

## **Abstract**

Studies on open source hardware (OSHW) have estimated a \$1 billion dollar market size with hundreds of startups and thousands of active projects and those numbers are growing. Traditional proprietary hardware is generally expensive and closed to improvements while OSHW is low cost and has design flexibility. The tradeoff is the necessity of comprehensive documentation with OSHW. This thesis shows that 95% of OSHW projects lack the documentation required to properly share designs for replication. This research studies the causes of this shortcoming and creates a process framework to improve project creation and sharing that if adopted, will allow users to consistently create high quality hardware and documentation.

This thesis collected data from surveys, interviews, and case studies. A study of over 100 projects on 7 platforms and stakeholder surveys was conducted to characterize existing OSHW practices. Over 20 educators, students, and makers, were interviewed to better understand design methodologies. Two ongoing hardware collaborations with Mount Sinai were used as case studies to test aspects engineering design and documentation.

The analysis showed OSHW projects average 7 of 10 documents needed for replication. Test documents were most underrepresented. Case studies teams only completed 64% of their original requirements primarily due the lack of inherited documentation and deviations from critical path tasks.

A new engineering design framework called PFO (Process Framework for Open Hardware) was created to fix the deficiencies discovered in the research. Future implementation of PFO will provide stakeholders with tools to seamlessly integrate process and data which will improve project completion rates and documentation quality.