Introduction to ESE112 Lab

Lab Overview

Introduction

- Introductory programming that is integrated with traditional engineering theory

- Involves 2 components:
  - Computer Programming Lecture with Java Programming Language (.5 cu)
  - Engineering Lab (.5 cu)

- You must enroll in both components
  - If you already know Beginner Level Java then you can take the Placeout Exam – details on website

ESE112 vs. CIS110

- How is it different from CIS110?
  - Unique lab component that is geared towards building real-world applications

  - Hands-on approach to engineering design
    - Construction and Programming of robots allows a wide range of scientific and engineering principles to put into perspective and practice

  - Get perspective what you can see in future courses

  - Work with cutting-edge research technology

Staff

- Instructor:
  - Diana Palsetia
    - Email: palsetia@seas.upenn.edu

- Course Website:
  - http://www.seas.upenn.edu/~ese112/
**Lab Goals**

- Able to apply knowledge of mathematics, science, and engineering
- 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 major overview**

- **Electrical/Electronics Engineering**
  - Technology behind
    - Power & Energy
    - Gadgets: LCD displays, computers, phones, robots
    - Communication Devices: Radio, cell phones, WiFi, satellites
  - Electrical engineers concerned with:
    - electricity to transmit energy (power engineering)
    - using electric signals to sense, store and transmit information (electronics engineering)
- **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

**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
Working on a Physical System

- ESE112 star attracter “EduBot”
  - Hexapod 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

Lab Logistics - Grading

- Grading (Lab is 0.5 cu)
  - Pre-lab exercise: 15%
  - Lab Report Write-ups: 70%
  - Final Exam: 15%

- 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
  - 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 (please write legibly)

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 on the website

  - You may use course notes & lectures provided and any external source (properly cited) with exception of past years lab/students

  - Late report will incur penalty of 10% per day up to 4 days and then no credit
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

- Throughout the semester you may choose your own groups
  - HOWEVER, you may not work with the same person twice throughout the semester

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

- Topic: Intro to Electrical Circuit Theory
  - Theory: Voltage, Current, Resistance, Electrical laws (Kirchhoff Laws)
  - Lab: Make changes Electro-mechanical Mouse system based on the theory

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

Lab Content (contd..)

- Math & Computing concepts
  - E.g. Robotic System: Idea is to build autonomous navigating robots
    - Robots are equipped processors that can command the robot subsystem
    - We can program the robot to evaluate its surrounding as it moves

- Topic: Introduction to Linux Platform
  - Theory: Interact with robot hardware & software
  - Lab: Downloading program on robot hardware

- Topic: Dance Lab
  - Theory: Kinematics and Leg movement
  - Lab: Write a Java program to choreograph the robot to a song

- Topic: 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..)

- Communication & Writing Development
  - Work with TCP (Technical Communication Program) to improve proficiency in the skills of communication

- Effective use of Library Resources
Edubot Demo

- Let's take a walk with the Edubot