6.111 Final Project: Checkoff Sheet
Virtual Surround Sound
Harrison Hall

Deliverables

- Inter-aural Time Delay(ITD)
  1. Delays the audio signal appropriately to each ear for planar source direction identification around the head for low frequencies(<1.5 kHz).
     1.1. Will show this model working for both stationary and moving(changing azimuth and ,time permitting, elevation) sound sources.
  2. Tests:
     2.1. A software implementation of the module(Matlab or Java) that generates correct output for specified PCM and azimuth data.
     2.2. Demonstration of the module working on the Labkit on a pair of headphones through the AC97 module.

- Inter-aural Level Difference(ILD)
  1. Changes the sound pressure(decibel) level of an audio signal at a specified azimuth for planar direction identification of a sound source using frequency domain via an FFT.
     1.1. Will show this model working for both stationary and moving(changing azimuth and ,time permitting, elevation) sound sources.
  2. Tests:
     2.1. A software implementation of the module(Matlab or Java) that generates correct output for specified PCM and azimuth data.
     2.2. Demonstration of the module working on the Labkit on a pair of headphones through the AC97 module.

- Room Echo
  1. To externalize the sound from coming from within the user's head, a model of the room is added that takes into account reverberations and reflections.
     1.1. We will exhibit a simple time-delay model in which a delayed monaural signal is passed to both ears.
     1.2. Time permitting, a more complex system will be implemented in which each ear receives a different modified and delayed signal to represent more complex room designs commonly seen in audio programs as: "concert hall" or "live performance".
  2. Tests:
     2.1. A software implementation of the module(Matlab or Java) that generates correct output for specified PCM and azimuth data.
     2.2. Demonstration of the module working on the Labkit on a pair of headphones through the AC97 module.

- Combined Model
  1. This is a full signal path for a single audio source that produces PCM data for both the left and right ears of the user by the combination of the ITD, ILD, and Room Echo from a single input of PCM data and a azimuth and elevation determination.
     1.1. Will show this model working for both stationary and moving(changing azimuth and ,time permitting, elevation) sound sources.
  2. Tests:
     2.1. Utilizing the software implementation for the each of the modules(Matlab or Java), we will pass the output of one into the other to generates correct output for specified PCM and azimuth data.
     2.2. Demonstration of the module working on the Labkit on a pair of headphones through the AC97 module.

- Multiple Signal Sources
    1. Using the combined model for the each sound source, allow multiple sound sources to coexist in the system an have their output be summed to send to the left and right ears. The number of channels is ideally 6, the number of channels in 5.1 theater surround sound. The locations of the sound sources will be fixed at the ideal locations as specified by Dolby.
    2. Demonstration of the working system will be done on the Labkit with each channel and a combined channel(of all sources) for each ear visible on the Logic Analyzer.

- UI(Time permitting)
    1. Allow the user to view the placement of the speakers and control, in rotation and translation in the X-Y plane, a digital avatar representing their location and orientation relative to the sound sources.
    2. The results of this will be viewable in the same manner as the Multiple Signal Sources module.

- Real-Time Streaming(Time permitting)
    3. Ideally, a way will be found to stream decoded Dolby PCM data onto the Labkit so the user can watch a movie and hear the audio soundtrack is virtual surround sound in real-time.