Disruptive technologies

Garden Roots project

Masters in Design

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Content

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Garden Roots

In the current climate of war and uncertainty, we could all use an increase in resilience regarding our food supply. Garden Roots is a way of bringing food production right to your building!

Make use of the unused space in your basement by installing a Garden Roots vertical carrousel and get fresh mushrooms in return all year round. The smart sensors in the growing trays regulate watering, humidity, and oxygen levels so that you don't have to worry about it. In addition, the Garden Root app will make sure you know when to come and pick your mushrooms!

The system also includes a composting station which collects the green waste of the building, to create a closed system that is resilient against any future events that may occur.

Company

The company "Garden Roots" is in charge of the installation of the carousels with shelves in which vegetables will be planted and grown. Upon contracting the company's service, the carousel will be installed, and the community will be offered access to an app and a compost storage box. The company will access the building once a month, for the installation of the compost prepared with spores and nutrients on the shelves. It will also collect the compost deposited in the garbage cans by the neighbours to be reused by the company. This company will have access to the facilities and will be able to receive notifications if something stops working.

Installation

The main installation consists of a carousel with shelves on which vegetables are grown. Each shelf has a closed box to maintain the temperature and humidity required for that type of vegetable. Each box has different sensors that will keep the parameters adjusted. Regularly the parameters detect when the vegetables have grown and are ready to be harvested. This is reflected in the application to which the community users have access and from this, they can reserve times to pick the vegetables. Upon arrival at the carousel, it can detect each user's key and the carousel will offer access to the bin they have reserved. This prevents them from having access to all the vegetables and regulates that vegetables that have not yet grown are not harvested.

These sensors can also detect when something is wrong, and maintenance is needed. In this case, the sensors will send a message to Garden Roots itself, so they are informed of the issue and can solve it accordingly.

The Community

The building community will pay a fee for the installation and maintenance mandatory for all neighbors. This will encourage the use of the service. They will not be in charge of the maintenance of the machinery and the growth of the mushrooms (or other vegetables), but they will oversee collecting the compost from their homes and managing their reservations through the app. We focus this service on new homes that have not yet occupied all the space in their basements. We think the service will be most attractive to buildings with young or middle-aged families.

Application

The application displays the different shelves with the different vegetables and allows one to reserve a picking schedule when the vegetables are ready to be picked. The application will control the number of times users can go to pick the vegetables per week, ensuring that the number of vegetables that each neighbor takes is balanced and there is no inequality.

In case none of the users has picked up or reserved the vegetables, it will send a notification to all users to inform them that they can pick them up. In case you have exceeded the number of times you can pick up vegetables but there are vegetables that need to be picked up, neighbors will have the possibility to pick them up. This will ensure that all the mushrooms that need to be picked because they are full-grown, will be picked at the correct time.

Future lines

The first step towards the self-cultivation of vegetables was initiated with installations in the basements of buildings. Taking future steps would include the use of rooftops and exterior walls of buildings. In the same way, we started this technology with a reduced number of vegetables, thinking about the possibility of growing other vegetables in the next steps of the development of the technology, such as vegetables that require much more difficult environments to maintain.
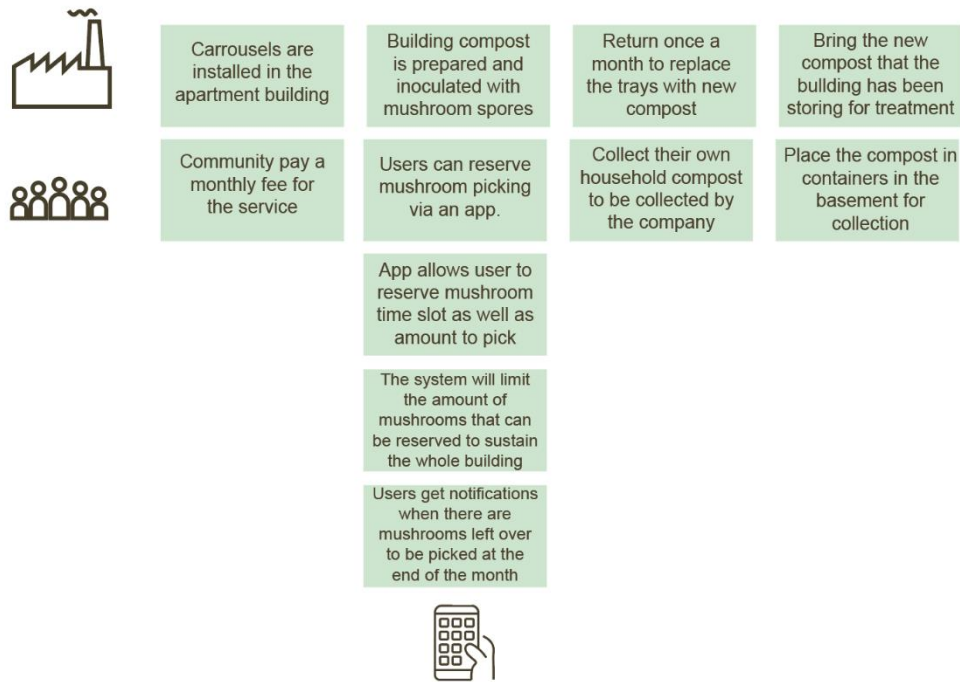
Carrousels are installed in the apartment building	Building compost is prepared and inoculated with mushroom spores	Return once a month to replace the trays with new compost	Bring the new compost that the building has been storing for treatment
Community pay a monthly fee for the service	Users can reserve mushroom picking via an app.	Collect their own household compost to be collected by the company	Place the compost in containers in the basement for collection
	App allows user to reserve mushroom time slot as well as amount to pick		
	The system will limit the amount of mushrooms that can be reserved to sustain the whole building		
	Users get notifications when there are mushrooms left over to be picked at the end of the month		

Figure 1. Main Scheme of the elements

App system

The app has different functions that enable the user to be informed about the mushroom growth as well as "book" a time to pick mushrooms. When the user wishes to collect mushrooms, they can go on the app and see if there are any mushrooms ready that they are able to pick. If so, they can choose how many grams they wish to pick, out of a selection that the app displays based on how much the household has already picked that month, and how many mushrooms are available to be picked. When the user enters the basement, they can scan a QR code which connects the cupboard to the person wanting to pick and rotates the carrousel displaying only the shelf that the user can pick from. When the user is done, the carrousel will rotate back, and the cupboard will be closed to preserve the climate inside for the mushrooms.
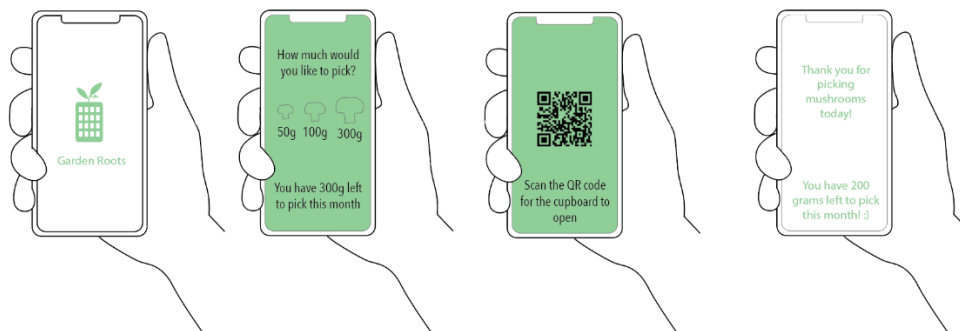

Figure 2. App

The app can also send notifications to the users if there are mushrooms left towards the end of the soil cycle (the trays are replaced with new fertilized soil and spores every four weeks) that they can pick. In this case, it is first to come, first serves. The users will be told how much is left and how many days are left of the cycle before the trays are replaced. Here, the user can then choose to pick the mushrooms that are left or deny them.
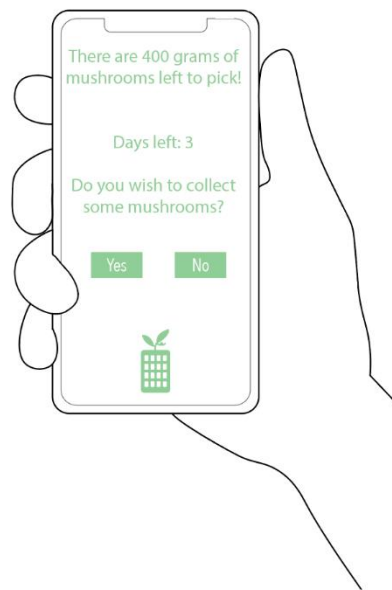

Figure 3. App notification

Intended user group

The intended user group for this service is persons living in apartment buildings, most likely condominiums. This can be families or persons living alone. The service system will take into consideration how many people are living in one apartment by feeding this information into the app. The number of people in one apartment will then be considered in the monthly ration of mushrooms that can be picked, to ensure equal distribution without the need for any organization made by one person. An initial installment of the system may require relatively high upfront costs, so the intended user group will initially be working adults (and not e.g. students). Although the installation cost will fall onto the housing cooperative and not directly, on the individuals living in the building, there will be a monthly cost included in facility costs, that will cover the service costs (replacements of trays and compost handling).

Since this type of system initially most likely won't be cheaper than buying mushrooms and other vegetables in a regular store, the intended user group will value resilience self-sustaining food. More information on values and resilience will be found below.

Values

With this new system we offer a new category to the building, as a **resilient** building, it can be attractive to young people who are interested in local production and are interested in self-production of vegetables, guaranteeing a continuous production at your disposal.

The company can create new values or enhance existing ones for the users in terms of **accessibility** and **quality.** The products will be available to the consumer close to their own home where they can monitor how they are grown and kept themselves.

This type of urban farming allows for optimizing unused spaces and giving residents of buildings a sense of **sharing and ownership.** Consumers who value **sustainability** will also be able to find new ways to practice sustainable food consumption by local production as well as reusing waste materials to make compost for farming.
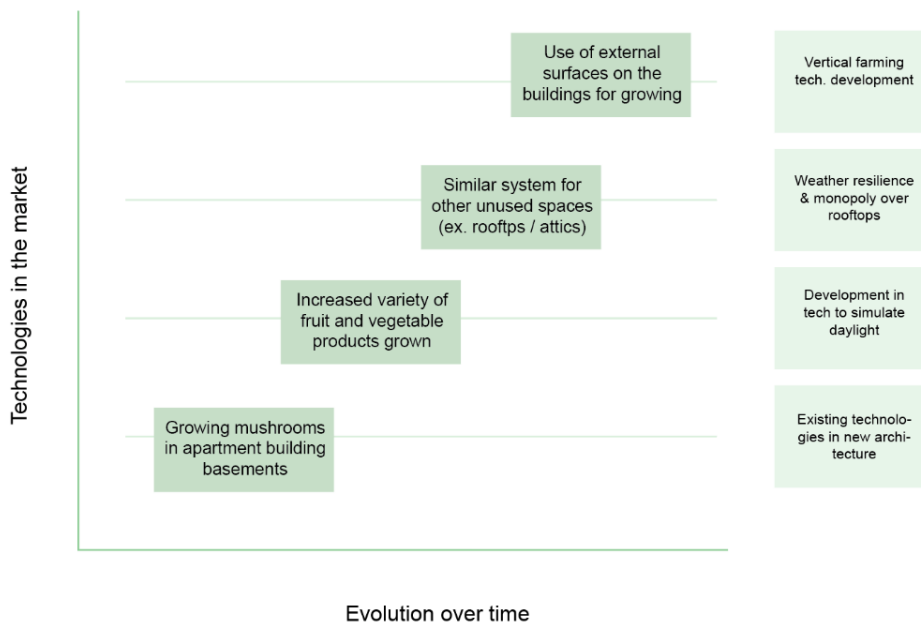

Figure 4. Graphic of the technology and its evolution over time

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Branding

As a representation of the brand and the service, we have created some images illustrating the use of the app on the mobile phone, the service sign on one of the walls of the building, the boxes for the transport of the compost, and an example of advertising the service in a magazine.

Figure 5. Gardenroots app.

Figure 6. Poster in a building /basement

Figure 7. Packaging

Figure 8. Magazine advertisement

Components

The technical elements that we incorporate in each of the shelves of the carousel are sensors that will allow us to adjust the growth of mushrooms and automatically control the interior environment of each of the boxes. Some of the sensors we incorporate are humidity sensors, water sprinklers with valves, temperature controllers, and LEDs with different intensities.
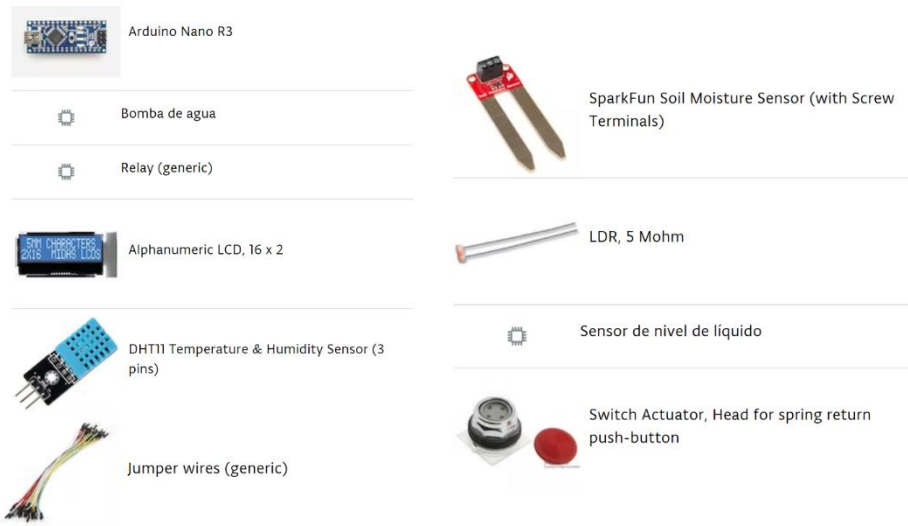

Arduino Nano R3

Bomba de agua

Relay (generic)

Alphanumeric LCD, 16 x 2

DHT11 Temperature & Humidity Sensor (3 pins)

Jumper wires (generic)

SparkFun Soil Moisture Sensor (with Screw Terminals)

LDR, 5 Mohm

Sensor de nivel de líquido

Switch Actuator, Head for spring return push-button

Figure 9. Technical components
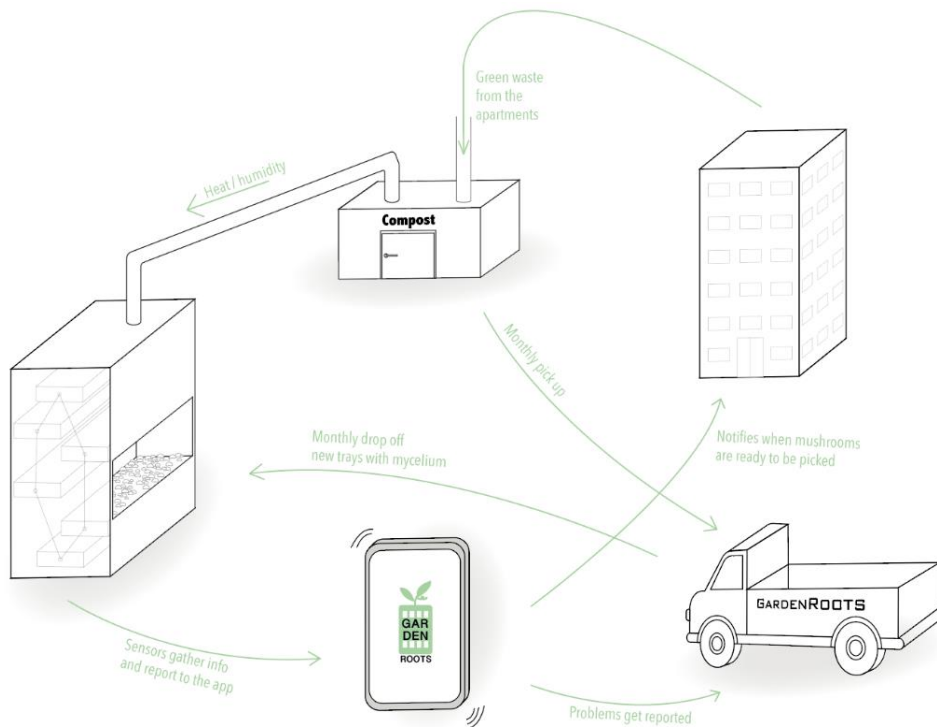
System / Stakeholder Map

Figure 10. Stakeholder map displaying the system of the service
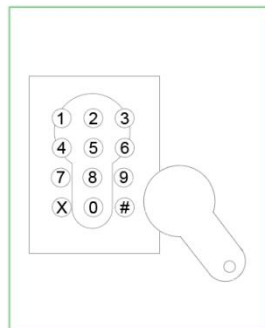
Story Board

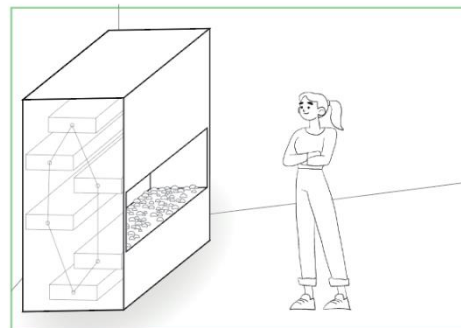User decides she wants to cook with some mushrooms for dinner tonight.

Decides she can go pick some from the local farm that the building has in the basement.

Goes on the app to check if there are any mushrooms ready that she can pick in the basement.

She can use her key tag to enter the room in the basement.

Identified via the app, the carrousell cupboard recognizes which shelf is free for the user to take from.

The user can cook with the mushrooms she picked

Figure 11. Storyboard displaying the potential route of a user of the service.

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Resilience system

One of the main objectives of this system is to create a resilient system within the buildings so that the neighbors of the community would not be completely dependent on supermarkets such as ICA. Considering the resilience graph, we focussed the project on adapting the community to be prepared before an event occurs, adapting to new needs much easier. Some of the events with which we can be more resilient include environmental catastrophes, new adaptations of city layouts, a more sustainable adaptation of buildings, and reduction of meat consumption or local consumption needs.
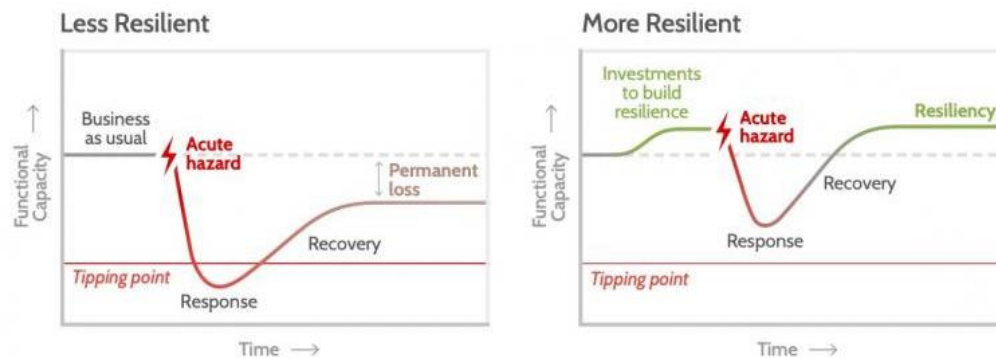

Figure 12. Resilience in time and capacity. (Source: https://toolkit.climate.gov/image/3144)

We are aware of the fact that mushrooms alone in themselves will not increase resilience that much. However, this first step in disrupting supermarkets like ICA. Developing the technology will allow for other plants to be grown and different places like the rooftop to be occupied by even more plants. It also wouldn't stop there: every unused space of public buildings can also be repurposed for plant growth. With this goal before us, we can see how this system will disrupt supermarkets as they exist today.