

Senior Design Final Report

INART VR

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Table of Contents

1. Introduction	3
1.1 Background	3
1.2 Design Principles	4
1.3 Design Benefits	4
2. Related Technologies	5
2.1 Existing Solutions	5
3. System Architecture	6
3.1 Overview	6
3.2 Data Flow	6
3.3 Implementation	7
4. Results and Conclusion	8
4.1 Results	8
4.2 Future	8
5. References	9

1. Introduction

1.1 Background

The Institute for Interactive Arts, Research, and Technology (INART) is an interdisciplinary institute that focuses on creating stories through digital mediums. INART sponsored the project INART VR, which is intended to create a photo-realistic virtual environment and virtual characters to allow real actors to be placed into a virtual space using green screen technology for a virtual production set. The project is developed in Unreal Engine 4, a powerful real-time 3D creation platform. The project also provides the implementation and animation of virtual characters that interact with the user through artificial intelligence. INART VR serves to simplify the process of virtual filmmaking by providing virtual sets and various tools.

The project provided two virtual sets for two separate short films produced by the TVF Advanced Production team of Cal State LA. The first set was the development of a realistic hotel environment to be used in the short film *Hotel Paraiso*, which follows a woman in a surreal experience in a hotel. The second (current) set developed an interactive environment for the launch of the book *Interactive Storytelling for the Screen* by Sylke Rene Meyer, which is a book that discusses interactive storytelling as a form of participatory and low-fi narrative practice at the intersection of analog and digital space. The environment is used to portray a digital story in which the user explores various locations in order to gain pieces of information regarding the book and encounters a virtual rabbit that acts as the guide for the user and interacts with them through artificial intelligence technology. The environment was also used for the short film, *Unreal Realities* which follows a protagonist who gets pulled into a digital world and experiences the book as an interactive experience. This report focuses on the development of the second set.

1.2 Design Principles

The main deliverable is the interactive book environment.

- The environment is intended to be visually realistic and shall allow the user to interact with the environment in various ways such as object interaction or with non-playable characters (NPCs).
- The environment shall be primarily designed in Unreal Engine 4.
- The project must also successfully tell the digital story our liaison is attempting to portray as an interactive experience for the user.
- The system shall allow live actors to add their recordings into the environment through chroma keying technology such as green screen
- The system shall provide various tools such as virtual camera sequencers, camera rig rails, and the ability to bookmark camera shots throughout the environment.

1.3 Design Benefits

Developing the environment in an interactive manner allows for the user to experience the story digitally. Part of the interactivity within the environment is the virtual characters that are used to help guide the user through the experience. The project is specifically developed in Unreal Engine because it is notable for the capability of creating the most realistic 3D environments.

The tools provided were created to remove the complexities of virtual filmmaking and ease the process of obtaining difficult camera shots through the camera sequencers by making the camera recording through a specific time frame. The camera rig rails provide a more defined path in order to match specific movements of live actors or to ensure the camera did not collide or overlap with virtual objects. Camera bookmarking was also developed in order to save preplaced cameras and add or delete cameras within the scene. The live actors then add their recordings into the environment as their background using green screen technology. Life-like environments were required so that the background can be suited for the live actors in a natural manner.

2. Related Works and Technologies

2.1 Existing Solutions

Unreal Engine and Unity are both popular real-time 3D creation platforms that provide various complete 3D environments and assets in the respective online stores. Considering the intention of the project is to portray a digital story, our implementation of our virtual environments require unique settings in order to fulfill the story respectfully and to develop it in an interactive manner for the user to experience. While the project contains assets from Unreal Engine's marketplace, the assets were merged, modified, and repurposed to create unique scenes that were desired for filming.

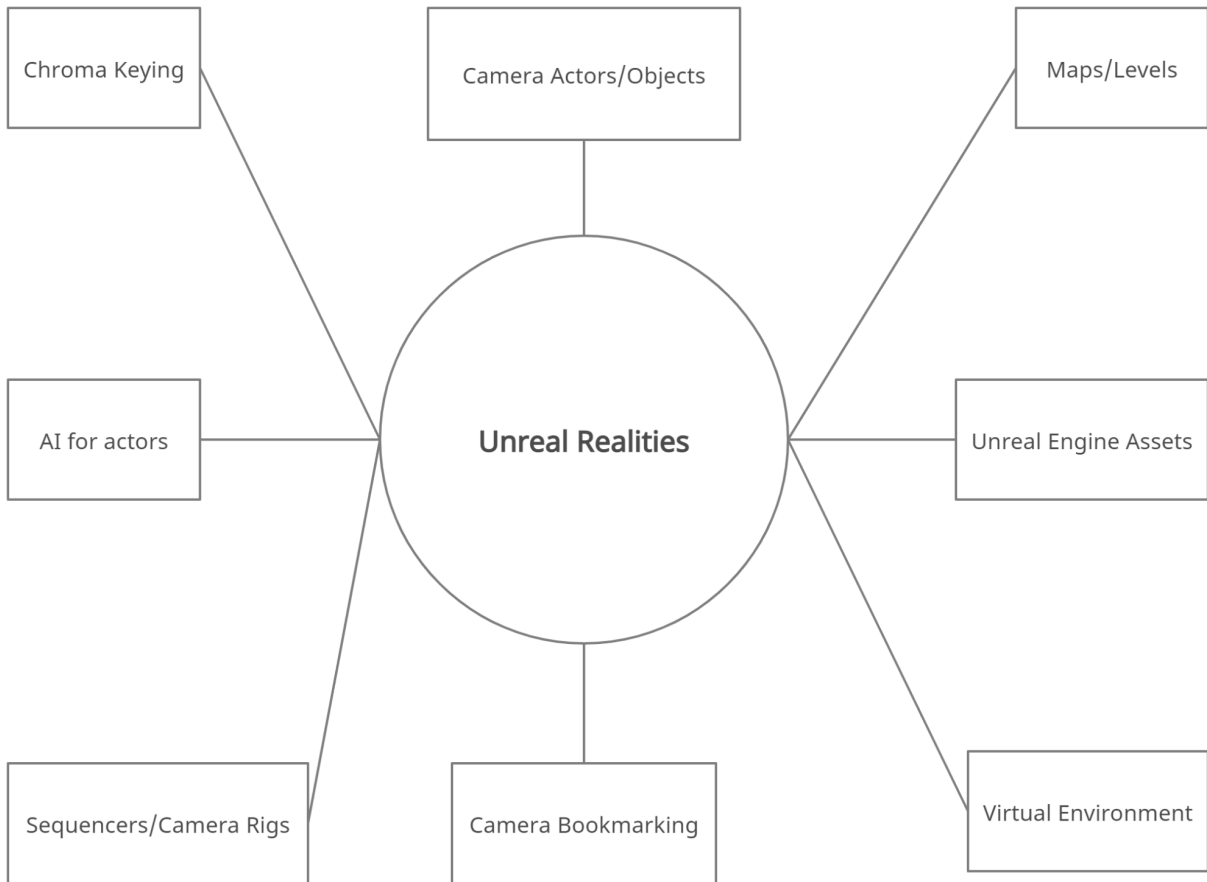
Unreal Engine also provides various tools with the purpose of recording the environment but are not immediately accessible to filmmakers due to a learning curve, thus the project provides unique tools that are simple to use for the average user.

3. System Architecture

3.1 Overview:

Satisfy by the graph below.

3.2 Data Flow:



3.3 Implementation:

This project required the desert, city/office, book nook, contributor's hallway, and A.I. bunny.

Desert

The desert is a map that the live actor will start at for the film. The desert is meant to be the placeholder for the book written by our liaison, Sylke Rene Meyer, in which it is looked at as a shrine for its massive size. The main actor will enter the desert by helicopter and jump out to come upon the book. The bunny will be there to greet the actor and ask them to enter the book.

City/Office

The city is used to allow the actor to have a scenic walk and transition into the office. The office is the main area in which the actors will be interacting with different objects and talking to the A.I. bunny. Within the office scene we will also be placing the book nook for the actor to enter into.

Book Nook

The book nook is used to capture the effect of falling into the depths of a book and being separated from reality. The actor will approach the book nook which will suck the actor into its tiny world. A book nook is meant to look like a tiny city/setting within a bookshelf which was perfectly captured within our project.

Contributor's Hallway

The contributor's hallway is a simple hallway filled with A.I. bunnies, frames and pictures of all the contributors that helped write the book. There is not much interaction in this setting as it is meant to showcase everyone that has helped/contributed to the publishing of the book.

A.I. Bunny

The A.I. bunny is meant to be an actor/character that constantly interacts with the actor as the bunny is guiding the live actor through the environment. The A.I. bunny is used in every setting whether it is simply moving on its own or it is talking to the live actor.

4. Results and Conclusions

4.1 Results

The final result is the virtual world that acts as an interactive book for *Interactive Storytelling for the Screen*. The virtual environment contains various 3D realistic settings such as lounges, hallways, and landscapes. The project also implemented animations and A.I. systems for virtual characters that direct the user along the environment.

The final product also provides several tools to aid filmmakers when recording in this virtual set which include camera sequencers, camera rig rails, and camera bookmarking.

The process of development faced several challenges, one of which was matching the live actors lighting to the environment's lighting which made certain shots or scenes look unnatural. Also, due Unreal Engine storing environments locally, when changes are made to the environment or models, developers are forced to deal with downtime due to the environments being very large file sizes, thus making file-sharing difficult. Unreal Engine is also a computationally expensive program and environments, so some members and users had issues working within the program due to a lack of sufficient hardware.

4.2 Future and Improvements

The following suggestions are for future improvement of the project:

- Development of a system that allows the matching of actors lighting to the environments lighting in order for scenes to look visually natural.

- The addition of more virtual characters to improve the experience of the interactive book
- Development of a system that allows the user to automatically fix camera placements for shots and pans
- Adding more AI functionality for the virtual characters in order for them to be able to switch animations.

5. References

- Unreal Engine Documentation: <https://docs.unrealengine.com/en-US/index.html>
- INART: <https://www.calstatela.edu/al/institute-for-interactive-arts-research-and-technology>
- Interactive Storytelling for the Screen: <https://www.routledge.com/Interactive-Storytelling-for-the-Screen/Meyer/p/book/9780367819972>
- Hotel Paraiso: <https://vimeo.com/480916820>
- Unreal Realities: <https://vimeo.com/541410650?ref=em-share>