Pocket Science Lab

Powerful and Portable Mini Open Hardware Device for Open Science

PSLab.io

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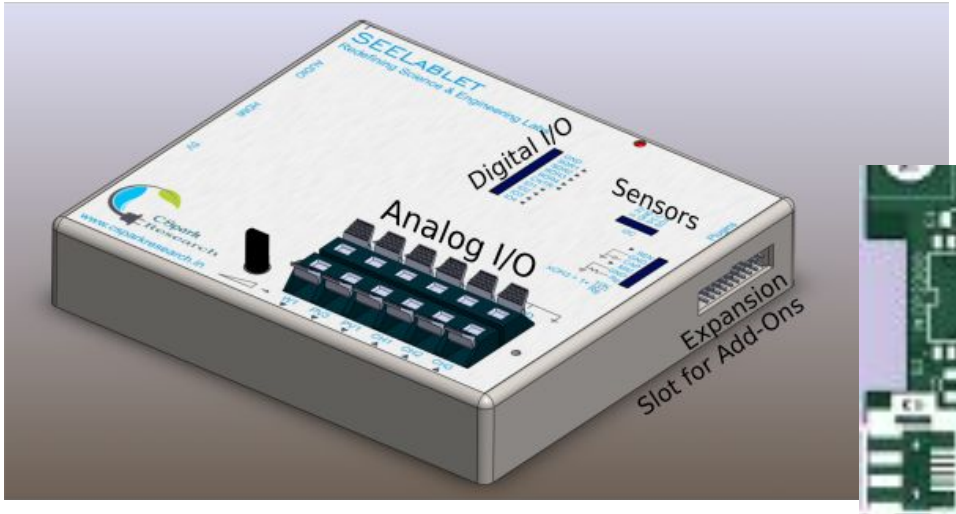
foss asia

Asia's Open Tech Organization
Improving People's Lives Since 2009

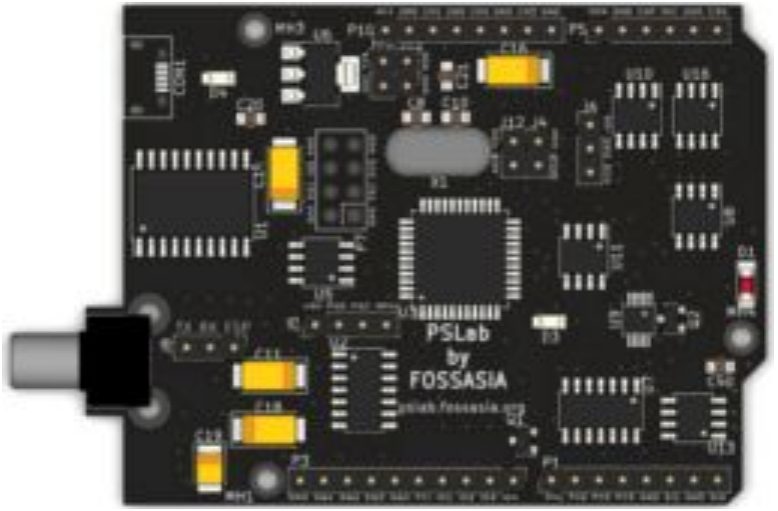
Proudly developed at FOSSASIA


Features:
• USB Powered
• ADC and DAC with 12 bit resolution
• Time interval measurements with microsecond resolution
• Programmable square wave generator
• Fundamental low frequency LCRO and frequency counter
• Data
and Graphics using Python Language
LINETEK

Original SEELABLET



First Open PSLab Version in Arduino Uno Form Factor




FORTH
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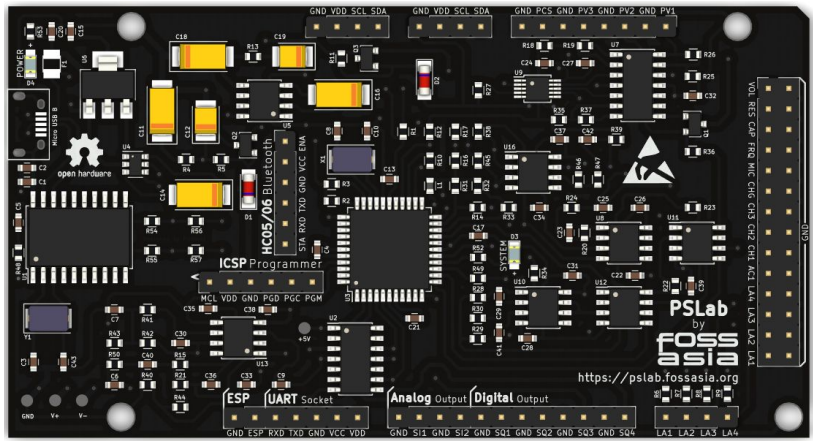
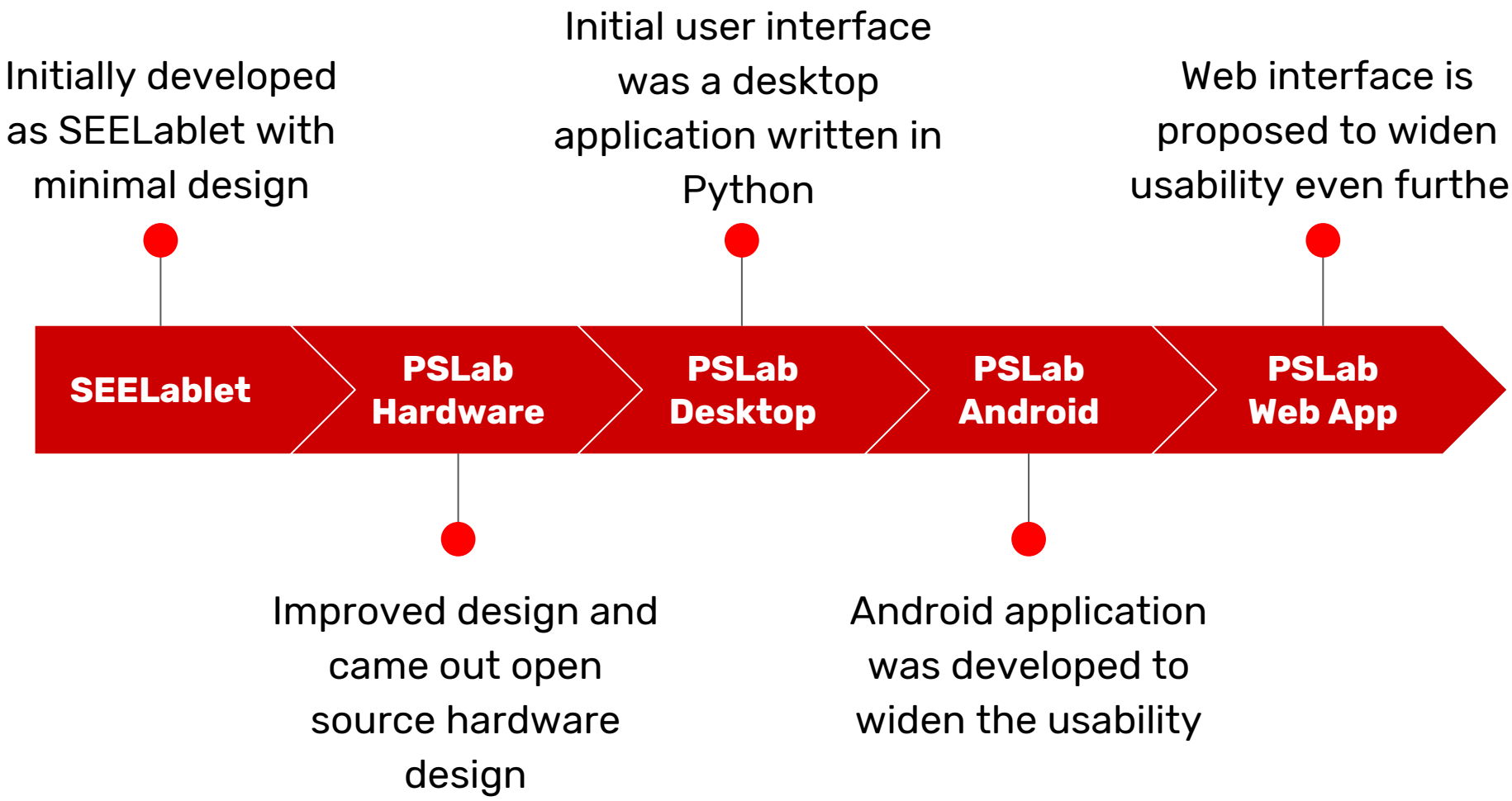
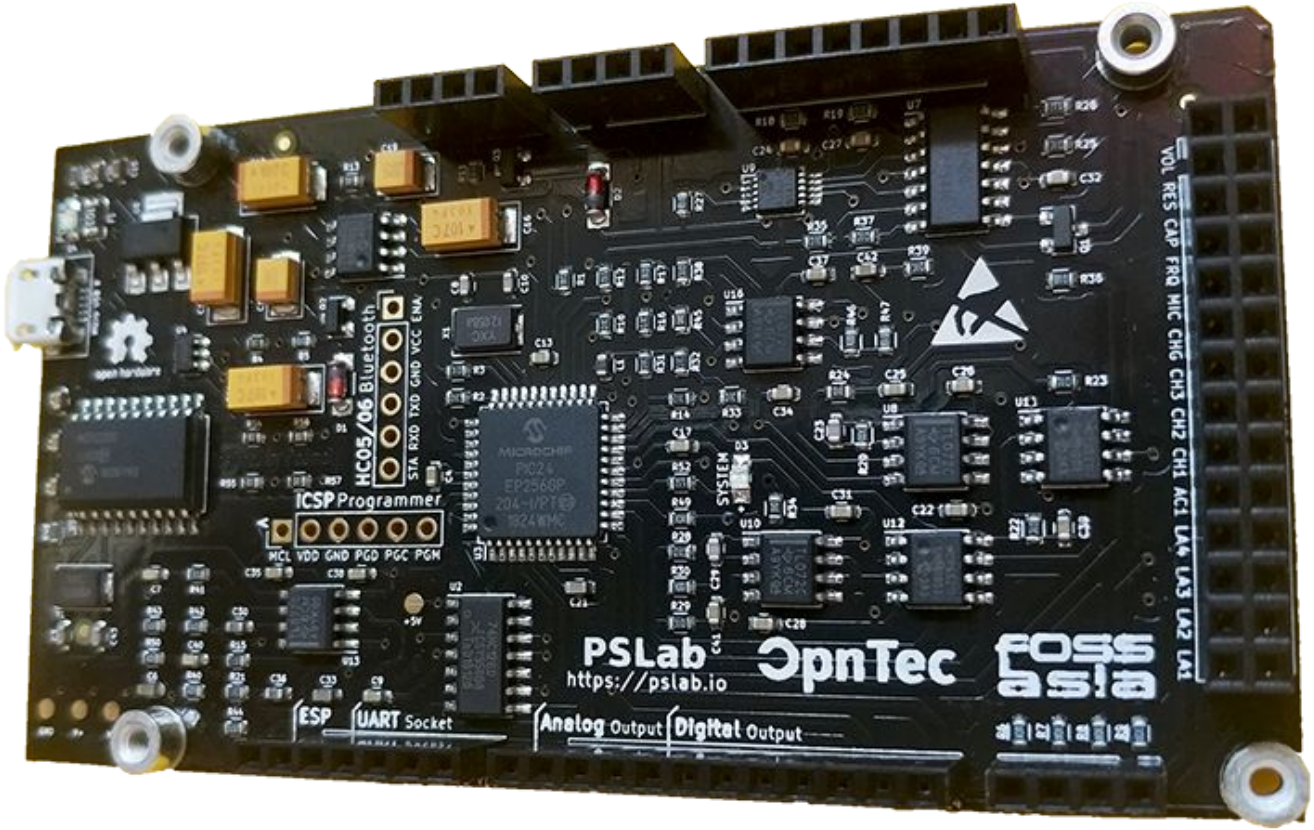
FORTH

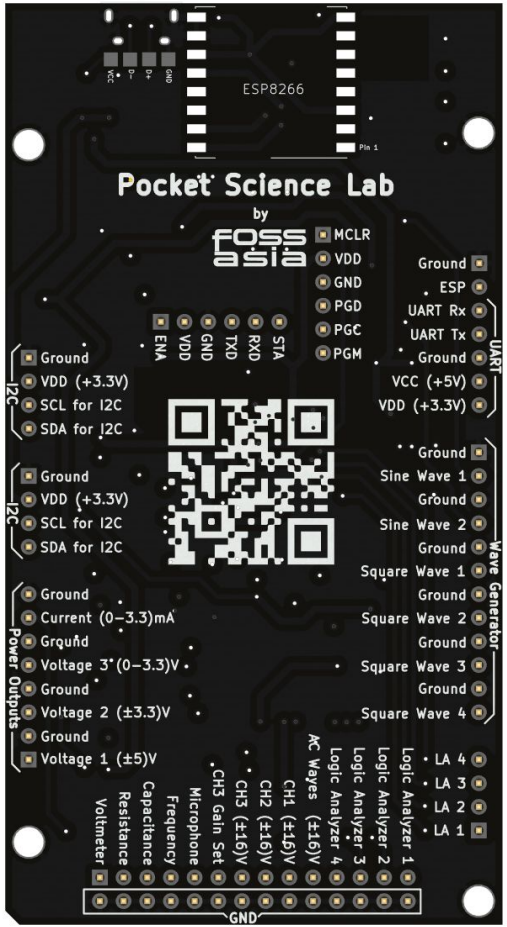
Pocket Science Lab with Form Factor Arduino Mega



- Now supports Bluetooth module and wifi module ESP8266
- Many small enhancements for newbies, especially the backside with description
- 4 more digital pins to add one more sensor

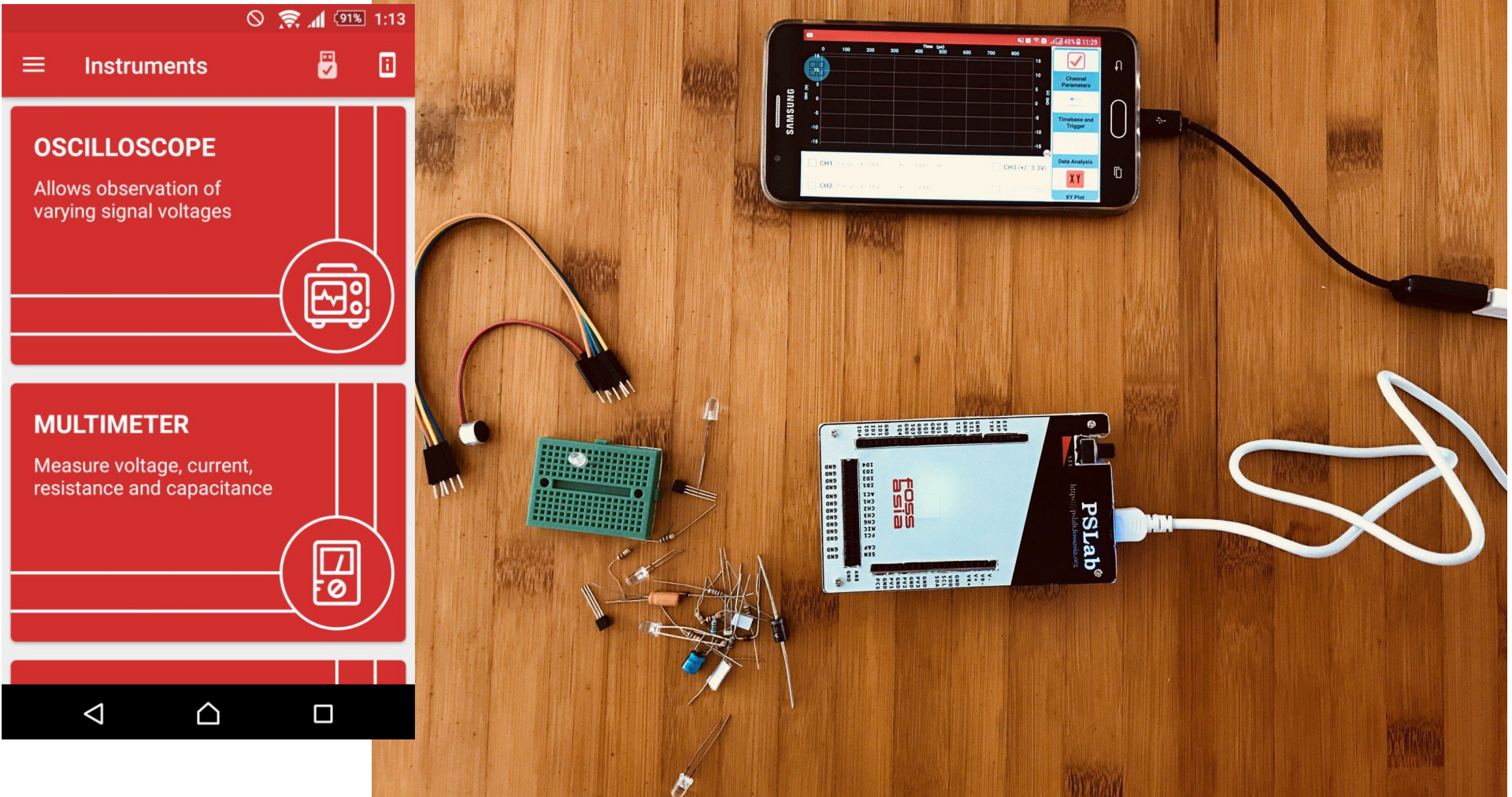

Initially developed as SEELablet with minimal design
Initial user interface was a desktop application written in Python
Web interface is proposed to widen usability even further
SEELablet
PSLab Hardware
PSLab Desktop
PSLab Android
PSLab Web App
Improved design and came out open source hardware design
Android application was developed to widen the usability

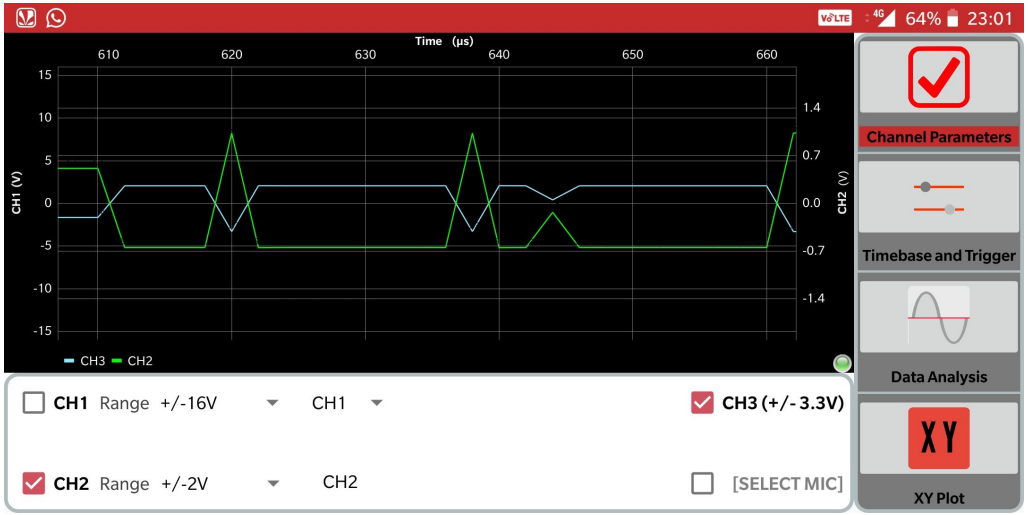

PSLab
https://pslab.io
OpnTec
foss asia
HC05/06 Bluetooth
STA RXD TXD GND VCC ENA
ICSP Programmer
MCL VDD GND PGD PGC PGM
ESP
UART Socket
Analog Output
Digital Output
VOL RES CAP FRQ MIC CHG CH3 CH2 CH1 AC1 LA4 LA3 LA2 LA1



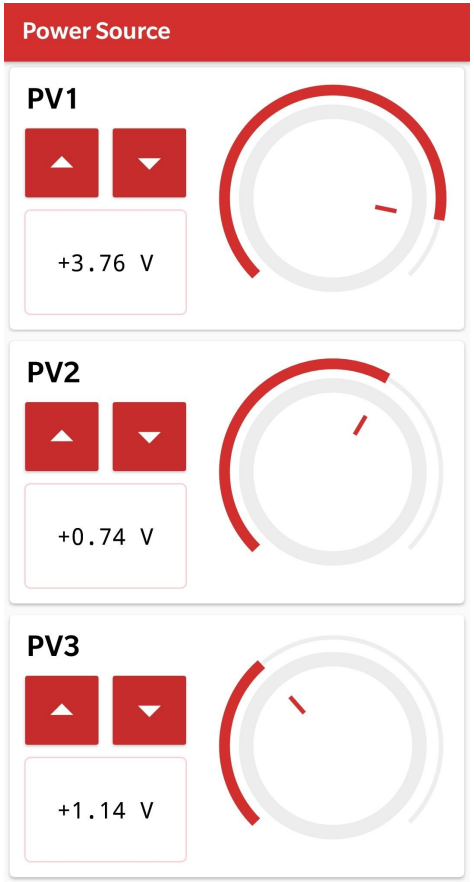
PSLab - How to use it?

- Array of useful control and measurement tools
- The integrated components can be used by pins
- Functionalities can be accessed through:
  - PSLab Desktop app
  - PSLab Android app
  - Your own apps

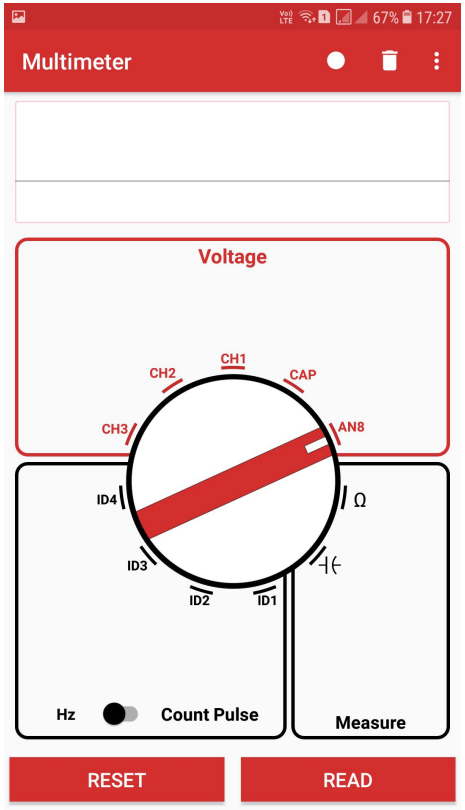

91% 1:13
Instruments
OSCILLOSCOPE
Allows observation of varying signal voltages
MULTIMETER
Measure voltage, current, resistance and capacitance
SAMSUNG
Channel Parameters
Timebase and Trigger
Data Analysis
XY Plot
foss asia
PSLab



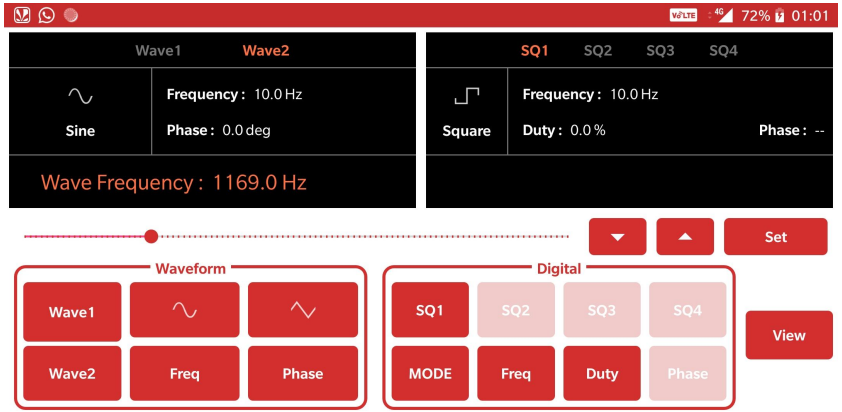
Oscilloscope



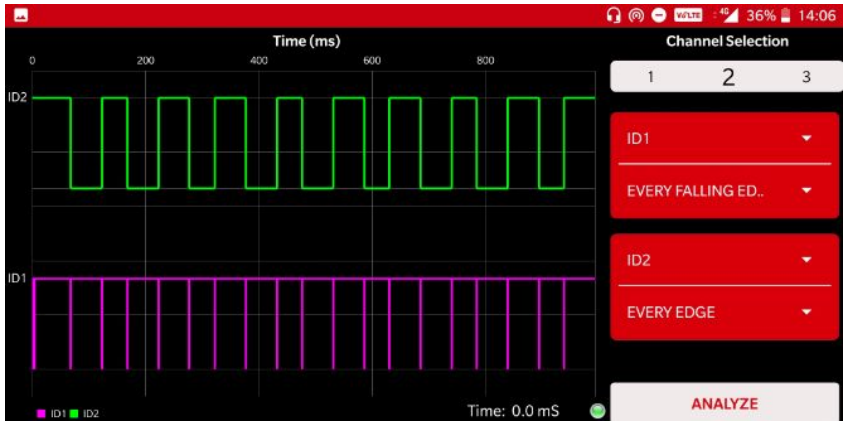
Power Source



Multimeter



Wave Generator



Logic Analyzer

Channel Parameters

Timebase and Trigger

Data Analysis

XY Plot

CH1 Range +/-16V

CH1

CH3 (+/- 3.3V)

CH2 Ran

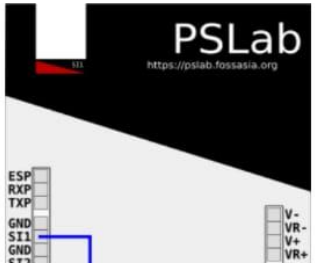
Show Guide

Hide Guide

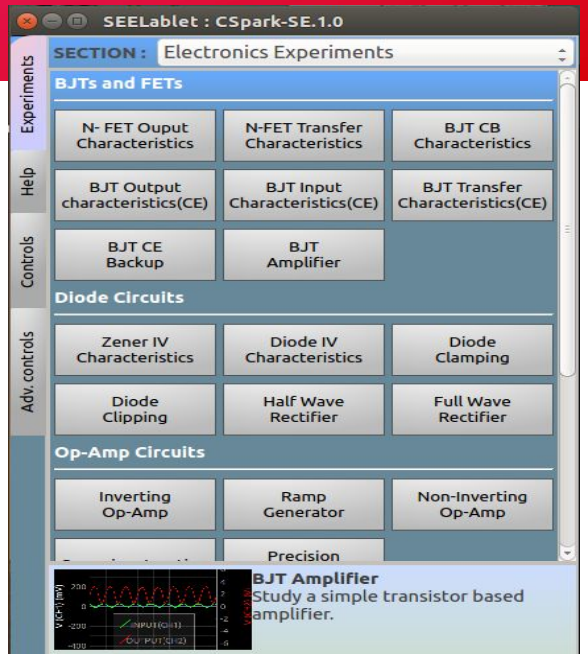
Oscilloscope

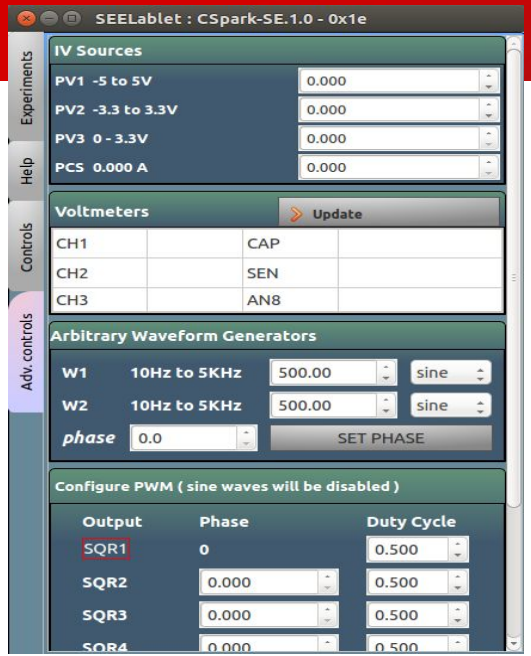
• Oscilloscope in PSLab gives out many of the functionalities of a commercially available Oscilloscope. It has 4-channels with a MIC in, 2 Sine wave generators and 4 PWM square wave generators, can change the timebase, analyses signal and does Sine and Square wave fitting and plots channel to channel voltage.

• To read from a Sine wave or a square wave, you can connect the Output wave pin and a Channel to the Oscilloscope as follows.



Desktop App





So far, major functionalities include: *Select*, *Control*, *Settings* & *Help*. It spans 50+ different scientific experiments and general purpose test & measurement

What can it do

It can function as a..

Oscilloscope

Multimeter

Logic Analyzer

Wave Generator

Power Source

Accelerometer

Barometer

Compass

Sensors

Luxmeter

Software Stack

- **PSLab-Python** [https://github.com/fossasia/pslab-python]
  Python communication library for using the device with systems that support Python as well as hardware access routes.

- **PSLab-Desktop-Apps** [https://github.com/fossasia/pslab-desktop-apps]
  Collection of PyQt based graphical utilities that provide a host of interfaces such as an oscilloscope, data logger, sensor viewer, and over 50 dedicated experiments for physics and electronics.

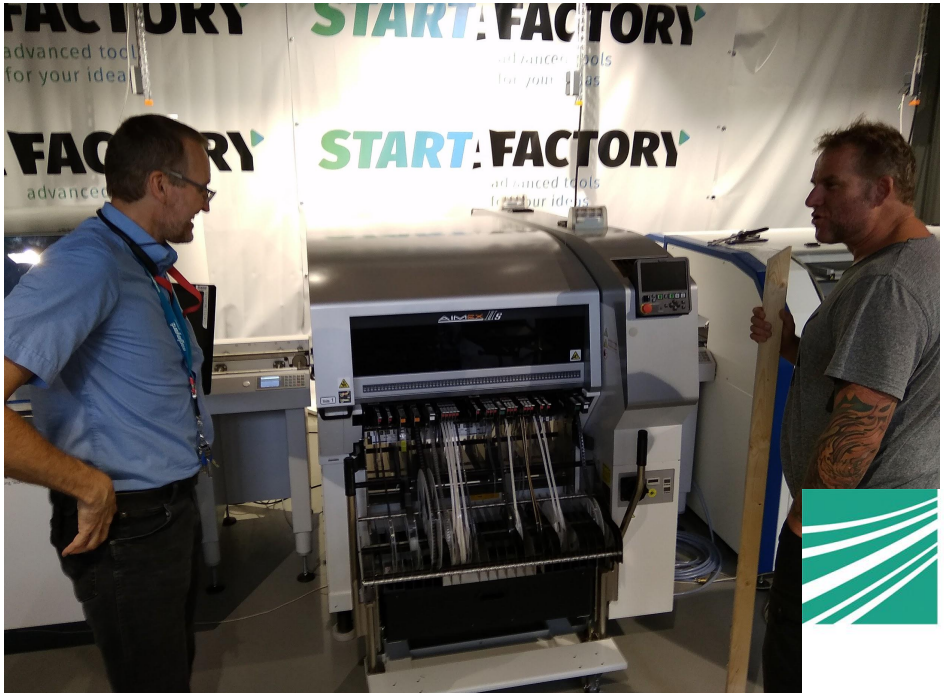
- **PSLab-Android** [https://github.com/fossasia/pslab-android]
  Android application that enables using the PSLab connected via the OTG port. Supports applications such as oscilloscope, logic analyzer, data logger, and several experiments.

- **PSLab-firmware** [https://github.com/fossasia/pslab-firmware]
  The state machine code which runs on the microcontroller which forms the heart of the PSLab-hardware device.

Hardware Specifications

- 4-Channel up to 2MSPS Oscilloscope. Software selectable amplification stages
- 12-bit Voltmeter with programmable gain. Input ranges from +/-10 megavolt to +/-16 Volt
- 3x 12-bit Programmable voltage sources +/-3.3 Volt,+/-5V,0-3 Volt
- 12-bit Programmable current source. 0-3.3 milliamps
- Supports Advanced Plugins/Add-on Modules
- 4-Channel, 4 megahertz (MHz), Logic Analyzer
- 2x Sine/Triangular wave generators. 5 Hz to 5 KHz. Manual amplitude control for SI1
- 4x Pulse width modulation (PWM) generators. 15 nS resolution. Up to 8 MHz
- Capacitance Measurement. pF to uF range
- I2C, SPI, UART data buses for Accel/gyros/humidity/temperature modules etc

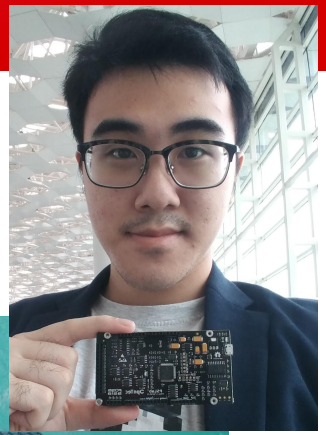
Producing batches in China/Shenzhen and Fraunhofer IZM in Germany Berlin

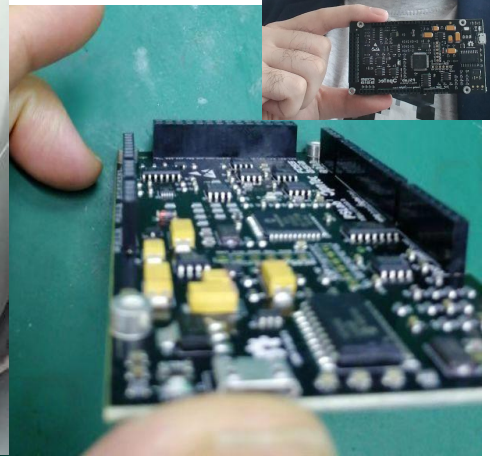


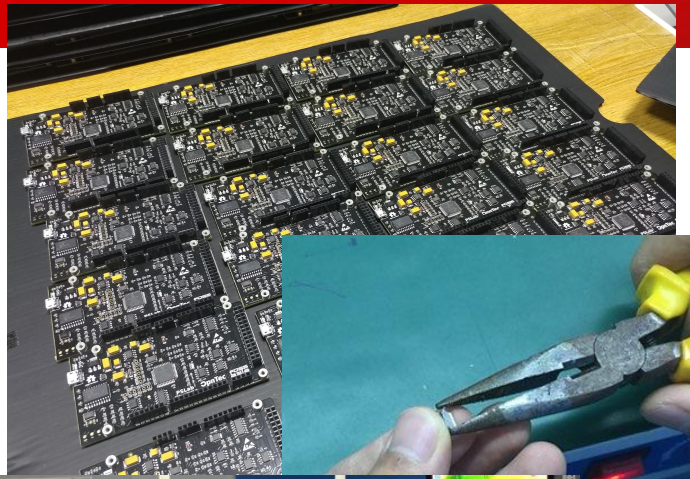
Fraunhofer

IZM

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

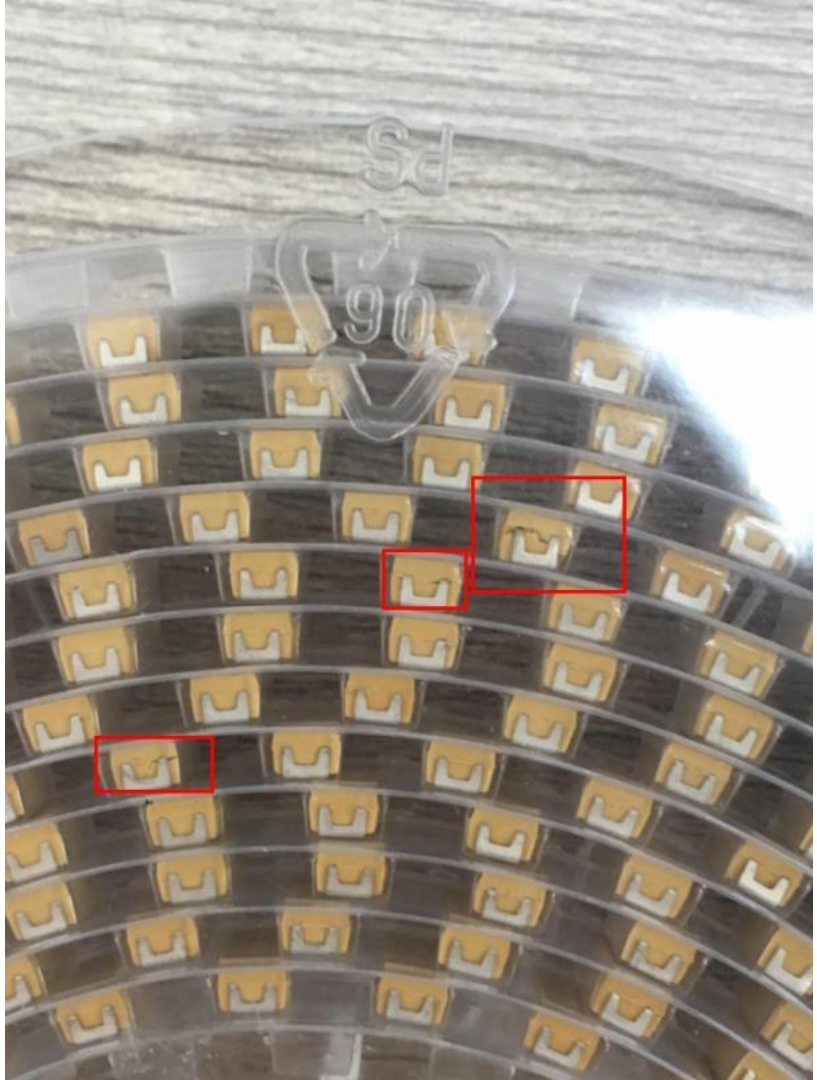






Hardware Production - Lessons Learned

- ❏ Creating a BOM and Coordinating with Producers is a Full-Time job
- ❏ There are parts in reels, tubes etc. - prices are different
- ❏ Best is to have someone who can speak Mandarin
- ❏ Expect Components to Become Unavailable
- ❏ Understand offers of “Remanufactured”
- ❏ Micro USB headers didn’t fit into the PCB
- ❏ The female pin headers are not soldered straight
- ❏ Some PSLabs didn’t work due to reflashing problem
- ❏ Expect Faulty Parts


PS
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Hardware Production - Lessons Learned

- Don’t always find the cheapest price as this will bring down the quality of goods. You might receive reels with some components broken or the manufactured product will face problems. The cheapest parts are either refurbished, scattered or clones.
- Non crucial components as resistors and capacitors should be replaced with cheaper no-name brands.
- Be ready to anticipate extra charges while production.
- Let them know how to test the finished product so you don’t have to do the testing yourself.
- Always know when are the public holidays.

What's Next? Tutorials, Education, Workshops

How can you get involved in the project?

- ❏ Feedback, issues, documentation.
- ❏ Upgrade the desktop app (Python 3.7)
- ❏ IoS application?
- ❏ Share your PSLab experiments with the community (Blog articles, videos)
- ❏ Conduct workshops
- ❏ Become a sales partner
- ❏ Produce PSLab Casing

Where to buy a PSLab?

- FOSSASIA Stand
- Europe/Singapore: **PSLab.io**
- China: Seed Studio, Tao Bao
- Japan: switch-science.com
- Coming up: Russia, Vietnam, India, Thailand

FOSSASIA SUMMIT SINGAPORE
March 14 - 17, 2019
2019.fossasia.org

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