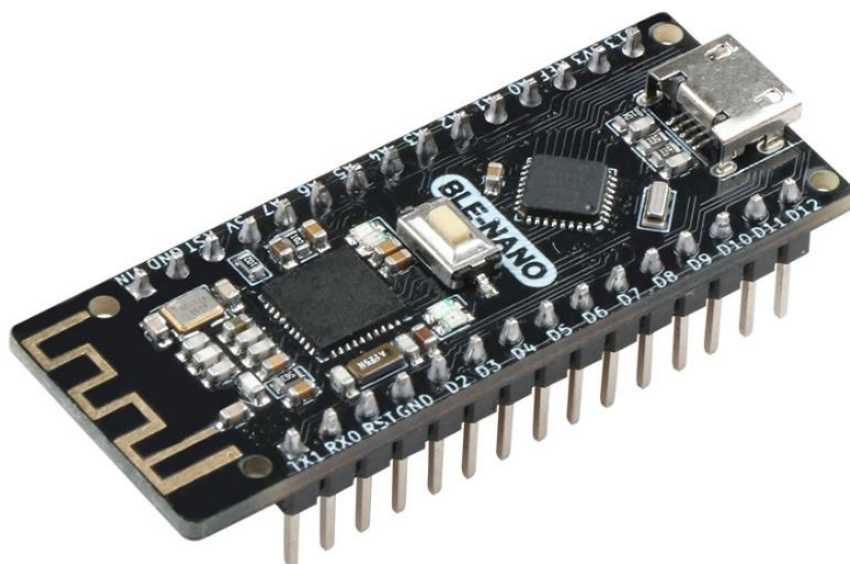


BLE-Nano

operating manual

V.1.6



Revised Version Of History

Date	Version	Description	Author
2019-1-29	V. 1. 0	Create	Ken. chen
2019-4-9	V.1.1	Perfect AT Command	Ken. chen
2019-5-25	V.1.2	Fix Led description	Ken. chen
2019-7-29	V.1.3	Add AT command note	Ken. chen
2019-7-30	V.1.4	Add iphone connection method introduction	Abbott. chen
2019-8-9	V.1.5	Overall document improvement	Belle. xu
2020-1-3	V.1.6	Modification diagram	Abbott. chen

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1.1 Introdunct

Ble - Nano bluetooth 4.0 protocol is based on perfect combination Arduino Nano by emakefun to create customer research and development of a revolutionary product, function and the pin is fully compatible with traditional Arduino Nano motherboard, scope of work frequency of 2.4 GHZ, modulation mode for the GFSK, maximum transmitted power of 0 db, the largest launch distance of 50 meters, USES the import original TI CC2540 chip design, support user through AT commands to modify to check the device name, service UUID, transmission power, such as matching password instructions, convenient use and flexible. The size of the product is very small, suitable for many applications where there are severe restrictions on the size.

We provide Android and IOS mobile phone demo, you can quickly develop a communication with the phone hardware device. Just like the popular wearable mobile phone peripheral devices, all of them can be developed with the Ble Nano platform. You can connect the Ble Nano with the bluetooth 4.0 device, realize the wireless transmission between the two bluetooth devices, and set the master and slave. Even establish bluetooth HID connection with PC. At the same time, we provide developers with a great degree of freedom and support, the user can not only by the AT command debugging Ble - Nano, you can also add on Ble - Nano controller Arduino compatible extension board, sensor, motor and servo drive, emakefun exclusive research and development of bluetooth host mode automatic connection from the machine function, and support for more than 20 bytes to send, it is more convenient to use.

1.2 Product Parameter

- ◆ It is fully compatible with the Arduino nano-v3.0 pin and its usage method
- ◆ BLE chip :TI CC2540
- ◆ Work channel : 2.4G
- ◆ Transmission distance: 50m
- ◆ Supports AT directive to configure BLE
- ◆ Support USB virtual serial port, hardware serial port, BLE three-way transparent transmission
- ◆ Support master and slave switch
- ◆ Supports sending over 20byte.
- ◆ Supports iBeacons
- ◆ Interface: Mircor-Usb
- ◆ Input voltage: Usb power supply, Vin6~12V, 5V

- ◆ MCU: ATmega328P-MU QFN32
- ◆ Bootloader: Newest Arduino1.8.8
- ◆ Pin: Two Lines 2.54mm-15Pin
- ◆ Size: 48mm x 19mm x 12mm
- ◆ Weight: 18g

1.3 Pin define

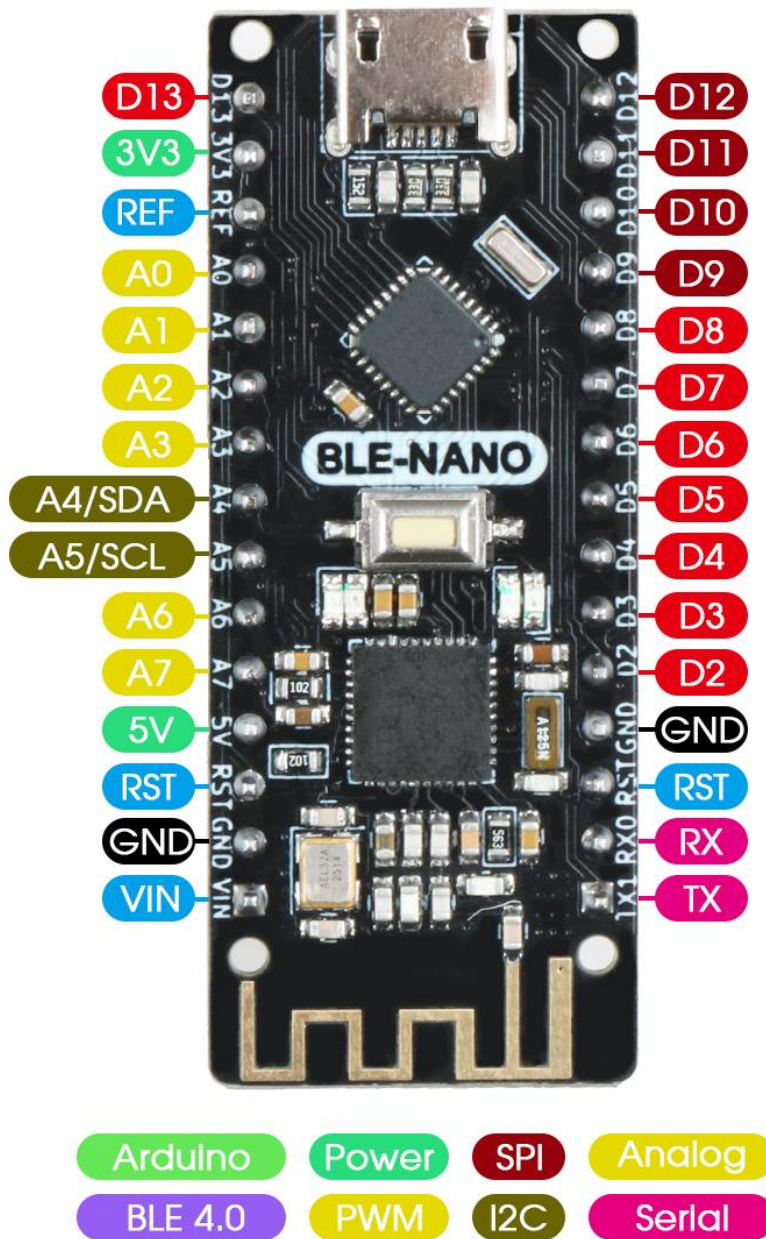


Figure 1.3.1 pin description

1.4 Indicator LED description

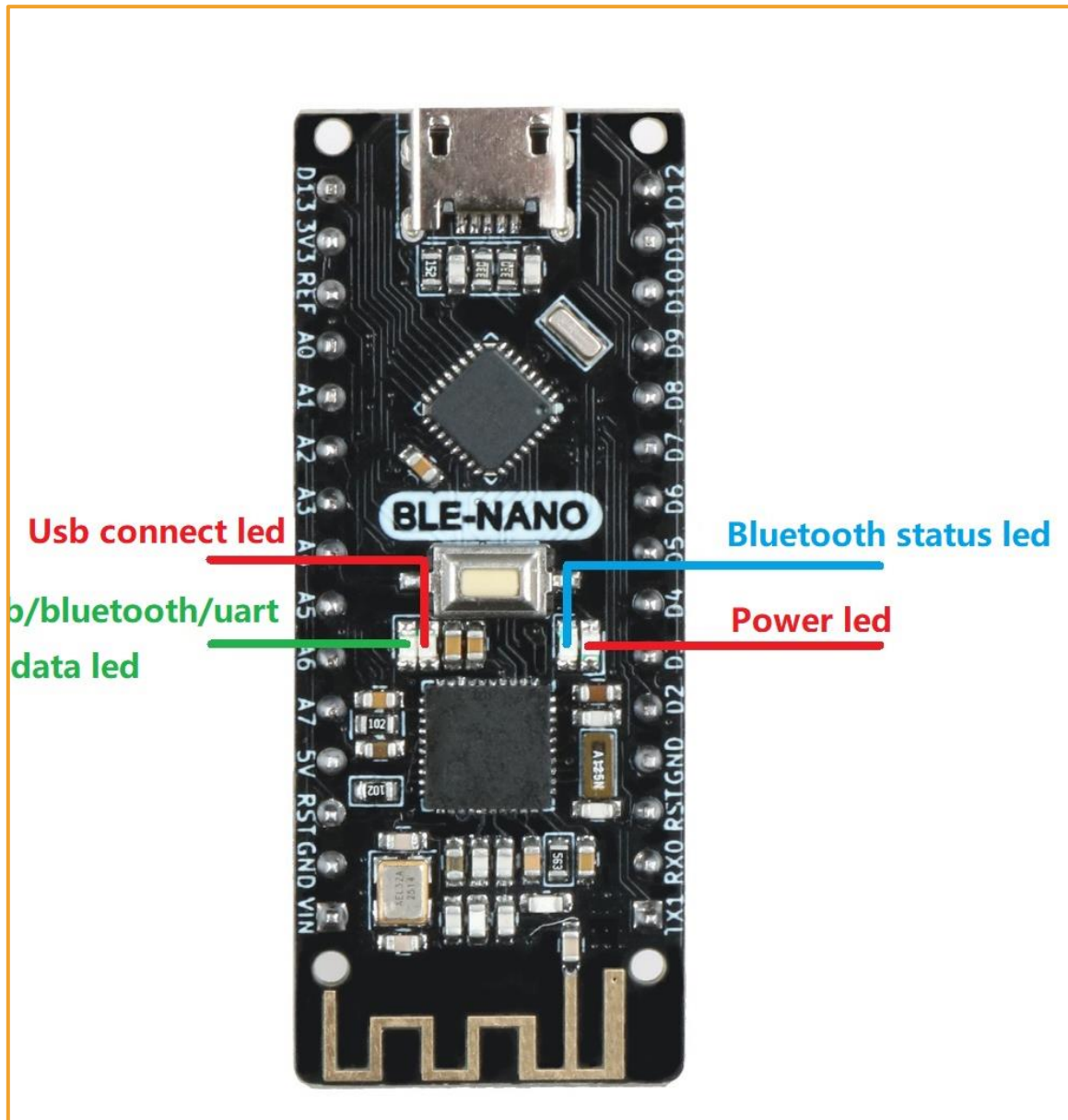


Figure 1.3.2 indicator light description

- ◆ When the bluetooth is not connected, the blue light will flicker, and the blue light will always be on
- ◆ The green light flashes when the module communicates with other bluetooth data, or when usb has data, or when ATmega328P sends serial data
- ◆ The green light flashes when the module communicates with other bluetooth data, or when usb has data, or when ATmega328P sends serial dataWhen the USB data cable is connected successfully,

the USB light will be on. If only the power light is on after connecting the USB cable, but the USB indicator light is not on, it means that the usb-micro cable is broken, please replace it

Chapter 2 drive installation preparation

2.1 Ble-Nano driver install

- 1) Right-Click “Computer” → “attribute” → “Device manager” → check “port (COM<) ” ,
If you look at this figure 1.1

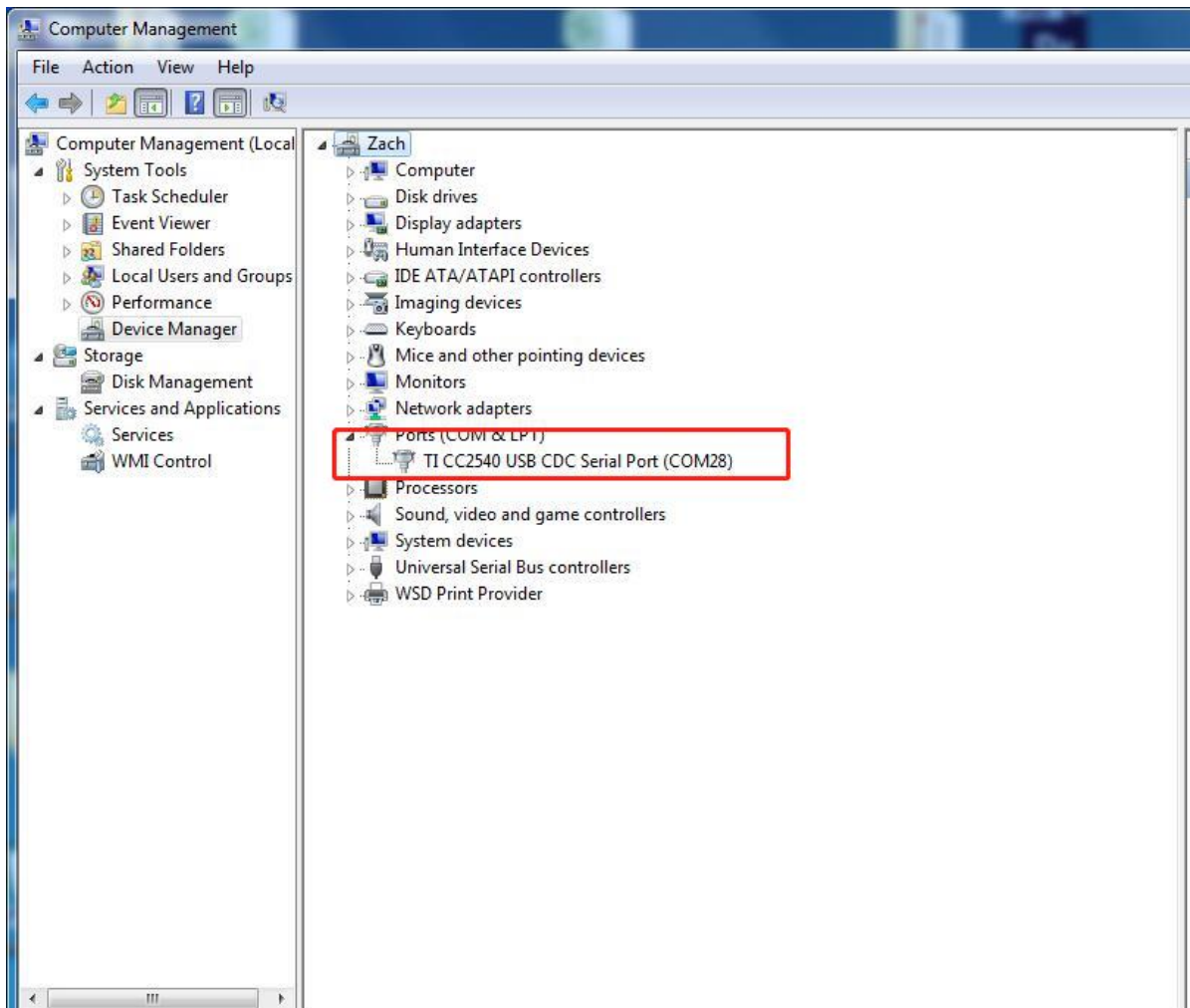


Figure 1.1 Drive the successful installation interface

- 2) The driver has been installed successfully. Then we open the IDE and select the corresponding development board model and port in the toolbar. If it appears as shown in figure 1.2, the computer does not recognize the development board and needs to install the driver.

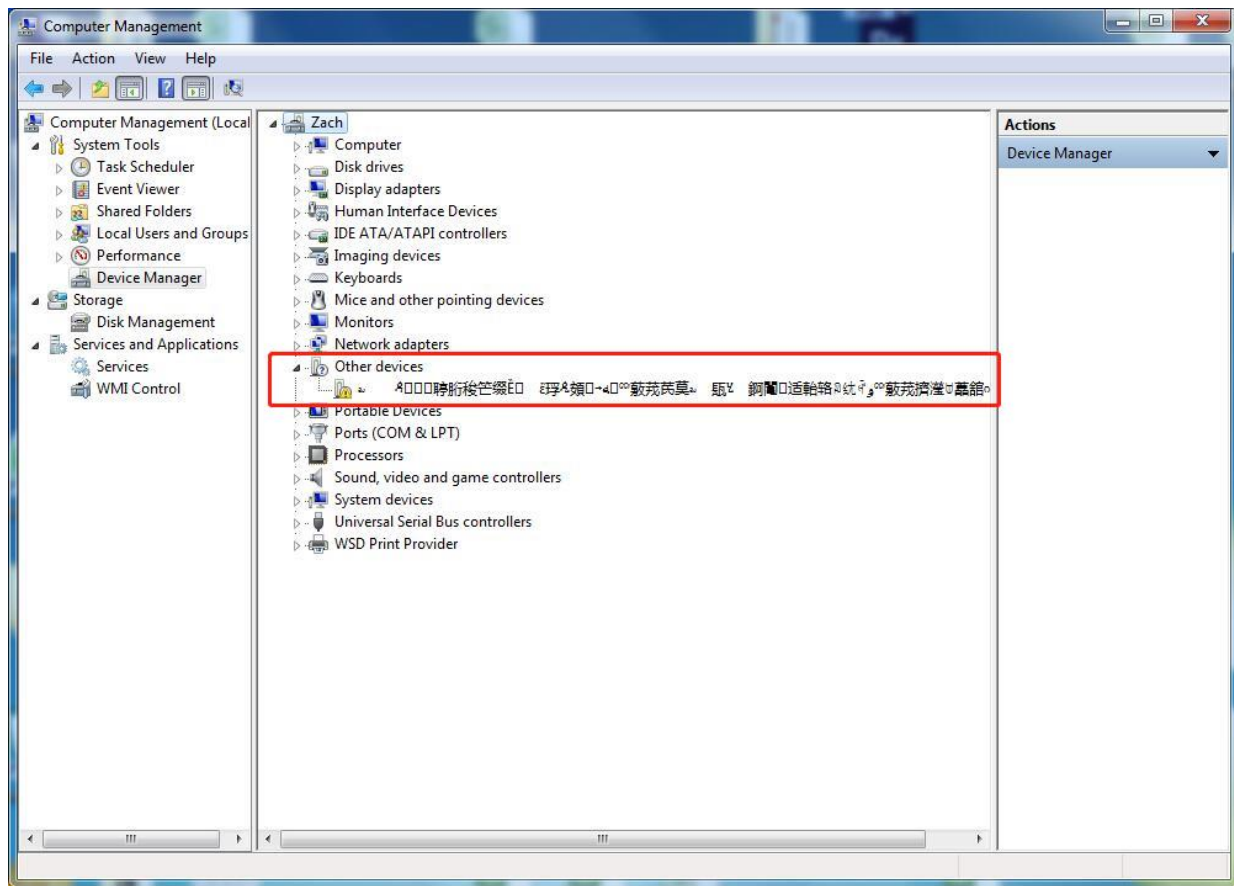


Figure 1.2 The driver failed to install the interface

- 3) Right-click the USB serial port and select the update driver software option, as shown in figure 1.3.

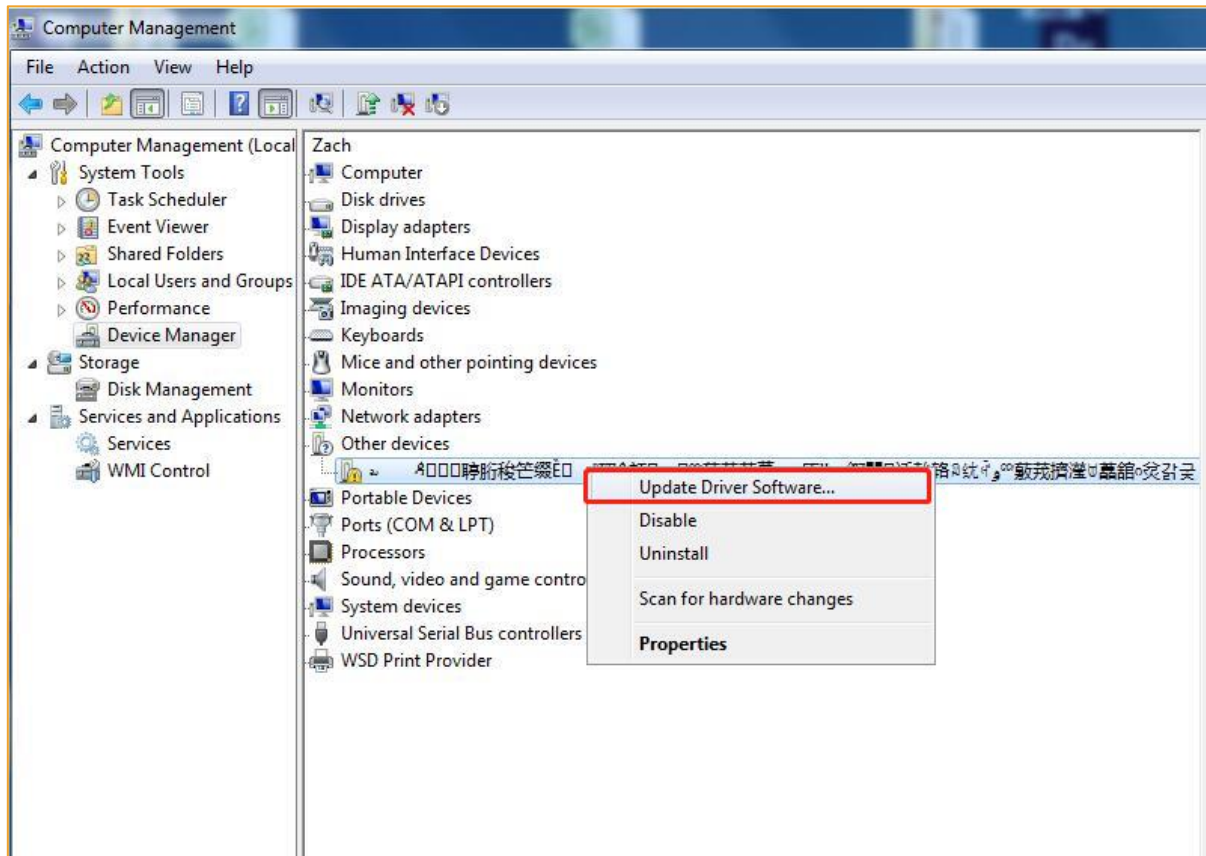


Figure 1.3 Update successful

- 4) Click "browse the computer to find driver software" as shown in figure 1.4, and click "browse" as shown in figure 1.5

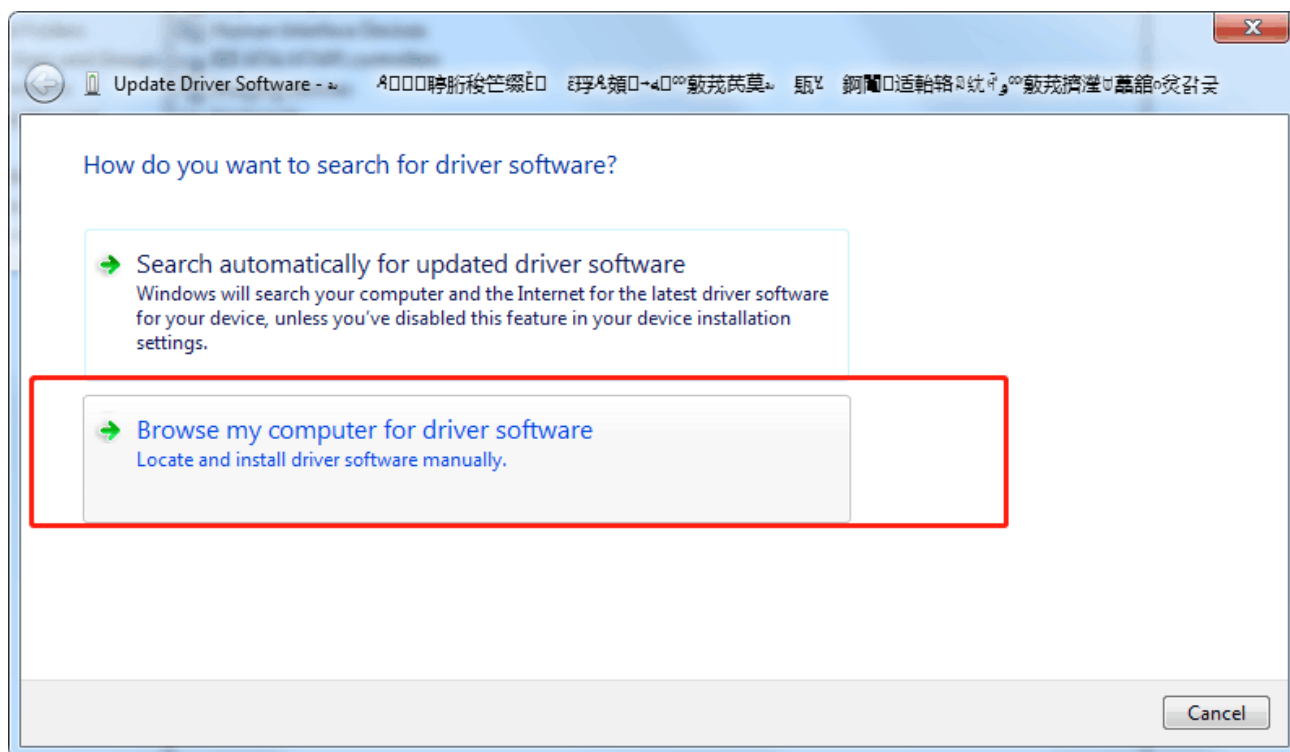


Figure 1.4

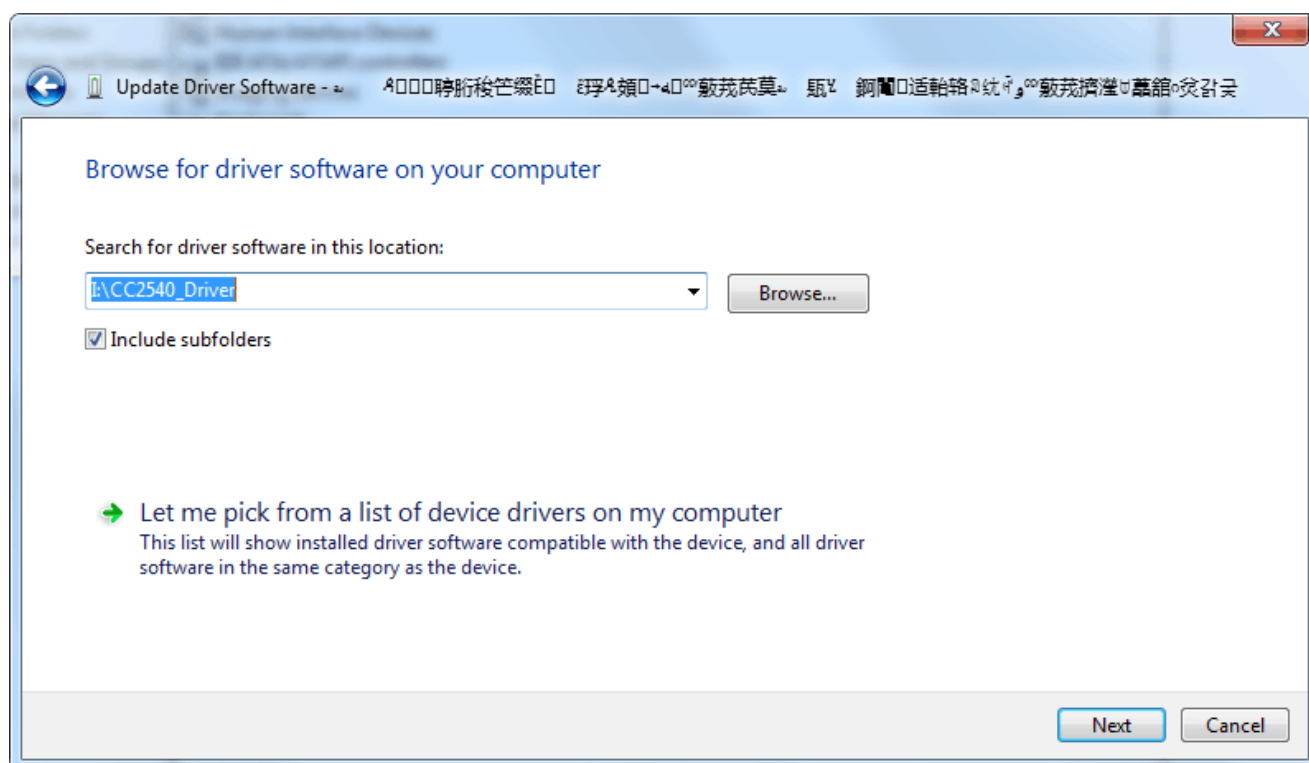


Figure 1.5

Driver path: "CC2540_Driver \ ccxxxx_usb_cdc.inf" click "next", as shown in figure 1.6

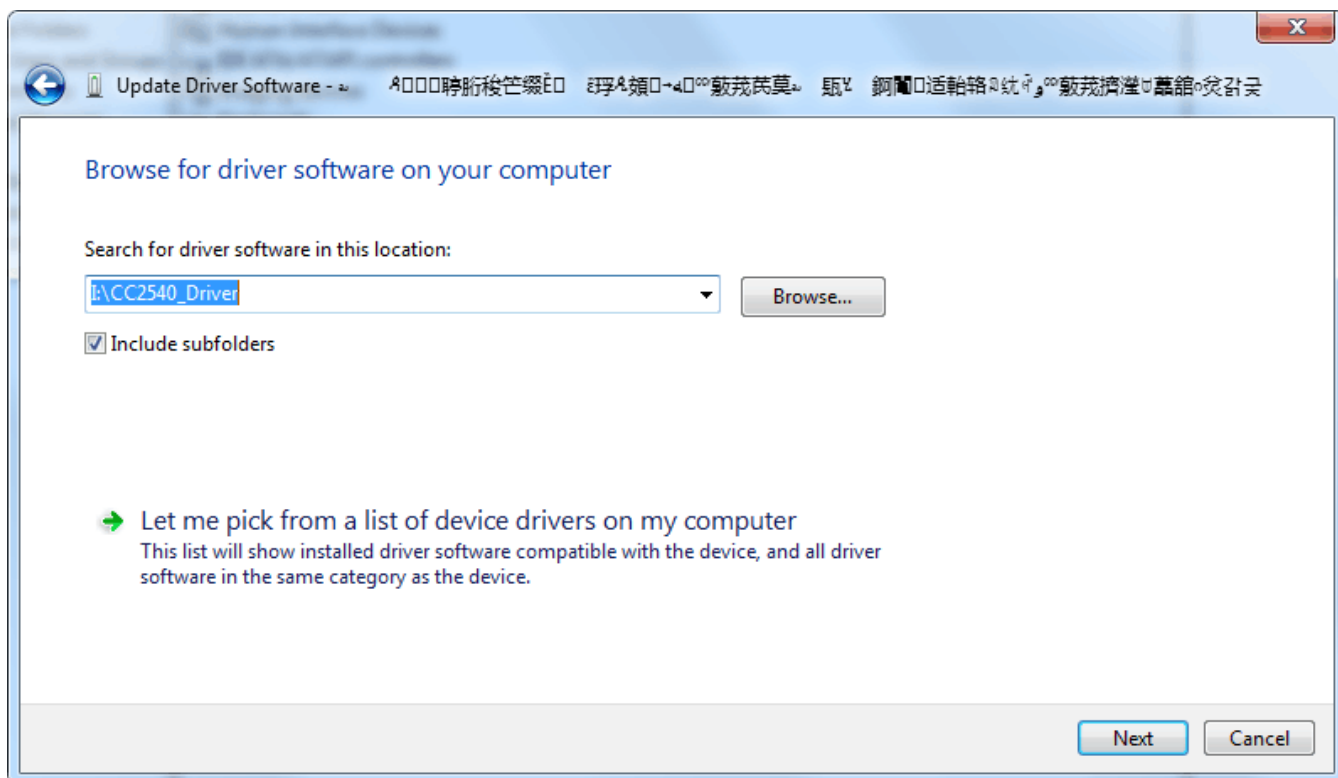


Figure 1.6 choose the driver file

- 5) Click "always install this driver software" in the popup window as shown in figure 1.7

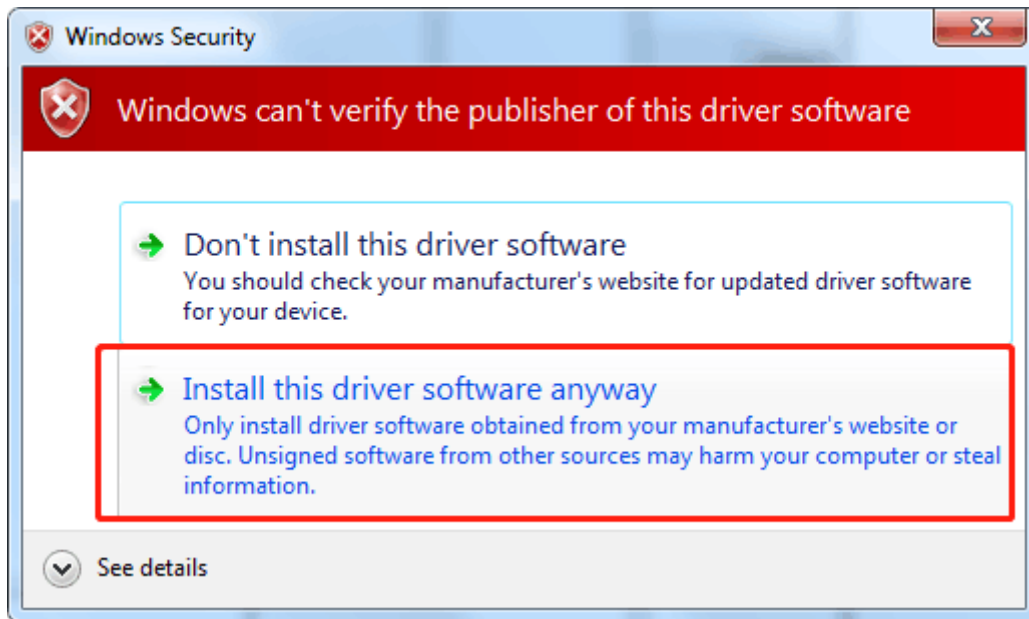


Figure 1.1.7

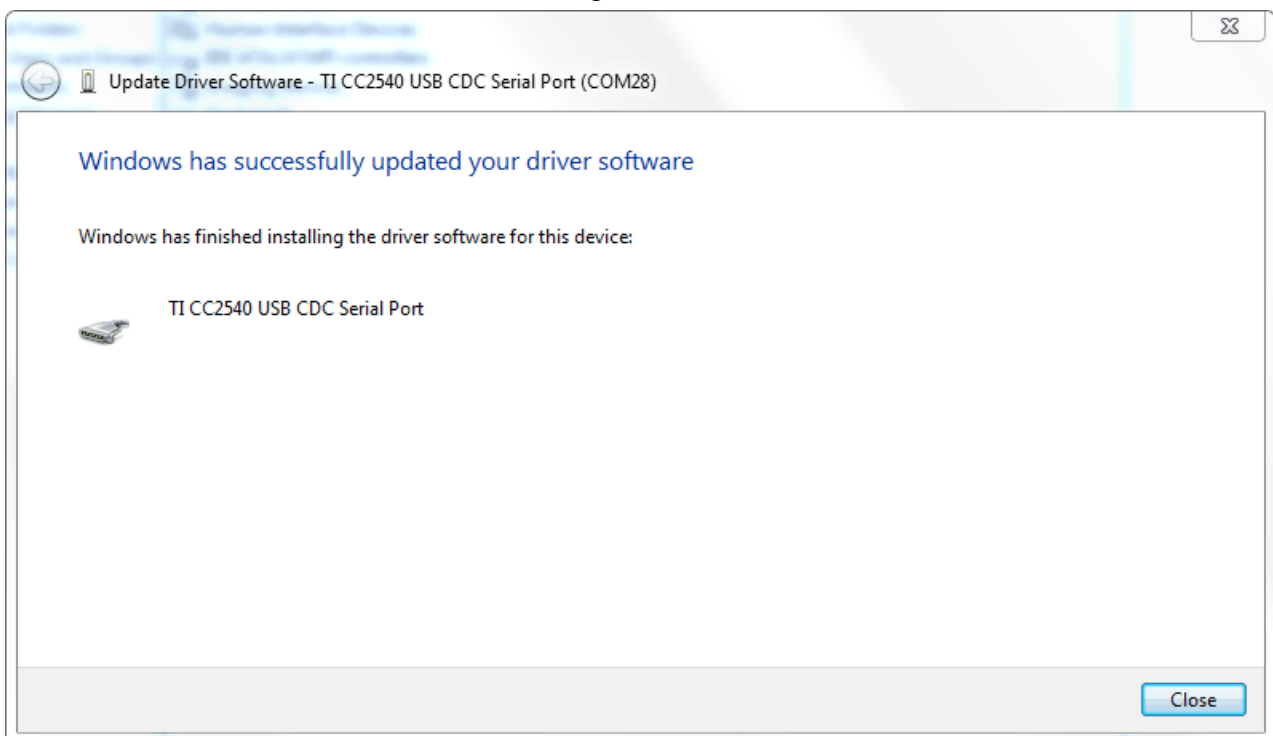


Figure 1.1.8 Driver installation successful

At this point, we have the driver installed. Next, we will install the Arduino IDE.

2.2 Ble-Nano downloads programs through the arduino IDE

BLE-Nano burns the latest version of Bootloader, so you need to use the latest IDE (version 1.8.8 or above) to burn the program : <https://www.arduino.cc/en/Main/Software> download latest Arduino IDE

1) "tools - \board -Arduino Nano"

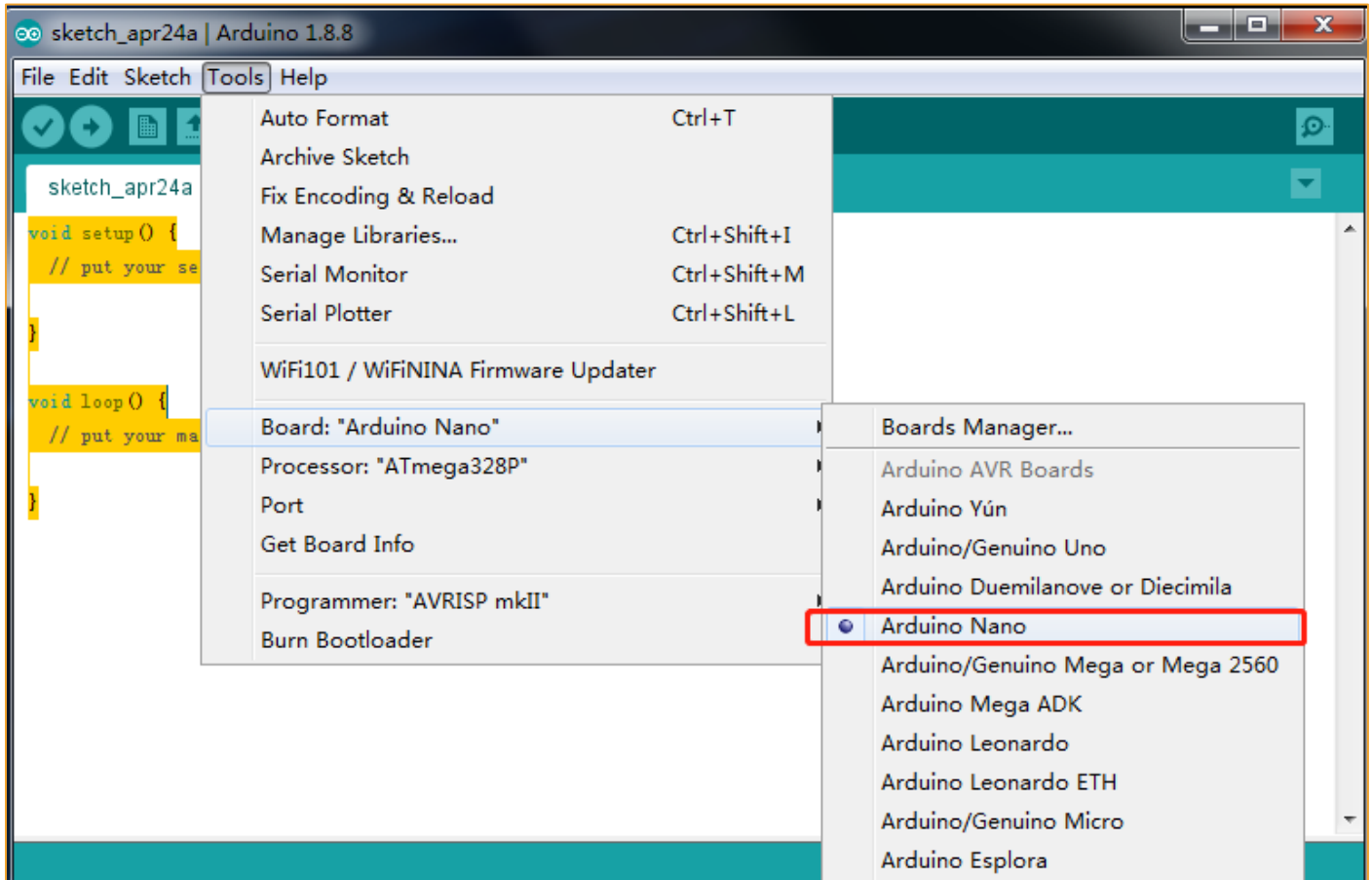


Figure 2.2.1

2) click "tool-processor --" ATmega328P ";

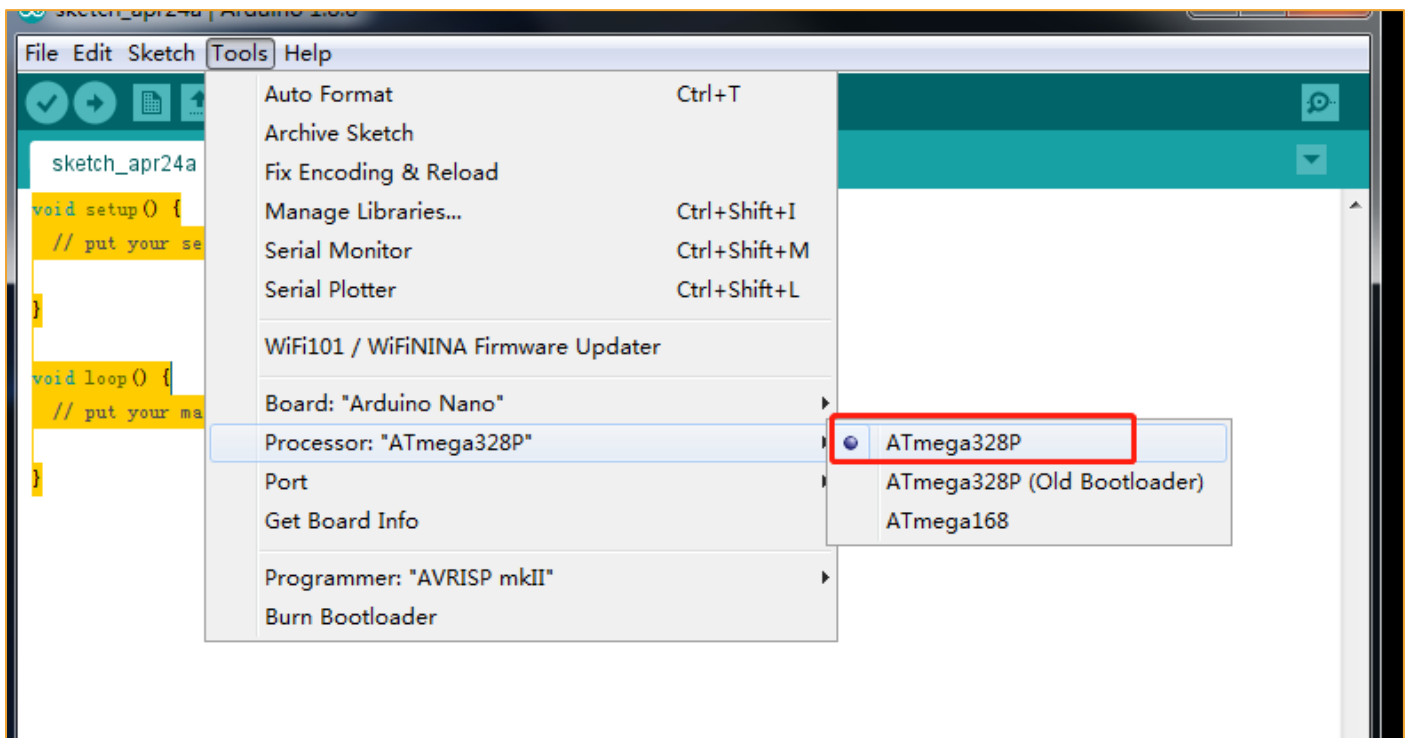


Figure 2.2.2

3) open the Arduino IDE software and click "tools -- port -- COM17(different computer port Numbers are different)", as shown in figure 2.2.3

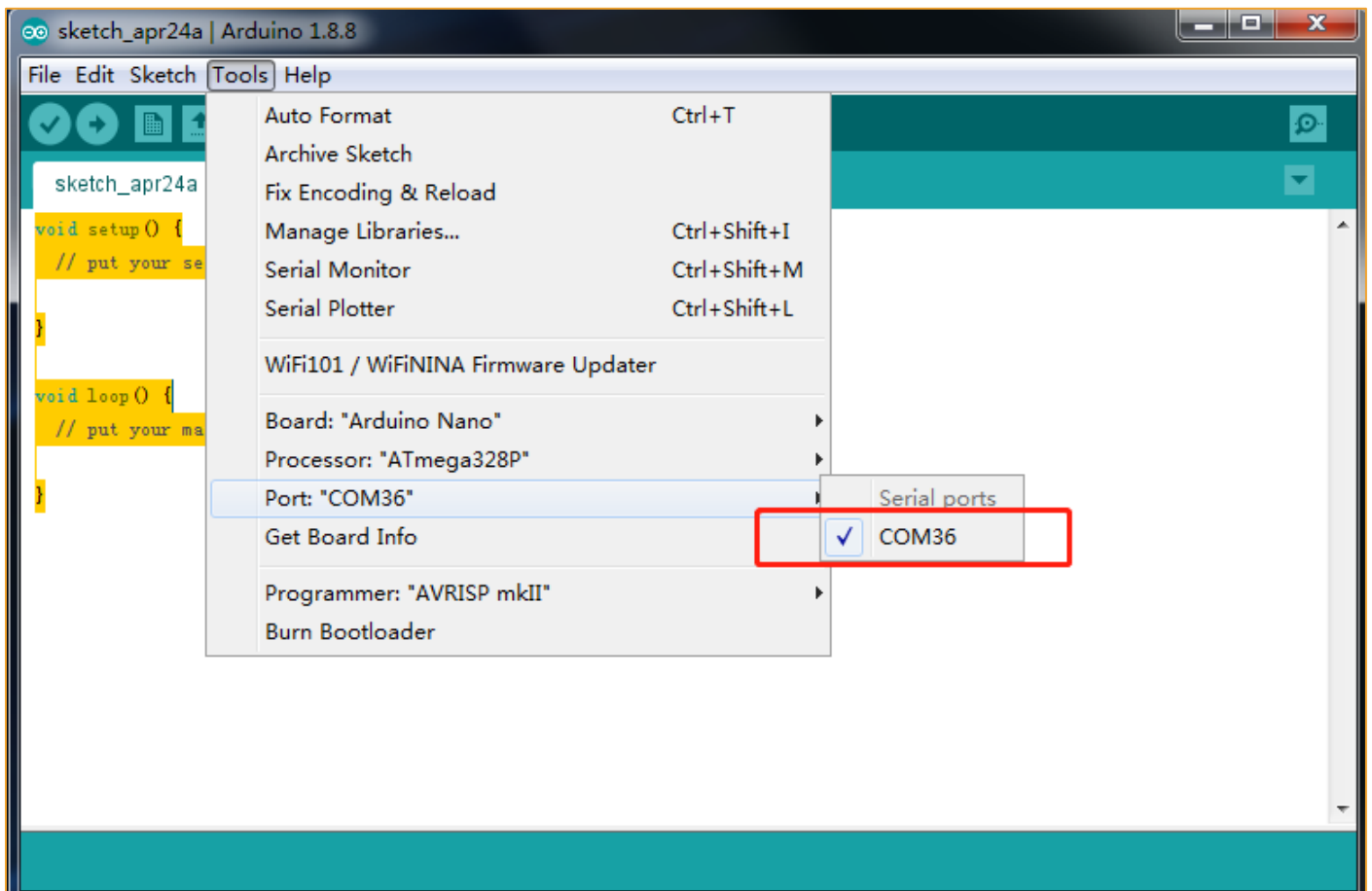


Figure 2.2.3

4) open the Arduino IDE software, click "serial monitor", and send AT instructions;

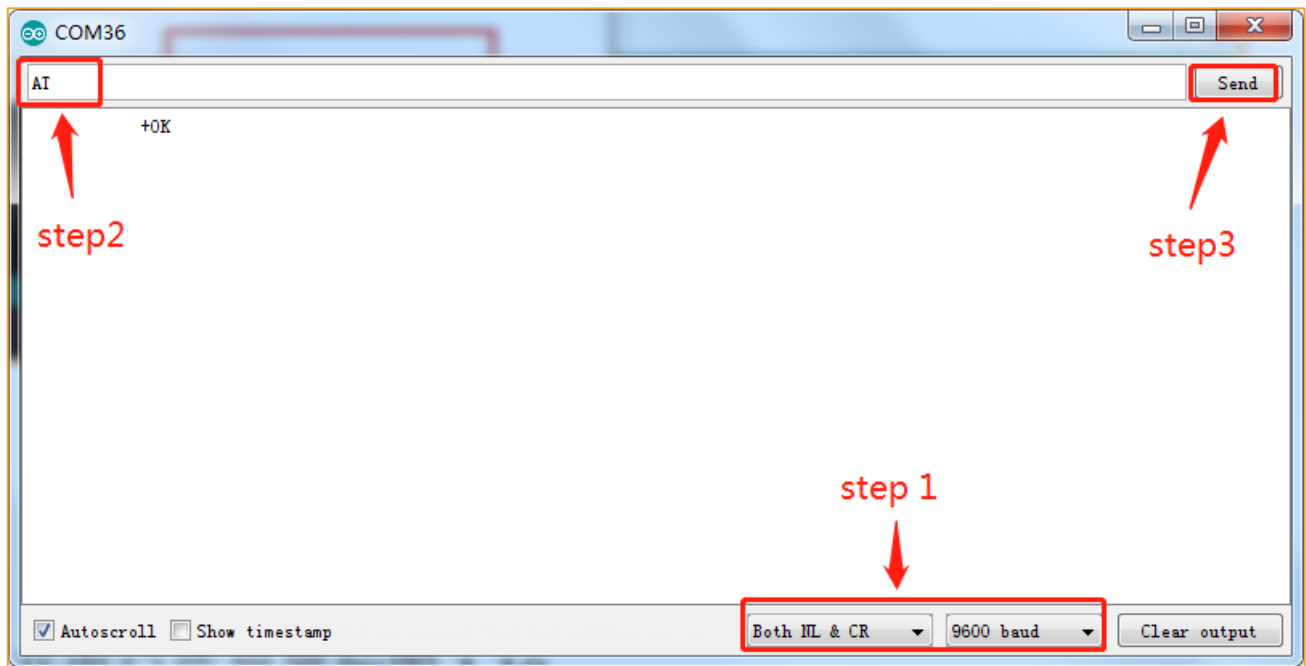


Figure 2.2.4

Chapter 3 Ble-Nano and electronic device connection

3.1 Ble-Nano Connect to your android phone

- 1) Open the Arduino IDE, connect the serial port as shown in figure 1.9, and open the serial port monitor as shown in figure 1.10.

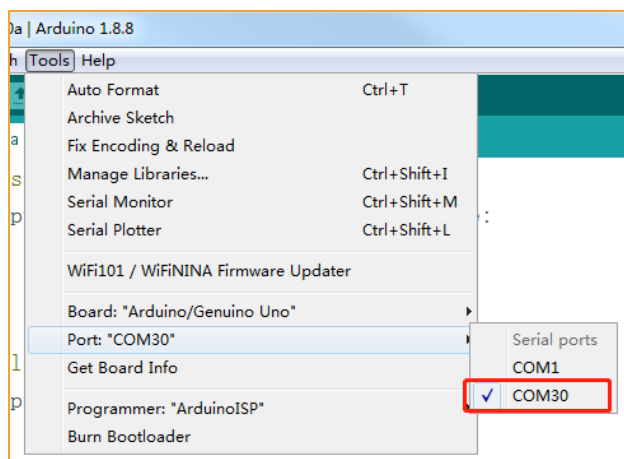


Figure 3.1.1

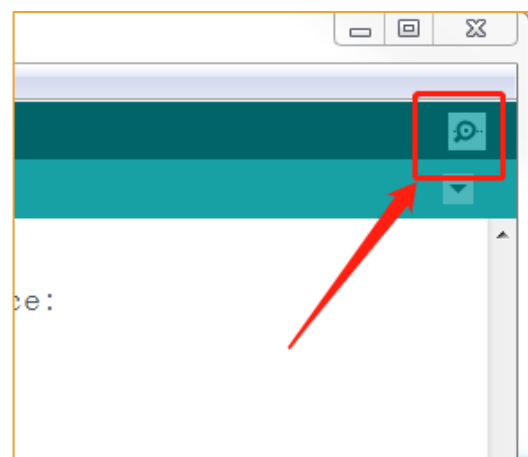


Figure 3.1.2

- 2) The test AT instruction is shown in figure 1.11. The USB and bluetooth data transmission mode of BLE-Nano is set as USB serial port data and BLE transmission as shown in figure 1.12

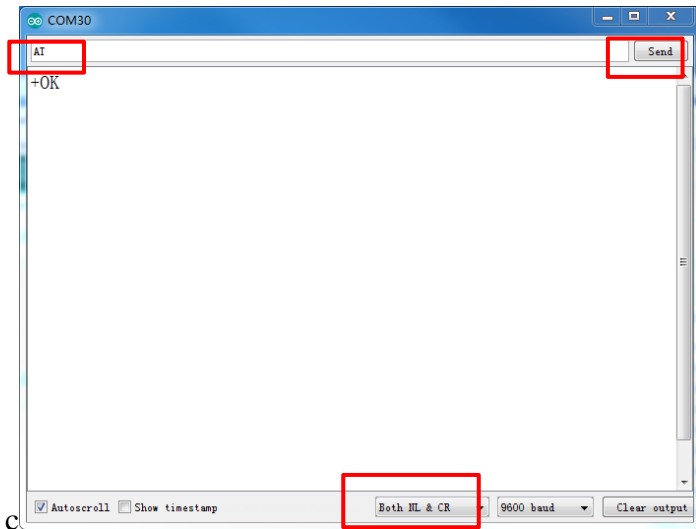


Figure3.1.3

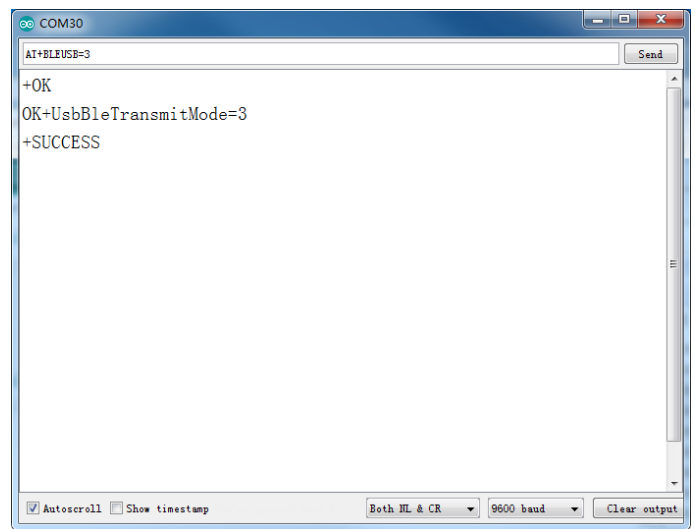


Figure 3.1.4

- 3) Install **“Ble-Nano\TestApp\BLETestTools.apk”** and open Bluetooth, Get location info permissions

Note: Ble-Nano is bluetooth4.0 not Classic Bluetooth, So we can't connect in phone's setting we need use “BLE test tools”.

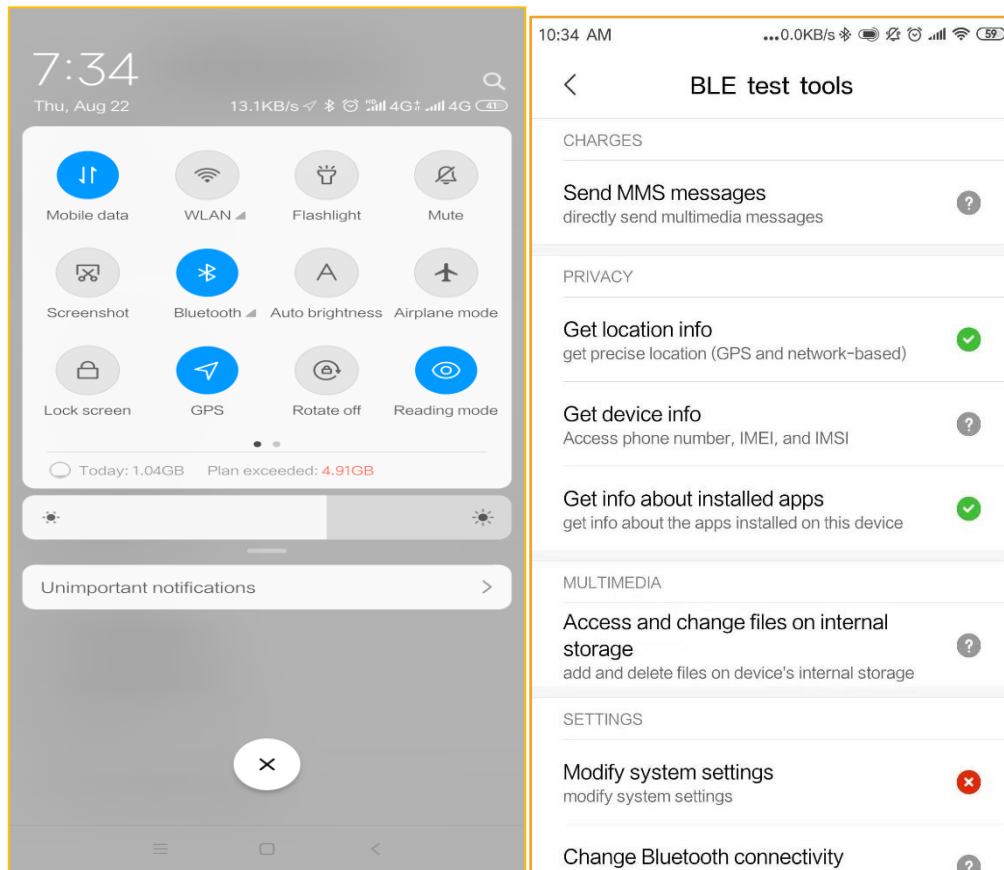


Figure 3.1.5

on the phone(IOS install LightBlue On apple store) and open the test APP. The interface is shown in figure 1.13. Find the corresponding bluetooth name (Ble-Nano) and click to connect. After connection, as shown in figure 1.14, four options will appear to test different functions, respectively. Because here we only test whether bluetooth can send and receive data normally, so we select SK Service and select SK_KEYPRESSED as shown in figure 1.14 and 1.15



Figure 3.1.6



Figure 3.1.7

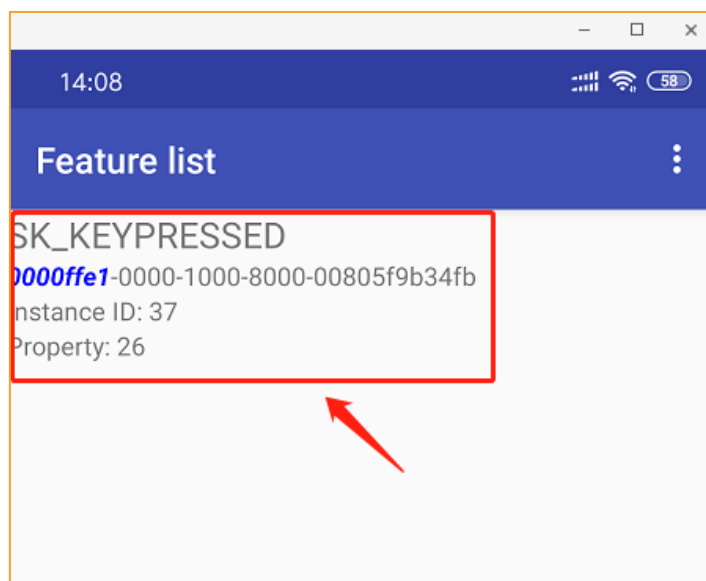


Figure 3.1.8

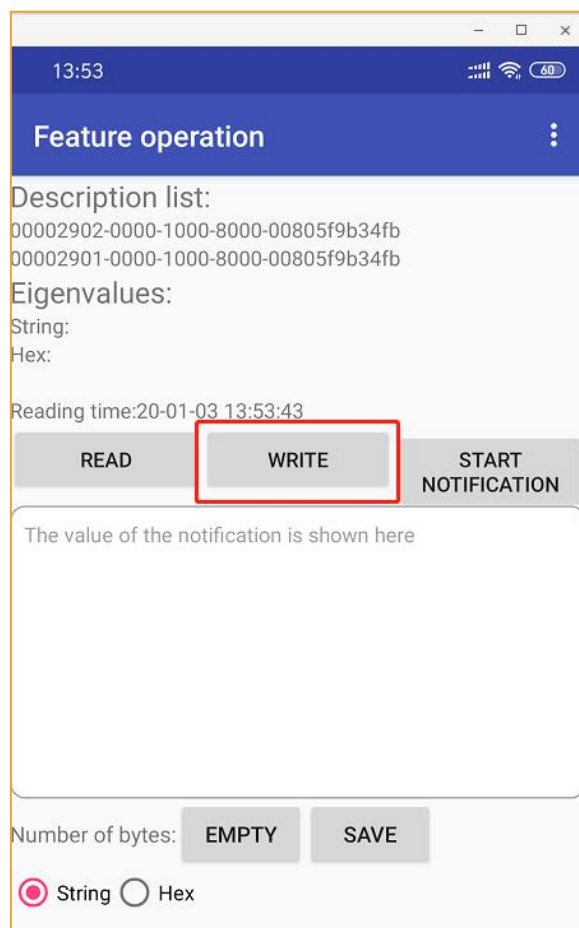


Figure 3.1.9

- 4) After clicking "sk-keypressed", as shown in FIG. 1.17, we can see that there is a "write" button. Click to enter the interface as shown in FIG. 1.18

☒ String
 ☐ Hex

Write value

TIMED TRANSMISSION

100

ms To tal

00

01

02

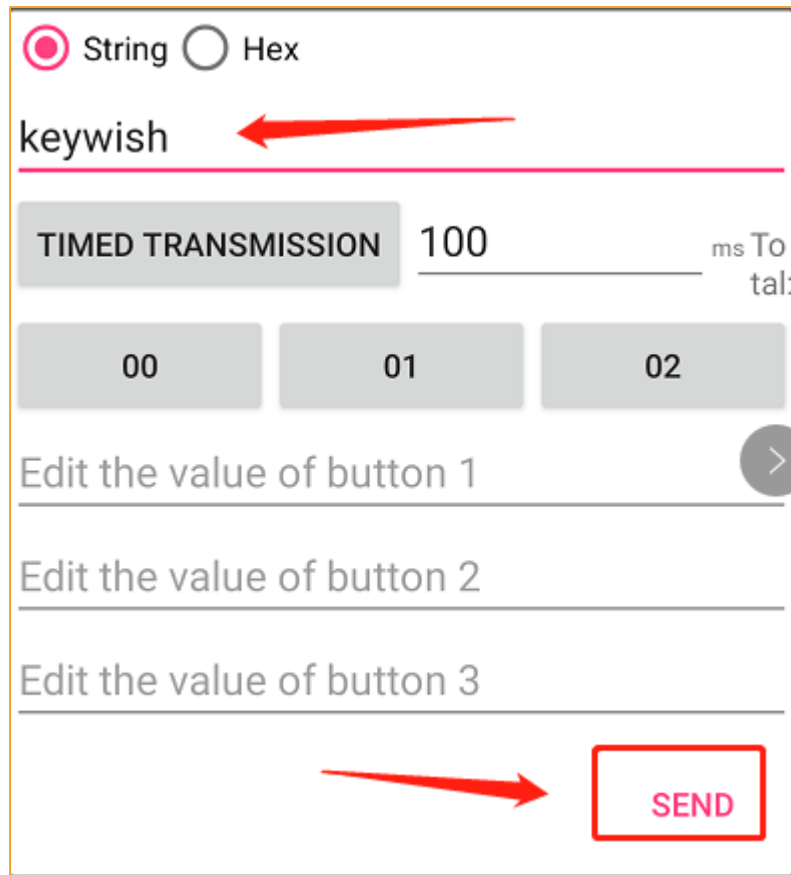
Edit the value of button 1

Edit the value of button 2

Edit the value of button 3

SEND

Figure 3.1.10



☒ String ☐ Hex

keywish

TIMED TRANSMISSION 100 ms To tal:

00 01 02

Edit the value of button 1

Edit the value of button 2

Edit the value of button 3

SEND

Figure3.1.11

- 5) After clicking "send", we can see that the content sent by the mobile phone is printed on the serial port monitor, as shown in figure 1.19, indicating that the bluetooth module can normally send data. Of course, in order to test the accuracy more accurately, we can test it several times and try to test it in different environments.

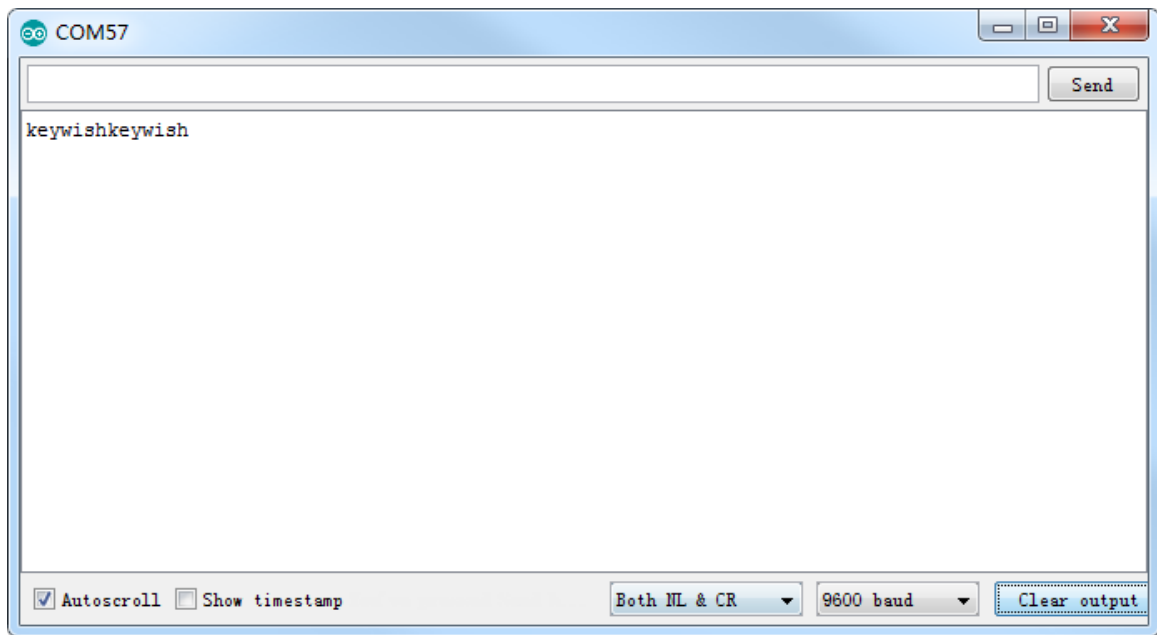


Figure 3.1.12

- 6) As shown in figure 1.20, we can input the content we want to Send on the serial monitor, and then click "Send" to Send the data to the mobile APP via bluetooth, as shown in figure 1.21。

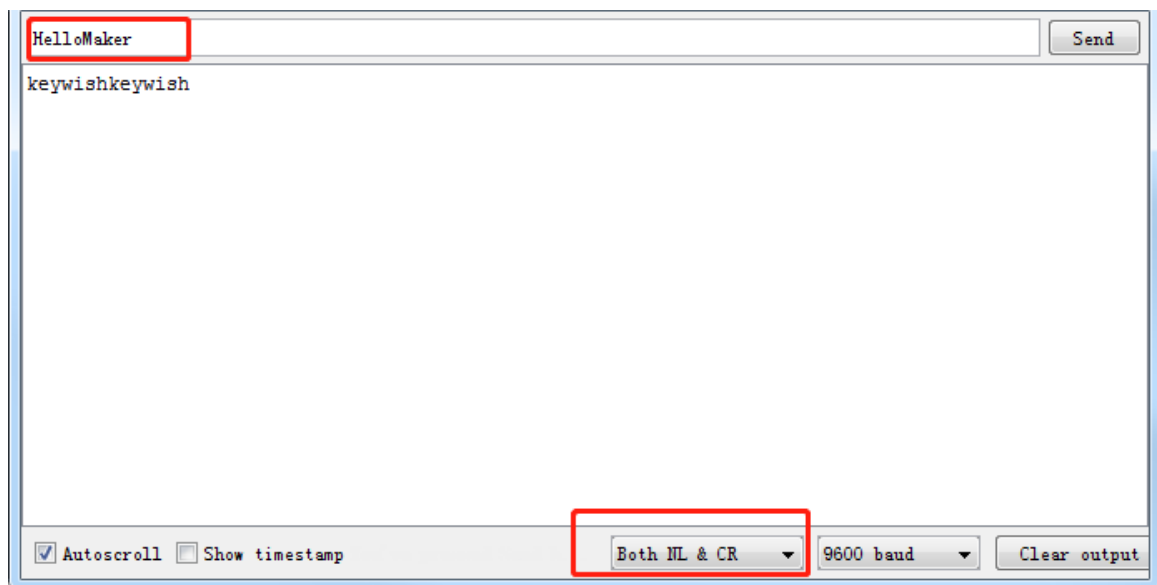


Figure3.1.13

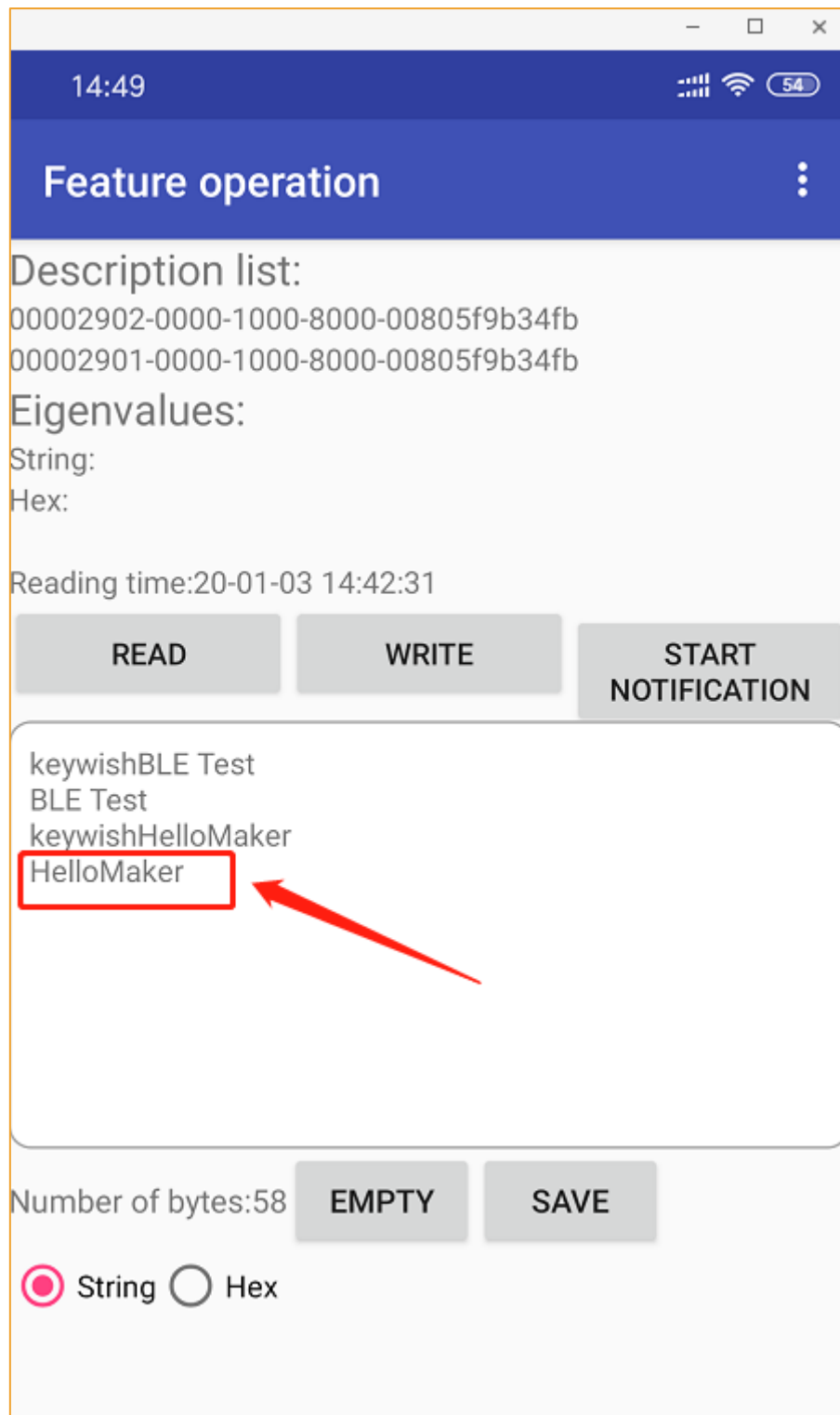


Figure 3.1.14

In the above test process, both PC terminal and android terminal can send and receive data normally, indicating that the Ble-Nano communication is normal and achieves the expected effect.

3.2 Ble-Nano connect to your iphone

1. Search LightBlue in the APP store to download the software LightBlue®Explorer.



Figure 3.2.1

2. Install the APP, open APP and scan device name Ble-Nano

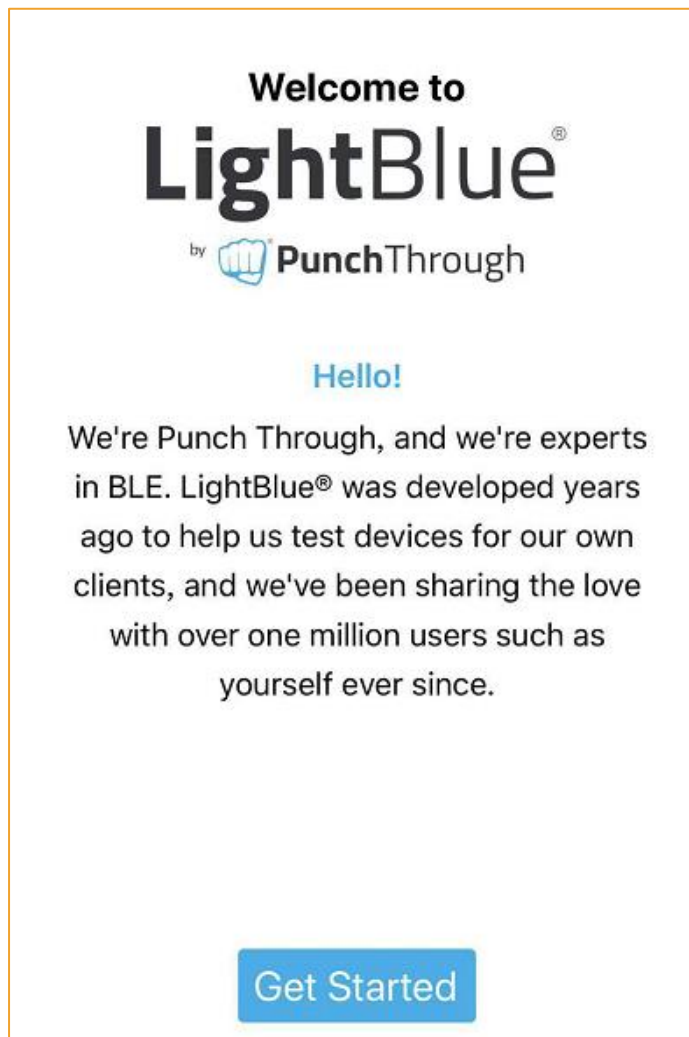


Figure 3.2.2

3, Connected BLE-NANO

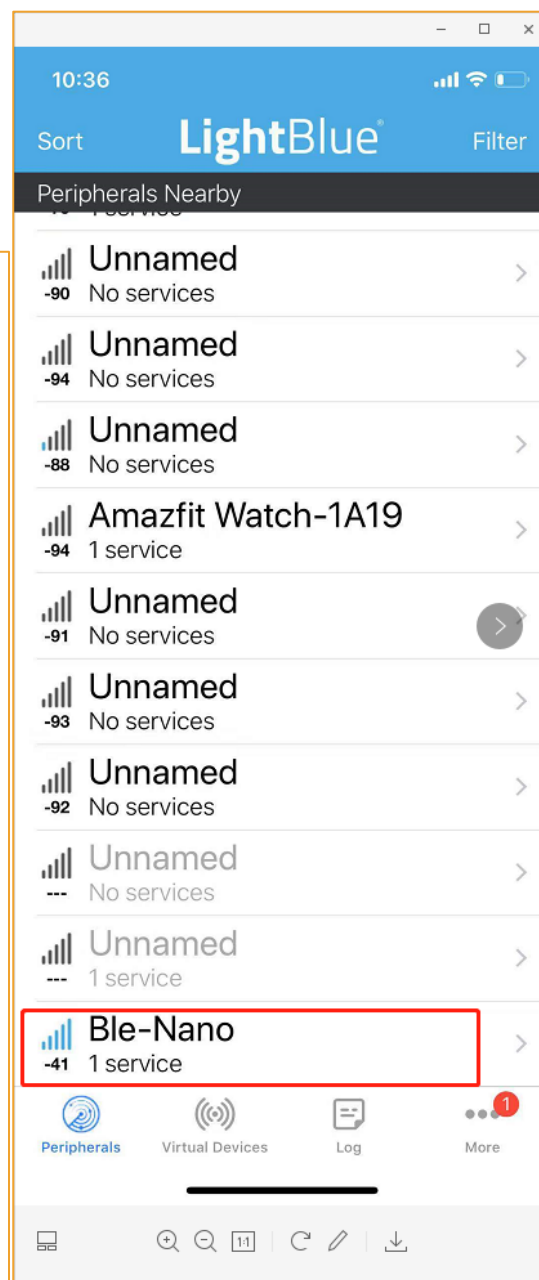


Figure3.2.3

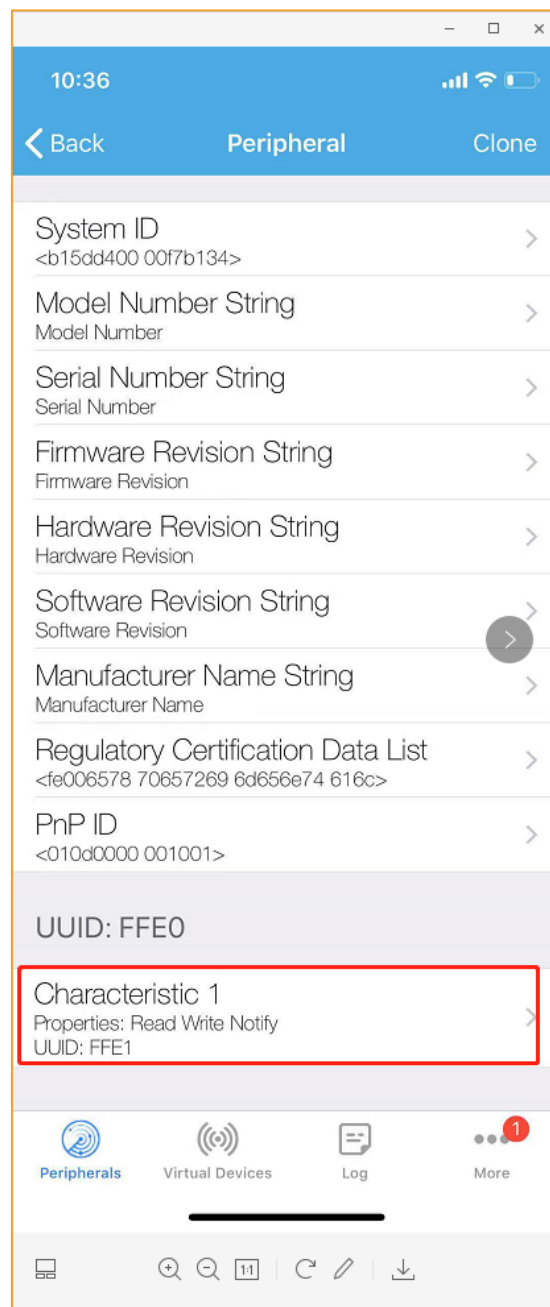


Figure 3.2.4

3. Select the character type and click Write new value, Input characters to give BLE-NANO send data.

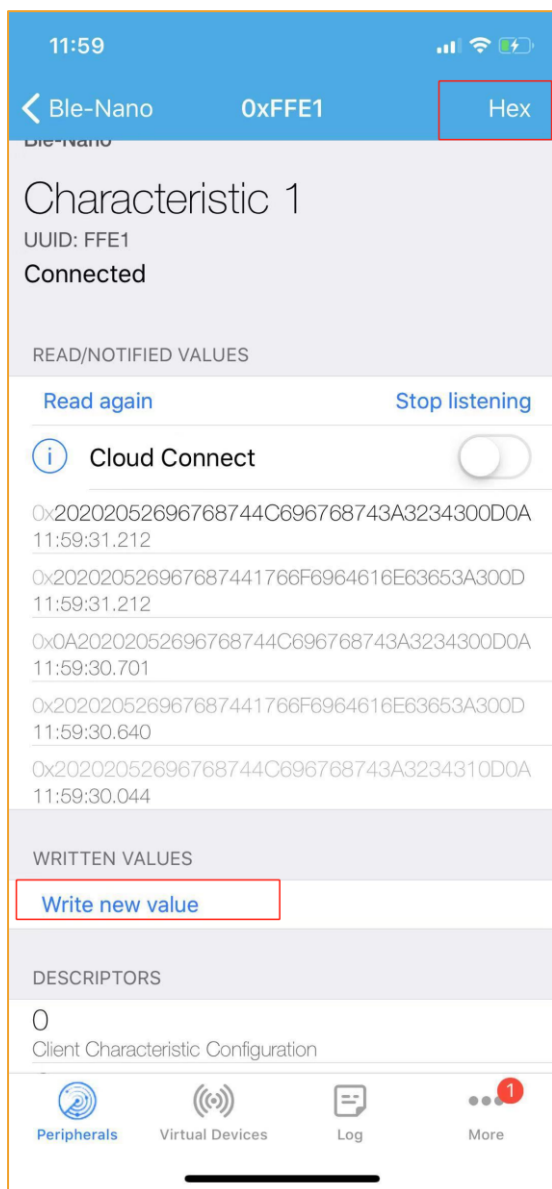


Figure 3.1.5

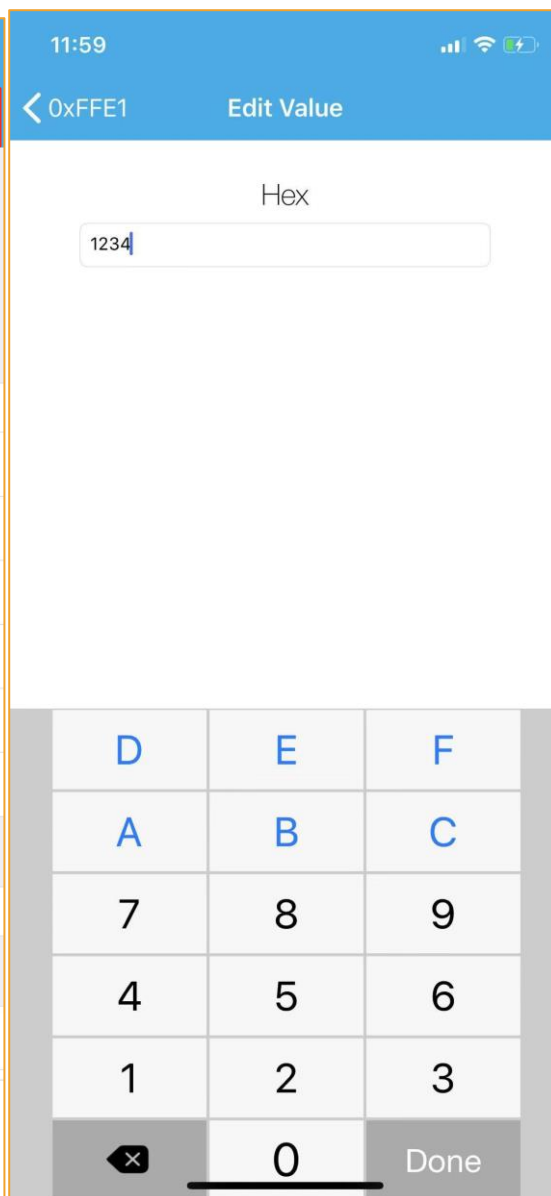


Figure 3.1.6

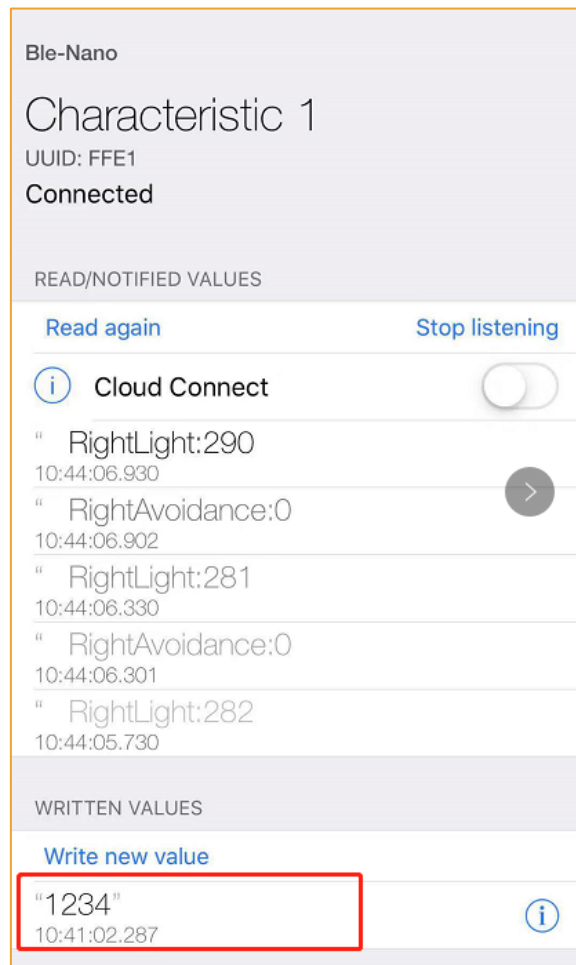


Figure 3.1.7

3.3 Ble-Nano with Windows10 Bluetooth connect

Note: Ble-Nano is bluetooth4.0 not Classic Bluetooth, So we can't connect in Win10's setting we need download "BluetoothLEExplorer"

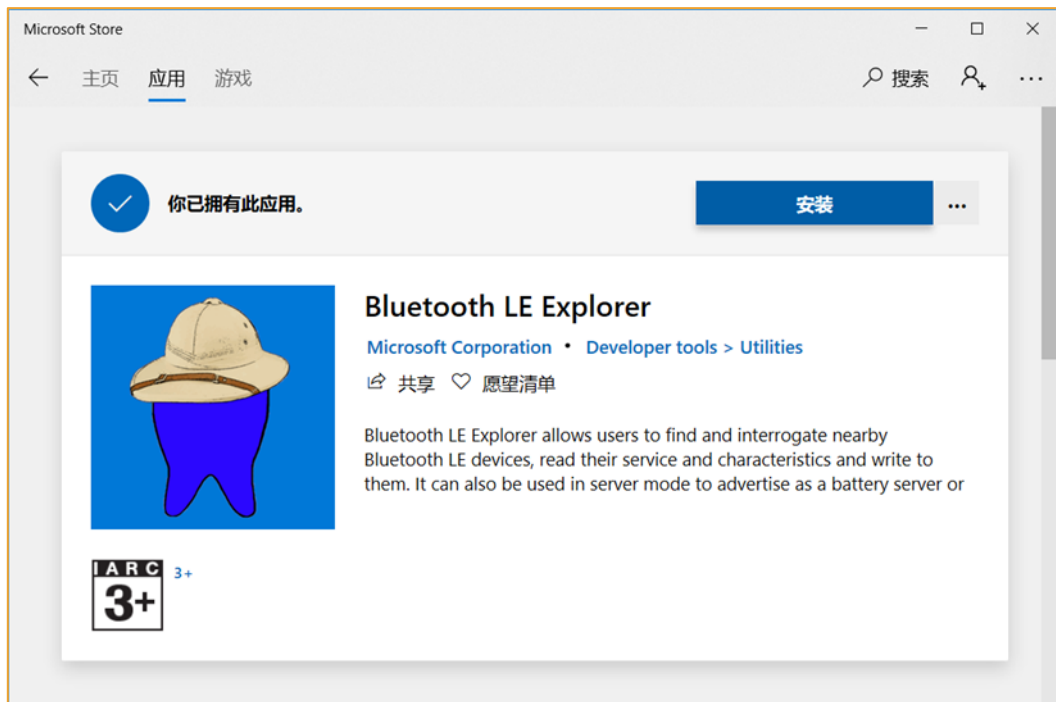


Figure 3.3.1

First turn on the usb and bluetooth switches on the board

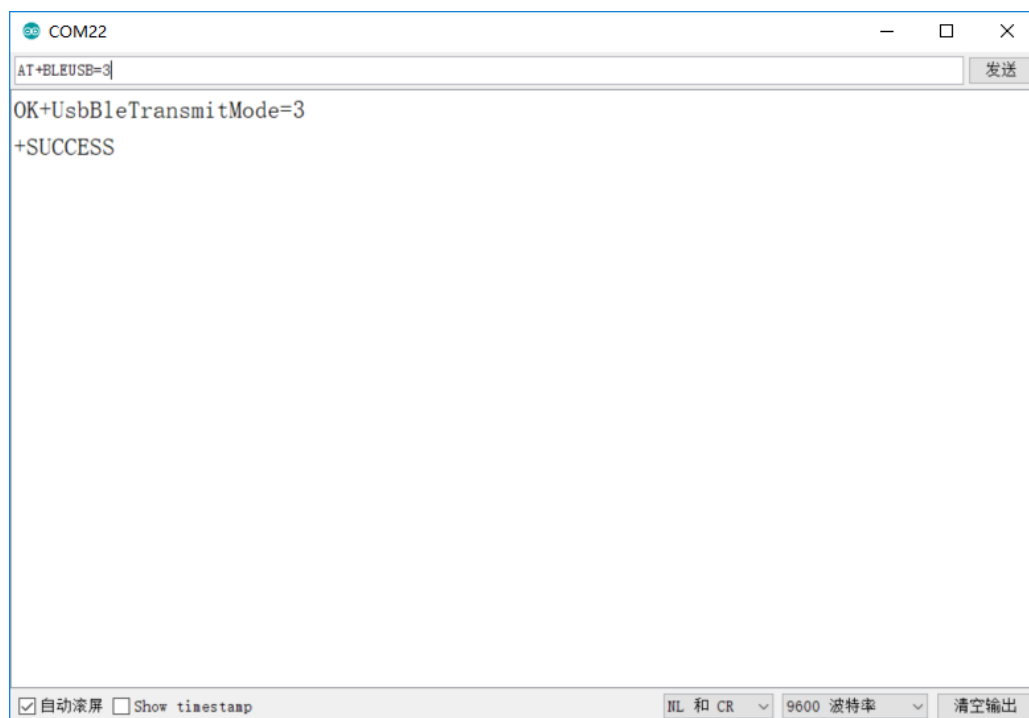


Figure 3.3.2

Click start scan

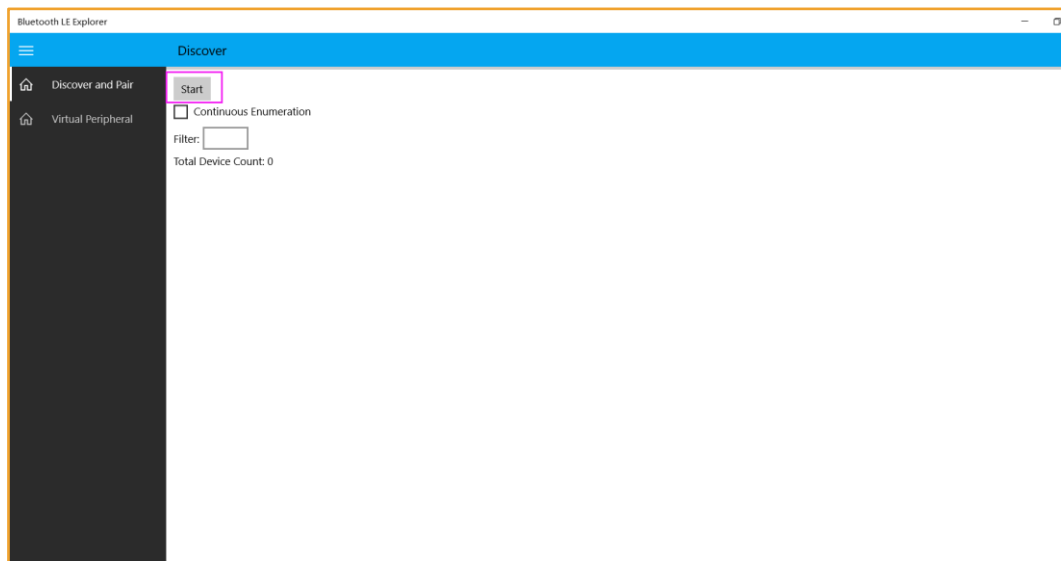


Figure 3.3.4

Find our device named Ble Nano and click link

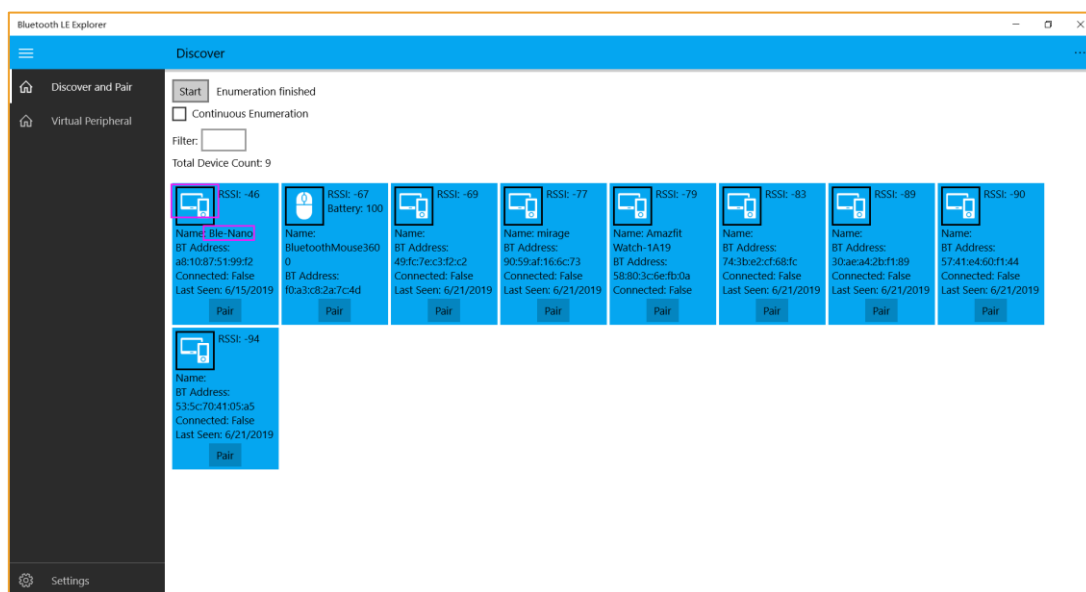


Figure 3.3.5

We select character character codesCharacteristic1

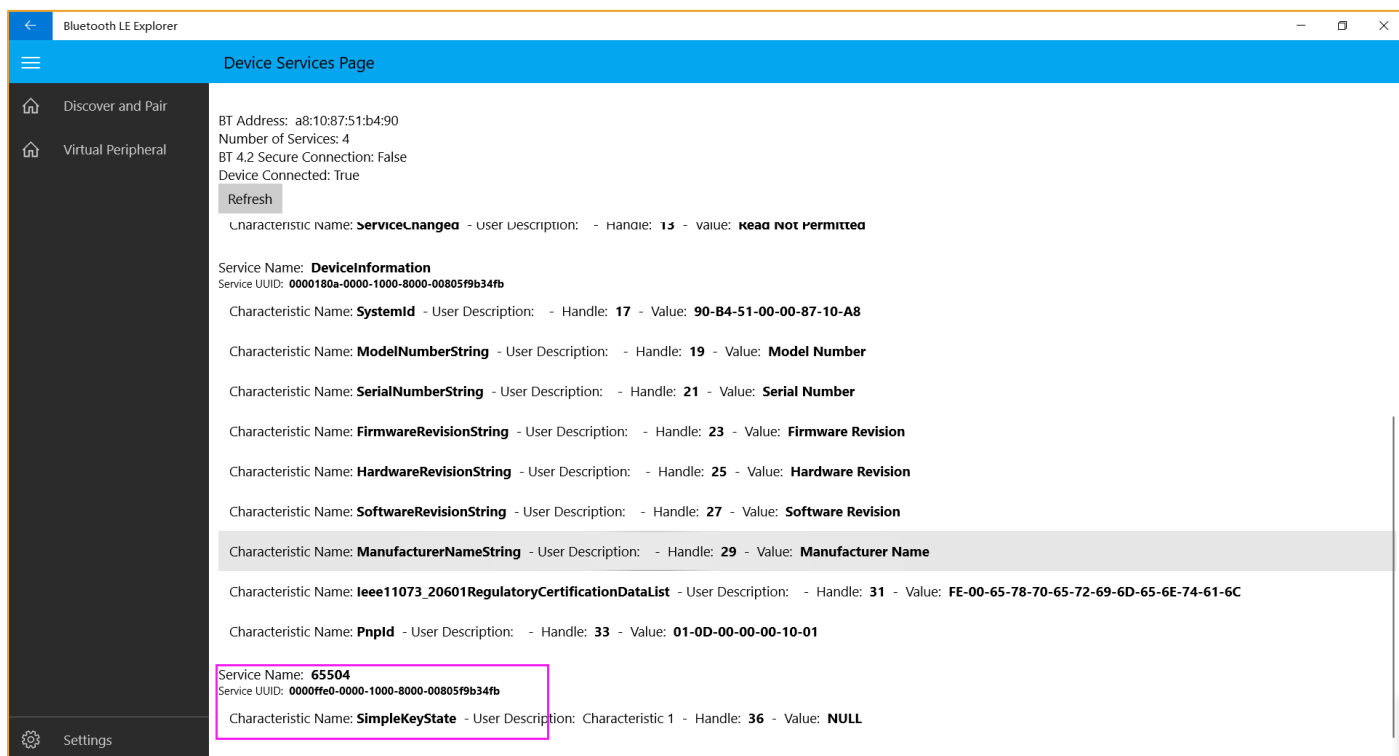


Figure 3.3.6

Win10 send helloworld to Ble-Nano:

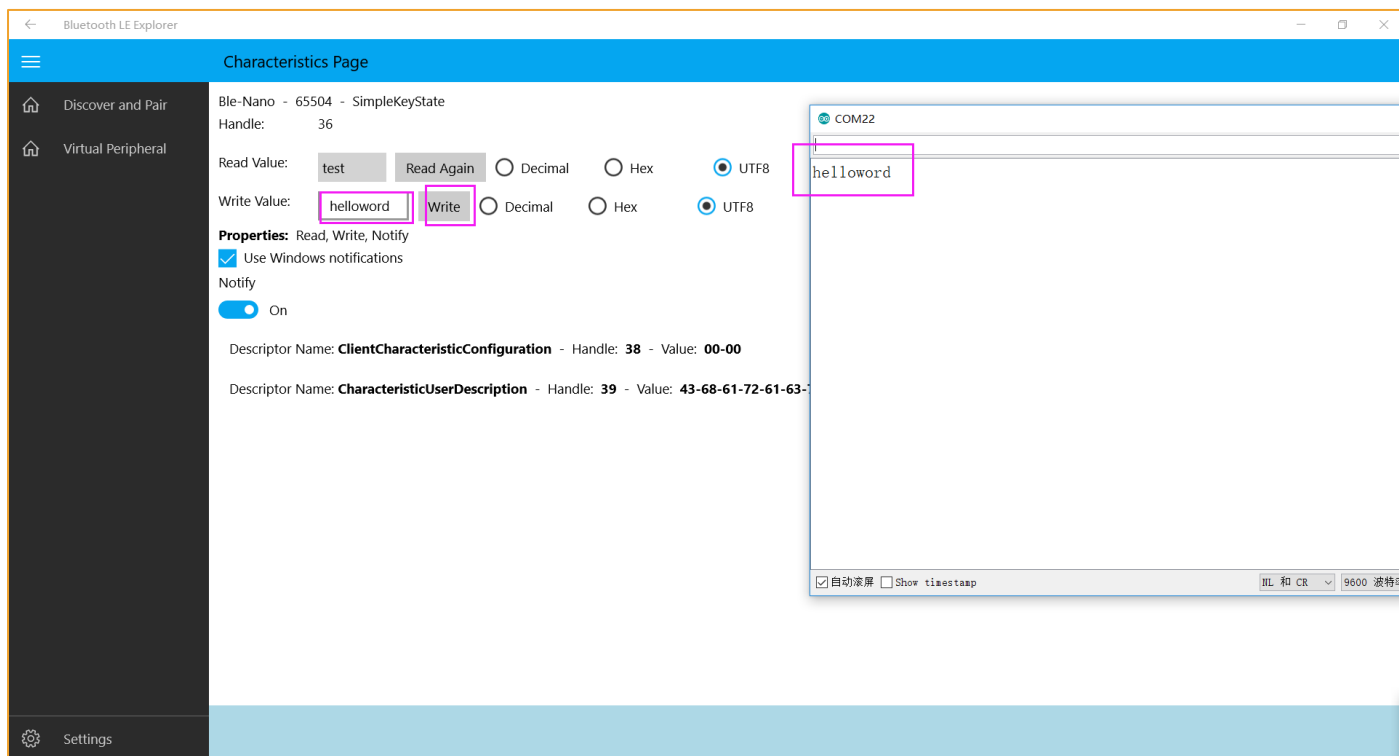
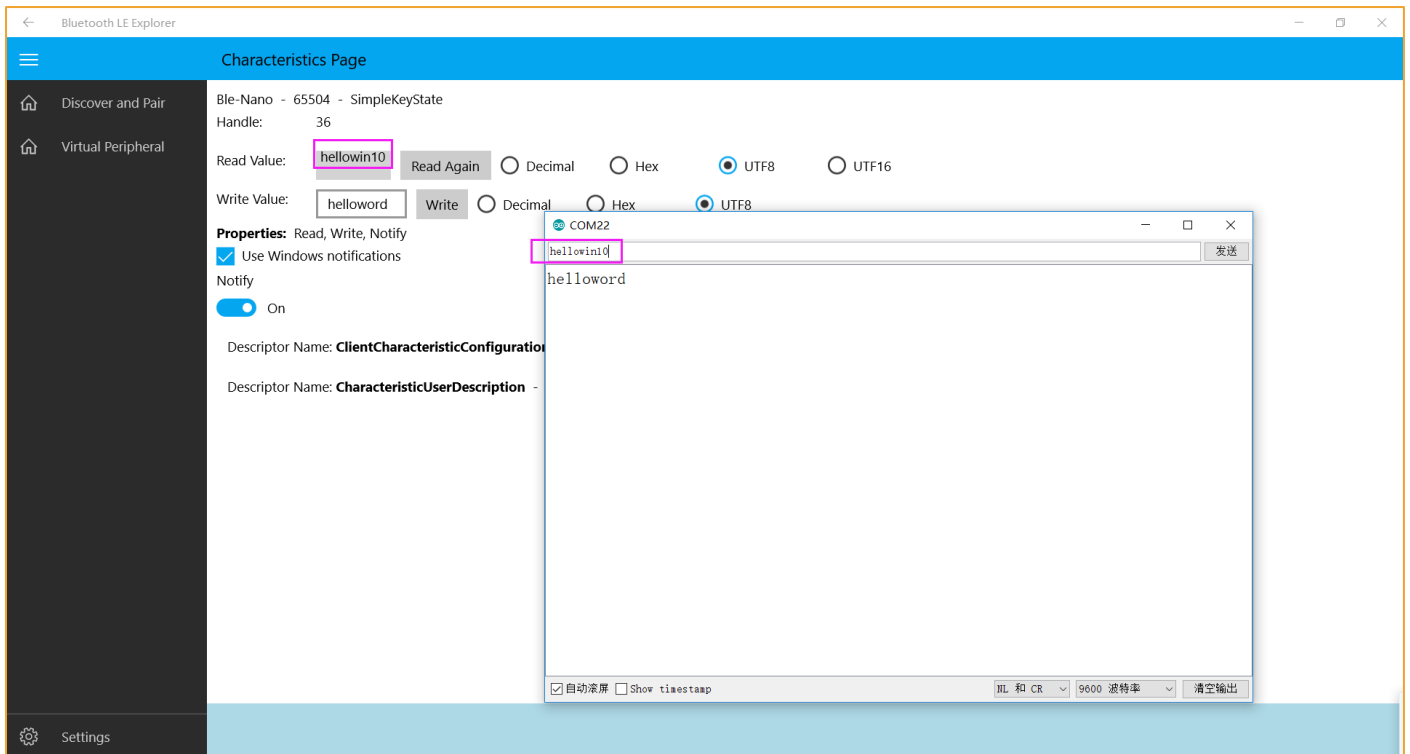


Figure3.3.7

Ble-Nano send helloworld

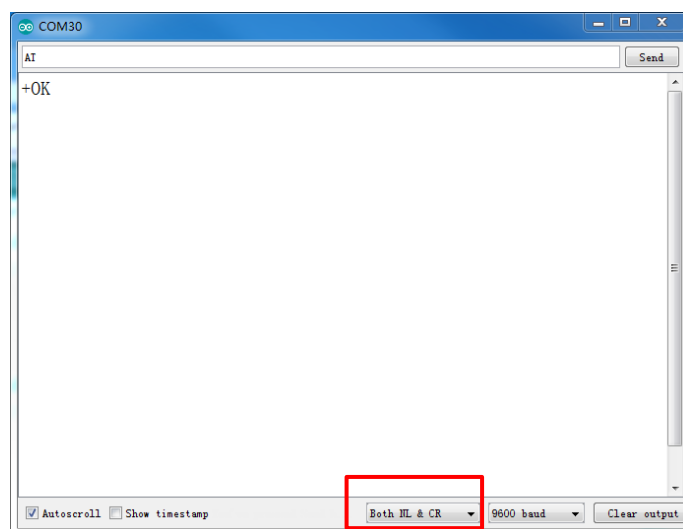


Figuer 3.3.8

Chapter 4 introduction of AT instruction

4.1 AT instruction set

Users can communicate via a serial port and bluetooth chip, a serial port using Micro - USB cable, baud rate support. 9600192 00384 00576 00115 200. The default baud rate of the serial port is 9600bps. (note: when sending the AT command must be carriage returns, the AT command can only be effective in the module not connected state, once the bluetooth module is connected to the equipment, bluetooth module into data passthrough mode), the AT commands are case sensitive, both ends in return, newline characters: \r \n)



Note: Need send CRLF end line

List	Command	Effect	M/S	Work Mode	default
1	AT+ALL	Print all the configuration information for the BLE configuration	M/S	/	/
2	AT+BAUD	Configure serial port baud rate	M/S		9600
3	AT+PARITY	Set the serial port check bit	M/S		0
4	AT+STOPBIT	Set the serial port stop bit	M/S		0
5	AT+NAME	Configure bluetooth device name	M/S		Ble-Nano
6	AT+VER	View the BLE firmware version number	M/S		V1.1
7	AT+MAC	View bluetooth 12-bit MAC address	S		/
8	AT+ROLE	Configure the BLE master-slave mode	M/S		1
9	AT+SCAN	Scan surrounding bluetooth devices	M		/
10	AT+CONN	Connect the scan result to the subscript of bluetooth	M		/
11	AT+CON	Connect the corresponding Mac address to bluetooth	M		/
12	AT+AUTOCON	Automatically connect to the nearest slave bluetooth, and restart to take effect	M		0
13	AT+DISCON	Break the current link	M		/
14	AT+AUTH	Set whether a password is required for a bluetooth connection	S		0
15	AT+PASS	Set the bluetooth connection password	S		000000

16	AT+ MODE	Set bluetooth working mode	M/S		0
17	AT+ BLEUSB	Set bluetooth USB and bluetooth data transfer modes	M/S		0
18	AT+ TXPOWER	Set bluetooth transmission power	M/S		0
19	AT+MINI_INTE RVAL	Set the minimum communication interval of BLE chip	M/S		6
20	AT+MAX_INTE RVAL	Set the maximum communication interval of BLE chip	M/S		6
21	AT+SRVUUID	Get the bluetooth signature UUID	M/S		0xFFE0
	AT+CHARUUID	Gets the character signature	M/S		0xFFE1
21	AT+RXGAIN	Set the BLE receive gain	M/S		1
22	AT+RESETR	Bluetooth device software restart	M/S		/
23	AT+SETTING	system settings	M/S		/

4.2 AT Instruction set specification

1、 Test instruction

Command	Response	Parameter
AT	+OK	NULL

2、 Print all configuration instructions for Ble-Nano

Command	Response	Parameter
AT+ALL	Detailed configuration information	Null

3、 Configure serial port baud rate

Command	Response	Parameter
AT+BAUD=<Param>	OK+Baud=<Param> +SUCCESS	0:9600 1:19200 2:38400 3:57600 4:115200

4、 Configure the check bit for the serial port

Command	Response	Parameter
AT+PARITY=<Param>	OK+Parity=<Param> +SUCCESS	0:NULL 1: even parity check 2: Odd Parity Check

5、 Configure the stop bit for the serial port

Command	Response	Parameter
AT+STOPBIT=<Param>	OK+StopBit=<Param> +SUCCESS	0:1bit 1:2bits

6、 Configure bluetooth name

Command	Response	Parameter
AT+NAME=<Param>	OK+Name=<Param> +SUCCESS	Bluetooth Name

7、 Query BLE-Nano firmware version

Command	Response	Parameter
AT+VER	OK+Version=<Result>	Null

8、 Query the Mac address of bluetooth

Command	Response	Parameter
AT+MAC	OK+Mac=<Result>	Null

9、 Query sets bluetooth master-slave mode

Command	Response	Parameter
AT+ROLE=<Param>	OK+RoleMode=<Param> +SUCCESS	0:Master 1:Slave

10、 Bluetooth master slave mode scans nearby slave

Command	Response	Parameter
AT+SCAN	OK+Scan OK+DISC[0]:xxxx OK+DISC[1]:xxxx	Null

.....
OK+SCAN DONE

11、 Connect slave bluetooth by scanning return index

Command	Response	Parameter
AT+CONN=<Param>	OK+CONN=<Param>	Scan slave bluetooth subscript Numbers

12、 Connect the slave to bluetooth by connecting the master to the slave via bluetooth Mac address

Command	Response	Parameter
AT+CON=<Param>	OK+CON=<Param>	Slave bluetooth address

- OK+Scan
- OK+DISC[0]:3234CFE9D1C3
- OK+DISC[1]:464288AEAB8F
- OK+DISC[2]:3CA5080A62FB
- OK+DISC[3]:30AEA42BF189
- OK+DISC[4]:58803C6EFB0A
- OK+SCAN DONE
- AT+CONN=1 Represents the second bluetooth device scanned by the connectionAT + CON = 464288AEAB8F Connect directly to a device with the Mac address 464288AEAB8F

13、 Enable bluetooth automatic connection mode

When enabled, the bluetooth module will automatically connect to the device that was successfully connected last time

Command	Response	Parameter
AT+AUTOCON=<Param>	OK+AutoCon=<Param> +SUCCESS	0: Close automatic connection 1: Automatic connection at startup

14、 Disconnect from the current bluetooth device

Command	Response	Parameter
AT+DISCON	OK+Disconnect	Null

15、 Set whether a password is required for a bluetooth connection

Command	Response	Parameter
AT+AUTH=<Param>	OK+AuthMode=<Param> +SUCCESS	0: Not need Password connection required 1: Password connection required

16、 Setting the bluetooth connection is a password

Command	Response	Parameter
AT+ PASS=<Param>	OK+ PassWord=<Param> +SUCCESS	

17、 Set bluetooth working mode

Command	Response	Parameter
AT+ MODE=<Param>	OK+ WorkMode=<Param> +SUCCESS	0: unvarnished transmission 1: driving pattern 2:iBeacon

18、 Set bluetooth USB and bluetooth data transfer modes

Command	Response	Parameter
AT+ BLEUSB=<Param>	OK+UsbBleTransmitMode=<Param> +SUCCESS	0:close 1:USB Serial data to BLE 2:BLE data to USB 串口 3:USB Serial data and BLEunvarnished transmission

19、 Set the bluetooth transmission power

Command	Response	Parameter
AT+ TXPOWER=<Param>	OK+TxPower=<Param> +SUCCESS	0:4db 1:0db 2:-6db 3:-23db

19、 Sets the minimum communication interval in milliseconds for the BLE chip

Command	Response	Parameter
AT+MINI_INTERVAL=<Param>	OK+ Mini_Interval=<Param> +SUCCESS	For PC and Android, it is recommended to set it to 10iOS

		device, and it is recommended to set it to 20
--	--	---

20、Sets the maximum communication interval in milliseconds for the BLE chip

Command	Response	Parameter
AT+MAX_INTERVAL=<Param>	OK+Max_Interval=<Param> +SUCCESS	For PC and Android, it is recommended to set it to 10 iOS devices and 40

21、Set the BLE receive gain

Command	Response	Parameter
AT+RXGAIN=<Param>	OK+RxGain =<Param> +SUCCESS	0: Typical Gain 1: HG(high gain)

22、Set the BLE feature code UUID

Command	Response	Parameter
AT+SRVUUID	Service UUID=0XFFE0	

23、Set the BLE character feature code

Command	Response	Parameter
AT+CHARUUID	Char UUID=0XFFE1	

24、Software Reset

Command	Response	Parameter
AT+RESETR	null	NULL

25、System setting

Command	Response	Parameter
AT+SETTING=<Param>	+SUCCESS	DEFAULT: factory data reset PARI_DEFAULT :Clear pairing information

4.3 development instructions

Because bluetooth of the product is pass-through function, bluetooth programming is actually to read and write arduino serial port (Serial)

BLE protocol stipulates that the length of each bluetooth packet should not exceed 20byte, and the data transmission interval of each packet should be more than 150ms, otherwise it is easy to lose the packet. We need to pay attention to two points when programming

4.4 Ble-Nano master-slave communication and Processing application

Most of the time, we use Ble Nano and Processing to complete our own ideas. The simplest solution is as follows

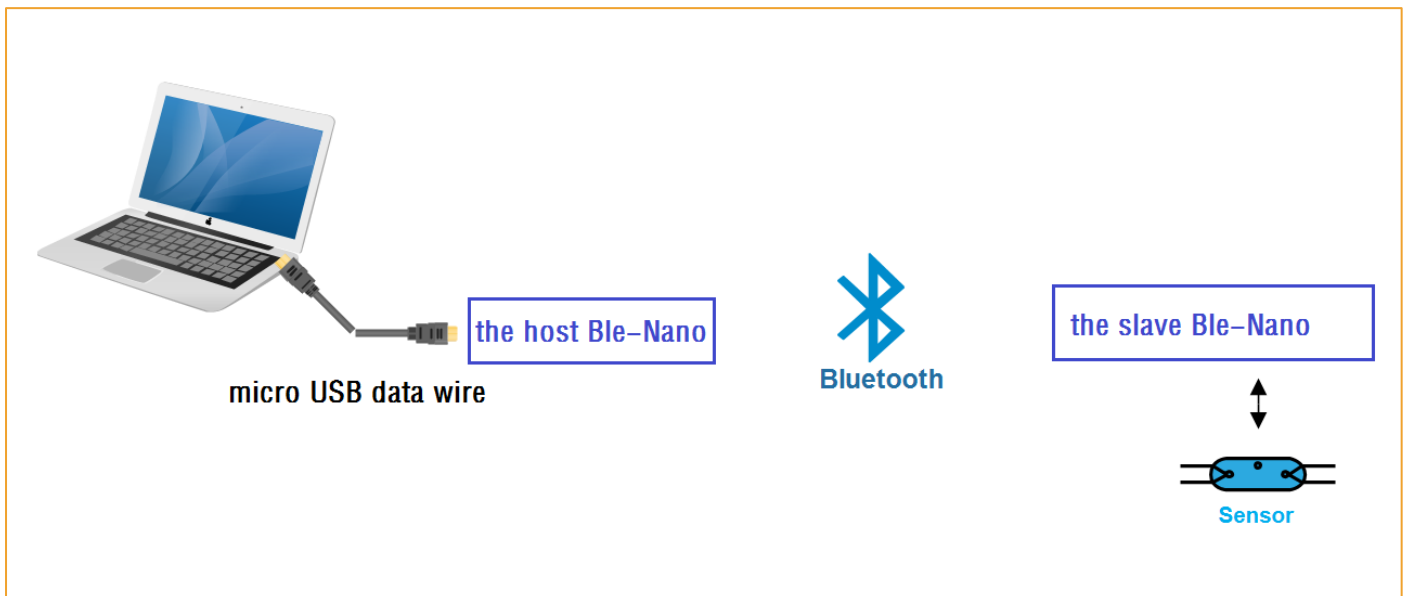


Figure 4.4.1

Step1. First read the MAC address of the slave (COM57) usb connection to the slave (COM52) as follows

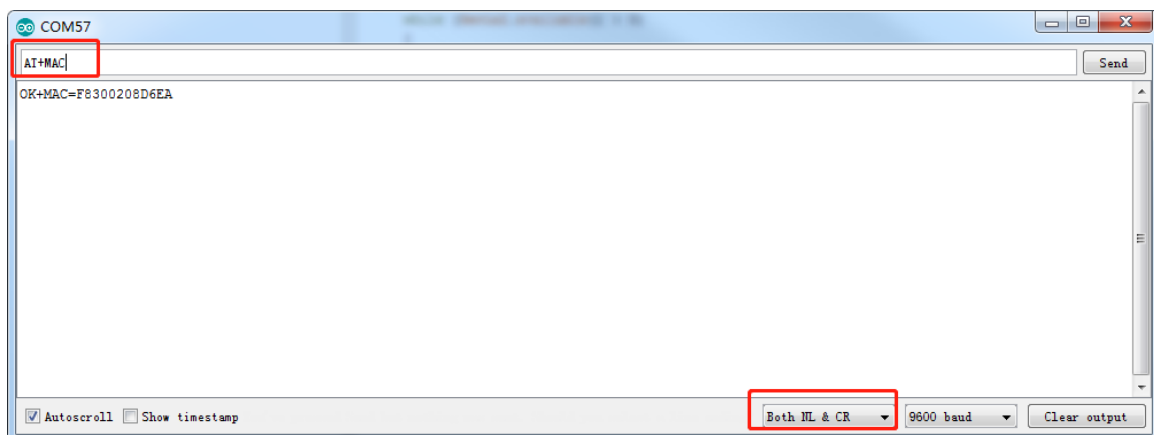


Figure 4.4.2

Step2. Connect USB to host Ble Nano and set it to host (COM52) mode

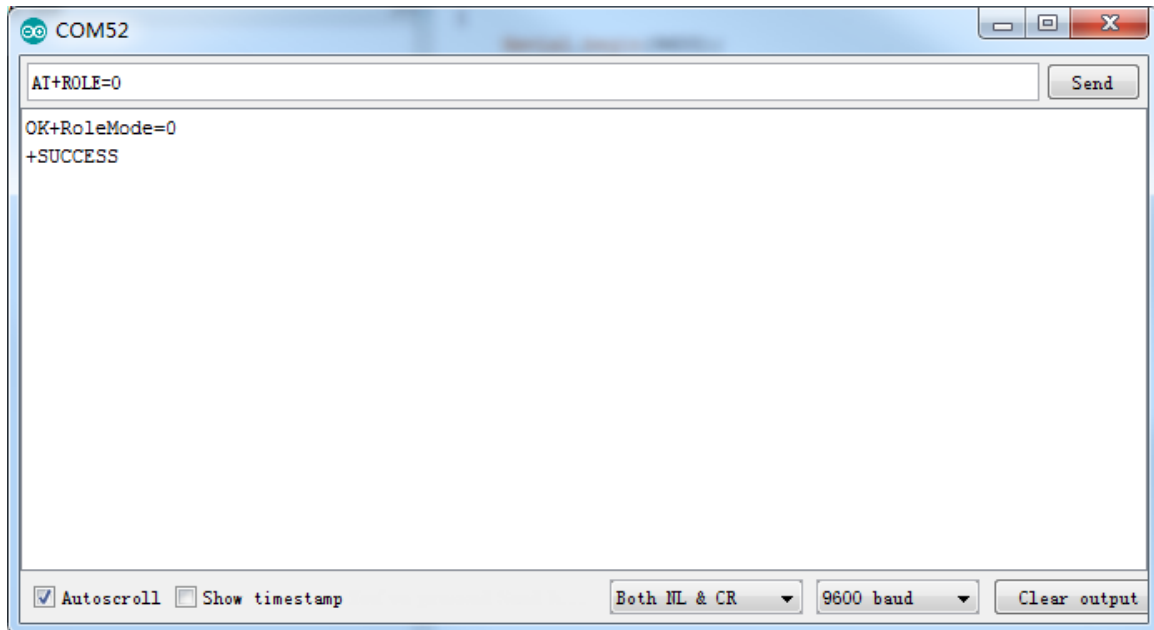


Figure 4.4.3

Step3. Turn on the automatic connection function of (COM57) to facilitate direct connection next time

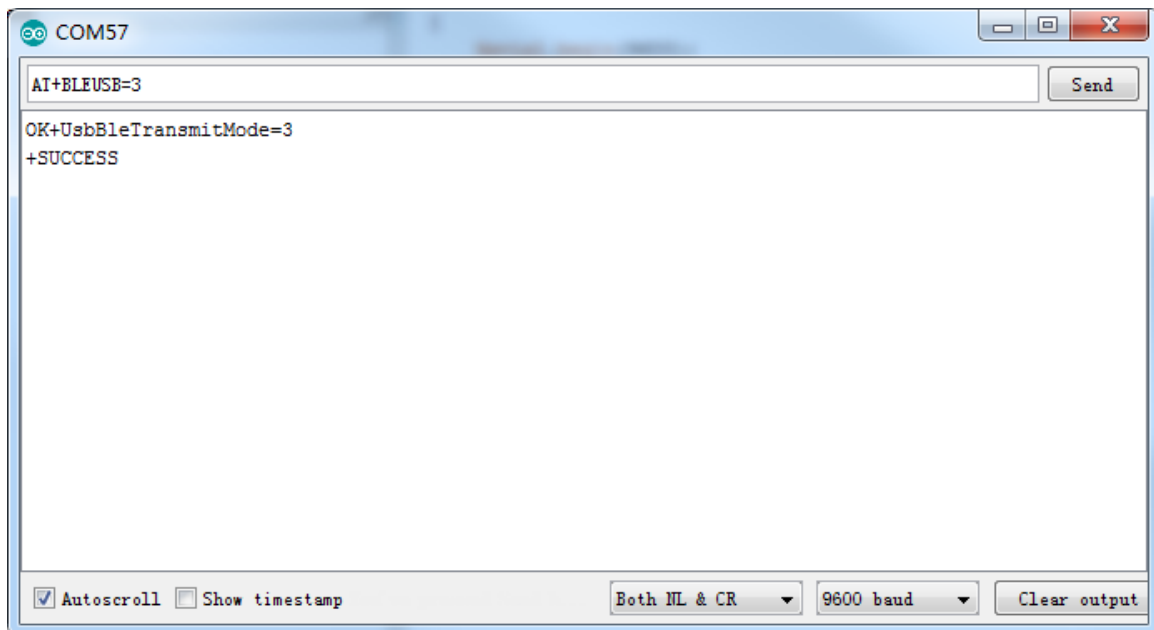


Figure 4.4.4

Step4. AT+BLEUSB=3 host (COM52) open USB serial port and bluetooth communication function so that bluetooth can communicate directly with USB port

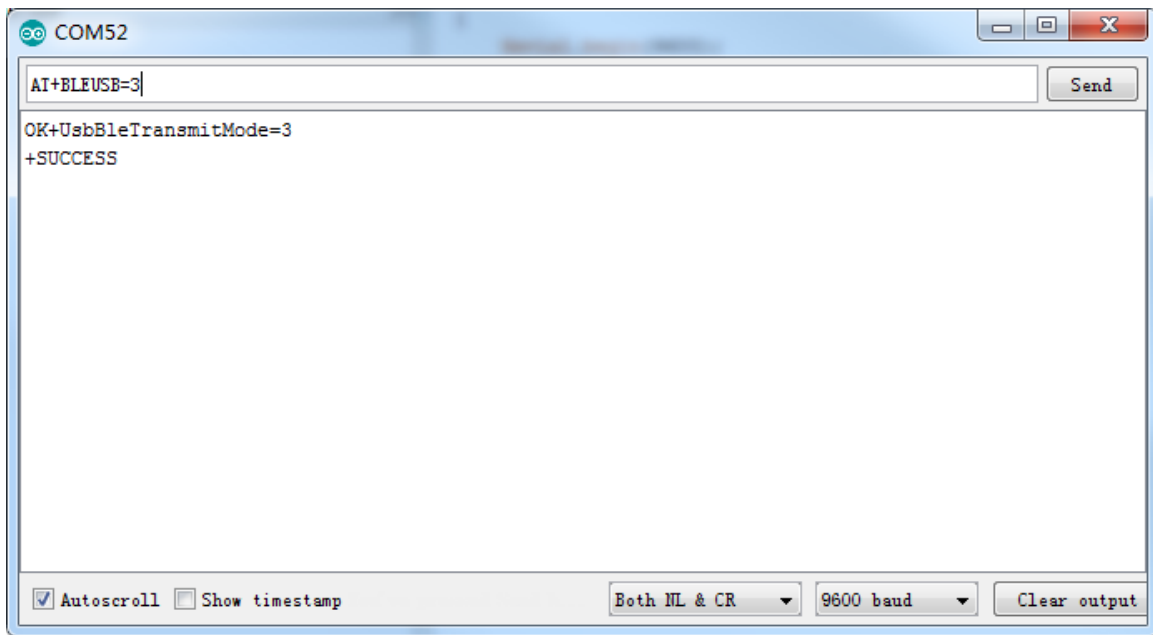


Figure 4.4.5

Step5. AT+CON add slave machine (COM57) MAC address can be directly connected

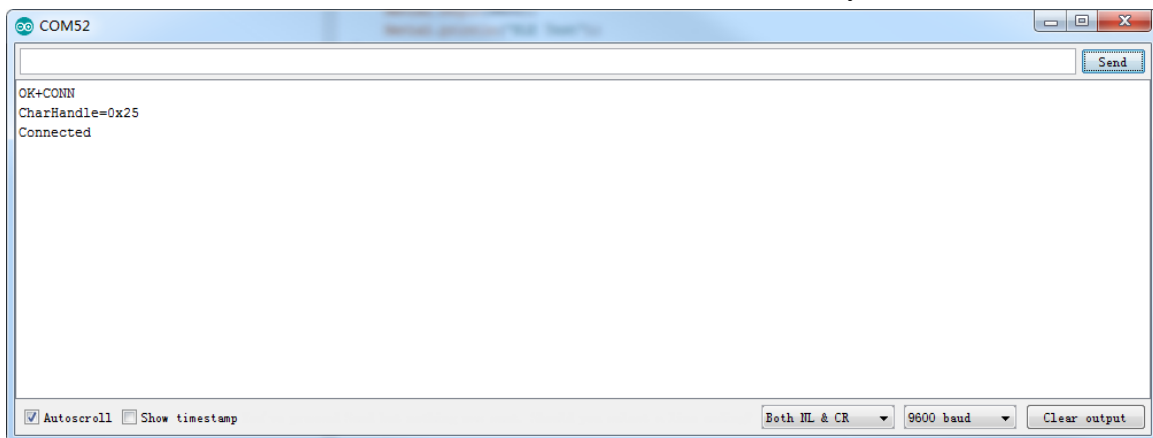


Figure 4.4.6

Note that if there are other programs in the host that will affect the use, it is recommended to burn a blank program in the host arduino

The host connects to the computer by creating a virtual port. In my computer device manager, I can see the port number

The corresponding port number can complete the communication

4.5 FAQ

Q1: What is the difference between a Ble-Nano and a regular Nano board, and how do I start using this development board

A1: Ble - is the Nano in the original official arduino Nano V3.0 adding CC2540 Mini bluetooth 4.0 interface
- Usb upgraded to a more general Micro - Usb interface, pin function is fully compatible with latest Bootload
Bootload burning need to use the above 1.8.8 IDE can burn, other methods of use please refer to the official arduino Nano usage.

Q2 : Common problem of abnormal communication between bluetooth 4.0.

A2: Recommended inspection steps:

- 1) Update firmware to latest version;
- 2) Restore factory Settings by AT instruction (AT+SETTING=DEFAULT). (see: configure BLE devices by AT instruction)
- 3) Check whether the communication baud rate of bluetooth module, program code and other relevant places is consistent; (the control panel with a crystal oscillator frequency of 8MHz supports a baud rate of up to 38400bps.)
- 4) Whether the bluetooth device supports 4.0 or not, there will be compatibility problems with the bluetooth module of CC2540 and other brands. Please try your best to connect with the bluetooth module of CC25xx

Q3 :Why can't my phone connect to the Ble-Nano, and even if it does, it can't communicate?

A3: Please check whether your mobile phone supports bluetooth 4.0. In addition, please use the Scan button in the APP to Scan the connection of Ble-Nano. No password is required for connection. The bluetooth setting interface and other BLE apps are not supported.

Q4:How to use Ibeacon function?

A4: Not support

Q5 : Does Ble-Nano support multi - connection? I want to connect many slave machines with one host, how many can I connect at most?

A5: Ble-Nano does not support multi-connection, but the idea of multi-connection can be realized by constantly switching binding slave machines.

Q6 : Why can't the Ble-Nano bluetooth 4.0 products connect to bluetooth 2.0 devices?

A6: In order to achieve very low power consumption, our Ble-Nano series adopts single-mode Bluetooth Smart, which is optimized in both hardware and software, and can only support BLE, but not connected to Bluetooth 2.0 devices.