Oculus Rift: A Virtual Tour of Bolin Science Hall

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Funding: Intramural Research and Creative Endeavor Award

Introduction:
The purpose of this research project is to develop software that will run on the Oculus Rift headset. The goal is to create a virtual tour of Bolin Science Hall. Users wearing the headset will be able to walk through the building making decisions regarding which rooms to enter and which way to look. The scene will change based on real-time decisions of the user.

Background:
In 1965, Ivan Sutherland described "The Ultimate Display" in which he envisioned a display connected to a computer that would "serve as a looking-glass into a mathematical wonderland constructed in computer memory" [1]. Sutherland's vision is quickly becoming a reality. Virtual reality currently has practical applications in a multitude of areas, including therapy, education, training, gaming, and entertainment [2] [3] [4]. We are only beginning to realize the role that VR will soon play in our daily lives.

Fig. 1 Oculus Rift DK2 headset and positional tracker

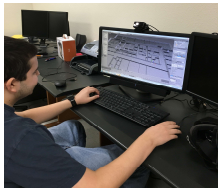

Fig. 2 Chris generating the first floor model of Bolin Science Hall in Blender

Methods:
Since an open source 3D modeling suite was desired, we used Blender to create the base for our model of Bolin Science Hall. We chose Blender because it is a cross-platform software that runs well on Microsoft, Linux, and Apple computers. The 3D Bolin model created in Blender (Figure 2) was loaded into the Unity game engine, a cross-platform tool used to create interactive experiences for the Oculus Rift. C# was used within Unity to bring our Blender-generated models to life, creating the beginnings of a virtual tour. One sub-team experimented with a relatively new technology, Matterport, a camera that allows rapid visualization of physical spaces. An Oculus Rift DK2 headset and positional tracker (Figure 1) were used to visualize our 3D virtual tour.

Fig. 3 Above: actual picture of the graphics computer lab.
Left: Graphics computer lab in Unity.

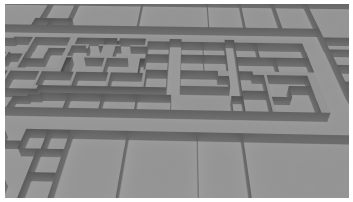

Fig. 4 Top view of the Blender-generated model of the first floor of Bolin Science Hall

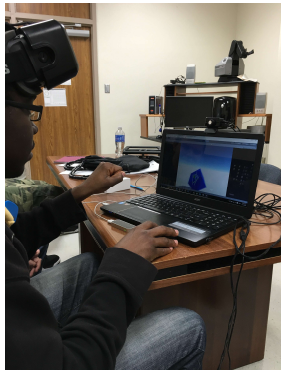

Fig. 5 Cavaughn manipulating a model in Unity using the DK2 headset and leap motion positional tracker.

Current Status:
At this time, the floor plan model of Bolin Hall's first floor is complete (Figure 4). Textures on walls, floors, and desks have also been completed. We currently have a working demo that contains desks, computers, and functioning doors in the computer graphics lab (Figure 3). All modeling and texturing was done in Blender. Animations for the functioning doors were created in Unity. We experienced some difficulty while adding collision detection to doors and walls in Unity. Due to the way Unity handles the mirroring of objects we had to manually make duplicate objects in Blender so that we could have doors that open to the left or to the right.

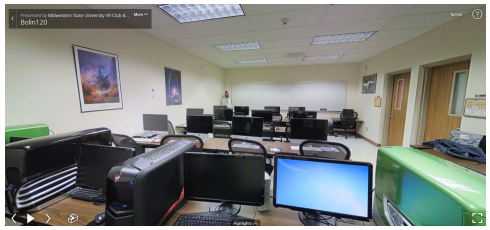

Fig. 6 Stitched one-sided Matterport model image of computer graphics lab.

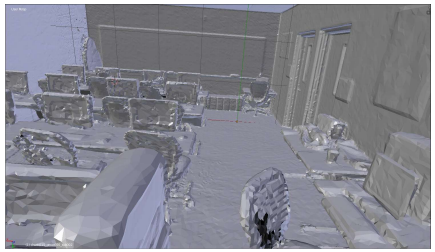

Fig. 7 Matterport model imported into Blender.

Matterport:
The excitement of gaining access to this new technology was tempered by the inability to acquire a decent looking model in Blender. Another weakness of the Matterport camera was that it only provided a one-sided view of the image. The Matterport model (Figure 6) was automatically stitched together using multiple camera images. From within Blender, it became apparent that images created with Matterport would not be useful for this project due to the poor model quality (Figure 7).

References:
[1] I. E. Sutherland, "The Ultimate Display," in Proceedings of IFIP Congress, Washington, D.C., 1965.
[2] T. Mazuryk, M. Gervautz, "Virtual Reality History, Applications, Technology and Future," Institute of Computer Graphics, Vienna, 1002.
[3] H.G. Hoffman, "Virtual Reality Therapy," Scientific American, pp. 58-65, August 2004.
[4] F.P Brooks Jr., "What's Real About Virtual Reality," in IEEE Computer Graphics and Applications, 1999.