

Fall 2019  
CS 480/580: Intelligent Mobile Robotics  
Assignment 2 (9% of total grade)  
~~Due time: Tuesday 9/30 11:59 PM~~  
**Due time: Tuesday 10/1 11:59 PM**

## GOAL

The goal of this assignment is to give students first-hand experience of using mobile robots in simulation. More specifically, students will learn how to use ROS packages to do mapping, localization, and SLAM, and how to create programs to drive the robot to move in unknown environments.

For technical questions, please first post on Piazza and leave it there for at least 24 hours. You are indirectly helping other people by doing so. If no one knows the answer, please email the instructor.

## INSTRUCTIONS

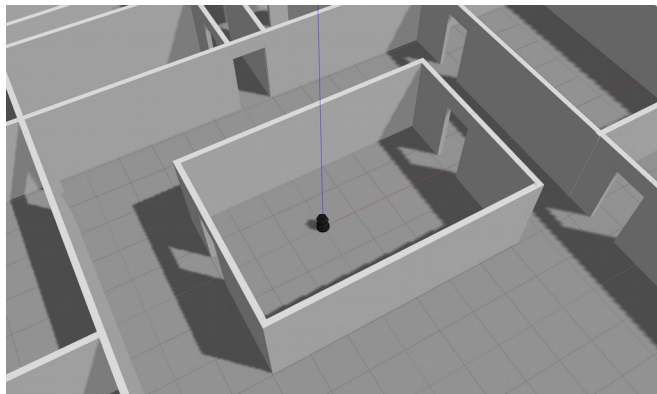
*Students will use Ubuntu 16.04 with ROS Kinetic.*

*This assignment can be done using **either C++ or Python** (no preference). There is a prebuilt Gazebo world environment provided:*

***Gazebo world for Kinetic:***

<https://dl.dropbox.com/s/1q30x5qxf0mme7l/kinetic.world>

The following is a visualization of the world environment through Gazebo:



Students will need to develop code (while using existing ROS packages) to enable a mobile robot to autonomously build a map of the world.

For instance, one may want to repeatedly send control signals to the robot platform to help it cover the whole world. At the same time, one may want to run a mapping algorithm, e.g., Gmapping, to build the map. The following is a link to Gmapping in ROS:

<http://wiki.ros.org/gmapping>

To start Gazebo, you can use the following command:

```
roslaunch turtlebot_gazebo turtlebot_world.launch world_file:=/path/to/kinetic.world
```

To start Rviz for visualization, you can use the following command:

```
roslaunch turtlebot_rviz_launchers view_navigation.launch
```

The most important is to enable the robot **exploration** behaviors in the map building process. Random exploration is one strategy, while wall following (e.g., always turn right a bit if the robot cannot move forward) can be slightly better.

## WHAT TO TURN IN

~~Students will submit a link to a YouTube video (in the body of your submission email) that shows:~~

Students will submit a link to a YouTube video (or two links to the two videos separately), which will be placed in a readme.txt file in the src folder, that shows:

1. the robot (in Gazebo) autonomously navigates in the world; while a map being incrementally constructed in Rviz
2. autonomous navigation to a predefined position using the learned map

Students also need to turn in a single file (in tar/zip/rar format), and name it as your last name (initial in uppercase) followed by the initial of your first name (uppercase). For example, the file name should be “ZhangS.tar” for the instructor. This tar file includes the code, as well as the generated world map.

Students will need to create a package (that includes a single launch file) in such a way that

running the following command will start the autonomous map building process.

```
roslaunch ZhangS assign2.launch
```

***The instructor may ask students for live demonstrations. In that case, please do not take it personally.***

Upload your submission (less than 2M) to Blackboard.