

# bitalino

from a paper towel to the world



board



freestyle



plugged

**Hugo Silva**

[hsilva@lx.it.pt](mailto:hsilva@lx.it.pt)

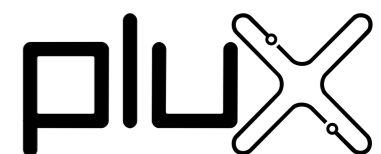


[facebook.com/BITalinoWorld](https://facebook.com/BITalinoWorld)



[twitter.com/BITalinoWorld](https://twitter.com/BITalinoWorld)

 instituto de  
telecomunicações  
in collaboration with



# about me

Hugo Silva, PhD  
Researcher  
[hsilva@lx.it.pt](mailto:hsilva@lx.it.pt)

Co-Founder  
Chief Innovation Officer  
[hsilva@plux.info](mailto:hsilva@plux.info)



instituto de  
telecomunicações

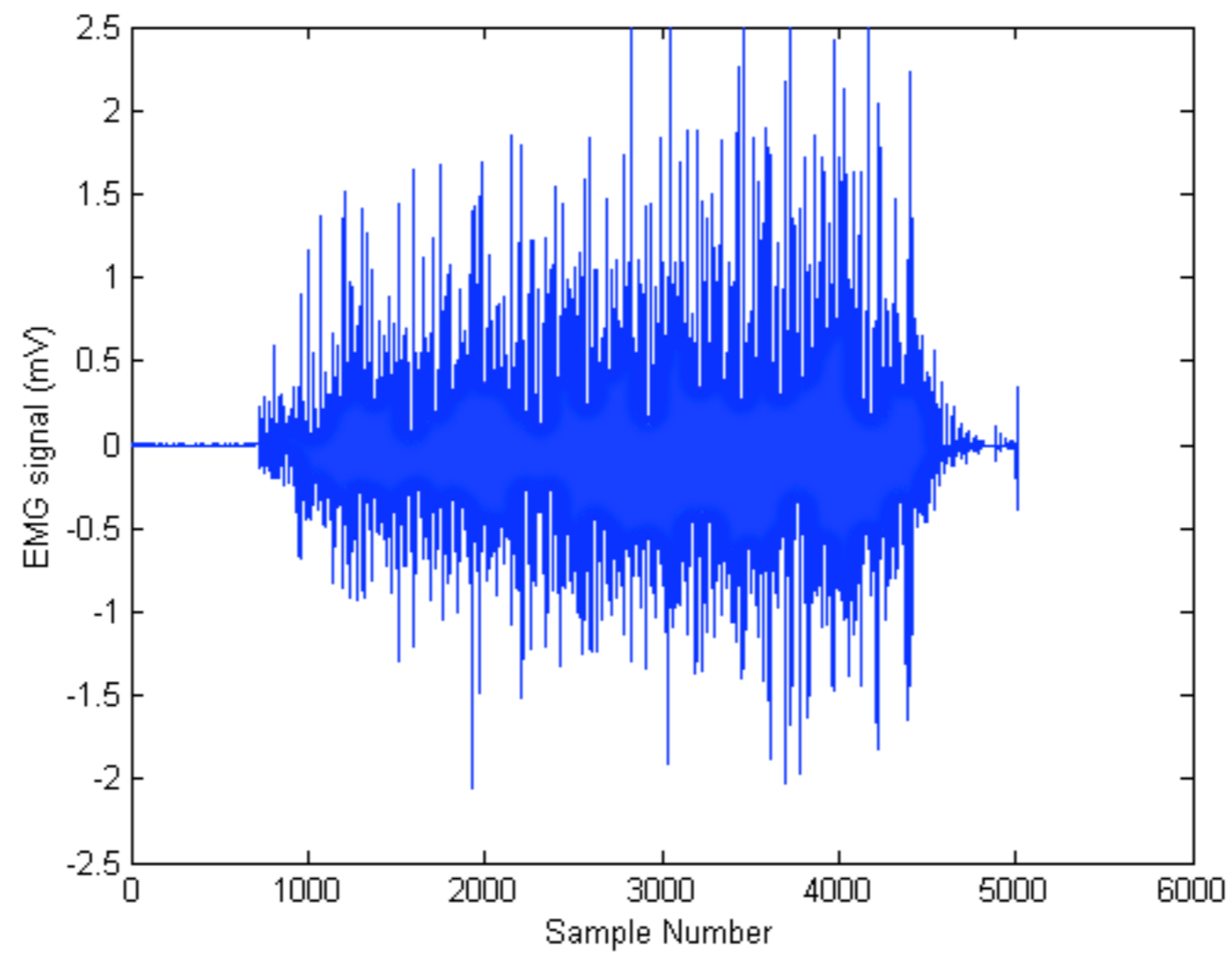
*creating and sharing knowledge for telecommunications*



wireless  
biosignals

plus











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creating and sharing knowledge for telecommunications

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- About IT
- Scientific Areas
- Positions
- News and Events

## Key IT Indicators

About IT > Key IT Indicators

### SCIENTIFIC OUTPUT

Year	Books	Books Chapters	Journals	Patents	Conferences	MSc Theses	PhD Theses
2000	1	7	42	n.a	193	13	5
2001	3	6	67	n.a	263	11	8
2002	4	26	81	2	188	16	6
2003	6	18	101	2	326	40	10
2004	5	21	101	3	289	34	13
2005	7	31	127	4	414	29	12
2006	13	34	148	15	371	35	8
2007	6	31	166	13	564	83	18
2008	14	51	211	11	461	178	29
2009	12	54	226	19	623	206	18
2010	17	50	274	23	601	209	26
2011	12	59	283	16	659	202	35
2012	24	54	360	12	554	216	42
2013	18	63	336	6	551	193	39
2014	6	21	133	0	106	42	44





Dakshina Ranjan Kisku  
Phalguni Gupta  
Massimo Tistarelli

Multibiometrics Systems:  
Modern Perspectives to  
Identity Verification

Secure Multimodal Biometric Systems



Multibiometrics Systems: Modern Perspectives to Identity Verification: Secure Multimodal Biometric Systems [Paperback]

Dakshina Ranjan Kisku (Author), Phalguni Gupta (Author), Massimo Tistarelli (Author)

Be the first to review this item | Like (0)

Price: \$90.00 & this item ships for FREE with Super Saver Shipping. Details

In Stock.

Ships from and sold by Amazon

5 new from \$89.99

Quantity: 1

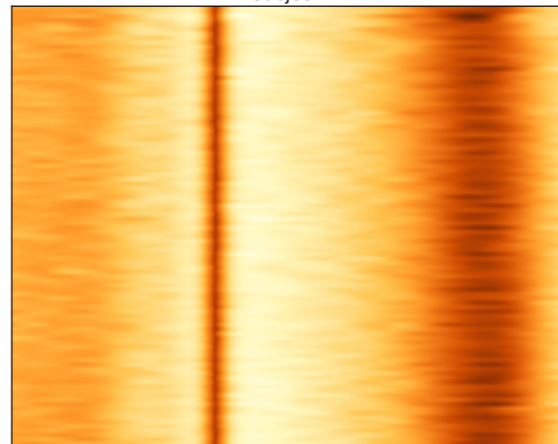
Add to Cart

or

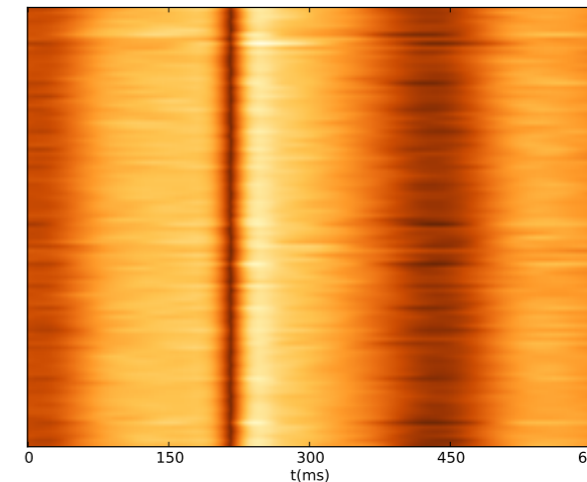
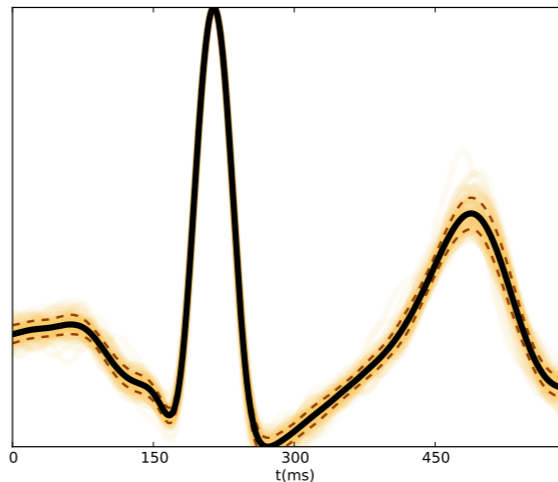
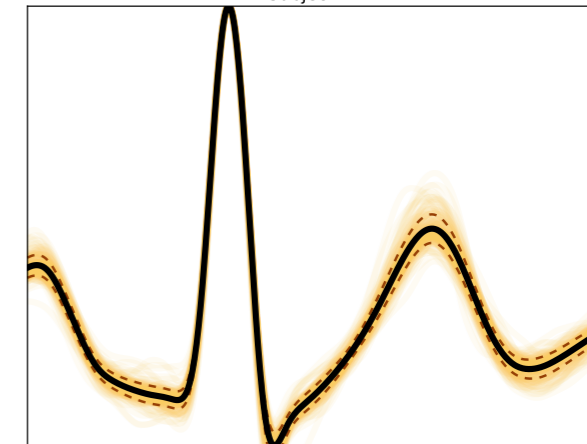
Sign in to turn on 1-Click ordering.

Add to Wish List

Subject A



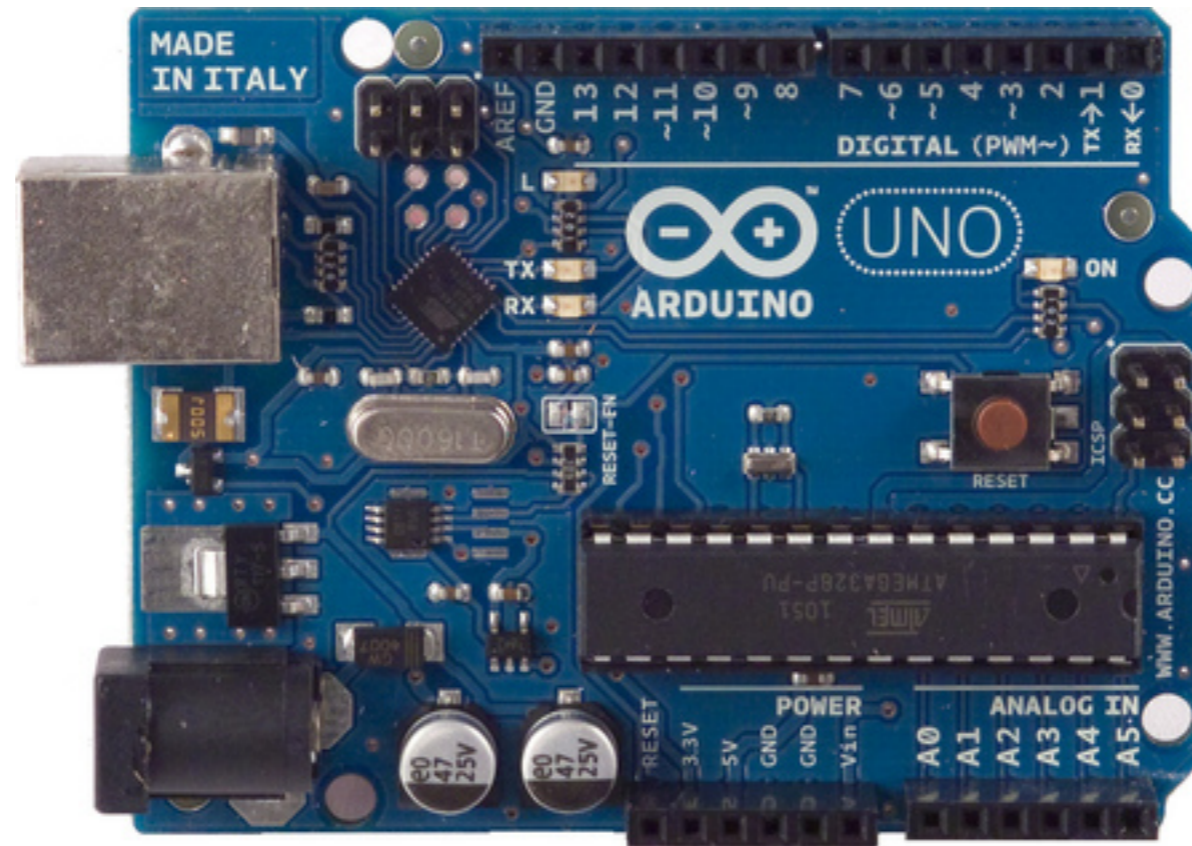
Subject B



0 150 300 450 600  
t(ms)

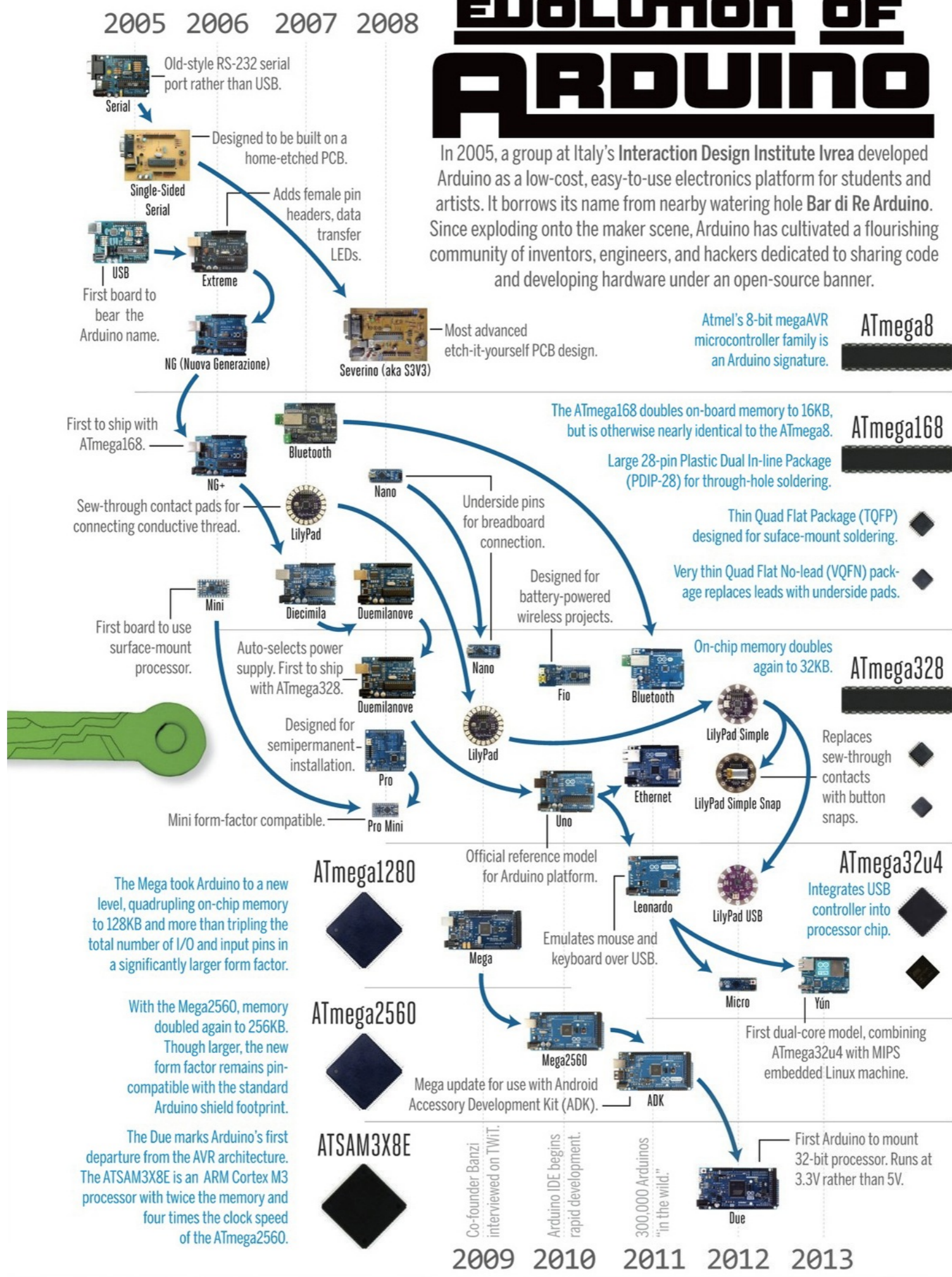
0 150 300 450 600  
t(ms)

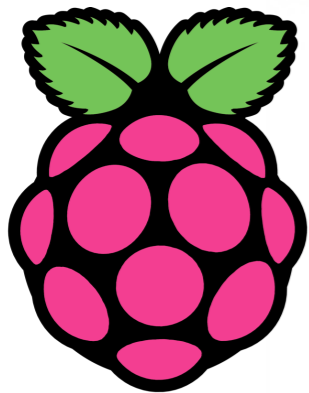
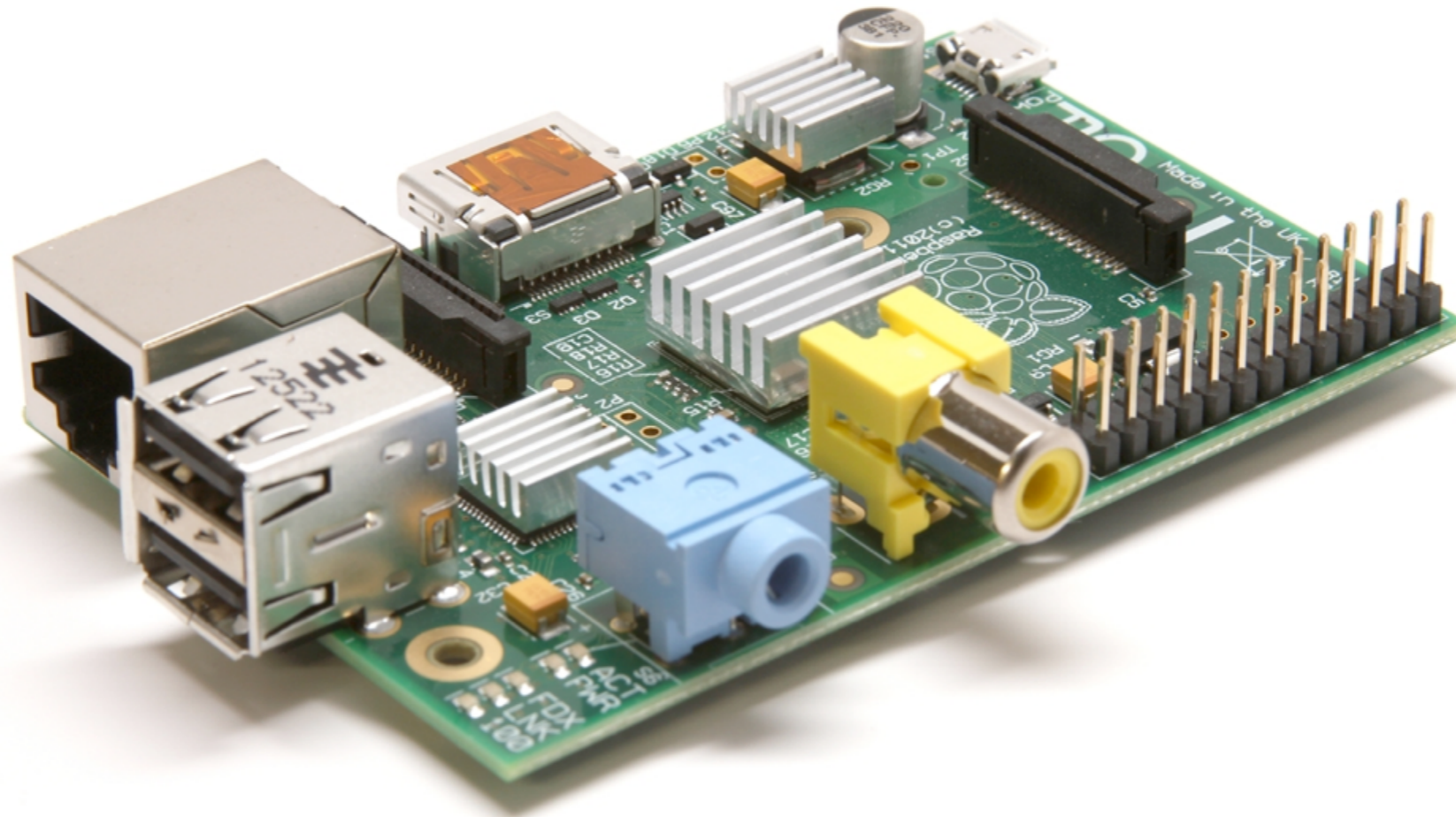
HOW DO  
WE DEPLOY  
DOZENS  
OF BIOSIGNAL  
ACQUISITION  
STATIONS?



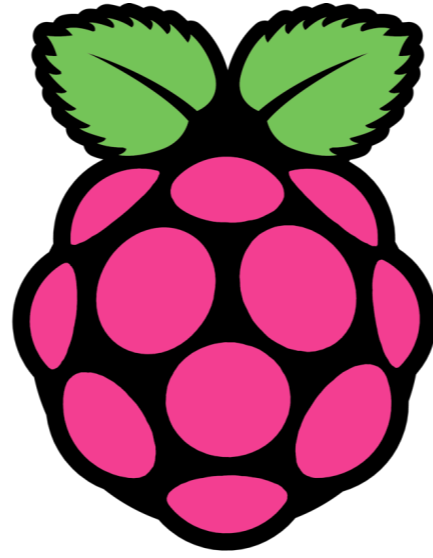
# EVOLUTION OF ARDUINO

In 2005, a group at Italy's Interaction Design Institute Ivrea developed Arduino as a low-cost, easy-to-use electronics platform for students and artists. It borrows its name from nearby watering hole Bar di Re Arduino. Since exploding onto the maker scene, Arduino has cultivated a flourishing community of inventors, engineers, and hackers dedicated to sharing code and developing hardware under an open-source banner.





**Raspberry Pi**  
<http://www.raspberrypi.org/>



**RaspberryPi**

8.0M

UNITS SOLD  
DURING IN THE FIRST 4 YEARS

AND WHEN INSPIRED  
PEOPLE  
USE THESE...

AWESOMENESS  
HAPPENS!



a freakin' **flamethrowing** halloween pumpkin



back to the future sneakers



# back to the future sneakers



[http://www.youtube.com/watch?v=k\\_Efr2TaEPo](http://www.youtube.com/watch?v=k_Efr2TaEPo)

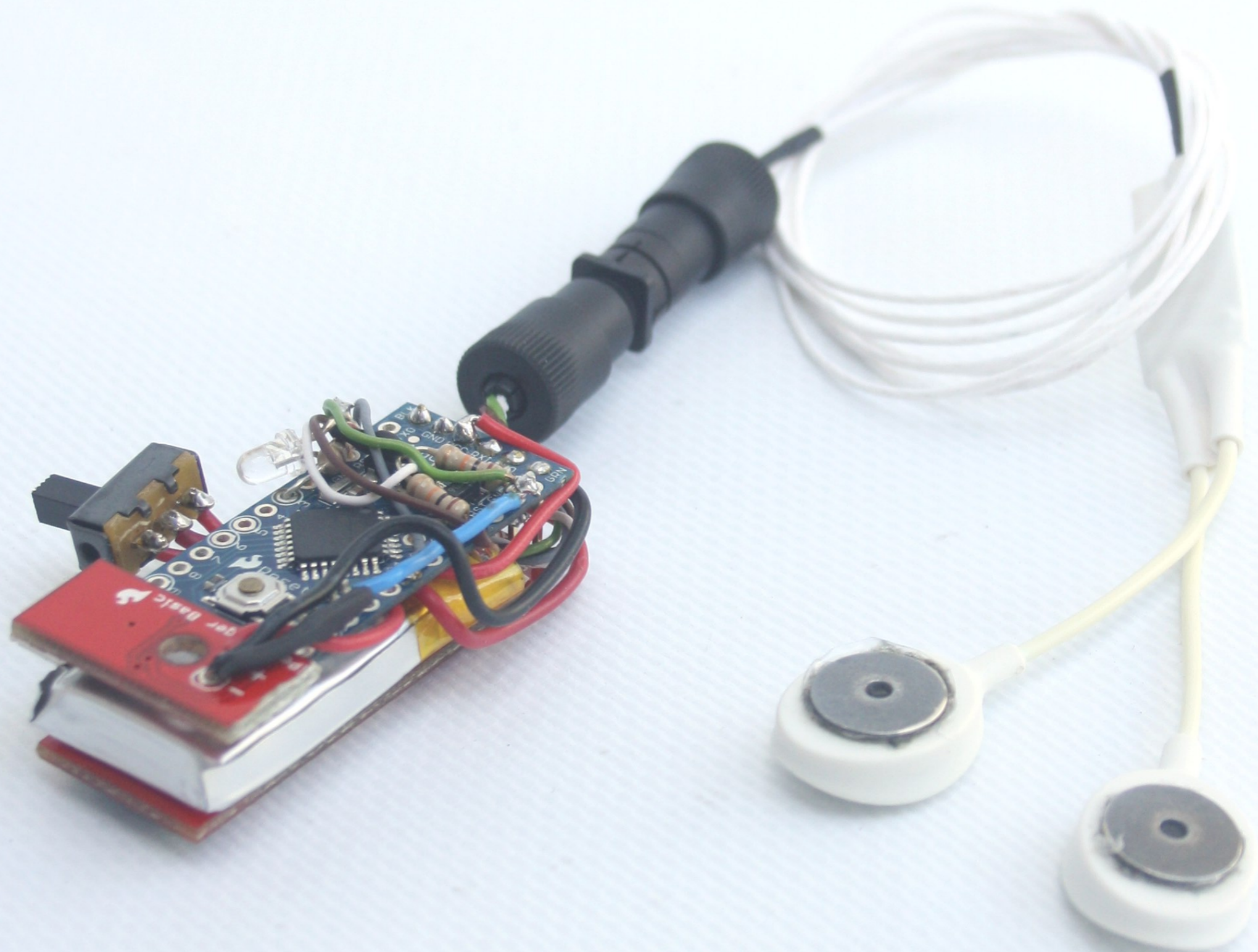
BUT WHAT ABOUT  
**BODY**  
SIGNALS?



SÃO JOÃO  
HOSPITAL



WELL... WE SET  
OUT TO  
CHANGE  
THE PARADIGM

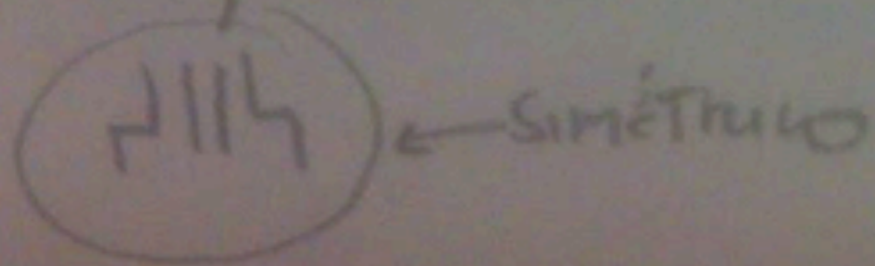
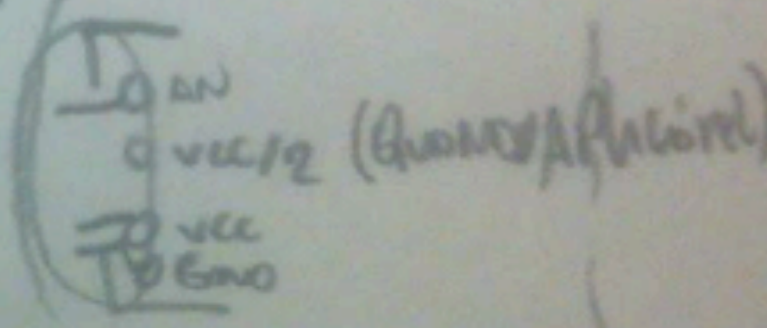
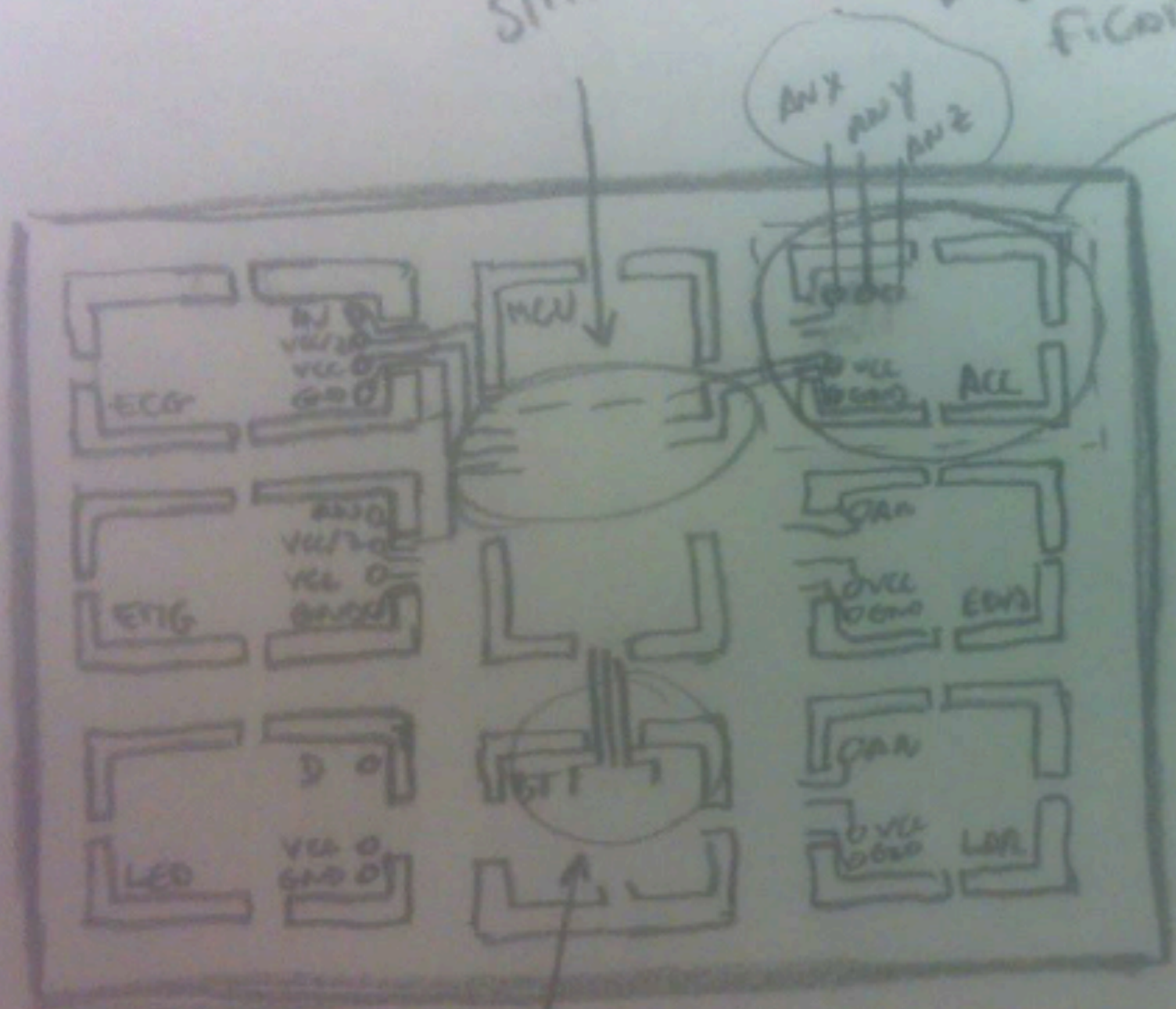




SIMÉTRICO

MAIS DO QU  
UN CANAL: SU UN  
É LIBRO E MAS  
FICAM EM LINHA

Colocar na mesma  
Posição em todas  
LASTAS INCLUSIVE



# bitoline

A low-cost toolkit to learn and prototype applications using body signals.

It's for students, teachers, makers, artists, researchers, developers, ... no electrical skills required!



board

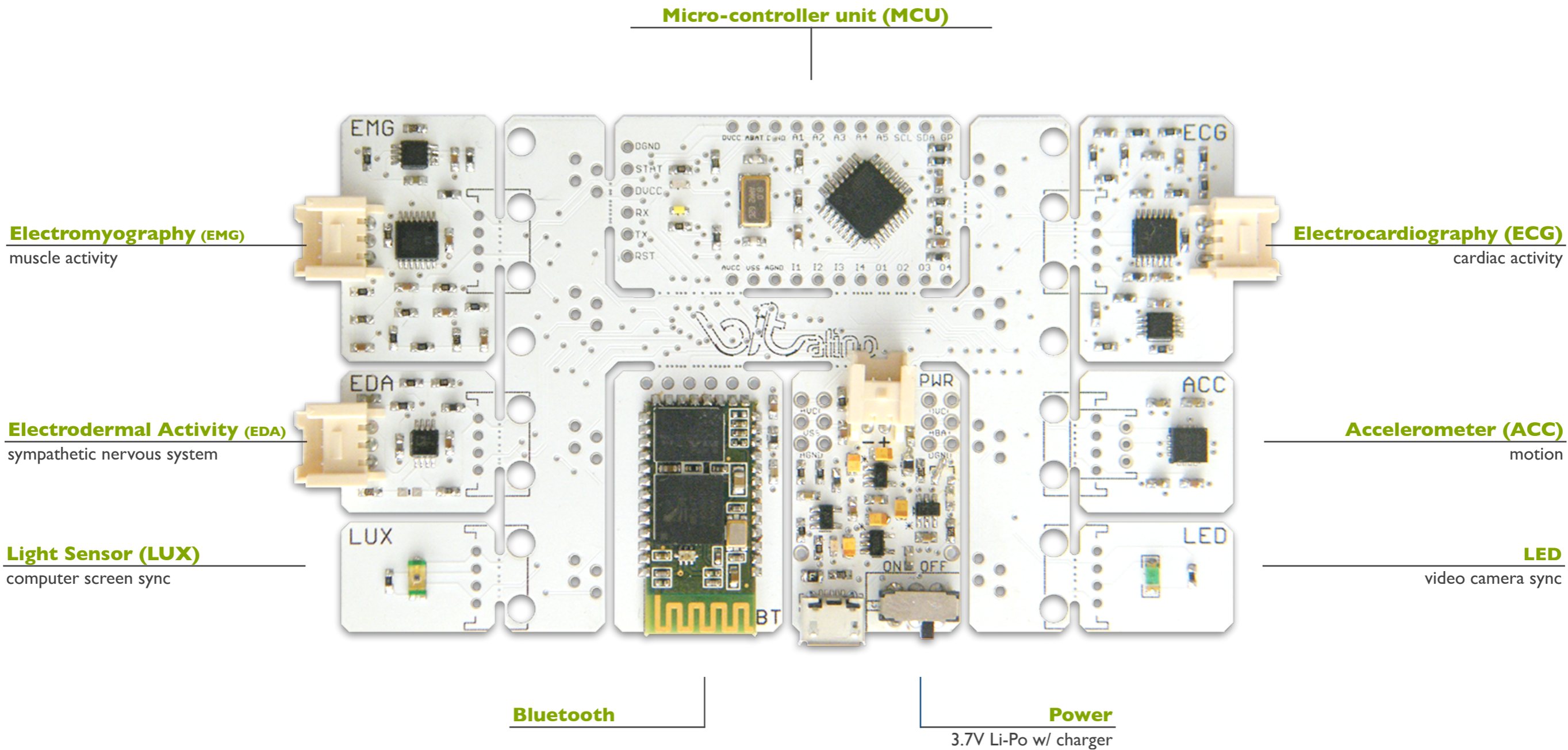


freestyle

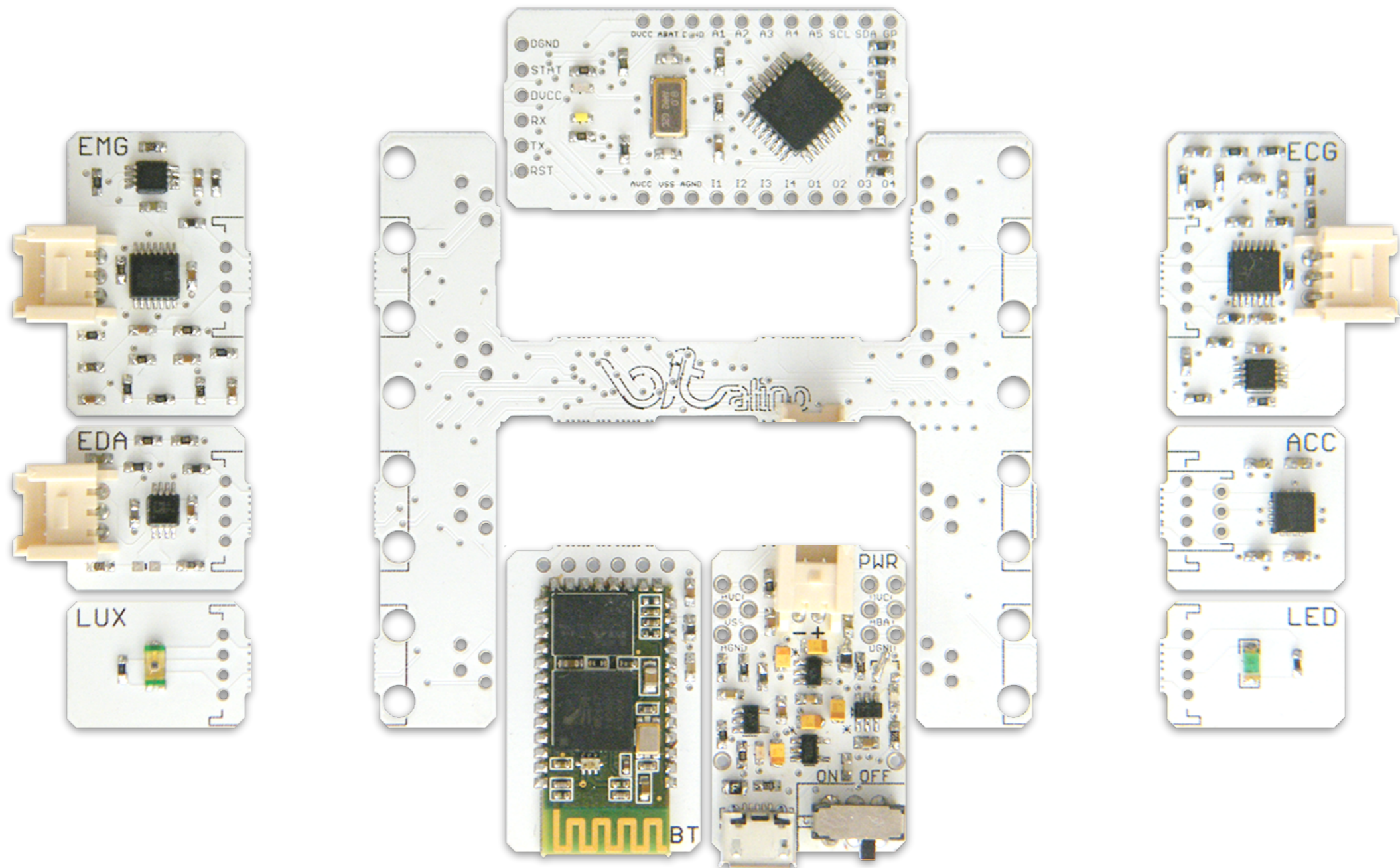


plugged

# the first DiY toolkit in the world for biosignals...



with **imagination** being really **the limit!**



EXPLORATION

WITH POTENTIAL

**TARGET**

CUSTOMERS

TRIGGERED ON

AUG

15

2013

30

UNITS

SOLD

BEFORE WE HAD ANYTHING

LAUNCHED ON  
SEPTEMBER

2013



A/B PRICE  
TESTING  
WITH  
UNBOUNCE



a low-cost toolkit that allows anyone from students to professional developers to

**create projects & applications**

with physiological sensors

**Low-cost**  
100x cheaper than your average physiological data acquisition system



**Fun**

The same joy you've had with the little blocks that can't be named due to trademark issues

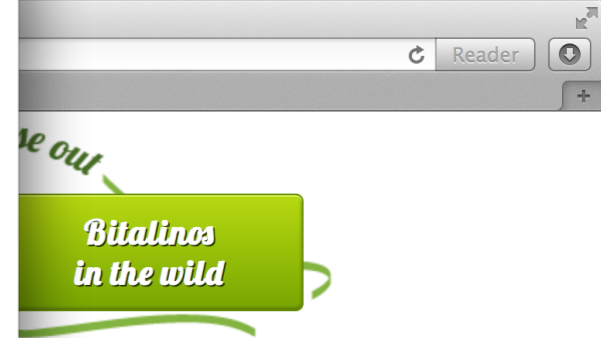
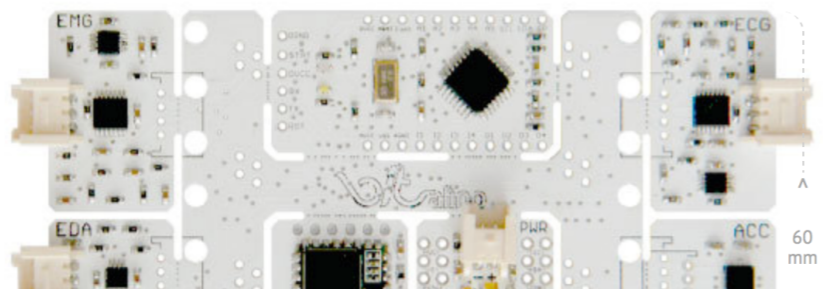
from **€149**

+ taxes, shipping & customs

**What's included**



BUY ONE



anyone developers to

**create projects & applications**

with physiological sensors

**Low-cost**  
100x cheaper than your average physiological data acquisition system



**Fun**

The same joy you've had with the little blocks that can't be named due to trademark issues

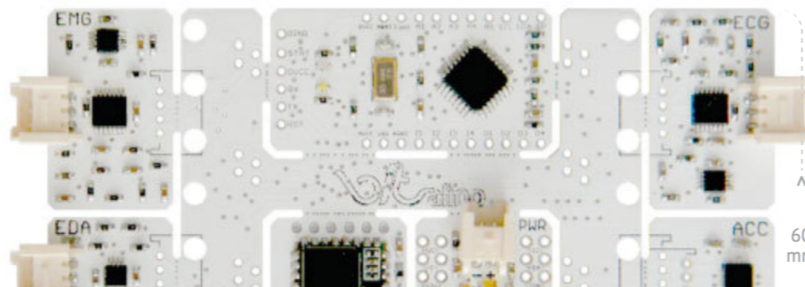
from **€99**

+ taxes, shipping & customs

**What's included**



BUY ONE



MANUALLY  
QUALIFYING  
POTENTIALS AS  
ORDERS



### E.U. Business?

European Union VAT gives tax exemption benefits

[Business Account](#)

### No VAT Number?

No worries. Visit the store and pick your products now!

[Go To STORE](#)

### Store Login

User Name

Password

Remember Me

# Welcome!



Boards



Accessories



Support

[European Union Business Account](#)



Handy Tools

3

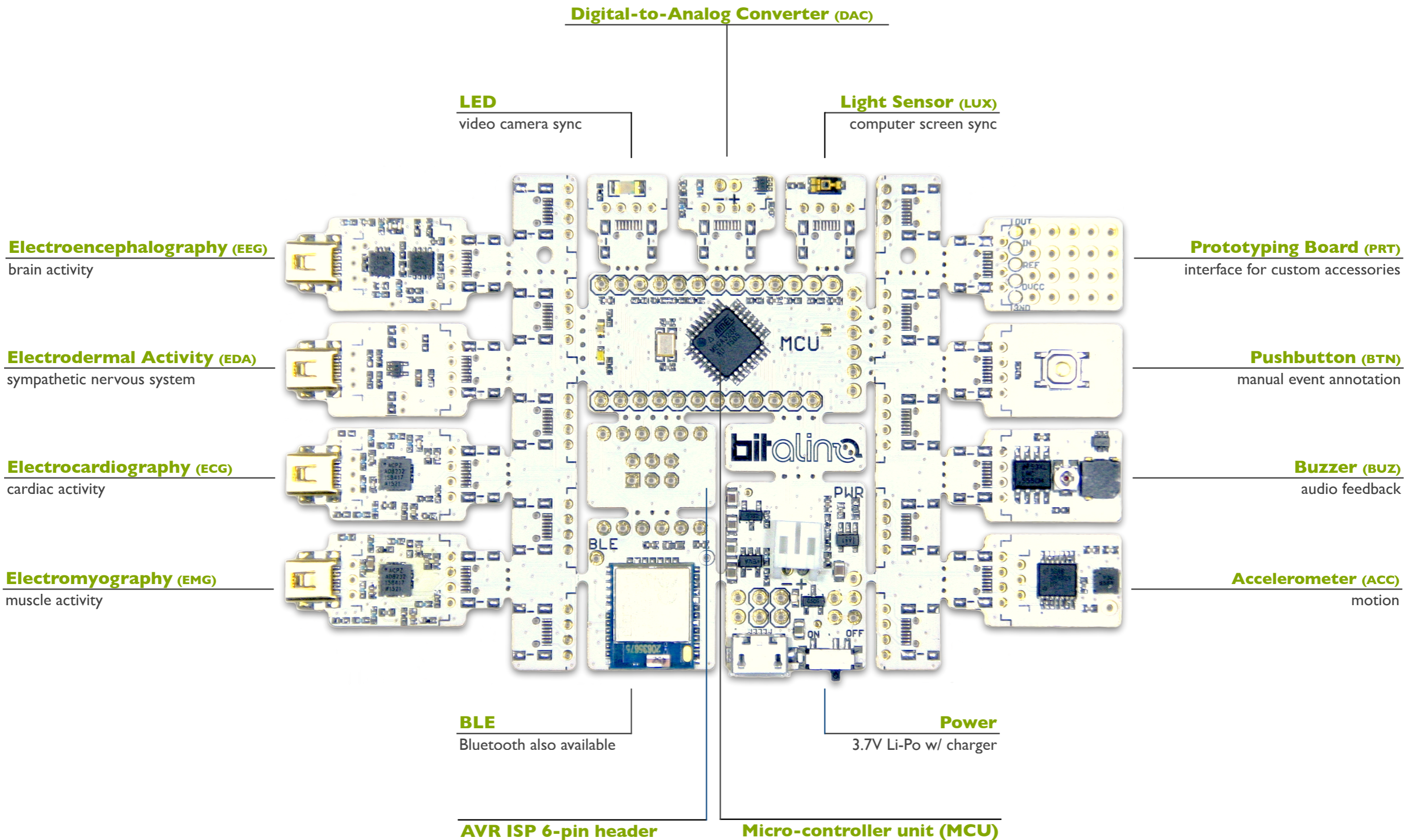
MONTHS  
WAITING

< 1%

OPT-OUT

CONTINUED  
ASSUMPTION  
VALIDATION  
WITH THE WORLD

# the most advanced DiY kit for biosignals...



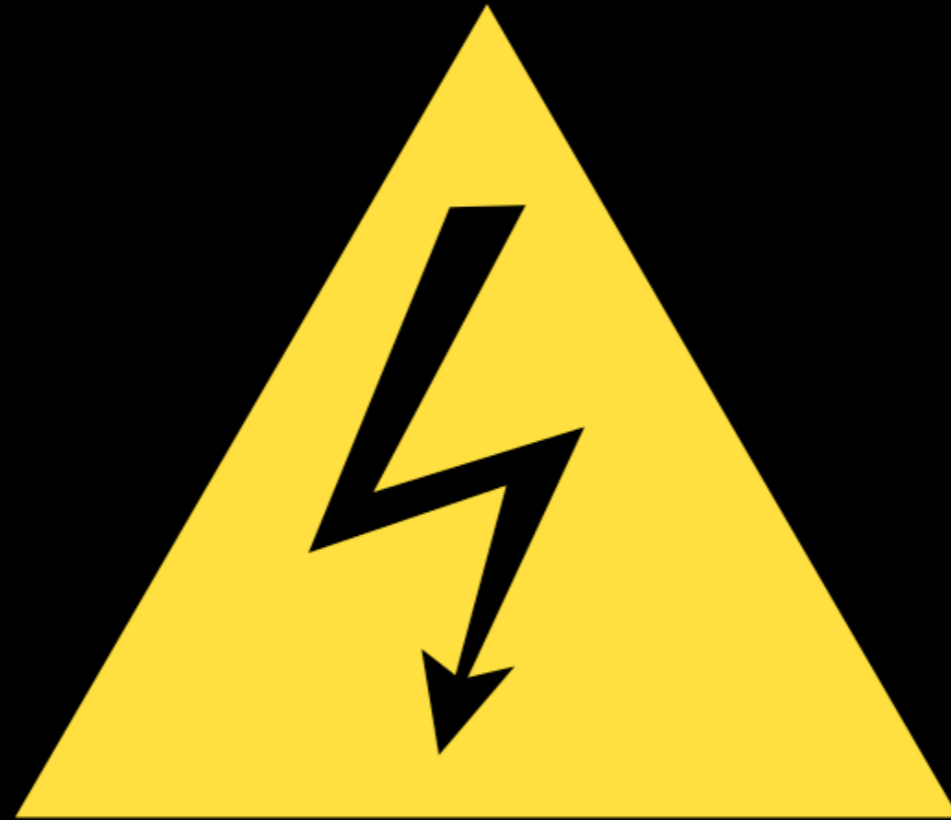


VERY IMPORTANT TO

**LISTEN**

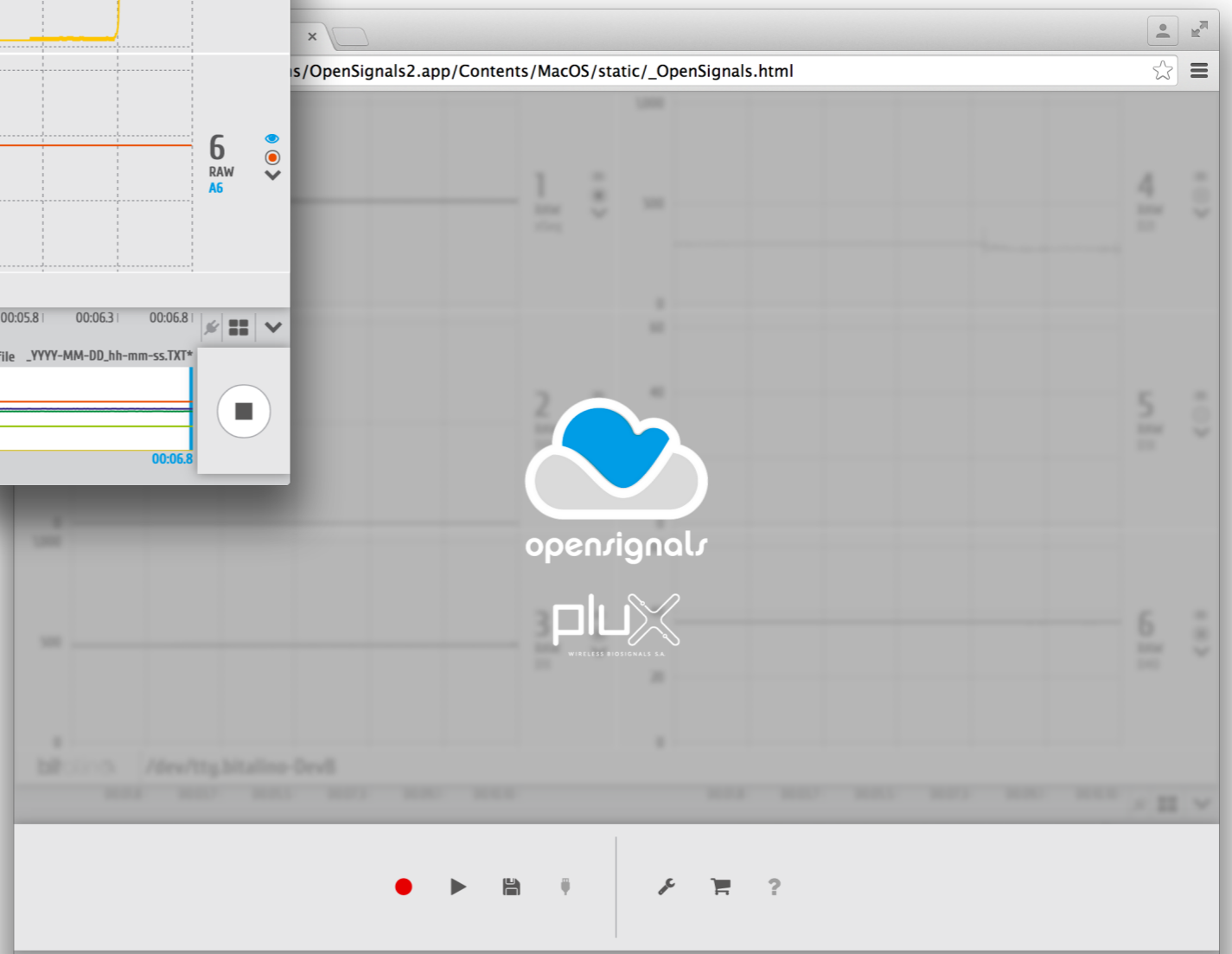
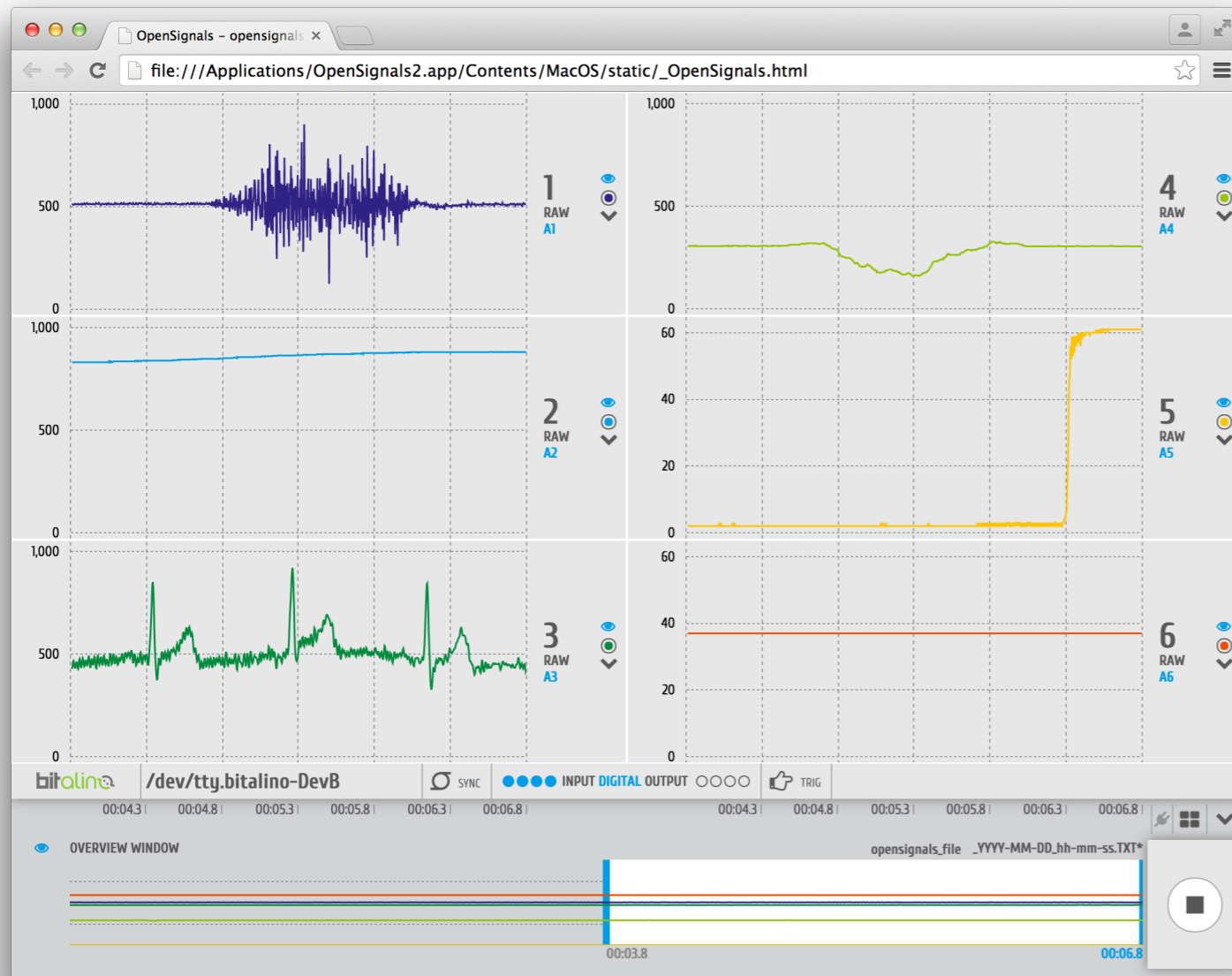
TO USER

FEEDBACK



BEWARE OF THINGS THAT  
COST YOU EXCESSIVE TIME

there's free **software to go with it** as well

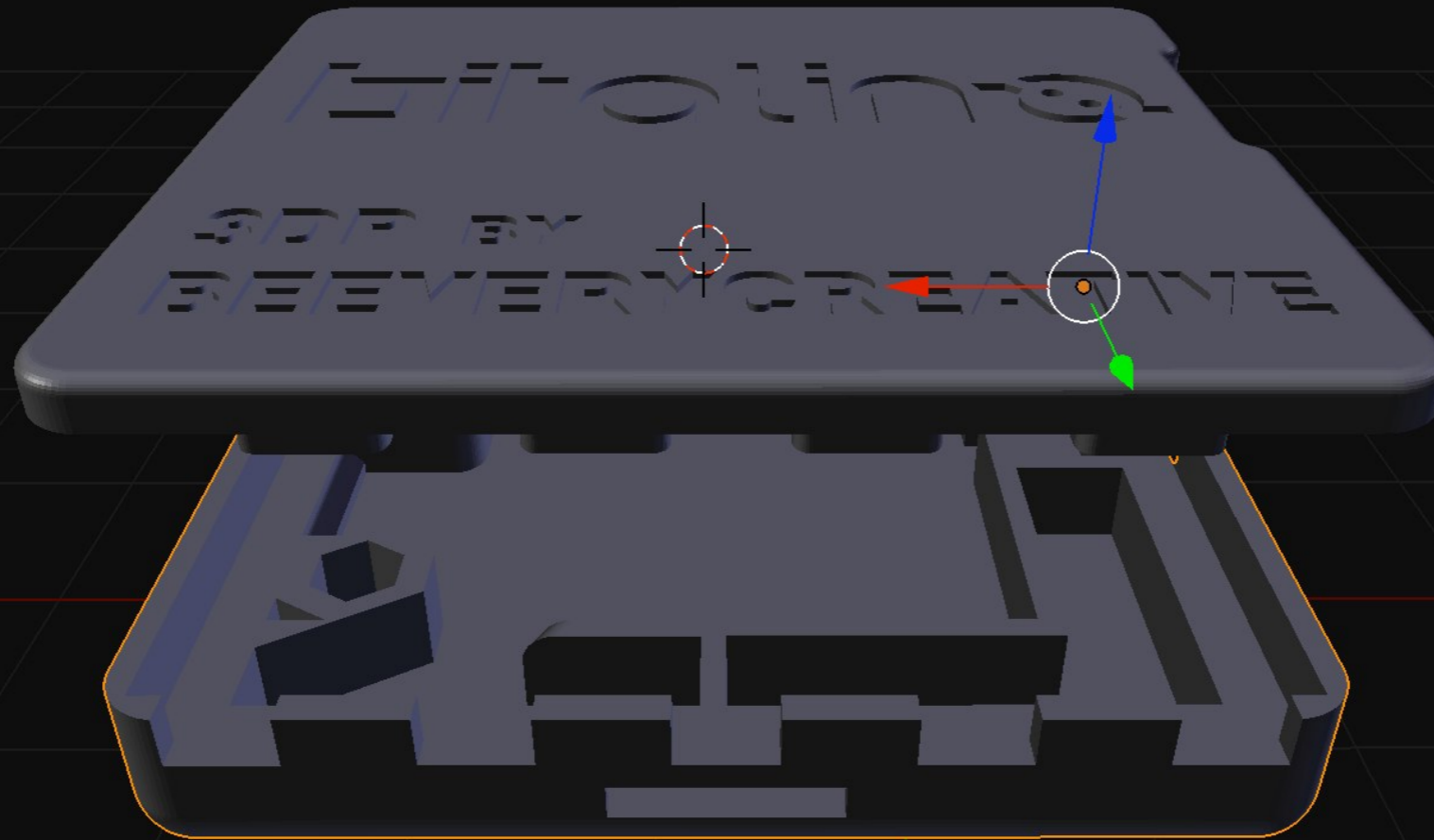


# programming APIs

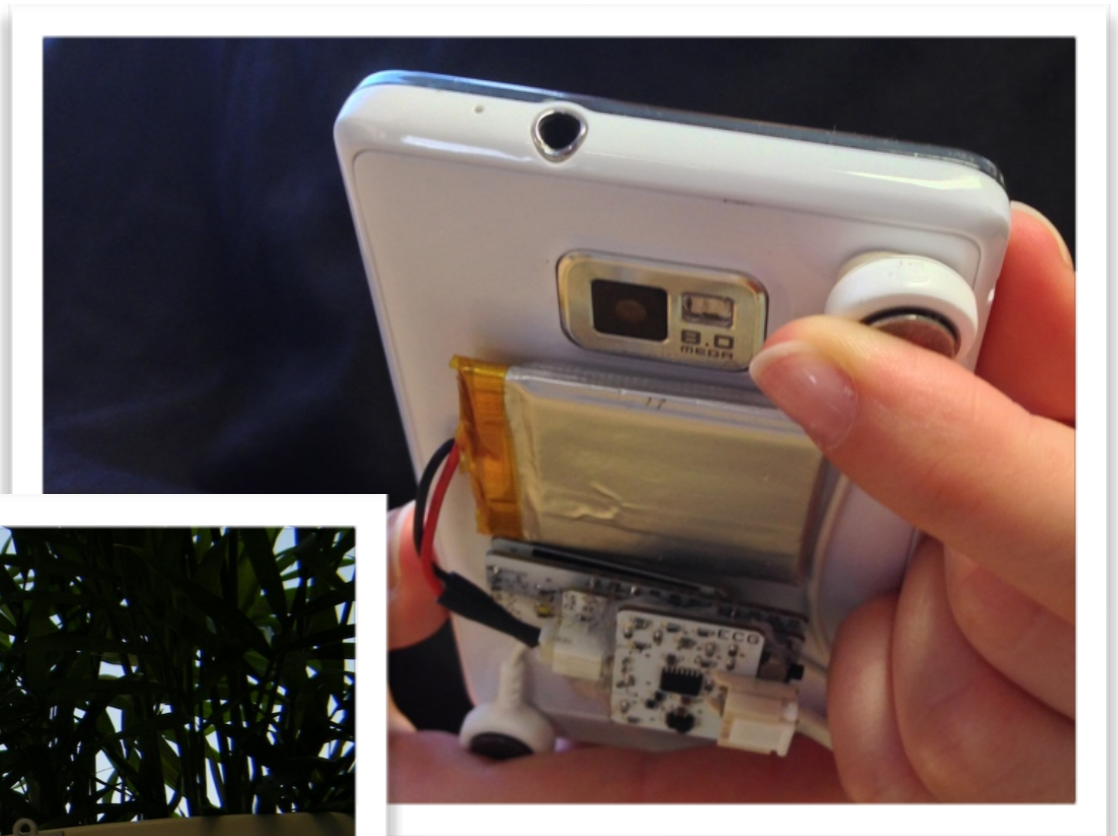


**C++**

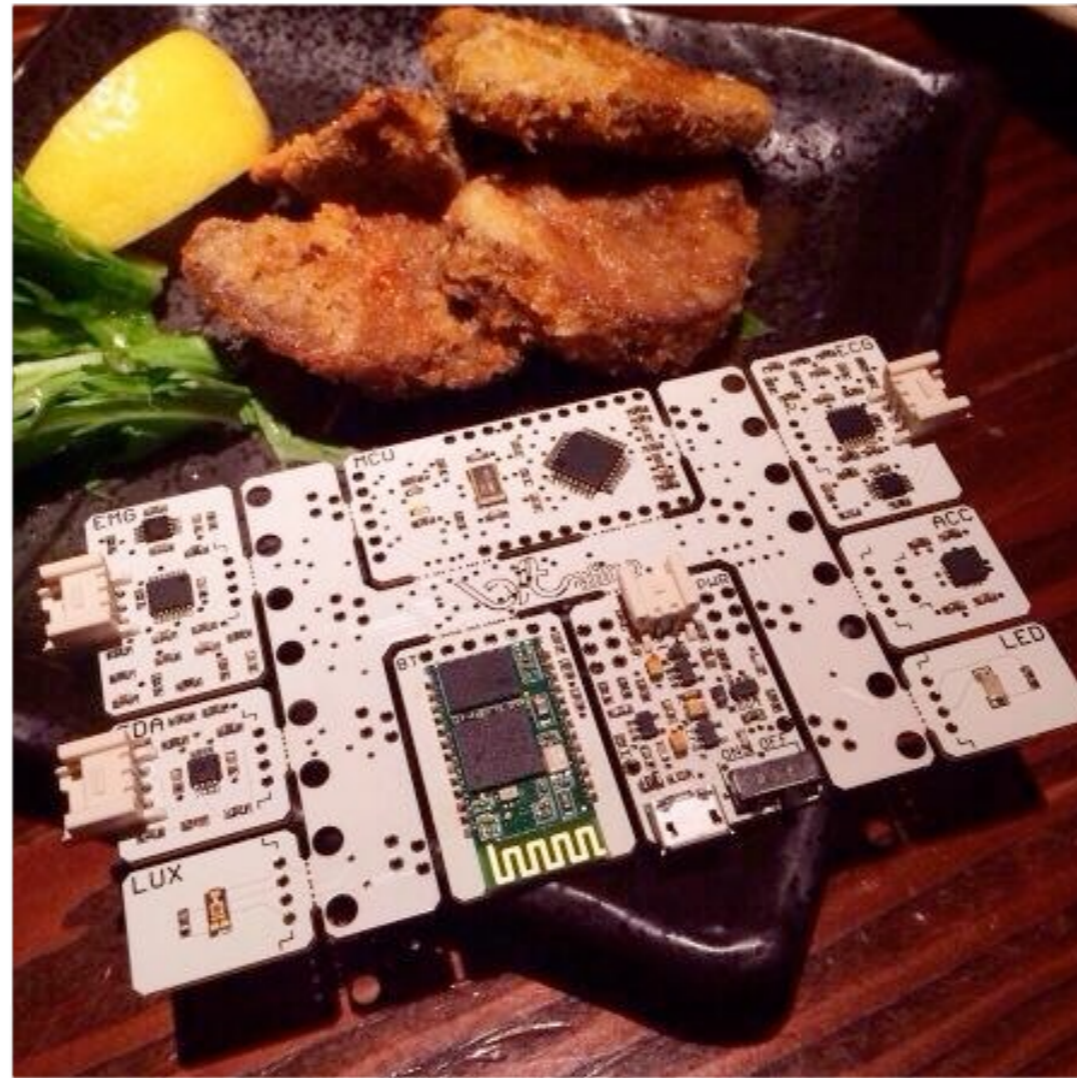
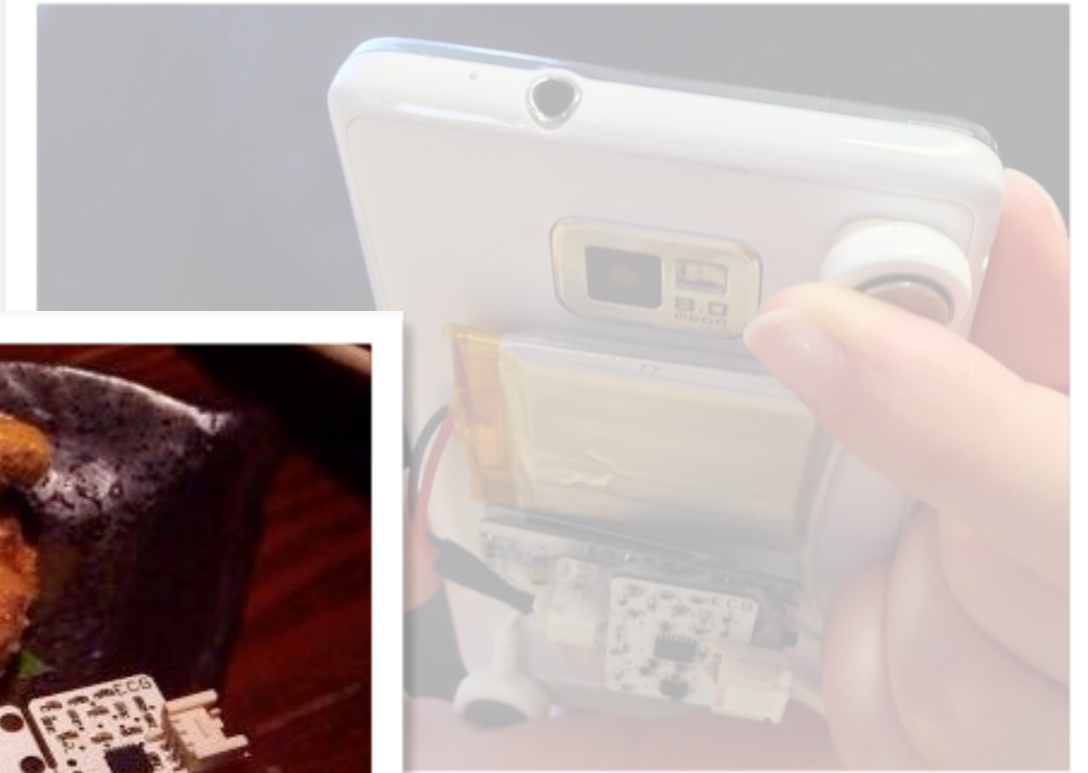




# a vibrant community



# a vibrant community



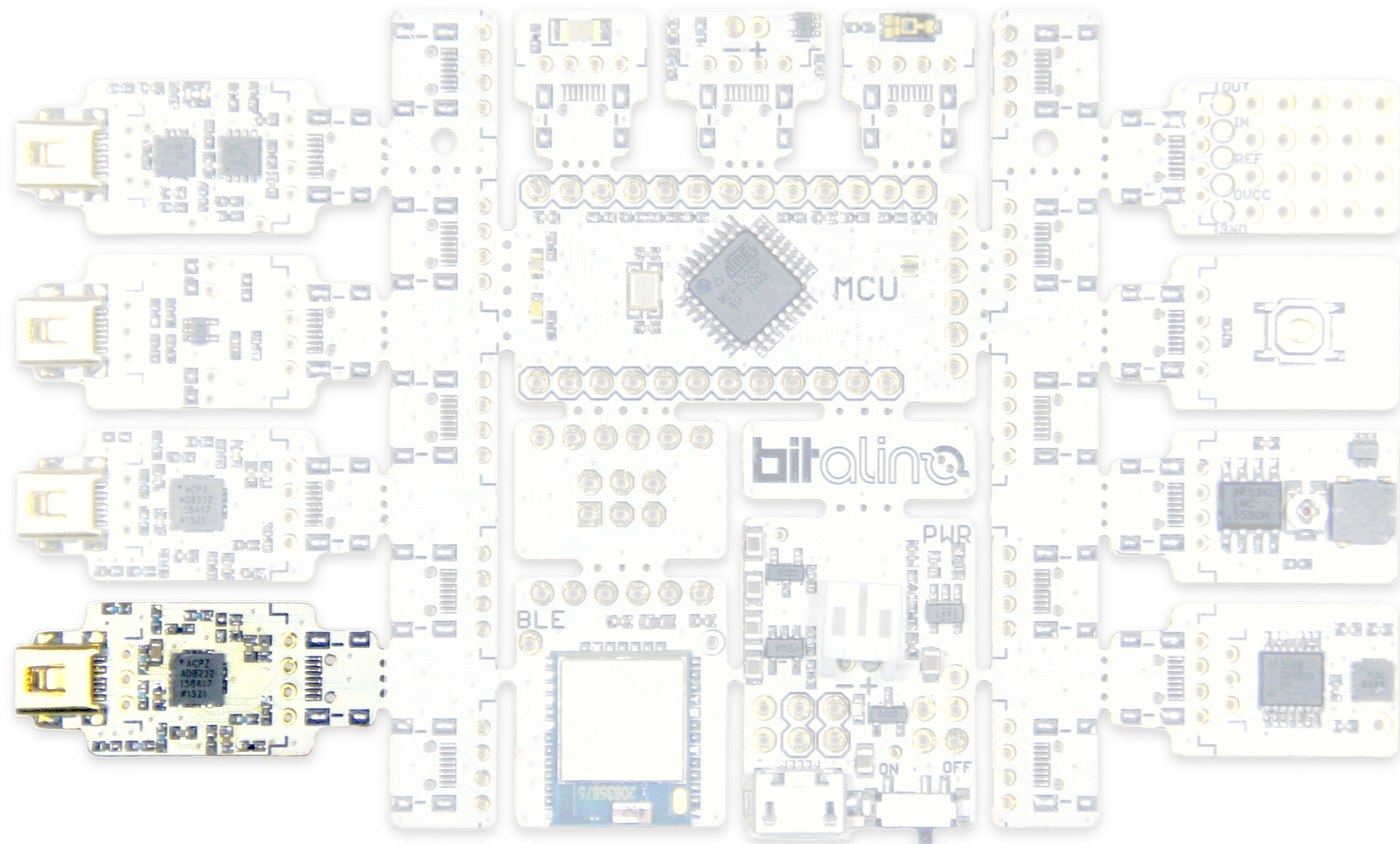
**live broadcast** from a body





FINE, BUT WHAT  
IS IT GOOD  
FOR?

**Electromyography (EMG)**  
muscle activity



# EMG | Muscle Signals

## collect

---

where: above any muscle

when: 1000Hz

how: EMG - voltage

issues: motion artifacts, ECG interference, bad grounding, powerline noise

## process

---

onset detection

envelope detection

noise removal

spectral analysis

## extract

---

muscle contraction duration

muscular tension

activation timing

(between muscles)

## understand

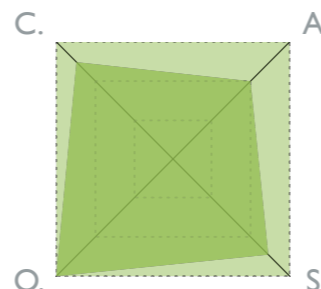
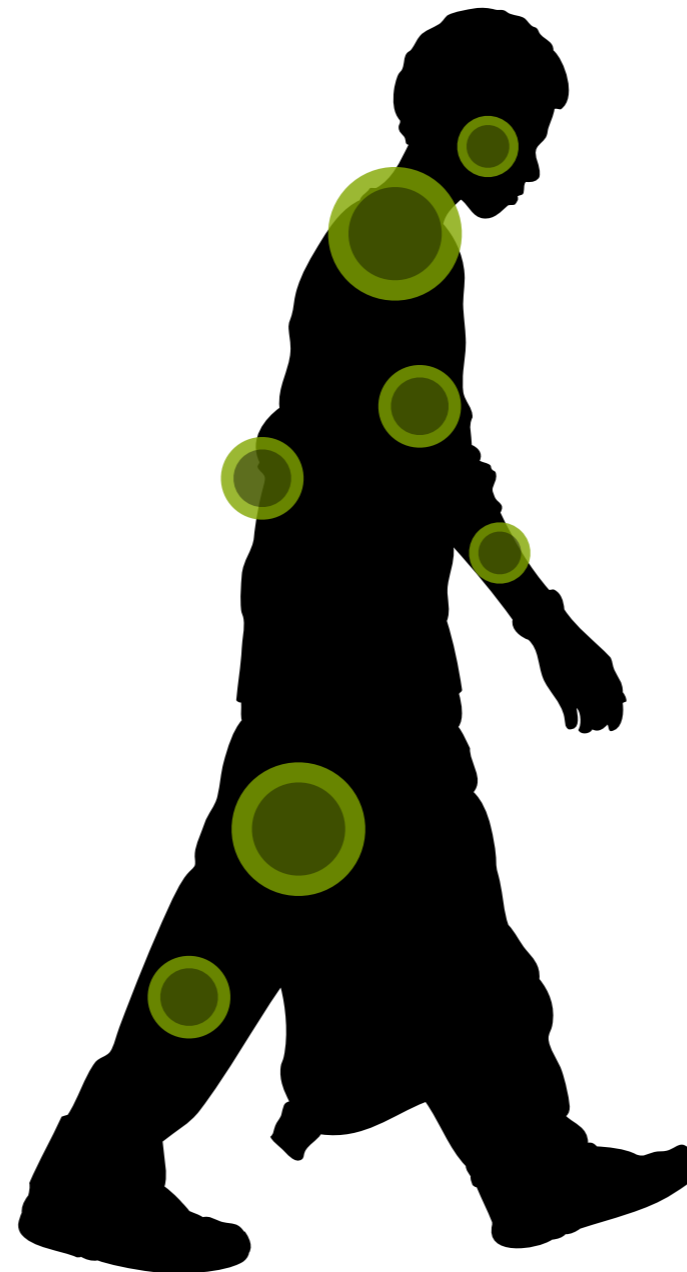
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movement strategies

muscle coordination

muscle fatigue

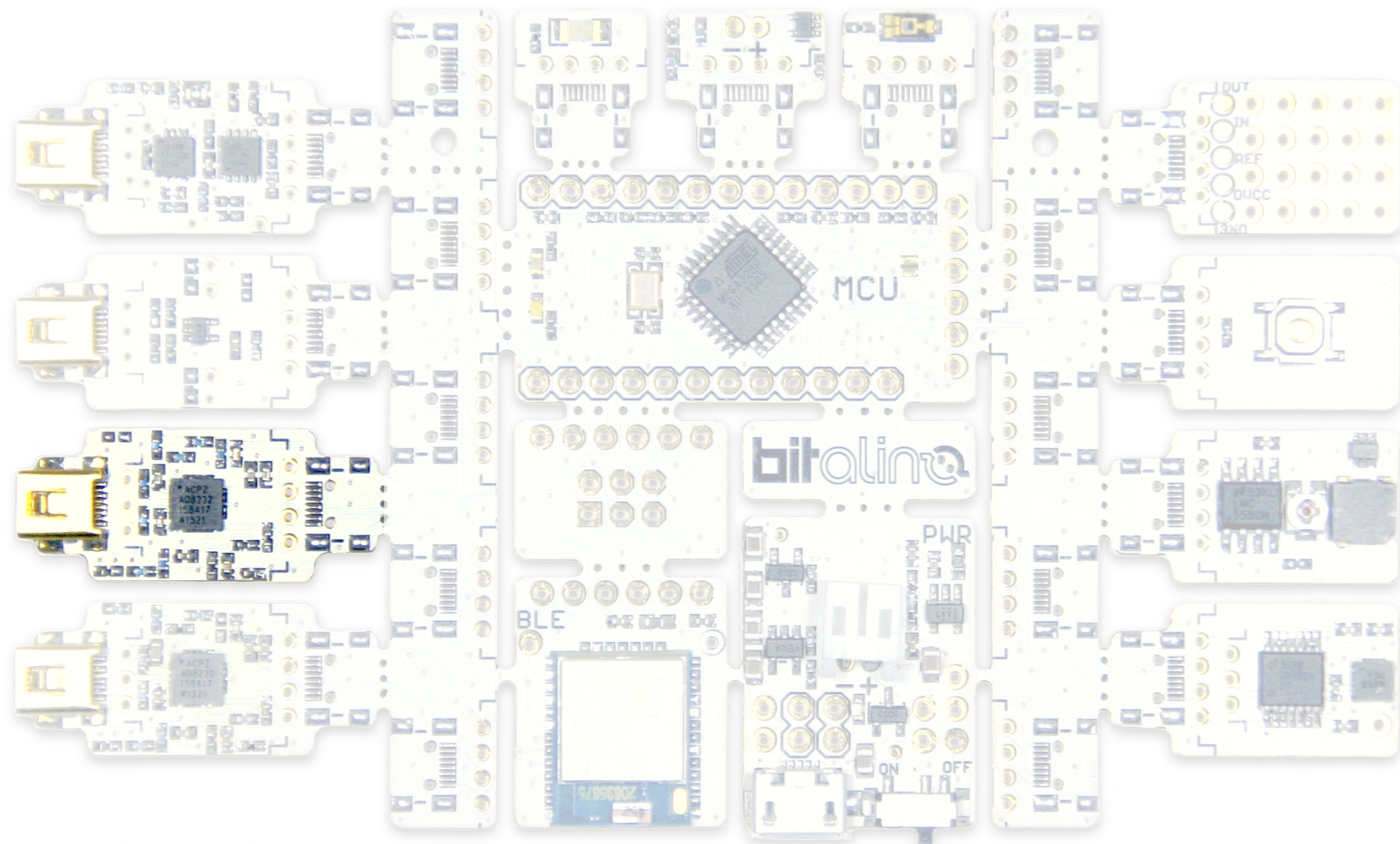
anxiety level





Living with ALS

**Electrocardiography (ECG)**  
cardiac activity



# ECG | Cardiac Signals

## collect

---

where: chest, hands, or neck

when: 250Hz

how: ECG - voltage

issues: motion artifacts, EMG interference, powerline noise

## process

---

peak detection

segmentation

noise removal

## extract

---

heart rate/heart rate variability

fiducial points annotation

R-peak amplitude

(modulated by respiration)

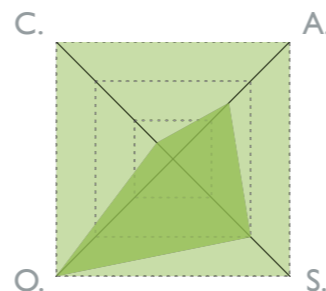
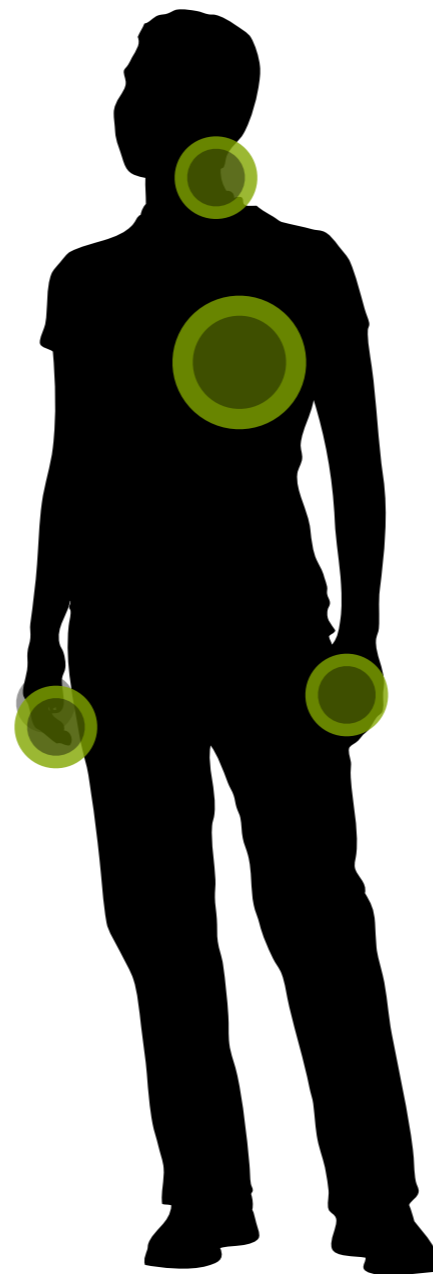
## understand

---

stress/concentration level

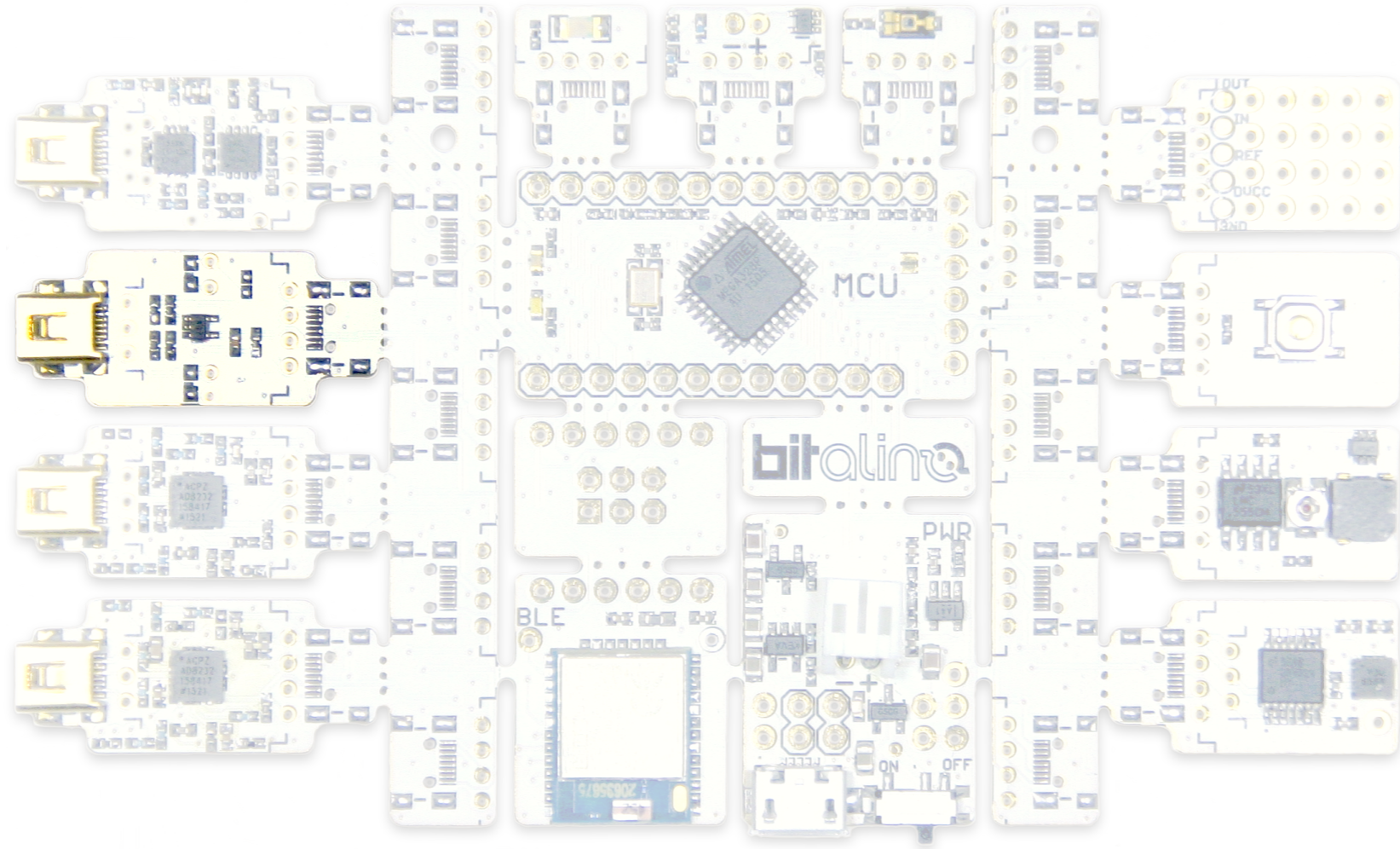
cardiac dysfunctions

physical effort





**Electrodermal Activity (EDA)**  
sympathetic nervous system





# EDA | Emotional Arousal

## collect

---

where: sweat glands

when: 2Hz

how: EDA - resistance

issues: ambient hear, motion artifacts, powerline noise

## process

---

onset detection

noise removal

peak detection

## extract

---

event amplitude

rise time

tonic level

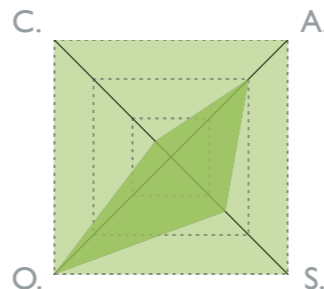
## understand

---

reaction to a stimuli

hyperhidrosis

arousal level





# Accelerometer | Motion

## collect

---

where: skin surface

when: 1Hz

how: MEMS - capacitance

issues: motion artifacts, natural tremors

## process

---

epoching

noise removal

spectral analysis

## extract

---

movement patterns

step counting

tilt/angle

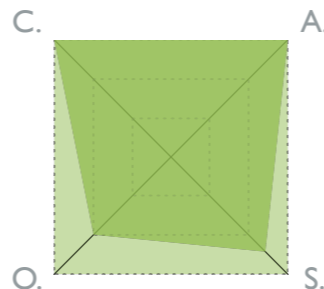
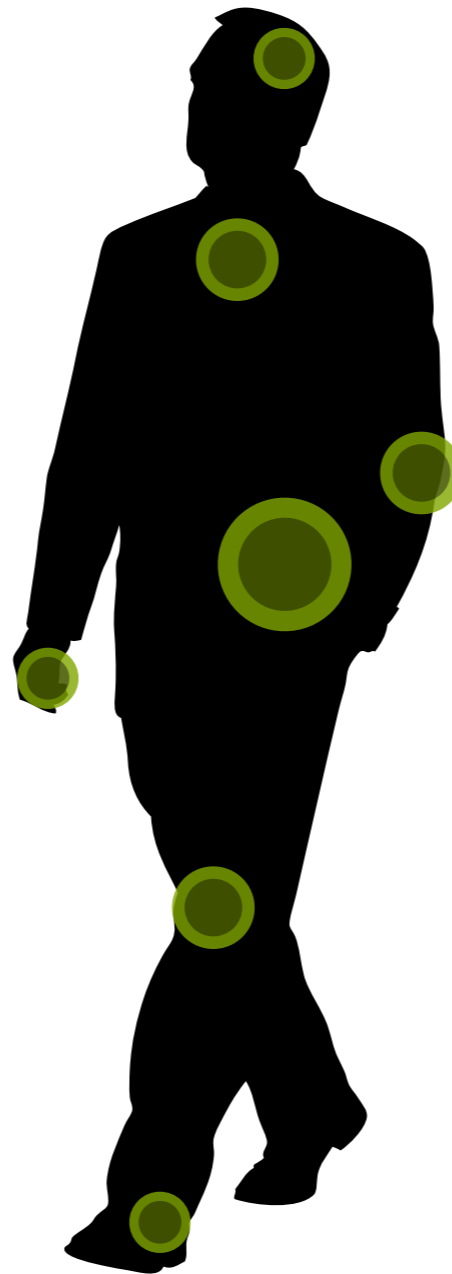
## understand

---

metabolic equivalent of task

gestures/posture

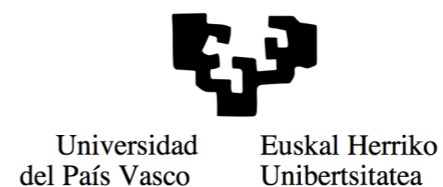
range of motion

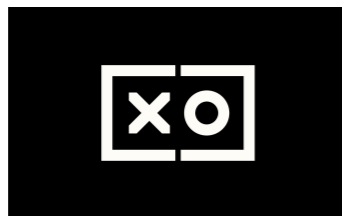
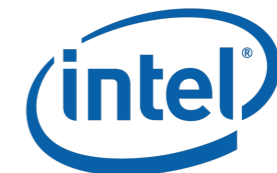




SO... WHERE  
DO WE STAND  
TODAY?







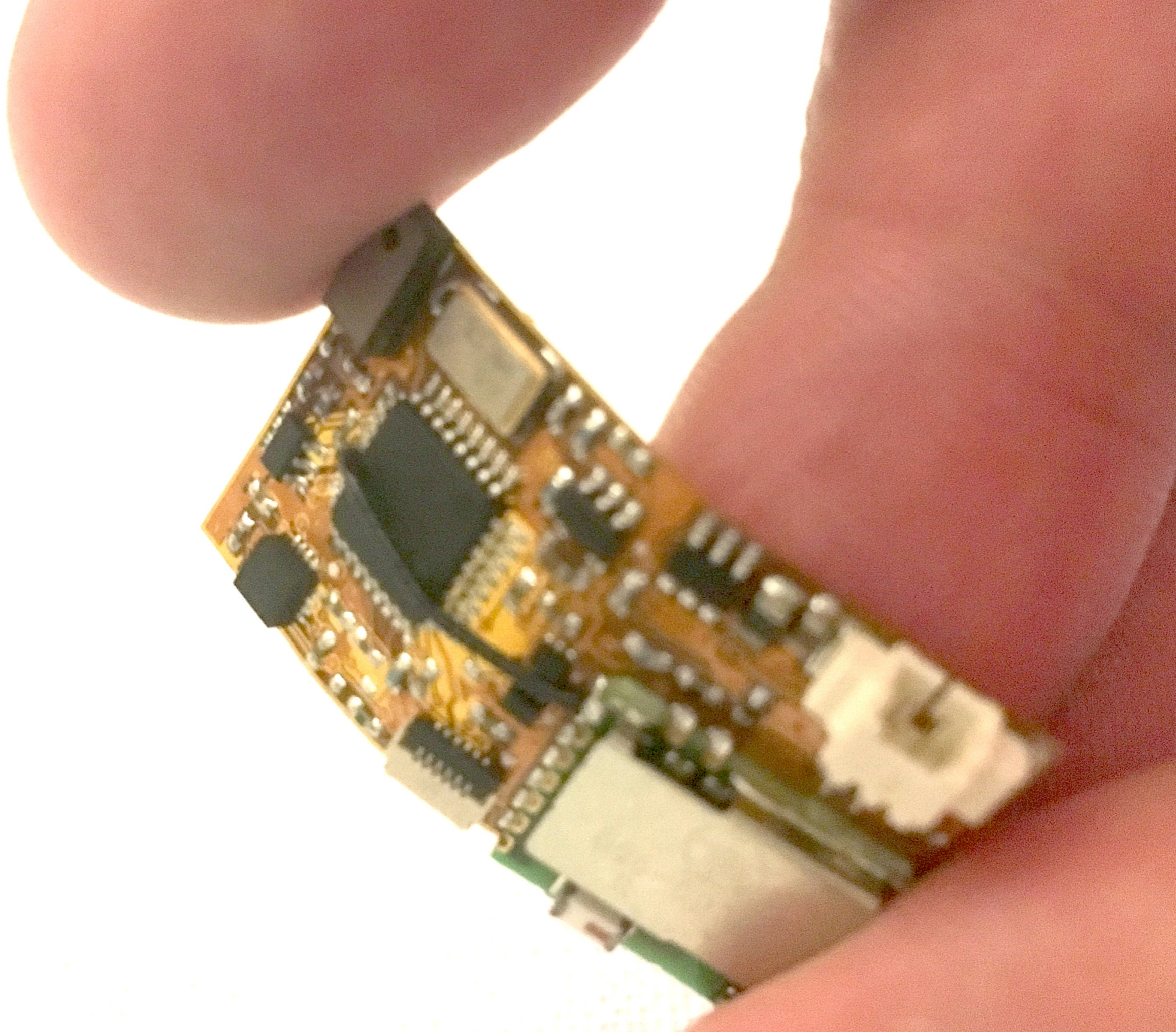
Volkswagen







A GLOBAL ENABLER  
FOR NEW  
BUSINESS  
OPPORTUNITIES





# TRICOUL SMART CARE ÎȚI MONITORIZEAZĂ INIM

DUPĂ AJUTOR, ÎNSĂ MEDICII NU AU MAI PUTUT FACE NIMIC PENTRU TÂNĂR

ANTENA 3

POLIȚIȘTII AJU

FEATURED IN

TOP

WORLDWIDE

MEDIA

# A DIY body sensor kit for app developers and tinkerers

BITalino: What if you could make your own body signals monitor?

**O BITALINO PERMITE CONSTRUIR TECNOLOGIA DE BIOSINAIS COMO SE FOSSE LEGO**



engadget

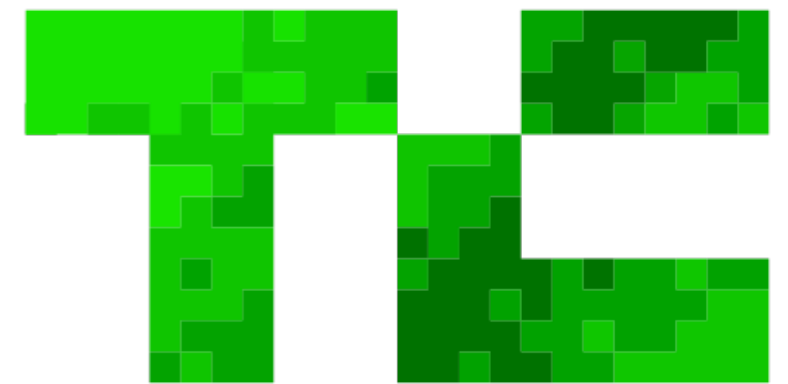
TheScientist  
EXPLORING LIFE, INSPIRING INNOVATION

Make:  
makezine.com

EE Times medGadget

The New Zealand Herald

TC TechCrunch



WIRED

# A DIY body sensor kit for app developers and tinkerers

BITalino: What if you could make your own body signals monitor?

## O BITALINO PERMITE CONSTRUIR TECNOLOGIA DE BIOSINAIS COMO SE FOSSE LEGO

「Bitalino」は、さまざまな体のインプット情報を集めて、直接コンピューターに送る。簡単にいえば、手を動かすことでラジコンのヘリコプターを無線操縦したり、指をパチンと鳴らすだけでドアを開けるようなことができるようになる。



engadget

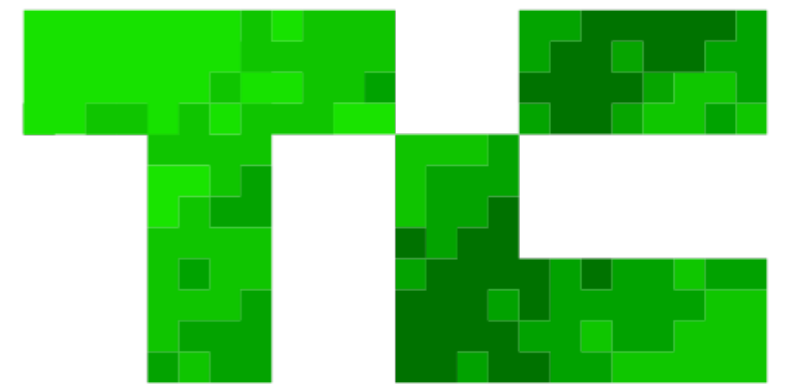
TheScientist  
EXPLORING LIFE, INSPIRING INNOVATION

Make:  
makezine.com

EE Times medGadget

The New Zealand Herald

TC TechCrunch



WIRED



# Industrial & Enabling Tech

## 'Industrial & Enabling Tech' prize category

Below are the innovators competing in the 'Industrial & Enabling Tech' category of the Innovation Radar Prize 2017. This prize category aims to recognise new technologies and components, developed with EU-funding, that have industrial relevance and/or potential to enable the emergence of new applications.

### Winners



🌟 CATEGORY WINNER

#### Plux

BITalino is a low-cost hardware and open-source software toolkit to learn and prototype biomedical applications. It has been primarily designed for students, teachers, makers, artists, researchers and corporate R&D, with no electrical skills being required.



BETTER  
STILL



## ***What our users are saying***

***"Bitalino provides great opportunities to explore the benefits of biomedical signals to enhance the interfaces used by people with special needs"***

by Prof. Júlio Abascal  
Professor  
University of the Basque Country

***"Bitalino allows students to experiment & perform hands-on activities based on multiple physiological sensors"***

by Dr. Andreas Keil  
Professor of Psychology  
Center for the Study of Emotion & Attention  
University of Florida

***"This board looks so good that it makes you want to eat it"***

by Henrique Gouveia  
CEO  
Formiga Luminosa Design Studio

***"On the day I've received my Bitalino I couldn't even sleep without trying all the sensors and tweaking the Java API"***

by Paulo Pires  
Professional Developer

***"Bitalino provided me easy access to key biomedical signals and gave me a complete experience approaching this domain for the first time."***

by Borja Gamecho  
PhD Student  
University of the Basque Country

A VERY  
IMPORTANT  
DETAIL

U190814  
DAC  
UCC  
END  
NC  
PHM



U190814

Designed in Portugal  
Built for the world



# Bit

DIY biosignals

uCC END UREF UBLE ABAT  
cfs uCC END SCL MISO MOST /S

TX RX  
UCC

U190814

A FEW THINGS  
THAT WORKED  
OUT FOR ME  
SO FAR?

# |

NEVER MUCH INTO  
FOOTBALL,  
GOING OUT,  
SLEEPING UNTIL LATE,  
OR VIDEO GAMES

#2



SOLVING REAL  
WORLD  
PROBLEMS

#3

UNDERSTANDING

MVP

#4

LEARNING FROM  
**FAILURES**  
AND VALUING THEM  
MORE THAN  
**SUCCESS**

#5

BEING  
RESILIENT

# bitalino

redefining biomedical education, research and prototyping, by making otherwise inaccessible tools available to everyone!



board



freestyle



plugged

**Hugo Silva**

[hsilva@lx.it.pt](mailto:hsilva@lx.it.pt)



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