LOSH Report 2022

August 2, 2022

1 Intro

1.1 Welcome to our OSHdata report

Happy to see you here! You are reading the first report on data of the **Library of Open Source Hardware** (LOSH). LOSH is a distributed knowledge base for open source hardware (OSH) designs aiming to support design reuse, making OSH more explorable and its metadata available as Linked Open Data (LOD). Our crawlers search different platforms for OSH, extract metadata about them and store them as LOD. You can explore the knowledge base through our frontend (which features a meta search engine for OSH): `https://losh.opennext.eu/`. All software modules, raw data and related documents are published under a free/open license – you can explore and improve all bits of this project or basically fork the whole system if you like.

This undertaking is based on the Open Know-How initiative by the Internet of Production alliance. We've been closely collaborating with the OSH community since the very beginning of LOSH. Our efforts partly merged with the OSHdata project, which published annually reports based on data crawled from the list of OSHWA-certified OSH projects. Since OSHWA published its API, no crawling is needed anymore. And since LOSH is here to collect data also from other platforms, we decided to take care of regular OSHdata reports – now also including data from other platforms. See the details of this handover in this blogpost.

Generally, all data you will find here is also publicly available in the LOSH knowledge base. This report is generated using the LOSH-Reporter tool (GPL-3.0-or-later). All we do is running a bunch of pre-defined queries on LOSH's knowledge base using that tool. If you want to look into the raw data yourself, e.g. to run some self-defined queries, find it here (CC0-1.0). The report you are reading is licensed under the Creative Commons Attribution 4.0 International License (CC-BY-4.0). This license covers the entire report, including all text and graphics. OSHdata is a project of the Open Hardware Observatory e.V. (non-profit) since 2021 (before is was a project of Kenny Consulting Group, LLC).

1.2 Get in contact with us

OSHdata is hosted by the Open Hardware Repository e.V. (non-profit) since 2021. Feel free to reach out to Robert to get in touch: rm@oho.wiki

LOSH was started inside the EU-H2020-founded OPEN_NEXT project back in 2020 and is hosted and maintained by Open Source Ecology Germany e.V. (non-profit) since 2022. You can reach these folks via eMail (verein@ose-germany.de) or Telegram (@OSEGWelcome) – don't be shy; looking forward to e-meet you :)

You can also sign up for our newsletter or follow us on Twitter via @OSHdata or LinkedIn under @OSHdata.

2 LOSH Data

2.1 Introduction

Currently, LOSH collects data from the following platforms:

- GitHub.com
- Wikifactory.com
- OSHWA Certification List
- Thingiverse.com

Additionally we have scripts catching data from:

- Appropedia.org
- Open Know-How (including e.g. Fieldready.org)

and making it available via GitHub:

- original TOML manifests in the LOSH-list
- cleaned-up TOML manifests and their RDF representation as Turtle files in losh-rdf

The minimum threshold for LOSH to be recognised as an OSH project is to have:

- a free/open license,
- a README file and
- at least one source file (other than the README.md, CONTRIBUTING.md or an image).

If you are curious about the LOSH project and want more details e.g. to how data is collected you can find more information linked below:

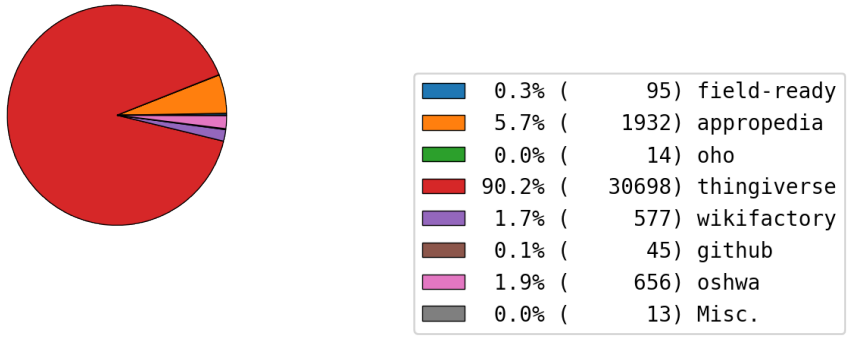
- some introductory slides,
- the OKH-LOSH metadata specification containing all relevant definitions,
- the D3.3 delivarable report explainging the LOSH ecosystem,
- the D3.4 deliverable report explaining the data collection.

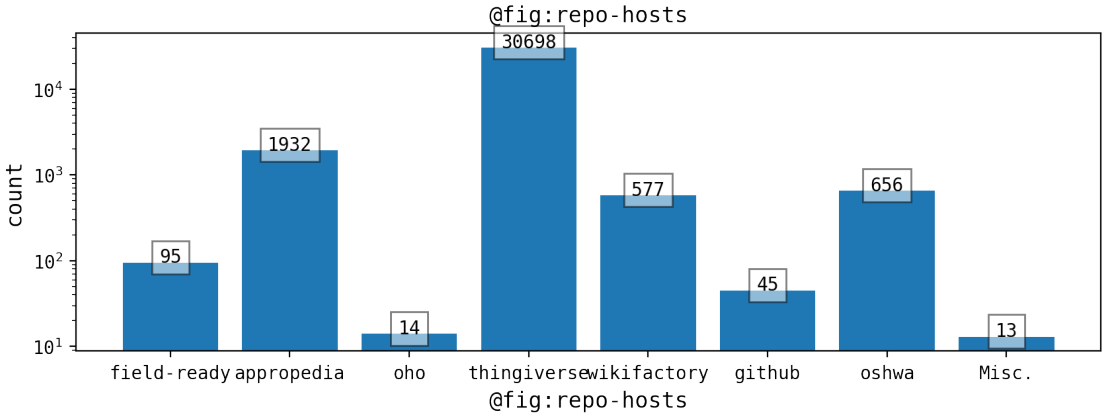
2.2 Data Sources

2.2.1 Current Data

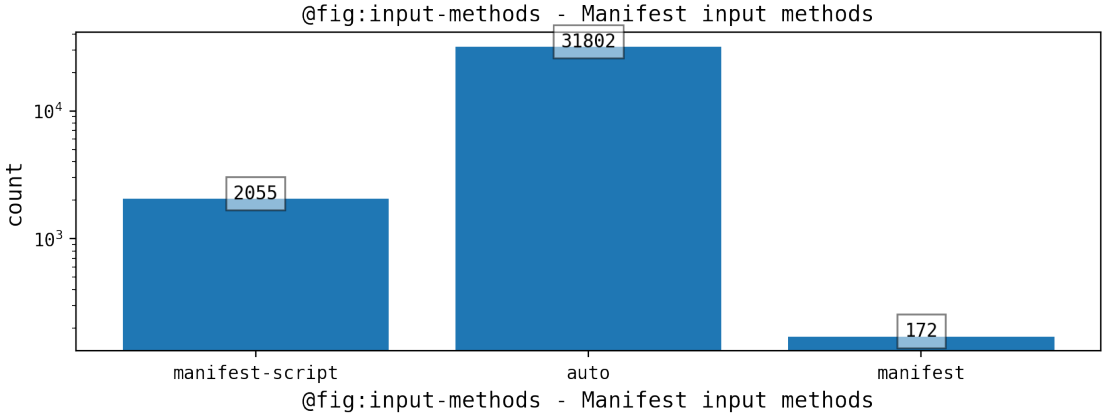
By the publishing date of this report, the LOSH knowledge base contains:

@fig:repo-hosts-percent - Projects per Repo-Host





@fig:input-method-dist shows the distribution of upload methods that have been used for this data set.



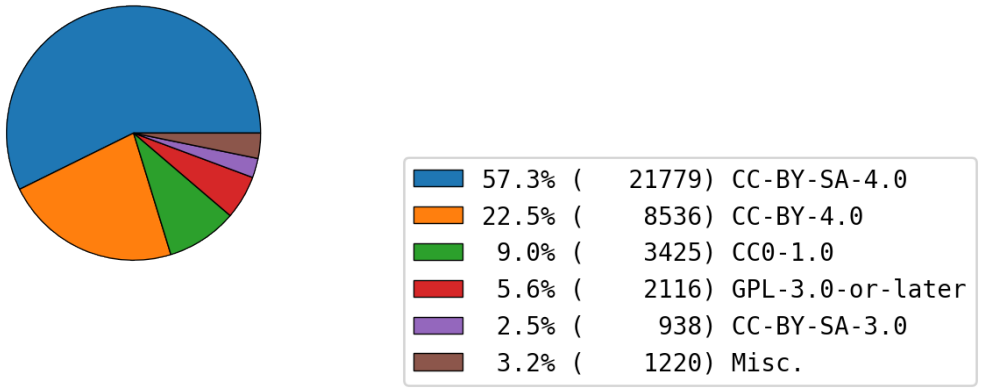
2.2.2 History

This is the very first of the LOSH Reports. :-)

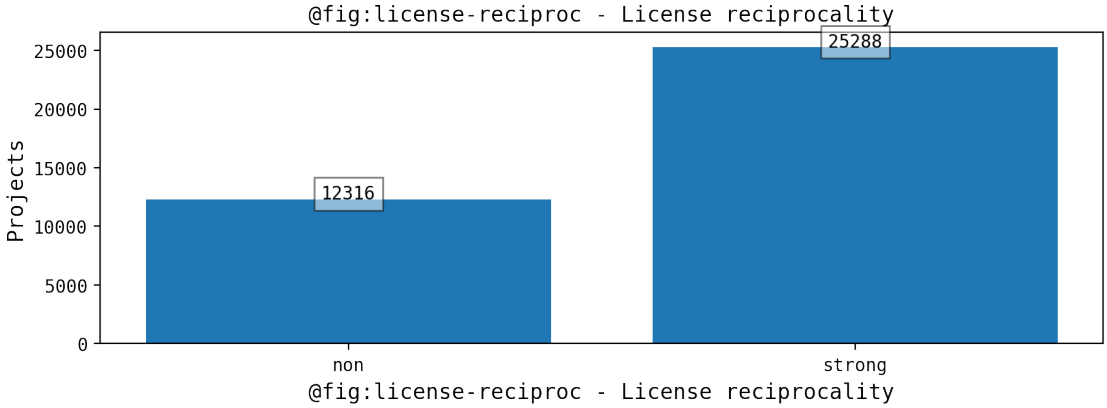
2.3 Licenses

What separates a piece of open source hardware from a proprietary one is primarily its license.

@fig:license-dist - Licenses



Totalled, @fig:license-dist is the overall distribution of licenses used by the projects.



2.4 Hardware Types

2.4.1 Open Technology & Documentation Readiness

Open Technology and Documentation Readiness Levels (OTRL, ODRL, as defined in ref) give a good approximation:

1. how mature the hardware design itself is (OTRL) and

2. how mature and open the documentation is (ODRL).

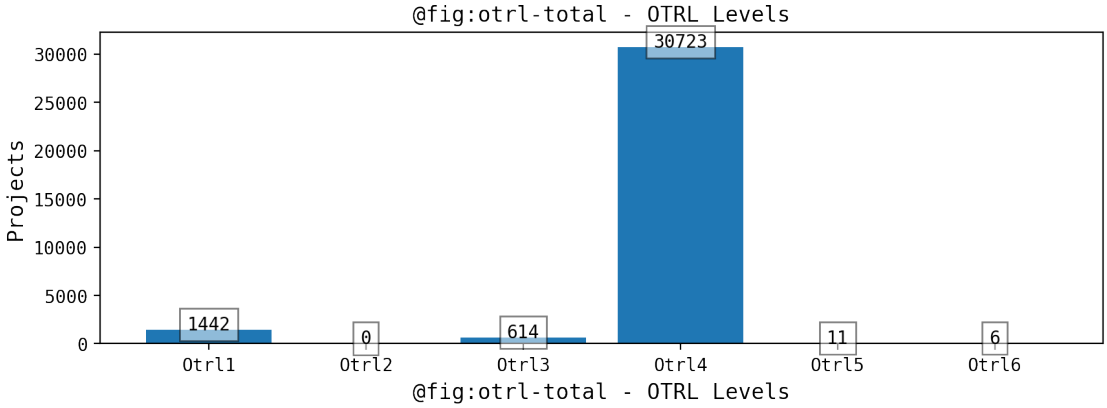
The different levels are:

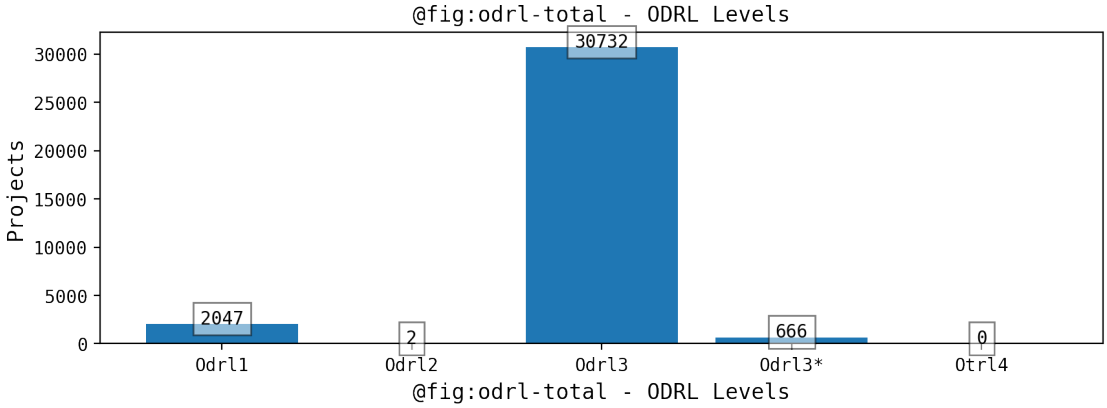
[copy from publication]

So the two extreme cases would be:

- an OSH design with OTRL-6 and ODRL-1, meaning a safe-to-use product that could be circulated on the market, but has barely any documentation published appart from a README, maybe a few STEP files and bearing a free/open license;
- an OSH design with OTRL-1 and ODRL-4, so a design still in the ideation phase, but exeptionally well-documented, even with documents for a (future) CE-Certification published under a free/open license.

Among the whole knowledge base, the readiness levels distribute as shown in @fig:otrl-total and @fig:odrl-total



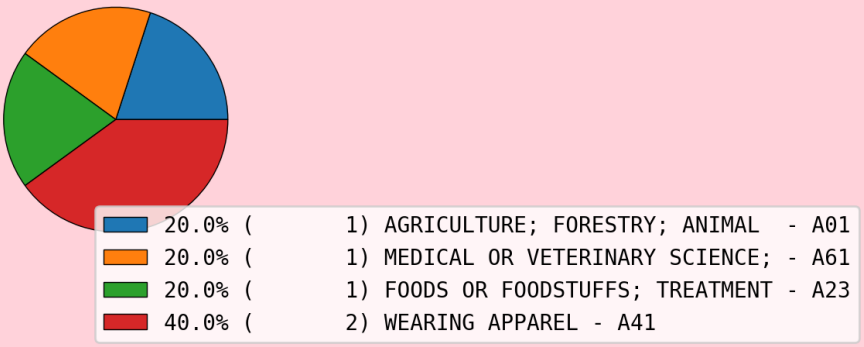


2.4.2 Technology Categories

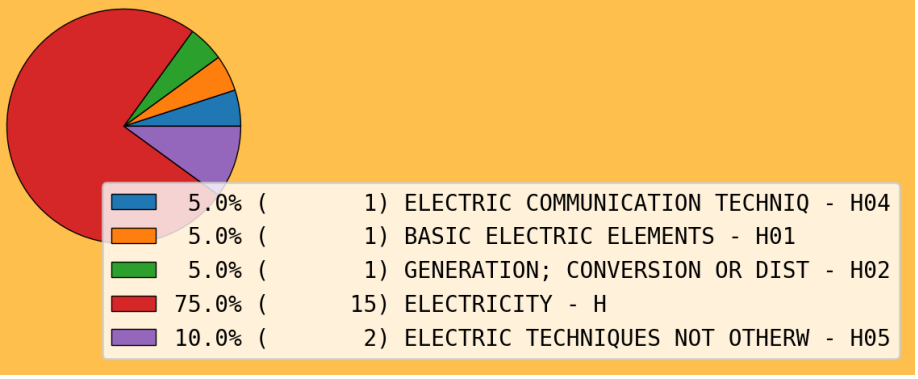
Classifying hardware by it's technology can be a non-trivial task – every online platform seems to run their own from-scratch-developed category system. LOSH tries to merge some of those category system into a single, established one that has been around for a while: patent classes, specifically the Cooperative Patent Classification system (CPC). This may even help patent agents when searching for relevant open source designs (#defensive-publishing).

However, since LOSH can only process data that is provided in the first place, patents classes are only available for 64 OSH projects (that is 0.19 % of the knowledge base). @fig:cpc-total shows the total distribution of top-level CPCs, @tbl:cpc-legend provides the full designation for those IDs.

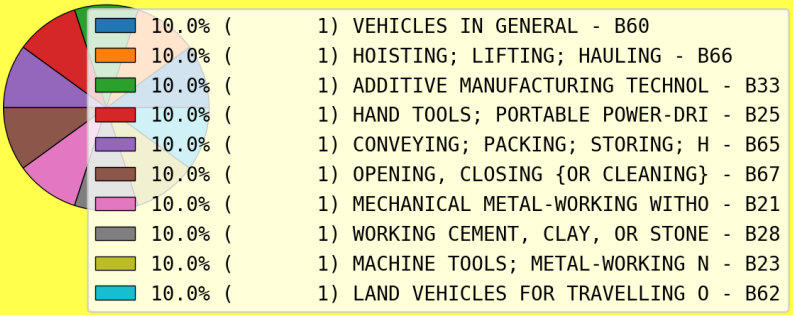
@fig:cpc-cats - CPC cat A - HUMAN NECESSITIES



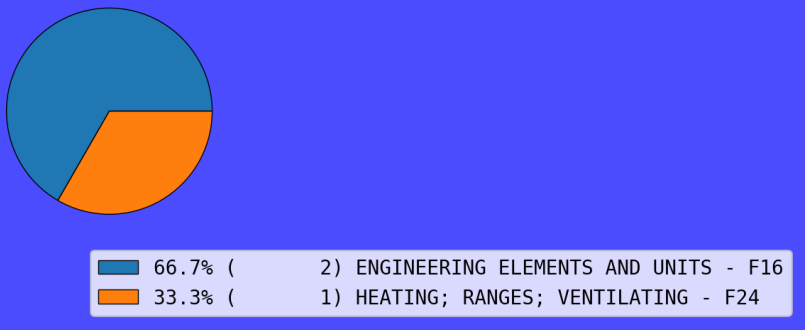
@fig:cpc-cats - CPC cat H - ELECTRICITY



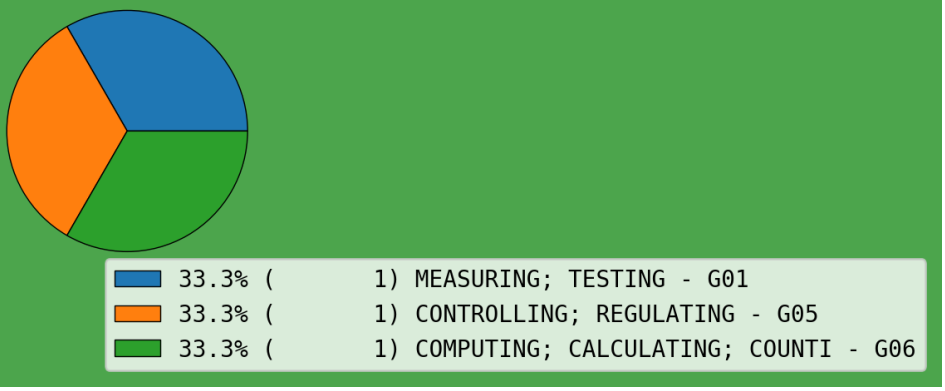
@fig:cpc-cats - CPC cat B - PERFORMING OPERATIONS; TRANSPO



@fig:cpc-cats - CPC cat F - MECHANICAL ENGINEERING; LIGHTI



@fig:cpc-cats - CPC cat G - PHYSICS



@tbl:cpc-legend

CPC ID	#Projects	Title
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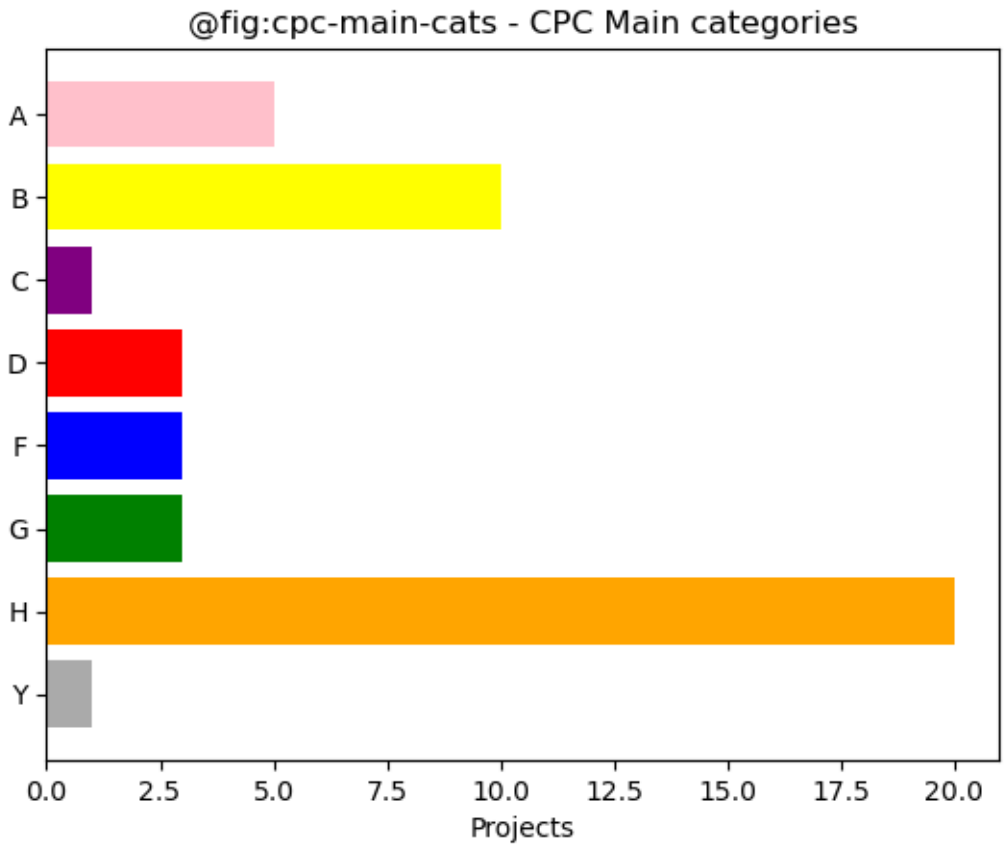
A01	1	AGRICULTURE; FORESTRY; ANIMAL HUSBANDRY; HUNTING; TRAPPING; FISHING
A61	1	MEDICAL OR VETERINARY SCIENCE; HYGIENE
A23	1	FOODS OR FOODSTUFFS; TREATMENT THEREOF, NOT COVERED BY OTHER CLASSES
A41	2	WEARING APPAREL
H04	1	ELECTRIC COMMUNICATION TECHNIQUE
H01	1	BASIC ELECTRIC ELEMENTS
H02	1	GENERATION; CONVERSION OR DISTRIBUTION OF ELECTRIC POWER
H	15	ELECTRICITY
H05	2	ELECTRIC TECHNIQUES NOT OTHERWISE PROVIDED FOR
B60	1	VEHICLES IN GENERAL
B66	1	HOISTING; LIFTING; HAULING
B33	1	ADDITIVE MANUFACTURING TECHNOLOGY
B25	1	HAND TOOLS; PORTABLE POWER-DRIVEN TOOLS; MANIPULATORS
B65	1	CONVEYING; PACKING; STORING; HANDLING THIN OR FILAMENTARY MATERIAL
B67	1	OPENING, CLOSING {OR CLEANING} BOTTLES, JARS OR SIMILAR CONTAINERS; LIQUID HANDLING

CPC ID	#Projects	Title
B21	1	MECHANICAL METAL-WORKING WITHOUT ESSENTIALLY REMOVING MATERIAL; PUNCHING METAL
B28	1	WORKING CEMENT, CLAY, OR STONE
B23	1	MACHINE TOOLS; METAL-WORKING NOT OTHERWISE PROVIDED FOR
B62	1	LAND VEHICLES FOR TRAVELLING OTHERWISE THAN ON RAILS
F16	2	ENGINEERING ELEMENTS AND UNITS; GENERAL MEASURES FOR PRODUCING AND MAINTAINING EFFECTIVE FUNCTIONING OF MACHINES OR INSTALLATIONS; THERMAL INSULATION IN GENERAL
F24	1	HEATING; RANGES; VENTILATING
G01	1	MEASURING; TESTING
G05	1	CONTROLLING; REGULATING
G06	1	COMPUTING; CALCULATING; COUNTING
C12	1	BIOCHEMISTRY; BEER; SPIRITS; WINE; VINEGAR; MICROBIOLOGY; ENZYMOLOGY; MUTATION OR GENETIC ENGINEERING
D03	3	WEAVING
Y02	1	TECHNOLOGIES OR APPLICATIONS FOR MITIGATION OR ADAPTATION AGAINST CLIMATE CHANGE



3 Highlighted projects

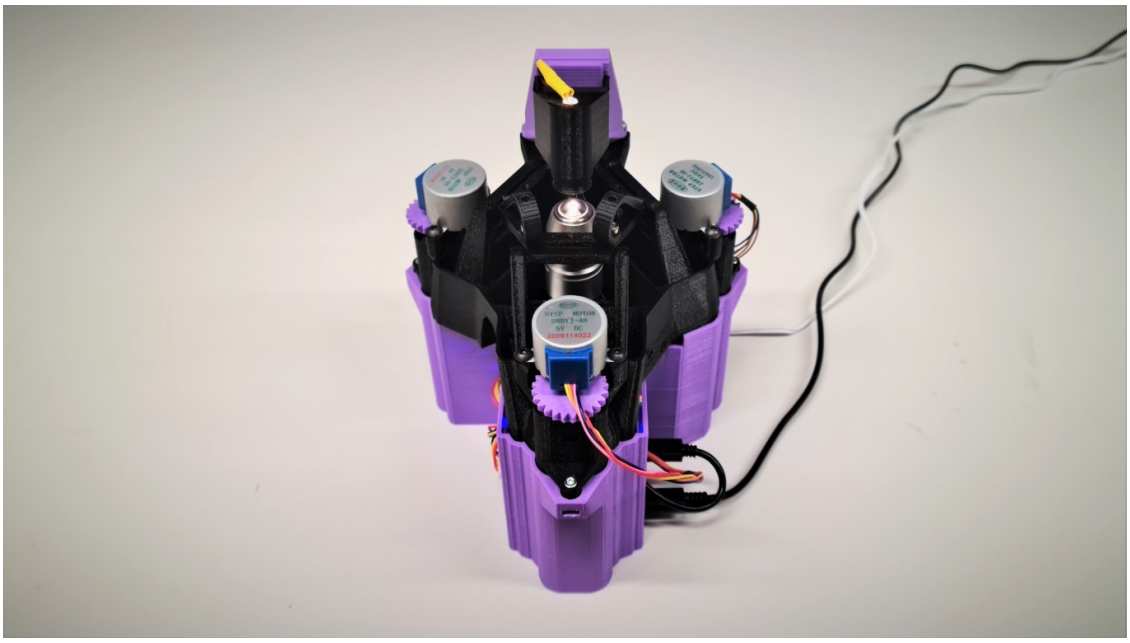
We'd like to take the opportunity to highlight a few selected OSH projects. The team has found that these should be featured as "flagships", providing a reference for what OSH can be in in practice.

If you want to see a specific OSH project highlighted here, feel free to submit your suggestion to rm@oho.wiki, so we can consider it for our next edition of the report.

3.1 The ultimate open source laptop

MNT Reform is an open source hardware laptop, designed and assembled in Berlin. We found that it features the first laptop that is 1) usable as an actual workstation and 2) as open source as possible. Any component in this laptop can be replaced; the product gets shiped with printed circuit diagrams. They even developed some KiCAD modules themselves to make their hardware development possible with a FOSS tool chain. The hardware is licensed under CERN-OHL-S-2.0, firmware and related software under GPL-3.0-or-later. Find the source under `https://source.mnt.re/reform/reform/`. There's also a noteable fork of the design here.

3.2 A 3D-printable microscope



OpenFlexure is a low-cost remote controllable microscope that allows for sub-100 nm fibre alignment with a monolithic plastic flexure stage (reference). To make this possible, the motion control relies on bending rather than moving parts. Apart from being an impressive piece of engineering it is also one of the first OSH projects to get officially community-assessed according to DIN SPEC 3105-2 by OSEG's confirmity assessment body (see below) – and it has been found to provide the best documentation these folks (and our team) have seen in a while (their GitLab repository even performs automated collision tests of parts during development). The microscope comes in a low-cost and a high-performance variant. To make OSH documentation possible (and relatively effortless) at this scale, they even developed their own documentation tool: GitBuilding (GPL-3.0-or-later). Hardware and software source files are available under `https://gitlab.com/openflexure` (e.g. the delta stage is licensed under CERN-OHL-1.2). Most of the core development team are based at the University of Bath (yes, where the RepRap comes from) and the University of Cambridge.

3.3 Open source satellites in space

UPSat is the first satellite made entirely of open source soft- and hardware. It was a project of the University of Patras and the Libre Space Foundation – and indeed launched into space! UPSat left Cape Canaveral (Florida) at April 18, 2017 11:11 EDT to reach the International Space Station (ISS). From there it got released in orbit, see a picture minutes after its deployment above. All data and telemetry that was sent from UPSat is publicly available. However, UPSat decayed at November 13, 2018. Hardware and software source files are available under `https://gitlab.com/librespacefoundation/upsat` (e.g. the frame structure is licensed under CERN-OHL-1.2). The hardware was mainly built and tested in Hackerspace.gr, a hackerspace that aims to provide a 24/7 open space for open source folks and their projects in Athens (Greece).

3.4 Community-based assessment of OSH

Not an actual OSH project, but here to raise the documentation quality of OSH and provide a trustful assessment procedure e.g. for funding bodies.

DIN SPEC 3105 is an official standard published under a free/open license (CC-BY-SA-4.0) defining:

- requirements that qualify hardware as “open source hardware” and
- a community-based assessment process to validate that a given version of a project meets these criteria.

In 2021 two OSH organizations have launched a so-called “confirmity assessment body according to DIN SPEC 3105-2” and hence can act as an independent, community-based authority to verify the licensing scheme and documentation quality of OSH projects. For more information please refer to the organizations directly:

- OHO Certification Center by Open Hardware Observatory e.V. (non-profit);
- OSEG-CAB by Open Source Ecology Germany e.V. (non-profit).

4 Outro

We hope you have enjoyed readings this report and maybe even found a few things valuable for your own projects. Besides that we believe, you might have tons of suggestions how to improve this report, since it is the first one we publish. If you want to support our work, please reach out to rm@oho.wiki.

We also want to point out that we observe lots of (good) motion in the field of OSH and that we are not the only report on the state of OSH. See for instance the annual report from our friends from OSHWA under `https://stateofoshw.oshwa.org/`.

A big THANK YOU to all the human beings out there contributing to our global ecosystem of open source technologies. Keep it up.