Homework 3- Planning

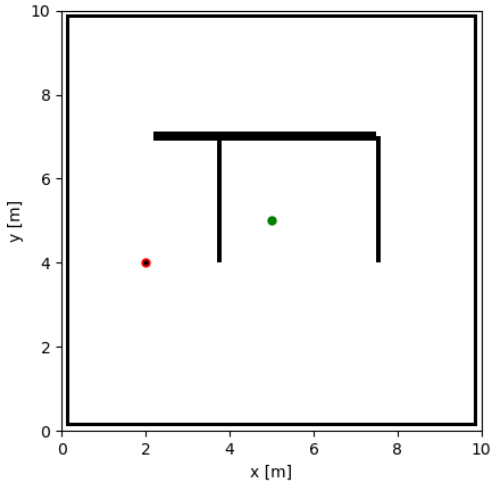
-- Course: *Intelligent Robotics – Professor: Qi Hao*

Coding Homeworks. Most of coding assignments will be done by Python(>=3.5) under a simple robotics simulator. You can follow the Coding instruction to use this simulator to complete the coding question1,2,3. Your final submission should be a compressed package with extension .zip, which includes your codes and explanations (you need to know how to write the manuscript with Markdown or LATEX, the scan version is also accepted). Your code should be run step-by-step without any error. Real-time animation is also encouraged.

Note: The graphs as shown below are only simple demonstrations to help your understanding. You can develop your own algorithms to achieve higher performance.

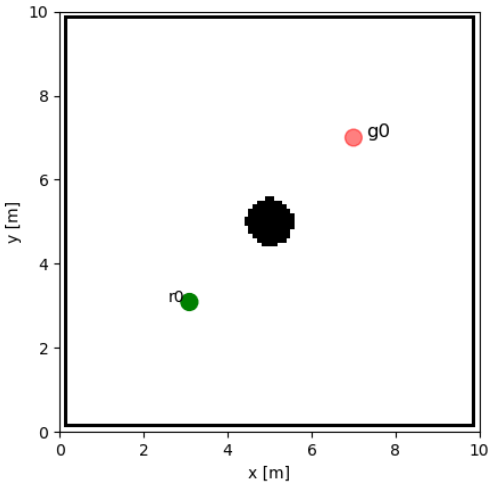
Question1

Simulate the Astar algorithm depending on the given grid map. You can follow the Coding instruction to use the robotics simulator ir_sim 1.1.8 to complete this task.



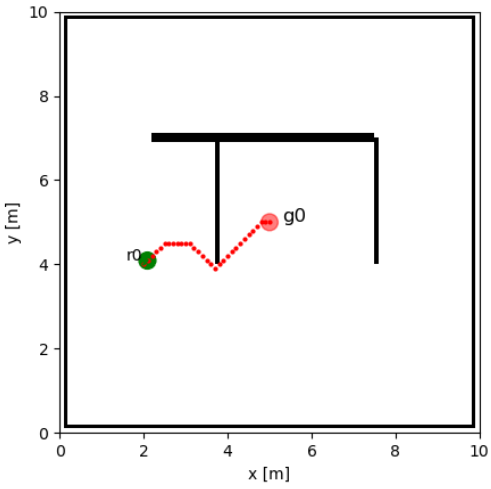
Question2

Simulate a robot to achieve the collision avoidance motion with dynamic window approach (DWA). Please follow the Coding instruction to complete this task under ir_sim 1.1.8.



Question3 - Extra Credit

Combine the Astar and dwa to achieve the 5D planning under the given grid map. Please complete this task by following the Coding instruction.



Coding instruction

Install the intelligent robotics simulator

```
pip install ir_sim == 1.1.8
```

Code for question1

There are four files for question1 in the source folder, *question1.yaml*, *question1_run.py*, *Astar.py*, and *grid_graph.py*.

- *question1.yaml* is the configuration file for the simulator.
- *question1_run.py* is the main program
- *Astar.py* is the file to perform A star algorithm. **You should complete this file for the coding task.**
- *grid_graph.py* is the file that defines the class about the grid map for you to use.

You should complete the file *Astar.py* and run *question1_run.py* to show the simulation results by the following command:

```
python question1_run.py
```

If you want to save the animation, you can run this command:

```
python question1_run.py -a
```

Code for question2

There are four files for question1 in the source folder, *question2.yaml*, *question2_run.py*, *dwa.py*, and *grid_graph.py*.

- *question2.yaml* is the configuration file for the simulator.
- *question2_run.py* is the main program
- *dwa.py* is the file to perform dwa algorithm. **You should complete the cost function in this file for the coding task.**
- *grid_graph.py* is the file that defines the class about the grid map for you to use.

You should complete the functions in *dwa.py* and run *question2_run.py* to show the simulation results by the command:

```
python question2_run.py
```

If you want to save the animation, you can run this command:

```
python question2_run.py -a
```

Code for question3

There are two main files for question3 in the source folder, *question3.yaml*, *question3_run.py*. In question3, you should utilize the file and function defined and completed the in question1 and question2 to complete the 5D planning. You should complete the function **astar_cost** in the file *dwa.py* to complete this task.

Please run the following commands to see the simulated results:

```
python question3_run.py
```

If you want to save the animation, you can run this command:

```
python question3_run.py -a
```

Note: All the gain arguments should be tuned for your own task.