UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG
School of Computer Science

Robotics

Assignment

1 Formalities

- You are allowed to work in groups. The maximum group size is 4 and the minimum group size is 2.
- The assignment handin will be made up of
  1. A video showing your code in action (about 3 min in length)- make sure that you describe your work in the video,
  2. The scripts that make up your agent.
  3. A one page document outlining the algorithms and techniques used in your project. In the worst case you can spill over to two pages, but try your best to keep it to one page.

2 SurveillanceBot

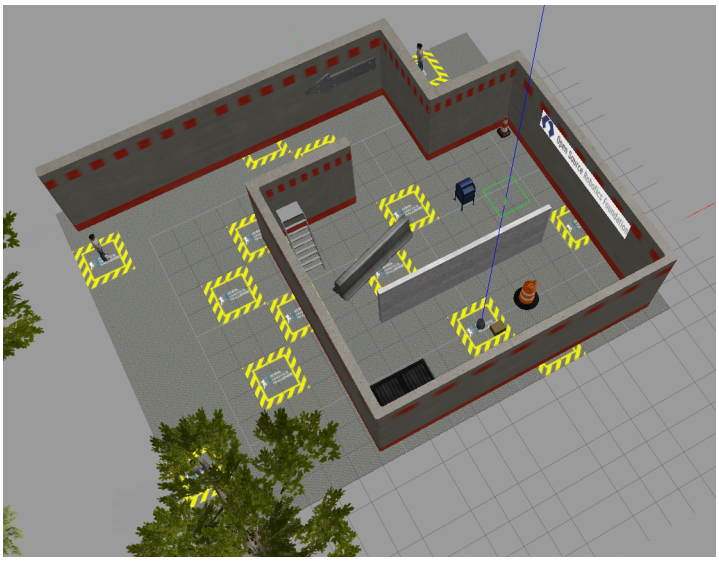
2.1 The mission

You have been hired by a top secret government agency to deploy a robot to monitor an environment looking for a suspicious object.

The robot is a simple turtlebot, for government budget reasons. The environment is given to you in figure 2.1.

Your requirements are as follows:

1. Create and join your assignment groups on moodle
2. Your robot needs to explore and build a map of the highlighted section of the environment, shown in figure 2.1. Note that you can use gmapping for this. Note that gmapping has a number of parameters which must be set in order to function effectively. For example, the minimumScore argument works better if set to 100000. If you find that your mapping is just not functioning effectively, you probably need to find better parameters.



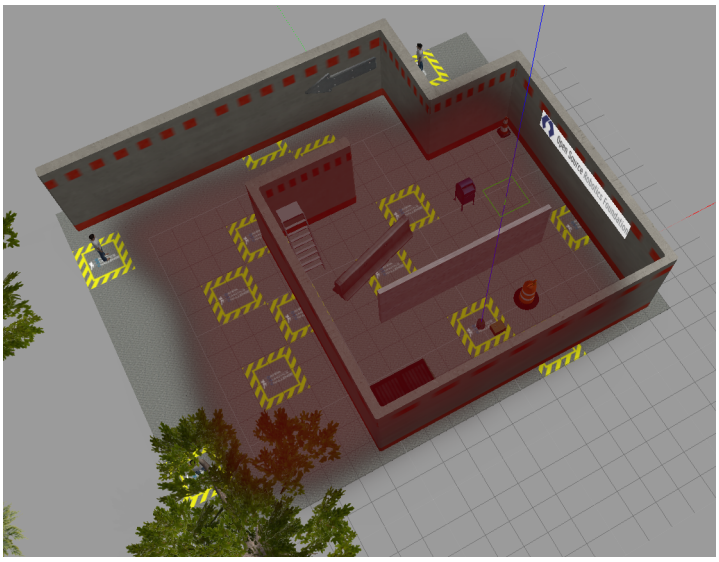
3. You must then provide a node that reads a location (x, y) from standard input and navigates to that location. You must use the occupancy map along with some control mechanism and motion planning algorithm that you implement in order to do this. You can use the gazebo state service to get your current location, or you can use the built in particle filter provided by the amcl module. It will be easier to use the state service though.

4. **Masters only** - You must also provide a node that does a visual scan of the pixels from the robot to determine if a Utility Cart is in the current view of the robot. The Utility Cart can be inserted anywhere into the world for testing. Note that the Utility Cart is a large, bright green object and so can be detected a bit more easily than most things. If a utility cart is found, the node should output "Yes" to the /witsdetector topic, otherwise it should output "No".

5. The submission must include a video which shows everything working. You must navigate to at least two different locations and show the node successfully outputting Yes or No to indicate the presence or absence of the Utility Cart.

2.2 Setting up the environment

In order for the setup to work, you need ROS kinetic installed. The system has been tested using the singularity based install that is available on the course page on moodle. Once you have launched your system, you can download the environment and compile it. On future runs, you should not need to repeat those steps, and can just run it as necessary.



2.2.1 Downloading

You can download the environment from the lamp server using the following commands. These should be run from inside your singularity or docker environment.

```
wget https://lamp.ms.wits.ac.za/robotics/robot_assignment_ws.tar.gz
tar zxvf robot_assignment_ws.tar.gz
```

2.2.2 Compiling

You can then compile the environment using catkin_make from inside the workspace folder in the docker or singularity instance.

```
cd robot_assignment_ws
catkin_make
```

2.2.3 Running

You will need multiple tabs to run the simulator, as you will need to start various components, and then will need to run your code in yet another tab. In one tab, type:

```
./startWorld
```

You can press Ctrl+Shift+T to open new tabs. You will have another terminal from which you can run your custom code. Don't forget to set up your terminal by typing:

```
source devel/setup.bash
```

Consider reading through the startWorld script to see how it works.

2.2.4 Example

A brief tutorial on how to do mapping with a simulated turtlebot can be found at the following link:

Click here

Note that when you do your gmapping, you should be sure not to start another gazebo instance.