CSC 375/475: Introduction to Robotics

Instructor

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Class Hours

Tu 5:45-9:00 PM in Room 503 in 14 E Jackson Blvd (Daley)

Course Web Page

This syllabus, as well as the class lecture notes, homework assignments, and other useful links can be found on D2L. Please check the D2L portal discussion /forum regularly.

Course Description

This course presents an overview of robotics in practice and research with topics including basic kinematics, localization, 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. Students usually work in teams of two. Groups are typically self-formed but can be randomly assigned by the instructor when necessary. Depending on the availability of robot kits, the instructor may allow solo member groups. This course will also expose students to some of the contemporary happenings in robotics, including current robotics research, applications, and robot contests (via assignments, reports, and discussions).

Note: This course is offered as part of the Global Learning Experience (GLE) program where some overlapping material is taught collaboratively with the São Paulo State University, Brazil. As part of this experience, you will be collaborating with them for achieving the objectives of select activities (up to 3). This is an excellent opportunity for you to gain experience working with outside parties. You will be provided more information in class.

Course Objectives

- Develop a fundamental understanding of robotics
- Understand robot motion (kinematics)
- Understand robot sensing (perception)
- Learn concepts robot localization, motion planning.

Prerequisites

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

Course Format

This is a hands-on course where you will spend most of the time assembling robots, writing code, and testing. In addition to the regular meeting on Thursday, you will be given access to the hardware material for carrying out the project work. The course primarily follows the flipped classroom concept. The course material will be posted on D2L. The course provides the material you will need to understand the fundamental concepts covered during course.

Important:

- This is a hands-on class. Students are strongly advised to take part in all the sessions. Students are not permitted to enter 15 mins after the class has started. Use of portable electronic devices is prohibited.
- Homework can be individual or group efforts (as required). You will be advised accordingly. In group submissions, clearly identify (percentage-wise) member contributions.
- You can change groups, but it is difficult if you are the only group that needs a change in the class.
  Each group must sign a team contract (D2L>Logistics) upon the distribution of the LEGO Mindstorms kits.

Required software:

- Each group is encouraged to purchase RobotC (http://www.robotc.net/). As the hardware is given for you to take home, this enables you to complete homework at home without having to come to the lab.

Related textbooks:

- Introduction to Autonomous Mobile Robots, 2nd Edition by Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza, MIT Press, 2011.

Grades and exams

The course grade will be apportioned as follows:

Homework (written, in-class quizzes)	30%
Lab Programming assignments	30%
Competitive Challenges	30%
Participation	10%

Homework: Homework/demo instructions/competition rules will be distributed via D2L. Hard copies will not be distributed. Homeworks are due at the specified dates and times. Late assignments will not be accepted for grading. There will be a total of 8 written homework assignments, but only the best 6 counts toward the final grade. All group members must be present for demos. A student not

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present for the demo will receive zero for that demo, unless under extreme circumstances.

Exams: There are no written exams. Instead, there are up to 4 competitive challenges. Each challenge will test the material mastered up to the competition date. A challenge is typically carried out in a specified environment in which each group needs to program their LEGO robot to achieve the desired objective. The overall points will be based on a defined set of performance indices.

The grading rubric for normalized marks:

A	A-	B+	B	B-	C+
95-100	91-94	88-90	85-87	81-84	77-80
C	**C-**	**D+**	**D**	**F**	**I**
73-76	69-72	65-68	61-64	0-60	*

* Incomplete: An incomplete grade is given only for an exceptional reason such as a death in the family, a severe illness, etc. Any such reason must be documented. Any incomplete request must be made at least two weeks before the final and approved by the Dean of CDM. Any consequences resulting from a poor grade for the course will not be considered as valid reasons for such a request.

To do well in this course: Attend the class, prepare for the class by reading the material and chapters in the books each week as indicated, participate in discussions, start working on the homework early, and talk to me promptly if you have any problems.

Policies

Deadlines for adds, drops, and withdraws

See the deadlines in https://www.depaul.edu/university-catalog/academic-handbooks/graduate/university-information/pages/academic-calendar.aspx

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.

Online Course Evaluations

Evaluations are a way for students to provide valuable feedback regarding their instructor and the course. Detailed feedback will enable the instructor to continuously tailor teaching methods and course content to meet the learning goals of the course and the academic needs of the students. They are a requirement of the course and are critical to continue to provide you with the highest quality of teaching. The evaluations are anonymous; the instructor and administration do not track who entered what responses. A program is used to check if the student completed the evaluations, but the evaluation is separate from the student's identity. Since 100% participation is our goal, students are sent periodic reminders over three weeks. Students do not receive reminders once they complete the evaluation. Students complete the evaluation online in CampusConnect.

Academic Integrity and Plagiarism

This course will be subject to the university's academic integrity policy; the following is an excerpt from the policy. More information can be found at http://academicintegrity.depaul.edu/. If you have any questions be sure to consult with me.

Academic Policies

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/Current%20Students/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.

Course Schedule & Objectives

The tentative weekly schedule is as follows:

- Week 1:
  - *Introduction to Robotics, LEGO Mindstorms kit*
- Week 2:
  - *Robot programming fundamentals*
- Week 3-4:
  - *Basic movements of LEGO robot*
- Week 5-6:
  - *Kinematics of LEGO robot motion*
- Week 7-8:
  - *Perception, Sensors of LEGO kit*
- Week 9-10:
  - Robot localization, *Robot control*
  - *Motion planning and navigation*