# RBE 3002 Unified Robotics IV: Navigation

### Lab Assignment #5: Mobile Robot Exploration

### Introduction

In this final project, you will implement mobile robot exploration, enabling your robot to explore and generate a map of an unknown environment.

### Objective

Your TurtleBot has been hired as a building surveyor. In this role, the robot must autonomously generate a map of whatever closed space it has been placed in. To ensure that this job is not given to a competitor, generating the map can take no longer than 20 minutes.

The final mapping demo will take place in the AK 120. To prepare for the demo you can practice generating maps for rooms that are easily accessible throughout the week, such as AK120 or AK108, and the basement level rooms of the building. The environment you will be mapping in the final demo will be free of moving obstacles (i.e., people).

Upon successful completion of this project, you will be able to:

1. Autonomously set navigation goals that allow the robot to efficiently discover new areas of the state space.
2. Plan a path and navigate to these goals while avoiding obstacles.
3. Generate a complete map of the space.
4. Halt exploration once the entire space is explored.

### Deadlines

1. PDR’s will be held next Thursday during lab, 4/20/2017
2. Final project Demo’s will be held 4/27/2017 in the Robot Pits in the Rec Center.

*(Please note that dates and times may change as it is the end of the term and we have to work with scheduling with the Rec Center. Please watch for any announcements on canvas)*

**Your presentation will be alongside your demonstration.**

### PDR

The goal of the PDR is to evaluate your group’s plan for the implementation and execution of the final project. Each group will meet with the TA’s to present the plans for completing the project, including a detailed system diagrams.

### Final Project Report

Final submissions must be made through Blackboard. Please submit:

1. Your code should be on a private GitHub repo that is shared with the TA’s and Professor. **The code should be well-organized and commented and must include a ReadMe file to provide an overview of your code organization and instructions for how to run it.**
2. A formal report describing your implementation, including screenshots of the interface when appropriate. Include examples of mapping results in the form of images of the map. This could be for the final demo space in the gym, or for one or more spaces in AK.
3. A video (as a file or YouTube link) demonstrating the capabilities of your system. The video should include both a video of the robot, and screen capture of RVIZ during operation.
4. Any external code used for this lab should be referenced and cited within the formal report.

### Project Presentations

During the lab period, each group will make a short presentation (~5-10min) describing their final project solution. Videos and screen shots of the interfaces are encouraged. All members of the team must participate, and each team should seek to demonstrate their mastery of the course content. Questions will be asked to each team member after the presentation. The presentation will be worth 15 points towards the final project grade.

### Robot Navigation

Some things to keep in mind for the Final Project:

* Paths should be highlighted on RVIZ such as the robot A\* path, frontiers, expanded walls
* Ensure your expanded walls will work – many times teams don’t take into account the wider laptops and the USB plugs on the sides!
* The robot should stop when the space has been explored.