

Unity3DBrainLinkProSDK V1.0.4

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SDK Version: 1.0.4

MCU: 4.201

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Update record:

- 1. V1.0.4 Added the switch of Ap and angle value
- 2. V1.3.3 Added new Bluetooth data fields HRV
- 3. V1.0.1 Android SDK optimization, adding detailed development steps
- 4. V1.0.0 Unity3D Mobile SDK



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Unity3D BrainLinkProSDK Development Manual

Introduction

This guide will guide you how to use the Unity3D BrainLinkProSDK to get brainwave data from Macrotellect's hardware. This will allow your mobile application to receive and use brainwave data such as BLEMIND and BLEGRAVITY, and you can get them via Bluetooth, Macrotellect's hardware, and the file resource Unity3D BrainLinkProSDK.

Function:

Receive brain wave data.

The file contains:

- API reference (this document)
- Asset/iOS
- Asset/Android

Supported hardware devices:

- Data format with battery life
- BrainLink_Pro

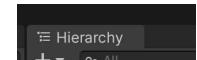
Supported iOS/Android version:

iOS 9.0 + / Android SDK 26+

Supported Unity 3D version:Unity2019 +

Unity3D using method

Create new gameObject"ThinkGearManager",



- Add ThinkGearMnanger.cs script
- Detailed method ——Demo scene and Demo.cs script

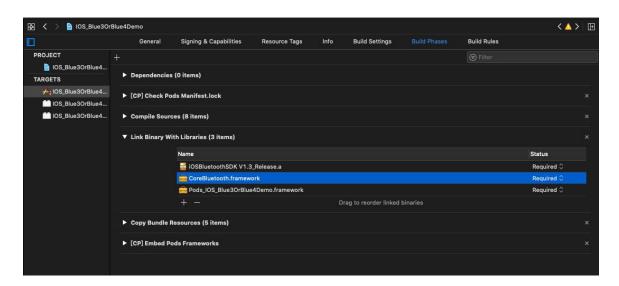


iOS configuration:

Step 1:

- 1.1 in Xcode project TARGETS Build Phases import IOS system framework as following
- CoreBluetooth . framework

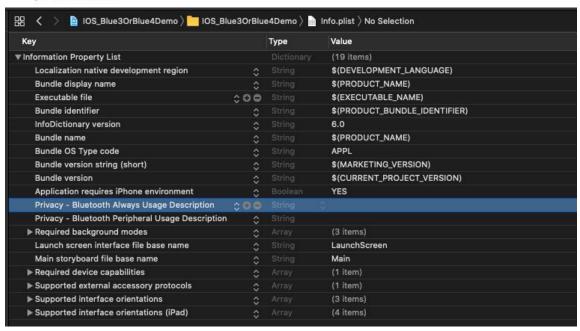
As picture:



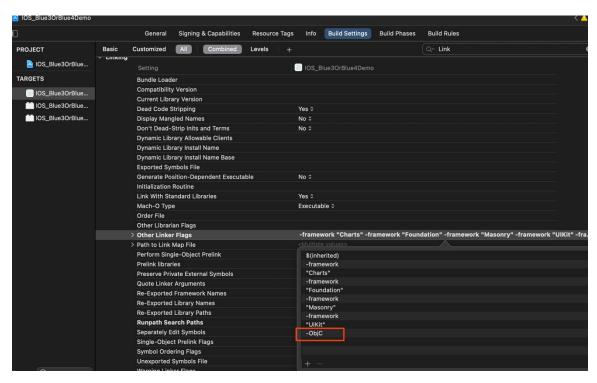
add Bluetooth permission to Info.plist (IOS13 Need to add Bluetooth permission Privacy — Bluetooth Always Usage Description, Privacy — Bluetooth Peripheral Usage Descriptio)

As picture:





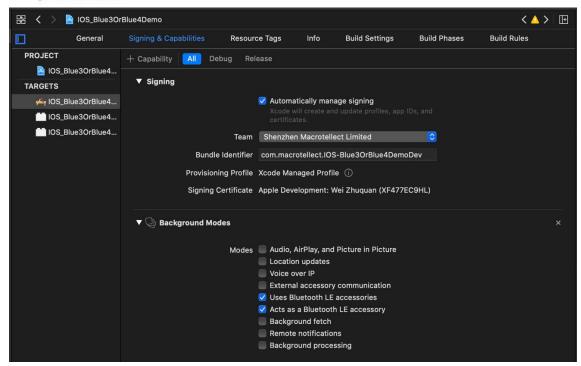
TARGETS Build Settingslink--->add from "Other Linker Flags: -ObjC



1.2 If you want Bluetooth to run in the backend, please set as follows, you don't need to set it if you don't need it

As picture:





Step 2:

IN UnityAppController.mm file

```
Import header file
#import "Blue4Manager.h"
Add method at the end of the file
extern "C"{
    void SendSettings(char *settings){
         NSData *data = [[NSString stringWithCString:settings encoding:NSUTF8StringEncoding]
dataUsingEncoding: NSUTF8StringEncoding];
         [[Blue4Manager shareInstance] writeToProAWithCode:data];
    void Connect()
         // Bluetooth connection settings
         [Blue4Manager logEnable: YES];
                                                                 [[Blue4Manager
                                                                                       shareInstance]
configureBlueNames: @[@"BrainLink_Pro", @"BrainLink_Lite", @"BrainLink", @"BrainLink_Lite_P", @"BrainL
ink_Lite", @"ROYWOS", @"BrainLink_Pink"] ableDeviceSum: 1];
          // Bluetooth connection successful
```



```
[Blue4Manager shareInstance] blueConBlock = ^(NSString *markKey) {
               if ([markKey isEqualToString:@"1"]) {
                      // Determine the connected device
                   NSLog(@"A Device Bluetooth connection is successful");
                   UnitySendMessage("ThinkGearManager", "ReceiveContentState", "yes");
          };
         // Bluetooth disconnection callback
         [Blue4Manager shareInstance].blueDisBlock =
                                                       ^(NSString *markKey){
              if ([markKey isEqualToString:@"1"]) {
                  // Determine the connected device
                  NSLog(@"A Device Bluetooth disconnect"):
                  UnitySendMessage("ThinkGearManager", "ReceiveContentState", "no");
//
                         UnitySendMessage("ThinkGearManager", "ReceiveBlueToothType", "");
         };
         //Data callback of the first device (A) Data callback of other devices as hzlblueDataBlock_B
与 hzlblueDataBlock_A's same coding method
         [Blue4Manager shareInstance].hzlblueDataBlock_A = ^(HZLBlueData *blueData, BlueType conBT,
BOOL isFalseCon) {
                   if (conBT == BlueType_Pro) {
                        if (blueData.bleDataType == BLEMIND) {
                             // If the signal value is 0, the Bluetooth device is worn
                             // Note: If the Bluetooth device is connected but not worn, the signal value
is greater than 0 and less than or equal to 200
                                        UnitySendMessage("ThinkGearManager", "ReceiveBlueToothType",
"4_0");
                                UnitySendMessage("ThinkGearManager", "ReceivePoorSignal", [[NSString
stringWithFormat: @"%d", blueData.signal] cStringUsingEncoding: NSUTF8StringEncoding]);
                                     UnitySendMessage("ThinkGearManager", "ReceiveBatteryCapacity",
[[NSString
                                                    stringWithFormat: @"%d", blueData.batteryCapacity]
cStringUsingEncoding: NSUTF8StringEncoding]);
                                UnitySendMessage("ThinkGearManager", "ReceiveAttention", [[NSString
stringWithFormat: @"%d", blueData.attention] cStringUsingEncoding: NSUTF8StringEncoding]);
                                UnitySendMessage("ThinkGearManager", "ReceiveMeditation", [[NSString
stringWithFormat: @"%d", blueData.meditation] cStringUsingEncoding: NSUTF8StringEncoding]);
                                    UnitySendMessage("ThinkGearManager", "ReceiveDelta", [[NSString
stringWithFormat: @"%d", blueData.delta] cStringUsingEncoding: NSUTF8StringEncoding]);
                                    UnitySendMessage("ThinkGearManager", "ReceiveTheta", [[NSString
stringWithFormat: @"%d", blueData.theta] cStringUsingEncoding: NSUTF8StringEncoding]);
                                UnitySendMessage("ThinkGearManager", "ReceiveLowAlpha", [[NSString
stringWithFormat: @"%d", blueData.lowAlpha] cStringUsingEncoding: NSUTF8StringEncoding]);
                                UnitySendMessage("ThinkGearManager", "ReceiveHighAlpha", [[NSString
```



```
stringWithFormat: @"%d", blueData.highAlpha] cStringUsingEncoding: NSUTF8StringEncoding]);
                                 UnitySendMessage("ThinkGearManager", "ReceiveLowBeta", [[NSString
stringWithFormat: @"%d", blueData.lowBeta] cStringUsingEncoding: NSUTF8StringEncoding]);
                                 UnitySendMessage("ThinkGearManager", "ReceiveHighBeta", [[NSString
stringWithFormat: @"%d", blueData.highBeta] cStringUsingEncoding: NSUTF8StringEncoding]);
                              UnitySendMessage("ThinkGearManager", "ReceiveLowGamma", [[NSString
stringWithFormat: @"%d", blueData.lowGamma] cStringUsingEncoding: NSUTF8StringEncoding]);
                              UnitySendMessage("ThinkGearManager", "ReceiveHighGamma", [[NSString
stringWithFormat: @"%d", blueData.highGamma] cStringUsingEncoding: NSUTF8StringEncoding]);
                                UnitySendMessage("ThinkGearManager", "ReceiveHeaetRate", [[NSString
stringWithFormat: @"%d", [blueData.heartRate_intValue]] cStringUsingEncoding: NSUTF8StringEncoding]);
                              UnitySendMessage("ThinkGearManager", "ReceiveTemperature", [[NSString
stringWithFormat: @"%f", [blueData.temperature floatValue]] cStringUsingEncoding: NSUTF8StringEncoding]);
                                  NSString *hrvStr = @"";
                                  if (blueData.HRV != nil) {
                                       for (int i = 0; i < blueData.HRV.count; i++) {
                                           if(i >= 1){
                                                hrvStr = [hrvStr stringByAppendingString:[NSString
         stringWithFormat: @", %dms", [blueData. HRV[i] intValue]]];
                                           }else{
                                                hrvStr = [hrvStr stringByAppendingString:[NSString
         stringWithFormat: @"%dms", [blueData.HRV[i] intValue]]];
                                 UnitySendMessage("ThinkGearManager", "ReceiveGrind4_0", [[NSString
stringWithFormat: @"%d", [blueData.grind intValue]] cStringUsingEncoding: NSUTF8StringEncoding]);
                                   UnitySendMessage("ThinkGearManager", "ReceiveAp4_0", [[NSString
stringWithFormat: @"%d", blueData.ap] cStringUsingEncoding: NSUTF8StringEncoding]);
                                 UnitySendMessage("ThinkGearManager", "ReceiveHardwareversion4_0",
[blueData.hardwareVersion cStringUsingEncoding:NSUTF8StringEncoding]);
                        else if (blueData.bleDataType == BLEGRAVITY) {
                                  UnitySendMessage("ThinkGearManager", "ReceiveXValue", [[NSString
stringWithFormat: @"%d", blueData.xvlaue] cStringUsingEncoding: NSUTF8StringEncoding]);
                                  UnitySendMessage("ThinkGearManager", "ReceiveYValue", [[NSString
stringWithFormat: @"%d", blueData.yvlaue] cStringUsingEncoding: NSUTF8StringEncoding]);
                                  UnitySendMessage("ThinkGearManager", "ReceiveZValue", [[NSString
stringWithFormat: @"%d", blueData.zvlaue] cStringUsingEncoding: NSUTF8StringEncoding]);
                        else if (blueData.bleDataType == BLERaw) {
```



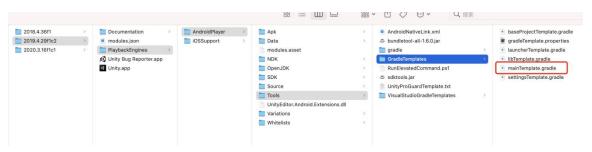
```
UnitySendMessage("ThinkGearManager", "ReceiveRawdata", [[NSString
stringWithFormat: @"%d", blueData.raw] cStringUsingEncoding: NSUTF8StringEncoding]);
                   else if (conBT == BlueType_Jii){
                        if (blueData.bleDataType == BLEMIND) {
                                 UnitySendMessage("ThinkGearManager", "ReceiveAttention", [[NSString
stringWithFormat: @"%d", blueData.attention] cStringUsingEncoding: NSUTF8StringEncoding]);
                               UnitySendMessage("ThinkGearManager", "ReceiveMeditation", [[NSString
stringWithFormat:@"%d",blueData.meditation] cStringUsingEncoding:NSUTF8StringEncoding]);
                                     UnitySendMessage("ThinkGearManager", "ReceiveBatteryCapacity",
[[NSString
                                                    stringWithFormat: @"%d", blueData_batteryCapacity]
cStringUsingEncoding: NSUTF8StringEncoding]);
                             UnitySendMessage("ThinkGearManager", "ReceiveBlutToothType", "4_0");
                   else if (conBT == BlueType_Lite) {
//
                                      UnitySendMessage("ThinkGearManager", "ReceiveBlueToothType",
"").
                        if (blueData.bleDataType == BLEMIND) {
                               UnitySendMessage("ThinkGearManager", "ReceivePoorSignal", [[NSString
stringWithFormat: @"%d", blueData.signal] cStringUsingEncoding: NSUTF8StringEncoding]);
                                UnitySendMessage("ThinkGearManager", "ReceiveAttention", [[NSString
stringWithFormat:@"%d",blueData.attention] cStringUsingEncoding:NSUTF8StringEncoding]);
                               UnitySendMessage("ThinkGearManager", "ReceiveMeditation", [[NSString
stringWithFormat: @"%d", blueData.meditation] cStringUsingEncoding: NSUTF8StringEncoding]);
                                     UnitySendMessage("ThinkGearManager", "ReceiveBatteryCapacity",
[[NSString stringWithFormat:@"%d",0] cStringUsingEncoding:NSUTF8StringEncoding]);
                                    UnitySendMessage("ThinkGearManager", "ReceiveDelta", [[NSString
stringWithFormat: @"%d", blueData.delta] cStringUsingEncoding: NSUTF8StringEncoding]);
                                    UnitySendMessage("ThinkGearManager", "ReceiveTheta", [[NSString
stringWithFormat: @"%d", blueData.theta] cStringUsingEncoding: NSUTF8StringEncoding]);
                                UnitySendMessage("ThinkGearManager", "ReceiveLowAlpha", [[NSString
stringWithFormat: @"%d", blueData.lowAlpha] cStringUsingEncoding: NSUTF8StringEncoding]);
                                UnitySendMessage("ThinkGearManager", "ReceiveHighAlpha", [[NSString
stringWithFormat: @"%d", blueData.highAlpha] cStringUsingEncoding: NSUTF8StringEncoding]);
                                 UnitySendMessage("ThinkGearManager", "ReceiveLowBeta", [[NSString
stringWithFormat: @"%d", blueData.lowBeta] cStringUsingEncoding: NSUTF8StringEncoding]);
                                 UnitySendMessage("ThinkGearManager", "ReceiveHighBeta", [[NSString
stringWithFormat: @"%d", blueData.highBeta] cStringUsingEncoding: NSUTF8StringEncoding]);
                              UnitySendMessage("ThinkGearManager", "ReceiveLowGamma", [[NSString
stringWithFormat: @"%d", blueData.lowGamma] cStringUsingEncoding: NSUTF8StringEncoding]);
                              UnitySendMessage("ThinkGearManager", "ReceiveHighGamma", [[NSString
stringWithFormat: @"%d", blueData.highGamma] cStringUsingEncoding: NSUTF8StringEncoding]);
```





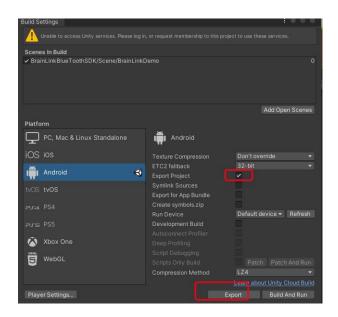
Android Configuration:

1. Find in the unity installation directory main Template. gradle



Add: implementation 'androidx.appcompat: 1.1.0'

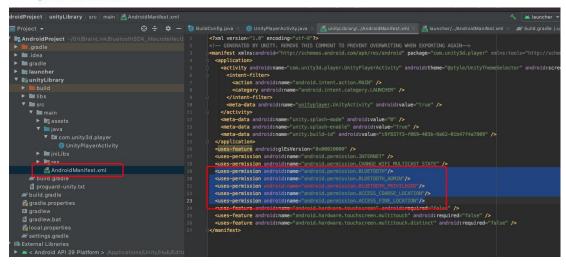
2. Export the android project of unity as shown below



3.In the exported android project, add Bluetooth and positioning permissions to AndroidManifest.xml in the unityLibrary directory, as follows

```
<uses-permission android:name="android.permission.BLUETOOTH"/>
<uses-permission android:name="android.permission.BLUETOOTH_ADMIN"/>
<uses-permission android:name="android.permission.BLUETOOTH_PRIVILEGED"/>
<uses-permission android:name="android.permission.ACCESS_COARSE_LOCATION"/>
<uses-permission android:name="android.permission.ACCESS_FINE_LOCATION"/>
```





Add authorization code to UnityPlayerActivity, as follows

```
requestPermissions();
String[] permissions = new String[]{
       android.Manifest.permission.BLUETOOTH,
       Manifest.permission.ACCESS_COARSE_LOCATION,
       Manifest.permission.ACCESS_FINE_LOCATION
};
private void requestPermissions() {
   ArrayList<String> permissionList = new ArrayList<>();
   for (int i = 0; i < permissions.length; <math>i++) {
       if (ActivityCompat.checkSelfPermission(UnityPlayerActivity.this, permissions[i]) !=
PackageManager.PERMISSION_GRANTED) {
          permissionList.add(permissions[i]);
   if (!permissionList.isEmpty()) {
       String[] mPermissions = permissionList.toArray(new String[permissionList.size()]);
       ActivityCompat.requestPermissions(UnityPlayerActivity.this, mPermissions, 100);
}
@Override
public void onRequestPermissionsResult(int requestCode, @NonNull String[] permissions, @NonNull int[] grantResults) {
   if (requestCode == 100) {
       for (int i = 0; i < grantResults.length; i++) {
          if (grantResults[i] == PackageManager.PERMISSION_DENIED) {
             boolean showRequestPermission =
ActivityCompat.shouldShowRequestPermissionRationale(UnityPlayerActivity.this, permissions[i]);
          }
}
```



```
infroidProject | unityLibrary | src | main | lava | cem | unityDay | allower | allowers | allowers
```



Unity3D BrainLinkProSDK V1.0.4 iOS API Reference

HZLBlueData Reference

```
Overview
This class is the data model
Enum
typedef enum : NSUInteger {
    BlueType_NO = 0,
    BlueType_Lite,
/* Connected to BrainLink_Lite data format device, there are BLEMIND, BLERaw type data */
    BlueType_Pro,
/* Connected to BrainLink_Pro data format device, with BlemIND, BLEGRAVITY, BLERaw type data */
    BlueType_Jii,
/* Connected is Jii */
}BlueType;
typedef NS_ENUM(NSUInteger,BLEDATATAYPE){
         BLEMIND = 0, // Brainwave data
         BLEGRAVITY,
                                   // Gravity data
         BLERaw,
                                    // Raw blink data
};
Brainwave data:
    signal, Device wearing quality
    attention, Attention Level
    meditation, Relaxation Level
    delta,
    theta,
    IowAlpha,
    highAlpha,
    IowBeta,
    highBeta,
    lowGamma,
    highGamma,
    ap, Appreciation Level
    batteryCapacity, Battery capacity percentage
    hardwareVersion, Device firmware version
    grind
    grind
             Blink
    temperature Temperature
                Heart Rate
    heartrate
    HRV
            Heart rate variability
```



Gravity data:

- xvlaue,
- yvlaue,
- zvlaue

Raw Blink Data

- raw,
- blinkeye

Annotation:

Connect Jii, Only signal, attention, meditation, batteryCapacity, ap

Connect BrainLink_Lite, Only signal, attention, meditation, delta, theta, lowAlpha, highAlpha, lowBeta, highBeta, lowGamma, highGamma, raw, blinkeye

Instructions of some Instance Property

- signal:Signal Value. When the signal is 0, it means that it has been worn, when the signal value is greater than 0 and less than or equal to 200, it means that the hardware and the mobile phone have been connected via Bluetooth
- batteryCapacity: Battery capacity percentage
- ap: Appreciation Level
- hardwareVersion: hardware version. The first version value is 255, when you update the hardware successfully, the version value of the hardware will become smaller
- xvlaue: X axis value of gravity sensor swing forward and backward pitch angle
- yvlaue: Y axis value of gravity sensor Swing left and right Yaw angle
- zvlaue: Z axis value of gravity sensor Wing swing roll angle



Blue4Manager Reference

Overview

This class deals with the interaction between Macrotellect hardware and Bluetooth devices

Instance Property

Callback for successful Bluetooth connection

@property(nonatomic,copy)Blue4Connect blueConBlock;

Bluetooth disconnection callback

@property (nonatomic, copy) BlueConnectdismiss blueDisBlock;

Note: Bluetooth devices are A B C D E F in the order of connection

Use the above method, for example, there are 6 data callbacks

(hzlblueDataBlock_A,hzlblueDataBlock_B.....), In order to ensure the independence of data, data between various devices can be accepted at the same time without affecting each other.

Up to 6 Bluetooth 4.0 devices can be connected, and 6 can be connected but it is difficult to connect successfully.

If you want to use a single connection, the input parameter of ableDeviceSum is 1, just call hzlblueDataBlock_A.

Data callback of each device

```
@property(nonatomic,copy)Blue4DataBlock hzlblueDataBlock_A;
@property(nonatomic,copy)Blue4DataBlock hzlblueDataBlock_B;
@property(nonatomic,copy)Blue4DataBlock hzlblueDataBlock_C;
@property(nonatomic,copy)Blue4DataBlock hzlblueDataBlock_D;
@property(nonatomic,copy)Blue4DataBlock hzlblueDataBlock_E;
@property(nonatomic,copy)Blue4DataBlock hzlblueDataBlock_F;
```

Connection status of each device

```
@property (nonatomic, assign)BOOL connected_A;
@property (nonatomic, assign)BOOL connected_B;
@property (nonatomic, assign)BOOL connected_C;
@property (nonatomic, assign)BOOL connected_D;
@property (nonatomic, assign)BOOL connected_E;
@property (nonatomic, assign)BOOL connected_F;
```

Method

Whether to print log or not by default

+ (void)logEnable: (BOOL)enable;

Initialization (singleton)

+ (instancetype)shareInstance;



Connection configuration

Parameter Description:

```
blueNames: The name of the device that can be connected (Bluetooth 4.0 device)

NSArray *blueNames = @[@"BrainLink", @"BrainLink_Pro", @"jii@jii-***"];

1.jii@jii- Indicates that the device name with jii- prefix can be connected. There is jii@ which means it is a jii device @ The following is the device name *** means that the prefix is the same

/*! @ brief connection configuration (only for Macrotellect internal testing)

appSoleCode: app Unique code

defaultBlueNames: An array of default connectable Bluetooth names

ableDeviceSum: Number of Bluetooth devices that can be connected

result: the name of the device that can be connected when"back"

-(void)configureBlueNamesWithAppSoleCode: (NSString *)appSoleCode defaultBlueNames: (NSArray*)defaultBlueNames ableDeviceSum:(int)ableDeviceSum result:(void(^)(NSArray*))result;

*/
```

ableDeviceSum: Number of Bluetooth devices that can be connected
—(void)configureBlueNames:(NSArray *)blueNames ableDeviceSum:(int)deviceSum

Connect a Bluetooth device
—(void)connectBlue4;

Disconnect the Bluetooth device

-(void)disConnectBlue4;

Manually test fake connections (Fakeonnection definition: When signal is equal to 0 and the 10 consecutive values of attention and medition remain unchanged, it is considered a fakeonnection, The SDK will disconnect the Bluetooth connection of the current device and automatically connect again)

- -(void)testAFalseCon:(BOOL)isTest; // Manually test the fake connection of A device
- -(void)setTestToZero;// Cancel all manual test fake connections



Unity3D BrainLinkProSDK V1.0.4 Android API Reference

UnityThinkGear.cs script

SetBLLinstenner(string objectName) this method initiate detection, parameter is mount receive call back method's script game object, in this demo, it is ThinkGearManager, use ConnectBluetooth()connection method after initiate detection

The callback method is in the ThinkGearManager.cs script ReceiveXX