

Multi-Vehicle Patrolling for Assessing Port Disruptions

matplotlibpython

AtlassianBitbucket

Student: Mathew Silva
Product owner: Leonardo Bobadilla
Instructor: Masoud Sadjadi

Objective

Our objective for this project was to create a system that would plot patrol routes for autonomous vehicles. Using our system, autonomous air, ground and sea vehicles can be used to patrol Port Everglades and monitor specific user defined areas for suspicious activity making the port more secure and productive.

Patrol Area



Port Everglades is one of the most active cargo container ports in the world.

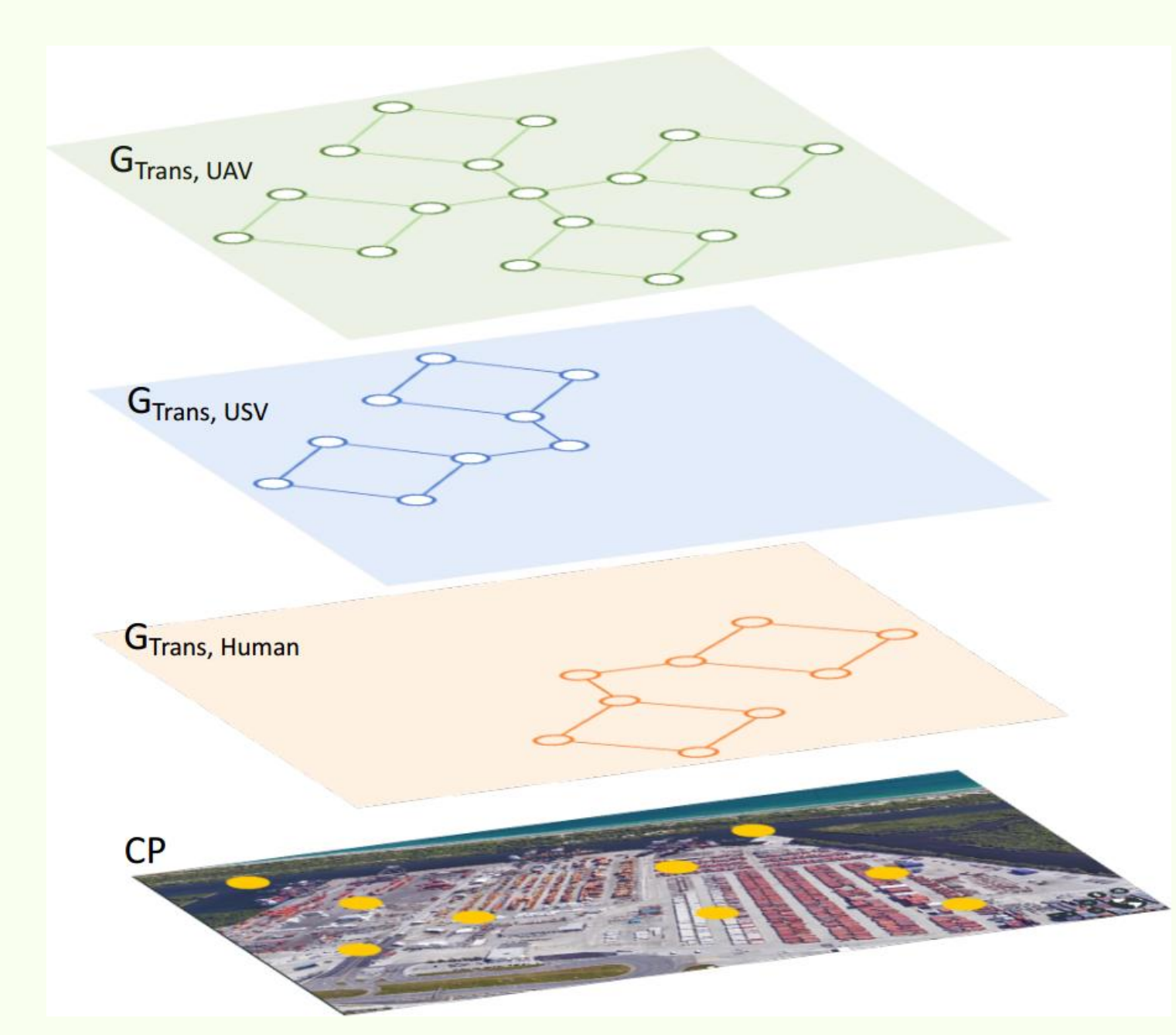
There are many areas that are critical for port security and productivity.

Figure 1. An illustration of critical infrastructure points from a distribution based on a survey taken by Port Everglades. Point size corresponds to relative importance.

Requirements

- The system should take into account vehicle type (air, ground or sea).
- When determining routes, critical points should take priority over other areas.
- Patrol routes should be no longer than the set energy budget for each vehicle.
- Patrol routes must be randomized to some degree so that their next action is not predictable to observers.

Motion Maps



A discrete network of nodes is used to represent the traversable paths for each type of vehicle.

The network is overlaid on a birds-eye view of the port to show the area for which each node corresponds.

Figure 2. A visualization of how different vehicles have different networks of traversable nodes.

Class Diagram

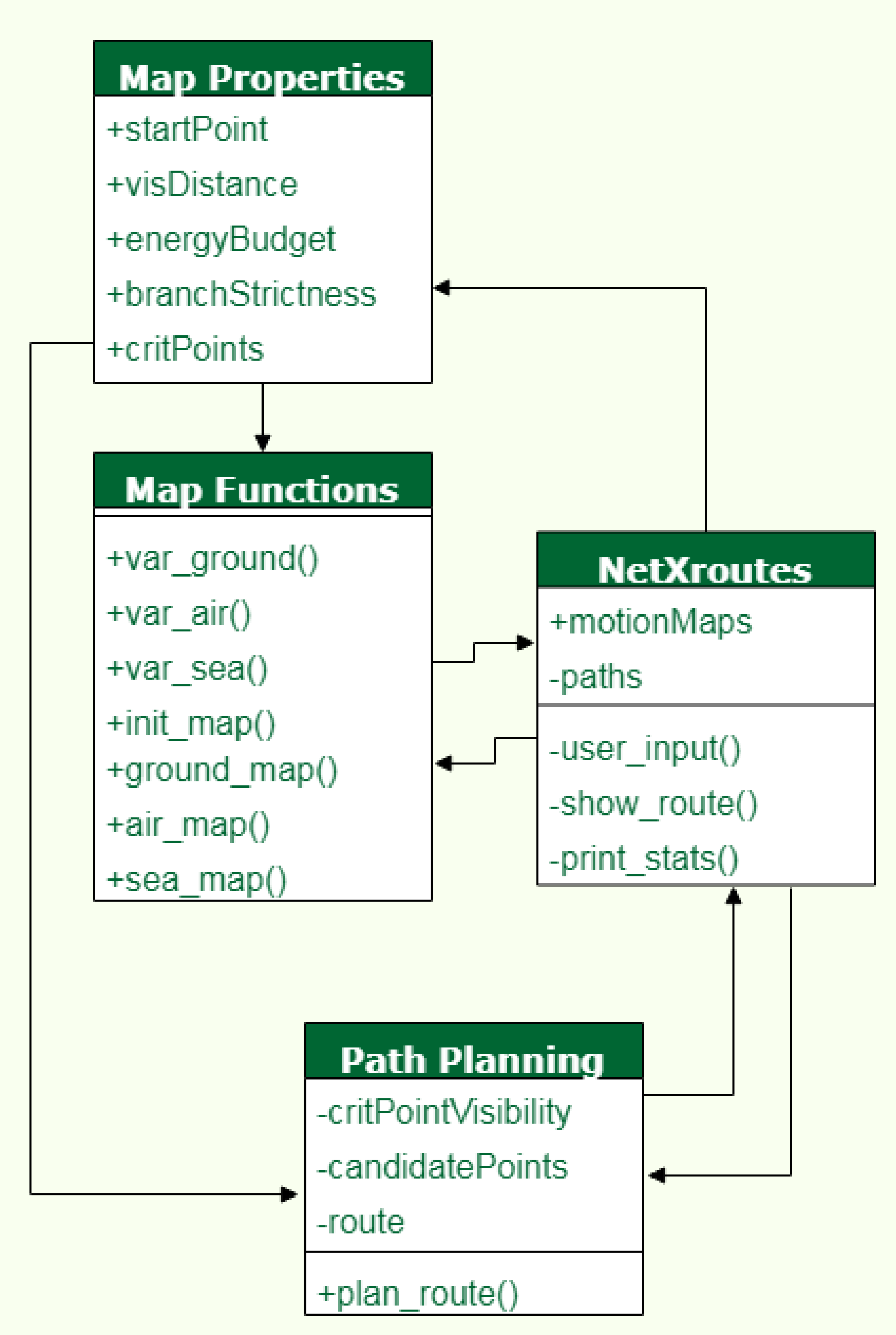


Figure 4. A simplified diagram of the four classes that make up the system.

Patrol Routes

After running the route planning algorithm all of the points that will be traversed and seen are recorded.

All of the recorded points are plotted on top of a birds-eye view of the port for user reference.



Figure 3. A sample output of a route that would be taken by a ground vehicle. The red points show the route taken and the blue points show the areas seen from the route.

Acknowledgements

This project was a collaborative effort between Gabriel Weaver, Leonardo Bobadilla, Tauhidul Alam, Alexander Campaneria and myself. It would not have been possible with out each of their ideas and guidance.