
EECE 276

Embedded Systems

Introduction

Instructor: G. Karsai

TA: Steven Welch

Course basics

- Topic: Advanced design course on embedded microcontroller applications, with focus on hardware, software, and systems issues.
- Lectures: MWF, 9-10AM, FGH110
- Office hours: MWF 10AM (notify in class)
- Labs: Per schedule, FGH 208
- <http://eecs.vanderbilt.edu/Courses/ee276/>

Course basics

- Text: Real-time Systems Design and Analysis (3rd Edition) by Phillip Laplante, Wiley-Interscience, 2004. ISBN 0-471-22855-9.
- Class pack: labs, additional data sheets
- Lectures:
 - » Review: micros, hardware, interfaces (2+ wks)
 - Brief intro to HC12 (Motorola)
 - » Embedded system design
 - Real-time OS capabilities (2+ wks)
 - Design techniques (4 wks)
 - Real-time languages (1 wk)
 - Engineering issues (2 wk)

Course basics

- Labs:
 - » 2 person groups, individual reports
 - » Schedule
 - 1-2: Logic analyzer, In-circuit-emulator – **68HC11**
 - 3: RTOS on a PC
 - 4-8: Real-time programming on HC12
 - Lab practical (individual)
- Project:
 - » Non-trivial group project, both SW and HW
 - » Groups: 2 .. 4 people – (unless grad student)

Course basics

- Project:
 - » Parameters:
 - HC12 board, with robot and/or demo board
 - Must include hardware design task
 - Software: based on RTOS and techniques learned in class (e.g. tasks, interrupts, etc.)
 - Continuous progress is expected
 - *The project may involve significant amount of work - self study of technical literature*
 - **Design must be functional and demonstrated**
 - Documentation is necessary – User and Technical Manual
 - Part of evaluation: confidential evaluation report on teammates

Course basics

- **Project:**
 - » **Process**
 1. From groups – come up with an interesting idea
 2. Project proposal
 3. Preliminary design review
 4. Order parts
 5. Design
 6. Critical design review
 7. Implementation, integration
 8. Final demonstration
 9. Documentation

Course basics

- Schedule:

- First lab week: Sep 4
- Project proposals due: Sep 22
- Midterm #1: Sep 29
- Preliminary design review: Oct 2
- Parts list due: Oct 6
- Midterm #2: Oct 27
- Critical design review: Nov 3
- Lab practical week: Nov 6
- All labs due: Nov 17
- Project reports start: Dec 4
- Projects demos **DUE**: Dec 7, 5PM: No excuses.
- Final: Dec 12, 2PM.
- Project documentation **DUE**: Dec 15, 5PM.

Course basics

●Grading:

Lecture:

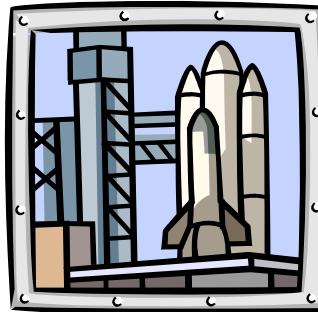
- Quizzes: 10%
- Midterms (2): 2 * 30%
- Final: 30%

Labs

- Lab book: 20%
 - Lab practical exam: 20%
 - Project performance: 60%
- Letter grade will be relative to performance of the entire class.

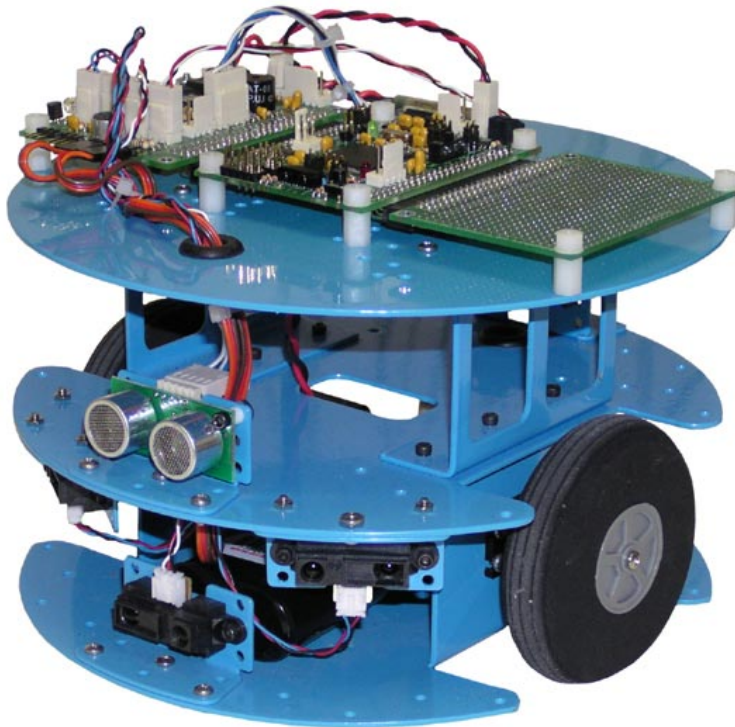
●Other details: See syllabus.

What Is an Embedded System?



Non-computing application of a computer

What Is an Embedded System?



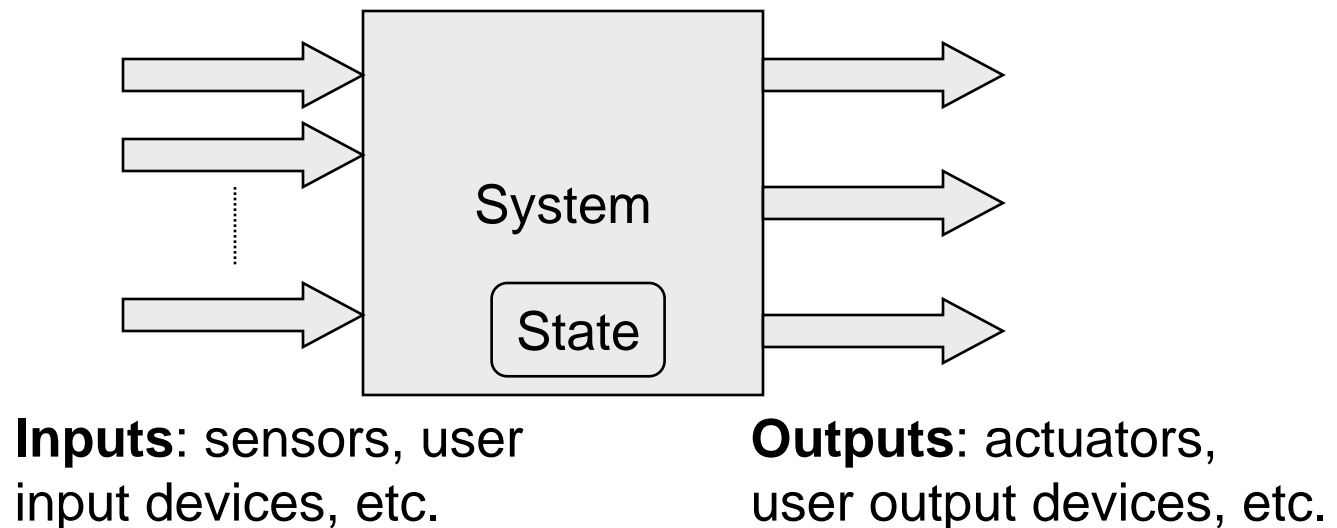
www.technologicalarts.com

System and real-time concepts

The topic of the course:

Embedded System Development
(using microcontrollers)

A (computer) system:



System and real-time concepts

System:

Mapping of *inputs* to *outputs*.

State:

Memory of the system, influences how the mapping works.

Response time:

Time difference between the *stimulus* (change in inputs) and the *response* (change in outputs)

Real-time system:

System that satisfies *explicit* and *bounded* constraints on the response time. If it does not, it has failed.

Correct answer at the wrong time is wrong.

System and real-time concepts

Reactive system:

- Driven by changes in the environment – activities are scheduled and triggered by events.

Soft real-time systems:

- Performance is degraded but not destroyed by failure to meet response-time constraints. Example?

Hard real-time systems:

- Any violation of response-time constraints leads to disaster. Example: Aircraft flight control system, safety monitoring and control system

Firm real-time systems:

- Can miss a few deadlines. Example: [Roomba](http://www.irobot.com) (www.irobot.com)