Music 3SI
Introduction to Audio / Multimedia Application Programming

Contact Info.
Instructor (Course Leader): Woon Seung Yeo (woony@ccrma.stanford.edu)
Faculty Sponsor: Jonathan Berger (Chair, Department of Music)

Time and Place
Friday 1:15~3:05, Knoll classroom (660 Lomita Dr.)

Course Website
http://ccrma.stanford.edu/courses/3SI/

Introduction
Music 3SI is an introduction to various topics of audio/multimedia programming. We explore the
basics of programming tools and environments, software libraries, graphic user interface design,
audio plug-in architecture, and network communication.
As an introductory course, it is primarily targeted at musicians, artists, and/or entry-level program-
mers who want to develop their own software. On the other hand, it provides an overview of audio/
multimedia programming topics to advanced programmers.

This course is also designed to serve as a series of practical programming tutorial sessions for a
number of courses offered at the Center for Computer Research in Music and Acoustics (CCRMA).

Outline of Topics:

Programming:
- Basic concepts of C/C++
- Integrated Development Environments (IDE)
- GUI design and implementation: Cocoa, Qt

Audio:
- Audio software design issue
- Audio APIs: Stk
- Introductory Audio DSP

Audio Plug-ins:
- VST plug-ins
- Max/MSP and/or Pd externals

Visual/Multimedia:
- Graphic APIs and basic drawing programming
- Multimedia application: merging audio with visual
- Sonification and visualization

Network communication:
- Audio streaming
- Open Sound Control (OSC)
Pre-requisites
Beginner or intermediate level programming skill in C/C++. Given its introductory nature, this course is designed to be suitable for people without much software engineering background, and will cover some important programming topics in class. Please contact the instructor if you have any questions regarding your programming experience.

Some familiarity with graphic user interface libraries, such as Cocoa (OS X) or Qt will also help, but is not required.

Homework
Students will be given two programming assignments. These assignments will involve the topics covered in class, and will require programming in C, C++, and/or Objective-C languages on Macintosh or Linux platform. For each assignment, a detailed in-class demo and a template project will be provided as a starting point.

Final Project
There will also be a final project with presentation. Your project will be in place of a formal final exam, and can be on any topic related to lectures and assignments. A one-page project proposal is due by the 7th week.

Grading and Units
As a SIC course, Music 3SI is offered with only Credit/No Credit option up to two units. Credit will be given based on in-class participation, homework, and final project presentation.

Course Materials
There is no required textbook: weekly reading materials will be posted on course website, or handed out in class.
Weekly Schedule

Week 1 (4/7): Introduction
- Course overview & application demos

Week 2 (4/14): Audio Programming (1)
- C/C++ review
- Overview of audio APIs (Stk and RtAudio)
- Assignment #1 (due in two weeks)

Week 3 (4/21): Audio Programming (2)
- Audio effect & DSP basics (Stk effect/instrument classes)
- Fast Fourier Transform: FFTW

Week 4 (4/28): Plug-ins
- VST SDK
- Pd externals programming (optional: Max/MSP)
- Assignment #2 (due in three weeks)

Week 5 (5/5): GUI (1) - Cocoa
- Overview of GUI programming / threads
- Cocoa API & Interface Builder
- Guest lecturer from Apple Computer Inc.

Week 6 (5/12): GUI (2) - Qt
- Qt API & Qt designer

Week 7 (5/19): Visuals
- Image processing basics
- OpenGL with Cocoa/Qt
- Core Image (optional: Core Graphics)
- Final project proposal due

Week 8 (5/26): Multimedia Application - Merging Visual with Audio
- Mappings between audio and visual: sonification and visualization
- Application demos: SonART, R.S.V.P.
- Optional: iTunes plug-in

Week 9 (6/2): Network Communications
- Audio streaming over network (InetWvIn/InetWvOut classes of Stk)
- Open Sound Control (OSC)

Week 10 (6/9): Final Project Presentation