NEOSPACE TRACKER

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NEO SPACE ORGANISATION

Contents

Problem Statement

Space has long been a fascination for humanity for decades, a recent resurgence in popularity has seen a growing interest from the general public to understand complex topics. To satisfy the ever-growing demand for space-related information, sites are constantly being developed to provide information stored across different APIs. But, these sites have their respective problems and drawbacks. For example, NASA's Centre for Near Earth Object Studies (CNEOS) website looks bland, consists of complex terminologies and lacks visuals for user engagement. The Sky Live website is another example of disorganised content with no interactive features, and the provided orbit diagram is extremely cluttered with no filters to remove some data. These existing systems are critiqued in the following table:

Characteristics	**NEOSpace**	**CNEOS (NASA)**	**The Sky Live**	**Wikipedia**
Engaging Pages				
Layman Friendly				
Simple Navigation				
Visual Representations				
Pleasant Displayed Data				
Data on Past NEOs				
NEO search				
Data Filters				
Data on Present NEOs				
Mars Rover Photo Data				
Mars Images from Multiple Rovers				
Filters for Easier Photo Navigation				
Photo Descriptions				
Astronomy Picture of the Day				

These faults do not pose much of a problem to veteran enthusiasts but for newcomers, navigating these sites to retrieve any information proves to be daunting and difficult. Thus, existing websites that display this content are either too lengthy for a user to engage in or too dull for a user to gain insight. Using NASA's vast collection of API's, we aspire to create a site that is both interactive and informative, presenting data specifically about near-Earth objects (NEOs). By focusing on a specific topic, we aim to present detailed, well presented data for those who have a general interest in NEOs without cluttering their page with unrelated data. This will make the information more interesting, especially for younger users who are intrigued on learning more about space exploration.

Furthermore, through specific design choices, we will create an interface that is fully interactive, responsive to user’s commands. This will allow the user to feel a sense of control over the information that they're receiving, further capturing their attention. The site will also be quite dynamic, changing constantly based on the input provided by the users. This will capture the engagement of younger users, who typically have a shorter attention span, allowing them to not feel 'bored' or 'unmotivated' and thus continue to pursue their interest.

User Stories

The 'Filter' feature

Description: On the "Near Earth Objects Page" there will be an optional menu bar to the left which when selected reveals a side panel. This side panel allows users to search near-Earth Objects (NEOs) for a particular criterion (e.g. time, name, size, type).

Feature: Apply a filter that allows users to search a particular NEO by time.

As someone who is interested in space,

I want to be able to see a list of NEOs when entering a specific range of time,

So that I can view past NEO objects.

Scenario: View a list of NEOs when inputting a date/time range

Given I am on the "Near Earth Objects" page

When I press on the left panel in the NEO page

Then a search bar should pop up which allows you to select the hour, day, month, year in a minimum and maximum range.

When I specify the input range for time

And I enter the input range

Then a list of clickable NEOs within those times/dates should appear.

Feature: Search for a particular near-Earth object (NEO) by name.

As someone who is interested in physics and space,

I want to search for a particular near-earth object by name,

So that I can see a visual representation of this object.

Scenario: Search for a particular near-earth object by name

Given I am on the "Near Earth Objects" page,

When I press on the left panel,

Then a search bar should pop up.

When I type in the name of a particular object in the search bar,

Then a drop-down list of search results will appear.

When I click on one of the search results,

Then I should see the desired object's location relative to earth.

Feature: View near-Earth Objects (NEOs) by time of occurrence.

As someone who is interested in space and time,

I want to be able view which NEOs are present in any given time.

Scenario: View a list of the NEOs in the past x days

Given I am on the "Near Earth Objects" page,

When I click on the left panel,

Then a search bar should pop up under the time of occurrence heading,

When I specify the input number 'x' into the search bar,

Then a list of clickable NEOs in the past x days will be available.

Feature: Filter the search results of near-Earth objects (NEOs) based on their brightness. With the basis of unit of measurement being absolute magnitude.

As someone who is interested in the brightness of objects in space,

I want to view a particular subset of NEOs based on their absolute magnitude,

So that I can see whether they are bright or dim.

Scenario: Filter particular NEOs with x units of absolute magnitude

Given I am on the "Near Earth Object" page,

When I click on the left panel,

Then a search bar should appear to the left under the absolute magnitude heading.

When I specify the input number 'x' into the search bar,

Then a list of clickable NEOs with approximately x magnitude will be available.

Feature: Filter search based on classification of near-Earth Objects (NEOs).

As someone who is interested in space and time,

I want to be able to search on the type of NEO (asteroids, comets or meteoroids),

So that I can see a particular type of NEO.

Scenario: Search on the type of NEO.

Given I am on the "Near Earth Objects" page,

When I click on the left panel,

Then an additional filter bar should pop up to the left.

When I select "type",

Then a checklist should pop up with the types,

And when I select which type of NEO I want to view (asteroids, comets or meteoroids),

Then I should be able to view this particular subset of NEO on the page.

Information on Near-Earth Objects

Description: Provided users are on the "Near Earth Objects" page, selecting a near-earth object (NEO), will result in a panel appearing on the right side. This panel will contain a list of information on that NEO such as size, velocity, and distance. Users will also have the option at the top of the page to select a timeline slider where they can view recent NEOs up to a selected date.

Feature: View NEOs within a given range from current date to recent date.

As someone who is interested in space

I want to view the most recent NEOs by an interactive slider,

So that I can view NEOs within a given time range.

Scenario: View NEOs within a certain time range.

Given I am on the "Near Earth Objects" page,

When I drag the time slider bar which is to the top right,

And I specify the time,

Then all NEOs within that date will be displayed.

Feature: Compare the distance of near-Earth objects (NEO) from Earth with a real-life size comparison {e.g. How many certain football fields and other familiar measurements it takes to fit from Earth to NEO}

As someone who is interested in the distance of NEOs from the Earth,

I want to be able to find how far a certain NEO is from Earth with familiar measurements,

So that I can quantify the distance with a real-life analogy.

Scenario: View the distance of a NEO from Earth through a real-life comparison

Given I am on the "Near Earth Objects" page,

When I have selected on the chosen NEO,

Then an optional drop-down menu will appear to the right,

And when I click on toolbar called size comparison,

When I select the chosen size comparison from the drop-down menu,

Then a straight line from Earth to NEO appears with the size comparison displayed above it.

Feature: Calculate the size of Near-Earth Objects (NEO) in relation to object's which exist on Earth {a certain unit e.g., football fields}.

As someone who is interested in the size of NEO

I want to be able to make a real-world analogy,

So that I can visualise the size of the NEO.

Scenario: View how many {certain units e.g., football fields} can fit across the length of the extra-terrestrial object

Given I am on the "Near Earth Objects" page and have selected an extra-terrestrial object,

When I click on a field in the toolbar called size comparison,

Then a drop-down menu will show up with a list of objects that can be used for measurement,

When I select the chosen size comparison {e.g. football fields},

Then a straight line appears with a numerical value of how many {a certain unit e.g. Football fields} fit across the NEO appear right above the line.

Feature: View information on a particular object such as its velocity, distance, speed orbit from Earth.

As someone who is interested in physics and space,

I want to view information on a particular near-Earth object (NEO),

So that I can be given quantitative data on the NEO.

Scenario: View information on a particular near-earth object

Given I am on the "Near Earth Objects" page,

When I click on an object that I am interested in,

Then a right-side bar should appear that displays information on a particular object such as its velocity, size and distance from earth.

Picture of the Day

Description: A webpage which allows users to view the "Astronomy Picture of The Day"

Feature: View NASA's astronomy picture of the day

As someone who is interested in the beauty of space and astronomy,

I want to easily be able to find the astronomy picture of the day.

Scenario: View the astronomy picture of the day

Given I am on the "Main" page,

When I click on the Earth,

Then l am redirected to the "Picture of the Day" page which showcases the astronomy picture of the day with a description of the image.

Mars Rover Features

Description: Pages that allow users to view images and information/data related to those images.

Feature: View photos of Mars from a chosen Rover.

As someone who is interested in recent explorations of Mars,

I want to view a specific Rover,

So that l can view photos of Mars.

Scenario: View Mars Rover Photos

Given I am on the "Main" page,

When I click on Mars,

Then the "Mars Rover photos" page will be displayed,

And different tabs on top left with different Rover missions are showcased,

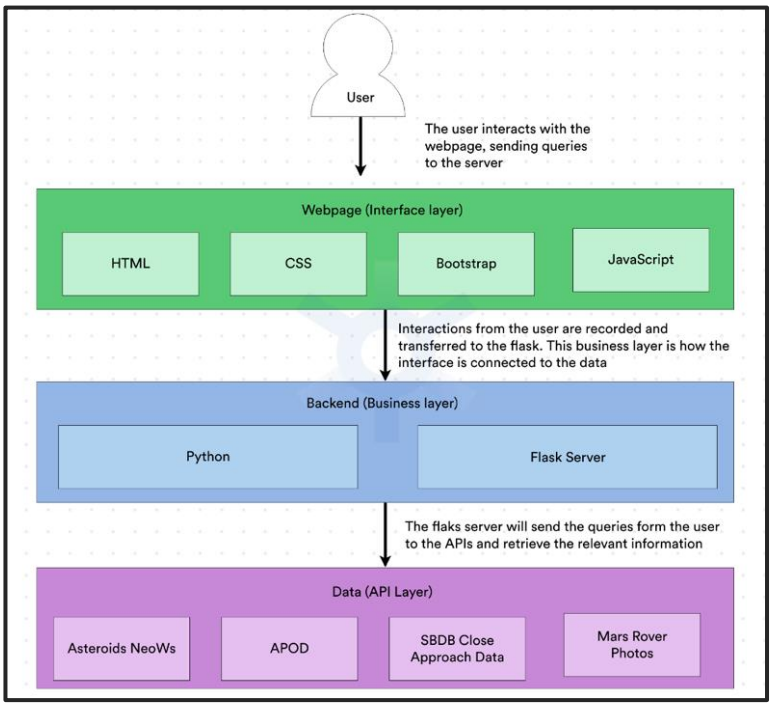
When I click on one of the tabs,

Then images and description of this Rover exploration will be displayed.

Software Architecture

The architecture of our software system has been described by using the layered model for software architecture. This allows us to clearly differentiate between the main components of the system and their interrelationships. There exists three key layers within our system: Interface, Business, API.

Each layer is only able to interact with the one below or above it to prevent the system from being too complicated. In general, the interface layer (as in the frontend) will communicate with the user, receiving requests. The flask server will process these requests in the backend and send necessary queries to the API. The APIs will answer the given queries and return data back to the flask, which returns the information to the frontend and hence the user.

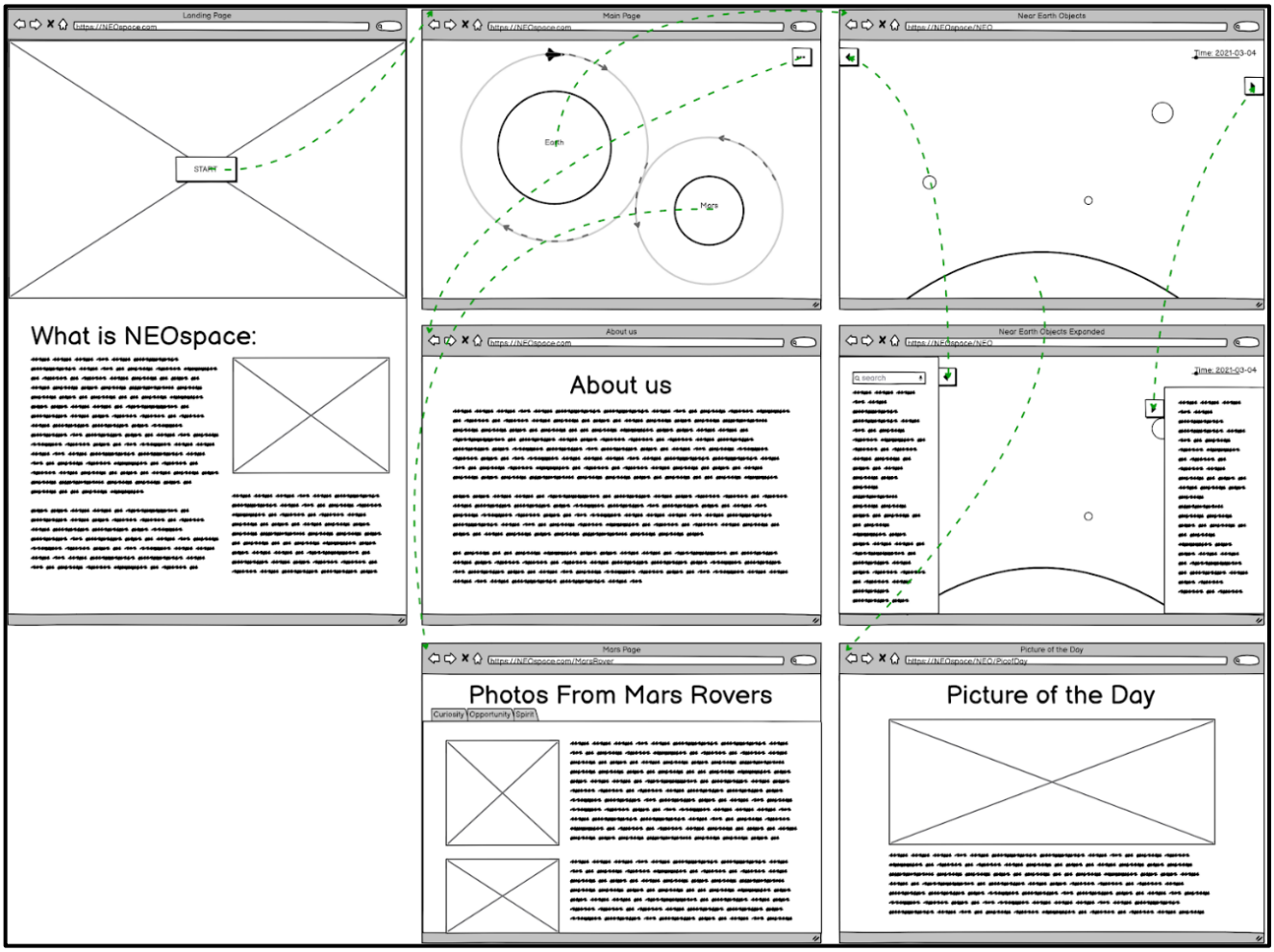


Interface layer: This is the layer that the users interact with. It is composed of the languages that will be used to construct the user interface of the site. For us, this includes HTML, CSS, JavaScript and Bootstrap. The interface will interact with the backend (business layer), sending queries passed in by the user.

Business layer: This is the layer that the developers will be interacting with the most. It consists of languages used to implement the backend, which currently only includes python. The developers also have control over the Flask server, which will act as a middle ground between the backend and frontend, processing queries and passing information.

API layer: This layer concerns the interactions between the data and the backend. The APIs listed here are what we intend to use to obtain information about specific queries and presented back in a user-friendly manner. Two of the APIs (Astronomical Picture of the Day (APOD) and Mars Rover Photos) are image-oriented while the other two (Asteroids NeoWs and SBDB Close Application Data) focus on raw data about NEOs.

Low Fidelity Prototype:

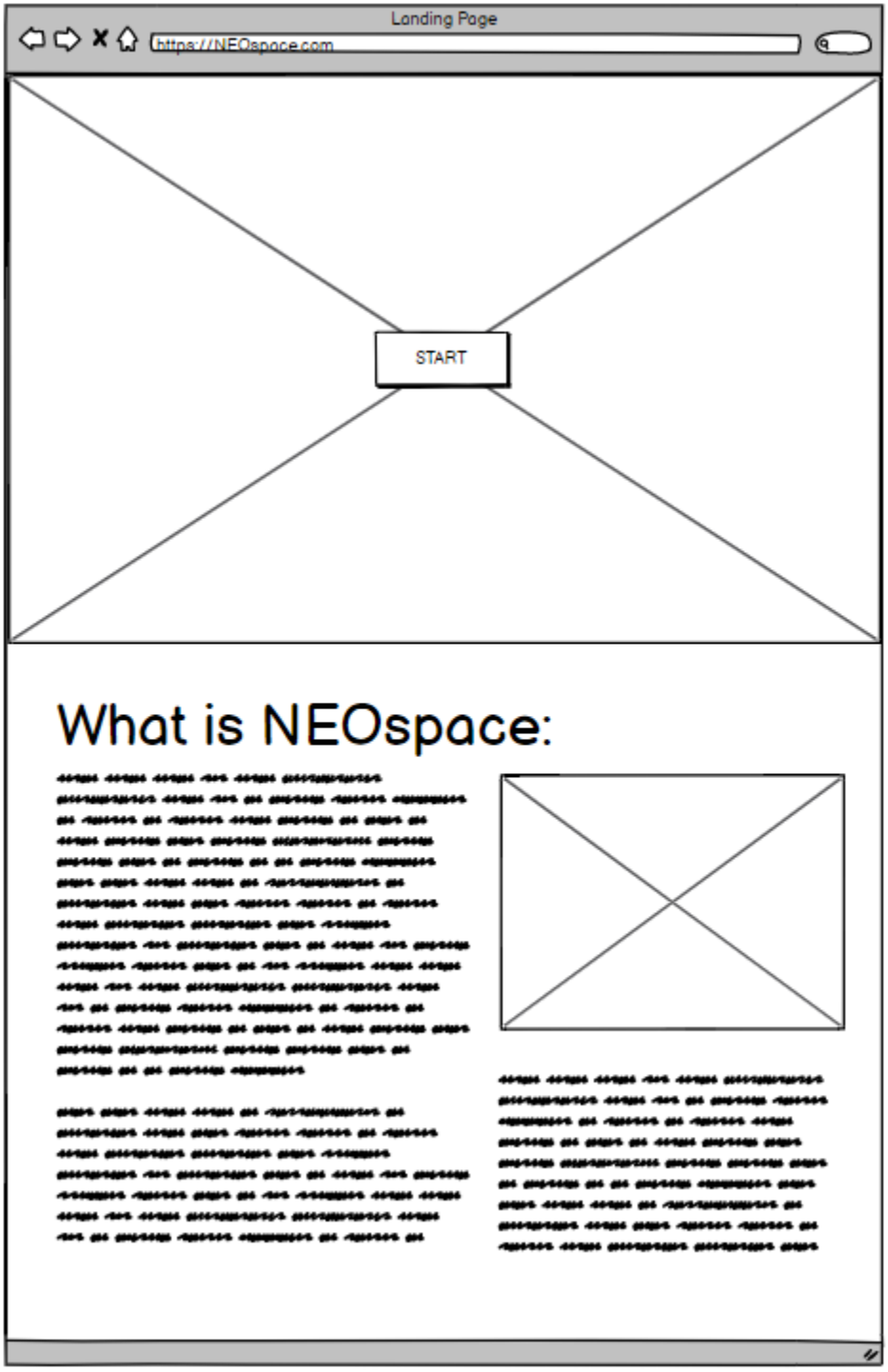


The diagram gives an overview off all the pages and how they will interact with each other.

Link to prototype

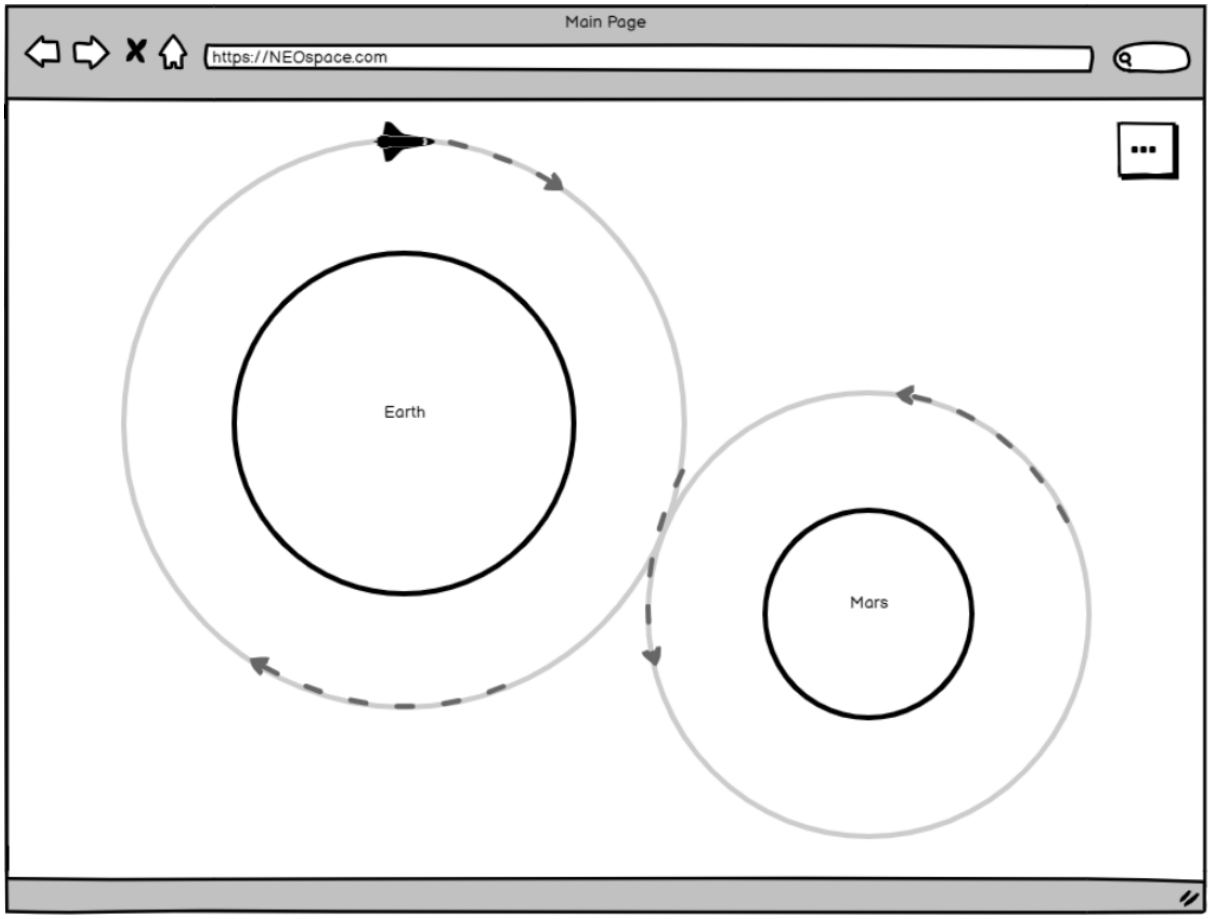
https://balsamiq.cloud/sqpuzh1/pygv9z6

Landing Page



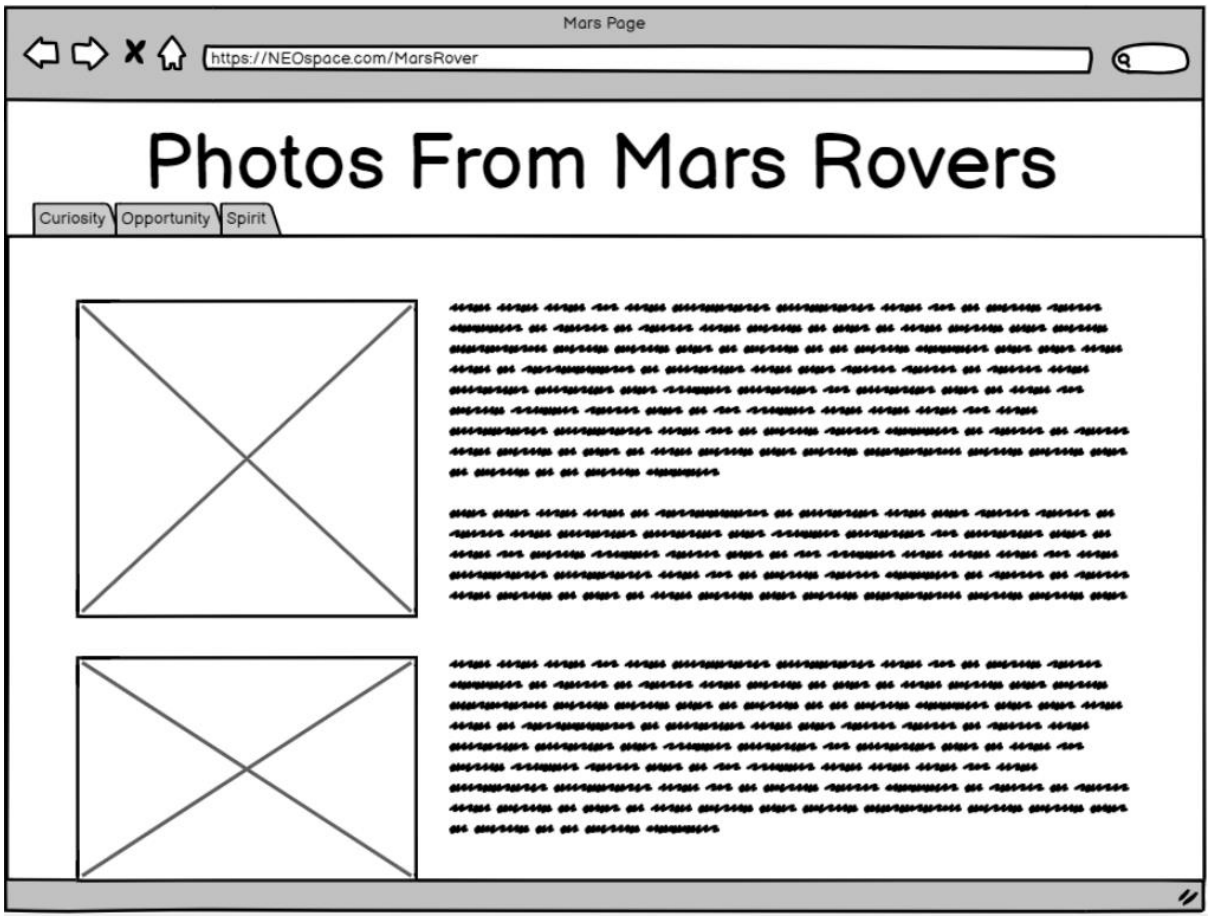
This is the page that users will be greeted with as they enter the website. This page provides a description of the functionality and purpose of the site. This screen is intentionally kept simple, not cluttered with too many buttons or text. This will make users more interested in exploring the site and increases their curiosity. It will also cause the site to not be too overwhelming or confusing for new users.

Main Page



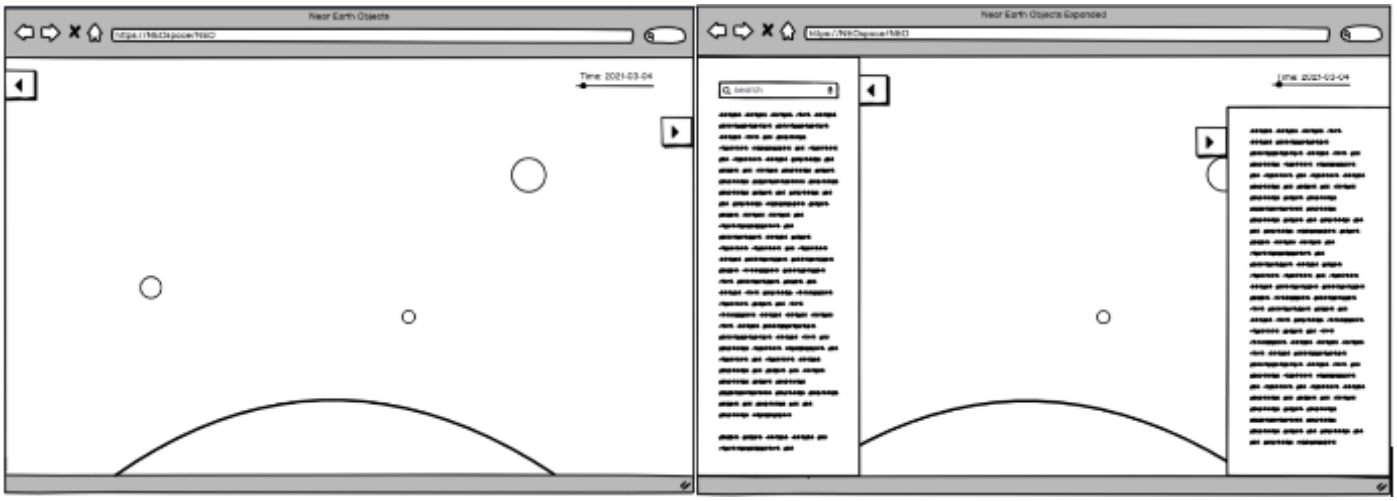
The opening page is an interactive page where users have the choice to click either on Earth or Mars and learn more about each topic. The cursor is a rocket ship that can orbit around both planets, providing a more engaging aspect for the user. This page's simplicity will help the site to not be too overwhelming or confusing for new users.

Photos from Mars rovers



When users click on the Mars planet, a new page will open, displaying photos from the Mars Rovers with a description of the photo. At the top of the page, there will be buttons with different rovers listed on them, allowing users to specify which rover they would like to see photos from. The formatting of the page for all the rovers will remain consistent, with the images on the left side and a description of the image and its significance on it's right. Users will be able to click on the images (which will open them in a pop-up window) to zoom in.

Near Earth Objects

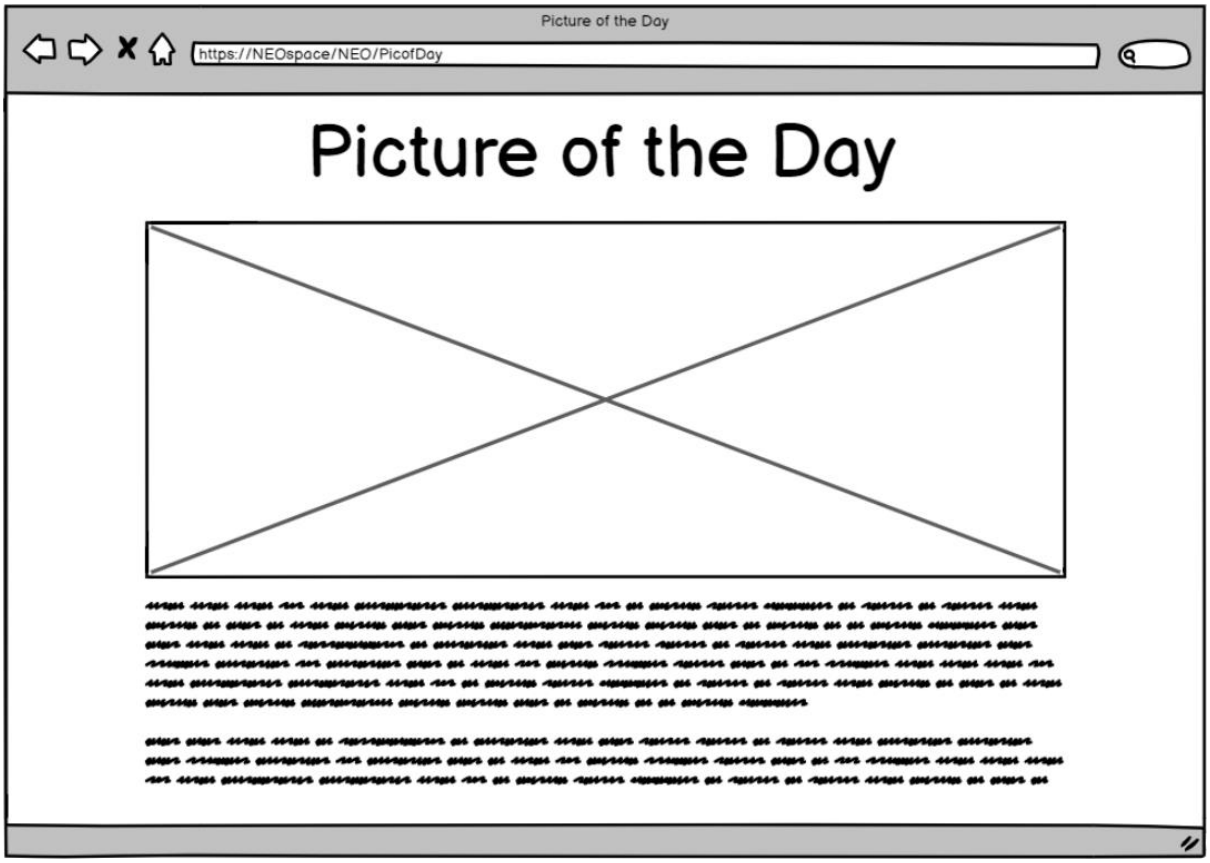


Clicking on the Earth will result in the users entering the NEOs page. In this screen, users will be presented with an interface that showcases part of the earth along with NEOs at a particular distance from it. Users will be able to click on the NEOs to display more information about them, such as their size, relative velocity, distance from earth, etc. This information will appear in a sidebar that will appear on the right of their screen.

There will be a menu option on the left side of their screen, that can be expanded to reveal a side panel on the left where users can navigate to different pages, search for specific items and apply filters.

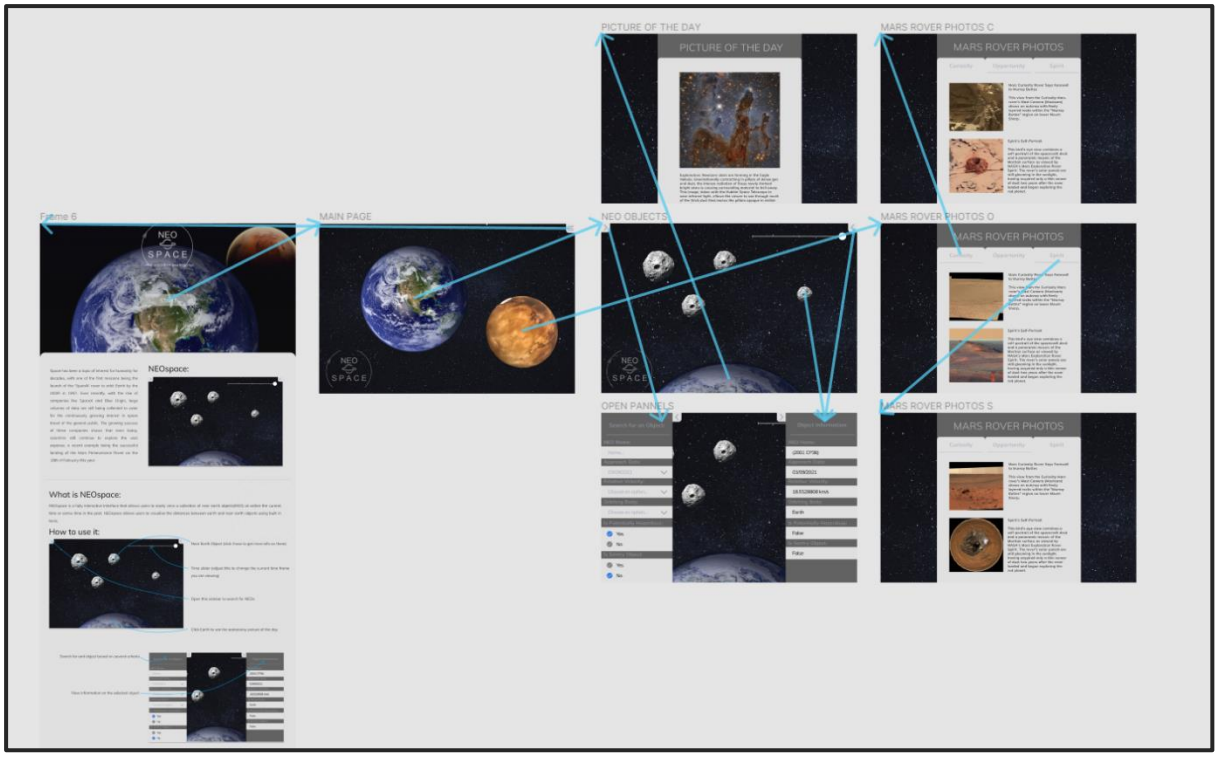
At the top of the page, there will be a horizontal bar resembling a timeline. Users will be able to slide across this bar to select a particular time. This will allow them to view all the NEOs present at that particular time.

Picture of the Day



The Earth on the NEOs page will also be clickable. It will open up a webpage with the astronomy picture of the day from the APOD API. Below the image there exists some text describing the image and its significance.

High Fidelity Prototype

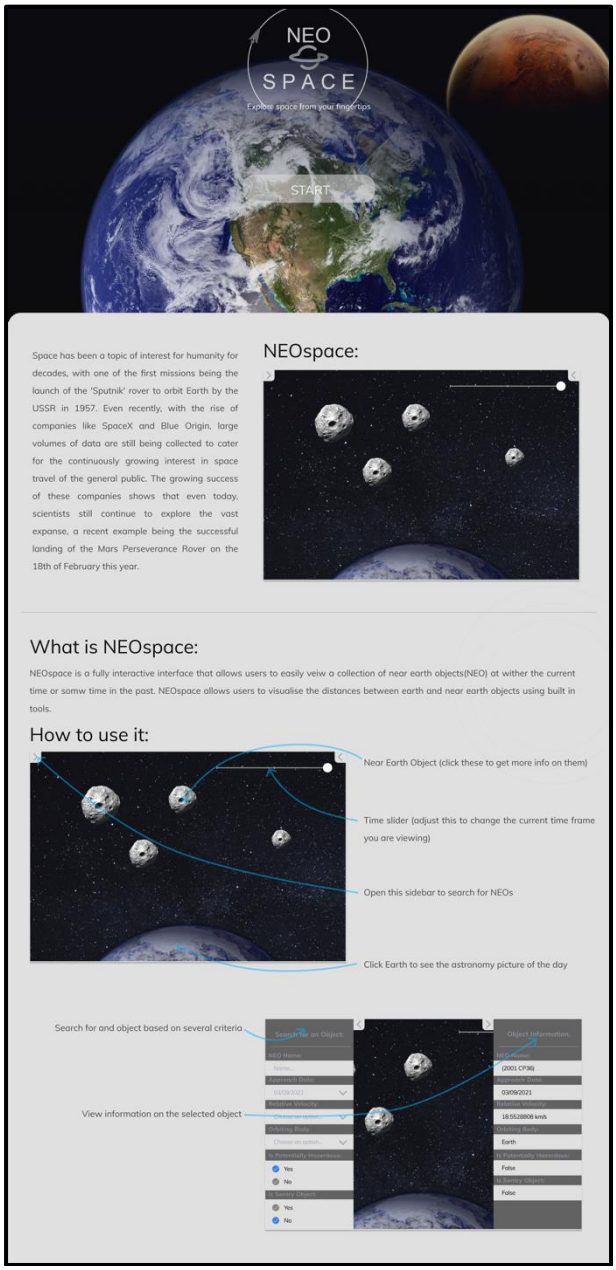


This diagram gives an overview off all the pages and how they will interact with each other.

Link to prototype

https://www.figma.com/proto/wvXMCdwyAFqAA0xhOAeZEM/Untitled?scaling=min-zoom&node-id=1%3A386

Landing Page



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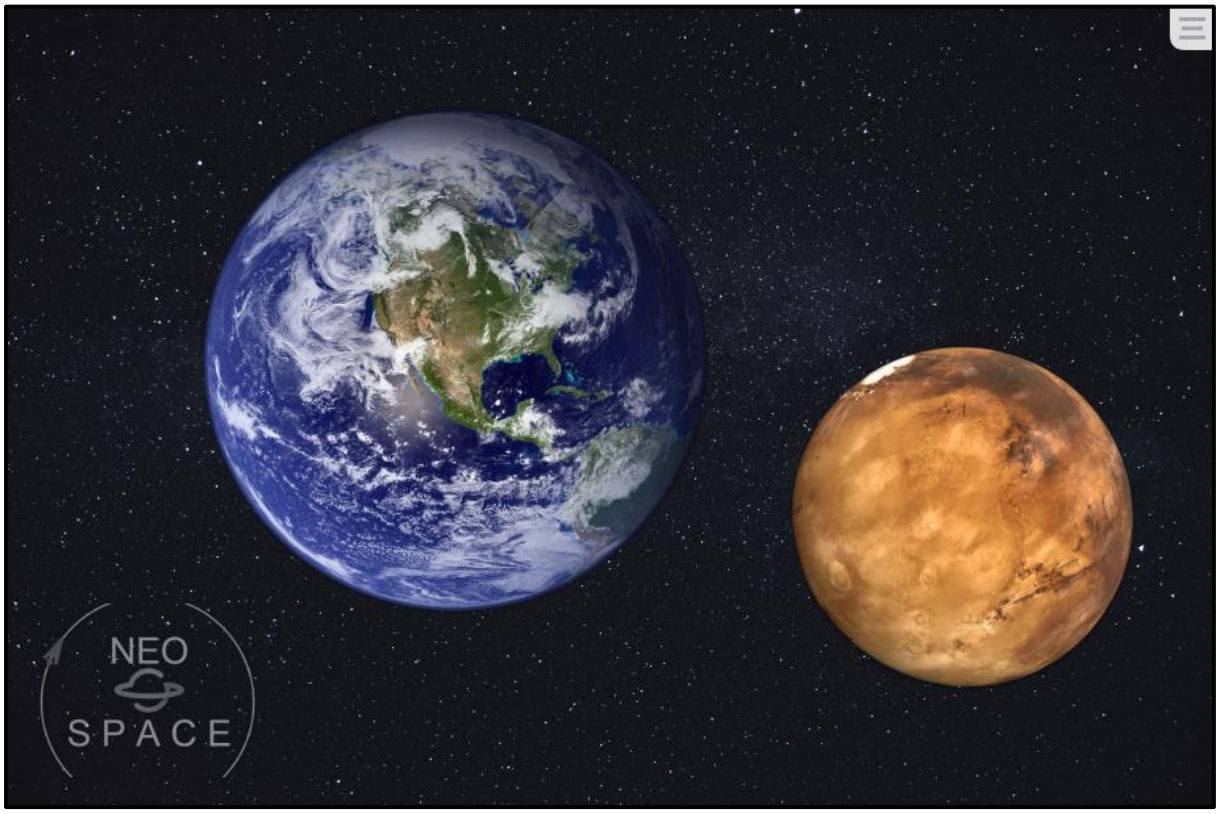
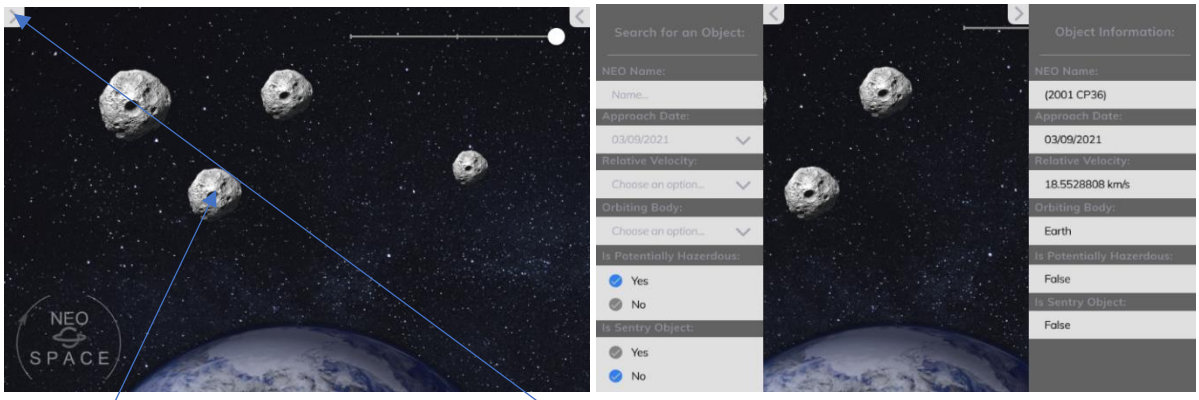
Main Page



The opening page is an interactive page where users have the choice to click either on Earth or Mars and learn more about each topic. The cursor is a rocket ship that can orbit around both planets, providing a more engaging aspect for the user. This page's simplicity will help the site to not be too overwhelming or confusing for new users.

Near Earth Objects

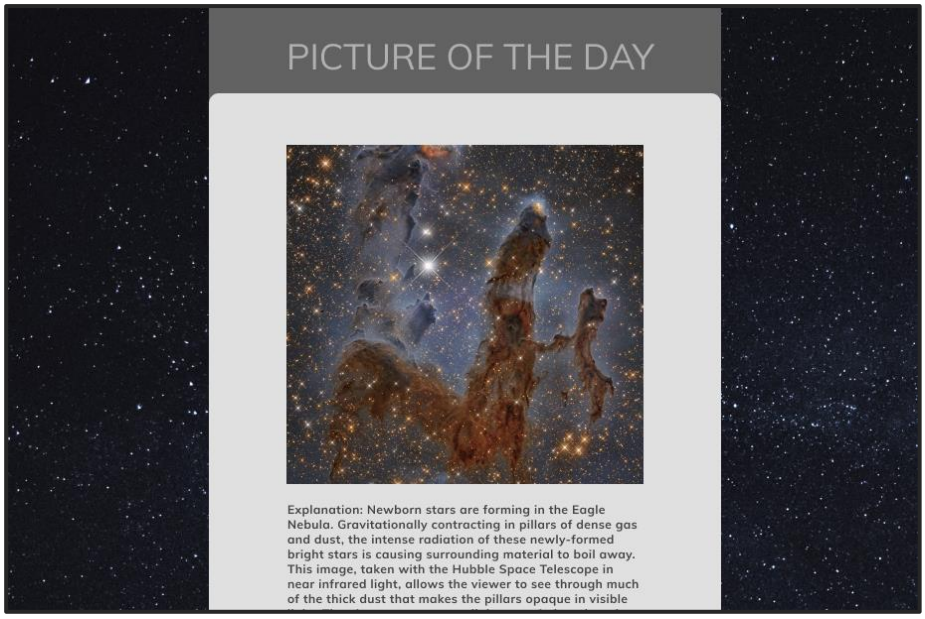


When a user clicks an object, the right panel will open up and more information about the selected object will be shown.

Clicking this button will reveal a side panel on the left where users can search for specific objects and apply filters.

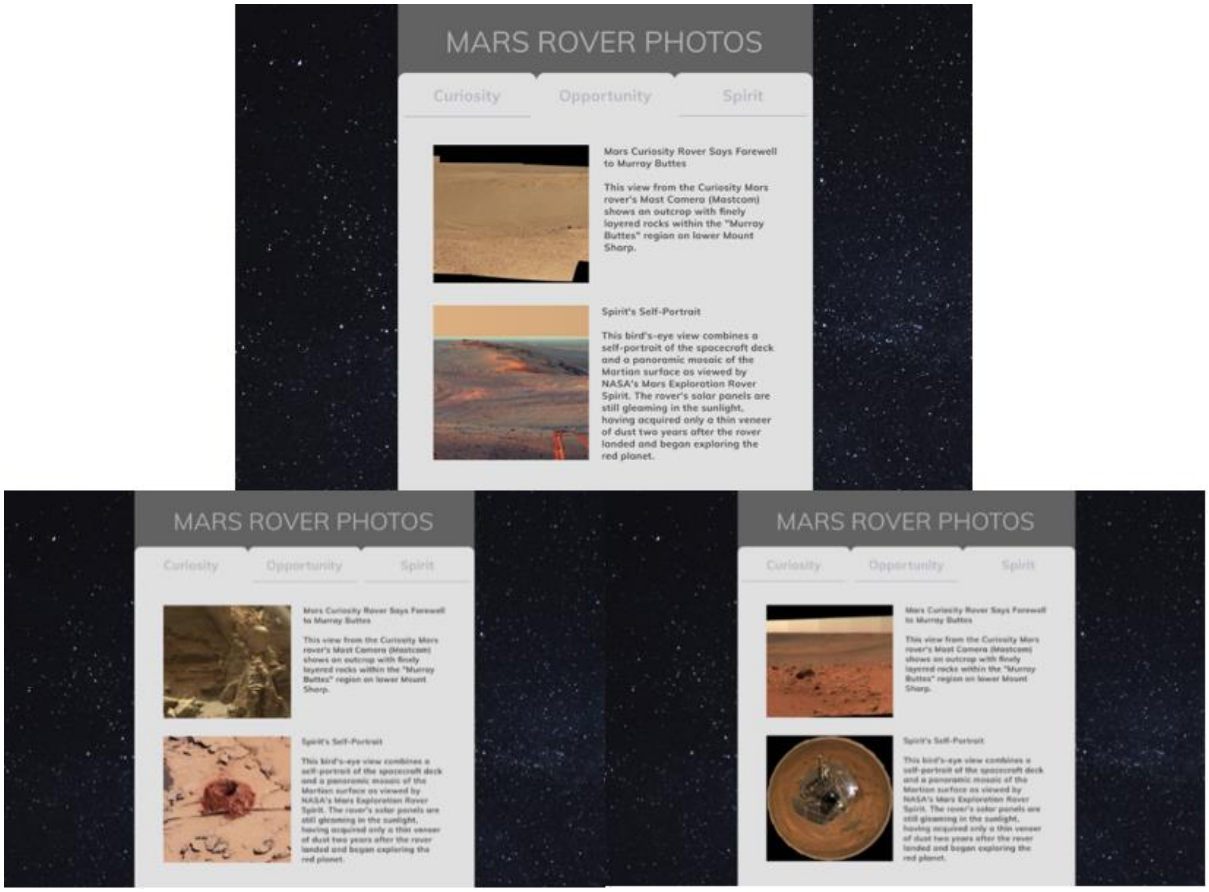
In this screen, users will be presented with an interface that showcases part of the Earth along with NEOs at a particular distance from it. At the top of the page, there will be a horizontal bar resembling a timeline. Users will be able to slide across this bar to select a particular time. This will allow them to view all the NEOs present at that particular time.

Picture of the Day



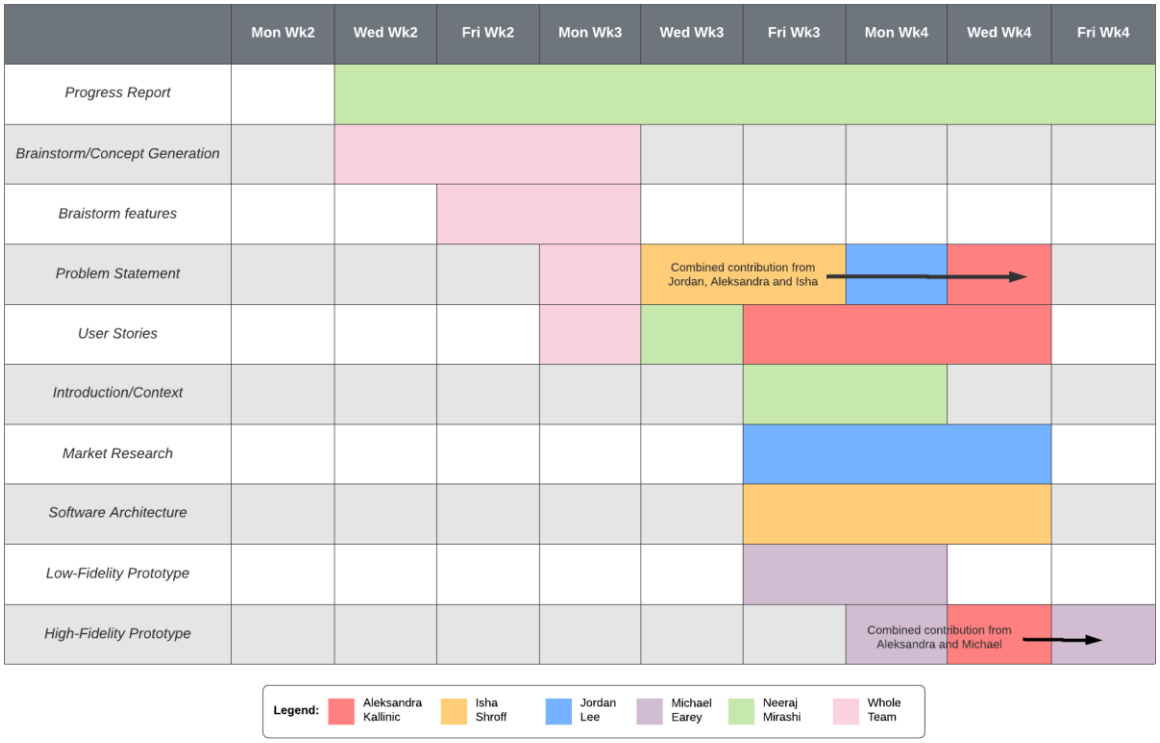
The Earth on the NEOs page will also be clickable. It will open up a webpage with the astronomy picture of the day from the APOD API. Below the image will be some text describing the image and its significance.

Mars Rover Photos



This page displays photos from the Mars Rovers with a description of each photo. At the top of the page, there will be tabs for each rover, allowing users to specify which rover they would like to see photos from. The formatting of the page for all the rovers will remain consistent, with the images on the left side and a description of the image and its significance on it's right. Users will be able to click on the images (which will open them in a pop-up window) to zoom in.

Project Management



Progress report: The group has been working on the progress report from the beginning of the project, keeping track of meetings, goals, deadlines and roles within the group. This document was mainly edited and maintained by Neeraj.

Concept Generation: The initial stages of the project, when the group collectively brainstormed ideas that were realistic and feasible to implement for this project. The final idea chosen (about using the NASA API) was initially suggested by Michael.

Brainstorm features: This stage consisted mainly of the group brainstorming features to implement with the NASA API, and more specific project ideas. This brainstorming of possible features was present throughout the project, however the main ideas chosen to implement were suggested during the times indicated by the Gantt chart.

Problem Statement: The group members each derived a small problem statement, which were then combined to generate a more profound problem statement. This was early on in the project, and since then, multiple members (namely Jordan, Aleksandra and Isha) have edited and improved the problem statement.

User Stories: These were generated over time as more features were considered. The group collectively developed some initial stories, and Neeraj and Aleksandra spent more time developing more stories and editing them.

Introduction/Context: Some context as to why we are undertaking this project and the need for more space related projects was undertaken by Neeraj.

Market Research: More in-depth research into the industry and other similar sites/programs was undertaken by Jordan.

Software Architecture: A model of the different components of the system and how they connect was created by Isha to provide insight on the architecture of the system.

Lo-fidelity Prototype: The basic concept of our site mapped out page by page. This was developed largely by Michael, with input from the whole group regarding design elements.

High-fidelity Prototype: A more detailed representation of our system, considering the aesthetic of the pages and connections between different pages. This was developed mostly by Michael and Aleksandra, with input provided by the group.

References

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