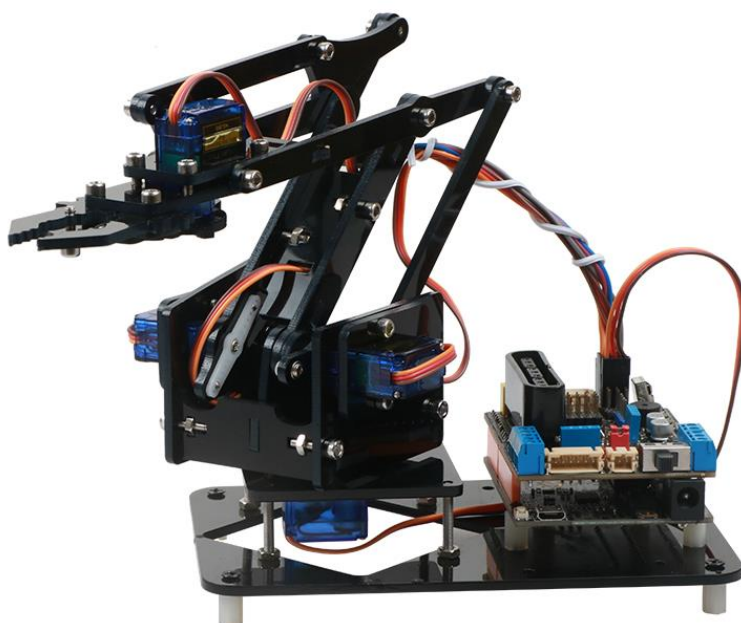


Robotic Arm

Instruction Manual

V. 1.0



Get last update from : <https://github.com/keywish/RoboticArm>

Revised history

Date	Version	Description	Author
2019/10/26	V.1.0	Create a document	Abbott.Chen

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Chapter 1 Installation of mechanical arm

1.1 Servo correction

Due to mechanical arm to do 4 degrees of freedom, there must be steering gear, so before installing the mechanical arm, we need to adjust the Angle of the steering gear, this is installed, we can be more fluent operation of mechanical arm the straightening process is shown in figure 1-1-1 assembly based on which the good aspects of mechanical arm (arm Angle is 90 degrees) the interpretation of people after assembly should be shown in figure 1-1-1 appearance, mechanical arm Angle can verify corrective steering Angle is correct, as many components of mechanical arm, the assembly is not easy, so want to re-read it before assembly installation video Understand the principle of coordination between moment arms

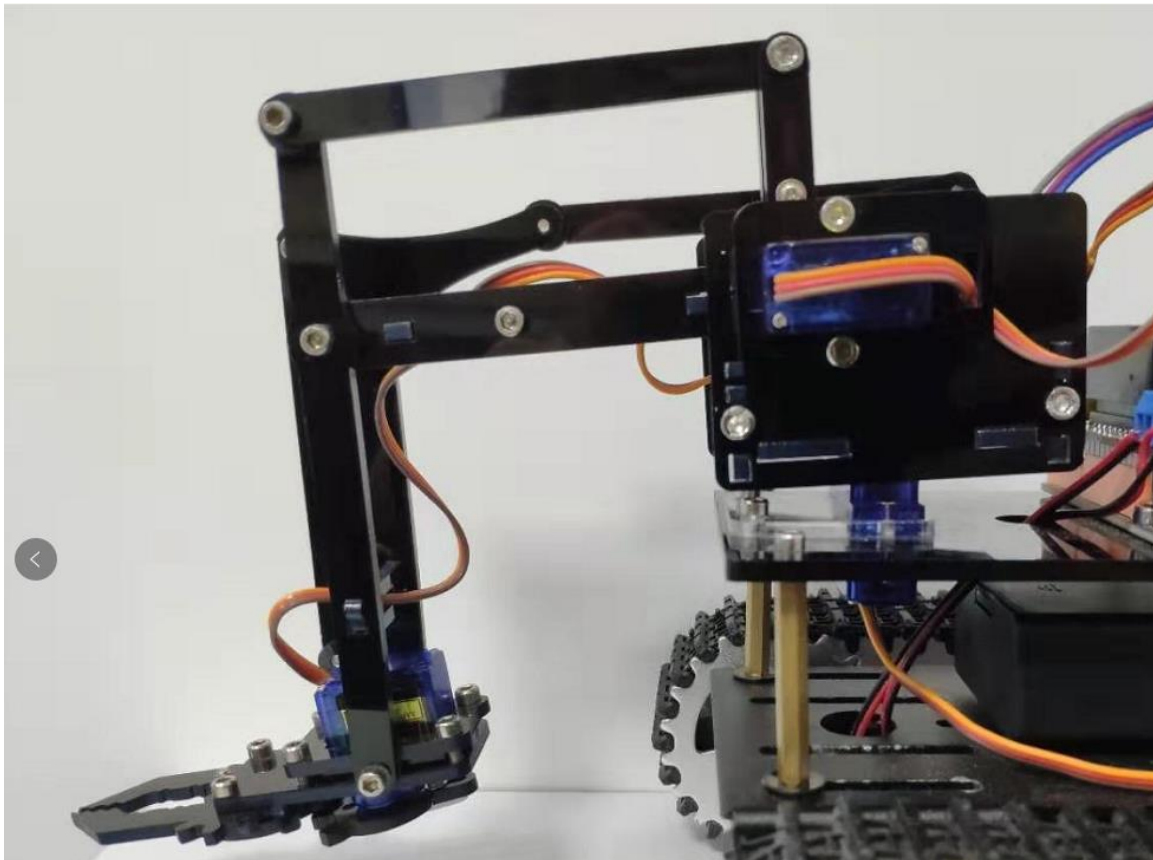


Figure 1-1-1

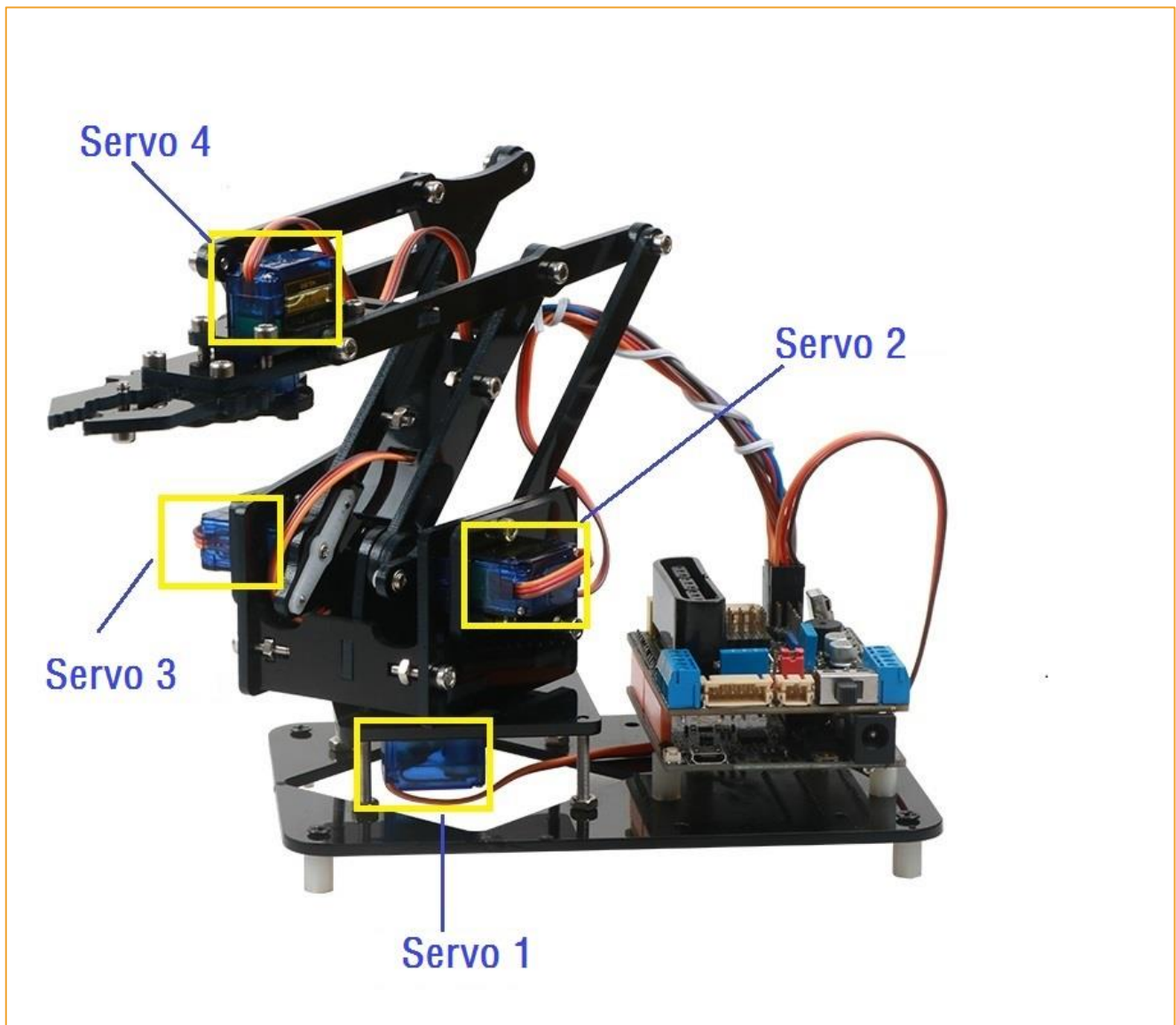


Figure 1-1-2

In order to facilitate the distinction, we numbered the steering gear of the mechanical arm as 1~4. In the following paragraphs, the steering gear number is used to distinguish them to avoid confusion. The steering gear should be installed as shown in figure 1-1-1, and the initial Angle of each steering gear is

- Servo 1: 90°
- Servo 2: 0°
- Servo 3: 180°
- Servo 4: 180°

During installation, the Angle of the steering gear is determined according to the moment arm Angle of the mechanical arm

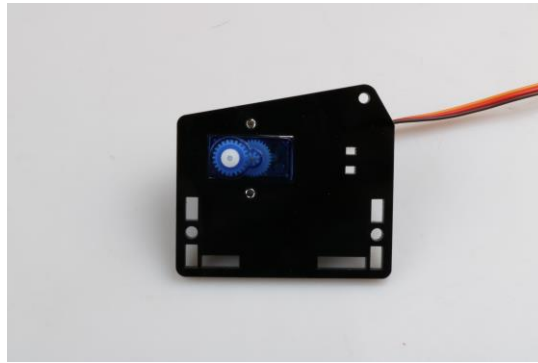


Figure 1-1-3-1

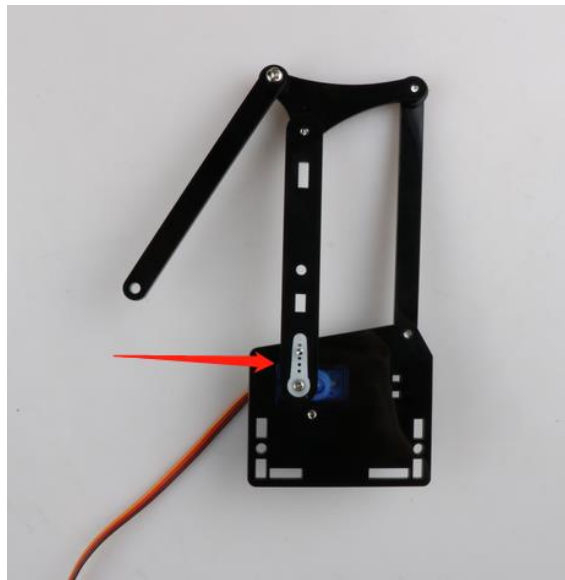


Figure 1-1-3-2

As shown in the figure 1-1-1-3 -1 to adjust the right side of the steering gear, namely no. 3 steering gear, to be installed into the figure 1-1-1-3 -2, considering the mechanical stroke of the moment arm, must first use the steering gear test program to adjust to 90 degrees, and then keep the steering gear Angle unchanged, install the rudder slurry, and then fixed rudder slurry other steering gear regulation principle is the same

The driving plate of the manipulator is PS2X&MotorDriverBoard4.0 (Figure. 1-1-3). The main control board is ble-uno board. PS2X&MotorDriverBoard4.0can be inserted on it

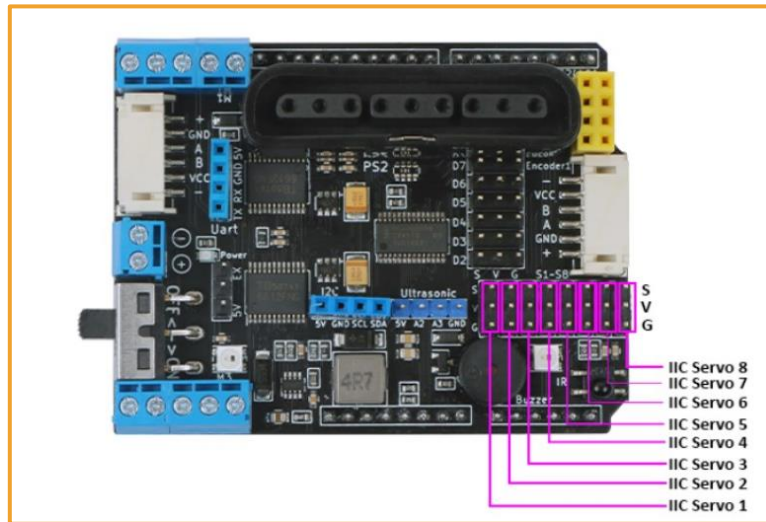


Figure 1-1-3 PS2X&MotorDriverBoard4.0

Correct the steering gear we need to first put the steering gear one by one and PS2X&Driver 1 pin connection, adjust one pin and then adjust the next pin, as shown in figure 1-1-5. Note: the pins of three lines of driver are shown in figure 1-1-4.



Figure 1-1-4

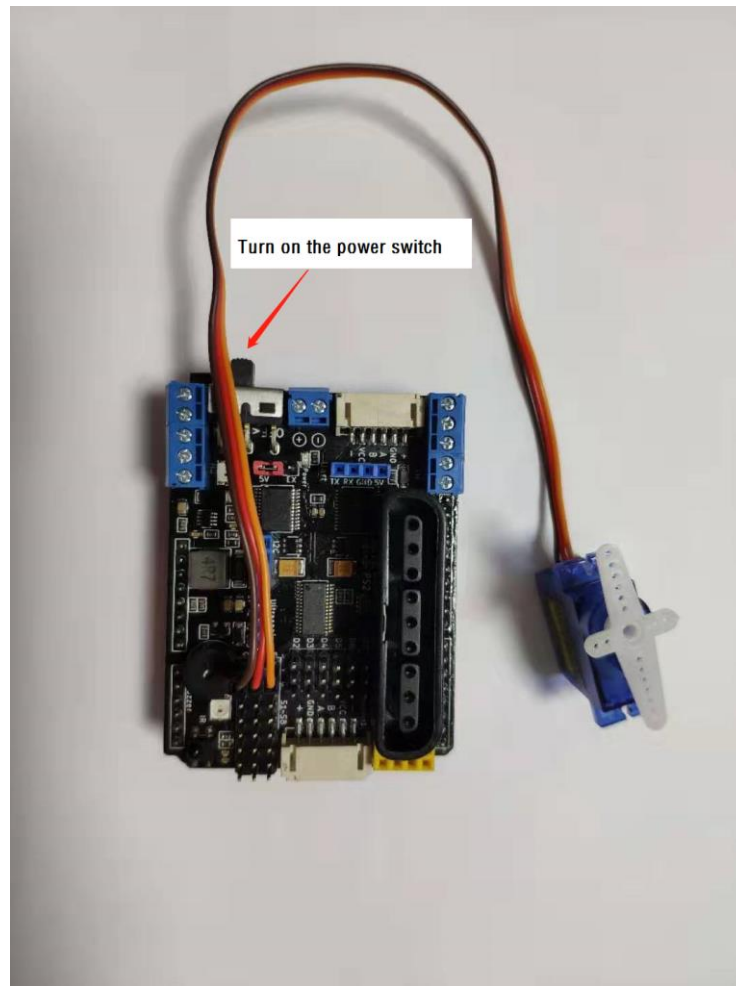


Figure 1-1-5

1. After connecting the cable, connect Ble-Uno to the computer via USB data cable
2. In the network disk data, open the steering gear test program and burn the steering gear recording program into ble-uno, the position of the steering gear test program : [Lesson\Single Robotic Arm courseware code\Servo_Test\Servo_Test.ino](#)
3. The three wires of the steering machine are signal wire (orange), power cord (red) and ground wire (brown). Install the rudder propeller without fixing screws. At the same time, power supply of 7~12V is required for the DC port of ble-uno

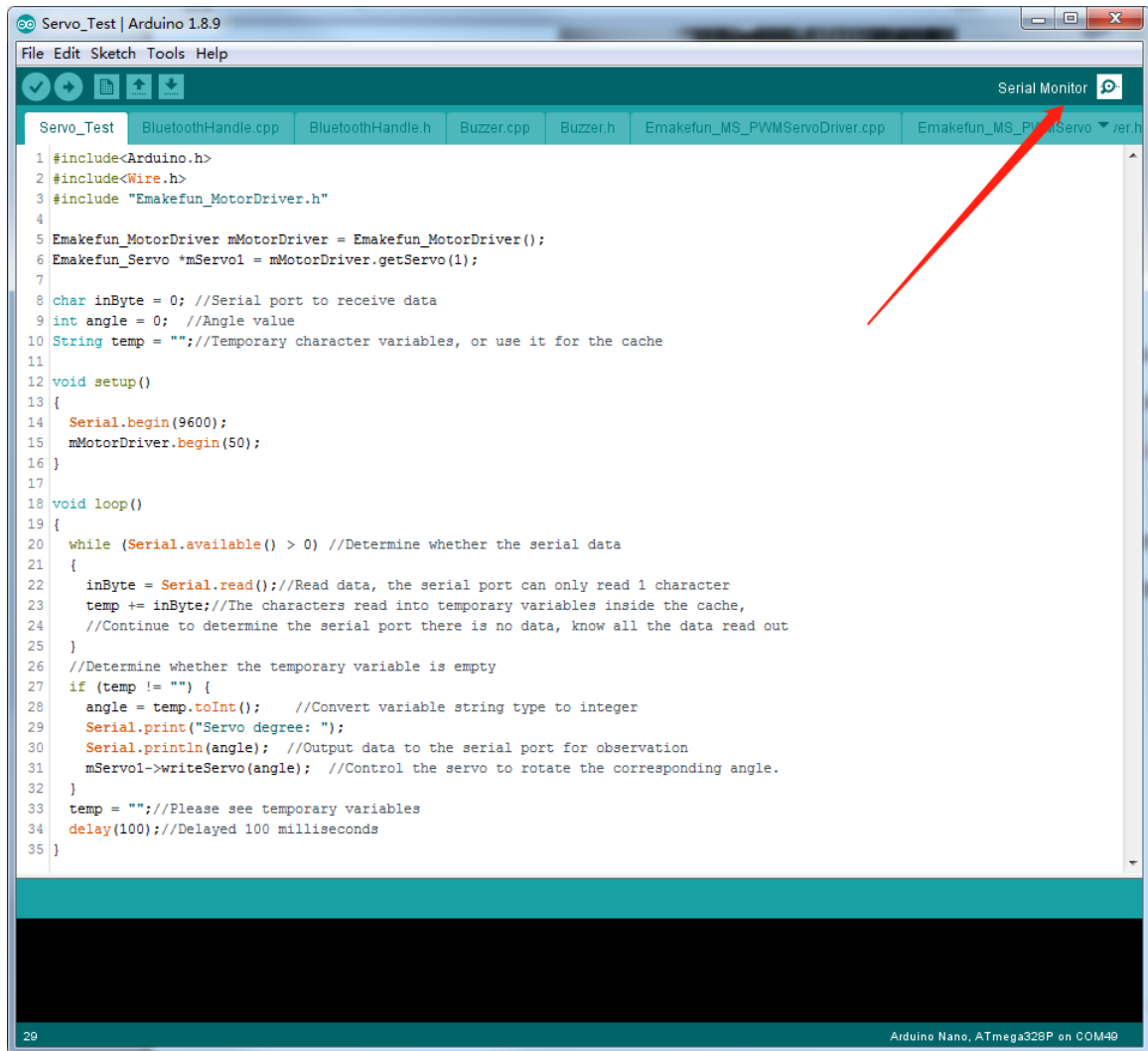


Figure 1-1-6

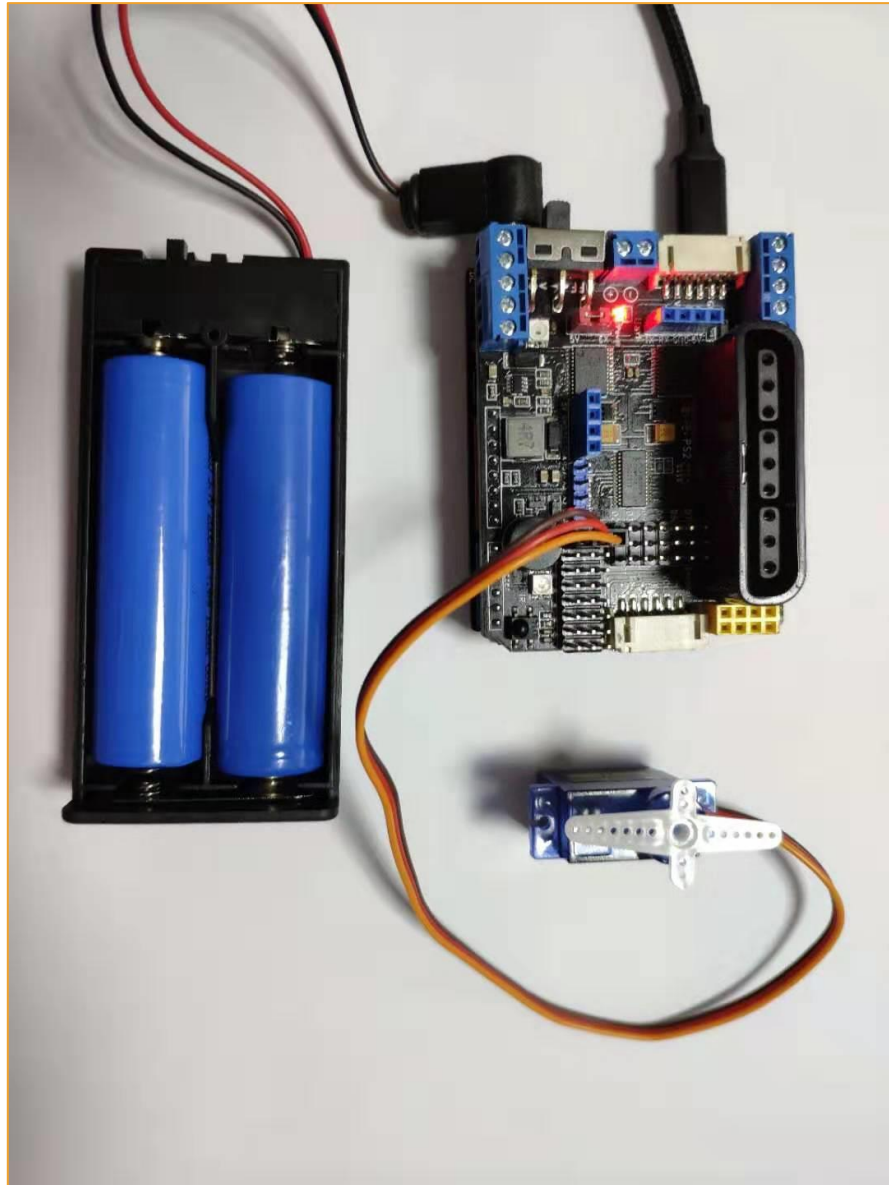


Figure 1-1-7

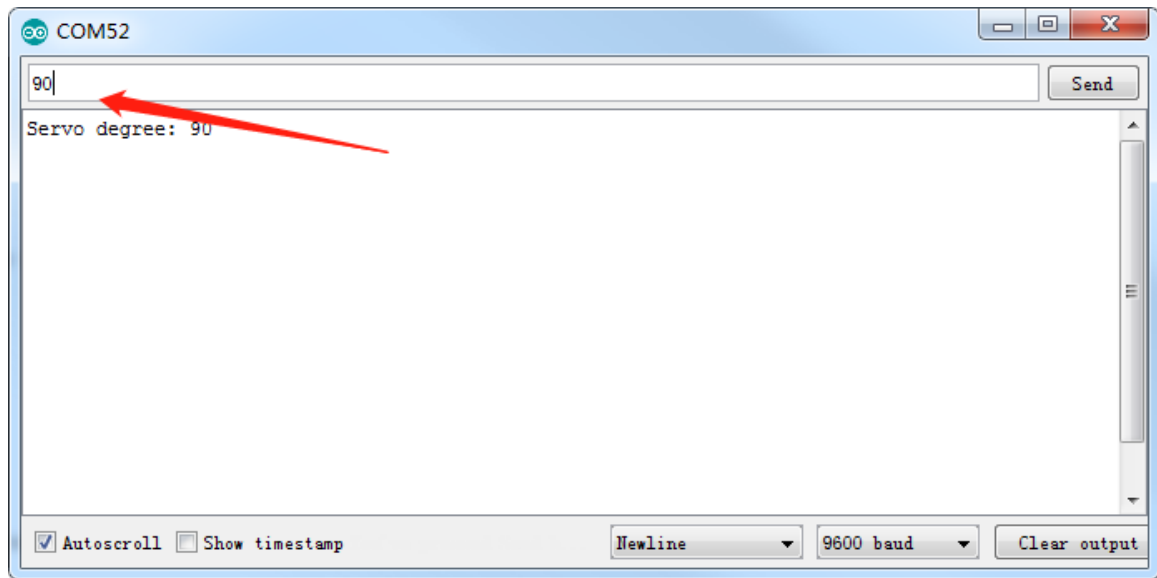


Figure 1-1-8

The setting of each steering gear is the same as the above steps. When adjusting one steering gear and then changing another, power off is needed. After connecting the line, power on is needed

1.2 Assembly arm

Note:

1. In the assembly process, the acrylic plate of the mechanical arm should not be fixed too tightly with screws, otherwise the steering gear may be blocked
2. During the installation of the steering gear, do not force forced rotation, so as not to damage the steering gear
3. There are many components of the mechanical arm. Please install it in a clean and tidy environment to prevent the components from being lost
4. Each part is unique and there is no spare part. Please be careful during installation and do not use violence to insert it, so that the whole mechanical arm cannot be installed normally due to the damage of the parts

Chapter 2 connection of steering gear and drive plate of the manipulator

2.1 Arm connection

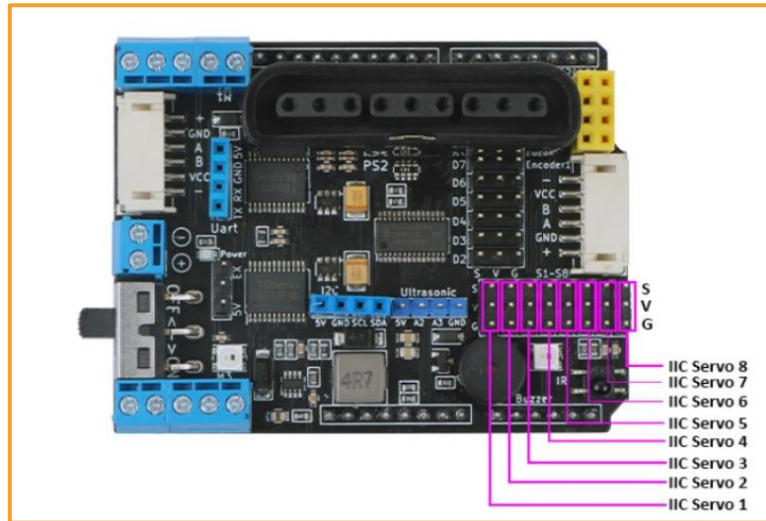


Figure 2-1-1

The manipulator has 4 servos and PS2X&MotorDriverBoard4.0 Wiring mode:

RoboticArm servo	PS2X&MotorDriverBoard4.0
Servo 1	I2C Servo 1
Servo 2	I2C Servo 2
Servo 3	I2C Servo 3
Servo 4	I2C Servo 4

Among them, the line of no. 4 steering gear is not long enough to reach PS2X&MotorDriverBoard4.0. After the line is connected with the dupont bridge, the steering gear line should be put together with the tie belt to prevent the winding of the steering gear while operating the manipulator

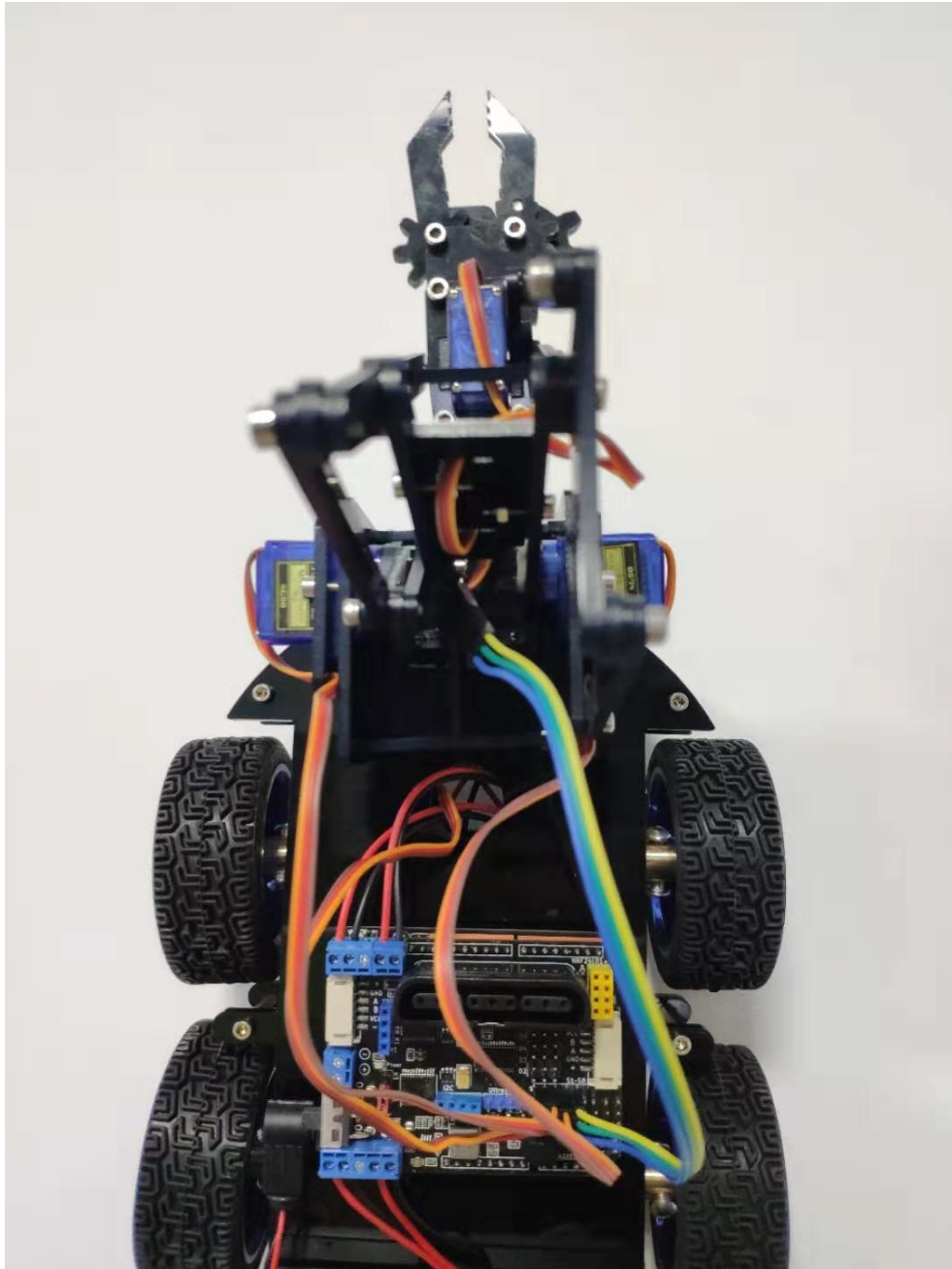


Figure 2-1-2

Chapter 3 PS2 remote control manipulator

3.1 PS2 remote controller function definition



Figure 3-1-1



Figure 3-1-2

- L1: Open the clip
- R1: Closed clamp

- Left rocker: the mechanical arm is deflected to the left
- The left rocker swings right and the mechanical arm turns right
- Push the right rocker forward: the manipulator clip falls
- Push the rocker back on the right side: the manipulator clip rises
- Right rocker push left: mechanical arm forward
- Push the right rocker to the right: the mechanical arm retreats

Note: due to the structural problems of the mechanical arm, the left and right steering gear has travel limitation, some angles cannot be reached, the initial Angle of the steering gear can be adjusted appropriately

- Burning PS2 control manipulator program:PS2X_RoboticArmControl
Program location "Lesson\Single Robotic Arm courseware code\PS2X_RoboticArmControl\PS2X_RoboticArmControl.ino"
- Turn on the power switch of the driver board, insert the PS2 receiving head, turn on the PS2 handle power supply, and use the PS2 handle to remote control the mechanical arm after successful pairing

Chapter 4 wireless handle remote control manipulator

4.1 Wireless Handle Board introduction

WirelessHandleBoard is composed of MPU6050, control lever and button. There is no MCU on the board, so it needs to connect one of the three Nano rf-nano and BLE Nano boards to work. If the Nano board is connected, it needs to connect nRf24I01+ module or jdy-16 bluetooth moduleWirelessHandleBoard has a total of 9 buttons, a rocker and two LED lights, and a UART interface is reserved. Users can refer to the program to complete the design of their specific needs with these hardware resources. the physical picture is shown in figure 4-1-2

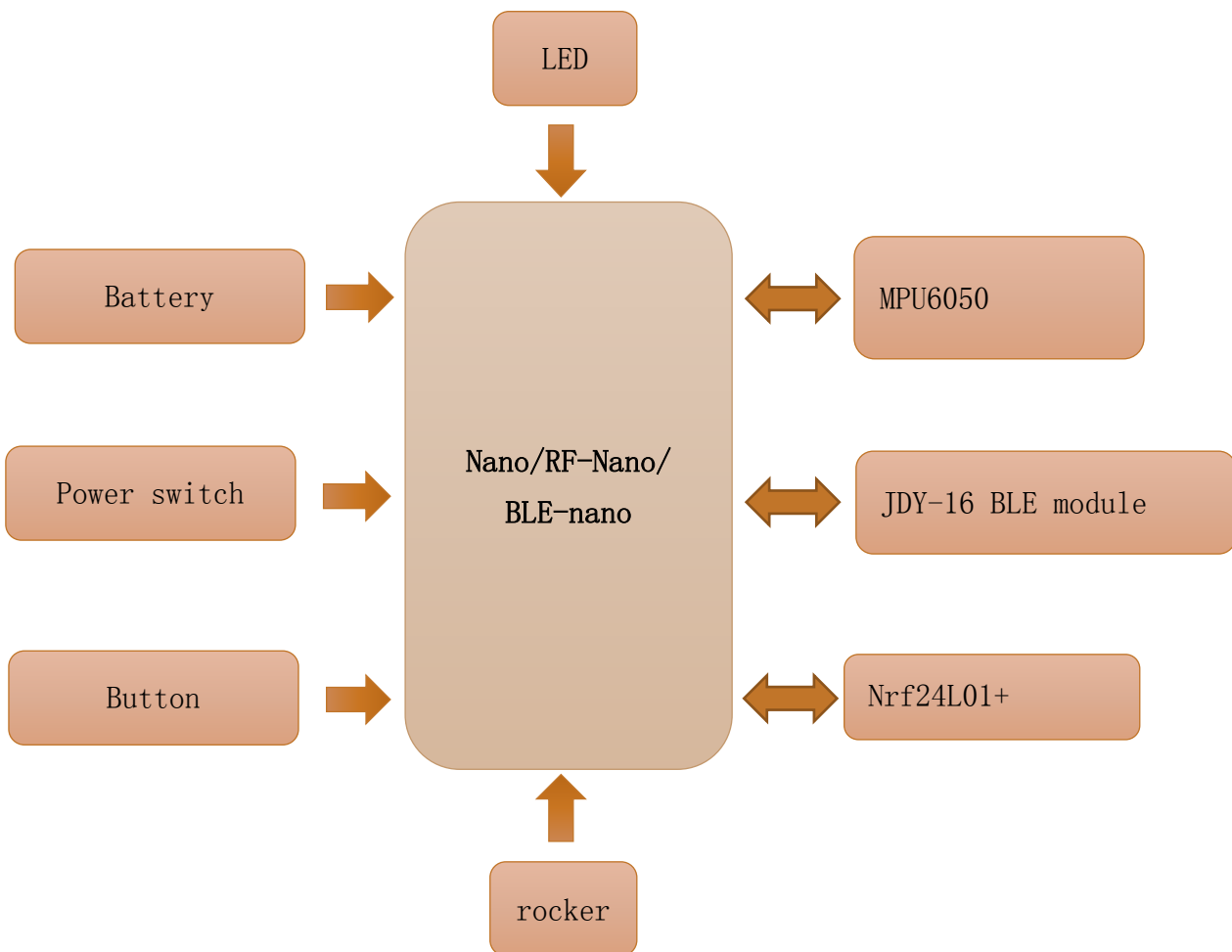


Figure 4-1-1 WirelessHandleBoard

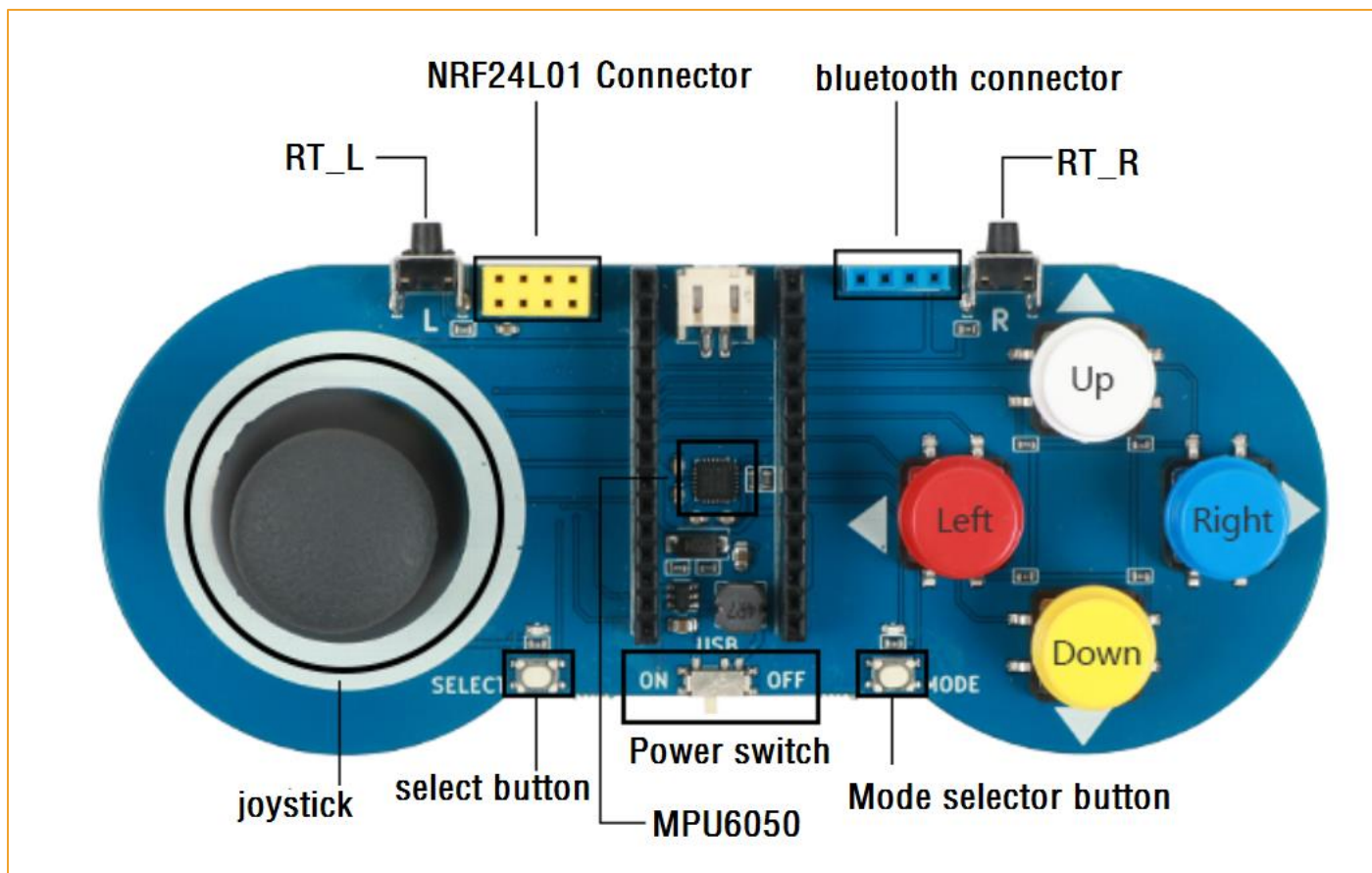
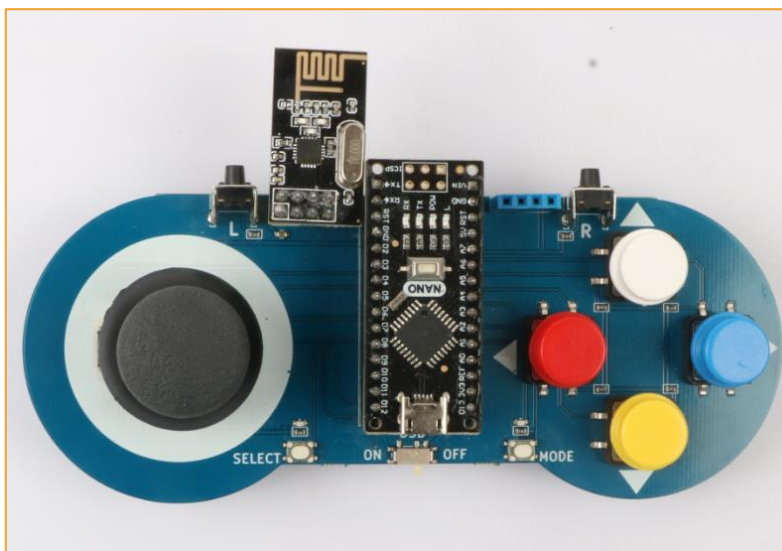


Figure 4-1-2 WirelessHandleBoard

4.2 Wireless handle module installation

4.2.1 Nano + NRF24L01+ Motherboard installation



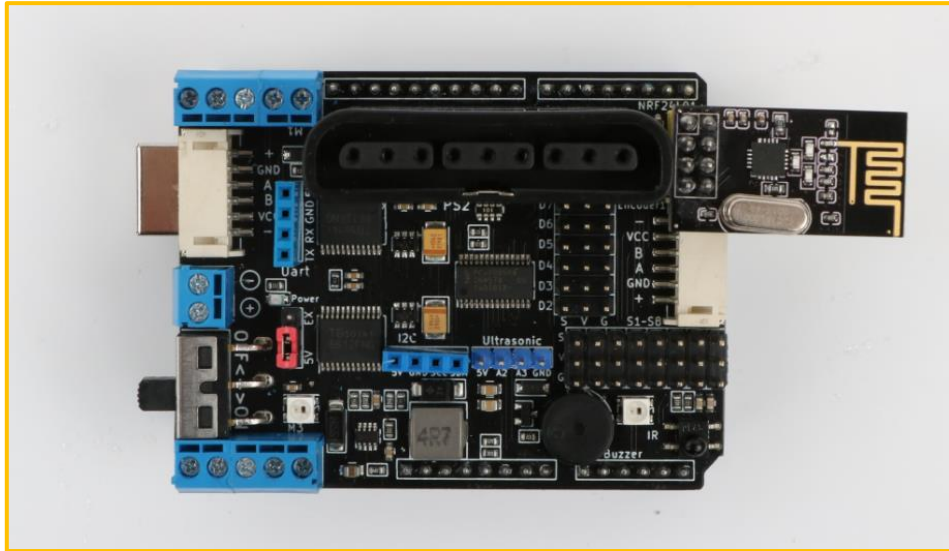


Figure 4-2-1

4.2.2 RF-Nano Module is installed

Recommendations can be used directly RF-Nano



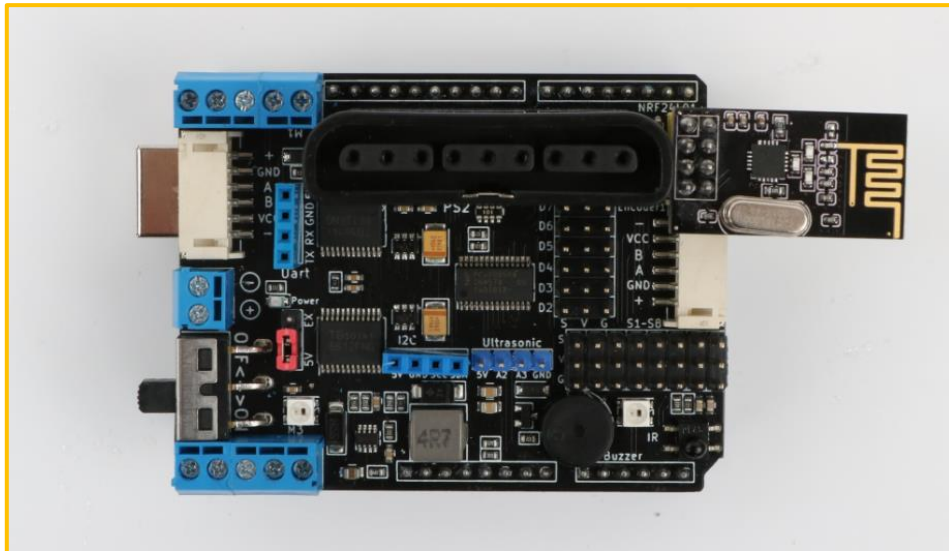


Figure 4-2-2 Nrf24l01+

4.2.3 BLE-Nano Module is installed

推荐可以直接使用 BLE-Nano

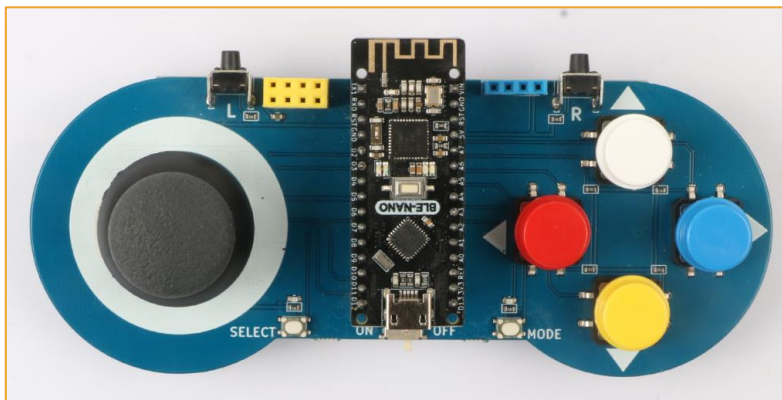


Figure 4-2-3

4.2.4 Wifi Module is installed

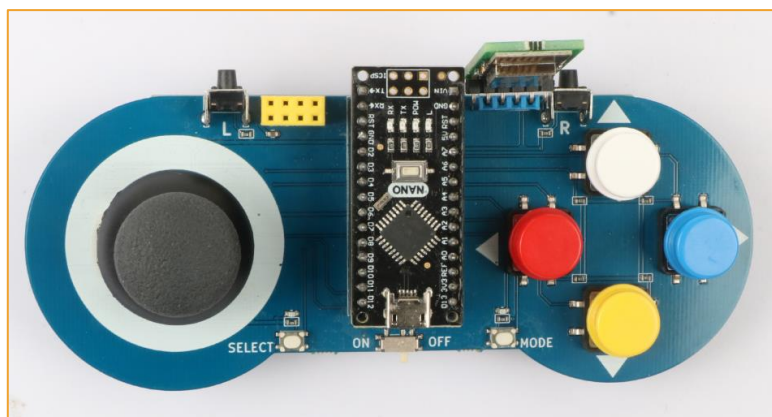


Figure 4-2-4

4.3 Function test of wireless handle

4.3.1 Independent key function test

Open :Lesson\Wireless handle courseware code\Module test program\Button_demo
\Button_demo.ino

Press the button serial port can be displayed

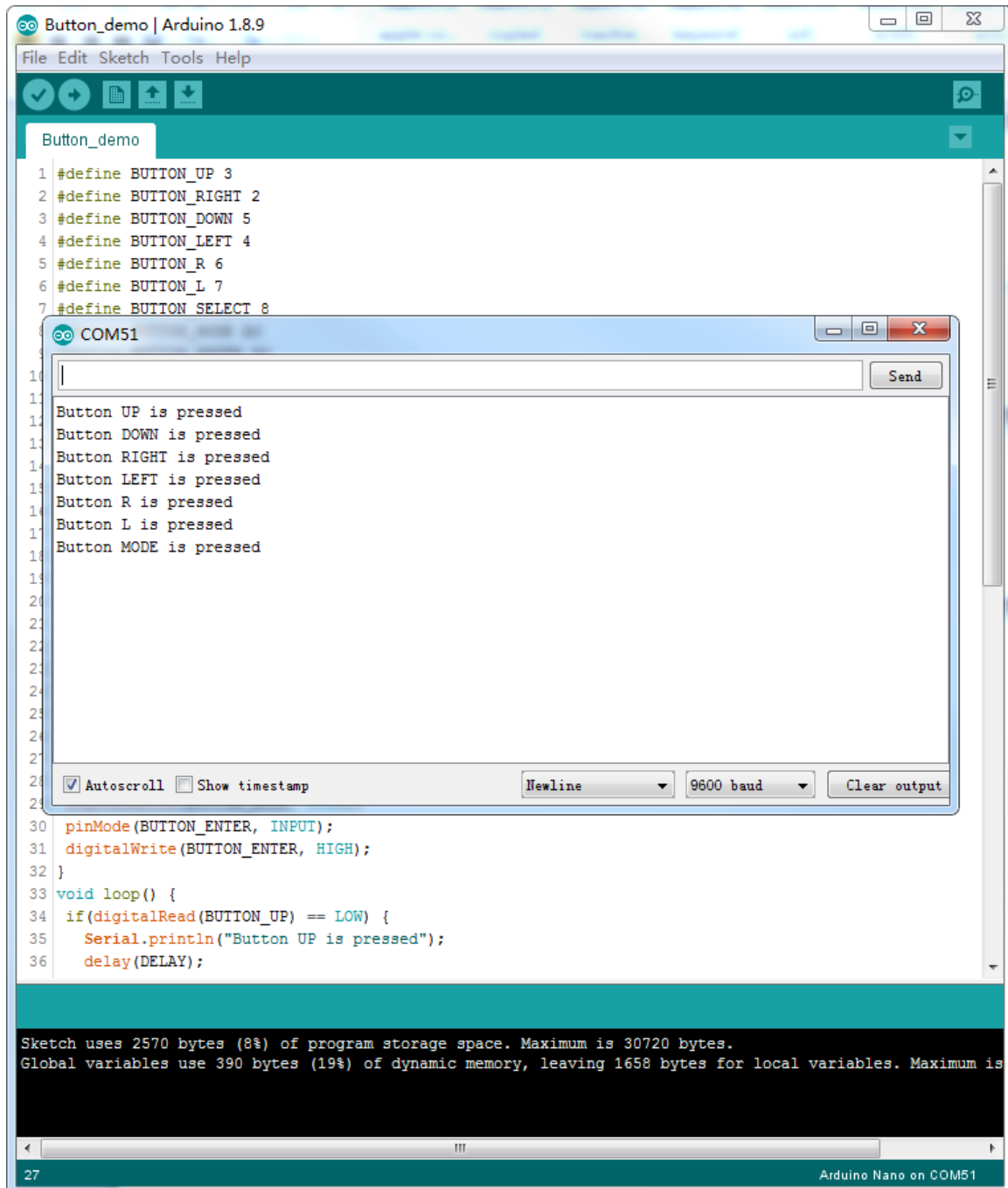


Figure 4-3-1

4.3.2 LED light flicker test

Open :Lesson\Wireless handle courseware code\Module test program \Led_demo\Led_demo.ino
Download to the board, we can see the blue and green LED waiting in alternating flashing

4.3.3 Rocker test

Open : Lesson\Wireless handle courseware code\Module test program
 \Rocker_demo\Rocker_demo.ino

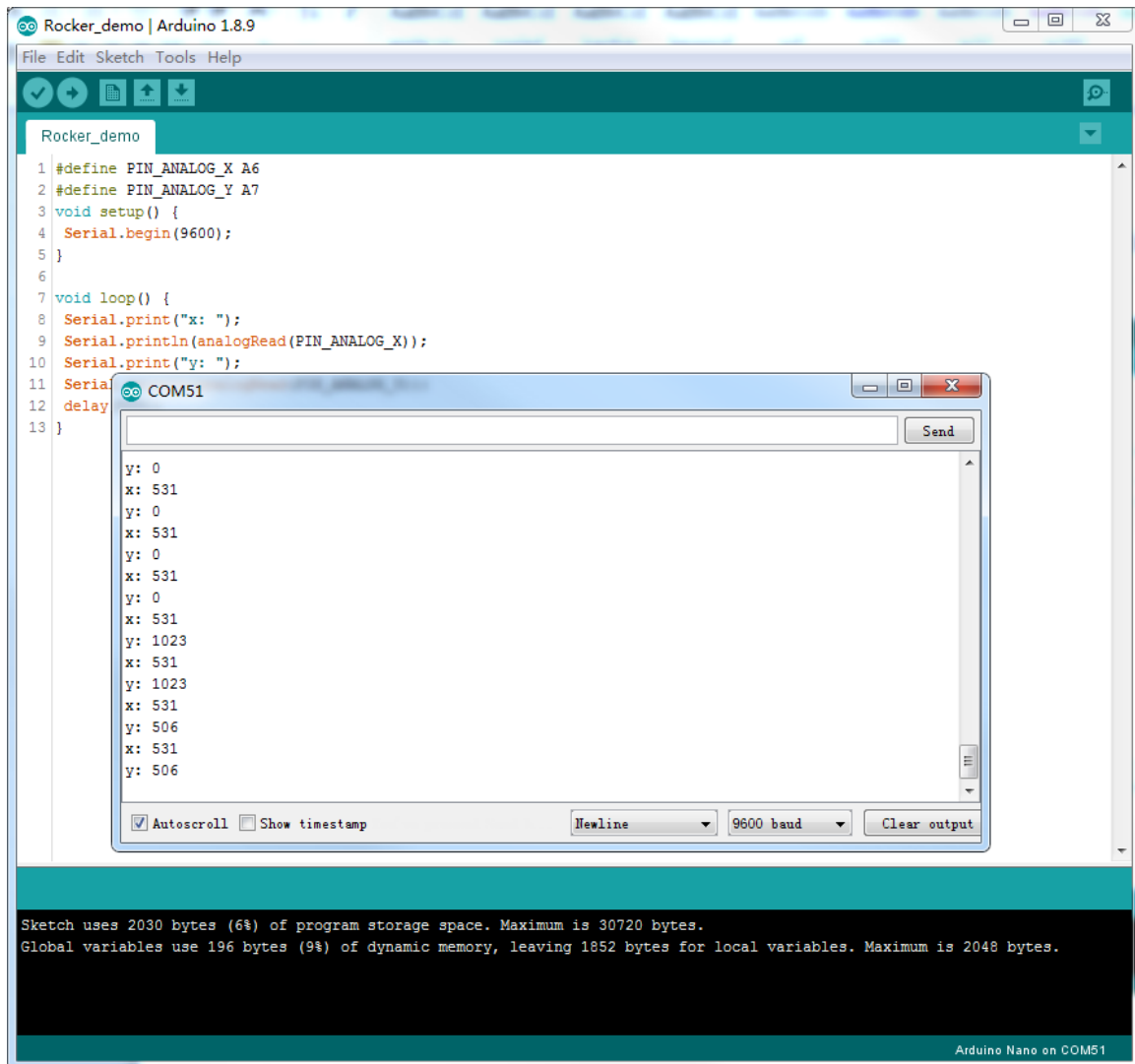


Figure 4-3-2

4.3.4 Mpu6050 test

Open : Lesson\Wireless handle courseware code\Module test program \MPU6050_demo \MPU6050_demo.ino

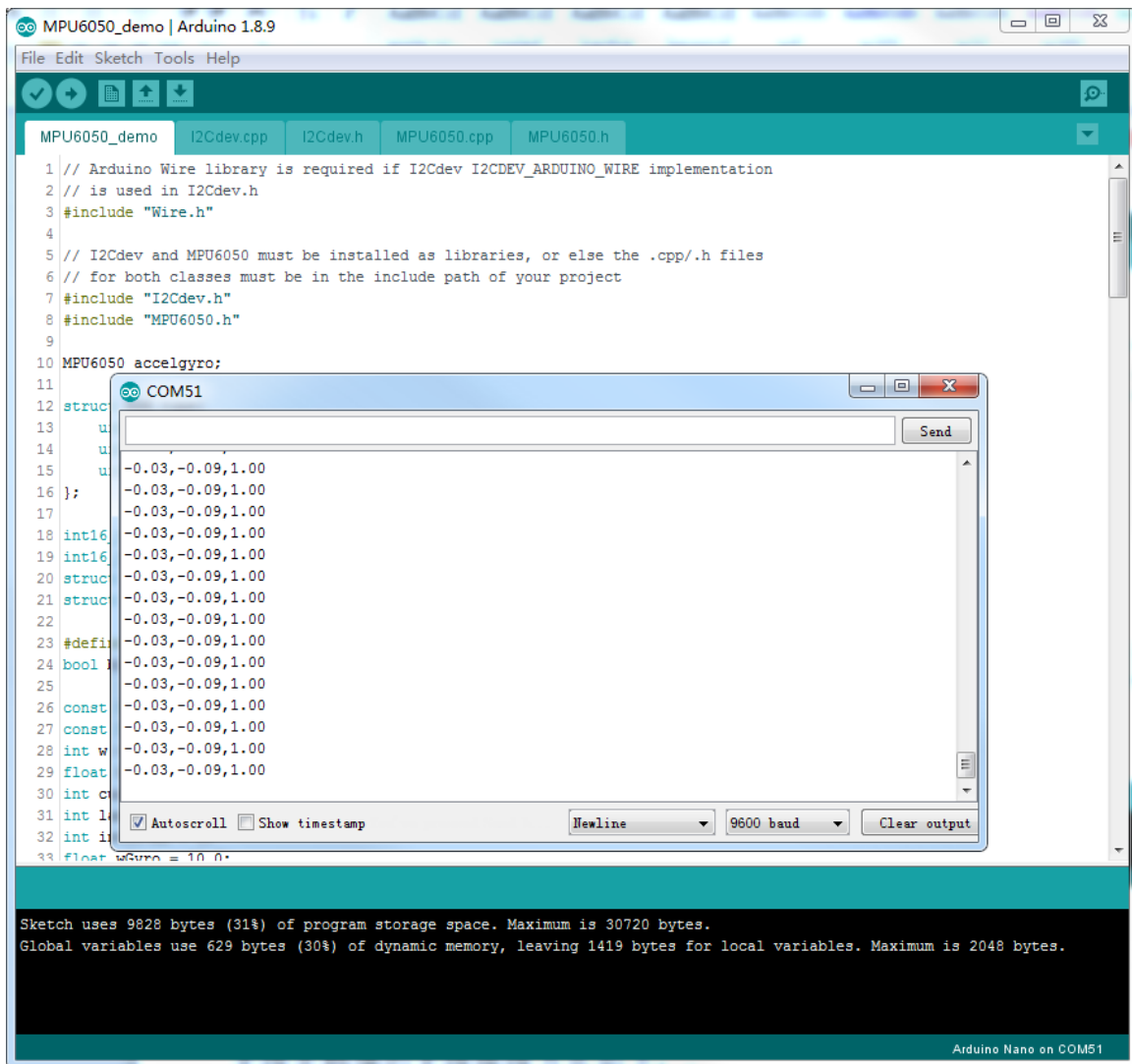


Figure 4-3-3

4.3.5 NRF24L01+ wireless module test

Wireless connection mode of wireless handle end is as follows

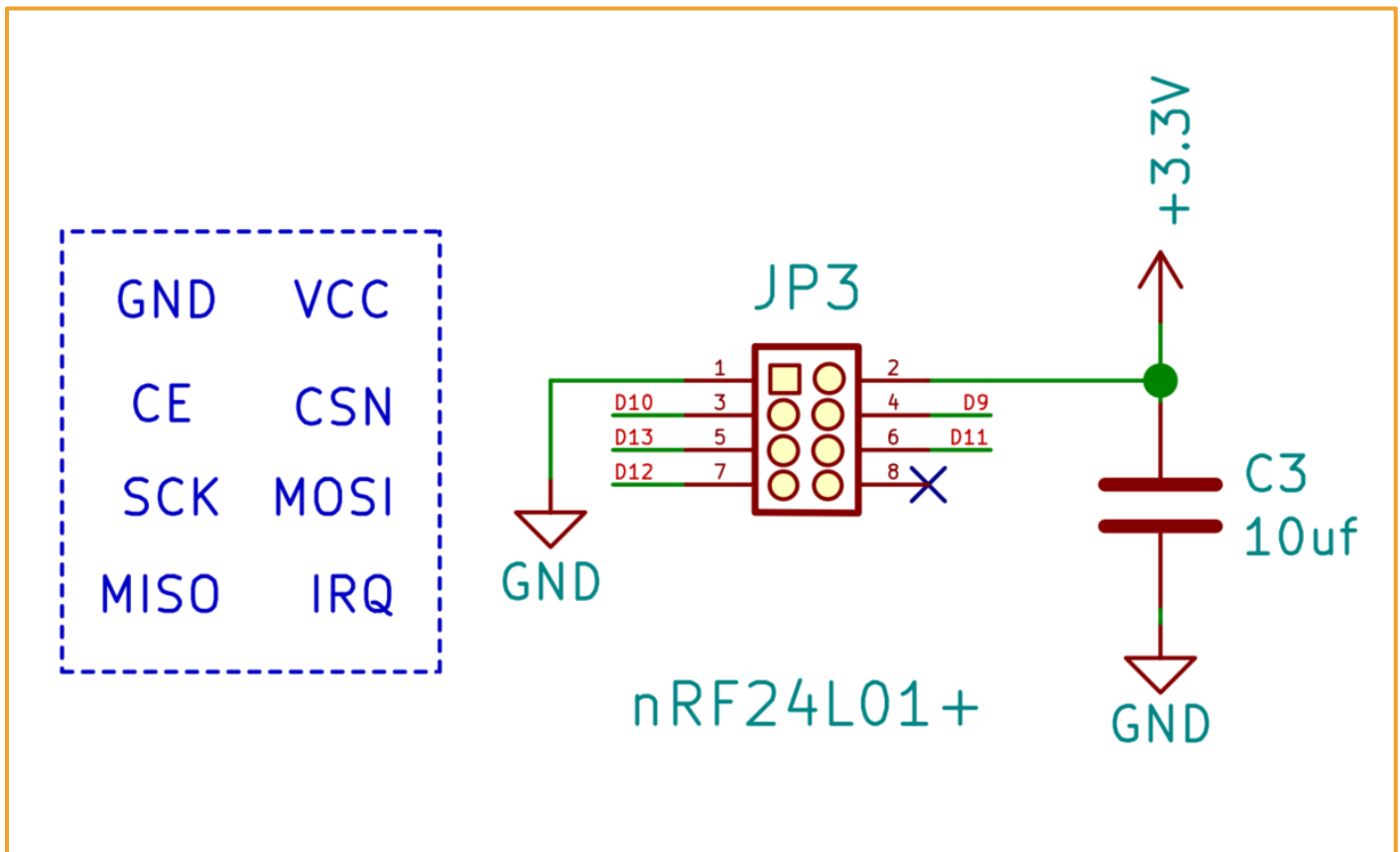


Figure 4-3-4

Download sender: [Lesson\Wireless handle courseware code\Module test program\nRF24L01_demo\Emmitter\Emmitter.ino](#)

The receiver downloads the receiver program : [Lesson\Wireless handle courseware code\Module test program\nRF24L01_demo\Receive \Receive.ino](#)”

Please pay attention to the wiring sequence of the module at the receiving end. If necessary, please modify the corresponding position of the code

```
#include <SPI.h>
#include "nRF24L01.h"

#define NRF24L01_CE 10
#define NRF24L01_CSN 9
```

图 4-3-5

4.4 WirelessHandleBoard Manipulator arm

- 1) Program path: Lesson\Wireless handle courseware code\Wireless button rocker control Robotic Arm \Nrf24L01_RoboticArmControl\Nrf24L01_RoboticArmControl.ino”
- 2) Burning Nrf24L01_RoboticArmControl.ino The program is burned to the Arduino UNO R3 master control board of the manipulator
- 3) Wireless 2.4g program path : Lesson\Wireless handle courseware code\Wireless button rocker control Robotic Arm \ WirelessNrf24L01Controller \ WirelessNrf24L01Controller.ino”
- 4) Burning WirelessNrf24L01Controller.ino Burn the program to the main control board of the remote control handle
- 5) The mechanical arm is connected to the external power supply (7.4V)

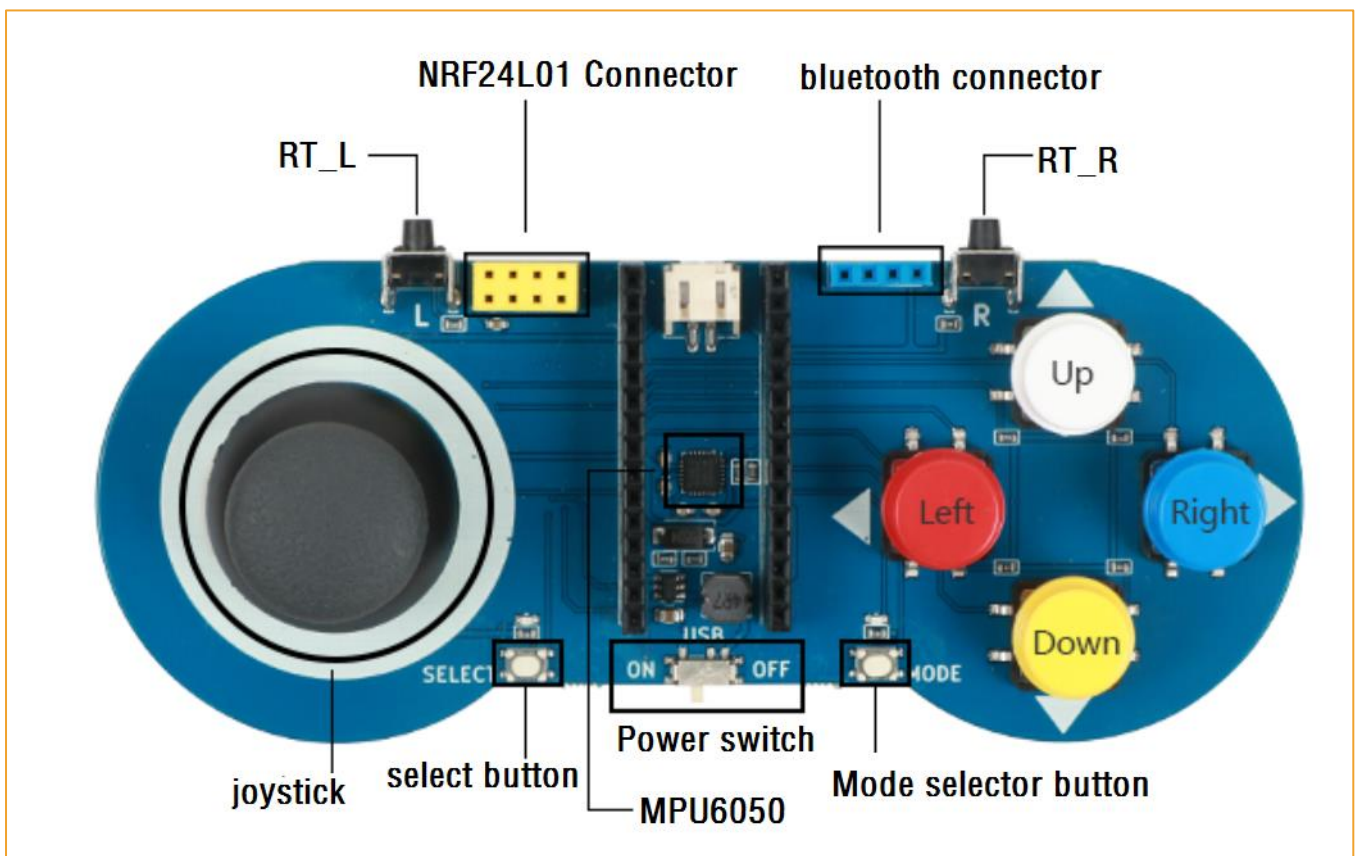


Figure 4-4-1 WirelessHandleBoard button define

by controlling WirelessHandleBoard, You can see the movement of the arm

Chapter 5 bluetooth /wifi mobile phone app remote control manipulator

5.1 Manipulator bluetooth /WiFi control

- To manipulator control motherboard burn procedures: Buletooth_RoboticArmControl
- Program path : Lesson\Single Robotic Arm courseware code\Buletooth_RoboticArmControl \ Buletooth_RoboticArmControl.ino”

- Install on mobile phone Emakefun_Robot APP,
- Turn on bluetooth in cell phone Settings and start APP
- Select hummer-bot, select bluetooth connection according to your own hardware with bluetooth module, and select WiFi connection with WiFi module
- After successful connection, it can be seen that the status indicator of bluetooth /wifi module changes from flashing to long and bright
- Enter the APP selection interface and select **Remote control**

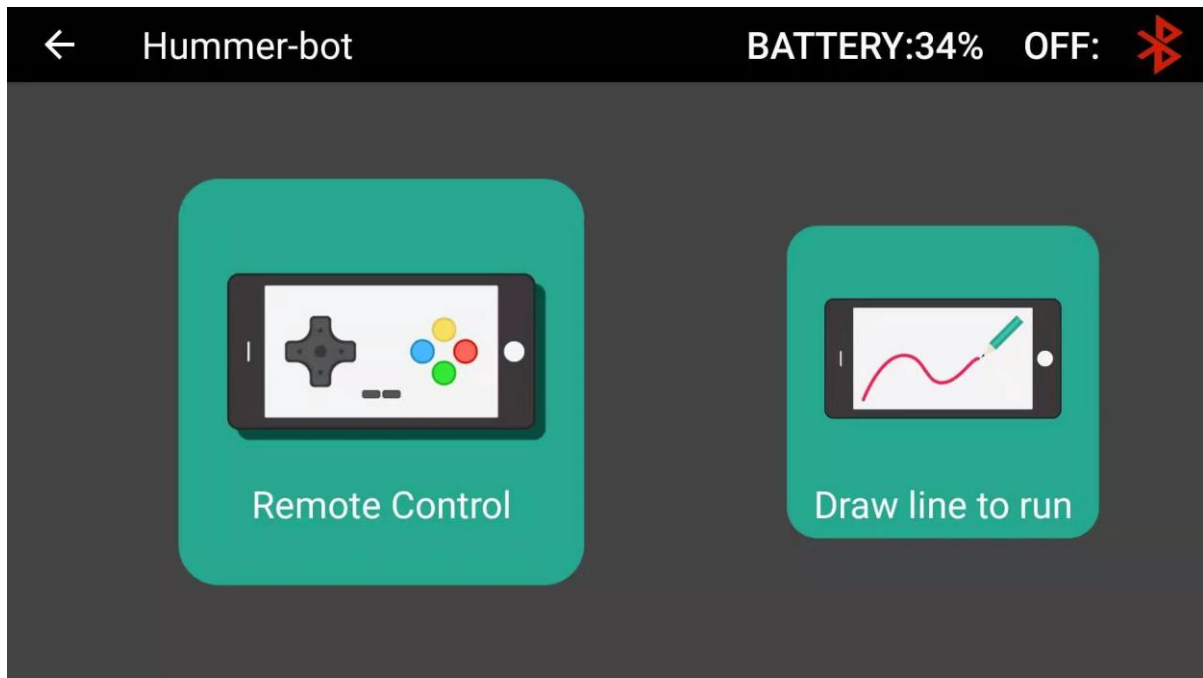


图 5-1-1

- Open the mode switch of the mechanical arm, and the control interface of the mechanical arm appears, as shown in figure 5-1-2. The mechanical arm can be operated

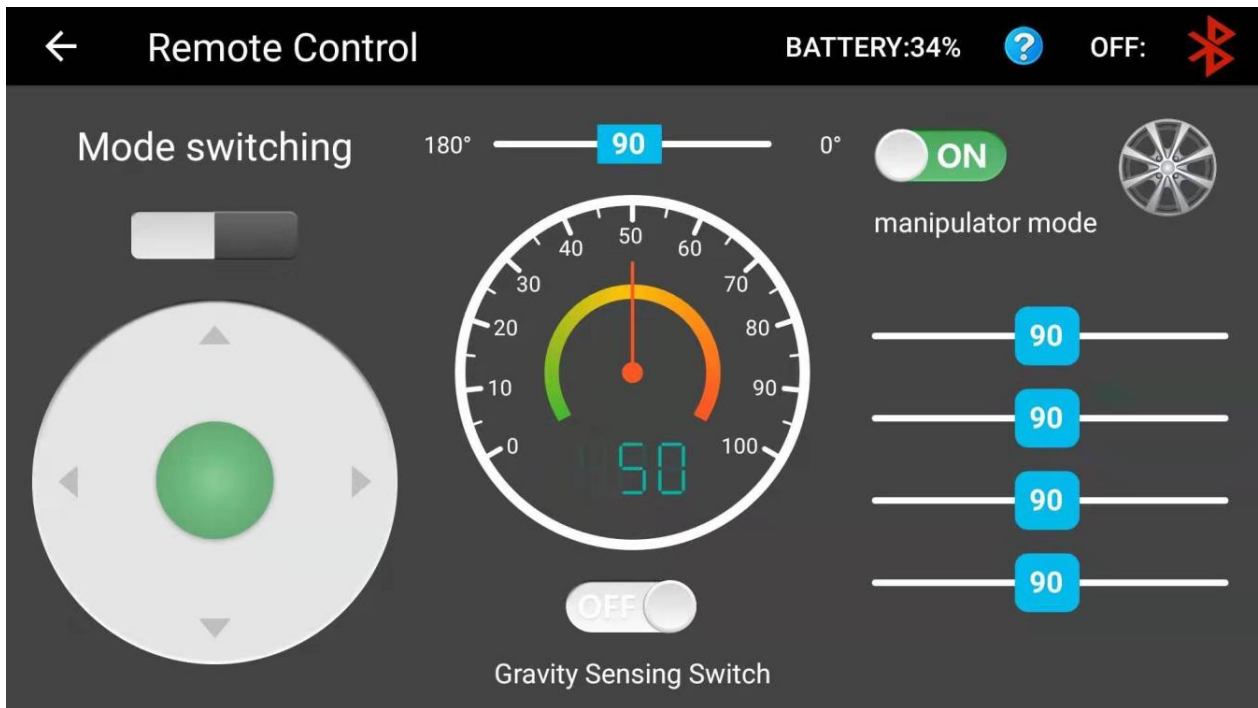


Figure 5-1-2

- Mark 1 is to send the Angle to I2C steering gear 1
- Mark 2 is to send Angle to I2C steering gear 2
- Mark 3 is to send Angle to I2C steering gear 3
- Mark 4 is to send Angle to I2C steering gear 4

6.1 installation

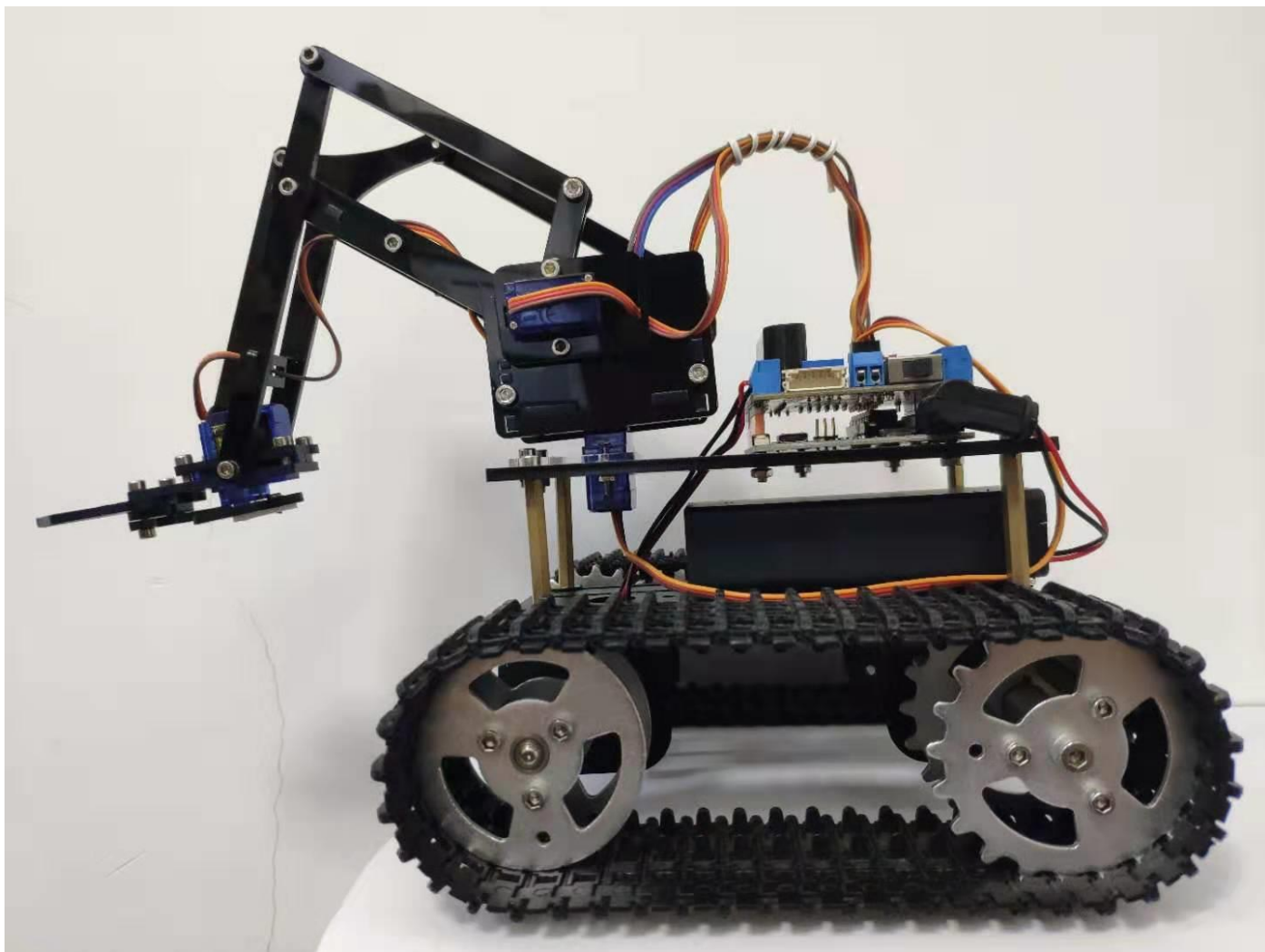


图 6-1-1

6.2 PS2 handle is used to control the panther-tank equipped with the manipulator

6.2.1 PS2 Handle button function definition

In the program, we instruct to read the test button. In this experiment, we want to implement the function of PS2 remote control car. First, we define all button functions as follows



Figure 6-2-1

- Mark UP: forward
- Mark DOWN: back up
- Mark LEFT: turn LEFT
- Mark RIGHT: turn RIGHT
- Mark A: acceleration
- Mark B: left spin
- Mark C: slow down
- Mark D: right spin
- Mark 3: control the front of the manipulator to clip the steering gear and open it (the manipulator is optional)
- Mark 4: control the front of the manipulator to clip the steering gear and close it (the manipulator is optional)
- Joystick Left and right rotation of the steering gear of the base of the manipulator (optional for the manipulator), 0-89 ° or 270-360 ° for the right turn of the bottom steering gear, and 90-269 ° for the Left turn of the bottom steering gear

- Joystick Right: Control the rotation of the left and right steering gear of the mechanical arm, 44-135 degrees for the right steering gear, 224-315 degrees for the right steering gear, 136-223 degrees for the left steering gear, 0-43 degrees or 315-360 degrees for the right steering gear control



图 6-2-2

- L1: Open the clip
- R1: Closed clamp
- Left rocker: the mechanical arm is deflected to the left
- The left rocker swings right and the mechanical arm turns right
- Push the right rocker forward: the manipulator clip falls
- Push the rocker back on the right side: the manipulator clip rises
- Right rocker push left: mechanical arm forward
- Push the right rocker to the right: the mechanical arm retreats

Note: due to the structural problems of the mechanical arm, the left and right steering gear has travel limitation, some angles cannot be reached, the initial Angle of the steering gear can be adjusted appropriately

6.2.2 Program to upload

- Open : Lesson\Robotic Arm combined with panther-tank4.0 courseware code\PantherTank_PS2X\PantherTank_PS2X.ino
- Upload the program to the ble-uno main control board
- Plug the PS2 receiver head into the expansion board

- Turn on the power switch of the car
- Start operation control car
- Start operation control car

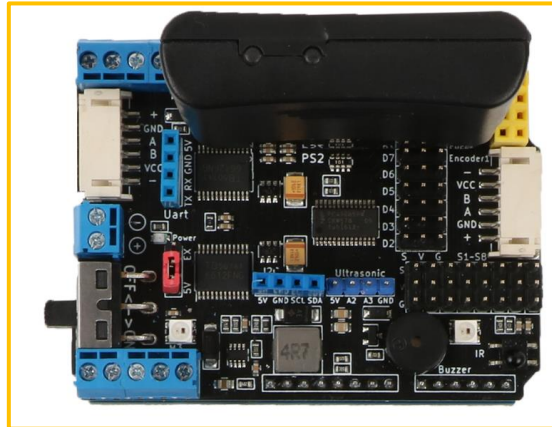


Figure 6-2-3

6.3 Use bluetooth /WiFi APP to control the panther-tank equipped with the robotic arm

- Open : Lesson\Robotic Arm combined with panther-tank4.0 courseware code\PantherTank_AllFunction\ PantherTank_AllFunction.ino
- Upload the program to the ble-uno main control board
- If there is a WiFi module, insert the WiFi module into the expansion board correctly, as shown in figure 6-3-1

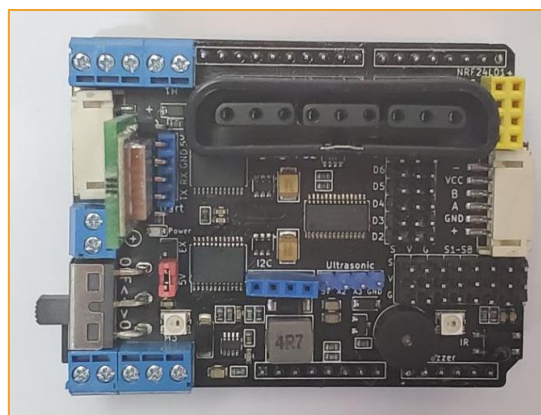


图 6-3-1

- Install KeywishBot APP
- Turn on the power switch of the car
- Open the APP to connect to bluetooth /WiFi

- Select panther-tank, choose bluetooth connection according to your hardware's bluetooth module, and choose WiFi connection with WiFi module

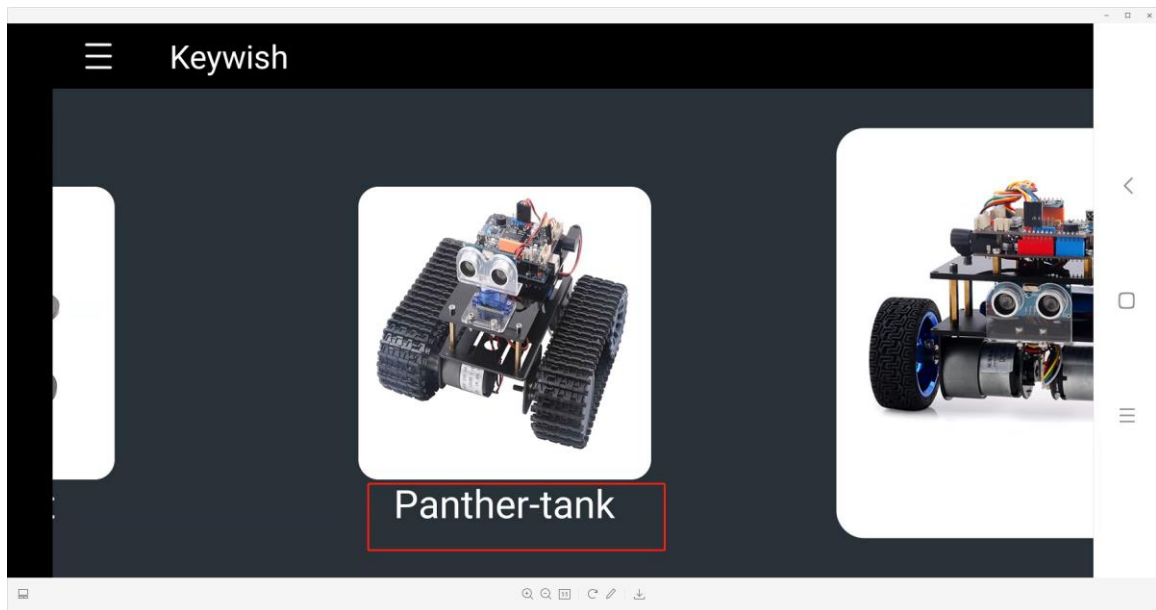


Figure 6-3-2

- After successful connection, it can be seen that the status indicator of bluetooth /wifi module changes from flashing to long and bright
- Enter the APP selection interface and select remote control

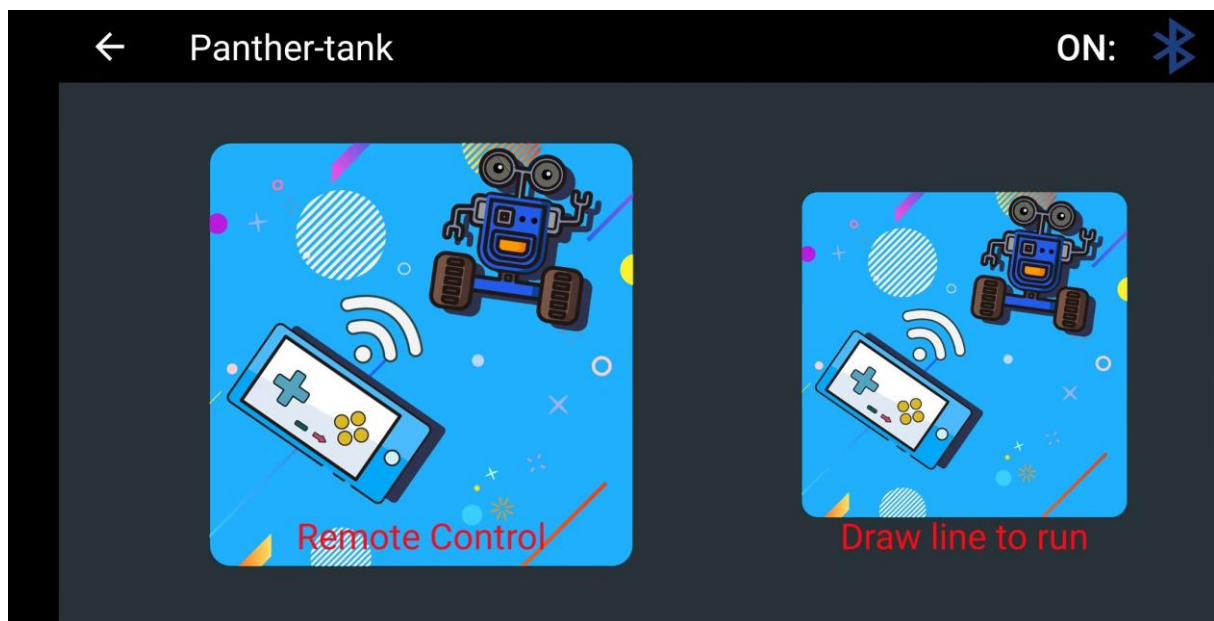


Figure 6-3-3

- Open the manipulator mode and the manipulator control interface appears

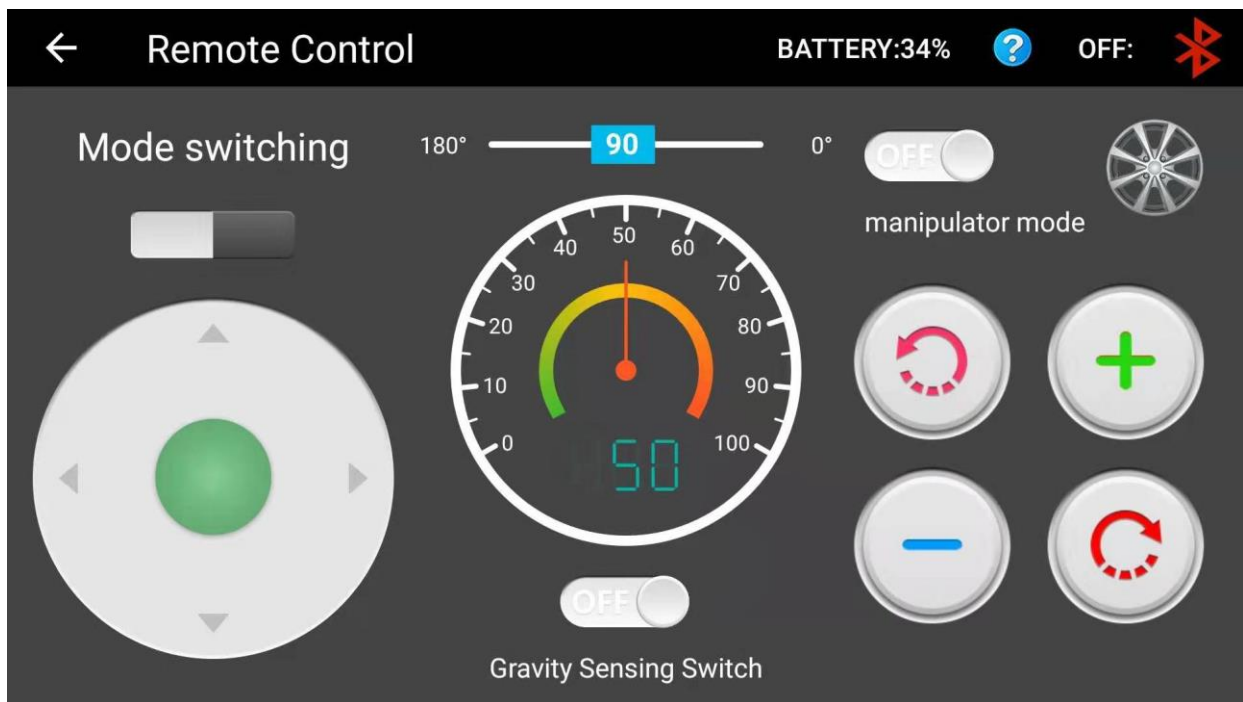


Figure 6-3-4

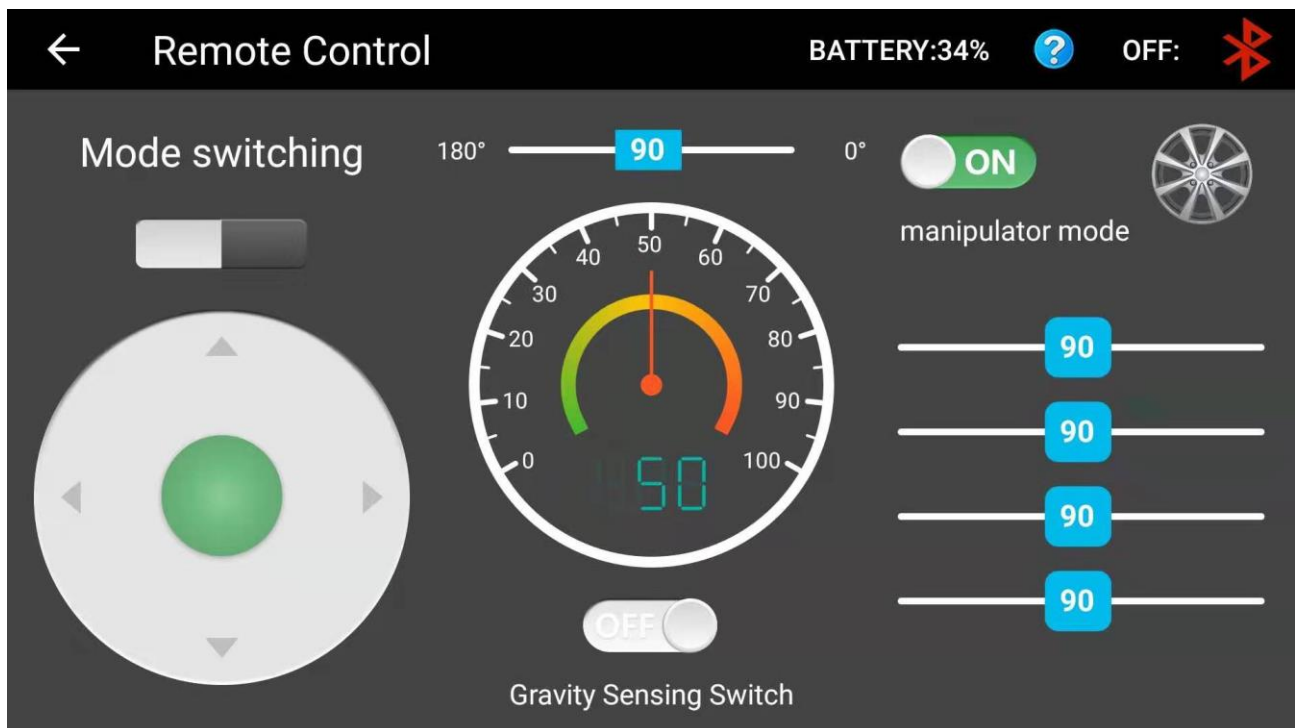


Figure 6-3-5

- Mark 1 is to send the Angle to I2C steering gear 1
- Mark 2 is to send Angle to I2C steering gear 2
- Mark 3 is to send Angle to I2C steering gear 3
- Mark 4 is to send Angle to I2C steering gear 4

Chapter 7 put the arm in hummer-bot

7.1 way to install

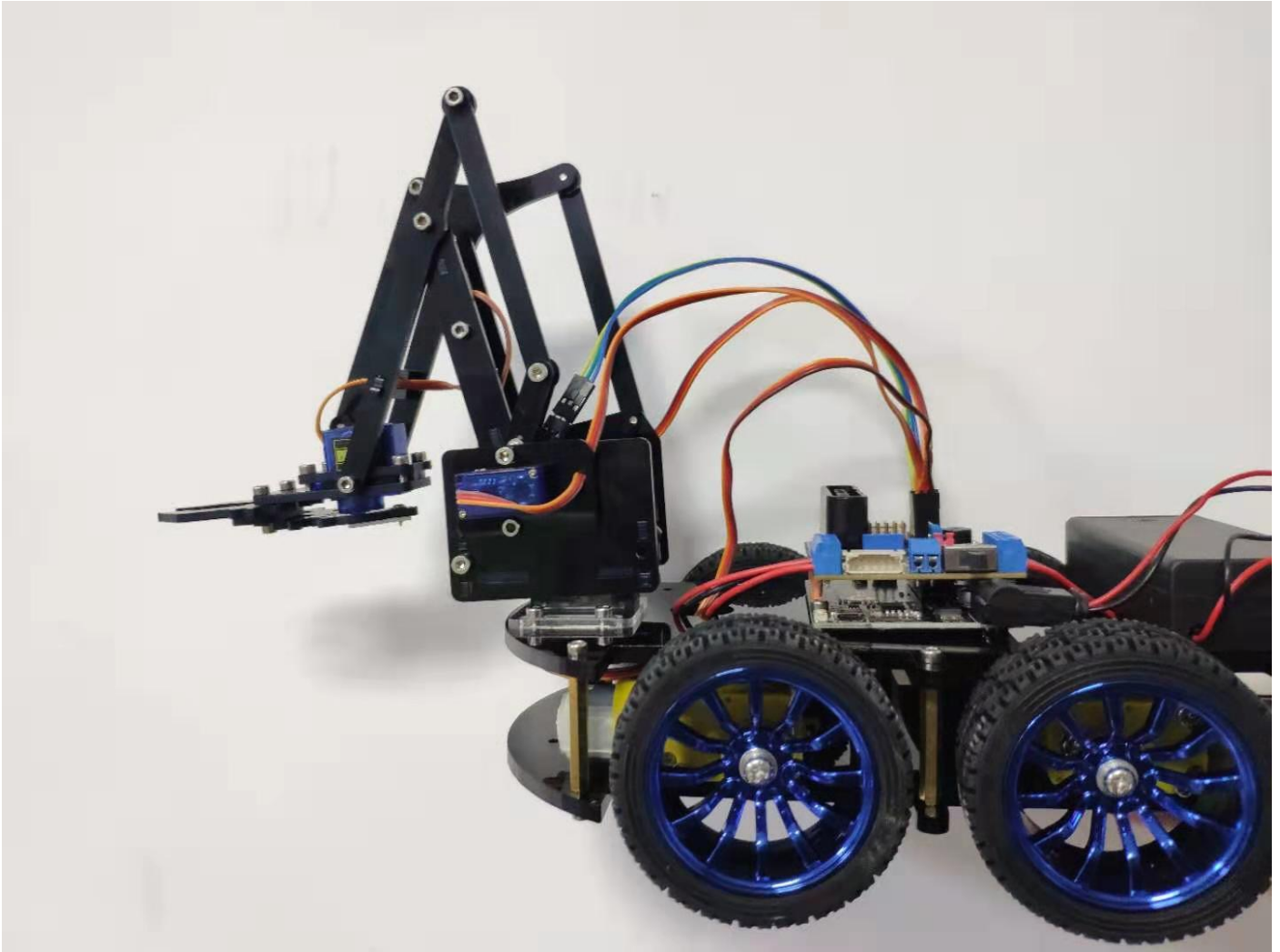


Figure 7-1-1

7.2 Connection mode

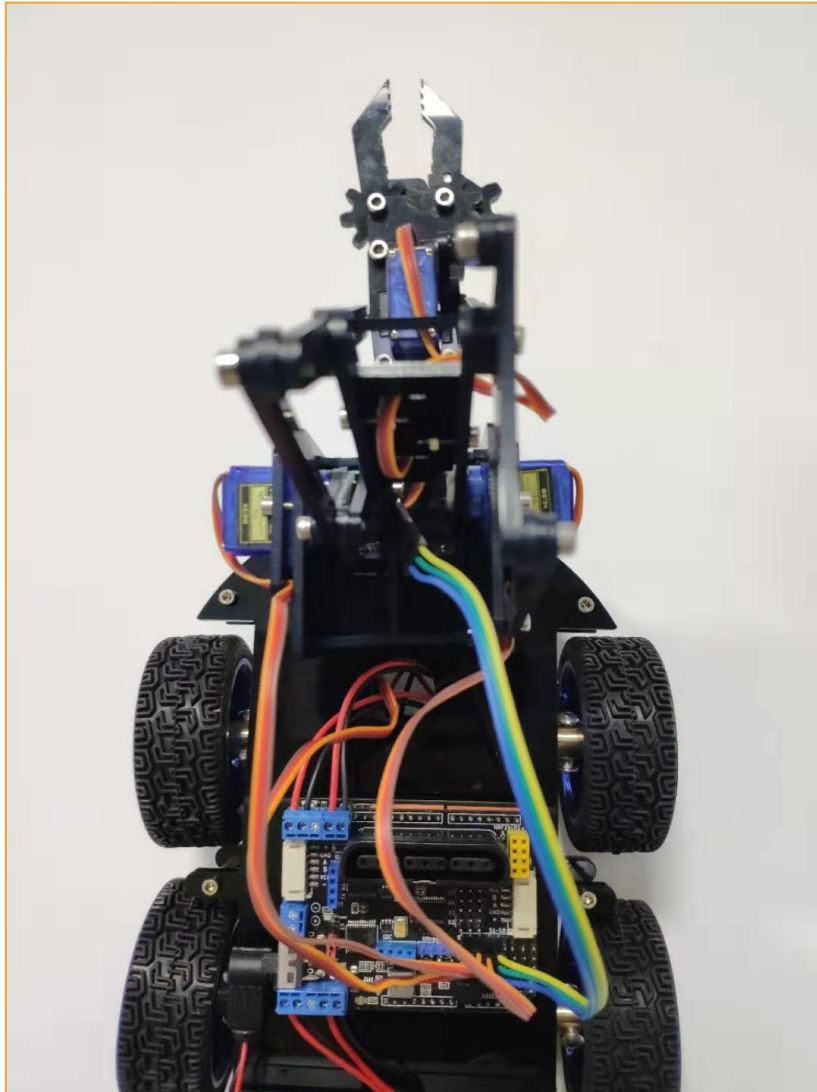


Figure 7-2-1

7.3 Control hummer-bot with PS2 controller

7.3.1 PS2 handle button function definition

In the program, we instruct to read the test button. In this experiment, we want to implement the function of PS2 remote control car. First, we define all button functions as follows:



Figure 7-3-1

- Mark UP: forward
- Mark DOWN: back up
- Mark LEFT: turn LEFT
- Mark RIGHT: turn RIGHT
- Mark A: acceleration
- Mark B: left spin
- Mark C: slow down
- Mark D: right spin
- Mark 3: control the front of the manipulator to clip the steering gear and open it (the manipulator is optional)
- Mark 4: control the front of the manipulator to clip the steering gear and close it (the manipulator is optional)
- Joystick Left and right rotation of the steering gear of the base of the manipulator (optional for the manipulator), 0-89 ° or 270-360 ° for the right turn of the bottom steering gear, and 90-269 ° for the Left turn of the bottom steering gear

- Joystick Right: Control the rotation of the left and right steering gear of the mechanical arm, 44-135 degrees for the right steering gear, 224-315 degrees for the right steering gear, 136-223 degrees for the left steering gear, 0-43 degrees or 315-360 degrees for the right steering gear control



图 7-3-2

- L1: Open the clip
- R1: Closed clamp
- Left rocker: the mechanical arm is deflected to the left
- The left rocker swings right and the mechanical arm turns right
- Push the right rocker forward: the manipulator clip falls
- Push the rocker back on the right side: the manipulator clip rises
- Right rocker push left: mechanical arm forward
- Push the right rocker to the right: the mechanical arm retreats

7.3.2 Program to upload

- Open : Lesson\Robotic Arm combined with hummer-bot4.0 courseware code\PS2X_4WD\PS2X_4WD.ino
- Upload the program to the ble-uno main control board
- Plug the PS2 receiver head into the expansion board
- Turn on the power switch of the car
- Start operation control car

- Start operation control car

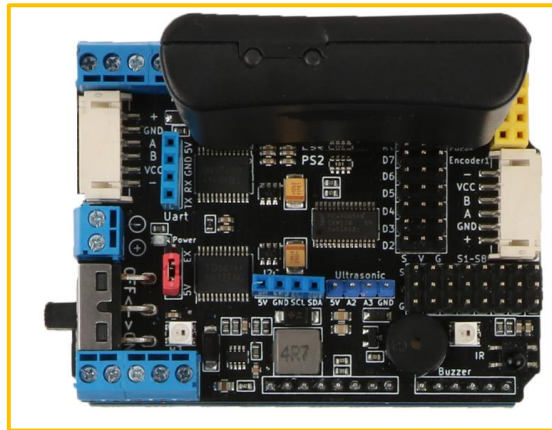


图 7-3-3

7.4 Use bluetooth /WiFi APP to control the Hummer-Bot equipped with the robotic arm

- Open : Lesson\Robotic Arm combined with hummer-bot4.0 courseware code\Buletooth_4DW \ Buletooth_4DW. **ino**
- Upload the program to the ble-uno main control board
- If there is a WiFi module, insert the WiFi module into the expansion board correctly, as shown in figure 7-4-1

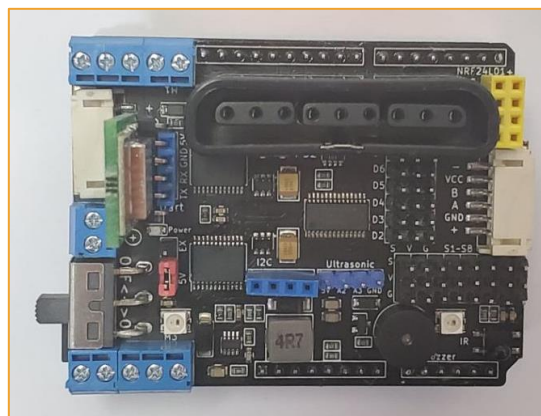
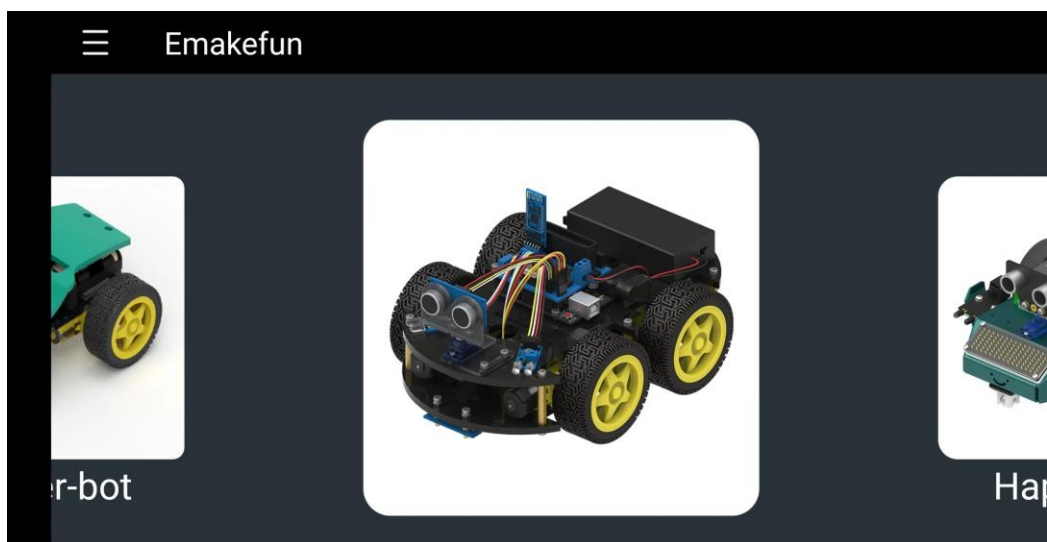


图 7-4-1

- Install Emakefun APP
- Turn on the power switch of the car
- Open the APP to connect to bluetooth /WiFi
- Select Hummer-bot, choose bluetooth connection according to your hardware's bluetooth module, and choose WiFi connection with WiFi module



- After successful connection, it can be seen that the status indicator of bluetooth /wifi module changes from flashing to long and bright
- Enter the APP selection interface and select remote control

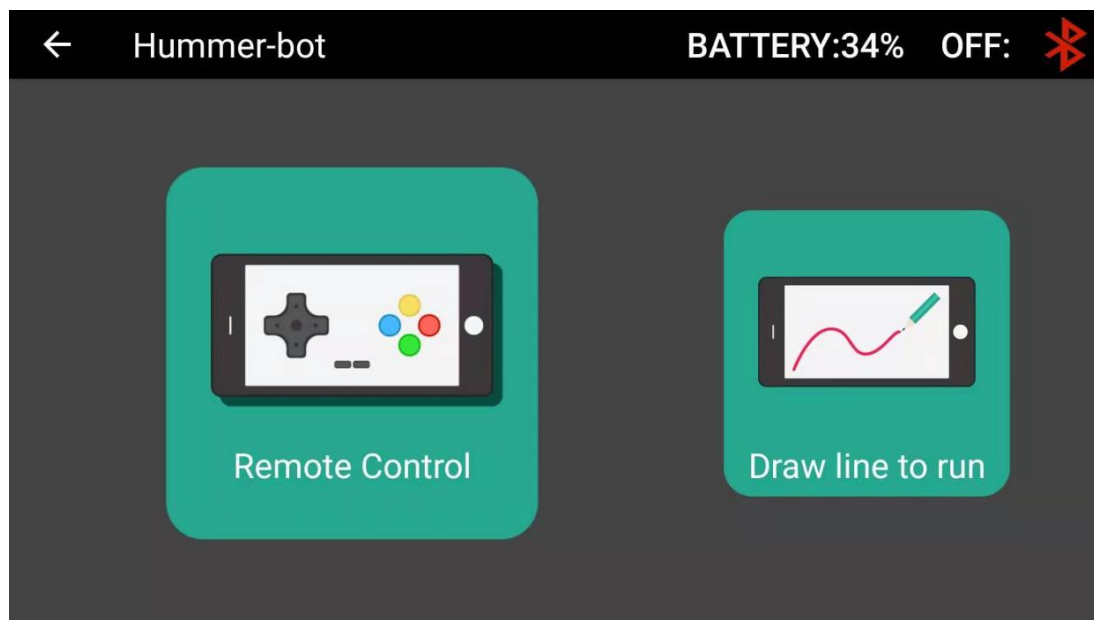


图 7-4-2

- Open the manipulator mode and the manipulator control interface appears

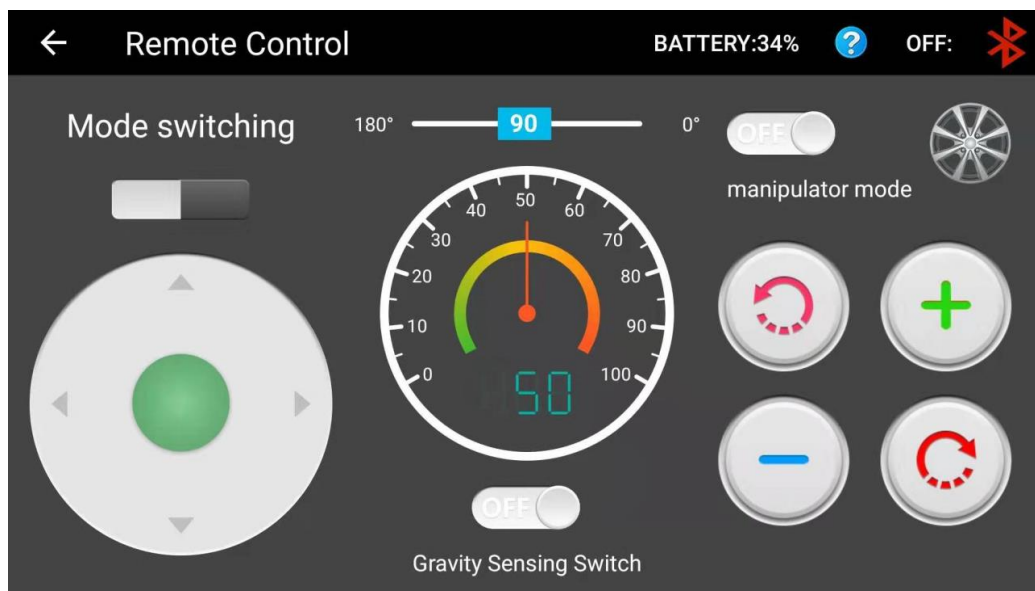


图 7-4-4

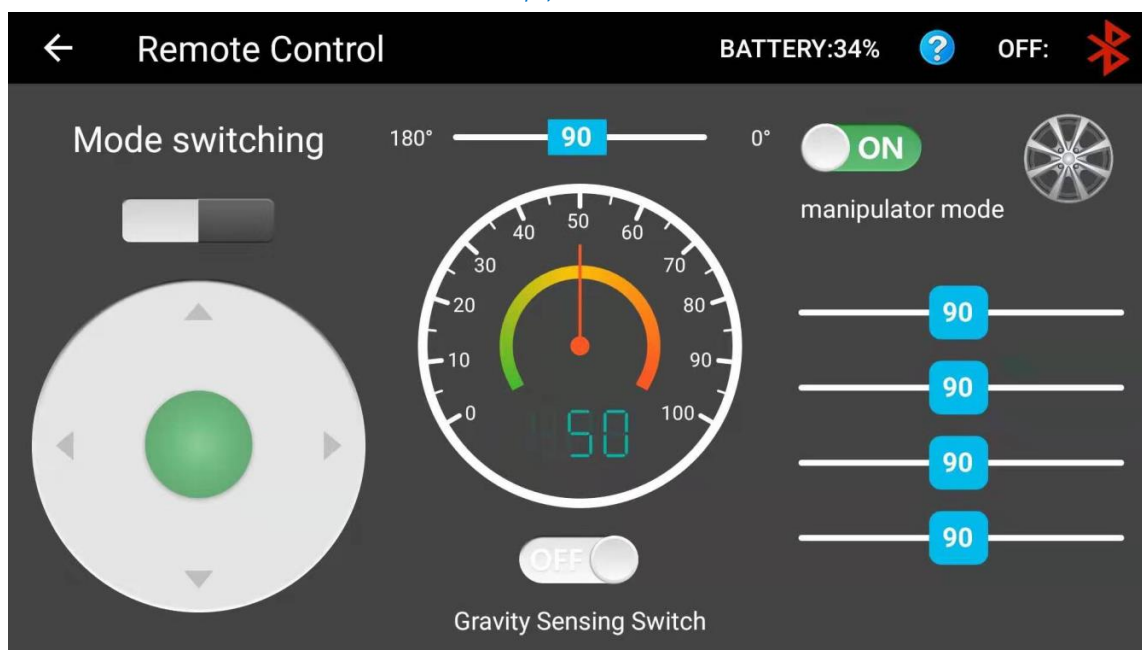


图 7-4-5

- Mark 1 is to send the Angle to I2C steering gear 1
- Mark 2 is to send Angle to I2C steering gear 2
- Mark 3 is to send Angle to I2C steering gear 3
- Mark 4 is to send Angle to I2C steering gear 4