Simple Audio Synthesizer User Manual

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Date of Submission: March 20, 2024

Chapter 1: Introduction

This document aims to provide a detailed description of a simple audio synthesizer, the technique of audio synthesis used, and a user manual. Implemented with the Web Audio API, this synthesizer runs in modern web browsers and is capable of generating and manipulating audio signals.

Chapter 2: Audio Synthesis Technique Description

The synthesizer utilizes Subtractive Synthesis, a technique that starts with a rich waveform (often one with many harmonics, like a square or sawtooth wave) and subtracts frequencies to shape the desired sound. Our synthesizer primarily allows for sound generation by modifying waveform, pitch, volume, and detune for more complex sound creation.

Mathematical Formulas

Pitch (Frequency): f = 440 * 2^((n-69)/12)
Where f is the target frequency (Hz), and n is the MIDI note number. This formula is used to convert MIDI note numbers to their corresponding frequency values. In our synthesizer, users can directly control the frequency (Hz) through a slider.

Volume (Gain): Volume directly controls the amplitude of the audio signal using a linear gain g, ranging from 0.0 (silence) to 1.0 (maximum volume).

Detune: δ = f * (2^(detune/1200) - 1)
Where δ is the deviation from the base frequency f in Hz, and detune is the detune value (in cents) obtained from the slider. This allows users to fine-tune the pitch for richer sound textures.

Chapter 3: User Manual

3.1 How to Run

Save the provided HTML and JavaScript code into files within the same directory, named synthesizer.html and synthesizer.js, respectively.
Open the synthesizer.html file with a modern web browser.

3.2 How to Use

Start Button: Click to begin sound generation.
Stop Button: Click to stop the sound.
Waveform Selection: Choose different waveforms (sine, square, triangle, sawtooth) from the dropdown menu to change the sound's basic texture.
Volume Slider: Drag to adjust the sound's volume.
Frequency Slider: Drag to adjust the sound's fundamental frequency (pitch).
Detune Slider: Drag to fine-tune the pitch, adding expressiveness and variety to the sound.

Chapter 4: Conclusion

This audio synthesizer provides a simple yet powerful interface for exploring the basics of audio synthesis. By adjusting the waveform, volume, pitch, and detune, users can experiment with and create a variety of unique sounds, suitable for applications in music production, game development, and audio design.