

CSC 375/475: Introduction to Robotics

Fall 2021

Course Logistics

Time and Location:

- **Lecture:** W 5:45 PM - 9:00 PM
- **Format:** In-person Room 503 Daley Building (14 E Jackson Blvd)

Instructor:

- Dr. Umer Huzaifa (mhuzaifa@depaul.edu)
- Please include “[CSE 375]” in your email subject line.
- **Office Hours:** Monday 3:00 PM - 4:00 PM, Friday 3:30 PM - 4:00 PM, **Location:** CDM 705

Online Resources:

- The open-source textbook is: Elements of Robotics by Mordechai Ben-Ari and Francesco Mondada, Springer Open, 2018. [link](#)
- D2L CSC 375/475 page
- Discord group [link](#)
- Following link is useful for learning about ROBOTC API:
https://www.robotc.net/WebHelpMindstorms/index.htm#Resources/topics/ROBOTC_Interface/Overview.htm

Catalog Description:

This course presents an overview of mobile robotics in practice and research with topics including kinematics, odometry, motion planning, and sensors. During the course, students assemble robots using the LEGO Mindstorms EV3 robot kit. The LEGO robot will be programmed by a variant of C language (RobotC) that provides a rich set of methods to interact with the robot sensor and actuators. These hands-on projects aim to reinforce the basic principles developed in course material. The graduate students enrolled in CSC 475 will be exposed to advanced topics in modeling, locomotion, and planning through reports.

By the end of this course you will be able to understand:

- robot motion (kinematics)
- robot sensing (perception)
- modeling of the environment (avoiding or embracing objects)
- programming multiple tasks

Prerequisites: You must have taken CSC 373 and CSC 374. In addition, for CSC 475 students: CSC 407.

Lecture Format:

The class will follow a flipped format where the students will be expected to read through the reading material for the week and the respective chapter before coming to the class. The lecture will go over the key points, and then will be dedicated to hands-on programming exercises on the robot platform.

Evaluation and Grading

Attendance:

Mandatory. In case of an event that prohibits you to join the class, you must inform the instructor in advance.

Course Components:

Grading Category	Percentage Grade (CSC 475)
Homework (and in-class quizzes)	25 % (15 %)
Programming Exercises	35 % (30 %)

Grading Category	Percentage Grade (CSC 475)
Competitive Challenges	30 % (25 %)
Class Participation	10 %
Research Topics (for CSC 475 students only)	20 %

Homework:

Homework will be posted on D2L. No late submissions will be accepted. It is recommended to start the homework early and communicate with the instructor as soon as you face difficulties.

Programming Exercises:

In each class, nearly half or more time will be dedicated to solving a few programming exercises focusing on the content covered in that week.

Competitive Challenges:

There will be two challenges where the simulation tasks will be performed by all the students. To make it exciting, a winner will be announced based on the fastest completion time.

Research Topics:

This part is specifically designed to expose the graduate students to the cutting edge ideas in the assigned topics in robotics. A *short paper* (2-3 pages) and a *demonstration* of the ideas is required for submission. The demonstration can be in the form of a *detailed original graphic*, *physical toy* or a *code implementation in a simulator*.

Course Evaluation Tools – Gradescope and D2L:

Gradescope will be used for grading and feedback. This platform allows to provide fast and accurate feedback on your work. As soon as grades are posted, you will be notified immediately so that you can log in and see your feedback. You may also submit regrade requests if you feel we have made a mistake. You will be enrolled in this tool by the first lecture.

D2L will be used for providing all the necessary course content, communicating the course information, and grading. You are automatically enrolled in this tool as you register for the course.

If you are not enrolled in any of the above online tools by the first lecture, please contact the instructor as soon as possible.

Policies

Academic Integrity:

- This course adheres to the DePaul University's policy on Academic Integrity. For complete information, please see: <http://academicintegrity.depaul.edu/>
- Cheating is any action that violates university norms or instructor's guidelines for the preparation and submission of assignments. This includes, but is not limited to:
 - Unauthorized access to examination materials prior to the examination itself.
 - Use or possession of unauthorized materials during the examination or quiz.
 - Having someone take an examination in one's place.
 - Copying from another student.
 - Unauthorized assistance to another student; or acceptance of such assistance.
- Plagiarism involves the presentation of the work of another as one's own.
- Plagiarism includes, but is not limited to the following:
 - The direct copying of any source, such as written and verbal material, computer files, audio disks, video programs or musical scores, whether published or unpublished, in whole or part, without proper acknowledgment that it is someone else's.
 - Submitting as one's own work a report, examination paper, computer file, lab report or other assignment that has been prepared by someone else (including research papers purchased from any other person or agency).
 - The paraphrasing of another's work or ideas without proper acknowledgment.
 - Working so closely with another person so as to produce identical code.
- Avoid any form of or the appearance of any form of academic misconduct, which will result in a minimum penalty of zero credit for the work in question, and may result in a maximum penalty of a failing course grade.

Important: All of the course content is copyright protected by the instructor or relevant individuals/organizations. No part of the course content can be uploaded or shared to any entity. One specific example of this violation would be Chegg and Coursehero. In case this violation

is discovered, strict action will be taken against the perpetrator.

Changes to Syllabus:

This syllabus is subject to change as necessary during the quarter. If a change occurs, it will be thoroughly addressed during class, posted under Announcements in D2L and sent via email.

Academic Calendar:

All students are required to manage their class schedules each term in accordance with the deadlines for enrolling and withdrawing as indicated in the University Academic Calendar. For more information, visit <http://www.cdm.depaul.edu/CurrentStudents/Pages/PoliciesandProcedures.aspx>

Students with Disabilities:

Students who feel they may need an accommodation based on the impact of a disability should contact me in private as early as possible in the quarter (preferably within the first week of class), to discuss their specific needs, and make sure that you have contacted the Center for Students with Disabilities (CSD). All discussions will remain confidential.

Note: The schedule items are subject to change. The modifications will be discussed in class.

Weeks	Lecture/Lab Exercise Topics	Homework Announced	Reading	Research Questions
Week 1 (Sept 8 - Sept 14)	Introduction to the Course (Lab 1 - Setting Up the Robot and Software)		Chapter 1, <u>Reading</u> <u>Week 1</u>	Research Topic 1 (Due: Sept 22)
Week 2 (Sept 15- Sept 21)	Basic Robot Movements (Lab 2 - Robot Movements)	HW 1 (Due: Sept 22)	Chapter 2, <u>Reading</u> <u>Week 2</u>	
Week 3 (Sept 22 - Sept 28)	Robot Sensors and Motor Encoders (Lab 3 - Sensing and Movement)		Chapter 3 (Sections 1- 3), <u>Reading</u> <u>Week 3</u>	Research Topic 2 (Due: Oct 6)
Week 4 (Sept 29 - Oct 5)	Parallel Tasks and Proportional Controller (Lab 4 - Parallel Programming Tasks)	HW 2 (Due: Sept 29)	Chapter 3 (Sections 4- 5), <u>Reading</u> <u>Week 4</u>	
Week 5 (Oct 6 - Oct 12)	Challenge 1 (Lab 5 - Search and Rescue)		Chapter 4	Research Topic 3 (Due: Oct 20)

Weeks	Lecture/Lab Exercise Topics	Homework Announced	Reading	Research Questions
Week 6 (Oct 13 - Oct 19)	Line Following (Lab 6 - Following a Path)	HW 3 (Due: Oct 13)		
Week 7 (Oct 20 - Oct 26)	Finite State Machines in Robotics (Lab 7 - State Machine Based Programming)		Chapter 5	Research Topic 4 (Due: Nov 3)
Week 8 (Oct 27 - Nov 2)	Odometry, Slew-rate and Localization (Lab 8 - Robot Motion Using Odometry Model)	HW 4 (Due: Oct 27)	Chapter 7	
Week 9 (Nov 3 - Nov 9)	Challenge 2 (Lab 9 - Multiple Paths and Starting Points)			Research Topic 5 (Due: Nov 16)
Week 10 (Nov 10 - Nov 16)	Intro to Robot Arms (Lab 10 - Forward and Inverse Kinematics, Kinematic Trajectory Generation)	HW 5 (Due: Nov 10)	Chapter 16 (Sections 16.1 - 16.4)	