

Unity3DBrainLinkProSDK V1.0.3

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SDK Version: 1.0.3

MCU: 4.201



更新记录:

1. V1.0.3 增加新的蓝牙数据字段 HRV
2. V1.0.1 Android SDK 优化, 添加详细开发步骤
3. V1.0.0 Unity3D 移动端 SDK

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Unity3D BrainLinkProSDK 开发指南

介绍

本指南将教你如何使用 Unity3D BrainLinkProSDK 从宏智力公司的硬件中获取脑电波数据。这将使您的移动端应用程序能够接收和使用脑波数据，如 BLEMIND 和 BLEGRAVITY，你可以通过蓝牙，宏智力公司的硬件，和文件资源 Unity3D BrainLinkProSDK 来获取他们。

功能:

接收脑波数据。

文件包含:

- API 参考(此文档)
- Asset/iOS
- Asset/Android

支持的硬件设备:

- 有电量的数据格式
 - BrainLink_Pro

支持的 iOS / Android 版本:

- iOS 9.0 + / Android SDK 26+

支持的 Unity3D 版本:

- Unity2019+

Unity3D 中使用方法:

- 在场景中新建物体“ThinkGearManager”，挂载 ThinkGearManager 的脚本
- 调用方法见 Demo 场景以及 Demo.cs 脚本

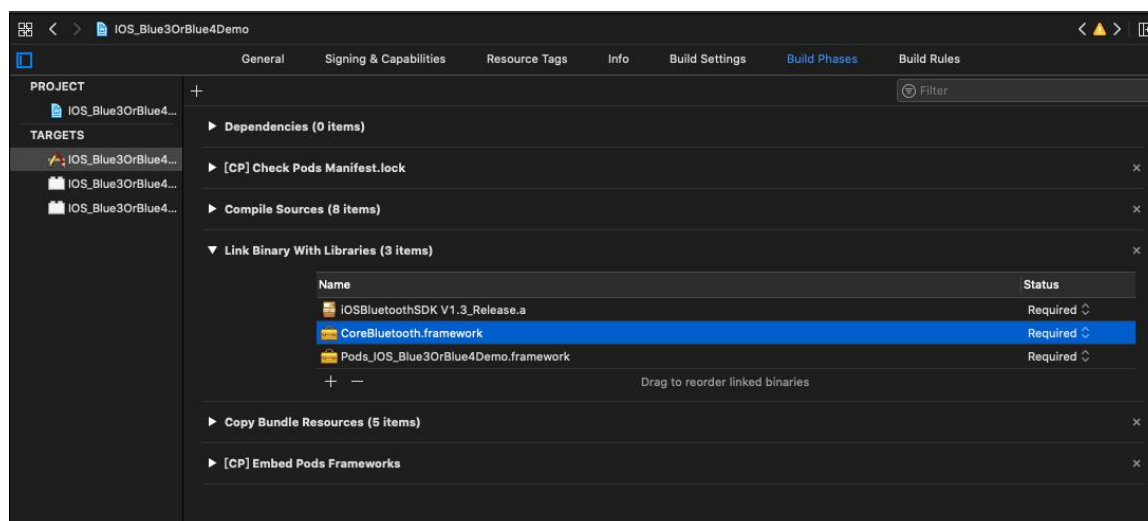
iOS 端配置：

第一步：

1.1 在 Xcode 项目里 TARGETS — Build Phases 导入 iOS 系统框架库如下

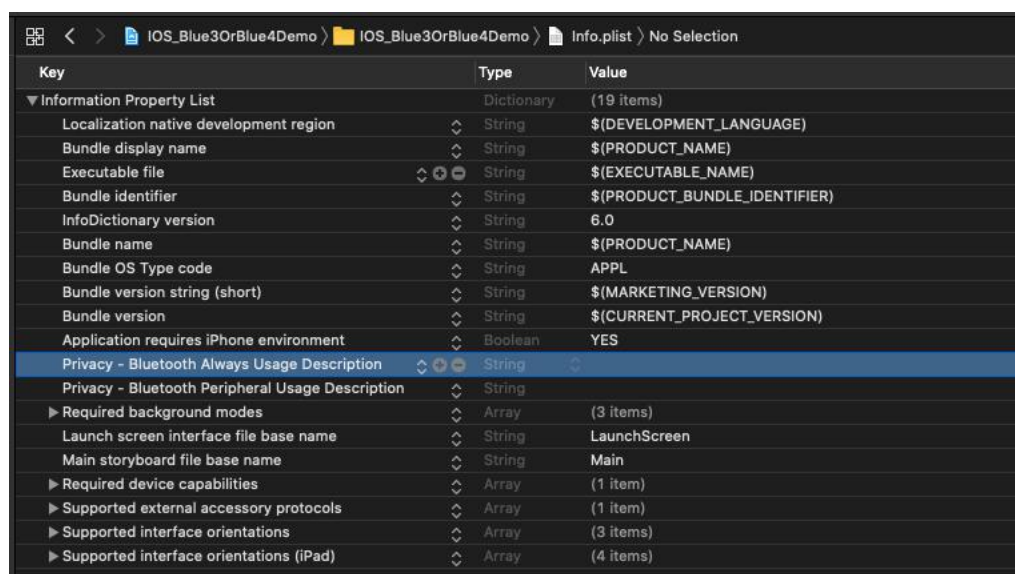
- CoreBluetooth.framework

如图：

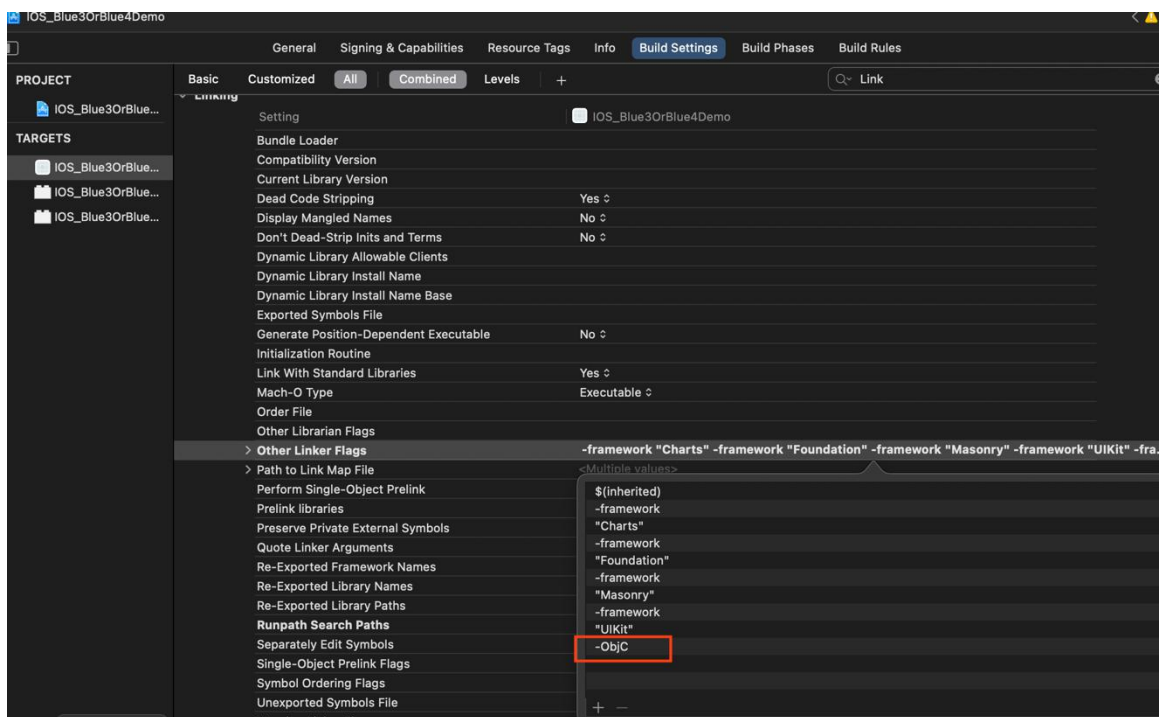


在 Info.plist 里添加蓝牙权限（iOS13 需要添加蓝牙权限 Privacy — Bluetooth Always Usage Description, Privacy — Bluetooth Peripheral Usage Description）

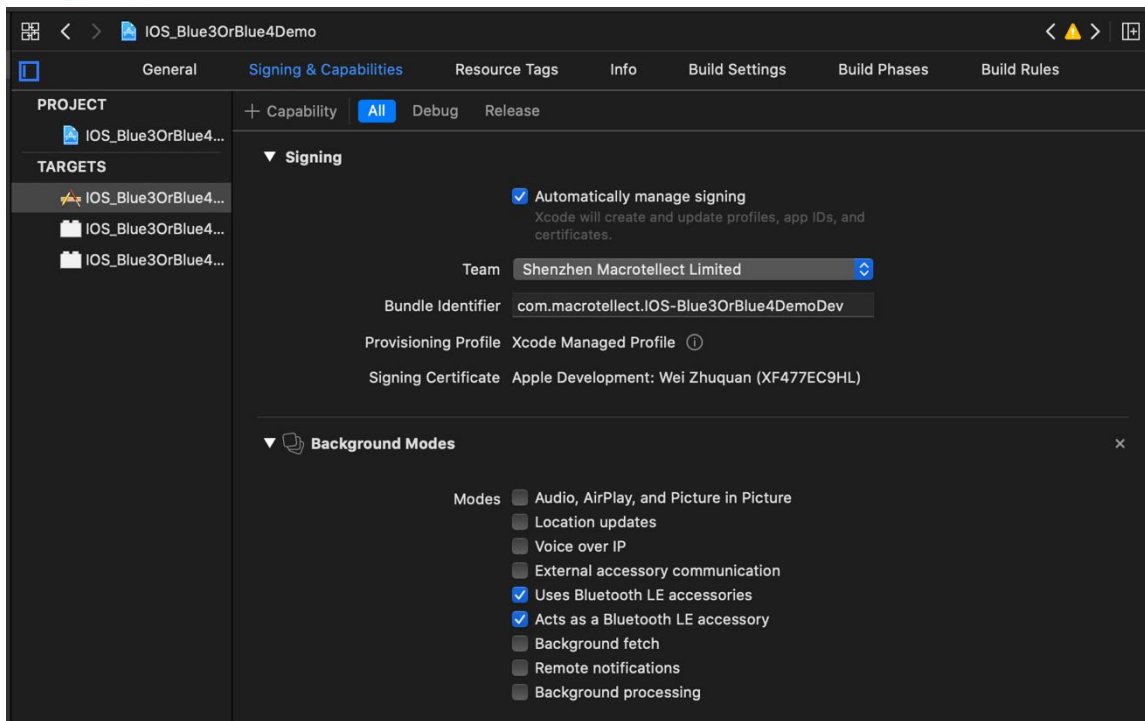
如图：



在TARGETS Build Settings中的link--->Other Linker Flags 中加入：-ObjC



1.2 如果你想让蓝牙可以在后台运行，请如下设置，不需要则不必设置
如图：



第二步:

在UnityAppController.mm文件中

导入头文件

```
#import "Blue4Manager.h"
```

在文件末尾添加方法

```
extern "C" {
    void Connect()
    {
        // 蓝牙连接设置
        [Blue4Manager sharedInstance]
        configureBlueNames: @[@"BrainLink_Pro", @"BrainLink_Lite", @"BrainLink", @"BrainLink_Lite_P", @"BrainLink_Lite", @"ROYWOS", @"BrainLink_Pink"] ableDeviceSum: 1];

        // 蓝牙连接成功
        [Blue4Manager sharedInstance].blueConBlock = ^(NSString *markKey) {
            if ([markKey isEqualToString:@"1"]) {
                // 判断连接的设备
                NSLog(@"A 设备 蓝牙 连接成功");
                UnitySendMessage("ThinkGearManager", "ReceiveContentState", "yes");
            }
        }
    }
}
```

```

};

// 蓝牙断开回调
[Blue4Manager sharedInstance].blueDisBlock = ^(NSString *markKey){
    if ([markKey isEqualToString:@"1"]) {
        // 判断连接的设备
        NSLog(@"A 设备 蓝牙 断开");
        UnitySendMessage("ThinkGearManager", "ReceiveContentState", "no");
    }
    UnitySendMessage("ThinkGearManager", "ReceiveBlueToothType", "");
};

// 第一个设备(A)数据回调 其他设备数据回调如 hzlblueDataBlock_B 与 hzlblueDataBlock_A
的写法相同
[Blue4Manager sharedInstance].hzlblueDataBlock_A = ^(HZLBlueData *blueData, BlueType conBT,
BOOL isFalseCon) {
    if (conBT == BlueType_Pro) {
        if (blueData.bleDataType == BLEMIND) {
            // 信号值为 0 即佩戴了蓝牙设备
            // 注：如果连接了蓝牙设备而未佩戴，信号值为大于 0 且小于或等于
            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]);

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

```
    }

    if (isFalseCon) {
        NSLog(@"A 设备假连接");
    }
};

[[Blue4Manager sharedInstance] connectBlue4];

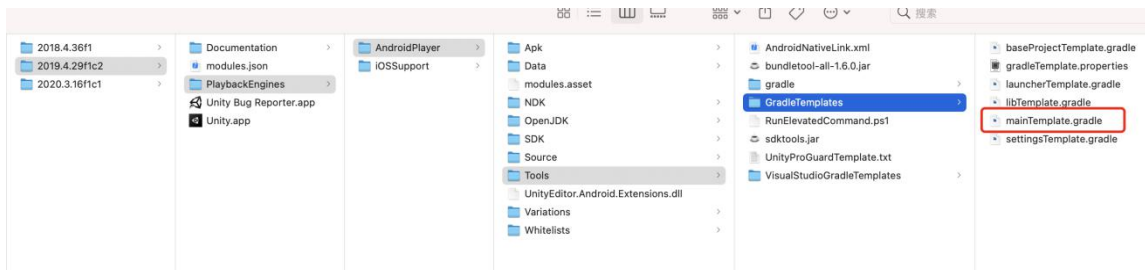
}

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

}
```

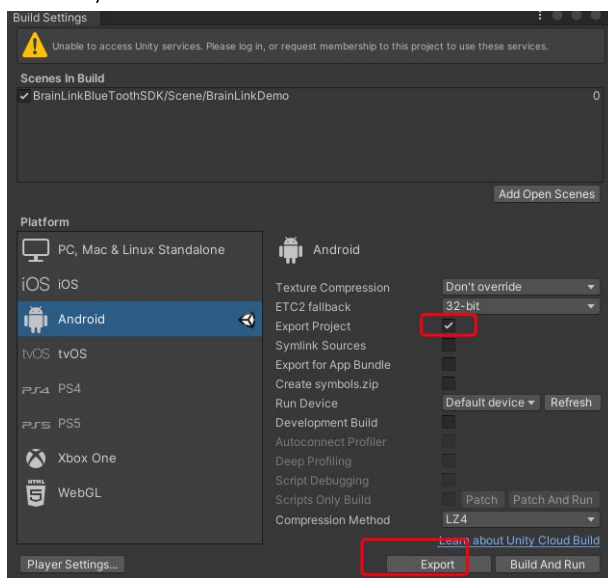
Android 端配置:

1. 在 unity 安装目录中找到 mainTemplate.gradle



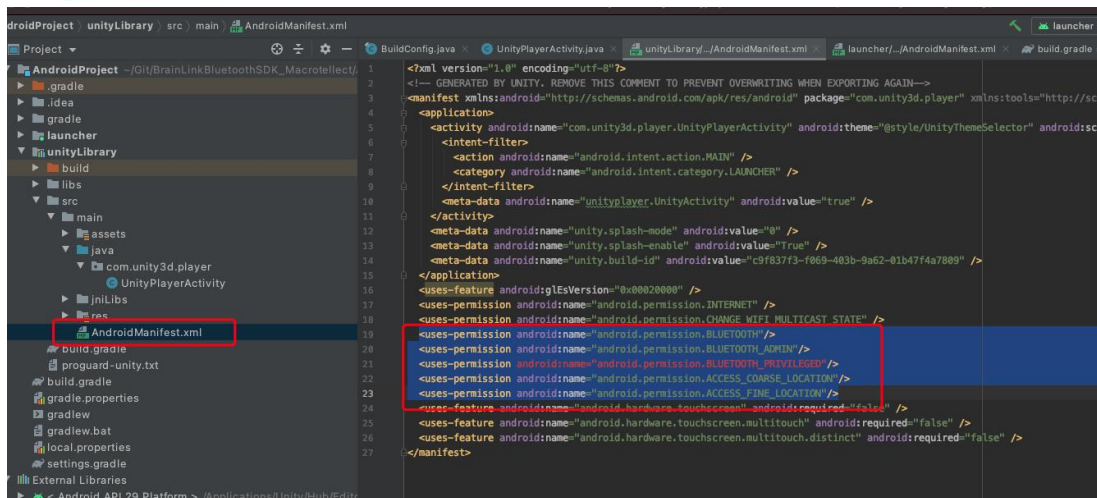
添加: implementation 'androidx.appcompat:appcompat:1.1.0'

2. 导出 unity 的 android 项目 如下图



3. 在导出的 android 项目中, unityLibrary 目录下的 AndroidManifest.xml 里添加 蓝牙、定位权限, 如下

```
<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"/>
```



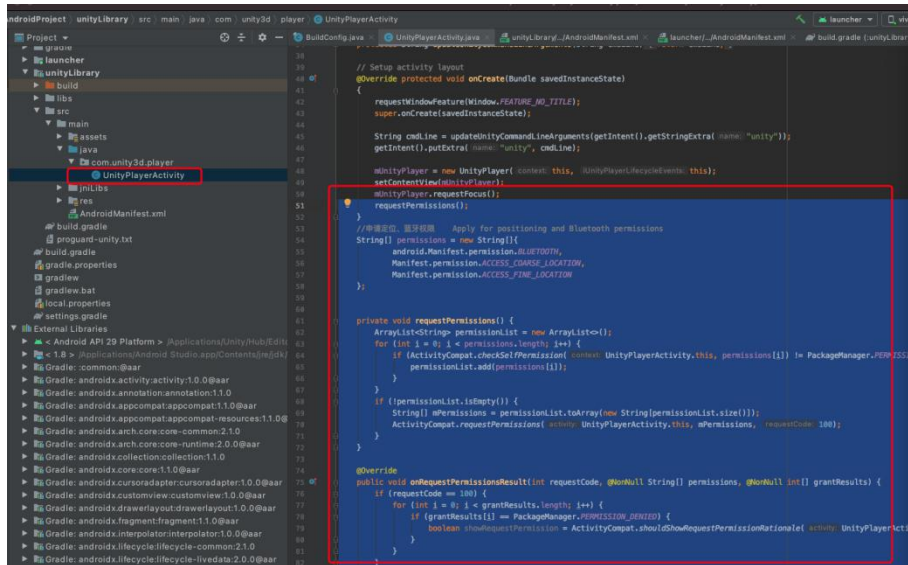
在 UnityPlayerActivity 里添加授权代码，如下

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



```

38
39
40 // Setup activity layout
41 @Override protected void onCreate(Bundle savedInstanceState) {
42     requestWindowFeature(Window.FEATURE_NO_TITLE);
43     super.onCreate(savedInstanceState);
44
45     String cmdLine = updateUnityCommandLineArguments(getIntent().getStringExtra("unity"));
46     getIntent().putExtra("unity", cmdLine);
47
48     mUnityPlayer = new UnityPlayer(this, mUnityPlayerLifecycleCallbacks);
49     setContentView(mUnityPlayer);
50     mUnityPlayer.requestFocus();
51     requestPermissions();
52 }
53
54 // 申请权限 授予权限 Apply for positioning and Bluetooth permissions
55 String[] permissions = new String[] {
56     Manifest.permission.ACCESS_FINE_LOCATION,
57     Manifest.permission.ACCESS_COARSE_LOCATION,
58     Manifest.permission.ACCESS_FINE_LOCATION
59 };
60
61 private void requestPermissions() {
62     ArrayList<String> permissionList = new ArrayList<>();
63     for (int i = 0; i < permissions.length; i++) {
64         if (ActivityCompat.checkSelfPermission(this, permissions[i]) != PackageManager.PERMISSION_GRANTED) {
65             permissionList.add(permissions[i]);
66         }
67     }
68     if (!permissionList.isEmpty()) {
69         String[] mPermissions = permissionList.toArray(new String[permissionList.size()]);
70         ActivityCompat.requestPermissions(this, mPermissions, REQUEST_CODE);
71     }
72 }
73
74 @Override
75 public void onRequestPermissionsResult(int requestCode, @NonNull String[] permissions, @NonNull int[] grantResults) {
76     if (requestCode == REQUEST_CODE) {
77         for (int i = 0; i < grantResults.length; i++) {
78             if (grantResults[i] == PackageManager.PERMISSION_GRANTED) {
79                 continue;
80             } else {
81                 // Should show a dialog to explain why we need this permission
82             }
83         }
84     }
85 }

```

HZLBlueData 参考

Overview

该类是数据模型

Enum

```
typedef enum : NSUInteger {
    BlueType_NO = 0,
    BlueType_Lite,
    /*连接的是 BrainLink_Lite 数据格式设备 ,有 BLEMIND、BLERaw 类型数据 */
    BlueType_Pro,
    /*连接的是 BrainLink_Pro 数据格式设备, 有 BLEMIND、BLEGRAVITY、BLERaw 类型数据 */
    BlueType_Jii,
    /*连接的是 Jii*/
}BlueType;

typedef NS_ENUM(NSUInteger, BLEDATATYPE){
    BLEMIND = 0,          //脑波数据
    BLEGRAVITY,           //重力数据
    BLERaw,               //Raw 眨眼数据
};
```

脑波数据:

- signal, 设备佩戴质量
- attention, 专注度
- meditation, 放松度
- delta,
- theta,
- lowAlpha,
- highAlpha,
- lowBeta,
- highBeta,
- lowGamma,
- highGamma,
- ap, 喜好度
- batteryCapacity, 电池电量百分比

- hardwareVersion, 设备固件版本
- grind
- grind 眨眼
- temperature 温度
- heartrate 心率
- HRV 心率变异性

重力数据:

- xvlaue,
- yvlaue,
- zvlaue

Raw 眨眼数据:

- raw,
- blinkeye

注释:

连接 Jii, 只有 signal, attention, meditation, batteryCapacity, ap

连接 BrainLink_Lite, 只有 signal, attention, meditation, delta, theta, lowAlpha, highAlpha, lowBeta, highBeta, lowGamma, highGamma, raw, blinkeye

Instructions of some Instance Property

- signal: 信号值。当信号为 0, 表示已经戴好, 当信号值为大于 0 且小于等于 200, 表示硬件和手机通过蓝牙已经连接
- batteryCapacity: 电池容量百分比
- ap: 喜好度
- hardwareVersion: 硬件版本。第一个版本值为 255, 当你更新硬件成功后, 硬件的版本值将会变小
- xvlaue: 重力传感器 X 轴值 前后摆动 俯仰角
- yvlaue: 重力传感器 Y 轴值 左右摆动 偏航角
- zvlaue: 重力传感器 Z 轴值 翅膀摆动 滚转角

Overview

该类处理宏智力硬件与蓝牙设备之间的交互

Instance Property

蓝牙连接成功的回调

```
@property(nonatomic, copy)Blue4Connect blueConBlock;
```

蓝牙断开回调

```
@property (nonatomic, copy) BlueConnectdismiss blueDisBlock;
```

Note: 蓝牙设备按照连接顺序依次为 A B C D E F。

使用如上方式, 比如有6个数据回调(hzlblueDataBlock_A, hzlblueDataBlock_B), 是为了保证数据的独立性, 各个设备间的数据可以同时接受, 互不影响。

蓝牙4.0设备最多可以连接6个, 可以连接6个但是连接成功比较难。

如果要使用单连接, ableDeviceSum传入参数为1, 只调用hzlblueDataBlock_A即可。

各个设备的数据回调

```
@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;
```

各个设备连接状态

```
@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

是否打印 log 默认不打印

```
+ (void)logEnable: (BOOL)enable;
```

初始化(单例)

```
+ (instancetype)shareInstance;
```

连接配置

参数说明：

blueNames: 可以连接的设备名称 (蓝牙 4.0 设备)

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

1. jii@jii-表示可连接带 jii-前缀的设备名称 有 jii@表示是 jii 设备 @后面是设备名称 ***表示前缀相同即可

/*! @brief 连接配置(仅用于宏智力公司内部测试)

appSoleCode: app 唯一码

sdkVersion: sdk 版本号

defaultBlueNames: 默认的可连接蓝牙名称数组

ableDeviceSum: 可以连接的蓝牙设备个数

result: 返回可以连接的设备名

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

ableDeviceSum: 可以连接的蓝牙设备个数

```
-(void)configureBlueNames:(NSArray *)blueNames ableDeviceSum:(int)deviceSum
```

连接蓝牙设备

```
-(void)connectBlue4;
```

断开蓝牙设备

```
-(void)disconnectBlue4;
```

手动测试假连接 (假连接定义: 当 signal 等于 0, attention 和 meditation 的连续 10 个值不变的时候, 认为是假连接, SDK 会断开当前设备的蓝牙连接, 再次自动连接)

```
-(void)testAFalseCon:(BOOL)isTest; //手动测试 A 设备假连接
```

```
-(void)setTestToZero; //取消所有手动测试假连接
```

Unity3D BrainLinkProSDK V1.0.2 Android 端 API 参考

UnityThinkGear.cs 脚本中

SetBLLinstenner(string objectName) 此方法开启监听, 参数为挂载接收回调方法脚本的物体名, 本 Demo 中为 ThinkGearManager, 开启监听之后调用 ConnectBluetooth()连接方法
回调方法在 ThinkGearManager.cs 脚本中 ReceiveXX