CS26410 2013/14
Introduction to Robotics
Assignment One
Navigating an Occupancy Grid

Tom Blanchard - ttb7, Myra Wilson - mxw

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Submission:

The submission for this assignment will be in two parts: the code for the assignment will be submitted via blackboard, and the writeup will be submitted in the cabinet/postbox in reception. Details of the contents of these submissions are given below. The five, two hour, compulsory practical sessions should be attended where code and programming details will be provided. This assignment is worth 50% of the total assessment for the module CS26410. Note that although you will be working in groups during the practicals, this is an "individual" assignment and must be completed as a one-person effort by the student submitting the work.

Submission of Code Your code should be submitted via blackboard by 4pm on Thursday 27th March. If your account is locked at the time of submission, you should use an alternative email account and email a copy of your code to Myra Wilson (mxw) by the time of the submission.

Writeup The assignment write up should be submitted on Thursday 27th March between the hours of 9.00 and 16.00 in the postbox in reception. Every piece of coursework MUST have a completed Departmental cover sheet showing information about the coursework, your student reference number, name and signature which is available from the intranet under Teaching and Resources. For the written assignment, your name and signature should be folded over and sealed to make your assignment anonymous.

If you are late submitting either code, writeup or both, please complete a Late Assignment Submission form (available on intranet under Teaching and Resources) and hand it in to the Departmental Office.

Assessment: Assessment for CS26410 is by two assignments, each worth 50% of the total mark. This assignment will be marked out of 50.

Task

This assignment has two parts. The first is to implement a simulated robot which navigates an occupancy grid. The second is to transfer this code to a real robot and investigate the differences between the simulated robot behaviour and the real robot behaviour. Work will be primarily carried out using the Player/Stage simulation environment. The work done in practicals will help build towards this assignment and provide opportunities to better understand the problem and potential solutions.

Simulated Navigation

The details for the simulator can be found in the practical sheets on blackboard. These will be explained in the practical session. Your task is to make a simulated robot navigate a supplied occupancy grid from a given start position to a given goal position. Your solution should be able to deal with any start/goal combination.

Your solution should then be expanded to be able to navigate the robot to any given goal position from an unknown start position. This will require that you localise your robot before planning and moving to the goal.

You should also design and implement testing strategies for your code, both for the soundness of the code, but also testing the navigation and localisation strategies you have implemented.

As the simulation environment allows you to use many different programming languages you are free to use any compatible language. The machines in the ISL are set up to use C++ . We cannot guarantee that we can help you or that it will work with another language. If you choose to use a language other than C++ then **you** must ensure that it works. You may use existing algorithms, for example A*/D* search as long as you explain and justify the decision.

The simulation environment is available on Department computers, so this part can be worked on outside the practical session hours.

Real Robot Experiments

You will be given time in the robot practical sessions to test the code you have developed on the real robot. Think about how you might compare the simulated environment with the real environment, what tests would be most appropriate, and how these tests could be set up.

You will need to consider the following areas:

1. Precise turning and movement.
2. Path planning.
3. Navigating a route.
4. Localisation of a robot.
5. Dealing with potential mapping errors.

Deliverables

Marking Criteria

Code - 10 marks out of 50 The code should be annotated and submitted via **Blackboard**. You must submit a **.zip** file containing the code, instructions for running and compiling and any resources required by your solution. Marks will be allocated for the readability and appropriateness of your algorithms.

Code Development - 20 marks out of 50 In this section, you should detail the process you went through to obtain your final solution. This should include alternatives you tried, and the steps you followed to your solutions for the parts of the problem. Detail which algorithms you used and why you felt they were appropriate.

Code and Algorithm testing - 10 marks out of 50 Test your algorithms and code. Provide details to show you checked out start/goal positions, and how you tested your localisation. Detail your trial runs (how many, what did they show?). Discuss how well your algorithms and design worked, do you feel your algorithms be improved?

Real Robot Comparison - 10 marks out of 50 Provide a detailed description of how the real robot differed from the simulation. Why were there differences, and what tests did you try on the robots? Discuss what problems you think you would have faced, if you were to develop your solution further to successfully run on one of the Pioneer robots used in the practical.

The report should also contain a substantial amount of 'evidence' in the form of pictures, graphs, bits of code and any other resources that help to present your solution which do not count towards the word count.

Document History

Version	Date	Author(s)	Description
1.1	Semester 2, 2013	Tom Blanchard	Initial Version
1.2	Semester 2, 2013	Tom Blanchard & Mark Neal	Added Hand-in section and marking scheme.
1.3	Semester 2, 2014	Tom Blanchard & Myra Wilson	Changed project slightly to accommodate other assessed work.