

CSCI-6962 Mobile Robotics

Spring 2001

Instructor: Prof. Wes Huang
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office: Amos Eaton 111, x8189
office hours: Tuesdays 4-6pm (or by appointment)

classroom: Sage 3704
times: Monday and Thursday 10:00am - 11:20am
prerequisites: CSCI-2300 Data Structures and Algorithms
MATH-2010 Multivariable calculus
or equivalents (also see below)
text: Dudek and Jenkin, "Computational Principles of Mobile Robotics"
www: <http://www.cs.rpi.edu/courses/spring01/mobile-robotics>

Course description

This course is an in depth study of algorithms for mobile robots. The primary topics are motion planning, localization, mapping, navigation, sensor fusion, and mobile robot software architectures. The unifying themes of this course are how mobile robots can navigate in known and unknown worlds and how to structure software to control a mobile robot. We will study recent works from the robotics research literature, and there will be a series of programming projects to implement several of the algorithms we cover.

Prerequisites

The formal prerequisites listed above are intended to ensure that students are reasonably sophisticated programmers and that they have a reasonably broad math background. There will be several programming projects as part of the assignments, and robotics tends to draw from a variety of math topics such as linear algebra, calculus, and differential equations.

Course activities & grading

This course is taught in lecture format, though there will be several reading discussion classes. The main activities for this course are the assignments and reading and discussing research papers.

There are four assignments on the tentative schedule. These will consist primarily of a programming project, though there may be a few written questions. My intent with these projects is to have students build up a reasonably sophisticated mobile robot simulator and implement motion planning, mapping, and navigation algorithms over the course of the semester. The last project could involve implementation using the mobile robots in my lab.

For each research paper, a one page reading report will be due. For approximately half of these papers, we will devote an entire class to discussing the paper. Attendance at these discussion classes is required; you should come prepared to participate.

There will be other occasional reading assignments during the semester for which you do not need to write a reading report, but I will expect you to come to class prepared.

Your grade will be determined according to the following (tentative) breakdown:

65%	Assignments
25%	Reading reports
10%	Class participation (primarily discussion classes)

You must "pass" all assignments in order to receive a passing grade for this class.

Course policies

The following policies will be clarified as necessary during the semester and will be revised if necessary. The course home page will be updated with the current versions.

Academic honesty

I encourage you to discuss readings and assignments with others. However, I expect that any assignment or reading report that you turn in to be your own work — the product of your understanding of the course material and your own efforts in completing the assignment or examination.

More specifically, it is inappropriate to give or receive code for an assignment to or from anyone else.

The Rensselaer Handbook of Student Rights and Responsibilities defines several types of academic dishonesty, all of which are applicable to this class. Students found in violation of academic dishonesty policies may receive a failing grade for this course.

Please contact the instructor if there is any question about academic (dis)honesty.

Late work

Late work places an additional burden on the teaching staff and is unfair to those students who turn in their work on time.

Unless you make *prior* arrangements with the instructor, assignments and reading reports are due at the beginning of class (10:00am) on the day they are due. Assignments turned in up to 24 hours late receive a 10% penalty; after that, late assignments are subject to a 20% penalty and will be accepted for a week after the deadline.

Attendance

Attending class is generally expected. Attendance is required for the discussion classes; missing these classes will reduce your class participation grade.

Excuses

If there is some good reason that you must miss a discussion class or that you will need an extension on an assignment, contact me in advance. If you do not contact me in advance, I will ask you to get a letter from the Dean of Students. They will verify excuses and write a memo. This way I can be assured of a valid excuse without needing to be privy to students personal lives.

Tentative Schedule

Week				Topic	Reading	Assignments
1	M	Jan	8	Introduction	1 & 2	
	R	Jan	11	Motion planning: Intro	5	Paper 1 out
2	M	Jan	15	NO CLASS!		
	R	Jan	18	Motion planning: C-space methods		RR 1 due, Assign 1 out
3	M	Jan	22	Discussion on Paper 1		Paper 2 out
	R	Jan	25	Motion planning: workspace methods		RR 2 due
4	M	Jan	29	Sensing: sensor characteristics	3	
	R	Feb	1	Sensing: Kalman filtering & sensing		Assign 1 due
5	M	Feb	5	Sensing: Kalman filtering & sensing		Paper 3 out
	R	Feb	8	Pose maintenance: Dead reckoning	7	RR 3 due, Assign 2 out
6	M	Feb	12	Discussion on Paper 3		Paper 4 out
	R	Feb	15	Pose maintenance: Landmarks		RR 4 due
7	T	Feb	20	Pose Maintenance: Landmarks		
	R	Feb	22	Mapping: Sonar	8	Assign 2 due
8	M	Feb	26	Mapping: Bayesian approaches		Paper 5 out
	R	Mar	1	Mapping: Other approaches		RR 5 due, Assign 3 out
9	M	Mar	5	Discussion on Paper 5		Paper 6 out
	R	Mar	8	Navigation		RR 6 due
10	M	Mar	12	SPRING BREAK		
	R	Mar	16	SPRING BREAK		
10	M	Mar	19	Navigation		
	R	Mar	22	Navigation		Assign 3 due
11	M	Mar	26	Architectures: Introduction	6	Paper 7 out
	R	Mar	29	Architectures: Early efforts		RR 7 due, Assign 4 out
12	M	Apr	2	Discussion on Paper 7		Paper 8 out
	R	Apr	5	Architectures: Early efforts		RR 8 due
13	M	Apr	9	Architectures: Behavioral		
	R	Apr	12	Architectures: Behavioral		Assign 4 due
14	M	Apr	16	Architectures: Three layer		
	R	Apr	19	Architectures: Three layer		
15	M	Apr	23	TBA		
	R	Apr	23	TBA		

RR = Reading report