

CS373 Group 12

Members: Name - GitLab ID, eid

- Amal Babu - @amalbabu12, ab73464
- Summer Ely - @spe358, spe358
- Jinjie Liu - @JinjieLiu, jl82669
- Nathan Sussman - @NathanSuss, nes924
- Megan Zhao - @banye0913, dz4782

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.

Phase I User Stories - Received:

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 - Phase I Received:

- 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.

Phase II User Stories - Received:

Updates On Progress Towards Phase 1 User Stories In Phase II:

- Stories #1, 2, 4, and 5:
 - Based on our knowledge of all of the phases, phase II had the most to accomplish. For phases I and II we have been more focused on establishing the groundwork for our objectives. Groundwork such as setting up our database, allowing our frontend to access that data through flask and nginx, and displaying dynamic information to the user. In phases III and IV we plan to look towards implementing as much information as we can regarding the attributes of our models - as these stories generally request. Story #1 specifically requests a type of sorting and searching, which is one of the objectives of phase III.
- Story #3:
 - We would very much like to implement simplification of information as requested eventually. However, this objective will likely be one of the last things we implement in phase IV. We believe it is more important to prioritize efficiently providing all of our information to the user in an easily navigable way. Making the information more understandable to the general public will be a secondary objective.

Phase II User Stories - Received:

1. Alf Cen A lacking a Luminosity Class:
 - a. Alf Cen A is lacking a luminosity class. I would like to know what luminosity class Alf Cen A is. If it doesn't have one, I would also like to have the reason why explained on its instance card.
2. Better Units of Measurement:
 - a. I would like more or better units of measurement that are easier for a lay-person to understand. For instance, it's hard for me to conceptualize "Jupiters" as a unit for the radius on the planets model page (or Kelvin, light years, what is UNITS for star age too?). "Earths" or other more normalized units might make more sense for the average person to understand these different numbers.
3. Better resizing of text to window size on splash page:
 - a. When I resize the browser window on homeplanet.me, the text on the splash page gets cut off (specifically, "Your go-to source for all things astronomy" gets cut off on the ends). I would like the splash page to have better resizing of text so that it looks cleaner in a smaller window size. This could be achieved either through shrinking font size or moving text to a newline when it is cut off (it seems like you already do this on your model pages so maybe you could just copy that behavior over to your about page).
4. Formatting of developer cards on About Page:
 - a. Related to #46 [Better resizing of text to window size on splash page] on the about page when I shrink my browser window size, the developer about cards overlap with each other, cutting off large portions of each developer's picture. I would like this to be cleaned up so that in a small browser window each developer card is fully visible and legible. This would probably be achieved by automatically moving each card to a new line when the window size is shrunk.

5. Multiple photos of planets, stars, and moons:
 - a. I would like to be able to see a gallery of photos for each model instance when I click on its respective image. Many planets look different through different filters or angles (for instance: the dark side of the moon AND the light side of the moon). It would be nice to have more than just 1 photo available for a model instance without it cluttering up the instance's page.

Response to Stories - Phase II Received:

- Story #1 - Alf Cen A lacking a Luminosity Class:
 - We are still working on the website at the time of writing this. We believe that we may be able to implement displaying luminosity for all of our stars before phase II is finished. If not, then we will implement this in phase III.
- Story #2 - Better Units of Measurement:
 - Similarly to the third user story from phase I, we do believe this is a good idea. Making it so the units of measurement we provide are more readily understandable for everyone would better serve to educate people about our universe. This feeds into our overall motivation for the project, so we do want to implement this. This specific request is easier than the requirements from the related phase I request, so we will likely implement it in phase III. The only reason we have not implemented this in phase II is the time constraint.
- Stories #3 and #4:
 - #3: *Better resizing of text to window size on splash page*
 - #4: *Formatting of developer cards on About Page*
 - While phases III and IV do add additional features, we anticipate that we will have more time in them for polishing our site. These stories are related to polishing our site, and so we will implement them in phase III. The reason we have not implemented these in phase II is the time constraint on turning in our project. However, we do view these stories in particular as strictly necessary for the final version of our site.
- Stories #5 - Multiple photos of planets, stars, and moons:
 - Unfortunately, space is a very big place. Astronomers have cataloged a lot of celestial objects, but it's difficult to achieve different angles of observation for anything outside of our solar system. Furthermore, there aren't very many images of celestial objects in different filters/spectrums of light. Therefore, this particular story is probably impossible for us to implement. We will keep an eye out in case a solution presents itself.

Phase I User Stories - Given:

1. Safety information:
 - a. I am a parent of a 16 year old girl who is about to get her drivers license. I am very nervous about her driving, as car accidents are one of the leading causes of death in teenagers. I would love if your website had information about safety ratings for different cars, and if I could sort the list to see the safest cars.
2. Pricing:

- a. Hi, I am a full time student who works a minimum wage job. I need to buy a car to drive to work, but I can barely afford my tuition as it is. I would like to be able to see a list of the cheapest cars. Gas is also expensive, so I would like to be able to see the gas stations around me and be able to compare their prices.
- 3. Charging Stations:
 - a. Hi, I recently bought a Tesla Model X. I love this car, but I have been nervous to drive it because I am worried I will run out of charge and not be able to find a charging station. It would be very handy to be able to search charging stations by their location, so I can plan my trips and make sure I'm never stranded without a way to charge my car.
- 4. User Story: Car Listings:
 - a. Hello, I have been trying to buy a Honda Civic for some time now, but I can't seem to find any dealership that has them in stock. It would be great if your website had a list of car listings I could search through to find a Civic for sale. Thanks!
- 5. Electric vs Gas:
 - a. Hi, I want to buy a car but I'm torn on if an electric or gas-powered car is better for my situation. I would love to be able to compare the attributes of different electric and gas-powered cars so I can make an informed decision.

Phase II User Stories - Given:

- 1. Work car concerns:
 - a. Hi, I am buying a car for daily life. I mainly use it to work, and I do not travel often. I wonder what kind of cars would suit me better. Based on my daily usage, I would prefer a vehicle with lower fuel costs and more convenience to fix if there's something wrong. Would your website provide information on that?
- 2. ADAS:
 - a. Hi, I am a new driver and this will be my first car. I've learned that ADAS is pretty important. I wonder if your website is going to be providing any information on that?
- 3. New customer:
 - a. Hi, I am completely new to the car-buying process. Is your website going to provide customer service or any crash course on car buying?
- 4. Car price in the past and future:
 - a. Due to the pandemic, I figure car price has been fluctuating a lot. Would your website be providing the car price during the past based on different dealers as well? Also, I think a model to predict the future car price will help the customer to make an easier decision.
- 5. Ranking for the car:
 - a. Hi, I wonder if your website is going to be providing a ranking based on horsepower, capacity, and swept volume?

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/20771905/2s83tFWkc>

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>

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.
- EC2/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.
- Jest - A frontend testing library
- Selenium - A frontend testing library
- Flask - A tool for connecting the backend database to the frontend where it is displayed through URL routes.
- Nginx - A proxy that allows us to access the flask routes

Hosting:

We are still hosting on AWS, but we switched to EC2 instead of Amplify. We liked that EC2 acted as a remote machine, and it made the implementation of the backend server easy, so we decided to use it instead.

Phase 2 Features

- Database Implementation:
 - We implemented the database using Python and SQLAlchemy. We also used MySQL to initialize the database. We created a schema, and then wrote a python script that filled the rows and columns of the database with the data we had previously pulled from RESTFUL API's in Phase 1. We also implemented a handful of image scrapers from the web, and included the links that these scrapers returned in the database
- Flask Implementation

- The implementation of the flask is based on Python and SQLAlchemy. Depending on the MySQL we set up in advance, we use the ORM model to read the data from the database, collect them, and return them to the user. In the backend we provide 10 APIs, including one just used for testing, to provide different data to users on their requirements. All APIs require to GET requests because we don't allow the user to modify the data we store in the database.
- Pagination explanation:
 - For each of our models, we get a JSON with a list of all of our instances where the related attributes are held in a dictionary. For example, we could get a list of all of our stars. For each item in that list, we create a star page that displays all of the information in the dictionary. This ends up being a lot of stars, and we limit the number of stars displayed on a page to 12. We used a react template for implementing the actual pages.

NOTE:

We ran out of free gitlab minutes for our pipeline, so we ran our Jest and Selenium tests manually. Screenshots follow:

```

PASS src/ tests /JestTests.test.js
Overall rendering tests
  ✓ App renders without crashing (35 ms)
  ✓ About Page renders without crashing (7 ms)
  ✓ Home Page renders without crashing (5 ms)
  ✓ Moons Page renders without crashing (4 ms)
  ✓ Planets Page renders without crashing (4 ms)
  ✓ Stars Page renders without crashing (5 ms)
  ✓ Moon Instance Page renders without crashing (5 ms)
  ✓ Star Instance Page renders without crashing (4 ms)
  ✓ Star Instance Page renders without crashing (5 ms)
  ✓ NavBar renders without crashing (3 ms)

Test Suites: 1 passed, 1 total
Tests:       10 passed, 10 total
Snapshots:   0 total
Time:        1.387 s, estimated 2 s
Ran all test suites.

python3 ./frontend/gui_tests/selenium runner.py
/usr/lib/python3/dist-packages/requests/__init__.py:89: RequestsDependencyWarning: urllib3 (1.26.12) or chardet (3.0.4) doesn't match a supported version!
  warnings.warn("urllib3 ({}), or chardet ({}), doesn't match a supported version")

===== WebDriver manager =====
Current google-chrome version is 107.0.5304
Get LATEST chromedriver version for 107.0.5304 google-chrome
Driver [/home/n8suss/.wdm/drivers/chromedriver/linux64/107.0.5304.62/chromedriver] found in cache
.....
Ran 10 tests in 2.044s

OK

```