**Motivation:**

The principle system requirements that impacts the path planning team are:

Req 1: The system shall perform a search for targets in an unknown environment

1.2: The system shall navigate unknown environment, avoiding collisions with obstacles

Req 4: The system shall be autonomous

These suggest important derived requirements:

1. We are operating in an unknown environment, therefore, re-planning will be necessary as obstacles are found
2. Therefore, computational load must be a minimum such that the time required for re-calculation of the path is on the order of milliseconds

**Proposed solution:**

While the overall search pattern has not yet been finalized, with no prior idea of where a target is the entire space will need to be searched. Therefore, it is likely we will employ a simple back and forth swath search. In order to navigate around local obstacles however, a path planning algorithm becomes necessary.

In order to achieve necessary planning time, a 2D path will be calculated in lieu of a 3D one.

Two algorithms are being evaluated, A\* and PRM.

**Algorithm Details:**

A\*/Voronoi

A\* is a widely used algorithm which uses weighted cost functions to determine which node to choose.

Cost:

Where g(n) is the known cost of getting from initial to node n and h(n) is an estimate of cost to get from n to goal node (shortest path).

Inputs:

A\* uses as list of nodes defining locations that are able to be visited. In the 2D case, these nodes are listed in terms of their x and y coordinates.

Outputs:

A\* will generate a path. This path is comprised of a list of nodes which will guide the vehicle from start to goal nodes.

Obstacle avoidance: