ROBONICA LINFA
An introduction

Milan, Italy - March 31th 2015
Robonica srl

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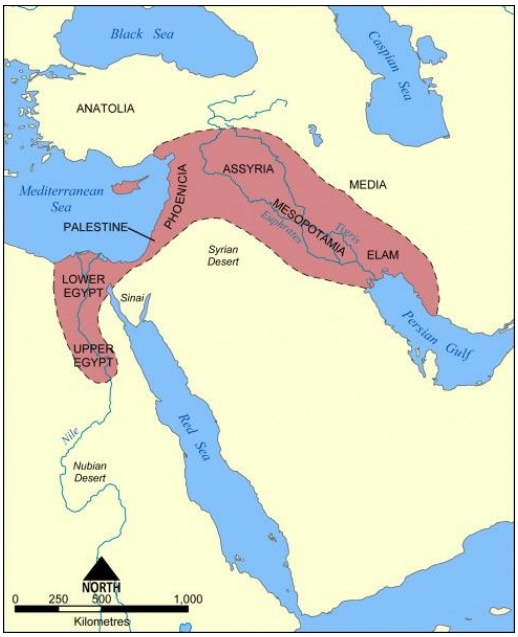
Linfa - *Eat Different*

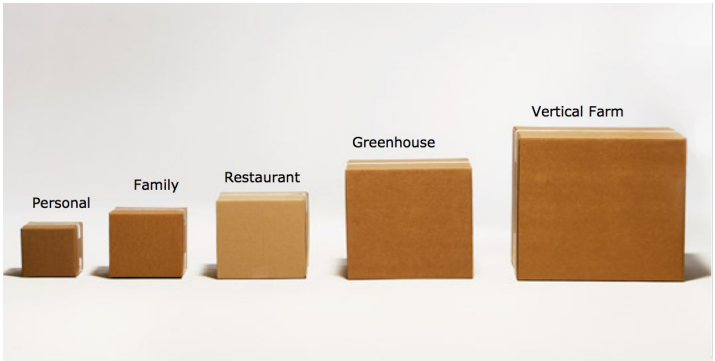
Preamble

West societies are based on *Technology*. *Technology* orients our lives and the way we imagine our future as *Human Beings*. Thinking about *Technology* as a neutral tool is misleading. It's a prejudice feeding itself and deeply nested in our minds from the time when *Technology* has been established in the *Fertile Crescent*, where *Agriculture* was born.



Ironically, *Agriculture* currently accounts for most of the threats to *Nature* and to *Human Beings* themselves. In a couple of decades we should be able to feed a world population of 9 billions people. At the same time, the more people we have to feed, the more *Agriculture* accounts for damaging the *Nature*. Moreover, people are rapidly moving from rural areas to cities, asking for growing varieties of food without even knowing about their seasonality. As a consequence, the international trade of agricultural products has doubled from 400 to 800 billion USD in less that 10 years, because the rural areas are far away from the places where produces are eventually processed and finally consumed. We need to rethink our relationship with *Agriculture* by exploiting its main offspring: *Technology*. Thanks to *Technology* we can now start to bring produces closer to the cities, as it was 10 thousands years ago, at the very beginning of the history of the *west society*.

Description



Robonica firmly believe that the above *Agriculture* paradox could be progressively dissolved by merging technologies developed in different disciplines: *Hydroponics & Botanics*, *Internet of Things* (IoT), *Artificial Intelligence* (AI), *Industrial Design* and *Digital Manufacturing*.

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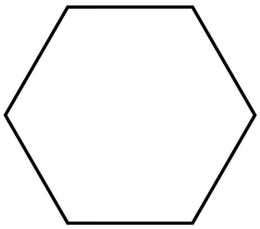
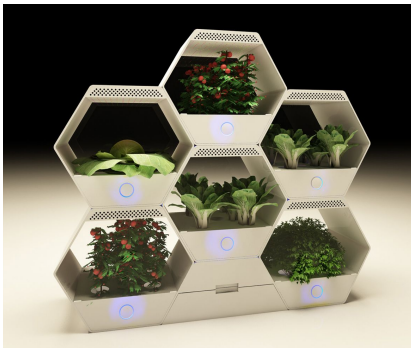
While Robonica is fascinated by the *Vertical Farm* concept, oriented at bringing agriculture produces closer to the places where they are consumed to alleviate the damages induced to Nature, we are also worried by the enormous difficulties that such an idea has to face at the current stage, even in the most developed countries like US. So, we decided to start by aggressively scale down the *Vertical Farm* concept. We desire that people could cultivate high quality produces directly where most of them live, in the homes of the biggest metropolises of the *World*.



This decision brought us to immediately consider the need of thinking holistically about the traits of the product. It had to be:

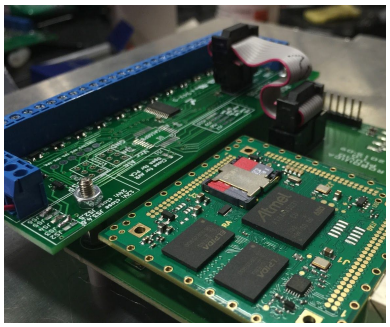
- easy to be used by anyone;
- elegant and evocative of Nature;
- connected through Wi-Fi;
- controlled and monitored by a smartphone;
- modular to scale up, depending on the household needs of greens.

We finally came up with a simple geometric shape for a home product: the hexagon.



The hexagon is one of the most elegant and diffused elementary shapes in *Nature*, both for inanimate entities and living beings (e.g. honeycombs, water crystals, graphite crystals, basalt columns, epithelial cells in the human eye, Saturn's north pole, etc.). It scales with ease in any direction of the three-dimensional space and it can accommodate a large number of vegetable shapes.

When in September 2014 Robonica won the Food-Tech Startup Initiative by Intesa San Paolo, despite not having been founded yet, the company immediately attracted the attention of the press, because of the young age of its main founder and the multidisciplinary approach followed by involving in the project top of the art professionals in the Design and IoT fields. The very first prototype was based on an Arduino micro-computer to program the feedback controllers and it has been progressively replaced by a Raspberry Pi and finally by a proprietary hardware architecture in collaboration with Alessandro Rubini, one of the most famous GNU/Linux programmers in the world. Robonica Linfa employs advanced HW and SW technologies. The onboard micro-computer is connected to the corresponding cloud services via Wi-Fi. For each different produce, it downloads a



corresponding specialized *digital farmer* from the cloud. The *digital farmer* applies a *digital receipt* which is specific for each genetics. The onboard micro-computer monitors the local environment via sensors and it continuously stabilizes the growing parameters via actuators. Each *digital receipt* replicates environmental parameters corresponding to the natural place and season of the cultivated vegetable. For example, even by living at the top floor of a skyscraper in NYC, the user can cultivate and eat anytime and at her place (i.e. cm-0) a produce originally cultivated in Sicily during spring or the summertime. The user monitors and interacts with the box, even remotely, through her smartphone. The smartphone app even allows the user to apply different diets to the vegetable, depending on her personal diet need and taste. This is a very interesting concept, because it allows us to think about the food we eat in a very different way. If you have a specific diet need, you can feed differently the food you're going to eat by just a click on your smartphone, and the internal *digital farmer* will apply a different diet of nutrients to the produce. Everything is automated. As a user, you only need to buy seeds and nutrients, fill the water tank and click a "start cycle" button from your smartphone. The duration of the growing cycle in soilless cultivation is ⅓ shorter and it depends on the chosen vegetable. It can be a couple of weeks or a couple of months. From a power consumption point of view, thanks to the adoption of the LED technology, the user is going to spend 2 or 3 Euros per month, depending on the local cost of electricity.

One of the most important aspects of the project is that we wanted the box to have a very nice-looking aspect. Linfa is an hydroponics box, but it is also a beautiful lighting object you can place everywhere in your home. Vegetables are sensitive to red and blue light only, but we added some green LEDs as well. This way you can switch on its green LED lights without disturbing the sleep of the plants during the dark time, or you can integrate the red and blue lights with the green one to enjoy more natural colors. We also have an internal camera. It automatically takes photos from the top of the box and sends them to the cloud services to automatically create time-lapse videos and to be analyzed by image-processing algorithms. These algorithms judge the health of the produces and possibly suggest to the *digital farmer* a diet correction for the plants. They also predict the expected harvest time and quantity. As a by-product, at the end you'll also have a time lapse video of the entire cultivation cycle that you can share with your buddies too.

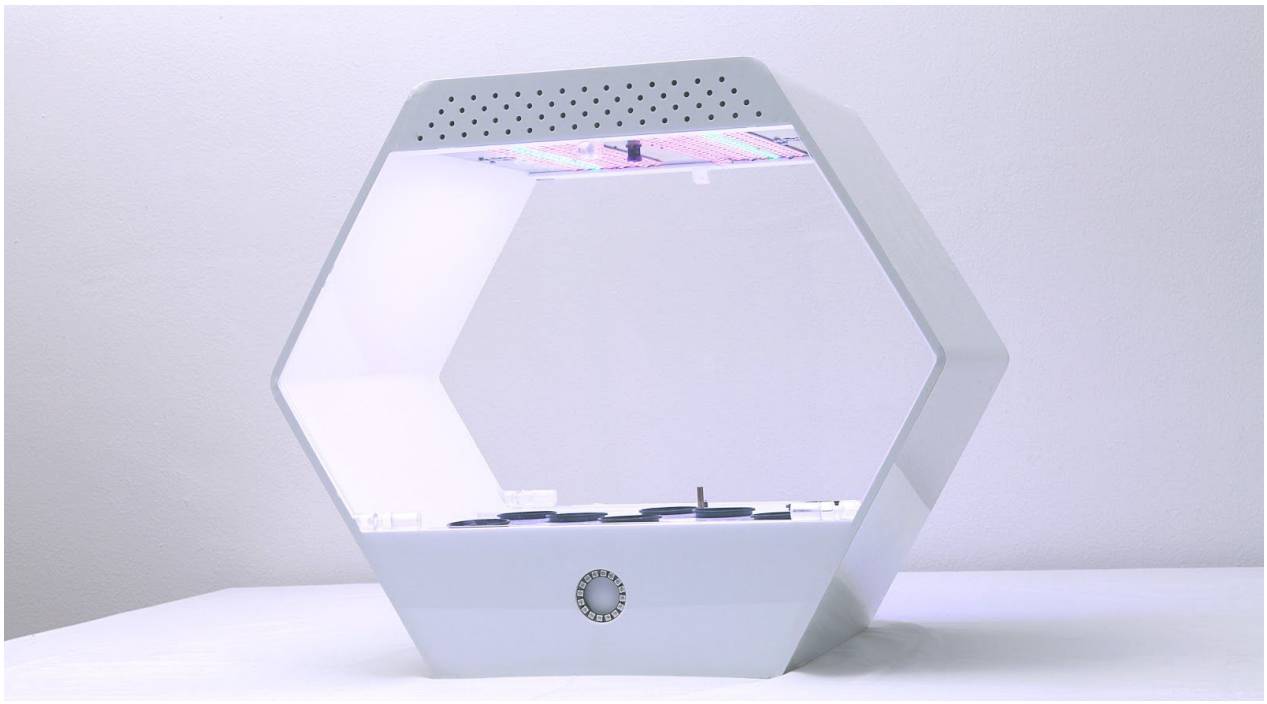
State of the Project

Robonica adopted the *Lean Production* methodology from the very beginning and it recently reached the 3rd prototype generation which includes:

- Intellectual property
    - Copyright of the Hexagon Design
    - Patented system architecture
- Proprietary onboard hardware (pre-production)
- LED design (pre-production)
- Software
    - onboard feedback controller and networking layers
    - remote machine learning
    - cloud services
    - iOS App
- Design For Manufacturing blueprints
    - Luxury
    - Mass-Market
- Botanical
    - Professional botanical studies from Scuola Superiore Sant'Anna in Pisa (where *aquaponics* has been invented in the Seventies)

Currently Robonica is completing the detailed Design For Manufacturing project in order to be able to launch a crowdfunding campaign in October 2016. Robonica was also able to find a few business angels which helped it a lot both by financing the project and by assisting it in building a company, which requires an impressive amount of expertise in very different fields and a total dedication as well. Our dream for the future is to contribute to repairing Nature and see a hydroponic box in every home of every big city on the planet.

Photos



Third Generation Prototype

Third Generation Prototype while cultivating basil

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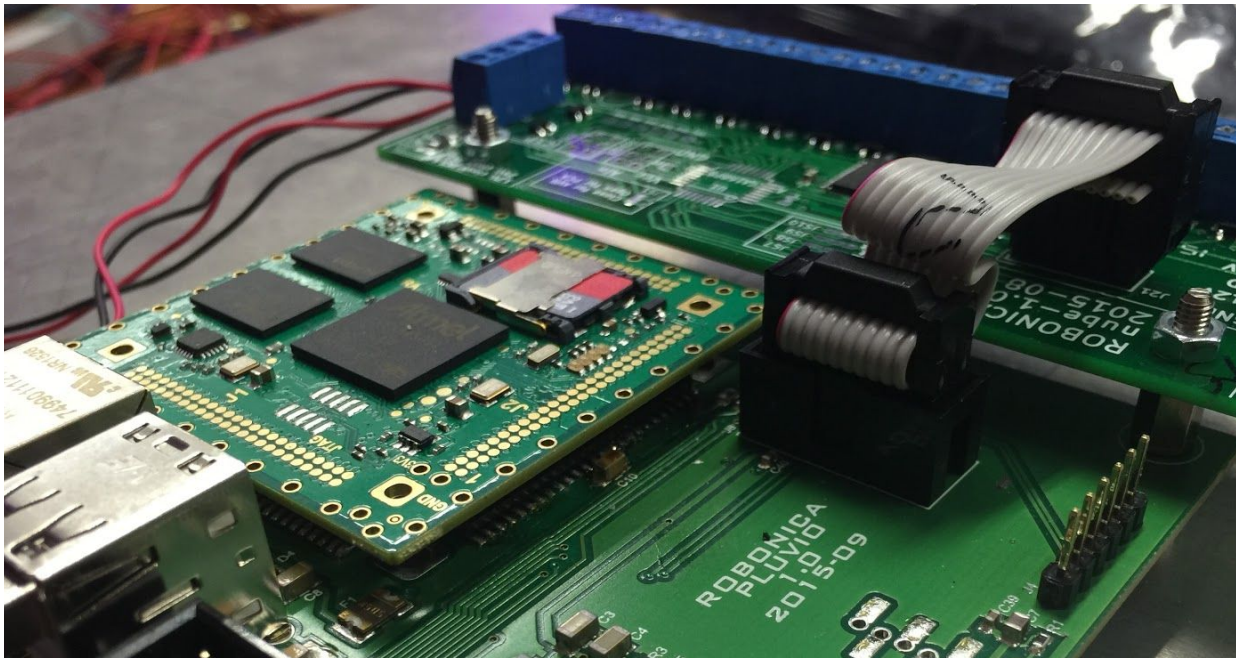
Trio Composition (3rd Gen. Prototype)

iOS App while cultivating Bluebarries



Proprietary Hardware Gen. 1.1

Custom LED lighting system

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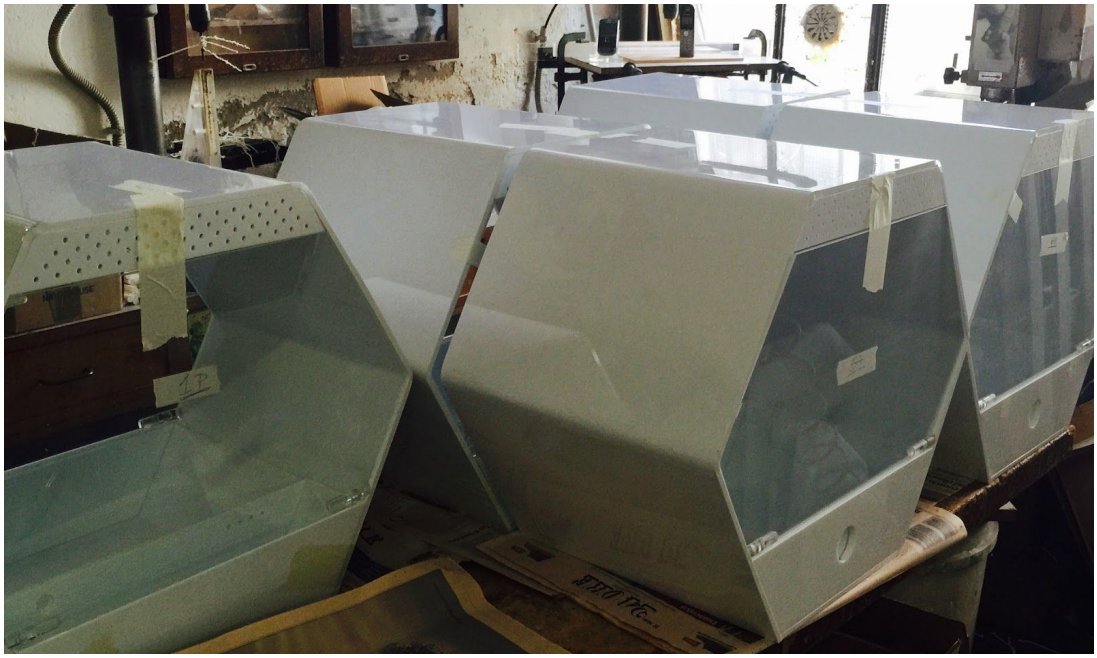

3rd Generation Prototype Frame

2nd Generation Prototype in a kitchen context

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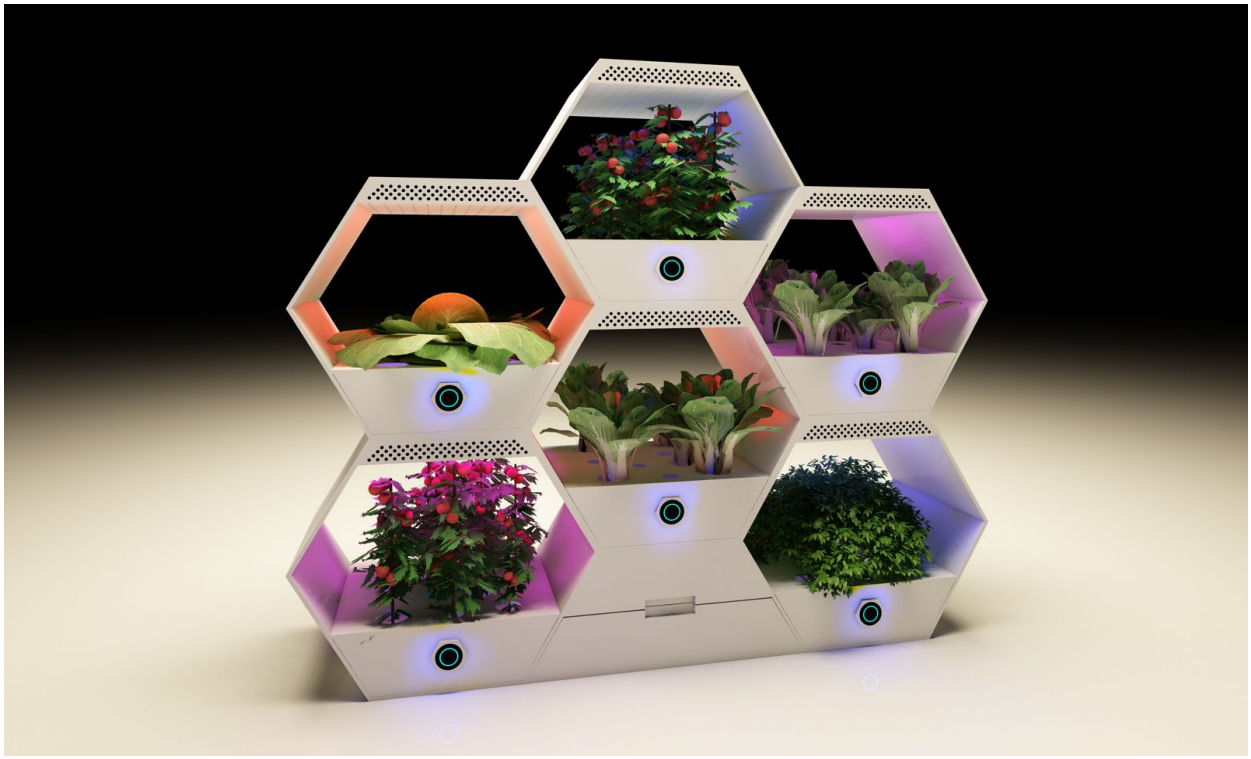

Initial Rendering (Hive Composition)

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