Open Hardware

Introduction

Open Hardware (OH) or “Open Source Hardware (OSHW) is a term for tangible artifacts — machines, devices, or other physical things — whose design has been released to the public in such a way that anyone can make, modify, distribute, and use those things.”[1]

The general benefits of open source methods and open tech innovation are:

- Access to knowledge and product designs
- Fast and distributed exchange of skills and knowledge
- Accelerated innovation due to collaborative development
- Low development costs and more expertise
- Easy adaptation and customization

What do you need for Open Tech?

- Tools & Materials: depends on the technology
  Always try local sourcing first!
- License Example: A proper license for the product design
  - for design-files, digital work: cc-by-sa (Creative Commons)[2]
  - for hardware, functionality: CERN OHL (OH License)[3]
- Open Source Software: Linux and platform independent if possible
  - Examples: see section →*Resources*

[1] www.oshwa.org/definition

[2] www.creativecommons.org/licenses/by-sa/4.0/

[3] www.ohwr.org/cernohl

ASKotek

Access to Skills and Knowledge – Open Tech Emergency Kit

This basic Open Tech Kit provides all tools and materials to learn and distribute knowledge and product development.

The set contains:

- Basic electronics and connections
- Soldering and cutting tools
- Mechanical and measurement tools
- A Linux computer and some adapters
- Guidelines and additional things to get creative and start innovation on the spot

The kit can be used on side, in the field and can function as a startup tool-set for building a co-working space, learning hub or any other innovation community setup.

It is designed to be modular, mobile and adaptable to any location or situation to share knowledge and empower innovation.

Open Tech Skills

Training and Team

Resources

OPEN TECH, OPEN HARDWARE + ELECTRONICS

MOZILLA WEB LITERACY

https://learning.mozilla.org/en-US/web-literacy

Web literacy 21st Century Skills: Problem-Solving, Communication, Creativity, Collaboration. Share, design, code, compose, remix, navigate, connect, open practice, contribute.

OPEN! METHODS & TOOLS FOR COMMUNITY-BASED PRODUCT DEVELOPMENT

opensourcedesign.cc

Current practices of open source product development & concrete guidance to support design process efficiency of open source product development projects.

OPEN SOURCE HARDWARE ASSOCIATION

https://www.oshwa.org/

Open hardware community ensuring technological knowledge is accessible to everyone. Collaborative development of technology that serves education, environmental sustainability, and human welfare.

OPEN SOURCE EDUCATION

https://opensource.com/education/13/4/guide-open-source-education

A guide to free and open source education. Stories about creating, adopting, and sharing open source solutions.

AFRIMAKERS

http://www.afrimakers.org

Empowers makers in Africa to develop sustainable projects using rapid prototyping to solve local challenges.

APPROPEDIA

http://www.appropedia.org/Welcome_to_Appropedia

Sharing knowledge to build rich, sustainable lives.

IFIXIT

https://www.ifixit.com/

The free repair guide for everything, written by everyone.

INSTRUCTABLES

http://www.instructables.com/

Share what you make with the world, and tap into an ever-growing community of creative experts. Participate in make-a-thons through the platform. Add your own instructables.

OPEN SOURCE ECOLOGY

http://opensourceecology.org/

Open source industrial machines can be made for a fraction of commercial costs, designs shared online free, to create an open source economy which increases innovation by open collaboration.

WIKIFAB

http://wikifab.org/

Open source hardware documentation platform. Tutorials to make anything, written by everyone.

WIKI-HOW

http://www.wikihow.com/

“We're trying to help everyone on the planet learn how to do anything. Join us.”

Open Tech Linux Software Installation

(on Ubuntu based OS)

Please run:

sudo apt update

sudo apt upgrade

sudo apt install gdebi software-properties-common libavcodec-extra ffmpeg redshift firefox libreoffice shutter vlc pinta pdfshuffler geogebra darktable gthumb trash-cli gimp inkscape openshot kazam audacity kdenlive freecad librecad fritzing kicad

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Open Hardware Process

Documentation Principals

One key instrument of Open Hardware is clear documentation. In order to stay on track while developing or adapting a product, it is highly recommended to document the process to create an easy pattern to follow: → *Open Hardware Guide*. This saves time and prototyping iterations.

Therefore good sketches and pictures of the steps are needed, that trace the development process clearly and simply in the order that it happens. The following template might help as you take important notes along the way:

Project: Name and Team	Date and Step/Workday
CC-BY-SA (digital) CERN OHL (hardware)	Open Process Documentation (OPD) – Nr #

Steps: • • •	Notes:
Flops:	Tops:
Open Questions:	marked as solved: [ ] [ ] [ ] . . .

Steps: Follow all working procedures & note the process step-by-step in the order it happens. Keep it clear and simple, note additional tips or details.

Flops & Tops: What went wrong and should be avoided?

What went right and is noted as best practice?

Open Questions: What challenges, problems still need to be solved?

(NB: This section is key to make progress and help others to participate in the process and get on board the project)

Open Hardware Guide

Documentation Principals

Using your Open Process Documentation (OPD) the next part is to create a clean and visualized Open Tech Guide for the current version.

This Guide is key to empower further development and innovation.

The following template is given as a best practice reference:

Project: Name and Team	Date of release
CC-BY-SA (digital) CERN OHL (hardware)	Open Hardware Guide | Version Nr. #

<table>
<tr><td rowspan="4">Steps:
1.
2.
3.
4.
5.
6.
7.
8.
9.
10. ...</td><td>Tools:
1.
2.
3.</td></tr>
<tr><td>Materials
1.
2.
3.</td></tr>
<tr><td>Tips and Usage
•
•</td></tr>
<tr><td></td></tr>
<tr><td>Possible Improvements
•
•</td><td>Open Questions
•
•</td></tr>
</table>

+ References (weblinks) if available

Solar Charger

Open Hardware Guide

Project: Solar Charger	Date: 26th November 2016
CC-BY-SA (digital) CERN OHL (hardware)	Open Hardware Guide

[Pictures] + Diagram SolarCharger

Steps:

1. Draw diagram of the charger for easy understanding (optional)
2. Open your ASKotek kit for tools
3. Get circuit board and solder the diode and LED in place
4. Solder the resistor in the front of the LED
5. Connect to the LED lights to the negative side
6. Solder the capacitors with long side connected to the outer regulator legs
7. Fix regulator with black side facing you and connect between diode and resistor
8. Connect the other side of the regulator to the capacitor (long side connected)
9. Connect all the negatives sides together
10. Cross the middle pin to the negative with side to LED
11. Behind the diode (1. option) or to the right capacitor connect the positive wire from solar panel
12. And the other negative to the negative side
13. Connect female USB. Positive on red and negative on black
14. Test the Solar Charger in the sun

Tools:

1. Color-coded wire (red and black)
2. Soldering iron
3. Soldering grease
4. Soldering Sucker
5. Helping hand (magnifier & clamps)
6. Soldering wires

Materials

1. Solar panel 8V +/- 250mA
2. Resistor 1200 Ohm (1. option)
   Resistor 600 Ohm (2. option)
3. 1 Diode
4. Capacitor one 10 µF
5. Capacitor two 100 µF
6. Female USB
7. 5V Regulator
8. Circuit board
9. LED light (red one)

Tips and Usage

1. Can be used for charging phones
2. Environmentally friendly
3. Saves money
4. Test with mobile phone or LED light

Open for improvements

- Build a casing

Open Questions:

- How to find + and – wires on female USB (if not red and black)?
- What if somebody is surrounded with no material, how to use old electronics?

LED Light

Open Hardware Guide

Project: LED light (rechargeable)	Date: 26th November 2016
CC-BY-SA (digital) CERN OHL (hardware)	Open Hardware Guide

[Pictures] + Diagram LED

Steps:

1. Measure battery voltage
2. Calculate and sort out resistors
3. Measure and cut circuit board
4. Identify the negative and positive lines
5. Start to solder the resistors (solder on board)
6. Solder the big LED lamp
7. Connect the batteries and LED to the switch
8. Solder charging red LED
9. Light up the big LED

Tools:

4. Breadboard (test circuit board) + wires
5. Helping hand (magnifier & clamps)
6. Multimeter
7. Soldering iron plus support
8. Soldering wire

Materials

4. Resistors (600, 25, 10 Ohm)
5. USB (male)
6. Red LED 2V
7. Big white LED 3V
8. Switch
9. Diode

Tips and Usage

1. Draw your own electrical current diagram
2. Take safety measures while handling soldering iron
3. Always test on a breadboard before soldering

Possible Improvements

- Show red LED only when charging
- Build a casing

Open Questions

- How to prevent the battery from discharging too much over time with simple electronics?

Phone Stand

Open Hardware Guide

Project: Phone Stand	Date: 26th November 2016
CC-BY-SA (digital) CERN OHL (hardware)	Open Hardware Guide

[Pictures]

Steps:

1. preparation of working space
2. get the cardboard and place on the table
3. measure the length and thickness of the phone and chose outside measure
4. start cutting the back of the phone holder
5. measure the phone holder part if not done already and cut the phone stand.
6. cut the side flips and glue them together, depending on the phone size
7. cover it with duct/gaffer tape (optional)
8. Insert the phone in the back of the phone holder
9. join the top flap with stand using paper clips.

Tools:

1. scissors
2. ruler
3. cutter
4. flat space mobile phone
5. marker pen

Materials

1. cardboards
2. liquid glue
3. paper clips
4. tape (optional)

Tips and Usage

1. keep away from water
2. portable, flexible and easy to maintain

Possible Improvements

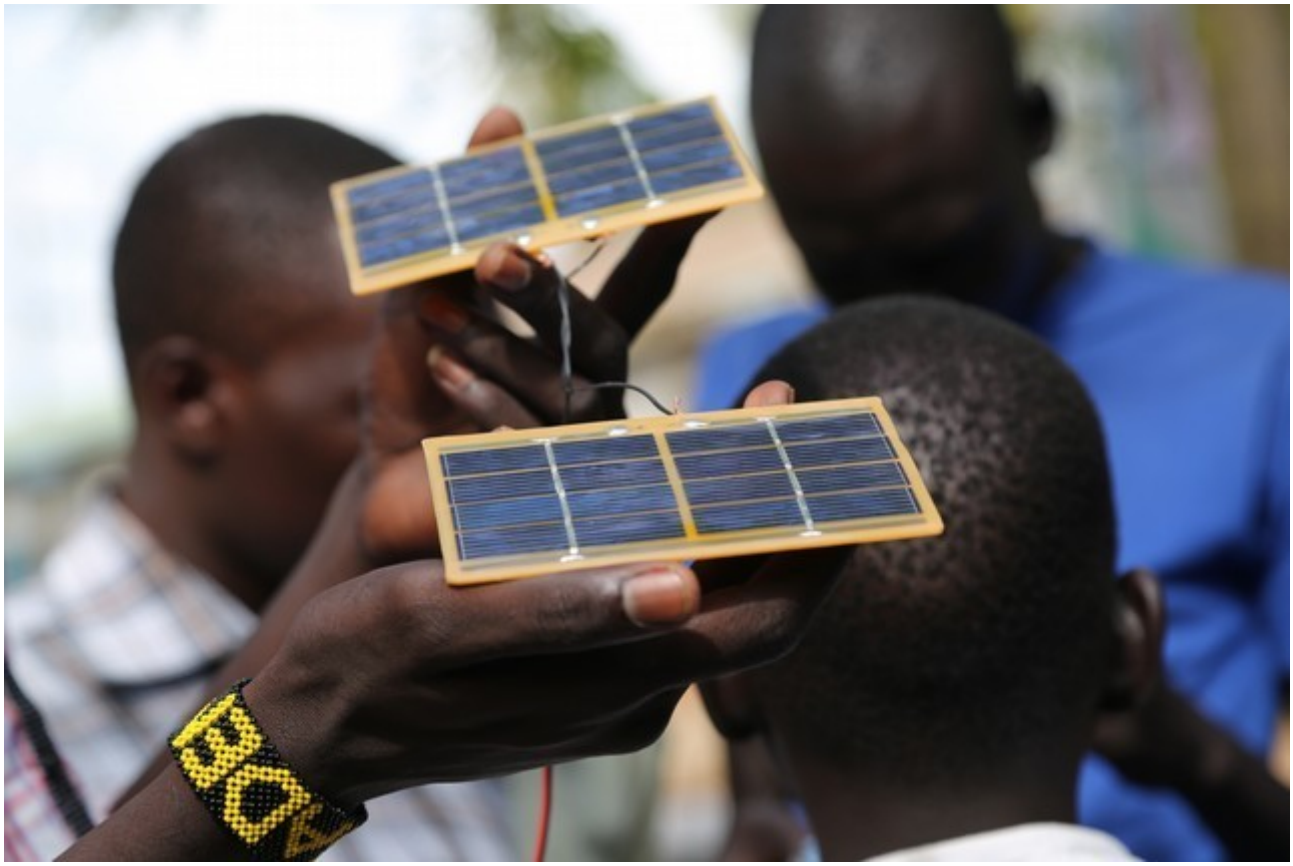
1. make some extra holes on phone holder in order to charge your phone directly.
2. make extra holes for the headset
3. make holes to support the volume side

Open Questions

- What other materials are possible?

Title page – OPEN HARDWARE GUIDE

jHUB Kampala, 2016



BACK

[Organisations, simular to OLG]