

BROADENING THE OPEN SOURCE LANDSCAPE: Insights from the Open Source Hardware Association

By Gabriella Levine and Alicia Gibb



Open source hardware is an alternative to the patent intellectual property (IP) structure. The communally written and accepted definition states, “Open source hardware is hardware whose design is made publicly available so that anyone can study, modify, distribute, make, and sell the design or the hardware based on that design. The hardware’s source, the design from which it is made, is available in the preferred format for making modifications to it.

Ideally, open source hardware uses readily-available components and materials, standard processes, open infrastructure, unrestricted content, and open source design tools to maximize the ability of individuals to make and use hardware. Open source hardware gives people the freedom to control their technology while sharing knowledge and encouraging commerce through the open exchange of designs.”¹

More organizations in industry, design, and technology are adopting the open hardware definition as part of their missions and values, broadening the landscape of source files available for use. Open source hardware has been applied to electronics, fashion, furniture, musical instruments, bio-engineering, and much more. Arduino, a microcontroller and IDE (Integrated Developer Environment) software platform developed for hobbyists to make electronic prototypes, has expanded the world of hardware development for electrical engineers, artists, hobbyists, and even youth.² Open hardware projects cover a range including industrial machines (Open Source Ecology), 3D printers (RepRap), environmental disaster relief efforts (Protei, OpenRelief), space programs (DIY Space Exploration, Mach 30), and underwater robotics (OpenROV).

The Open Source Hardware Association (OSHW) is a pending 501(c)3 nonprofit founded to educate people about open source hardware, collect data from the community, and voice community standards. OSHWA aims to represent the open hardware movement globally.³

Innovating Based on Models

Technology has always been innovated based on other people’s successes, from the discovery that Earth was round to the invention of the telephone, steam engine, or airplane. Although patent laws were originally designed to protect inventors’ ideas and benefit the public good, today patents can sometimes constrain further innovation. Open source is founded upon the belief that the more designs and processes can be open and shared, the quicker that innovation can happen. Open source hardware generally benefits consumers because it enables them to test, alter, and iterate upon the product, thereby allowing for competition within the free market.

There are many examples of successful businesses openly sharing software, such as Mozilla and Linux, but the rise of the open hardware trend is just beginning. This growing trend is founded in the belief

that sharing ideas, designs, and methodologies can bring technological innovation and manufacturing mainstream on local and global scales, making it easier to engineer new solutions to complex problems. Open hardware projects that facilitate free sharing of documentation, source code, and CAD designs are an approach to proliferate innovation.

How to Create Open Source Hardware

As the previously shared open source hardware definition explains, one must document the complete and preferable versions of the files for a design, rather than an intermediate or obfuscated version. For mechanical components and physical designs, the preferable versions are the original CAD files, and for circuit boards, the original schematic and board layout files. The open hardware community has generated a list of best practices for documenting and sharing work related to a piece of hardware so that others can use and modify the work.⁴

Unfortunately, a technology that attempts to be open will often incorporate original design files in proprietary formats from expensive software tools because an open source software equivalent does not exist. In this case, it's helpful and encouraged to offer versions of the design in alternative or intermediate formats that can be viewed and edited with common or free programs. Such formats include PDFs of circuit schematics, Gerbers for circuit board layouts, and IGES or STL files for mechanical objects. These allow people without access to expensive or proprietary software to make use of the design as best possible. However, releasing the *original* files as well defines the core of open source hardware best practice.

Many individuals and companies that produce open source hardware publish design files on their websites when a product goes on sale (e.g., Arduino).⁵ Others store their files in online version control systems (e.g., GitHub or Google Code), so that they are public throughout the design and development process. Further, there are websites specifically designed for sharing hardware designs, like Thingiverse and Instructables.^{6,7} If the inventor adheres to the open source hardware definition, then he or she may use the open hardware logo to denote to the community that the project is open and the source files are publicly available.

Collaboration is Vital in the Open Source Hardware Community

The open source hardware community is made up of a diverse set of people and backgrounds. Participants

often categorize themselves as DIY-ers, engineers, makers, hackers, artists, and activists, and often a combination of these categories. Communities of these people participate in the DIY movement, the rise of makerspaces/hackerspaces (places where like-minded people collaborate and innovate in science, tech, and art), the maker movement, and the open source hardware movement. Similar to the sharing ethos that occurs in the maker and DIY cultures, the open source hardware movement began as a way for people to share information and documentation for fabricating hardware. Several companies and open source hardware projects have branched from other open projects as a result of the knowledge and skill sharing in collaborative work facilities.

In 2012, OSHWA conducted a survey to collect data about the open source hardware community. The survey had 2,000 participants, although this is not representative of the entire open source hardware community. The survey found that 44 percent of the participants were using open source hardware for their jobs/careers. Only 14 percent of participants reported that none of their income comes from building open source hardware, while 86 percent of participants make some or all of their income from open source hardware. Fifty-two percent reported living in the U.S., though this number could be high as the survey was in English, and U.S.-centric despite OSHWA's best efforts to reach out internationally.

Why Go Open?

Patents were created to incentivize inventors and spur innovation in exchange for 20 years of exclusive rights. Patentees have to disclose to the public how their innovation was created. In today's patent system, 20 years may no longer be a realistic timeframe for the pace of technology innovation in the digital age. The barriers and frustrations that the patent system has created are steering inventors to adopt a new alternative to patents: open source hardware. It is vastly easier to innovate on a technology which is open with free, publicly available source files. Open source hardware creates products not driven by building monopolies, but driven by capitalistic pursuits and technological innovation in an open environment. This type of information sharing leads to powerful opportunities for companies and individuals to learn from each other.

To further illustrate these ideals, Nathan Seidle, former OSHWA board member and open hardware business owner of SparkFun Electronics, was invited to testify

to the House Subcommittee on Courts, Intellectual Property and the Internet.⁸ Seidle uses open source hardware rather than patents because his products are innovated within weeks, not years. His products also get copied and reproduced by consumers and users. Patented works get copied, too, but Seidle reports that it is more lucrative to out-innovate a copied product than to litigate. Open source hardware companies value a large community using, sharing, and making derivative products, working towards a common goal of bettering the world of electronics and prototyping tools.

Individuals and companies value open source hardware to make technologies more accessible and attainable by a broader audience. Additionally, open source hardware piggybacks off the DIY movement by valuing giving others design files to build things themselves and fix them when broken. People find it beneficial that open source hardware aligns with the DIY and maker ethics, valuing the ability to control, alter, and personalize the items which one owns. As products swing back to personalization from mass market goods, open source hardware makes personalization of goods possible. Not only does personalization benefit the consumer, but the fact that companies can build off of, curate, and improve other open source hardware products

also means the consumer is getting a better product. Inventors are creating the marketplace and alternate IP system that they want to be part of.

The Future of Open Source Hardware

OSHOWA hosts an annual Open Hardware Summit, which continues to grow each year and attract attendees and sponsors from bigger and bigger businesses. Open source hardware tools, such as open source laser cutters (e.g., Lasersaur) and open source jigsaws are now making it to mainstream markets.^{9,10} Along with these new advancements and growth within the community, OSHOWA recognizes that people want more options for their hardware, even in the open source niche. OSHOWA is looking to develop a labeling system that would graphically represent which parts of a project were open source (e.g., the mechanicals, the electronics, the process, etc.), which parts can be easily fixed if broken, which parts can be recycled, and which parts have instructions for troubleshooting. As open hardware increases the options that inventors have when releasing their technologies, OSHOWA hopes to grow the number of innovations using open source hardware and continue to relay the benefits of open source hardware to the general public. **Q**

Alicia Gibb is the founding President and Executive Director of the Open Source Hardware Association (OSHOWA). Prior to becoming an advocate for OSHOWA, Gibb was a researcher and prototyper at Bug Labs, where she ran the academic research program and the test kitchen, an open R&D lab. She is a member of NYC Resistor, co-founder of the Open Hardware Summit, and a member of the advisory board for Linux Journal. Gibb holds a degree in Art Education, an M.S. in Art History, and an M.L.I.S. in Information Science from Pratt Institute.

Gabriella Levine is President of the Board of the Open Source Hardware Association, and a hardware designer interested in the relationship between technology and ecology. Levine's sculptural and robotic works include *Protei Inc.* (open source sailing drones), *Sneel.cc* (biomimetic swimming snake robots that sense environmental data), and *OCP* (Ocean Collaboration Platform developing marine technologies). She teaches at ITP (Interactive Telecommunications Program, NYU) and CIID (Copenhagen Institute of Interaction Design), and has presented globally at symposia and lectures including the Open Hardware Summit, Startup Festival, TEDxNavesink, and *Unreasonable@State*. Gabriella holds a Master's degree from ITP, Tisch School of the Arts, NYU.

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