In order to be prepared for the PDR, we need to outline our robot’s node structure. This document serves to provide that outline and to specify the algorithms we will be using for our frontier analysis.

We intend to rely on gmapping for path planning, obstacle avoidance and SLAM. Our program will subscribe to gmapping’s occupancy grid, and use the following algorithm:

* Wavefront out from the robot, terminating at unexplored cells. The terminal cells form the frontier. If the wavefront terminates without finding any unexplored cells, then the map is complete. In that condition publish the map to a new topic in rviz (displayed in a unique color to let the user know the map is complete).
* Divide the frontier into subfrontiers using simple blob detection. Compute the center of mass for each subfrontier.
* Select a random center of mass, and publish it as a navigation goal for gmapping’s built-in path planner.
* As the robot drives to the goal, monitor gmapping grid updates. For each update (as time allows), wavefront out from the goal point to determine whether it is reachable. If the goal point is determined to be unreachable, stop driving. Otherwise, drive until the goal is reached, then repeat the algorithm.

This project should only require one algorithm, namely the wavefront search. We will use a single node to handle both event control and wavefront execution, due to the lack of any parallel processing requirement. Implementation tasks are as follows:

1. Create skeletal node that can receive updates from gmapping\_slam and publish navigation goals.
2. Develop a wavefront algorithm which accounts for the geometry of the robot in determining accessible points.
3. Determine probabilistic parameters which produce reasonably accurate map results in the program given the known properties of obstacles in the room.