Disk Wars VR

Technical Design Document

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Introduction

Disk Wars VR is a 3D virtual reality arena combat game based on the Disc Wars games seen in the “Tron” movie franchise. It is an e-sports game in which two players - restricted to opposite sides of an arena - compete to hit each other by throwing disks within a confined environment, in which these disks will bounce around until they either hit an opponent, or the respective player catches it to throw it again. The goal of the gameplay is for it to be fair, easy to learn, hard to master, and fun for players of all skill levels.

Disk Wars VR is developed for the PC platform using Unity 2017 as the game engine. It uses the HTC Vive virtual reality headset for the VR integration, as well as allowing for roomscale to track the player’s movements along with the Vive wand controllers for tracking the player’s hand movements.

Technical Overview

Target Platform:

Disk Wars VR is developed for PCs using the Windows 10 operating system and the HTC Vive VR headset. Disk Wars VR should be compatible with other headsets like the Oculus Rift, but our target hardware for testing is the Vive.

System Requirements:

Operating System: Windows 10

Processor: Intel i5-4590, AMD FX 8350 equivalent or better

RAM: 4 GB or more

Video Card: Nvidia GeForce GTX 970, AMD Radeon R9 290 equivalent or better

Peripherals: Keyboard, mouse, HTC Vive headset & wand controllers

Software Tools:

* Unity 2017 (Game engine and development environment)
* Blender (model creation)
* GIMP (texture creation)
* Studio One (music and sound creation)

Engine:

The engine being used to develop Disk Wars VR is the Unity engine, more specifically Unity 2017. Using Unity was an easy choice for us because all members of the team have prior experience in making video games using the engine. Unity allows for unified development in almost every area of the game, ensuring we have to use as little additional software to to develop the game as possible.

File Formats:

* .jpg, .png -- image and texture files
* .mp4, .wav -- music and sound files
* .cs, .unity, .prefab, .mat, .physicMaterial, .asset, .json -- Unity files
* .exe -- final game executable
* .blend -- Blender model files

Directory Structure:

Unity projects contain four main folders, some containing other folders:

Assets → Materials, Prefabs, Scenes, Scripts

Library → ShaderCache, Metadata

ProjectSettings

UnityPackageManager

Coding Guidelines:

* Meaningful and consistent variable naming, to avoid confusion
* Commentation to explain code between multiple programmers
* //TODO comment tags to show what needs to be worked on
* Consistent use of tabs and spacing to ensure readability

Technical Features

Input:

Disk Wars VR uses two HTC Vive wand controllers to allow the player to emulate the use of their hands while playing in virtual reality. The Unity VR plugin allows us to faithfully map the player’s hand movements to the in-game movement, meaning the player does not have to use teleportation or other common VR options for controlling their movement, and instead move in a natural way.

Game Engine:

The game is programmed using Unity 2017 as the engine. The team had prior experience with using Unity for game development, so we decided that it would be easiest to use for Disk Wars VR.

Physics Management:

We decided early on that rather than using Unity’s built-in physics system, we would implement our own for Disk Wars VR. The motivation behind this was that we were dissatisfied with the realism-oriented physics that Unity provides, and thus decided to write a physics system ourselves.

Camera System:

As a virtual reality game, there is not a traditional camera system that the player needs to control. Instead, the gameplay is viewed through a first-person perspective that is completely controlled by the player’s real-life head movement. This allows for the player to look at multiple angles while their hands are out of sight, unlike most traditional games where the players hands are visible at all times.

Multiplayer:

The multiplayer of the game involves network player versus player play. This is essential over local player because as far as we know, most consumer VR headsets do not support local multiplayer due to space limitations. We will handle the backend of the multiplayer with a server, most likely programmed with Python or using Unity’s built-in networking system.

Gameplay Features

Player Movement:

As a virtual reality game, movement will be controlled by the player’s VR headset and hand wands. Movement within the virtual environment will be one-to-one with the player’s real-world movement. Movement of the headset moves the virtual head and torso, while movement of the hand wands moves the virtual hands.  
The virtual environment itself will be no bigger than the player’s real-world play space, so there will be no need for teleportation or other movement mechanics. This presents a simple, intuitive experience for the player; while also avoiding the common problem of motion sickness.

Duel Mode:

This is the game’s primary game mode. Two players compete one-on-one in an arena, trying to throw their disks at each other while dodging each others’ disks. Every time a player lands a hit on the other player with their disk, they score one point and the next round starts with the disks reset their positions to their own player’s side. Each player only gets one disk (barring stretch goal power-ups), so if a player wants another chance to throw within one round, they’ll have to catch their own disk as it ricochets off the arena walls back to their side of the arena.

Practice Mode:

This is a single player mode in which the player is given a chance to practice disk throwing and catching mechanics in a safe environment. The player can safely bounce the disk off the walls and catch it on the rebound, as well as practice their aim on a dummy enemy.

Virtual Reality Integration:

Disk Wars VR, as the name implies, is a virtual reality game. The game is being developed solely for the HTC Vive, as this is the headset that our team owns to work with. In the future, we would like to port the game to the Oculus Rift as well.

Milestones

Pre-Production:

Creation and completion of the Technical and Conceptual Design documents, Art Bible, and Vertical Slice video. Also involved creation of the initial pre-production version of the game itself, which currently incorporates the disk-throwing physics of the game. Additional artifacts include basic models for a player character and a disk, a basic level for gameplay, and some preliminary sounds. All will need to be reiterated and implemented for future milestones.

Milestone 1:

To be implemented.

Milestone 2:

To be implemented.

Alpha:

To be implemented.

Beta:

To be implemented.

Final:

To be implemented.

Revisions

Version 0.10 (February 6th, 2018)

Document template created and initial information added

Version 0.20 (February 15th, 2018)

Added Technical Overview section

Version 0.30 (February 19th, 2018)

Added Technical Features and Gameplay Features sections

Version 0.40 (February 21st, 2018)

Added Milestones section

Version 0.50 (February 25th, 2018)

Expanded information for each section

Version 0.60 (February 28th, 2018)

Finalized document for Pre-production Milestone