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The construction and evaluation of a musical glove

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Abstract
A digital musical instrument is different from an acoustic one because its gesture controllers are decoupled from the sound synthesis. Because of this, it is possible to separately design the control interface and the sound synthesis independently, and then digitally implement the gesture-sound mapping. This allows diverse possibilities for musical expression. A particular kind of digital musical instruments are musical gloves. They can capture the hand gestures, which are later mapped into sounds. By means of electronic sensors and digital sound synthesis, this work consisted of building a musical glove. In the development of the work the gesture-sound mapping and sound possibilities were explored in an embedded system with low computational resources.

Key words:
Embedded systems, musical instrument, wearables.

Introduction

A digital musical instrument is different from an acoustic one because its gesture controllers are decoupled from the sound synthesis. Because of this, it is possible to separately design the control interface and the sound synthesis independently, and then digitally implement the gesture-sound mapping.

In this work we developed a musical glove using the following methodology. First, we developed a data acquisition device based on a microcontroller and electronic sensors. After that, we studied and created sound synthesis systems using the Pure Data[1] music programming environment. Last, we explored the possibilities brought by the new instrument in musical sessions, evaluating the gesture-sound mapping.

The sensing system is based on IMUs and bend sensors. One IMU were attached in each glove, capturing the hand movements. It controls the synthesis parameters, changing the sound timbre. The bend sensors control the amplitude of the sound. Each finger has a bend sensor attached to it, capturing the joints movements and defining each finger to a musical note.

The study and implementation of sound synthesis was based on computer music literature[2,3]. During the study we tested different types of synthesis techniques and chose one that was computationally efficient, given the use of a microcontroller, and that with few parameters could generate a plethora of sounds.

Results and Discussion

As shown in Figure 1, the musical gloves have a sensing system which sends sensor data to a computer. Then, the data is processed in the Pure Data environment and used as synthesis parameters.

The musical gloves still presents some problems that limit its potential as a musical instrument. The communication between the gloves is wired, which can disturb the performer during a presentation. Also, the use of Pure Data makes it necessary to use a support computer, which decreases the instrument portability.

Image 1. Musical gloves.

Conclusions

The musical gloves construction and evaluation was done in 3 parts : the development of a sensing system employing embedded system techniques, the study and implementation of sound synthesis, and the exploration of the gesture-sound mapping in musical sessions.

In future works, we plan to port all the sensing system and sound synthesis to a microcontroller capable to do real time audio synthesis, to eliminate the need for a support computer.

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[2]Puckette, M. S. The Theory and Technique of Electronic Music, 2007 .

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