Documentation Of JR-Desert, An Interactive Virtual Desert Themed World

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Introduction

With the recent technological advancements in the area of virtual reality, there is an opportunity for increasingly immersive and believable virtual world to be developed. Such worlds could allow certain individuals who normally (for reasons such as disability or financial trouble) would not be able to experience surroundings other than that of their everyday lives, gain somewhat of a different and interesting experience (albeit virtual). Also, the opportunity to create impossibilities within such worlds, whilst also keeping said impossible situations somewhat believable, is very interesting as such things cannot be experienced within actual reality.

JR-Desert aims to be such a virtual world, with the theme being based of real world desert environments and cultures, whilst also including some fantasy elements. The world includes multiple different interactable objects that have both audible and visual feedback, as well as multiple different environmental aspects in order to increase immersion within the world. All scripts that have been written from scratch are referred to as 'original scripts' within this document, and all external assets used are referenced at the end of this document.

JR-Desert Overview

Figure 1

Figure 2

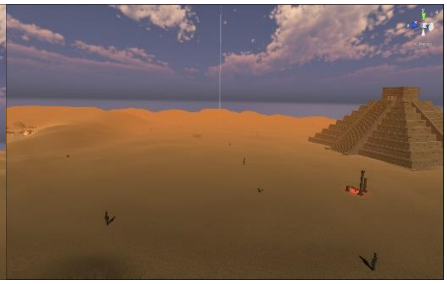

Figure 3

JR-Desert consists of three environmental areas, The Great Plains, The Great Desert, and The Desert Oasis.

Figure 1 shows where the user begins in the world, on top of a hill overlooking The Desert Oasis, with a view of The Desert Shack and a distant view of the Great Desert and Desert Pyramid. The Desert Oasis consists of a pond in front of The Desert Shack, which is surrounded by greenery and palm trees, and populated with water vegetation and other scenery objects and effects. In direct view of the user is a sign post with information about the user controls (WASD or arrow-keys to move, space to jump, 'e' to interact with objects and 'esc' to quit the program). The player movement is controlled through the original script, *PlayerMovment.cs*, which is linked to a cylinder *GameObject* as well as the main camera within the scene. The script will rotate the player *GameObject* based on the mouse X and Y axis input, and will move said *GameObject* based on WASD/arrow-key inputs.

$$\Delta y = \frac{1}{2} g \cdot t^2$$

Figure 4

The player jumping is calculated following the formula in *Figure 4* (*g* being the gravitational constant), and uses a ground check *GameObject* attached to the player *GameObject* to reset the vertical velocity once the player has returned to the ground (for which any object tagged with 'Terrain' is classified as the ground). The cursor is locked and hidden within the *Start()* method, and there is a condition within the *Update()* method to call *Application.Quit()* (which exits the program) when the player presses the escape key.

To the west of The Desert Oasis is The Great Plains (shown in *Figure 2*), which consists of mainly dead trees with a few boulders scattered between. To the east of The Desert Oasis is the Great Desert, which has different kinds of cacti scattered throughout, as well The Desert Ruins and the Desert Pyramid (which is climbable by the player) located in the south east of the world. Surrounding the world are desert hills of varying size.

Desert Shack Modelling And Interior

The Desert Shack was designed and modelled from scratch using Blender before being imported into the unity scene.

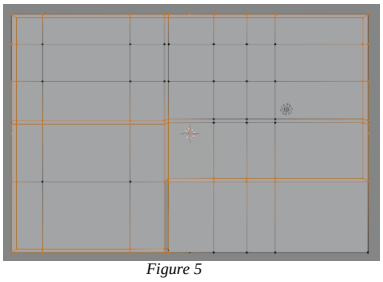

Figure 5

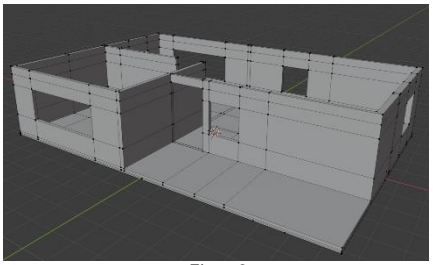

Figure 6

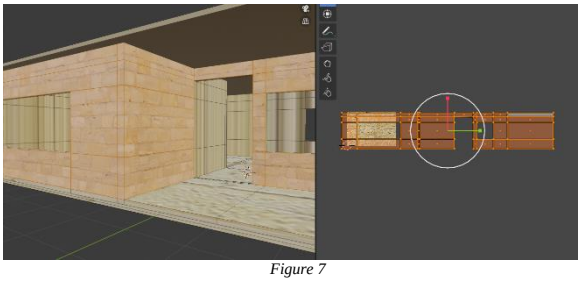

Figure 7

The initial object starts with a cube which is then stretched out and flattened to form the base of the shack. The *Loop Cut* tool is then used to split the base into sections for the different walls and windows, resulting in the basic floor plan seen in *Figure 5*. The walls are then extended upwards using the *Extrude* tool, and the windows/doors are cut out using the *Bridge Faces* tool (seen if *Figure 6*), before a simple roof is made from a rectangle of vertices. Texturing is done though *UV Mapping* the different sides of the model which is seen in *Figure 7*, it is important that the *UV Maps* are taken by project views (Front, Back, Right, Left, Top, Bottom) so that the textures are all seamless and are scaled evenly with each other otherwise this could intrude on immersion. The textures chosen follow the desert theme, with sandstone bricks for the outer walls, rough concrete for the interior walls, rusted corrugated metal for the roofing, and wooden planks for the flooring.

Figure 8

Figure 9

Figure 10

The imported model is populated with external assets within unity. The front porch consists of a hanging lamp next to a wooden chair angled towards The Desert Oasis pool (seen in *Figure 8*). A basic wooden door model is used to the fill the front door, and the window frames are filled with basic reflective glass *GameObjects* (all following the basic Desert Shack theme). The front room seen in *Figure 9* consists of a basic wooden table and chair, with an ashtray that gives of a smoke particle effect within the room. The side room seen in *Figure 10* has a window overlooking The Desert Oasis pool, and contains an old mattress and newspaper, as well as a wooden chair and lamp.

User Interaction

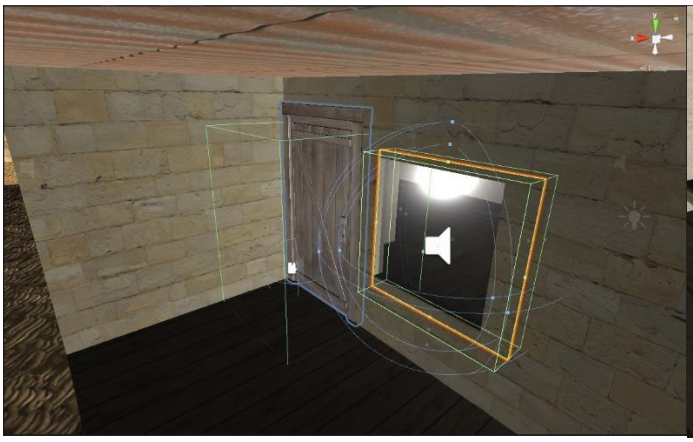

Figure 11

Figure 12

User interactions are controlled using *Box Collider* triggers along with the *OnTriggerEnter()* and *OnTriggerExit()* methods within a set of original scripts. When the player *GameObject* enters an interactable objects trigger collider (example trigger colliders are seen in *Figure 11* for the door and window objects), a Boolean flag is set to true within said objects original script (and set false once the player has left the collider). Within the original scripts *Update()* methods there are conditional statements which require both the trigger collider flag to be true, and the ‘e’ key to be pressed in order to execute the interactions feedback methods. All interactions have an *Audio Source* component that

will play its sound effect within a 3D radius around the object (with realistic effects such as the doppler effect) with the exception of the teleporter as its sound effect needs to be in range after the player has moved location. A helper text line also fades in once the player enters the trigger collider which notifies the user that the object is interactable, which is seen in *Figure 12* (the line will only appear once per object). The other feedback methods are specific to each interactable object type:

- **Front Door Object** – controlled with *DoorController.cs* that plays an open and closing animation on interaction
- **Lamp Object –** controlled with *LightController.cs* that turn on an off a light source around the lamp on interaction
- **Smoke Particle Effect –** controlled with *CigController.cs* that will disable the smoke effect on interaction (player cannot reenable it)
- **Window Object –** controlled with *BreakableWindow.cs* that shatters the window on interaction, this is done using the *breakWindow()* from an external asset
- **Stone Tablet Object –** controlled with *Teleport.cs* that teleports the user to another specific location on interaction

User Immersion

Figure 13

Figure 14

In order to increase immersion, multiple different extra environmental features are implemented. When the player first enters the world, a desert wind ambient sound will loop, which changes to an underwater ambient sound if the player enters The Desert Oasis pool. Furthermore, within the pool there are bubble particle effects and a blue water fog (*seen in Figure 13*) which gives the illusion of being underwater. In order to give the desert a sunset effect, an appropriate *skybox* is used, and the directional light is angled as to give objects long shadows in the direction corresponding with the *skybox's* sun, which is seen in *Figure 14*. In order for all the trees to sway in the same direction, a *Wind Zone* is set in the corner of the map. Since the world only populates one standard unity tile, invisible boundaries are set so that the player cant fall of the edge of the world breaking immersion. An orange desert fog is also set in the distance that helps hide the world edges.

Reflection

In conclusion JR-Desert successfully recreates a real world desert environment whilst also having multiple different interactions that provide the user with feedback. Impossibilities such as being able to teleport vast distances are also included, but in a way that fits the desert theme and does not break immersion. The user is also able to control the player object in a way that is similar to how movement happens in reality, in first person.

Further improvements could be made by expanding the terrain and potentially having teleports to multiple different areas with possibly more desert themed architecture such as a sphinx. Also, the idea of adding Non-Euclidian geometry and objects is particularly interesting, however due to the time constrains and assignment requirements this wasn't possible.

Asset References

Asset	Author	Use	Source
Wooden decking PBR texture seamless 21994	www.sketchuptextureclub.com	Desert Shack Flooring	https://www.sketchuptextureclub.com/textures/architecture/wood-planks/wood-decking/wooden-decking-pbr-texture-seamless-21994
Wall stone blocks texture seamless 20846	www.sketchuptextureclub.com	Desert Shack Exterior	https://www.sketchuptextureclub.com/textures/architecture/stones-walls/stone-blocks/wall-stone-blocks-texture-seamless-20846
Dirty metal rufing texture seamless 03672	www.sketchuptextureclub.com	Desert Shack Roofing	https://www.sketchuptextureclub.com/textures/architecture/roofings/metal-roofs/dirty-metal-rufing-texture-seamless-03672
CONCRETESTUCCO0254	www.textures.com	Desert Shack Interior	https://www.textures.com/download/ConcreteStucco0254/123257
Wooden Chairs 2 Variations	ANRUVAL_3D_MODELS	Desert Shack Chairs	https://assetstore.unity.com/packages/3d/props/furniture/wooden-chairs-2-variations-125757
Modular Medieval Lanterns	Alexandr Voevodov	Lamp Models	https://assetstore.unity.com/packages/3d/environments/historic/modular-medieval-lanterns-85527
Door low-poly 3d model	Konstantin Kozyrkov	Desert Shack Door	https://www.cgtrader.com/free-3d-models/architectural/door/door-c7ea28d7-d056-4a9d-a28d-39afac8b94b7
Low poly table	SoulTear	Desert Shack Table	https://www.cgtrader.com/free-3d-models/interior/kitchen/old-table-0fbf333a-e13f-4113-8b8c-d3242481be84
A box of Marlboro lights plus cigarettes	saeed4s	Desert Shack Cigarette	https://www.cgtrader.com/free-3d-models/various/various-models/marlboro-box-and-cigarettes
Vintage Metal Ashtray	Mattyew	Desert Shack Ash Tray	https://sketchfab.com/3d-models/vintage-metal-ashtray-e3a5fd374386419680a26a3acaa18728
Maches Free 3D model	catmartovski	Desert Shack Match Box	https://www.cgtrader.com/free-3d-models/household/other/maches
Effect textures and prefabs	Magicpot Inc.	Desert Shack Smoke Effect	https://assetstore.unity.com/packages/vfx/particles/effect-textures-and-prefabs-109031
Folded Newspaper	Valo Niskanen	Desert Shack News Paper	https://sketchfab.com/3d-models/folded-newspaper-8f2a04cbcf3741088978399924b46a92
Old dirty mattress	KIFIR	Desert Shack Mattress	https://sketchfab.com/3d-models/old-dirty-mattress-e914df64a021484a91613b38c28ee538
Breakable Windows	Gaik Software	Desert Shack Windows	https://assetstore.unity.com/packages/tools/particles-effects/breakable-windows-110383
Yughues Free Sand Materials	Nobiax / Yughues	Desert Terrain Texture	https://assetstore.unity.com/packages/2d/textures-materials/floors/yughues-free-sand-materials-12964
Water4Advanced	Unity Technologies	Oasis Pool Water	https://assetstore.unity.com/packages/essentials/asset-packs/standard-assets-for-unity-2018-4-32351#content
SpeedTree/Palm	Unity Technologies	Oasis Palm Trees	https://assetstore.unity.com/packages/essentials/asset-packs/standard-assets-for-unity-2018-4-32351#content
Yughues Free Bushes	Nobiax / Yughues	Oasis Plants	https://assetstore.unity.com/packages/3d/vegetation/plants/yughues-free-bushes-13168
HQ Rocks Pack	Next Level 3D	Rocks Everywhere	https://assetstore.unity.com/packages/3d/props/exterior/hq-rocks-pack-66895
FREE Rigged Skeleton and Bone Collection	Ferocious Industries	Oasis And Pyramid Bones	https://assetstore.unity.com/packages/3d/props/free-rigged-skeleton-and-bone-collection-166829
Treasure Chest	Amanda Alavi	Oasis Treasure Chest	https://sketchfab.com/3d-models/treasure-chest-0b8cbed26343414ab9f28ba6b5f023de
Painted Stela of Seter-au	Avatar of hmane Harvard Museum of the Ancient Near East	Stone Tablet Teleporter	https://sketchfab.com/3d-models/egyptian-tablet-01-photogrammetry- https://sketchfab.com/3d-models/painted-stela-of-seter-au-2c917d71a5cb48c1b574053fec3f26c2
Stylized Plants Kit	Infinity3DGame	Oasis Underwater Grass	https://assetstore.unity.com/packages/3d/environments/stylized-plants-kit-188109
Free Desert Plants	Lemuria	Great Planes Dead Trees	https://assetstore.unity.com/packages/3d/vegetation/free-desert-plants-32410
Ancient Ruins in the desert - Part2	NEKCOM Entertainment	Great Desert Ruins	https://assetstore.unity.com/packages/3d/environments/ancient-ruins-in-the-desert-part2-19178
Pyramid 2.0	Mirfen	Great Desert Pyramid	https://sketchfab.com/3d-models/pyramid-20-99f974856bf0444994bbe080fe9151a6
Cactus 1	rhcreations	Great Desert Cactus	https://sketchfab.com/3d-models/cactus-1-downloadable-976b67b80efd4a7388ec85bfc4e39ecf
Cactus 2	rhcreations	Great Desert Cactus	https://sketchfab.com/3d-models/cactus-2-downloadable-290ead6382604fb6b623dd0dc3deb07c
Free HDR Sky	ProAssets	Skybox	https://assetstore.unity.com/packages/2d/textures-materials/sky/free-hdr-sky-61217
Wooden Sign	Carlos	Desert Oasis Sign Posts	https://sketchfab.com/3d-models/wooden-sign-256975ecc4a947a79ffe2a0e963e8bbd