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Aerospace Engineering
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The International Space Station (ISS) Tracking Application

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Introduction

This report will describe the ISS Tracking Application that was created to successfully track the location of the ISS and properly return values that the user is able to request from the application. It will discuss how a user may be able to run the application successfully, as well as a discussion on ethical and professional responsibilities in engineering situations. Ultimately, the reader will be able to further understand the purpose of this application and encourage users to use such an application for their own needs.

Motivation

The motivation for this project was to create an application that could easily and effectively utilize the data provided by NASA to track the International Space Station. The goal was to be able to use every single part of the data provided, from the metadata to the predicted future data points, or epochs. Ultimately, the user should be able to successfully navigate themselves through the data using the application.

Importance

The importance of this application is that it can show the possibility of using such a data, one that changes frequently, to successfully provide information that is requested by the user. This type of application doesn't just stop at tracking the ISS; it can be used to manipulate any other data in a similar format to track or to simply provide information regarding the data. Finally, those that are interested in space or the ISS, in particular, may use this application to satisfy their curiosity.

Using the Application

For a user to utilize the application, users are able to query using a command like this:

```
$ curl localhost:5000/post-data -X POST
```

This command will load the data into the application by directly requesting the data from the NASA website. This insures that the data is always using the most updated version that NASA provides, ultimately being able to accurately track the ISS.

To return the entire data set, users are able to query using this command:

```
$ curl localhost:5000/
```

This command, however, must be run after the `"/post-data"` query to see the entire data set. This is an intentional design in the program so that it can reduce redundancy. This means that the `"/"` query won't be pulling data from the website, but the stored data inside the program itself. This makes it so that the `"/post-data"` query is the only query that will pull from the direct source.

In the same way as loading in the data, the user is able to delete the stored data:

```
$ curl localhost:5000/delete-data -X DELETE
```

The query that this project is mostly based off is the `"/now"` query, which can be run using this command:

```
$ curl localhost:5000/now
```

If done successfully, the output should look something like this:


```
{
  "Epoch": "2023-070T06:48:00.000Z",
  "Location": {
    "altitude": {
      "units": "km",
      "value": 419.7851549137822
    },
    "latitude": 28.659367107265545,
    "longitude": -126.3121600929075
  },
  "geo": "The ISS must be over an ocean...",
  "speed": {
    "units": "km/s",
    "value": 7.666292075028554
  }
}
```


This shows the Epoch key; the location in terms of altitude, latitude, and longitude; the geographical location; as well as the speed that the ISS is traveling at in this particular location.

The Epoch key, `"2023-070T06:48:00.000Z"` consists of a lot of information:

- It first starts with the year, in this case `2023`.
- Then it has which day it is in the entire year, `070` representing the 70th day in the year.
- Lastly, the numbers following the T is the time, `06:48:00` representing 6:48 (in GMT).

Ultimately, many different queries can be sent to this application, returning the values from the data that were requested. Those different queries can be explored on the github website, here, that contains the files needed to run the application.

Ethical and Professional Responsibilities in Engineering Situations

Ethical and professional responsibilities in engineering refer to the moral and legal obligations that engineers have to ensure that their work is carried out with the highest level of integrity, honesty, and accountability. These responsibilities include adherence to ethical standards, compliance with relevant laws and regulations, and the exercise of professional judgment and responsibility.

Engineers are expected to maintain the highest level of ethical conduct in their professional work. This includes being honest, fair, and objective in all their dealings with clients, colleagues, and the public. They must also take responsibility for the consequences of their work and make sure that their designs and products meet the required safety, health, and environmental standards. One example that pertains to this project includes the proper citation of data. If the data was not personally collected by the individual, which it wasn't in this case, it must be properly cited so that credit may be given to the proper individual or organization. This also means that the data can become credible, having quality and accuracy, if it comes from a highly reputable organization, NASA being the organization in this scenario.

Professional responsibilities in engineering also include the need to stay up-to-date with the latest developments and technologies in the field. Engineers must continually update their skills and knowledge to stay competent and effective in their work.

Ultimately, ethical and professional responsibilities in engineering are critical for ensuring that the work of engineers is carried out with the highest standards of integrity, professionalism, and accountability. By upholding these responsibilities, engineers can help to build trust and confidence in their profession and contribute to the advancement of society.

Data

The data was provided by the National Aeronatuics and Space Administration (NASA), using the ISS Trajectory Data provided on this website:
https://spotthestation.nasa.gov/trajectory_data.cfm

While there are two different types of files, this application uses the XML format and then converts it into a JSON format. This allows for the program to easily use the data, which gets converted into a python dictionary from the JSON format.

Ultimately, this data set consists of epochs, which is simply a point in time that the ISS is located. It is represented in 3D cartesian coordinates (X, Y, and Z components), as well the corresponding vector components (X_DOT, Y_DOT, and Z_DOT). The units of the coordinates are kilometers, while the vector components are in kilometers per second.

For more information, visit the original site (linked above).

Work Cited

Jaeestee [Steven Oh]. “ISS Tracker Application.” *github*, https://github.com/jaeestee/ISS-Tracker-Application

Keeter, Bill. “ISS Trajectory Data.” *Spot The Station*, NASA, Updated 27 July 2021, https://spotthestation.nasa.gov/trajectory_data.cfm