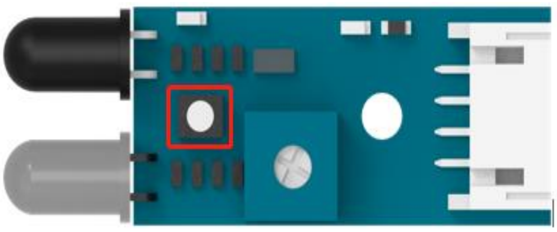


Figure 9-1

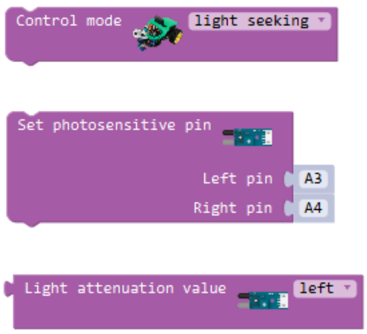


Figure 9-2

9.2 Light-fingding Program

Understanding the principle of the light-finding module and building blocks, we can build a Starterbot light-finding program, as shown in Figure 9-2-1.

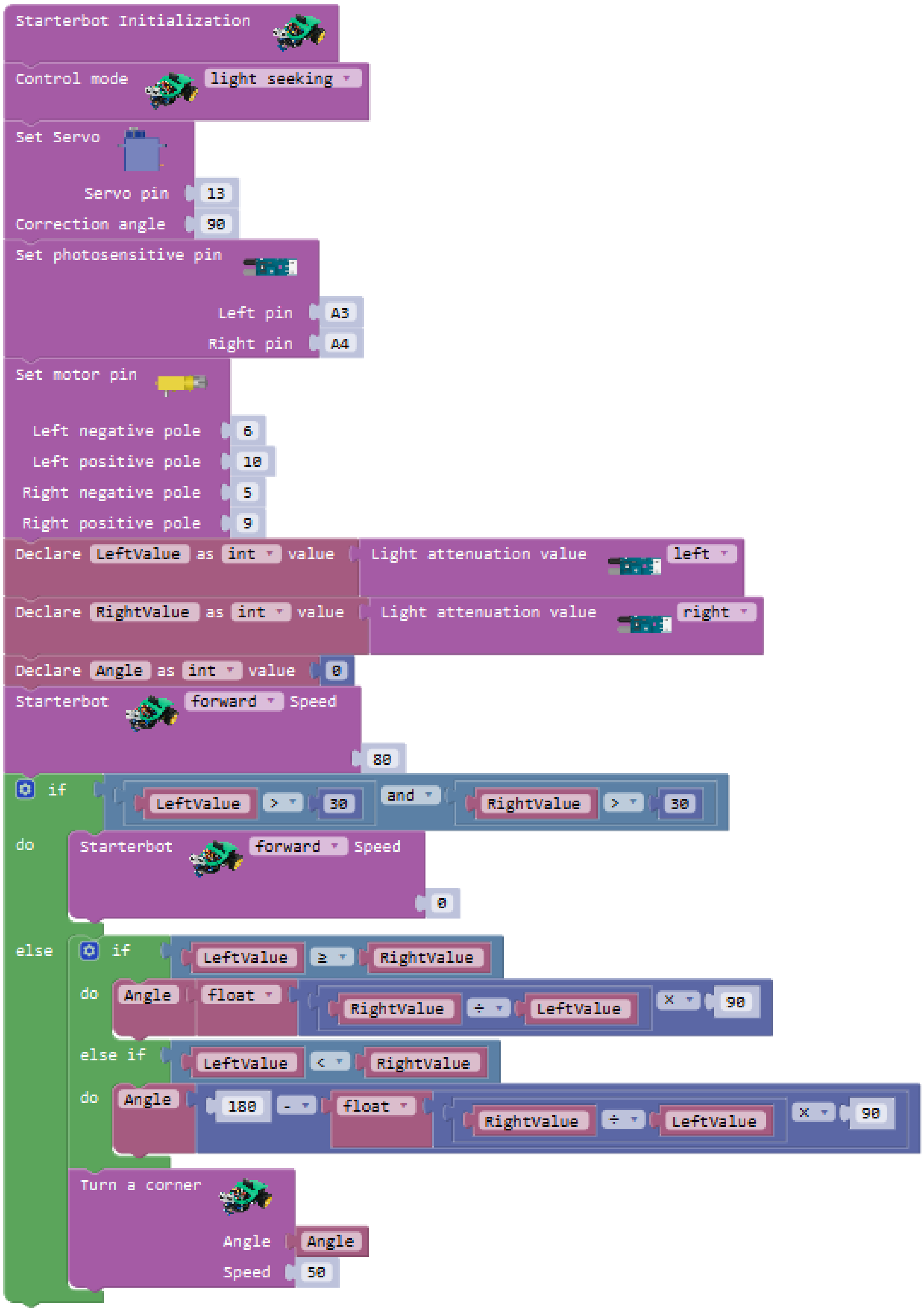

Starterbot Initialization
Control mode
light seeking
Set Servo
Servo pin
13
Correction angle
90
Set photosensitive pin
Left pin
A3
Right pin
A4
Set motor pin
Left negative pole
6
Left positive pole
10
Right negative pole
5
Right positive pole
9
Declare LeftValue as int value
Light attenuation value
left
Declare RightValue as int value
Light attenuation value
right
Declare Angle as int value
0
Starterbot
forward
Speed
80
if
LeftValue
>
30
and
RightValue
>
30
do
Starterbot
forward
Speed
0
else
if
LeftValue
≥
RightValue
do
Angle
float
RightValue
÷
LeftValue
×
90
else if
LeftValue
<
RightValue
do
Angle
180
-
float
RightValue
÷
LeftValue
×
90
Turn a corner
Angle
Angle
Speed
50

Figure 9-3