

Final Project:

(Required for graduate students.

*Undergraduates can participate if you want to replace
your lowest homework grade with your final project grade.)*

MULTIPLE DEADLINES:

#1: Project Proposal, Due: Monday, Mar. 19, 2007 at 23:59:59

#2: 5-minute presentation, Due: In class April 24 or 26 (specific day to be assigned)

#3: Project software and paper, Due: Wednesday, May 2, 2007 at 23:59:59

The purpose of the final project for this class is to enable you to explore your own ideas for the development of software for intelligent robotics. Based upon what we have studied in class, supplemented with your own ideas, your final project should first involve the definition of a new robot capability or robotic software issue you want to explore. You should then design, implement and evaluate your approach to the issue you are studying, or your algorithm for the new robot capability you are developing, using the Player/Stage or Player/Gazebo simulator. You also must write up your project and your results in a 2-5 page final project report (in the specific format described below). The extent of software development for the final project should be comparable to the software you developed for Assignment #3 or #4.

Ideas for your final project:

- *Foraging*: Define and implement two alternative algorithms for foraging and compare and contrast them using results from a variety of randomly generated environments.
- *Multi-robot formations*: Develop software that allows multiple robots to move in formation as they move from waypoint to waypoint.
- *Exploration and coverage*: Define, develop, and analyze an algorithm for “exploration” and “coverage” – i.e., visiting all areas of an environment, general enough to work in a variety of environments.
- *Traffic management*: Develop software for multiple robots to pass through a traffic intersection without collision (i.e., where the intersection does not allow more than one robot to pass through at a time)
- *3D Path Planning in Gazebo*: Use the Gazebo simulator (i.e., rather than Stage) to enable a robot to plan paths and navigate in a 3D environment.

You can select one of these ideas, or (perhaps better) define your own project along these lines. Use your creativity to explore an idea of interest to you in autonomous robot control.

Deadline #1 – Project Proposal:

To ensure that you are “on the right track” with your final project (in terms of scope and direction), please prepare a brief project proposal (maximum 1 page, typed but otherwise free-format) that describes your plans. Your project proposal should state:

- The problem you plan to address or the issue you plan to study
- Your intended approach
- Your planned experiments to evaluate your approach

Email this to Dr. Parker as a pdf file named “*yourlastname-Proj-Proposal.pdf*”. You can turn in your project proposal any time prior to the project proposal due date to get feedback and approval for your project. You will receive feedback on your proposal within 3 days of when you turn it in. You must have your project approved in advance in order to receive credit for your work.

Deadline #2 – Final Project Presentation:

You must prepare a 5 minute presentation of your results, to be given in class either April 24 or 26 (the specific date will be assigned later). Your presentation should clearly define your problem, your approach, your results, your analysis, and your conclusions. The purpose of this presentation is to allow the rest of the class to learn from your cool ideas. Be sure to practice your talk in advance, to ensure that you stick to the 5 minute time limit.

Final Project Report:

Your final project report will describe the algorithm you developed, the issue you studied, etc., and your results. The report should be from 2 to 5 pages (formatted as described below) that includes the following sections:

- Introduction: Outlines the problem or issue you studied.
- Approach: Describes your approach to solving the problem or studying the issue (e.g., a description of the algorithm you have developed).
- Results: Describes what your experiments were and what your results are.
- Discussion: Analyzes your results and discusses what they imply.
- Summary and Conclusions: Summarizes what you did and your findings, along with possible directions for further study if some issues are still inconclusive.

Your report should be written as if it were a robotics conference publication, in which your audience is technically knowledgeable about autonomous robotics, but not familiar with the specific work you have done. Your paper should also have the “look and feel” of a conference paper, with logical flow, good grammar, sound arguments, illustrative figures, etc. YOU MUST FORMAT your paper using the standard 2-column IEEE conference paper format (see <http://www.ieee.org/portal/pages/pubs/transactions/stylesheets.html> for style files). (An example of this paper format is attached.) Be sure to include screen dumps of your results, data, graphs, etc., as needed to describe your project and your results. The reader should be able to understand what you have done and what your software does without looking at the code itself.

Name your paper *yourlastname*-Paper.pdf.

Deadline #3 – Final Project Deliverables:

Use the submit script **594sir_submit** to submit your files. These should include:

- Your final project, with the main program named *yourlastname*-finalProj.cc. Other files can be named any way you like. The header of *yourlastname*-finalProject.cc should include instructions for how to run your code.
- Any other supporting files (e.g., input files, include files, etc) needed to compile your code
- Makefile
- Your project paper, named *yourlastname*-Paper.pdf

Final Project Evaluation:

Your final project will be evaluated based upon:

- 1) the thoroughness of your study (35%)
- 2) your analysis of your results (35%)
- 3) your presentation of your results (10%)
- 4) the quality of your final project report (20%).