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
OSCILLOSCOPE
Allows observation of varying signal voltages

MULTIMETER
Measure voltage, current, resistance and capacitance
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
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
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
Neurolab

- 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
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

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

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

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