

# Music From The Air

## Digital Theremin

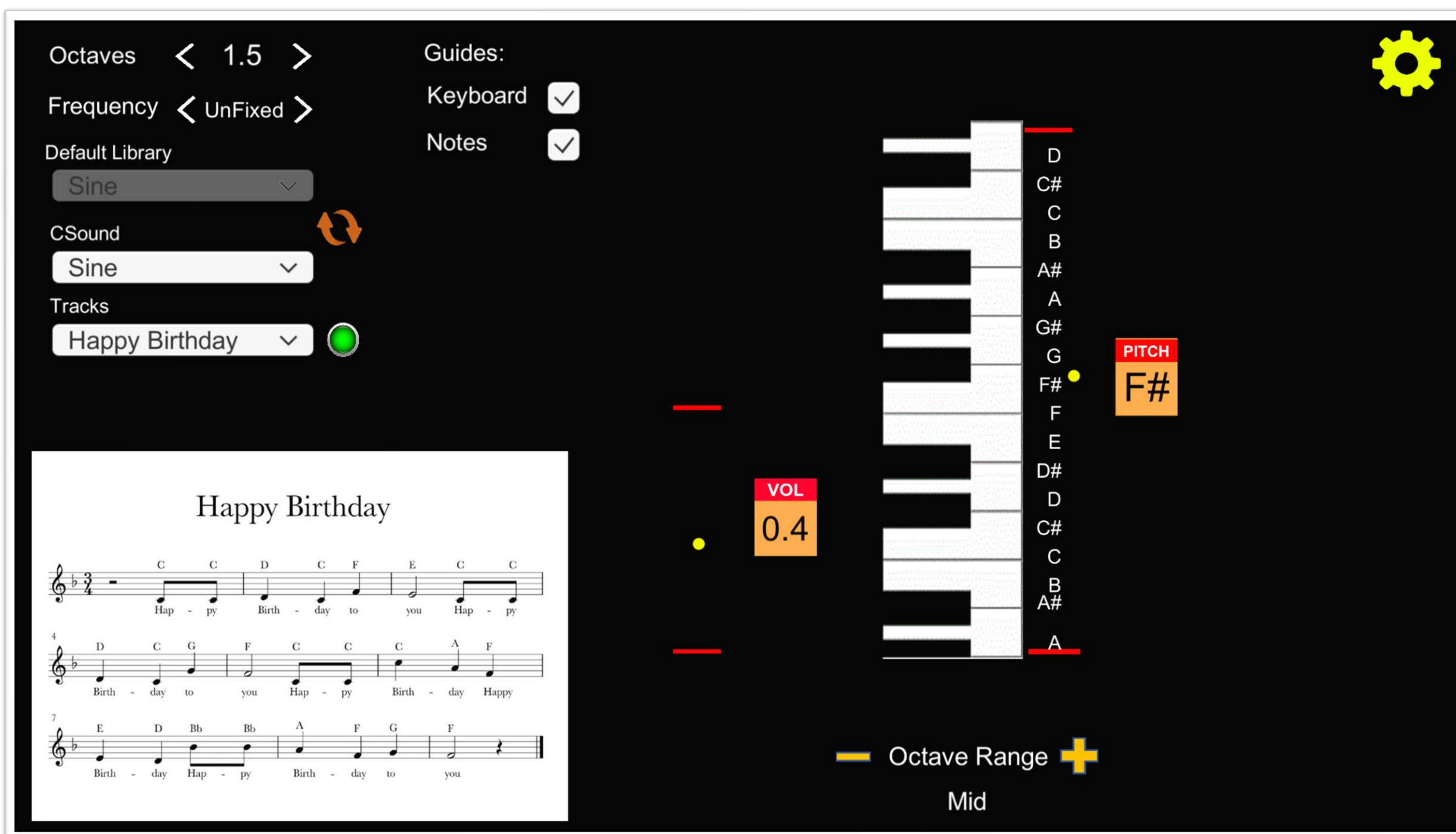
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### Project Objectives:

This project aims to simulate playing the Theremin instrument with the use of the Leap Motion Controller. One can create sounds by raising one's hand over the leap motion. Existing projects had created a digital Theremin but also introduced static and popping noise. In this project, Unity Engine and CSound libraries are explored to create high quality sounds.

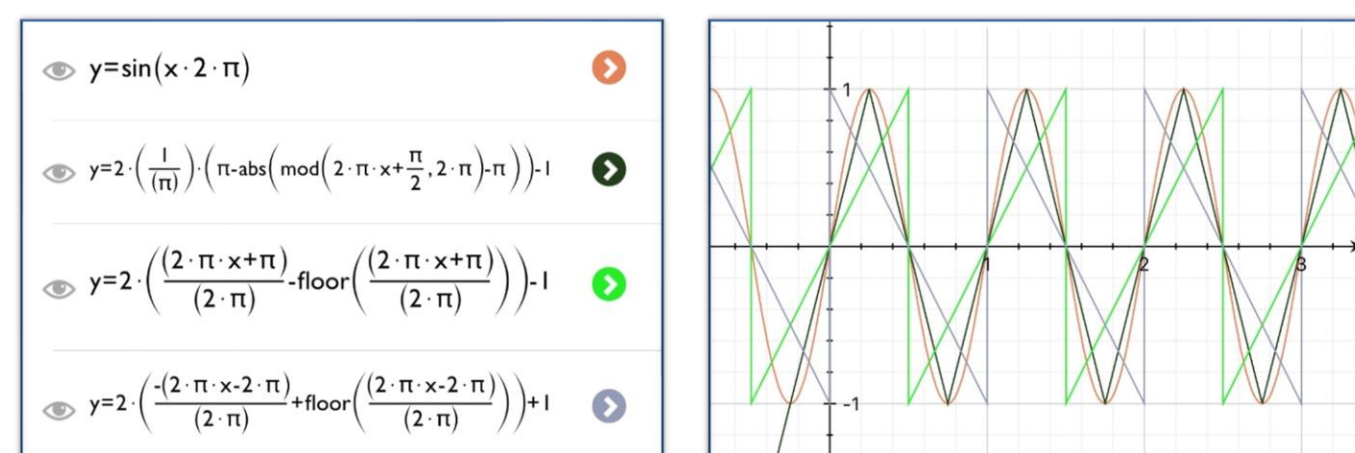
### Software User Interface



The yellow dots on the screen represent the current position of the user's hand detected by the Leap Motion. Users can customise the software by setting the number of octaves, display guides, sine wave function and background tracks.

### Different Wave Representation

The following illustrations include the mathematical formulas for producing sounds from different wave types-- sine, triangle, square and sawtooth.



### Csound Instrument

A Csound Script to create the sound of a Clarinet.

```
kfreq chnget "Frequency"
kamp chnget "Amplitude"
if kfreq <=10 then
  kfreq = 220
endif

kstiff = -0.3
iatt = 0.1
idetk = 0.1
kngain init p4 ;vary breath
kvibf = 5.735
kvamp = 0.1

asig wgclar .9*kamp, kfreq, kstiff, iatt,
idetk, kngain, kvibf, kvamp, 1
outs asig, asig
```

### Achievements

High quality sounds can be created without static and popping noise. The latency of the output sound is sufficient to play songs that are around 120BPM.

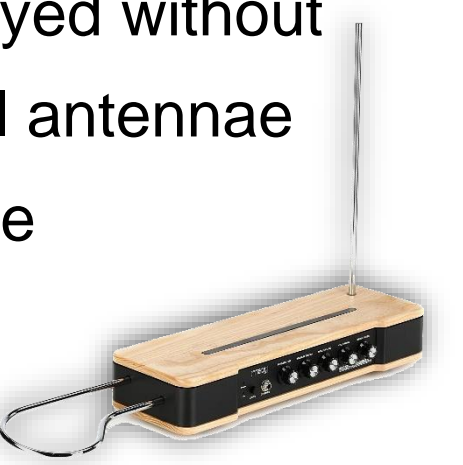
CSound library is also successfully integrated into the software to be able to play different instruments such as Clarinet, Trumpet and Flute.

Several background tracks are also integrated so users can play along with built-in songs such as Happy Birthday, Auld Lang Syne and Somewhere over the Rainbow.

### Project Importance

#### What is a Theremin?

A musical instrument that is played without physical contact. The two metal antennae sense the relative position of the thereminist's hands. One can control frequency with one hand, and amplitude with the other.



#### Why simulate the Theremin?

The Theremin is the hardest instrument to play. Users have to rely solely on perfect pitch to determine what note they are currently playing. A software that is able to display the current pitch that the user is currently playing would enhance the user's experience.

### Resources Used

#### 1. Leap Motion Controller

The Leap Motion Controller is an optical hand tracking module that captures the movements of your hands with unparalleled accuracy.

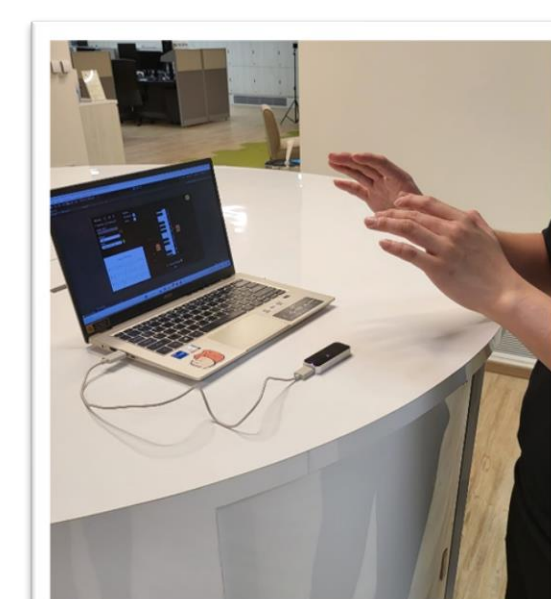


#### 2. Unity

Unity is a cross-platform game engine that supports a variety of desktop, mobile, console and virtual reality platforms. The ultra-leap plugin for unity allows the leap motion to be integrated with the unity applications.

#### 3. CSound

Csound is a C programming language that was created and optimized for sound rendering and signal processing. This project utilises Csound to create a variety of high-quality sounds.



Create sounds with hands. Right hand controls pitch, left hand controls volume.

**Demo**  
Scan here for demo!

