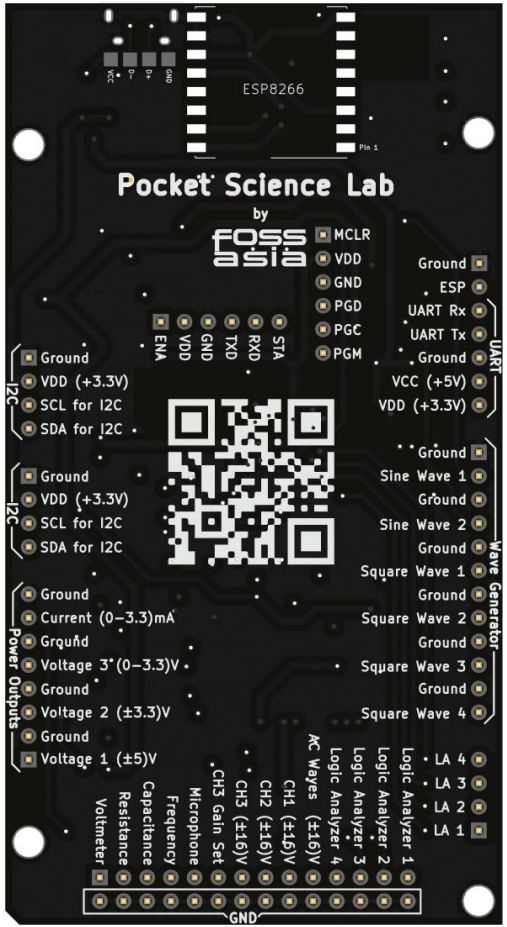
Continuous Integration for Open Hardware Projects

Mario Behling

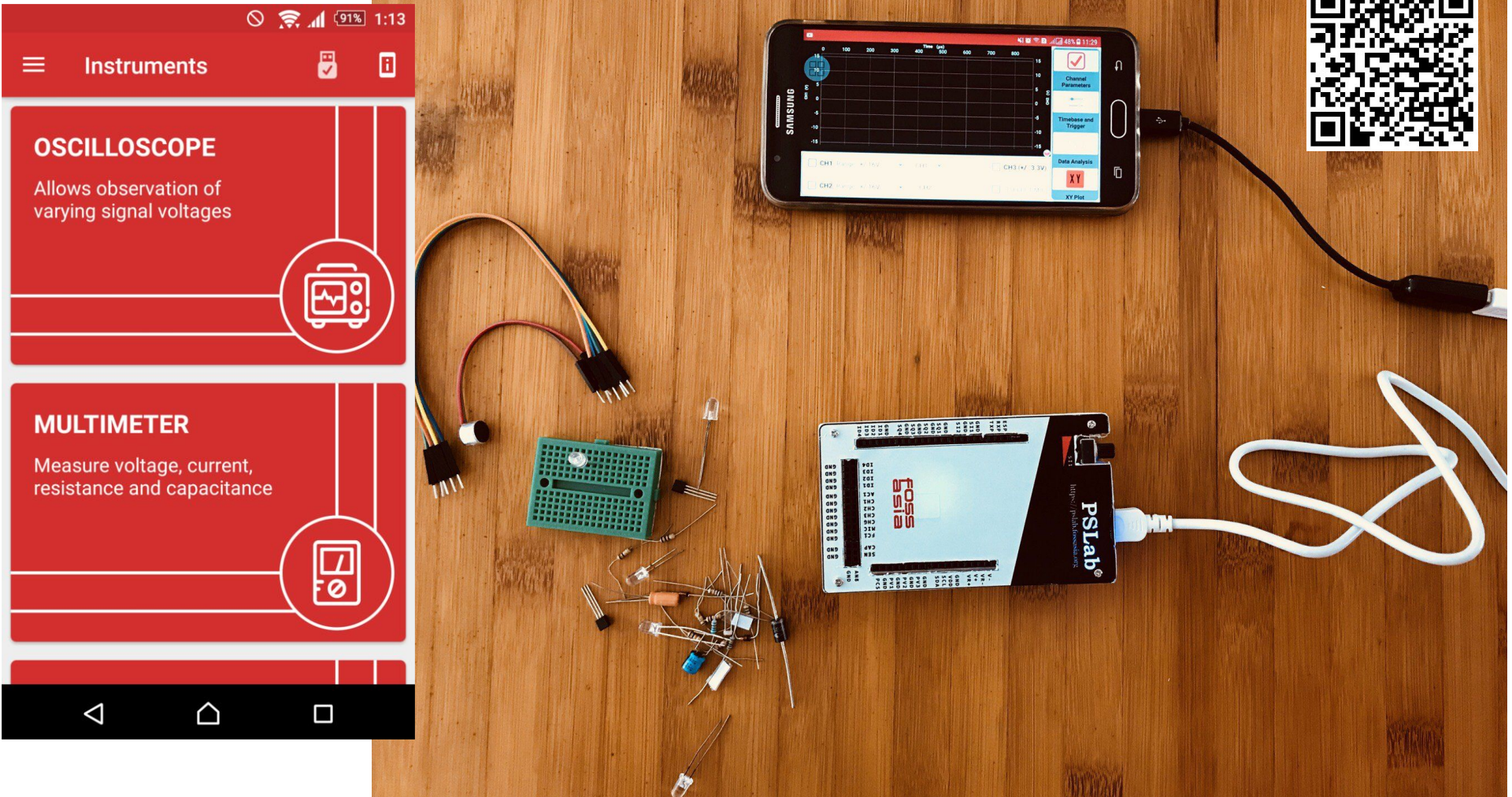
Mario Behling

- Founder of OpnTec GmbH
- EU Horizon 2020 Project “Open Next” with 19 partners across Europe
- Lived 10 years in Asia and co-founded the FOSSASIA Summit and Community
- Loves learning languages
- Used to play drums in a rock band
- Believes in Open Tech as a solution for many of our global problems

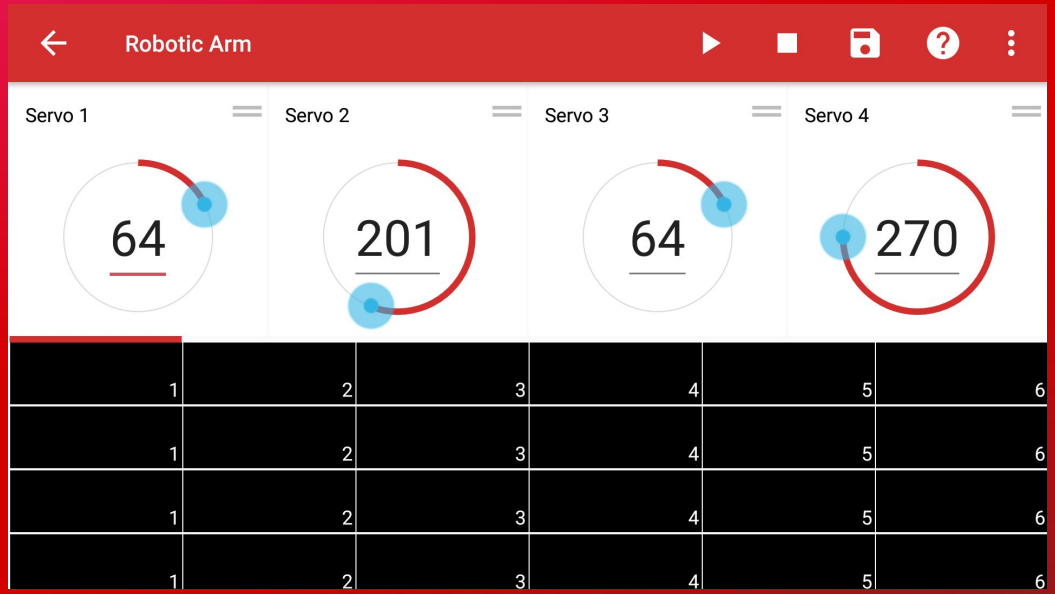


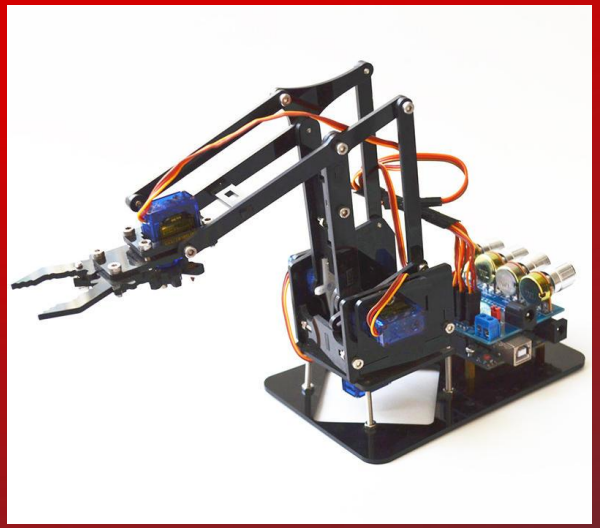
Project - Pocket Science Lab

- Useful control and measurement tools and robot controls
- Integrated components can be used by pins
- Functionalities can be accessed through:
  - PSLab Desktop app
  - PSLab Android app
  - Your own apps


91% 1:13
Instruments
OSCILLOSCOPE
Allows observation of varying signal voltages
MULTIMETER
Measure voltage, current, resistance and capacitance
SAMSUNG
Channel Parameters
Timebase and Trigger
Data Analysis
XY Plot
foss asia
PSLab

PSLab Android - Robotic Arm





User can use this feature to control 4 servos of the robotic arm.

What can it do

It can function as a..

Oscilloscope

Multimeter

Logic Analyzer

Wave Generator

Power Source

Accelerometer

Barometer

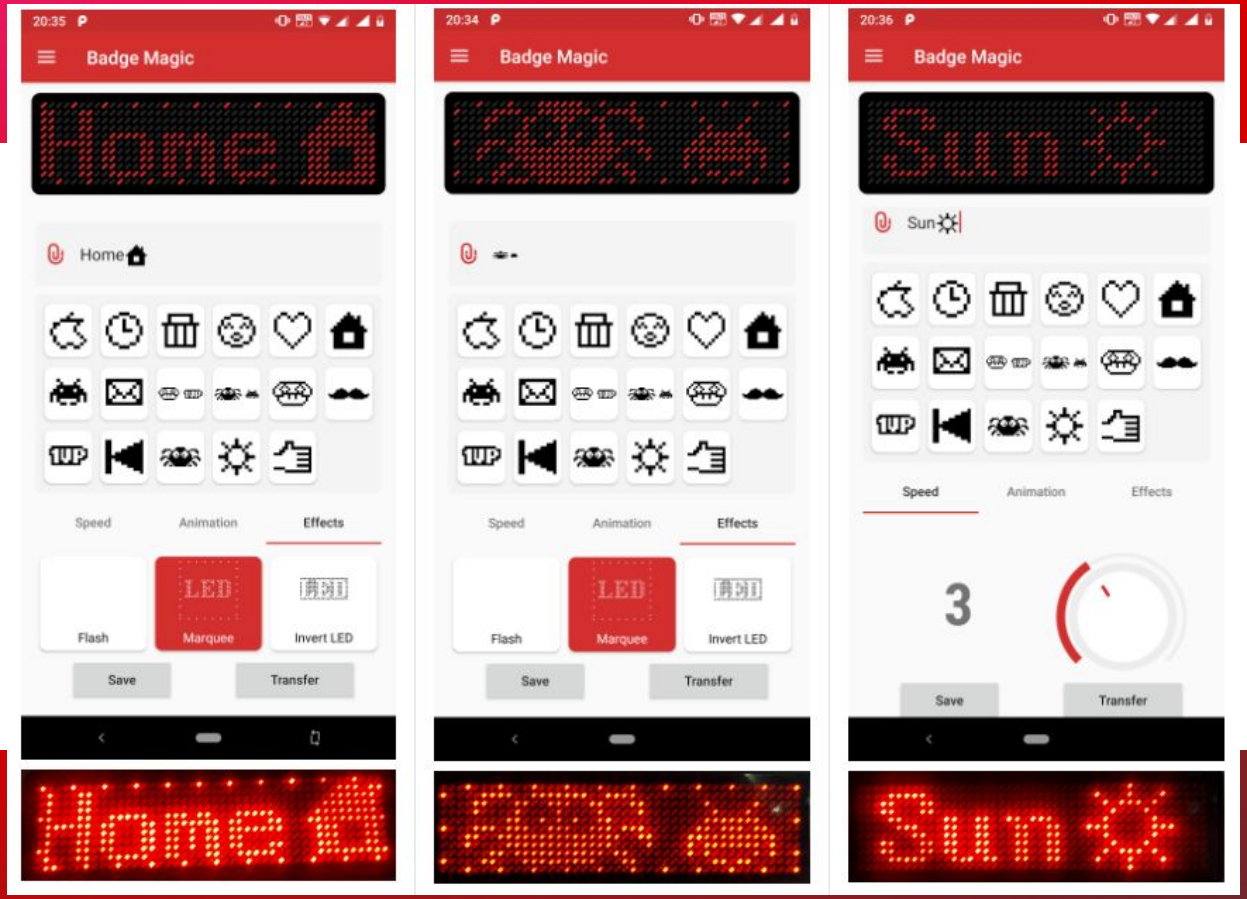
Compass

Sensors

Luxmeter

Badge Magic

- ❑ LED Badge
- ❑ Charge battery through USB
- ❑ Can be accessed through Bluetooth
- ❑ Configure through Android app (Open Source)
  - ❑ Add text
  - ❑ Add Cliparts
  - ❑ Draw

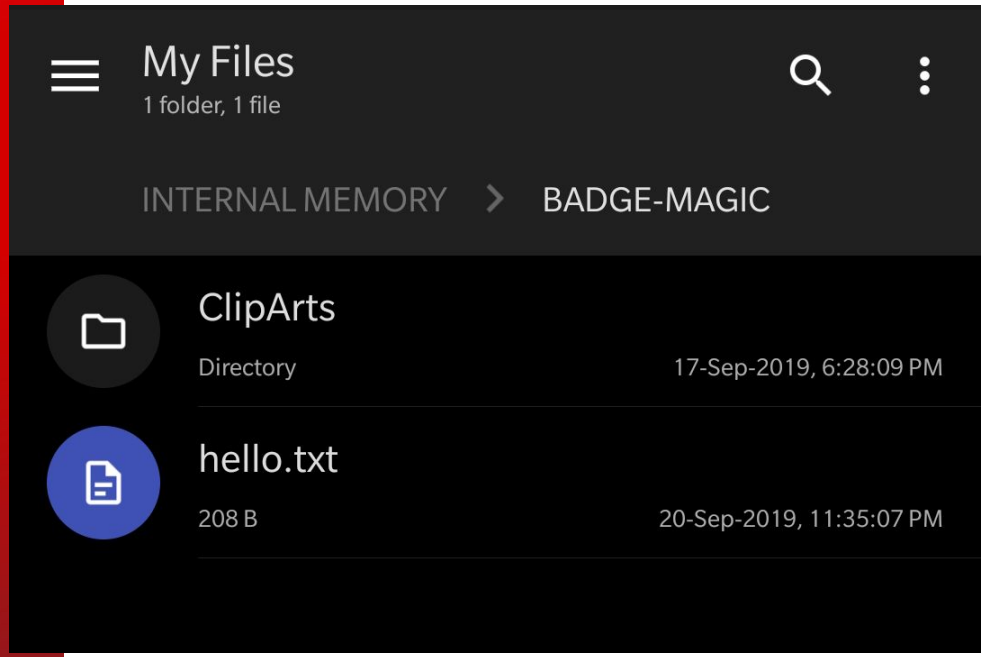


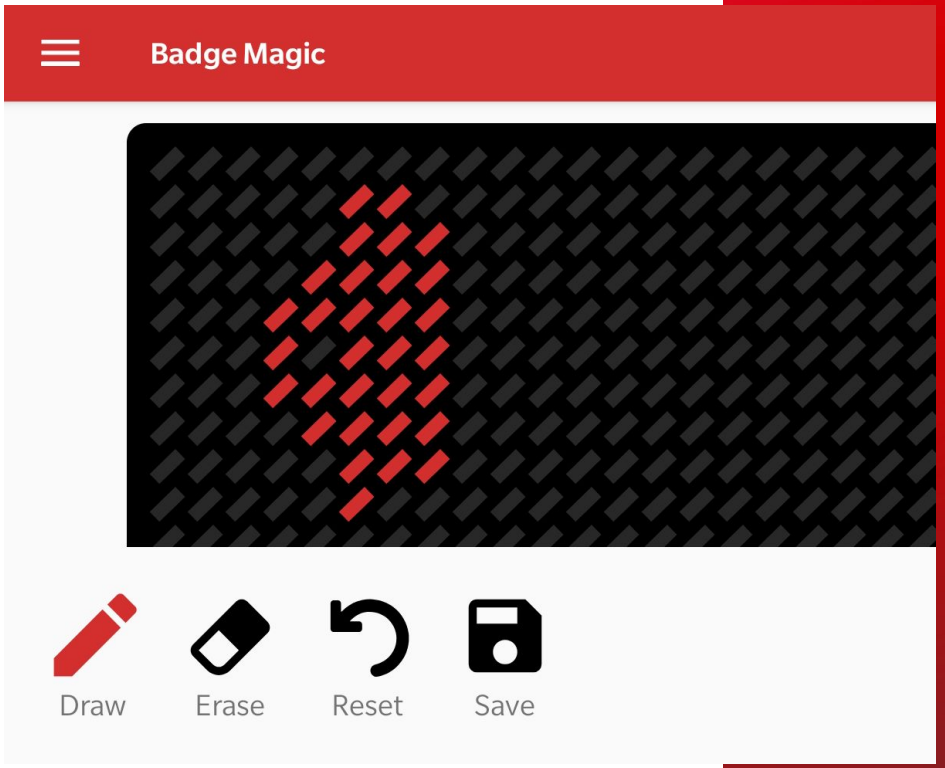
GET IT ON Google Play

Badge Magic

Save and Export

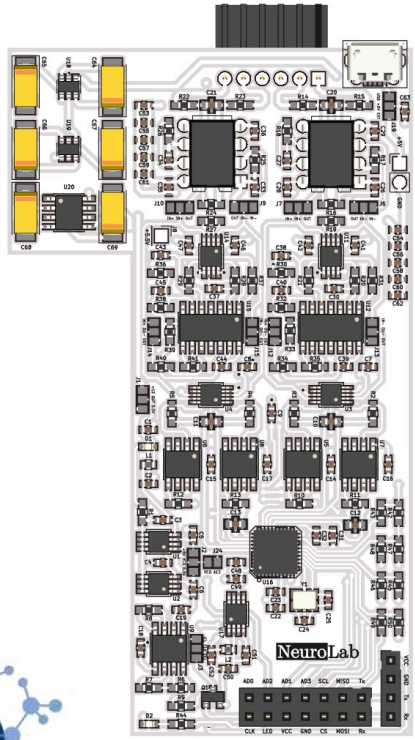
- Export Badges from one device to another
- Share badge configuration





Draw Badges

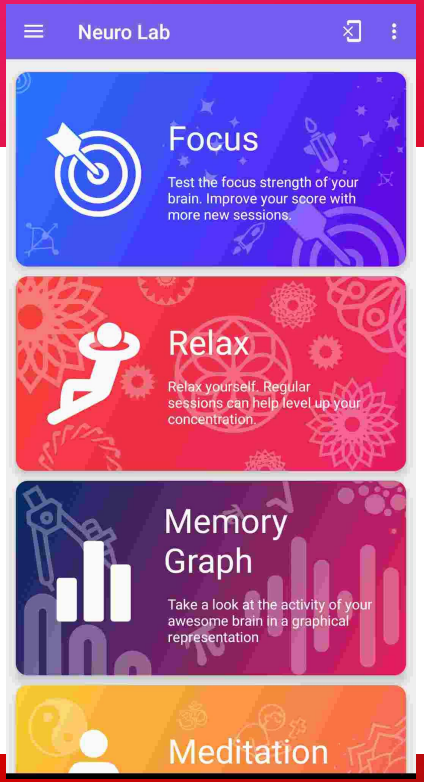
- Drawing Badges is fun
- You can add drawings to a personal list of clipart to add to a badge

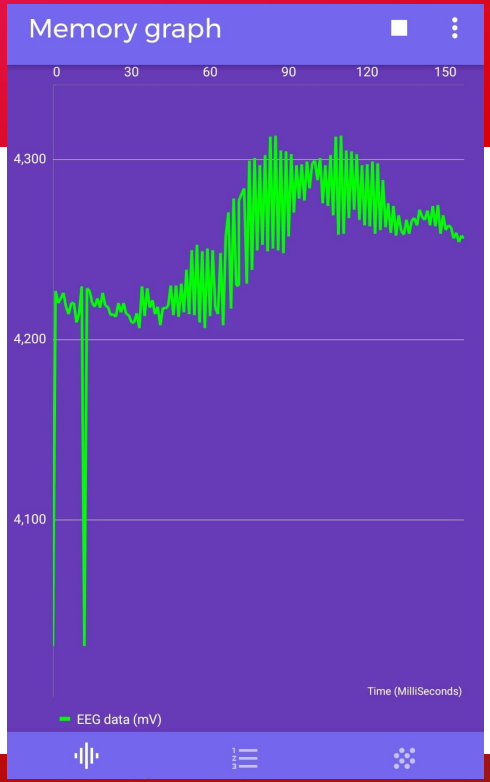


Understand your brain better

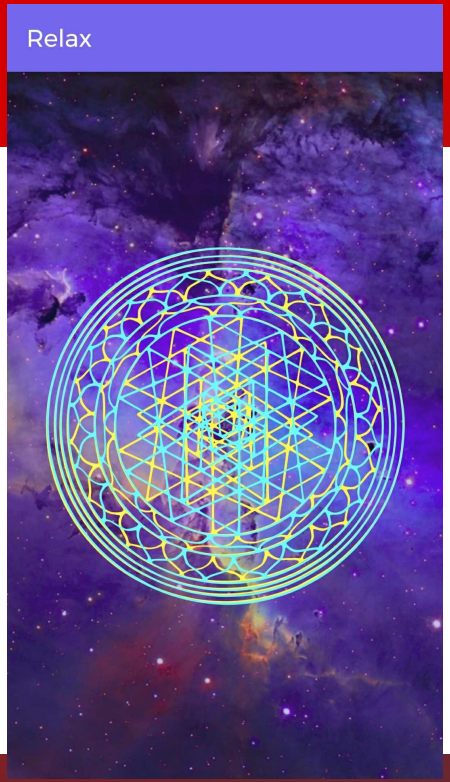
Neurolab

- An easy to use open hardware measurement headset device for brain waves
- Can be plugged into an Android smartphone
- Software application enables user to understand our brains better
- Tools to help users, e.g. relaxation and meditation


Neuro Lab
Focus
Test the focus strength of your brain. Improve your score with more new sessions.
Relax
Relax yourself. Regular sessions can help level up your concentration.
Memory Graph
Take a look at the activity of your awesome brain in a graphical representation
Meditation


Memory graph
0
30
60
90
120
150
4,300
4,200
4,100
Time (MilliSeconds)
EEG data (mV)

Neuro Lab
Focus
Test the focus strength of your brain. Improve your score with more new sessions.
Relax
Relax yourself. Regular sessions can help level up your concentration.
Memory graph
Take a look at the


Relax

Neurolab

Continuous Integration has been developed with the objective to reduce integration time and to provide continuous software updates (“builds”)

Continuous Integration of Software Today

- Build and test after each integration in a continuous cycle of builds
- Goal: Integration becomes a non-event
- Cycles include: Developing, building and compilation, executing automated tests and inspections
- Deploying software and receiving feedback

https://www.synopsys.com/company/resources/newsletters/prototyping-newsletter/continuous-integration-practices.html

Usual Dev Workflow with CI in FOSSASIA

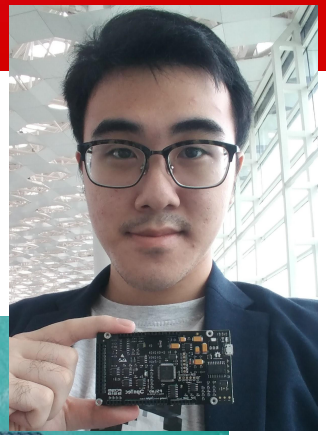
1. Function is developed in the developer's workspace
2. Build is run locally
3. Integration issues are resolved
4. A pull request is made to the development branch of the project (the mainline)
5. CI Tests are run with CI tools (Travis, Circle, Jenkins etc.)
6. Code is merged
7. Project is build and (automatically) deployed

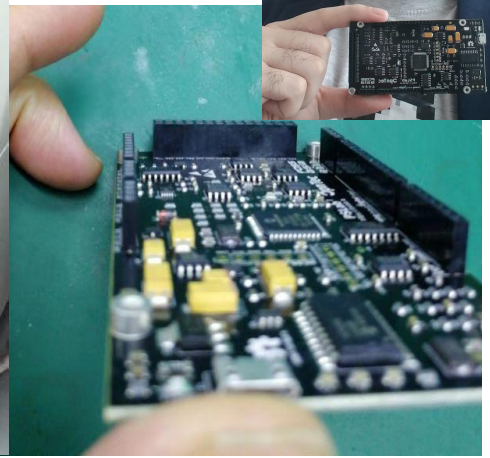
Hardware vs Software Development

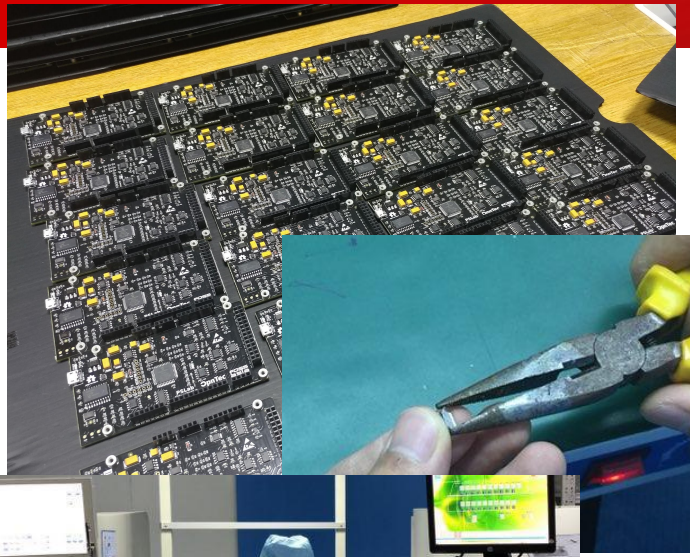
A lot of similarities:

- Configuration of project
- Writing and maintaining test cases/test scripts
- Triggering various test scenarios
- Collecting metrics
- Analyzing the results
- Keeping track of the logs

Producing batches in China/Shenzhen and Fraunhofer IZM in Germany Berlin





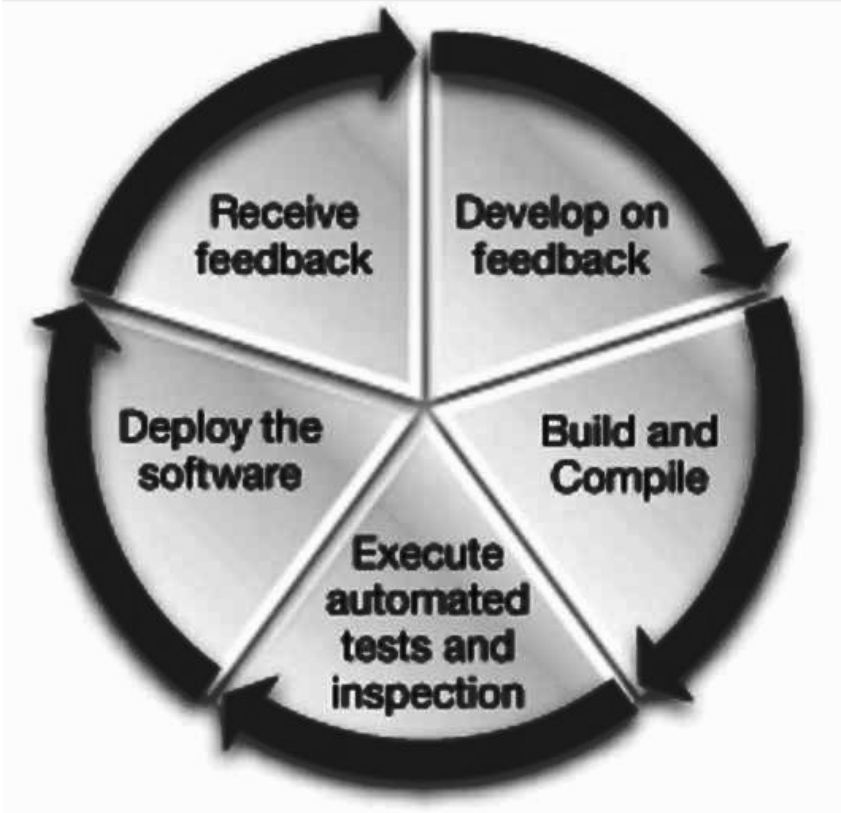


Continuous Integration for - Hardware Wishlist

- Configuration and Testing
- Creation of a BOM and “Digital” building of hardware
- Comparison of specifications ranges
- “Digital” and real device reflashing testing with standardized tools
- Possibly automatic recommendations of components based on requirements specifications (which need to be standardized)

Orchestrating tasks in the right sequence to implement an automated regression testing pipeline would simplify the tedious hardware validation processes.

https://tech.ebayinc.com/engineering/adapting-continuous-integration-and-delivery-to-hardware-quality



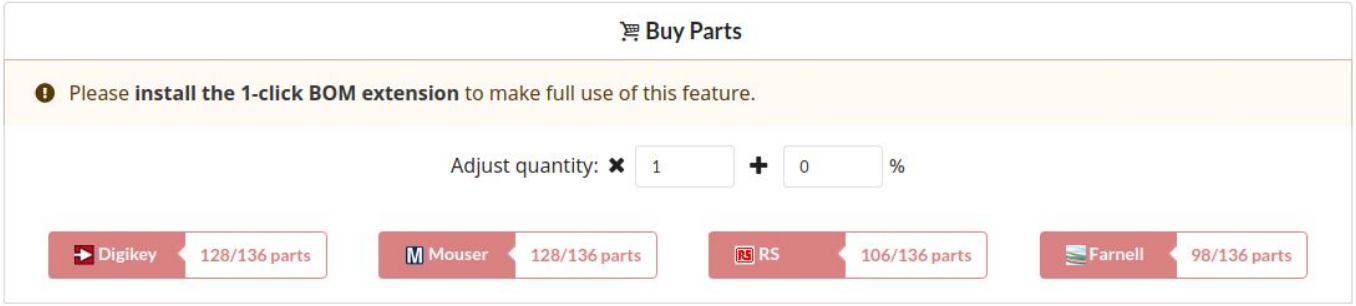
https://www.synopsys.com/company/resources/newsletters/prototyping-newsletter/continuous-integration-practices.html

To make hardware CI possible an automation engine becomes crucial.

The automation engine should be able to deploy changes as real hardware platform like in FPGA boards or actual prototypes, test if the system could actually be build and produce reports.

Creating Automatic “Deployments” using Kitspace and Yaml

- ❏ Kitspace enables the automatic generation
- ❏ On each merged PR a yaml file is executed that connects to Kitspace and generates parts list
- ❏ Parts list get matched with suppliers automatically and a one button order possibility is created



fossasia / **pslab-hardware**

Unwatch 28 | Unstar 1.2k | Fork 63

Code | Issues 24 | Pull requests 0 | Security | Insights | Settings

Branch: **master** ▾ **pslab-hardware** / **kitspace.yaml** — Find file | Copy path

kasbah Fix website link in kitspace.yaml (#103) — 71fad6e on Sep 10, 2019

1 contributor

5 lines (5 sloc) | 235 Bytes — Raw | Blame | History

```
1  color: black
2  summary: A small USB powered hardware extension for your Android phone or PC that lets you measure all kinds of things.
3  site: https://pslab.io
4  gerbers: schematics/Gerber_For_PSLab/
5  bom: docs/components/PSLab_BOM_Sheet.ods
```

https://github.com/fossasia/pslab-hardware/blob/master/kitspace.yaml

Order PCBs:

Compare PCB Prices:

Download Gerber Files

AISLER PCBWay ROYAL CIRCUITS OSHPARK PCBSHOPPER

Buy Parts

Please **install the 1-click BOM extension** to make full use of this feature.

Adjust quantity: ✖ 1 ✚ 0 %

Digikey 128/136 parts | Mouser 128/136 parts | RS 106/136 parts | Farnell 98/136 parts

References	Qty	Description	Manufacturer	MPN	Digikey	Mouser
C1 C2 C4 C5 C9 C13 C1...	21	16V 10%	KEMET	C0603C104J4RACTU	399-1097-6-ND	80C0603C104J4R
C11 C14 C16 C18	4	Tantalum 16V 6032-28	AVX	F931C107KCC	478-8239-1-ND	647F931C107KCC
C7 C40	2	16V 5%	Vishay	VJ0603Y103JXJPW1BC	VJ0603Y103JXJPW1BC-ND	77VJ0603Y103JXJPBC
C6 C15 C21 C33	4	16V 20%	3	EMK107BC6106MA-T	587-4867-1-ND	
C30 C36	2	16V 5%	KEMET	C0603C102J5RACAUTO	399-12989-6-ND	80C0603C102J5RAUTO
C20 C42	2	16V 20%	AVX	0603YD105KAT2A	478-1249-6-ND	5810603YD105K
C3 C8 C10 C43	4	16V 10%	Vishay	VJ0603A330JXJPW1BC	490-1415-1-ND	81GRM39C330J50

... 36 more lines

View All

From Continuous Integration to Sustainable Continuous Deployment, Redeployment and Recyclement

Ideally /↳To Dos:

- ❏ CI solution to enable us to publish a new version and devices to be produced anywhere automatically
- ❏ We need machine integration to deploy “fully automatically”
- ❏ In regards to sustainability we need “disassembly machines”
- ❏ Old devices could possibly be automatically be disassembled and components be reused or recycled.

Continuous Integration Can Enable Us to Make Open Hardware Economically Sustainable

- ❏ Make the development process more reliable and faster by automating parts of it
- ❏ Lower costs as we save development time through automation
- ❏ Speed up regular updates and support the building of a developer and user community (which cannot be copied)

Where to get the hardware

- PSLab github.com/fossasia/pslab-hardware
- FOSSASIA.com
- Europe/Singapore: PSLab.io
- China: Seed Studio, Tao Bao
- Japan: switch-science.com

Collaborate

- Contribute code
- Talk to us about contract work
- Help to develop tutorials
- Do workshops
- Meet us on the project chat

FOSSASIA Summit Singapore
Lifelong Learning Institute, March 19 - 21, 2020
summit.fossasia.org

OpenTechSummit Berlin
TU Berlin, May 21, 2020
opentechsummit.eu

Twitter, Github, FB, Linkedin:
@mariobehling
@fossasia @opntec

PSLab.io