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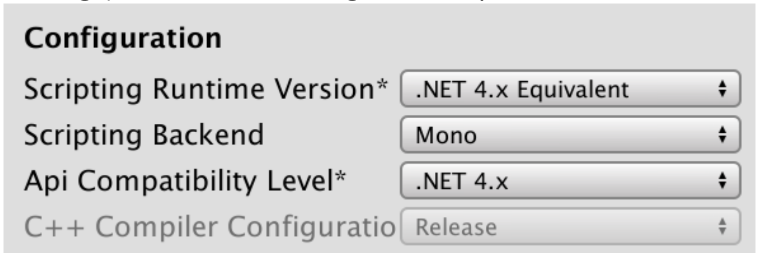
Arduino Unity Plugin

Requirements

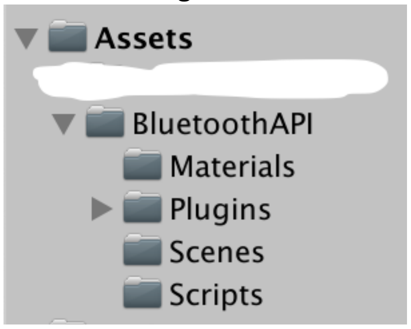
1. Switch Scripting runtime version to 4.x as 3.5 is already deprecated (found in Build Settings). No need to change on unity 2019.X and later.



Configuration

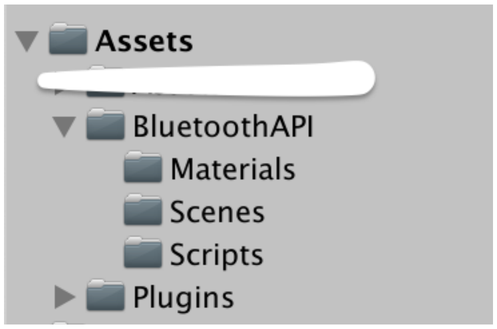
Scripting Runtime Version*	.NET 4.x Equivalent
Scripting Backend	Mono
Api Compatibility Level*	.NET 4.x
C++ Compiler Configuratio	Release

2. Move the Plugin Folder to the main Assets Folder



```
▼ Assets
    [redacted]
  ▼ BluetoothAPI
      Materials
    ▶ Plugins
      Scenes
      Scripts
```

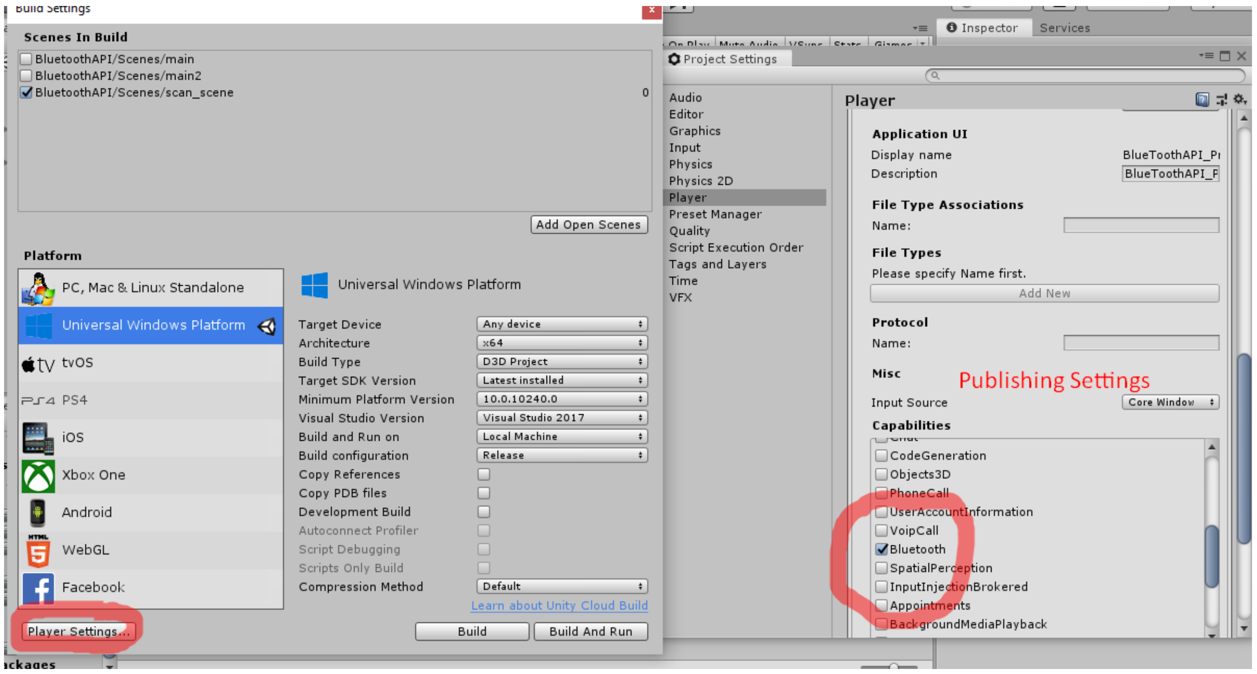
Before



```
▼ Assets
    [redacted]
  ▼ BluetoothAPI
      Materials
      Scenes
      Scripts
  ▶ Plugins
```

After

For UWP



Build Settings

Scenes In Build

- [ ] BluetoothAPI/Scenes/main
- [ ] BluetoothAPI/Scenes/main2
- [x] BluetoothAPI/Scenes/scan_scene 0

Add Open Scenes

Platform

PC, Mac & Linux Standalone
Universal Windows Platform
tvOS
PS4
iOS
Xbox One
Android
WebGL
Facebook

Universal Windows Platform

Target Device	Any device
Architecture	x64
Build Type	D3D Project
Target SDK Version	Latest installed
Minimum Platform Version	10.0.10240.0
Visual Studio Version	Visual Studio 2017
Build and Run on	Local Machine
Build configuration	Release
Copy References	☐
Copy PDB files	☐
Development Build	☐
Autoconnect Profiler	☐
Script Debugging	☐
Scripts Only Build	☐
Compression Method	Default

Learn about Unity Cloud Build

Player Settings... Build Build And Run

Inspector Services

Project Settings

Audio
Editor
Graphics
Input
Physics
Physics 2D
Player
Preset Manager
Quality
Script Execution Order
Tags and Layers
Time
VFX

Player

Application UI

Display name	BlueToothAPI_Pr
Description	BlueToothAPI_P

File Type Associations

Name:

File Types

Please specify Name first.

Add New

Protocol

Name:

Misc

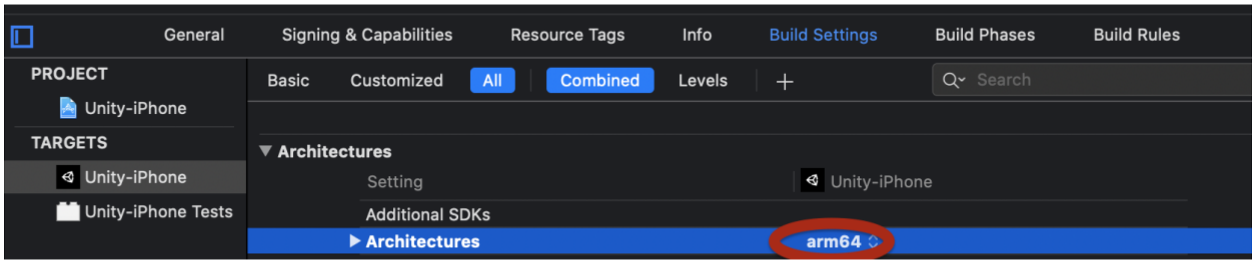
Publishing Settings

Input Source: Core Window

Capabilities

- [ ] CodeGeneration
- [ ] Objects3D
- [ ] PhoneCall
- [ ] UserAccountInformation
- [ ] VoipCall
- [x] Bluetooth
- [ ] SpatialPerception
- [ ] InputInjectionBrokered
- [ ] Appointments
- [ ] BackgroundMediaPlayback

3. For iOS



Architectures

Setting	Unity-iPhone
Additional SDKs	
Architectures	arm64

And add "NSBluetoothAlwaysUsageDescription" in plist file.

Supported Devices

1. Android
2. iOS
3. MacOS
4. Windows PC
5. UWP

Steps to establish connection

Bluetooth Classic

1. Pair the Bluetooth device externally
2. Get instance of BluetoothHelper, specify the name of the Bluetooth device you want to connect to if you know it
3. Implements BluetoothHelper events. [OnConnected, OnConnectionFailed, OnDataReceived…]
4. Set the stream manager (the way you want to split received stream bytes into messages and format data before sending) using [setLengthBasedStream, setTerminatorBasedStream, setFixedLengthBasedStream, setCustomStreamManager]
5. Scan for nearby devices (this step can be skipped)
6. Set the device name/address you want to connect to if not specified in step 2.
7. Call Connect function
8. Call start listening to start receiving data

BLE

1. Get instance of BluetoothHelper, specify the name of the Bluetooth device you want to connect to if you know it
2. Implements BluetoothHelper events. [OnConnected, OnConnectionFailed, OnDataReceived, OnCharacteristicChanged, OnServiceNotFound…]
3. *For serial way of communication*
   set the stream manager
   set Tx/Rx characteristic if using custom defined characteristics.
4. set Device name/address to connect to
5. Call Connect function

3. *For BLE communication mode using GATT services/characteristics*
   Subscribe to characteristics for notification/indication (this step can be skipped till after connection is established
4. set Device name/address to connect to
5. Call Connect function

BluetoothDevice Class

Properties

1. DeviceName: returns the advertised name of the Bluetooth device
2. DeviceAddress: returns the mac address of the Bluetooth device.
3. Rssi: returns the received signal strength indicator of the Bluetooth device found while scanning. If this value is not available, value **127** is returned.

BluetoothHelper Class

Static Vars and Methods

1. GetInstance (string *deviceName*)
    - deviceName: string identifying the Bluetooth module you are going to connect to
    - Returns BluetoothHelper Instance
    - If already called, returns the 1st instance of Bluetooth helper created.
    - Throws:
        i. BlueToothNotEnabledException: Bluetooth not turned on
        ii. BlueToothNotSupportedException: Bluetooth not supported
        iii. BlueToothNotReadyException: the Bluetooth device is not paired
        iv. BlueToothPermissionNotGrantedException: this is caused by not moving the plugin folder to the main assets folder
2. GetInstance()
    - Returns the BluetoothHelper Instance
    - deviceName will be set later when attempting to connect
    - This is helpful when there’s a need to scan for nearby Bluetooth and connect to one of them based on the scan result
    - If already called, returns the 1st instance of Bluetooth helper created.
    - Throws same exceptions as (1)
3. GetNewInstance(string *deviceName*) & GetNewInstance()
    - Create a new instance of bluetoothHelper, used when needed to connect to multiple devices. Each instance will have a unique id (integer)
4. GetInstanceById(int *id*)
    - Returns a previously created instance given an id.
    - If the id is incorrect, the result is null.

5. Bool SERIAL_COMM:
    - Default: False => connect to destination device using Bluetooth
    - True => connect to destination device using USB Cable. In this case, *deviceName* variable refers to the COM port name (example: *COM5*)
    - Serial communication is ONLY available on windows PC, and setting it to True for android devices has no effect.
6. Bool BLUETOOTH_SIMULATION
    - Default: False => Connect to actual Bluetooth device

- True => Emulate Bluetooth connected by providing a GUI interface to simulate receiving messages
- This variable ONLY has effect on Windows PC so you can simulate connecting to Bluetooth device if your laptop doesn't have Bluetooth, so you can always develop
- On not supported platforms, like iOS, MacOS… this is the default mode
- SET THIS VARIABLE TO *TRUE* IF YOUR COMPUTER DOESN'T SUPPORT BLUETOOTH

7. Bool BLE
   - Default: False => use Bluetooth Classic technology
   - True => use Bluetooth Low Energy technology
   - *Changing this value has no effect on windows version, since BLE is not currently supported on Windows PC by this plugin. Only Android, MacOS and UWP. Regarding IOS, only BLE is supported.*
     BLE is supported on UWP, and Bluetooth Classic on both Windows Desktop App and UWP
8. Bool ASYNC_EVENTS
   - Default : False => events raise by the plugin are synchronized with the main UI thread.
   - True : the events are raised asynchronously independently from the UI thread. If set to true, you can't update the UI when any plugin event is raised.

Properties and Methods

1. isDevicePaired():
   - for Bluetooth Classic
     i. return true if the device is already paired
     ii. return false if the device is not paired
   - for BLE:
     i. Returns true if, after scanning nearby devices, the Bluetooth device is found
     ii. Returns false if, after scanning for nearby devices, the Bluetooth device is not found
2. SendData(string *data*):
   - Send string data to the Bluetooth devices
3. SendData (byte[] data):
   - Send byte array data to the Bluetooth devices
4. Connect()
   - Connect to Bluetooth device
   - Invokes 2 events:
     i. OnConnected: when successfully connected to the device
     ii. OnConnectionFailed: when failed to connect to the Bluetooth device
5. setDeviceName(string *deviceName*)
6. setDeviceAddress(string *deviceAddress*)
   - These 2 functions set the properties of the device you wish to connect to.

One will override the other. So, you either connect by name or by mac address. setDeviceAddress function will trigger setDeviceName for IOS or MacOS BLE since connecting to a device by its mac address on IOS since it's not supported by Apple.
These 2 functions are useful if you are trying to connect to multiple devices, so you set the name of a device,connect, transmit data, call disconnect, set the name of another device connect and so on…

7. ScanNearbyDevices()
    - Scan for nearby Bluetooth devices
    - Return true if scan has started
    - Calling this function is a must when using BLE technology before connecting to a BLE device.
    - Invokes 1 event:
        i. OnScanEnded: returns a list of devices found
    - Not available for Windows PC (Desktop App)
8. getPairedDevicesList()
    - returns LinkedList<BluetoothDevice> showing all paired devices
    - Only available when using Bluetooth classic
9. setLengthBasedStream()
    - sets reading and writing mode of the stream based on its length.
      Example: Sending {0x02, 0x04, 0x65, 0xE5} from unity will result in sending: {0x55, 0x55, 0x00, 0x04, 0x02, 0x04, 0x65, 0xE5} knowing that 0x00 and 0x04 are the array length encoded on 2 bytes and 0x55, 0x55 are the preamble, to detect the start of the message. You don't have to worry about the encoding procedure or adding the preamble, as it is done automatically by the plugin.
      From the Arduino, to get the message follow this code:

```
void readBT()
{
  if(Serial.available() >= 2)
  {
    data_length = 0;
    //reading the preambles
    byte pre1 = Serial.read();
    byte pre2 = Serial.read();
    if(pre1 != 85 || pre2 != 85) return;
    while(Serial.available() < 2) continue;
    byte x1 = Serial.read();
    byte x2 = Serial.read();

    data_length = x1 << 8 | x2;

    data = new byte[data_length];
    i=0;
    while(i<data_length)
    {

      if(Serial.available()==0){
        continue;
      }
      timeout=0;
      data[i++] = Serial.read();
    }

    // process the data …
    delete[] data;
  }}
```

Now sending messages from the Arduino, {0x02, 0x04, 0x65, 0xE5} will be sent as: {0x55, 0x55, 0x00, 0x04, 0x02, 0x04, 0x65, 0xE5}
use this function to send from the arduino:

```
void sendBT(const byte *data, int length)
{
        byte len[4];
        //YOU HAVE TO PUT THE PREAMPLE WHEN SENDING FROM THE ARDUINO
        len[0] = 85; //preamble
        len[1] = 85; //preamble
        len[2] = (length >> 8) & 0x000000FF;
        len[3] = (length & 0x000000FF);
        Serial.write(len, 4);
        Serial.flush();
        Serial.write(data, l);
        Serial.flush();
}
```

10. setTerminatorBasedStream(string str)
    - set the writing and reading mode based on a terminator string to delimit the messages. Example, using \n (new line) to delimit incoming messages. "Hello\nHow are you" will be considered as 2 incoming messages in this case. This mode is not recommended for binary data transmission unless its delimited by the null character (\0). (for the moment)
11. setTerminatorBasedStream(string str, bool appendTerminator)
    - same as 10, but with the option to append the terminator or not after each sent message
12. setTerminatorBasedStream(byte[] terminator)
    - same as before, but the terminator will be a sequence of bytes.
13. setTerminatorBasedStream(byte[] terminator, bool appendTerminator)
    - same as 12, but with the option to append the terminator or not after each sent message
14. setFixedLengthBasedStream(int length)
    - set the reading mode based on the number of received bytes. Each "length" bytes will be considered 1 message. To get the data, use ReadBytes()
15. setCustomStreamManager(instance of class inheriting from StreamManager)
    - set your own way of delimiting messages replying to your protocol
    - override *formatDataToSend* to format data before sending to the Bluetooth module
    - override *handleReceivedData* : this is where you aggregate your data before rec eiving if internally through the bluetoothHelperInstance.
    - To invoke OnDataReceived on the Bluetooth helper instance, call: *this.OnDataReceived.Invoke(byte [] data);*
16. StartListening()
    - Required only when using stream managers
    - Start listening for incoming messages
    - Invokes 1 event:

OnDataReceived: called when a message is received

- Throws:
    i. BluetoothListeningMethodIsNotSetException: when neither of *setTerminatorBasedStream* or *setLengthBasedStream* or *setFixedLengthBasedStream* has been called
- No need for calling this method when subscribing to custom characteristics in BLE.

17. getGattServices()
    - Available for BLE mode only.
    - Returns the gatt services and characteristics on a peripheral
18. setTxCharacteristic(BluetoothHelperCharacteristic *characteristic*)
    - set the transmit characteristic in BLE mode.
    - Used when you want to benefit from using any of the stream managers (setLengthBasedStream, setTerminatorBasedStream…)
19. setRxCharacteristic(BluetoothHelperCharacteristic *characteristic*)
    - set the reading characteristic
    - Used when you want to benefit from using any of the stream managers (setLengthBasedStream, setTerminatorBasedStream…)
20. Disconnect()
    - Stops listening for incoming messages and disconnects from the Bluetooth device.
    - This method must be called in the OnDestroy() method in a MonoBehaviour class in case you need to use the Bluetooth in 1 scene:

      ```
      void OnDestroy()
      {
              bluetoothHelperInstance.Disconnect();
      }
      ```
    - In case you need to use the plugin in multiple scenes, don't call this function, but make sure to close all connections when exiting the app
21. isConnected()
    - returns True if we are connected to the Bluetooth device
22. Bool Available
    - returns True if we have incoming messages waiting to be read
23. Read()
    - Return a string representation of the incoming messages when available
    - In case of want binary data representation from the data, use ReadBytes()
24. ReadBytes()
    - Recommended when reading binary data.
25. EnableBluetooth(bool enable)
    - Used to enable/disable Bluetooth using the plugin. ONLY available on Android.
26. IsBluetoothEnabled()
    - Checks if the Bluetooth is enabled or not. Available on Android, MacOS and iOS.
    - For MacOS and iOS, it's not recommended to do the check in the Start function as it will always return false. A good practice will be in the Update function.
27. Subscribe(BluetoothHelperService service)
    - To subscribe to a characteristic of a service for "Notify, indicate", create a BluetoothHelperService instance (constructor takes service UUID) and call addCharacteristic function (taking BluetoothHelperCharacteristic as a parameter).
    - You can subscribe before or after the connection is established.
28. Subscribe(BluetoothHelperCharacteristic characteristic)

- Subscribe for notification or indication for the provided characteristic

29. WriteCharacteristic(BluetoothHelperCharacteristic characteristic, byte[] value)
30. WriteCharacteristic(BluetoothHelperCharacteristic characteristic, string value)
    - There two functions are used to write a value to a custom characteristic on which the service name must be set by calling characteristic.setService(string)
    - Throws:
        i. ServiceNotSetException : service name of the characteristic is null.
        ii. ServiceNotFound
        iii. CharacteristicNotFound
31. ReadCharacteristic(BluetoothHelperCharacteristic characteristic)
    - Read the value of a characteristic asynchronously, result received in event : OnCharacteristicChanged
    - Throws:
        i. ServiceNotSetException : service name of the characteristic is null.
        ii. ServiceNotFound
        iii. CharacteristicNotFound

Events to Listen to

1. OnConnected
2. OnConnectionFailed
3. OnDataReceived
4. OnScanEnded
5. OnServiceNotFound
6. OnCharacteristicNotFound
7. OnDescriptorNotFound
8. OnCharacteristicChanged

These events are already explained above,
To Listen to them, use this syntax:

```
//this could be written is the Start() function for example
bluetoothHelperInstance.OnConnected += OnConnectedFunction;


void OnConnectedFunction(BluetoothHelper bluetoothHelperInstance)
{
        //Yes, we are now connected, maybe we should start listening for incoming messages 😉
        bluetoothHelperInstance.StartListening();
}
```

Or this lambda expression syntax

```
bluetoothHelperInstance.OnConnected += (helper) => {
        helper.StartListening();
};

bluetoothHelper.OnScanEnded += (helper, nearbyDevices) =>
{
        //nearbyDevices is a LinkedList containing nearby devices
};
```

```
bluetoothHelper.OnCharacteristicChanged += (helper, value, characteristic) =>
{
        //value is a byte array
        //characteristic is a BluetoothHelperCharacteristic instance
};
```

Thank you for using this plugin
You can always contact me via email abouzaidan.tony@gmail.com is you have any question.
This plugin will always be Here!