FlexSynth – Blending Multi-Dimensional Sonic Scenes

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1. PROJECT DESCRIPTION

FlexSynth is an interpretation of The Sponge [1], a DMI embedded with sensors to detect squeeze, flexion and torsion along with buttons to form an interface using which musical sounds are generated and the sound is sculpted. The key idea of the sponge is to harness the properties of a retractable, flexible object that gives the performer wide range of multi- parametric controls with high resolution in a maximized gesture space, considering its high manoeuvrability. One of the main differences between Martin's Sponge and the FlexSynth is the spatial multiplexing of different synthesizers and virtual instruments, where the controls of each set of sounds exist in different regions of space, i.e. the orientation of the FlexSynth measured by the Inertial Measurement Unit (IMU: accelerometer, gyroscope, magnetometer) determines the sound/patch it controls. With apparent transfer of control from one instrument to another it is possible to achieve some level of transparency as compared to buttons for mode switches in multi-modal instruments [2], which make mode selection arbitrary and hidden from the audience.

The main artistic goal is to perform polyphonic electro-acoustic music. Considering the manoeuvrability of this DMI, it was really useful to have quick mode/patch changes with gestures such as rotating the sponge along the planar axis. This way the performer would be able to have different sound synthesis mappings with the ability to change them quickly to generate polyphonic sounds. Considering the different kinds of sensors that could measure force applied, elevation, tilt amount and switches triggered, the performer has several degrees of freedom while allowing both separable (mode switches) as well as integral (control tremolo depth while changing LFO parameters) control. An example from one of the performances include: triggering a huge percussion hit (jab: z-axis acceleration) with a long reverb (adjusting the dry-wet mix amount using the FSR) and quickly rotating the instrument once to play a melody while triggering a stereo-delayed drone sound using the switch matrix. This kind of spatial multiplexing of various synthesizers and sound samples allow dynamic mappings that could change over time.

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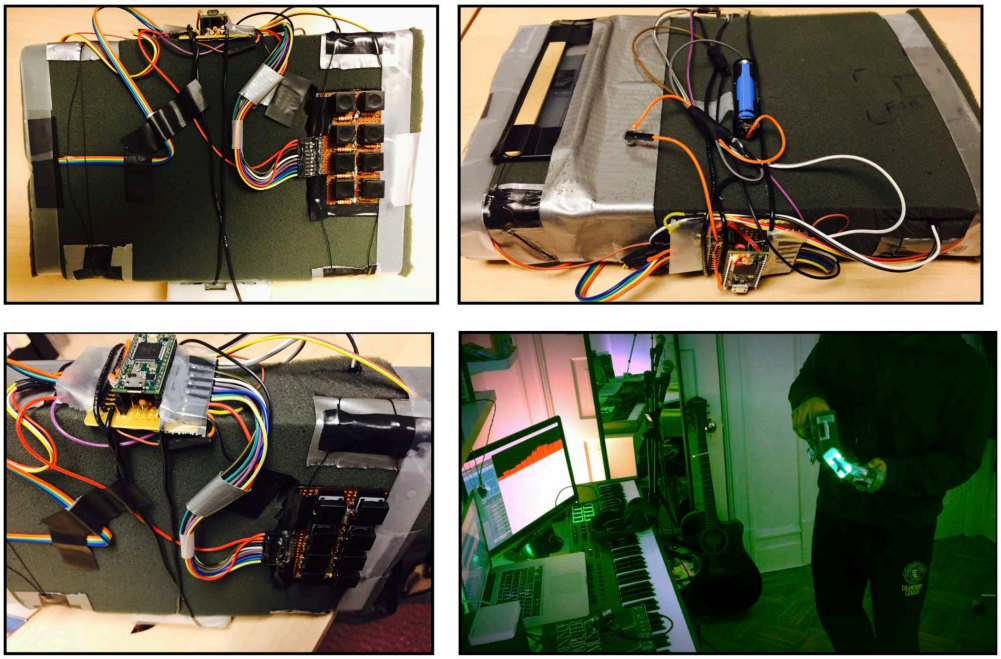

Fig. 1. FlexSynth – bottom view, top view, isometric view, during performance.

2. TECHNICAL NOTES

The Hardware includes a Teensy 3.2 microcontroller that performs signal acquisition by collecting all the data from all the sensors: switch button matrix, a slide bar using force sensing resistors and IMUs. All the sensor data is transmitted via an HC-05 Bluetooth transceiver and received on the laptop's native Bluetooth port. All intermediate calculations and signal conditioning, such as implementation of filters, sensor fusion computations of roll, pitch and yaw from the IMU data and position of press on the slide bar are carried out on the Teensy before transmission, hence reducing the amount of data to be transmitted. The sound synthesis is carried out in MaxMSP. A wireless vibrotactile feedback actuator (Vibropixel [3]) is placed in the front face of the foam to enhance the 'feel' of the instrument. Vibration feedback also eases playability as the vibrations are mapped to the orientation sensors; this will help performer to navigate the multi-parameteric sound space through the multidimensional gesture space. As the pitch and roll measured by the IMU changes away from the equilibrium position, the amplitude and frequency of the actuator increase, thus helping the performer get to various absolute positions and orientations easily. The Vibropixel also includes RGB lighting, which can be used as an additional visual feedback mechanism to improve the transparency and communication of musical gestures with the audience.

Detailed hardware and software description of the FlexSynth is available in [4].

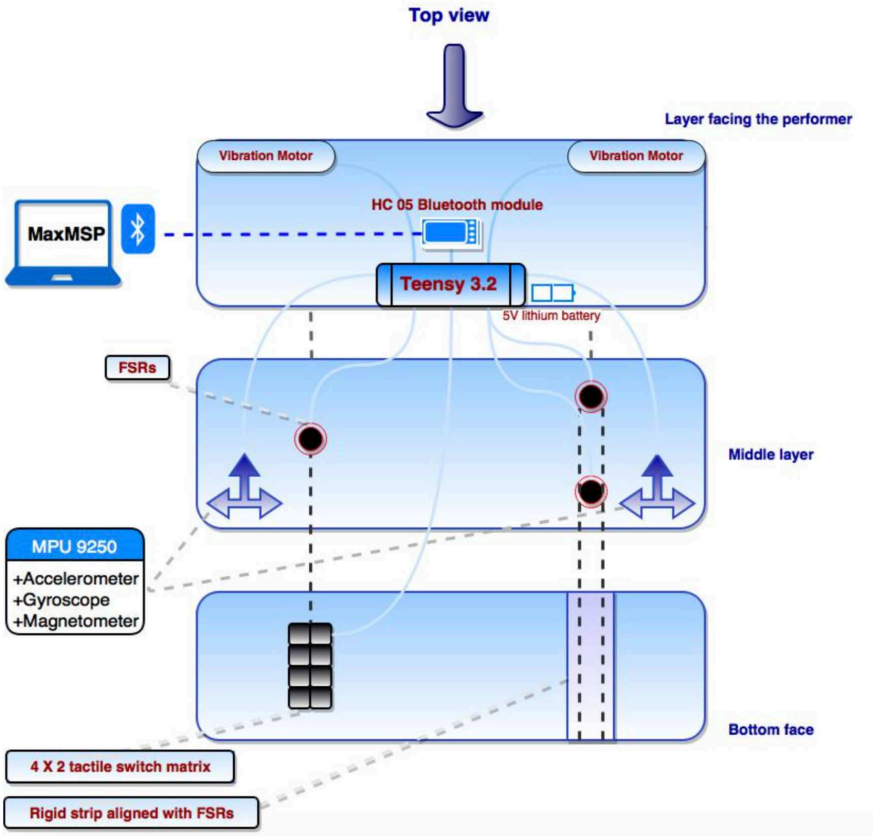

Fig. 2. FlexSynth – block diagram

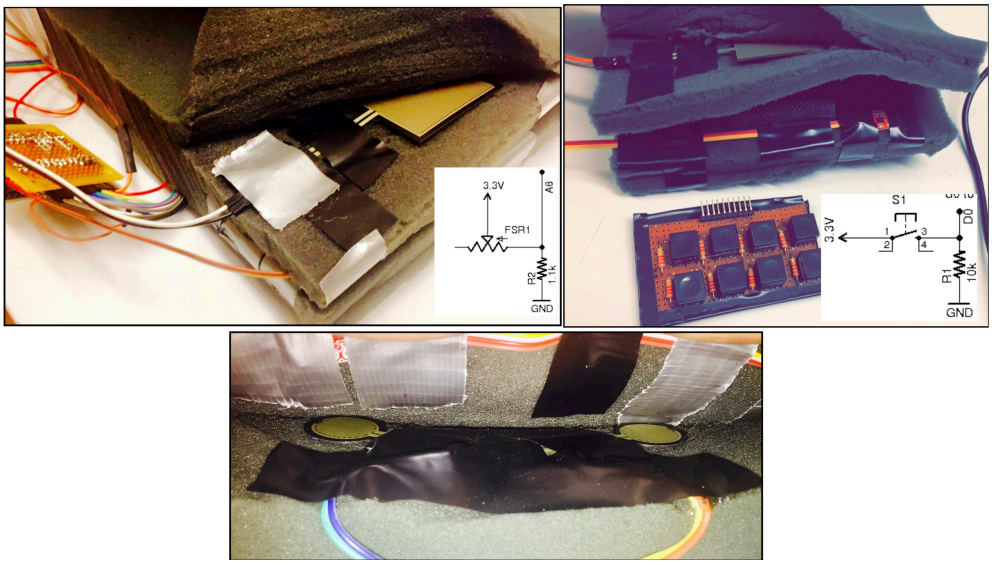

Fig. 3. FlexSynth – inside the FlexSynth
Left – large FSR, Right – switch matrix and IMU, bottom – small FSRs (slide bar)

3. PROGRAM NOTES

The FlexSynth creates lush and fantastical soundscapes, evoking the stillness of deep space and the turbulence and tumult of an ocean storm. Haunting melodic themes interweave with pure timbral modulations blending seamlessly with synthetic drones and acousmatic sonic gestures. The subtle orientation changes by the performer create smooth transitions between soundscapes while blending and exploring the multi-dimensional gesture space. The sound delves into dramatic crescendos, subtle delicately restrained silences, and all the vast dynamic range between. Every performance is an exciting journey and sonic experience.

4. MEDIA LINK(S)

- Video – solo performance: https://youtu.be/U7UMkQxeKC4
- Video – group performance: https://youtu.be/6C0c8fTA1eU

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