NORTHROP GRUMMAN
ENGINEERING & SCIENCE STUDENT DESIGN SHOWCASE
FLORIDA TECH

Cognitive-Driven UAS

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Goal

To provide enhanced safety when operating Remotely Piloted Aircraft Systems (RPAS) in close proximity to people by developing autonomous navigation capabilities while minimizing risk to people on the ground, and avoiding hazardous weather.

Previous Approaches

- Check and repair navigation, to avoid densely populated areas described as highly populated areas in flight maps.
- Augment check and repair, to include polygons representing weather formations. Weather data retrieved from weather API, and convex hull implemented to build polygons from data.

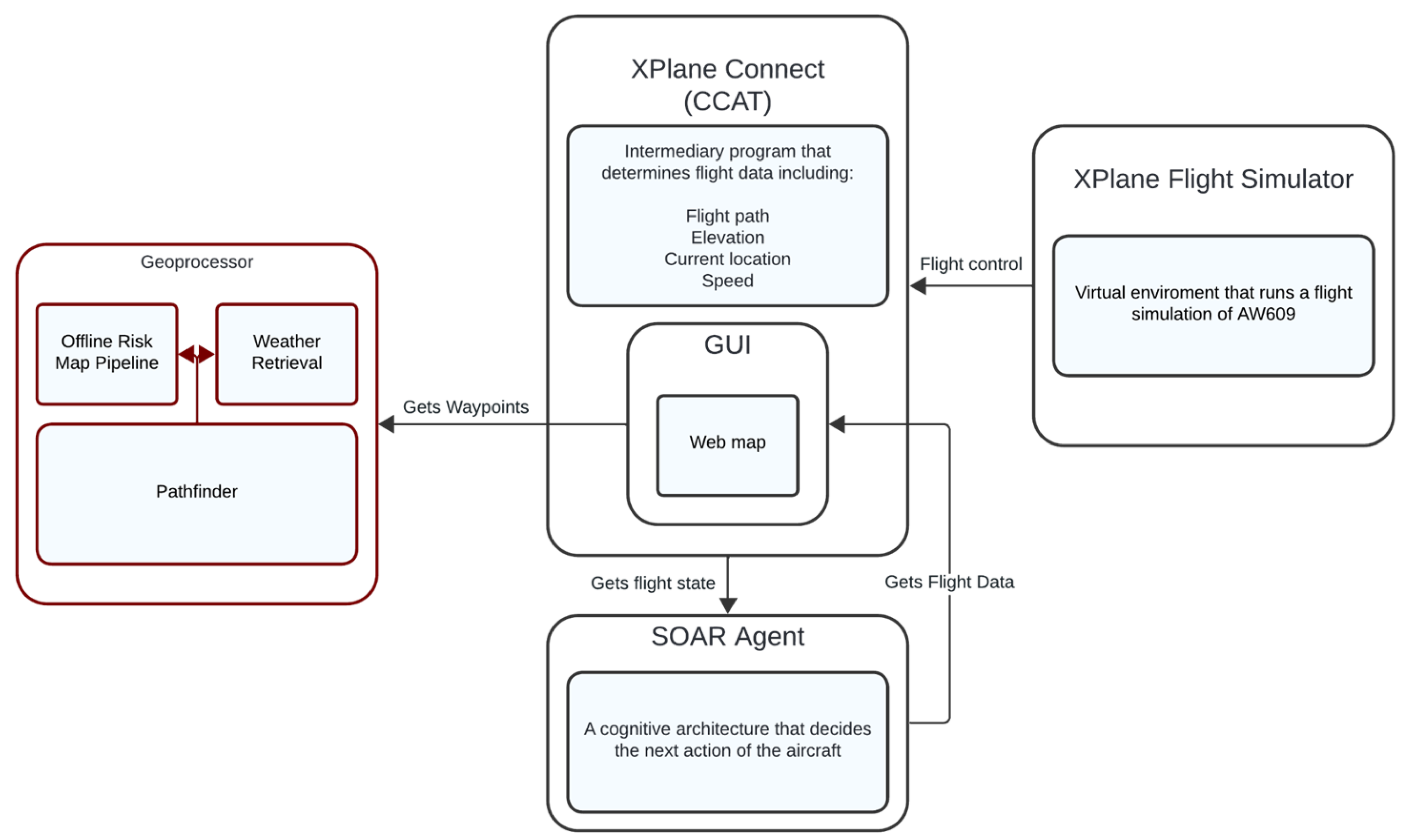
Our Approach

Previous approach relied heavily on manual data construction, as populated areas were manually described by enclosing polygons.

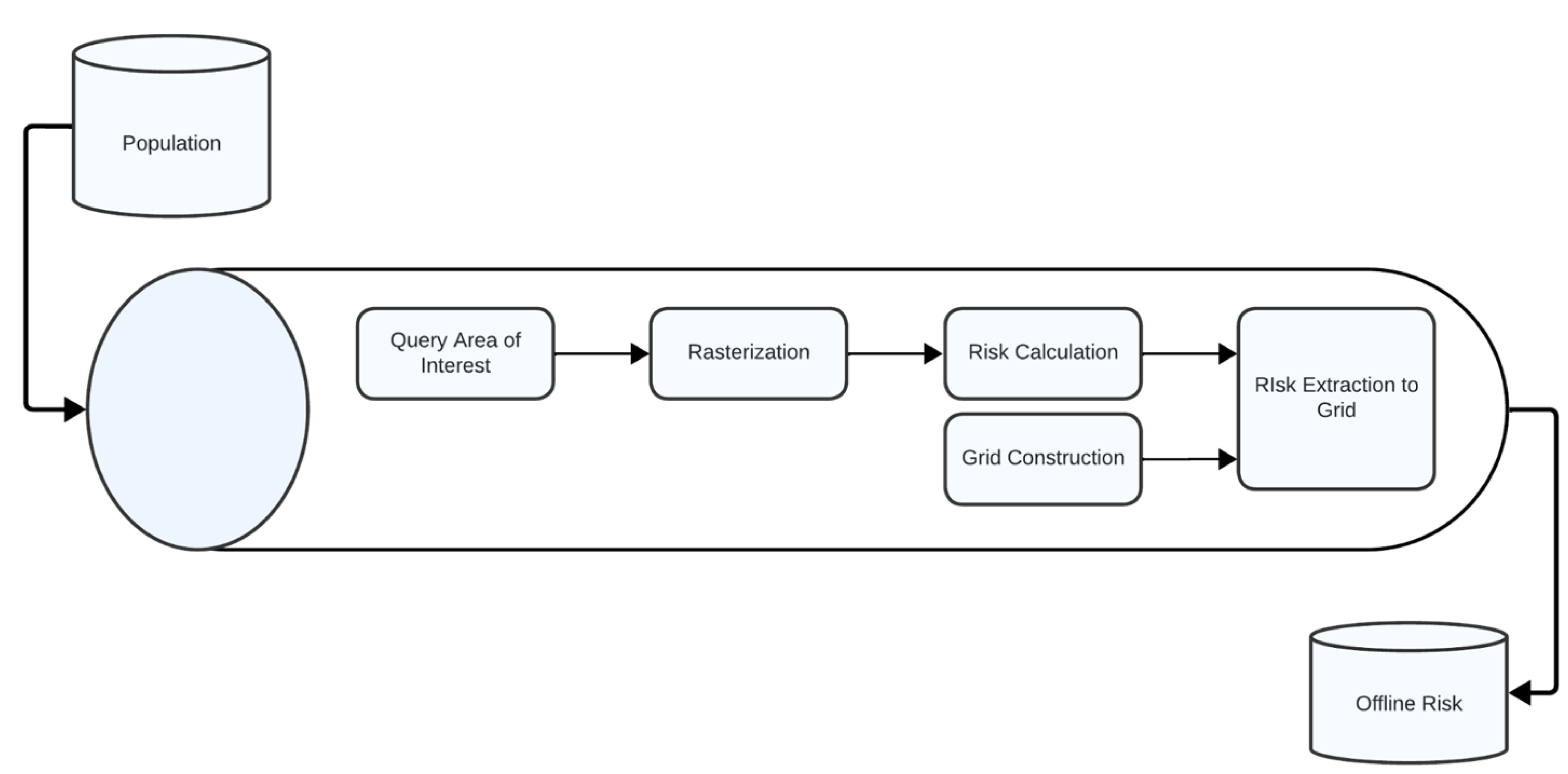
Transform project to use population database, and retrieve weather data from data providers.

Allows for quantification of risk, which is the first step to making context-dependent tradeoffs.

Software Architecture



Data Processing Pipelines

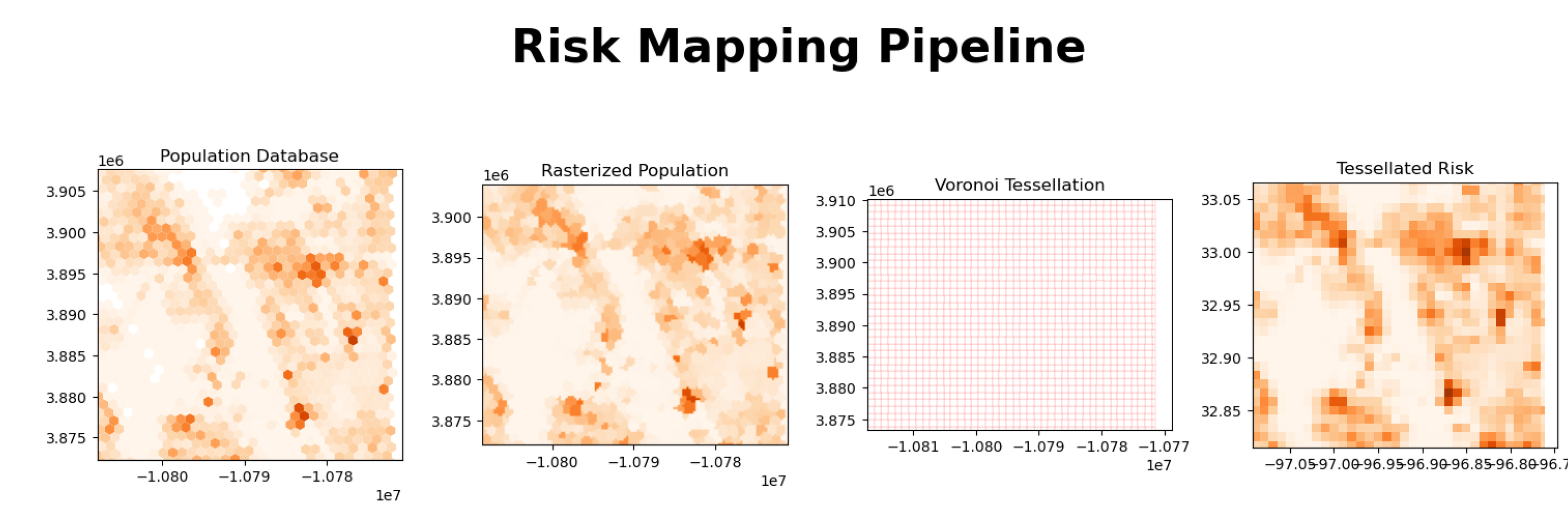


Challenges

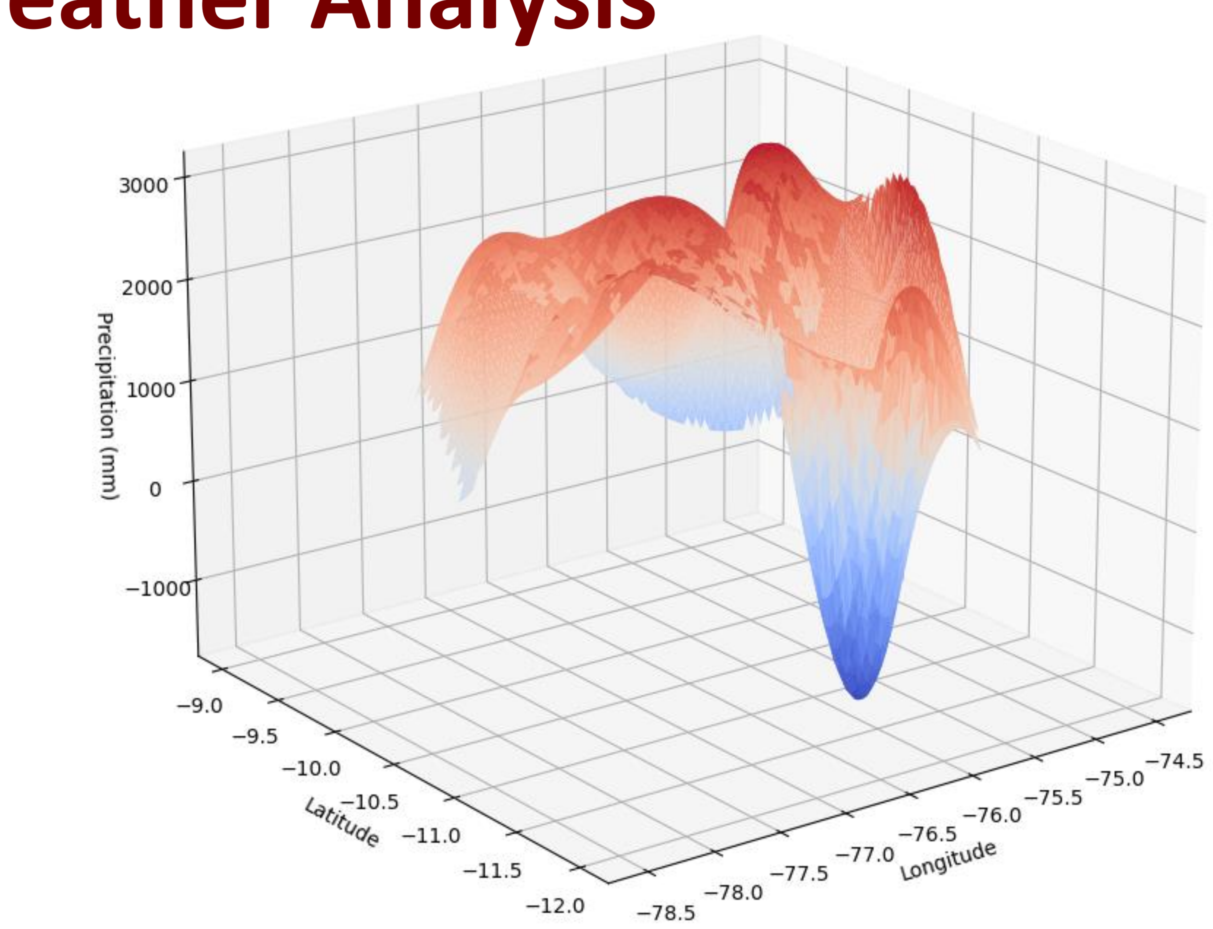
- Domain knowledge: We had to spend time researching geospatial terminology and methods.
- Data processing: Traditional geospatial methods proved too slow for our needs, so we worked to heavily optimize our code.
- Weather acquisition: Acquiring weather data quickly becomes difficult because of API rate-limiting and cost.

Spatial Analysis

Extraction was done by converting population and tessellation to arrays, then grouping, sorting, and zipping together.



Weather Analysis



Future Work

- Implementation of various pathfinding strategies
- Reinforcement learning with the SOAR agent to discover which factors are most important in safe flights.

Acknowledgements

- Kontur for the population data
- Previous Team