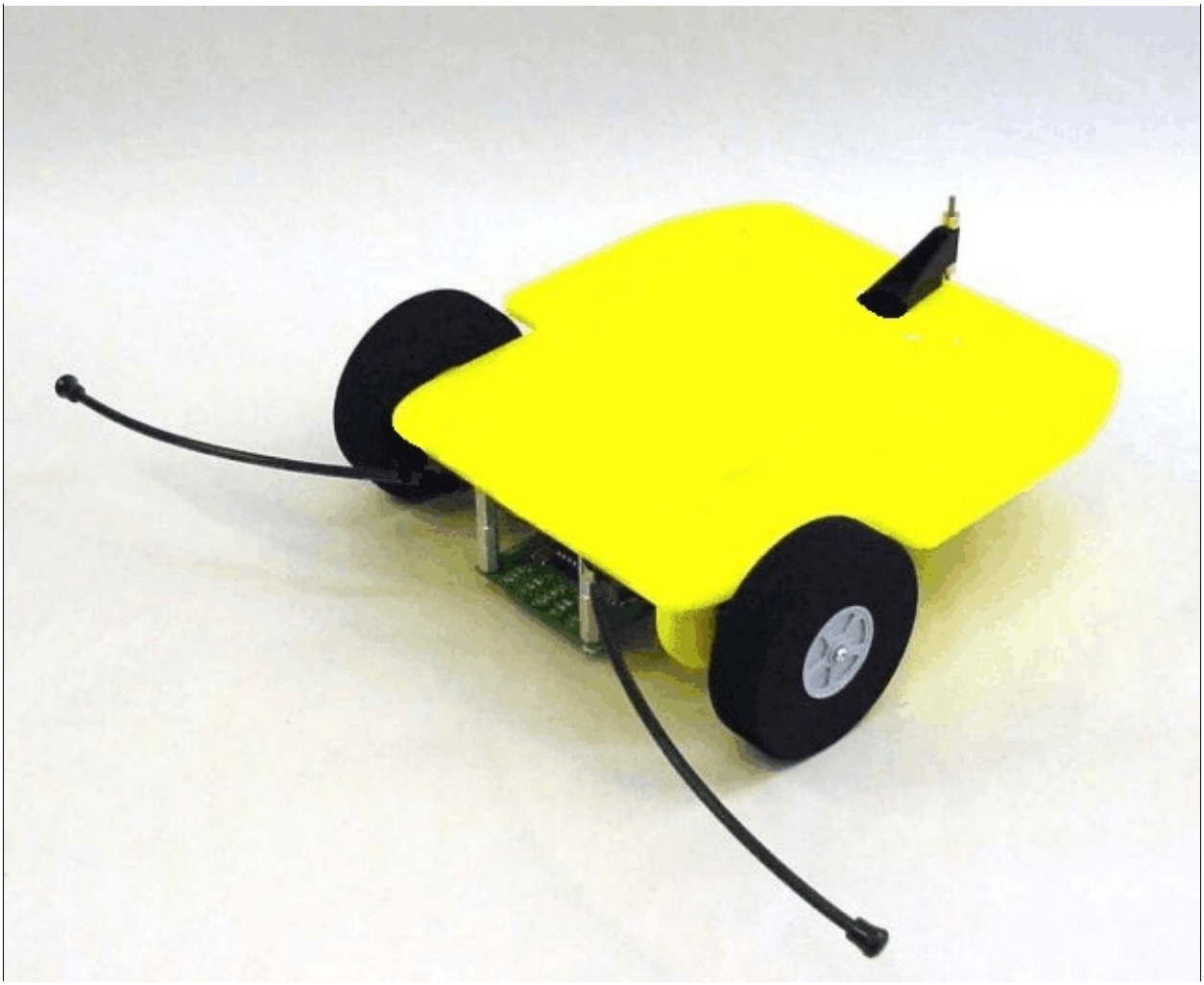
EE 466 Modern Digital System Design

Fall, 2002

Klipsch School of Electrical and Computer Engineering
College of Engineering
New Mexico State University

Semester Design Project

This semester each team will build a robot capable of following a line drawn on the floor. The basic chassis will be built from a CR2-NE kit, available from Lynx Motion Industries (www.lynxmotion.com). This kit provides a platform approximately 8" square supported by two motor driven wheels, a tricycle gear, battery holders, and on/off switch. In addition to the basic kit, each robot will have a line tracker module (TRA-KT) and bumper switch kit (BMP-01). The complete basic chassis, as seen from the front, is shown below. The line tracker module can be seen hanging below the platform. The two antenna-like projections in front of the wheels are extensions for the bumper switches. The assembly at the back is a pivot for the rear wheel.

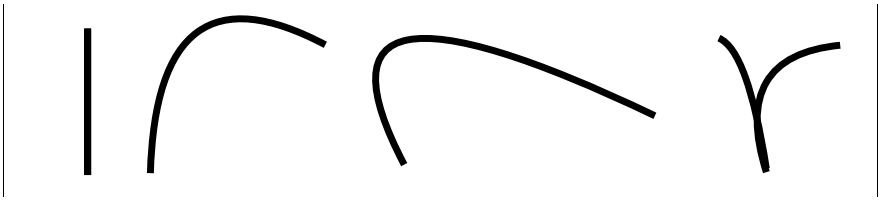


The front wheels are driven by servomotors, originally designed for remote control airplanes, an application which only requires the motors rotate ± 45°. The motors must be physically modified to rotate continuously. Directions for this alteration are included with the basic kit.

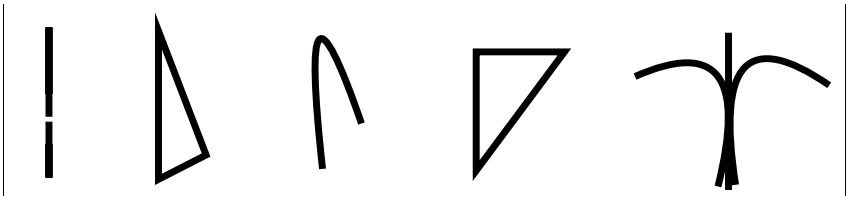
The robot's platform is sufficiently large to mount two breadboard sections. These should be mounted with thick double-stick foam pads, so the boards will clear screw heads and be reconfigurable.

THE TRACK

Once you have built the basic robot chassis, you are ready to design, implement, and test the electronics which control it. Each robot will be required to follow a track on the floor. Specifically, the track will be a strip of black friction tape, ½" wide, laid out on the floor tiles of room 203 (or another room with identical floor tiles). This track will be continuous and consist of straight line segments and arcs, with any radius down to 12". In addition, the track may branch into, at most, two paths. There will be a maximum of 10 branches. The following are legal:



However, these are not:



Paths may dead-end at a physical barrier, substantial enough to trip one, or both, bumper switches. The entire track will have a single designated start point and a single designated finish point.

THE TASK

Your robot will be expected to traverse the entire track, from start to finish, following the line. When you come to a branch, you must decide which to take. If the one you choose dead-ends, you must back up and take the other path. Teams will be judged on three abilities:

1. What percentage of the track was traversed. Ideally, this will be 100%. This is the most important ability.

2. How long it takes to go from start to finish. The faster, the better. This is the second most important ability.

3. On an immediate second try, can your robot go from start to finish without taking any wrong turns? In other words, can you remember the successful choices made at each branch?

MILESTONES

September 4, 6	Each team will give an oral and written report describing your design concept. In particular, explain your approach to generating the pulses needed to control speed and direction of the motors and your method of line tracking.
About Midterm	Each team will demonstrate their robot's abilities, on a track of my design, using an Altera 7128 EPLD as the control logic. The following two class periods will be dedicated to oral and written reports detailing the programmable logic phase of the project. See below for report specifics.
Finals Week	Each team will demonstrate their robot's abilities, on a track of my design, using a PIC 16774 microprocessor as the control logic. Then oral and written reports detailing the programmable logic phase of the project will be presented. See below for specifics.

REPORTS

Each member of your team is expected to participate in oral presentations. You will be graded on your oral presentation skills. The use of overhead projectors, chalkboards, and video projectors is strongly advised. These presentations should be practiced, polished, and formal, with an introduction and conclusion.

At the time the oral presentation begins, the presenting team will hand in a written report, covering the same material as the oral presentation, but in more depth. You will be graded on your technical writing skills, clarity of written expression, and organization. Of course, spelling, grammar, and punctuation count! As with the oral presentation, the written report must have an introduction and conclusion.

Both the oral and written reports should be aimed at an engineering audience, but one without specific knowledge of the project. Therefore, in the introduction you should describe the problem to be solved, the equipment available, and finally, your approach to solving the problem. Diagrams, charts, drawings, photographs, code listings, etc. may be included.