

A Simple Digital Harp

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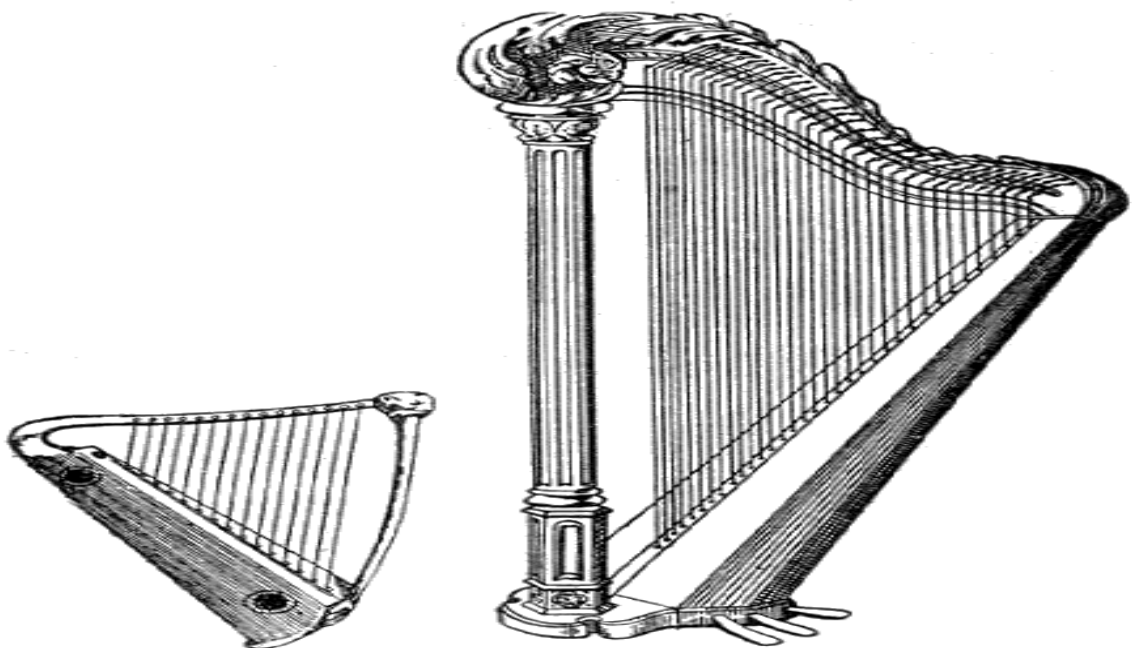
Aim: to build a harp that creates sound waves using sensors instead of any physical instrument that uses wire, silk or nylon.

What is a Harp?

Figure 1 shows a harp which is an ancient instrument still played around world. A harp is a string instrument in which strings are positioned perpendicular to a base called a soundboard. Harp strings can be nylon, gut, wire or silk. There are various types of harps available in the world like the pedal or concert harp, folk harp, lever harp or Celtic harp, wire-strung harp, and multi-course harp.

Harp playing techniques

There are various ways to play a harp according to the harp type. Mostly, a harp is played using hand fingers. To play a harp, we use all fingers except the last finger which is too small and weak to pluck on strings. To make playing easy, each finger is assigned a particular number, “1” for thumb, “2” for first finger, “3” for middle finger and “4” to ring finger.



Harps, p. 984.

Figure 1 Harp

Digital Harp Design

Figure 2 shows the digital harp. The digital harp is a combination of hardware, including IR distance sensors, Phidgetinterfacekit 8/8/8, computer, and speakers. The main difference between other harps and the digital harp is that the digital harp uses sensors instead of any strings. Sensors are placed horizontally on one base in such a way so it's sensing range is vertical. Now this sensors are connected to the Phidgetinterfacekit 8/8/8 with sensor cables. The Phidgetinterfacekit 8/8/8 is connected to a computer via a USB Cable. And the computer is connected to the speakers.

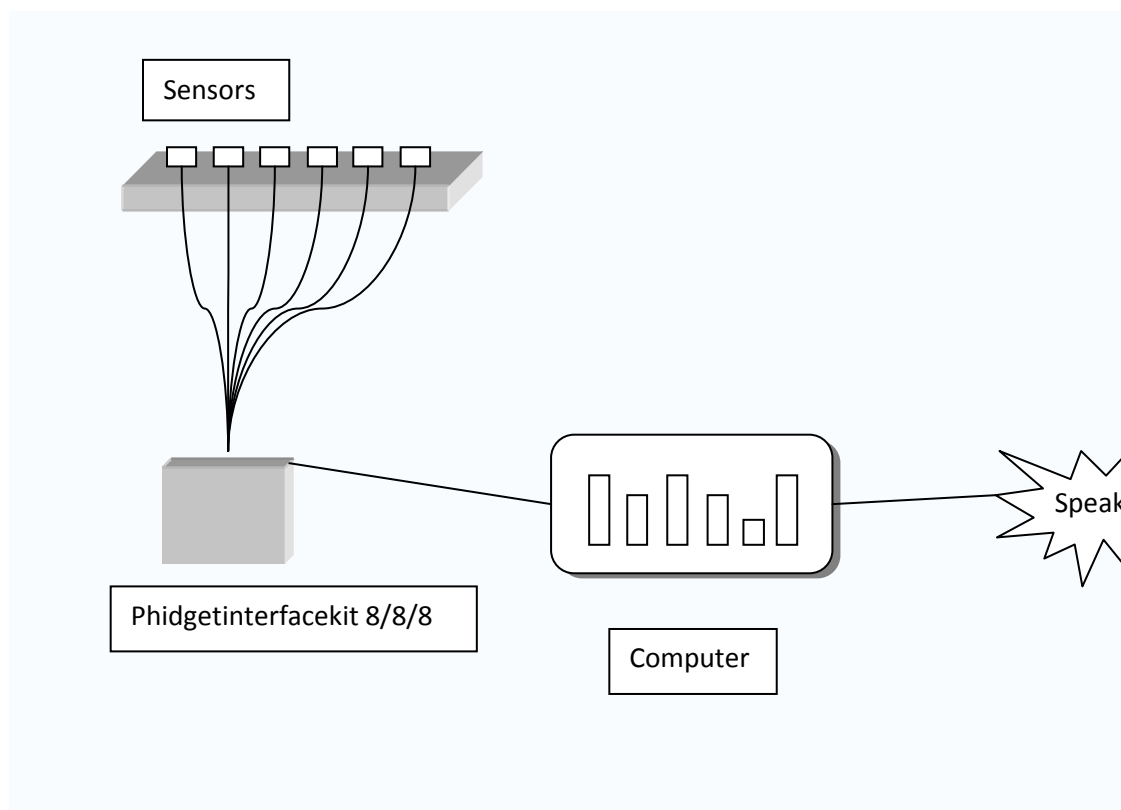


Figure 2 Digital Harp

How the digital harp works

The playing technique is somewhat similar to a normal harp. We are using sensors so there is no physical string available to pluck, we pluck in air within the sensors range. Input values from sensors are converted into sound waves using software running on the computer and these waves are transferred to the speakers for output. Figure 3 shows the sensory space of the digital harp. As mentioned earlier, sensors are placed horizontally in sequence, so that sensing ranges are vertical. Now I have divided this range into different groups (subranges) of values. For example 0-25, 26-50 etc.

The sensitivity of the sensors is converted into values using this software and the effect is shown on a GUI. This software also assigns different sound waves to each sensors and sensor value ranges. So, when the user plucks in the space corresponding to the subrange to which a sound is associated, that sound (e.g., a .wav file) is played as shown in Figure 3. For example, a finger placed at position “1. Wave” would identify a sound to be played. The distance of the finger above the sensor is expressed in terms of integer values output, via the Phidgets API calls, from the distance sensor. Each pair (sensor id - S_i , distance subrange from sensor S_i) is mapped to a specific sound.

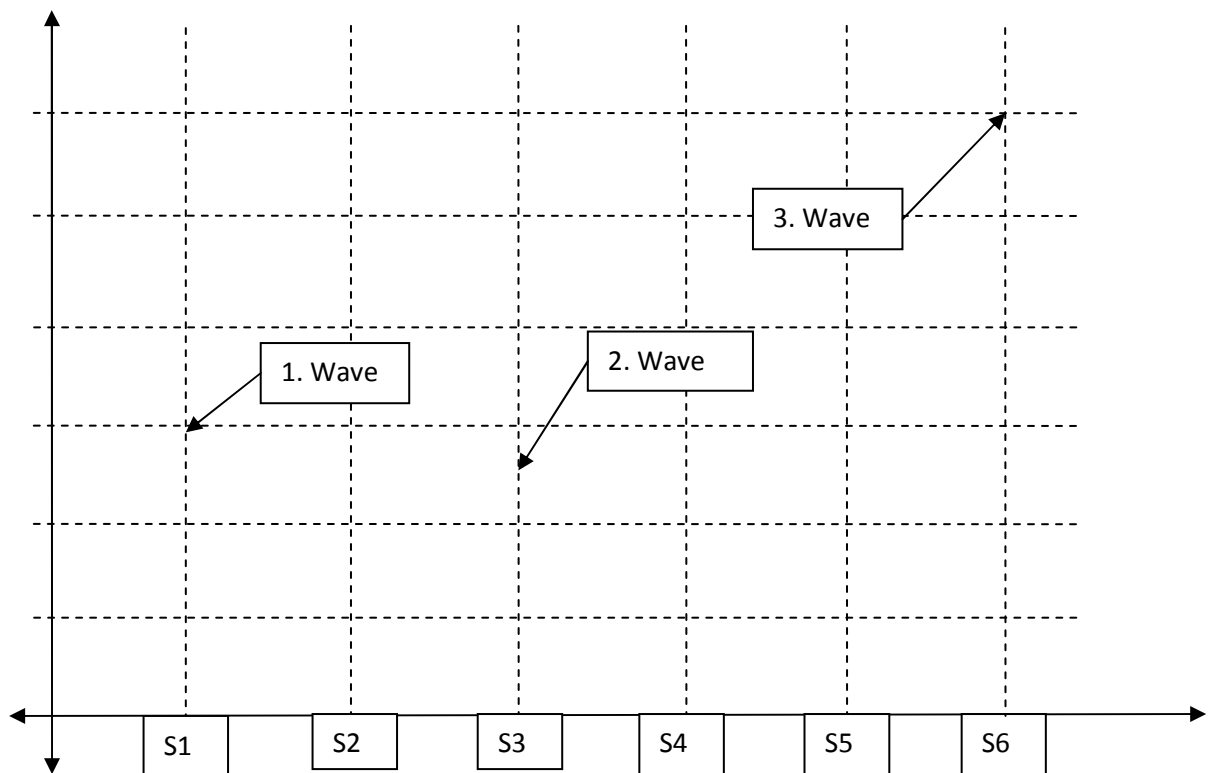


Figure 3 Sensory Space of the digital harp

Digital Harp

Figure 4 shows schematically the digital harp components, fairly self-explanatory. The sound converter performs the task of converting integer sensor values into corresponding playing of sound using sound file libraries. New sounds can be added to the library.

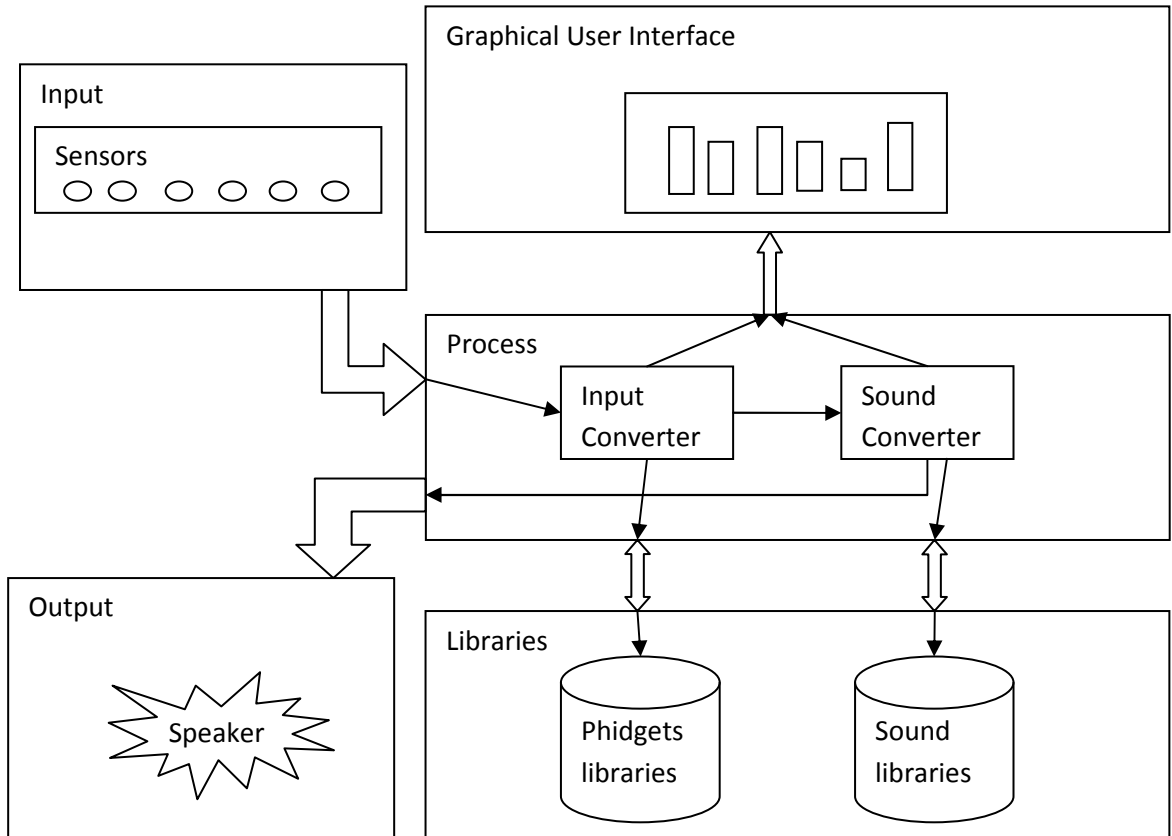


Figure 4 Block diagram for the digital harp