Challenge

WHEN LIGHT CURVES THROW US CURVE BALLS

The Team

INTERNATIONAL BOYZ

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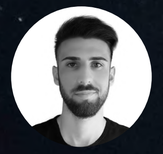

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Overview

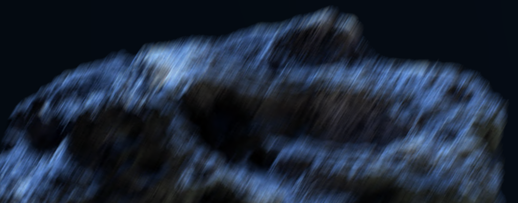
PROBLEM

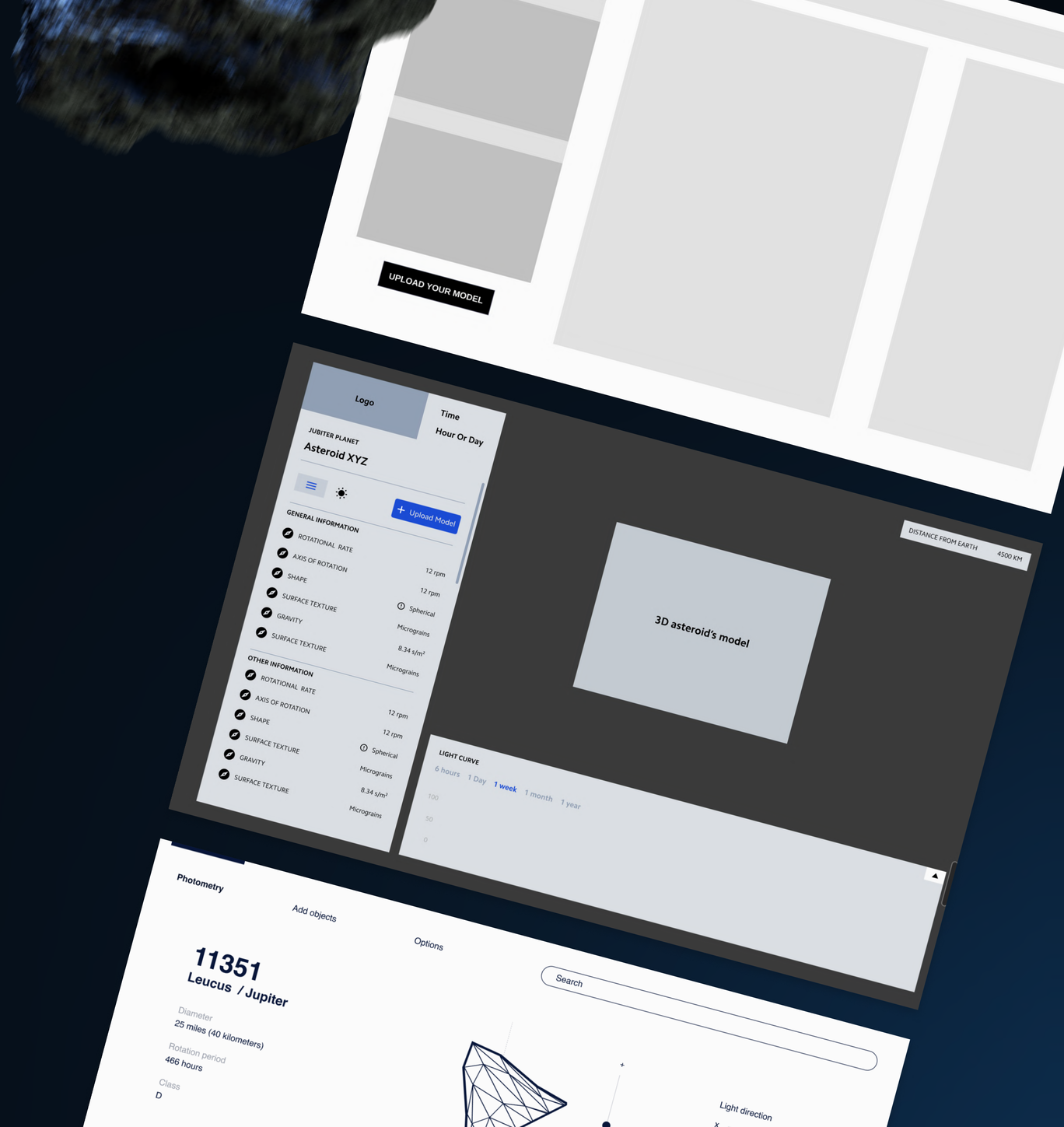
Scientists want to find out the shape of Trojan asteroids by examining their light curves, but can’t determine their shapes as they only appear as tiny bright lights from the earth.

OUR SOLUTIONS

We developed a tool that allows users to explore how the shape of an asteroid affects the appearance of its light curve by

- Freely moving the asteroid, and examining how its shape determines its brightness in the light curve.
- Easily accessing its properties on the same screen
- Uploading 3D models to test several shapes
- Study shapes of available asteroids in the Nasa’s database





Prototype

Change between asteroids

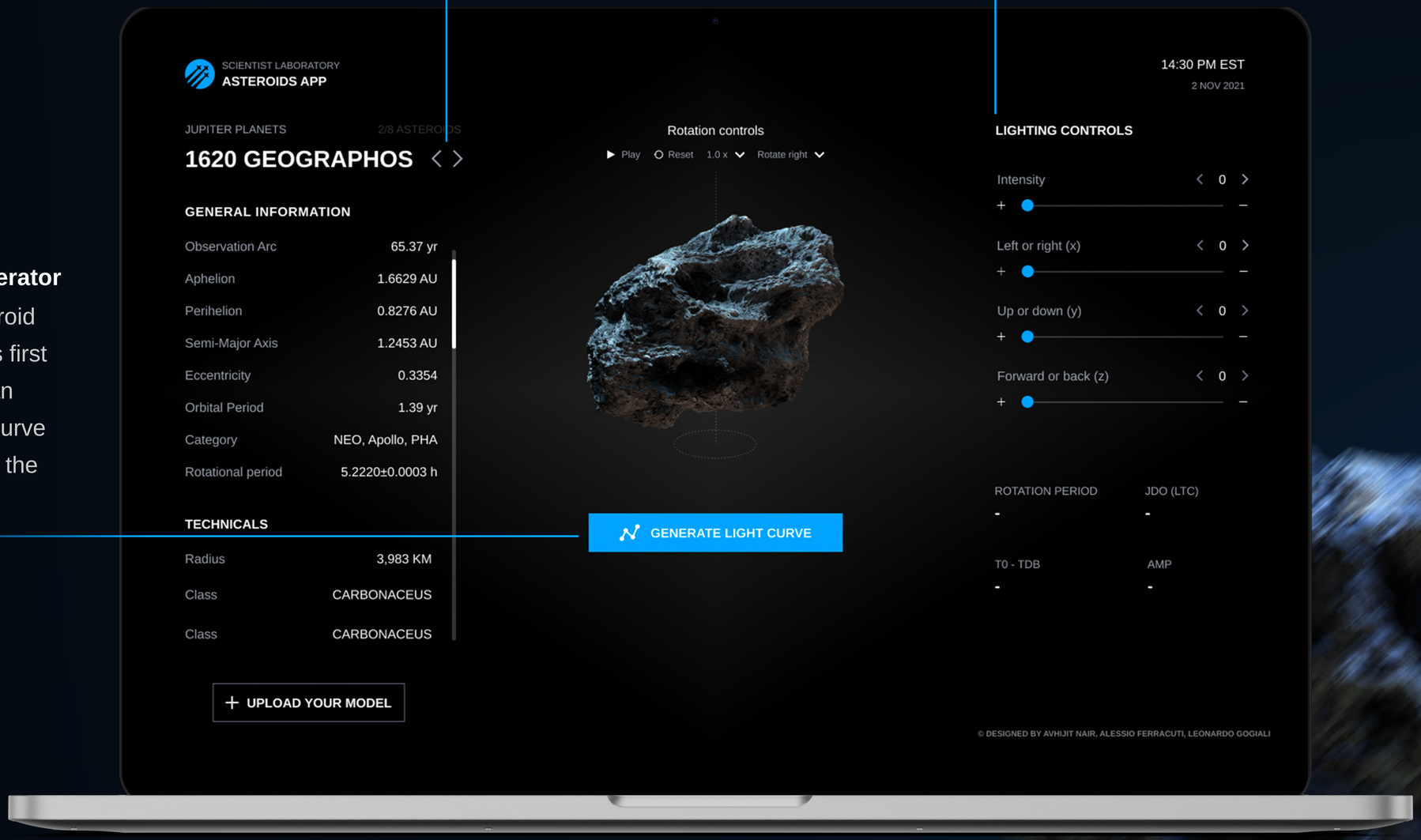
Using Nasa's data, users can switch between asteroids

Controlling light

Users can control and change the type of light

Light curve generator

After the 3D asteroid has completed its first rotation, users can generate a light curve chart by pressing the enabled button.



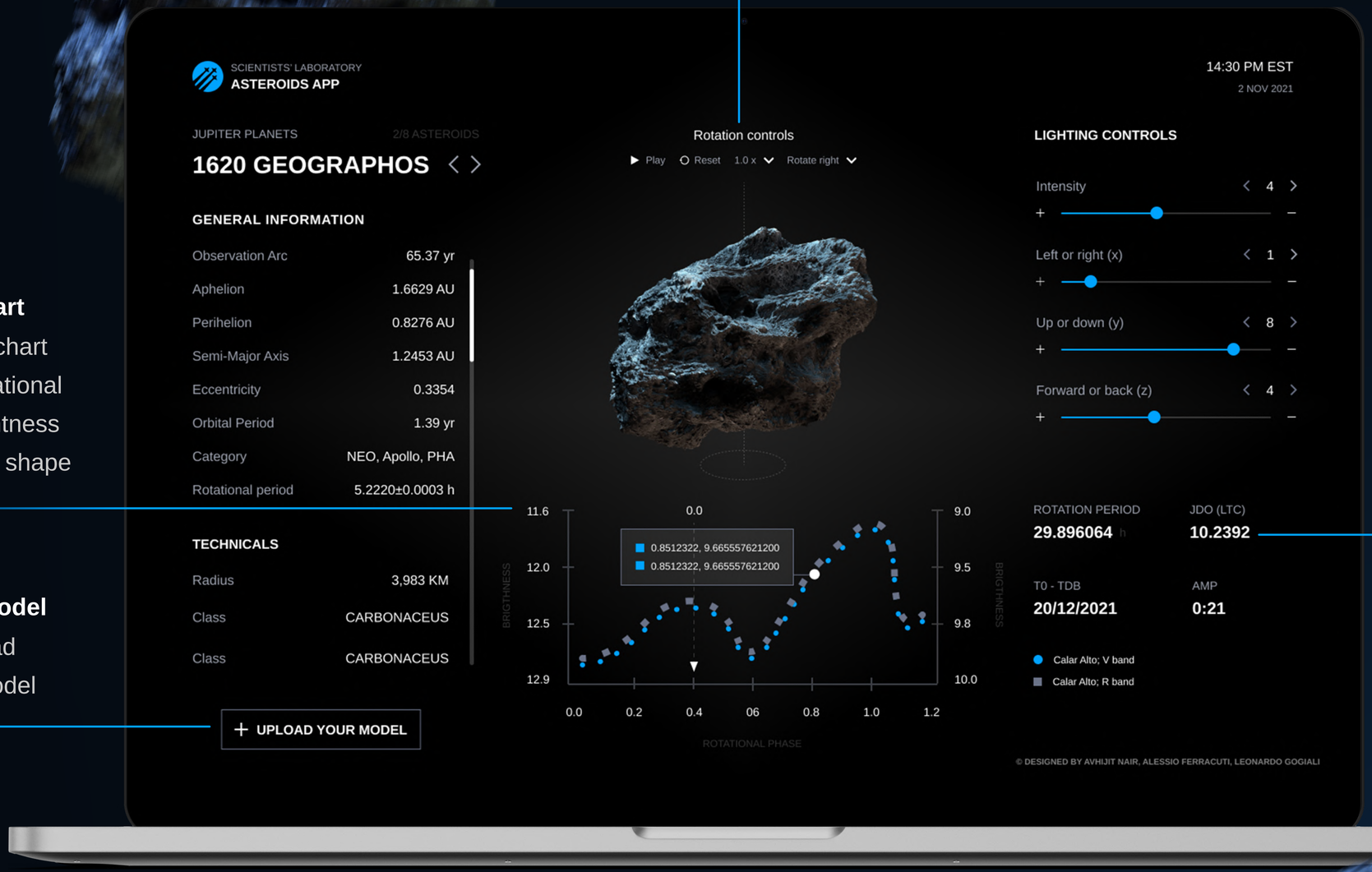
Prototype

Animation controls
Users can choose how to rotate the asteroid

Light curve chart
The light curve chart displays the rotational phase and brightness of the asteroid's shape

Upload your model
Users can upload their own 3D model

Chart's KPIS
These values change according to the graph



Process

METHODOLOGIES USED

We collaborated within the team to bring solutions to life by using the following methodologies

- Brainstorming sessions & Prioritization of features
- User journey maps
- Protopersonas
- User testing with the prototype

OUTCOMES

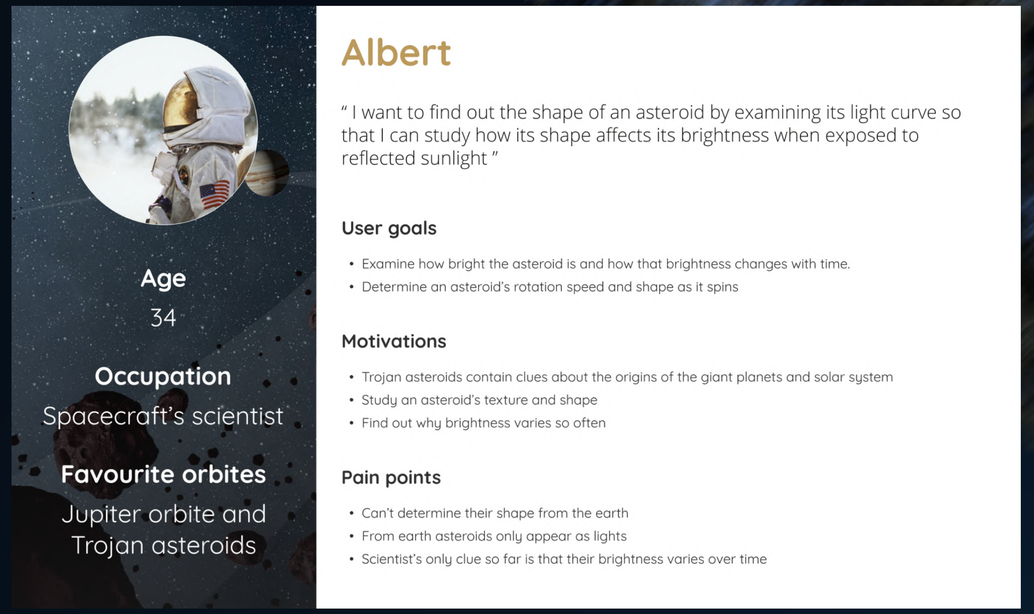
Before we started full development, we tested a realistic prototype with master graduates from the Space exploration and development systems' programme of Turin:

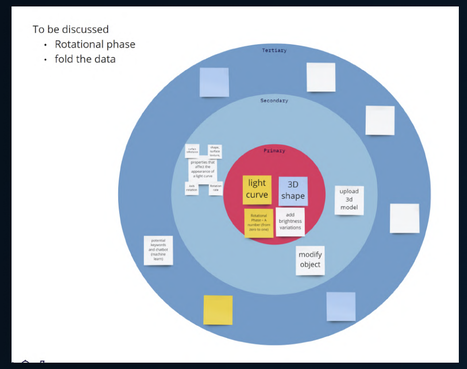
" I am amazed by how intuitive it is"

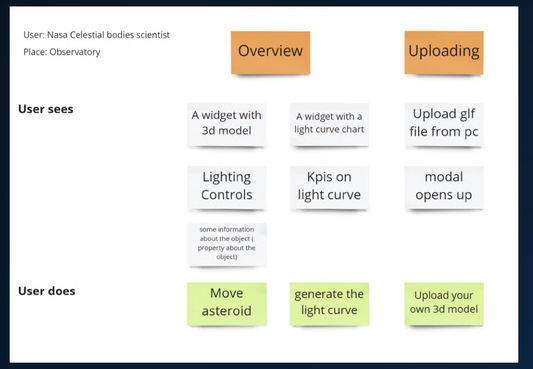
Participant 2

" I can finally look at an asteroid's properties so easily"

Participant 1







Technical details

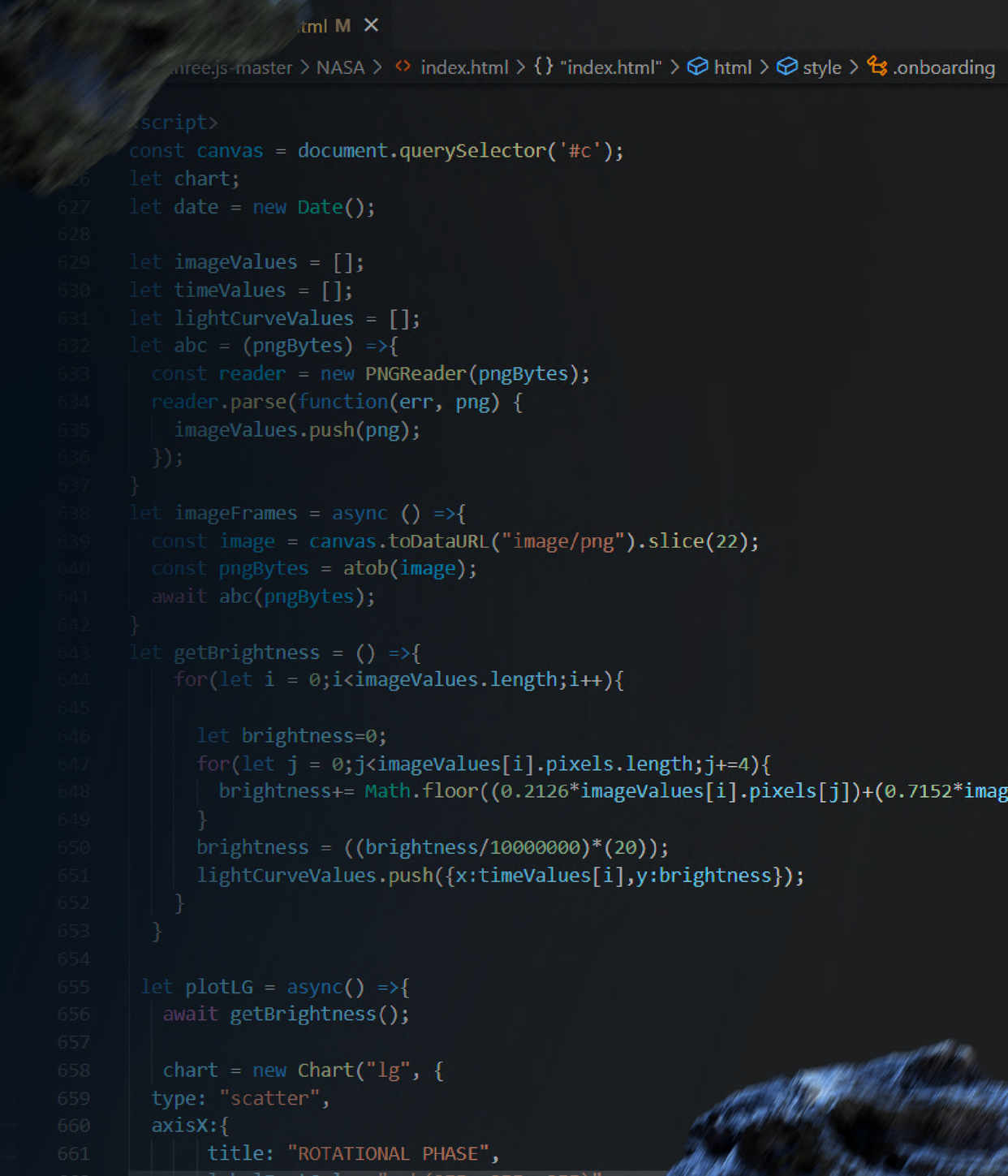
ALGORITHM STEPS USED TO GENERATE THE LIGHT CURVE

- The user specifies a rotation period for the asteroid (here we're considering 1 second = 1 hour for the purposes of simulation) and clicks the play button to rotate it 360 degrees and generate the data.

- During each frame of rotation , the brightness of pixels is calculated and used as a data point for that particular time step. The time step here acts as our rotational phase.

So for example if the user selects 10 from the dropdown, then the 3d model rotates 36 degrees per second, a snapshot of the frame is taken and the pixel brightness is calculated.

In this way, if there are 'm' frames and the pixel array size is 'n', then the algorithm grows by an order of O(m*n).



Conclusion

FINAL THOUGHTS

Collaboration and diversity of our skills led us to develop a fully working product in a matter of few hours.

IDEAS FOR THE FUTURE

If we had more time, we would have liked to make more advanced features, along with a complete user journey. From users logging into the tool and selecting the orbit they are interested in, to accessing an overview of all asteroids and examining their light curves individually.

If we had more access to resources and the internal NASA team, we would have loved to speak with celestial bodies observers to understand what values are most crucial to them when examining light curves.