Eobody2 : A follow-up to Eobody's technology

Marc Sirguy
eowave
6, rue Marceau
94200 Ivry-sur-Seine France
+33/6 61 70 20 50
marc@mesi.fr

Emmanuelle Gallin
eowave
6, rue Marceau
94200 Ivry-sur-Seine France
+33/1 45 15 41 95
emmanuelle@mesi.fr

ABSTRACT

Eowave and Ircam have been deeply involved into gesture analysis and sensing for a few years by now, as several artistic projects demonstrate (1). In 2004, Eowave has been working with Ircam on the development of the Eobody sensor system, and since that, Eowave's range of sensors has been increased with new sensors sometimes developed in narrow collaboration with artists for custom sensor systems for installations and performances. This demo-paper describes the recent design of a new USB/MIDI-to-sensor interface called Eobody2.

Keywords

Gestural controller, Sensor, MIDI, USB, Computer music, Relays, Motors, Robots, Wireless.

1. INTRODUCTION

The Eobody sensor system aimed to be as versatile as possible whilst keeping a "plug & play" approach to reach end-users who had no basis in computer programming and who would like to be able to experiment with sensors at a reasonable price (half the price of high-ends existing interfaces). This attempt was quite successful, thus satisfying: it showed that despite of the numerous contexts in which the device was used, its multiple functionalities solved the problem. After three years of commercializing the Eobody and sensors systems, our wish was to keep the same early idea of an even more flexible "plug & play" system, but extend it to other applications to make the Eobody2 become a versatile interface to control sensors as well as relays, gates, step motors… at the same time.

2. NEW DESIGN, QUESTIONS AND CHOICES

2.1 Discussing USB and wireless

The evolution of technical needs clearly marked the demand for two specifications: the Eobody2 had to be USB and wireless.

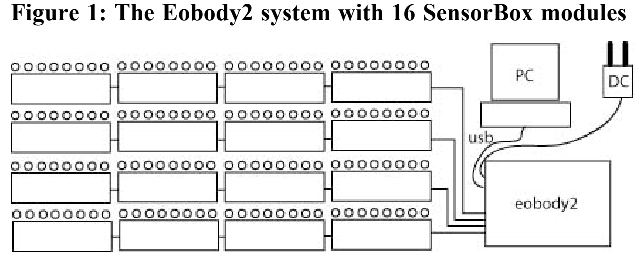
Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee.
NIME07, June 7-9, 2007, New York, NY
Copyright remains with the author(s).

The USB connection would offer the plug&play aspect, which was a priority to us – though Ethernet based systems (e.g. Ircam EtherSense) were usually too complicated to use for people who had no experience in computer programming. We were also aware that a USB self-powered system would require a permanent link to a computer – but wasn't it already the case for most of permanent installations anyway? It was also clear that end-users were expecting a wireless system, which was to bring other technical issues and design choices. If such a system was technically conceivable, it would have reduced the versatility of the system - e.g., a battery powered wireless system would not be adapted to permanent installations. A all-in-one unit with wire and wireless capabilities was also conceivable, but would have lead to a significant price increase, though the target was not the same. Another option was to design two separated modules, a wire sensor system and a wireless one, though this was opposite to our will to keep the versatility of the system. Then came the idea of a core unit supporting different modules, Sensorboxes, Relayboxes, etc., and among them, a wireless sensor module.

2.2 From Eobody to Eobody2

Many features of the Eobody1 have been re-thought and improved. Among these, the facility of a stand-alone mode: once the Eobody1 configured, the setup was stored in a non-volatile memory. Only one configuration setup could be stored in the unit at this time, but libraries could be stored on the host computer that runs the configuration editor. With the Eobody2, the setups are not stored in the core system, but inside the modules. This new configuration enables multiple storages. It's now possible to store an entire installation or performance setup inside a module and save it for a future use. In and outs have also been changed. With 4 RJ45 inputs to connect four 8-in SensorBoxes per input, the number of inputs has been increased to 128 (depending on module type). 4 encoders and 4 switches have replaced the 3 onboard potentiometers and 4 buttons from the Eobody1. These, like the analog inputs, can be mapped to any MIDI messages.

Figure 1: The Eobody2 system with 16 SensorBox modules



3.TECHNIQUES & IMPROVEMENTS

3.1 From MIDI to high-speed USB

The Eobody1 had a noise gate algorithm and a sub-sampling process because of the slow rate of MIDI compared to the amount of data we wanted to export (2). Thus, priority was given to sensor, and gesture (or sensor) noise could be removed, with significant gain on the dataflow bandwidth. Now, with high-speed USB, only the MIDI protocol ensures a maximum compatibility with most of the computer softwares. USB also enables to reduce significantly the latency from 2,5 ms to 1,5 ms.

Table 1: Eobody1 and Eobody2 latency comparison

	Eobody 1	Eobody2
Latency time	2,5 ms	1,5 ms
Latency per active in	150 µs/active in	46 µs/active in

3.2 High resolution up to 12-bit

The Eobody1 resolution was limited to 10-bit as the MIDI transfer rate could hardly support more. The Eobody2 resolution is now up to 12-bit. In audio, 12-bit would mean 4096 values allowing 85 cents per semi-tone in a 4 octaves range - though human ear can only perceive 8. This high resolution avoids 'scale effects' and allows a nearly linear conversion curve.

3.3 Self-powered USB 3,3V

Using USB delivers a 3,3V self-powering when the unit is plugged to a computer. Another issue was that some sensors needed a higher power supply than 3,3V. Some, like the Sharp distance sensors GP2D12 for example, need 5V. An external power plug has been added to power the unit up to 5V. Connected to 5V, SensorBoxes and other modules are also powered with 5V and can support any kind of Eowave sensors (3). A 3- position slide switch determines the power status: external – off – USB.

3.4 Sensors' range

Despite the fact that signal windowing is unavailable, signal zooming can be achieved using the 12-bit resolution and then scaling the value elsewhere.

3.5 Editor

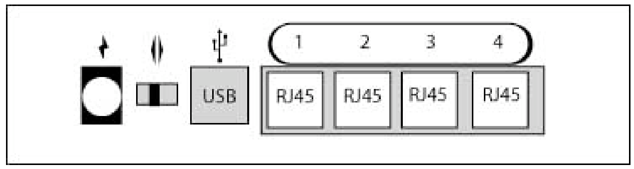
The Eobody2 editor is PC, Mac & IntelCore compatible. Major features from the Eobody1 editor have been maintained (status (on/off), bit depth (up to 12), zoom & offset, type of MIDI messages, channel, gate, sub sampling, Val1, Prm1, Prm2) (4). Some have been added: inverse (127 to 0). A special editor page is dedicated to each module (sensor, relay, etc.) and enables access to specific parameters. All parameter modifications are done in real time.

3.6 Inputs and other connectors

3.6.1 Inputs

With the Eobody1, sensors were connected to the interface via a D-sub to 8 jack 6,35'' pigtail cable (5). It was reported that this connector often supported too much tension from the sensors cables and was at the origin of 99 % of reported troubles). To avoid this, the pigtail cables have been replaced by 4 RJ45 inputs – each being plugged to a 8-in SensorBox for a total of 128 active in (16 in the first Eobody). The choice to use RJ45 connectors was mainly driven by the fact that this type of connectors can be found anywhere and are really cheap. Also, RJ45 cables are standard cables that can allow long cables – long cables are sometimes very useful for installations. The communication with the modules is made by SPI (Serial Peripheral Interface) bus (6). This protocol will enable to communicate with other type of modules for step motor controlling, relay controlling…).

Figure 2: The Eobody2 connections on the rear side



3.6.2 Sensors

The sensors jack connection is maintained. This type of connection is very common and can easily be fixed. Along with the release of the Eobody2, eowave sensor range will be increased with new types of sensors.

3.7 Module types

As a USB/MIDI-to-sensor interface, the Eobody2 is not only limited to musicians or performers. The Eobody1 has met a lot of interest for other applications such as healthcare apps, car simulators, fireworks triggering… and of course robot apps. With the Eobody2, all these application types will be directly accessible from the same core, just by adding the appropriate module (SensorBox, RelayBox, Wireless SensorBox...).

4. REFERENCES

(1) Fléty, E., "Interactive devices for gestural acquisition in the musical live performance context.", *Proceeding in SCI,* 2001 – Orlando, Florida – USA, pp 535-540.
(2) Fléty, E., "AtoMIC Pro : a Multiple Sensor Acquisition Device.", *in Proceedings of NIME*, NIME 2002 – Dublin, MIT Europe – Ireland, pp. 96-101.
(3) All eowave sensors are 5V compatible.
(4) See Eobody Editor Manual.
(5) The first Eobody used D-Sub connectors with locks and two pigtail cables distributed by the 15 pin D-Sub male plug to 8 regular jack plugs.
(6) Serial Peripheral Interface Bus or SPI bus is a synchronous serial data standard designed by Motorola that operates in full duplex mode. Devices communicate in master/slave mode where the master device initiates the data frame.