AERIAL EXPLORER VR

Team VR Mighty Pirates
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PREFACE

In this package we deliver everything that you will need to build the Application from scratch under the prerequisite that you know how to build the UE4 (Unreal Engine 4) itself and UE4 Android Applications.

This might be a complex task if you have not done it before, but to copy the complete documentation in this document would not be of much help, because it is very good documented online.

Note that you will need an Android working environment. The easiest way to set this up is described here:

- https://docs.unrealengine.com/latest/INT/Platforms/Android/GettingStarted/1/index.html

Please download the UE4 source code by following this guide:

- https://docs.unrealengine.com/latest/INT/GettingStarted/DownloadingUnrealEngine/index.html

Make sure you build on the GIT Tag 4.8.2-release plus our engine changes, that you can simply extract in the engine folder to overwrite and add some files. A GIT patch would not have been sufficient, because there are binary files that have to be added too. So we decided this would be the easiest way to reproduce out build.

Then build the Unreal Editor 4 editor by using this guide:

- https://docs.unrealengine.com/latest/INT/Programming/Development/BuildingUnrealEngine/index.html

After a successful compilation of the Development Editor Win64 build you need to register your editor in the system by running the Engine\Binaries\Win64\UnrealVersionSelector-Win64-Shipping.exe.

To build a working application for you will need to get an oculus signature file that is required for Gear VR development:

- https://developer.oculus.com/osig/

PACKAGE DOCUMANTATION

In the AerialExplorerVR.zip File you will find the folders:

- AerialExplorerVR
  - UE4 Project
  - UE4 Engine Patch
  - Documentation

The UE4 Project folder contains the UE4 Project itself along with the source code, the content, config files and additional build assets for the Android build.

The content of the UE4 Engine Patch folder must be copied into the cloned 4.8.2-release branch of the UE4 source code, as described below.

The documentation contains this document and some other insights.

SUPPORTED HARDWARE AND RESTRICTIONS

The DJI Phantom 3 does not allow live video preview via WiFi. We did not know that before joining the contest. This was problematic, because the Samsung Gear VR for the Samsung Note 4 occupies the only USB port.

We had a spare DJI Phantom 2 Vision+. This way we were able to work on a solution and deliver at least a proof of concept challenge entry. Later generations of the Gear VR have a USB port that is hopefully useable to connect to the drone's remote control. The Gear VR for the Galaxy S6 was just released but the timescale was too short and our budget too low to adapt that quickly.

That means our project is only tested with the following hardware Setup:

- DJI Phantom 2 Vision+
- Samsung Galaxy Note 4
- Samsung Gear VR for the Galaxy Note 4

BUILD AND RUN STEPS OVERVIEW/CHECKLIST

This guide is only tested on a Windows PC. It might work on Linux or Mac too, but you will need to change some details.

1. Unpack the delivered archive.
2. Install the Android build environment, like described in the preface and Epic Games docs
3. Clone the UE4 source code from github and check out branch 4.2.8-release, like described in the preface and Epic Games docs.
4. Copy the content of our UE4 Engine Patch folder into the root folder of the downloaded repository (the one containing the Engine folder).
5. Build the UE4 with build configuration Development Editor Win64, like described in the preface and Epic Games docs.
6. After the build, register the engine installation folder by running the Engine\Binaries\Win64\UnrealVersionSelector-Win64-Shipping.exe.
7. Now switch the Unreal Engine Version of our Project to the Engine that you just registered and generate the Visual Studio project files, both options can be found in the right click menu. (see Figure 1)

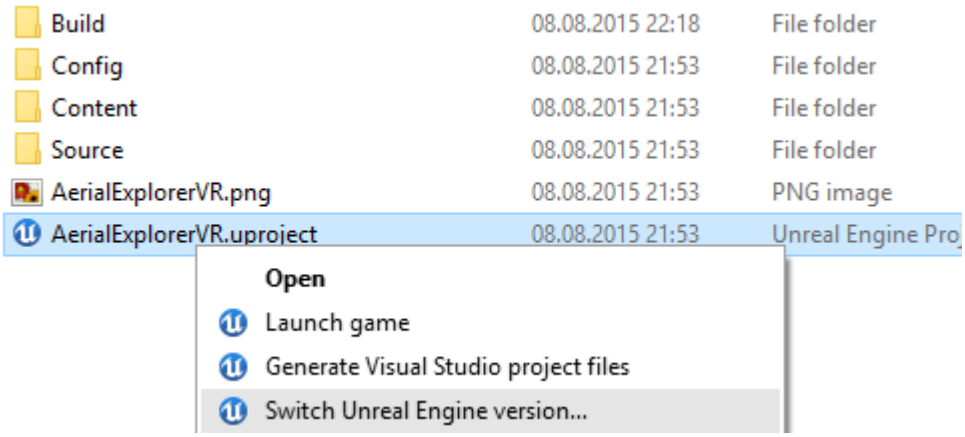

Figure 1 - The project file right-click menu

8. Now just double click the Project file. It will ask you for allowance to build the project. Just accept. In rare cases it might be that you need to build the complete solution one time in Visual Studio, again with Development Editor Win64 configuration.
9. When you arrived in the Editor you are half way there. Now configure your Android SDK, NDK, ANT and Java 1.8 Path in the Edit > Project Settings > Platforms – Android SDK. Make sure you have android-19 API level selected like shown in Figure 2.

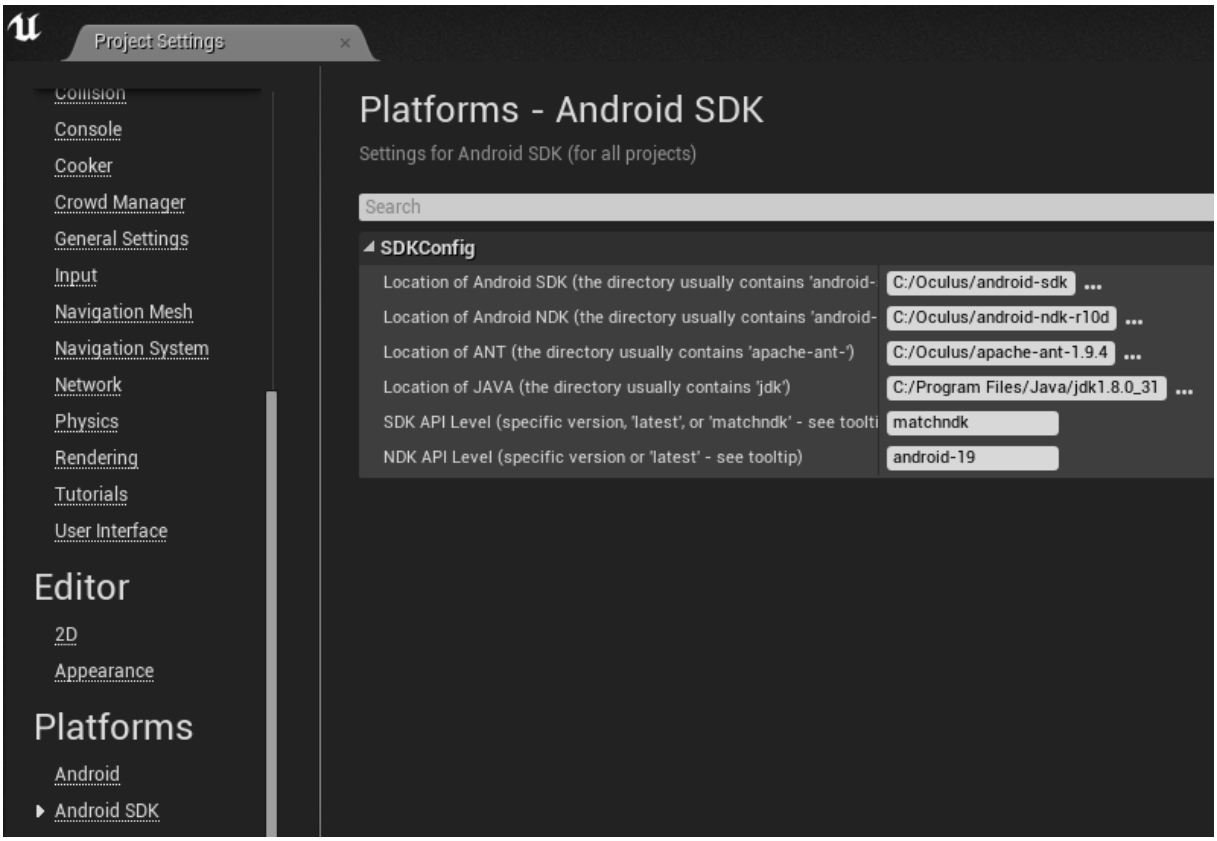

Figure 2 - Required UE4 Android SDK settings (your paths may vary)

10. Now you will need the **Oculus Signature File** especially for the serial number of your Samsung Galaxy Note 4 device. Without this the Application will just exit with an exception. **This step is absolutely important! Get your signature file from this website:** https://developer.oculus.com/osig/ **and copy it without any changes to the filename and content to the Project directory AerialExplorerVR\Build\Android\assets\.**

11. Before packaging the build configuration shipping should be selected to get the extra performance that we need for the video processing. The setting can be found under File > Package Project > Build configuration (see Figure 3)

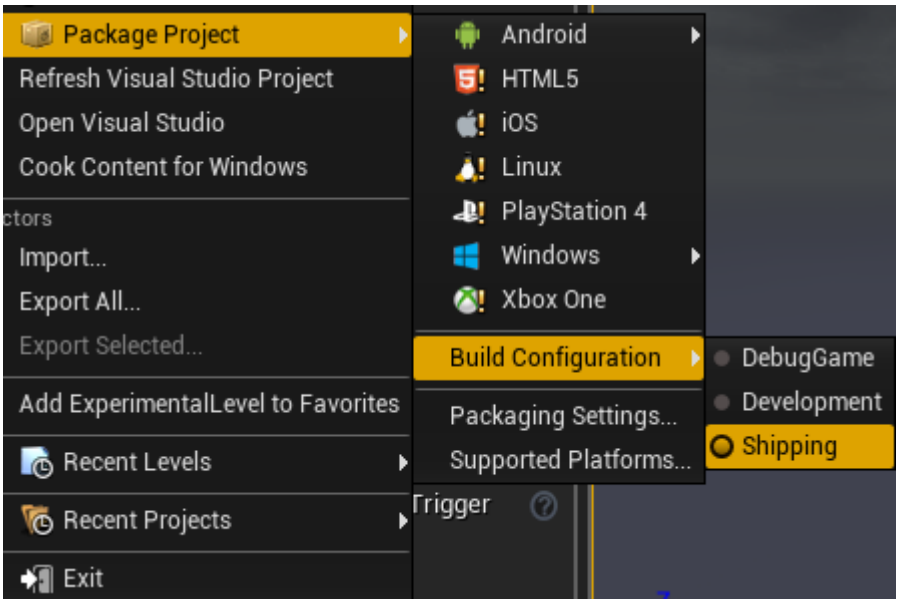

Figure 3 - Select build configuration shipping

12. Now you are ready to build and package the android application. Select File > Package Project > Android > Android (ASTC) like shown in Figure 4 – this step needs an hour to finish the first time (depending on your computer), but will be much faster on later builds.

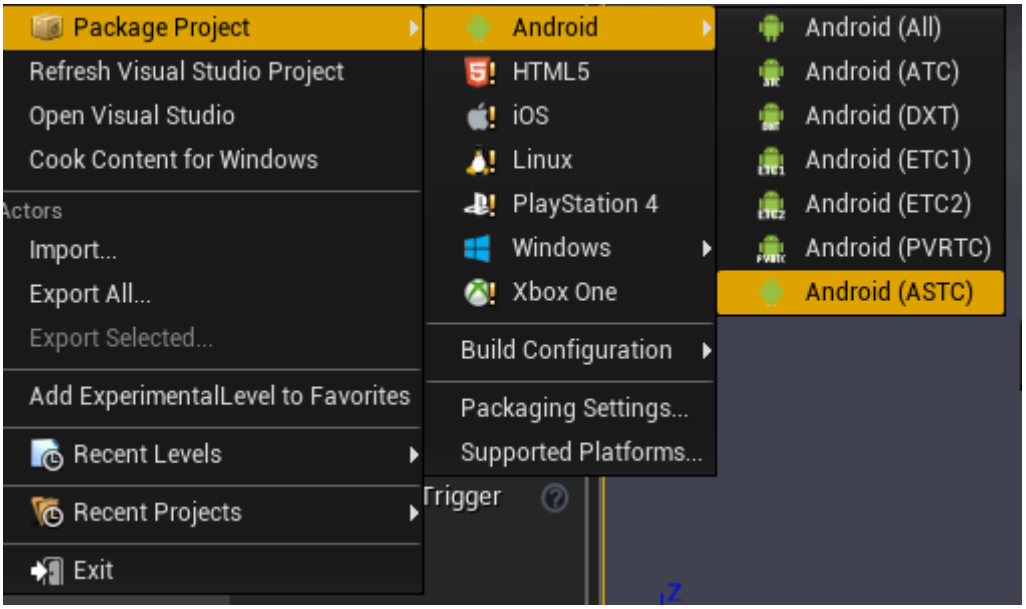

Figure 4 - Start packaging for Android (ATSC)

13. If the build was successful you will now be able to install on the Note 4 via USB and ADB. The script in the release directory that you selected will do that automatically, just make sure the device is connected and execute it. (see Figure 5)

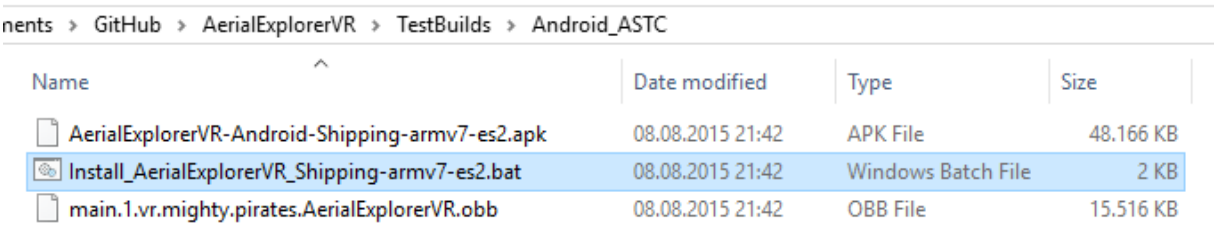

Figure 5 - Make sure the Note 4 is connected and run the install script

14. This step is inconvenient but necessary to validate our API key: Connect the phone to the internet and start the application. Plug it into the gear VR and wait a few seconds, now unplug it again. This will also close the application. – A future version will do this automatically with the right permissions, or we will have a DJI service running that works independend from the VR app and has to be set up before.
15. Now make sure the Galaxy Note 4 is connected to the Phantom 2 Vision+ via WiFi.
16. Start the application again, plug it into the Gear VR and enjoy.

CONCLUSION

Now you should be able to see the live stream on a screen in front of you. You can look around and change the distance to the screen by swiping the Gear VR touchpad forward and backward. Your head orientation will control the drone's camera pitch smoothly and the screen will follow, according to the incoming gimbal data. We have not yet implemented the yaw, because that would involve much more testing and we are not working fulltime on this project.

Nevertheless, we think this is a proof of concept. We have live video and coupled controls. The rest is just a matter of implementation expenses. UE4 and mobile VR is ready for immersive drone flights.

FUTURE

We would love to do further work on this project after the challenge. Our open points list for a potential Oculus Store release in December and maybe Google Cardboard release is:

1. More performance tweaks on the video stream from java to the game thread
2. Yaw rotation by head movement for drones with fixed forward camera and those with rotating camera
3. Stability and convenience when connecting to the drone, especially the first time
4. Writing even more forum posts until Epic Games finally implements Android Lollipop Anti-Aliasing for VR apps, this is a long time missing feature now
5. A Google Cardboard port as soon as the community plugin of UE4 Cardboard is production ready
6. Display of the current drone location with a reticle in the sky of the VR simulation, so the user will know where the drone is when he removes the VR Device from his eyes
7. At least one fun and immersive environment, like sitting in an alien flying saucer (maybe more environments could be in app purchase)
8. Support for the Phantom 3 and other drone models with the new Gear VR models that have an external USB