Path Coverage Planning

Arbitrary shape to polygon

Input: shapefile
Output: a polygon or a list of polygons as a piecewise function (maybe).

Currently considering:
Breaking the map area into two categories: large open areas & more complex terrains (so kind of like interpreting an area as trunk - open areas, and branches - complex areas attached to the trunk).
Large open area can be covered using grid-based sweep. More complex terrains can be covered using spiral spanning tree.

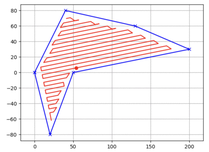
Need to look further into how to divide up the polygon to 1) minimize the number of polygons, 2) consider flying over areas that aren't included in the mapped region.

Path Generation given a Polygon

Ideal output is a set of parametric piecewise functions (given a time, the data can spit out the coordinate "longtitude and latitude")

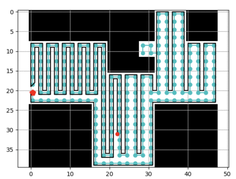
Do we want the drone to end at the same place where it started?

Grid-based Sweep

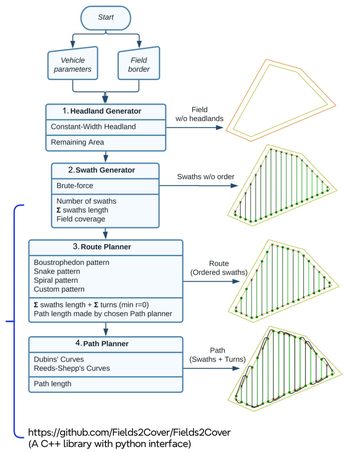


https://github.com/AtsushiSakai/PythonRobotics

Spiral Spanning Tree



https://atsushisakai.github.io/PythonRobotics/modules/path_planning/coverage_path/coverage_path.html



https://github.com/Fields2Cover/Fields2Cover
(A C++ library with python interface)

Breaking path into waypoints

Input: how sparse we want the waypoints to be (a set time interval).

Output: Based on the piecewise parametric function from the previous step, generate a set of coordinates with time stamps (or sequence) as waypoint.

Obtain Height Data from ArcGIS

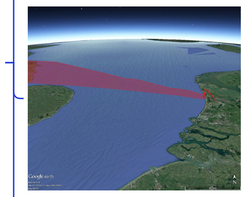
Given a longtitude and latitude, use a python function and ArcPy to contain the elevation at that coordinate.

This should be a function where:
input = (longtitude, latutude)
output = (elevation)

Visualize the Path on a 3D Map

Looks like a simple way to do this doesn't require ArcGIS integration, unless there is a reason we need to use ArcGIS for drone control.

Import coordinate and height parameters into google earth as a .kml file. Google earth can generate a visualization of flight path in respect to the map.



https://stackoverflow.com/questions/38507069/how-to-make-a-flight-path-projection-if-possible-in-python

Send Waypoint Information to Drone (and path calibration?)

Some potential things to look into in the future.
1) How will the drone interpret the waypoint data we send to it?
2) How can we make sure the drone is always following the given path?