

TouchSound: Making Sounds with Everyday Objects

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ABSTRACT

In this paper I am presenting TouchSound, a wearable device that generates sounds and music by interacting with everyday objects by hand. By mixing tactile and auditory sensations, TouchSound promotes enjoyable musical experiences. It could be used by musicians to explore new ways to perform music, for educators to teach music to kids, and provide an opportunity for people to play music by touching everyday objects.

Author Keywords

Tangible interfaces, musical instrument, ubiquitous.

ACM Classification Keywords

H5.2. Haptic I/O.

General Terms

Design

INTRODUCTION

Auditory and tactile sensations are two of the five basic sensations of human beings. With auditory sensation, people perceive sounds from the environment, and with tactile sensation, people feel the shape and texture of objects, as well as interact with them physically. The two senses are often experienced together. For instance, pianos and drums generate sounds when people press or beat them. Some researchers are trying to explore this combination in a further way. Hiroshi Ishii et.al [2] exploited glass bottles as an interface to control music and sounds. Smus et.al [1] from Carnegie Mellon University demonstrated jeans that people can drum on by tapping.

One of the limitations shared by these projects is that the music is confined to a group of certain objects. It would be impossible for people to play sounds or music without them. Is it possible for us to find a way to generate sounds or music by hand whenever and whatever we want without the presence of traditional musical instruments or certain music devices?

In this paper, I present TouchSound, a wearable device in progress which allows people to make sounds by touching the surface of various everyday objects. Wearing this bracelet-like device on one's wrist, the user can play with

sounds or even create music when they are at home, at the office, or on the street. No traditional instruments or specific "music objects" are needed. Music becomes ubiquitous with TouchSound. The richness of interaction of TouchSound could be used by musicians to perform music in new ways, or early music education for kids. It provides a novel music experience.

CONCEPT

A traditional way to store sounds is to embed sound signals in given materials like magnetic strips or compact discs. To play music, a corresponding device is needed to decode the information into a sound wave. We can interpret TouchSound as one of music players, that instead of reading information from certain materials, it extracts the information from everyday objects and translates the information to sounds. Such information could be the color of the surface of an object, the temperature, the conductivity, magnetism ability, etc. By carefully mapping such information into elements of sounds, we can play sounds with everyday things.

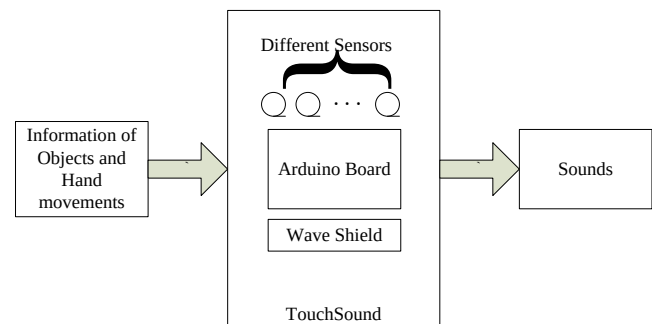


Figure 1. System Architecture.

The main part of the TouchSound system is an Arduino board with a wave shield to store sound effects. Several different sensors are connected to Arduino as system input and a speaker as sound output. Figure 1 shows the structure of the system.

Input

TouchSound acquires information with different sensors as the system input. The information is classified into two categories: object information and hand interaction information.

Information	Color	Temperature	Magnetism	Conductivity	Hands Movement	Hands Pressure
Sensors	Color Sensor	Temperature	Magnetometer	Resistor	Accelerometer	Pressure Sensor
Music Elements	Pitch	Timbre			Tempo	Loudness

Table 1. The sensors and mapping of information.

Object information refers to the information of an object's own properties. I use different sensors to recognize the color, temperature, magnetism and conductivity ability of the surface of an object.

Hand interaction information is generated when people interact with the object, including the movement of one's hand across the surface and the pressure generated against it.

Mapping

I use four basic elements to create music, pitch, timbre, loudness and tempo. The information acquired from sensors is mapped to these four elements. To be more specific, I mapped red, orange, yellow, green, blue, indigo and violet, the color of rainbow, to the seven music notes C, D, E, F, G, A, B. The color depth will influence the octave. To change the timbre, I mapped conductivity, magnetism, and temperature. Similarly, the speed of the hands movement and the pressure of touching are mapped to tempo and loudness, respectively. Table 1 demonstrates the system input and mapping of TouchSound.

Output

Following the mapping rules, Arduino will pick a corresponding sample from the wave shield, which will be played with certain time, loudness, through the speaker.

Appearance Design

TouchSound device is designed to be worn on user's wrist like bracelet. Arduino board will be replaced by LilyPad Arduino[3] and all the sensors will be sewed into the bracelet. Three 3 Volts Watch Batteries will provide the power for driving the device. See Figure 2.

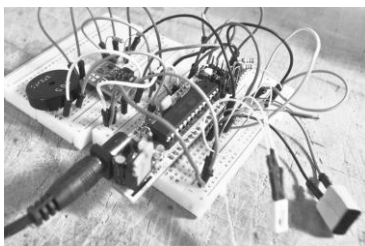


Figure 2. Picture of Current Prototype Hardware.

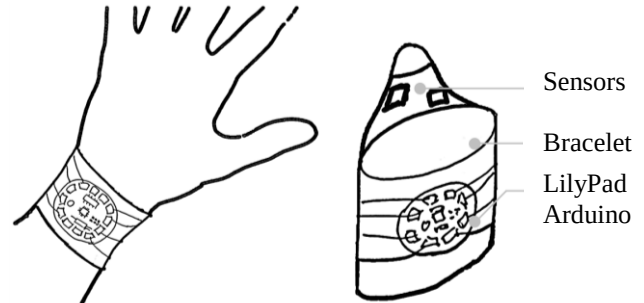


Figure 3. Appearance Design of TouchSound.

INTERACTION

Wearing TouchSound, people can touch objects like a wall, desk, clothes, or whatever they want to generate sounds. By touching surfaces with different colors, people can change the pitch of the sound, and by pressing their hands with different force, the sound will come with different volume accordingly. With one's hands movement at a different speed, the tempo of the sounds will also change. And if one's hand slides across a surface with different conductivity, temperature or magnetism, sound can be generated in different timbre. The diversity of generating sound with TouchSound makes the interaction have different possibilities.

CONCLUSION AND FUTURE WORK

In this paper, I describe TouchSound, a wearable device in progress for people to generate music by touching everyday objects. TouchSound can recognize information of normal objects and map them to basic music elements, so that one can perform music ubiquitously. In the future, I will keep working on construction TouchSound and make it appropriate to wear on one's hand.

REFERENCES

1. Boris Smus, Mark D. Gross, Ubiquitous Drums: a Tangible, Wearable Musical Interface, in *Proceedings of CHI 2010*, ACM Press
2. Hiroshi Ishii, Ali Mazalek, and Jay Lee, Bottles as a Minimal Interface to Access Digital Information, in *Proceedings of CHI 2001*, ACM Press
3. LilyPad Arduino, <http://www.arduino.cc/en/Main/ArduinoBoardLilyPad>