

JPL - Moon Augmented Reality Design Specification

Group 2

December 2025

Contents

1	System Parts and Modules	2
1.1	User Interface Module (UIM)	2
1.2	Registration Module (RM)	2
1.3	3D Model Module (3DM)	3
2	Directory Structure	3
2.1	Client Directory	3
2.2	Server Directory	3
3	Tools and Technologies	3
3.1	Vue.js	3
3.2	Express.js	3
3.3	Python (process.py)	4
3.4	MySQL	4
3.5	JavaScript Cropping Utility	4
3.6	Three.js	4
3.7	NASA MoonTrek API	4
4	User Interface Summary	4

This Design Specification provides a concise breakdown of all major parts, modules, tools, and components used in the MoonTrek: Telescope Augmented Reality project. It expands the Software Design Document (SDD) by describing each system part in slightly more detail.

1 System Parts and Modules

1.1 User Interface Module (UIM)

Purpose

The UIM displays the web application's visual interface, handles user interactions, and forwards user inputs (such as uploaded images and metadata) to the backend.

Components / Tools Used

- HomePage.vue
- UploadPage.vue
- ModelPage.vue
- ConnectPage.vue
- Supporting components: AnimatedStars.vue, ImageCanvas.vue, ImageUploadForm.vue, NavBar.vue

Inputs and Outputs

- **Inputs:** user-uploaded images, metadata, navigation actions
- **Outputs:** overlays, 3D model display, telescope connection interface

1.2 Registration Module (RM)

Purpose

The RM processes and registers the user's Moon image by comparing it with a reference image to generate a transformation matrix.

Components / Tools Used

- SIFT feature detection
- Circle detection algorithm
- Transformation matrix computation

Inputs and Outputs

- **Inputs:** cropped user image, reference Moon image
- **Outputs:** transformation matrix for overlay placement

1.3 3D Model Module (3DM)

Purpose

The 3DM generates a photorealistic 3D model of the Moon, Earth, and Sun based on the user's location and image timestamp.

Components / Tools Used

- Three.js rendering engine
- NASA lunar texture maps and reference datasets

Inputs and Outputs

- **Inputs:** latitude, longitude, date, time metadata
- **Outputs:** rendered Moon reference image for registration

2 Directory Structure

As described in the SDD, the project consists of a `client` and `server` directory.

2.1 Client Directory

Contains all UI-related Vue components, styling, and route definitions.

2.2 Server Directory

Contains:

- `process.py` – Runs RM algorithms.
- Reference images used during image registration.
- Express.js endpoint handlers for uploads and metadata.

3 Tools and Technologies

This section provides a concise breakdown of every tool used, aligning with the SDD.

3.1 Vue.js

Used for UI structure, routing, and page components.

3.2 Express.js

Provides backend routing and communication logic between modules.

3.3 Python (process.py)

Executes SIFT and related image-processing procedures.

3.4 MySQL

Stores user-uploaded images and associated metadata.

3.5 JavaScript Cropping Utility

Allows users to crop Moon images before processing.

3.6 Three.js

Renders the 3D model of the Moon, Earth, and Sun.

3.7 NASA MoonTrek API

Supplies scientific lunar data used for annotations and overlays.

4 User Interface Summary

The application implicitly consists of:

- Home Screen
- Upload Screen
- 3D Model Screen
- Telescope Connection Screen

Each corresponds directly to a Vue component already listed under the UIM section. No additional UI details are necessary for this Design Spec.