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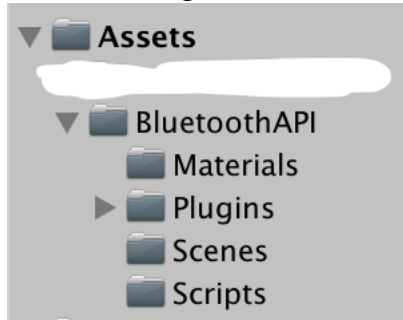
Arduino Unity Plugin

Requirements

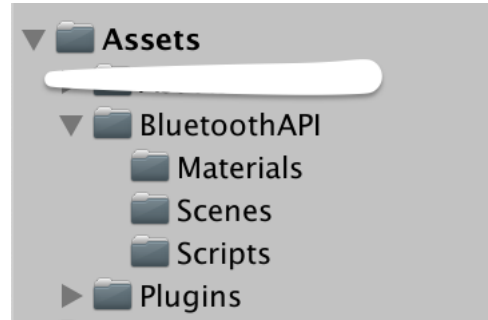
1. Switch Scripting runtime version to 4.x as 3.5 is already deprecated (found in Build Settings). No need to change on unity 2019.X and later.



2. Move the Plugin Folder to the main Assets Folder

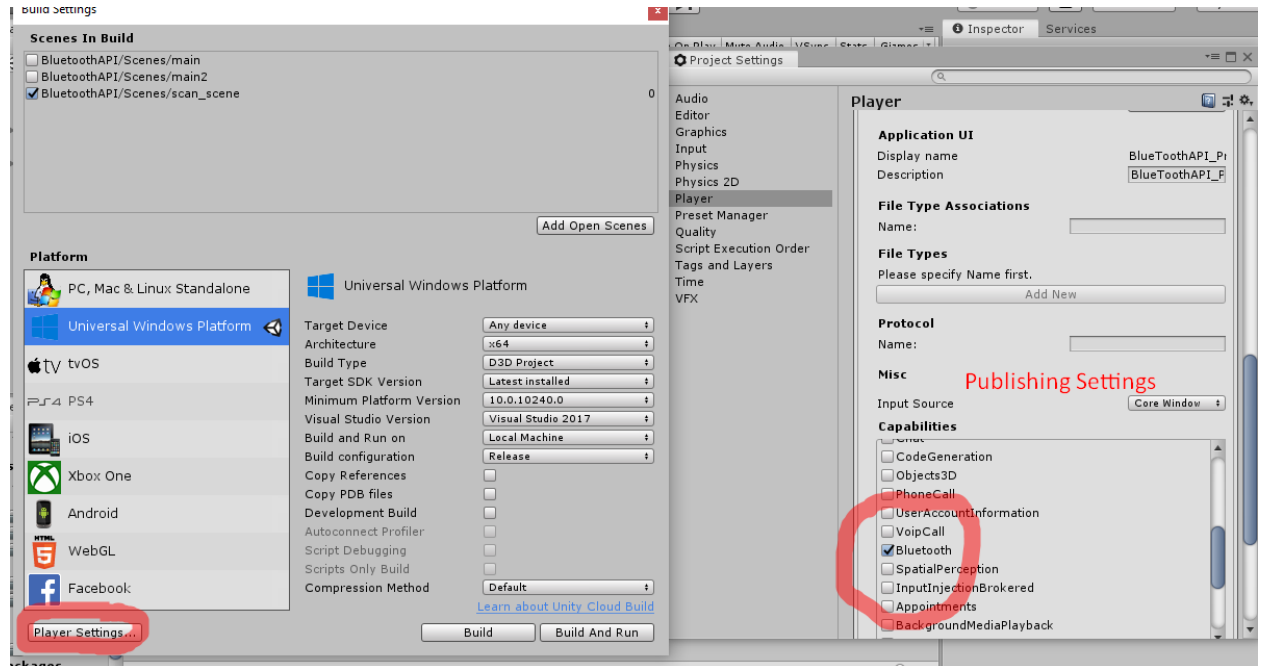


Before

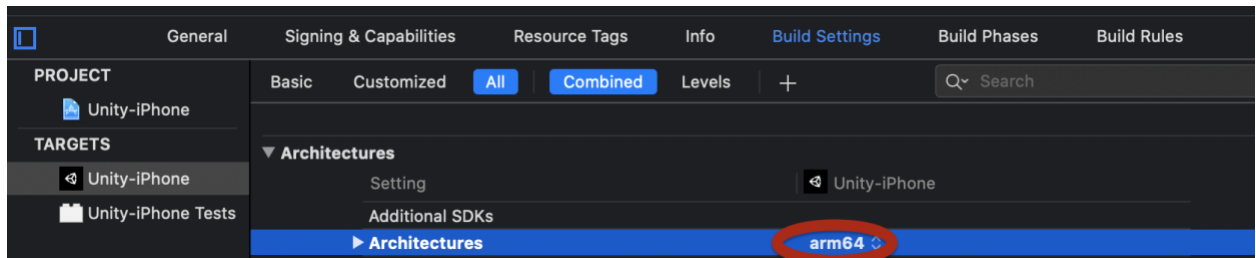


After

For UWP



3. For iOS



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. <i>For serial way of communication</i>
set the stream manager
set Tx/Rx characteristic if using custom defined characteristics. | 3. <i>For BLE communication mode using GATT services/characteristics</i>
Subscribe to characteristics for notification/indication (this step can be skipped till after connection is established) |
| 4. set Device name/address to connect to | 4. set Device name/address to connect to |
| 5. Call Connect function | 5. Call Connect function |

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 PREAMBLE 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, 1);
        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 receiving 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:
 - 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

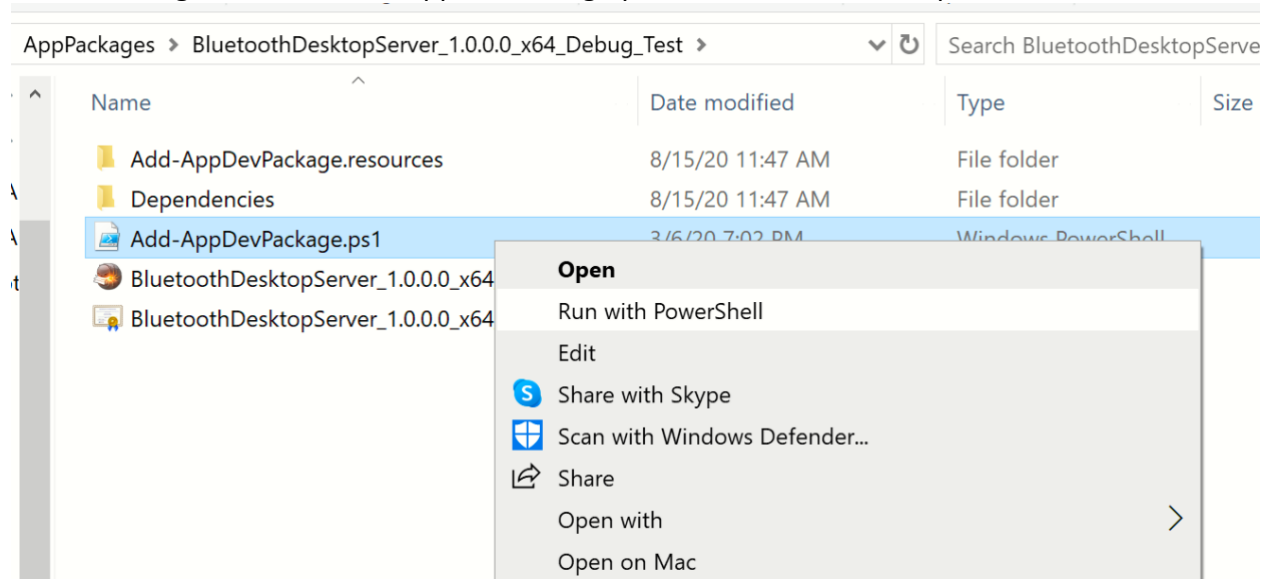
```
bluetoothHelperInstance.OnConnected += (helper) => {
    helper.StartListening();
};

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

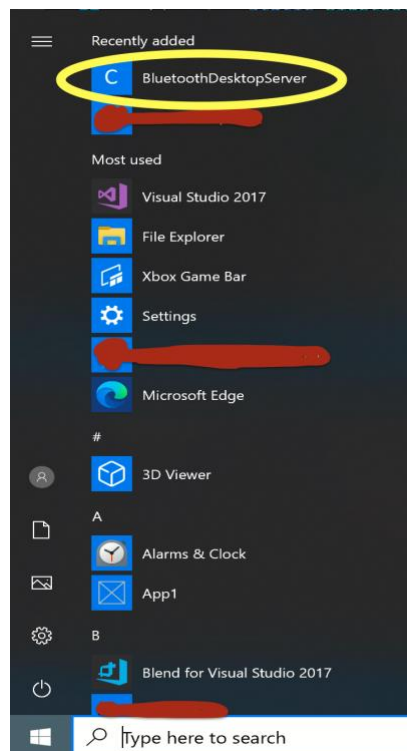
```
bluetoothHelper.OnCharacteristicChanged += (helper, value, characteristic) =>
{
    //value is a byte array
    //characteristic is a BluetoothHelperCharacteristic instance
};
```

Setup BLE in unity editor for Windows 10

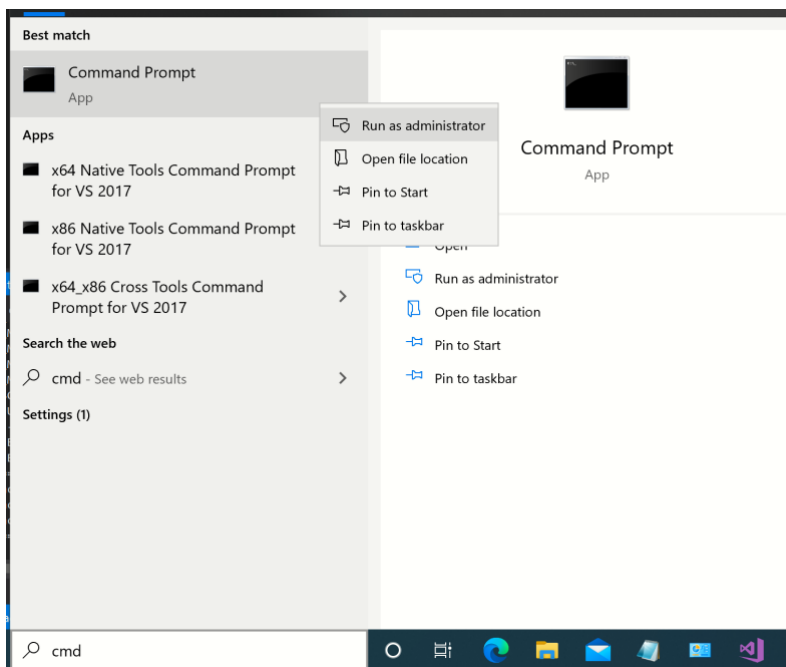
1. First you need to install the Bluetooth Desktop Server application that comes with the plugin.
 - a. Go to <https://drive.google.com/drive/folders/1RI0VtYsLcoiU5626Ey1C-dMhFs2S42HG?usp=sharing>
 - b. Download and extract the package corresponding to your pc version (x86 or x64)
 - c. Right click on “Add-AppDevPackage.ps1” and click “run with powershell”



- d. Follow the instruction to fully install the app



- e. Application will be shown in the start menu
2. Start the application from the start menu
3. Open CMD with admin privilege



4. Run the below command in CMD:
`CheckNetIsolation.exe LoopbackExempt -is -n=BluetoothDesktopServer_t05x7yb6e6yp0`
this is to allow tcp communication between the unity editor and the BluetoothDesktopServer application
5. In your C# code, set BluetoothHelper.BLE_AS_CLIENT = true;
6. If you don't have Bluetooth on the PC you are using and you have another PC running windows 10 with built in Bluetooth (assuming they are connected to the same network), you can install BluetoothDesktopServer on the other PC, run the application (and skip point 4), configure unity editor to connect to the other PC by setting BLE_SERVER_IP property equals of the ip address of the pc where BluetoothDesktopServer is installed.
Example : BluetoothHelper.BLE_SERVER_IP = "192.168.1.23"

Thank you for using this plugin

You can always contact me via email abouzaidan.tony@gmail.com if you have any question.

This plugin will always be [Here!](#)