Aquaponics NOW!

Research and realization and informal learning *versus* chance and risk

Design, implementation and usage of an aquaponics system in Spain (Castellon, Pais Valenciano)

Introduction

This white paper describes the design patterns, the implementation and usage of an aquaponics system as part of a social cultural project of the conceptual artist Juan Petry.

It take place in the campus of the *free university of informal education* UNIIE, located in east Spain in the village of Cervera del Maestre in Castellon.

Newer versions of this document are available under http://www.familiafeliz.eu/aquaponicsnow .

> **The main goal of research about aquaponics, of implementing a system and get knowledge about daily routine and running a system is collecting useful information for an independent open discuss, in a future of big scaled industrial aquaponic farming.**
>
> **Aquaponics is discovered and evaluated by research and scientific approach over more than 30 years. *Fish to plants* ratio or *feed to bed surface* ratio discussion focus the maximum output of fish or plants throughout a system and may develop robust handling rules for error tolerant systems.**
>
> **Till now not discussed is the economical impact on decentralized smaller or large scaled industrial system designs. Also not discussed is the impact of aquaponics in a competition with classical farming methods and its pressure on seed producers to have large quantities of identical seedlings available.**
>
> **Beside moral and ethic discussions aquaponics will question in with way "taste" of human food resources will change.**

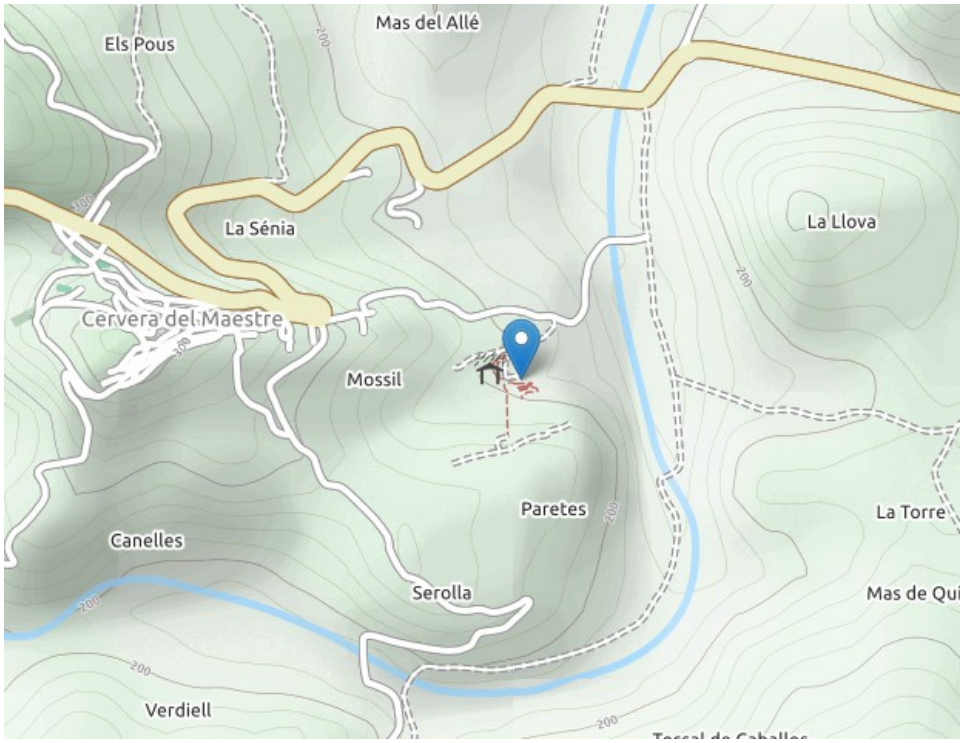
The project is designed as an open platform for exchange between local activists and foreign NGOs and universities.

The leading university is the MLU Halle with Prof. Martin Lindner (bio didactic).

Basic Information

Location

The system is located in the village of Cervera del Maestre, Castellon, Spain. It is part of the "social sculpture garden" of the campus of the free university of informal education UNIIE.



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Plot

To set up the system are different parts of 3 plots available. The plots are located in the so-called *MOSSIL* region of the village. The main – and first – part is a flat area located in the “social sculpture garden section” of the color garden.


main area for aquaponics

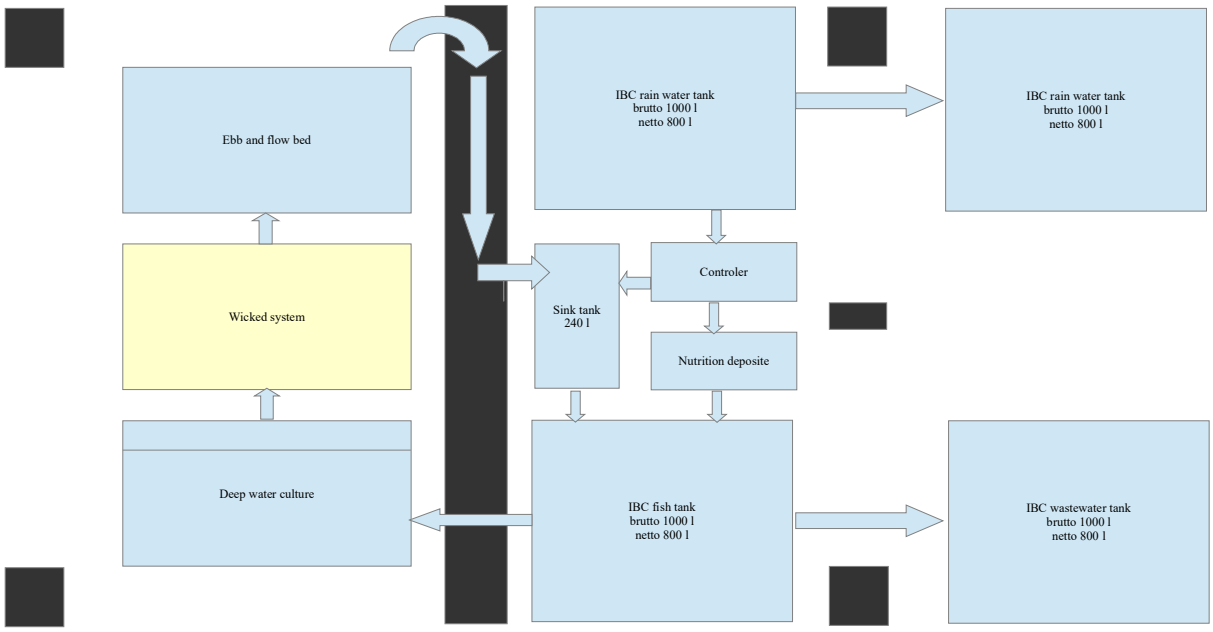
The plot is accessible by car or little truck. The area for the installation is not accessible by mobiles. Every part has to be carried by humans manually.

Design – Idea 1

One principal idea is, to up-cycle materials like refurbished international bulk container (IBC) for fish and water tanks and raised beds.

ibc – container (actually 3 are available)

The main idea is, to use natural resources and up-cycling as much as possible. For example rain water should be used to fill and recharge the fish tank and the system. Waste water (old water after harvesting the fishes or rescued after cleaning the system)should be used in other parts of the garden.



View from top

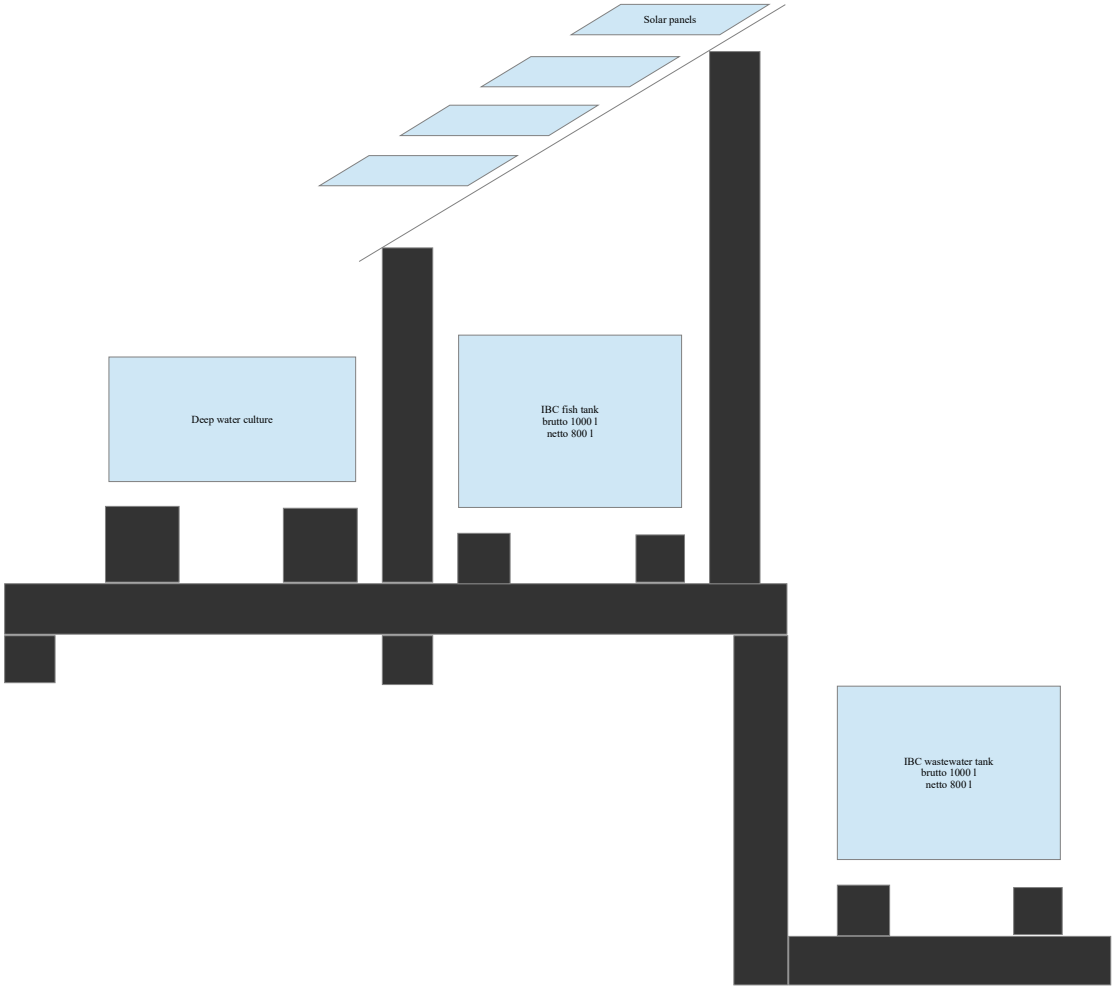
On the left side are three different types of raised beds in a line. Water move by gravitation from the fish tank to the deep water culture, from their to the wicked system and finally to the ebb and flow bed. The bed design should allow every of this types. The ebb and flow bed section should be ever the last and lowest.

The water move from the last bed to the sink tank (which is the lowest level of the water). The water is lifted by an air pump or normal pump, supported by solar panels on the roof.

The left side is south orientated. The wall in the middle support the roof (together with three pillars on the right side).

In case of strong rain harvested rain water from a first tank could be stored in a second one (right side, lower platform).

The roof should support also a water heating device (solar driven) and under the concrete platform should be a tube implemented to be able to cool the water in the system in summer.



View from side

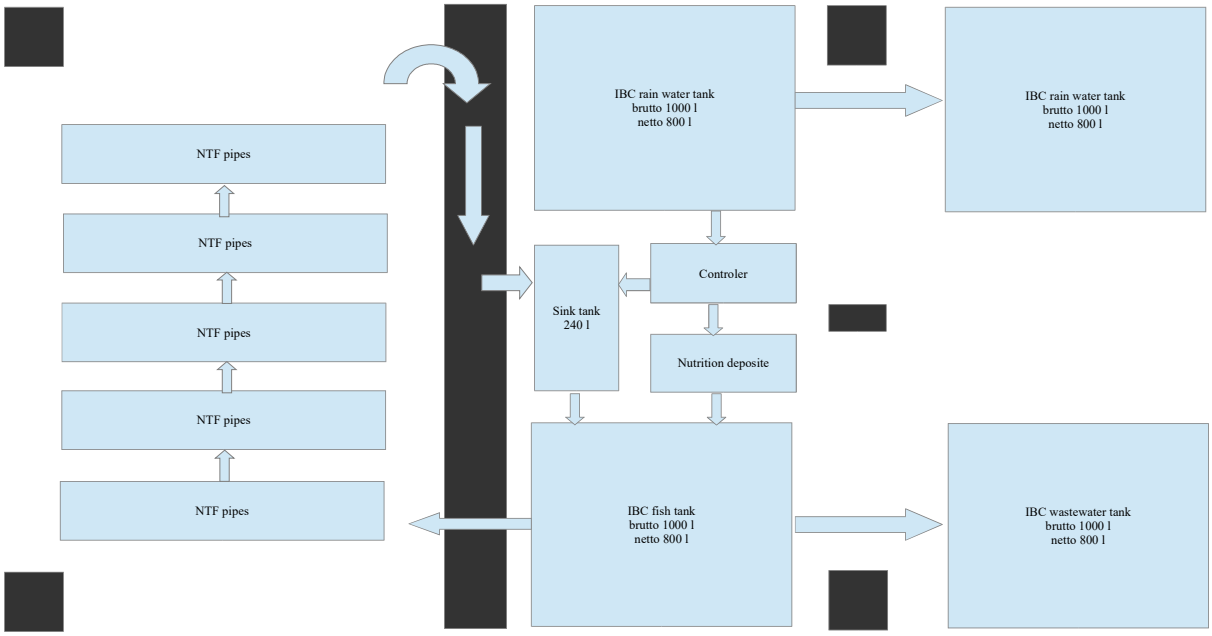
This design is modular. We could imagine to mount more than one system in a line. The first and main location supports 3-5 independent systems.

Each system is supported by a concrete platform (we calculate 20.000 – 30.000 kg weight for a system).

The roof protect the fish tank part form direct sunshine. It help to harvest rain water and support the solar panels.

Design – Idea 2

A possible second system module could be a NTF (Nutrient Film Technique). According to a gradient of 1 to 2 percent for each pipe the layout could be very different.

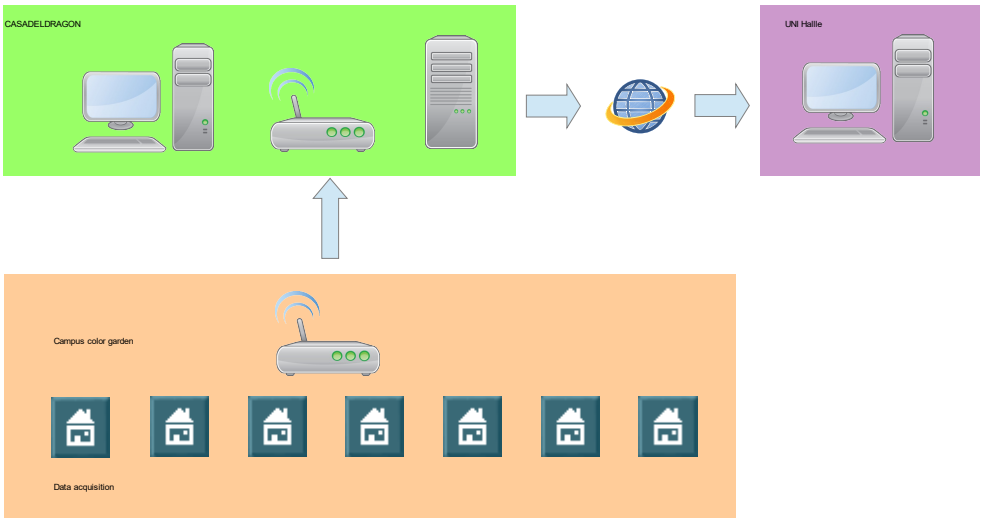


Every design has advantages and disadvantages for fish, plants, bacteria's and daily handling. Also from economical view the output of vegetables and fish per square meter and its values should be evaluated carefully.

Tools

One of the most important infrastructures to measure and acquire data is to establish a campus intranet solution based on arduino devices. This campus intranet should provide internet access and access to central database hosting the raw data of the devices (temperature, ph, water level).

The arduino platform is also useful for controlling and management of valves and other devices.



Intranet solution

Possible tasks from the scratch

1. digging wholes for foundation and platform
2. creating foundation
3. creating concrete platform on top
4. creating walls and pillars
5. creating roof
6. mounting solar panels
7. adding solar system technical infrastructure
8. adding electronic infrastructure
9. preparing raised beds (walls and foundation)
10. preparing tanks (walls and foundation)
11. preparing water cycle (pipes, tubes)
12. preparing rain water tanks and waste water tanks
13. connecting beds and tanks
14. implementation of sink tank and controller
15. establishing a campus intranet
16. connecting the campus intranet with the casadeldragon intranet
17. adding arduino systems to campus intranet
18. setup database

Open questions

Many questions will accrue by designing a system. We publish an open list of an decentralized living community here, and therefor from a private non-commercial point of view.

Design

What are advantages / disadvantages of backyard systems versus industrial scaled systems?

Which design is simple, easy to build and handle, possible to integrate up-cycled materials?

Which fish – plant combinations are useful?

Which sizes of components (bed, tank...) are useful?

Integrated solid cleaning and up-cycling or external?

How to create and maintain aerobic and anaerobic zones?

Where are zones of bacteria, fungi, phytoplankton and zooplankton in aquaponics systems and how we can monitor and regulate in- and output?

How we could establish a economic and easy-to-handle conversion of ammonia to nitrate(nitrification)?

How to move the water with lowest possible energy input (air pump versus water pump solutions)?

How to develop a new plant <> fish <> system design - ratio based on combination of PhD Rakocy (UVI) and PhD Lennard and other important factors (water temperature, air temperature, sun shine hours …)?

How to implement alternative methods based on contemporary mathematical models (Fuzzy logic, Game theories, Chaos theories)?

Handling and daily usage

How to design an easy handling and error-tolerant system?

How to maintain worst case scenarios (diseases like “brown blood disease” or technical dis-function of pumps and leakage)?

How to handle ph – drops (bacteria) and ph - rise (plants) in moments of changing the system (harvesting / re – planting)?

Economics, healthy food and well-being of animals and plants

Which backyard systems are sustainable under economic evaluation (beside hobby aspects?

Which system sizes are sustainable under economic evaluation?

How to evaluate economic output of aquaponics systems?

How to evaluate health status of organic food emitted by aquaponics systems?

How to measure well-being and health status of plants and animals?

What are advantages and disadvantages of aquaponics in case of urban gardening and zero km –

food production?

Which fish stocking densities are economically useful and healthy?

Ethic, moral and the question of taste

In which way a massive growth of aquaponic backyard systems will influence customer views on food?

How many fish we need, how many vegetables we need and what quantity could be emitted by aquaponics systems?

How aquaponics could and will influence the *taste* of its products?