The IPEM_EME: a Wireless Music Controller for Real-time Music Interaction

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ABSTRACT

The IPEM_EME is a sound and music controller based on wireless motion sensors and concepts of embodied music cognition. This paper and demonstration aims at further testing the public acceptability of the IPEM_EME.

1. INTRODUCTION

The IPEM_EME has been developed using the concepts of embodied music experience [1]. Based on the natural movements and/or expressive gestures of one (or more) user(s), the device allows the control of both sound (e.g. timbre) and music (structure).The result is a multi-purpose wireless music controller for real-time social music interaction.

2. TECHNICAL DETAILS

The IPEM_EME works with several sensors at the same time and each individual sensor steers multiple signals. The system consists of three main parts namely the motion sensors, called HOP sensors [2], which send their data to a Max/MSP [3] patch which extracts different features from the movement and controls musical playback by Ableton Live [4] (see also [5]).
The HOP sensors are custom made, standalone, wireless, 3 dimensional accelerometers which send their data at a rate of 100Hz to a dedicated receiver. This receiver is recognized in the computer as a COM port which enables the readout in Max/MSP. Each sensor has its own Li-Po battery which guaranties an operation time of 18 hours. The sensors have a dimension of 55mm (long) x 32mm (wide) x 15mm (thick) which makes them very suitable for placement on the hands of the users.
The acceleration data from the motion sensors is captured in Max/MSP which extracts several parameters from this data stream in real-time. Two parameters are currently used in the IPEM_EME, namely, triggering and orientation. (i) Trigger is calculated by taking the difference of two successive acceleration samples. This is done for each of the 3 measured directions after which the values are added and surpass a fixed threshold which is defined from extensive use. The approach eliminates the offset in acceleration due to the gravity of the earth. Furthermore the fixed threshold can be set to a small value which enables the successful use of very small movements. (ii) Orientation of the movement sensors is calculated using the constant force of the earth gravity. A tradeoff was found between stability, using low pass filters, and responsiveness, using no filters. Trigger and orientation signals are translated to MIDI messages which control music samples played back by Ableton Live.
Ableton Live is a commercial music software, which is often used for music composition and mastering, but also for performance. By using MIDI as a control it is possible to start/stop audio loops and change various parameters of build-in effects like reverb, delay, filter, etc.

3. SOUND AND MUSIC CONTROL

A successful music controller requires that performers, including non-musicians, embody their control of sound and music. Therefore, different typologies of movement of performers were analyzed and mapped onto potential sound and music influencing parameters. The current prototype of the IPEM_EME is based on (i) volume triggering, (ii) sample (or note) triggering, and (iii) timbre modulation.

The basis for each performance is a non-stop loop that offers a basic percussion track and chords. The other layers in the music can then be triggered or modulated by movement, so that the user(s) get an instantly enriching sound. (i) Volume triggering, for example, may control the volume of another (synchronized) percussion loop according to the quantity of movement. A movement discontinuation stops the extra percussion, giving the performer the feeling of an embodied control. (ii) Timbre modulation is done by rotating the hand. This can be done while triggering the 'hitting' movements needed for volume triggering. Multiple filters are possible, and even in combination: reverb, flanger, distortion, high pass and low pass filters. (iii) Sample (or note) triggering is based on an algorithmic pitch component that takes into account pitch distributions related to particular musical genres. These notes can be triggered through abrupt changes in movement, or with the rotation filter.

4. USER FEEDBACK AND FUTURE WORK

The IPEM_EME was firstly presented at Resonance, on February 16th 2008, in Ghent, Belgium. Participants could try five different performances and they were interviewed about their experience. In general, participants were enthusiastic about the embodied way of controlling the music. Musicians and non-musicians performed just as well, mostly with a small learning period before having grasped all the possibilities of the sensors.

Based on a first feedback of users, we conclude that the IPEM_EME has an interesting potential concept, which deserves further development in terms of visual feedback and social interaction paradigms.

REFERENCES

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