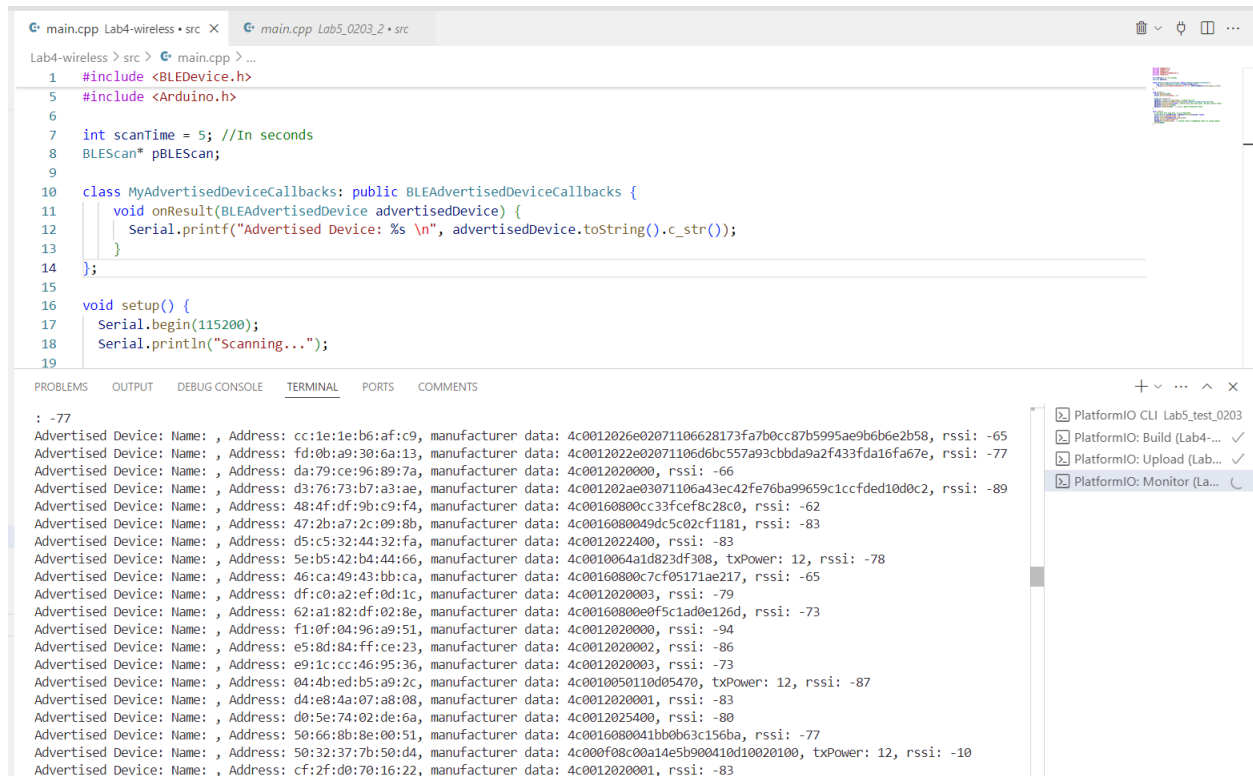


# Lab 4 - ESP32 Wireless Lab

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**Screenshot of your serial monitor displaying the number of Bluetooth devices detected using your MCU as BLEScanner**



The screenshot shows an IDE with two tabs: 'main.cpp Lab4-wireless' and 'main.cpp Lab5\_0203\_2'. The code in the first tab is a C++ program for an ESP32 acting as a BLE scanner. It includes `<BLEDevice.h>` and `<Arduino.h>`, defines a scan time of 5 seconds, and uses `BLEScan` to scan for devices. A class `MyAdvertisedDeviceCallbacks` implements `onResult` to print device details to the serial monitor. The `setup` function initializes the serial port at 115200 baud and starts scanning.

```
1 #include <BLEDevice.h>
2
3 #include <Arduino.h>
4
5 int scanTime = 5; //In seconds
6 BLEScan* pBLEScan;
7
8 class MyAdvertisedDeviceCallbacks: public BLEAdvertisedDeviceCallbacks {
9     void onResult(BLEAdvertisedDevice advertisedDevice) {
10         Serial.printf("Advertised Device: %s \n", advertisedDevice.toString().c_str());
11     }
12 };
13
14 void setup() {
15     Serial.begin(115200);
16     Serial.println("Scanning...");
17 }
```

The serial monitor output shows a list of detected Bluetooth devices with their names, addresses, manufacturer data, and RSSI values. The output is as follows:

```
: -77
Advertised Device: Name: , Address: cc:1e:1e:b6:af:c9, manufacturer data: 4c0012026e02071106628173fa7b0cc87b5995ae9b6b6e2b58, rssi: -65
Advertised Device: Name: , Address: fd:0b:a9:30:6a:13, manufacturer data: 4c0012022e02071106d6bc557a93cbbda9a2f433fda16fa67e, rssi: -77
Advertised Device: Name: , Address: da:79:ce:96:89:7a, manufacturer data: 4c0012020000, rssi: -66
Advertised Device: Name: , Address: d3:76:73:b7:a3:ae, manufacturer data: 4c001202ae03071106a43ec42fe76ba99659c1ccfded10d0c2, rssi: -89
Advertised Device: Name: , Address: 48:4f:df:9b:c9:f4, manufacturer data: 4c00160800cc33fcef8c28c0, rssi: -62
Advertised Device: Name: , Address: 47:2b:a7:2c:09:8b, manufacturer data: 4c0016080049dc5c02cf1181, rssi: -83
Advertised Device: Name: , Address: d5:c5:32:44:32:fa, manufacturer data: 4c0012022400, rssi: -83
Advertised Device: Name: , Address: 5e:b5:42:b4:44:66, manufacturer data: 4c0010064a1d823df308, txPower: 12, rssi: -78
Advertised Device: Name: , Address: 46:ca:49:43:bb:ca, manufacturer data: 4c00160800c7cf05171ae217, rssi: -65
Advertised Device: Name: , Address: df:c0:a2:ef:0d:1c, manufacturer data: 4c0012020003, rssi: -79
Advertised Device: Name: , Address: 62:a1:82:df:02:8e, manufacturer data: 4c00160800e0f5c1ad0e126d, rssi: -73
Advertised Device: Name: , Address: f1:0f:04:96:a9:51, manufacturer data: 4c0012020000, rssi: -94
Advertised Device: Name: , Address: e5:8d:84:ff:ce:23, manufacturer data: 4c0012020002, rssi: -86
Advertised Device: Name: , Address: e9:1c:cc:46:95:36, manufacturer data: 4c0012020003, rssi: -73
Advertised Device: Name: , Address: 04:4b:ed:b5:a9:2c, manufacturer data: 4c0010050110d05470, txPower: 12, rssi: -87
Advertised Device: Name: , Address: d4:e8:4a:07:a8:08, manufacturer data: 4c0012020001, rssi: -83
Advertised Device: Name: , Address: d0:5e:74:02:de:6a, manufacturer data: 4c0012025400, rssi: -80
Advertised Device: Name: , Address: 50:66:8b:8e:00:51, manufacturer data: 4c0016080041bb0b63c156ba, rssi: -77
Advertised Device: Name: , Address: 50:32:37:7b:50:d4, manufacturer data: 4c000f08c00a14e5b900410d10020100, txPower: 12, rssi: -10
Advertised Device: Name: , Address: cf:2f:d0:70:16:22, manufacturer data: 4c0012020001, rssi: -83
```

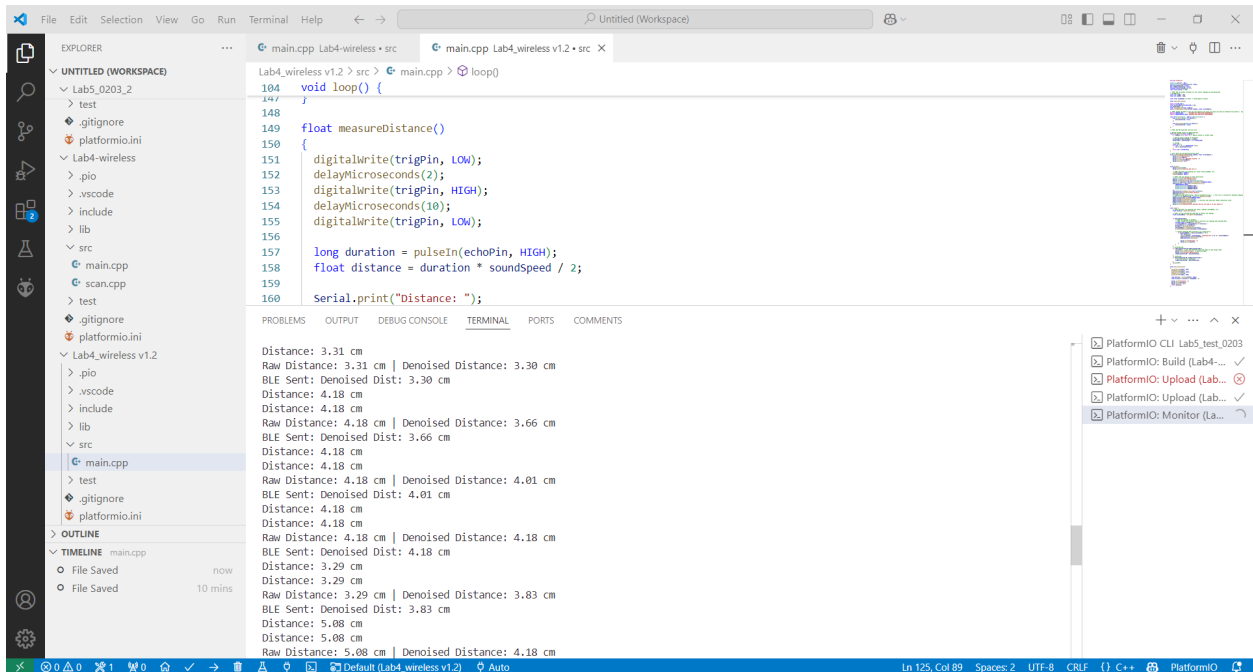
**Screenshot of the serial monitor of your client device to show a successful connection with your server device (make sure the server device's name is included).**

```

--- Terminal on /dev/cu.usbmodem101 | 9600 8-N-1
--- Available filters and text transformations: colorize, debug, default, direct, esp32_exception_decoder, hexli
fy, log2file, nocontrol, printable, send_on_enter, time
--- More details at https://bit.ly/pio-monitor-filters
--- Quit: Ctrl+C | Menu: Ctrl+T | Help: Ctrl+T followed by Ctrl+H
- Found our service
✓ Successfully connected to BLE server: XIA0_ESP32S3_Lily
- Found our characteristic
The characteristic value was: Denoised Dist: 5.36 cm
We are now connected to the BLE Server.
Setting new characteristic value to "Time since boot: 1"
Raw BLE Data: Denoised Dist: 5.37 cm
Extracted Distance: 5.37 cm | Max: 5.37 cm | Min: 5.37 cm
Collected 1 data points.
Setting new characteristic value to "Time since boot: 2"
Raw BLE Data: Denoised Dist: 5.37 cm
Extracted Distance: 5.37 cm | Max: 5.37 cm | Min: 5.37 cm
Collected 2 data points.
Setting new characteristic value to "Time since boot: 3"
Raw BLE Data: Denoised Dist: 5.37 cm
Extracted Distance: 5.37 cm | Max: 5.37 cm | Min: 5.37 cm
Collected 3 data points.
Setting new characteristic value to "Time since boot: 4"
Raw BLE Data: Denoised Dist: 5.37 cm
Extracted Distance: 5.37 cm | Max: 5.37 cm | Min: 5.37 cm
Collected 4 data points.
Setting new characteristic value to "Time since boot: 5"
Raw BLE Data: Denoised Dist: 5.37 cm
Extracted Distance: 5.37 cm | Max: 5.37 cm | Min: 5.37 cm
Collected 5 data points.
Setting new characteristic value to "Time since boot: 6"
Raw BLE Data: Denoised Dist: 5.37 cm

```

Screenshot of the serial monitor of your server device to show the raw and denoised sensor data.



**Screenshot of the serial monitor of your client device to show the current, maximum, and minimum data transmitted from your server device.**

```
Setting new characteristic value to "Time since boot: 39"  
Raw BLE Data: Denoised Dist: 5.24 cm  
Extracted Distance: 5.24 cm | Max: 7.84 cm | Min: 3.29 cm  
Collected 10 data points.  
Setting new characteristic value to "Time since boot: 40"  
Raw BLE Data: Denoised Dist: 6.07 cm  
Extracted Distance: 6.07 cm | Max: 7.84 cm | Min: 3.29 cm  
Collected 10 data points.  
Setting new characteristic value to "Time since boot: 41"  
Raw BLE Data: Denoised Dist: 5.83 cm  
Extracted Distance: 5.83 cm | Max: 7.84 cm | Min: 3.29 cm  
Collected 10 data points.  
Setting new characteristic value to "Time since boot: 42"  
Raw BLE Data: Denoised Dist: 4.48 cm  
Extracted Distance: 4.48 cm | Max: 7.84 cm | Min: 3.29 cm  
Collected 10 data points.  
Setting new characteristic value to "Time since boot: 43"  
Raw BLE Data: Denoised Dist: 3.06 cm  
Extracted Distance: 3.06 cm | Max: 7.84 cm | Min: 3.06 cm  
Collected 10 data points.  
Setting new characteristic value to "Time since boot: 45"  
Raw BLE Data: Denoised Dist: 3.01 cm  
Extracted Distance: 3.01 cm | Max: 7.84 cm | Min: 3.01 cm  
Collected 10 data points.  
Setting new characteristic value to "Time since boot: 46"  
Raw BLE Data: Denoised Dist: 3.78 cm  
Extracted Distance: 3.78 cm | Max: 7.84 cm | Min: 3.01 cm  
Collected 10 data points.  
Setting new characteristic value to "Time since boot: 47"  
Raw BLE Data: Denoised Dist: 4.25 cm  
Extracted Distance: 4.25 cm | Max: 7.84 cm | Min: 3.01 cm  
Collected 10 data points.  
Setting new characteristic value to "Time since boot: 48"  
Raw BLE Data: Denoised Dist: 3.89 cm  
Extracted Distance: 3.89 cm | Max: 7.84 cm | Min: 3.01 cm  
Collected 10 data points.  
Setting new characteristic value to "Time since boot: 49"
```

- python... ✓
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