

Final Project Report

VR Space Museum

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## Goals and Objectives:

The goal of the project is to create a puzzle-based 3D Museum based upon the eight planets of the solar system. To ensure the accuracy of data and information, NASA is used as a reference for the museum.

VR makes an excellent application for museums as it allows a person to get much closer to objects than they can in a real-life museum. It also allows a user to visit from anywhere in the world rather than the expensive costs to visit in person.

The VR Museum itself is filled many puzzles for the user to solve. These puzzles help assist with the learning experience. The player makes use facts and information found inside of each room to solve the puzzles needed to advance.

## Programs and Tools used:

Unity 3D: The project is created inside of Unity version 2021.2.171f1.

- Unity Assets:
  - ProBuilder and ProGrids – Tool used to create the building layout inside of Unity.
  - Snaps (Sci-fi edition) – Unity default asset for the walls and furniture used in the museum.
  - Unity's new input system – Allows easy configuration of new human input devices without having to change or edit scripts.
  - Universal Render Pipeline – Lighting and shading for the museum.

- Asset from Unity's Asset Store
  - HiTech SciFi Energy Cell by AntiDed GameDev – Energy cells used in the puzzles
- Blender – 3D modeling program to convert NASA's model assets into a usable format for unity.
- Visual Studios 2022 – C# Script programming.

## C# Scripts

First Person Camera: The first-person camera was programmed specifically for this program.

The camera has the following features:

- Picking up objects: Objects can be held either with the left or right hand.  
Additionally, objects can be held by both hands.
- The player has the ability to jump.
- The camera allows the player to interact with in-world computer interfaces.

Puzzles: There are generic puzzle scripts that are baseline for all puzzles. They include:

- Puzzle Coordinator – This class determines if the room's puzzles have been solved and which door to open. Some rooms require a specific condition and make use of this as a base class.
- Holder – This class enables an object to hold another object.
- In World GUI classes – Allows the changing of text, usage of buttons in the world.
- Audio Trigger – This class plays audio when the player is near a screen in world.

Planets: Planets have their own scripts for controller rotation and spin. This is due to some planets having a unique spin and rotation.

## Controls:

The default interface for the program are a mouse and keyboard.

Movement is conducted by using the WASD keys. W for forward, S for backwards, A and D for side-to-side movement.

Players can look around the environment with the use of the mouse, simply moving the mouse changes the direction the camera is looking at.

Picking up an object is done with the left and right mouse button. Left clicking on an object will pick it up with the left hand, and right clicking an object will pick it up with the right hand.

Objects that require both hands will be picked up when either mouse button is used.

The player can also interact with computer screens in world by using the left mouse button.

## Functionality:

Vision:

The museum makes use of sci-fi objects and walls from Unity's default Sci-Fi Snap assets. Lighting is accomplished with directional lights that are hanging in each room. These lights use the universal rendering pipeline to illuminate the rooms.

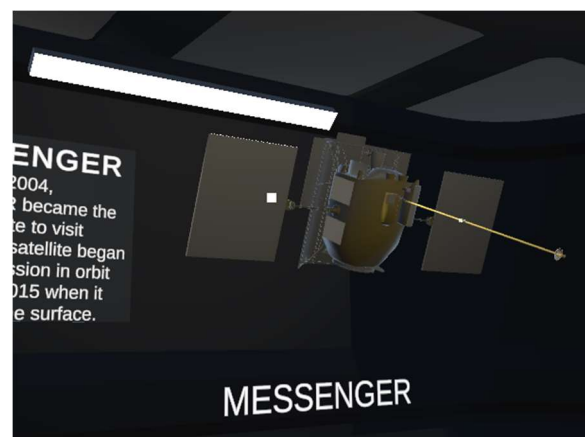


Figure 1- Lighting illuminating the Mercury room, there lights are futured in every room of the musume except the solar room.

Sound:

Audio files were produced by using AI text to speech. The AI software used to accomplish this was IBM's Watson sing the Olivia and Lisa voice sets.

[Watson Text to Speech Demo \(ibm.com\)](https://ibm.com)

A total of 14 sound files are in the museum.

Animation:

Planets are animated through the use of scripts to control their rotation speed and direction. Doors are animated by using Unity's animator. There are a few puzzle pieces that have unique animations due to how the player interacts with them.

Interactivity and Sensors

The player can interact with the environment in several different ways, with a mouse and keyboard:

- Holding Objects: Clicking on an object allows the user to pick them up in either hand.
- Rotation: Some objects are rotated when the user left clicks on them.
- Proximity: Audio files are played with the usage of proximity sensors.
- Touch: Some puzzles have unique interactions when clicked on, Venus for example will remove its cloud cover allowing the player to view the planet surface.

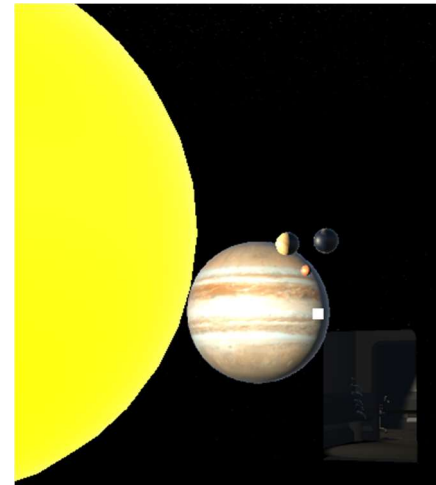


Figure 2- The planets in motion in the solar room. Each planet's size is based on real measurements against each other.



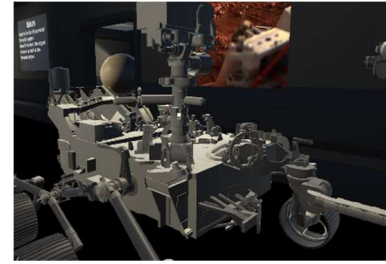
Figure 3 - In World GUI allowing the player to interact with screens in world.

## Avatars

Planets: Each planet is textured from imagery from NASA. In the case of the solar room and final puzzle the planets are scaled to the correct ratio against each other.

Moons: Moons have unique models from NASA. This is due to moons typically having a unique shape rather than strictly being round as is the case of Earth's moon.

Satellites and Rovers: Models of Mariner 10, MESSAGER, and Voyager can be found in the museum. Mars' rover Perseverance can be viewed in the Mars room.



*Figure 4- The Mars' rover Perseverance, an example of one of the models found inside of the museum.*

## Room for Improvement:

Many rooms can be expanded upon with additional information and models, the outer planet's moons would be an excellent point of expansion. This type of information is relevant to current events as scientists explore the possibility of life existing on some of these moons in the solar system.

Other areas of improvement are adding current and future space projects. The planetoids in the solar system such as Ceres, Eris, and Pluto, and the asteroid belt.

Given the unique characteristics of VR, the implementation of being able to visit a small area of the Mars or the Moon could be a fun activity as well. The first-person camera constructed for this project allows for adjustable gravity to assist with the immersion factor.

Lastly, implementation of VR itself. Much of the scripts were designed in-mind for VR. Unity's own asset NavMeshes also allow easy implementation of a common VR movement, teleportation, for users who experience motion sickness with stand stick movement.

## References

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