Department of Mechanical and Aerospace Engineering
University of California, Irvine
MAE 106 Mechanical Systems Laboratory
Winter 1999

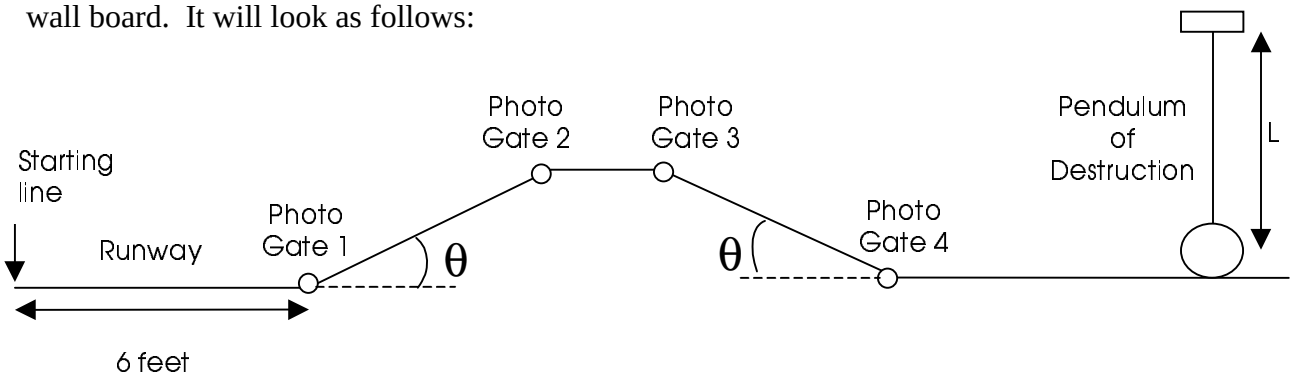
Final Project Details:
Cruise Control Crash Course

Project Summary:

Your final project involves the design of a battery-powered car that is capable of cruising at a constant velocity. The car should maintain its velocity whether it is travelling uphill, downhill, or on a level surface. On the day of the scheduled final (March 18, 8-10 AM in EG2110), there will be a contest testing your car. The car will be required to traverse a course that contains a hill, then pass through a swinging pendulum. The car will have to move at the appropriate speed so that the pendulum does not squash it.

Course Details:

The course will be four feet wide and approximately 35 feet long. It will be made out of white wall board. It will look as follows:



Notes:

1) There is a 6 feet-long runway for your car to get up to constant speed.
2) The time T_{12} it takes your car to pass between Photo Gate 1 and 2 will be measured, and compared to the time T_{34} it takes to pass between Photo Gates 3 and 4. The goal is for your car to make $T_{12} - T_{34} = 0$. Cars will be rank-ordered based on how close the time difference is to zero.
3) The angle theta will be less than 30 degrees.
4) The diameter of the mass at the end of the pendulum will be less than 6 inches.
5) *On the day of the contest*, you will be given the pendulum length L and the surface distance along the track from the starting line to the pendulum. The pendulum will be dropped from a starting angle of 15 degrees away from vertical. Based on these course parameters, you will have to select a suitable speed for your car. You should design your car with an adjustable, calibrated speed control, and you should do the math ahead of time to predict the desired speed for your car based on the unknown parameters.

For extra credit, you can incorporate automatic steering into your car, and the ability to track black electrical tape laid in a curved pattern on top of the wallboard.

Grading:
The final project is worth 30% of your grade. You grading will be based on:

1. the performance of your car the day of the contest
2. a written final project report

The goal of the written final project report is to describe your design as clearly as possible, and the effort you put into building and testing the car. One write-up should be turned in per project group.

Format for Final Project Write-Up (3-5 pages):

1. Summary (200 words or less)
2. Design
    A. Controller Design, including:
        block diagram
        brief summary of how the controller works
        dynamical equations and solution
        circuit diagrams/equations
        how you chose controller gain values
    B. Mechanical Design
3. Construction/Testing
    A. How you built the controller (include a parts list, including where you bought/procured the parts and how much they cost)
    B. Any tests you performed to calibrate/verify/improve performance (with graphs)