Astro VIZards - Milestone 2

List of Tools

- Typescript : We will implement all our codebase using TypeScript as the main language. Compared with standard Javascript, types will help us during development.
- React : This library will be the foundation as our plan is to build an interactive website that will serve users all the information about the satellites while proportioning tools for advanced filtering.
- Arcgis : Given that the main visualization in our project is a map, we opted to leverage this library that provides with accurate interactive maps and support for different markers.
- Satellite.js : The satellite data that we have comes from two sources: a database with textual information about them and a combination of different TLE lines that explains the satellite positions. We leverage this library from computing the spatial information of the satellites on the fly.
- Antd : We have opted to use a design library for the different components of the website.
- Observable Plot : Aside from the main visualization (the map) we want to provide to the users curated aggregated information in the shape of plots. We will use this library for that.

With respect to the lectures, **Maps** are quite important for us as we want to present the satellites positions and orbits. Jointly, **Mark and Channels** lecture is quite important in geospatial visualizations as being the way to leverage map spatial information.
Furthermore, the lecture about **Perceptual Colors** will guide us while choosing the colors used in all the visualizations to be adequate for all the users.

List of Features

Our current system displays the locations of the satellites on a world map as well as their trajectories. Ideally, we will implement a system that allows the user to choose a specific time and date and will update all the satellites positions (initially the website computes the position of the satellite at the instant of opening the viewer). Having the possibility of updating the satellite position as time advances could also be a nice feature.

In addition, we have two sidebars that enable the user to filter the satellites on various criteria (allowing arbitrary combination of them).
Currently, the users can filter the satellites based on the following:

- Purpose of the satellite's usage
- Country / Organization that launched the satellite
- Name of the satellite
- Contractor of the satellite
- Operator / Owner of the satellite
- The parties utilizing the satellite

Fig 1. A sketch of the launch sites visualization

In the future, we plan to add different visualizations (in terms of plots) regarding aggregated statistics or relations between the satellites. These small pills of information will be introduced on the details of the satellites or in specific pages.
We will also tentatively add support for links between these pages and the satellite view, allowing the user to explore this data in the easiest way.

Given all of our ideas, we still have some design questions that will be solved in the future:

- What type of map visualization can be more elegant and transmit more information in our context? Our current implementation is designed with 2D in mind, but a 3D one could be a nice addition.
- What information should go to the individual view of each satellite? Ideally a mixture of essential information plus some aggregated data would be the best combination. But aggregating data will mean to increase the precomputation that we already do to the data.
- What would be an ideal starting page for the user? The library does not support drawing all the satellites (and the map gets quite cluttered). A possibility could be to preselect some satellites that have some importance or randomly choose a subset of them and plot them. Right now we just clamp the maximum number of satellites that can be visible.

Screenshots from the Website

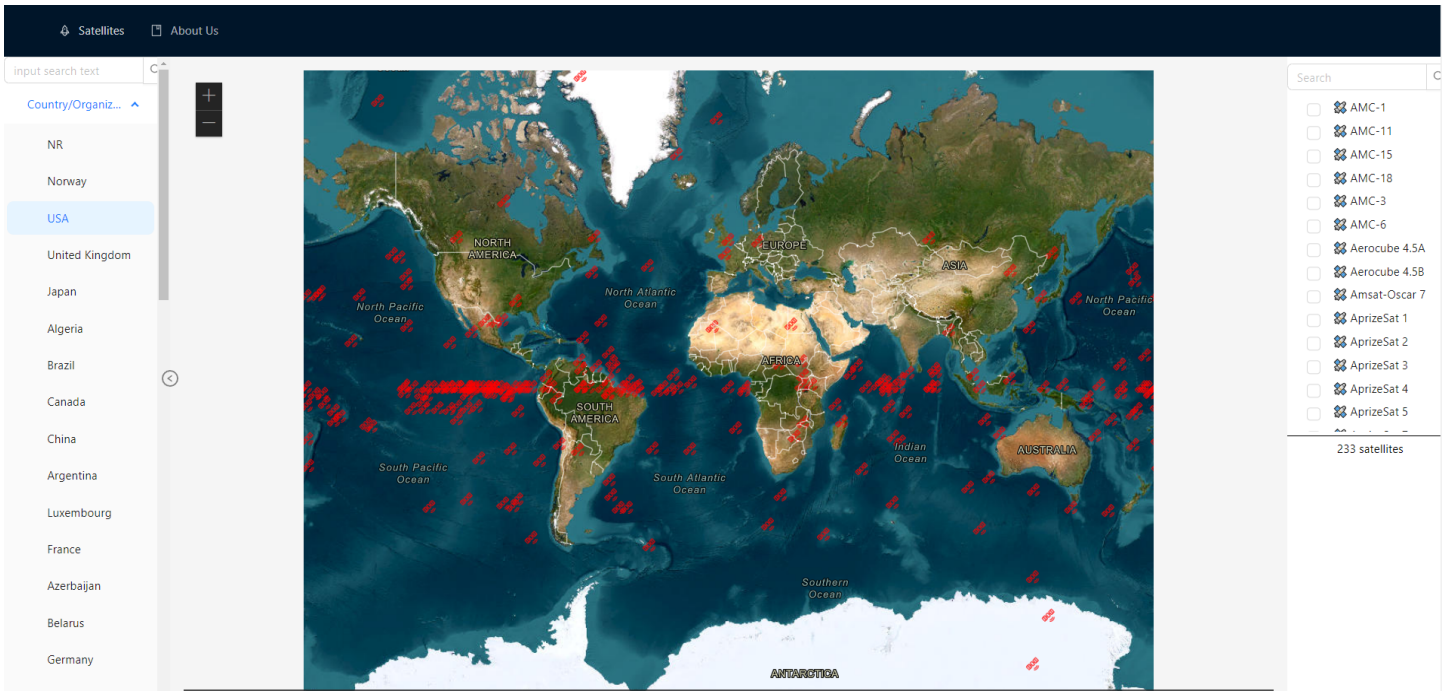

Fig 2. The main page of the website

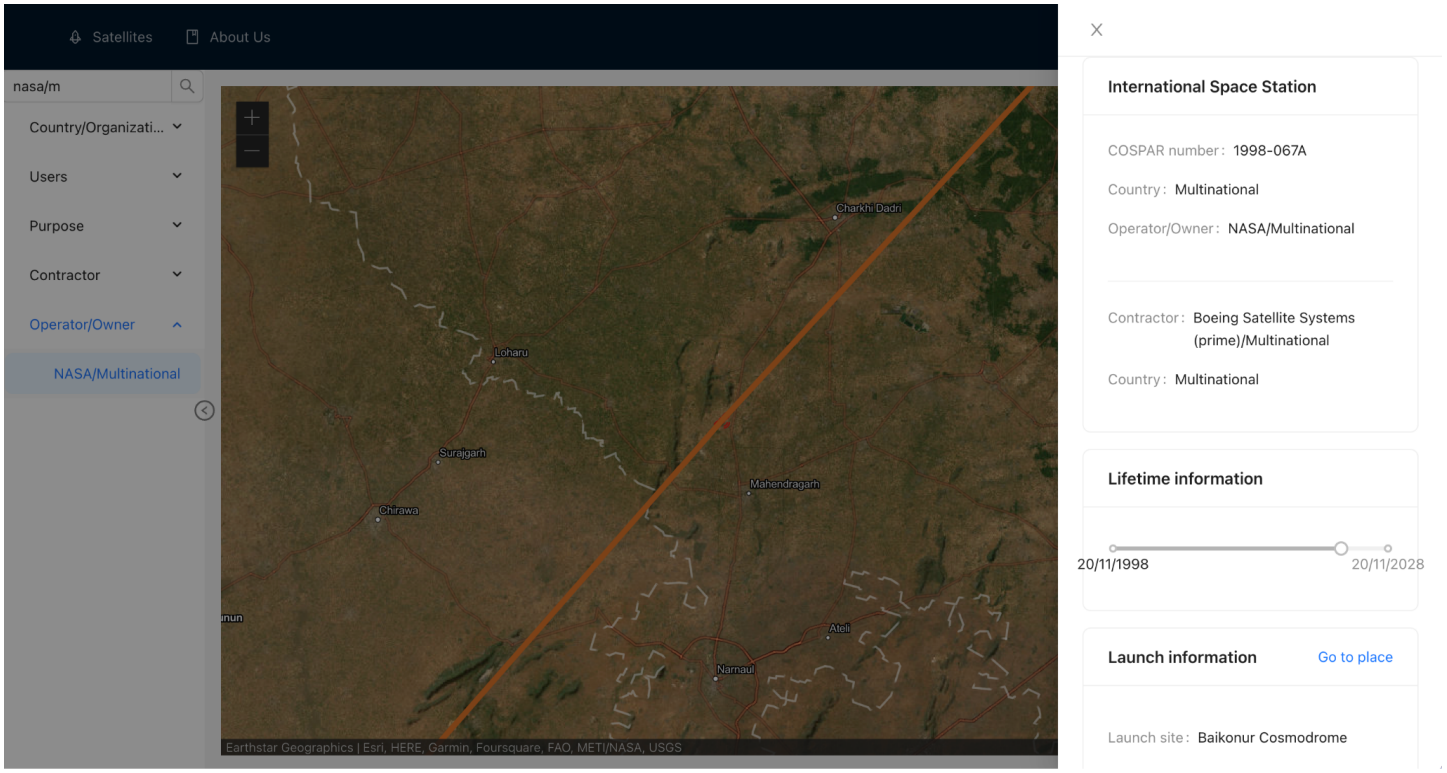

Fig 3. Satellite information screen

Figure 2 is a screenshot of the main page of the application where the satellites are displayed on the world map. Using the left and right sidebars, users can filter the displayed satellites by the aforementioned criteria. Shown in Figure 3, after clicking a satellite icon, we also display more information on the specific satellite including textual data or more curated information. Additionally, the orbit will also be displayed (orange line in the figure).

In addition to the already implemented screens, our objective is to provide different visualizations (plots) reflecting important statistics of the data. For instance, we aim to add a visualization showing launch sites of the satellites on the globe. Figure 1 is a sketch of this visualization.