3D Asteroid Viewer

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105

Abstract

This proposal describes a design for software that will assist with NASA's future mission, the Psyche Mission. Psyche, an asteroid orbiting mission planned for launch in August 2022, is an important mission because the Psyche asteroid may be made of a mixture of rock and metal, with metal comprising between 30-60% of its volume. Scientists think Psyche may consist largely of metal from the core of an early planet. Psyche may be able to tell us how Earth's core and the cores of the other terrestrial (rocky) planets came to be. This project provides a way to easily view and explore asteroids including Psyche, in the future, by creating a web browser-based application that can zoom in and rotate the asteroid to view its surface. This data will help future scientists and the public by giving them a view of asteroids that have already been explored. Although some planetary viewers exist for spherical bodies, the Psyche asteroid is not round like a planet, but has an arbitrary shaped body. For this specific project, since there is so little information about Psyche, another asteroid with an odd shape was chosen: the asteroid Vesta. This asteroid will be modeled in great depth to prepare for doing something similar with the Psyche mission data upon arrival at the asteroid.

Introduction and Background

Introduction

- Humans have been excited about space exploration throughout history
- Information gathered about space missions by NASA missions can affect everyone [1]
  - Information learned about planets and asteroids similar to Earth can be applied to this planet
  - Applied to other scientific projects
  - Give humans a better understanding of the solar system and where Earth's fate is headed
- Important to provide the public this information
  - 3D asteroid viewer is one way to provide this information
  - Gives data in a way easily understood by the public
- Students chose to model the asteroid Vesta
  - Information gathered in DAWN mission
  - "Vesta's history seems to be more similar to the rocky, terrestrial planets."
  - Shows Vesta was present for the beginning of the solar system, much like Psyche
- Asteroid has a similar core, mantel, and crust to other terrestrial planets including Earth
- Studying Vesta can give researches clear insight into how Earth was formed
- Vesta is both an asteroid and a protoplanet

Background

- 3D modeling is an increasing field
- Useful because they give users a better understanding of something that they are unable to view in person
- Unity is the software chosen for this project
- One of the best 3D modeling software right now, can be used for games, websites, and models
- One example of a unity project was an immersive 3D learning environment that was used to raise learning performance in humanities courses
- Ability of the Unity software to create state-of-the-art software has been proven and will continue to be proven with this project

System Design

Tools

- **Ryver**: Necessary in order to communicate with the NASA contacts, including industry advisor.
- **GitHub**: Important to have a way to share code between members of the team. This is a free, easy way to do so.

Software: Unity

- Used this software in order to import asteroid models, create scenes, and add scripts to objects in order to get a working asteroid viewer
- Watched and read several tutorials to learn about how to create scenes, and how to write C# scripts that interact with the scenes and the objects
- Unity was the main software used during this project, and the students feel as if they have a much greater knowledge of the software than they had before
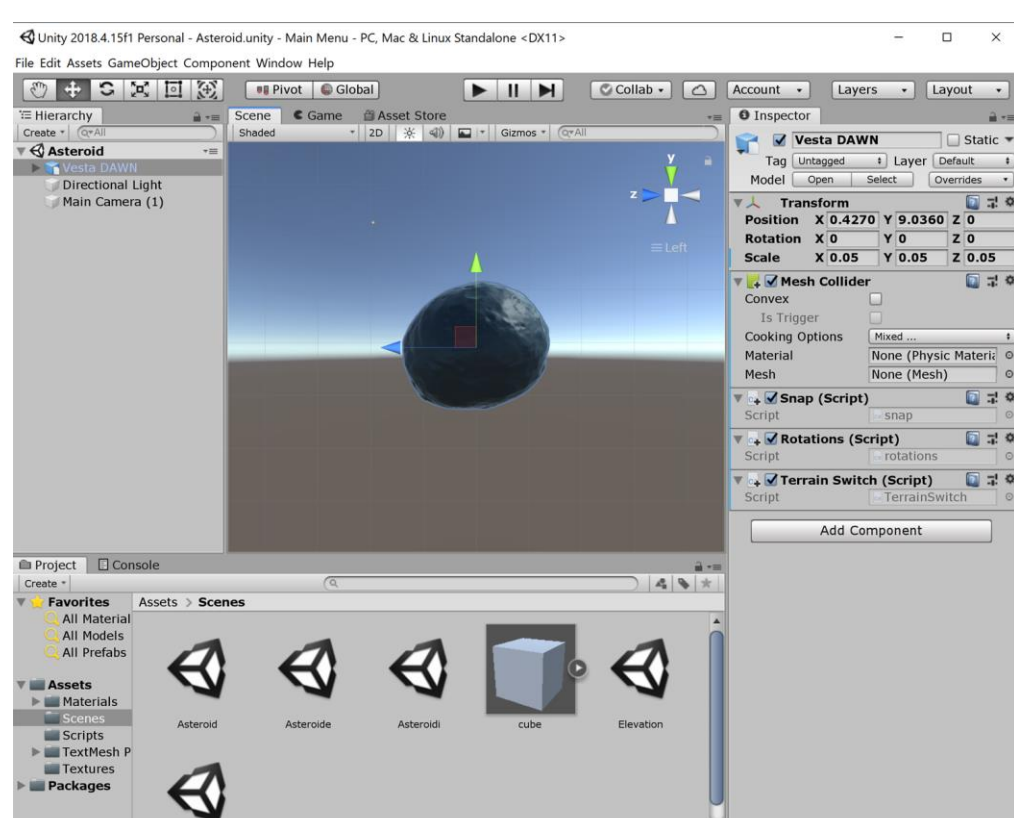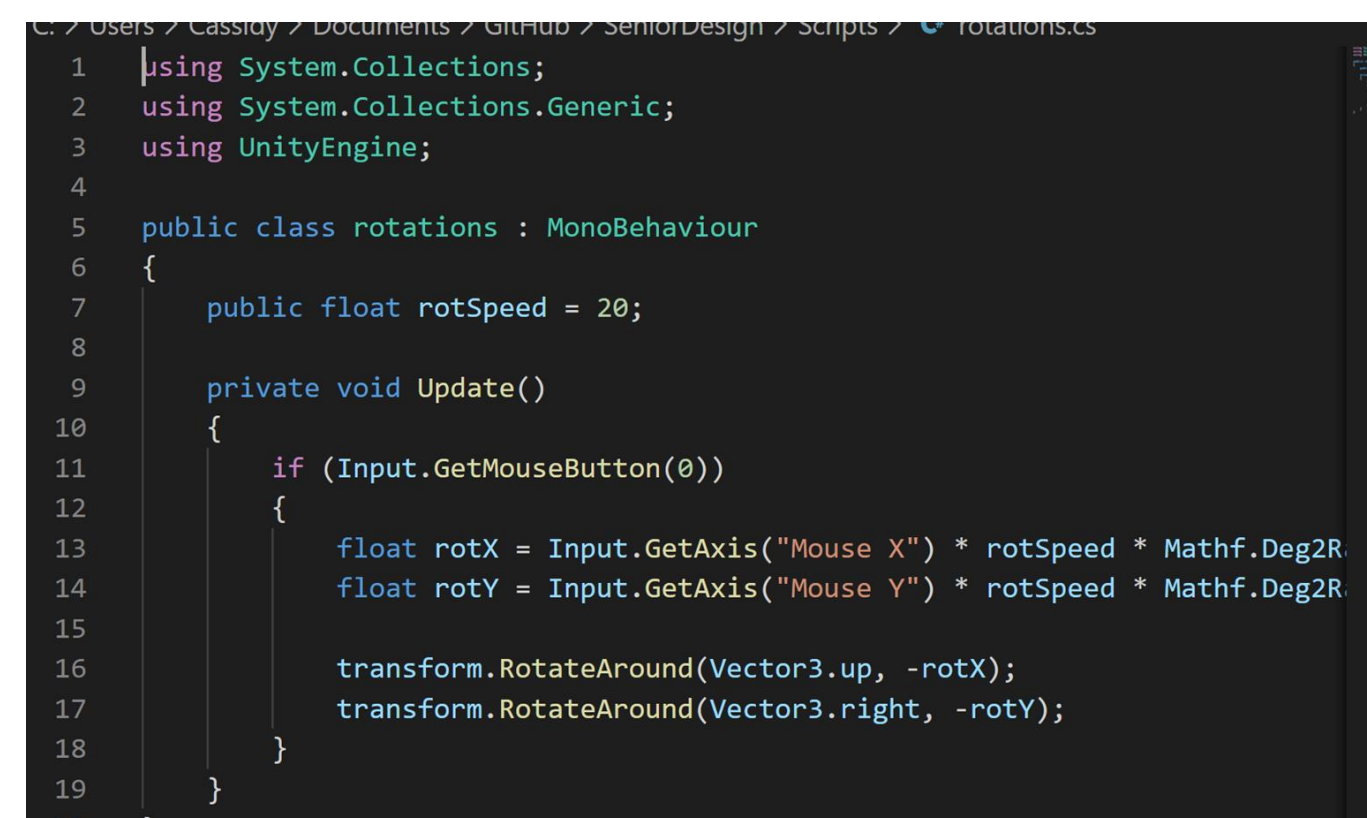

Fig 1: The project view in Unity

Fig 2: Unity Scripts

Domain Name and Hosting

- Purchased www.csuasteroidviewer.com
- Uses DNS servers and IP services provided by IcedHost.com
- Currently Hosted from Germany on an Intel(R) Xeon(R) CPU E3-1275 v5 64gb ram server
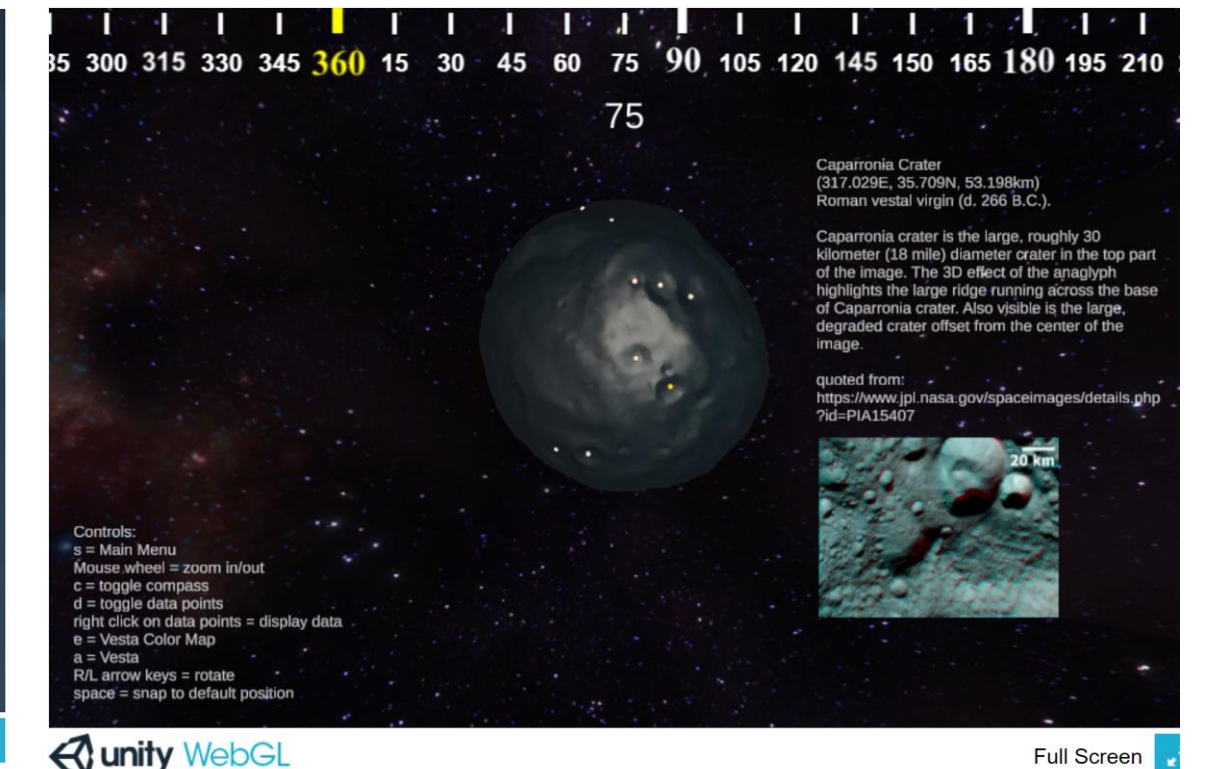

Fig 3: Home page of our website

Fig 4: Inside view with infos

Completed Features

- Modeled asteroid with rotate and zoom functionality
- A 'snap' function where the user is able to return to a set orientation by pressing a space bar if they get lost
- An information page where the user can get more data about the asteroid
- A start menu to welcome the user to the application
- When the user presses the 'c' key, a compass appears on the viewer to orient the user
- When the user presses the 'd' key, data points appear on the asteroid, that when clicked, provide more data to the user about that point
- When the user pressed the 'e' key, an elevation map appears over the asteroid, along with a height key so users can learn more about the terrain of the asteroid
- A key that remains in the left had corner of the viewer to ensure users know what commands to use

Experimental Results

Results and Data from Usability Survey

- Snap feature, rotation, zoom, compass, and the different modes generally work as expected
- Some problems with clicking on the information points, directions were added to clear this up
- Some users reported problems with font contrast
- The majority of the reviews were very positive and complimentary, saying the site was nicely designed and easy to use
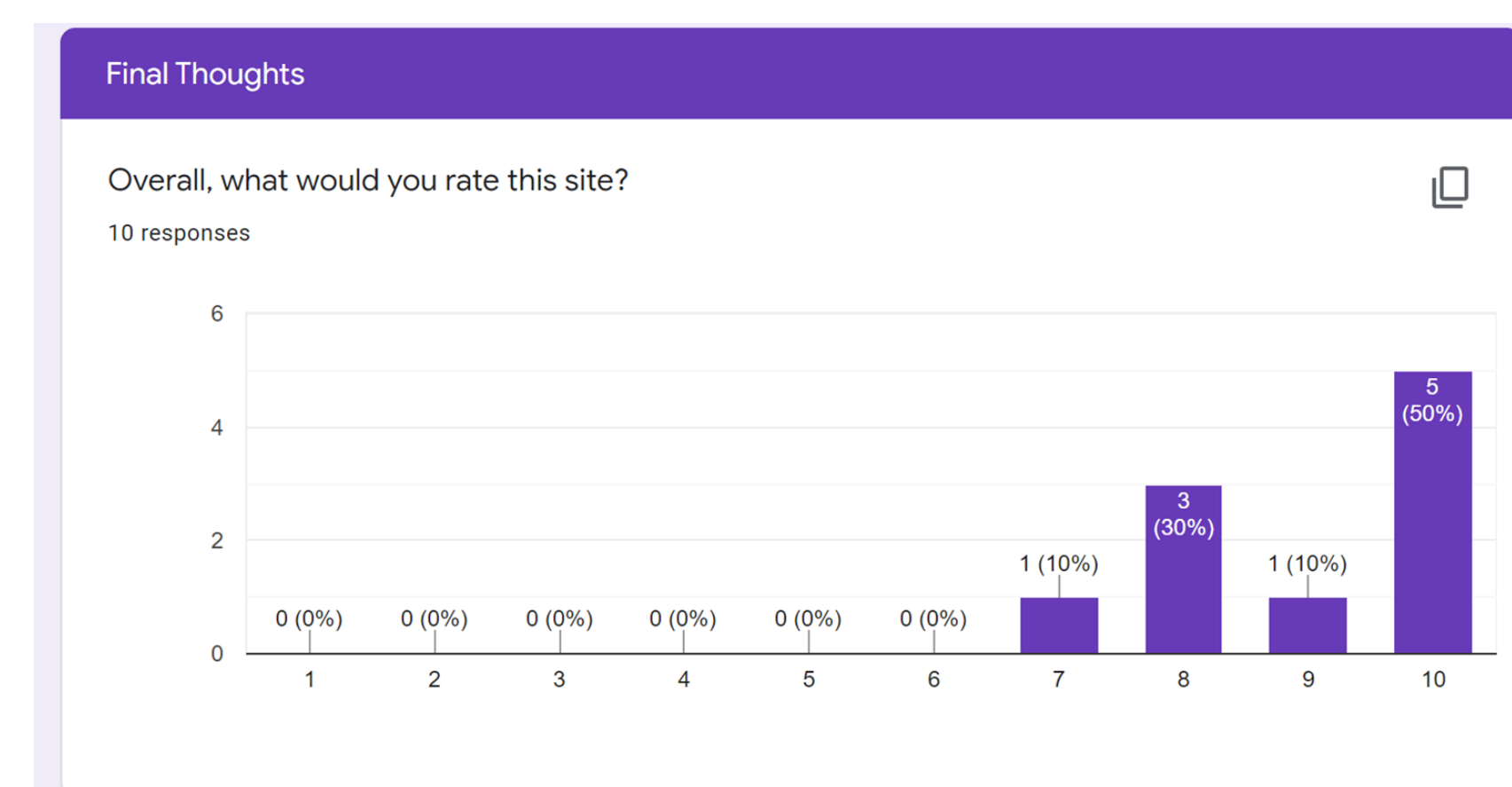

Fig 5: Final result of usability survey

Conclusion and Future Recommendations

- In summary, NASA has provided the students with an opportunity to learn and grow before entering the workforce
- Problem solved: building a 3D asteroid viewer in order to better see, interact with, and understand an asteroid
- Could give humanity clues towards the formation of planets, will definitely inform users by the wide variety of information presented
- End product was an asteroid viewer similar to that of original Google Mars

Recommendations

- The students provided access to their GitHub repository to their industry sponsor so that future students will be able to improve upon and expand the asteroid viewer.
- In the future, the team would like to see an increased amount of information points, their unmet stretch objective of a starry background that is accurate to Vesta, and a more interactive user interface, rather than pressing keyboard keys.
- The team looks forward to seeing what the future teams will do to expand upon their project.