Using the VRG and MPU9250 with Unity

ELEC4547 Emerging Tech in VR/AR 2023

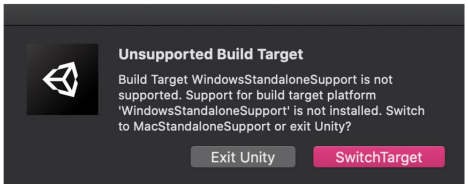
Unity for VR Development

Unity is a cross-platform game engine that can be used to create VR content. Educational licenses are free and available online for both Windows and Mac. The graphical interface and high level of documentation available online, including many great tutorials, will help you develop complicated scenes quickly.

We have put together a **demo project** (Modified from Stanford EE267 course material by Zhenyang and Wenbin to support VRG headset and MPU9250) which takes care of the stereo rendering and reading orientation data from your IMU. This is a great starting point for your final project! Below are instructions for how to setup this project on your computer.

Set-up Instructions

1. Download Unity version 2018.4.20 LTS. While this is definitely not the latest version released, a lot more bugs have been found and fixed.
2. When Unity prompts you to open a project, select the unzipped ELEC4547_unitystarter folder. If it prompts you to approve a build target change (as below), select SwitchTarget.

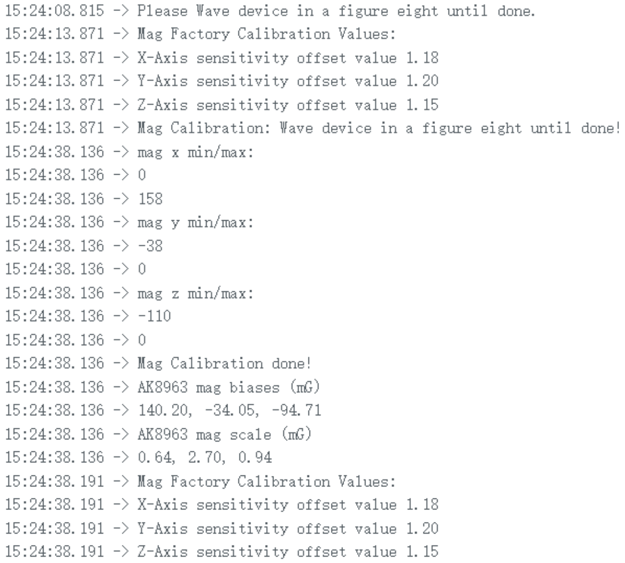


Unsupported Build Target

Build Target WindowsStandaloneSupport is not supported. Support for build target platform 'WindowsStandaloneSupport' is not installed. Switch to MacStandaloneSupport or exit Unity?

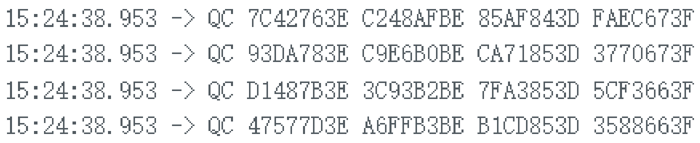
3. Connect the display and IMU to your computer. Run IMU.ino in the IMU folder included in the starter project. This script starts with calibration and then transfers orientation data to your PC. You should see the following output in Serial Monitor.

   Calibration:



```
15:24:08.815 -> Please Wave device in a figure eight until done.
15:24:13.871 -> Mag Factory Calibration Values:
15:24:13.871 -> X-Axis sensitivity offset value 1.18
15:24:13.871 -> Y-Axis sensitivity offset value 1.20
15:24:13.871 -> Z-Axis sensitivity offset value 1.15
15:24:13.871 -> Mag Calibration: Wave device in a figure eight until done!
15:24:38.136 -> mag x min/max:
15:24:38.136 -> 0
15:24:38.136 -> 158
15:24:38.136 -> mag y min/max:
15:24:38.136 -> -38
15:24:38.136 -> 0
15:24:38.136 -> mag z min/max:
15:24:38.136 -> -110
15:24:38.136 -> 0
15:24:38.136 -> Mag Calibration done!
15:24:38.136 -> AK8963 mag biases (mG)
15:24:38.136 -> 140.20, -34.05, -94.71
15:24:38.136 -> AK8963 mag scale (mG)
15:24:38.136 -> 0.64, 2.70, 0.94
15:24:38.191 -> Mag Factory Calibration Values:
15:24:38.191 -> X-Axis sensitivity offset value 1.18
15:24:38.191 -> Y-Axis sensitivity offset value 1.20
15:24:38.191 -> Z-Axis sensitivity offset value 1.15
```

Orientation data: (represented as quaternion in 4 bytes for serial port transportation)



```
15:24:38.953 -> QC 7C42763E C248AFBE 85AF843D FAEC673F
15:24:38.953 -> QC 93DA783E C9E6B0BE CA71853D 3770673F
15:24:38.953 -> QC D1487B3E 3C93B2BE 7FA3853D 5CF3663F
15:24:38.953 -> QC 47577D3E A6FFB3BE B1CD853D 3588663F
```

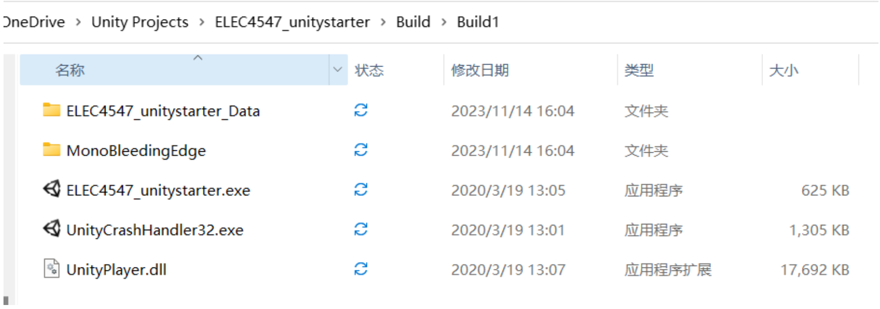
4. Close the Serial Monitor in Arduino IDE, then open the ReadUSB script and change the portName = "COM4" to the port name corresponding to your IMU. Usually the easiest way to check this is through the Arduino IDE interface by going into Tools -> Port.
5. Open the CardboardProfile.cs script (located in ELEC4547_unitystarter/Assets/Cardboard/Scripts) and check the parameters for the ELEC4547VRG to match your display. There is some variation be- tween our displays.
6. Double check that the "API Compatibility Level" is set to .NET 4.0. This can be found under Edit -> Project Settings -> Player Settings -> Settings for PC, Mac & Linux -> Other Settings.

Press the play button and you should see the scene moving with your IMU in the Play Window. Now you're ready to create something cool!

Build Instructions

To view your project properly from within your VRG headset you will have to build it. To do this:

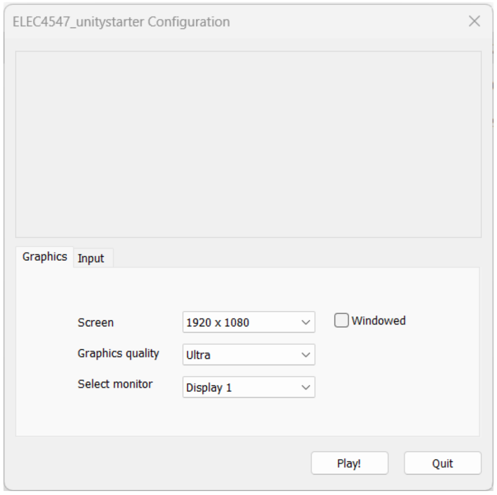
1. Save your project and then go to File -> Build Settings -> Build. It will prompt you to select a location, create a new folder in the "Build" folder. Try to avoid overwriting a build as this can cause errors. Instead just delete old builds once you are done with them.
2. To run your project, navigate to your designated build location and open the "ELEC4547_unitystarter" application (or other if you figured out how to rename it).



DneDrive › Unity Projects › ELEC4547_unitystarter › Build › Build1

名称	状态	修改日期	类型	大小
ELEC4547_unitystarter_Data		2023/11/14 16:04	文件夹	
MonoBleedingEdge		2023/11/14 16:04	文件夹	
ELEC4547_unitystarter.exe		2020/3/19 13:05	应用程序	625 KB
UnityCrashHandler32.exe		2020/3/19 13:01	应用程序	1,305 KB
UnityPlayer.dll		2020/3/19 13:07	应用程序扩展	17,692 KB

3. A popup will appear. Set the screen resolution to that of your display (in the VRG headset) and try medium/high graphics quality, depending on your computer specs. Then press Play! Confirm that you can see what you did in the Unity editor, but now fullscreen.



ELEC4547_unitystarter Configuration

Screen: 1920 x 1080 □ Windowed
Graphics quality: Ultra
Select monitor: Display 1

Note for anti-aliasing

Unity has a built-in functionality for performing anti-aliasing. The default anti aliasing quality in our starter project is set to 2x Multi Sampling to run our starter project smoothly on a laptop without a discrete GPU. However, the aliasing artifact is still visible with this setting. If your machine is powerful and you want to improve the rendering quality, you can set the anti aliasing quality to 8x Multi Samplingto have nice smooth edges. If your computer is not powerful and you want to reduce the computational load, you can also set it to Disabled.