Carleton University
School of Computer Science

COMP 2801
Introduction to Robotics
Course Outline (F2021)

Course Information

Instructor: Mark Lanthier (lanthier@scs.carleton.ca)

The course instructor will be on zoom during the class time. There will be no additional scheduled office hours … however … questions may be asked via email. You should ask all of your questions during the lab/class time, as you work on the lab assignments.

TAs:
Xi Chen (CharlesChen@cmail.carleton.ca)
Jiujiu Duan (JojoDuan@cmail.carleton.ca)
Elmira Ghoulbeigi (ElmiraGhoulbeigi@cmail.carleton.ca)
Yixiang Huang (YixiangHuang@cmail.carleton.ca)
Galen O'Shea (GalenOShea@cmail.carleton.ca)
Basam Mozan (BasamMozan@cmail.carleton.ca)
Hosuk Woo (JimmyWoo@cmail.carleton.ca)

Class: via zoom (ID posted on Brightspace)

Course Description

This course has been modified from recent years so as to allow a larger number of students to register in it. The course is an introduction to the field of mobile robots and their applications from a computer science perspective. The course will involve programming simulated mobile robots with various sensors such as wheel encoders, infrared distance sensors, ultrasonic distance sensors, cameras, compasses, accelerometers and laser range finders. Topics will include programming robot behaviors, position estimation and algorithms related to navigation, mapping, path planning, environment coverage and localization. A more detailed list of topics is as follows:

- Basic Movement and Sensing
- Wall Following Behavior
- Homing and Tracking
- Position Estimation
- Inverse Kinematics
- Beacon Triangulation
- Grid-Based Estimation
- Odometry Correction
- Navigation in Unknown Environments
- Mapping
- Sensor Models

- Improved Sensor Model Mapping
- Finding Obstacle Borders
- Converting to Vector Maps
- Path Planning for Convex Obstacles
- Path Planning for Non-convex Obstacles
- Shortest Paths
- Grown Obstacle Space
- Localization
- Coverage Algorithms
- Improving Coverage
- Laser Range Finders

Attendance Requirements

All class lectures will be "live" on zoom.   The lectures will usually take less than a half hour and will be followed by a lab assignment that you must complete at that time.   You MUST attend a class if you want to hand in the lab assignment that day.   Each lab assignment must be worked on and completed in your zoom breakout room before you leave if you want full marks.   You are allowed to miss two labs with no penalty … but you will need to reserve these "missed labs" for days that you are sick.

The instructor and some of the TAs will be available on zoom to help you during the lab session. You need to select the "Ask for Help" icon when in your breakout room to call for a TA to help.

You will be working in a breakout room with a different partner (randomly chosen by zoom) for each lab assignment (although, one student will work alone when the number of students that day is odd-numbered).

When on zoom, you do not need to have your camera on if you prefer not to. However, **your login name MUST match the name that you are registered for at Carleton** (not your nickname … your official name). That will allow TAs to verify who you are working with each time. Only one of you will submit your working version for grading and both students will share the same grade. Make sure to include BOTH names in the submitted source files.   You should have a working microphone.   It will slow your work down if you cannot communicate easily with your zoom partner and the TAs.   The TAs will have limited time in your breakout room when you need help, so time should not be wasted by being forced to use the chat system.

Prerequisites

A grade of **C-** (or better) in COMP1406 is **required** in order to take this course. There will be a LOT of JAVA programming throughout the course.

Evaluation

Component	Weight	Details
22 Labs	70%	Best 20 of 22 at 3.5% each … done during class
Team Project	15%	(done in class on Dec 8 and Dec 10)
Final Exam	15%	(time and date is yet to be determined)

Course Material Copyrighted

I plan to re-use these lab assignments for future offerings of this course. So **please do NOT share anything with anyone**.   This is meant to be a fun course where students get to learn to program robots. If lab solutions are shared (illegally as mentioned in the above copyright), then you are ruining the course experience for other students and you are opening up the way for plagiarism. You MAY NOT post your code solutions on GitHub or any other on-line resource. You may NOT post any of the course material online.

Laboratory Software

The course will use the **Webots** open source robot simulator, which is quite impressive visually. Check out the **cyberbotics.com** website to make sure that your laptop or desktop can support the 3D simulator.   You should install it and test out the demos right away.   Unfortunately, **if you cannot run this simulator, you will need to withdraw from the course**, as all labs are done within the simulator.

You will need to go to the website to download the Webots software.   In order to develop and run your JAVA code, it is also necessary to have the 64-bit version of the Java Development Kit (JDK) version 1.8 or later (which can be downloaded from the Oracle Technology Network). Follow the instructions in the User Guide on the cyberbotics homepage under the Documentation menu.   There is a subsection on the left called "Programming Language Setup". Unfortunately, you will need to do this on your own since we cannot meet together to debug. Try to do this before class starts. And "No" … you CANNOT use any other programming language for this course.

Cheating and Plagiarism (University Policies)

Sadly, every term, students are caught cheating on assignments.   Copying on an assignment or a test is considered plagiarism. Since you will be working with a partner on each lab, there will be one shared assignment solution between you and that student.   However, your code MUST NOT be copied/shared/obtained from any other students in the class.   Penalties for such offences can be found on the ODS webpage: https://science.carleton.ca/academic-integrity/.

So, in your breakout room, you and your lab partner are allowed to openly share your code, share your screen and even write your solutions together. Only one of you will submit the lab assignment which will contain both of your names. Keep in mind that you will have a different lab partner for each assignment.

Undergraduate Academic Advisor

The Undergraduate Advisor for the School of Computer Science is available in **Room 5302C HP**; or by email at **scs.ug.advisor@cunet.carleton.ca**. The undergraduate advisors can assist with information about prerequisites and preclusions, course substitutions/equivalencies, understanding your academic audit and the remaining requirements for graduation. The undergraduate advisors will also refer students to appropriate resources such as the Science Student Success Centre, Learning Support Services and Writing Tutorial Services.

Requests for Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request, the processes are as follows:

Religious & Pregnancy obligation: Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, visit Equity Services.

Academic Accommodations for Students with Disabilities: If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or pmc@carleton.ca for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made. For more details, visit the Paul Menton Centre website.

Survivors of Sexual Violence: As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and is survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: http://carleton.ca/sexual-violence-support

Accommodation for Student Activities: Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist. For more details, see the policy.

For more information on academic accommodation, please contact the departmental administrator or visit: http://students.carleton.ca/course-outline