



Freeform Production of Gorgeous Audio

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Overview

- Keyboard
 - Play a full octave with synthesized effects
- Noise Cancellation
 - Record just noise from current environment
 - Make new recordings, hear them played back afterwards with noise attenuated
- Game
 - Play Guitar Hero-esque game, either playing keyboard or singing into microphone
 - See notes falling on monitor
 - Get score based on accuracy



Menus

- There will be 2 menus, which maintain the state of the system
- The first is a top level menu that allows the user to choose between the 3 operation modes
- The second is within the game, to allow the user to choose which game mode they want to play in
- Both will be displayed on a lab computer monitor



Keyboard

- Takes user input from keys pressed
- User will be able to choose between different types of output waveforms, creating different sounds
- Will use sine wave, square wave, and triangle wave for different output sounds



Noise Cancellation

- User will record environment to let system hear the noise present
- System will take FFT (using FFT module) of noise, determine characteristic frequencies
- User will then make a new recording of anything they would like
- System will take FFT of different segments of input, compare strengths of frequency bins to corresponding bins in noise recording, will attenuate noise accordingly
- System will stitch together these modified FFT segments, smooth the resulting time signal, and play back the user's input with the noise attenuated
- Module will interact with 40K by 8-bit BRAM for recordings



Game Controller

- The game controller maintains the state of the entire game
- Interfaces with the Song Selection module to serially load the song from the BRAM (1K by 8-bit)
- Interfaces with the Note Analyzer module to determine user input
- Interfaces with the Scorer module to maintain and update the user's score
- Sends game display to the VGA Helper module
- Records user's input for later playback using 400K by 8-bit BRAM



VGA Helper

- Each menu and mode of the system will have a corresponding display
- This module will output all of the necessary VGA signals
- Its inputs will be all of the display requirements from the different modes, as well as the 2-bit mode-select signal so that it knows which mode it is in
- Instructions will be displayed in the keyboard and noise cancellation modes
- Instructions and falling notes will be displayed in the game mode
- Due to minimal color requirements, only 6-bit color is required



Note Analyzers

- There are two separate note analyzers, one for each input type
- Module takes the user input (keyboard or singing), and analyzes it to determine what the note is
 - For the keyboard, this involves reading the keyboard input
 - For the microphone, this involves using the FFT module to do a Fourier analysis on the input waveform and determining the dominant frequency
- Module serializes this note to a 4-bit index (0-12) and sends it out to other modules

