**AE 498 MPA: Intelligent Mobile Navigation**
Fall 2007 • CRN# 48365 • 3-4 units
http://www.ae.uiuc.edu/~tbretl/ae498mpa/

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### Time and Location

To be arranged (see website).

### Course Description

In this course you will learn the basic principles of motion planning by focusing on their application to navigation aids, which help real people make real decisions. Student teams will each work with a new Nokia N95 smartphone, donated by Nokia Palo Alto Research. We will use these phones as a platform to discuss embedded software development (with a crash course in Symbian C++ programming), localization and mapping (using GPS signals), search algorithms (to generate driving directions), and human-machine interaction (optimal interface design). The course will culminate in student projects.

### Prerequisites

There are no formal prerequisites. But this course will require some mathematical sophistication, a willingness to work independently, and the ability to complete a significant programming project.

### Required Texts

None.

### Recommended Texts

- Bertsekas. *Dynamic programming and optimal control, vols. 1-2*. Athena Scientific, 2005.
- Boyd and Vandenberghe. *Convex optimization*. Cambridge University Press, 2004. Available online at http://www.stanford.edu/~boyd/cvxbook/.
- Bryson and Ho. *Applied optimal control: optimization, estimation, and control*. Taylor and Francis, 1975.
- Choset et al. *Principles of robot motion: theory, algorithms, and implementations*. MIT Press, 2005.
- Cormen et al. *Introduction to algorithms*. MIT Press, 2001.
- de Berg et al. *Computational geometry: algorithms and applications*. Springer-Verlag, 2000.

- Latombe. *Robot motion planning*. Kluwer, 1991.
- LaValle. *Planning algorithms*. Cambridge University Press, 2006. Available online at http://planning.cs.uiuc.edu/.
- Sharp, Rogers, and Preece. *Interaction design: beyond human-computer interaction.* Wiley*, 2007.*
- Siegwart and Nourbakhsh. *Introduction to Autonomous Mobile Robots.* MIT Press, 2004.
- Thrun, Burgard, and Fox. *Probabilistic robotics*. MIT Press, 2005.

**Topics**

- Embedded software development using Python for S60.
- Decision trees ("20 questions localization").
- Localization and mapping using GPS data.
- Planning (solving stochastic shortest path problems using value iteration).
- "Control" and human interface design.

**Grading**

10% Attendance (miss 2 = 8%, 3 = 6%, 4 = 4%, 5 = 2%, >6 = 0%).
10% One in-class presentation of new material.
40% Homework (approximately 4 programming assignments).
40% Project (phone implementation + website (3 credits) and conference paper (4 credits)).

**Philosophy: "Finished Product"**

Submissions must be turned in on time (no credit for late work). Everything turned in must be complete and working. You will receive more credit if 50% of the assignment is turned in and perfect than if 100% of the assignment is turned in and imperfect.