Demonstrating the Technical Capabilities of Mixed Reality Presentations

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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ABSTRACT

Raytheon, a major U.S. defense contractor and industrial corporation, uses mixed reality demonstrations in business meetings, remote assistance, and factory maintenance. As part of a new company initiative, Raytheon required additional demonstrations to showcase their products. I utilized 3D modeling and presentation software to create mixed reality demonstrations, highlighting the software's capabilities for company executives. First, I created 3D models for specific objects and imported them into a virtual environment, where we added animations, commands, and workflows. Second, we showcased these demonstrations in both tablet and headset-based augmented reality (AR) formats. Through this work, we developed a concise workflow to create better demonstrations. As AR technology is constantly evolving, future work would revolve around a full integration of AR into business operations, as well as polishing the look of device interfaces to make them more usable.

1. INTRODUCTION

Raytheon manufactures radar systems, weapons, aircraft engines and turbines, communication systems, and more. For a company that produces many goods and services, it is extremely important to gain a better understanding of these technologies and how they work.

They must also have up-to-date presentation software to showcase their products. Showcasing higher quality and cutting-edge demonstrations creates more engaging experiences for the viewers. In addition, AR programs can be used to represent some products more accurately and can be applied to different areas as well.

2. RELATED WORKS

Unity (2024) outlines the process that someone could take to build an AR experience via their game engine. This involves using their mixed reality toolkit to create experiences compatible with AR environments, as well as a brief tutorial to manipulate relevant objects, such as the camera, hand controllers, and in-game objects.

Jakl (2018) describes how to use Simultaneous Localization and Mapping in AR to create digital overlays on top of a real-world object, by locating artifacts that

align with a digital model, creating a map of that model, and displaying data on top of the artifact through AR goggles.

Both sources helped to inform my approach. However, due to the private nature of Raytheon's software, I used proprietary software in the final implementation.

3. PROJECT DESIGN

Raytheon already had a few different kinds of software to create AR presentations, however my job was to document the workflow for future use, as well as to make improvements wherever possible.

The first AR experience was a replica of a jet engine. A to-scale 3D printed model of the engine was already acquired. I uploaded the same 3D model to a proprietary CAD software. In this software, I added animations to different components to replicate the process of assembling and disassembling the engine. These different animation steps were saved as sequences.

Following the creation of the sequences, I imported the model into a proprietary AR software development kit and placed the model as the central focus of the experience. I added buttons and menus to allow the viewer to select the sequence that would display, as well as to step forward and backwards through the animation keyframes.

I deployed this demonstration to both iOS and a proprietary AR headset. While the model and sequences were unchanged between the devices, I altered the UI to allow for the different input methods, such as tapping a device screen or recognizing hand gestures via the headset. Two experiences were created for each device, to allow for different environments to showcase the demonstration. The first was 'spatially tracked', where an arbitrary anchor point could be chosen for the model to remain locked to as the viewing device was free to orbit around the model. The second was 'model tracked', where the live environment was scanned to detect a real model of the engine. Once the model was found, the AR experience snapped and overlaid on top of the 3D model, allowing for users to see both the real model as well as any overlayed information as well.

4. RESULTS

My creation of this AR experience had benefits twofold. First this demonstration helped showcase my department's capabilities to upper-level executives and other department heads. Second, I helped to create a new step-by-step workflow for future use. This workflow was more concise and robust than the previous instructions and should allow for new users to create AR experiences with ease.

This project also had implications with how it will connect to other Raytheon programs, most notably the VirtualWorx® augmented reality system (2023). VirtualWorx® is a remote collaboration software that uses satellite communication, intending to connect a technology expert with a user in a remote location of the world to provide live guidance on how to troubleshoot, make a repair, or conduct regular maintenance.

5. CONCLUSION

Through the completion of this internship, I gained a better understanding of the 3D modeling process and AR environment creation. I was able to apply this knowledge to construct a 3D model of an engine, with the purpose of demonstrating how this software could be applied to other aspects of the business.

This work helped to showcase the overall value of this department and presentation medium to executives, who can utilize this software during company meetings or demonstrations. I established a more robust and sequential workflow to ease future users and improve the effectiveness of this type of presentation software.

6. FUTURE WORK

Future improvements to this software would be considering a full implementation with VirtualWorx®, to enhance the AR capabilities. Additionally, changes could be made by a UX expert to the overall interface to be more effective and easier to use by viewers.

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