Final Lab Project

1   Problem Statement

In these final hardware labs of the semester, your team will propose and complete your own project. Your project should be of the correct level of difficulty – nothing too trivial or simple, nothing too overly complex. You may consider the full breadth of different lab "areas" that we engaged this semester including: standalone breadboarding, a focus on the Arduino, a focus on the Arduino with sensors and actuators, a focus more on logisim, or some combination of these.

Your project should achieve some goal rather than be purely exploratory. For example, you should build something specific that accomplishes some task rather than having your goal be merely to learn about more devices and how they work.

2   Project Ideas

Here are some possible ideas to consider:

- **Elevator Circuit**
  Simulate the controller for an elevator that services a multi-floor building. You might focus more on hardware and build an actual working elevator model. Or you might focus more on control and software and build a more complex controller that simulates an elevator circuit. You might consider modeling elevator traffic and comparing the performance of two different controllers. There are a lot of ways to take this specific project in different directions.
- **Cache Controller**
  You might build a cache controller in logisim. This controller would implement (in hardware) the necessary logic to operate a cache. You might add it to the Y86 circuit we completed recently.
- **Garage Door Circuit**
  You might design a remote garage door opener. How are the sender and receiver to communicate? How would you design each part of the device? How might you encode the signal to prevent un-wanted entry by fake devices? Again, you can take this in a more "hardware" direction or "software" direction.
- **Autonomous Robot**
  You might build an actual wheeled robot to navigate the second floor of Olin. What sensors and actuators would you need? What other hardware would you need? How might our Ant Lab help design a controller for the robot? What would the robot's objective be?
- **Traffic Light Controller**
  Build a controller to control the timing of traffic lights in a small town. How does one time traffic lights? What are the considerations? How do you measure your objectives?
- **Inverted Pendulum**
  An inverted pendulum is the 2D equivalent of balancing a broom stick in the palm of your hand. The Arduino can sense the position of the broom stick and then make changes to the "hand" to keep the broom stick upright. (Challenging)

- **Arduino Blog**
  The Arduino blog site has several good project ideas. You can implement one of these (of sufficient complexity) or adapt it to your own needs.

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  blog.arduino.cc
  ```

- **Arduino Playground**
  This Arduino site has more than a dozen good project ideas. You can implement one of these (of sufficient complexity) or adapt it to your own needs.

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  playground.arduino.cc/Projects/Ideas
  ```

3 Deliverables

You have three primary deliverables for this lab.

1. **Concept: Friday, November 18**
   Your team should a PDF that presents your project concept in 2-3 paragraphs, and includes a hardware requirements list. Do not include wires, LEDs, or the Arduino itself, but *do* include all sensors and actuators that you need. You do not have to limit yourself to our inventory, and I will purchase new items *if we can argue usefulness in subsequent iterations of the 281 class*.
2. **Project Demo: Scheduled between Wed., Dec. 7 and Fri., Dec 9 by 4:30pm**
   You should demonstrate your working solution to the problem/goal presented in your concept document. Each demo should last approximately 10 minutes, and is scheduled independently with your instructor.
3. **Project Report: Friday, December 9**
   Your team should submit a full written report of your project which includes:
   - A complete project description.
   - A complete design solution.
   - A complete hardware description (diagrams as necessary).
   - A complete software description.
   - Any other analysis as appropriate for your project.
   The report should be VERY WELL written. A big part of your project grade is the quality of the report, beyond the quality of the project itself.

4 Grades

This project is worth twice that of a normal project, evaluating the novelty of the concept, the implementation and demonstration, and a complete and coherent lab report.