Home as a Health Care Hub

Lilypad™ Virtual Reality (VR) Experience Technical Guide

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FDA

I. Purpose

This document is intended to support users of the Lilypad™ VR experience. It outlines the technical requirements, processes for setup, and steps required to run the Lilypad™ VR experience.

II.System Requirements

Hardware

Computer

The Lilypad™ VR experience has been designed to run on a computer with these minimum recommended specifications:

- Processor: 24 Cores, 32 Threads, 5.8GHz Max Frequency
  - Basis of Design: 14th Gen Intel® Core™ i9 14900HX
- Graphics: 16,000 Cores, 24GB GDDR6X VRAM, 2.23GHz Base Clock
  - Basis of Design: NVIDIA Mobile GeForce RTX 4090
- Memory: 64GB DDR5 5200 MT/s, non-ECC, dual channel
- Display: 1920x1080
- Operating System Basis of Design: Windows 10
- Free space on Hard Drive: at least 5GB

VR Headset

The basis of design for the Lilypad™ VR experience is a Meta Quest 3 Headset along with its wireless handheld controllers and tethering cable (USB-C) provided by the manufacturer. Other VR headset models may be used but have not been validated with the Lilypad™ VR experience.

Software

The following software is required to run the Lilypad™ VR experience and must be installed on a PC.

- Windows 10 or later
- Manufacturer-provided VR Headset software: Meta Quest Link
- Steam and Steam VR

Space Considerations

The Lilypad™ VR experience is best viewed in room-scale mode. A clear and level space with the following dimensions is recommended: 10'x10'x7'. At minimum, a 3'x3'x7' space is necessary.

Ambient Lighting Conditions

The intensity of lighting in the presentation space should be between 320-500 lux to ensure tracking accuracy. Attempting to present in a room that is too dark may result in issues with headset movement accuracy.

Unobstructed Area

Please ensure the VR room-scale boundary is unobstructed and devoid of foot traffic. Consider a visual aide, such as a stanchion or floor tape around the room-scale boundary.

Ambient Noise

The VR experience includes audio narration, along with an instructional audio overlay. Please note that excessive ambient noise may diminish the Lilypad™ VR experience.

III. First-time Setup

## VR Accounts

Meta Horizon Account

A Meta Horizon account is required to run the Lilypad™ VR experience.

- To sign up for an account, go to https://horizon.meta.com/
- If you already have an account, log in to your Meta Horizon account using your username or password
- Download and install the Meta Quest Link desktop app: Install the Meta Quest Link app for your PC | Meta Store
- Once the app is installed, log in to your account

Steam Account

Steam and SteamVR are required to run the Lilypad™ VR experience.

- To sign up for an account, go to https://store.steampowered.com/join/
- Go to https://store.steampowered.com/ to install the Steam App
- After the Steam App has been installed, search the library for SteamVR
- Install SteamVR
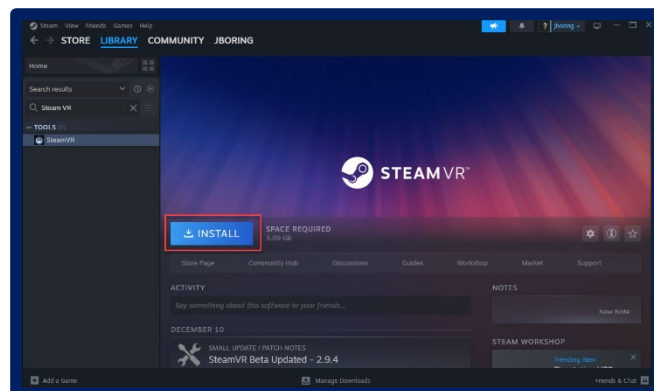
Hardware and Device Setup

VR Device Setup

For Meta Quest 3 device setup, follow instructions on How to set up your Meta Quest 3 | Meta Store, including:

- Powering on the devices
- Adjusting the devices
- Plugging the devices into the PC via the link cable
- Charging the devices or adding batteries

Running the Lilypad™ VR experience for the first time

1. Download the Lilypad™ VR experience (Lilypad.zip) to a local drive on the PC.
2. Extract the contents of the zip folder.
3. Connect your Quest3 Device using the link cable. The Meta Quest Link PC App launches automatically.
4. In the headset, you will see a prompt to enable Meta Quest link. Enable Quest Link using the controller.
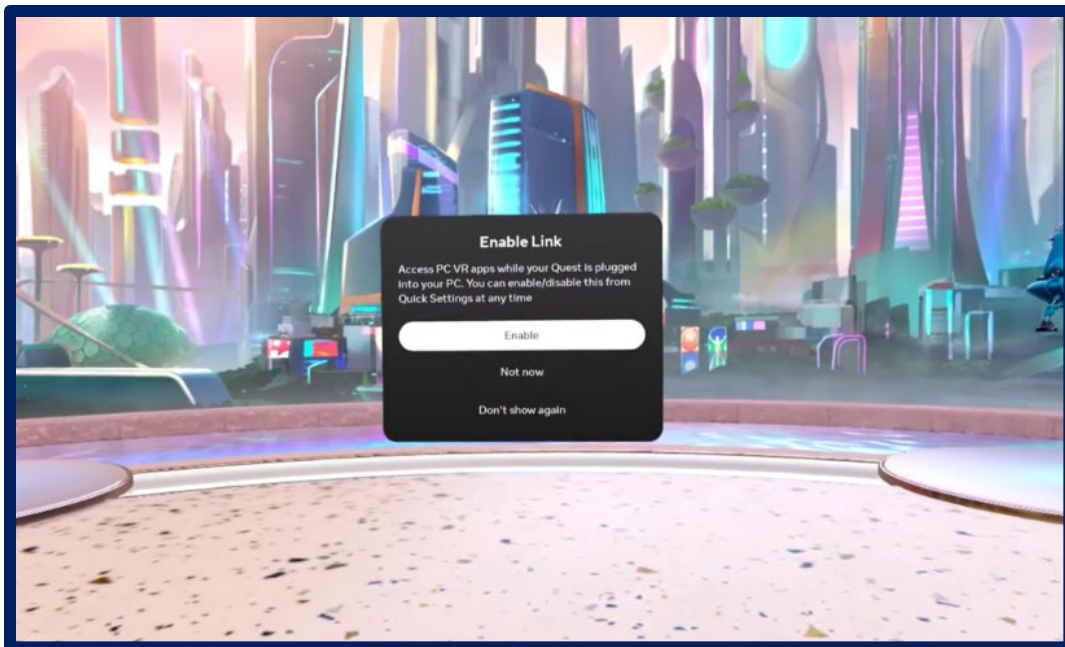
5. In Windows, set playback device to Oculus Virtual Audio Device
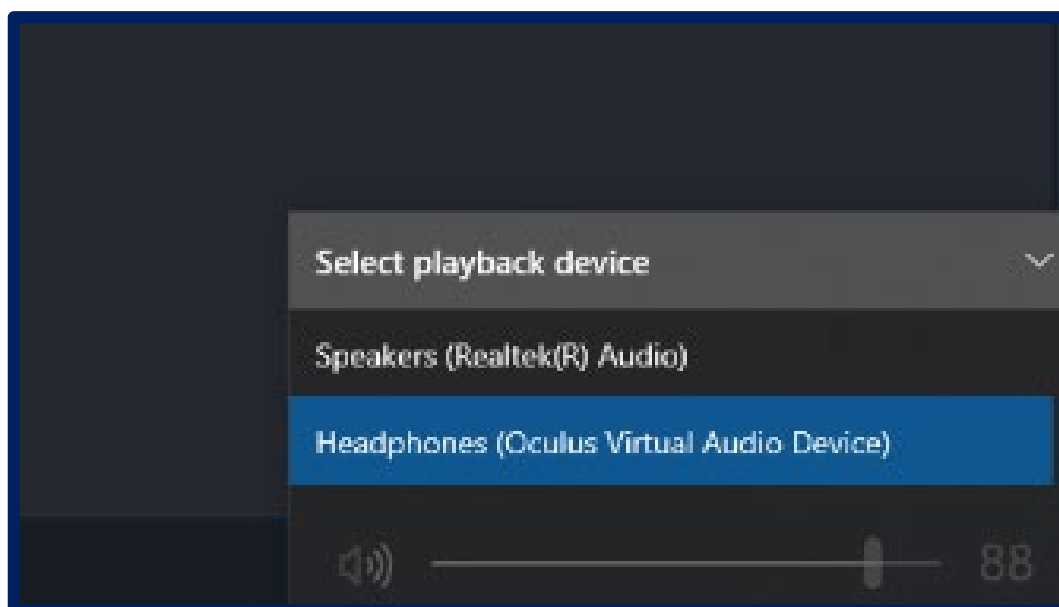
6. Run the FDA_VR.exe from the extracted folder location.
7. Upon startup of the Lilypad™ VR experience, the user will see the Home Screen area with rings in front of each of the personas.
8. Use the Tutorial (in Section V below) to gain familiarity with the different VR controls and interactions in the Lilypad™ VR Experience.

9. For a complete experience, please review the materials in the Personas section of the HHCH Idea Lab prior to entering the rings.
10. Upon entering any of the rings, an audio file will begin to play introducing users to the corresponding personas. Once the audio file is finished playing, the corresponding home scenario will load. If the user exits the ring before the audio has finished playing, the audio will stop playing. If the user re-enters the circle, the audio will restart from the beginning.

IV. Controls and Navigation

Controller Buttons

Right Controller (A)– Load the tutorial level.

Right Controller (B)– Toggle audio on/off. This applies to all audio, including narrations.

Left Controller (X)– Restart. This takes you back to the Start Point of the home environment.
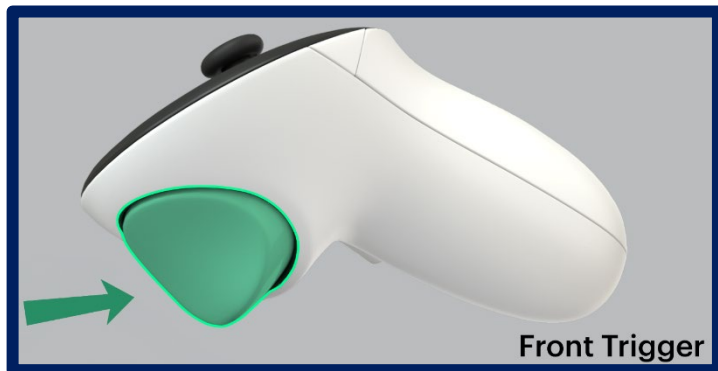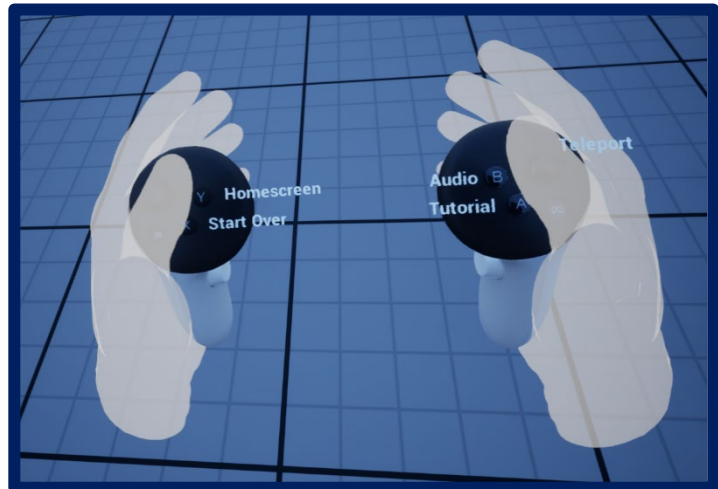
Left Controller (Y) – Return to the Home Screen.

Grip – Pick up objects in the environment.

Trigger – Object selection.

Left Thumbstick – To teleport to another area.

Right Thumbstick – To teleport to another area.

Meta Button – displays the Link Mode Menu, which can be used to pause and exit the Lilypad VR Experience.


Grab

Front Trigger

Movement and Teleportation

Movement within the simulation is achieved by two methods:

1. Looking around and physically walking around the virtual environment.
2. Use of the Thumbstick to teleport to different areas.

When you press the Thumbstick forward, you will see a glowing ring appear on the floor. This ring represents the designated location you wish to teleport. You can use the Thumbstick on either controller to teleport in that direction.

If the ring is not visible, it is likely you are attempting to teleport to a location it is not possible to teleport to in the simulation. Try moving the Thumbstick to select another location.
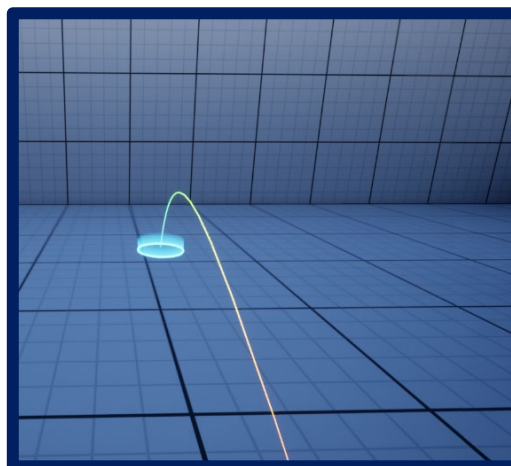
In-World Interactions

Picking Up Objects

Many items within the VR simulation can be "picked up," similar to how objects can be picked up in the physical world.

To pick up an object, move your controller to overlap the object in VR. Then, hold down the grip button on the side. The object will move with your natural hand movements so you can observe it from different angles.

Note: Not all objects have pickup functionality. Only objects that are required to be interacted with for the scenarios have been designed to be picked up.

Grab

Front Trigger
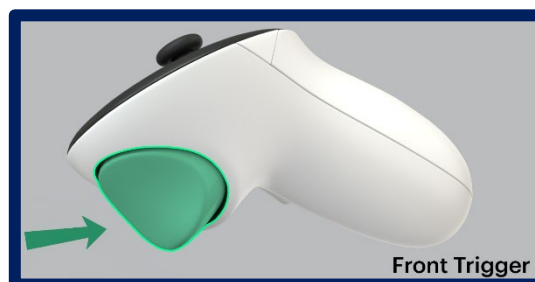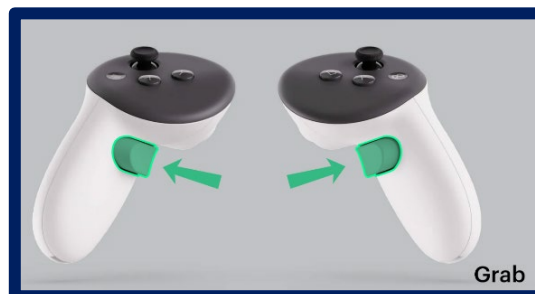
Toggling Light Switches

Light switches can be interacted with in the Lilypad VR experience by touching the light switch with either Controller.

In-world User-Interface buttons

UI buttons can be located throughout the Lilypad VR Experience to change "Modes", or spatial reconfigurations. When a UI Button is touched with either VR controller the "Modes" can become switched.

V.   Tutorial

The tutorial space helps familiarize users with the different VR controls and interactions in the Lilypad™ VR Experience. It covers navigation and interactions such as light switches, grabbing objects, and toggling objects.

In the tutorial space an audio narration will guide the user step by step through each interaction.

- An audio file will prompt the user to use the right Thumbstick to teleport.
- The user must then follow the directions to teleport anywhere in the level, prior to advancing on to the next portion. The user may begin to teleport in advance of the audio narrated completion; however, the subsequent audio prompt will only play after the current audio overlay has finished.
- The next step will guide the user to a specific spot using visual cues. A glowing ring will appear on the floor in the center of the level. The user must teleport within it to move to the next cue.
- The user is then guided to grabbing or picking up objects using the hand controller. There are objects on the table that can be picked up using the grip button. When the user releases the grip button, the object will drop to the floor. Upon release of the grabbable cubes the user advances to the next section.
- Next audio prompt guides the user through the toggle process. The user points the controller and uses the trigger button to change the highlight color on the ball.
- The user is then prompted to teleport near a light switch. The light can be toggled on or off by touching the switch with the controller.

After the completion of the tutorial, the user uses the (**Y**) button on the left-hand controller to return to the home screen.

At any time, the tutorial can be restarted by pressing the (**X**) button.

Home of Sean Gomez

Sean Gomez's apartment contains four main rooms: living room, kitchen, bedroom, and bathroom. There are a few other minor spaces such as closets and an entry foyer.

When the user loads Sean Gomez's home, they will begin the experience at the "Start Point" which is in the entry foyer, facing the kitchen and living room.
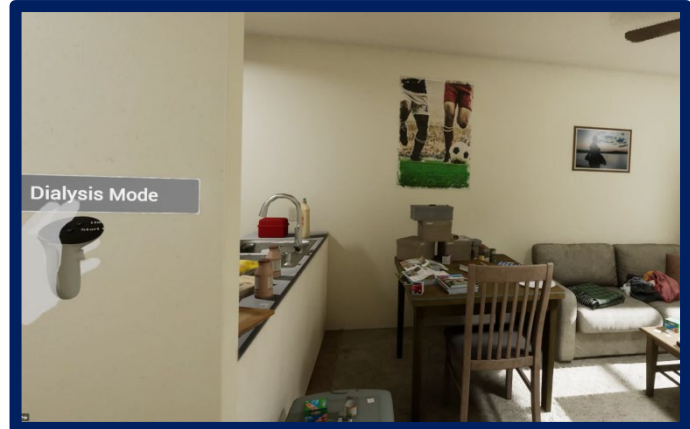

Image of Dialysis Mode (UI Location)

On the wall near the kitchen is a button labeled "Dialysis Mode." When the user touches either of the VR controllers to this button, the space is reconfigured to include a hemodialysis device and supplies. Pressing the Dialysis Mode button a second time will return the configuration to its original state.

In the kitchen, the refrigerator doors can be opened by touching the door handle. Contained within the refrigerator is an insulin pen which can be picked up.
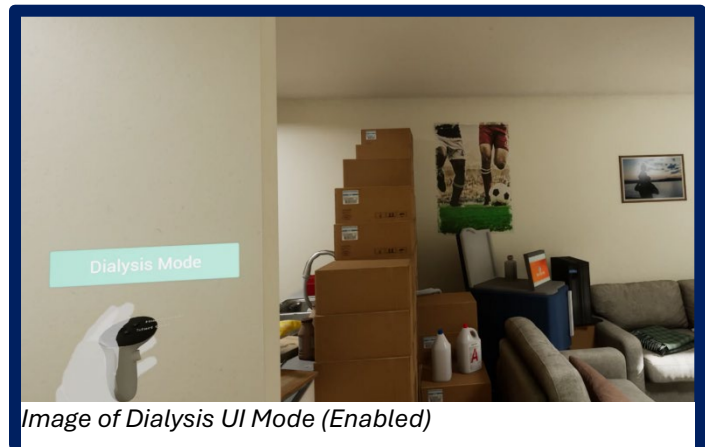

Image of Dialysis UI Mode (Enabled)

Additional diabetic supplies can be found throughout his home, allowing each user an opportunity to further engage with elements associated with scenarios associated with Sean's "Day in the Life" described in the Persona section of the HHCH Idea Lab. Feel free to interact with light switches, doors and the overhead fan.

Home of David Miller & Vivienne Chu

The home of David Miller and Vivienne Chu is a single-family residence and contains four main rooms: living room, kitchen, bedroom and bathroom. There are also several other minor spaces such as closets and an entry foyer.

When the user loads the Miller home, they will begin the experience at the "Start Point" which is at the entry foyer, facing the kitchen and living room.

On the wall nearest the bedroom is a button labeled "Day/Night Mode." Users can toggle between these day and night states using this button. This feature allows the user to experience the home at night as David experiences it during his sleep disturbances.

Diabetic supplies are found throughout their home. Feel free to interact with these supplies, light switches, the treadmill and objects on the dining table.

Day/Night Mode (UI Location)

Day/Night Mode UI Mode (Enabled)

Home of Melvin & Ladonna Thomas

The home of Melvin and Ladonna Thomas is a manufactured home that contains four main rooms: living room, kitchen, bedroom, and bathroom. There are also several other minor spaces such as closets and a laundry area.

When a user enters Melvin and Ladonna's home, they will begin the experience at the "Start Point" which is in the living room, facing the kitchen.

On the wall nearest the kitchen and in the bathroom are buttons labeled "Accessibility Mode." These buttons toggle to show accommodations for ADA (American Disabilities Act) Standards that are applied to the millwork (i.e. kitchen sink, bathroom lavatory). Pressing either of the these "Accessibility Mode" buttons a second time, will return the configurations to their original states. Grabbable objects are interspersed throughout their home, including a wheelchair and other medical supplies.
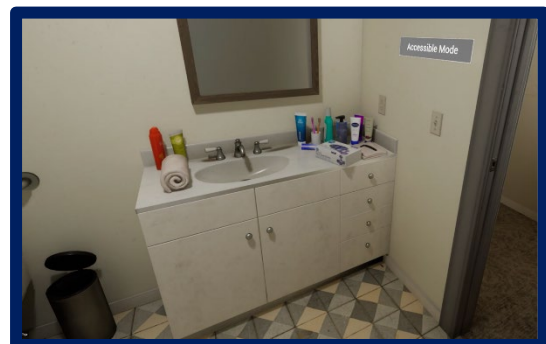
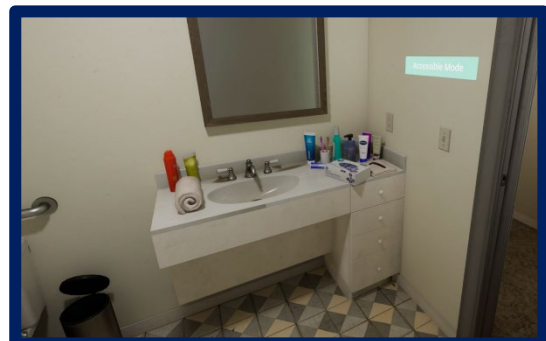Additional interactions include the operable doors and light switches.

Kitchen Accessible Mode (UI Location)

Kitchen Accessible Mode (Enabled)

Bathroom Non-Accessible Mode (UI Location)

Bathroom Accessible Mode (Enabled)

Home of Austin Miller

Austin Miller's apartment contains four main rooms: living room, kitchen, bedroom, and bathroom. There are also several other minor spaces such as closets and an entry foyer.

When the user loads Austin Miller's home, they will begin the experience at the "Start Point" which is in the entry foyer, facing the kitchen and living room.

Throughout Austin's residence, the user will find various medical supplies.

VI. Troubleshooting

<u>If the Lilypad VR Experience experiences latency</u>

o Check that the laptop is plugged into a power outlet and that all connections on the power cable are secure. The battery icon can serve as an indicator of whether the laptop is plugged in. Confirm power cable is connected to the source outlet.
o Check to confirm that the tethering cable is fully plugged into both the headset and the USB-C port on the back of the computer.
o Check that no other programs are running besides the VR simulation and Microsoft Windows.
o If you are using a laptop or PC other than the provided hardware for the simulation, ensure it meets or exceeds the specifications for the provided laptops, outlined under Prerequisites > Hardware > Computer. If the computer does not meet these specifications or you are unsure, use the hardware provided.

<u>If the simulation does not show inside the headset when Lilypad.exe is run</u>

o If only a black screen is seen inside the headset, check that the headset is turned on.
o If you see a home screen with colors (and not a grey/white background), ensure the VR headset is in linked mode. Unplug the USB-C cable, plug it in again, and enable linked mode via the prompt.
o If you see a home screen with a grey/white background and a grid on the floor, double check that SteamVR is running. Refer to Running the Simulation for the First Time for more information.

VII. Adding your device to the Lilypad™ VR Experience

This section outlines the core interactions within the VR project and provides guidance for users intending to make modifications and extend its functionality.

Player Setup

Default Player:

The VR Pawn serves as the default player character. This pawn is responsible for handling movement, interaction, and other VR-specific functionalities within the project.

Controls:

Most of the VR Pawn's controls follow Unreal Engine's default setup, ensuring familiarity for developers. Additional controls have been integrated using the **Enhanced Input Action system**, enabling extended functionality for specific interactions.
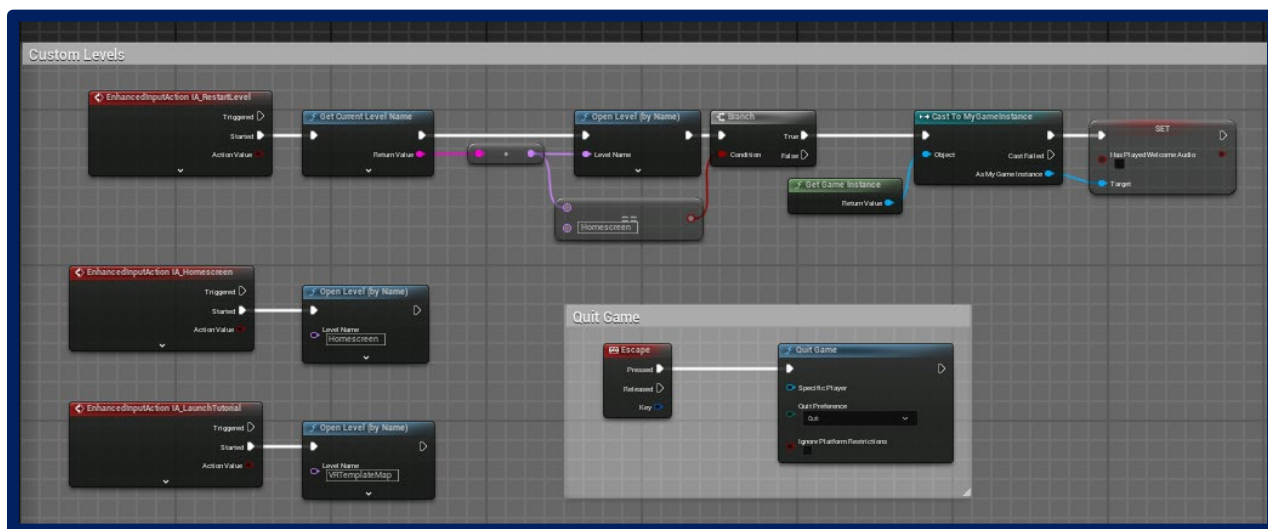

Enhanced input implementation inside VR pawn blueprint

Level Blueprint for Tutorial Map

Primary Governing Logic:

 The **Level Blueprint** for the Tutorial Map contains the majority of the overarching rules and scripts that dictate gameplay flow. This includes:

- o   Setting up tutorial objectives.
- o   Managing triggers and guiding players through the level.
- o   Coordinating interactions between key actors.
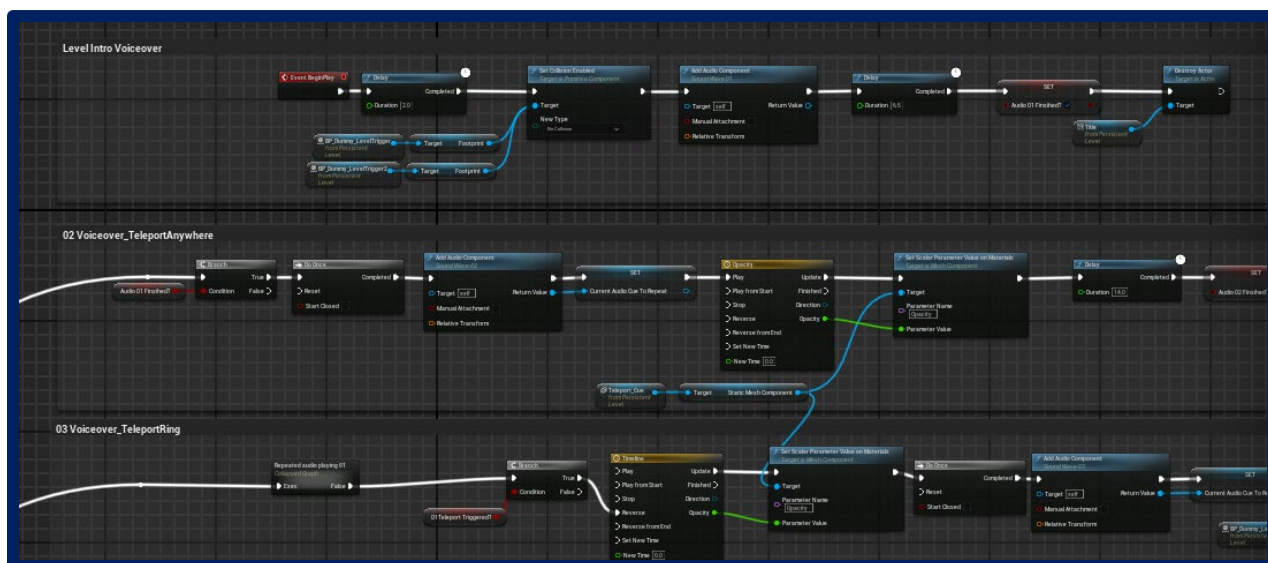
Interaction Framework

Blueprint Interfaces:

The project relies heavily on **Blueprint Interfaces** to facilitate communication between different actor blueprints. This modular approach ensures that interactions remain flexible and scalable.

Grabbable Actors:

Objects designed for user interaction, such as healthcare devices, are based on **Blueprint Actor** classes configured to respond to VR Pawn input events (e.g., grab, release).
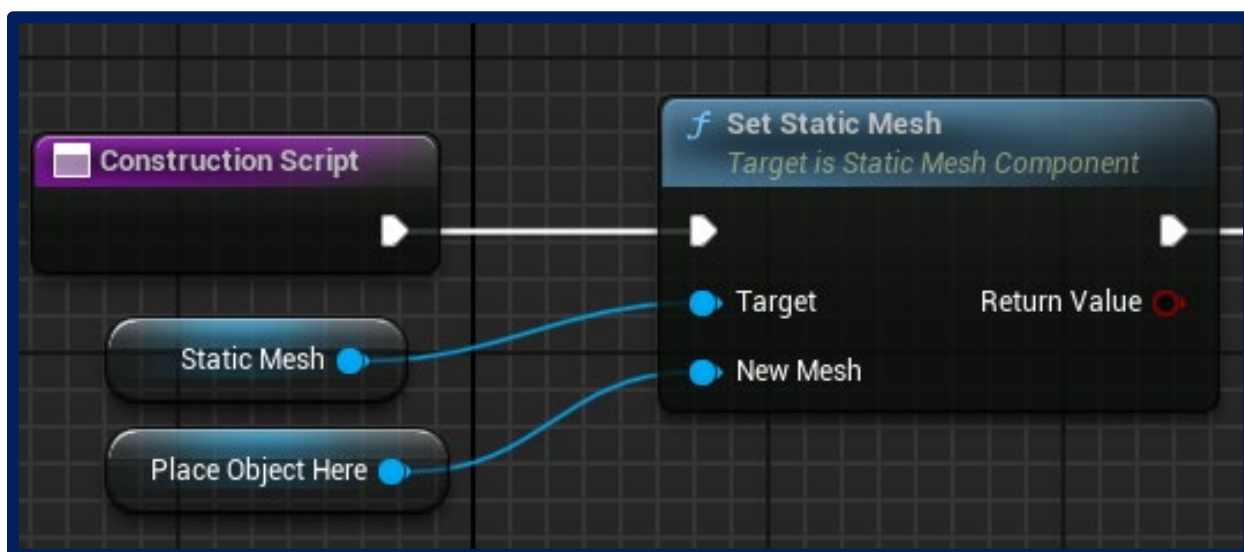
Construction script setting static mesh for the static mesh component. Allowing player to replace 3D asset as needed in the level scene.

Interactive Switches and Doors:

Interactive elements such as switches and doors are created as **Blueprint Actors**. These actors are designed to trigger specific actions when the VR Pawn interacts with their collision volumes.

Timelines have been used to handle transformations, as demonstrated in the door blueprint **(BP_Door_Room)** for opening and closing the door.
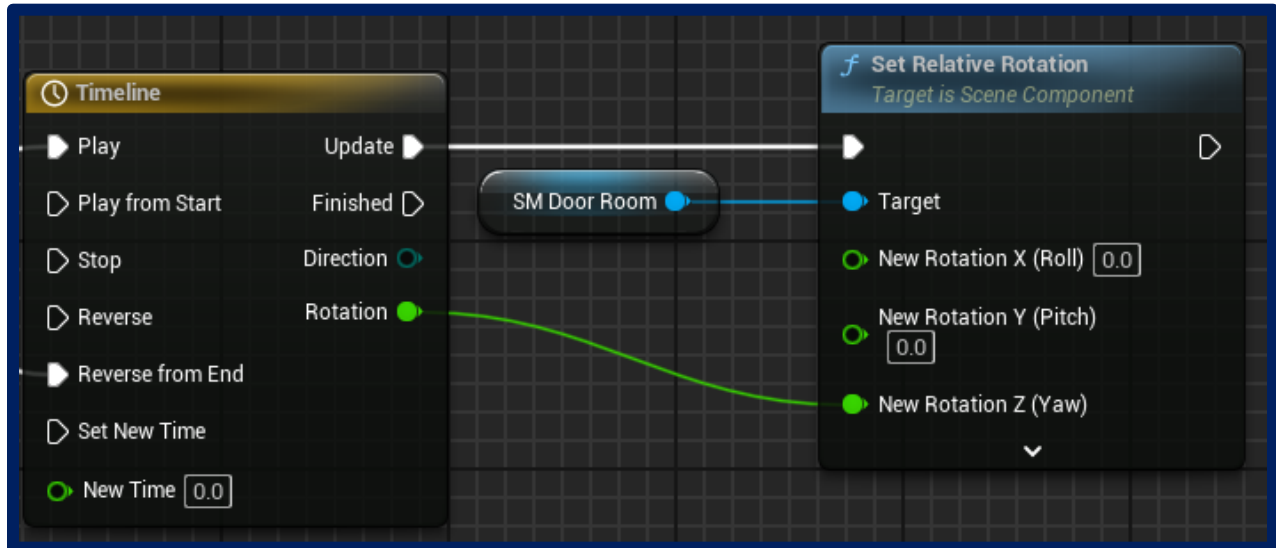

*Using timeline to animate **BP_Door_Room** blueprint.*

Blueprints like **BP_DialysisToggle** and **BP_ADAToggle** include a widget component and a collision box. These are constructed similarly to interactable elements like doors, but instead of using a timeline, they rely on level streaming functions to execute actions.
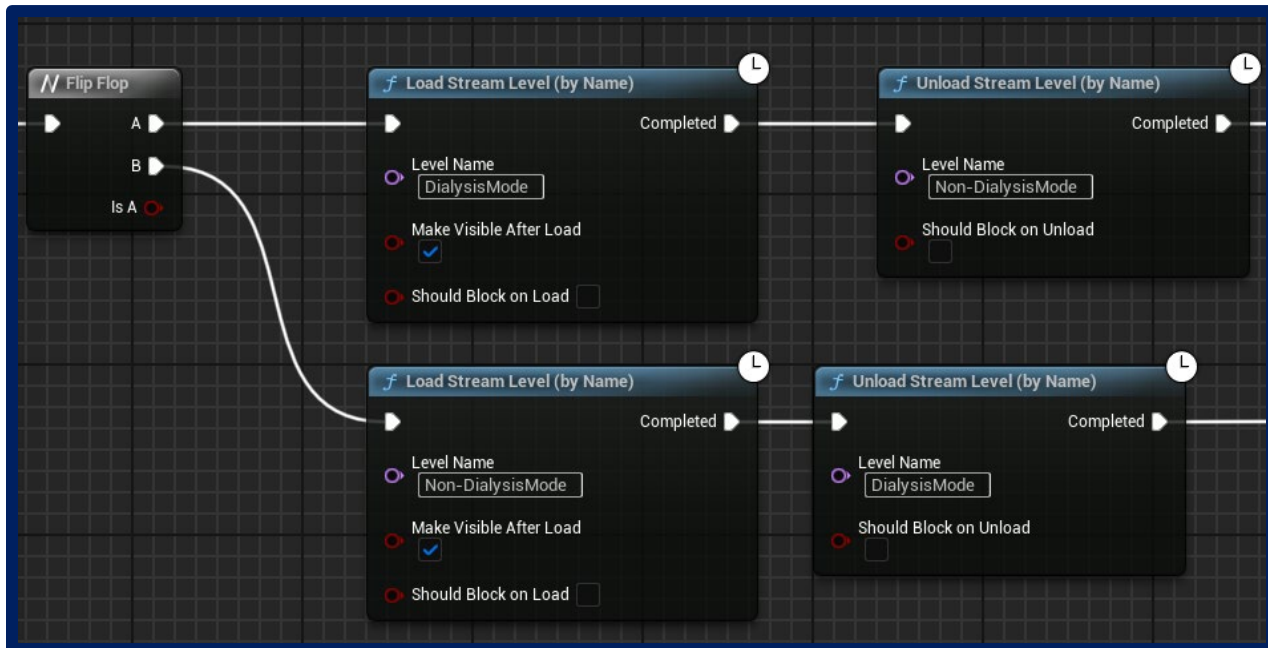
The FlipFlop node in the blueprint alternates between loading and unloading Dialysis mode within the Persistent level.

Finally, there are interactable lights and fans, which are controlled by switches. When the player interacts with the switch's 3D model, the switch's rotation is transformed. The blueprint then sends a message to specific lights through an interface to toggle their
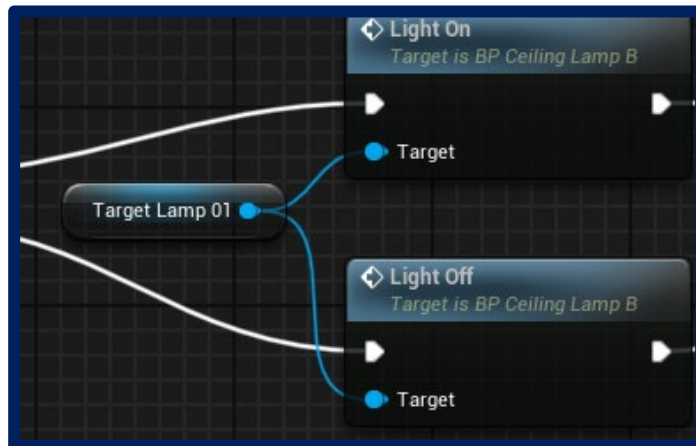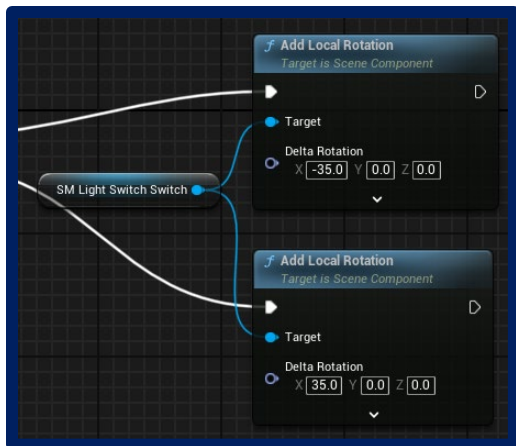
state.

*The left image displays the script used to transform the switch for visual feedback.*
The right image illustrates the interface reference used to send a message to a light, toggling its state between on and off.

Grabbable Objects:

To modify any grabbable Blueprint actor, search for the **BPI_Grabbable_BlankDesigner** blueprint.

Drag it into the environment and change the static mesh by adding a 3D model in the **Details Panel**.

Ensure that the mobility of Static mesh is set to **Movable.**
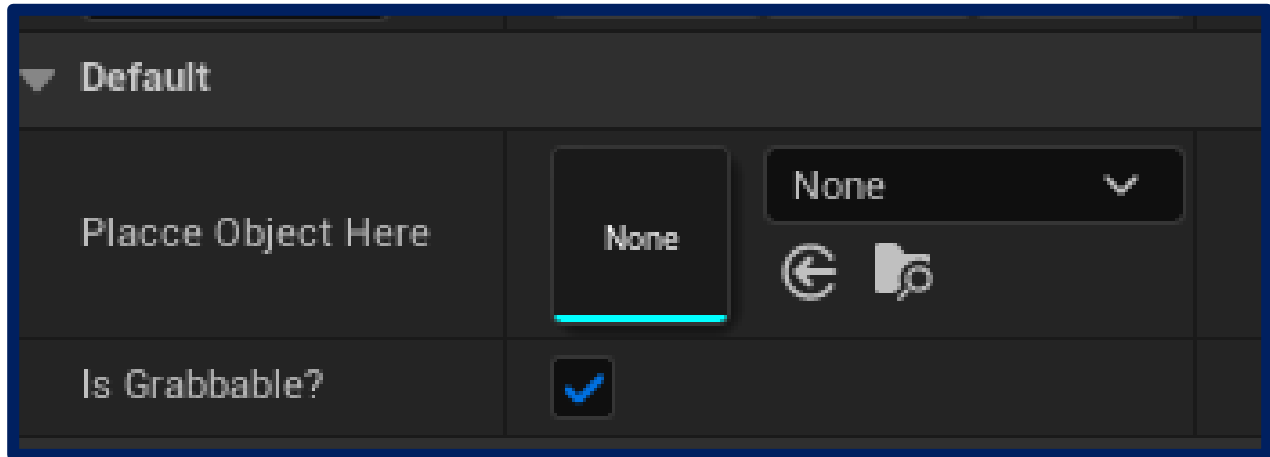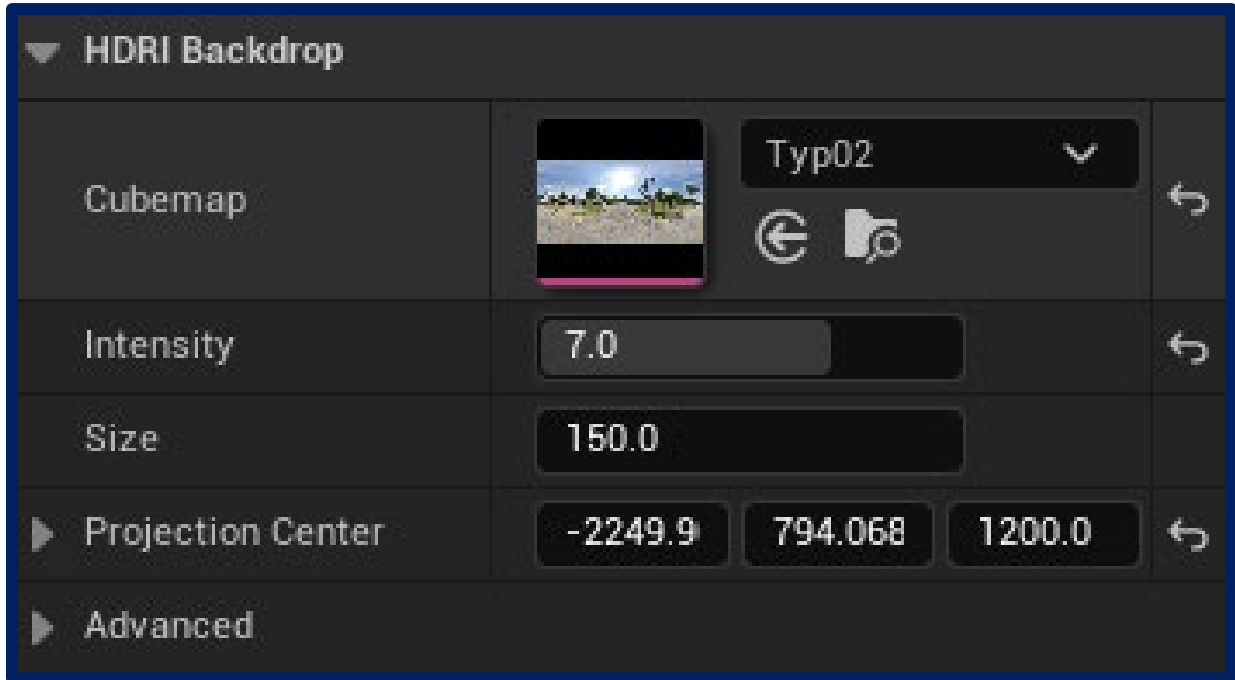

Details panel of the BPI_Grabbable_BlankDesigner blueprint to add a new Static mesh.

Adjusting Environment Settings

VR Environment and Lighting is reliant on the HDRI Backdrop. The plugin has been enabled for the exterior environment.

Swap the Cubemap as necessary to change the environment, change the intensity and Projection Center as needed.

Details panel of the HDRI back drop Blueprint to add a new HDRI and control its properties.

Game Instance

Map Transition Management: A custom **My**G**ame Instance** includes a variable that stores the name of the map to transition to from the Home Screen. This centralized storage allows seamless transitions between levels and ensures consistency in gameplay flow.