Software Design Document
for
MoonTrek Telescope Application

Version 1.0 approved

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## Revision History

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<td>First Draft</td>
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1. Introduction

1.1 Purpose

The purpose of this SDD is to explain in detail how the MoonTrek Telescope Application, MTTA, software requirements will be implemented. This document is based on the first version of the software.

1.2 Document Conventions

Major sections (1, 2, 3...) are labeled with bold larger font than subsections. Each major section begins on a new page. Lists are marked using bullet points or tables if specified.

1.3 Intended Audience and Reading Suggestions

The main users of this MTTA SDD are the developers that will write the corresponding SRS and write the software code. Developers may focus on sections 4 and 6 of this document. Reviewers will also approve this document.

1.4 System Overview

The MTTA software should include a User Interface that displays user requested data of lunar regions. This data will be transmitted via communication module that must interact with the existing MoonTrek Database of NASA JPL. The communication module should also permit interaction with user hardware, specifically telescopes.
2. Design Considerations

This section describes many of the issues which need to be addressed or resolved before attempting to devise a complete design solution.

2.1 Assumptions and Dependencies

- Celestron Telescope (Model Unknown) should be compatible with the software
- NASA’s MoonTrek API has existing calls that meet functional requirements.

2.2 General Constraints

Limited Vue Experience—Developing an Web-based application will be a first for some members of the group, and assuring that everyone is on the same page and understands what is going on will take a significant portion of the deadline time.

Limited Time as briefly alluded to developing an app for experienced professionals takes a lot of time, and even they have trouble meeting deadlines. Our application will be due by the end of the year, and we still have less time and less experience than professionals have.

Familiarity With Specific Data Types—When brainstorming about certain aspects of our application, we thought about Data Structures that we knew about conceptually, and knew would get the job done best, but had never used in actual practice.

2.3 Goals and Guidelines

- The application has a mandatory delivery date that must be met (end of June 2020)
- The application is an extension and user friendly version of the existing NASA MoonTrek portal

2.4 Development Methods

Our application does not use any published/formal methods for software design.
3. Architectural Strategies

- Use of Programming language: Python
- JavaScript Framework: Vue.js
- Use of Database/API: NASA Moontrek
- Reuse of prototype: NASA Trek ArcGIS REST Services Directory
- Operating System: application is web based
- Future plan: extending application to able to use as a phone application in IOS and windows operating system
4. System Architecture

Level 0 DFD

4.1.1 The User Interface Module

Refer to DFD 0 or DFD 1. Additional information can be found in section 6.1.

4.1.2 The Communication Module

Refer to DFD 0 or DFD 1. Additional information can be found in section 6.2.
Level 1 DFD

User

1.1 User Interface Module

Display

1.2 Communication Module

Telescope

Coordinates

MoonTrek Database

User Input

Image of Moon

User Input

Image of Moon

User Input and Coordinates

Image of Moon
5. Policies and Tactics

5.1 Choice of which specific products used
   Visual Studio Code, Amazon AWS. Additional products found in sections 6 and 8.

5.2 Plans for ensuring requirements traceability
   Refer to section 10.

5.3 Plans for testing the software
   Refer to section 10.
6. Detailed System Design

6.1 User Interface Module

6.1.1 Responsibilities
Provide input fields for user and update display user requested data.

6.1.2 Constraints
Shall not accept user input that will raise errors if processed.

6.1.3 Composition
This module does not have additional subcomponents at this time.

6.1.4 Uses/Interactions
This module will transmit user input to communication module and send response to the display.

6.1.5 Resources
Vue.js - JavaScript Framework

6.1.6 Interface/Exports
Input Fields - Receive input to send to communication module.
Bounding Box - Display image of moon’s surface.
Overlay Layer(s) - Display overlay with dataset information.

6.2 Communication Module

6.2.1 Responsibilities
Process query to MoonTrek database and send results to UI module.

6.2.2 Constraints
Processing time is affected by the size of data set requested.

6.2.3 Composition
This module has no additional subcomponents at this time.

6.2.4 Uses/Interactions
This module shall communicate with the UI module and should also interact with telescope hardware.
6.2.5 Resources

MoonTrek Database

NASA Trek ArcGIS REST Services Directory

6.2.6 Interface/Exports
7. Detailed Lower level Component Design

Additional components will be added here during development if needed.
8. Database Design

The application shall use NASA MoonTrek database and API.
# 9. User Interface

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<tr>
<th>User Interfaces</th>
<th>Descriptions for User Interface</th>
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<td><strong>Initialization</strong></td>
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<tr>
<td>3.1.0 Request</td>
<td>User will request MoonTrek website</td>
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<tr>
<td>3.1.2 Response</td>
<td>Website will display to user</td>
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<tr>
<td><strong>Web Home Page</strong></td>
<td></td>
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<tr>
<td>3.2.1 Logo Link</td>
<td>Website will take user back to Home Page</td>
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<td>3.2.2 Express Navigation Bar</td>
<td>Website will show express links of different pages</td>
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<tr>
<td>3.2.2.1 About Us Link</td>
<td>Website will direct user to description of our services</td>
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<td>3.2.2.2 Contact</td>
<td>Website will direct user to contacts page</td>
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<tr>
<td><strong>MoonTrek Services</strong></td>
<td></td>
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<tr>
<td>3.2.3.1 Moon Image</td>
<td>Website will display image from coordinates provided by telescope</td>
</tr>
<tr>
<td>3.2.3.2 Moon overlay services</td>
<td>Website will provide utilities to overlay informative images onto previous moon image.</td>
</tr>
<tr>
<td>3.2.3.3 Moon information services</td>
<td>Website will provide statistical location based information from Telescope coordinates</td>
</tr>
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## 9.1 Overview of User Interface

See the Flow diagram above
9.2 Screen Frameworks or Images

9.3 User Interface Flow Model

See the Flow diagram above
### 10. Requirements Validation and Verification

<table>
<thead>
<tr>
<th>Requirements</th>
<th>Modules/UI/Components and Testing Methods</th>
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</table>
| The application shall query and display different layers of date associate of the MoonTrek API and return specific details. | • Communication module and User Interface module  
• Running the application and getting a random section of the moon with a random layer selected |
| The limitation of user input, such as user cannot randomly input coordinate  | • User Interface module  
• Trying to enter an impossible coordinate and see if it’ll go through |
| The application shall be able to overlay layers and change opacity for visualization convenience. | • User Interface module  
• Trying out the different layers and the opacities when running the application |
| The application should allow user search for specific data set                | • User Interface module  
• Search for a specific data set while application is running |
| The application should be able to allow user to change the scale of the returning data layer | • User Interface module  
• Change the scale of the data layer while application is running |
| The interface will show the lists of the layers and users by clicking at the layers to use them. The layers will overlay the moon and return specific details. | • User Interface module  
• Run the application to see what layers we can use and use those layers to get those specific details |
| MoonTrek database contains many different moon layers, For example, “Surface Temperature of the moon”, “Grain Density” or “Gravity Degree Strength L1200”, etc. Moreover, MoonTrek database will provide WMTS endpoints, by using those layers just need to connect to the endpoint. | • Communication module  
• Running the application and trying to apply those layers to the section of the moon you are viewing |
11. Glossary

Terms used in this document may be found in section 1.4 of the corresponding SRS document of this project.
12. References

MoonTrek API

https://trek.nasa.gov/tiles/apidoc/trekAPI.html?body=moon

Vue.js Framework

https://vuejs.org/

WMTS Implementation Standard

https://www.opengeospatial.org/standards/wmts