Name: Alan Kilian

Title: Design and construct a Holonomic motion platform and control system.

Description: This project will produce a mechanical device that can move about on a hard-surfaced floor while carrying enough batteries to be able to move for 30 minutes. The device will be able to move in any direction while keeping the same orientation as well as change its orientation while keeping the same location. The device will be controlled through a ``tether'' wire from a desktop PC.

Background and Rationale: I have been building machines and electronic devices for many years and have a lot of experience with these systems. This project builds on the experience of project #1 "Develop a tuning guide for PID control systems". The successful completion of a degree in mechatronics will require an understanding of mechanical, electrical and computer systems as well as the tools used to design and implement each of these systems in order to produce a machine capable of performing a specific task. This project intends to demonstrate proficiency using the tools required to design, build and test a small electro-mechanical system.

Objectives: Demonstrate the ability to calculate a theoretical estimate of electrical power consumption, to design an appropriate power source, to construct a power source and to measure the performance of the power source, verifying that it meets the design goal of providing enough power to run the robot for 30 minutes.

Demonstrate the ability to select electronic components suitable for use in implementing a closed-loop control system for small electric motors.

Demonstrate the use of printed circuit board design tools at an intermediate level.

Demonstrate the ability to select mechanical components, fabricate machined parts and assemble a simple working mechanical system.

Methods: Using the motion control system, motors and encoders from project #1, design and build a printed circuit board to control three motor and encoder systems. Research possible mechanical systems that will allow the machine to perform the required motions. Select a mechanical design, acquire or build the required parts, assemble and test the mechanical system. Develop a theoretical estimate of the required power, select and build a power system to meet the required time of operation. Tune the control system for the completed mechanical system. Write software for a desktop PC to demonstrate the required motions.

Results: The project will result is a working electromechanical system capable of performing the required motions. It will also be desirable if the project results in a description of the system suitable for publication in a popular-press magazine.

Schedule: 8/00 Selected a mechanical design, and acquired parts. 20 Hours
9/00 Fabricated parts, and assembled mechanical system. 35 Hours.
10/00 Studied electrical power requirements, selected and implemented an electrical system. 30 Hours
11/00 - 1/01 Learned electrical and printed circuit board design tools, designed and build circuit boards for the project. Est 80-120 Hours
10/05 Design and implement the software for the final demonstration. Est 20-40 Hours

Evaluator: Dr William Durfee Department of Mechanical Engineering, University of Minnesota.

Evaluation: Discuss how well the student demonstrated his understanding of the process of designing, constructing and testing a printed circuit board.

How well did the student demonstrate the ability to select mechanical components, fabricate machined parts and assemble a simple working mechanical system? How did this project compare to other undergraduate projects of a similar nature?

Discuss how the student demonstrated the ability to calculate a theoretical estimate of electrical power consumption and his ability to create a power system meeting the requirements.

In what ways did the student demonstrate his ability to design and construct a mobile robot capable of producing the motion described in the *description* section?

Bibliography:
PIC-SERVO / PIC-ENC Servo Motion Control Chipset (n.d.) Retrieved December 9, 1999 from http://www.jrkerr.com/psdata.pdf

Hunt, Steven (1999, January) National Semiconductor Application note 693 LM628 Programming guide. Retrieved from http://www.national.com/an/AN/AN-693.pdf

Dahlin, Tom & Krantz, Don (1992) "Closing the Loop on DC Motor Control" The Computer Applications Journal, 28, 50-57

DC Motors Speed Controls Servo Systems (2nd Ed.). (1973) Minneapolis, MN: Electro-Craft Corporation

Jones, Joseph l., Flynn, Anita M. (1993) "Mobile Robots Inspiration to Implementation" Wellesley, MA: A K Peters