Interreg

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Northern Periphery and Arctic

GLOW2.0

Deliverable 2.2.1 Demo-version of the immersive technology.

Author: Marius Wang
UiT The Arctic University of Norway
Faculty of Engineering Science and Technology
Contributors: Karelia UAS, Udaras/UnaG, SSNV, WestBIC, PLAKY

Photo: Noel Bauza/ Pixabay

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1 Introduction

From work package 2 in period 2 (01.06.2023 – 30.11.2023) the Activity 2.2 – Design and development of the immersive technology/ virtual planetarium across the scalable outputs, generated the Deliverable 2.2.1 – Demo-version of the immersive technology.

Activity 2.2 includes the design and development of immersive technology (coding), meaning:

- Choosing one of the concepts described in Activity 2.1 for piloting together with the project partners and SMEs involved in the project.
- Establishing the location and the surroundings on Earth in one of the associate partners' countries.
- Star sky recreation.
- Design interaction and adapting user experience elements to the virtual reality.

2 Development of the demo version

Concept chosen was a full-scale virtual environment with stars, earth, earth's moon and with the possibility to control the day/night-time, clouds, and aurora. ***Location*** selected is Ballycroy, Ireland (54.023623, -9.821064). Using the star map and planet/moon content collected from NASA, the stars has been ***recreated*** into the virtual environment and displayed in the demo.

The ***virtual*** environment presented as a demo, contains two of the four stages that were listed earlier:

- ✓ First stage was to create stars and planets (partly done in the Period 1).
- ✓ Second stage was to establish the locations where the "virtual tourist" is spectating from.
- Third stage would be implementing storytelling with a narrator.
- Fourth stage would be a preview of a real video or photograph captured from that location.

With the stars and skies developed in the concept, the development has been continued to further improve the visuals and the performance to achieve the highest possible quality and

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framerate. The concept did also only support desktop experience, and it has been added compatibility for virtual reality (VR) and support for the VR headset used for development and testing. In preparation of using a laptop for the demonstration in Ireland, it was added possibilities to scale the software and the resolution according to the hardware in the laptop. The scalability groups are presented in Figure 1.

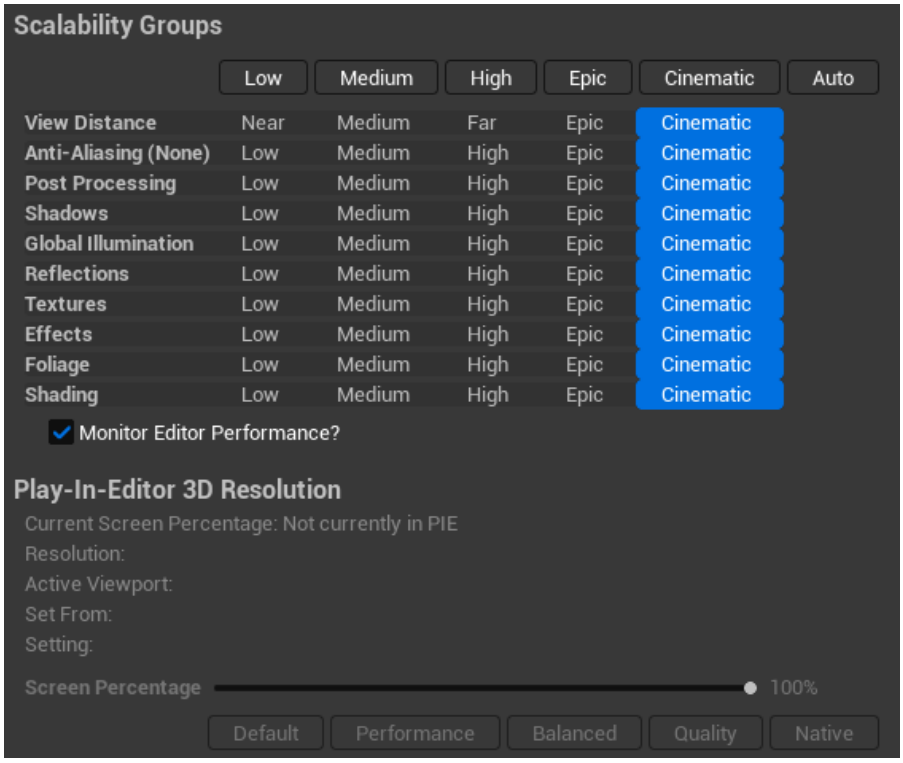

Figure 1 – Scalability Groups.

The parameter that corresponds to the different settings are listed in the *Appendix* 1.

The week before the partner meeting in Ireland, media and pictures was recorded in Ballycroy National Park to support the recreation of the virtual environment of the destination. Detailed pictures of the location and the landscape was a part of creating the design inside the

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application. A few 3D scans were also done, one of them is shown in Figure 2. If opened in MS WORD, it is an interactive 3D model.

Figure 2 - 3D model of stone in Ballycroy

After creating the 3D models, they were imported into the virtual environment to be a part of the demonstration the week after.

3 Demonstration of the demo version in Ireland

The application was made for showcasing and displayed few elements from the selected locations (Figure 3.). The application was made for high-end VR computer and a high-resolution VR headset for the ultimate experience, but due to the lack of performance with the

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laptop the experience and the picture quality were not as desired. The application was running in the lowest settings and reduced resolution (720p) to achieve decent framerate to avoid motion sickness.

The following hardware was used for the showcasing and demonstration of the virtual planetarium in Ireland:

- VR headsets HTC Vive Pro Eye

- ASUS G703 laptop designed for graphical workload with the following specification:

- 64-bit processor and operating system
- OS: Win 10
- Processor: i9 9980HK
- Memory: 32 GB RAM
- Graphics: Nvidia RTX 2080 (8 GB VRAM)
- DirectX: Version 12
- Network: WiFi 6 / 2.5 Gbit LAN
- Storage: 2 TB available space
- Sound Card: Any
- VR Support: OpenXR, Seated, Standing, Roomscale. Valve Index, HTC Vives and Pico using SteamVR. Oculus headsets with Oculus Runtime. WMR headsets with WMR Runtime.
- Additional Notes: Virtual Desktop not recommended (Questlink/Airlink Fully Supported).

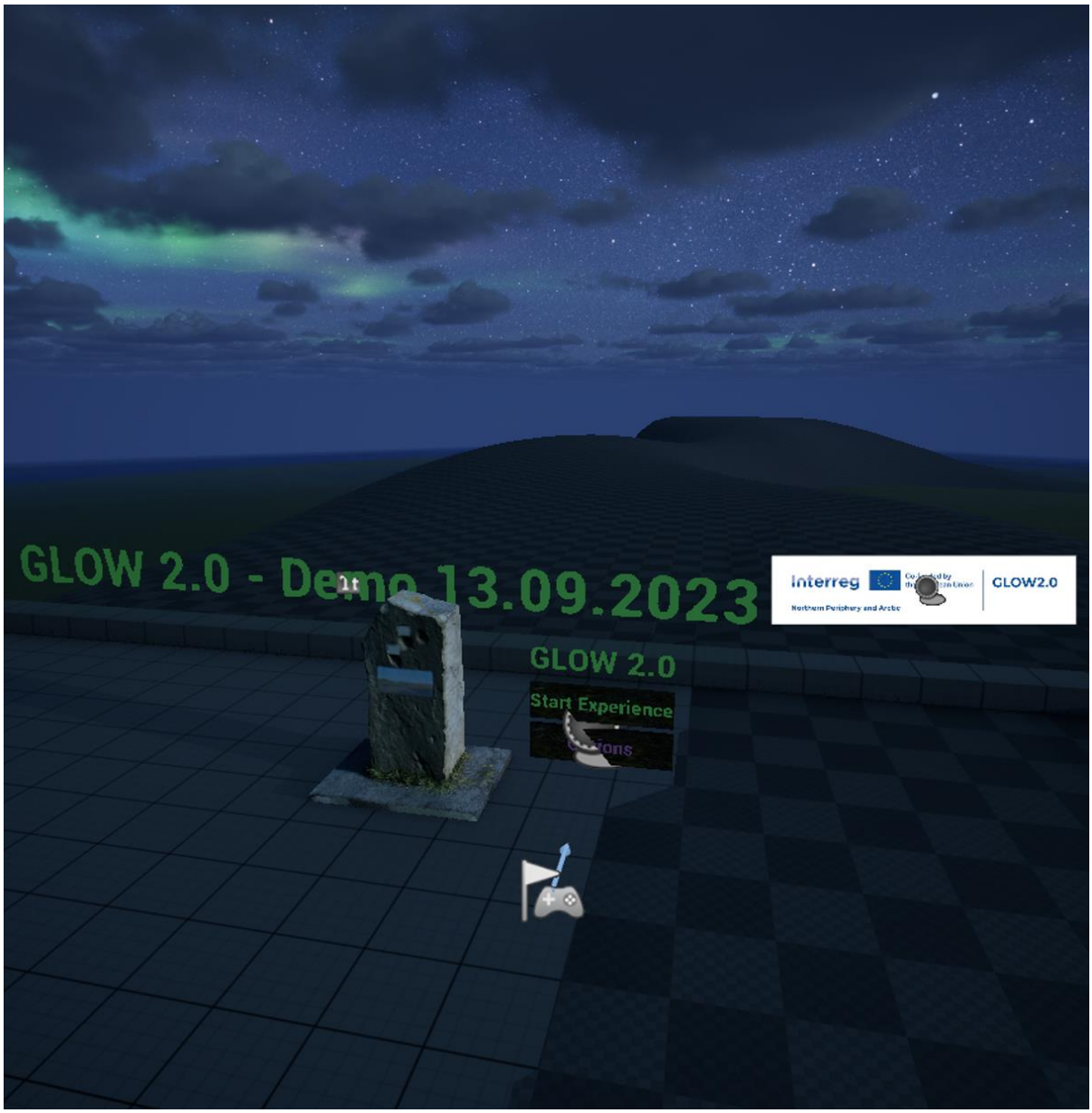

Figure 3 – Screenshot from the virtual environment demo with the stone added.

The demonstration (Fig.4.) was attended by both project partners and stakeholders from Ireland. As the performance were poor during this demonstration, it was agreed to have a second try during the project partners meeting and learning journey in Narvik, Norway in February 2023 (Period 3) to get the intended experience in VR.

Figure 4 – Picture from the demonstration in Ireland

4 Further work

After the data collection during the stay in Ireland, the main development has been creating the landscape in the virtual world to resemble the real world. By using the photos, topographic map (https://en-ie.topographic-map.com/map-rgp/Ireland/) and terrain map (Google), the foundation of the landscape has been created.

In Figure 2 and Figure 3, a comparison is made between the virtual world and the real world. To make the comparison as accurate as possible, a virtual camera has been created with the same camera- and lens settings as the real camera used to take the picture.

Due to high demand and low availability the planned workstation was not used in the start of development. A custom build computer for graphical application was used to create the

software for the demo. The professional workstation was acquired after the demonstration was presented:

- Dell Precision 7865 (AMD Threadripper Pro, 512 GB RAM, Nvidia RTX 6000 x2).

Figure 2 – Screenshot from the virtual world

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Figure 3 – Picture taken in Ballycroy

Appendix 1. Parameters linked to scalability groups.

LogConfig: Applying CVar settings from Section [EffectsQuality@3] File [Scalability]
LogConfig: Set CVar [[r.SSGI.Quality:3]]
LogConfig: Set CVar [[r.SkyAtmosphere.AerialPerspectiveLUT.FastApplyOnOpaque:1 ; Always have FastSkyLUT 1 in this case to avoid wrong sky]]
LogConfig: Set CVar [[r.SkyAtmosphere.AerialPerspectiveLUT.SampleCountMaxPerSlice:4]]
LogConfig: Set CVar [[r.SkyAtmosphere.AerialPerspectiveLUT.DepthResolution:16.0]]
LogConfig: Set CVar [[r.SkyAtmosphere.FastSkyLUT:1]]
LogConfig: Set CVar [[r.SkyAtmosphere.FastSkyLUT.SampleCountMax:128.0]]
LogConfig: Set CVar [[r.SkyAtmosphere.SampleCountMin:4.0]]
LogConfig: Set CVar [[r.SkyAtmosphere.SampleCountMax:128.0]]
LogConfig: Set CVar [[r.SkyAtmosphere.TransmittanceLUT.SampleCount:10.0]]
LogConfig: Set CVar [[r.SkyAtmosphere.MultiScatteringLUT.SampleCount:15.0]]
LogConfig: Set CVar [[fx.Niagara.QualityLevel:3]]
LogConfig: Applying CVar settings from Section [FoliageQuality@3] File [Scalability]
LogConfig: Applying CVar settings from Section [ShadingQuality@3] File [Scalability]
LogConfig: Set CVar [[r.HairStrands.SkyLighting.IntegrationType:2]]
LogConfig: Set CVar [[r.HairStrands.SkyAO.SampleCount:4]]
LogConfig: Set CVar [[r.HairStrands.Visibility.MSAA.SamplePerPixel:4]]
LogContentStreaming: Texture pool size now 1000 MB
LogRenderer: Display: Recreating Shadow.Virtual.PhysicalPagePool due to size or flags change. This will also drop any cached pages.
LogConfig: Applying CVar settings from Section [ViewDistanceQuality@Cine] File [Scalability]
LogConfig: Set CVar [[r.ViewDistanceScale:10.0]]
LogConfig: Applying CVar settings from Section [AntiAliasingQuality@Cine] File [Scalability]
LogConfig: Set CVar [[r.FXAA.Quality:5]]
LogConfig: Set CVar [[r.TSR.History.R11G11B10:0]]
LogConfig: CVar [[r.TSR.Velocity.Extrapolation:1]] deferred - dummy variable created
LogConfig: Applying CVar settings from Section [ShadowQuality@Cine] File [Scalability]
LogConfig: Set CVar [[r.Shadow.MaxResolution:4096]]
LogConfig: Set CVar [[r.Shadow.MaxCSMResolution:4096]]
LogConfig: Set CVar [[r.Shadow.RadiusThreshold:0]]
LogConfig: Set CVar [[r.VolumetricFog.GridPixelSize:4]]
LogConfig: Set CVar [[r.VolumetricFog.HistoryMissSupersampleCount:16]]
LogConfig: Set CVar [[r.Shadow.Virtual.MaxPhysicalPages:8192]]
LogConfig: Set CVar [[r.Shadow.Virtual.ResolutionLodBiasLocalMoving:0.0]]
LogConfig: Set CVar [[r.Shadow.Virtual.SMRT.RayCountDirectional:16]]
LogConfig: Set CVar [[r.Shadow.Virtual.SMRT.SamplesPerRayDirectional:8]]
LogConfig: Set CVar [[r.Shadow.Virtual.SMRT.RayCountLocal:16]]
LogConfig: Set CVar [[r.Shadow.Virtual.SMRT.SamplesPerRayLocal:8]]
LogConfig: Applying CVar settings from Section [GlobalIlluminationQuality@Cine] File [Scalability]
LogConfig: Set CVar [[r.Lumen.ScreenProbeGather.RadianceCache.NumProbesToTraceBudget:1000]]
LogConfig: Set CVar [[r.Lumen.ScreenProbeGather.DownsampleFactor:8]]
LogConfig: Set CVar [[r.Lumen.ScreenProbeGather.TracingOctahedronResolution:16]]
LogConfig: Set CVar [[r.Lumen.ScreenProbeGather.FullResolutionJitterWidth:.5]]
LogConfig: Set CVar [[r.Lumen.TranslucencyVolume.TracingOctahedronResolution:4]]
LogConfig: Set CVar [[r.Lumen.TranslucencyVolume.RadianceCache.ProbeResolution:16]]
LogConfig: Set CVar [[r.Lumen.TranslucencyVolume.RadianceCache.NumProbesToTraceBudget:1000]]
LogConfig: Applying CVar settings from Section [ReflectionQuality@Cine] File [Scalability]
LogConfig: Set CVar [[r.SSR.Quality:4]]
LogConfig: Set CVar [[r.Lumen.TranslucencyReflections.FrontLayer.Enable:1]]
LogConfig: Applying CVar settings from Section [PostProcessQuality@Cine] File [Scalability]
LogConfig: Set CVar [[r.DepthOfFieldQuality:4]]
LogConfig: Set CVar [[r.RenderTargetPoolMin:1000]]
LogConfig: Set CVar [[r.LensFlareQuality:3]]
LogConfig: Set CVar [[r.Bloom.ScreenPercentage:100]]
LogConfig: Set CVar [[r.DOF.Gather.ResolutionDivisor:1 ; do the gathering at full resolution]]
LogConfig: Set CVar [[r.DOF.Gather.EnableBokehSettings:1 ; bokeh simulation when gathering]]
LogConfig: Set CVar [[r.DOF.Gather.RingCount:5 ; high number of samples when gathering]]
LogConfig: Set CVar [[r.DOF.Scatter.MaxSpriteRatio:0.25 ; only a maximum of 10% of scattered bokeh]]
LogConfig: Set CVar [[r.DOF.Recombine.Quality:2 ; highest slight out of focus]]
LogConfig: Set CVar [[r.DOF.Recombine.EnableBokehSettings:1 ; bokeh simulation on slight out of focus]]
LogConfig: Applying CVar settings from Section [TextureQuality@Cine] File [Scalability]
LogConfig: Set CVar [[r.Streaming.PoolSize:3000]]

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FURTHER INFORMATION

GLOW2.0 - Green Energy Technologies for Tourism Project has been funded by Interreg Northern Periphery and Arctic Programme.

Link to project website: NPA GLOW