



JPL VR Trek

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Rizwan Vazifdar, Ruben Heredia



Agenda

1. Objective
2. Software / Hardware Utilized
3. OpenXR
4. Functionalities
5. User Interface
6. Essential Scripts
7. Challenges
8. Future Implementations
9. Acknowledgments
10. Questions



Objective

Presented By: Fabio Carrasco

Objective

- Develop a **VR** educational experience.
- Offer informative content on **planetary** landscapes.
- Use **OpenXR** for VR app compatibility across devices.





Software / Hardware Utilized

Presented By: Bryan Lopez



Unity 2021.3.8

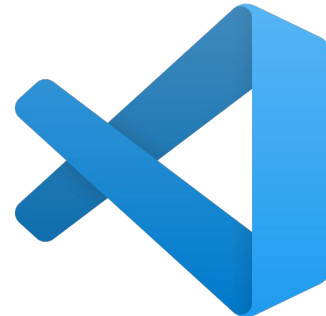
- Long term support
- Stability
- Compatibility

Plastic SCM

- Distributed version control
- Support for large files
- Reliable branch/changeset management

Visual Studio Code

- Unity integration
- Scripting & Debugging





C#

- Object-Oriented Programming Language
- Native integration with Unity
- Cross-platform compatibility

Meta Quest 2

- Wireless standalone VR
- Hand tracking
- OpenXR support

OpenXR

- Open standard
- Reduced development time
- Cross-platform compatibility



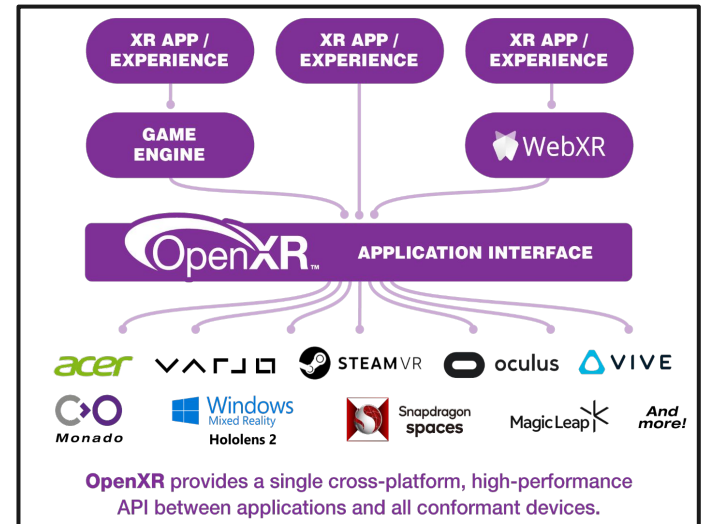


OpenXR

Presented By: Justin Vuong

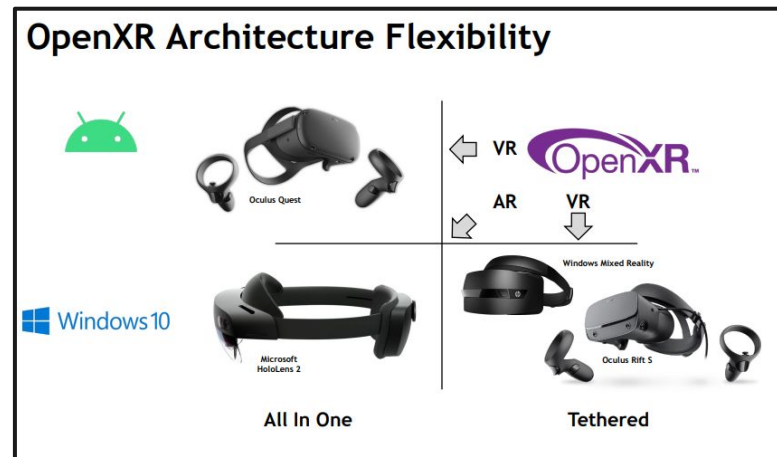
What is OpenXR?

- OpenXR is an open royalty-free API that allows access to AR and VR platforms/devices
 - Created by Khronos Group
- Translates AR and VR functions (XR) to a uniform standard, solving XR fragmentation



OpenXR Compatibility

- Compatible Platforms:
 - Head mounted displays
 - Mobile devices
- Supported Input Devices:
 - Motion controllers
 - Hand tracking
 - Able to recognize 26 unique joints per hand
 - Eye tracking
 - Haptic feedback
 - And many more





Functionalities

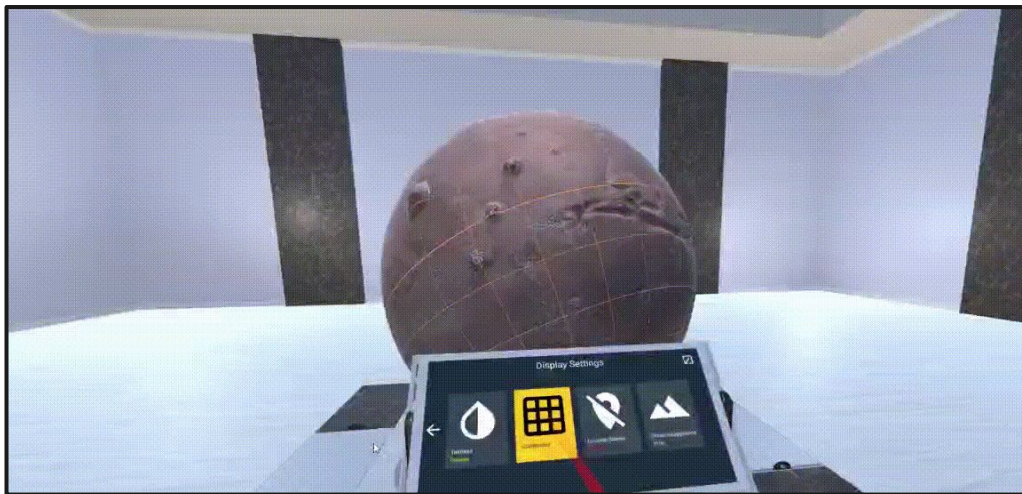
Presented By: Ari Jasko

Terrain Exaggeration



Slider is used to increase/decrease the terrain exaggeration multiplier.

Texture Toggle



Texture button toggles (enables/disables) the current texture.

Lighting



Flashlight (enabled/disabled using left hand trigger)



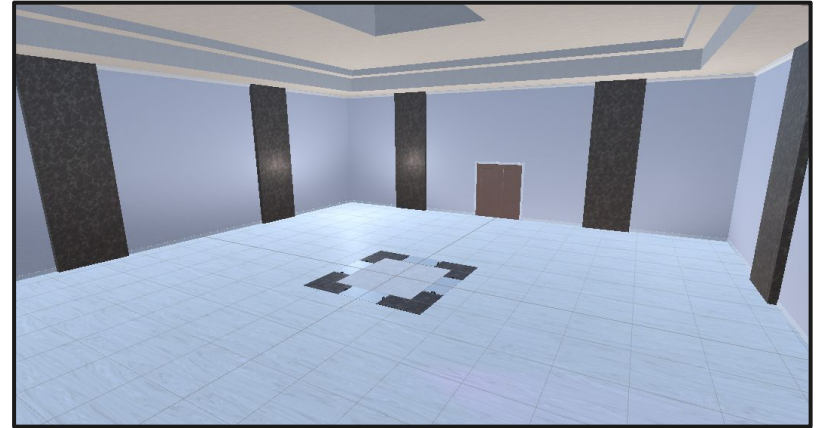
User Interface

Presented By: Ruben Heredia, Ayush Singh

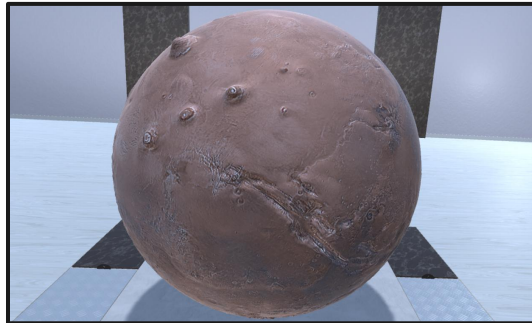
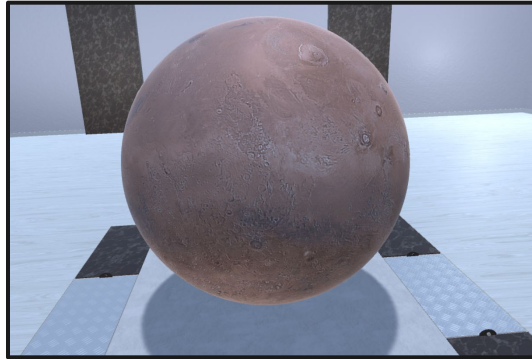
User Interface

Main Room

- Purpose:
 - Place the user in a simple and comprehensible environment to access of the program.
- Materials
 - Marble
 - Tiling
 - Wood
- Lighting
 - Interior
 - Spot Light
 - Point Light
 - Exterior
 - Directional Light (Skylight)



User Interface



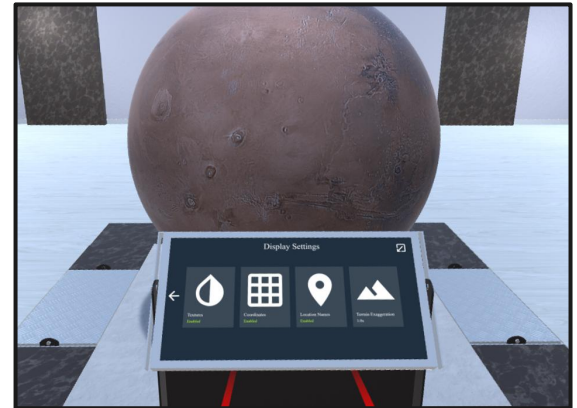
Globe

- Purpose
 - Provide a visual representation of the selected planetary body.
- Functions
 - Globe Rotation
 - Direct globe interaction
 - The user is able to rotate the globe and view their preferred orientation
 - Terrain Exaggeration
 - Accessed through the control panel menu.
 - Emphasizes peaks and depths of the planetary terrain.

User Interface

Control Panel

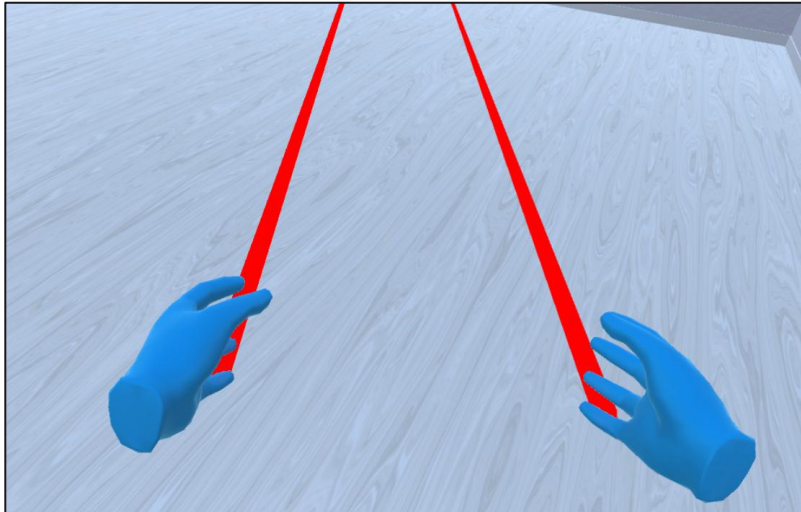
- Purpose:
 - Allow the user to interact with the globe and enable different interaction functions.
- Functions
 - Terrain Exaggeration
 - Increase/Decrease terrain exaggeration multiplier.
 - Texture & Globe Coordinate Grid
 - Toggle texture & globe grid that divides the globe into different sections.
 - Display Settings
 - Alter graphic settings for program to be functional on OpenXR devices.
 - Resolution





User Interface

Hands (Controllers)



- Purpose
 - Provide a visual model of the user's hands ease interactions with the VR Trek program.
- XR Interaction Toolkit 2.0.4
 - Unity Asset Package that contains OpenXR hand models and controller input scripts.
- Raycast
 - Visual laser pointer that helps the user select/interact with objects in the game scene.



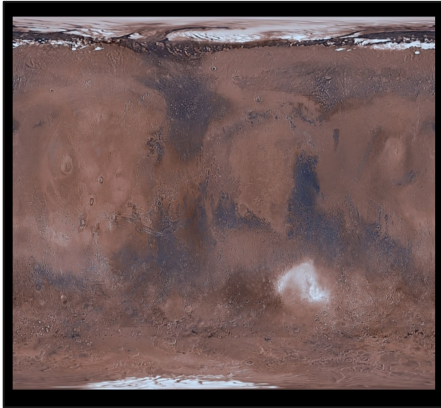
Essential Scripts

Presented By: Ly Jacky

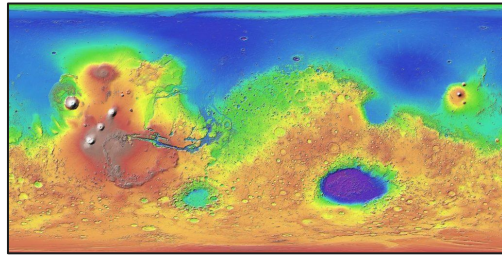


Service Manager

Texture of Mars

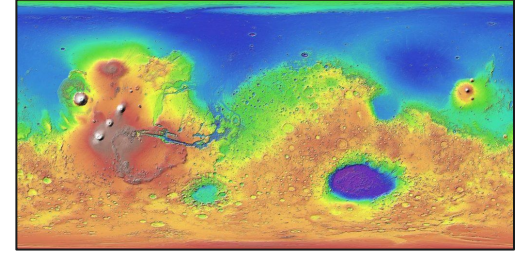
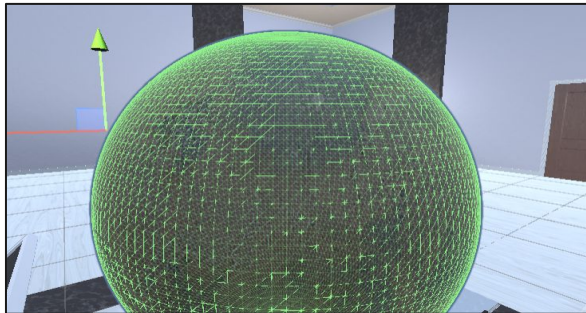
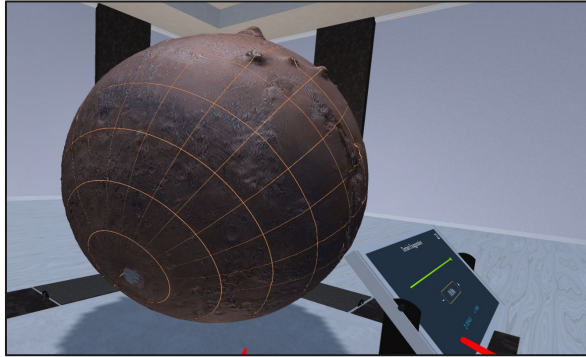


DEM



- Service Manager
 - Manager that handles all of the API calls made to the JPL Server
- To create the globe we receive different TIFF images from the JPL server
 - Digital Elevation Model (DEM)
 - Texture of Mars

Terrain Model Manager



Globe

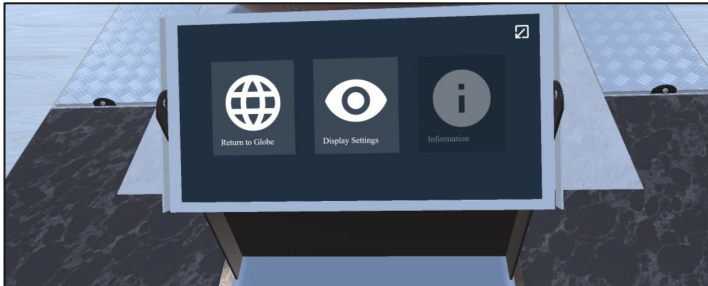
- Only one instance of this class occurs in the life cycle of the application
- Creates globe and adds textures given
 - Uses Digital Elevation Model (DEM) to create height exaggeration
 - Uses Mars Texture TIFF to give the globe the correct colors
- Each pixel of DEM file gets mapped to a vertex on the Globe



Control Panel User Interface



- The user interface is built using Angular
- ZFBrowser was used to incorporate the Angular application in Unity
- Angular was used as a way to speed up the development



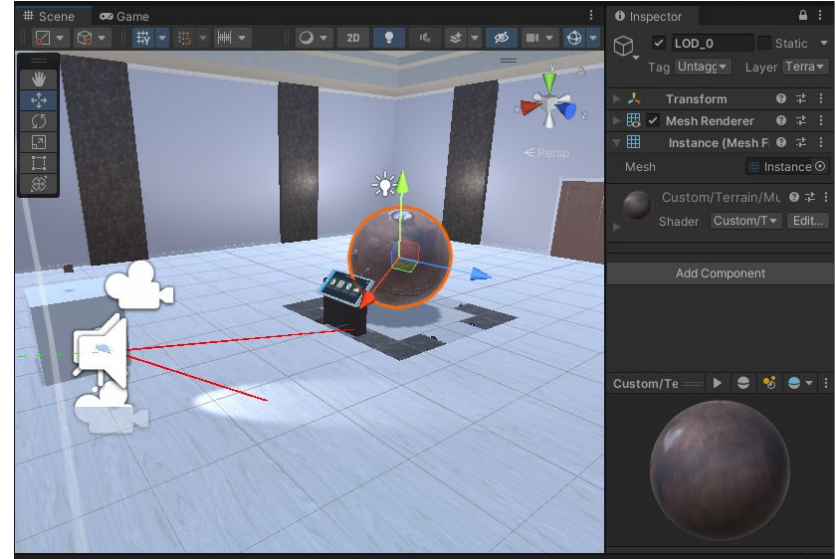


Challenges

Presented By: Lucca Andrade

Challenges

- Lack of documentation
 - Uncommented and undocumented proprietary code
- Object Oriented customized Architecture
 - Important Objects generated on runtime
 - Non-standard class structure for controllers functions and Globe generation





Challenges

```
private void OnEnable() {  
    // Unsupported library to be replaced  
    // SteamController = GetComponent<SteamVR_TrackedController>();  
    // SteamController.PadClicked += PadClickedHandler;  
    // SteamController.PadUnclicked += PadUnclickedHandler;  
  
    Controller = GetComponent<CustomController>();  
  
    // new custom button handlers  
    Controller.TriggerClicked += TriggerClickedHandler;  
    Controller.TriggerUnclicked += TriggerUnclickedHandler;  
    Controller.MenuButtonClicked += MenuButtonClickedInternal;  
    Controller.MenuButtonUnclicked += MenuButtonUnclickedInternal;  
    Controller.Gripped += GrippedHandler;  
    Controller.Ungripped += UngrippedHandler;  
}
```

- Translation of code to the new open standard
 - Steam_VR API → Unity Input System
 - Customized Controller inputs
 - Unsupported shaders → Custom Universal Rendering Pipeline

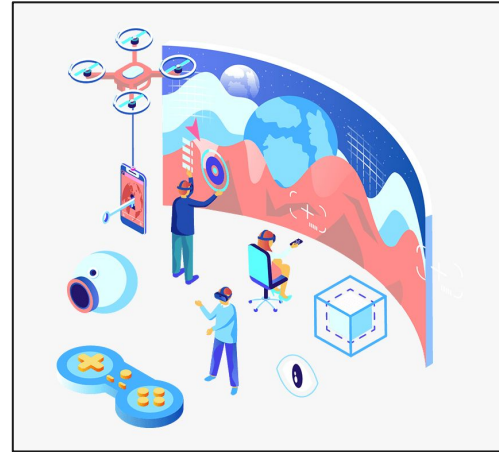



Future Implementations

Presented By: Enrique Guardado, Rizwan Vazifdar

Future Implementations

- Moon & other terrains
- Multi-user mode
- Virtual tours
- Classroom integration

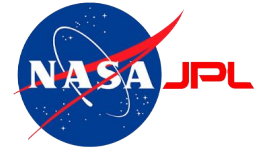


- 
- Add more planetary **interaction** tools.
 - Incorporate **haptic** feedback and **audio** to provide users with a more **immersive** experience.
 - Implement User Interface **features** in the Control Panel.





Acknowledgements



- Advisor
 - Dr. Krum
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 - Richard Kim
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- JPL VR Trek Source Creator:
 - Alvin Quach



Questions?



Thank You!