“Tourism in VR” - Final Project Report

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Abstract: This virtual tourism project presents an immersive exploration of diverse natural landscapes, namely snowy terrains with the enchanting allure of dense forest ecosystems. Designed to provide users with an unparalleled adventure from the comfort of their homes, the experience begins with a picturesque journey through pristine snow-covered landscapes. The user starts off with a magnificent view atop a snowy mountain, skiing their way down into the forest terrain.

This virtual adventure then takes you into a vibrant forest filled with trees, rocks, and different kinds of grass. The detailed design of the forest makes it feel like a real nature experience, immersing you in the detailed sights. You can wander through hidden paths, interact with animated virtual plants and foliage, and then test your aim at a shooting range in the middle of the forest with interactable guns and responsive targets. Whether seeking relaxation or adventure, this virtual tour promises an unforgettable journey through the wonders of winter and the enchantment of vibrant forest landscapes.

Introduction/Motivation: This project was developed to offer a tour of nature that people can experience from the comfort of their homes. It improves accessibility to all, regardless of restrictions such as health issues, financial issues or harsh environments that make it unfeasible to explore an area. The primary inspiration for this project is National Geographic’s VR, which lets you explore icebergs and snowy terrain in the Antarctic and then go kayaking with the whales, while also letting you switch up and transition into the Inca Citadel in Peru, where you could encounter Alpacas and see what mummy worship looks like. This motivated me to develop a dual terrain project where the user could not only move around and look around but also interact with the surroundings and take part in engaging activities, so that their VR experience resembles an actual tour.

This project also serves as the basis for other kinds of tourism which are quite difficult to access or are life threatening by nature, such as space exploration or deep-sea exploration, where the user could have an open world experience by being able to explore a small part of space or the deep seas, which are unconventional tourism choices. Furthermore, the incorporation of interactive elements, such as the shooting range, hints at the potential for virtual environments to serve as platforms for various activities beyond traditional tourism. Gaming, education, and even therapeutic applications could be integrated, expanding the project's impact across different domains.

Background: Several immersive VR Tourism experiences have been executed with a great level of detail and interactive elements. Some noteworthy projects include Google Earth VR, which offers a globe-spanning experience, allowing users to virtually explore real-world locations. This project has been instrumental in introducing users to the concept of virtual tourism on a global scale. However, it tends to focus more on static environments and does not have as many interactive elements incorporated in our project.

The VR Skiing Simulator by Weidong Huang et al. presents a notable reference in the context of our project's snowy terrain. This simulator aims to replicate the physics of skiing in VR, providing users with a realistic skiing experience. While this work focuses on a specific aspect of winter sports, our project extends beyond skiing, integrating varied terrains and interactive elements, creating a more holistic and engaging virtual tourism experience. In terms of interactive forest environments, "The Lab" by Valve Corporation introduces a pocket universe called "Longbow," allowing users to engage with a virtual forest and shoot arrows. While this offers an interactive forest experience, ours differs by integrating various terrains, and introducing an open-world concept for exploration.

In the educational domain, "Ocean Rift" by Dr. Llyr Ap Cenydd stands out as an underwater exploration VR experience. Although it excels in educational content, it differs from our project which focuses more on terrestrial landscapes, incorporating dynamic changes in terrain, and integrating gamified elements, such as the shooting range, to enhance user engagement. Valve Corporation's ‘Destinations’ takes a community-centric approach, creating a VR platform where users can explore virtual worlds generated by the community. This project emphasizes user-generated content, offering a wide range of destinations, from historical sites to imaginative landscapes. ‘Destinations’ fosters a shared exploration experience, showcasing the potential of collaborative virtual tourism.

Viveport Infinity's Virtual Reality Travel is another significant player in the VR tourism space, curating a collection of virtual reality travel experiences. By collaborating with various VR developers, Viveport Infinity provides users with the opportunity to explore diverse destinations, cultures, and historical sites through immersive virtual environments. This diversity contributes to a rich tapestry of travel experiences within the VR ecosystem. ‘Sansar’, a social virtual reality platform, introduces virtual tourism through user-created experiences. Users can visit virtual destinations, participate in events, and engage with others in shared virtual spaces. This project emphasizes the social aspect of VR tourism, allowing users to connect with fellow explorers in the virtual world.

Apollo 11 VR takes a unique approach by recreating the historic Apollo 11 moon landing mission. This educational VR experience allows users to relive key moments of the mission, from liftoff to walking on the moon's surface. Apollo 11 VR demonstrates the potential of virtual reality in providing immersive educational journeys through significant historical events. Google Arts & Culture VR allows users to explore art collections and cultural heritage sites worldwide. Users can virtually visit museums, view artworks in 3D, and learn about cultural history, enriching the VR tourism landscape with educational and artistic content.

Design: The project aims to create an immersive virtual tourism experience using Unity 3D, specifically tailored for the Oculus Quest 2 to ensure a seamless experience on this particular platform. The scope encompasses the development of two distinct terrains – a snowy landscape and a lush forest environment. These terrains are vastly different from one another, the first being a snowy terrain that is set quite high, allowing for skiing through an obstacle course, followed by the user transitioning into a forest terrain, wherein they can explore the map as it were an open world, providing a sense of discovery and setting the tone for a tour. Users will also encounter interactive elements such as a shooting range within the forest, which provides them with a dynamic activity apart from roaming the area. The forest, however, must be vibrant and animated, with a diverse selection of flora and possible fauna as well that may interact with the user. Since each terrain is different in this project, more terrains could be added to the collection for future expansions. Also, the activities must be related to the terrain for the experience to be immersive and seamless. For example, a lake terrain must have activities such as swimming or boating and not paragliding.

Details: As I wanted to implement skiing in the project, the initial plan was to let the user climb up to the skiing cliff, but since that proved to be quite time consuming and also a tedious experience for the user, I decided to mold the entire first terrain into tall mountain with a very steep incline so that the user could begin there and then move on to the forest terrain next. Since the user could go down the mountain in a lot of ways, a clear path had to be created using Unity’s sculpting features as shown below, which make sure that they do not stray off, and successfully make it to the next level of the project:

A screenshot of a video game

Description automatically generated

Raised edges along the sides of the ski ramp ensure that the user does not go offtrack.

A challenge that I faced and overcame was preventing the Oculus (and my PC) from lagging while running the application. I identified the source of this lag to be the large numbers of animated trees, grasses and foliage, which was making movement less fluid and also freeze at times. I found a solution in being selective in which areas would receive these trees, such as the entrance of the second (forest) terrain as shown in the picture below:

A video game screen shot of a forest

Description automatically generated

The high density of trees was reduced from other areas the user was not likely to explore, as well as from faraway hills which were inaccessible by the locomotion capabilities of the player model. This reduced the processing strain on both the Oculus device and my PC, which reduced lag considerably and while maintaining the quality of user experience.

Discussion:

A snow covered mountain with red poles

Description automatically generated with medium confidence

The start area with ski poles at the mountaintop.

As seen above, the user starts off grabbing ski poles and jumps down into the ski ramp, avoiding trees and rocks with colliders built into them for an authentic ski experience. I found the user to go astray a lot of times in the ski ramp, so barriers were raised on the sides so that the user didn’t go off track. The navigation after the slope was kept quite simple, with grassy trails denoting the areas where the user could go and explore. A shooting range was implemented as the end of the first trail as shown below:

A video game screen with trees and a hill

Description automatically generated

The shooting range with guns amidst the forest.

I intended to add animated animals such as wolf packs and bears instead of the green spheres but a lack of availability of assets compatible for Android builds was an issue. Also, adding these models would cause errors in compilation since most of these animal assets were not supported by the Universal Render Pipeline (URP) that is needed to build to the Oculus. The process of developing the project – all the way from initially sculpting the terrain to building the shooting range was immensely fun and was one that challenged my creativity and technical skills with each implementation of the project over the past few months.

Conclusions/Future Work: Future work for this Unity 3D project opens up exciting possibilities for expansion and refinement. One avenue for development involves the expansion of terrains, introducing diverse landscapes such as deserts, tropics, or coastal regions. This addition would broaden the scope of virtual tourism experiences, offering users an even more extensive array of immersive destinations to explore. Additionally, the project could benefit from the integration of a variety of interactive activities within each terrain, catering to different user preferences and enhancing the overall engagement factor. Features like wildlife observation, fishing, or geological exploration could be seamlessly integrated to diversify the virtual tourism adventure.

To provide a more dynamic and evolving experience, considering the implementation of seasonal variations within the existing terrains is a compelling option. Simulating changes in weather, foliage, and overall ambiance would add a layer of realism and variety, making the virtual environments more responsive to the passage of time. Also, exploring the incorporation of social interaction features could elevate the project's appeal. Enabling users to share their virtual tourism experiences through multiplayer modes, collaborative exploration, or shared virtual spaces for interactions would foster a sense of community within the virtual environment.

Enhancing the educational aspects of the project is another avenue for future development. This could involve expanding the depth of information provided about the natural elements within the environments, introducing guided tours, informative pop-ups, or even interactive quizzes to offer users a richer understanding of the ecosystems they explore. Furthermore, the project could evolve by integrating with emerging technologies. This might include features like haptic feedback, eye-tracking capabilities, or compatibility with new VR hardware, ensuring that the project stays up to date with the latest technological advancements.

In conclusion, the ‘Tourism in VR’ project for Oculus Quest 2 brings virtual tourism to life, letting users explore snowy mountaintops and lush forests. Future plans include more diverse landscapes, activities like wildlife observation, and social features for community interaction. Seasonal changes and educational enhancements will make the experience more dynamic and informative. The project offers an interactive, engaging open world experience that could be the foundation for more expansive, awe-inspiring works to follow.