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2.007 Design and Manufacturing I
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Milestone 2

Develop Strategy and Work Toward Final Car Design

Schedule for: week of 9-13 February.

Deliverable: 3-5 pages in your lab notebook before next week's lab

Week's Activities

The first of this week's activities is for you to finalize your (winning!) strategy so you can move on to your design concept and then detailed design. Second you will implement in lab (manufacture/assemble) the car you designed last week.

1. Strategy Selection

A strategy is a *feasible* framework for achieving a challenging goal. The term "strategy" is frequently used loosely in non-scientific fields to dignify a hoped-for outcome. In technical fields the connotation is that the strategy is feasible, i.e. not contravening the laws of physics or expected constraints on the project. For instance, is planning to crush cans in less than 10 seconds a violation of power constraints?

The goal obviously is to do well in the contest. The challenge comes from the fact that about 150 other people have the exact same goal. The concept of a framework is that it is an initial top-level approach which you can proceed to detail with confidence.

Having explored your kit and the contest and developed three preliminary strategies (Milestone 1), you are in a position to refine these and determine your winning strategy. Do experiments and analyses as required, break your strategy into various steps, and collect information and ideas from your peers, previous contests, the UAs, the shop guys, and lab instructors to aid you in this process. As in making any decision, establishing the criteria for the selection (decision) is essential.

2. Car (Platform) Manufacture

This week you are to manufacture (build) your simple car, as modified from the standard design. It would be very useful to summarize your observations after you've tested it in as precise a manner as possible, and then draw key implications for your final car design. Examples: If wheels are separated by over X inches, one of my wheels may get stuck into a slot in the box when I try to leave. Therefore, the width of my car wheels should not exceed (X - safety margin.)

Second, you obtained a feel for the forces and velocity available from your design. Can you estimate these from the motors you used and compare them with reality? Consider the implications of these for your strategy. For instance, in the strategy time-line, what would be a reasonable amount of time to allocate to cross the table and return? Were the cars slow?

By narrowing in on your strategy, you should be able to draw implications for the key parameters of your car. Center of gravity, width, length, and % of weight over the drive wheels are some of the key parameters. It's important to get an idea of where and how your operational modules will go on your cars; i.e. think of your car as a platform for these modules. Refine and finalize your preliminary design from week 1 as appropriate

based on your latest learning, and prepare an implementation plan for building your final car. As always, a good plan for the building steps can avoid later redesign and rework. (Measure twice; cut once!) Then build it, seeing if you can get it right the first time!

Milestone 2 Specific Deliverables

As for last week, the deliverables should be documented in your laboratory notebook and turned into your lab instructor, as determined by your section practices, before the following week's laboratory. For this week and all successive weeks, you should meet with your peer group. Bring your completed lab notebook to your peer group meeting, and have your peers review your work. It is useful if they can annotate your work directly using some kind of color code, i.e. Alice uses a red pen and Joe uses a blue ballpoint pen so your lab instructor can decode who did what. You are perfectly free to modify your work following the peer review, e.g. if one of your peers says that your extending arm "violates St Venant's principle," add to your notebook to prove it isn't in violation or resolve the problem.

1. Strategy Summary

Summarize your selected strategy. You should provide a time-line, a prediction of the range of your scores based on likely outcomes, how you will defend if necessary, and a an outline of the key risks and countermeasures. Complete an analysis of **at least one** key step in your strategy to demonstrate its feasibility. For instance, how much energy does it take to lift a bale to some height? Where will you get the power to do this? What's a conservative projection of the time required? Also provide the reasons (in a comparative table for instance) as to why you chose your specific strategy. Be prepared to explain/demonstrate to your section that your strategy is **feasible**. ie can meet all the various constraints.

Respond also to your instructor's comments from Milestone 1.

2. Final Car Design

Since you have experience with your simple car, develop an initial design for your final car with a labeled dimensioned sketch in your notebook. Refine your acceleration and velocity predictions for this version.

In pursuit of learning, that is doing it better the next time, you should also summarize in your notebook what you learned in the design and build process. How well did you do in implementing your plan for building the simple car?

N.B. In 2.007, section instructors establish the specifics of how their sections operate. So one instructor might ask, for instance, that you format your strategy deliverable into a five minute presentation. These variations will be communicated in your individual section. But by and large, all sections will follow reasonably closely with these milestone requirements.