

Embodied Interactions with E-Textiles and the Internet of Sounds for Performing Arts

Abstract

This paper presents initial steps towards the design of an embedded system for body-centric sonic performance. The proposed prototyping system allows performers to manipulate sounds through gestural interactions captured by textile wearable sensors. The e-textile sensor data control, in real-time, audio synthesis algorithms working with content from Audio Commons, a novel web-based ecosystem for re-purposing crowd-sourced audio. The system enables creative embodied music interactions by combining seamless physical e-textiles with web-based digital audio technologies.

Motivation

Creating artifacts for tangible, embedded and embodied interactions becomes more and more concerned by the “humanization” of the digital by looking at how analog and digital design spaces can be interlocked. Returning to traditional, natural materials as analog gateways to the digital world is central to the so-called post-digital art.

We propose sonic controllers that work more closely to the body using garments incorporating electronic textile or e-textile: fabrics turned into soft sensors and actuators by using conductive material when manufacturing or manipulating a textile surface.

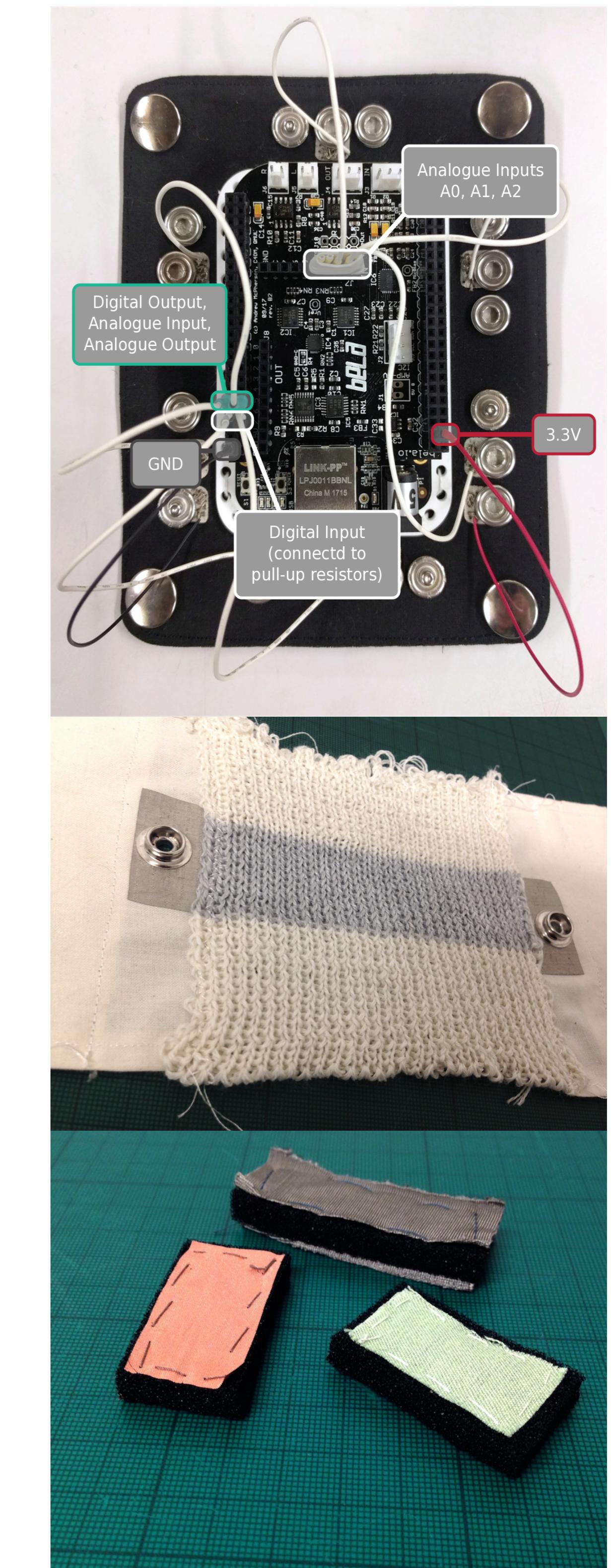
Design

- E-textiles augmented with Internet of Sounds (IoS) capabilities.
- Designed for both novices and experts.
- Sonic control data are generated through movement of the e-textile (e.g., press, tilt, or stretch) and voice input (e.g., a melody, an onomatopoeia).
- Data is mapped to audio synthesis parameters (e.g., pitch shifting, time-stretching, delay, granular synthesis) that affect sound files retrieved from online databases.
- Sound retrieval can be done prior to the performance using a browser-based desktop or mobile application, or during the performance.

Hardware and Software Architecture

Sensors and Actuators

- Stretch, pressure and orientation/tilt are the most versatile sensors.
- Stretch sensors knitted from conductive yarns or from non-conductive knit fabric coated in a conductive polymer. As they stretch, they change their resistance.
- Resistance-based pressure sensors; when two electrodes are placed on either side of a variable resistance material, the electrodes can measure the change in resistance when pressure is applied.
- A small loudspeaker is worn on the body to playback the generated audio.



Wearable Computer

- A computing system is controlled by Bela, a low-latency audio signal processing platform (bela.io/).
- A fabric circuit board was created to provide a soft circuit breakout board for five analog inputs and two digital inputs.
- Internet connectivity is added to the Bela board with a Wi-Fi USB dongle interfacing.

Software

- Pure Data (Pd) to attract those new to programming and to suit artistic communities.

Web Services

- A client script running on Bela provides an interface to the Audio Commons API.
- Audio Comoms supports the IoS: interconnected smart musical instruments and haptic wearables for performer and audience interactions.
- The Audio Commons initiative (audicommons.org) brings Creative Commons (creativecommons.org) audio content from online repositories, such as Freesound, to creatives from the music and audiovisual production industries.
- A script allows selected files to be downloaded from the Internet to the board so that they can be played back and processed by Pd patches.

Methodology

Technology Probes

A tool to understand social, engineering, and design aspects. Information on user experience to improve the next design iteration.

- (1) a set of workshops;
- (2) showcase of our work-in-progress system to the TEI community;
- (3) future performances making use of our system.

Making Workshops

- A kit of previously constructed handmade textile sensors provided for participants to use in their prototypes. Participants are also taught how to make basic sensors so that they can construct bespoke shapes for their prototypes.

Reference

S. Skach, A. Xambó, L. Turchet, A. Stolfi, R. Stewart, M. Barthet, “Embodied Interactions with E-Textiles and the Internet of Sounds for Performing Arts”, Proc. Int. Conf. on Tangible, Embedded and Embodied Interactions (TEI), ACM, <https://doi.org/10.1145/3173225.3173272>, 2018

Acknowledgements

This work was supported by the European Commission Horizon 2020 projects Audio Commons (grant 688382) and Internet of Musical Things (grant 749561), and the EPSRC and AHRC Centre for Doctoral Training in Media and Arts Technology (EP/L01632X/1). We thank Giulio Moro for his assistance with the Bela platform and to An Liang for her help with preparing the workshops.

