Theremizer Product Design Specifications

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Version 1.0

Executive Summary

The Theremizer is a sound control and manipulation device. It produces an audio output that sounds otherworldly and has been used in famous songs like the theme from Star Trek and the Beach Boys "Good Vibrations". It is controlled by moving your hand further or closer to an antenna to change the pitch. The Theremizer also accepts an external audio input, and if provided, will modulate this external audio input using amplitude modulation which will create wild sounds. The Theremizer's output is then run through a classic Voltage Controlled Filter, the AS3320. This shapes the sound further using resonance and by changing the cutoff. Our objective is to make an affordable, interesting, musical device that can interact with other standard musical equipment.

Market Analysis

This would be primarily marketed towards analog synthesizer enthusiasts. There is a large market of modular synthesizer users that are always looking for interesting audio sources and control methods.

There currently is nothing on the market that meets the same criteria as what the Theremizer does, as most theremins are much more expensive, and the cheaper ones don't have musical filtering on the output, or any modulation possibilities within the device.

We believe this device could be sold for $120.00, as devices with a smaller feature set are being sold for $100 currently. We are adding features (filtering, modulation) that are highly desired in the modular synthesizer community, a community that has no problem spending significant money on devices. This device should be affordable to purchase in order to compete in an otherwise cost-prohibitive marketplace.

Requirements

Functionality

An antenna must modulate the frequency of an oscillator which is heterodyned with another to produce an audio output of at least one octave. The device must be capable of feeding it's output to other audio processing blocks, or a separate audio amplifier. The device must have an enclosure that is self-stable. The device should accept and modulate an external signal, then mix against the theremin output.

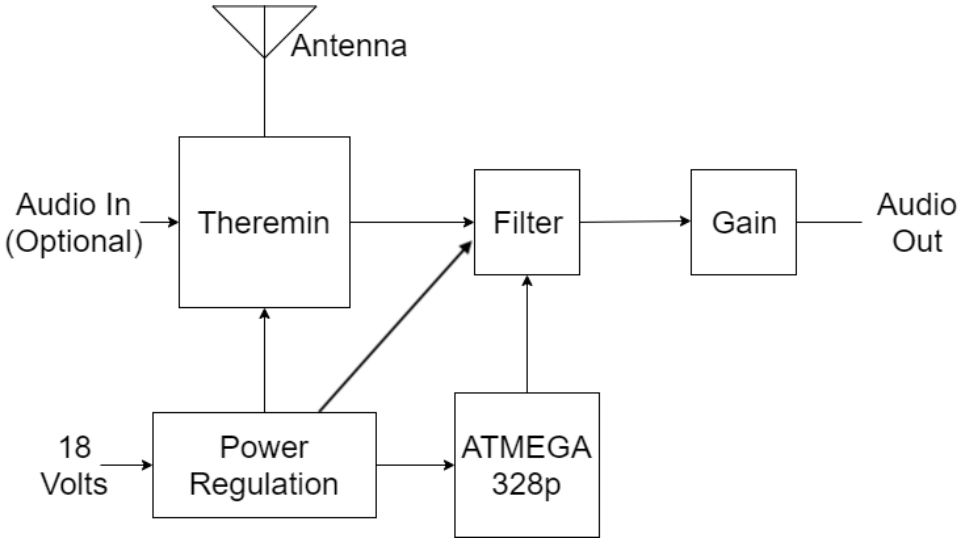
Performance

To make the device useful for musicians, it will have a user controlled filter with a minimum cutoff of at least 5 kHz. It will have a user controlled output up to at least 1 V amplitude. The output and input impedance will be compatible with industry line-level standards and will have an impedance of less than 600 Ω and greater than 10 kΩ respectively.

Economic

The device must be affordable to produce, with a total parts cost less than $60. All parts must be available for volume purchase, in active production, or easily substitutable by a component in current production.

System Architecture



Design Specification

- Sensors will be the antenna in the theremin circuit, and the ADC's on the processor. Antenna will input varying capacitance based on hand distance to theremin, and ADC's will measure voltage to vary PWM from the ATMega328p to control filter cutoff, resonance and gain.
- Actuators will be the mixer/modulator used in the theremin circuit (currently MC1496) which will output the modulated signal, the gain stage of the filter (AS3320), and the PWM output of the ATMega328p.
- Processors will be the ATMega328p and the filter, the AS3320.
- Power will be supplied by an 18 V wall transformer and regulated by two switching regulators, one for the $\pm$ 15 V required for the filter and theremin and one for the 5 V required for the ATMega.
- We will attempt to program the ATMega without using the Arduino bootloader, but may switch if neccessary.
- We will use Atmel/AVR Studio to write the code and program the processor.