

Unity3DBrainLinkProSDK V1.0.0

Date: 0621 2022

Author: Liang Fang

SDK Version: 1.0.0

MCU: 3.1

Table of Contents

Unity3DBrainLinkProSDK V1.0.0.....	1
Unity3D BrainLinkProSDK Development Manual.....	3
Introduction.....	3
iOS configuration:.....	4
Android Configuration:.....	11
Unity3D BrainLinkProSDK V1.0.0 iOS API Reference.....	13
HZLBlueData Reference.....	13
Blue4Manager Reference.....	15
Unity3D BrainLinkProSDK V1.0.0 Android API Reference.....	16

Unity3D BrainLinkProSDK Development Manual

Introduction

This guide will guide you how to use the Unity3D BrainLinkProSDK to get brainwave data from MacroTelligence'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, MacroTelligence'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

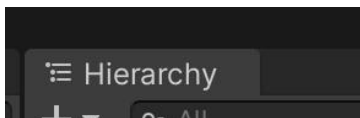
Supported iOS/Android version:

iOS 9.0 + / Android SDK 26+

- Supported Unity 3D version:
Unity2019 +

Unity3D using method

- Create new gameObject“ThinkGearManager”,



- Add ThinkGearManager.cs script
- Detailed method ---Demo scene and Demo.cs script

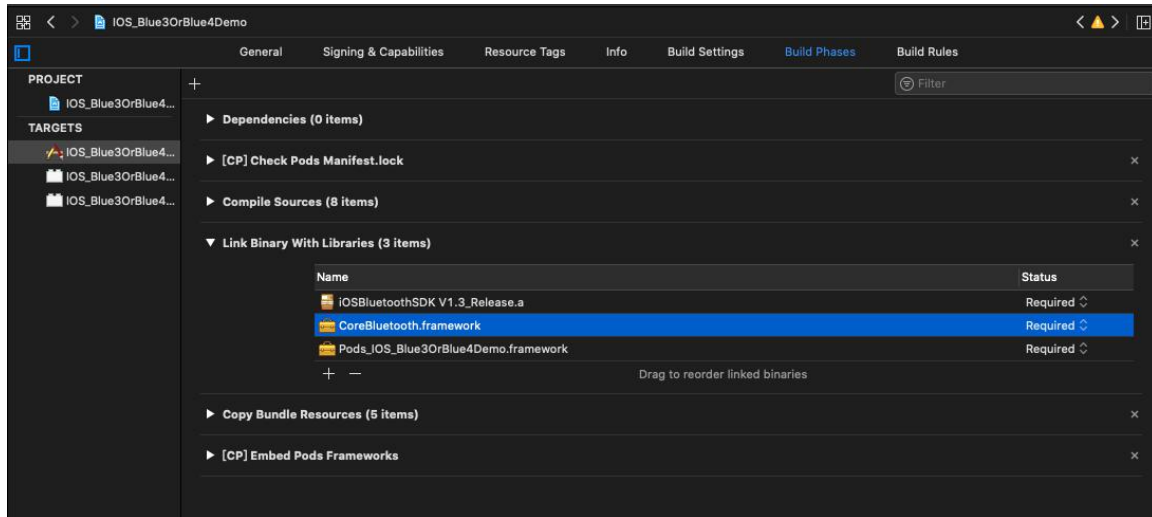
iOS configuration:

Step 1:

1.1 in Xcode project TARGETS — Build Phases import iOS system framework as following

- CoreBluetooth.framework

As picture :

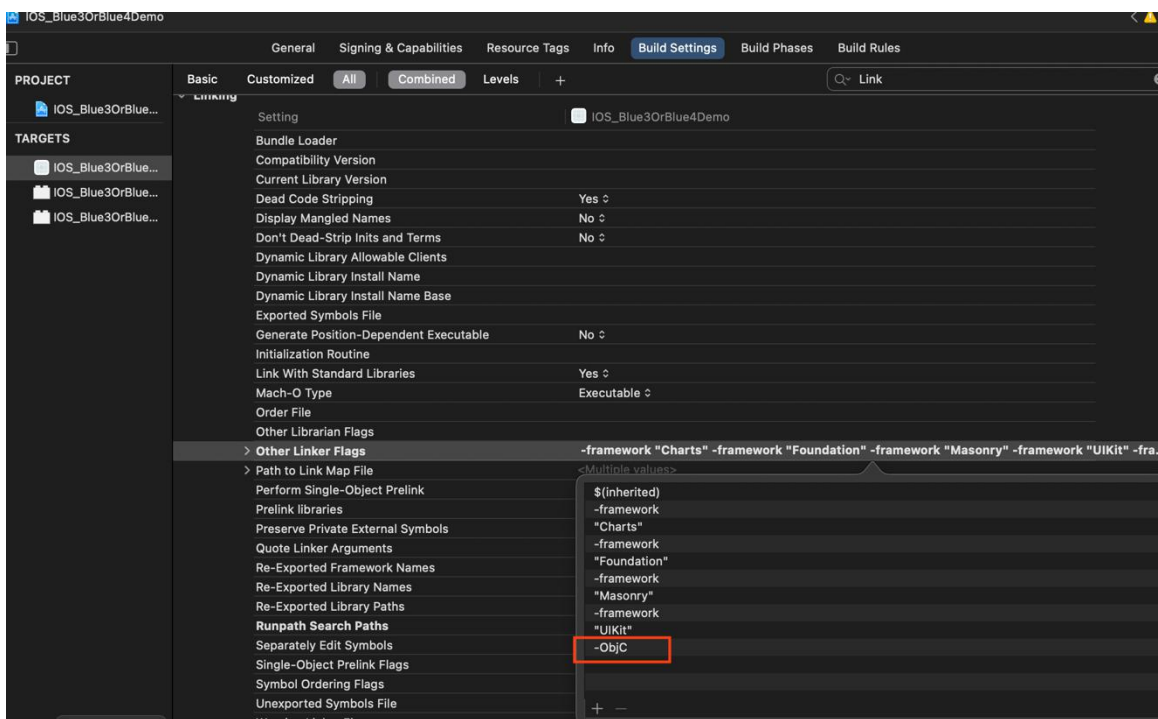


add Bluetooth permission to Info.plist (IOS13 Need to add Bluetooth permission Privacy — Bluetooth Always Usage Description, Privacy — Bluetooth Peripheral Usage Descriptio)

As picture :

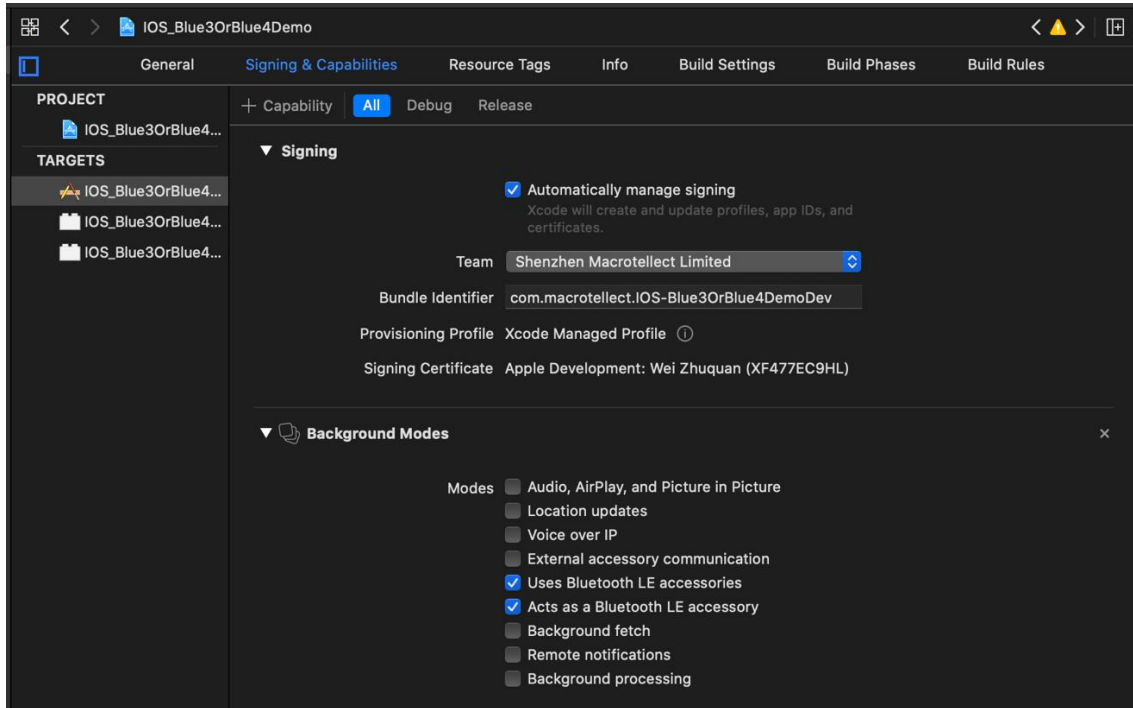
Key	Type	Value
▼ Information Property List		
Localization native development region	String	\$(DEVELOPMENT_LANGUAGE)
Bundle display name	String	\$(PRODUCT_NAME)
Executable file	String	\$(EXECUTABLE_NAME)
Bundle identifier	String	\$(PRODUCT_BUNDLE_IDENTIFIER)
InfoDictionary version	String	6.0
Bundle name	String	\$(PRODUCT_NAME)
Bundle OS Type code	String	APPL
Bundle version string (short)	String	\$(MARKETING_VERSION)
Bundle version	String	\$(CURRENT_PROJECT_VERSION)
Application requires iPhone environment	Boolean	YES
Privacy - Bluetooth Always Usage Description	String	
Privacy - Bluetooth Peripheral Usage Description	String	
▶ Required background modes	Array	(3 items)
Launch screen interface file base name	String	LaunchScreen
Main storyboard file base name	String	Main
▶ Required device capabilities	Array	(1 item)
▶ Supported external accessory protocols	Array	(1 item)
▶ Supported interface orientations	Array	(3 items)
▶ Supported interface orientations (iPad)	Array	(4 items)

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 Connect()
    {
        // Bluetooth connection settings
        [Blue4Manager logEnable:YES];

        [[Blue4Manager sharedInstance]
configureBlueNames:@[@"BrainLink_Pro", @"BrainLink_Lite", @"BrainLink", @"BrainLink_Lite_P", @"BrainLink_Lite", @"ROYWOS", @"BrainLink_Pink"] ableDeviceSum:1];
        // Bluetooth connection successful
        [Blue4Manager sharedInstance].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 sharedInstance].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 sharedInstance].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", "ReceiveHeartRate", [[NSString
stringWithFormat:@"%d",[blueData.heartRate intValue]] cStringUsingEncoding:NSUTF8StringEncoding]);

UnitySendMessage("ThinkGearManager", "ReceiveTemperature", [[NSString
stringWithFormat:@"%f",[blueData.temperature floatValue]] cStringUsingEncoding:NSUTF8StringEncoding]);

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]);
        }
        else if (blueData.bleDataType == BLERaw) {
            UnitySendMessage("ThinkGearManager", "ReceiveRawdata", [[NSString
stringWithFormat:@"%d",blueData.raw] cStringUsingEncoding:NSUTF8StringEncoding]);
        }
    }

    if (isFalseCon) {
        NSLog(@"A Fake device connection");
    }
};

[[Blue4Manager sharedInstance] connectBlue4];

}

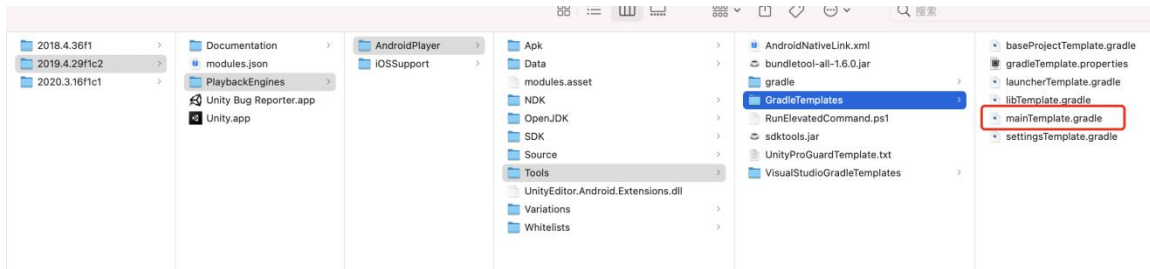
void disconnect(){
    [[Blue4Manager sharedInstance] disconnectBlue4];
}

```

}

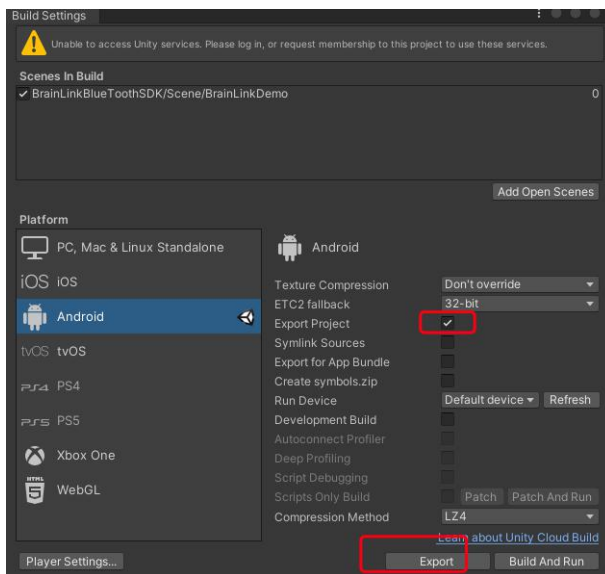
Android Configuration:

1. Find in the unity installation directory mainTemplate.gradle



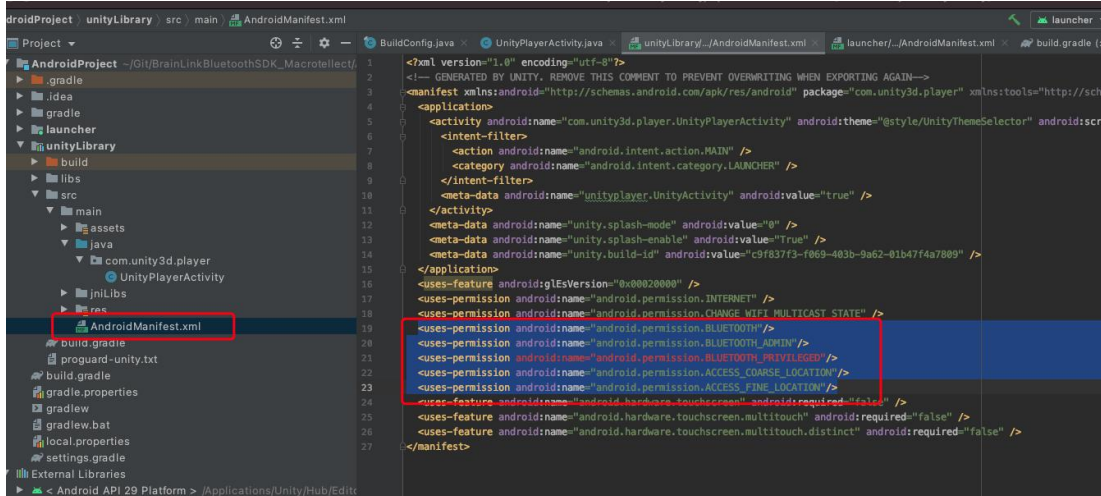
Add: implementation 'androidx.appcompat:appcompat:1.1.0'

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"/>
```



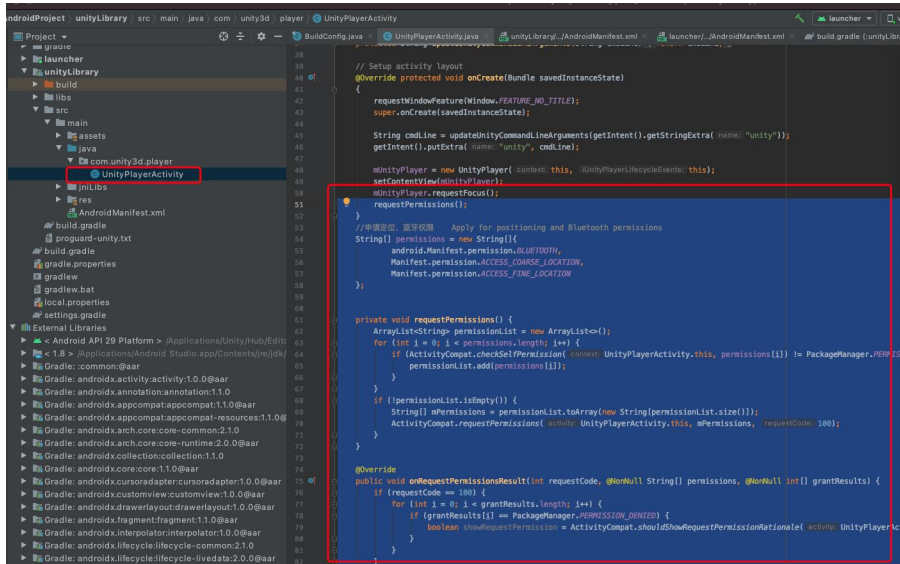
Add authorization code to UnityPlayerActivity, as follows

```
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; 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]);
            }
        }
    }
}
```



Unity3D BrainLinkProSDK V1.0.0 iOS API Reference

HZLBlueData Reference

Overview

This class is the data model

Enum

```
typedef enum : NSInteger {
```

```
    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(NSInteger, BLEDATATYPE){
```

```
    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,
- lowAlpha,
- highAlpha,
- lowBeta,
- highBeta,
- lowGamma,
- highGamma,
- ap, Appreciation Level
- batteryCapacity, Battery capacity percentage
- hardwareVersion, Device firmware version
- grind
- grind Blink
- temperature Temperature
- heartrate Heart Rate

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 MacroTelligence 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 MacroTelligence 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 (Fakeconnection definition: When signal is equal to 0 and the 10 consecutive values of attention and meditation remain unchanged, it is considered a fakeconnection, 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 V1.0.0 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