Course Outcomes	CSC 4700 s2

CSC 4700 s2: Special Topics in Computer Science

"Programming Embedded Interfaces"

Credit Hours: 3 hours

Prerequisites: CSC 3102 or permission of department.

Prerequisites by Topics:

Some prior programming experience is expected.
Some C experience is valuable.
Python or Java experience is useful, but not required.

Catalog Course Description:

May be taken for a max of 9 cr. Hrs. when topics vary. Total hrs earned in CSC 2700 and 4700 should not exceed 9 hrs. Specialized areas of current interest in computer science.

Students will examine the concepts and practice, and work hands-on with programming embedded interfaces to sensors, actuators, displays, networks, and people. In the process, they will gain experience both in directly programming embedded devices (in C); and high-level networked control of multiple embedded devices (in Python or Java). Students will also gain familiarity with example hardware and application domains relevant to embedded interfaces.

This is a project-oriented class. Working in small teams, students will learn to build working systems using embedded processors and interfaces (no prior electronics experience is necessary); to program these interfaces; to connect these devices with physical sensors, actuators, and displays; and to use these in real applications.

Course Outcomes:

1. Be familiar with the composition, design, and implementation of embedded systems,
2. Be familiar with both medium level and high level languages appropriate for embedded systems development techniques (e.g., C and Python),
3. Be familiar with reading and understanding processor and component datasheets
4. Be familiar with driving use contexts, including human-computer interaction, environmental sensing and actuation, etc.,
5. Be familiar with the basics of interfacing hardware and software,
6. Be familiar with working on a team to create and apply embedded systems,
7. Be exposed to history of embedded interfaces

Texts and Other Course Materials

The class builds on roughly a dozen required and recommended online readings.
The text "Physical Computing" (O'Sullivan and Igoe) is recommended, but not required.

Major Topics

- Introduction to the PIC microcontroller,
- Embedded programming in C,
- Embedded control and applications in Python and Java,
- Reading datasheets for microcontrollers and enabling components,
- Embedded communication (wired and wireless, including I^2C, RS232, USB, Bluetooth),
- Human-computer interaction,
- Introduction to sensors, actuators, and displays,
- Environmental sensing and actuation,
- Issues related to energy and power ,
- Related design and fabrication technologies.

Assignments/Projects/Laboratory Projects/Homework

Three projects:

1) Basic embedded programming in C
2) Basic embedded control in Python or Java
3) Final project applying (1) and (2) to a topic of student interest

Homeworks:

1) Questions on contextual readings
2) Questions on basic electronics
3) Review in preparation for midterm
4) C and Python application examples
5) Review in preparation for final

Curriculum Category Content (estimated in semester hours)

Area	Core	Advanced	Area	Core	Advanced
Algorithms	5% *(2h)*	5% *(2h)*	Data Structures	2% *(1h)*	2% *(1h)*
Software Design	10% *(5h)*	10% *(5h)*	Prog. Languages	10% *(5h)*	10% *(5h)*
Computer Arch.	20% *(10h)*	20% *(10h)*			

Relationship to Criterion 3 Outcomes

A	B	C	D	E	F	G	H	I	J	K
*	*	*	*	*	*	*	*	*	*	*

Math and Fundamentals:

Bitwise operations in binary and hexademical
Base converstions

Data Structures:

Bitfields for state representation and messaging
Class libraries for embedded communiations, sensing, control, and display
Class libraries for streaming Internet content (e.g., RSS)

Algorithms and Software:

Watchdog timers
Interrupt handlers
Embedded control loops
Event-based programmings
Internet to embedded system interlinkages

Computer Organization and Architecture:

Datasheet fundamentals
PIC processor fundamentals
Embedded communication networks and protocols

Concepts of Programming Languages:

Embedded programming in C
Embedded control in Python and Java

Social and Ethical Issues:

Embedded systems in applied use contexts, including human-computer interaction and environmental sensing systems.
Discussions of resource and societal implications of varying levels of power consumption

Oral Communication (presentations)

Every student is required to make _3 oral presentation(s), typically of 10 minutes duration.

Written Communication:

Every student is required to make extended (multi-paragraph) English responses in both homeworks and midterm + final examinations.

Course Coordinator: Dr. Brygg Ullmer
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