CS148 – Final Project and Final Paper

1 Dates

- Final Project demonstration: December 12, 2006
- Final Project write-ups due: December 17, 2006, electronic handin by 10pm
- Final Paper due: December 18, 2006, electronic handin by 10pm

2 Introduction

The purpose of this project is to implement an effective control policy for the Roomba Pac-Man task. This project will be implemented on the 5th floor of the CIT with Roombas. Your control policy should allow your Pac-Mac client to explore and cover relevant features of the world. You may choose the specific implementation of the control policy yourself. The goal of the project is to develop a policy that will consume pellets at all of the food locations, navigate to all the power-ups, and avoid ghosts.

3 Specification

For this project you will develop a client that competes in the Roomba Pac-Man task on the 5th floor of the CIT. Your robot will have a single 20 minutes trial to play Roomba Pac-Man, with an optional restart. For each trial, your robot will have 3 lives. Your robot will have sensory information in the forms of: a blobfinder, odometry, bump sensors, and virtual wall detection. You will also be provided a map with the locations of fiducials and walls. However, the start locations of your robot, ghosts, and food will not be revealed until 5 minutes prior to each trial. The starting configurations will differ group to group (and trial to trial).

You are tasked with developing a control policy that will cover the entire area, namely visit all of food piles and power-ups, in the Roomba Pac-Man area. This project is open-ended in that you may choose to implement whatever control policy you think will be most effective for the Roomba Pac-Man task. To that end, deliberative, reactive, hybrid, and behavior-based systems are all viable solutions.

In developing your client, we are also looking for creative approaches to the task based on material covered in class.

Finally, your client should be robust to different starting configurations. As mentioned previously, the starting locations of your robot, the food pellets, and the ghosts will be different for each trial (and each group). Your robot should be able to perform well regardless of starting configuration.

4 Final Project Deliverables and Grading

The final project involves two main deliverables, a demonstration of your planning client (in class on 12/14) and electronic submission of your work (project write-up, source code, and other materials, by 10pm 12/17). In particular, your project write-up should address design choices with regards to your choices for ensuring coverage, as well as the aspects of your client that are innovative. Please refer to the course missive for details about electronic submission and project write-up format. Addendums to electronic submission:

- The name of the assignment for the handin script is final_1

  (note that there is another name for Fictional Robot Paper)

- the write-up should be named "login_final.pdf" (example, cjenkins_final.pdf).

- other materials, such as a video of your client in action, should be put in a subdirectory named "materials/"

Both your handin and your actual robot will determine your grade. Your implementation and write-up will be scored in the following manner:

Implementation		Write-up	
Coverage	20%	Thesis/motivation	5%
"Creativity"	10%	Approach	15%
Pac-Man Performance		Evaluation	10%
-Perception (Feature recognition)	5%	Discussion	15%
-Decision Making (situational reaction, approach)	5%	Conclusions	5%
-Robustness to dynamic initialization	10%		

Note: Coverage will be defined as the percentage of environment features (i.e., power-ups and food locations) visited divided by their total number.

5 Final Paper Description

The final paper for the class is a document analyzing a fictional robot. This paper will discuss the feasibility of the robot (in terms of factors such as its engineering, algorithms, social sophistication, and cost) and necessary technologies for realizing this robot. Additionally, this paper must answer the following question: "What is the point of robotics?". Specifically, the answer to this question should include an argument about the need and most pertinent applications for robotics in society.

If you were to write about "Rosie the Robot" (from The Jetsons cartoon), for instance, an outline of your paper might address the following points (non-exclusively):

- Plant:
  - Power Source: Container, Charging Source
  - Motors
  - Materials and rigid body construction
  - Computation [1]
  - Memory and storage
  - Expected construction cost over time
- Sensing
  - Exteroception: Vision, Range sensing, Thermal
  - Proprioception: Tactile, Pose
- Perception:
  - NLP/Speech Recognition
  - Localization
  - Object Recognition
  - Emotional Awareness
- Motion Control
  - Movement
- Cognition:
  - Internal reward, drives, and notions of goals
  - Asimov's Three Laws
  - A notion of external reward and/or human happiness
  - Learning
  - Exploration

[1] Clearly using some version of *nix.

Do not treat this as a list for you to fill out. This is simply some points the course staff brainstormed if we were to realize Rosie the Robot. From your coverage of a fictional robot, your paper should also examine the role of robotics in society and directions for future innovations. Construct an argument of how robotics could contribute to improving economic and social issues. This argument should balance the potential problems and consequences of robotic technology.

A rough page count for each section of your write up is:

- Fictional Robot Analysis: 6-10 pages
- Point of Robotics: 2-3 pages

6 Final Paper Deliverables and Grading

The final paper involves a single deliverable, electronic submission of your paper by 10pm on 12/18. Addendums to electronic submission:

- The name of the assignment for the handin script is final_2
- the write-up should be named "login_paper.pdf" (example, cjenkins_paper.pdf).
- other materials, such as pictures of your fictional robot and illustrations of modifications to it, should be put in a subdirectory named "materials/"

Your final paper will be scored in the following manner:

Final paper grading	
Fictional Robot Analysis	(70%)
- Motivation for robot	10%
- Analysis of robot feasibility	20%
- Analysis of robot strengths/shortcomings	20%
- Proposal of necessary enabling technologies	20%
"What is the point of robotics?"	30%