CISC 3415 [32.5] Principles of Robotics
3 hours; 3 credits

Basic principles of mobile robotics: architectures, mathematical foundations, control algorithms, human robot interaction, and practical applications. Applications include robots in the home, and robots in search and rescue work. Involves programming different kinds of robots.

Objectives

1. Students will be able to demonstrate understanding of the theoretical basis of mobile robotics.
2. Students will be able to demonstrate understanding of the challenges and opportunities that robotics technology offers modern society.
3. Students will be able to develop and test programs that control mobile robots for a variety of tasks.
4. Students will be able to demonstrate effective working on a team or in a working group.
5. Students will be able to describe technical work in writing.

Syllabus

1. The scope of robotics and the history of robotics.
2. Robot locomotion; wheeled and legged robots.
3. Control architectures.
4. Kinematics; the mathematics of robot motion and using it to develop low-level control algorithms.
5. Perception; sensors and sensing.
6. Probabilistic filtering; the mathematical framework for localization and mapping algorithms.
7. Localization; how to determine where your robot is using a map.
8. Mapping; how to construct a map.
9. SLAM; simultaneous localization and mapping.
10. Path planning and navigation.
11. Multi-robot systems.
12. Human-robot interaction.
13. Applications of robotics.
14. The future of robotics.

The course will include practical classes that will involve students programming both wheeled and/or legged robots (in C, C++ and/or Java), illustrating the principles introduced in the lectures and implementing the algorithms discussed therein.

Textbook

Introduction to Autonomous Mobile Robot, Siegwart and Nourbakhsh, MIT Press, 2003.

Bibliography

1. *Autonomous Robots*, Bekey, MIT Press, 2005.
2. *Probabilistic Robotics*, Thrun, Burgard, Fox, MIT Press, 2006.
3. *Principles of Robot Motion: Theory, Algorithms and Implementations*, Choset, Lynch, Hutchinson, Kantor, Burgard, Kavraki and Thrun, MIT Press, 2005.
4. *Behavior-based robotics*, Arkin, MIT Press, 1998.