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Can Open-Source Hardware Save Lives? Study provides new insights into open-source manufacturing of ventilators

Right at the start of the COVID-19 pandemic, the open-source hardware community took action to help manufacture much-needed medical equipment. In a recent study, Fraunhofer IPK researchers explore how ventilators can be manufactured quickly, safely and in a decentralized manner.

April 2020: The SARS-CoV-2 pandemic is straining healthcare systems to the limit of their capacity, and in some cases beyond. The shortage of life-saving ventilators is particularly critical, as manufacturers' supply chains are partially breaking down.

At this point, individuals, communities, companies, and research institutions are beginning to design and develop ventilators that can be manufactured using local and freely available resources – as open-source hardware (OSH). Ventilators are comparatively complex devices which contain mechanical, electrical and software components. Their manufacturers must comply with strict regulations imposed by national authorities. So how do we ensure that decentralized manufacturing is implemented effectively and efficiently? And how can one guarantee the safety and functionality of the ventilators produced?

The OPEN.Effect project started in May 2020 with the goal of collecting, analyzing, and evaluating information on open-source projects for manufacturing ventilators during the pandemic. Scientists from the Fraunhofer Institute for Production Systems and Design Technology IPK collaborated with the nonprofit organization Public Invention to develop a solution approach based on the COVID VENT LIST, a publicly viewable list of projects on open-source ventilators that was jointly edited by the project partners. The results of the research will be fed back into the COVID VENT LIST to help evaluate past projects and plan and implement future ones.

Based on Public Invention's preliminary work on the COVID VENT LIST, the researchers were able to quickly build a nuanced understanding of the global open-source hardware landscape. This allowed them to interview 27 contributors to 14 representative projects in the OSH community about their experiences. Interviewees came from a variety of disciplines, including project management, software and hardware development, and design. A variety of organizational forms were also represented, from open communities to non-profit organizations, research institutes to companies. The interviews were based on 13 criteria for OSH projects developed from the preliminary research, including examples such as openness, buildability, and COVID-19 suitability.

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The results of the interviews provide an overall picture of the status of the projects, which approaches have proven to be optimal, and which challenges have emerged. Based on this information, the authors of the study derive guidance that may be helpful for other OSH projects in the future. For example, one of the recommendations in the area of buildability is that, due to the difficult supply chain situation, standardized components and interfaces should be used to enable modularity and interchangeability of different systems.

Overall, the study shows that it is possible for open communities to successfully develop and manufacture rapid and secure solutions to a critical problem during the pandemic.

The full English-language study is now available for free download at www.ipk.fraunhofer.de/open-effect-en.

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**Can open-source ventilators be manufactured safely on a large scale? Left: © Fraunhofer IPK
Right: © phonlamaiphoto / Adobe Stock**