EE 382: Introduction to Design

Electrical Engineering Department
New Mexico Tech

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Instructors:

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Course Objectives

- Learn an approach to design, project management and team work.
- Learn to use spec sheets and design according to available components.
- Learn how to write technical documents and give presentations.
- Perform various case studies.
- Integrate skills learned and experiments used in previous courses into a creative design process.

Project

- Design an autonomous vehicle that is capable of navigating outdoors through specific waypoints and/or landmarks. The terrain will consist of both paved road as well as off road portions. At each waypoint there will be objects with various characteristics that your robot must identify and locate (e.g., something emitting heat, RF signal, etc.). The exact characteristics of the waypoints will be determined throughout the semester.

Tasks

- **Sensor suite:** aiding sensors for location determination and collision avoidance.

- **Low-level control/sensor integration:** real-time control of the robot motion and processing/handling of the sensor data.

- **High-level control/coordination:** Information management, path planning, and successful navigation of the robot through the waypoints.

Project Specifics

- Outdoor environment.
- Path is a combination of paved and unpaved terrain.
- GPS availability is not guaranteed.
- Objects of different attributes will be placed at each waypoint (tentative)
  - Color
  - Temperature
  - RF emission
  - Reflectivity
  - Location by navigation
  - High contrast object
- Robot has to perform an action indicating when it has reached each desired waypoint.
- Team budget: TBD.

Provided Items

- Robotic platform

- 2 Dual High Power H-bridge motor drivers

- Lithium Iron Phosphate (LiFePO4) Battery Pack

- Battery charger (shared by all teams)

Grading

Assignments: (survey papers, etc.)   10%

Preliminary Design Review: 10%

Midterm Functionality & Design (functional prototype):   25%

Final Presentation: 10%

Final Report (including electronic version):   10%

Final Functionality & Design: 25%

Group Members Evaluation: 10%

In general, same grade is given to the entire team. Occasionally, higher grade will be given to team members who make outstanding contribution, and lower grade to members making inadequate contribution.

Assignments

- Assignment 1: Write a survey paper on autonomous navigation

- Assignment 2: Write a paper on how you plan to use some of the techniques you surveyed in the previous assignment in your project.

Milestones

- Assemble robot and test with H-bridge
- Initial design intentions: central control, sensor subsystems, power, etc.
- Initial test of control system. Use a control unit to have the robot go in a square
- Down selection of sensors.
- Sensor integration and testing.
- Complete prototype testing and evaluation

Expectation from You

- Attend class
- Work efficiently within your team
- Complete assignment and milestones
- Regularly check the website for updates, announcements and deadlines.
- Complete the project

Your Expectation of Us

- It is a design course, so you will be guided but not provided with the solution.
- You will be provided with a series of presentations to help you with your project.
- We will be available during the class period and during office hours.