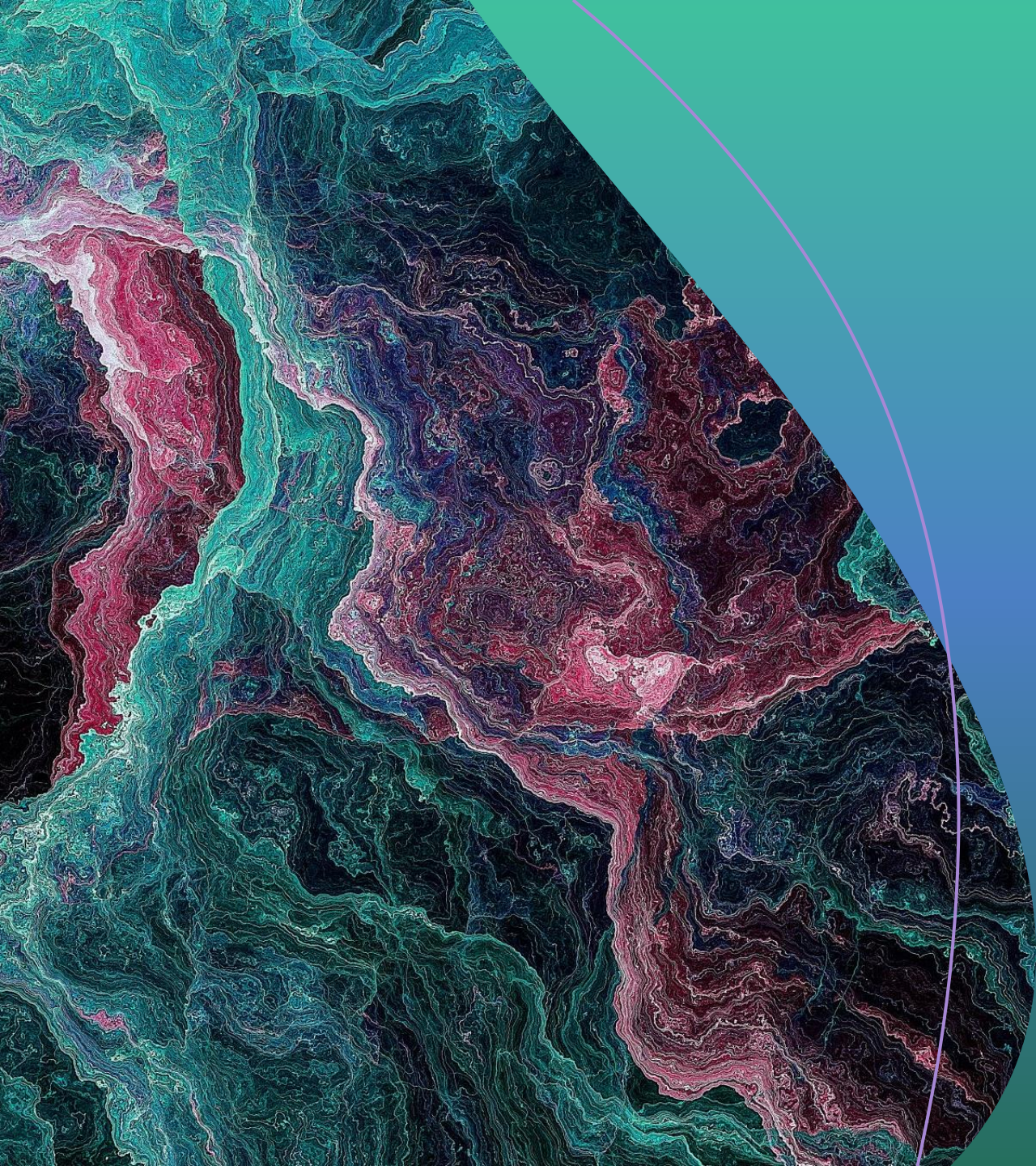




Task 1A
Final Submission
Day – 8 [16th December]
Summative Assessment
Odd Semester 2022–23

Siddhant Iyer

IADP Year – 2

Task 1A [Day 1-3]

Home Gardening in India:

The home garden is traditionally a very important piece of land for rural households. This tradition has recently gained popularity in urban cities too. Home gardens contain areas for growing food, medicinal plants, and trees in some cases, and for raising animals and fish. It is a place incorporated into living areas that also produce a variety of fruits, vegetables, or flowers. These gardens have different types according to the areas in which they're setup in. These include terrace gardens, balcony gardens, and indoor gardens.

Benefits of having a Home / Terrace Garden

Having a home garden is very useful and also soothing. One can enjoy completely organic and homegrown produce like various fruits, vegetables, and also flowers. Growing a garden at home is considered to be a very relaxing hobby. A home garden can also help in utilizing spaces such as balconies and terraces and add a splash of green to liven up the space. They also make the house look more visually appealing. It also helps in keeping spaces cooler. It allows one to grow herbs and other medicinal plants which are always useful. When used in terraces, it can also help in harvesting rainwater.

Some examples of Home / Terrace Gardens

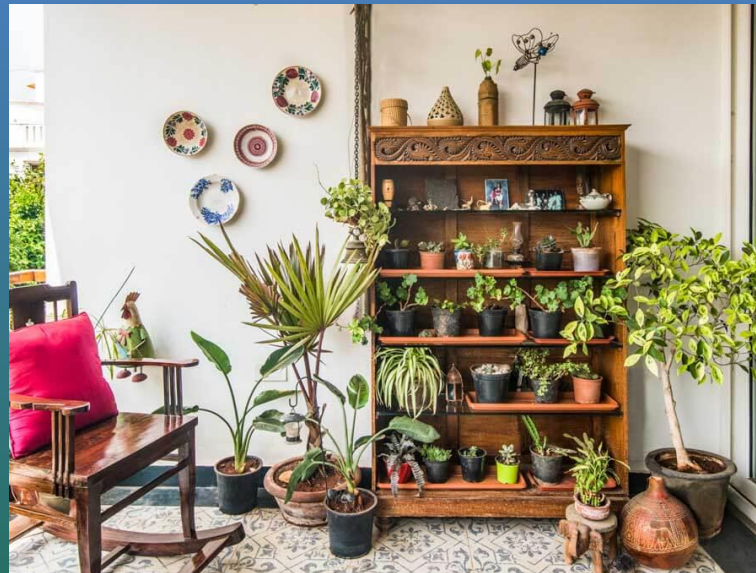


Image Credits:
Google / Arch Daily

Requirements and Basics for starting your own Home Garden

Pre-planning is key when you are thinking of setting up a garden that will give you a good yield of produce all year round.

1. Make sure the terrace / roof-top or balcony has enough sunlight along with some shady spots.
2. Easy access to water
3. Some basic support material for climbers and creepers (if any).
4. Find the right soil.
5. Use basic gardening tools like gloves, spades, wedges, shears, and others to mix soil, trim, or prune, cut leaves & branches and to harvest the produce.
6. Put the plants in an adequately sized container.
7. Once done, avoid overwatering, excessive manuring, overcrowding plants, inadequate watering, or insufficient manuring to ensure successful growth.

What Can be Used for Planting?

For home gardening, one can easily use things lying in and around them. One needs to keep a few things in mind while picking a container. Anything that holds soil and drains out excess water can be used. Based on the life cycle of the plant, one can choose the appropriate material. Every plant requires certain amount of space to grow, therefore select your container accordingly.

Now if on a budget, one can use containers from household items. For example, egg cartons are perfect for seedlings or plants with a limited shelf life. Oil cans could be used to grow curry leaves, rosemary, or chili. PET bottles have a long shelf life and can be used to grow any plant that doesn't require a lot of root space. Cane baskets can be placed over old plates and spider plants, or peace lilies can be grown in it. Tyres, old drawers, and mango crates can be used to create vegetable patches.

Tools and Instruments

To nurture a blooming garden, one needs proper tools and equipment to dig the soil, sow seeds, trim plants and nurture the plants. Appropriate gardening tools can make taking care of your garden easier and more fun. Gardening tools have special features that make them apt for gardening tasks such as digging, planting, pruning, and weeding. These tools and equipment are designed to perform different tasks and help in carrying out gardening chores efficiently. Garden tools and equipment can either be 'hand tools' or 'power equipment'.

Some of the tools, equipment, containers, and gadgets used:

- | | |
|-----------------------|--|
| 1. Gardening Gloves | 13. Hydroponic tray [for Hydroponics] |
| 2. Trowel | 14. Plant Pots [plastic, earthen (mud /clay), ceramic, etc.] |
| 3. Spade | 15. Automatic watering devices |
| 4. Weed puller | |
| 5. Watering can | |
| 6. Hand fork and claw | |
| 7. Spray bottle | |
| 8. Dibber | |
| 9. Pruner | |
| 10. Garden scissors | |
| 11. Seed tray | |
| 12. Seedling tray | |

Tools for gardening are available at various E-retailers like Amazon, Flipkart, Pepperfry, Trustbasket, and other manufacturers like TATA Agrico, etc.

Issues

Some of the issues that people generally face while starting / planning / owning a home are as follows:

1. Space constraints
2. No time for working people
3. Becomes a hassle when pests come in
4. Taking care of them while travelling
5. Birds and other insects trampling plants / eating the fruits

Hydroponics

Different from the traditional way of growing plants in soil, hydroponics is a growing system where plants are allowed to grow without soil. Since we are so used to plants growing in the soil that anything other than soil may come as a surprise. However, over the years, hydroponics has gained popularity because of its obvious advantages over soil. With hydroponics, plants are grown in an artificially controlled environment without soil. But since plants need nutrients and water for growth, which they typically extract from the soil, they can continue to absorb both water and nutrients from an artificial nutrient-rich solution. The roots of the plants are directly dipped in the nutrient-rich solution, so plants can easily absorb nutrients and continue to grow even without soil.

Hydroponics is the technique of growing plants using a water-based nutrient solution rather than soil, and can include an aggregate substrate, or growing media, such as vermiculite, coconut coir, or perlite. Hydroponic production systems are used by small farmers, hobbyists, and commercial enterprises. This seemingly subtle shift in growing food (i.e., skipping the soil) is revolutionary -- it allows growers to produce food anywhere in the world, at any time of the year, and to net higher yields with fewer resources.

Advantages

Growing seasons and regions are always in major flux as temperatures change and growing conditions change along with them. Even in “normal” conditions, there are plenty of places where the ground just isn’t conducive for farming (like deserts, cities, marshy areas, etc). Plants are commonly grown hydroponically in a greenhouse or contained environment on inert media, adapted to the controlled-environment agriculture (CEA) process. Plants commonly grown hydroponically include tomatoes, peppers, cucumbers, strawberries, lettuces, etc. If you compare the health of the plants that grow in soil with plants growing under hydroponics, then the latter translates into healthier and stronger plants. Also, the yield from hydroponics is more vibrant because it contains more vitamins and nutrients compared to the plants grown in soil. And this is exactly why hydroponics is not just a popular approach among indoor gardeners but is also one of the most favourite methods among commercial farmers.

And since plants grown hydroponically are healthier compared to plants grown in soil, they are also less prone to pests and diseases. In case, you put a sick plant right next to a healthy plant in a hydroponic setup, you would be surprised to see that the sick plant does not affect the health of healthy plant (which is generally the case in plants grown in soil). So, in plants grown hydroponically, you get to see nature working such that the strongest plants survive. On the other hand, if you look at the health of plants grown in soil, you would be surprised to see that there is a stark difference between the health of plants grown in the soil compared to those grown hydroponically.

What you need

- 1. Fresh water** filtered with a balanced pH. Most plants like water with a pH level around 6–6.5. Acidity of water can be changed with solutions found at local hardware, garden, or hydroponic store.
- 2. Oxygen.** In traditional farming, roots can get the oxygen needed for respiration from pockets of air in the soil. Depending on your hydroponic setup, one can either leave space between the base of your plant and the water reservoir or oxygenate the container (like bubbles in a fish tank), which one can accomplish by buying an air stone or installing an air pump.
- 3. Root Support.** Even though you don't need soil, plant roots still need something to hold on to. Typical materials include vermiculite, perlite, peat moss, coconut fibre, and rockwool. Materials that might compact (like sand) or that don't retain any moisture (like gravel) won't work.
- 4. Nutrients.** Plants will still require plenty of magnesium, phosphorus, calcium, and other nutrients to stay healthy and productive [like when growing in the ground, they need healthy soil and fertilizer]. When growing plants without soil, this “plant food” must be included in the water that's feeding your plants. While one can technically make their own nutrient solution, it's easy to buy mixtures found online and in stores. The nutrients used in hydroponic systems can come from many different organic or inorganic sources, including fish excrement, duck manure, purchased chemical fertilizers, or artificial nutrient solutions.
- 5. Light.** If growing plants indoors, one might have to invest in some special lighting. Each kind of plant will have a different requirement for light that it needs (typically referred to as Daily Light Integral or DLI).

Benefits and Statistics

Hydroponics offers many advantages, notably a decrease in water usage in agriculture. To grow 1 kilogram of tomatoes using intensive farming methods requires 214 litres of water; using hydroponics, 70 litres. Hydroponic cultures lead to highest biomass and protein production compared to other growth substrates, of plants cultivated in the same environmental conditions and supplied with equal amounts of nutrients. Since hydroponics takes much less water and nutrients to grow produce and climate change threatens agricultural yields, it could be possible in the future for people in harsh environments with little accessible water to grow their own plant-based food. Hydroponics is not only used on earth but has also proven itself in plant production experiments in space.

Physical Submissions

15-12-22

Design Intervention (planned):

Container / ~~structure~~ / space in balcony or terrace.

1. Container. → Concept.

For container ~~space~~, things to include:

- Swappable for using in a hydroponic/soil based setup.
- Easy plug-in and expand system
- Easy access to remove and add plants
- Include features to be able to add fishes.
- QUICK DISCONNECT PORTS FOR WATER FLOW

TRAY THAT CAN BE USED TO CONVERT THE CONTAINER TO BE USED IN A HYDROPONIC SETUP.

2. Space in balcony / terrace. → Concept.

TOP VIEW

SUPER LONG CONTAINER (RESERVOIR) THAT HOUSES FISH & OTHER INVERTEBRATES.

MULTI-LEVEL WALL MOUNTED CONTAINERS

Legend:

- Blue square: FLOW → UP
- Red square: FLOW → DOWN

use the concept of plug and disconnect systems from quick disconnect systems used in PC watercooling.

AR 6/12/PM

SRISHTI MANTAL
INSTITUTE OF ART, DESIGN & TECHNOLOGY, BENGALURU
A Government End of World, Bengaluru

☒ UNDERGRADUATE ☐ POSTGRADUATE

Academic Year 2022-23 Semester ☒ ODD ☐ EVEN

Semester of Study 1 / 2 / 3 / 4 / 5 / 6 / 7 / 8

Program B.Des Course IADP

Name IYER SIDDHANT HARSHANA Roll No. 215307046 Date 06/12/22

Name of Submission TASK 1A: UNDERSTANDING CONTENT Page No. 2

CURRENT ISSUES & SOME FIXES FOR THEM.

1. NO SPACE.
2. NO TIME FOR WORKING PEOPLE. [WATERING & CARE]
3. BECOMES A HASSLE WHEN PESTS COME IN.
4. WHAT TO DO WHEN TRAVELLING?

FOR HYDROPONICS, USE A TIMER ACTIVATED PUMP. [LIKE THE ONES USED IN FISH TANKS]

FOR SOIL-BASED FARMING, TIMER-BASED IRRIGATION SYSTEMS CAN BE USED. [THEY ARE PRETTY CHEAP]

SPACE CONSTRAINTS

- FOR HOUSES WITH SPACE CONSTRAINTS, THE SIZE OF THE CONTAINER CAN BE CUSTOMIZED (scaled up and down)
- ALL SYSTEMS SHOULD BE EASILY SCALABLE (in terms of number of containers)
- STACKABLE AND EASY TO STORE

CONNECTORS FOR CONTAINERS (CONCEPT)

SIMPLE CONNECTOR FOR CONTAINERS IN A STRAIGHT LINE

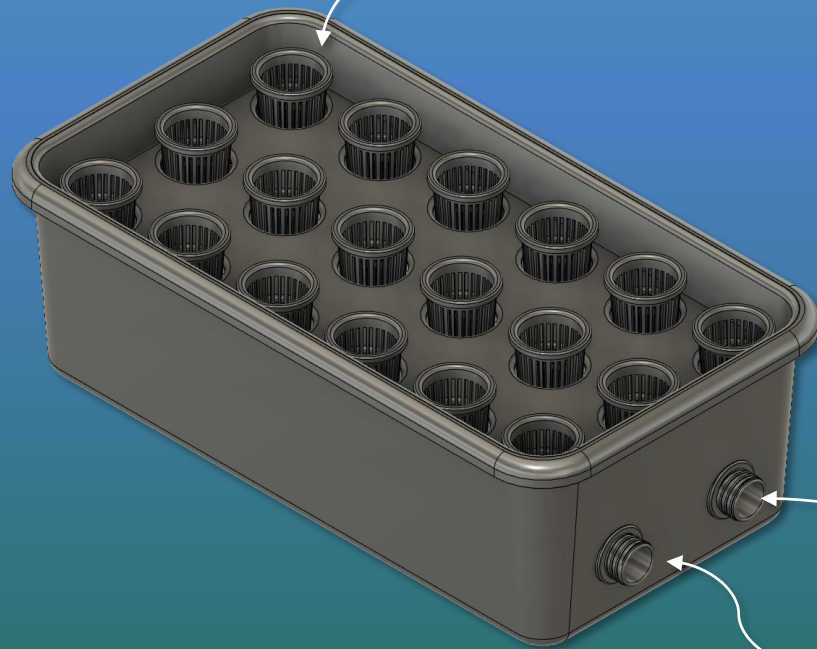
CONNECTOR WITH PROVISION TO ATTACH TUBES FOR CONTAINERS SET AT AN ANGLE.



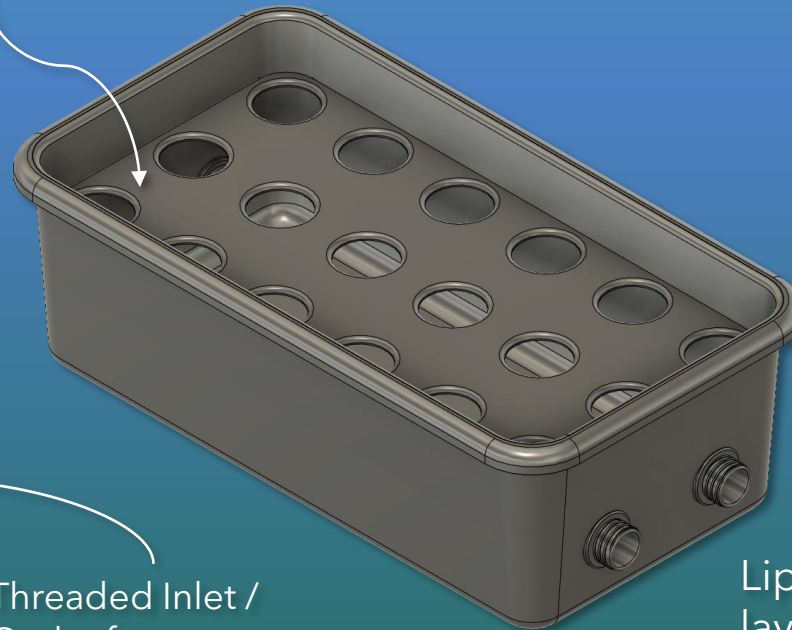
Digital
Prototype of the
Container
[Made using
Fusion 360]

Different Layers of the Container

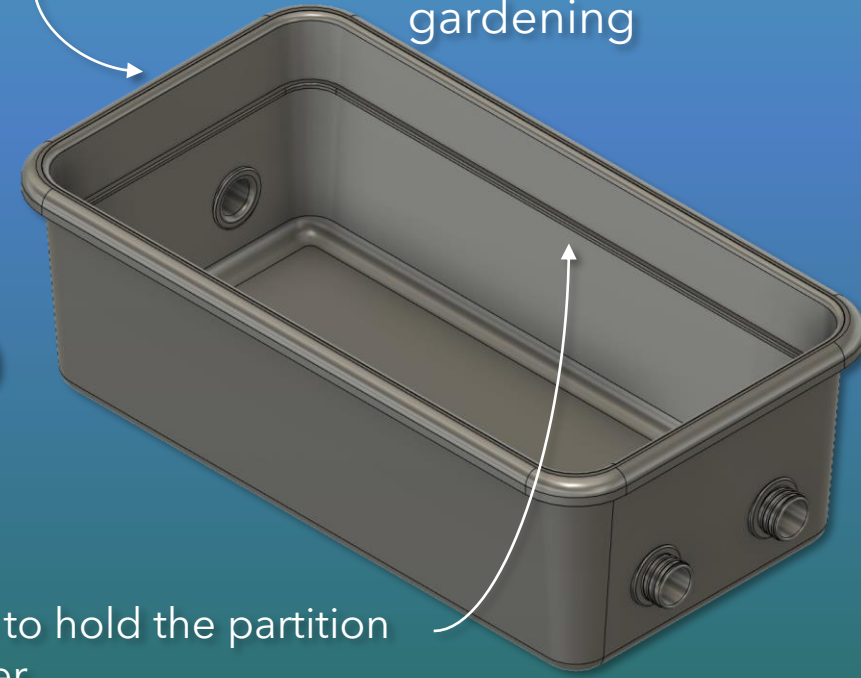
With planter pots and partition



With partition



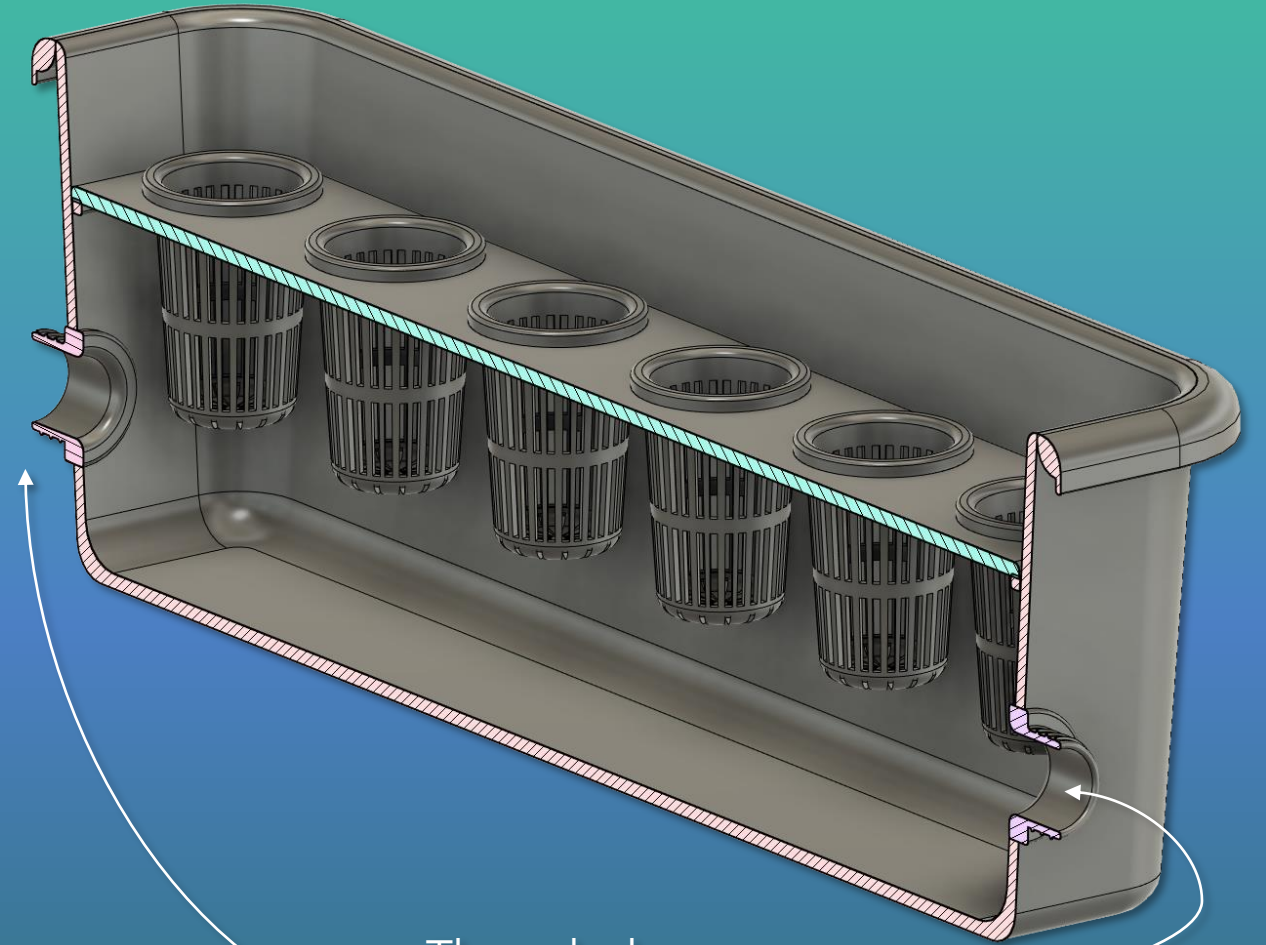
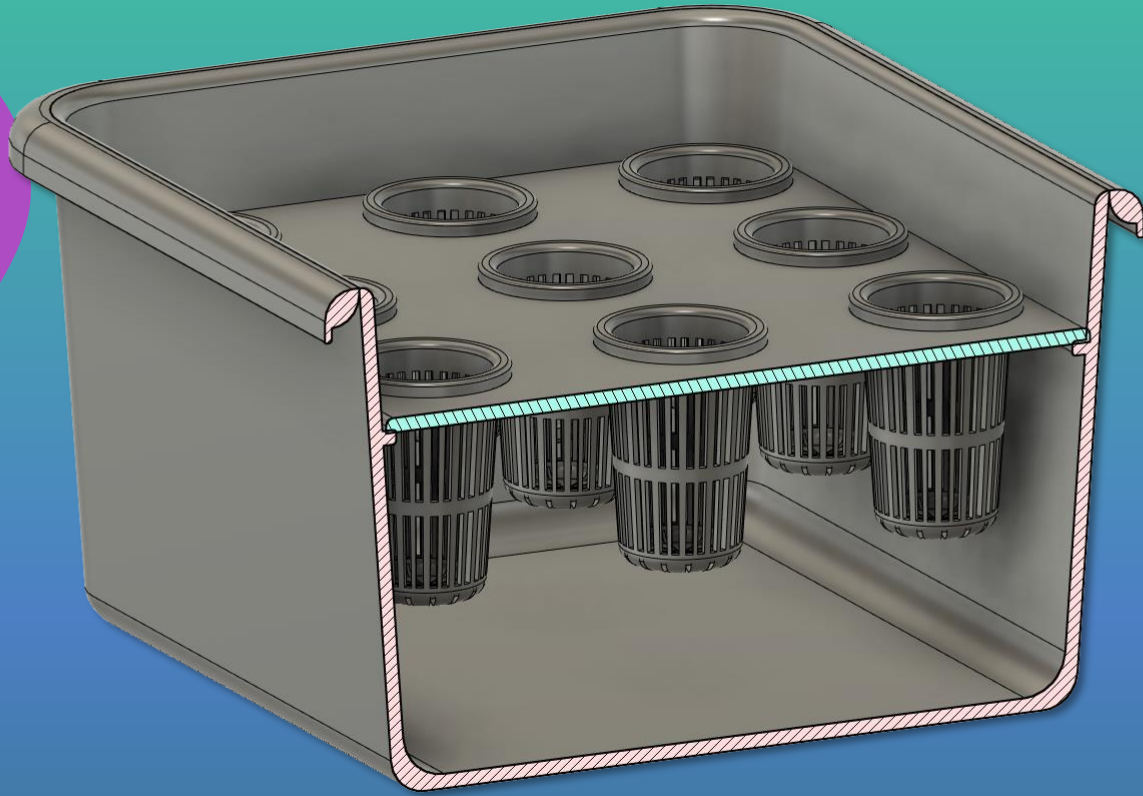
Just the container with Threaded ports for water



This configuration can be used for soil based gardening

Threaded Inlet / Outlet for water

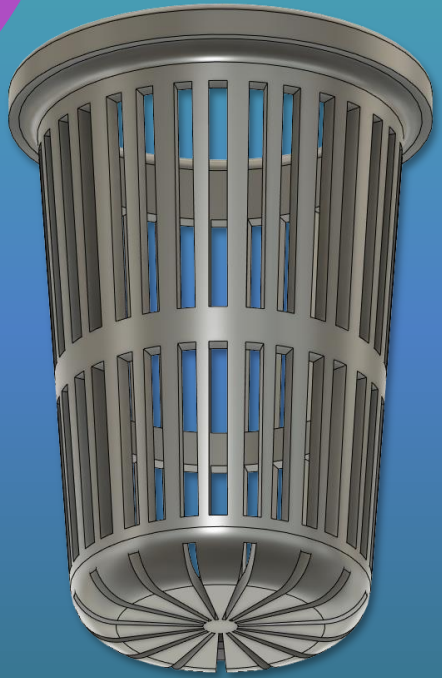
Lip to hold the partition layer



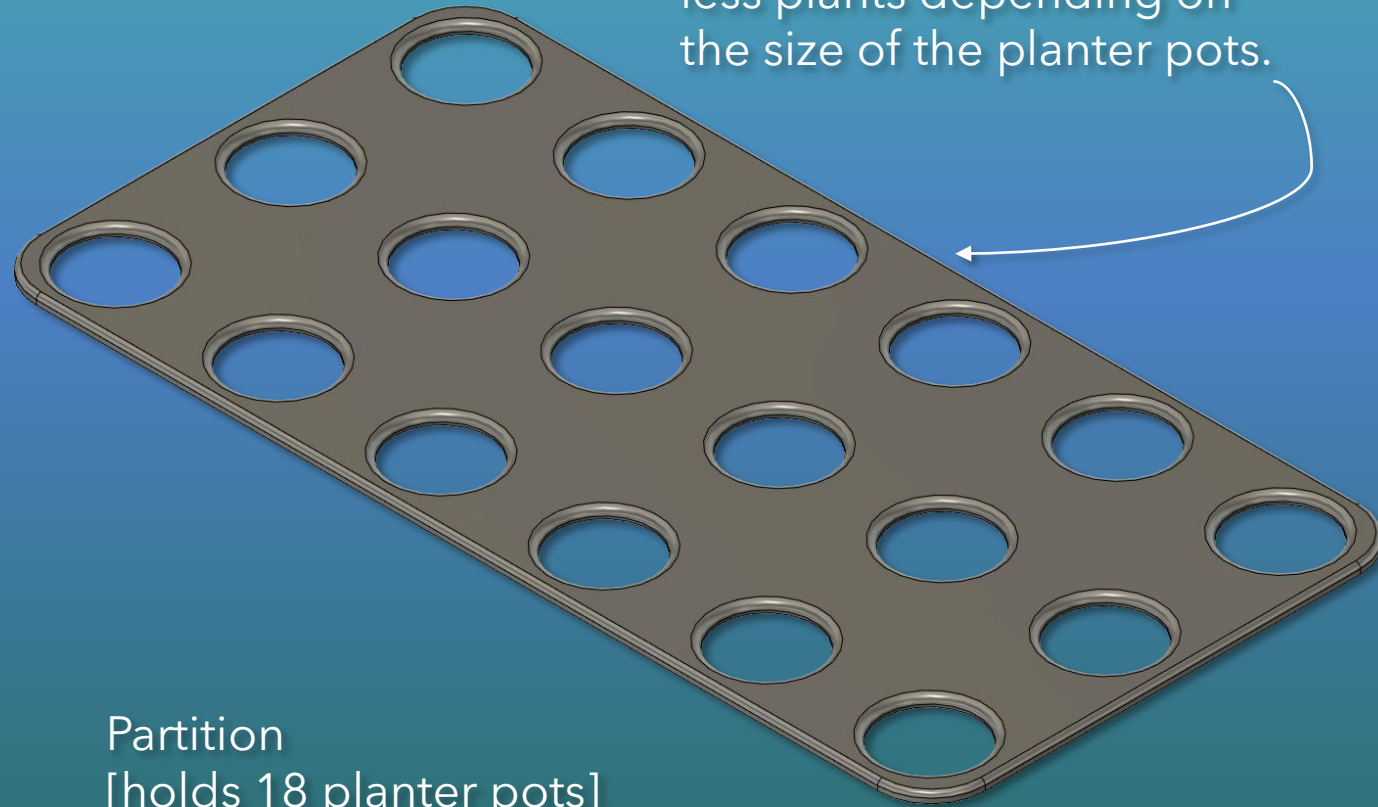
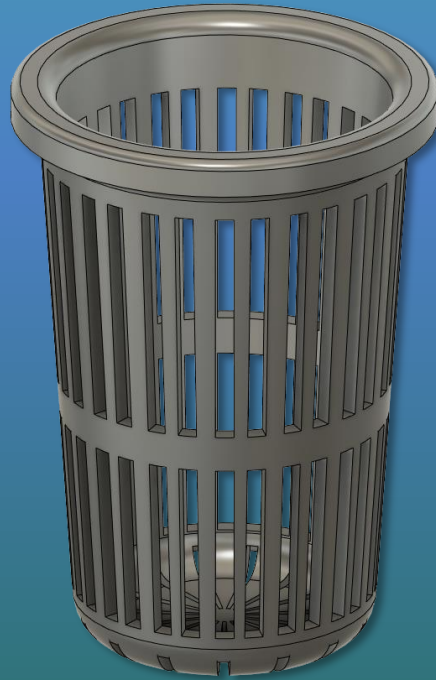
Section View

Threaded
Inlet / Outlet for
water

Planting Pots and Partition



Planting Pots

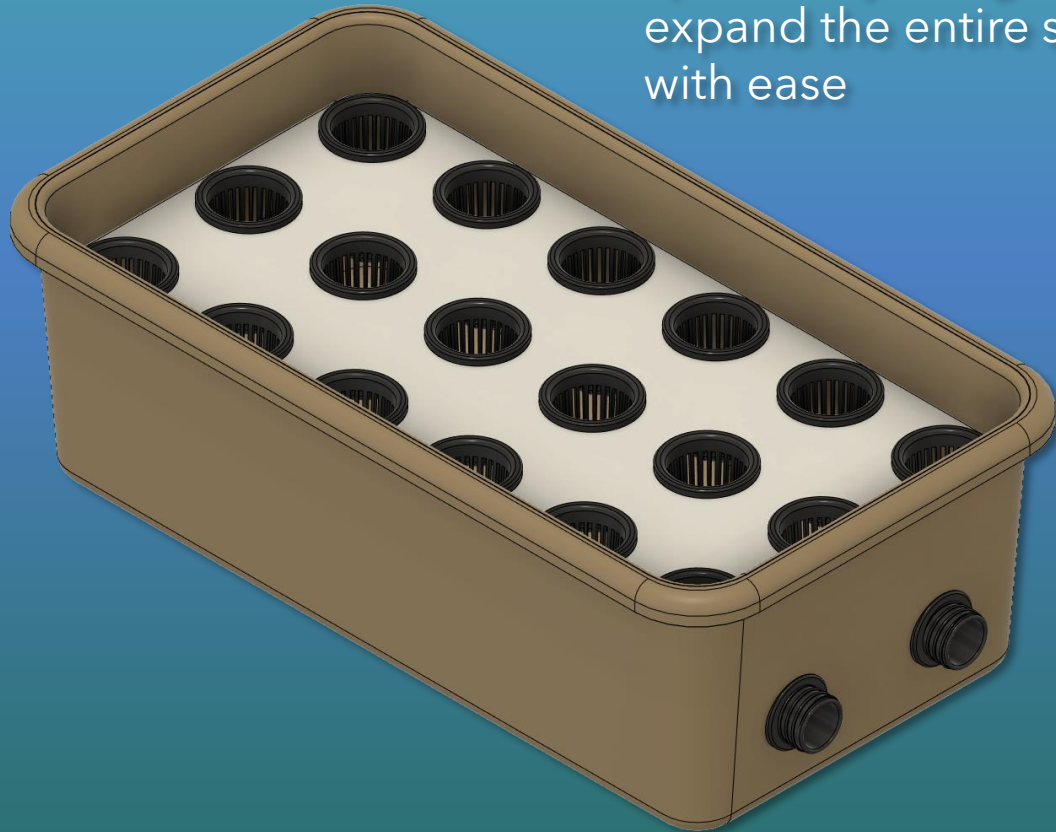


Partition
[holds 18 planter pots]

Partition layer can be changed to hold more or less plants depending on the size of the planter pots.

Container with Texture

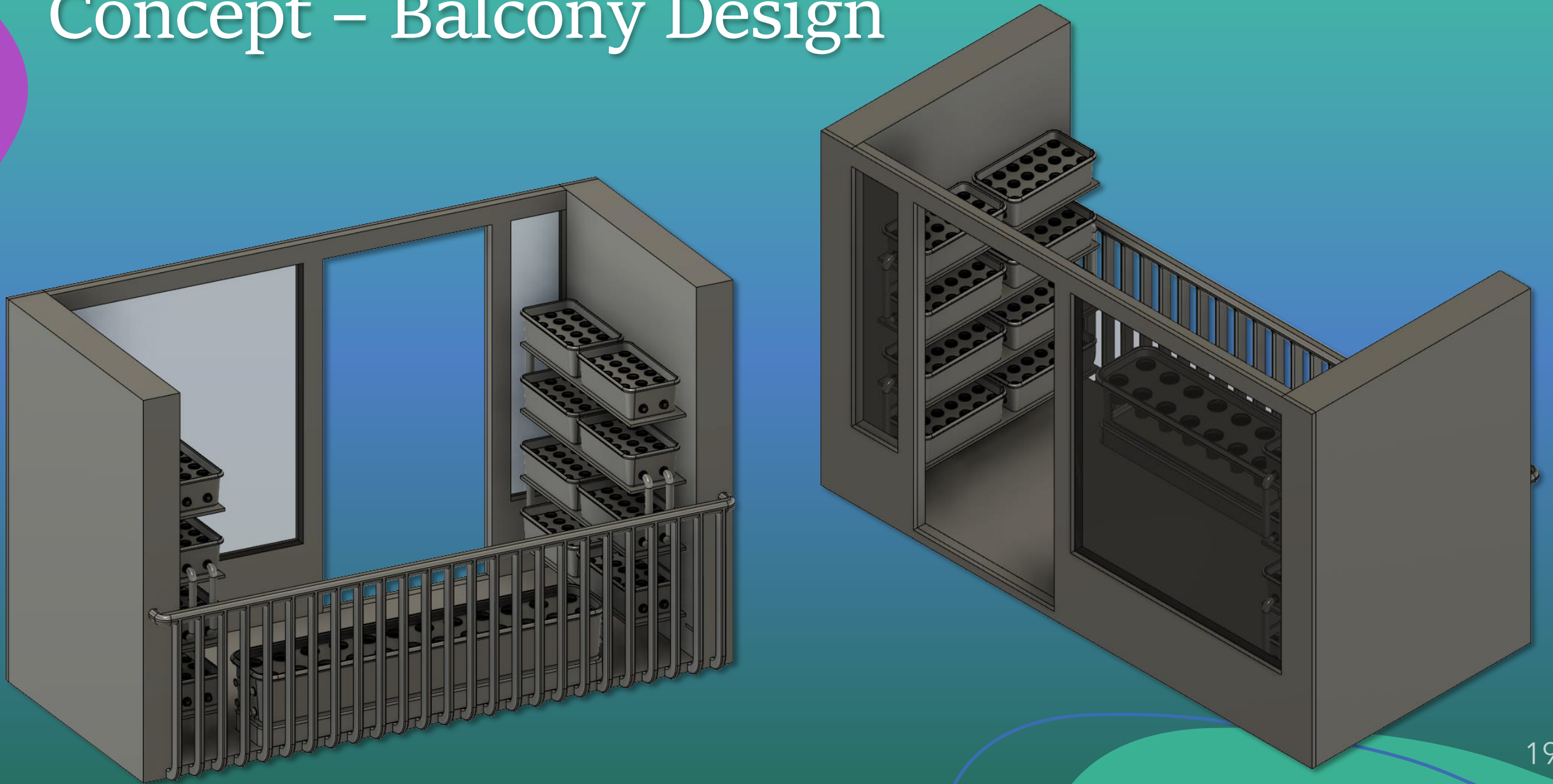
The Inlet and outlet are specifically designed to expand the entire system with ease



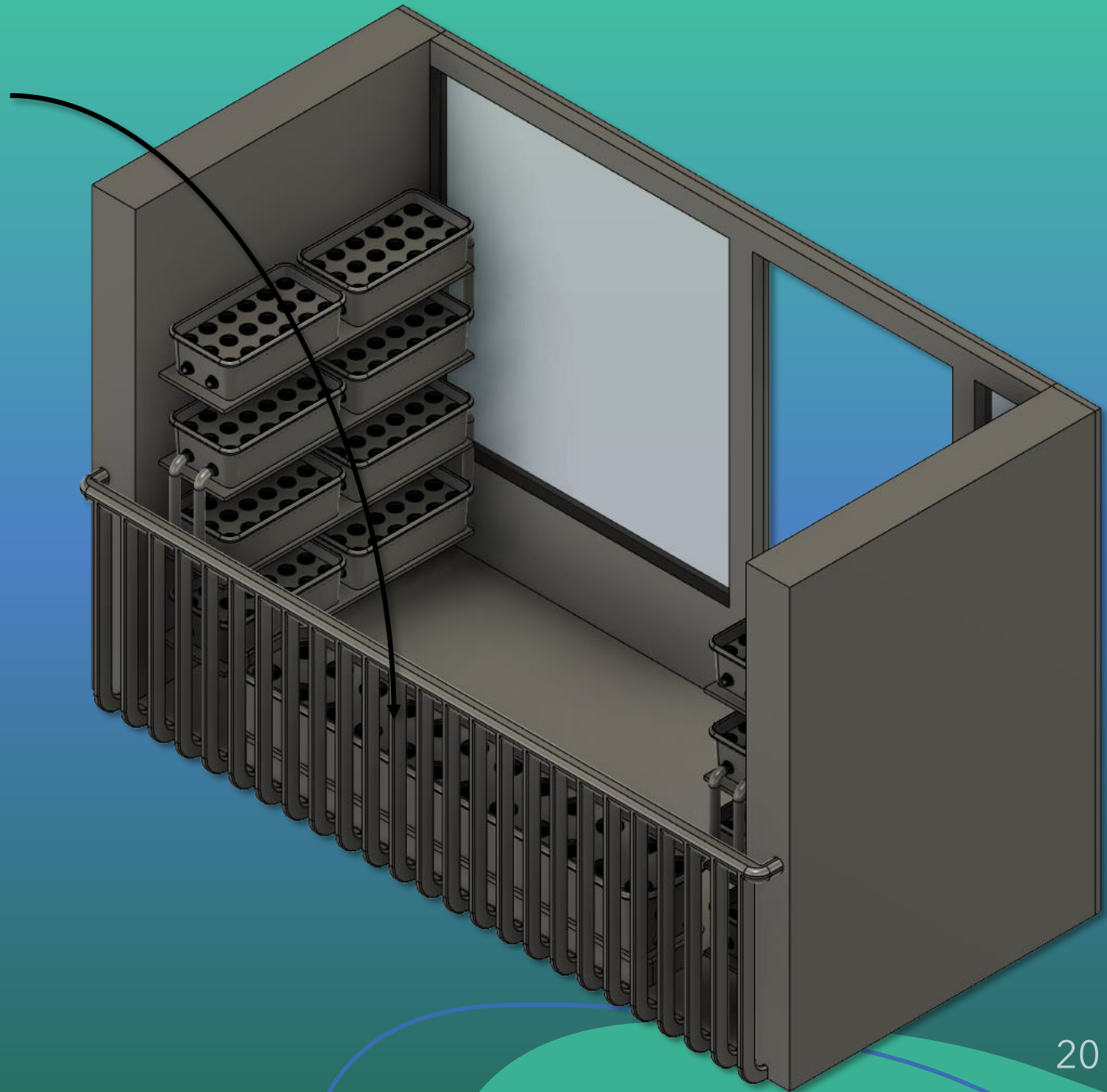
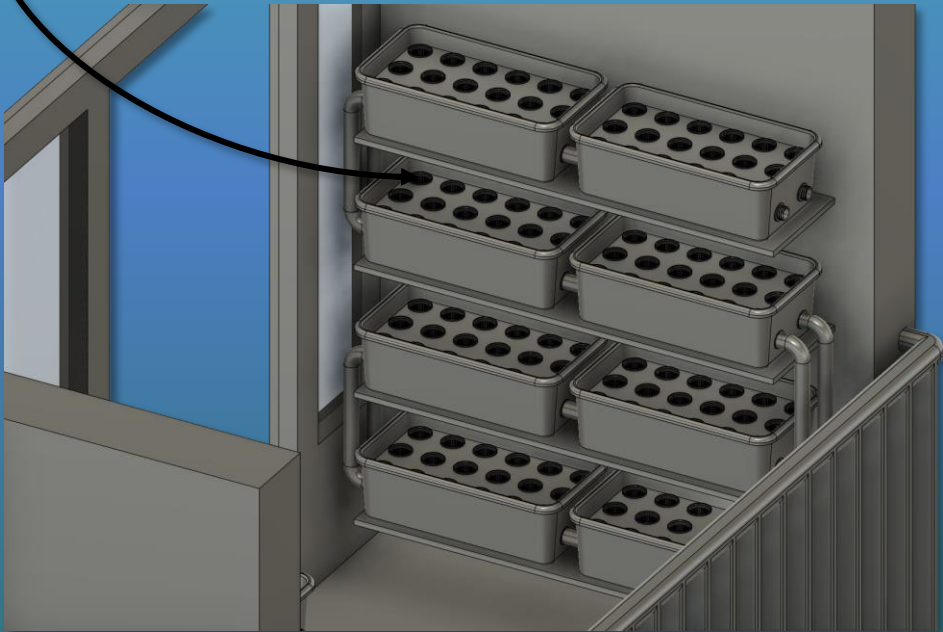
The containers can be set right next to each other or at an angle with the help of tubes.



Concept – Balcony Design

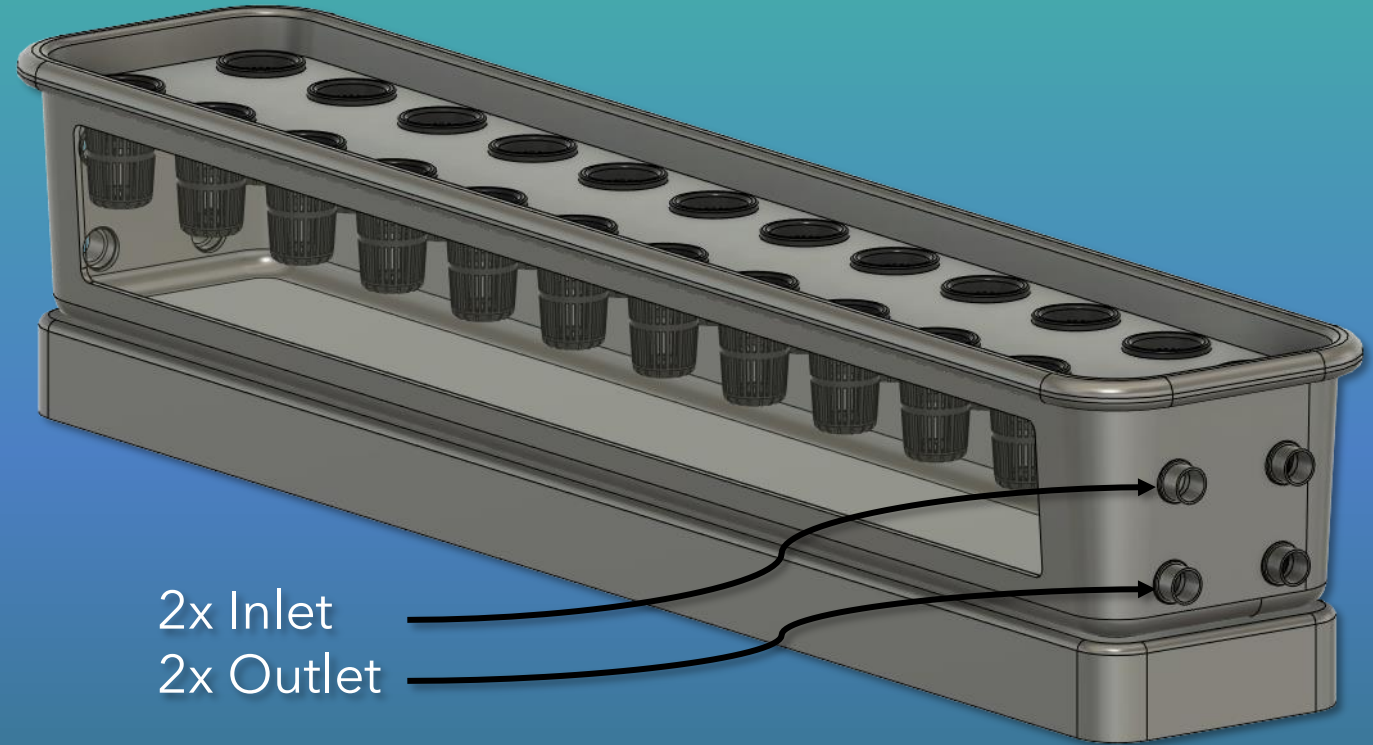
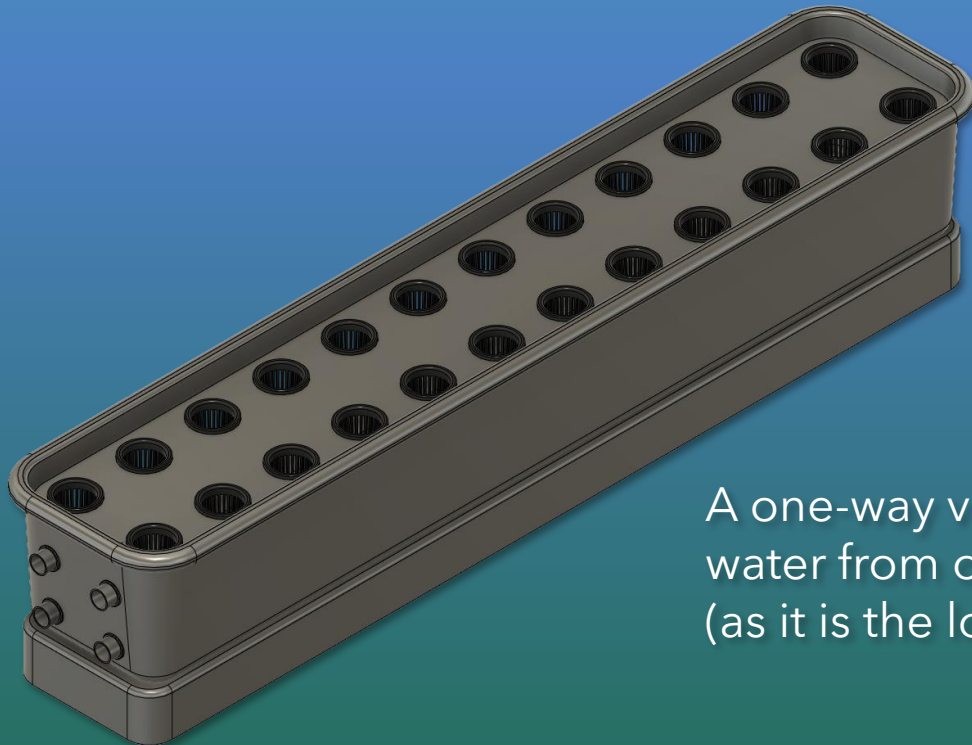


Containers set in rows with tubes connecting them to the large container (Water Reservoir) which also houses fishes



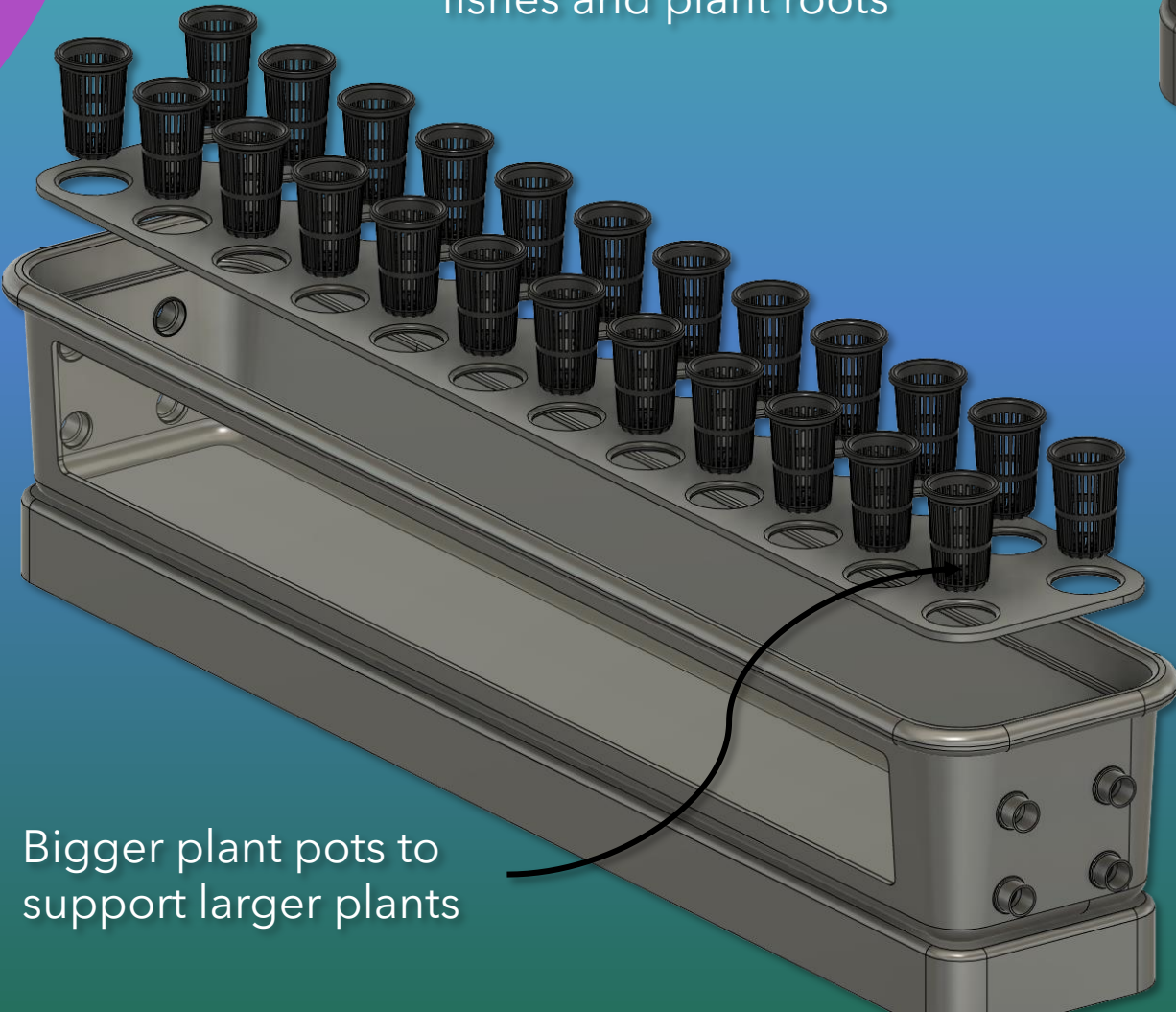
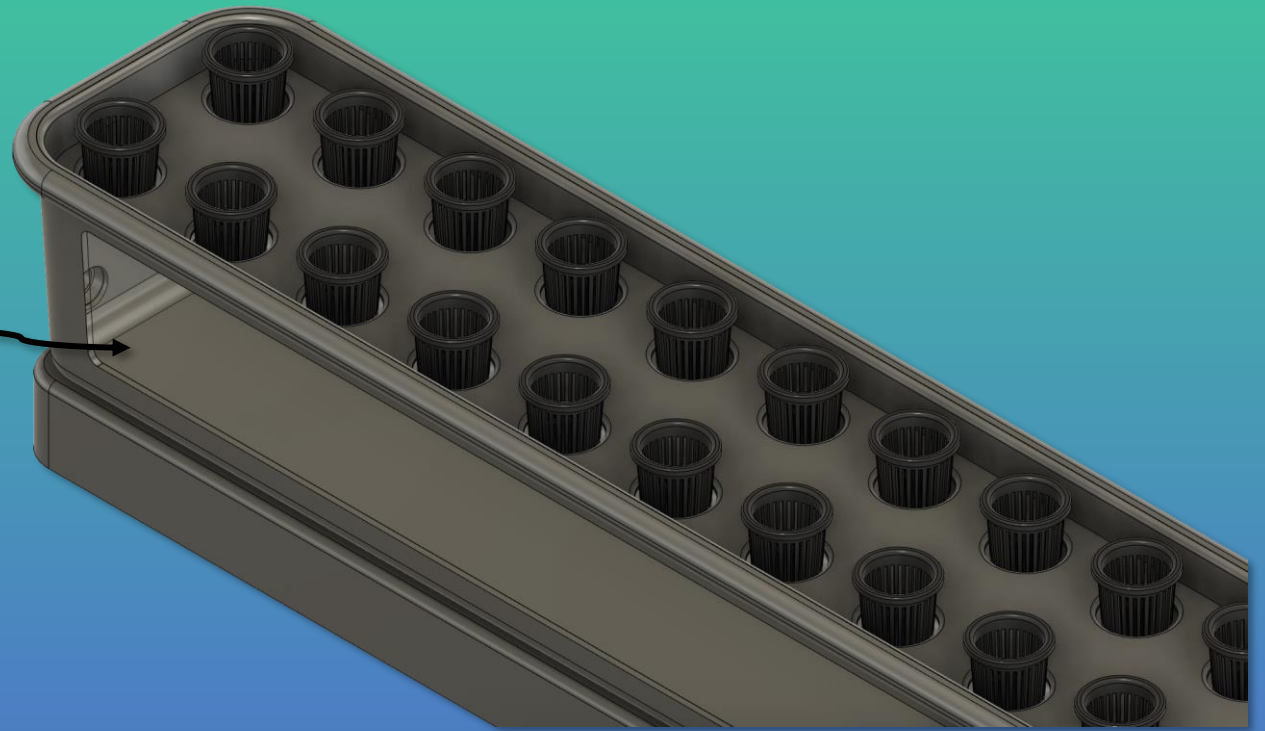
Large container / reservoir design

The outlet from the container feeds into a pump on either side that keeps the water flowing through the loop

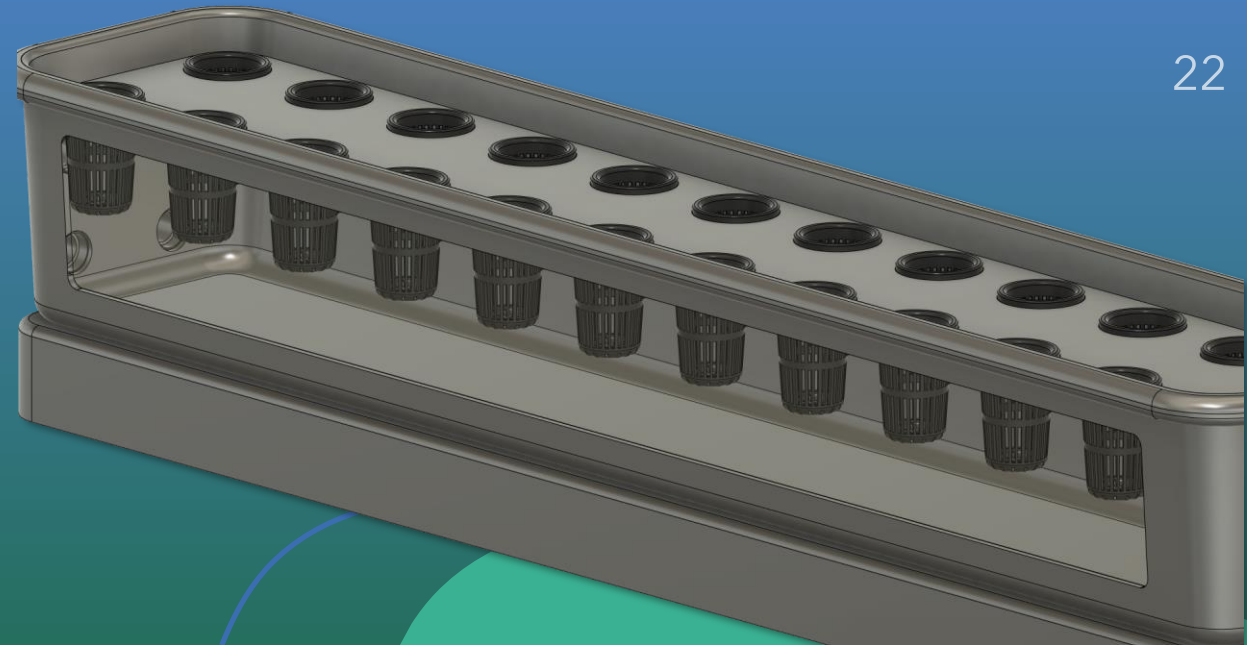


A one-way valve is fitted on both the inlet and outlet to stop water from overflowing when the pump isn't functional (as it is the lowest point in the loop)

Glass side panel to view the fishes and plant roots



Bigger plant pots to support larger plants



Task 1B [Day 4]

Area and Scope of the Interventions

There are so many people who absolutely love plants and gardening. Even the thought of gardening excites them, and they always dream about having a little garden to themselves at home. But, since we live in cities, and always have a space crunch, having a good gardening space is next to impossible, unless you wish to invest a hefty amount to buy a house with a great garden space. With the interventions that I plan on making, my goal is going to be to provide cheap yet durable products, tools and also some systems to help people start their own garden in a place that they choose. These could be anything ranging from kitchen countertops, drawing rooms, bedrooms, windowsills, to large spaces like balconies and even terraces.

Broadly, the agenda is to come up with ideas that are effective, efficient, and somewhat modular, and could help the user tackle some of the issues faced while owning a house garden. With these ideas, I am primarily looking at small, yet efficient ways of home gardening that also takes very little space. I am also looking at different ways for making these ideas easily scalable, for the users to make the most out of them. Apart from this, I would also look at certain pain points / issues [like watering them properly and on time] and try to tackle them in some way. In addition, I would be adding features to the concepts that might help educate users on various aspects related to the house gardens, that could help them have a better outcome in the future.

Users / Target Audience

Everybody loves green plants and large foliage plants. Just looking at these plants brings a sense of calm and peace and relaxes our mind. In today's world where everybody is frantically trying to keep up with work and their urban lifestyle, mental health becomes a key factor. And so indoor plants have gained a lot of popularity in recent times. Lack of access to green space and time have led to people taking care of a few indoor plants at home. Everybody wants to have beautiful, houseplants that are easy to care for that, and require low-maintenance.

The target audience for my planned intervention are working people who like to have plants at their home but also want to keep it low maintenance. It also includes people that don't have a lot of time to take care of the plants and also, people who don't wish to put in a lot of work but also don't mind enjoying the produce occasionally. For this, I would mostly be using low maintenance indoor plants, that require low light, and are less demanding than others, and make spaces look richer. It could also be very helpful for people who are just getting into the hobby of having an indoor garden.

Intention / Advantages of the Ideas

Time Saving: With the ideas, I am going to focus on reducing the time taken to manage and maintain the plants. This could be achieved by making a self-watering system, that would drastically reduce the frequency at which they would need to be watered. Apart from this, I would also be looking at easy methods for trimming, harvesting and managing the plants themselves.

Cost Saving: Making products that are cheap yet effective is going to be a priority. Also providing users with cheaper household alternatives [like reusing old containers for planting] is something that I wish to incorporate too.

Space Saving: All ideas that I come up with will be focused on utilising space effectively and efficiently. The products and tools will be easily storable when not in use or would serve multiple functions. The products will also be easily scalable as per the space that is available. This would be achieved by making them modular.

Ease of use: The products, tools, and systems would be made with easy usage in mind. They would help in maintaining the plants without the needing a lot of attention.

Technologies / Methods that could be used

1. **Hydroponics:** Hydroponics is the technique of growing plants using a water-based nutrient solution rather than soil, and can include an aggregate substrate, or growing media, such as vermiculite, coconut coir, or perlite.
2. **Soil-based gardening:** Traditional way of growing plants in pots or containers filled with soil.
3. **Aquaponics:** Aquaponics is a food production system that couples aquaculture (raising aquatic animals such as fish, crayfish, snails or prawns in tanks) with hydroponics where the nutrient-rich aquaculture water is fed to hydroponically grown plants.
4. **Vertical Gardening:** Vertical gardening with upright structures can be a boon for apartments. Indoors, you can grow small-stature houseplants as vertical gardens by creating living walls of color and texture that helps filter out indoor air pollutants.



Task 1C
Ideas, SWOT Analysis,
Final Design,
Prototype, Storyboard,
Poster and Final
Reflection

The 10 ideas

CONTAINER THAT COULD BE USED IN A SOIL-BASED OR HYDROPONIC SETUP

13/12/22

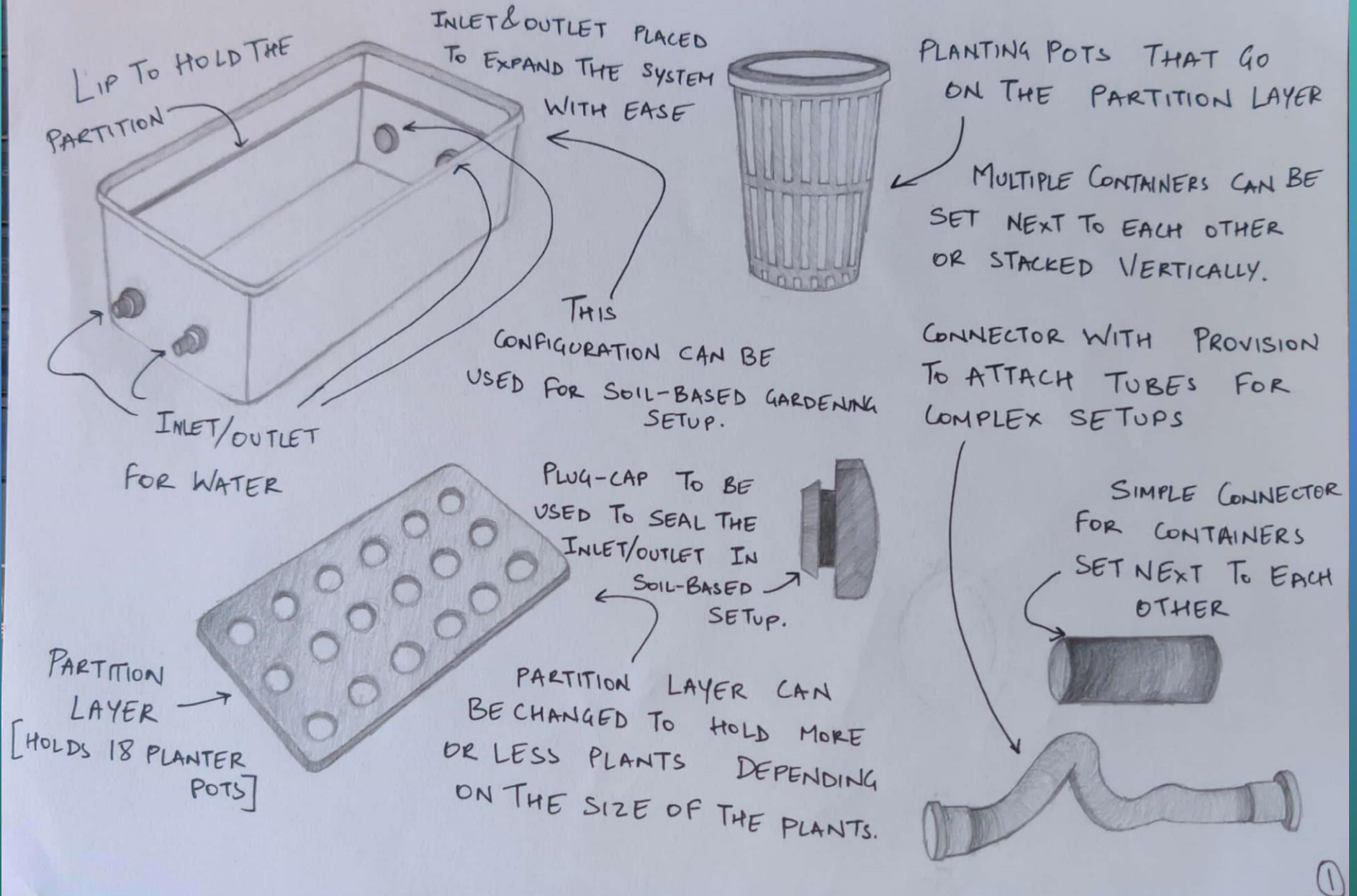
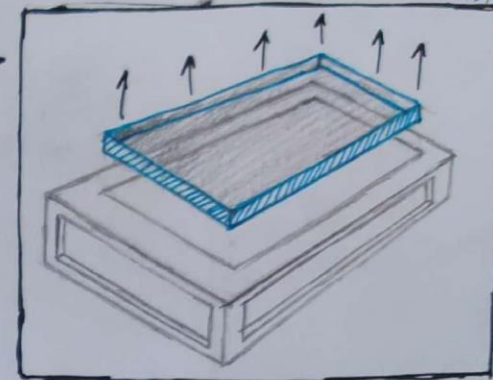
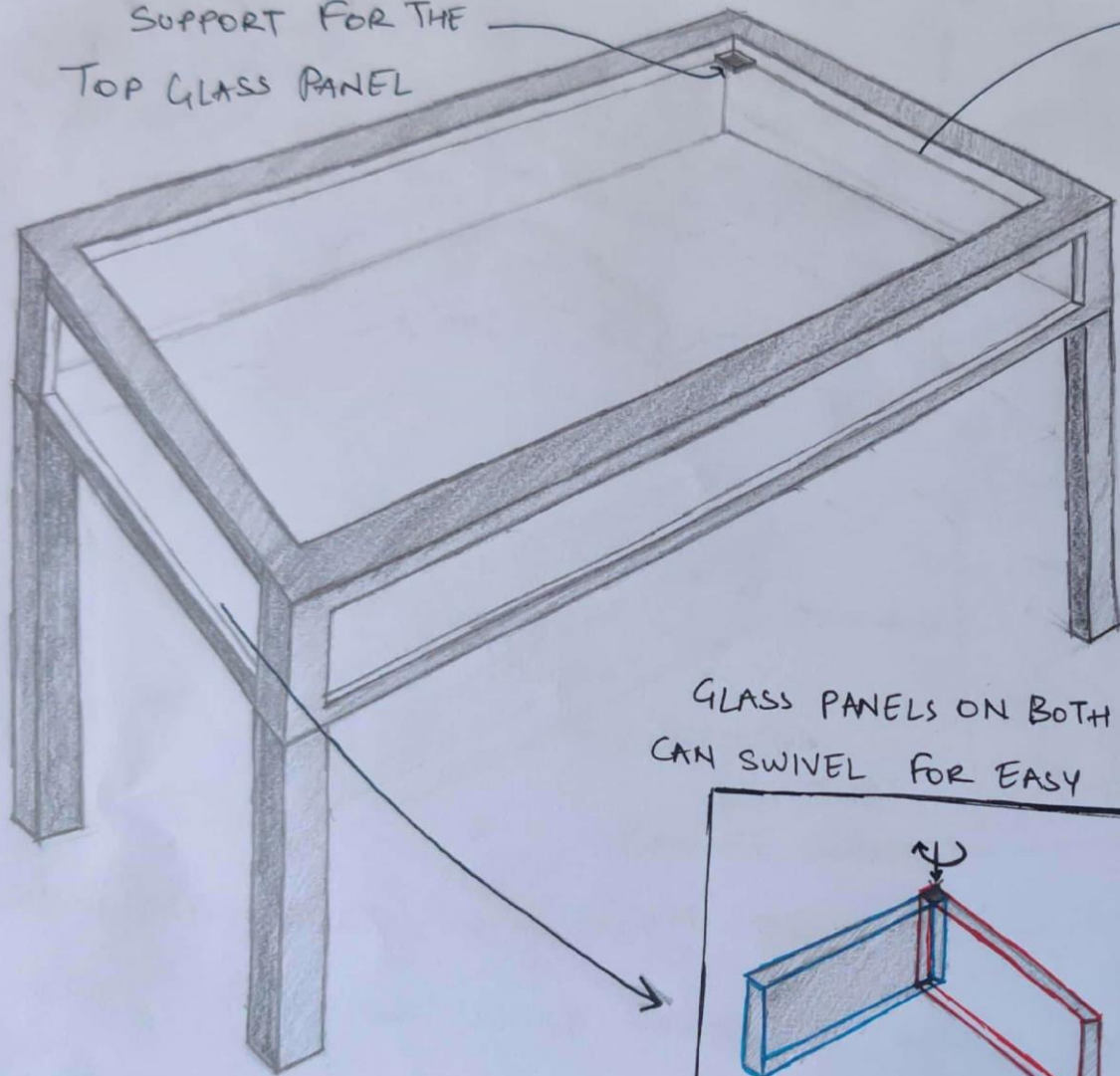


TABLE / DESK GARDEN

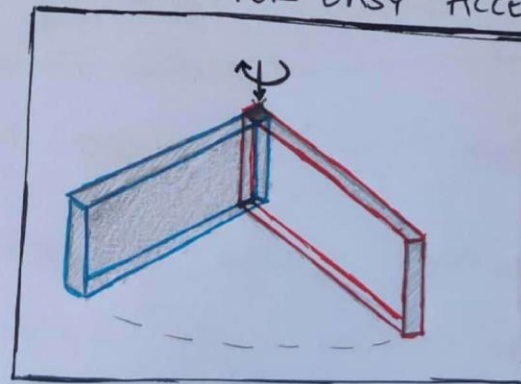
SUPPORT FOR THE
TOP GLASS PANEL



TOP GLASS PANEL CAN
BE REMOVED FOR EASY
ACCESS.

THIS DESK CAN BE
USED NORMALLY, BUT
IT HAS A HOLLOW
SPACE WITHIN WHICH
COULD BE USED TO
GROW PLANTS.

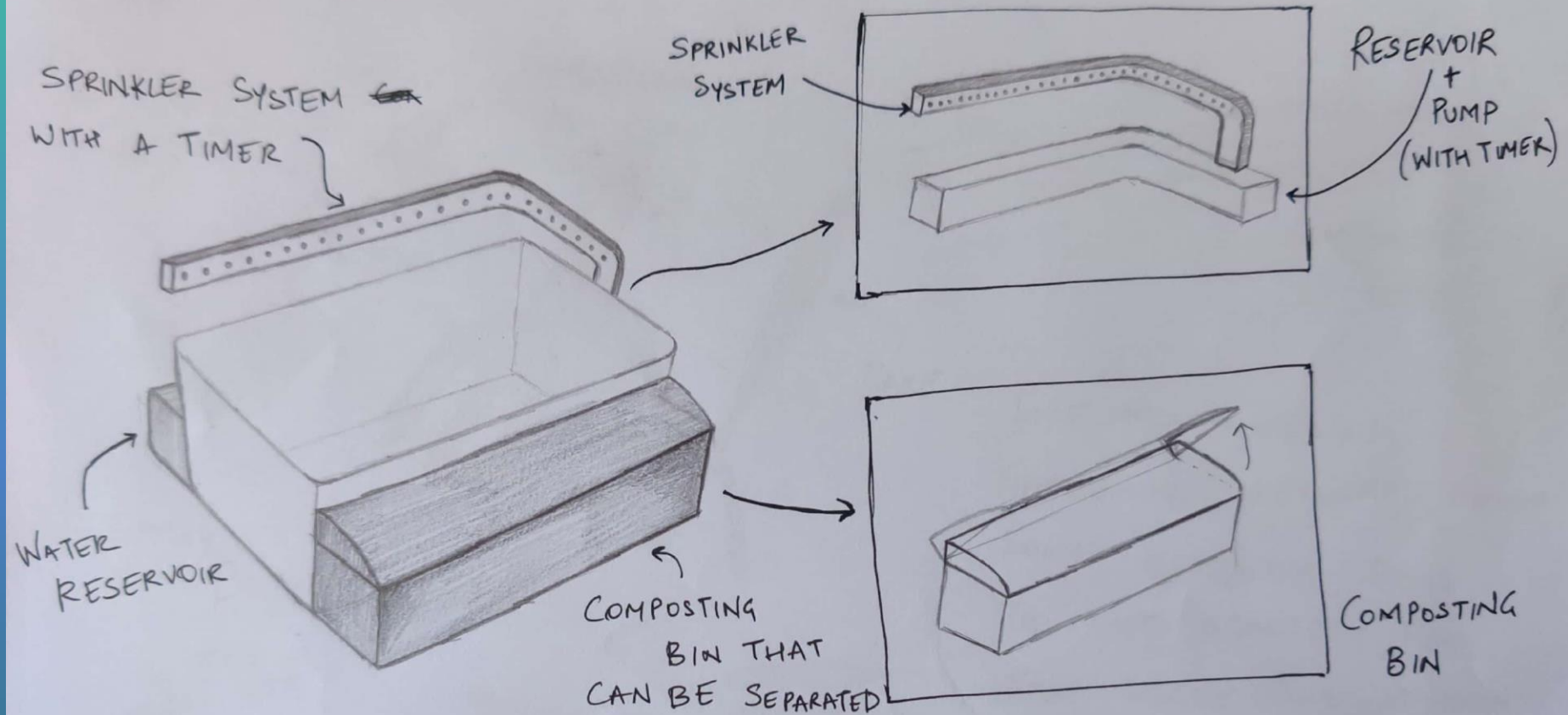
GLASS PANELS ON BOTH SIDES
CAN SWIVEL FOR EASY ACCESS



IT ADDS A SPLASH OF
GREEN TO ANY
WORKSTATION.

INSPIRED BY: SERPA DESIGN & LINUS
TECH TIPS.

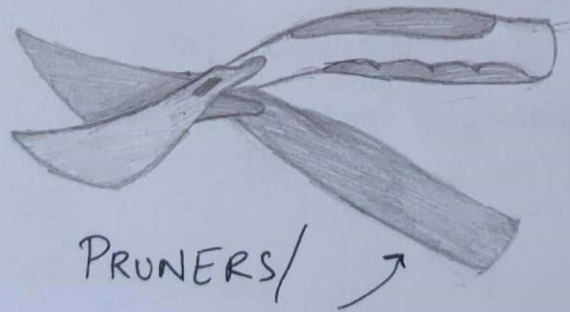
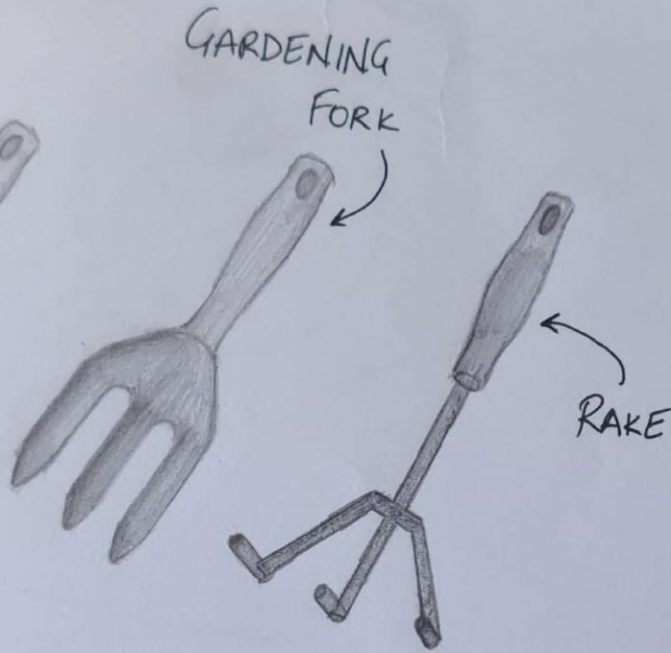
TABLETOP HERB GARDEN WITH COMPOSTING BIN



THIS HERB GARDEN HAS BEEN DESIGNED TO SERVE THE IDEA IS TO HAVE A SMALL NURSERY ON A KITCHEN TABLETOP OR SHELF WITH A VARIETY OF HERBS. MULTIPLE FUNCTIONS WHILE HAVING A SMALL FOOTPRINT. THIS IS IDEAL FOR A BEGINNER AS HERBS ARE QUITE EASY TO GROW.

GARDENING TOOLS SET

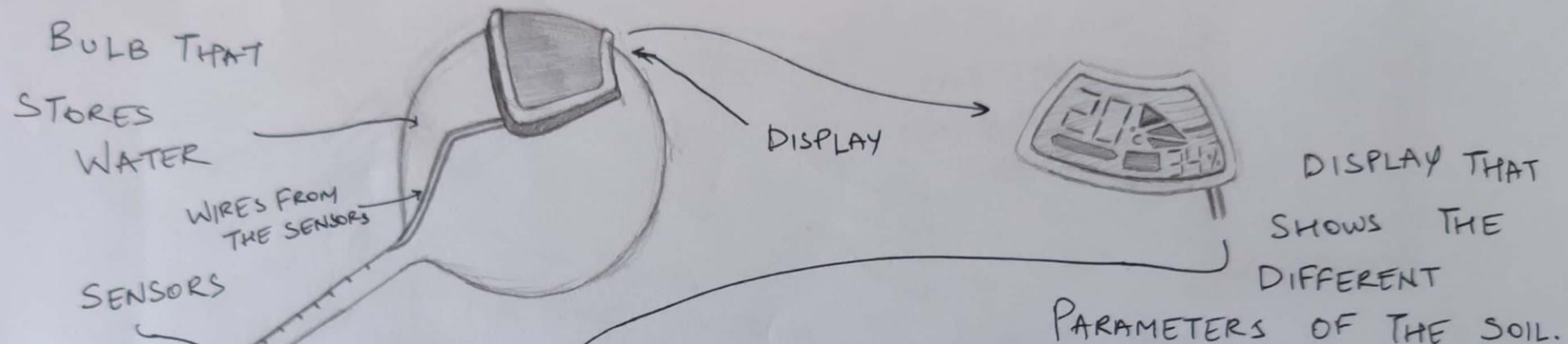
20/12/22



PRUNERS/
PRUNING SHEARS

LIKE MOST HOBBIES, GARDENING REQUIRES ~~SOME~~ SOME ESSENTIAL TOOLS TO GET STARTED. FOR EASY USAGE AND HANDLING, THIS TOOLS SET HAS BEEN MADE WITH A SUPER COMFORTABLE HANDLE. ④ IT INCLUDES ALL BASIC TOOLS TO GROW AND MANAGE A HOME GARDEN

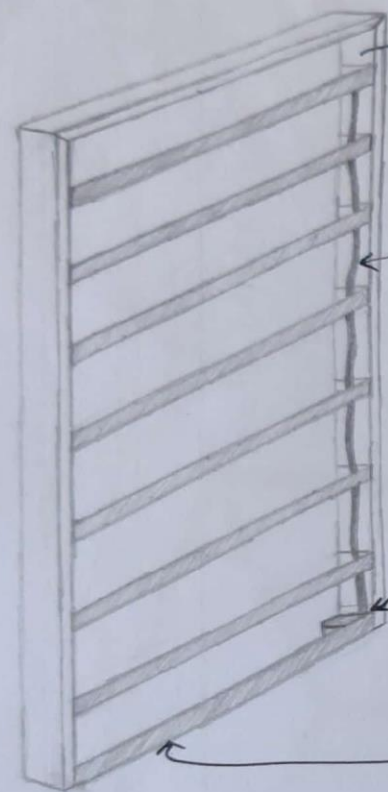
WATERING BULB WITH THERMOMETER, MOISTURE SENSOR, AND GARDENING METER.



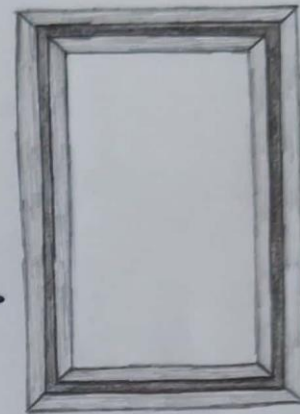
THE THERMOMETER, MOISTURE SENSOR, AND GARDENING METER THAT IS CONNECTED TO THE DISPLAY

THE WATERING BULB IS DESIGNED TO PROVIDE WATER TO PLANTS OVER A LONG DURATION. THIS WATERING BULB ALSO READS AND DISPLAYS DIFFERENT PARAMETERS OF THE SOIL. ~~THE~~ IT ALSO USES THE VALVE TO ~~GET~~ ALTER AND GET IDEAL GROWING CONDITIONS. (5)

VERTICAL GARDEN FRAME WITH WATERING FEATURE



CAN ALSO
USE A FRAME
FOR BETTER
~~EFFECT~~



TUBING
FOR THE WATERING
SYSTEM.

LEVELS THAT
CAN ACCOMODATE
PLANT POTS.

PUMP
WITH TIMER

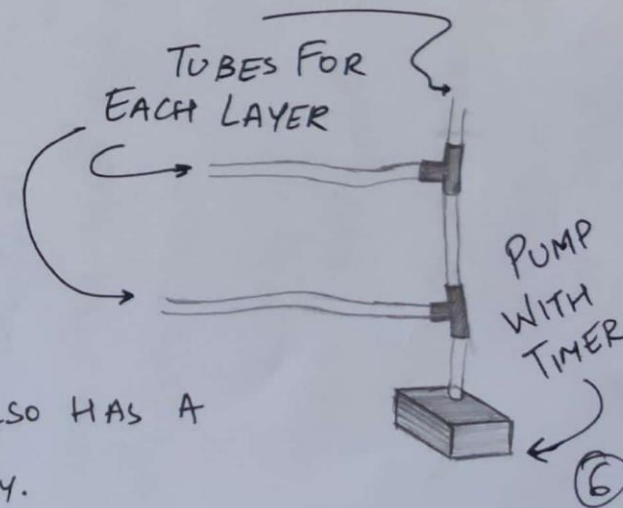
WATER RESERVOIR

FLOW DIAGRAM

TUBES FOR
EACH LAYER

PUMP
WITH
TIMER

THE VERTICAL GARDEN FRAME HAS ^{MULTIPLE} LEVELS THAT CAN ACCOMODATE PLANT POTS. THESE LEVELS HAVE AN IRRIGATION SYSTEM BUILT IN WITH A WATER RESERVOIR IN THE BOTTOM-MOST LEVEL. THE PUMP ALSO HAS A TIMER BUILT-IN, WHICH WATERS THE PLANTS AUTOMATICALLY.



FISH TANK - BUT BETTER

GLASS
DOOR
WITH
HINGES

OPTION-1

SOIL-BASED
SETUP.

USES SOIL
TO GROW PLANTS
IN THE BOTTOM
HALF OF THE TANK.

VERTICAL
PLANTING
SYSTEM

TUBE FOR
IRRIGATION

OPTION-2

HYDROPONIC
SETUP.

HAS A HYDRO-
PONIC SYSTEM
IN THE BOTTOM
HALF OF THE TANK.

VERTICAL
PLANTING
SYSTEM

TUBE FOR
IRRIGATION

PRACTICALLY A
GLASS FISH-TANK PLACED
ON ITS SIDE.

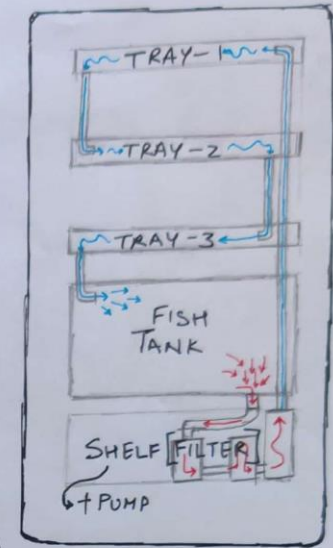
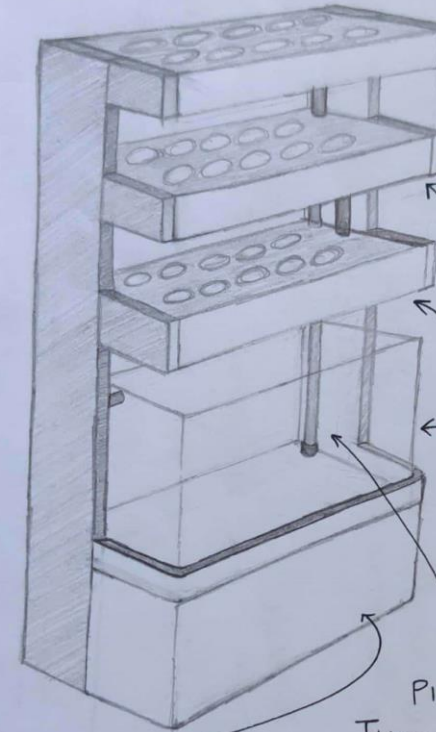
GLASS SECTION TO MAKE
A CONTAINER THAT CAN BE
USED TO PLANT PLANTS.

THIS CAN BE ~~MADE~~ MADE WITH AN
OLD FISH TANK IF NEEDED.

BOTH OPTIONS ALSO HAVE PROVISION TO ACCOMMODATE
PLANTS VERTICALLY AND ALSO WATER THEM.

⑦

AQUAPONICS SHELF



FLOW DIAGRAM

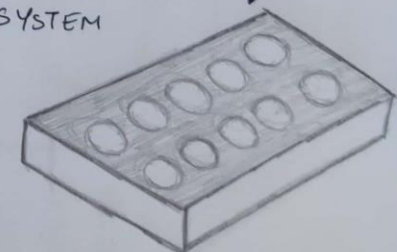
FISH
TANK

HYDROPONICS
TRAYS

BOTH ARE REMOVABLE

PIPES/TUBES
THAT CONNECT DIFFERENT
PARTS OF THE SYSTEM

SHELF THAT
HOUSES THE FILTRATION
SYSTEM



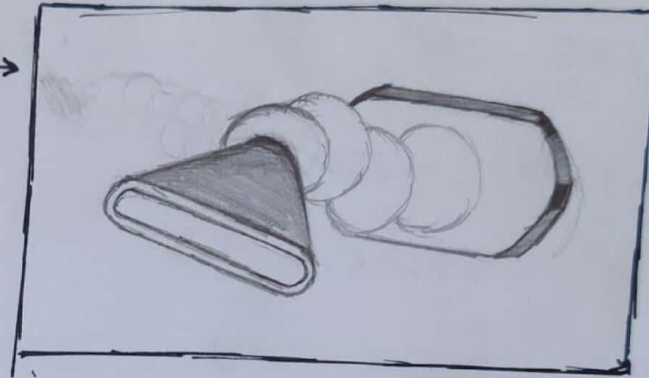
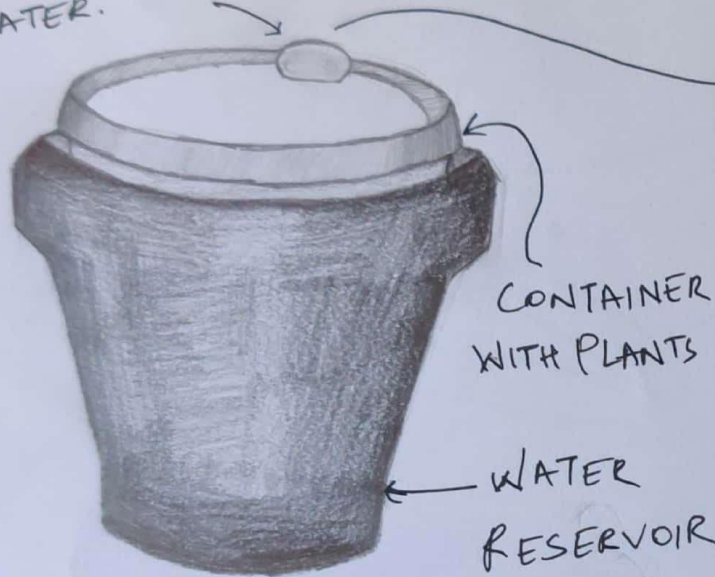
THE AQUAPONICS SHELF COMBINES HYDROPONICS AND
AQUACULTURE. IN THIS SETUP, PLANTS ARE GROWN IN
HYDROPONIC SYSTEMS WITH THEIR ROOTS IMMERSSED IN
NUTRIENT-RICH EFFLUENT WATER FROM THE FISH TANK.

⑧

SELF-WATERING PLANT CONTAINER WITH RESERVOIR

By Ron
13-12-22

NOZZLE FOR
WATER.



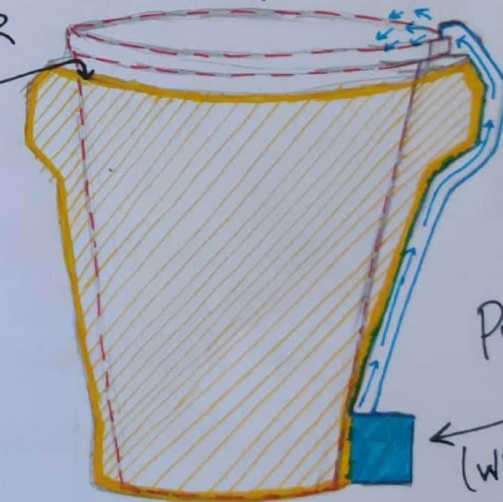
NOZZLE FOR
WATERING THE
PLANTS.

THE NOZZLE CAN BE REPOSITIONED
TO OPTIMIZE THE PROCESS.

CONTAINER
WITH PLANT

THE SELF-WATERING PLANT CONTAINER
HAS A WATER RESERVOIR ALONG THE PERIMETER
OF THE MAIN POT. THIS IS CONNECTED TO A
PUMP WHICH HAS A TIMER, THAT WATERS THE
PLANTS AT CERTAIN ^{CUSTOMIZABLE} INTERVALS.

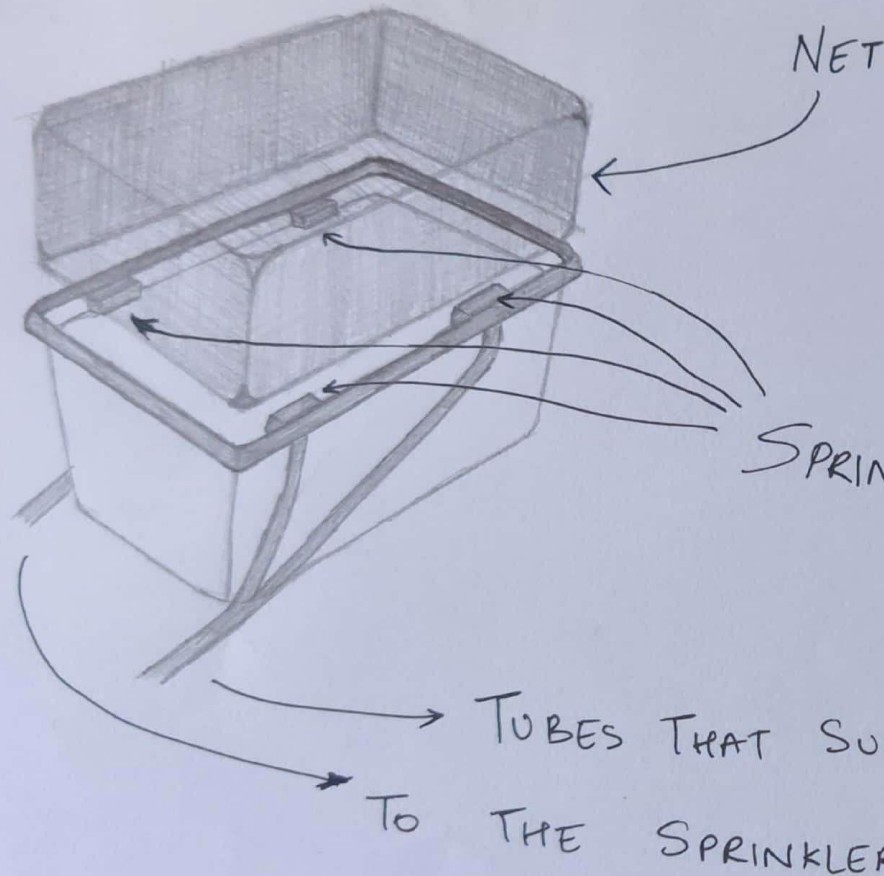
RESERVOIR



PUMP
(WITH
TIMER) ⑨

OUTDOOR PLANT POTS WITH NET. WITH SPRINKLERS

14.12.22



THIS DESIGN HAS A NET/MESH SCREEN THAT CAN BE PLACED ON THE CONTAINER. THIS SCREEN WILL PROTECT THE PLANTS FROM INSECTS AND BIRDS.

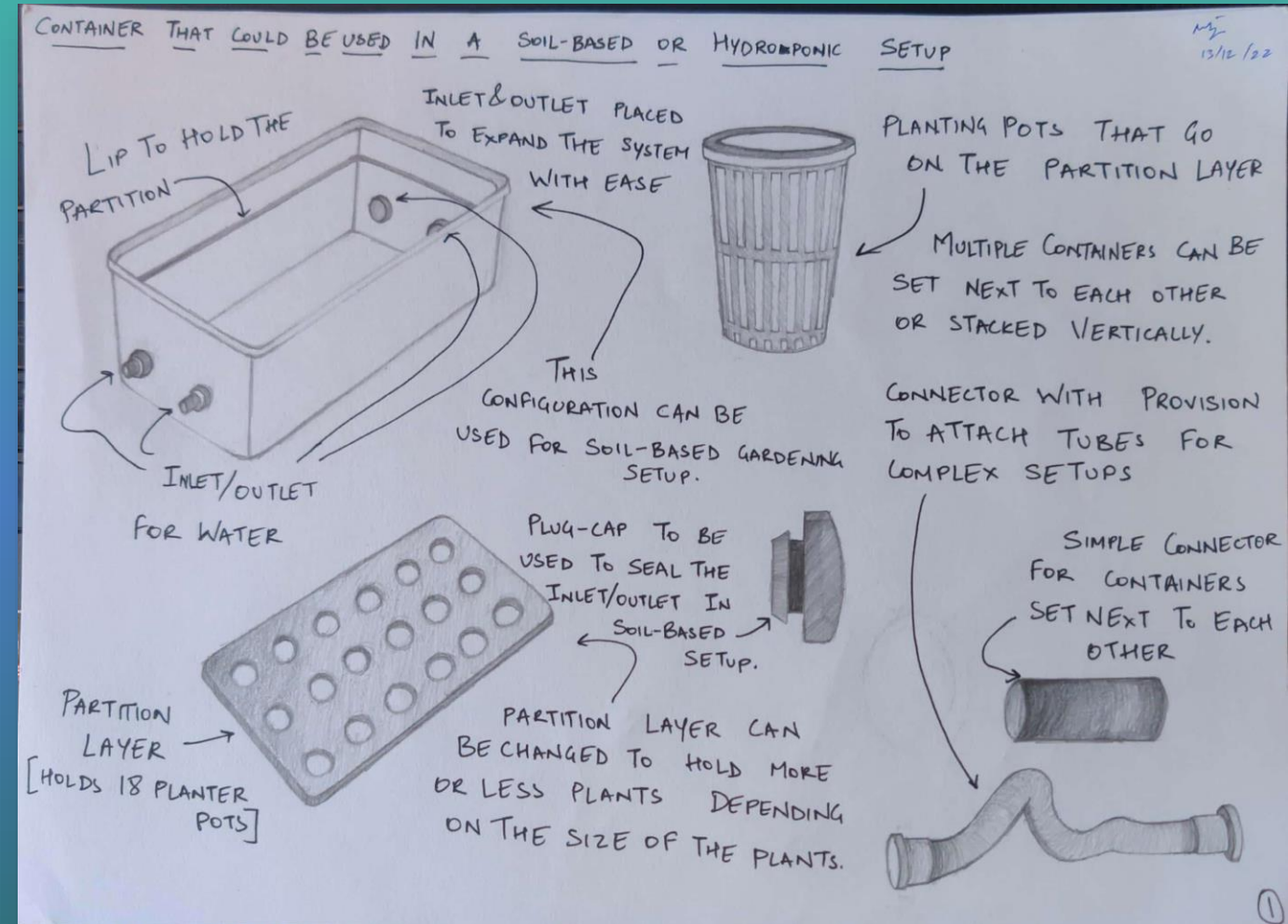
THE SIZE OF THE MESH CAN BE CHANGED ACCORDING TO THE SIZE OF THE PLANTS GROWING INSIDE.

IT ALSO HAS SPRINKLERS THAT ~~COULD~~ COULD BE CONNECTED TO A WATER SOURCE TO WATER THE PLANTS.

(10)

#1 – Multi-functional container

This container is designed to be used in a hydroponic or a soil-based setup. The container has an inlet / outlet on both sides to make it modular [Multiple containers can be stacked vertically or used in a row]. These could be blocked out. The container also comes with a plug-cap to seal the port when used in a soil-based setup. For use in a hydroponic setup, there is a partition layer that is provided, which holds the planter pots at an optimal height. There is a provision to install 18 planter pots in the current configuration, but this can be easily modified to match the specific requirement. It also comes with various fittings to expand the system as required. Along with this, the container itself can be scaled up and down to utilize the desired space effectively.



Strengths

1. Can be used in both hydroponic and soil-based system
2. Easy to use
3. Easy to expand
4. Easy access to add or remove plants
5. Easily scalable
6. Easy to store when not in use

Weaknesses

1. Compost bin is very small
2. Cannot accommodate a lot of plants
3. Has a small reservoir to store water
4. Needs to be placed where there is indirect sunlight

Opportunities

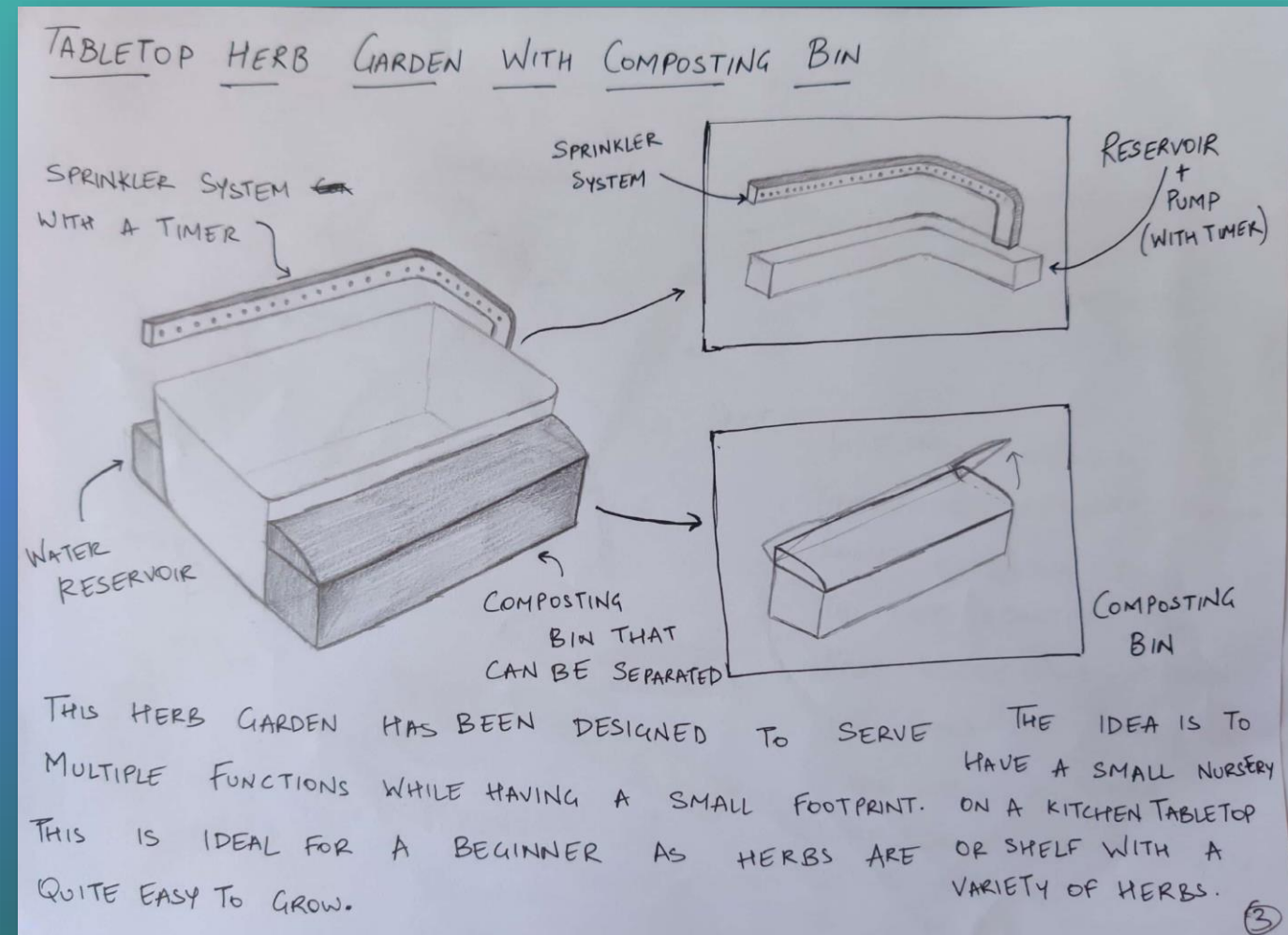
1. Growing demand for small green spaces within houses

Threats

1. Hydroponics isn't very well-known and trusted in India
2. Waterborne diseases can affect plants
3. Difficult to maintain a hydroponic system [becomes difficult to regulate nutrient input]
4. Could become expensive overtime

#2 – Tabletop herb garden with composting bin

This herb garden has been specially designed to serve multiple functions, while having a small footprint. Herb gardens are ideal for beginner growers, as most herbs are easy to grow. The idea is to have a small nursery on a kitchen tabletop, or shelf, with a large variety of herbs and aromatics. This indoor herb garden allows users to enjoy fresh herbs year-round without needing an outdoor gardening space to grow them. It also has a water sprinkler system, which is connected to a water reservoir and has a pump with a built-in timer, to water the plants. It also has a detachable composting bin which could produce organic fertilizer, beneficial for the growth of the herbs. The composting bin can be easily detached from the main container for easy usage.



Strengths

1. Waters plants automatically
2. Produce available throughout the year
3. Usually better than dried herbs
4. Adds a splash of green to the kitchen
5. Produces organic compost
6. Compost increases nutrient content of soil
7. Organic produce

Opportunities

1. Not a lot of similar products in the market
2. Can be looked at as a 'DIY' kit
3. Can be good for people just getting into hydroponics as it could be easily reversed into a soil-based system if needed
4. Could be easily modified by users and optimized for different scenarios

Weaknesses

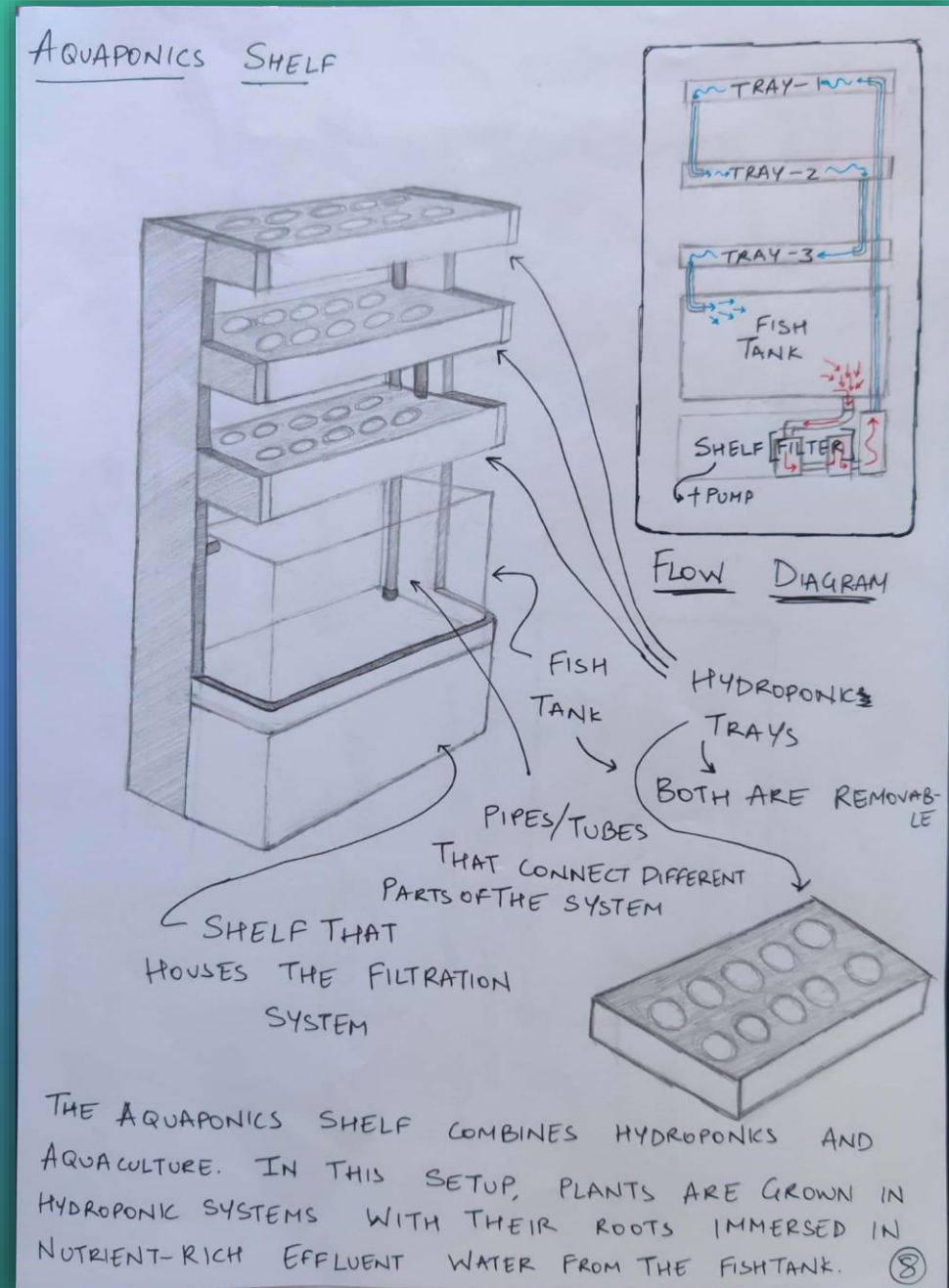
1. Has too many attachments / components
2. Has little components that could possibly get lost
3. Won't be as useful if used as a standalone in a hydroponic system [needs a pump and circulation]

Threats

1. Has a lot of competition
2. Many other designs include a light
3. Some of the other designs have provisions to accommodate more plants
4. Many similar products already exist in the market

#3 – Aquaponics Shelf

The Aquaponics shelf combines hydroponics and aquaculture [fish culture]. In this setup, plants are grown in hydroponic systems, [tray 1-3] with their roots immersed in the nutrient-rich effluent water from the fish tank. This enables the plants to filter out the ammonia that is toxic to the aquatic animals but is useful for plant growth. After the water has passed through the hydroponic system, it returns to the fish tank. This is a continuous cycle. This setup is perfect for users who like growing plants and also like to keep fishes. The system has 3 hydroponic trays, [refer to the flow diagram] that can be populated with plants. There is also a filter that is attached to the outlet of the fish tank. This may or may not be used as per the specific requirement of the system. The trays and the fish tank can be slid out of the shelf for easier usage. All fittings are threaded and can be easily disconnected when the need arises.



Strengths

1. Uses an Aquaponic system
2. No need for external nutrition for plants
3. Easy to use and access plants
4. No need for extensive filtration of water
5. Easy to maintain with removable components
6. Organic produce
7. Not a lot of water is used

Weaknesses

1. Could become expensive
2. Has a complex system
3. Requires electricity else plants won't be able to grow
4. Has a large footprint
5. Requires constant monitoring and maintenance

Opportunities

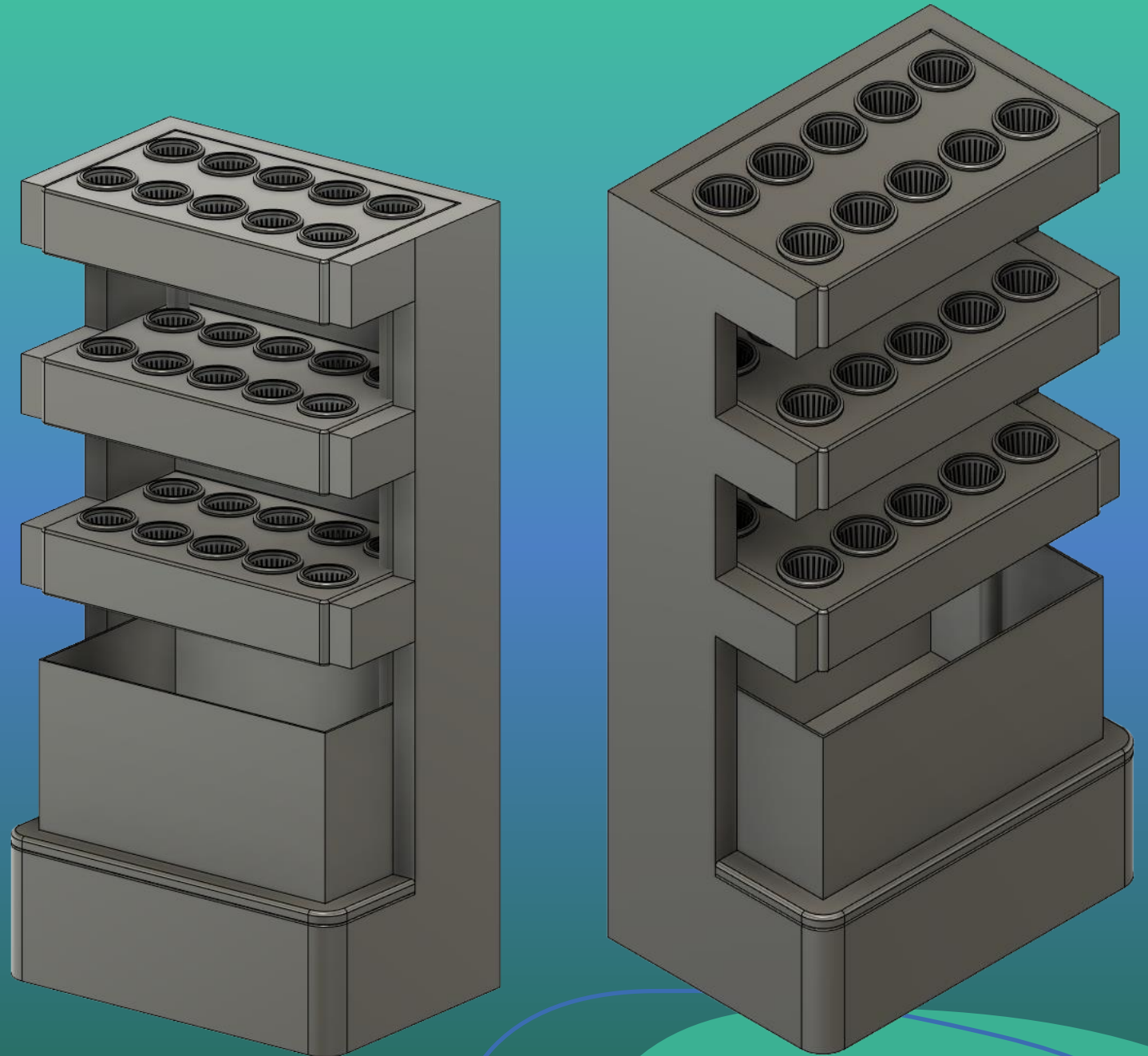
1. Not a lot of competitors
2. Not a lot of similar streamlined products in the market
3. Has a big target audience [people who like growing plants and fish]
4. Aquaponics is better than soil-based gardening system

Threats

1. Many people rely on DIY solutions for aquaponics which could potentially be cheaper
2. Difficult to maintain the balance between the systems
3. Aquaponics isn't very well-known

Final model – Prototype [Made using Fusion 360]

process
pictures



Components

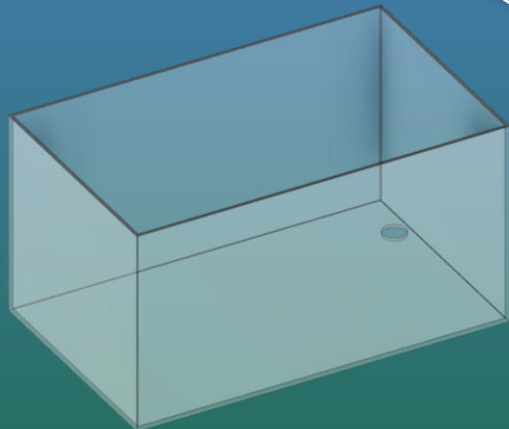


Hydroponic tray with partition layer and planter pots

Wooden shelf



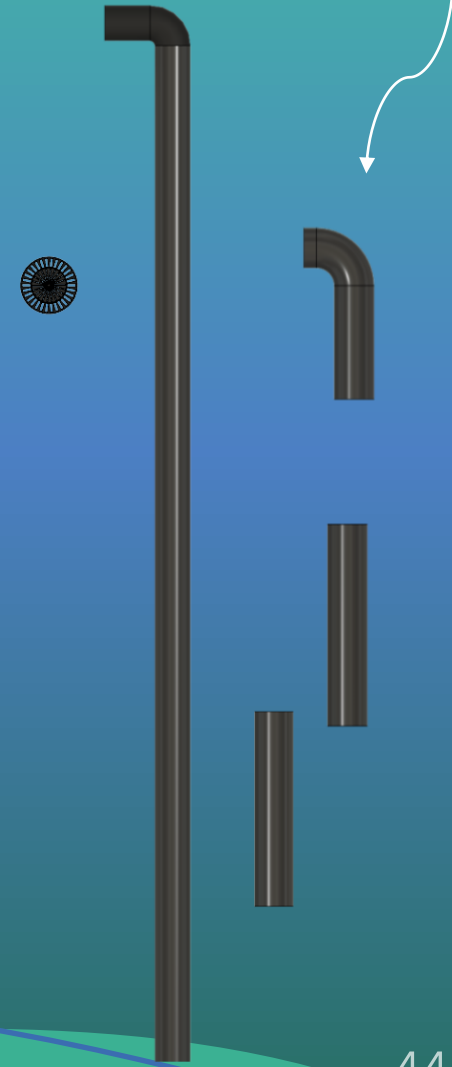
Fish tank



Planter pots



Pipes that connect the different components together



Dimensions



Shelf:

L = 90 cm
B = 60 cm
H = 180 cm

Tank:

L = 78 cm
B = 47 cm
H = 43 cm

Hydroponic Tray:

L = 78 cm
B = 47 cm
H = 15 cm

Hydroponic Tray Partition:

L = 78 cm
B = 47 cm
H = 2 cm

Pipes:

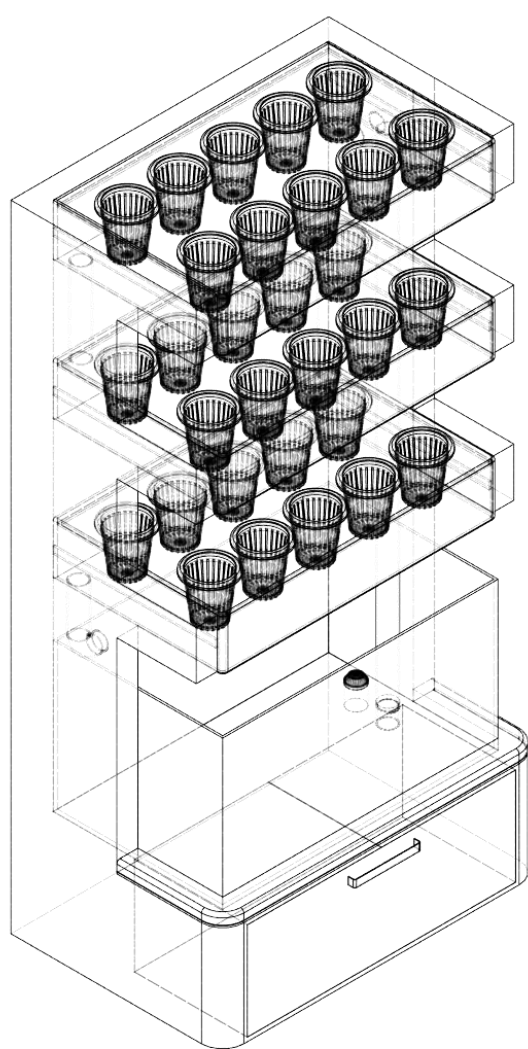
Radius = 2.4 cm

Planter Pots:

Top Radius = 13.2 cm
Bottom Radius = 8 cm
H = 13.3 cm

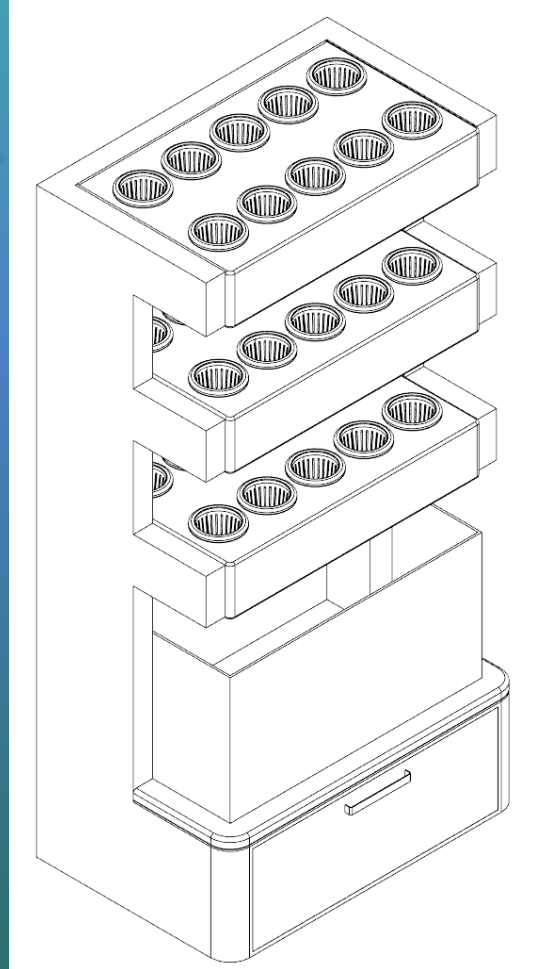
The model is made in 1:1 scale in Fusion 360

Wireframe Models

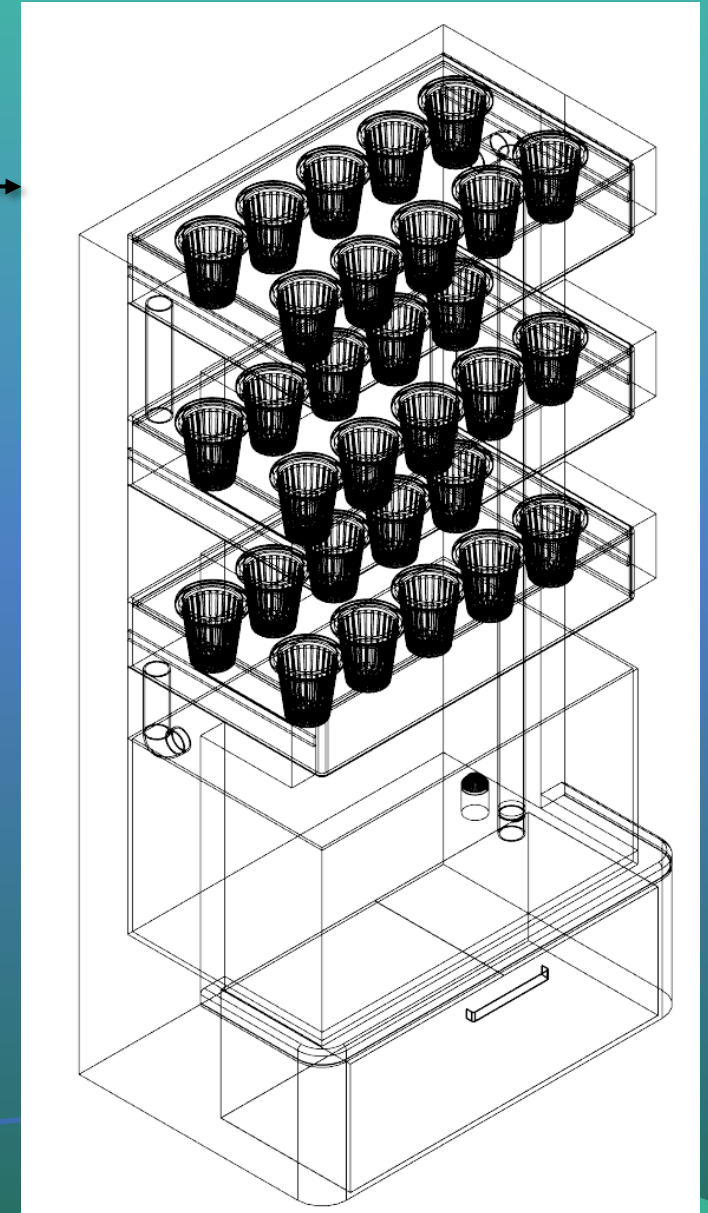


Wireframe
with **Visible**
edges only

Wireframe
with **Hidden**
edges



Wireframe
with **All**
edges



Materials Used

Wood for the shelf [Solid wood or Ply with laminate]

Polypropylene for planter pots

Durable Plastic for hydroponic trays [ABS, Polypropylene, etc]

PVC [Polyvinyl Chloride] Pipes

Glass or acrylic for the fish tank [Glass is more durable and scratch resistant]

Metal handle for the lower compartment



polypropylene, a synthetic resin built up by the polymerization of propylene.

ABS plastic [Acrylonitrile butadiene styrene] is a common thermoplastic polymer used for 3D printing prototype development and injection molded part manufacturing

Material and Variations



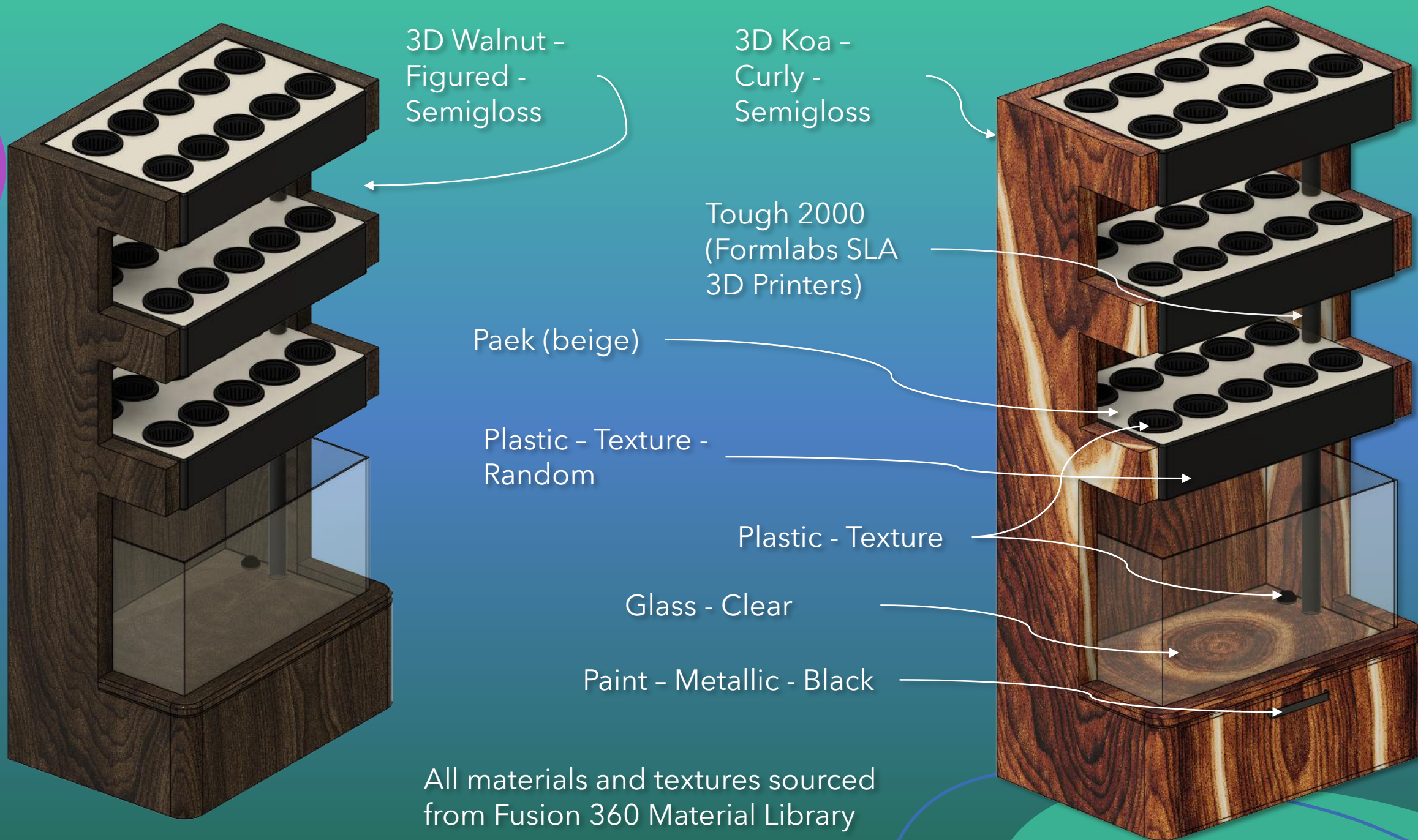
3D Koa -
Curly -
Gloss



3D Walnut -
Semigloss



3D Koa - Curly -
Semigloss





Storyboard

Interesting.. I see a lot of different parts here

Hmm... Looks like some assembly is required..



No worries, lets get started!

Wow! Take a look at this beautiful wooden shelf!

I can see a couple of channels on the sides. Wonder what they're for.

Let me install the fish tank first

It looks so good!

The tank just sits right into the groove! I can see a couple of holes on the bottom. That's what the tubes might be for.



The Instruction manual tells me to install one of these trays next.

Ha. Neat! It just slides into the channels on the sides! Nice!

Hmm.. This tray thingy sits perfectly into the tray.

Wonder what goes in next..



Okay. So that's what these planters do! I gotta say, they fit in perfectly!

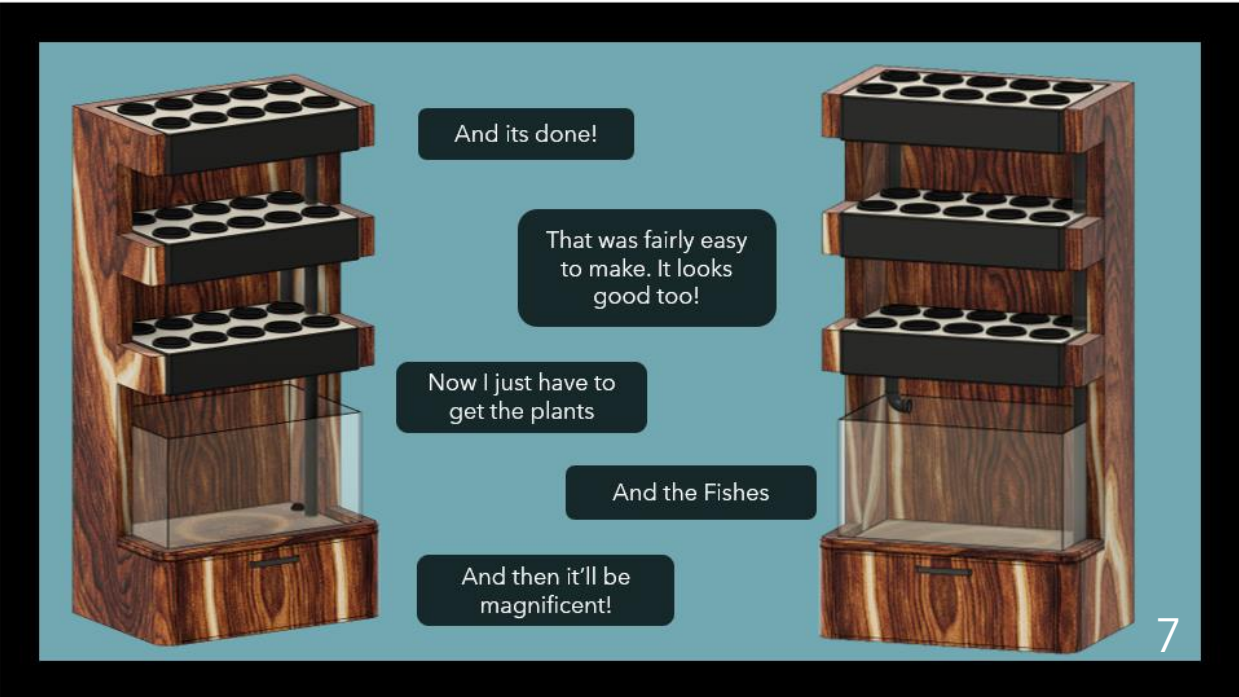
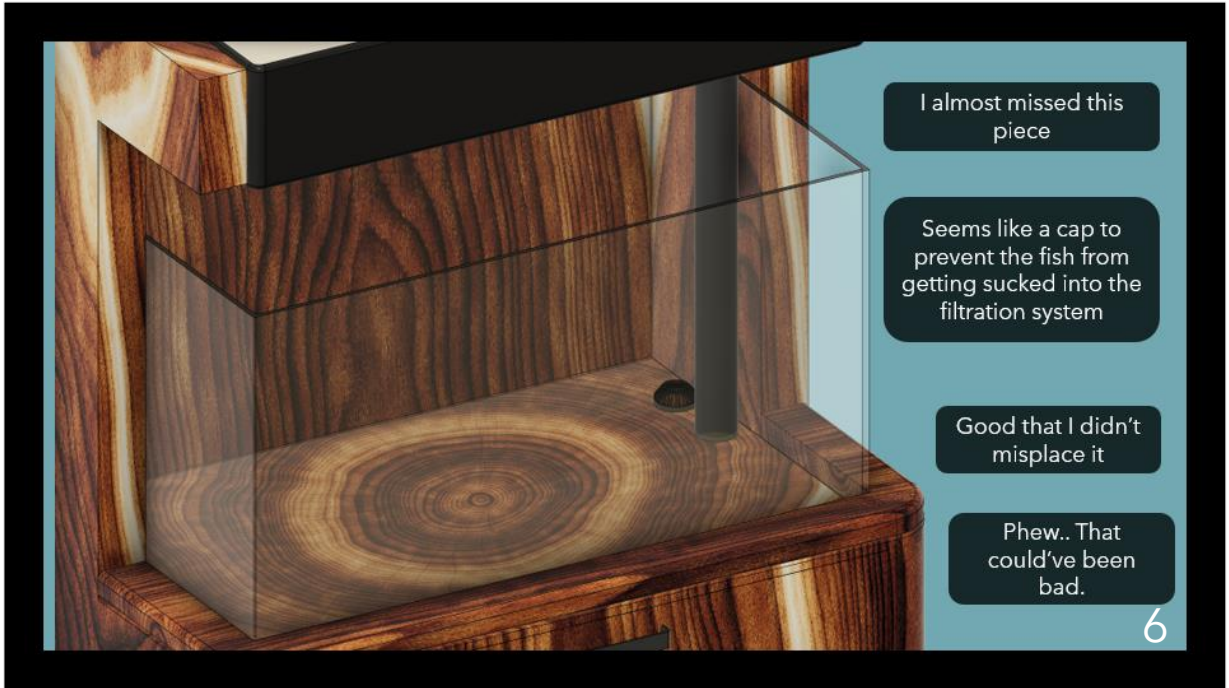
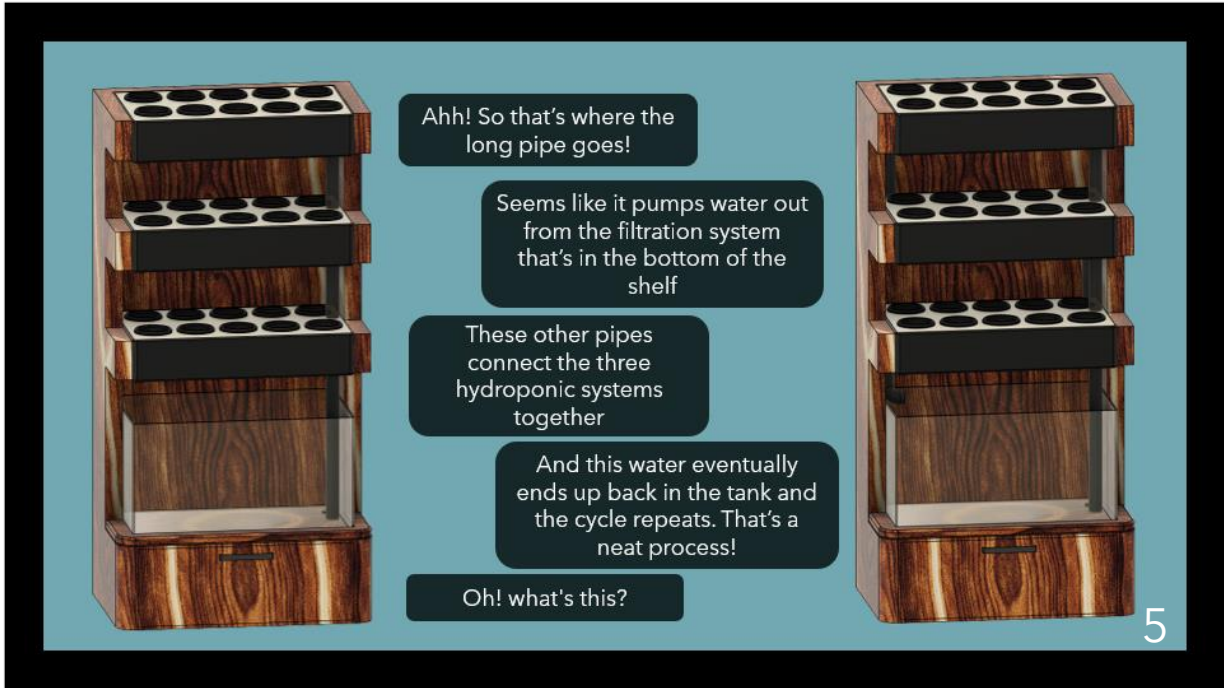
Now I just have to repeat the past couple of steps 2 more times.

Aaaandddd all done!

Wow that looks nice!

Now I just have to figure what these pipes do and where they go.





The Storyboard was made on PowerPoint

Aquaponics Shelf

The **Aquaponics shelf** combines **hydroponics** and **aquaculture** [fish culture]. In this setup, plants are grown in hydroponic systems, with their roots immersed in the nutrient-rich effluent water from the fish tank. This enables the plants to filter out the ammonia that is toxic to the aquatic animals but is useful for plant growth. After the water has passed through the hydroponic system, it returns to the fish tank. This is a continuous cycle. **This setup is perfect for users who like growing plants and also like to keep fishes.**

Some Features

1. Easy to maintain with removable components



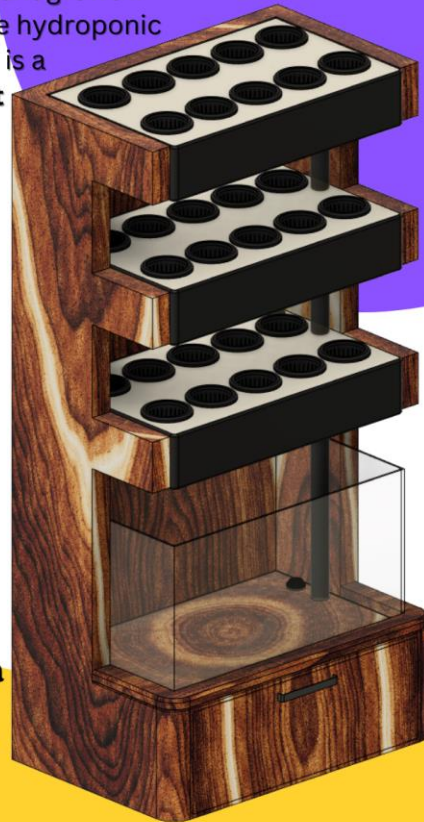
2. Uses an Aquaponic system

This means that there is **no need to supply external nutrition** for plants and also, there is **no need for extensive filtration of water**.

3. Has a big target audience

This is the **perfect product for people who like growing plants and fish**. Currently, **there aren't a lot of similar products that are as streamlined in the market**. This means that **there aren't a lot of competitors** for the aquaponics shelf.

Siddhant Iyer
IADP - YEAR 2



Poster

Poster made using Canva

Final Reflection

Working for this SA has been really insightful and helpful. For the initial task, I focused on researching about indoor gardens. Initially my plan was to create something exclusively for an external space like a balcony or a terrace, but eventually, I felt that having something that could be kept in a balcony or inside the house itself was something that more people would like to do. In the initial days, along with the research, I came with an idea for a modular container that could be used in a hydroponic or soil-based setup with small modifications. This was a nice 'Side quest' as it got me thinking about incorporating hydroponics and aquaponics into my designs. It also made me understand the need for modularity and easy usage in the designs. This helped me create my design brief.

With a basic concept in mind, I proceeded to make the different iterations. This was a tall order as I also had to satisfy certain intents that I had specified in the design brief. Also, I tried to play around with different methods and technologies like hydroponics, aquaponics, vertical gardening, etc. Once I was satisfied with my iterations, I proceeded to shortlist a few and work on the SWOT analysis. The selection process was interesting as I gathered inputs from a wide spectrum of people like students from different fields (design, engineering, medicine), and a wide variety of family members (parents, grandparents, relatives). In the end, I was left with 3 completely different class of products. Working with a SWOT analysis is something that I had never done before, and I have to say, it was really helpful for selecting and working on the final product.

After selecting the idea for the final outcome, I proceeded to make a 3D model using Fusion 360. It was a really streamlined and straightforward process. I then played around with some different materials and finishes for the same. After this, I proceeded to work on the storyboard. I chose to make a scene where a user is assembling the product itself. I used various images to help the flow of the story. Then I proceeded to make the poster. This was again interesting to do as I planned on doing it with Canva which I have never used before. Working for this SA encouraged me to use a lot of digital tools which I had never used before. Overall, the process was really helpful and inspiring.

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