CS373 Group 12

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Website Name: HomePlanet.me

Motivation: HomePlanet most practically can be a resource for teachers and students to quickly access basic information about celestial objects. In this way, we are motivated to help spread knowledge and interest in the general population about space and astronomy. The easier it is to access this kind of information, the more likely people are to learn about it. For this reason, our motivation is to make it easier to access some of the information provided by NASA and other organizations about space. The website may also be useful for scientists and the general population for recreation or research, as it will provide quick and easy access to an array of basic sortable and searchable information about planets, moons, and stars.

User stories:

1. Search and sort by star type and age:
    a. As an astronomer, I would like to be able to search, sort and/or filter stars by their age and stage in their lifecycle (eg: Solar Type, Hot Blue, Red Dwarf, Red Giant, White Dwarf, Neutron Star, maybe Black Holes). I think it would be interesting to see how this star age attribute maps to the habitability of the planets that orbit them (Black Holes and Neutron Stars probably don't have many nearby habitable planets because of how exotic they are). I want to make sure when I'm looking at habitable planets that they orbit around relatively stable stars using this feature.
2. Planet/Exoplanet distance from home star:
    a. I would like for each Planet/Exoplanet to include information regarding the distance it orbits from its own star in terms of a standardized unit (miles, km, etc). I would also like these values in terms of AU (1 AU is roughly the distance of Earth to our own Sun), so it is easier to understand the numbers. I think this would be great if it could possibly

be incorporated into the model diagram of the planet's orbit that was mentioned in the project proposal.

3. Orbit eccentricity and stableness:
    a. As an Astronomer, I would like to be able to view information about the eccentricity of planets' and moons' orbits. Ideally I would like this to be presented in a fashion able to be understandable by an average person for educational purposes. I would also like the stableness of the orbit to be communicated in some way (it might even be fine to just rank the stableness of the orbit as “stable”, “slightly unstable”, and “very unstable” for the user to see and hide the more complicated numbers under the hood; I just want a general idea of the stableness, exact numbers aren't necessary).
4. Planet and moon rotation:
    a. I would like information about the local rotation of planets and moons. For example, Uranus rotates about an axis nearly at a 90 degree angle to its orbit around the Sun. Ideally, this rotation would be relative to the orbital plane of the galaxy the planet is in or planet the moon is rotating about respectively.
5. Grouping based on solar system and galaxy:
    a. As someone without much knowledge of constellations or planet names, I would like to be able to view what solar systems and/or galaxies different planets, moons, and stars reside in (Andromeda, Milky Way, etc). If a star or planet is not associated with a system, I would like to see that too. For instance, Betelgeuse is a “rogue star” that has run away from its system and is not associated with any star system, but it would still be listed as a part of the “Milky Way” galaxy as a whole.

Response to stories:

- Stories #1, 2, 4, and 5:
    - Certainly! We are still in the early development stages of the website at the moment, but we plan to include all of the information that we can reliably find about all of our celestial objects. As you all mentioned, we hope to include information about star types and their ages, about the distances of planets - and moons - from the bodies that they orbit (or if they are rogue), about the rotation plane of all bodies, and about the galaxies and solar systems that each object resides in. We'll include

everything we can, but we'll keep an extra special eye out for what you all requested!

- Story #3:
    - While your request is about information to include (we will focus on orbit eccentricity and stability), you touched on a point that is very important. There are many terms in astronomy that are possibly not readily understood by someone who doesn't study the subject. We will look into providing explanations about the various types of data that we provide. That way someone who is using our website for education can learn about what all of the different measurements actually mean. Furthermore, providing a way to simplify some of the numbers into more understandable terms is something we will look into. If it is feasible, performing automatic general transformations of raw numeric data into more descriptive terms like "stable", "unstable", etc. could be very helpful to users who don't have a reference for what normal would look like for all of the data we provide. Either way, the raw data will still be provided.

RESTful API:

- We've documented the RESTful API we are using for our website using Postman. This is where we are drawing the information about stars, moons, and planets from: https://documenter.getpostman.com/view/20771905/2s83tFHWkc

Models: While our website could be expanded to as many models as there are measured celestial bodies, we have decided to focus the scope of this project on three models: stars, moons, and planets. We will be able to organize these bodies based on attributes such as mass and radius. We will be able to search through the models based on name, habitability, etc. Bodies that relate to each other (such as planets and their moons) will be listed as connected on their instance pages. A list of all currently planned attributes can be found below, as well as in the GitLab readme: https://gitlab.com/NathanSuss/group12-cs373

Planets/Exoplanets:

- Filterable Attributes: Mass, radius, orbital period, temperature, distance from Earth, gravity, number of moons

- Searchable Attributes: Name, whether it is potentially habitable or not, names of moons that orbit it, name of the star it orbits, planet type (Gas giant, Terrestrial, etc)
- Connection to others: Each planet orbits a star and some planets have moons

Stars:
- Filterable Attributes: Mass, radius, apparent magnitude (brightness), absolute magnitude, distance from Earth in lightyears
- Searchable Attributes: Name, constellation that the star belongs to, names of planets that orbit it, names of moons that orbit it
- Connection to others: Each star will have moons and planets that orbit it

Moons:
- Filterable Attributes: Mass, radius, gravity, temperature, axial tilt
- Searchable Attributes: Name, planet it orbits, whether it is potentially habitable or not
- Connection to others: Each moon orbits a planet which orbits a star
- Media: Each galaxy has planets and stars that are in it

Tools:
- React - A tool for developing a frontend GUI.
- MUI - A UI library for react to assist the frontend development process.
- Bootstrap - A css framework used to make websites look more appealing.
- Postman - A tool used for developing and documenting APIs.
- Amplify/AWS - A web hosting service provided by Amazon.
- Namecheap - A domain name registrar that offers free domain names.
- Discord - A general communication tool which we used to organize working on the project.

Hosting:
- We are hosted by Amplify, which is an Amazon Webhosting Service. This service is connected directly to our GitLab, so it always displays our most recent build. Our domain name - homeplanet.me - was acquired through Namecheap, and it is also connected to Amplify.

Current state of our app

- So far the volume of our displayed data is fairly low. We have a page for stars, planets, moons, and we have an about page. Each of the model pages contains data about the celestial body it displays, drawn from our API. We also have a navbar, and a title page. Our about page updates dynamically based on information from our GitLab. On each of our instance pages, we have two pieces of media- an image of the celestial body and an image of its orbit.

How the app works:

- We scraped our planet, moon, and star data from the APIs using Python scripts located in our /data/ folder. We then hardcoded the data we got from these APIs and put them in the PlanetList.js, MoonList.js, and StarList.js files, respectively. These are then referenced from their respective instance page files and their media and attributes are both displayed on these instance pages. We also used React, Bootstrap, and MUI components - such as Card - to display the Models on the Planets, Moons, and Stars pages. For our About page, we dynamically derive the data, such as number of commits and issues, from the GitLab API.

Challenges we faced

- Scheduling was our first challenge. Every additional member added to a team makes full group meetings more and more difficult. After a period of partial meetings that were mostly planned on the same days that they occurred, we ended up agreeing to meet every Monday, Wednesday, and Friday briefly to talk about what each person needed to be doing. Between meetings we would work separately on tasks, largely guiding ourselves on the details. This way, each person could learn about a different facet of the project and deal with it themselves, thus increasing overall group efficiency.
- Learning about all the tools we would need to use was also a big challenge. Often, it wasn't clear what the source was for many of the problems we faced. A very helpful guide was looking at the projects of past semesters. This gave us a place to start from, and it helped to clarify when we were on the right path. We also used learning resources like codeacademy. There were not many tutorial-esqe resources for learning about using AWS, Amplify, and connecting to Namecheap. In this case, we resorted to reading through documentation and manuals until we had learned enough to fix the problems

we faced. Of course, Google was usually the first line of defense for learning and fixing issues. The TAs also posted a couple of resources that were useful.