Introduction to ESE112 Lab

Lab Overview

Staff

- Instructor:
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- Lab Co-ordinator:
  - Sansern Somboonsong
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Lab Logistics – Grading

- Grading (Lab is 0.5 cu)
  - Pre-lab exercise: 20%
  - Lab Report Write-ups: 60%
  - Quizzes: 20%
    • Announced a week in advanced

- Missing Labs
  - Due to the nature of the course, making up missed labs is not possible.
  - Unexcused absences will result in a 15% penalty for that lab

Lab Logistics - Prelab

- Before lab period we will post lab with related background material
  - http://www.seas.upenn.edu/~ese112/
  - There is no textbook for this course

- Questions termed as “Pre-lab” are to be completed & turned in at the start of the lab
  - Work individually
  - Preferably typed
**Lab Logistics - Lab Report**

- Post-lab Write-ups
  - A technical report to communicate the findings of your lab experiments
  - Is to be done *individually*
  - The report must be typed
    - See report writing guidelines document (coming soon!)
  - You may use course notes & lectures provided and any external source (properly cited) with exception of past years lab/students

**Lab Logistics - Working in Lab**

- Labs are to be done in groups of 2 or 3
  - You are encouraged to collaborate within your group and use any resources available to you
  - However, you may not discuss the lab with other groups

**Lab Logistics - Working in Lab (contd..)**

- Throughout the semester you may choose your *own* groups
  - HOWEVER, you may not work with the same person *twice* throughout the semester
  - Post-lab experience will ask what your and your group-mates contributions to the lab
    - In extreme cases your grade will be adjusted based on your effort
    - If you feel for any reason you cannot reasonably work with one or more of your group-mates, see the instructor immediately

**Lab Goals**

- Introduce you to Electrical and Systems Engineering (ESE)
  - Expose you to topics you will see in future courses
- Develop problem solving and critical thinking skills
  - Investigate solutions by applying and evaluating information gathered from, or generated by observation, experience, and reasoning
- Adapt to different thinking and working styles when working in a team
ESE

- Electrical Engineering
  - Technology behind
    - Power & Energy
    - Gadgets: LCD displays, computers, phones, robots
    - Communication Devices: Radio, cell phones, satellites
  
- System Science and Engineering (SSE)
  - Aspects of engineering pertaining to a system

ESE (contd..)

System

- An arrangement (pattern, design) of parts which interact with each other within the system’s boundaries (form, structure, organization) to function as a whole

Ben Franklin – Urban Challenge
http://www.benfranklinracingteam.org/

Rhex
http://kodlab.seas.upenn.edu/~edubot/wiki/index.php/Main_Page

ESE (contd..)

SSE

- Designing and developing a system requires integration of several scientific and technical fields
  - Math and Sciences (physics, chemistry)
    - Basis of Electrical Engineering
  - Computing (computer science)
  - Mechanical & Material Engineering
  - Biology/Bioengineering

Computer & Telecommunications Engineering (CTE)

- Computer Systems & Information Exchange (Internet)
  - Design & Building computers (embedded and general purpose) & networking systems

ESE (contd..)

Working on a Physical System

- In ESE112 we will use Edubot
  - hexapedal (six legs) robot
  - independently moves forward or backward
  - climbs over a variety of terrains

- Exemplifies Core ESE Disciplines
  - EE – electrical devices; electrical circuits
  - CE – embedded and distributed computation
  - SSE – composition, multiple hierarchies of subsystems

ESE112
Lab Content

- Electrical Engineering concepts in Robotic System
  - Robots use sensors to get information and actuators for navigation
    - Both components convert one type of energy to or from electrical energy
- Lab1: Intro to Concepts
  - Theory: Voltage, Current, Resistance, Electrical laws (Kirchhoff Laws)
  - Lab: Make changes Electro-mechanical Mouse system based on the theory

- Lab2: Build a Light Sensor
  - Theory: Electrical Components & Lab devices
  - Lab: Design and Implement sensor that turns off when it is dark

Lab Content (contd..)

- Math & Computing concepts in Robotic System
  - Idea is to built autonomous navigating robots
  - Robots are equipped processors that can command the robot sub-system
    - We can program the robot to evaluate its surrounding as it moves
- Lab3: Interact with robot hardware & software
  - Theory: Linux Platform
  - Lab: Downloading program on robot hardware
- Lab 4: Dance Lab
  - Theory: “Kinematics” and Leg movement
  - Lab: Write a Java program to choreograph the robot to a song
- Lab 5: Optimize walking gait of the robot
  - Theory: Derivative, min/max, gradient descent
  - Lab: Write a Java program to would maximize the walking speed

Lab Content (contd..)

- Concepts from Mechanical & Material Engineering and Biology
  - Lab 6: Tentative

Edubot Demo

- Lets take a walk with the Edubot