

# Synthetic Data Pipeline for Pose Estimation

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ENGINEERING & SCIENCE

STUDENT DESIGN SHOWCASE

FLORIDA TECH

## Motivation

The currently there is no simple way to create satellite motion data. To do this users need to animate a single clip for every use case needed. We seek to create an easy to use pipeline for generating large amounts of synthetic data for satellite pose estimation.

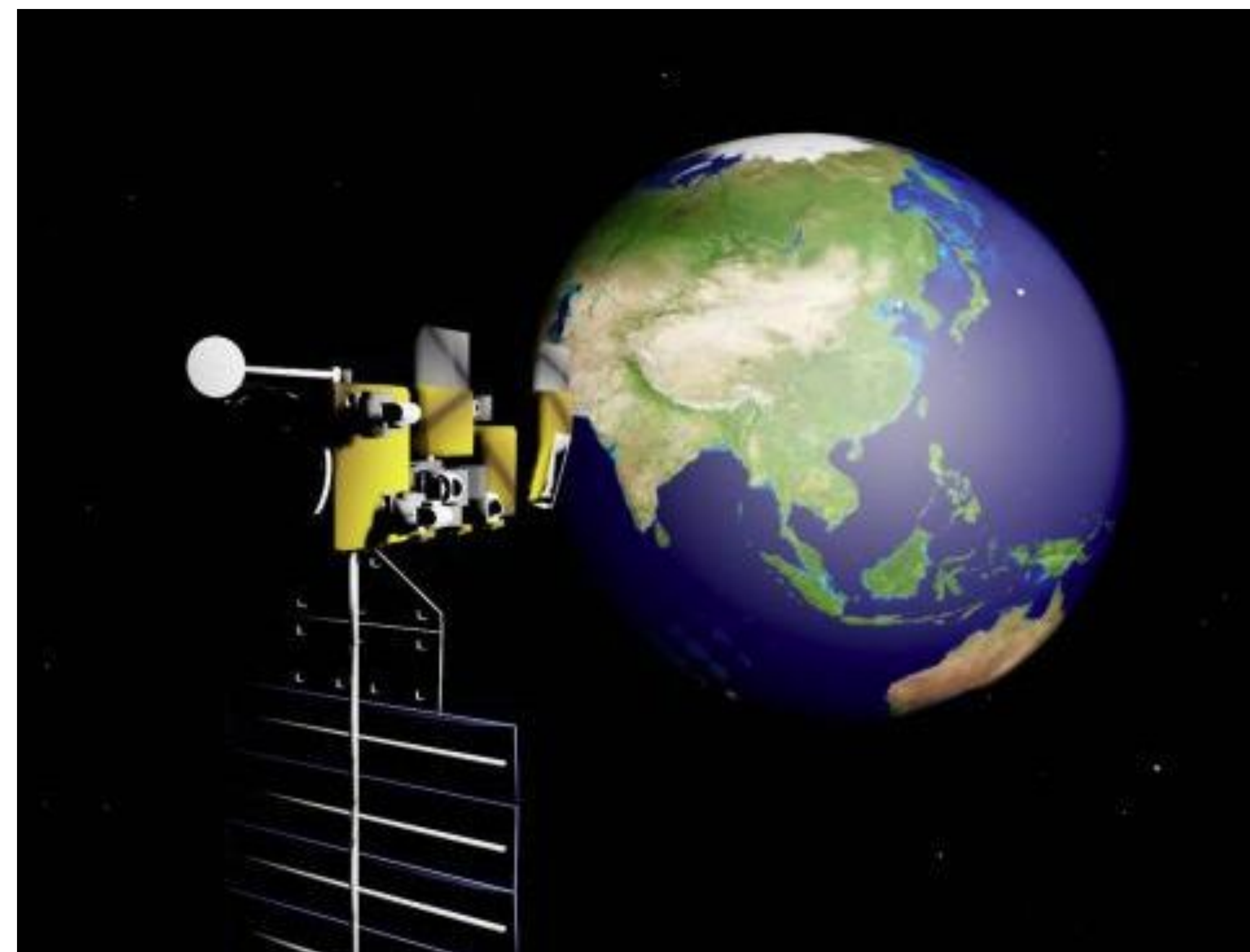
### Goal

- Create an automated system that can render footage of a satellite in motion
- Enable the user to upload their models and backgrounds
- Allow for adjustable the path of motion and lighting features

## Approach

- First find an appropriate software that will allow for programmable rendering
- Learn how to import objects and backgrounds into the 3d space
- Create methods that allow the motion of those objects
- Understand digital cameras to capture stills from the 3d space
- Develop a tool to configure all features for easier usage
- Return video or still images from rendering as well as positional and rotational data

## Rendered Image



## Configuration

```
[lighting]
light_type = "SUN"
location = [10, -10, 10]
energy = 10000
rotation = [0.0, 3.14, 0.0] #Necessary if using sun

[camera]
location = [0.0, -6.5, 0.0]
rotation = [1.5, 0.0, 0.0]
lens = 20

[satellite]
satellite_file= "/models/nasa-aqua-satellite-obj/nasa-aqua-satellite.obj"

[background]
background_file= "/code/space.jpg"

[flightpath]
flight_path_type = "FUNCTION" #
positions = [[0,0,0],[5,6,1]] #If using "POINT"
rotations = [[0,0,0],[0,0,0]]
x_eq = "t-24"
y_eq = "2"
z_eq = "t*t"

[animation]
# yes or no for still vs video
animation_lenth = 2 # In seconds
file_format = "JPEG"
output_dir = "Frames/img"
```

## Features

- Custom .obj model and .jpg background selection
- Satellite and Camera motion based of received functions or extrapolated from point values
- Lighting from a point or grid sun lighting from specified direction
- Generated stars to show background motion

## Tools Used

- Blender - 3d environment
- BPY - python library to control 3d space and objects in blender
- TOML - configuration file
- Github - project housing

## Evaluation/ future work

The data pipeline was evaluated for ease of use and received positive feedback. The project will be used research teams to train machine learning models to guess the movement and rotation of satellites.