Dr. A. Antonio Arroyo & Dr, Eric M. Schwartz
Electrical & Computer Engineering Department

EGN 1935: ECE (AD)VENTURES Fall 2014

Revision 0

http://mil.ufl.edu/1935/

Catalog Data: ECE Adventures. Credits: 2. Requirement: Freshman or Sophomore Standing. Description: If you are unsure of your major or would like to learn about potential experiences of an Electrical and Computer Engineering student, this course is for you! In EGN 1935 you'll learn about robots and experiment with sensors and actuators. This process will help you discover many basic ECE concepts. Grades are based on attendance and class participation. No exams.

Textbook: Fred Martin, *The 6.270 Robot Builder's Guide*, MIT Media Lab, Cambridge, MA, 1992 downloadable from our web site at the bottom of the page at http://mil.ufl.edu/imdl/handouts.htm.

Reference: Joseph Jones, Bruce Seiger & Anita Flynn, *Mobile Robots: Inspiration to Implementation*, 2nd edition, A.K. Peters Publishers, Natick, MA, 1998. Fred Martin, *Robotic Explorations*, Prentice-Hall, 2001.

Coordinators: **A. Antonio Arroyo**, Ph.D., PE, Associate Professor, MAE-B 338, 392-2639, **arroyo@mil.ufl.edu**. Areas of specialization: Machine intelligence, artificial intelligence, microprocessors and embedded systems microprocessors and embedded systems, expert systems, human-machine interaction, computer software and hardware systems, pattern recognition, digital signal / natural language and speech processing.

Eric M. Schwartz, PhD, Master Lecturer, MAE-B 321, 392-2541, **ems@mil.ufl.edu**. Areas of specialization: Robotics, microprocessors and embedded systems (hardware and software), digital design, autonomous mobile agents, machine intelligence, controls, robot manipulators.

Teaching Assistants: Mason Turner, Khaled Hassan

Goals: To discover principles of Electrical and Computer Engineering via implementation in an autonomous robotic platform. Students are familiarized with electronic instrumentation (including multi-meters, power supplies, waveform generators and oscilloscopes), electronic equipment (including soldering irons and proto-boards) electronic components (including batteries, switches, LEDs, resistors and logic gates), electro-mechanical actuators (including DC motors, servo motors and solenoids), electronic sensors (including IR emitter/detectors, CdS cells, sonar and cameras) electronic circuits (including switch circuits, LED circuits, voltage divider circuits, motor driver circuits, basic digital circuits, piezo speakers, printed circuit boards), robot software (GUI, C-functions, C programs) to control robot behavior, and presentation software tools (MS PowerPoint).

Prerequisites: None

Topics: (Tentative)

1. Power supplies, batteries, multi-meters, oscilloscopes, waveform generators, soldering, hand tools, rudimentary robot programming.
2. Proto-boards, switches, LEDs, resistors, bump sensors, pull-up/down resistors.
3. Voltage divider, CdS cells, potentiometers.
4. IR, modulated IR emitter/detectors, PWM signals, DC motors, servos.
5. Other sensors, actuators, simple behavior software
6. Intermediate robot programming, behavior creation and arbitration.
7. Piezo speakers, sound generation, digital signals, sampled data, sampling frequency, sonar.
8. Cameras, magnetic sensors, laser bump, modern sensors and actuators, radio frequency, ICs,

Computer Usage:

Students will use a simple language (such as our version of LOGO, POGO, BASIC or function calls in C) to develop very simple behaviors on an autonomous robotic platform. PCs (or personal laptops) will be used to develop some rudimentary robot software. MS Word and MS PowerPoint will also be used.

Laboratory Projects:

Students will conduct 6 laboratory projects during the semester (one every two weeks). Each lab sessions corresponds to one or more of the eight topics listed above. In the first lab students are allowed to play, muse and compete in teams attempting to solve a maze with a robot.

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Grading

Grades are based on ATTENDANCE, two small oral presentations, and laboratory and class participation. No exams, quizzes or homework. Attendance is taken in all classes and labs. Students are allowed 1 absence during the semester. A second absence will result in a grade of A-; a third absence results in a B; a fourth absence results in a C; a fifth absence results in a D; more than 5 absences results in an E. It is important to arrive promptly to each class/lab; late arrivals will count as ½ of a missed class/lab (i.e., ½ absence).

Times and Locations of Class and Lab

- Classes are Tuesdays, periods 8-9 (3:00-4:55pm) in CHE 237
- After the first class, verify your lab time at http://mil.ufl.edu/1935/admin/s14_lab_time.htm
- Lab meetings are in NSC 407 during one of the below time blocks (determined during our first class)
  - Section 1: Mon, periods 7-8, with Khaled Hassan
  - Section 2: Tues, periods 8-9, with Andrew Gray
  - Section 3: Tues, periods E1-E2, with Mason Turner
- Student lab assignments can be found at http://mil.ufl.edu/1935/admin/f14_lab_time.htm

WEEK/DAY		DATE	LAB #	Lecture #	Tentative Weekly Topics / Comments
1	T	26 Aug		0	Course Syllabus, Web Site, Motivation, Logistics
2	T	2 Sept		1	Power, Batteries, multi-meters, instrumentation, switches, LEDs, Resistors, voltage, current, circuits, ICs, AC vs DC
3	T	Week of 9 Sept	1		Introduction to the Lab, soldering irons, scope, software, adding LED(s) to a robot, dead reckoning, solving a maze, maze contest
4	T	16 Sept		2	Voltage Divider, Bump Sensors, pull up/down resistors, CdS cells, variable resistors, resistor ladder networks, A/D, battery level sensor.
5	T	Week of 23 Sept	2		Light sensing with CdS cells, A/D ports, voltage divider, battery level (self-monitoring) sensor, bump sensors, pots, multiple bump
6	T	30 Sept		3	DC Motors, Servos, PWM signals, IR sensors, modulation, transistors, H-Bridges, motor drivers
7	T	Week of 7 Oct	3		Add a servo "head" to a robot, add IR and CdS sensors to a robot, PWM signals, cables to connect CdS and IRs
8	T	14 Oct		4	Introductory robot programming, simple behavior software, serial and parallel communications, Serial I/O
9	T	Week of 21 Oct	4		Developing behaviors on a robot, RS-232, interface to a PC, Feedback & Monitoring, find a beacon
10	T	28 Oct		5	Digital signals, Sampled-data, tones, sampling frequency, piezo speakers, Making Oral Presentations. Advanced topics, modern sensors, show & tell, MIL, CIMAR, Robot Team plan for the contest, MS PowerPoint basics.
11	T	Week of 4 Nov	5		Adding a piezo speaker to a robot, playing music on a robot, vision, USB.
12	T	11 Nov			**Veteran's Day, UF classes suspended**
13	T	18 Nov		6	Advanced topics, modern sensors, show & tell, MIL, CIMAR, Robot Team plan for the contest, MS PowerPoint basics
14	T	Week of 25 Nov	6		Multiple sensors/behaviors, Class Contest, Make Video.
15	T	2 Dec		7	Final Oral Presentations, Dress up, Video, Wrap up, Evaluations, Feedback
16	T	9 Dec		No Class	**No Class**