Green Wall Project

indoor automated and connected plant growing systems

Main Doc

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Background

The Green Wall venture was created at the time Sensorica was working with CDEC Rosemont on Project VIE. The plan was to install green walls in the space that was supposed to host the Sensorica Montreal lab/community. These green walls were imagined to serve the purpose of mobile physical space separators, food supply and green laboratory for indoor micro-farming. Project VIE failed, and soon after the *LED Green Wall* project lost momentum.

In parallel, other Sensorica projects related to food growing were developed and lumped under the GreenSense brand, which later changed to GrowSense. Meanwhile, John, a sensorican from Australia, continued a relentless work of integrating open source hardware and developed software for automated and connected urban agriculture.

The goal of the project is to prototype and produce ***indoor, automated and connected plant growing systems*** (hardware and software). Some of this technology will be applied to large scale greenhouse operations.

Important links

Venture page on Sensorica

Development steps

Prototyping

- [October 2022] Emanuel took over the prototyping of the Green Wall at the Sensorica lab, after 2 dormant years (COVID).
- [Sept 2020] prototyping green wall (with air purification capability) at the Sensorica Montreal lab, an effort led by Tibi. Open development doc.
- GrowSense software and hardware test rig designed and prototypes in Australia by John. Open development space.
- We are experimenting at the pot level, effort led by Bruce. Open development doc.

Contact the lead individuals if you want to contribute to their efforts!

Community building

Following Tibi's leading effort of building the community around the Green Wall venture, employing a *stepladder approach*.

1. Bootstrap the assembly of the frame, or the mechanical structure - **completed**, watch video.

2. Collaborate on the assembly of the piping and on the potting (ongoing)
3. Collaborate on the integration of electronics and software (ongoing)

During each step, the work is thoroughly documented in the development doc. At the end of each Step, a video is created and will be broadcasted on social media to find other interested people who might want to join the process. The video should announce the next steps and should contain an invitation to collaborate.

In step 1, Tibi, Bruce and John collaborate and coordinate. Step 2 should increase the team to a minimum of 7 peers. Step 3 should increase the team up to 20 peers. The group should grow through *socializing work* (punctual social media sharing of progress, mostly after Step 1), *organized outreach* (videos published at the end of every phase, with calls to action), all supported by good and up to date documentation. Onboarding and engagement building will be done mostly through workparties, which will be organized on social media, after the publication of each Step video.

Culture: the group will be infused with values of responsibility and investment. Participants will be asked to contribute not only with their time, but, if possible, also with money, to buy parts for the completion of the prototype. The NRP is used like in any other Sensorica project, to account for everyone's contribution.

A meritocratic **governance** will be implemented.

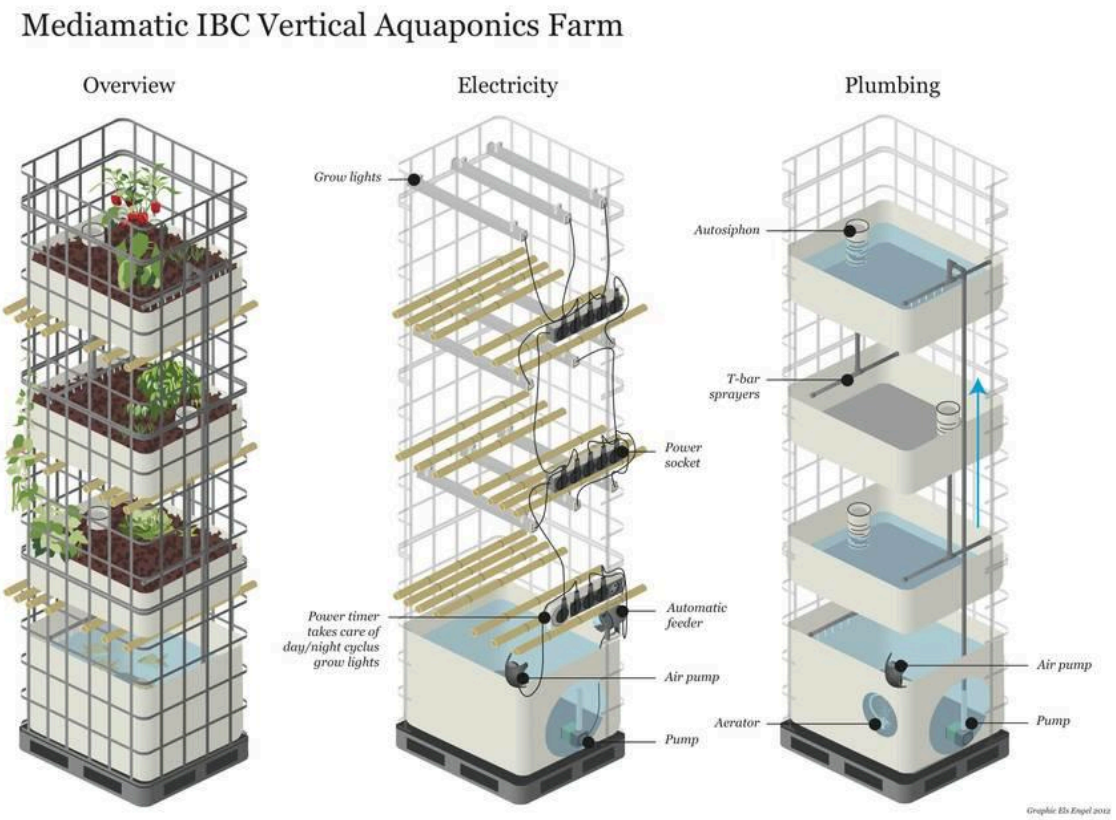
Economic model building

By Tibi
Contact a few commercial organisations that are already selling green walls. Show them our work and the growing organisation, and convince them to use Sensorica as the open space in between them in which they interact with each other and with the crowd. Sensorica can become the innovation space, helping these existing commercial actors to advance their product development. Obviously, CAKE would sign a deal with all of them, to kick back a portion of their profits to the Sensorica affiliates that are involved in the work. This is collaborative, crowdsourced open innovation, the model that we've been pedaling for a while. We have a list of at least 5 of these organizations. If we make a compelling proposition we can get 2 or 3 to start with. That would be enough to get the ball rolling. We need to convince them that they have something to lose if they don't take the offer.
If we succeed, these existing commercial organisations become essentially exchange firms for Sensorica, which they can see as their open innovation network. So we don't need to learn and develop our market, we leverage their market penetration, their manufacturing capabilities, their service capabilities, and they benefit from rapid and low cost, open source innovation. Much more effective, in my mind, than mounting everything from scratch.

Designs and prototypes

[Sensorica's lab Green Wall](#).

Indoor green walls require LEDs for light supplement. Indoor green walls can be closed systems to control the temperature and moisture level, and perhaps CO2 levels. A candidate material for enclosure is [ETFE](#). They can also be open, exchanging with the surrounding environment.



[open page](#)

Design constraints

Mobile walls: on wheels.
Physical dimensions: going through doors and being able to transport using a small rental cube.
Weight: every part can be lifted by a single person.

Possible modules

- Mechanics
    - frame/structure
    - cover?
    - on wheels
- Hydraulic
    - tubing, pumps, valves,
- Electronics
    - Sensors: humidity, temperature, light levels, weight, plant growing, chemical?
    - Controller
    - LED light system
    - Alarm systems
- Water filtration/sterilization - UV LED + ultrasound for controlling bacteria/virus levels.
- Biochemical sensing

Service module: mobile module to service every wall.

Design of the wall and plant selection.

Starting plants

Bruce is Sensorica's specialist in plants and soil. Since the current location of the Sensorica Lab has full sun western exposure, hardy moderate to high light interior plants were employed such as Ficus Lyrata, Coffea Arabica, Philodendron Cordatum Var. Hedera Montgomery. These are species that are best adapted to the ambient interior conditions that one would find in an interior setting in the middle of the winter i.e. low humidity, 9 hours of daylight and a temperature of 23 C. These would be the best options for experimental basis, without the need for supplemental light.

Greens (lettuce, spinach, arugula), strawberries, herbs, beans, green onions, microgreens (sprouts) but they can be a problem, because as we soak them in water we can transfer pathogens.

Mushrooms.

Tomatoes need a lot of nitrogen and are prone to a lot of problems.

Watchout for disease - closed spaces are prone to bugs.

Some plants require pollination.

Other ideas

Extension to aquaponics (first proposed by Yasir).
Aquaponic closed and closed circuit system.
Hydroponic closed system prototype with highly controlled environment.

Past partners

Roland a Ste-Julie

Fournir les éléments que nous visualisons utile pour la fabrication du premier prototype serre mobile hydroponique du mur vert, si possible des éléments des autres serres, aquaculture et vermi-composte. Roland sera en mesure de créer une maquette 3D qui nous pourrons présenter dans les différents projets de financement. Ceci est donc une étape importante du projet et de son démarrage.

Normand

Pompes tuyauterie (schéma de fonctionnement et dimension), ce que ça prendrait pour faire les mélanges automatiquement (algues et autre nutriment), méthode de mélange utiliser, méthode de contrôle utiliser etc.. il nous faut imaginer les contrôles requis. les bassins de mélange, les systèmes d'approvisionnement en eau minéralisée contenant les différents oligoéléments.

Les premier essais et développement des semis pour approvisionner les station se feront chez Normand et Mado, au départ, puis ils verront avec leurs homologues et avec notre support à développer un réseau d'approvisionnement diversifié et fiable pour rendre le produit encore plus intéressant, en plus de développer de nouvelle technique de production, ou les meilleurs technique suivant la nature de la plante, qu'elle soit racine, feuillage, à vocation alimentaire, décorative ou médicinal. Les marchés sont grands et le besoin en développement tout autant.

Mado

Les plantes qui seraient cultivées au départ avec leurs critères de croissances, espaces requis et occuper au point de maturité, ceux qui demandent le travail des bourdons. etc.. les requis en eau racinaire et pulvérisation par espèce...etc...

Benoit Racine

Les contrôles pour ventilation (dilution de l'air) , humidité, génération et contrôle de CO2, les alarmes, l'éclairage LED, la structure le système de vitre et d'échange d'air avec l'Extérieur, les sources de chaleurs complémentaires et de refroidissement.

Tibi (SENSORICA)

Les capteurs à développer, les requis matériels pour maintenir à distance la programmation et la surveillance et gestion de croissance des plantes et autres paramètres du système, les idées de section mobile, pour la récolte toujours a la même hauteur. Système de récolte automatisé, robot semeur et récolteur pour la gestion du mur continue. robot fait en impression 3D.
Voir aussi les possibilités des spectromètres

- Spectruino
- Photosinq
- Publiclabs.org spectrometers

Le système de vision pourrait se transformer en spectromètre afin de lire la signature de la santé des plantes pour en faire une saine gestion. Je développerais ce projet avec Tibi, son importance est cruciale pour en faire un système d'approvisionnement fiable. moins il y aura d'intervention humaine, plus le système pourrait être vendu comme fiable pour monsieur et madame tout le monde.