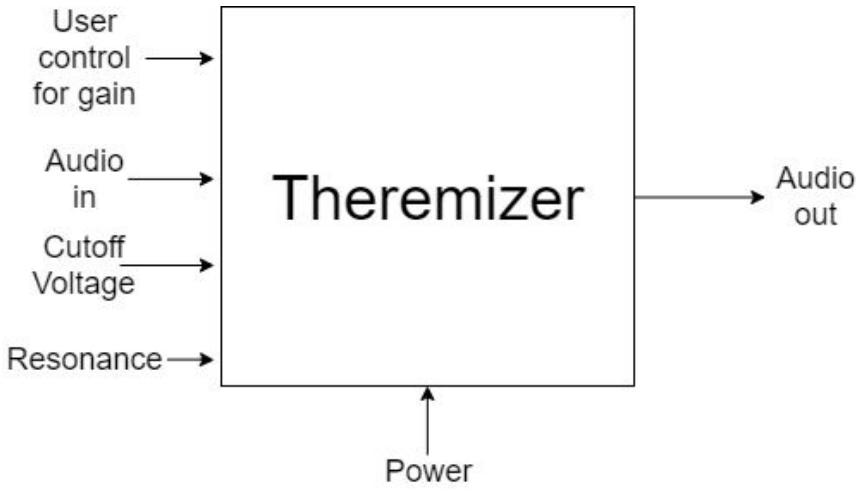
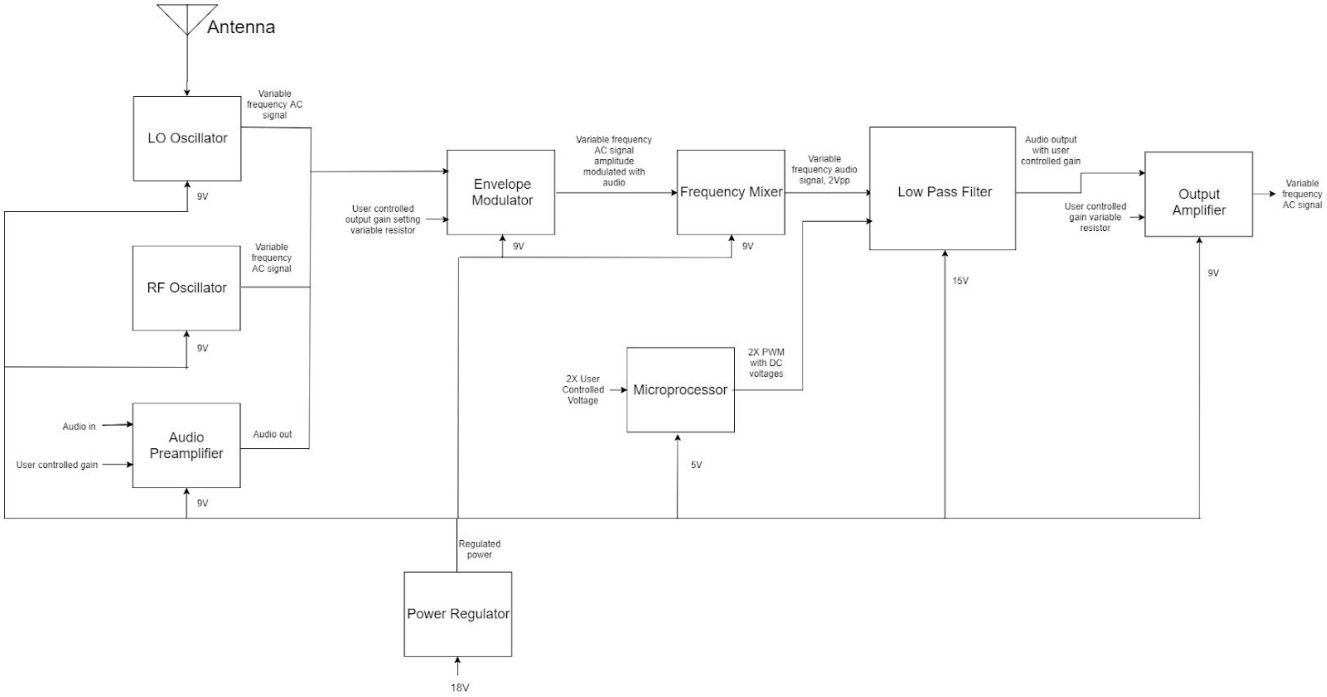
Team 18
ECE 411
14 November 2019

Functional Decomposition of Theremizer

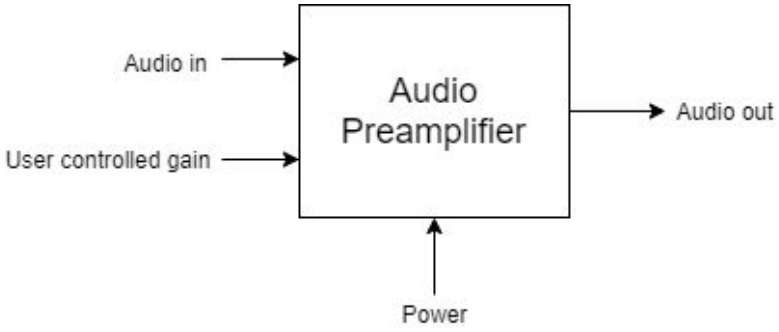
High Level Block Diagram



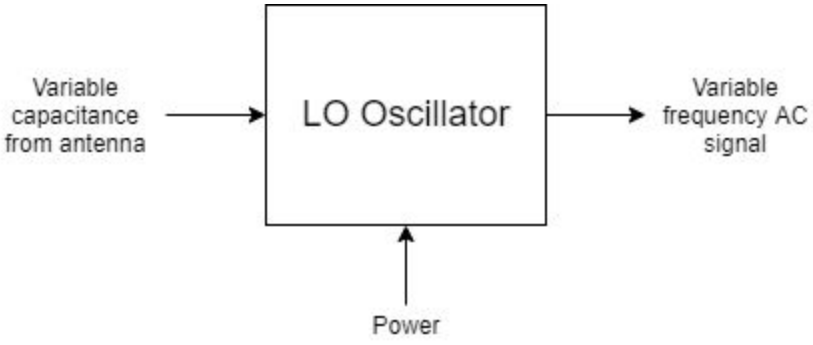
Next Level Block Diagram



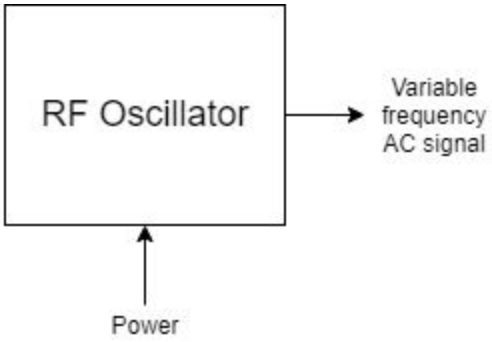
Top Level Block Diagram for Each Module



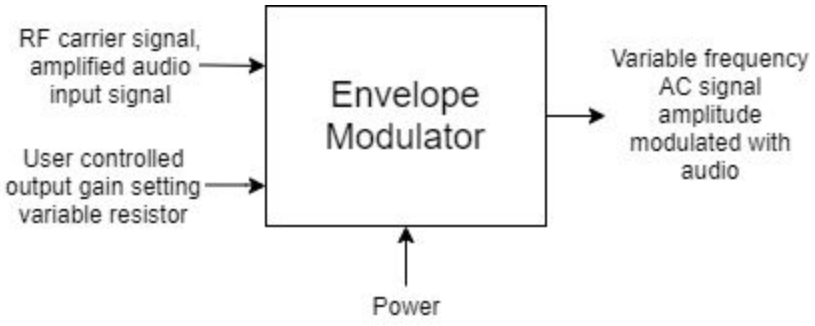
Module	Audio Preamplifier
Inputs	Power (9V DC) Audio in (up to 2Vpp) User controlled gain, variable resistor
Outputs	Audio out up to 8Vpp max, typical 2Vpp
Functionality	Variable gain stage, up to 40dB (buffer with k on block diagram)



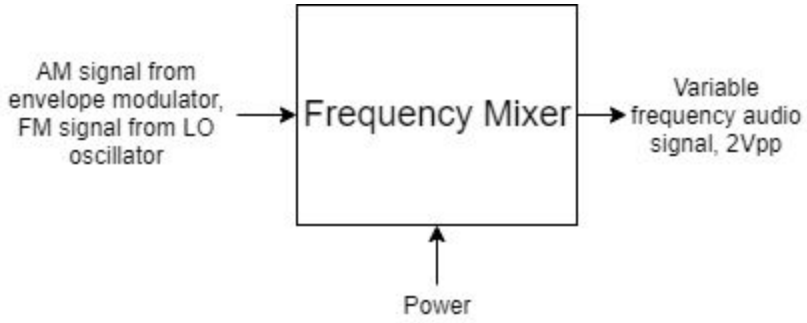
Module	LO Oscillator
Inputs	Variable capacitance from antenna Power (9V DC)
Outputs	Variable frequency AC signal, 1Vpp
Functionality	Generate frequency modulated carrier for Theremin mixer



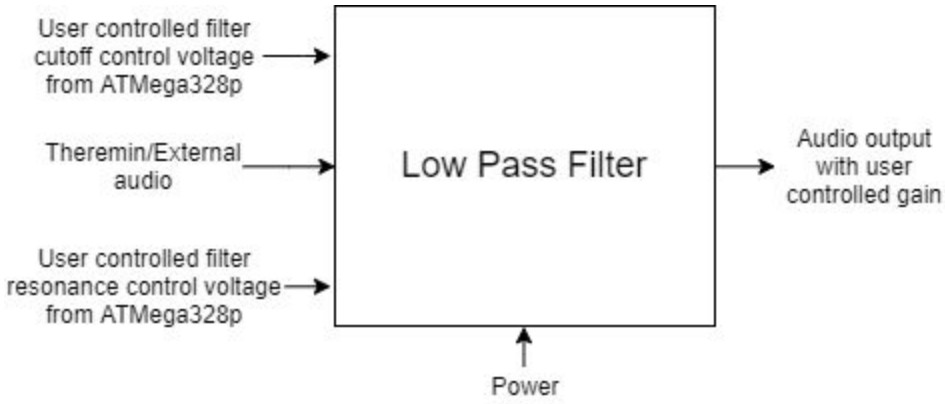
Module	RF Oscillator
Inputs	Power (9V DC)
Outputs	Variable frequency AC signal, 2Vpp
Functionality	Generate carrier frequency for AM signal carrying input audio



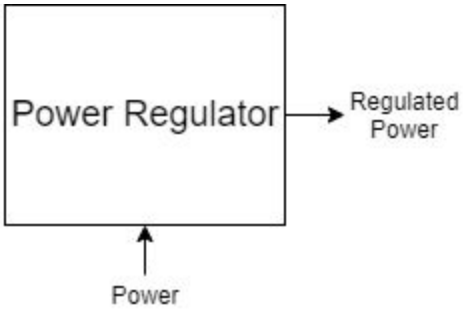
Module	Envelope Module
Inputs	RF carrier signal, amplified audio input signal Power (9V DC) User controlled output gain setting variable resistor
Outputs	Variable frequency AC signal amplitude modulated with audio up to 8Vpp max, typical 2Vpp
Functionality	Modulate carrier signal with input audio, adjustable output gain



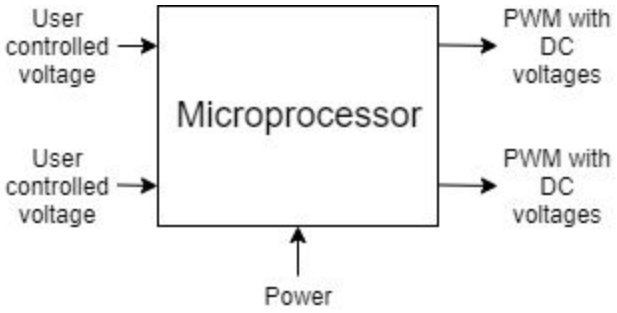
Module	Frequency Mixer
Inputs	AM signal from envelop modulator, FM signal from LO oscillator Power (9V DC)
Outputs	Variable frequency audio signal, 2Vpp
Functionality	Frequency mix and heterodyne the carriers and baseband signal to produce baseband audio output



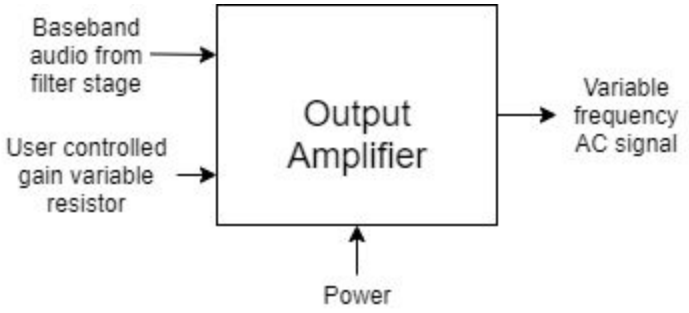
Module	Low Pass Filter
Inputs	Theremin/External audio, 2Vpp Power (±15V DC) User controlled filter cutoff control voltage from ATMega328p (0-180mV) User controlled filter resonance control voltage from ATMega328p (0-1V)
Outputs	Audio output with user controlled gain up to 4Vpp max
Functionality	Filters raw audio signal from theremin/external audio in a “musical way”, provides up to 2X gain for output to next block in user’s signal chain, allows user to control output audio frequency response.



Module	Power Regulator
Inputs	Power (>9V DC, <18V DC)
Outputs	Regulated power (±15VDC @ 65mA, 5VDC)
Functionality	Provides regulated power to the theremin, filter, and ATMega328p



Module	Microprocessor
Inputs	Power (5V DC) 2X User controlled voltage (0-3.3V)
Outputs	2X PWM with DC voltages (0-180mV & 0-1V)
Functionality	Take in voltages sent by the user and output controlled PWM with DC voltages



Module	Output Amplifier
Inputs	Power (9V DC) Baseband audio from filter stage User controlled gain variable resistor
Outputs	Variable frequency AC signal, max 8Vpp, typical 2Vpp
Functionality	Provide user-controlled output gain from no volume to 20dB