JPL - Moon Augmented Reality Snapshot Objectives

Group 2

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Start Objective

The starting objective of the MoonTrek Augmented Reality Application is to establish the user interface and backend components necessary for the web application. This includes the following key components:

- Setting up the Docker environment with Vue.js frontend, Express.js backend, MySQL database, and Python image processing service.

- Developing a user-friendly interface on the Vue.js web application with navigation between Home, Upload, and Model pages.

- Implementing the MySQL database to store user images and EXIF metadata (timestamp and GPS coordinates).

- Creating image upload functionality using Multer middleware to handle JPEG and PNG files up to 10MB.

- Extracting metadata from uploaded images automatically, with a fallback form for manual entry when metadata is missing.

- Establishing connection to NASA MoonTrek API and documenting available endpoints for lunar feature data.

1st Checkpoint Objective

The primary objective for Snapshot 2 is to implement the core image processing algorithms and 3D model generation for context-aware image registration. This includes:

- Developing the circle detection algorithm using Python and OpenCV to automatically identify the moon in uploaded images.

- Implementing the SIFT (Scale-Invariant Feature Transform) algorithm for image registration between user images and reference images.

- Building the Three.js 3D model that positions Earth, Moon, and Sun based on the user's timestamp and GPS coordinates.

- Applying LRO WAC texture mapping to the 3D moon model and implementing directional lighting for realistic shadows.

- Generating reference images from the 3D model that match the user's viewing angle for accurate SIFT registration.

- Calculating transformation matrices to account for rotation, scale, and translation differences between images.

2nd Checkpoint Objective

The primary objective for Snapshot 3 is to integrate the NASA MoonTrek API and implement the overlay system that displays lunar features on user images. This includes:

- Integrating NASA MoonTrek API to fetch crater names, maria (lunar seas), and Apollo landing site data.

- Implementing coordinate mapping to translate WAC composite coordinates to user image pixel positions using the transformation matrix.

- Building the overlay display system that accurately positions crater names and landing site markers on the annotated image.

- Creating interactive UI controls including a dropdown menu for layer selection and an opacity slider for overlay transparency.

- Optimizing the processing pipeline to ensure the complete workflow from upload to annotated result completes within 60 seconds.

Due Date Checkpoint

The primary objective of Snapshot 4, or the Due Date checkpoint, is to finalize the YourMoon database feature and make final adjustments to the application. This includes:

- Implementing the YourMoon database submission system with an image cropping interface for users to contribute moon images.

- Integrating machine learning validation to verify submitted images are actual moon photographs.

- Conducting comprehensive testing across different browsers (Chrome, Firefox, Safari, Edge) to ensure WebGL compatibility.

- Performing final optimizations to improve SIFT registration speed and overall system performance.

- Completing all documentation including final versions of the SDD, SRS, Design Specification, and README user manual.

- Making minor interface adjustments to improve usability and address any remaining bugs or errors discovered during testing.