ROMI
ROBOTICS FOR MICROFARMS

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1 Overview

The ROMI project has been built with a IPR strategy based on the open hardware model (OSH). This strategy is approved by the whole consortium and has been clear objective of the project proposal.

The following results of the ROMI project are susceptible for exploitation:

- The **LettuceThink** rover (WP2). This includes the hardware design and the software to operate the rover.
- The **3D Plant Scanner** (WP2, WP5 & WP6): This includes the hardware design and the software for the 3D plant scanning, data storage and data post-processing.
- The **cablebot** (WP3): In the initial proposal, there was no intent to commercialise the drone because the market is hyper-concurrential and saturated. However, making the cablebot available, possible as an integrated package with the rover, may be a possibility.

In addition, throughout the project **data sets** will be collected that may be of interests to third parties. The IPR and availability of these datasets is discussed in D8.1 - Data Management Plan.

In the remainder of this document, we first present the study of the Open Hardware model that we performed in order to deepen our understanding of OSH model and its institutions. Following that, we briefly look at the OSH model in the context of ROMI. In the last section, we briefly recall the main aspect of our Data Management Plan.

2 Open Source Hardware model

2.1 What is Open Source Hardware

2.1.1 History and definition of the Open Source Hardware

“Open source hardware is hardware whose design is made publicly available so that anyone can study, modify, distribute, make, and sell the design or hardware based on that design” (**Open Source Hardware Association 2016**).

The Open Source Hardware movement (OSH) was built after the Open Source Software movement (OSS), which itself emerged from the Free Software Movement led by Richard Stallman in 1985. Advocating for free use and distribution of software against monopolies such as Microsoft and IBM, the movement was concerned with the ethical reasons of freely using (in terms of liberty of use documentation and ideas of others), modifying and distributing software[1].

The different Open ideology [branches] have a core characteristic: it emerges as an alternative product development pattern based on free distribution of information. Open hardware is a work-in-progress: there is no precise and legal definition of an Open Hardware project and no criteria

[1] https://www.researchgate.net/publication/316884384_DETC2017-68195_WHY_OPEN_SOURCE_EXPLORING_THE_MOTIVATIONS_OF_USING_AN_OPEN_MODEL_FOR_HARDWARE_DEVELOPMENT

had been set up. As such, with a sufficient level of cooperation and collaboration, a network of individuals sharing 3D printing design, could be considered as open hardware[2].

2.1.2 Opening hardware: elements of context

Open Source Hardware (OSH) is a term for tangible artefacts - machines, devices, or other physical things - whose design has been released to the public in such a way that anyone can make, modify, distribute, and use those designs[3].

This hardware component, underlies an adaptation to the realms of tangible products of the original Open Source Software concepts[4] :

- Software is digital by nature: it is made of series of characters, a format that can be shared and displayed online without specific tools. Hardware may need to be described through more complex constructs like 2D or 3D schematics, which may require more specific software to be edited and displayed[5].
- The aspect of physical object design in OSH has strong impacts on required skills, tools, and infrastructure. This aspect is even increasingly salient as the focus of OSH progressively expands towards many other forms of hardware than electronic hardware, like mechanical, construction, medical, optical, agricultural or textile hardware[6].

OSH is a work-in-progress, there is no standards and definitions of what an Open Hardware project is certainly, and how to make it. Every practitioner and academics had their own definition of Open Hardware, putting emphasis on different elements[7]. Through these definitions main elements of context in which the OSH model evolve are:

- A precise and free-of-use documentation,
- The involvement of a community around the project.

2.1.3 The Open Source component: the free use of the Documentation

TAPR (the creator of the TAPR License, one of the OSH-dedicated license[8]) considered that the main element in OSH is the documentation, its accessibility and its free use: “Open Hardware is a thing - a physical artifact, either electrical or mechanical - whose design information is available to, and usable by, the public in a way that allows anyone to make, modify, distribute, and use that thing. Design information is called "documentation" and things created from it are called "products."”[9].

The OSHWA (Open Source Harware Association - https://www.oshwa.org/) identified it as a main element to characterized an OSH project : “open source hardware is hardware whose design is made publicly available so that anyone can study, modify, distribute, make, and sell the design or hardware based on that design” (Principle 1.0).

One of the main element of context in common with definitions and

Every hardware could be the subject of OSH, once the documentation is:

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[2] As an example: the Thingiverse project, a web platform to upload and download 3D printing plans. https://www.thingiverse.com/

[3] https://www.researchgate.net/publication/316884384_DETC2017-68195_WHY_OPEN_SOURCE_EXPLORING_THE_MOTIVATIONS_OF_USING_AN_OPEN_MODEL_FOR_HARDWARE_DEVELOPMENT

[4] https://openhardware.metajnl.com/articles/10.5334/joh.7/

[5] https://www.worldscientific.com/doi/abs/10.1142/S021987701100260X

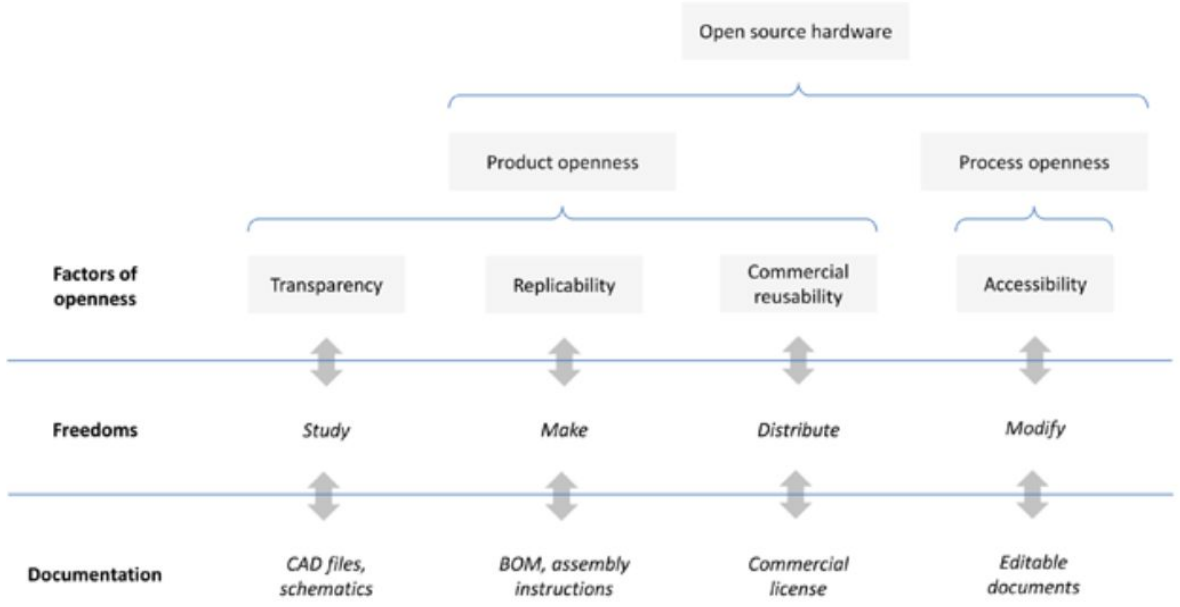
[6] https://openhardware.metajnl.com/articles/10.5334/joh.7/

[7] https://openhardware.metajnl.com/articles/10.5334/joh.7/

[8] See XXX

[9] http://www.tapr.org/ohl.html

- **Enough detailed to allow the reconstruction and the use of the object**: it includes schemes, notices, plans, requirement specifications and designs. Other elements, less technical, could be created specifically to explain some points (videos, assembly instructions, etc.), in order to allow anyone, even the less technical, to, at least, use the product.
- **Public accessible to anyone**: this point tends to be more and more important in the definition of an OSH project. Recently, in august 2018, the OSHWA has decided to give an OSH certification back because the documentation was not accessible online anymore.
- **Free of use**: all the documentation has to be free of use. This free of using, modifying and distributing mean to have a specific license, which allow, on the one hand, those aspects and, on the other hand, guarantee those rights to everyone with a prohibition of selling it or place the documentation under a copyright license.



Source: *https://openhardware.metajnl.com/articles/10.5334/joh.7/*

2.1.4 The collaborative component: a living project

The open source hardware (OSH), which is a recent movement appeared in 2010s, transfers open source from their origins in software development to the physical objects. Like free and Open Source Software, OSH is an internet enabled phenomenon. As such, platform and communities are playing a strong role in fostering product-related data sharing, community-based product development as well as the emergence of OSH-based business models[10].

Another definition of the OSH puts the emphasis on the community around a project: « OSH can be described as individual or participatory realisation of a shared product design [...] Unlike in software, attributing appropriate licences is not sufficient to call hardware open source. Given OSH is a sociotechnical phenomenon, the answer primarily depends on how the product documentation enables co-development and replication."[11].

This definition considered the collective aspect of the designs as the primary determinant of Open Hardware. In OSH project, the community are not clients and the project manager entity has not to provide a customer service. In the OSH theory, an Open Hardware project has to create a conceptual

[10] https://openhardware.metajnl.com/articles/10.5334/joh.7/
[11] https://openhardware.metajnl.com/articles/10.5334/joh.7/

space that support collective spirit and collaborative problem solving within a continuum from individual to collective intelligence[12]. The role of the project manager is to define a degree of collaboration with and within the online community, and a place (physical or digital) to communicate[13].

Thus, the community is here online. As with online forums, members can be moderators, fully active contributors, contribute only once or sporadically, or observing passively[14]. In the philosophy, social dynamics co-create OSH products. Depending on the participatory roles of actors, they may engage as followers, replicators, developers, or community managers. In the frame of open innovation, in addition, actors may as well include individuals, firms, as well as any other types of organizations[15].

Open source systems set a community-based context of process learning, as well as effective technology outputs. In contrast, within the purely proprietary context, purpose is realized by the efficient generation of technology outputs within organisations with clear boundaries[16].

As a consequence, a project manager has to ensure a communication with the community.

2.1.5 Which degree of openness ?

⇨ What information has to be shared in order to allow any interested person to study, modify, make and distribute a piece of hardware ?

No further details on the nature of the documentation to be published has been given. However the 3 factors of openness are introduced as preconditions for an OSH project:

- Transparency refers to the possibility for any interested person to access sufficient information to understand the product in detail without restriction.
- Accessibility refers to the possibility for any interested person to edit design information and therefore to further develop the product.
- Replicability refers to the possibility for any interested person to physically produce the product.

2.2 Legal rules : Open Licences

No national laws provide legal standards for an Open Hardware project and no legal standards are required to call a project OSH. Any producer may self-certify at any time that their products as Open Source Hardware. The licenses are developed by associations (as the Open Initiative Association, the Free Software Association, etc.).

Since 2016, the OSHWA sets standards to characterize a project as OSH and offer a labelling system, through the form of a contract between the society/association and the OSHWA. To obtain the certification, 5 criterias concerning the product has to be fulfilled:

1. Create products that comply with the community written open source hardware definition hosted by OSHWA.

[12] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.455.9072&rep=rep1&type=pdf
[13] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.455.9072&rep=rep1&type=pdf
[14] http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.455.9072&rep=rep1&type=pdf
[15] https://www.researchgate.net/publication/228315250_Getting_Clear_About_Communities_in_Open_Innovation
[16]https://www.researchgate.net/profile/Michael_Wade6/publication/220580481_A_Comprehensive_Review_and_Synthesis_of_Open_Source_Research/links/563b5c7c08aeed0531de7d8a/A-Comprehensive-Review-and-Synthesis-of-Open-Source-Research.pdf

2. Ensure that all of the creator's own contributions to an open source product using the certification mark are shared as open source in accordance with the agreement and these requirements.
3. Ensure all parts within the creator's control are open source. Use best efforts to distinguish any third-party proprietary components. Third-party components such as chips must have fully accessible and shareable datasheets for hardware to be considered open source.
4. Self-certify each project into the program by completing the online license form and responding to yearly renewal requests.
5. Register with OSHWA each unique product bearing the Certification Mark, and otherwise abide by the usage guidelines.

⇨ Based on the evaluation of a pool of 20 OSH projects whose products embedded both software and hardware components, Balka, Raasch, and Herstatt (2014) highlighted that hardware components were generally less documented than the software components. As noted above, in order to be certified under this program all parts, designs, code, and rights under the control of the creator must be made open according to the open source hardware definition hosted by OSHWA.

2.3 IPR rules

The growing interests of commercializing OSS led to the approvals of a set of licenses managed by the Open Source Initiative, a formal organization founded in 1998 in charge of reviewing and approving open source licenses[17].

All open source licenses implements the principle of copyleft, which allow every user of the content to copy, modify and redistribute an open-patented work, with conditions or not, for a commercial purpose or not.

Open Source licenses differs from commercial licenses in two main points:

- Open licences offer a perpetual, worldwide, non-exclusive, no-charge, royalty-free, irrevocable patent license,
- The Open licences concern the original work (artistic content, software or hardware) and the adapted content.

2.3.1 Lacks of Open Source Hardware dedicated licenses

An open Hardware project contains at least 3 components:

- A creative component : designs, schematics, images, etc
- A software component
- An hardware component

All of the components have to be licensed, otherwise national standards applied, and every EU Member States have different standards in terms of intellectual property. To ensure an homogeneous protection for all parts of an OSH, two dedicated worldwide licenses have been implemented.

[17] https://www.researchgate.net/publication/316884384_DETC2017-68195_WHY_OPEN_SOURCE_EXPLORING_THE_MOTIVATIONS_OF_USING_AN_OPEN_MODEL_FOR_HARDWARE_DEVELOPMENT

- CERN Open Hardware License[18]
- TAPR Open Hardware License[19]

⇨ See the "Annexe 1 – Comparison of Open licences" to obtain more information

However, those dedicated licenses are not complete: OSH License specifically covered the documentation (technical files and process of fabrication) of the technical materials. Software components, explanatory videos and not technical files are not covered by the licenses.

In the absence of clear guidance on this issue, it is not easy to draw a line between which piece of hardware is open source and which is not, even when licensing terms may be clear.

2.3.2 Case study

In order to compare the legal models implemented in different OSH project, we provide in the Annexe 2 "Comparison of legal models" a list of OSH projects with the licenses used.

Those list was established after the OSH project created in 2017 and referenced in the Open Hardware Journal "HardwareX"[20].

It appears that most of the hardware projects in 2017 used a Creative Common License or an Open Source Software license (or a combinations of the two) instead of the OSH Licenses. The latter are very recent and still developing, and a lot of mist stay around the legal validity[21]. Most of the projects prefers to use a combination of other licenses to provide an appropriate protection.

2.3.3 The Creative Common Licenses family

The Creative Commons Licenses are the first-born of the Open Source Movement. CC licenses are legal tools that creators and other rights holders can use to offer certain usage rights to the public, while reserving other rights. 6 different licenses offer 6 combinations of rights an obligations, without needed to be ported.

CC Licenses wear on two types of content:

- The "Material": artistic or literary work, database. CC Licenses could covered software, but not hardware.
- The "Adapted material": derived from or based upon the original material: translated, altered, arranged, transformed, or otherwise modified.

CC Licenses are limited for an OSH project by two sides:

- The Creative Commons family explicitly[22] not cover the hardware.
- The license protect only identified materials: every material which is not marked under the CC License is not consider as Open Source material.

2.3.4 Open Software Licences

Open Software licences are numerous. We concentrate on the licences validated as Open Source Software licences by the Open Source Initiative[23].

[18] https://www.ohwr.org/documents/294
[19] https://www.tapr.org/ohl.html
[20] https://www.sciencedirect.com/journal/hardwarex/vol/1/suppl/C
[21] https://opensource.com/law/15/2/intro-open-hardware-licensing
[22] "CC licenses are appropriate for all types of content you want to share publicly, except software and hardware.", https://wiki.creativecommons.org/wiki/Considerations_for_licensors_and_licensees#Considerations_for_licensors
[23] https://opensource.org/licenses

Licences provide rights and obligations:

- On the source code, all software or parts of the software explicitly patented
- On the original material and the derivated work

The GNU General Public License, developed by the Free Software Foundation, is considered as the main license of the area.

2.3.5 Conclusion

A complete legal protection of an OSH project need to implement at least two different licenses.

1. Determine the objects to protect (image, videos, technical files, etc).
2. Applied licenses, depending the different obligations regarding the distribution

2.4 Security Standards

Open Source Hardware Licenses do not provide any warranties concerning the legal standards: even a machine which not comply with the security standards could obtain a license.

The security standards are set up at the EU level, through the 2006/42/CE directive for machineries. The security standards are homogeneously applied in all the EU area, however the implementation has to be validated by a special committee. The validation of the craft provide the "CE" marking, which allow a product to be commercialised in all the EU area[24].

Besides, at the international level a special set of ISO regulation concerning the agricultural electronic is currently under development (ISO/TC 23/SC 19)[25].

2.5 Business Models

The OSH is built as a disruptive change on the upstream end of value chains toward value-co-creation, and liberty of use. However, the "liberty of use" was not necessarily interpreted as a free product in the end. Indeed, OSH provides successful businesses for which the scientific community identified corresponding value creation models.

Economic exploitation is free. In Annex 3 – Business Models we provide an overview of the main business models in the OSH projects.

The study was realised after the list of Open Source Hardware Projects recently published in:

- The OSHWA certification website : http://certificate.oshwa.org/certification-directory/
- The CERN License repository : https://www.ohwr.org/projects/cernohl/wiki/cernohlprojects
- HardwareX projects : https://www.sciencedirect.com/journal/hardwarex/vol/4/suppl/C

2.6 Sources

Associations :

OSHWA Foundation : https://www.oshwa.org/

[24] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32006L0042
[25] https://www.iso.org/committee/47156/x/catalogue/

Open Source Initiative : https://opensource.org/

Open Source Hardware Summit : https://2018.oshwa.org/

Repositories :

Open Hardware Repository : https://www.ohwr.org/

Journals :

Hardware X : https://www.journals.elsevier.com/hardwarex

Journal of Open Hardware : https://openhardware.metajnl.com/

3 OSH model applied to ROMI

Our IPR model is based on the commitments that have been written in the Grant Agreement and we that was already proposed during the proposal preparation:

- "All project results will be accessible under an open hardware/software model"
- "The spin-off will build its business model based on Open Hardware and Free Software technology model"

The technical annex of the Grant Agreement details these topic:

- On the topic of project result exploitation

"An exploitation plan based on an Open Hardware business model"

"Creation of a Spin-off company

Open Hardware model

In the second half of the project (M25-48), the prototype will be finalised into commercial grade releasable platform. This activity takes place in WP8, and relates specifically to Objective 6. The platform itself will be sold to the market through the creation of a new start-up company by the end of the thirty sixth (36) month programme of work. This creation will be prepared by the Exploitation Board of the project (see section 3.2). Over the past two years, partner Sony has already started building up a support network in the Paris region for the creation of a spin-off. It can count on the help of Iaac, which in recent years has established itself as a key partner in Barcelona's highly dynamic start-up scene. The spin-off will build its business model based on Open Hardware and Free Software technology model. Notable successes of such business models include the Arduino platform for electronics, the Lulzbot 3D printer (Aleph Objects 42), the CNC producer Inventables, OSVehicle, etc. Other relevant companies include Adafruit and Sparkfun, who have set up complex ecosystems for electronics and robotics components."

- On the topic of project result dissemination

"A significant effort is spent in the management of the user community. Most of the communication channels are online (social networks, collaborative platforms).

The community is highly implicated in the participative design of new developments. All software and hardware components are documented and modifiable.

A high investment in brand recognition.

Relentless focus on R&D (design, usability, development and documentation); hardware production and logistics is outsourced.

The main value of the company is (i) its community of users and contributors, (ii) the brand recognition, and (iii) the ecosystem of third party developers and service providers.

Inspired by the success of the Arduino ecosystem, we will register a trademark to control the quality of third-party software and hardware tools. In addition to selling Open Hardware, the company will have a license structure for third parties that wish to use name of the robot to advertise the quality and compatibility of their products. The start-up will also provide assistance to those designers who develop apps and tools for the robot, to bring their products to the market using a profit-sharing mechanism."

- On the topic of intellectual property

“All of the partners have made their work available under free software licenses. Most of the technology will therefore be free of license fees or royalties. During the first six months of ROMI, the consortium will do an in-depth analysis of the licensing situation in order to assure that the situation is completely clear. In case some of the technologies are non-free, the option to license the technology will be discussed among the partners.

Trademark: The spin-off will deposit a trademark to

- *protect the branding of the platform,*
- *control the quality of the apps and extensions produced by third party developers,*
- *obtain a license fee and/or revenue sharing agreement for companies that use the brand name*
- *to promote the compatibility of their products with the platform.”*

“ROMI's data management policy will be developed in the WP8 as a complete Data Management Plan (DMP) that will be carried out during the first six months of the project (See deliverable D8.1: Data Management Plan). We will consult experts in the Open Data field that will support our data management plan.”

3.1 Evaluation of prior knowledge in the the Consortium Agreement

Our consortium agreement has been prepared by taking into account this commitment. Thus, we check that all background (pre-existing knowledge) brought to the project is proposed on open license (the foreground is talked in the Data Management Plan):

List of background brought to the project

IAAC

Describe Background	Specific limitations and/or conditions for implementation (Article 25.2 Grant Agreement)	Specific limitations and/or conditions for Exploitation (Article 25.3 Grant Agreement)
Smart Citizen Platform and other web tools	Licensed under AGPL v3.0	Licensed under AGPL v3.0
Smart Citizen Kit Firmware Firmware	Licensed under GLP v3.0	Licensed under GLP v3.0
Smart Citizen Hardware	Licensed under CERN OHL v1.2	Licensed under CERN OHL v1.2
Smart Citizen Enclosures and accessories	Licensed under Creative commons CC-Attribution-ShareAlike 4.0 International	Licensed under Creative commons CC-Attribution-ShareAlike 4.0 International
The plans of the Nero Drone by Noumena	Licensed under Creative commons CC-Attribution-ShareAlike 4.0 International	Licensed under Creative commons CC-Attribution-ShareAlike 4.0 International

Software Developed for Nero Drone by Noumena	ReImplementing existing GDAL library X/MiT as NERO grasshopper library X/MIT	ReImplementing existing GDAL library X/MiT as NERO grasshopper library X/MIT

SONY

Describe Background	Specific limitations and/or conditions for implementation (Article 25.2 Grant Agreement)	Specific limitations and/or conditions for Exploitation (Article 25.3 Grant Agreement)
The plans of the 3D scanning station	Licensed under the Creative Commons Attribution-ShareAlike 4.0 International Public License	Licensed under the Creative Commons Attribution-ShareAlike 4.0 International Public License
The plans of the LettuceThink prototype	Licensed under the Creative Commons Attribution-ShareAlike 4.0 International Public License	Licensed under the Creative Commons Attribution-ShareAlike 4.0 International Public License
The core software of the LettuceThink platform (source code and binaries)	Licensed under the GNU General Public License version 3	Licensed under the GNU General Public License version 3
The software of the prototype of the weeding application (source code and binaries	Licensed under the GNU General Public License version 3	Licensed under the GNU General Public License version 3
The software of the prototype of the 3D scanning application (source code and binaries)	Licensed under the GNU General Public License version 3	Licensed under the GNU General Public License version 3

INRIA

Describe Background	Specific limitations and/or conditions for implementation (Article 25.2 Grant Agreement)	Specific limitations and/or conditions for Exploitation (Article 25.3 Grant Agreement)

PlantGL : Python-based geometric library for 3D plant modelling at different scales	PlantGL is distributed under CeCILL-C license.	PlantGL is distributed under CeCILL-C license.
LPy : An open source python version of the Lindenmayer Systems	LPy is distributed under CeCILL-C license.	LPy is distributed under CeCILL-C license.
OpenAlea : Modeling framework for Python libraries and tools that address the needs of current and future works in Plant Architecture modeling. OpenAlea includes modules to analyse, visualize and model the functioning and growth of plant architecture.	OpenAlea is distributed under CeCILL-C license.	OpenAlea is distributed under CeCILL-C license.

CNRS and legal entities composing the Laboratoire Reproduction et Développement des Plantes as joint research unit

Describe Background	Specific limitations and/or conditions for implementation (Article 25.2 Grant Agreement)	Specific limitations and/or conditions for Exploitation (Article 25.3 Grant Agreement)
Measurement tool et measurement protocol for the Arabidopsis Thaliana phyllotaxy	Accessible to consortium partners to perform measurements	Acknowledgement of the use of the CNRS protocol required
Database of raw data and statistics of the Arabidopsis phyllotaxy	Accessible to consortium partners to validate results of plant scanning algorithms	Acknowledgement of the use of the CNRS database required

3.2 OSHWA label

The OSHWA label does not provide any additional legal protection other than the protection offered by licences applied to the designs and software. However, the label signals a strong commit towards the OSH community. As such, we will seek certification for at least the LettuceThink rover and the 3D Plant Scanner (https://certification.oshwa.org/).

This process will be started when the prototypes have become sufficiently “stable” (when the devices are sufficiently usable and when we don’t plan any major changes to the design) and before we start the exploitation of the results.

3.3 Creation of a community of users/developers

The community of users/developers is one of the most valuable part of the OSH business model. Iaac and Sony are therefore communicating the project towards the various communities (farmers, makers, ...) that are most likely the early adopters of our results:

- Presentations and demonstration at the FabCity Summit and Campus in Paris.
- Presentations in many FabLabs.
- Presentation at the International Forum for Agricultural Robots, Toulouse.
- Workshops with various farmers networks and representatives of the Ministry of Agriculture.
- Presentations at dedicated networking events for innovation in agriculture.

As the prototypes become more usable and documented, we plan to increase visibility on the Internet, and particularly through dedicated forums on the ROMI web site.

4 Data Management Plan

The data management (Deliverable D8.1) gives information on the IPR policy of Foreground generated during the project. Results are sorted-out in different categories:

1. **Design files**: This category covers any of the following: the documents describing the hardware & software design, the experimental set-up, the protocols of the field studies, the hardware design etc.

2. **Source code**: The program files, the analysis scripts...

3. **Collected & created data**: This includes the data collected in the indoor & outdoor field studies and in the phenotyping experiments, but also the collection of generated images used in the machine learning (see below). It is important also to distinguish between:
   - **Experimental data sets**: These sets include data that is collected during development, testing, and exploring. The data may be voluminous, noisy, unstructured, and incomplete.
   - **Systematic data sets**: This data has clear scientific value. These data sets were systematically collected, cleaned, and prepared and may therefore have more value for the scientific community. The data sets that are used in publications by the consortium fall into this category.

   The (collected and created) datasets that are most useful for publication are:

   1. **Outdoor Studies Data**: Data collected using the NERO drone and LettuceThink robot during the outdoor field studies: the photos taken automatically (drone, robot and time lapse cameras) and the environmental data.
   2. **Plant Models Images**: The synthetic images created to train deep learning networks or to test computer vision algorithms.
   3. **Scanning Data**: Data collected using the plant scanner: Images captured for selected

plants in indoor/outdoor settings using various 2D and 3D cameras images to evaluate the algorithms of the scanner.

4. **Adaptive Systems Data**: Data collected during the experiments of the adaptive systems (development, testing, reference).
5. **Phenotyping Data**: Data collected through the manual scoring from laboratory experiments on Arabidopsis thaliana (and possibly other plants).
6. **Plant Growth Data**: The datasets used to analyse the plant growth. This dataset will probably be a subset of the other datasets (1, 2 & 4 above).

4. **Analysis results**: This category covers the manuscripts that document the analysis and evaluation of the data. This may include figures, selected datasets and source code that are used to illustrate the texts.

5. **Media files**: This contains photos, videos, and audio recordings that document the ROMI project and visual material for presentations. These data are not already classified in the other categories

These datasets may overlap. This is most obvious for the Plant Growth Data that uses data from the field studies but an overlap may also exist, for example, between the Scanning Data and the Outdoor Studies Data.

The IPR policy of each of this type of data is the following one:

	Design files	**Source code**	**Collected & created data**	**Analysis results**	**Media files**
Licensing	Creative Commons license	Open Source license	Creative Commons and/or Open Data license	Creative Commons and/or Open Data license	Creative Commons license
Embargo			Available last three months of project end. Data sets and analysis results may be made available after an embargo period to allow for scientific publications.		NA
Useable by third-parties	Yes	Yes	Yes	Yes	Yes
Data quality assurance process	Best effort, no guarantees	Best effort, no guarantees	Experimental data sets: Internal review Systematic data sets: Following best practices of targeted scientific community	Following best practices of targeted scientific community	NA
Length of time	5 or 10 years	10 years	5 years (large, experimental data sets), 10 years (other)	10 years	10 years

Design files: The design files will be made available as under a Creative Commons license. The files will be made available during the last three months of the project, or before according to the needs to collaborate with third parties. A snapshot of the files will be kept on the ROMI project server for at least 5 years.

Source codes

The software will be made available under a Free or Open Source license. It will remain accessible on cloud-based code repositories and is freely useable by third parties under the conditions laid out in the license. The source code will be copied to the public repository only after significant testing by the project partners, and the code will have well-defined versions to aid with the tracking of problems. The partners will make the best effort in assuring the quality of the code but cannot guarantee usability and do not give any warranty against failures, data loss or damages that may have been caused by the software.

Collected & created data

The data will be licensed under Creative Commons CC BY 4.0 International. All data will become available during the last three months of project end. Parts of the data can become available even before due to journal publications. An embargo period to allow for scientific publications may be applied.

The data can be re-used by other scientists. Neighboring disciplines and interdisciplinary research groups might also be interested, because of our chosen methodological approach.

The data quality is ensured by different measures. These include validation of the sample, replication, comparison with results of similar studies and control of systematic distortion.

As open formats are used for data archiving, the data will remain re-usable until the repository withdraws the data or goes out of business.

Analysis results

The process of validation of a project deliverable is accurately described in the consortium agreement. All deliverables are public.

Media files

The media files will be licensed under the Creative Commons CC BY 4.0 International license. The files will become available on the web site during the course of the project and remain available as long as the web site is online. There is no specific embargo period but before the files are uploaded to the server we will assure that those concerned by the files (ex. because they appear in a photo) have given their agreement for its distribution.

5 Annexes

5.1 Annex 1 - Comparison of open licences

https://media.romi-project.eu/documents/D1.1/Annexe_1-Comparison_Open_Licenses.xlsx

5.2 Annex 2 - Legal models

https://media.romi-project.eu/documents/D1.1/Annexe_2-Legal_Models.xlsx

5.3 Annex 3 - Examples of business models

https://media.romi-project.eu/documents/D1.1/Annexe_3-Buisness_models.xlsx