The latest document is on the GitHub.
If you have any questions or issues, please post an issue on GitHub.
https://github.com/kshoji/Unity-MIDI-Plugin-supports

This document explains how to install the plugin, and to use the plugin's features.

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MIDI Plugin for Mobile and Desktop

This plugin provides MIDI transceiving features to your mobile app(iOS, Android, Universal Windows Platform), desktop app(Windows, OSX, Linux), and WebGL app.
Currently implemented `MIDI 1.0 protocol` only.

Available MIDI interfaces for platforms

The available MIDI interfaces for each platforms are listed below.

Platform	Bluetooth MIDI	USB MIDI	Network MIDI (RTP-MIDI)
iOS	○	○	○
Android	○	○	△(experimental)
Universal Windows Platform	-	○	△(experimental)
Standalone OSX, Unity Editor OSX	○	○	○
Standalone Linux, Unity Editor Linux	○	○	△(experimental)
Standalone Windows, Unity Editor Windows	-	○	△(experimental)
WebGL	○	○	-

About limitations

Android

- USB MIDI is supported API Level 12 (Android 3.1) or above.
- Bluetooth MIDI is supported API Level 18 (Android 4.3) or above.

iOS / OSX

- Supported iOS version 11.0 or above.
- Bluetooth MIDI support is Central mode only.

UWP

- Supported UWP platform version 10.0.10240.0 or above.
- Bluetooth MIDI is not supported.
- To use Network MIDI(RTP-MIDI) feature, enable `PrivateNetworkClientServer` at `Project Settings > Player > Capabilities` setting.

Windows

- Bluetooth MIDI is not supported.

WebGL

- Supporting MIDI devices are depend on the running OS/Browser environment.
- WebGL may not access to another server resources with UnityWebRequest, so put resource files(such as SMF) into `StreamingAssets`.
- You *should* modify `index.html` file of `WebGLTemplates` directory like below. This enables to access Unity's runtime from `unityInstance` variable.
    - Or, copy `MIDI/Samples/WebGLTemplates` files to `Assets/WebGLTemplates`, and select `Default-MIDI` or `Minimal-MIDI` template from `Project Settings > Player > Resolution and Presentation > WebGL Template` setting.
    - For more information, see Unity official document of WebGL Templates.

Original:

```
      script.onload = () => {
        createUnityInstance(canvas, config, (progress) => {
          progressBarFull.style.width = 100 * progress + "%";
        }).then((unityInstance) => {
```

Modified: add global `unityInstance` variable.

```
      var unityInstance = null; // <- HERE
      script.onload = () => {
        createUnityInstance(canvas, config, (progress) => {
          progressBarFull.style.width = 100 * progress + "%";
        }).then((unityInst) => { // <- HERE
          unityInstance = unityInst; // <- HERE
```

Network MIDI

- The error correction(RTP MIDI Journaling) protocol is not supported on experimental support specified above.

How to install plugin

1. Import the unitypackage from the Asset Store view.
2. Select the app's platform; iOS or Android. and build the sample app.
    - The sample scene is found at Assets/MIDI/Samples directory.

About build PostProcessing

PostProcessing: iOS

- Additional framework will be automatically added while building postprocess.
    - Additional frameworks: `CoreMIDI framework`, `CoreAudioKit.framework`
- `Info.plist` will be automatically adjusted while building postprocess.
    - Additional property: `NSBluetoothAlwaysUsageDescription`

PostProcessing: Android

- `AndroidManifest.xml` will be automatically adjusted while building postprocess.
    - Additional permissions: `android.permission.BLUETOOTH`, `android.permission.BLUETOOTH_ADMIN`, `android.permission.ACCESS_FINE_LOCATION`, `android.permission.BLUETOOTH_SCAN`, `android.permission.BLUETOOTH_CONNECT`, `android.permission.BLUETOOTH_ADVERTISE`.
    - Additional feature: `android.hardware.bluetooth_le`, `android.hardware.usb.host`
- If you want to use the USB MIDI feature on Oculus(Meta) Quest 2, please UNCOMMENT below to detect USB MIDI device connections.

The part of `PostProcessBuild.cs`

```
    public class ModifyAndroidManifest : IPostGenerateGradleAndroidProject
    {
        public void OnPostGenerateGradleAndroidProject(string basePath)
        {
            :

            // androidManifest.AddUsbIntentFilterForOculusDevices(); // UNCOMMENT
THIS LINE FOR OCULUS QUEST 2
```

How to implement features

Initializing Plugin

1. Call `MidiManager.Instance.InitializeMidi` method on `Awake` method in MonoBehaviour.
    - A GameObject named `MidiManager` will be created in `DontDestroyOnLoad` at the hierarchy view.

    > NOTE: If the EventSystem component already exists in another place, remove gameObject.AddComponent() method calling at MidiManager.Instance.InitializeMidi method.

2. (BLE MIDI only)
    - Call `MidiManager.Instance.StartScanBluetoothMidiDevices` method to scan BLE MIDI devices.
        - This method should be called in the `InitializeMidi` method's callback action.
3. (RTP-MIDI only)
    - Call `MidiManager.Instance.StartRtpMidi` method with session name and udp port number to start RTP-MIDI session accepting.

```
private void Awake()
{
    MidiManager.Instance.RegisterEventHandleObject(gameObject);
    MidiManager.Instance.InitializeMidi(() =>
    {
        MidiManager.Instance.StartScanBluetoothMidiDevices(0);
    });
}
```

Fig.1 Awake method will be like above.

Terminating Plugin

1. Call `MidiManager.Instance.TerminateMidi` method on `OnDestroy` method in `MonoBehaviour`.
    - This method should be called on finishing Scene or finishing to use MIDI functions.
2. (RTP-MIDI only)
    - Call `MidiManager.Instance.StopRtpMidi` method to stop RTP-MIDI session communications.

```
private void OnDestroy()
{
    MidiManager.Instance.TerminateMidi();
}
```

Fig.2 MidiManager termination.

Work with RTP-MIDI (experimental feature for non-iOS platforms)

- Start RTP-MIDI session:
  - Call `MidiManager.Instance.StartRtpMidi` method with session name and udp port number to start RTP-MIDI session accepting.
  - This will start listening to the udp port with the specified port number. The another computer can connect with the app.
- Stop RTP-MIDI session:
  - Call `MidiManager.Instance.StopRtpMidi` method to stop RTP-MIDI session communications.
- Connect another RTP-MIDI running computer:
  - Call `MidiManager.Instance.ConnectToRtpMidiClient` method to start connection with another computer.

```
// Starts to listen UDP 5004 port with session name "RtpMidiSession".
MidiManager.Instance.StartRtpMidi("RtpMidiSession", 5004);
...
// Stop the session
MidiManager.Instance.StartRtpMidi(5004);

// Connect to another machine's RTP-MIDI session
MidiManager.Instance.ConnectToRtpMidiClient("RtpMidiSession", 5004, new
IPEndPoint(IPAddress.Parse("192.168.0.111"), 5004));
```

Fig.3 using RTP-MIDI features

MIDI device attaching/detaching event handling

1. Call `MidiManager.Instance.RegisterEventHandleObject` method to register GameObject to receive event;
2. Implement interface `IMidiDeviceEventHandler` for event receiving.
    - `OnMidiInputDeviceAttached`, `OnMidiOutputDeviceAttached` will be called on a new MIDI device connected.
    - `OnMidiInputDeviceDetached`, `OnMidiOutputDeviceDetached` will be called on a MIDI device disconnected.

```
public void OnMidiInputDeviceAttached(string deviceId)
{
}

public void OnMidiOutputDeviceAttached(string deviceId)
{
    receivedMidiMessages.Add($"MIDI device attached. deviceId: {deviceId}, name:
{MidiManager.Instance.GetDeviceName(deviceId)}");
}

public void OnMidiInputDeviceDetached(string deviceId)
{
}

public void OnMidiOutputDeviceDetached(string deviceId)
{
    receivedMidiMessages.Add($"MIDI device detached. deviceId: {deviceId}, name:
{MidiManager.Instance.GetDeviceName(deviceId)}");
}
```

Fig.4 device attach/detach events handler

All codes are found at `Assets/MIDI/Samples/Scripts/MidiSampleScene.cs` file.

MIDI Event Receiving

1. Implement event receiving interface written in `IMidiEventHandler.cs` source code, named like `IMidiXXXXXEventHandler`.
    - If you want to receive a Note On event, implement the `IMidiNoteOnEventHandler` interface.
2. Call `MidiManager.Instance.RegisterEventHandleObject` method to register GameObject to receive event;
3. On receiving a MIDI event, the implemented method will be called.

```
public class MidiSampleScene : MonoBehaviour, IMidiAllEventsHandler,
IMidiDeviceEventHandler
{
    private void Awake()
    {
        MidiManager.Instance.RegisterEventHandleObject(gameObject);
        ...
```

Fig.5 example of implementation IMidiAllEventHandler and calling the `RegisterEventHandlerObject` method in `Awake`.

```
public void OnMidiNoteOn(string deviceId, int group, int channel, int note, int
velocity)
{
    receivedMidiMessages.Add($"OnMidiNoteOn channel: {channel}, note: {note},
velocity: {velocity}");
}

public void OnMidiNoteOff(string deviceId, int group, int channel, int note, int
velocity)
{
    receivedMidiMessages.Add($"OnMidiNoteOff channel: {channel}, note: {note},
velocity: {velocity}");
}
```

Fig.6 MIDI Note On/ Note Off event receiving handler
All codes are found at `Assets/MIDI/Samples/Scripts/MidiSampleScene.cs` file.

MIDI Event Sending

1. Call the `MidiManager.Instance.SendMidiXXXXXX` method somewhere. Like this:

```
MidiManager.Instance.SendMidiNoteOn("deviceId", 0/*groupId*/, 0/*channel*/,
60/*note*/, 127/*velocity*/);
```

2. deviceId can be obtained from `MidiManager.Instance.DeviceIdSet` property (type: HashSet<string>).

```
if (GUILayout.Button("NoteOn"))
{
    MidiManager.Instance.SendMidiNoteOn(deviceIds[deviceIdIndex], 0, (int)channel,
(int)noteNumber, (int)velocity);
}
```

Fig.7 Sending MIDI Note On message

All codes are found at `Assets/MIDI/Samples/Scripts/MidiSampleScene.cs` file.

Creating and start using a Sequencer

```
var isSequencerOpened = false;
var sequencer = new SequencerImpl(() => { isSequencerOpened = true; });
sequencer.Open();
```

Fig.8 Creating SequencerImpl instance and Open it.

All codes are found at `Assets/MIDI/Samples/Scripts/MidiSampleScene.cs` file.

Read SMF as a Sequence, and play it

```
sequencer.UpdateDeviceConnections();

using var stream = new FileStream(smfPath, FileMode.Open, FileAccess.Read);
sequencer.SetSequence(stream);
sequencer.Start();

...

sequencer.Stop();
```

Fig.9 Read a SMF and play it.

Record a sequence

```
sequencer.UpdateDeviceConnections();

sequencer.SetSequence(new Sequence(Sequence.Ppq, 480));
sequencer.StartRecording();

...

sequencer.Stop();
```

Fig.10 Set a new Sequence to record, and start recording MIDI data

Write the sequence to a SMF file

```
var sequence = sequencer.GetSequence();
if (sequence.GetTickLength() > 0)
{
    using var stream = new FileStream(recordedSmfPath, FileMode.Create,
FileAccess.Write);
    MidiSystem.WriteSequence(sequence, stream);
}
```

Fig.11 Write a SMF from recorded Sequence

Android: Use CompanionDeviceManager to find BLE MIDI devices

You can use CompanionDeviceManager for BLE MIDI device connection on Android.

To enable this feature, add `FEATURE_ANDROID_COMPANION_DEVICE` to the `Scripting Define Symbols` setting.

```
Project Settings > Other Settings > Script Compilation > Scripting Define Symbols
```

Tested devices

- Android: Pixel 4a, Oculus Quest2
- iOS: iPod touch 7th gen
- UWP/Standalone Windows/Unity Editor Windows: Surface Go 2
- Standalone OSX/Unity Editor OSX: Mac mini 3,1
- Standalone Linux/Unity Editor Linux: Ubuntu 20.04 on VirtualBox
- MIDI devices:
    - Quicco mi.1 (BLE MIDI)
    - Miselu C.24 (BLE MIDI)
    - TAHORNG Elefue (BLE MIDI)
    - Roland UM-ONE (USB MIDI)
        - NOTE: This device didn't work with iOS.
    - Gakken NSX-39 (USB-MIDI)
    - MacOS Audio MIDI Setup (RTP-MIDI)

Version History

- v1.0 Initial release
- v1.1 Update release
  - Add MIDI sequencer(playing / recording MIDI sequence) feature
  - Add SMF reading / writing feature
  - Add BLE MIDI Peripheral feature on Android
  - Fix USB MIDI receiving issues on Android
  - Fix BLE MIDI sending issues on Android / iOS
  - Fix BLE MIDI receiving issue(NoteOn with velocity = 0) on Android
- v1.2.0 Update release
  - Add experimental RTP-MIDI support for Android, or other platforms.
  - Add USB MIDI support for Universal Windows Platform(UWP).
  - Add Android 12's new Bluetooth permissions support.
  - Fix MIDI tranceiving performance improvement on iOS, Android.
  - Fix EventSystem duplication error when the sample scene appended multiple times.
  - Fix Android BLE MIDI's issue around fixed timestamp.
- v1.2.1 Bugfix release
  - Fix sequencer thread remains after closing
  - Fix Android ProgramChange message failure
  - Fix System exclusive logging issue
  - Fix ThreadInterruptException issue on UWP
  - Fix SMF reading/writing issues around System exclusive
  - Some performance improvements
- v1.3.0 Update release
  - Add platform support for Standalone OSX, Windows, Linux
  - Add platform support for WebGL
  - Add support for Unity Editor OSX, Windows, Linux
  - Changed Sequencer implementation from Thread to Coroutine
  - Fix iOS/OSX device attaching/detaching issue
- v1.3.1 Bugfix release
  - Issue connecting to Quest 2 via cable
  - Sample scene stops working.
  - Byte is obsolete on android
  - Any way of negotiating MTU?
  - Can't get it to work on iOS
  - Have errors with sample scene
  - Android permissions requesting issue
  - Add: Android CompanionDeviceManager support

Contacts

Report issues on GitHub

- GitHub supports repository: https://github.com/kshoji/Unity-MIDI-Plugin-supports
    - Search and report issues: https://github.com/kshoji/Unity-MIDI-Plugin-supports/issues

About plugin author

- Kaoru Shoji : 0x0badc0de@gmail.com
- github: https://github.com/kshoji

Used Open Source Softwares created by me:

- Android Bluetooth MIDI library: https://github.com/kshoji/BLE-MIDI-for-Android
- Android USB MIDI library: https://github.com/kshoji/USB-MIDI-Driver
- iOS MIDI library: https://github.com/kshoji/Unity-MIDI-Plugin-iOS
- MidiSystem for .NET(sequencer, SMF importer/exporter): https://github.com/kshoji/MidiSystem-for-.NET
- RTP-MIDI for .NET: https://github.com/kshoji/RTP-MIDI-for-.NET
- Unity MIDI Plugin UWP: https://github.com/kshoji/Unity-MIDI-Plugin-UWP
- Unity MIDI Plugin Linux: https://github.com/kshoji/Unity-MIDI-Plugin-Linux
- Unity MIDI Plugin OSX: https://github.com/kshoji/Unity-MIDI-Plugin-OSX

Used example MIDI data by others

specified as UnityWebRequest's URL source. The SMF binary file is not included.

- Prelude and Fugue in C minor BWV 847 Music by J.S. Bach
    - The MIDI, audio(MP3, OGG) and video files of Bernd Krueger are licensed under the cc-by-sa Germany License.
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