1 Dates

The important dates are as follows:

- Assigned: November 7, 2005
- Project demonstration: December 7, 2005
- Project writeups due: December 12, 2005

2 Introduction

In the upcoming weeks, you will be working on a project of your own invention. Proposals for this final project will be handled informally between your group and the instructor. The final demonstration will most likely consist of two parts: you will have a chance to demonstrate all of the specific behaviors of your robot to the course staff, and then there will be a "Demoday/Talent Show," open to the public, where you can show off your robot in all of its glory.

We are making a couple of provisions to allow you more freedom with this project than you have had previously: we realize that it is difficult to be restricted to the limited hardware of one brick, two motors, two touch sensors, etc., and so we will distribute the small amount of extra materials that we have to groups based on need. For projects that require more resources than the issued robot kits, there are several robots with a generic configuration available for use in the ai lab. We will determine if this is workable once we look at the project proposals.

Note that the final paper handin deadline is firm. We are giving you some time after the final demonstration for you to add finishing touches and clearly describe all the work you did in the last few days, so we expect them to be handed in on time so that we can begin grading them. Please submit your final report, final project source code, and any accompanying material (e.g., slides) via the handin script under the assignment "final".

Proposal

Your proposal should describe the premise of your project and give a detailed description of the tasks your robot will complete. This description will give the course staff a basis for suggesting the scope of the final project and starting point for implementation. If your proposal is too vague, we will try to point you in the right direction.

This year, an written final project proposal is not required. However, explicit approval of your final project idea must be approved by the course staff by November 18. Class on 11/10 will be dedicated to discussing project ideas.

It is suggested to consider the following in your design process:

CS148 Lego Track – Final Project

- A concrete description of your project. Discuss the premise behind it as well as what is involved both in terms of building and coding. You should explain why it is interesting and complicated enough for you to spend four weeks working on it. If you would like to join up with another group, be sure to justify this—why is your project significant enough to require four people working on it?
- A complete description of the tasks your robot will be able to accomplish by the time of the preliminary demonstration. This will be the basis for your grade. You should break down your final task into many smaller ones and list each one that you will demonstrate at this time. Explain what each task requires the robot to do, whether in hardware or in software, and how you will demonstrate it. Be specific—if this were RoboSoccer, it wouldn't be enough to say that 'the robot will recognize the goal,' instead you would need to describe the exact behavior of the robot, e.g., 'when the robot passes over three black lines in succession, it will recognize this as the goal by giving two beeps.'
- A complete description of the tasks your robot will be able to accomplish by the time of the final demonstration. This should include any tasks that were not included above as well as any from above that need to be more complicated for the final. Also describe how all the different parts of your robot will work together to accomplish your larger goal, and explain how you will demonstrate this.
- A list of potential problems that you may encounter. Describe what they are and how you plan to work around them.
- A description of the method you plan to use to accomplish your task. This should include a sketch of the robot you plan to build and an outline of the algorithms you plan to use. You will not be bound to this, but we want to see what you are thinking.
- A list of additional items that you need. This can include LEGO-specific equipment, like motors and sensors, as well as more general items, like lamps and rubber balls. Be sure to indicate which items are required, which items are helpful, and which items would allow for extensions. Be aware that our budget is very limited and while we will do our best to distribute the resources we have, we can't guarantee anything. You may have to purchase some of these items yourself. If you would like to use one or more additional robots, indicate that here as well.

3 Preliminary Demonstration

During class on Thursday, December 1, you will be expected to demonstrate the basic behaviors of your robot that you have detailed in your proposal. This will be informal to allow feedback from the course staff.

Demoday

The Final Presentation/"Talent Show" is still not entirely planned since we don't know yet what projects there will be and how much time it will take to demonstrate and evaluate them. Each group will have a designated period of time to demonstrate their robot in detail to the course staff (this is the basis of your grade), during a more general demonstration to the public. As the day approaches, we will ask each group for an estimate of how long it will take to demo their robot so that we can plan out the exact schedule.

Final Report

As with every other project this semester, each of you will be required to hand in an individual writeup for the final. This writeup should begin with the conception of your project idea, and continue with a thorough and comprehensive account of the steps by which you achieved your final product. Note the various ideas you had, experiments—both successful and failed—special algorithms, hardware designs, and overall theories behind your project. Additionally, you should present ideas for extending the project to address the limitations and extend the functionality of the robot.

The final report should follow the format set forward during the class. You must decide what material and discussion is pertinent and appropriate in discussing the project. Given the significance of the report, it would be to your advantage to err towards including more detail and discussion.

This project is your time to shine, so make sure we know everything you went through!

Grading

Implementation		Writeup	
Final demonstration	50%	Thesis/motivation	5%
		Approach	10%
		Evaluation	10%
		Discussion	15%
		Conclusions	5%
		Presentation	5%

The breakdown of your grade is as follows:

Project Ideas

We will discuss project ideas further on 11/10, but here are a few to get you thinking:

CS148 Lego Track – Final Project

- Map/Room Learning The robot would be able to explore an unknown environment, making a map as it goes along. Then later it would be able to use that map to navigate.
- Hide and Seek This requires multiple robots, some to 'hide' and some to 'seek.' This includes object detection, robot detection, and escape mechanisms.
- Ball Handling (Getting a Ball Down a Field) Two robots would work together to move a ball down a field, passing it back and forth between them.
- **Animal Behavior** The robot(s) would demonstrate some type of animal behavior, e.g. flocking or food gathering.
- Self-calibrating Robots The challenge is to write a program that isn't tied to the configuration of your robot, but instead can perform equally well on different robots. Ideally, your program could be downloaded onto any robot with a basic set of motors and sensors and the robot would then learn to perform a set of tasks using that configuration.

Robot Printer Mobile and articulated robots for drawing images

Brain Transplanter Transferring bricks between different robots

Supervisory Control Learning control policies from demonstration