



Collaborative Visualization for Solar System Treks (CVSST)

Senior Design 2020-2021

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Project Advisor: Dr. David Krum

Liaison: Emily Law

Overview

- Solar System Treks (SST)
 - JPL web portal
 - NASA data of planets, asteroids, and moons
 - Satellite photography and 3D terrain models
- Collaborative Visualization (CV)
 - Multiple users can examine the data together
 - Collectively work on new ideas and projects in real time



Outline

- Introduction
- Project Planning
- Feasibility Assessment
- Feasibility Assessment (Web)
- VR & AR
- Feasibility Assessment (Unity)
- Decision
- Requirements Document
- Personas, Use Cases, Scenarios
- Things We Were Not Expecting
- Project Timeline & Next Steps
- Conclusion

Introduction

- Sponsor: JPL
 - Liaison: Emily Law
 - JPL Team: Eddie Arevalo, George Chang, Richard Kim, Shan Malhotra
- Goal:
 - Develop networked visualization software to support collaborative markup of solar system terrain.



Introduction: Members and Roles

- Project advisor: Dr. David Krum
- Project lead: Montague La France
- Project co-lead: Stanley Do
- Customer liaison/requirements lead: Christopher Smallwood
- Architect lead: Abdullah Alshebly
- Documentation lead: Zipeng Guo
- Demo/presentation lead: Miguel Sanchez
- QA lead: David Tang
- Components (UI, backend, database): Jose Garcia, Odasys Soberanes, Johnny Lee

Project Planning

Optimistic Beginnings

- Discord
- Outlook
- Zoom
- Asana
- Sharepoint

Rough Middle

- Lack of Use/Need of Asana
- Disorganized Meeting Agenda
- Disorganized Email

Streamlined End

- Smartsheet
- Meeting Template
- Email Template

Project Planning: Communication

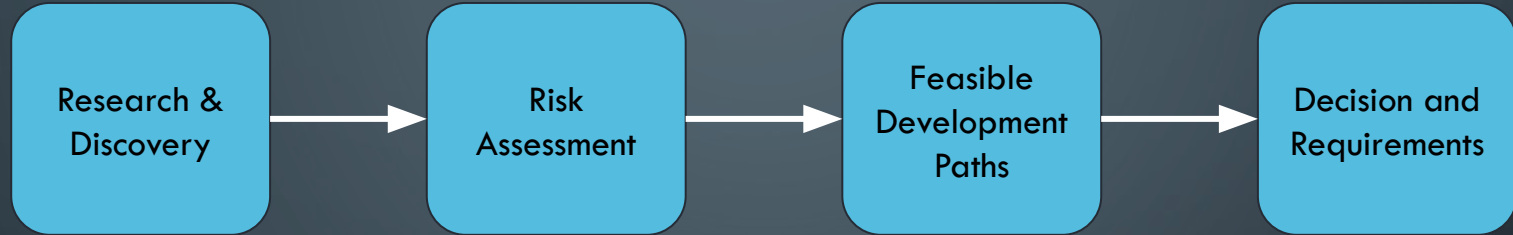


*Communication
is Key!!!*

Project Planning: Software Development Life Cycle

- Agile Project Management
 - Freedom and Flexibility

Feasibility Assessment

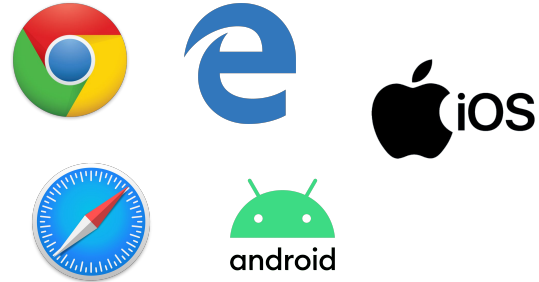


How does it help us?

1. Lets us learn about the current software and technologies in use.
2. Keeps the amount of time, resources, and documentation available in mind.
3. Builds a path towards a more successful project.
4. Helps the customer know our limitations and clarifies requirements.

Feasibility Assessment (Web)

- Web-based collaboration over existing Trek software:
 - CesiumJS is an extremely powerful framework for 3D geospatial visualization.
 - More access to users and the public.
 - Seamless integration with existing software.
 - Supports large amounts of users.



VR & AR

Virtual reality (VR):

- Use computer technology to create a simulated environment.
- VR places the user inside an experience.
- Users are immersed and able to interact with 3D worlds .

Augmented reality (AR):

- Blends what the User sees in their real surroundings with digital content generated by computer software.
- AR systems layer virtual information over a camera live feed.



VR & AR

How this is useful for this project ?

- Collaborative visualization, in (VR) and (AR) can be helpful in generating new insights.
- Team of researchers or students can examine the data thoroughly together in simulated environment where they can easily move around and manipulate the environment.

Feasibility Assessment (Unity)

What it is:

- Real time development platform
- Video Games
- Automotive Transportation & Manufacturing
- Film Animation & Cinematics
- Architecture, Engineering & Construction



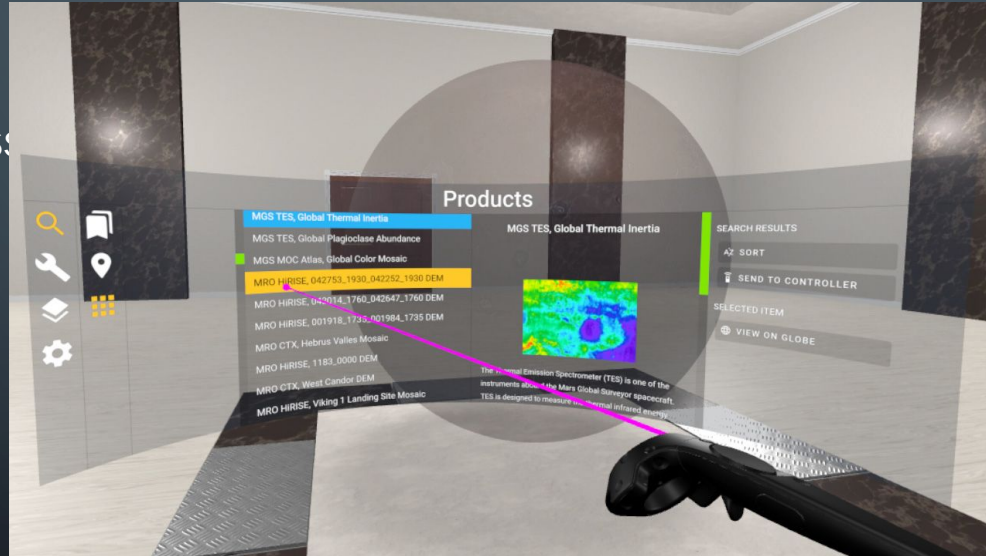
How it helps us:

- Powerful platform
- Ease of manipulation for 3D data
- VR & AR quality support
- Takes out the technical work

Feasibility Assessment (Unity - VR Room)

What it is:

- Desktop application
- VR Implementation of S



How it works:

- HTTP & JSON Requests
- XR Browser
- HTC Vive (Steam)

Feasibility Assessment (Unity - Possible Approach)

HTTP/JSON Requests

- Get Requests
 - Using links to NASA SST
 - Pull data
 - Layers & 3D models
 - Implement JPL toolkit for interactions with data

Photon Networking API

- Bolt Matchmaking
 - Sessions
- Client Hosted
- Communication
 - Voice, video, chat

Web XR

- Virtual Reality (VR)
- Augmented Reality (AR)



Montague La France

Decision

- Presented both components (Web and Unity Components) to the customer
- Decision:
 - Web Technology Component
 - Focus on Collaborative Sessions
 - Future development: VR and AR capabilities
 - Front-end Frameworks
 - JavaScript libraries (Socket.io and Cesium)
 - Database



Requirements Document

- Draft requirements from Personas, Use cases, and Scenarios
- Need more time
- In Progress:
 - Section 4: Requirements Specification
 - Section 5: Other Nonfunctional Requirements
- Revise document throughout the project

Personas, Use Cases, Scenarios

- Represents different user types.
- Personas examples:
 - John is an ex-military, 35-year-old Mission Planner who works for NASA.
 - Nick is a 20-year-old college student with a love for space.
 - Tom is a 40-year-old high school teacher who is currently teaching a science class.



Personas, Use Cases, Scenarios

- Use Cases and Scenarios
 - Provides one or more scenarios.
 - Illustrates interaction between end users and the system.
- Importance:
 - Shows how our software might be used.
 - Draft requirements.
- Example:
 - Nick is a 20-year-old college student with a love for space.
 - Nick and his friends want to be able to collaborate in a smooth way
 - We provide: Create a room, share the waypoint location, Real Time Collaboration (Send Live Chat Messages)

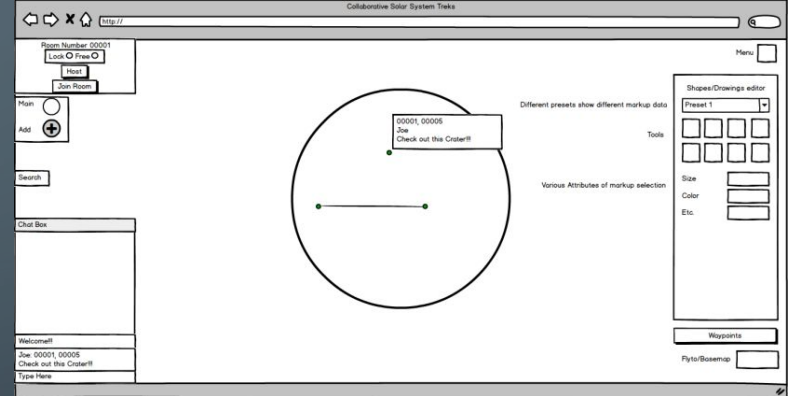
Things We Were Not Expecting

- Decision made at end of October
- Stronger focus on Use Cases, Personas
- Avoid choosing specific technical solutions (for now)
- Need more time to draft requirements



Project Timeline & Next Steps

- Planning (8/28/20 - 10/30/20)
- Requirements (10/26/20 - 12/11/20)
- Design (11/27/20 - 1/5/21)
- Implementation (1/5/21 - 2/26/21)
- Testing (2/26/21 - 4/30/21)
- Closure (5/1/21 - 5/14/21)



Conclusion

- We want to implement Collaboration onto Solar System Treks.
- Created a project plan following SDLC (Software Development Lifecycle) for the software.
- Current Path
 - Explored two routes (Unity vs Web).
 - Going forward with design in Web.
- Now focused on Requirements and early Design document.

The image features a dark blue background with white, stylized circuit board traces in the corners. These traces consist of lines and small circles, resembling electronic components or connections. The word "Questions?" is centered in a white, sans-serif font.

Questions?