Theremin: Electronic Instrument

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Overview

The theremin is an electronic instrument that uses two antennas to sense the distance of your hand to change the frequency and amplitude of the electric signal, which is then amplified through the instrument to control the pitch and volume of the instrument's output noise. We propose to create a simple model of the theremin instrument using two ultrasonic distance sensors.

Peripherals

1. Ultrasonic Distance Sensors x2 (LV MAX: SEN 00639)
    a. with inverted UART (RS 232)
2. I2S audio output with DMA

Software Design

The software will use looping to sample the distance of the hands from the ultrasonic distance sensor using the maximum frequency of the sensor. This will generate an interrupt which will read the x and y position of the hands. When these values are detected to have changed past a threshold, we will generate a new sine wave with a different frequency, store it into memory, and continuously DMA that part of memory to the output I2S to change the pitch of the audio. In order to control the volume, we will use the distance from the second sensor and the I2S controls to change the gain of the signal.

Goals

1. Control the frequency (pitch) of the I2S audio output based on distance of object from distance sensor by generating a new sine wave at each interrupt
2. Stretch goal: Control the gain of the electrical signal based on distance of object from distance sensor, and therefore volume of the I2S audio output

Group Responsibilities

Ryan will be responsible for interfacing the sound sensors with the board to get the distance of the object as an RS 232 input and Sayali will be responsible for interfacing the audio output with the input from the ultrasonic distance sensors. Both partners will still be responsible for understanding the two parts of the project and how their interfaces interact.