

Project Title: Celestial Explorer: A VR Adventure in Space

Setting/Context:

The project merges **education and entertainment** into a virtual reality experience. It serves as both a learning platform for space physics and an interactive adventure for casual VR users. By simulating interplanetary travel and immersive gravity experiments, the project provides a compelling environment that bridges the gap between traditional education and modern VR-based learning.

Concept and Purpose:

The **Celestial Explorer** project transforms how users engage with the concepts of space, planets, and gravity. Through interactive mechanics and immersive visuals, it enhances users' spatial understanding and curiosity about celestial phenomena. The primary goal is to foster an **experiential learning** platform where users can explore space freely while understanding its underlying principles through direct interaction.

The project addresses the following objectives:

1. **Exploration:** Provide an immersive platform to explore celestial bodies in detail.
 2. **Engagement:** Gamify space travel and physics demonstrations to maintain user interest.
 3. **Education:** Simulate real-world phenomena like gravity to teach complex concepts intuitively.
 4. **Accessibility:** Design an experience suitable for all users, including those new to VR.
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Intended Experience:

1. **Spaceship Exploration:**

Users start inside a spaceship, which serves as the central hub for interplanetary exploration. A **scrollable navigation panel** allows them to select and travel to destinations. Once a planet is selected, the spaceship "travels" through space to the chosen celestial body, accompanied by visual effects that simulate interstellar travel.

2. **Interactive Wrist Menu:**

A **wrist-mounted menu** is activated on the left hand, offering options to:

- Exit the spaceship to explore the planet.
- Teleport back to the spaceship for safe re-entry.
- Adjust the user's travel speed while outside the spaceship.
- Display information about the celestial body, including its size, composition, and historical significance.

3. **Planetary Flying Mechanic:**

Once outside the spaceship, users can freely explore the planet's surface using a

superman-style flying gesture with their right hand. The flying direction aligns with the user's gaze, offering intuitive navigation. This mechanic makes planetary exploration seamless and enjoyable while emphasizing freedom of movement in a low-gravity environment.

4. **Lunar Gravity Scene:**

On reaching Earth, users can land on a dedicated **moon landscape scene**, accessed through a button in the wrist menu. This scene focuses on showcasing lunar physics through interaction:

- **Distance Grab Gesture:** Users can grab colored rocks scattered across the lunar surface from a distance using hand gestures.
 - **Object Manipulation Gesture:** Rocks can be manipulated to stay at a fixed distance from the user, simulating how objects behave in reduced gravity.
 - **Dropping Physics:** Users can drop objects and observe their slower descent, highlighting the moon's lower gravitational pull compared to Earth.
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Main Interactions:

- **Spaceship Navigation:** Interact with a panel to scroll and select celestial destinations.
 - **Wrist Menu:** Use the left-hand menu to teleport, view information, or adjust speed.
 - **Flying Gesture:** Explore planets using right-hand gestures, with movement guided by gaze direction.
 - **Physics Demonstration:** Grab and manipulate rocks in the moon scene to explore gravity and object dynamics.
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Target Users:

This experience caters to:

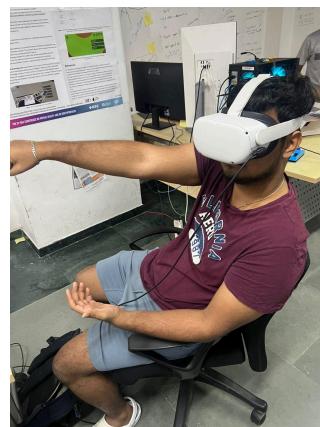
The project targets **space enthusiasts**, **students**, and **casual VR users** aged 12 and above who are interested in interactive, educational VR experiences. Its gamified yet informative approach ensures broad appeal to learners and entertainment seekers alike.

- **Students (12+):** To learn space physics interactively.
- **Space Enthusiasts:** To explore celestial bodies virtually.
- **Casual VR Users:** To enjoy a gamified exploration experience.

Testing Results for VR Space Exploration App

1. Participants Overview

- **Experienced with VR:**
 - Armaan (Age: 19, Frequent VR user, enjoys space exploration games).
 - Harsh (Age: 19, Occasional VR user, enjoys action-adventure games).
- **Not Experienced with VR:**
 - Noel (Age: 20, Never used VR before).
 - Rahul (Age: 20, New to VR, limited exposure).
 - Tharun (Age: 20, Never used VR, skeptical about it).



2. Usability Testing Results

A. Experienced Users (Armaan, Harsh)

Task 1: Palm Menu Interaction

- **Armaan:** Quickly navigated the palm menu. No confusion with button labels. Fast response with gestures.
- **Harsh:** Minor hesitation with the speed changer at first, but once familiar, completed tasks swiftly. No issues with the Speed or Information buttons.

Task 2: Speed and Elevation Control

- **Armaan:** Adjusted speed and information effortlessly. Felt the controls were highly responsive.
- **Harsh:** Very comfortable adjusting speed; however, preferred more granular control over speed for precise movements. Suggested a smoother transition when adjusting speed rapidly.

Task 3: Immersion and Movement

- **Armaan:** Enjoyed the fluid camera movement when entering/exiting the spaceship. Felt immersed in the environment. No motion sickness.
- **Harsh:** Appreciated the immersive experience. Enjoyed the ability to freely move in space but suggested enhancing visual elements to increase immersion (e.g., more detailed planets). No motion sickness reported.

Motion Sickness Test:

- Both experienced users reported **no motion sickness** or discomfort after 15-20 minutes of continuous use. Both felt fine with the movement speed and spatial orientation.

Additional Feedback:

- Armaan suggested adding more interactive elements (e.g., tools for exploration).
- Harsh recommended adding more environmental effects, like particle systems or background sounds, to enhance the space experience.

B. Inexperienced Users (Noel, Rahul, Tharun)

Task 1: Palm Menu Interaction

- **Noel:** Struggled initially with opening the palm menu. Took longer than expected to find the Speed control.
- **Rahul:** Had some confusion with the buttons and initially mistook the "Enter Spaceship" as a spaceship controller button.
- **Tharun:** Had significant difficulty understanding the layout of the palm menu.

Task 2: Speed and Elevation Control

- **Noel:** Found the speed adjustments too sensitive. Accidentally overshot the desired speed multiple times. Felt overwhelmed by the movement control options.
- **Rahul:** Initially confused about how to control the speed. Took time to adapt to the Speed changer, but once familiar, adjusted speed without issues.
- **Tharun:** Struggled with understanding how to increase speed. Also, reported feeling lost while trying to move toward a specific planet.

Task 3: Immersion and Movement

- **Noel:** Found the free movement disorienting, especially in moon-gravity. Felt slight dizziness after 5 minutes of continuous movement.
- **Rahul:** Was able to handle movement better than Noel but felt uneasy after 10 minutes, reporting lightheadedness.
- **Tharun:** Experienced motion sickness very quickly after 3 minutes of movement. Felt nauseous after 10 minutes and had to stop.

Motion Sickness Test:

- **Noel:** Experienced **mild motion sickness** after about 5 minutes of free movement and required a break after 15 minutes.
- **Rahul:** Reported **light dizziness** after 10 minutes. Felt better after pausing movement for 2-3 minutes.
- **Tharun:** Felt **nauseous** after 3 minutes of movement. Could not continue beyond 10 minutes.

Task: average time to complete

Non experienced users:

- Palm menu gesture: 15 secs**
- Flying : 3 secs**
- Moon rocks interaction: 5 secs**
- Information panel: 3 secs**

Experience user:

- Palm menu gesture: 5 secs**
- Flying : 1 secs**
- Moon rocks interaction: 2 secs**
- Information panel: 1 secs**

Additional Feedback:

- **Noel:** Suggested that the app could include a tutorial or a slower-paced onboarding experience.
- **Rahul:** Would appreciate more visual cues, like arrows or paths, for guidance.
- **Tharun:** Mentioned that movement control was overwhelming, and he felt disconnected from the virtual environment.

3. Overall Summary

Strengths:

- **Experienced Users:**
 - Fast, intuitive interaction with palm menu and movement controls.
 - High immersion levels with smooth camera transitions.
 - No motion sickness or discomfort.
- **Inexperienced Users:**

- Enjoyment of space environment when seated or stationary.
- The ability to explore the app with some guidance.

Challenges:

- **Experienced Users:**
 - Minor suggestions for improving the visual environment (e.g., more particle effects).
 - Desire for more precision in elevation control.
- **Inexperienced Users:**
 - Struggled with movement and speed controls, requiring a more guided approach.
 - Experienced motion sickness, especially with free movement.

Motion Sickness Insights:

- **Inexperienced Users** reported varying degrees of discomfort, with **Tharun** experiencing the most severe motion sickness.
 - **Rahul** and **Noel** both experienced mild discomfort, suggesting that a smoother or more gradual introduction to movement may be necessary.
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4. Recommendations for Improvement

- **For Experienced Users:**
 - Fine-tune camera and movement transitions for more fluidity.
 - Add more interactive elements and environmental features to enhance immersion.
- **For Inexperienced Users:**
 - Add a **tutorial mode** with step-by-step instructions for controlling speed and elevation.
 - Implement a **comfort mode** with reduced movement speeds and an option for guided paths to minimize dizziness.
 - Consider adding more customizable movement settings (e.g., teleportation vs. free movement).
 - Include a **motion sickness setting** that allows users to control the intensity of movement or add comfort features like static backgrounds.