CPSC470-Proposal Draft

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1 Problem I am solving

The problem I am trying to solve is that the Forest Service wants a VR simulator to allow them to train firefighters safely. Currently they train them with classes, then they go out and start real fires and cut down trees. This requires lots of planning to make sure that it is safe for everyone, but inherently has a lot of danger. By adding in VR training as an intermediate step between initial classes and hands on training firefighters will be better equipped in how to handle real fires and how they spread.

2 Literature Survey

I did search online to find if a similar program was being developed but was unable to find anything that was exactly what I am developing. There are VR simulators that exist for smaller things, such as learning how to put a house fire or a car fire out, but not for forest fire simulations. This is of interest to the Forest Service as they run an internship to develop it. I have been in correspondence and collaboration with Russel A. Parsons in order to develop the VR simulation.

- Section 3 talks about how VR can be applied in different fields such as design, games, films, simulations, visualization and many other domains, but it also allows integration and creation of different learning contexts which make it successful as a training tool. It further talks about how VR can be used to train in dangerous areas without having any risk. [1]
- This article is about medical education and training. The introduction talks about how there has been a shift towards more interactive and simulation based learning. Recently another shift towards VR and AR applications has been happening. The section on interactive VR covers how an interactive VR simulation can provide immediate feedback on how the user did automatically. This allows learners to examine their performance in detail and provides the opportunity for blended learning. [2]

- This article covers the types of VR setups and the benefits of using VR in general in the introduction. Section 3.1 covers First Responder Training, including firefighters. Their findings were that VR and AR training lowers the rate of errors over the traditional PowerPoint approach. It shows a picture of a fire truck control panel that is realistic to how the actual one on the truck looks and operates. [3]

3 Proposed Methodology

My methodology is to use documentation, tutorials, and existing projects to help me determine the best way to implement my ideas into the project.

4 Research Question

My research question is as follows: Is an interactive VR simulation possible using Unity and FDS?

5 Timetable for work

- 2/26/22 – Getting the new VR system to work with movement and interactions.
- 3/15/22 - Switch from WFDS to FDS
- 3/31/22 – Implement fire creation/removal as well as ray tracing for interactions
- 4/15/22 – Implement tree creation/removal
- 4/26/22 – Implement trench creation/removal

6 State of the program before starting

Currently the program is capable of reading in a .FDS file, generating the terrain, calling WFDS, reading WFDS data, and displaying fires using time slices. Unity has switched to a new VR framework that uses a new input system. Currently I have head and hand tracking, but will need to allow movement of the player around the scene. Will need to re-implement ray tracing to find the interaction of where the user is pointing and the terrain so that new fires can be started at that location, but that requires getting VR working with the new system.

I would like to get trees implemented as well as the ability to remove trees from the simulation. As we have discussed, proper interactions in the simulation are impossible due to WFDS limitations. I will need to switch from WFDS to FDS to get proper restarts and not the broken ones that WFDS has.

References

[1] M. Pérez-Ramírez and N. J. Ontiveros-Hernández. *Virtual reality as a comprehensive training tool*. Oct. 2009. URL: https://www.researchgate.net/publication/266020983_Virtual_Reality_as_a_Comprehensive_Training_Tool (visited on 02/24/2022).

[2] J. Pottle. *Virtual reality and the transformation of medical education*. Oct. 2019. URL: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6798020/ (visited on 02/24/2022).

[3] B. Xie et al. *A review on Virtual reality skill training applications*. Apr. 2021. URL: https://www.frontiersin.org/articles/10.3389/frvir.2021.645153/full (visited on 02/24/2022).