EE-4735
Embedded System Programming

Curricular Designation: EE: elective, CpE: elective

Catalog Description:
EE 4735 - Embedded system programming introduces concepts and skills of microcontrollers with limited resources. Describes basic microcontrollers interfaces with sensors, motors and networks. Topics include microcontroller programming using C, real time operating systems, embedded networking and embedded control, sensor networks, and mobile robotics. Credits: 4.0 Lec-Rec-Lab: (2-0-2) Semesters Offered: Spring Pre-requisites: EE 3170 or EE3175 or CS 3421.

Textbooks(s) and/or Other Required Materials:
1. Being a course in a rapidly evolving area, the lectures will be substantially based on papers from literature most of which can be located in on-line databases such as IEEE eXplore, ACM digital library etc.

Prerequisites by Topic:
1. Familiarity in programming in C/C++.
2. Familiarity microcontrollers and interfaces.

Course Objectives:
1. Familiarity with the basic microcontroller architecture and the features
2. Mastery of the interfacing techniques for connecting microcontrollers to a variety of sensors and actuators (both digital and analog).
3. Familiarity with the different considerations and constraints that software developers for embedded systems must deal with.
4. Familiarity with power management methods.
5. Mastery of basic communication protocols both wired and wireless.
6. Mastery of a complete set of tools for embedded systems programming and debugging.
7. Familiarity with implementing several embedded systems with particular focus on robotics
8. Programming experience with MSP 430+RF2500

Topics Covered:
1. Development tools (IAR workbench)
2. Microcontroller architecture and programming
3. General purpose I/O
4. Timers, D/A and A/D
5. Encoders, sonar and robot kinematics with GPIO and timers
6. Wireless communications and networking
7. Real time systems and Real time operating systems
8. RTOS case study
9. Mobile control of mobile robots

**Relationship of the Course Content to Program Outcomes:**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Topics and Level of Coverage</th>
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<tbody>
<tr>
<td>a</td>
<td>an ability to apply knowledge of mathematics, science and engineering</td>
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<td>b</td>
<td>an ability to design and conduct experiments, as well as to analyze and interpret data</td>
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<tr>
<td>c</td>
<td>the ability to design a system, component, or process to meet desired needs within realistic constraints such as...</td>
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<td>d</td>
<td>an ability to function on multi-disciplinary teams</td>
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<td>e</td>
<td>an ability to identify, formulate and solve engineering problems</td>
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<td>f</td>
<td>an understanding of professional and ethical responsibility</td>
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<td>g</td>
<td>an ability to communicate effectively</td>
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<td>h</td>
<td>the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental and societal context</td>
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<tr>
<td>i</td>
<td>a recognition of the need for, and an ability to engage in life-long learning</td>
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<td>j</td>
<td>a knowledge of contemporary issues</td>
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<td>k</td>
<td>the ability to use the techniques, skills, and modern engineering tools necessary for the practice of electrical engineering</td>
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**Contribution of Course to Meeting Degree Requirements:**
4 Credit Hours – Engineering Topics

**Class/Laboratory Schedule** (note: 1 hour = 50 minutes):
Lecture: 56 hours = 4 hours/week for 14 weeks

**Prepared by:**
Jindong Tan, Associate Professor, Sep 30, 2009