International Space Station Tracker

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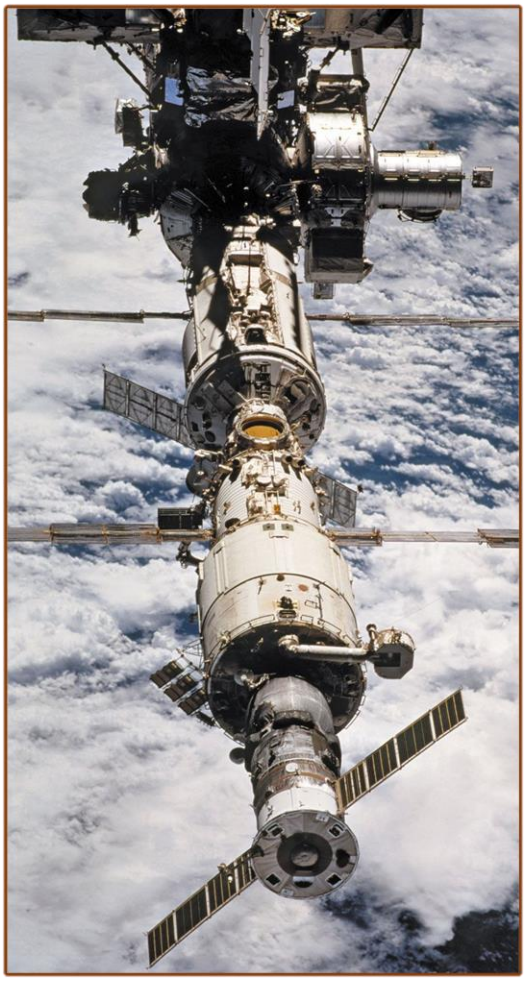
Motivation

The International Space Station (ISS) is a modular facility in space orbiting the Earth. From its launch in 1998, it has served as a laboratory to run experiments for various scientific fields and assisted in monitoring the Earth's climate and natural disasters. Additionally, it has played a critical component in space exploration, providing a platform to test new technologies for usage in future space missions.

The ISS itself is a fascinating example of a human engineering accomplishment. It is one of the most comprehensive spacecrafts ever built, taking 10 years and 30 total missions for it to be assembled. It is an exciting tool that provides unique opportunities for the public to learn about space and the latest developments. Tracking the ISS's movements is essential for the safety of the spacecraft, as well as to protect the crew inside who run experiments aboard. Additionally, by monitoring the ISS, the effects of microgravity on spacecrafts can be researched for the development of technology to make space flight more efficient.

With developments in the aerospace industry, various manmade objects have been launched into space and are still in orbit. Tracking the ISS is crucial as it can help prevent collisions with the other manmade objects, as well as debris in space. As a result of the speed the ISS travels, even small objects being in contact can have significant, unintended consequences. Thus, by having the ability to track the spacecraft, potential collisions can be avoided to ensure the safety of the station and the crew.



Tracking the ISS provides essential data of the spacecraft interacting with the space environment. The data can be studied to develop better materials, mechanical systems, and other functions of the spacecraft to improve the efficiency and reliability. This can provide insight into designing future spacecrafts that can tolerate the conditions of space, and to identify any challenges that may be present in future space missions.

Project Description

The objective of this project is to develop an application where users can request data regarding the ISS. The program utilizes various Python libraries to request the data from the ISS NASA website and returns information the user queries for. In total, the user can request using thirteen different routes,

including the current location of the ISS and the speed of the ISS at a given time.

Flask is utilized for the development and usage of this application. Flask itself is a Python library for building web servers. It provides a basis to handle requests made and to return responses. In addition to Flask, containers are used which allows the application to run quickly with all the needed parts. Docker is utilized to package these containers, which permit any operating system to pull and make use of the container.

To run the project, the source file (iss_tracker.py) and Dockerfile are needed. Users will first need to pull the image from Docker Hub. Afterwards, the containerized Flask application can be started. If the user chooses to build a new image from the Dockerfile instead of pulling the existing image, they can do so as well. After the image has been built and the container is running, the user can start making requests to the program. Once the Flask application is running, it will output as follows:

```
 * Serving Flask app 'iss_tracker'
 * Debug mode: on
WARNING: This is a development server. Do not use it in a production
 deployment. Use a production WSGI server instead.
 * Running on all addresses (0.0.0.0)
 * Running on http://
 * Running on http://
Press CTRL+C to quit
 * Restarting with stat
 * Debugger is active!
 * Debugger PIN: 217-112-909
```

Requests to the API

In total, there are thirteen different requests a user can make. Twelve allows the user to output and manage the ISS data, and the last includes a help request

which will inform the user what requests are available. Once the Flask application is running, the "`help`" request can be run by:

```
curl localhost:5000/help
```

This will output the available requests:

1. `curl localhost:5000/`
2. `curl localhost:5000/epochs`
3. `curl 'localhost:5000/epochs?limit=<int>&offset=<int>'`
4. `curl localhost:5000/epochs/<epoch>`
5. `curl localhost:5000/epochs/<epoch>/speed`
6. `curl localhost:5000/epochs/<epoch>/location`
7. `curl localhost:5000/now`
8. `curl localhost:5000/comment`
9. `curl localhost:5000/header`
10. `curl localhost:5000/metadata`
11. `curl -X DELETE localhost:5000/delete-data`
12. `curl -X POST localhost:5000/post-data`

The first request will output all data from the ISS Trajectory Data source. The next nine requests output data that pertains to the specific request after the "`/`". The last two requests manage the data. If the "`DELETE`" request is made, it will delete the ISS data gathered from the source. Afterwards, if any data requests are made, it will result in an error. The user can reload the data from the source by running the "`POST`" request. This will allow for the data requests to be available again and run without error.

Ethical & Professional Responsibilities in Engineering

A key part in designing and developing applications for public use is ensuring that the program is reliable. Users expect applications to work consistently and a failure of the app can affect the wider public. For example, in instances

where a certain application is used to deliver critical medical information, any delay or failure can cause unintended harm to a patient. Thus, it is important to take appropriate precautions while developing applications, such as backing up and placing redundancies in the program, to eliminate or at the very least minimize failures.

ISS Data Source

The ISS Trajectory Data used in this project is made available by NASA. The data is open for use by the public, and can be requested from their website. Specifically, the data used in this project is an XML data set, which is converted into a dictionary using the "`xmltodict`" Python module. NASA also provides the data in the "`.txt`" format. More information with details can be found on the NASA website.

Citations

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