

# Building a synthesizer using Csound and the Intel Galileo: towards an Internet of Things music programming environment

Lazzarini Victor<sup>1</sup>, Timoney Joe<sup>1</sup>, Byrne Shane<sup>1</sup>

<sup>1</sup> Maynooth University, Maynooth, Co. Kildare, Ireland

[shane.byrne.2011@nuim.ie](mailto:shane.byrne.2011@nuim.ie)

## Summary

This paper explains how the Intel Galileo can be configured to run as a music synthesizer. A special build of the music programming language application Csound was configured to run on the Intel Galileo. Achieving this meant that the Galileo could be set up to receive Midi information over USB that could drive a music synthesizer system. Furthermore, sound parameters could be controlled using Midi to allow real-time timbral change. The next step is to integrate this in as an Internet of Things (IoT) music application, providing a new technology platform to allow musicians to program, compose and play music from disparate locations.

## 1. Introduction

It is only recently that Internet of Things music synthesis applications have emerged. One example was the Universal Orchestra from Google [1]. This was a Google Chrome experiment run with the Science Museum in London. It allowed users from around the world to communicate using their web browser to play either real or virtual versions of a set of orchestra instruments. Patchwerk is a web browser-based application that lets the user control a massive modular synthesizer, housed at MIT, and listen to the results [2]. A similar facility is now available for those making sonic experiments using the littleBits synthesis system [3]: cloudBit turns any object into an Internet-connected device. This can be applied for interactive musical purposes, also. For example, in the area of sonification, creating geographically distributed musical installations, Internet-based synth control or even creating new types of audience interaction. The next addition to these nascent IoT music systems is from Csound [4], recently configured to run on the Intel Galileo [5]. Csound is an incredibly powerful and versatile audio processing and software package. This will allow music programming, composition and playback within the IoT framework.

## 2. Background

Initial work was done as part of a Master's thesis [6] project that involved the use of a Raspberry Pi and an

Arduino to run and control Csound. The fact that the Intel Galileo is effectively a perfect marriage of these two technologies affords the developer the option of incorporating the board into situations where connectivity and wearable technologies are required. An ideal application is in creating sound art installations, particular those driven by kinematics. Running the Csound software package on a Linux image on the Galileo makes the implementation of these ideas considerably easier. The connectivity possibilities of the Intel Galileo also allows for the further possibility of manipulating audio within Csound using data collected from remote locations. The full presentation will develop all these ideas and more to further demonstrate how the Galileo opens up the IoT possibilities for Csound. A live sound example will also be presented.

## References

- [1] The universal Orchestra, <http://www.chromeweb lab.com/>
- [2] Patchwerk, <http://synth.media.mit.edu/patchwerk/>
- [3] littleBits, <http://littlebits.cc/>
- [4] Csound, <http://www.csounds.com/>
- [5] <http://www.youtube.com/watch?v=ogYdJsKKxJk>
- [6] Shane Byrne, Master's Thesis in Creative Music Technologies, Maynooth University, 2014