PSLab
Pocket Science Lab from Development to Production

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PSLab - How to use it?

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

It can function as a...

- Oscilloscope
- Multimeter
- Logic Analyzer
- Wave Generator
- Power Source
- Accelerometer
- Barometer
- Compass
- Sensors
- Luxmeter
OSCILLOSCOPE
Allows observation of varying signal voltages

MULTIMETER
Measure voltage, current, resistance and capacitance
Hardware Specifications

- 4 x Channel Oscilloscope (2MSPS)
- 12 bit Voltmeter (Input +/-10 megavolt to +/-16 Volt)
- 12 bit Programmable voltage sources → +3V, ±3.3V, ±5V
- 12 bit Programmable current source → 3.3 milliamps (mA)
- 4 x Channel Logic Analyzer (4 MHz)
- 2 x Sine wave generators (10 Hz to 5 KHz)
- 4 x PWM generators (8 MHz)
- Capacitance Measurement (pF to uF)
- Resistance Measurement (mΩ to MΩ)
- I2C, SPI, UART data buses (Accelerometer, Gyroscopes ...)
- Frequency Counter (16 MHz)
Waveform Generators

- **SI1**: 5 Hz – 5 KHz arbitrary waveform generator. Manual amplitude control up to +/-3 Volts
- **SI2**: 5 Hz – 5 KHz arbitrary waveform generator. Amplitude of +/-3 Volts. Attainable via software
- **SQx**: There are four phase correlated PWM outputs with maximum frequency 32 MHz, 15 nano second duty cycle, and phase difference control.
Original SEELABLET

Project development starts with KiCad in 2014
First Open Hardware PSLab Version in Arduino Uno Form Factor
Form Factor Arduino Mega

Assembly optimized version having components mounted only on top side
Pocket Science Lab with Form Factor Arduino Mega

- Supports Bluetooth module and wifi module ESP8266
- Last version many small enhancements for newbies, especially the backside with description and QR code
- 4 more digital pins to add one more sensor
Producing batches in China/Shenzhen and Fraunhofer IZM in Germany Berlin
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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
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.
Pocket Science Lab Next

- Add SD Card
- Add small battery for time
- Additional pins
- Miniaturizing components where possible
Pocket Science Lab Next - Optional Components / Being Discussed

- GPS chip
- Sim card module
- Moving ESP to top
- Integrate sensors, e.g. Gyroscope, Accelerometer
- Mounts for screen
- Integration with LED Badge
Initially developed as SEELablet with minimal design.

Improved design and came out open source hardware design.

Initial user interface was a desktop application written in Python.

Android application was developed to widen the usability.

Web interface is proposed to widen usability even further.
Oscilloscope

Power Source

- PV1: +3.76 V
- PV2: +0.74 V
- PV3: +1.14 V
PSLab Android - Oscilloscope

Sine and square fitting for waves added
PSLab Android - Oscilloscope Built-in Mic

User can use smart phone microphone as input
PSLab Android with Maps

2 different flavors: Play Store and Fdroid supporting OpenStreetMap and GMaps
PSLab Android - Generate Config

Generate config files for instruments and transfer it to PSLab board to log the data automatically.
User can use this feature to control 4 servos of the robotic arm.
PSLab Desktop - Oscilloscope
PSLab Desktop

Logic Analyzer

Multimeter

Robotic Arm
How to make Open Hardware Economically Sustainable

- Create a business around it: Sell it, fund developers and production.
- Build a community. Projects can be forked and copied, communities can not.
- Create an ecosystem of Open Hardware + Free/Open Source Software with regular updates (Constant new releases make it hard for copycats to keep up)
- Create developer documentation
- **To do:** Create good end-consumer documentation
LED Badge Magic

Neurolab
Where to get our hardware

- PSLab [github.com/fossasia/pslab-hardware](https://github.com/fossasia/pslab-hardware)
- FOSSASIA Stand
- FOSSASIA.com
- Europe/Singapore: PSLab.io
- China: Seed Studio, Tao Bao
- Japan: switch-science.com
FOSSASIA Summit Singapore
Lifelong Learning Institute, March 19 - 21, 2020
summit.fossasia.org

OpenTechSummit Berlin
TU Berlin, May 20 - 21, 2020
opentechsummit.eu

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