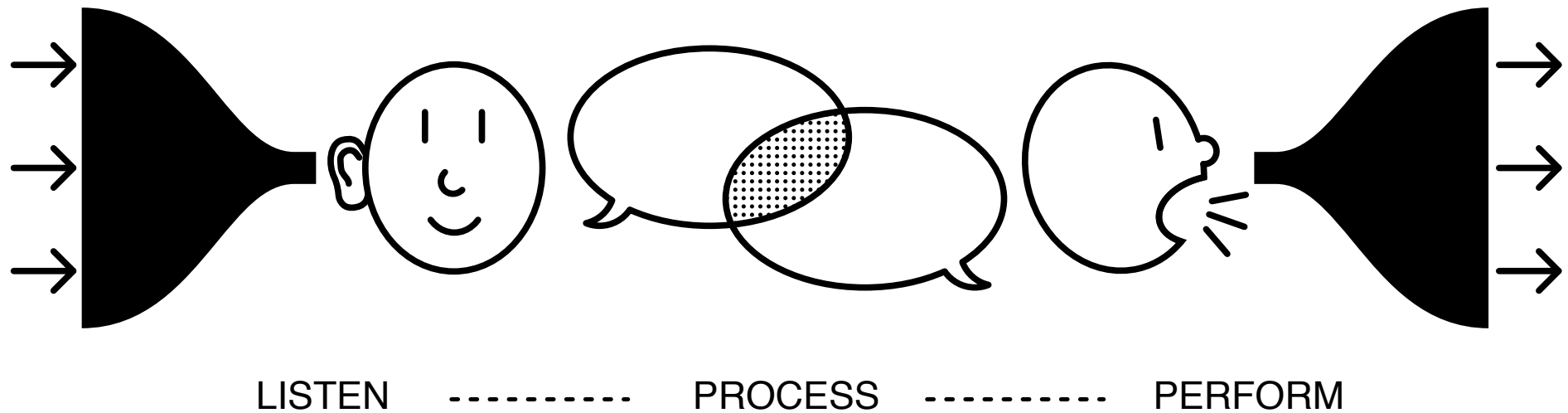


Gainer/Funnel



Shigeru Kobayashi (from Gainer/Funnel development team)

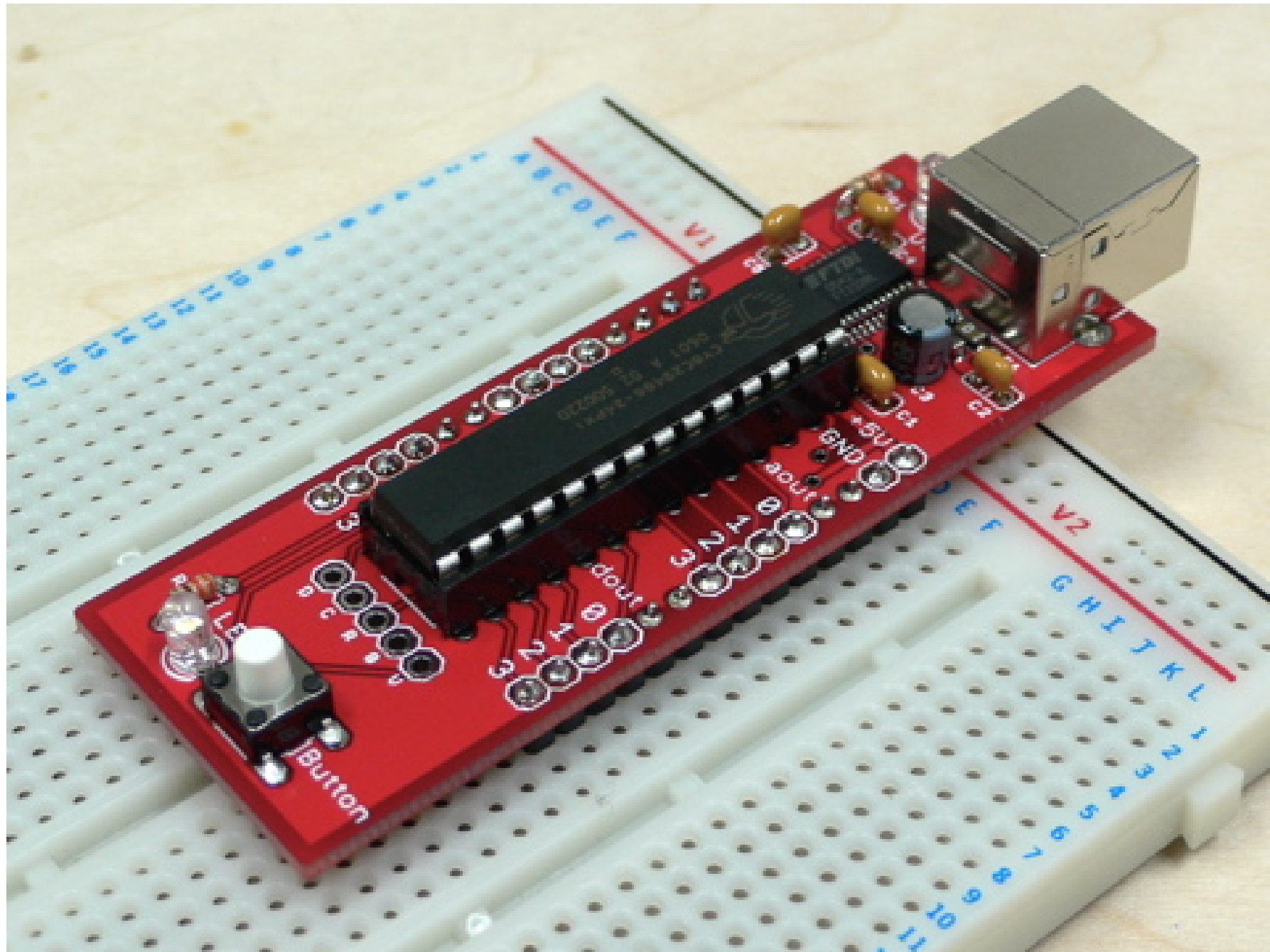
Background

- Roland Corp. (April 1993 - June 2004)
 - Sound designer
 - Software engineer
 - No experience of hardware development...
- IAMAS (July 2004-)
 - Started exploring/teaching Physical Computing

What is Gainer?

Overview

- A toolkit for Physical Computing
- Consisting of an I/O module and software libraries



What is Gainer?

Gainer I/O module

- Designed to use with breadboards
- Based on PSoC microcontroller
 - Built-in OpAmp
 - Reconfigurable port settings
- Open source^{*1}

^{*1} New BSD license

What is Gainer?

Software libraries

- Multi platform support (on Mac and Win)
 - Flash (MX 2004 and 8)
 - Processing
 - Max/MSP
- Open source^{*2}

^{*2} New BSD license

What is Gainer?

Software libraries: Flash

Listing 1 Flash code example

```
var io:Gainer = new Gainer("localhost", 2000, ...);

io.onReady = function() {
    this.beginAnalogInput();
}

_root.onEnterFrame = function() {
    var brightness:Number = io.analogInput[0];
    ...
    io.analogOutput(0, value);
}
```

Gainer in action!

Example 1: Gainer Kaidan

- Media installation
 - 6 Gainer I/O modules
 - 24 sensors/actuators
 - > 120 breadboards
 - > 11,000 jump wires
 - 4 weeks
 - Flash and Max/MSP
- NTT InterCommunication Center [ICC]

Gainer in action!

Example 2: Mountain Guitar

- Musical interface (prototype)
 - 1 Gainer I/O module ZigBee (prototype)
 - 1 proximity sensor,
3-axis acceleration sensor,
2 photocells, 1 FSR and 5 switches
 - Max/MSP with VST plug-ins
- NIME'07 demo session

Results

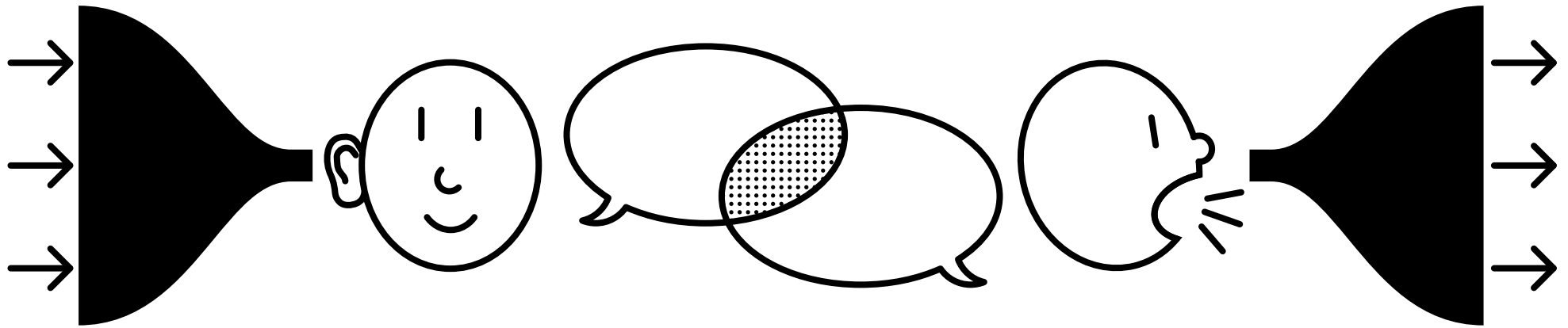
- > 500 units have been shipped^{*3}
- 5 open workshops (in Japan and Korea)
- 'Gainer + Flash' community growing rapidly in Japan

^{*3} Since June 2006, through a distributor

Problems

- For beginners, still difficult to handle analog inputs...
 - Threshold detection
 - Filtering (e.g. LPF, HPF...)
 - Scaling and converting units

Funnel



LISTEN **PROCESS** **PERFORM**

What is Funnel?

- Funnel is NOT a Gainer v2.0
- Re-designed from scratch reflecting experiences through Gainer v1.0

What is Funnel?

Keywords

- Multi I/O module support
- Pseudo code like programming

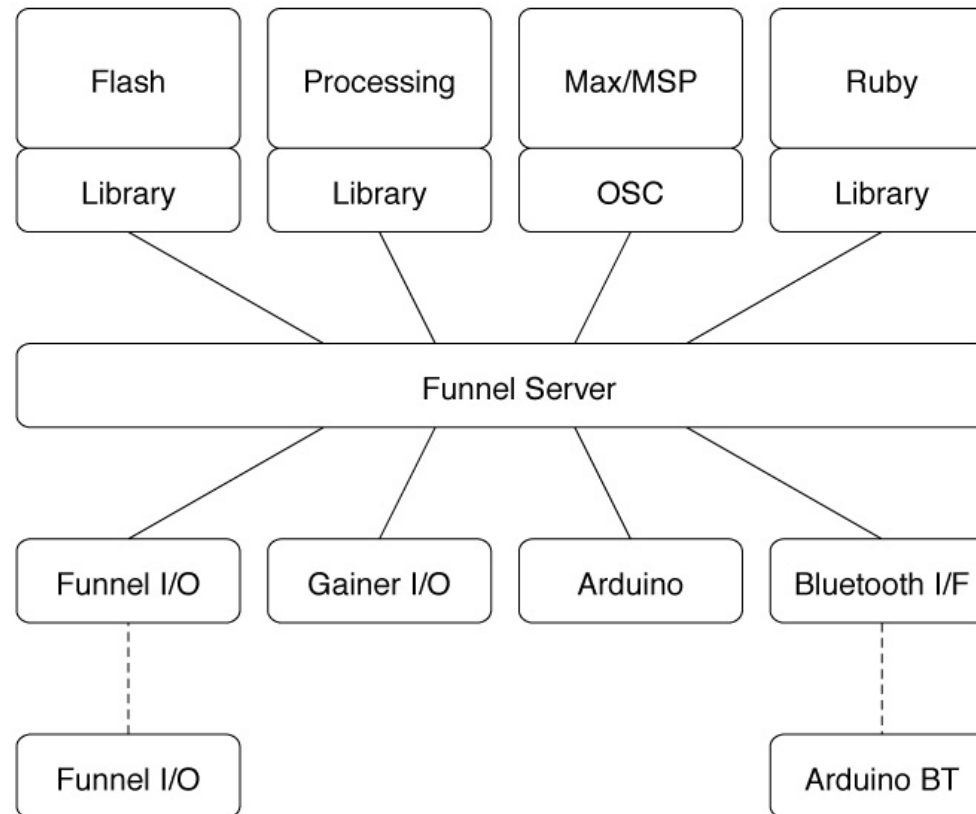
Multi I/O module support

Problem

- An I/O module doesn't cover all user needs
 - The Number of inputs/outputs
 - Special functions (e.g. touch sensor)
 - Cost
 - Standalone capability

Multi I/O module support

Solution



Pseudo code like programming

Problem

- Handling analog inputs is not so simple
 - Threshold detection with hysteresis
 - Filtering (e.g. LPF, HPF...)
 - Scaling and converting units etc...

Listing 2 ActionScript 2 + Gainer

```
var io:IOModule = new IOModule(...);
var lastStatus:int = -1; // -1: unknown, 0: low, 1:high
var threshold:int = 50;
var hysteresis:int = 50;

loop() {
    if (io.analogInput[0] < (threshold - hysteresis)) {
        status = 0;
    } else if (io.analogInput[0] > (threshold + hysteresis)) {
        status = 1;
    } else {
        status = lastStatus;
    }

    if ((lastStatus == 0) && (status == 1))
        handler();

    lastStatus = status;
}
```

```
function handler() {  
    ...  
}
```

Pseudo code like programming

Solution

- Edge detection (rising and falling edge)

Listing 3 ActionScript 3 + Funnel

```
var io:Funnel = new Funnel(...);
io.port[0].threshold = 50;
io.port[0].hysteresis = 10;
io.port[0].edgeDetection = enabled;

io.port[0].onRisingEdge = function() {
    ...
}
```

Pseudo code like programming

Problem

- Control actuators with time varying factors are not so simple
 - Blink a LED at a specific frequency
 - Drive a LED with a specific wave (e.g. sine, square, triangle...)

Listing 4 ActionScript 2 + Gainer

```
var io:Gainer = new Gainer(...);
var value:Number = 0;
var i:Number = 0;

var blinkTimer:Timer = new Timer(20, 0); // 20ms interval, forever
blinkTimer.addEventListener(TimerEvent.TIMER, dimming);
blinkTimer.start();

function dimming():Void {
    i += 1;
    if (i < 255) {
        value += 1;
    } else if (i < 509) {
        value -= 1;
    } else {
        i = 1;
    }

    io.analogOutput(0, value);
}
```

Pseudo code like programming

Solution

- Oscillator (e.g. Sine, Triangle, Square...)

Listing 5 ActionScript 3 + Funnel

```
var io:Funnel = new Funnel(...);
var dimmer:Osc = new Osc(Wave.TRIANGLE, 0.5); // wave, frequency

dimmer.onUpdate = function(val:float) {
    io.port[0].value = val;
}
```

Pseudo code like programming

Solution: And more...

- Port properties for popular cases
 - maximum
 - minimum
 - average
- Scaler (e.g. linear, square root curve...)
- Filter (e.g. LPF, HPF...)

Current state

- Implementing based on API draft
- v1.0 will be released by the end of 2007
- Feedback is always welcomed!

kotobuki@gmail.com

Thanks!

Shigeru Kobayashi

<http://gainer.cc>

<http://funnel.cc>

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