

Game Design Document (GDD) for Aditya L1 Mission Simulation (AR)

1. Mission Overview

Title: Aditya L1 Mission Simulation (AR)

Objective: Simulate the key stages of the Aditya L1 mission, including the launch, orbit insertion, and reaching Lagrangian Point 1, to educate users on solar observation and space weather.

2. Target Audience

- Students interested in space science and missions.
- Enthusiasts of ISRO missions.
- Gamified educational users.
- AR explorers looking for immersive experiences.

Mission Timeline & Gameplay Stages

Phase 1: Pre-Launch Setup (T - 15 minutes to launch)

Objective: Prepare the rocket and spacecraft for launch.

Gameplay Mechanics:

- AR Interaction: Users can place the PSLV rocket model in AR and interact with various pre-launch checks.
- Task: Engage in a checklist for launching Aditya L1 (fuel loading, system checks, payload validation, etc.).
- Educational Content:

- Explain PSLV's role and key features.
- Provide an introduction to the Aditya L1 mission objectives.

Completion Condition: All launch checks must be completed within the allotted time.



Phase 2: Rocket Launch (T = 0 to T + 5 minutes)

Objective: Simulate the launch of Aditya L1 into space.

Gameplay Mechanics:

- AR Animation: Visualize the PSLV rocket launching in AR.
- Task: Users can adjust trajectory mid-flight by avoiding atmospheric turbulence or debris. Gamification will be done with touch controls.
- Educational Content:
 - Explain the stages of the PSLV launch (Stage 1, Stage 2, Stage 3).
 - Provide real-time data on altitude and speed during each phase.
 - Discuss with Kalpana AI how different stages help the spacecraft escape Earth's atmosphere.

Completion Condition: Successful separation from the PSLV third stage.



Phase 3: Orbit Insertion (T + 10 minutes to T + 60 minutes)

Objective: Place the Aditya L1 spacecraft into its initial elliptical Earth orbit.

Gameplay Mechanics:

- Interactive Orbital Mechanics: Users guide the spacecraft into an elliptical orbit by adjusting its trajectory and velocity and not through joysticks but we will think about how to incorporate the mobile device gyroscope in it to control the actions.

- Task: Perform adjustments to the spacecraft's thrusters for precise orbit insertion.

- Educational Content:

- Explain elliptical orbits and how they differ from circular orbits.

- Teach orbital mechanics basics (apogee, perigee, orbital speed).

- Describe how the spacecraft uses onboard thrusters to adjust the orbit.

Completion Condition: Achieve a stable elliptical orbit around Earth.



Phase 4: Transfer to Lagrangian Point 1 (T + 60 minutes to several days)

Objective: Initiate the transfer from Earth's orbit to Lagrange Point 1 (L1).

Gameplay Mechanics:

- Trajectory Adjustment: Users must adjust the spacecraft's path, ensuring it aligns with L1's position.

- Task: Solve puzzles or interactive challenges to adjust the spacecraft's velocity and course corrections at certain intervals.(this is yet to be think about in more detail)

- Educational Content:

- Explain the Lagrangian points and their importance in space missions.

- Introduce gravitational balance and how it helps Aditya L1 stay in a stable position between the Sun and Earth.

- Discuss the spacecraft's journey through space, the challenges of navigation, and how the spacecraft adjusts its course.

Completion Condition: Correctly align and reach the L1 point.



Phase 5: Arrival at L1 (T + Several Days to Weeks)

Objective: Position the Aditya L1 spacecraft at the Lagrangian Point 1 and begin its mission of solar observation.

Gameplay Mechanics:

- Orbital Adjustment: Users will use thrusters and real-time data to keep the spacecraft in its orbit around L1 by utilising the gyroscope of the mobile.
- Task: Balance the gravitational forces to stabilize the spacecraft in the L1 region.
- Educational Content:
 - Dive deeper into the science of solar observations.
 - Teach about the instruments onboard Aditya L1, such as the Visible Emission Line Coronagraph (VELC) and Solar Ultraviolet Imaging Telescope (SUIT).
 - Explain what types of solar data the spacecraft collects and how it is used on Earth.

Completion Condition: Successfully position the spacecraft for continuous solar observation.



Phase 6: Solar Observation and Data Collection (Continuous Mission)

Objective: Simulate solar data collection and monitor space weather.

Gameplay Mechanics:

- Data Visualization: Allow users to view real-time solar data and visualizations of solar flares, coronal mass ejections, and solar wind.
- Task: Users can manipulate different payloads to observe various phenomena of the Sun.
- Educational Content:
 - Explain the science behind each payload and its mission (e.g., VELC for solar corona).
 - Discuss the importance of monitoring solar activity for space weather predictions.

Completion Condition: Successful observation of solar phenomena, with users achieving points for capturing specific solar events like solar flares or CMEs.

Phase 7: Gamified Challenges and Quizzes

Objective: Test user knowledge and keep them engaged through challenges.

Gameplay Mechanics:

- Quizzes and Challenges: After completing certain stages, users take on educational quiz

questions about Aditya L1 and the Sun.

- Task: The faster and more accurately users complete the challenges, the more points or badges they earn.
- Educational Content:
 - Reinforce knowledge of orbital mechanics, solar phenomena, and the mission's purpose.
 - Provide deeper insights into how solar data can affect life on Earth (e.g., space weather's impact on technology).

Completion Condition: Correctly completing challenges and collecting all achievements.

Phase 8: Completion and Final Debriefing

Objective: Summarize the entire mission and provide feedback.

Gameplay Mechanics:

- Mission Debrief: After all stages are complete, provide users with a mission summary and feedback on their performance.
- Task: Review key learning points and highlight the importance of each stage of the Aditya L1 mission.
- Educational Content:
 - Reinforce the role of space missions in understanding solar activity.
 - Discuss how Aditya L1's data contributes to our knowledge of space weather and its applications on Earth.

Completion Condition: Successfully completing all phases and challenges.

Reference links

[PSLV C40](#)

[ADITYA L1](#)

[ISRO Aditya L1 Misson Details](#)