

Major Project Research Portfolio

Regrow, Indoor Kitchen Garden Project

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Project introduction text

In this project, I want to focus on regrowing vegetables and greens in an efficient and beneficial way. There is plenty of information on regrowing vegetables, but products specifically made for it are difficult to find. The internet presents you with several DIY solutions, but very few actual products.

By regrowing your own vegetables and greens, you can reduce the amount of food waste, lowering the amount of pollution. I also believe that sustaining ourselves will become a norm as a part to better pollution.

Problem statement

“How to reduce food waste in the home without interfering the visual appearance of the kitchen”

NEED

Be able to re-grow greens in an efficient way

Intergrate product into lifestyle

SHOULD/WANT

Accessible - no need for major physical constraints / usable for “everyone”

Moduality - costomizable to users use

Hydroponic sytem

Ability to reperpouse cooking water - eliminate the use of store-bought fertilizer

Add to the visual apperance of the kitchen

CAN

Compost compartments

Possibility to grow from seeds as well

Storage for grown vegetables

Sensor overlooking the crops - to see growing progress

Soilbased compartments

Mushroom compartment - source of fiber, protein, and antioxidants

Why is growing your own greens beneficial?

By growing your own food, you are helping to reduce the high amounts of fossil fuels burned that fill the environment resulting from importing foods from other countries.

When regrowing vegetables and greens from scraps, the greens are already paid for, meaning all new growth is "free", and can reduce the consumers food expenses

Households that grow their own vegetables eat 40% more vegetables a day.

No plastic packaging is required when you harvest vegetables straight from the "garden", which also reduces fossil fuel inputs.

Growing your own food has much health benefits: It helps you eat more fresh vegetables, and you decide what kinds of fertilizers and pesticides come in contact with your food. Letting you control what is going into your body and when to harvest your food.

Households that grow their own vegetables are 3.5 times more likely to eat their 5 a day.

Benefits in Children



Involving children in the growing process can:

- Encourage an understanding of changes over time
- Encourage an understanding of how plants grow
- Encourage patience

Involving children and having a growing garden in your home brings a deeper understanding of growing your own food and reusing resources. This involvement can also better children's relationship with food, as they gain an attachment to the food they're growing. Children participating in gardening are therefore more likely to explore vegetables and greens they never tried before.

In the UK, households throw away about 9.5 million tons of food waste every year. Approximately 30% of this food is still fresh/usable.

Top 9 foods wasted in UK households:

1. Bread

4. Leftovers

7. Eggs

2. Bagged salads

5. Fresh fruit

8. Cheese

3. Fresh vegetables

6. Milk

9. Meat

Looking at the most wasted food waste categories in household waste, we can affect the amount of food waste by being more conscience of our choices when it comes to throwing out and buying food.

According to surveys the most wasted vegetable is the potato, (whos survey?) with 1.6 million wasted every year. Potatoes and many other vegetables have the ability to regrow even after its seen as " unusable". with the right system and care some vegetables can regrow usable resources or even a whole new vegetable.



Potato

Any section with an " eye", plant in soil w the " eye" up when slightly dry



Root crops

Retaining tops of root crops, placed in water, greens on root crops can be harvested as they grow (within days) Can be transplanted into soil.



Lettuce and leafy greens

Regrow lettuce and leafy greens by retaining the root section, and place in a shallow dish of water. New growth will come in days - harvest as it grows or transplant



Herbs

Regrow from cuttings, place in water pick leaves so they do not touch the water. After rooting can be transplanted into the soil to grow into a full plant.



Bulb greens and onions

A small section of stem/ bulb/stem put in a dish with shallow water Can be harvested as they grow or plant in soil to potentially grow a full plant

Hydroponic systems

What is a hydroponic system?

A hydroponic system is a branch of hydroculture. It's a cultivation process without soil, bringing the plant's roots into efficient contact with water, oxygen and nutrients.

Mediums can be used to support plants, such as clay pellets, perlite, coconut fibre and more

The concept is based on the plants basic needs, Water, oxygen and nutrients

Pros and Cons

Not depending on the season – all-year harvest

Use 90% less water than soil-based farming

Can be expensive depending on the system – and not very cost-effective

Need less physical labour. But needs monitoring every day

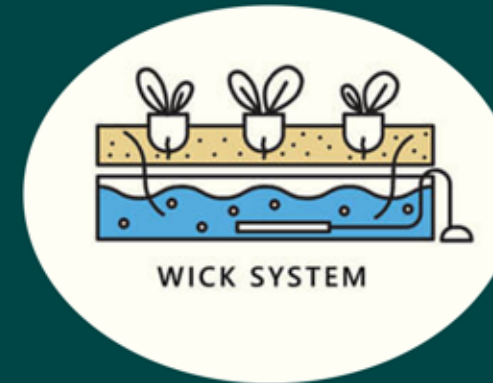
What system will work for me?

There are a lot of different hydroponic systems.

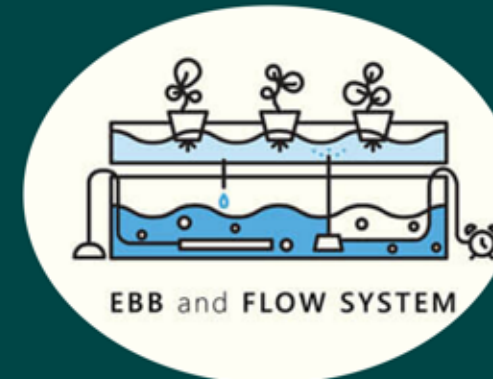
Today Deep Water Culture (DWC) and Nutrient Film Technique (NFT) is the most widely used.

I think these including the Drip system are the direction I'm going in and will research more information about.

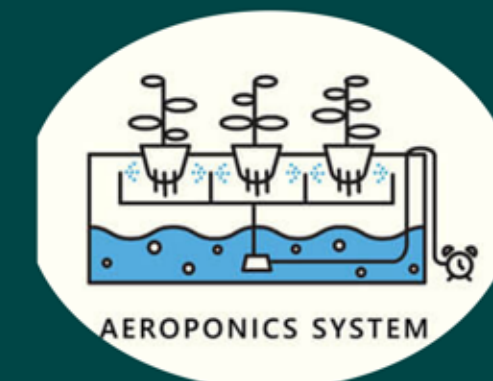
The Wick System might be an alternative for soil based compartments



Good home-based (DIY) system
but prone to fungal disease and root rot
Less control



Efficient use of water, nutrients and energy, encourages healthy roots
Unfavourable environmental conditions



Most productive but more expensive
More technical
Needs more equipment to operate



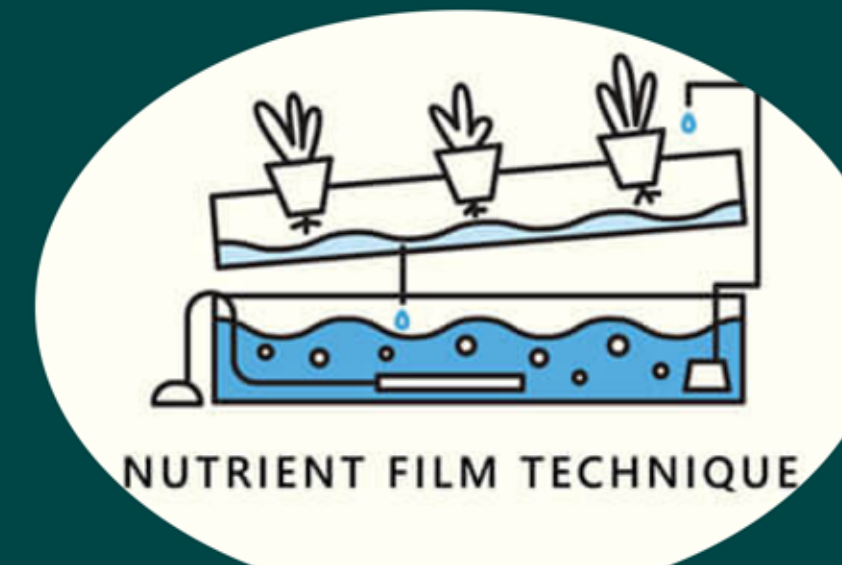
Less technical and can be sized

Low maintenance

Requires air pump

Not suitable for larger plants

Important that the placement of the roots in water is right

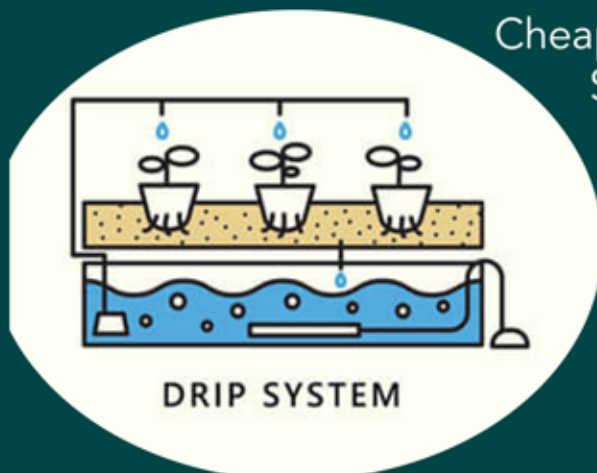


Recirculating system – less waste of resources

Requires frequent monitoring

Fewer issues with oxygenation

Can clog up nutrient channels



Cheap and easy to maintain

Simple system, even on commercial scale

2 options:

1. nutrient recovering system

2. non-recovering system

Can be used if soilbased compartments are added

Whats already on the market?

There are not a lot of products on the market specifically to regrow your own greens and vegetables. Yes, growing your own vegetables is widely known and used by many consumers, but because of seasonal changes in a lot of countries, growing crops all year can be difficult.

There is plenty of information on how to regrow vegetables as well, but products specifically made for it is difficult to find. The internet presents you with several DIY solutions, but very few actual products.

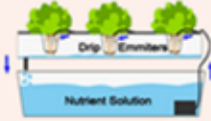
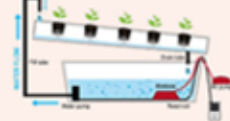
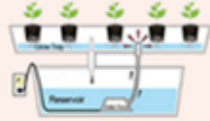
The product for growing your own greens is mostly designed to grow vegetables and greens from seeds or already cultivated plants.

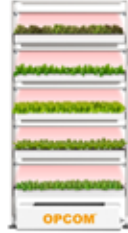
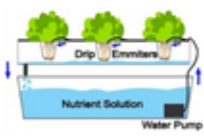
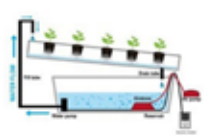
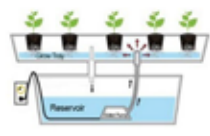
In this project, I will take inspiration from existing products in the hydroponic market and implement them into a system for re-growing greens. I might have to figure out a new system for stabilising and maintaining the greens

Hydroponic manufacturers/designers
ive been inspired by

OPCOM

- Taiwan based company
- Based on mudularization
- Products for home, school and commercial space provides products asossiated with hydroponics

Full Line Technology		
DFT Pallet AI Farm	NFT Pallet AI Farm	Aeroponics Pallet AI Farm
		
Deep Flow Technique (DFT)	Nutrient Film Technique (NFT)	Aeroponics
		
Micro Green Herb	Leafy	Vine Medicine Plant
864 Pots	720 Pots	12 Pots

Full Line Technology			
	GrowBox2	GrowCube	Grow Wall 3
Model			
	Deep Water Culture (DFT)	Nutrient Film Technique (NFT)	Aeroponics
Technology			
Plant	Micro Green Herb	Leafy Baby Leafy	Vine Medicine Plant

Whats on the market

IKEA - Växer/Krydda series

Ikea launched a line of hydroponic systems in 2016
- bringing hydroponics to a larger market. - allows consumers to grow plants and vegetables, without soil or sunlight

Product is no longer sold on the website

Developer: Ronnie Runesson.



Krydda pots/shelf system with Växer hydroponic system
- two products that work together



came in several sizes, ranging from smaller window grow boxes to larger units

Vegger

- Based in Wageningen, Netherlands
- Smart indoor gardens

Groenten



cultivation system
- vegetables, herbs and microgreens

Wand



Wall-mounted indoor garden

Klim Op



Advanced garden for climbing plants

Model 3



4 meter high indoor garden - for mass production

Fibonacci

Based on technologies designed by Russian and Italian agronomists



Model AG-4, AG-8, AG-12
1-2 person



Model AG-16, AG-24
3-5 person



FIBONACCI HOME

Innerworkings and materials

What is needed in a hydroponic system:

- Water pump
- airstone w. pump (or similar alternative)
- Water tank
- Over flow drain
- UV light (
- Climate control system
- Watering system

↳ that controls nutrients and mineral supply

possibility to combine into a modular / replaceable "compartment"

↳ if the system fails, there are arrangements to combine it can send the system over board and get a new working compartment

broken one can be fixed and sent to new customers w. broken parts

in an cabinet as a modular system

Climate System exchanging flow

Find a solution for how wires and tubes are going to be connected



Materials

PLASTICS

Plastic can be used in hydroponic systems as long as they are 100% food safe and BPA-free.

Unsafe plastic can leak harmful chemicals into the system and get into the plants.

Plastic is a good material for hydroponic systems as when airtight prevents water from evaporating or getting contaminated with pests and other outside sources.

Different hydroponic systems have different needs. Some plastics react differently in certain situations.

The shell/coating determines how it will maintain during specific tasks – such as roots can grow through or food safety

100% food safe and BPA-free plastic

Food grade silicone





Vertical farming
Can harvest up to
52 plants per m²
↓
without the necessity of soil
Usually grown from seeds

Aeroponic system

In this system ~ 80% of the time is exposed to air, allowing 100% oxygen availability.

without the necessity of increasing nutrient absorption resulting in a 35% increase of nutrient density compared to regular soil.

when germinated and put in the machine



agricultural rock wool

after a few weeks they should be ready for transplanting

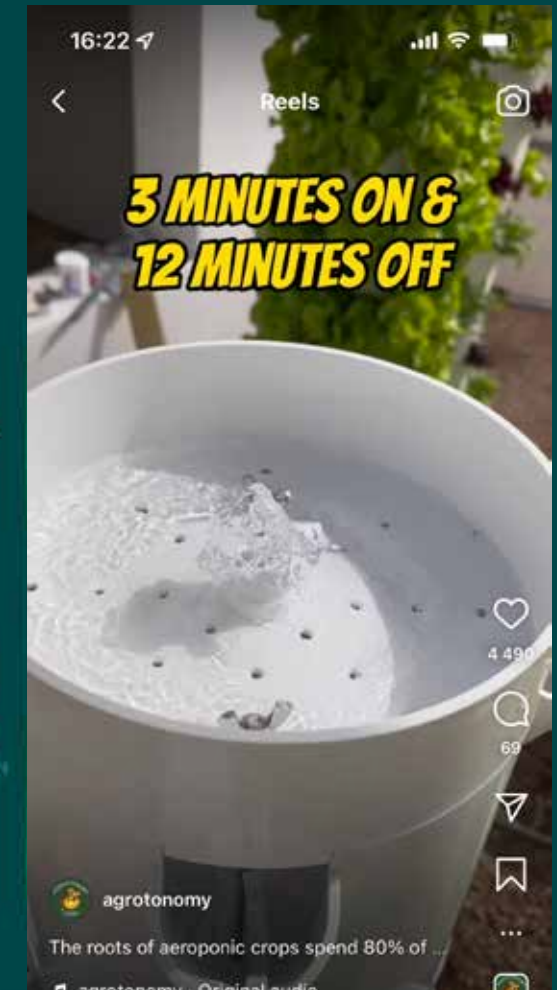
Can we skip this process by using food scraps?



Having several 'compartments' to grow diff veg.

Sketch from sketchbook

double door for cultivating of smaller veg.



agronomy

The roots of aeroponic crops spend 80% of ...



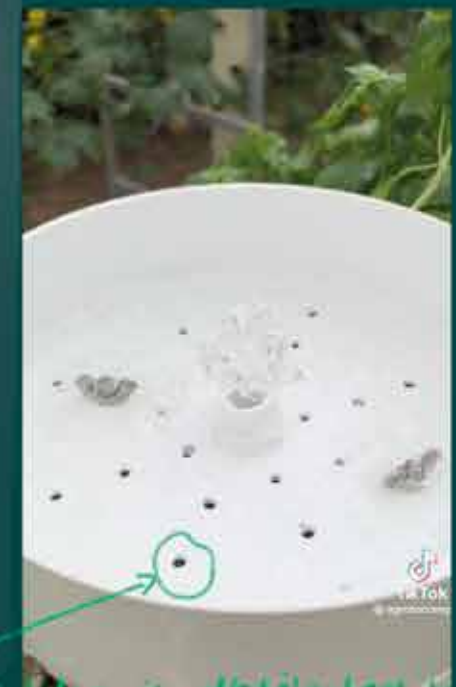
When regrowing lettuce should be cut around this area.



Usually has a structure inside to hold roots together

Can diff veg be in the same system?

"create" the same form of "nodding" method adjusting it to the crops
Will it need a "replacement" for the missing roots?
(Wick system?)



Water is distributed by a pump that brings the water to the top
Holes at the top allows water to be evenly distributed

Test growing

Spring onion

First attempt at regrowing spring onions in a DIY hydroponic system (DWC)

Water had to be changed regularly due to no bumps or flow in the water.

Within 14 days I achieved a usable vegetable.
For the crops to be even better i would try adding nutrients to the water next time to see if there is a bigger difference.
(i think it will be)



8th October



22nd October

Lettuce

First attempt at regrowing lettuce in a DIY hydroponic system (DWC)

Rot started to appear early, indicating that the experiment had failed, but i wanted to see what would happen if kept going. Water had to be changed regularly (more often than the spring onion) this could be fixed by having circulation and air supply in the water, or its been exposed to bacteria.

After 1 week and 6 days , growth slowed drastically down and rot took over.



4th October



17th October

Potatoes



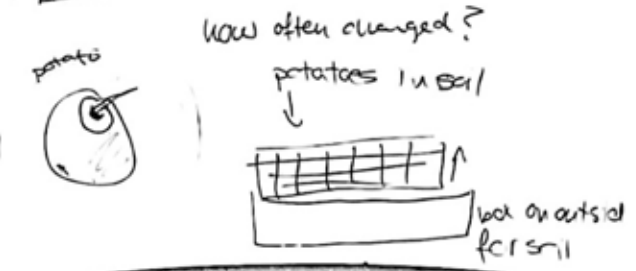
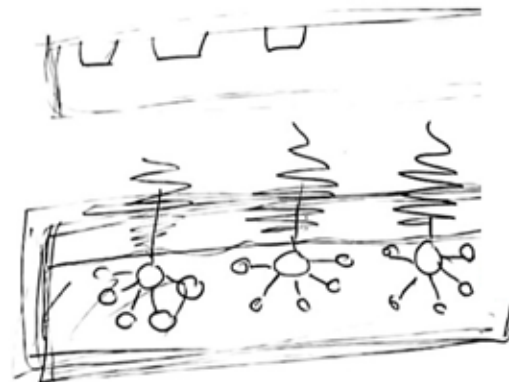
Sketches



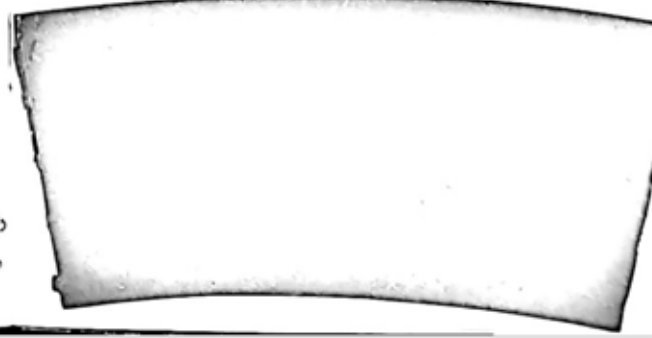
1 kg purple?
mist/rain sun,



clear about growing from waste
important bit
design the system
cognitive mapping
grow from waste taste
send

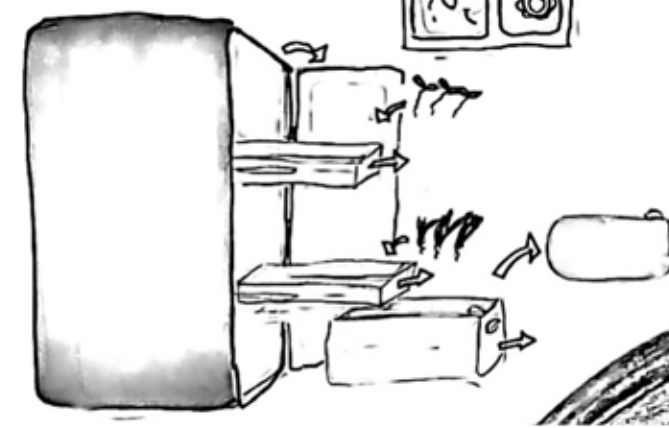
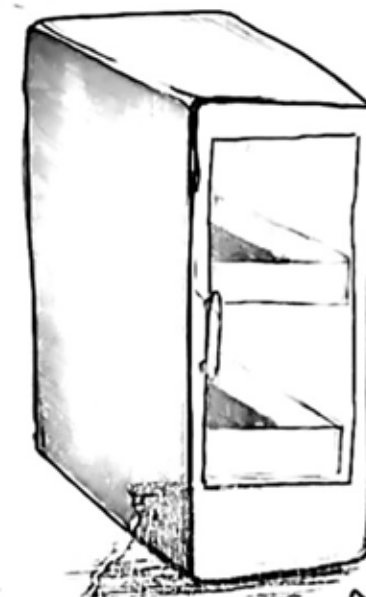


carbon accounting
how can we reduce the carbon footprint of the product
use for new (right to repair)
send back
cool
change the way we live
don't need to look



Essential ->
water waste
starch water
Chemical free washing liquid
Hoodropoli
Zero folics

we people don't want to waste food
how can i reuse waste in the home?
Don't have it represent something awful
integration into lifestyle



Prototypes and testing

First prototypes (3D printed)

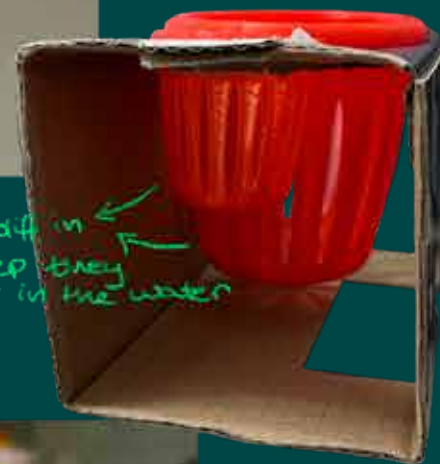


DIFFERENT SIZES FOR DIFFERENT SIZED VEG.

TEST TO SEE how "holders" sit
- holes wider
- size more specified

Larger veg. might not need as much height

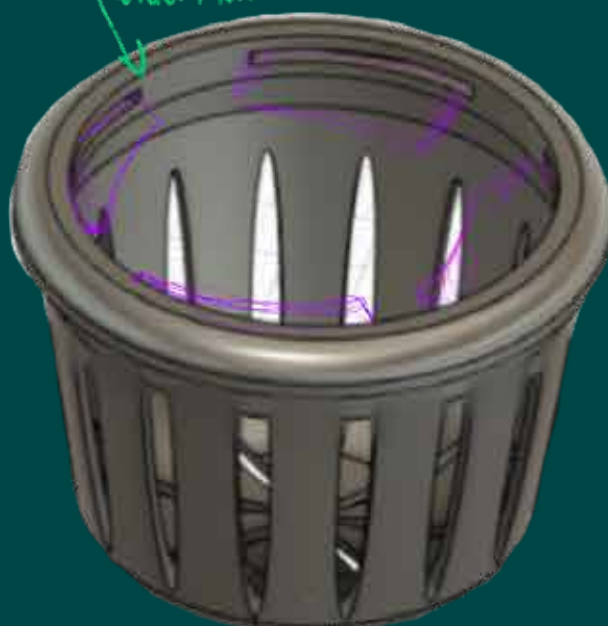
big diff in how deep they would sit in the water



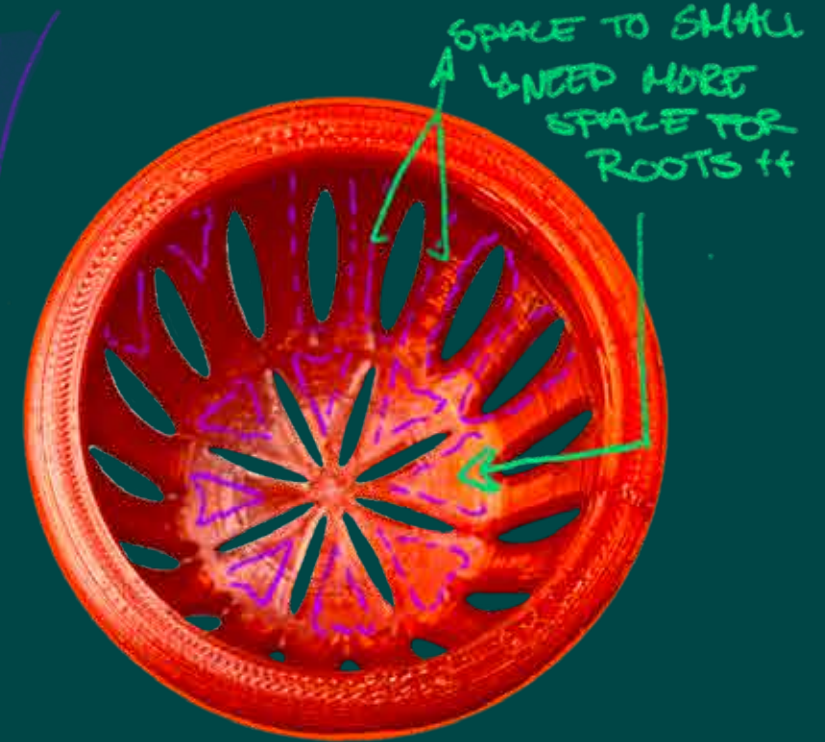
Larger veg. in wider/lower "holders"



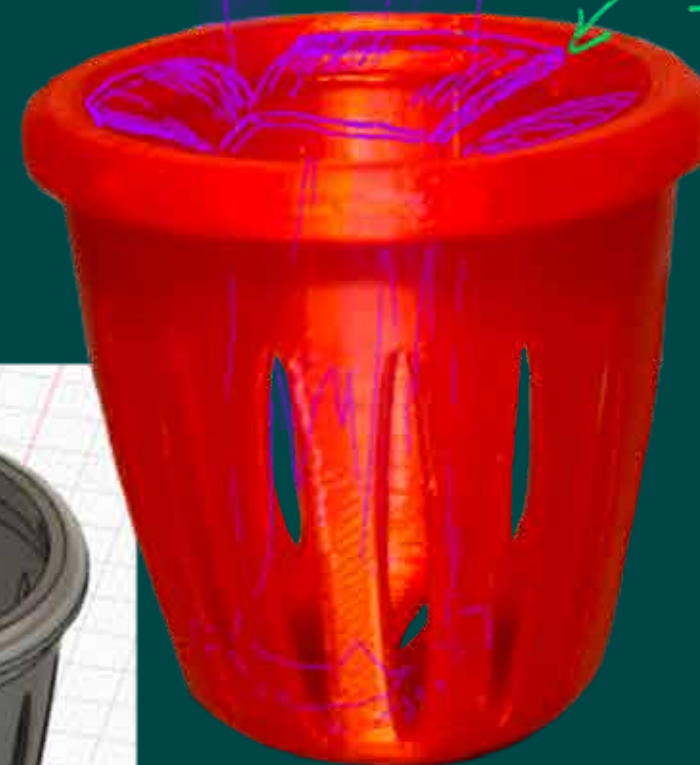
thinner/smaller veg. - smaller/taller "holder"



first fusion drawing of "holder"



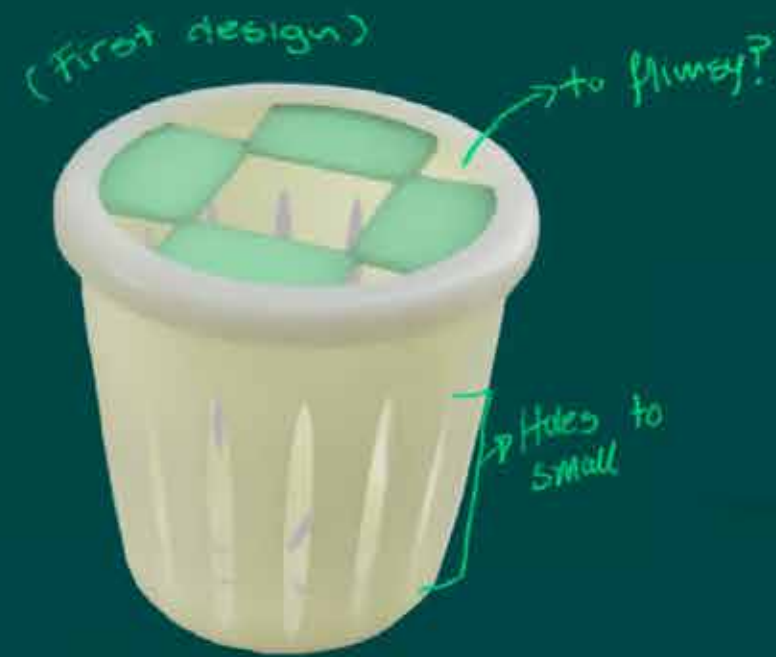
foodsafe silicone to hold veg. in place



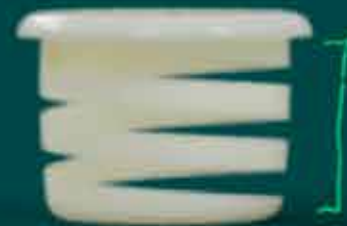
Holder w silicone fitted might get too flimsy / not sturdy



New design



"New" design for more sturdy "holders"

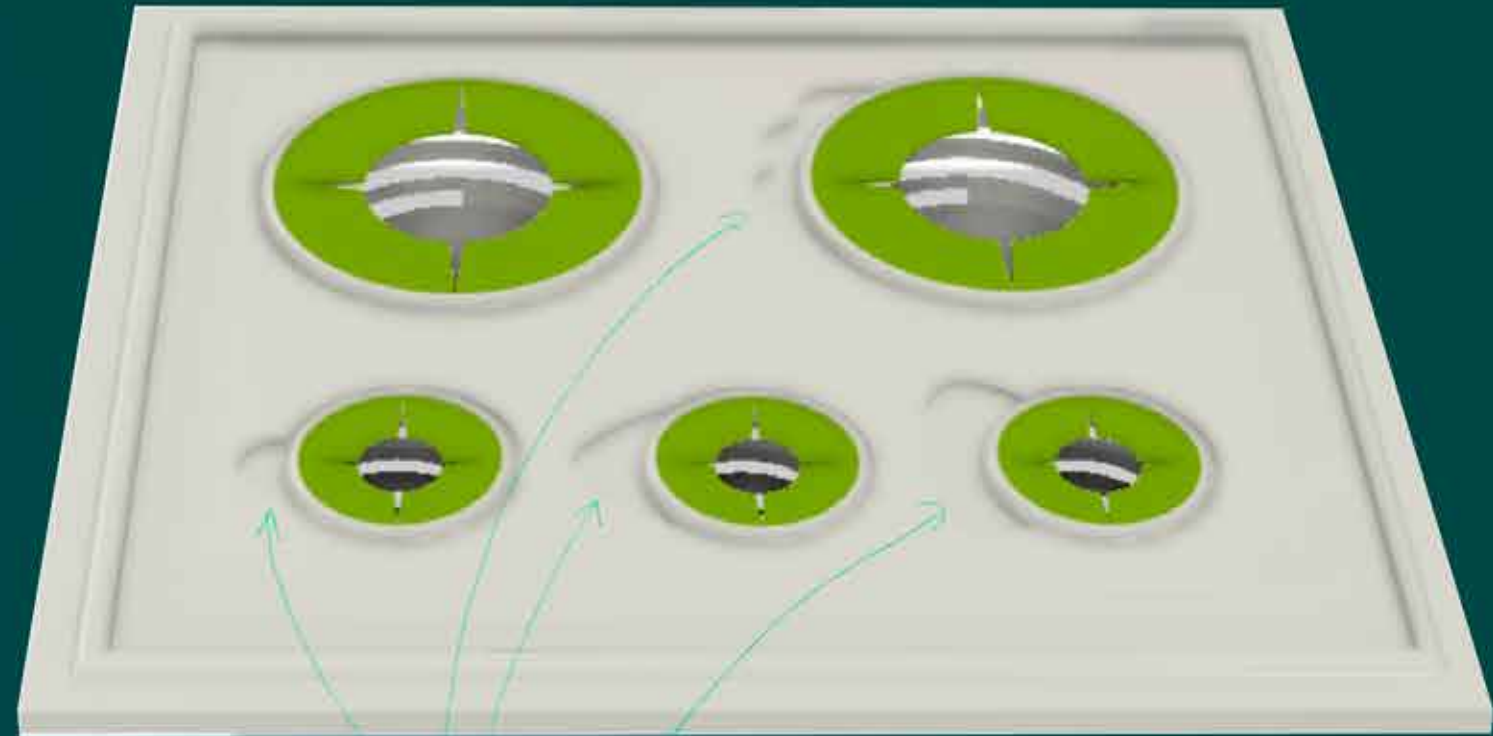


Same height but diff sizes for diff. veg.

Second design

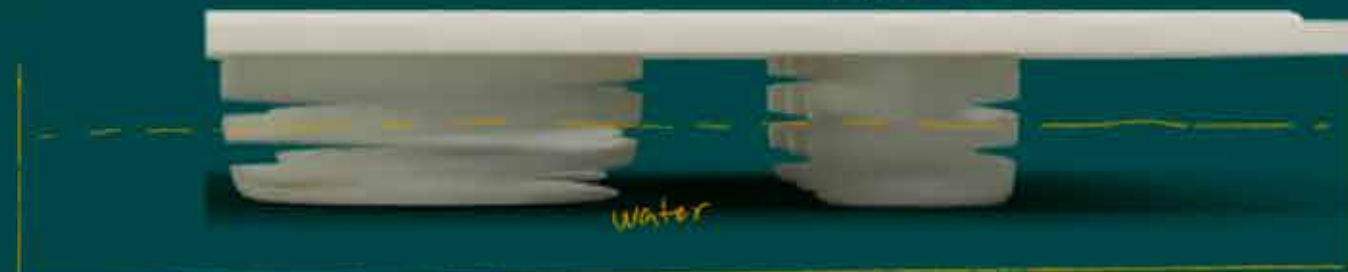
! need to do test 3D print to see if design could be strong enough. → Will spiral breaker

sturdier and looks better



diff. grip slots to find what work best.

diff veg. will be exposed to the same water level despite size



Survey answers

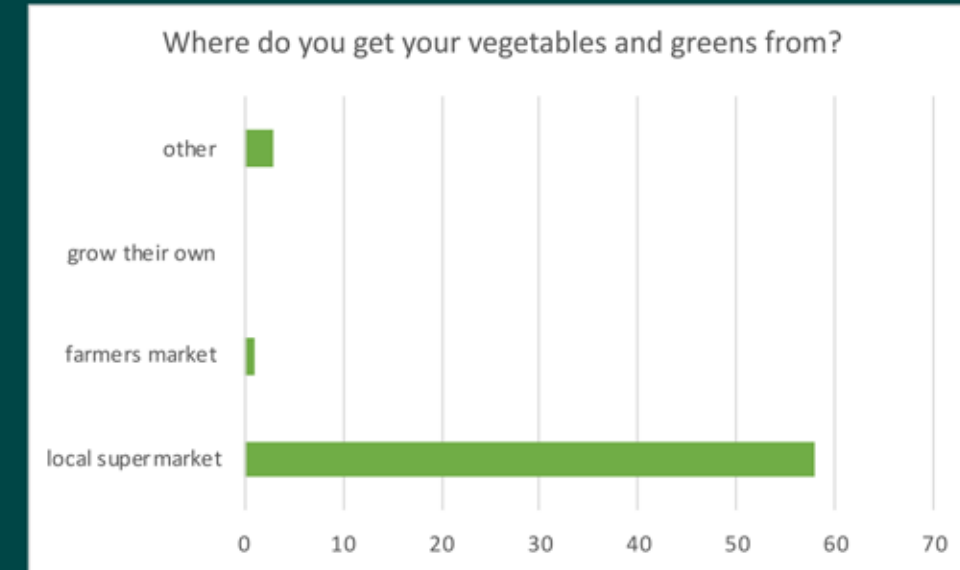
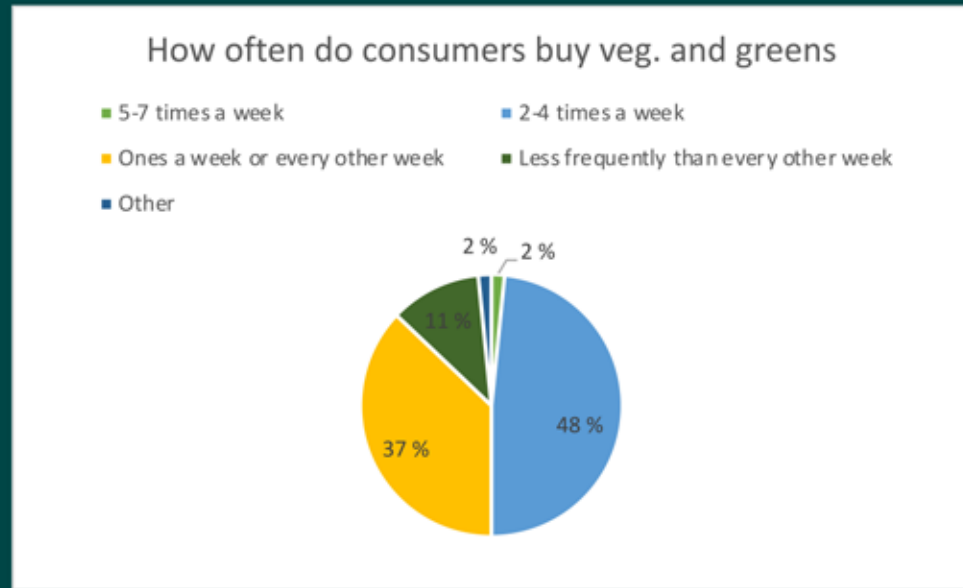
In a survey sent out to consumers ranging in age, interests and nationality, they were asked to answer basic questions regarding greens and regrowing greens.

Information about the survey that might be good to know:

This survey had 62 participants

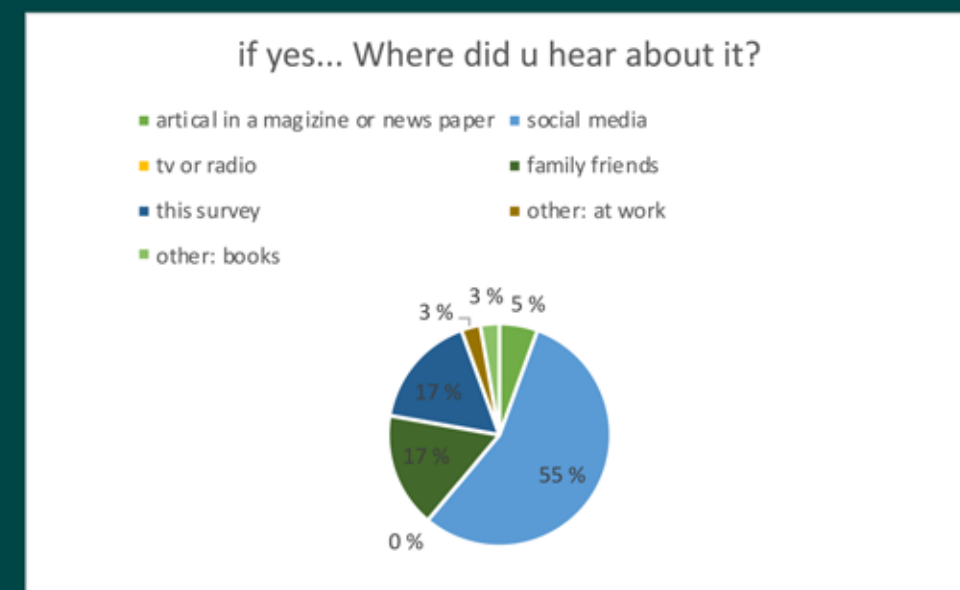
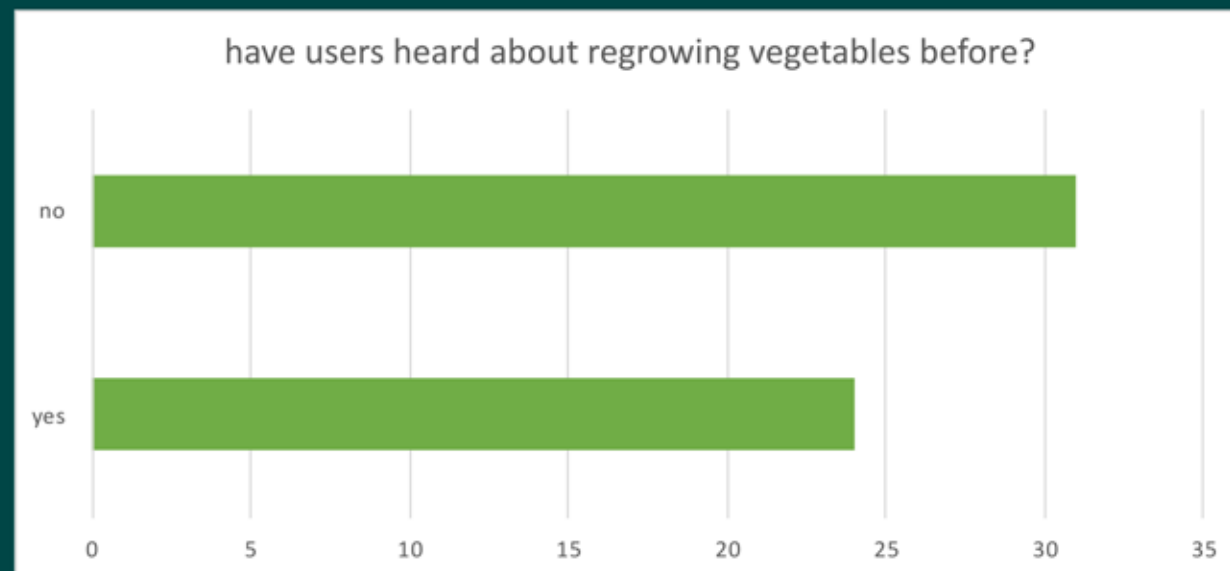
Most of the participants come from Norway and the UK.

Even though age was not a question in this survey, age-range vary from 19/20 to over 80 years old.



For the survey we can see that most people answering the survey **shop for vegetables more than once a week** - with the majority saying they shop for greens at their **local supermarket up to 2-4 times a week**.

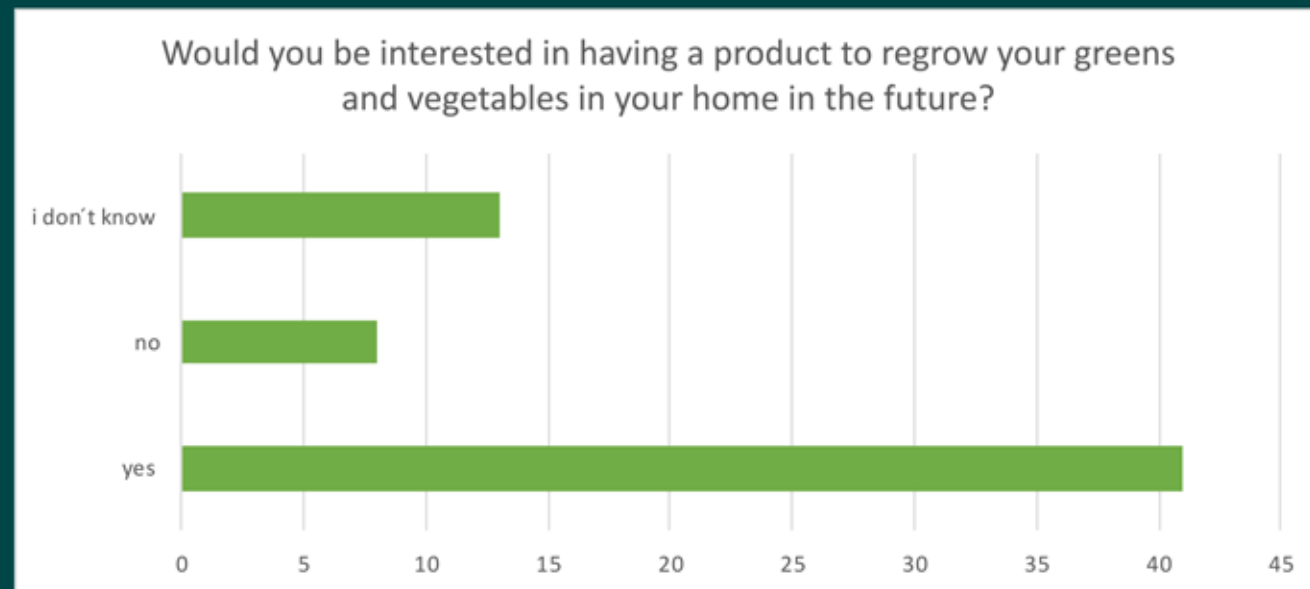
About 40% of bagged salad gets thrown away every year in the uk, totalling 2 million tons every year - just by growing salad in the home can refuse these numbers as well as saving consumes money.



Over half of the respondents has never heard about regrowing your own food before. The participants that have heard about regrowing greens has mostly gotten the information through social media. This shows the lack of education around resources and growing your own food.

I believe that bringing a product on the marked that shows consumers how easy it could be to self-sustain a small portion of your diet - and the nutritious values it can bring.

Survey answers



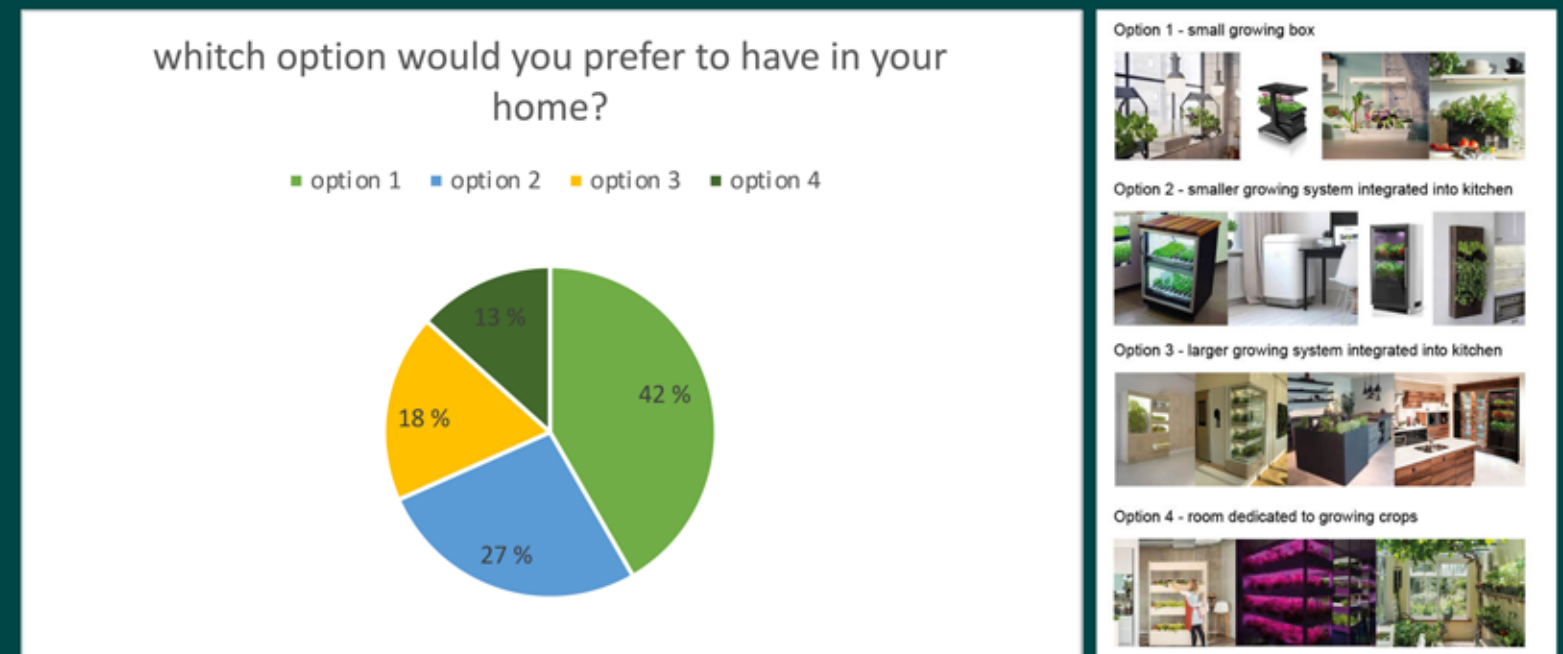
Questions asked were regarding if the participants would be open to having a product that can regrow their greens in the future - the majority responded positively or were not sure.

As products like this have not been widely represented on the market yet other than the DIY solutions - regrowing greens and vegetables are not that known about, and a consumer with no knowledge can struggle to find the benefits when the DIY solutions fall short.

During the last question, I gave the participants 4 different options for hydroponic systems to see what the consumer market is ready for. I believe that bringing a huge product onto the market can intimidate consumers, and therefore they would shy away, instead of trying it out.

for the answers I've concluded that starting with a smaller product that can be built on - can expand later - is more beneficial as the product needs to grow with the consumers not the opposite.

a lot of respondents were concerned about space but still wanted to be able to maximize the potential crops.



Option 1
"seems easy and more common"

Option 2
«I feel like there should be room for at least a few different veggies to grow, for it to be worth the space and worries. But on the other hand, a smaller one would be more aesthetic so I imagine needing to find the balance between practical and aesthetic»

Option 4
«Volume production to become self sufficient and feed my family. Though houses would have to be redesigned to accommodate»

Option 4
"Because the last couple of years i have started growing green plants and are loving it. And i think it would give a good feeling to grow your own food»

Option 1
«easy to store in the kitchen. Does not require a lot of space»

Option 1
«Because there is a limit for how much space I want to use for a growing system»

Option 3
«not to big and feels like a part of the kitchen»

Option 4
«I would prefer option 4 if I had a spare room. Although given British weather and space perhaps option 2 would be more practical for average households.»

Option 2
«Practical placement and integrated solution»

Sketches



Concept 1 small growing box

FROM THE MARKET
SMALL GROWING BOXES

For re-growing of smaller greens

↳ start small, then expand

• Can have a circulating water-system or "manual"

↳ water pump, tubing, filter

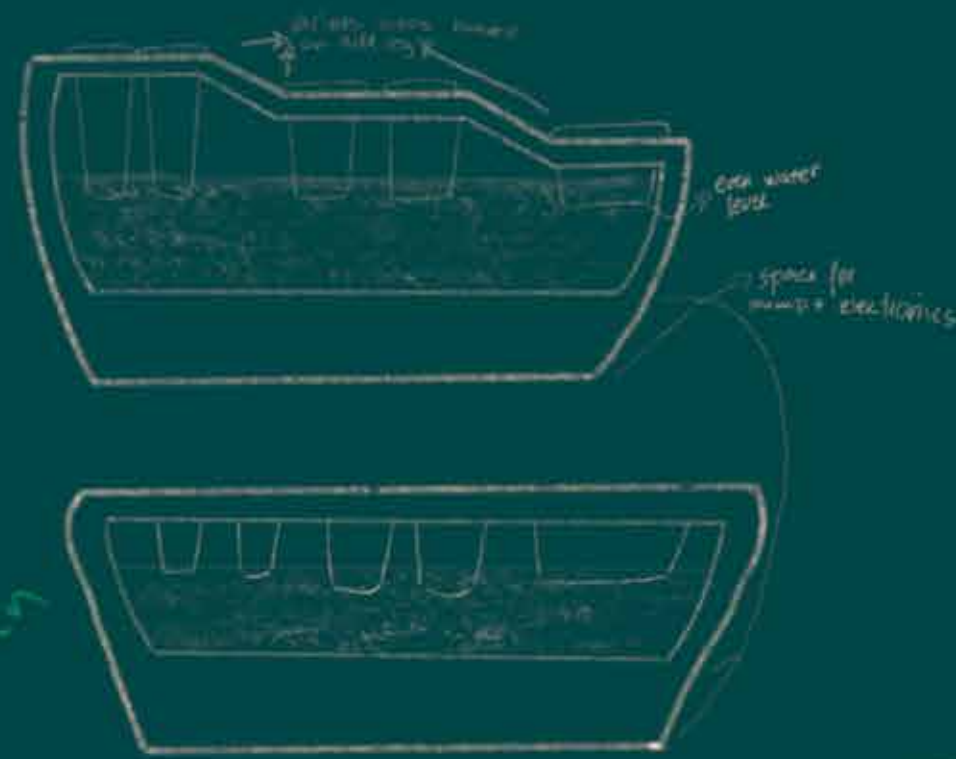
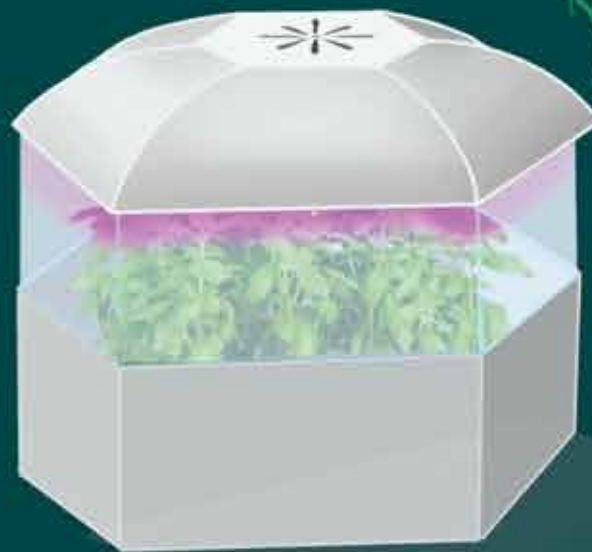
• Most likely to be used:

• DWC

• Aeroponics

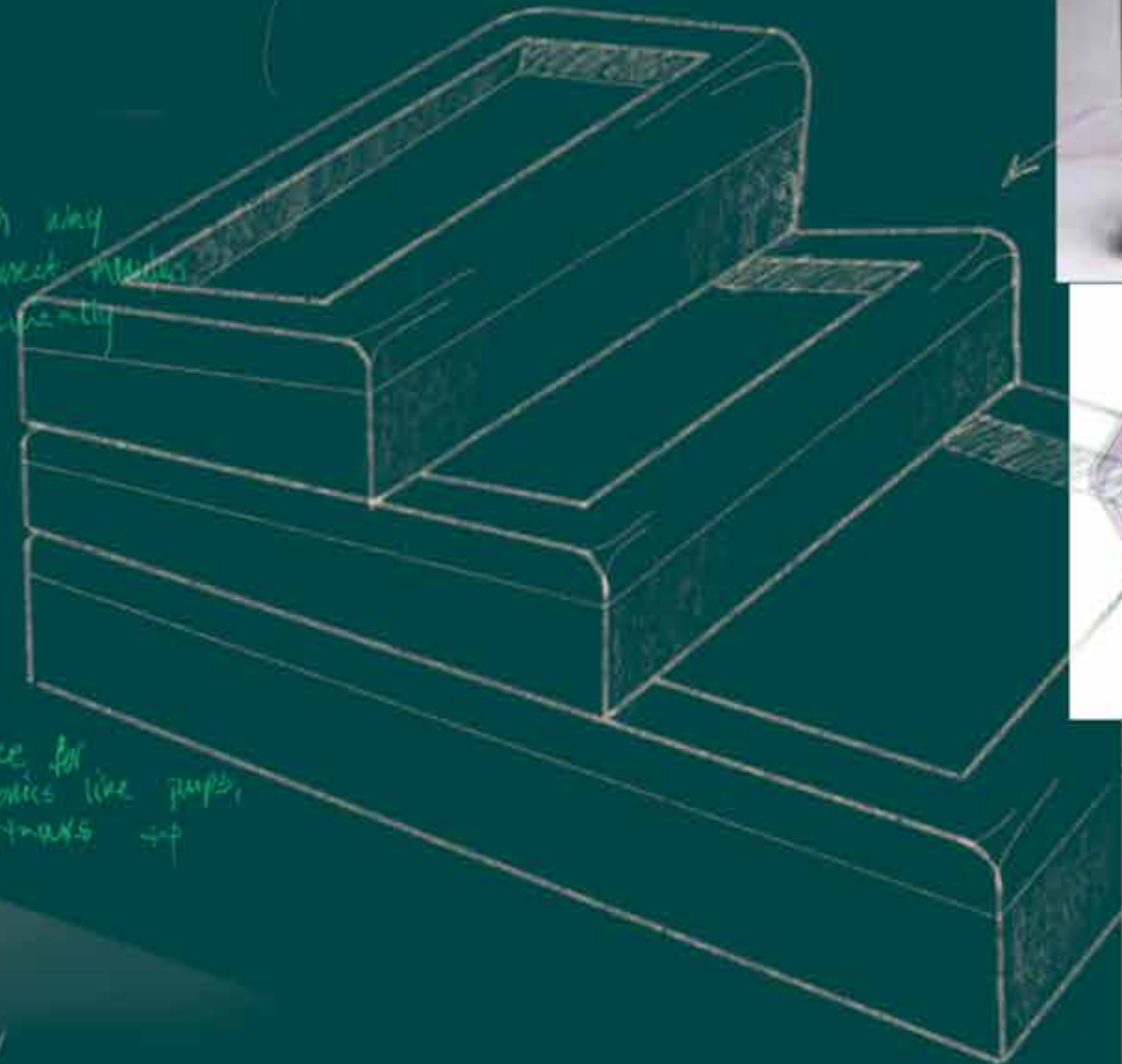
↳ "Drip system" / filter

↳ manual/stainless pump



↳ find a way to connect modules horizontally

↳ space for electronics like pumps, water tanks etc



Concept 2 under the counter system

- Deep water culture (DWC)
- Not too big - can still be very effective

Hydroponic system integrated into the kitchen elements.

↳ options to have the system visible or not



A smaller system → but can add more to get more growing space



CONCEPT 2.1

- Aeroponic system



Can we "move" up and down / widen



screen to monitor crops
invisible if wanted/needed

→ NFT or DWS → Deep Water system
Nutrient Film technique

If soil based compartment:
- Wick system



able to grow bigger crops and veg.

try to get making drawer

possibility for soil compartment