Final Report: FOSH Literature Review

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Our project was a systematic literature review of Free and Open Source Hardware (FOSH). Since starting to look at the literature on this subject, we have learned many things.

Firstly, the field is relatively new, yet somewhat vast at the same time. The types of hardware we are considering were very limited. There have been two journals that have been started since 2017, and our project will base most of its review. This is good news for our project since it means our review is a systematic review of almost *all* the literature on this subject.

Given the new information, we have refactored and refined some of our research questions. Some questions from the proposal may be beyond the scope of a single paper to be answered, so some may be omitted altogether.

You can see a repository of our project along with a working document **??** that goes over the details here (Not finished).

Additional Key Words and Phrases: Open source design, Open source hardware

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1 INTRODUCTION

1.1 Background and Motivation

The free and open source movement is defined by the following four principles:

> A program is a free software if the program's users have the four essential freedoms:
> - The freedom to run the program as you wish, for any purpose (freedom 0).
> - The freedom to study how the program works, and change it so it does your computing as you wish (freedom 1). Access to the source code is a precondition for this.
> - The freedom to redistribute copies to help your neighbour (freedom 2).
> - The freedom to distribute copies of your modified versions to others (freedom 3). Doing this gives the whole community a chance to benefit from your changes. Access to the source code is a precondition for this.
>
> A program is a free software if it gives users adequately all of these freedoms. Otherwise, it is non-free. While we can distinguish various non-free distribution schemes in terms of how far they fall short of being free, we consider them all equally unethical.

[Stallman 2015].

These four principles have started a movement that has revolutionised intellectual property and specifically technology. We have seen the vast social and technical benefits of this movement. The free and open source movement has democratised access to information and technology: any person has access to the basic principles of [Stallman 2015] on the best software. The movement's technical benefit has been the increase of innovation and collaboration. It is no wonder when neighbours help each other build, we have software like the Linux Kernel, Mozzila Firefox, and many others.

These four principles have been applied to other fields than software. Similar to the free and open source software (FOSS), free and open source hardware (FOSH) is any piece of information that is needed to exercise the four principles as it applies to hardware. These include anything such as design files, blueprints, specifications, documentation, and even software for the building, designing, modifying, distributing, and using hardware. A common example of FOSH is Arduino used for single board microcontrollers in a variety of applications.

FOSH has been growing in interest over the years. This is evident in terms of the increasing number of projects, associations, literature. The Open Hardware Association tracks 2057 FOSH projects to date [OSH 2021]. It also lists multiple journals that have started since 2017. These include,

- Journal of Open Hardware
- HardwareX
- The Journal of Open Engineering
- Computers, Design and Technologies from MDPI
  - https://www.mdpi.com/journal/computers
  - https://www.mdpi.com/journal/designs
  - https://www.mdpi.com/journal/technologies

The new development FOSH provides researchers an interesting study on the open source movement outside the common FOSH movement. This is the goal of this project.

1.2 Research question

To understand FOSH one needs to understand its various types, scopes and applications. Therefore, we ask

RQA: What are the types, scopes, and applications of FOSH?

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Secondly, to measure the level of freedom as described by the four principles of [Stallman 2015], we ask

RQB: What are the licences of the components of FOSH in each type?

Thirdly, we would like to understand the collaboration environments of FOSH.

RQC: How do the collaborations of FOSH take place?

1.3 Significance

The results of this study are significant as they provide insights to understanding the free and open source movement. Its results can be used to improve aspects of FOSS or other similar movements both socially and technically.

Answers to the application of FOSH can determine the success or limitations of the movement. The information on licencing could provide answers to the importance practitioners have on the principles, as well as how they are packaging their products. Understanding collaboration environments is essential to understanding the social aspect of how people exercise the four principles of freedom defined by [Stallman 2015].

2 METHODOLOGY

The main methodology of the systematic literature review is backward propagation. To answer the question regarding the collaborative environments, our method is a grey literature review. The qualitative questions posed can be effectively answered by a systematic literature review, as the movement is very young. Most if not all the literature on the subject can be reviewed, along with all the projects listed by the Open Source Hardware Association.

2.1 Search Strategy and Selection Criteria

The publications of the FOSH journals were the initial pool of publications for our search.

TODO add what we did

2.2 Data Extraction and Analysis

2.3 Quality assessment

3 RESULTS

4 DISCUSSION

Discuss the potential future developments, opportunities, and challenges that FOSH is facing as well as identify the fields where we could focus more attention on FOSH

5 CRITIQUE AND SOLUTIONS

6 CONCLUSION

Conclude the result we found and answer the research questions.

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to be finished

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