Department of Mechanical and Aerospace Engineering
University of California, Irvine
MAE 106 Mechanical Systems Laboratory
Winter 2000

Final Project Details:

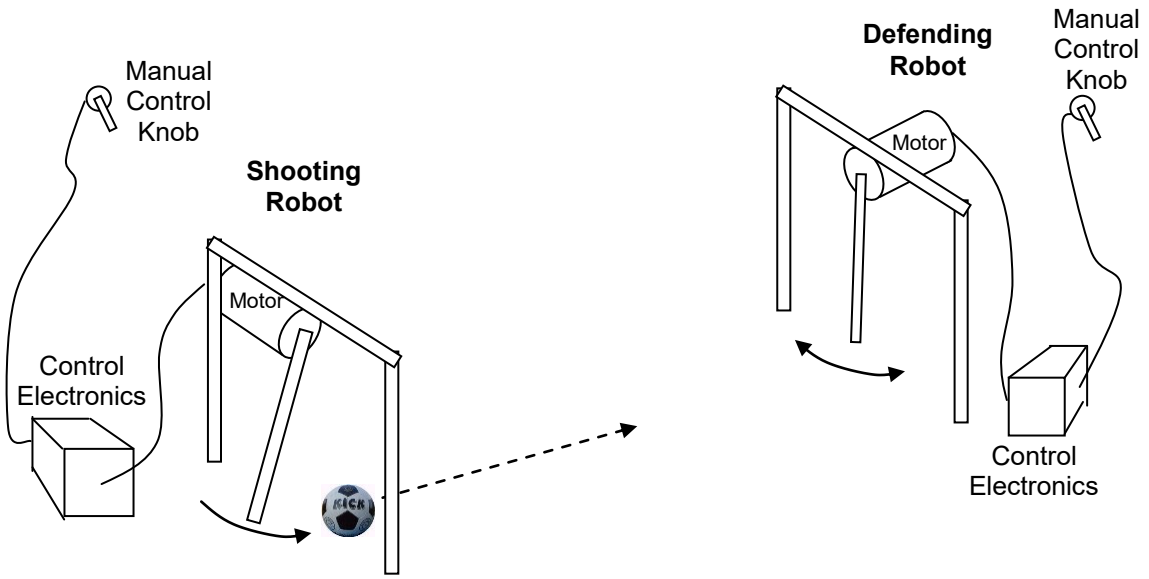
PELE′ 2001

Project Summary:
For your final project you will design and build a teleoperated robotic soccer player capable of both kicking a ball into a goal and defending the goal. You are expected to work in project groups of 2 or 3. On the day of the scheduled final (Tuesday, March 20, 4-6 PM) there will be a tournament testing your robotic soccer player. The tournament will be held in the MAE106 Lab.

Lab Hours:
The lab will be open from 8-12 A.M. and 1-5 P.M from February 26th until the contest. If the lab door is locked, you must sign-in with Dwayne Gates in room EG2118 before the lab will be opened. For safety reasons, there must always be at least two students in lab for the door to be opened for you, so bring a partner. While you are in lab, do not leave the room unattended. You are responsible for all laboratory equipment while you are in the lab. Sign-out with Dwayne when you leave.

There will be no lecture March 13th or 15th to allow time to work on your project. Prof. Reinkensmeyer will be available in lab during the regular lecture time on those days for consulting. In addition, your TA's will be available in the lab during your regular lab time that week.

Setup:



Contest Rules:
The contest will be a single-elimination tournament similar to a soccer "shoot-out". Two teams will be selected. The referee will toss a coin and the team that wins the toss will take the first kick. The kicks will be taken alternately by the teams. Subject to the conditions explained below, both teams will take five kicks. The kicks will be taken alternately by the teams. If, before both teams have taken five kicks, one has scored more goals than the other could score, even if it were to complete its five kicks, no more kicks will be taken. If, after both teams have taken five kicks, both have scored the same number of goals, or have not scored any goals, kicks will continue to be taken in the same order until one team has scored a goal more than the other from the same number of kicks.

Notes:
1) The distance between goals will be 31¼".
2) The width of the goals will be 11".
3) The robot motor will be required to rest on a ring stand.
4) The height of the ring stands will be 14".
5) The diameter of the rings on the ring stands will be 4".
6) Two practice fields will be available in lab.
7) The same robot and control system must be used for both kicking and defending.
8) You will be allowed to adjust the yaw angle of the robot on the ring stand before kicking or defending.
9) The leg of the robot must be able to fit through a paper-towel core (at all times).
10) The ball will be a ping-pong ball.
11) You will be provided with a power supply for your motor (the same ones used in the labs).
12) You are not allowed to store energy in your system *before* the kick.
13) Your robot must be teleoperated using a potentiometer to control leg angle.
14) Your robot must use a feedback controller.

Starter Kits:
You will be provided with a starter kit comprised of:
- 1 Pittman DC Gearhead Motor
- 1 Butyrate Tube (1.5")
- 1 Vinyl Tube (1.5")
- 1 Garolite Collar (.5")
- 2 Spring Pins

The tubing, collar, and pins are useful for coupling the motor shaft to a lever and to a potentiometer. The kit may be checked out from Duane Gates in EG2118 beginning Feb 28th, 8 AM – 12 PM, 1 PM – 5 PM. ***IMPORTANT!!!!!: You must return the kit in order to receive your final grade. If the motor is not in working order, you will be required to pay for it ($23.50).***

Other Required Parts:
You will need to purchase other components for your project, such as a protoboard, potentiometers, resistors, wire, op-amps, and MOSFETS. The total cost of your project should be under $20. Suggested vendors are:

- Radio Shack: 4716 Barranca Parkway, Irvine (949)552-1091 (and other locations)
- Marvac Electronics: 2001 Harbor Blvd., Costa Mesa (949)650-2001
- Fry's Electronics: 10800 Kalama River Ave., Fountain Valley (714)378-4400 (and other locations)

You can also purchase parts from bulk vendors, such as:

- Digikey: www.digikey.com
- Newark Electronics: www.newark.com

To avoid a service charge for small orders, you may want to partner with several groups when ordering from these vendors.

Grading:

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

1. the performance of your catapult on 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 catapult. One write-up should be turned in per project group.

Format for Final Project Write-Up (<= 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, including:
        any mathematical analysis you did in the design
        a parts list, including where you bought/procured the parts and how much they
3. Testing: Any tests that you performed to calibrate/verify/improve performance (with graphs)

Projects with quantitative analysis and detailed experimental testing will score higher.