Pomona College

Computer Science

Fall 2024: CSCI 181RT

Real-Time Systems in the Real World

Lecture 3

Tuesday, January 28, 2025
Edmunds Hall 105
2:45 PM - 4:00 PM

Professor Jennifer DesCombes

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Agenda

- Schedule Announcement
- Go Backs
- Survey
- Discussion on Reading
- A Simple Set of Requirements
- A Simple Real-Time System Design
- Lab Preparation
- Assignment
- Look Ahead
- Action Items

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Go Backs

- General?
- Action Item Status
  - Thank you to Cameron Hatler for taking notes.
  - AI250121-1: Approve Submitted PERMs - OK to Close
  - AI250123-1: Mitchell gets a bonus point for ‘missing period’ - OK to Close
  - AI250123-2: David get bonus point for ‘RTOSes’ - OK to Close

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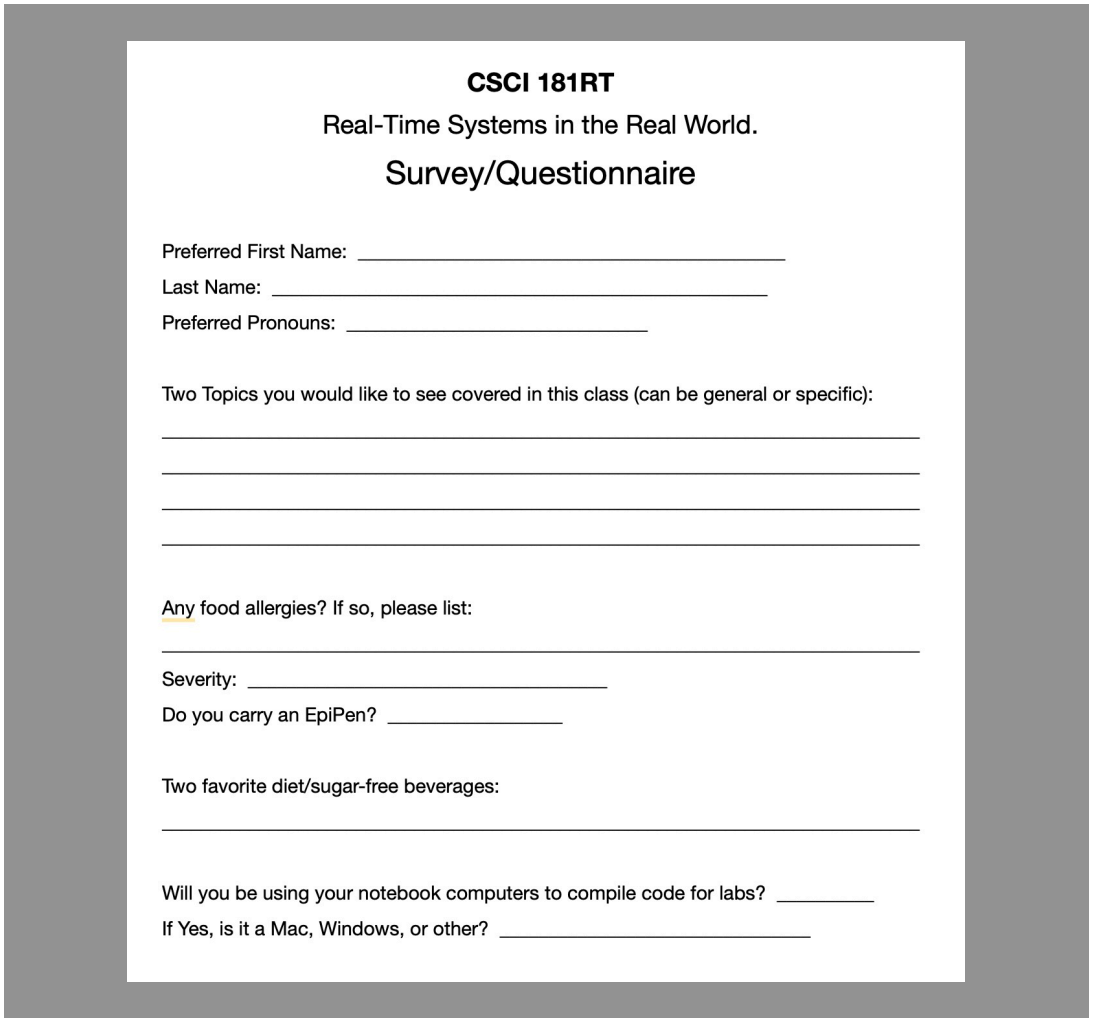
Survey



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Real-Time Systems in the Real World.

Survey/Questionnaire

Preferred First Name: _____

Last Name: _____

Preferred Pronouns: _____

Two Topics you would like to see covered in this class (can be general or specific):

_____

_____

_____

_____

Any food allergies? If so, please list:

_____

Severity: _____

Do you carry an EpiPen? _____

Two favorite diet/sugar-free beverages:

_____

Will you be using your notebook computers to compile code for labs? _____

If Yes, is it a Mac, Windows, or other? _____

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Discussion on Reading

- K & R
  - Reasonable Amount of Reading?
  - General Questions?
- Discussion on *Coding From 1849 to 2022: a Guide to The Timeline of Programming Languages*
- Discussion on *The Development of the C Language*

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A Simple Set of Requirements - Elevator Music Controller

- On Button, Off Button, Volume + Button, Volume - Button
- Requirement
  - If the **On Button** is pushed, turn the audio on
  - If the **Off Button** is pushed, turn the audio off
  - If the **Volume +** Button is pushed, increase the audio level
  - If the **Volume -** Button is pushed, decrease the audio level
- Hardware Design is Already Completed, But Not Yet Fabricated
- Four Available Buttons

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A Simple Set of Requirements - What is Not Stated Elevator Music Controller

- Functionality
  - If the System is Already On - **On Button** Does _____?
  - If the System is Already Off - **Off Button** Does _____?
  - If at Maximum Audio Level - **Volume +** Does _____?
  - If at Minimum Audio Level - **Volume -** Does _____?
  - How Many Steps Should the Audio Level Have ?
  - What is the Minimum Audio Level ?
    - If Zero Audio Level is Minimum, Should **Volume +** Turn On System ?
    - If Some Audio is Minimum, Should **Volume -** Turn Off System

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A Simple Set of Requirements - What is Not Stated Elevator Music Controller

- Functionality (More Questions)
  - What Happens if the On Button and Off Button are Pressed Simultaneously ?
  - What Happens if the **Volume +** and **Volume 1** are Pressed Simultaneously ?
  - Priority Between On/Off and Audio Level Functions ?
  - Should the Audio Level Buttons Auto-repeat (press and hold) ?
    - If Yes, How Long a Delay Before Start ?
    - If Yes, How Fast is The Repeat ?
    - If No, Why Not?

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A Simple Set of Requirements - What is Not Stated Elevator Music Controller

- Functionality (More Questions)
  - Default Power On Audio Level ?
    - Should Level Be Saved From Prior Operation?
    - Does Hardware Support This?
  - Upon Turn On - Should Audio Ramp-up To Desired Audio Level (otherwise known as the *theatre lighting effect*)
  -

A Simple Set of Requirements - What is Not Stated Elevator Music Controller

- Timing
  - How Fast Should the Software Respond to Buttons?
  - Other System Timing Requirements?
- Hardware
  - Availability ?
  - Simulation Capability ?
  - Interfaces to Buttons and Outputs (Port, I2C, SPI, Serial, etc.) ?
- Growth Potential
- Schedule

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A Simple Real-Time System Design
Elevator Music Controller

- All Real-Time Systems are Repetitive
  (well almost all)
  - Single Main Loop for Most Simple Systems
  - while(true), for(;true;), do/ while(forever), etc. [Editors Note - no bonus points for errors in pseudo code]

Endless Loop

- Simple Serial Port Monitoring Task (L11)

```
// Serial Port task

#include myOSCalls.h
#include mySerialPort.h

#define true 1

while(true) {

    // Process serial port
    uartChar = readUART( );
    If (uartChar != 0)
    {
       processChar( uartChar );
    }
    myOSSleepms(5);

}
```

A Simple Real-Time System Design
Elevator Music Controller

- Two Types of Logic and Control Approaches
- Combined Data and Control Blocks
  - Logically Simple - Works for Simple Systems
  - Acquire Input Data (button state), Take Action
  - Examine Next Input Data
- Separate Data and Control Blocks
  - Can Support More Complex Logic
  - Acquire All Data
  - Take All Actions Based on All Acquired Data
- Has Impact on Team Development, Simulation, and Testing

Assignment - Lab Preparation

- Online C Compilers - A Quick Survey
  - https://www.onlinegdb.com/online_c_compiler
  - https://www.jdoodle.com/c-online-compiler
  - https://www.scaler.com/topics/c/online-c-compiler/
  - Others?
- If you are just learning C:
  - Try some simple control logic and variable use
- If you are competent at C (self rated 5 or above):
  - Work with each of these tools to determine which ones are best as character input from a keyboard - no timeouts, etc.

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Assignment - Readings

- Lecture Reading

  Google topic - software requirements analysis
  Spend about 15 minutes on this - just get an idea on the scope of products available.

  Software Requirements Analysis for Real-Time Process-Control Systems
  https://www-users.cse.umn.edu/~heimdahl/csci8801-fall06/readings/jaffe-tse.pdf

  K&R - None Today

- Lab Reading - Ongoing, No New Assignments

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Look Ahead

- Discuss Readings
- More Simple Real-time Systems
- Lab Discussion

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Action Items and Discussion

AI#:	Owner	Slide #	Document	Action