Synthetic Data Pipeline for Pose Estimation
Software Design Document

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Overview

Purpose:

The purpose of this document is to describe the system architecture and design of the synthetic data pipeline for the Pose Estimation project. The purpose of this project is to generate video renders of satellite flight paths using 3D animation software in order to generate data for the primary machine learning research group.

Scope:

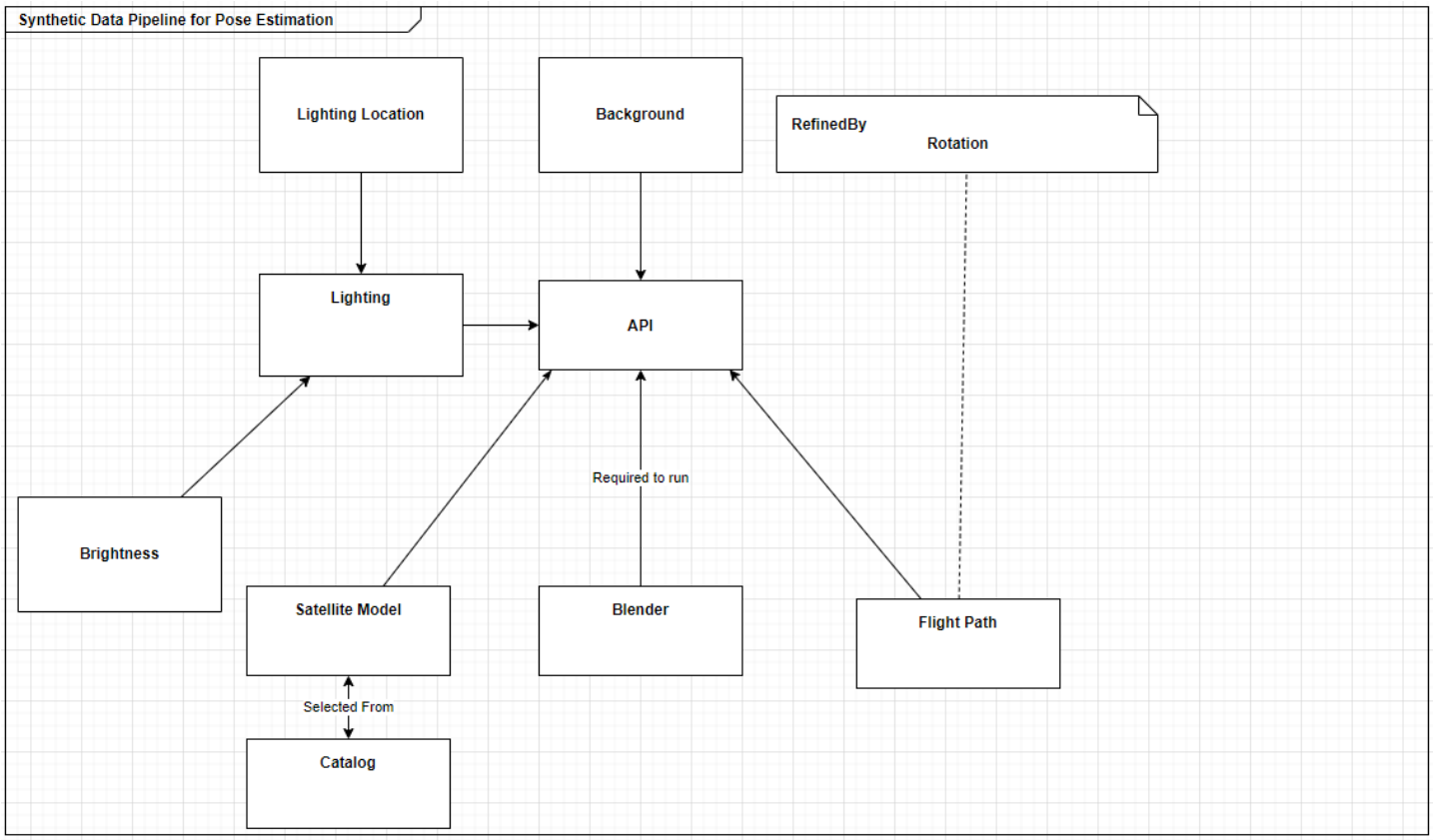
The scope of this document is the system design of synthetic data pipeline. It does not cover subcomponents from outsourced software that may be used within the project.

Context (Audience):

The context in which this product is going to be used is to generate a large amount of data sets for the client team (primary research group). However any party that needs different permutation of flight path depending on setting and satellites

Summary:

The purpose of this document is to describe the system design for Project's final product which is a API that return video rendering of flight paths depending on the flight setting and satellite model


Synthetic Data Pipeline for Pose Estimation
Lighting Location
Background
RefinedBy
Rotation
Lighting
API
Required to run
Brightness
Satellite Model
Blender
Flight Path
Selected From
Catalog

Description

- Lighting
    - Lighting Location
        - This will represent the location (pixel coordinates) of the main light source/s in the video render. This will help standardize how the rendering will be viewed as the satellite follows its flight path.
            - This will also help standardize the data set of the client team as their ML models might require their light source to be homogeneous across their entire/partial data set.

    - Brightness
        - The user is able to adjust how bright or how dim the light source is. This would either give the user a good idea as to where their flight pattern is going or it can be used to simulate the sun

- Catalog
    - This Catalog contains a selection of Satellite Models that the user can choose. There are plenty of different types of satellites and having a catalog will help determine different flight paths for different satellites

    - This will be helpful in generating large amounts of data as one of the client's requirements was to be able to create numerous permutation of flight paths by changing the setting and satellite model

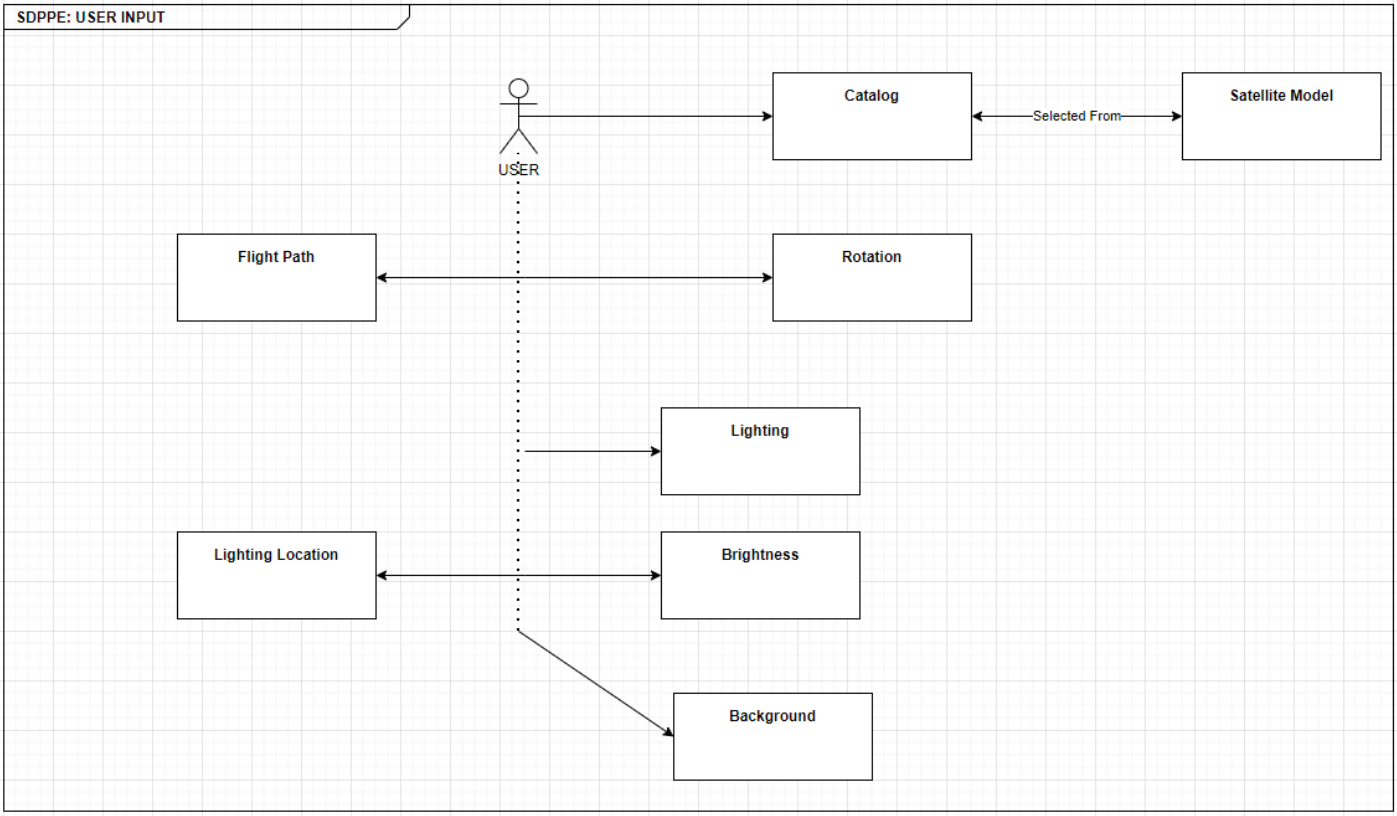
- Background
    - Another component of controlling the lighting is to control the background of the rendering. This is important because we do not know exactly what client models will be able to read so we must provide flexibility on our part.

- Satellite Models
    - These models will be used as a base for the flight simulation. Different models will have different flight paths depending on the lighting and rotation settings. (Note: According to the Requirement Doc and Test Doc, the user just selects from a list of satellites. Making your own satellite model is an option but not necessary)
    - The client team must be able to load their own models as their project needs to create a lot of training data with very little work by using different combinations.

- Flight Path
    - This will be the path that the satellite model will go through and will most likely simulate the flight path of most satellites orbiting earth

    - This path needs to be adjustable to create different alternative paths that can be contribute to their training or testing data set

- Rotation
    - The model will be given custom input to rotate in any direction. This rotation can also be used in conjunction with the flight path.
    - This will be represented as satellite rotation (orbit) which is represented as a
        - **Rotation axis** which is a unit vector indicating the direction of an axis of rotation as an angle θ
        - The **magnitude of the rotation** is the motion of a certain space without considering direction
- Blender
    - The tool that is necessary to use in order to make this simulation possible.


SDPPE: USER INPUT
USER
Catalog
Selected From
Satellite Model
Flight Path
Rotation
Lighting
Lighting Location
Brightness
Background

Description

This is the client UML which represents the functionality of the final product. Our final product is an API which has all of these different parameters and inputs.

- Catalog
    - Satellite Models
        - This is a menu describing all of the possible models that can be loaded into the 3D rendering

- Flight Path
    - Rotation
        - This is input parameter under which is represented by two components
            - Rotation axis
                - This is represented by a unit vector indicating the direction of an axis of rotation as an angle θ
            - Magnitude of rotation
                - Force of rotation represented by integers

- Lighting setting
    - Lighting location
        - This is represented by the location (pixel coordinates) of the main light source/s in the video render.

    - Brightness
        - This is represented as candelas per square meter (integer)

    - Background
        - This is represented as png or equivalent data formats