htc

VIVE WAVE

Build Unreal Engine 4.27 / 5.0 OpenXR applications on VIVE Focus3

September. 2022

Revision History

Revision	Date	Description
1.0.0	May 2022	Formal release.
1.0.1	Jul 2022	- Supported UE5.0. - Added Hand Interaction and Wrist Tracker.
1.0.2	Aug 2022	- Supported UE OpenXREyeTracker plugin. - Added VIVE Focus3 controller model in sample zip. - Renamed plugin folder name to ViveOpenXRAndroid.
1.0.3	Sep 2022	- Supported Facial Tracking. - Renamed plugin name to VIVE OpenXR Plugin – Android.

1. Introduction

VIVE Wave runtime had already supported OpenXR standard on VIVE Focus3. Welcome to join OpenXR of Wave runtime.

Since Unreal Engine 4.27, Epic Games claimed that the OpenXR Plug-in which allowed to develop the cross-platform applications for OpenXR is Production-Ready. In this guide, you will learn how to build an OpenXR app running on Focus3 through the following step-by-step sections.

What you will learn in this guide:

- Download pre-built Unreal Engine 4.27 / 5.0 through Epic Games Launcher
- Package, install and run VIVE OpenXR - Android application on VIVE Focus3
- Porting scene to use VIVE OpenXR - Android SDK

What Wave support on Focus3 in this release version:

- HMD tracking pose and XR rendering
- Controller tracking pose, key input, and haptics
- Hand tracking pose and Hand Interaction
- Wrist Tracker
- Eye Tracking
- Facial Tracking

Okay. Let’s get started to create your VIVE OpenXR - Android content on Focus3!

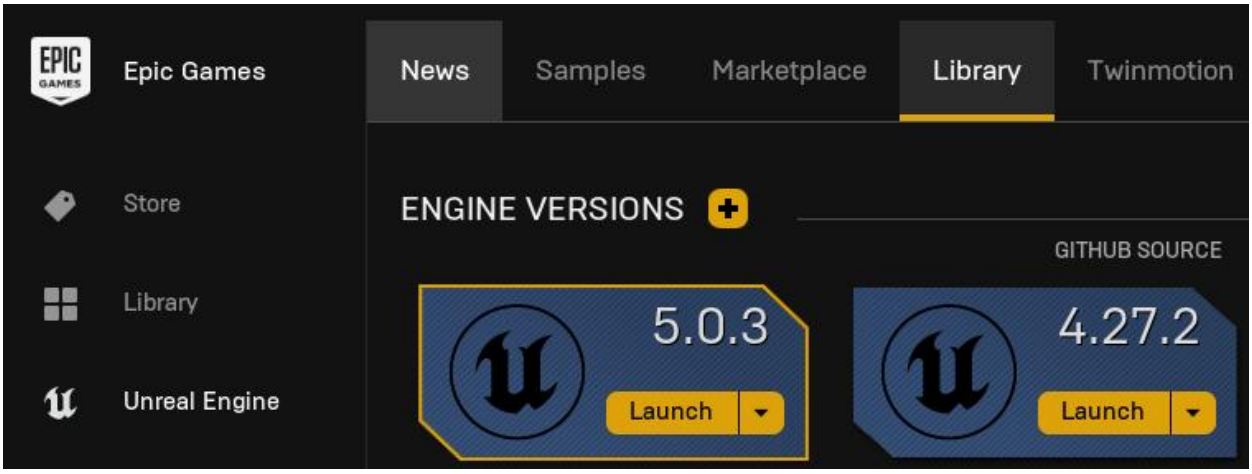
2. Download Pre-built Unreal Engine

2.1 Download Epic Games Launcher.

Download Epic Games Launcher here.

2.2 Download Unreal Engine by Epic Games Launcher

Navigate to ***Unreal Engine > Library*** and add ENGINE VERSIONS **4.27.2** or **5.0.3**.



3 VIVE OpenXR - Android SDK

3.1 VIVE OpenXR - Android Plug-In

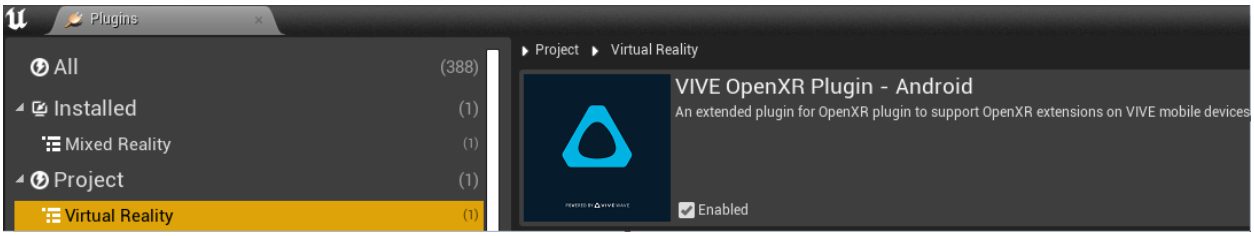
The **VIVE OpenXR - Android Plug-In** is at **<Where you unzip wave_openxr_plugin_<version>.zip>\ViveOpenXRAndroid**.

3.2 How to import VIVE OpenXR - Android Plug-In

Steps:

1. Copy and paste **ViveOpenXRAndroid** to *<Your Project Folder>\Plugins* such as *<Your Project Folder>\Plugins***ViveOpenXRAndroid** (Create a directory named "Plugins" if the project doesn't have.)
2. Double-click **<Your project>.uproject** to launch the project.

Then click *Unreal Engine Editor > Edit > Plugins*, the **VIVE OpenXR Plugin - Android** should be in the category *Project > VirtualReality*. Please relaunch the editor if the VIVE OpenXR Plugin - Android did not include in the Plugins list.



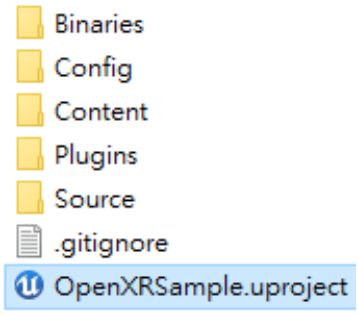
3.3 OpenXRSample

OpenXRSample is a sample project which includes scenes which let you experience our features such as input, hand tracking or other advanced features.

Unzip wave_openxr_sample_<version>.zip to get it. Please note that, you should import VIVE OpenXR - Android Plug-In before packaging the android apps.

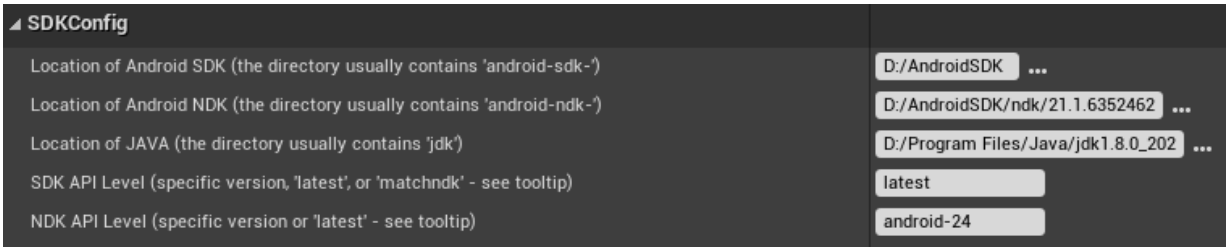
4 Package the Android Sample

Please make sure you already import the VIVE OpenXR - Android Plug-In. Then launch OpenXRSample**OpenXRSample.uproject**.



4.1 Project Settings of Android Environments

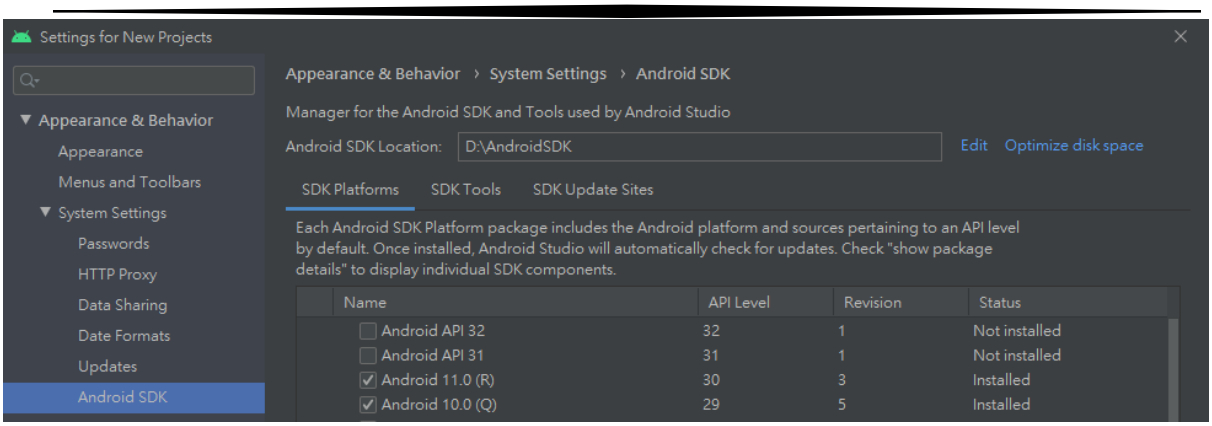
Click **Edit > Project Settings** to open the Project Settings window and navigate to **Platforms > Android SDK**.



You could refer [Setting up Android SDK and NDK for Unreal] to set up.

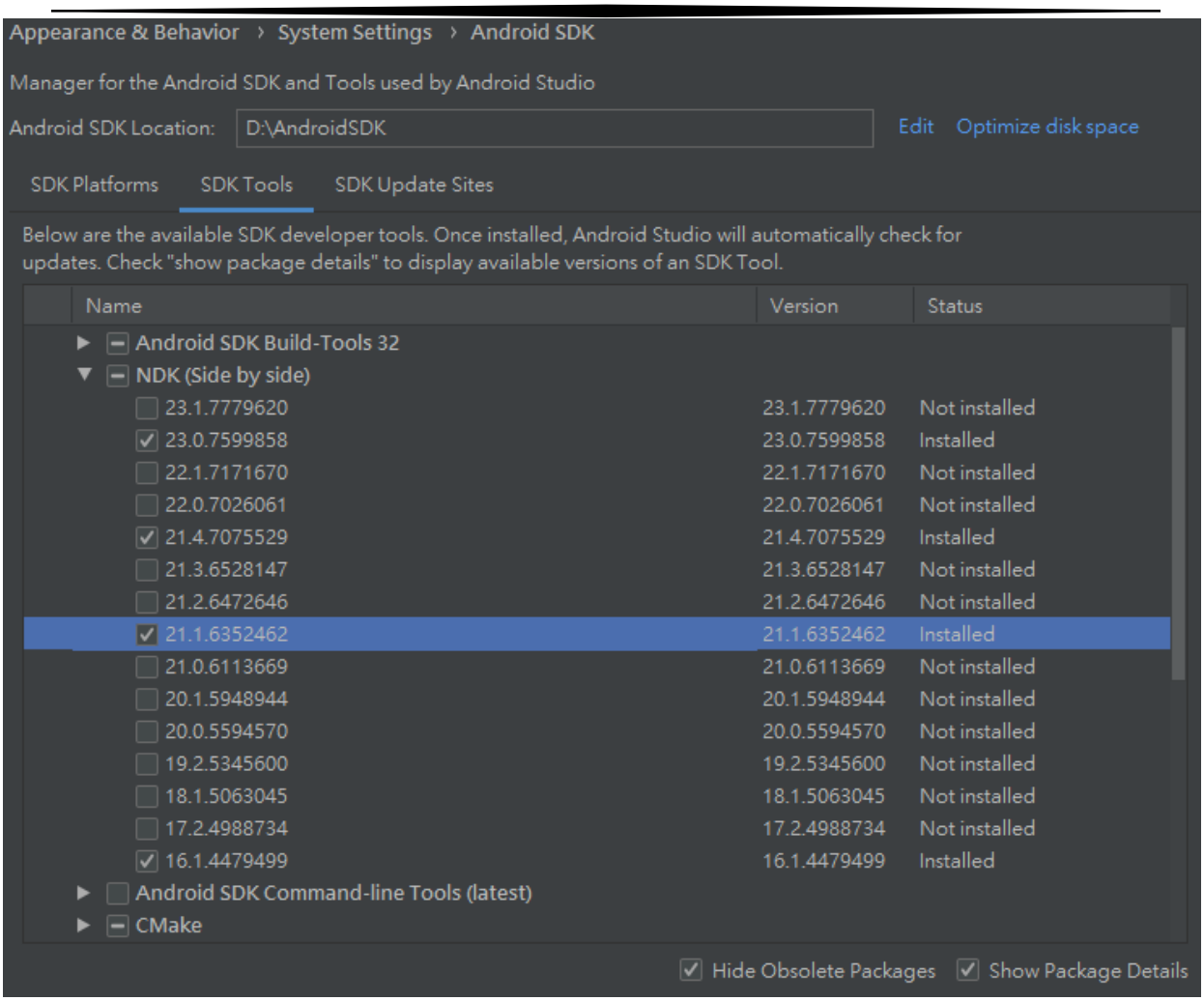
4.1.1 Location of Android SDK

Download Android Studio if you haven't yet. In Android Studio Editor, click *Tools > SDK Manager* and navigate to *Appearance & Behavior > System Settings > Android SDK*. The **Android SDK Location** is the path to be filled.



4.1.2 Location of Android NDK

Please fill your Android NDK(**21.1.6352462**) path to it. The NDK could be downloaded in the Android SDK. Click the tab **SDK Tools** and select **Show Package Details** at bottom right of the page to see the options.

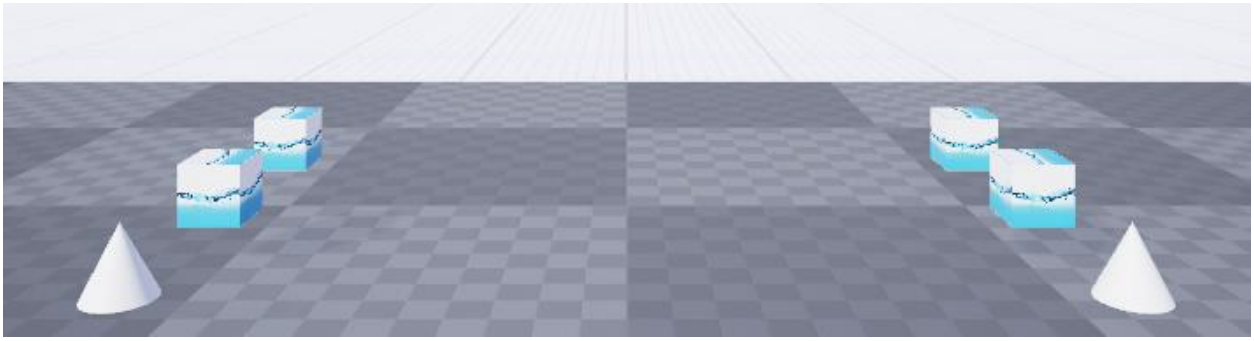


4.1.3 Location of JAVA

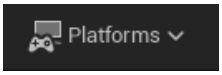
It is recommended to install [jdk1.8.0](jdk1.8.0).

4.2 Package the ButtonTest to an Android APK

You will see the current level is **ButtonTest** which is located at *Content > ButtonTest > ButtonTest.umap*.



In UE4.27, click **File > Package Project > Android > Android(ASTC)** to package the android application. In UE5.0, click **icon Platforms > Android > Package Project** to package it.



Then you will see the OpenXRSample-arm64.apk in the path *<path to OpenXRSample>/Android_ASTC/*.

Then you can execute **Install_OpenXRSample-arm64.bat** to install the android application automatically. For more information, refer to Android Getting Started.

Launch the sample **OpenXRSample** in Focus3, you can use right controller to control right objects and left controller to control left objects.

The far cube presents the button “touch” and “axis” actions. The far cube will change color when touching a button and rotate when the button has axis. Only **Trigger** and **Grip** button have axis.

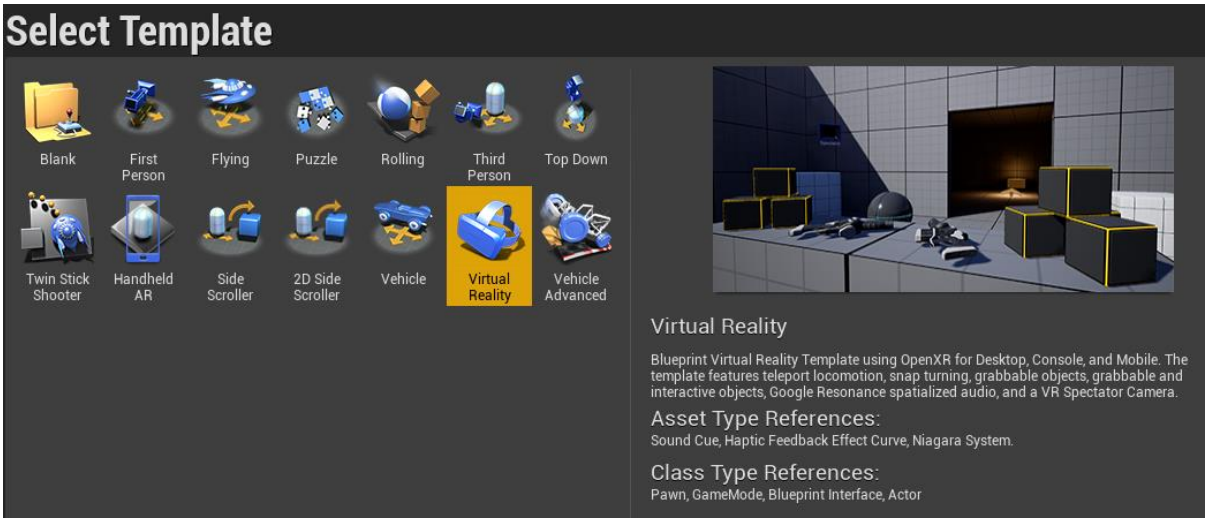
The near cube presents the button “press” action and will change color when pressing a button.

The cone presents the **Thumbstick** axis and will move when you operate the **Thumbstick** button.

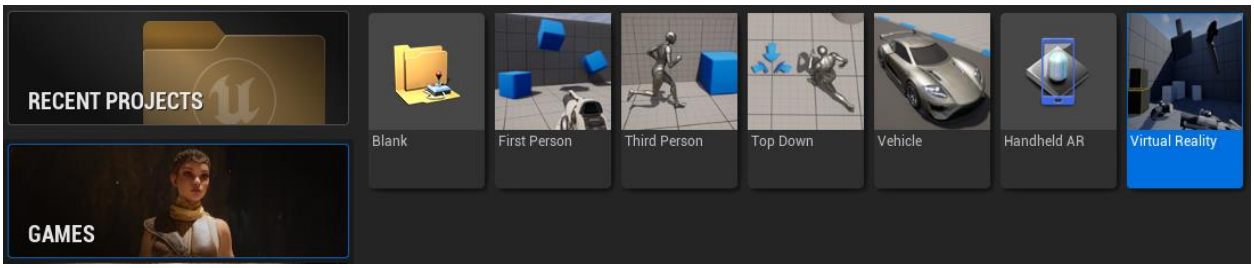
5 Porting scene to use VIVE OpenXR - Android

Unreal offered a Virtual Reality template project for starter. You can migrate your scene to the project and refer the video below to get started.

In UE4.27, select Virtual Reality project in the template list.



In UE5.0, click **GAMES** then select Virtual Reality project.



[Creating AR and VR Projects with Unreal Engine | Webinar]

5.1 Import VIVE OpenXR Android Plug-In

Please refer chapter 3.2 above to see how to import the VIVE OpenXR - Android Plug-In.

5.2 Disable other Virtual Reality Plugin-Ins

Please keep **Oculus OpenXR**, **Oculus VR** and **SteamVR** disabled, and keep **OpenXR**, **OpenXREyeTracker**, **OpenXRHandTracking**, **VIVE OpenXR - Android** enabled.

5.3 Project Settings

5.3.1 Project Settings of Unreal Engine

We assumed you migrate your scene to Virtual Reality project which Epic Games offered. You can refer other settings in Virtual Reality project that we didn't mention below.

Enable **Support arm64** and disable **Support armv7**. (Skip this in UE5 because UE5 did not support armv7 anymore.)

Enable **Support Vulkan**. **(MUST)**

Disable **Show launch image** to get rid of the non-stereo splash while launching app.

5.3.2 Project Settings of VIVE OpenXR Android Plug-In

Click **Edit > Project Settings** to open the Project Settings window and navigate to **Plugins > VIVE OpenXR - Android**.

5.3.2.1 Enable Hand Interaction

Select this option to enable Hand Interaction feature. For more information, see chapter 6.2.

5.3.2.2 Enable Wrist Tracker

Select this option to enable Wrist Tracker feature. For more information, see chapter 6.3.

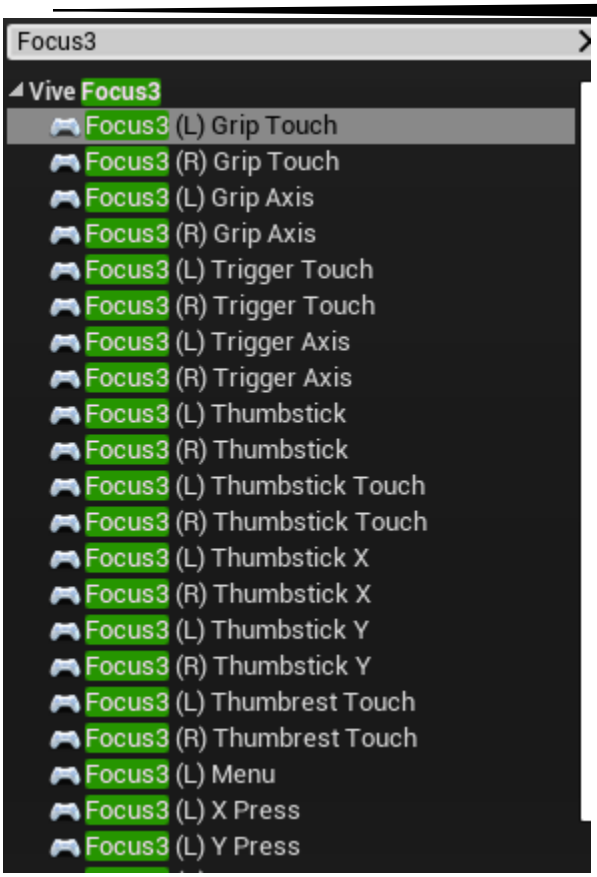
5.3.2.3 Enable Focus3 Controller

Select this option to support Focus3 controller.

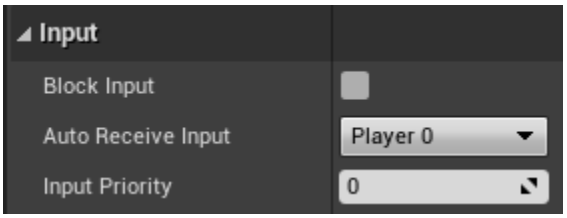
5.4 Input

To use the Focus3 controller input, you have to apply the **Input** action and axis mappings. Refer to this guide for detailed information.

Go to **Project Settings > Engine > Input** to configure the **Action Mappings** and **Axis Mappings**. You can see the inputs of **VIVE Focus3** by typing “Focus3” in the action specifying window.



Note: you have to enable the **Auto Receive Input** option in your blueprints to retrieve inputs.



5.5 VIVE Focus 3 Controller Model

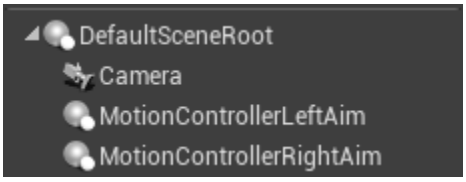
Because the OpenXR extension for controller model is still under discussion, we provide the VIVE Focus 3 controller asset for use now if the application needs.

5.5.1Download the sample zip

Please download the sample zip and copy OpenXRSample/Content/Models/Controller to your project.

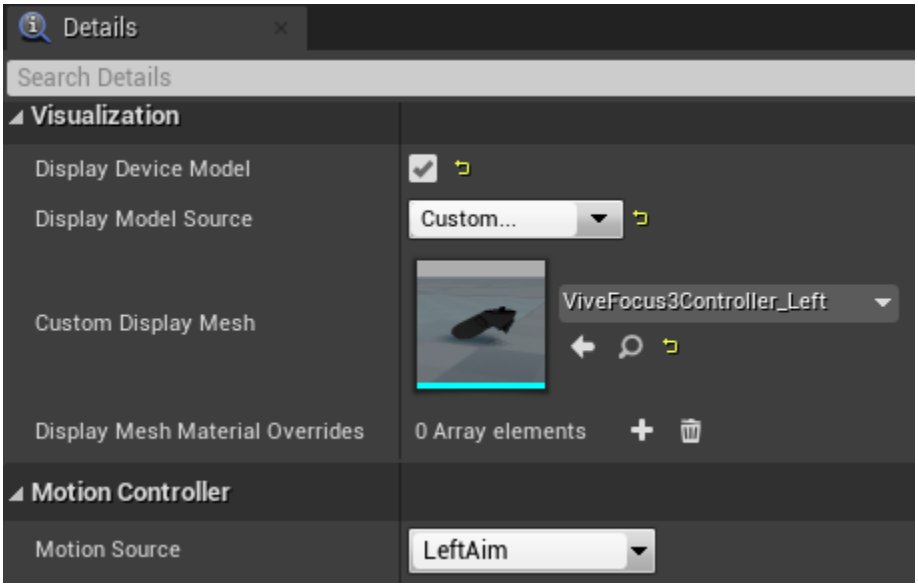
5.5.2Setup the Controller Model in MotionController

Add MotionController components in your VRPawn if you didn’t have. Such like:



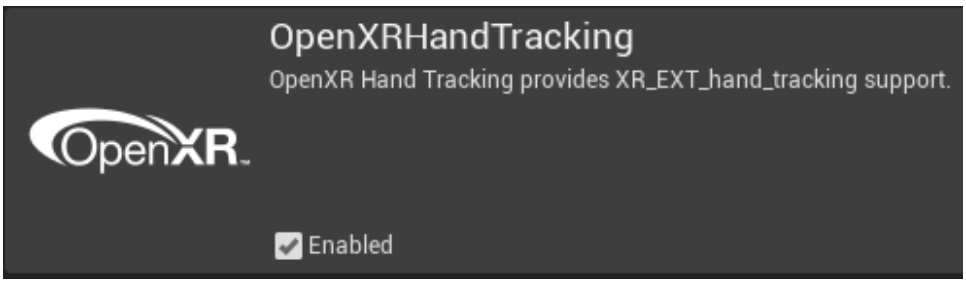
Click the MotionController component and check these settings:

1. Enable **Display Device Model.**
2. Set **Display Model Source** as Custom.
3. Select **Custom Display Mesh** as ViveFocus3Controller with the desired hand.
4. Select the **Motion Source** as LeftAim or RightAim.



6 Advanced Features

6.1 Hand Tracking



Please make sure the OpenXRHandTracking is enabled and refer to OpenXRSample/Content/NaturalHand/NaturalHand.umap

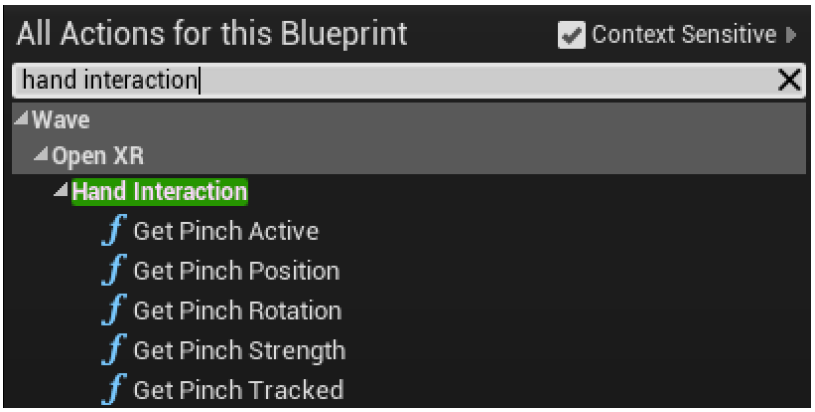
6.2 Hand Interaction

Use pinch motion to interact with Actors.

6.2.1Project Setting

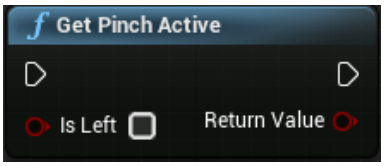
Click **Edit > Project Settings** to open the Project Settings window and navigate to **Plugins > VIVE OpenXR - Android**. Select **Enable Hand Interaction** to enable this feature.

6.2.2Blueprint Function Libraries



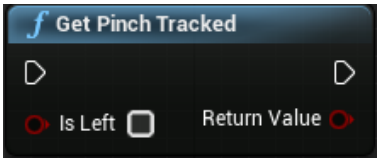
You can retrieve these pinch status of left hand if **Is Left** is true and the status of right hand if **Is Left** is false.

6.2.2.1 Get Pinch Active



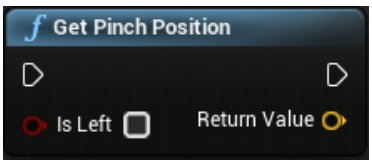
Checks if the pinch motion is active.

6.2.2.2 Get Pinch Tracked



Checks if the pinch motion is tracked.

6.2.2.3 Get Pinch Position



Retrieves the position of pinch origin of left or right hand.

6.2.2.4 Get Pinch Rotation

Retrieves the rotation of pinch origin of left or right hand.

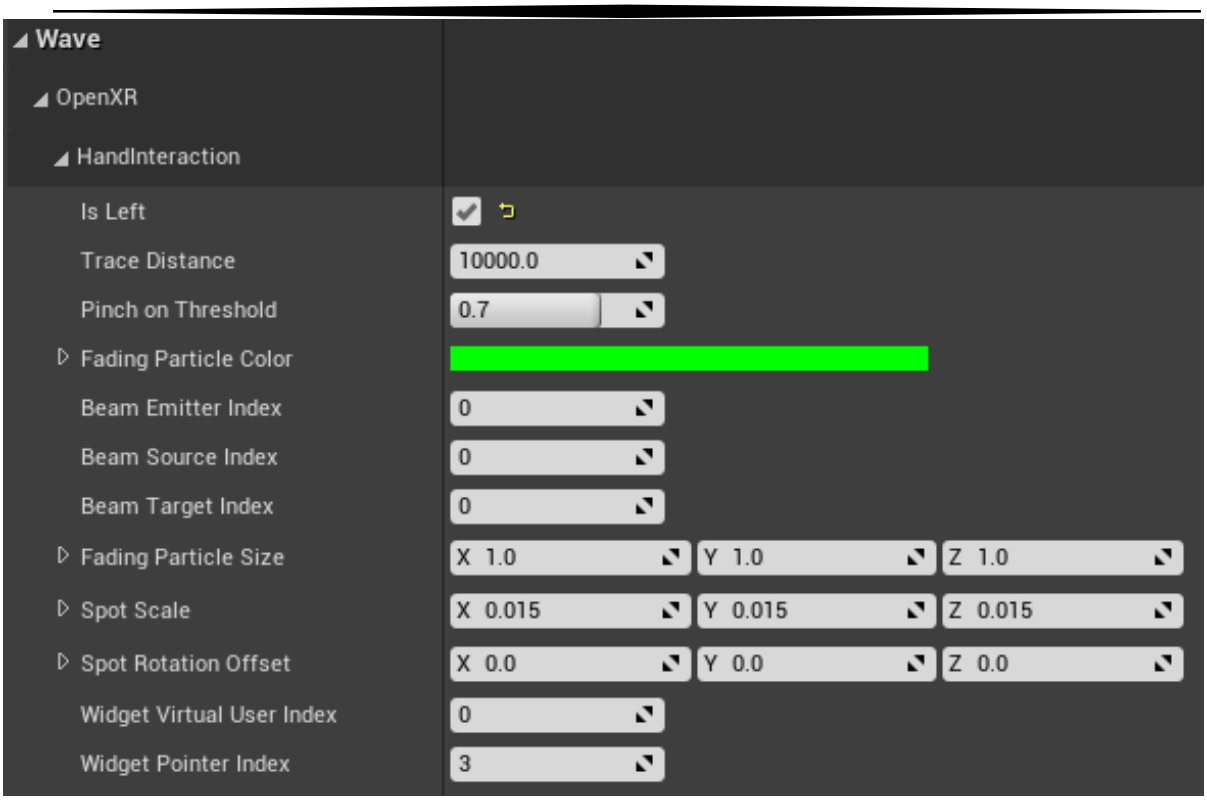
6.2.2.5 Get Pinch Strength

Retrieves the pinch strength of left or right hand. The return value should be [0, 1]. 1 means the index finger is closed to thumb very much.

6.2.3Wave Hand Pointer

Wave Hand Pointer is a SceneComponent which use the Hand Interaction feature. Wave Hand Pointer makes you easy to interact with Actors by hand.

The detail of Wave Hand Pointer:



Please refer OpenXRSample/Content/NaturalHand/NaturalHand.umap to see the sample.

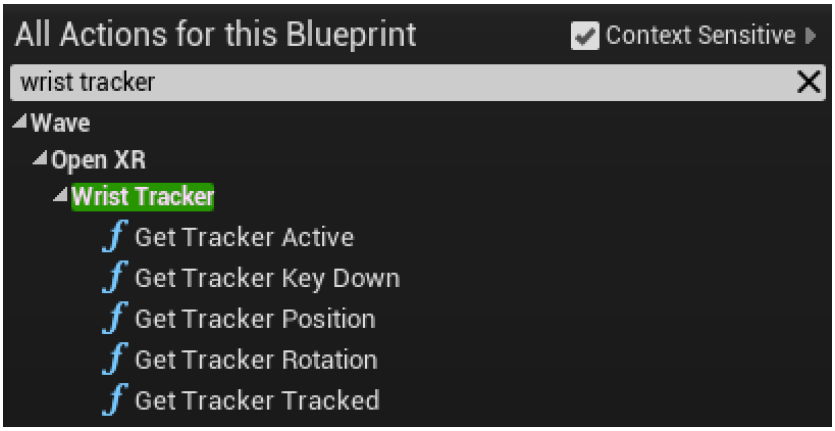
6.3 Wrist Tracker

Retrieve the status of Wrist Tracker.

6.3.1Project Settings

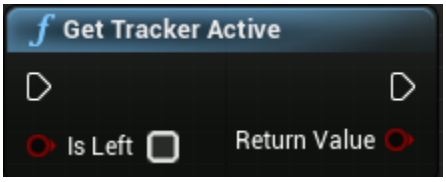
Click **Edit > Project Settings** to open the Project Settings window and navigate to **Plugins > VIVE OpenXR - Android**. Select **Enable Wrist Tracker** to enable this feature.

6.3.2Blueprint Function Libraries



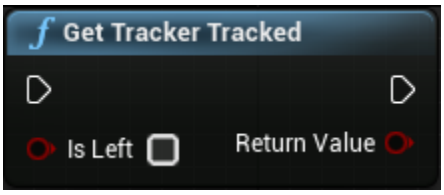
You can retrieve these tracker status of left or right device by setting **Is Left**. The **L / R** light mark the device is left or right. The L light will be on if the tracker is the left device.

6.3.2.1 Get Tracker Active



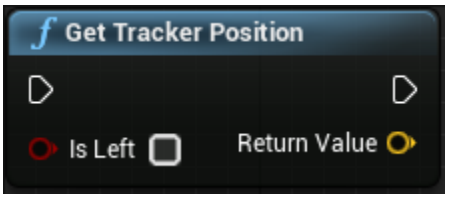
Checks if the tracker is active. (The device is connected or not.)

6.3.2.2 Get Tracker Tracked



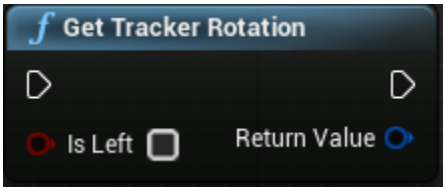
Checks if the tracker is tracked.

6.3.2.3 Get Tracker Position



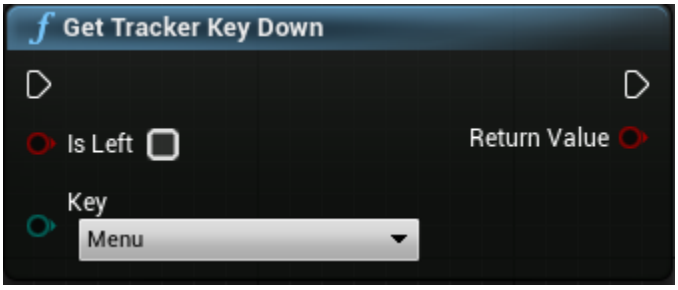
Retrieves the position of the left or right tracker.

6.3.2.4 Get Tracker Rotation



Retrieves the rotation of the left or right tracker.

6.3.2.5 Get Tracker Key Down



There are two buttons for each tracker. They are **Menu** and **Primary**.

Checks if these buttons pressing or not (releasing).

Note: You cannot retrieve the key status of Menu on the right device since it's a reserved key.

6.3.3Key event of Tracker input

The Get Tracker Key Down Blueprint Function is a polling way to get key status. If you want to listen one key event when the button had been pressed or released. You can register your input action event and add Tracker inputs in it:

Click **Edit > Project Settings** to open the Project Settings window and navigate to **Engine > Input**.

There are four inputs belongs to tracker, two for each tracker:

Tracker (L) Menu, Tracker (L) X Press, Tracker (R) System and Tracker (R) A Press.

Note: You cannot retrieve the Tracker (R) System key status since it's a reserved key.

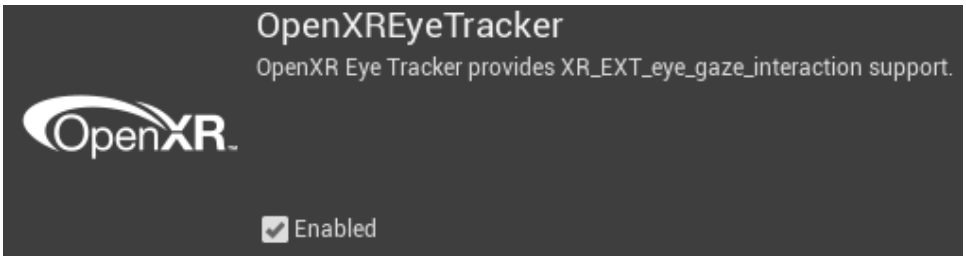
For example, I register the Input Action TriggerRight and add the **Tracker (R) A Press** in it, then I can listen the key event by InputAction TriggerRight.

For more information, refer to InteractiveExperiences-Input.

6.4 Eye Tracking

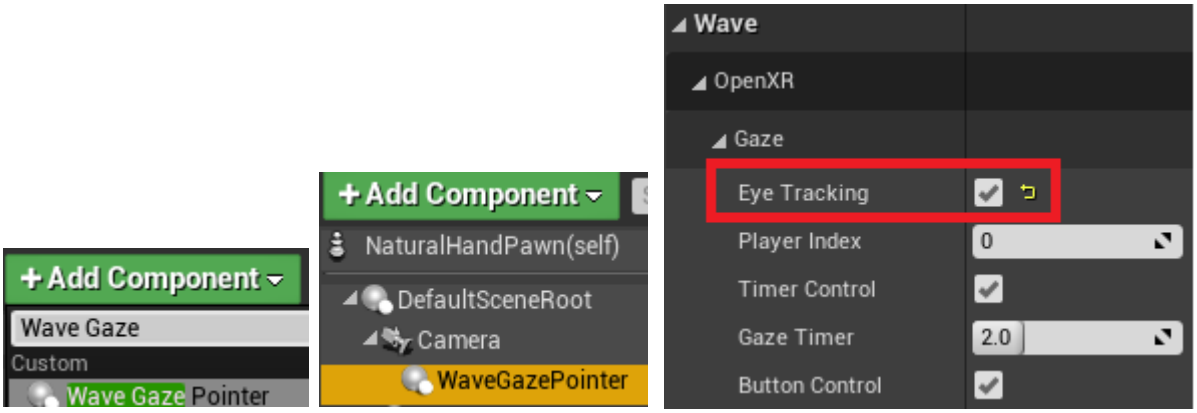
Unreal engine provides the **Eye Tracking** feature by enabling the **OpenXREyeTracker** plugin from *Plugin > Built-In > Virtual Reality > OpenXREyeTracker*.

After enabled the **Eye Tracking** feature, you can access the **Eye Tracking** data from [UEyeTrackerFunctionLibrary]interface.



6.4.1Eye Gaze

VIVE OpenXR Android plugin provides a [SceneComponent]named **WaveGazePointer** which can use the **Eye Tracking** data as gaze direction. By using the **WaveGazePointer** with **Eye Tracking** enabled, you can see a moving gaze pointer accompanying with your sight. We demonstrate the **Eye Gaze** which uses **WaveGazePointer** in the sample *OpenXRSample > Content > NaturalHand*.



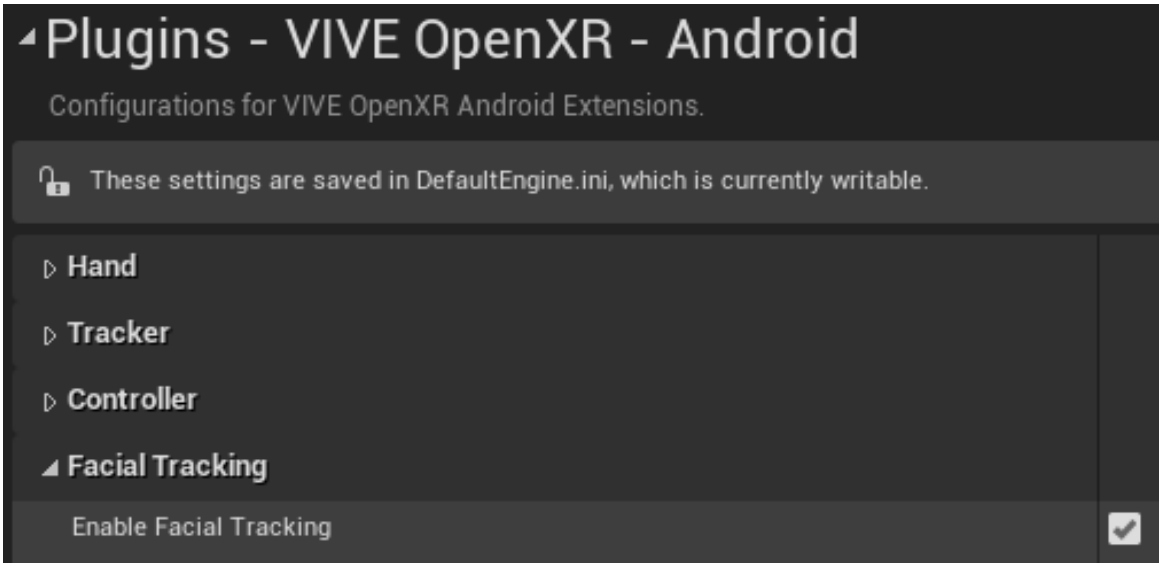
If you don’t enable the **Eye Tracking** option, the gaze pointer will be fixed at the center of screen.

6.5 Facial Tracking

VIVE OpenXR Android plugin supports the OpenXR 12.68. XR_HTC_facial_tracking specification.

6.5.1 Project Settings

Before using the **Facial Tracking** you have to enable the feature in *Project Settings > Plugins – VIVE OpenXR – Android > Facial Tracking*.



6.5.2 Blueprint Function Library

VIVE OpenXR Android plugin provides the Blueprint Function Library of **Facial Tracking** in ViveOpenXRAndroid > Source > ViveOpenXRAndroidFacialTracking > Public ViveFacialExpressionEnums.h and ViveOpenXRAndroidFacialTrackingFunctionLibrary.h.

```
UENUM(BlueprintType, Category = "ViveOpenXRAndroid|OpenXR|FacialTracking")
enum class EXrFacialTrackingType : uint8 {
	None = 0  UMETA(Hidden),
	Eye = 1,
	Lip = 2
};
```

```
/** The avatar's eye relative blend shape.*/
UENUM(BlueprintType, Category = "ViveOpenXRAndroid|OpenXR|FacialTracking")
enum class EEyeShape :uint8 {
      Eye_Left_Blink = 0   UMETA(DisplayName = "Left_Blink"),
      Eye_Left_Wide = 1    UMETA(DisplayName = "Left_Wide"),
      Eye_Left_Right = 2   UMETA(DisplayName = "Left_In"),
      Eye_Left_Left = 3    UMETA(DisplayName = "Left_Out"),
      Eye_Left_Up = 4      UMETA(DisplayName = "Left_Up"),
      Eye_Left_Down = 5    UMETA(DisplayName = "Left_Down"),
      Eye_Right_Blink = 6  UMETA(DisplayName = "Right_Blink"),
      Eye_Right_Wide = 7   UMETA(DisplayName = "Right_Wide"),
      Eye_Right_Right = 8  UMETA(DisplayName = "Right_Out"),
      Eye_Right_Left = 9   UMETA(DisplayName = "Right_In"),
      Eye_Right_Up = 10    UMETA(DisplayName = "Right_Up"),
      Eye_Right_Down = 11   UMETA(DisplayName = "Right_Down"),
      Eye_Frown = 12       UMETA(DisplayName = "Reserved"),
      Eye_Left_Squeeze = 13  UMETA(DisplayName = "Left_Squeeze"),
      Eye_Right_Squeeze = 14 UMETA(DisplayName = "Right_Squeeze"),
      Max = 15              UMETA(Hidden),
      None = 63             UMETA(DisplayName = "None"),
};

void GetIsFacialTrackingEnabled(bool& result)
```

- Checks if **Facial Tracking** is enabled in Project Settings.

```
bool CreateFacialTracker(EXrFacialTrackingType trackingType)
```

- Creates a facial tracker before retrieving the **Facial Tracking** data.

```
bool bool DestroyFacialTracker(EXrFacialTrackingType trackingType)
```

- Destroys a facial tracker when not using **Facial Tracking** anymore.

```
bool GetEyeFacialExpressions(bool& isActive, TMap<EEyeShape, float>& blendshapes)
```

- Retrieves the weightings of eye's blend shape.

```
bool GetLipFacialExpressions(bool& isActive, TMap<ELipShape, float>& blendshapes)
```

- Retrieves the weightings of lip blend shape.

6.5.3Sample code

You can find the sample code ViveOpenXRAndroid > Source > ViveOpenXRAndroidFacialTracking > Private - FT_AvatarSample.cpp demonstrates the usage of **Facial Tracking** blueprint function library.

```
/** The prediction result relative blend shape.*/
UENUM(BlueprintType, Category = "ViveOpenXRAndroid|OpenXR|FacialTracking")
enum class ELipShape :uint8 {
  Jaw_Right = 0                UMETA(DisplayName = "Jaw_Right"),
  Jaw_Left = 1                 UMETA(DisplayName = "Jaw_Left"),
  Jaw_Forward = 2              UMETA(DisplayName = "Jaw_Forward"),
  Jaw_Open = 3                 UMETA(DisplayName = "Jaw_Open"),
  Mouth_Ape_Shape = 4          UMETA(DisplayName = "Mouth_Ape_Shape"),
  Mouth_Upper_Right = 5        UMETA(DisplayName = "Mouth_Upper_Right"),
  Mouth_Upper_Left = 6         UMETA(DisplayName = "Mouth_Upper_Left"),
  Mouth_Lower_Right = 7        UMETA(DisplayName = "Mouth_Lower_Right"),
  Mouth_Lower_Left = 8         UMETA(DisplayName = "Mouth_Lower_Left"),
  Mouth_Upper_Overturn = 9     UMETA(DisplayName = "Mouth_Upper_Overturn"),
  Mouth_Lower_Overturn = 10    UMETA(DisplayName = "Mouth_Lower_Overturn"),
  Mouth_Pout = 11              UMETA(DisplayName = "Mouth_Pout"),
  Mouth_Smile_Right = 12       UMETA(DisplayName = "Mouth_Smile_Right"),
  Mouth_Smile_Left = 13        UMETA(DisplayName = "Mouth_Smile_Left"),
  Mouth_Sad_Right = 14         UMETA(DisplayName = "Mouth_Sad_Right"),
  Mouth_Sad_Left = 15          UMETA(DisplayName = "Mouth_Sad_Left"),
  Cheek_Puff_Right = 16        UMETA(DisplayName = "Cheek_Puff_Right"),
  Cheek_Puff_Left = 17         UMETA(DisplayName = "Cheek_Puff_Left"),
  Cheek_Suck = 18              UMETA(DisplayName = "Cheek_Suck"),
  Mouth_Upper_UpRight = 19     UMETA(DisplayName = "Mouth_Upper_UpRight"),
  Mouth_Upper_UpLeft = 20      UMETA(DisplayName = "Mouth_Upper_UpLeft"),
  Mouth_Lower_DownRight = 21   UMETA(DisplayName = "Mouth_Lower_DownRight"),
  Mouth_Lower_DownLeft = 22    UMETA(DisplayName = "Mouth_Lower_DownLeft"),
  Mouth_Upper_Inside = 23      UMETA(DisplayName = "Mouth_Upper_Inside"),
  Mouth_Lower_Inside = 24      UMETA(DisplayName = "Mouth_Lower_Inside"),
  Mouth_Lower_Overlay = 25     UMETA(DisplayName = "Mouth_Lower_Overlay"),
  Tongue_LongStep1 = 26        UMETA(DisplayName = "Tongue_LongStep1"),
  Tongue_Left = 27             UMETA(DisplayName = "Tongue_Left"),
  Tongue_Right = 28            UMETA(DisplayName = "Tongue_Right"),
  Tongue_Up = 29               UMETA(DisplayName = "Tongue_Up"),
  Tongue_Down = 30             UMETA(DisplayName = "Tongue_Down"),
  Tongue_Roll = 31             UMETA(DisplayName = "Tongue_Roll"),
  Tongue_LongStep2 = 32        UMETA(DisplayName = "Tongue_LongStep2"),
  Tongue_UpRight_Morph = 33    UMETA(DisplayName = "Tongue_UpRight_Morph"),
  Tongue_UpLeft_Morph = 34     UMETA(DisplayName = "Tongue_UpLeft_Morph"),
  Tongue_DownRight_Morph = 35  UMETA(DisplayName = "Tongue_DownRight_Morph"),
  Tongue_DownLeft_Morph = 36   UMETA(DisplayName = "Tongue_DownLeft_Morph"),
  Max = 37                     UMETA(Hidden),
  None = 63                    UMETA(DisplayName = "None"),
};
```

7 Known Issues

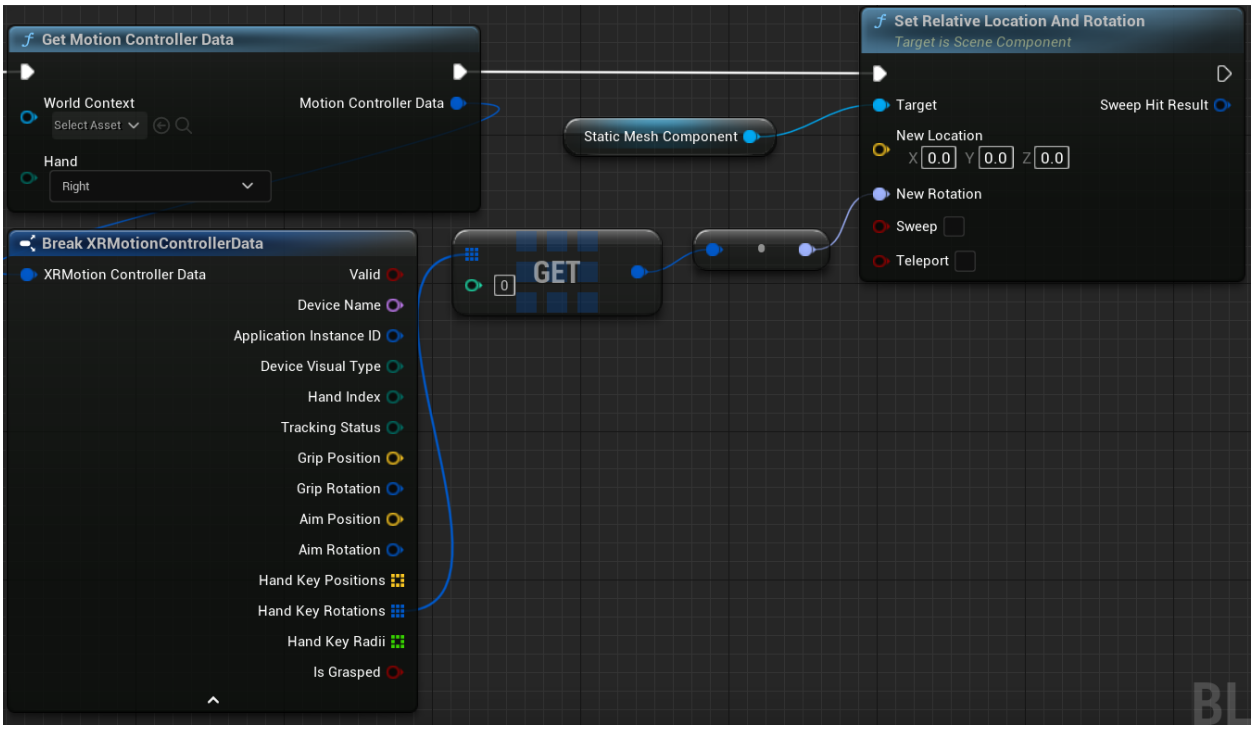
8 Troubleshooting

1. *Apps with development build may crash after turning off HMD by pressing power bank or take off for a while and put it on.*

[How to fix]

Select *project settings > Project > Packaging > Project > Build Configuration* as Shipping.

2. *[UE5][HandTracking][ShippingBuild] The Actor may disappear when you convert Hand Key Rotation (Quat) to Rotator and set the rotation to the Actor.*



[How to fix]

Make sure the Quat **IsNormalized(Quat)** first.