Household AQUAPONICS system

Guide:
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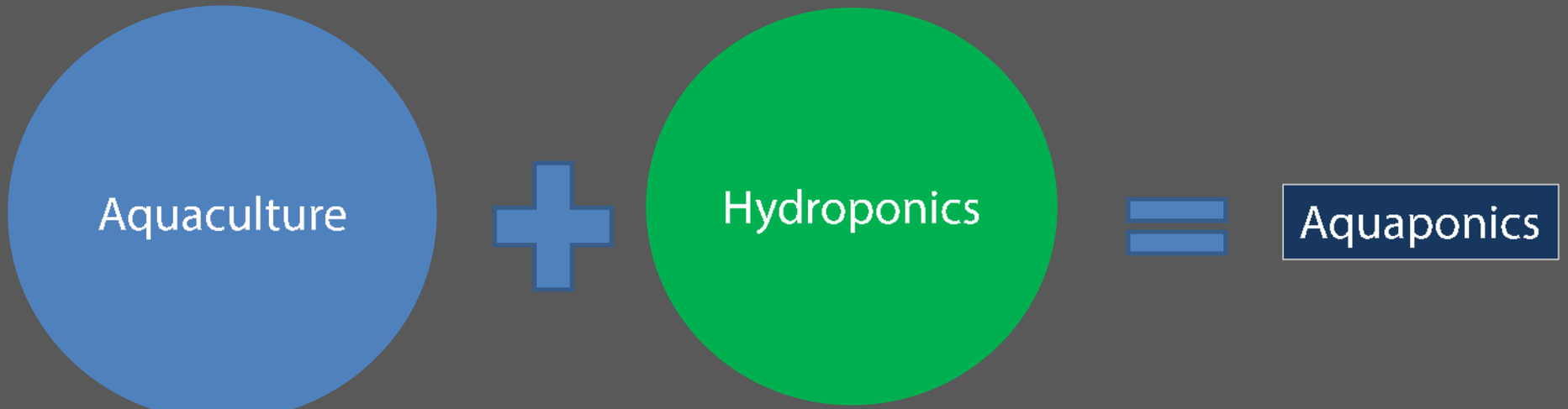
Why Aquaponics?

Project proposal: The project proposal came from Mr. Subhrankar Mukherjee, Project Manager: Aquaponics and **Spirulina Eco Park Project**, CIFE, Mumbai.

Interesting Concept to explore which has future potential.

What is Aquaponics?

Aquaponics is the combination of aquaculture, and hydroponics. It allows you to produce fish and plants in the one system with a large reduction in water use[1]



1. http://goo.gl/VUTno7

How does it work ?

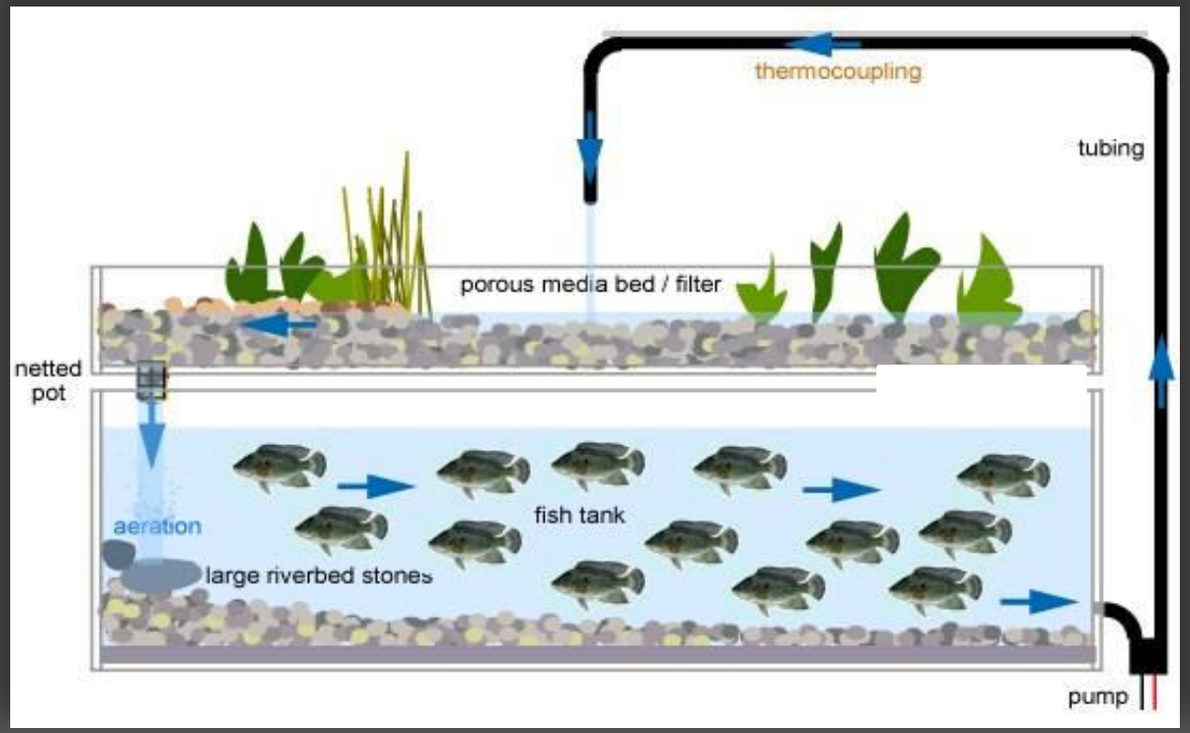


Image.1

1. Fish are raised in a tank
2. Water from the fish tank is pumped to the plants
3. Bacteria convert ammonia to nitrite (NO2) and nitrate (NO3)
4. Plants absorb the nutrient rich water
5. Filtered water is returned to the fish tank, clean

[2]:http://goo.gl/VUTno7
Image.2: http://goo.gl/hPKCra

Components of an Aquaponics System

- Fish tank
- Plant system
- Plants
- Fishes
- Medium
- Water pump
- Air pump

[2]:http://goo.gl/VUTno7
Image.2: http://goo.gl/hPKCra

Image.2

Image.3

Image.4

Image.5

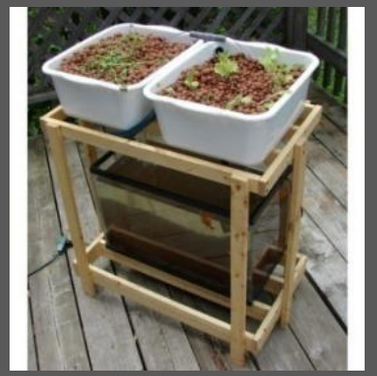


Image.6

Image.7

Fish tank

- 19 liter water for every grown fish
- Uses aquarium, barrels, traditional tanks, food-grade tanks, pools, or ponds

Plant trays

- Plastic storage containers, buckets, rain gutters or half barrels which are strong and deep enough to hold 6-12″ of medium

Image.5, 6 Source: http://goo.gl/KYIUDK
Image Source: http://goo.gl/dal59D
Image.3, 4 Source: http://goo.gl/yFtqte

Medium

- Provide support for the roots and plant
- Hold some water when no water is running through the system
  E.g. Clay pebbles, Perlite, Rockwool & gravel

Water pump

- For recycling the water
- Pumping the water from the fish tank into the plant trays

Air pump

- Dissolve air in water through aeration
- Both fish and plant pulls air from water

Image.8

Image.9

Image.11

Image.10

Image.9: http://goo.gl/gy7C4V
Image.10: http://goo.gl/ogxmXu
Image.11: http://goo.gl/57sePu

Plants

Suggested plants to use include many Asian vegetables, as well as tomatoes, basil cucumber, various herbs, melons, eggplants and chilies

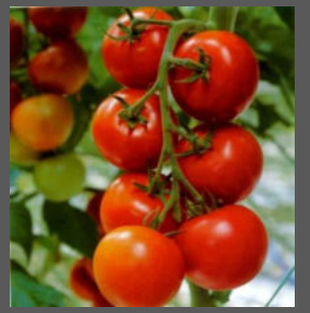
Basil

Cucumber

Strawberry

Eggplants

Watercress



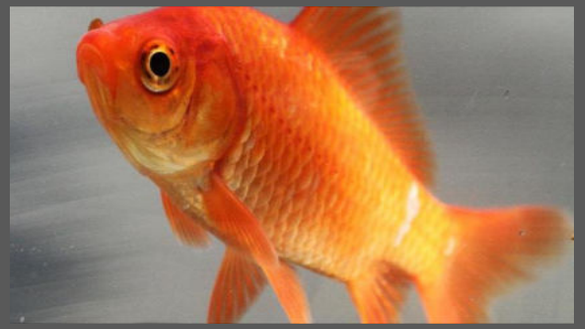
Tomato

Image source: http://goo.gl/NOX6ce

Fishes

Suggested fishes for use in an Aquaponics system.

Sleepy cod



Goldfish

Barramundi.

Koi

Carp

Tilapia

Trout

Bluegil

Source: http://goo.gl/V0ilWO

Types of Aquaponics

The most commonly used type of aquaponic systems are

1.Media Filled Growbeds

2. Nutrient Film Technique

3.Deep Water Culture

Image source: http://goo.gl/NOX6ce

1.Media Filled Growbeds

Image.1

Media Filled Growbeds are the simplest form of aquaponics. They use containers filled with a suitable growing media such as expanded clay balls, pumice stone, gravel or something similar. Water from a fish tank is pumped over the media filled beds and plants grow in the rock media

Source: http://goo.gl/4lwuPkf

2.Nutrient Film Technique

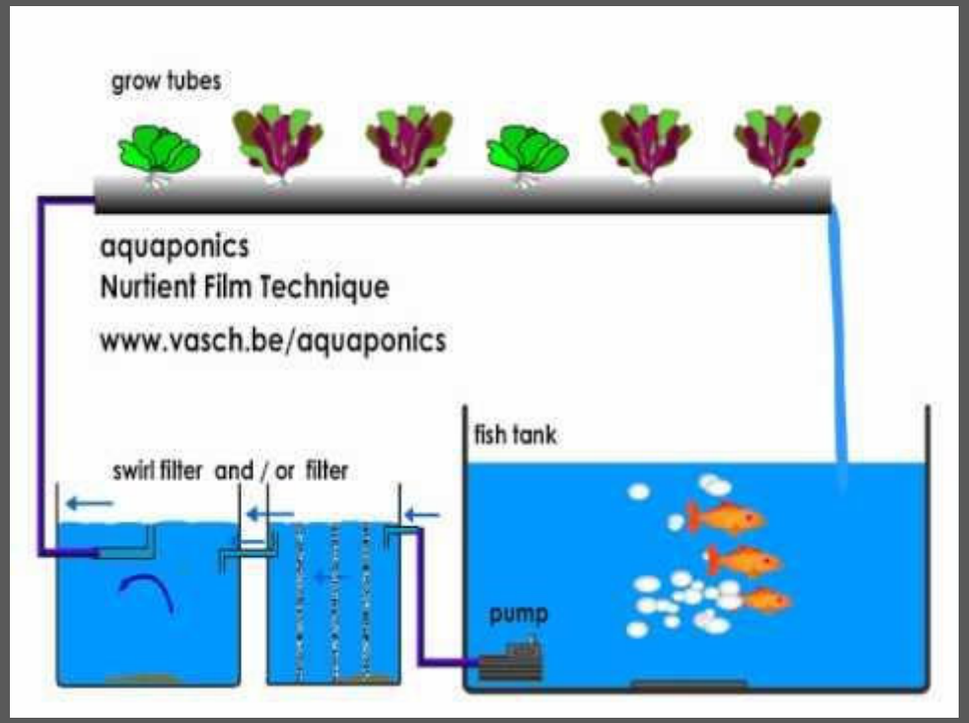


Image.14

Nutrient Film Technique is a commonly used hydroponic method, but is not as common in aquaponic systems. In NFT systems, nutrient rich water is pumped down small enclosed gutters, the water flowing down the gutter is only a very thin film. Plants sit in small plastic cups allowing their roots to access the water and absorb the nutrients

Source: http://goo.gl/VEYV4E

3.Deep Water Culture

Image.15

Deep Water Culture works on the idea of floating plants on top of the water allowing the roots to hang down into the nutrient-rich water. This can be done in a number of ways and this method is one of the more commonly practiced commercial methods.

Image.15: http://goo.gl/mOxJ51

Advantages of Aquaponics

- Growth of plants is significantly faster
- Significant reduction in the usage of water
- Waste from fish is used to feed the plants
- No need to use artificial fertilizers
- Significant reduction in land is required to grow the same crops as traditional soil methods
- Fish and plants create a polyculture producing two products
- Local food production, enhances the local economy and reduces food transportation
- Continuous organic fertilizer
- Works in drought or places with poor soil quality

The Cause/Why this project ?

Why Aquaponics is not popular in India ?

It requires Promotion

What is promotion ?

Any form of communication a business or company uses to inform, persuade, or remind people about products and to improve its image

- A message issued in behalf of some product, cause, idea, person or institution
- Act of raising in rank or position
- Encouragement of the progress, growth or acceptance of something
- The advancement of some enterprise

Purposes of Promotion

- Explains major features and benefits of products
- Tells where products are sold
- Advertises sales on products
- Answers customer questions
- Introduces new products
- Create a favorable image of the product

Source: http://goo.gl/QZG00f

Aquaponics in other parts of the world

" Aquaponics isn't yet widely known in Japan. So we've designed this product to introduce aquaponics in the form of a display. We hope that, if people understand the concept, aquaponics will become widespread."

N.I. Teijin Shoji

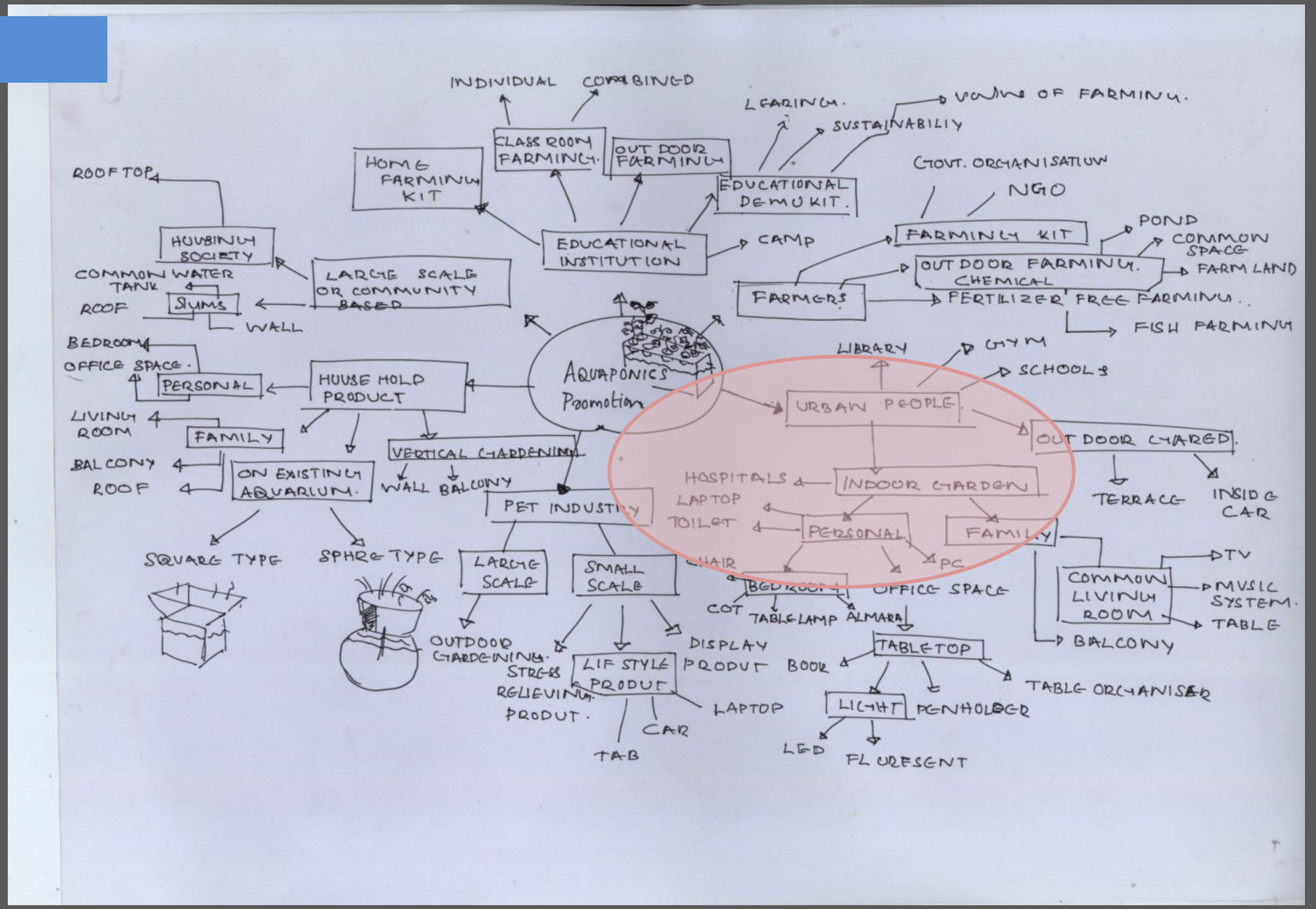
(An entrepreneur from Japan)

Source: http://goo.gl/mOxJ51

What should I do in Aquaponics ???

From data collection and general survey it was fund that aquaponics system is quite efficient yet it is not well known enough among people.

Mind map


AQUAPONICS
Promotion
EDUCATIONAL INSTITUTION
CLASS ROOM FARMING
OUT DOOR FARMING
HOME FARMING KIT
EDUCATIONAL DEMU KIT.
INDIVIDUAL
COMBINED
LEARING.
SUSTAINABILIY
VALUE OF FARMING.
CAMP
HOUSING SOCIETY
LARGE SCALE OR COMMUNITY BASED
ROOFTOP
COMMON WATER TANK
ROOF
SLUMS
WALL
FARMERS
FARMING KIT
GOVT. ORGANISATION
NGO
POND
COMMON SPACE
OUT DOOR FARMING.
CHEMICAL
FARM LAND
FERTILIZER FREE FARMING.
FISH FARMING
HOUSE HOLD PRODUCT
BEDROOM
OFFICE SPACE.
PERSONAL
LIVING ROOM
FAMILY
BALCONY
ROOF
ON EXISTING AQUARIUM.
VERTICAL GARDENING
WALL
BALCONY
PET INDUSTRY
SQUARE TYPE
SPHERE TYPE
LARGE SCALE
SMALL SCALE
OUTDOOR GARDENING.
STRESS RELIEVING PRODUT.
LIF STYLE PRODUT
DISPLAY PRODUT
LAPTOP
CAR
TAB
URBAN PEOPLE
LIBRARY
GYM
SCHOOLS
OUT DOOR SHARED.
TERRACE
INSIDE CAR
HOSPITALS
LAPTOP
TOILET
INDOOR GARDEN
PERSONAL
FAMILY
CHAIR
PC
BEDROOM
OFFICE SPACE
COT
TABLE LAMP
ALMARA
COMMON LIVING ROOM
TV
MUSIC SYSTEM.
TABLE
BALCONY
TABLETOP
BOOK
TABLE ORGANISER
LIGHT
PENHOLDER
LED
FLURESENT

Why urban context ?

- Less availability of space for farming or gardening
- Water availability
- Less knowledge about farming
- Convey the value of Agriculture and Sustainability
- Pollution in urban area

Design Brief

Design a house hold Aquaponics system in urban domestic context which should be:

- Promotional (awareness)
- Inspirational (close to nature, grow their own food)
- Accessibility (usability, collapsibility, transportation& manufacturability)
- Informational (technology)
- Destressing (relaxation, hobby)

Existing Household Aquaponics system

New technology in aquarium & aquarium accessories

Vinyl Aquarium

- Extremely affordable prices
- Collapsibility

There are two concepts.
One is simply a clear tank liner that would be installed within a typical plywood tank. The viewing window could be made out of lightweight acrylic since some flexing will not hinder the integrity of the tank.

The other concept is to make the tank frame completely out of pipe. Sleeves would be welded onto the liner at all 4 corners allowing the liner to be pulled tight so it will hold its shape when filled.

Collapsible aquarium

This design for an aquarium comprises a base supporting thereon an expandable concertina-shaped collar that is fixed to the base by a watertight gasket. The upper rim of the collar contains a series of spaced-apart posts that engage keyhole openings set along the bottom circumference of a dome-shaped lid, which is fixed to the collar in a watertight manner.

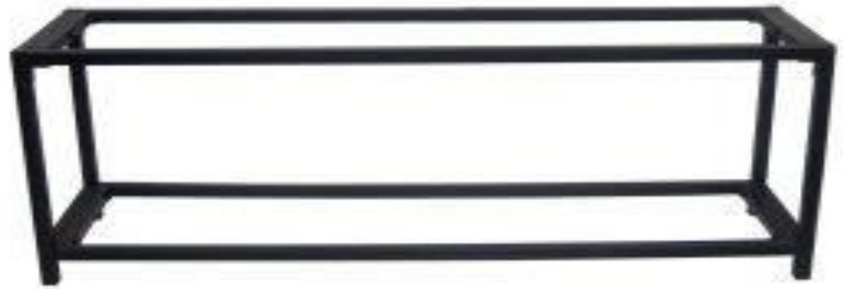
The lid is cleaned or replaced without removing the fish from the aquarium by extending the collar upwards, causing the water level to drop below the upper rim of the collar

Aquarium Stands

Collapsible aquarium stands - all the strength or standard and whale stands plus the convenience of trouble-free transport and storage.

Features:

- Made from durable, square steel tubing
- Welded to ensure added strength
- Painted black for lasting rust protection
- Available in a variety of sizes
- Available in two types -STANDARD and WHALE

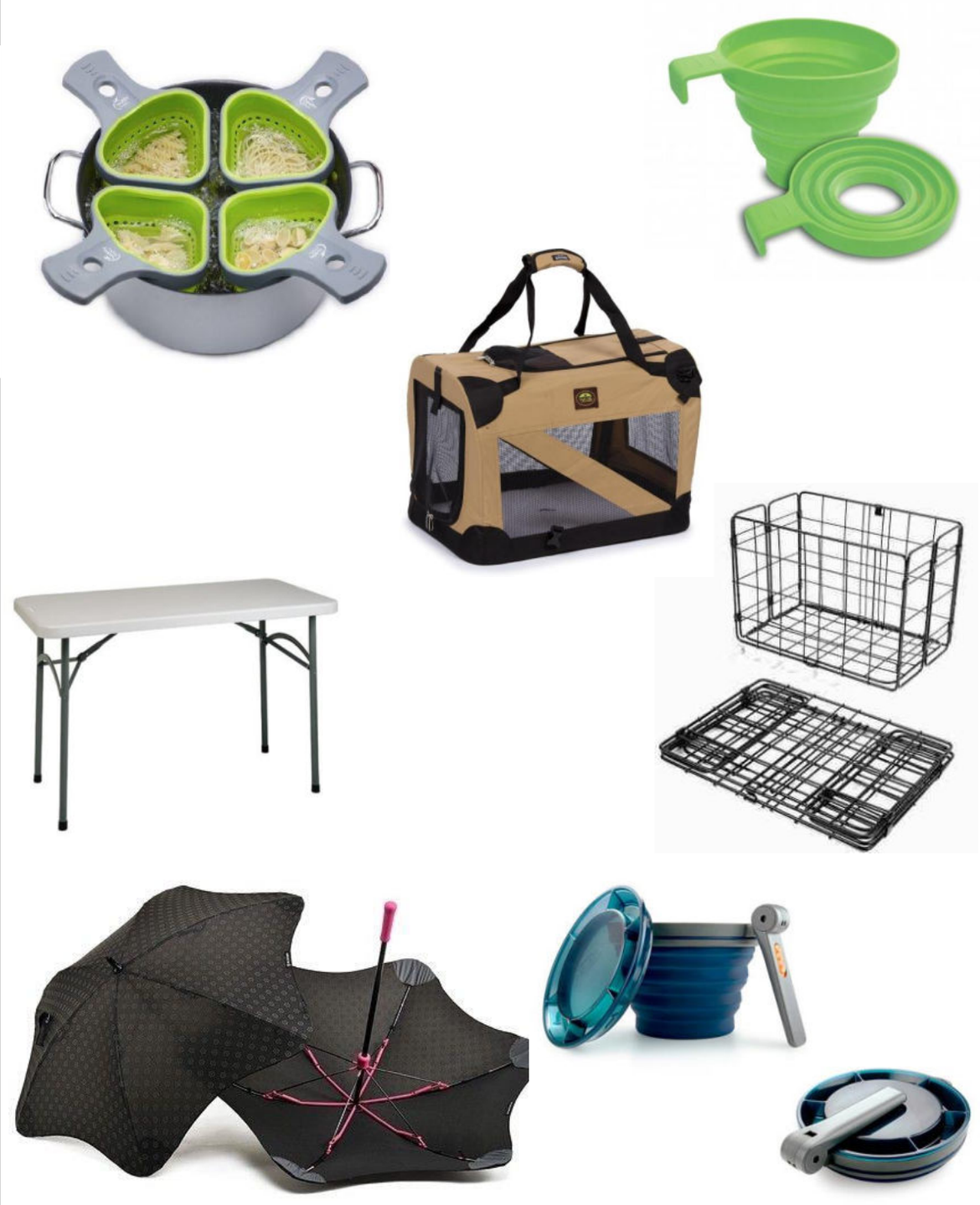


Study in collapsibility

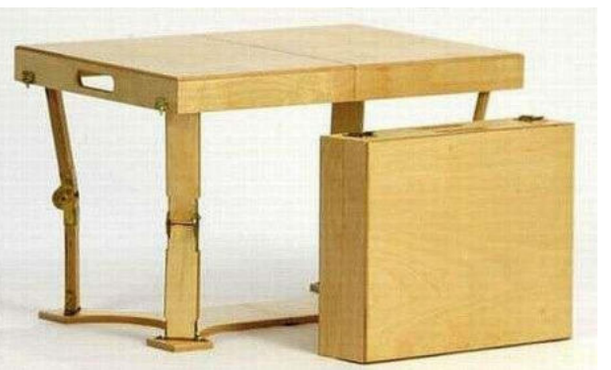
•Collapsibility is an elementary design principle applied to a grate many every day objects, from telescope to umbrellas newspapers to Venetians blinds to perambulators.

• Collapsible work by adjustment, which is basic strategy for survival.

•Collapsible are smart man made objects with the capacity to adjust in size to meet a practical need.



Study of Collapsible Home furniture



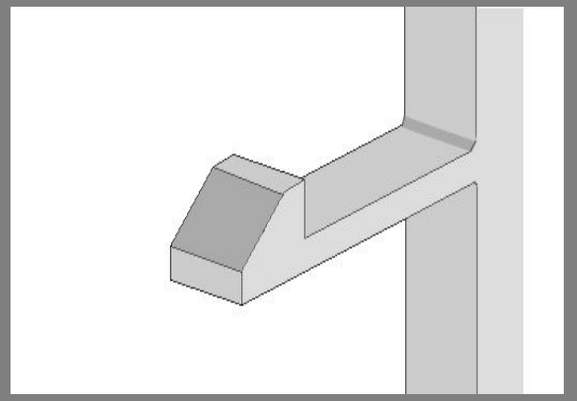
Study in Plastic joints

Plastic parts can be joined using a variety of assembly techniques; some of them allowing disassembly, others creating a permanent joint.

- Mechanical Fasteners
- Plastic Threads
- Press-Fittings
- Snap-Fits

Snap joints

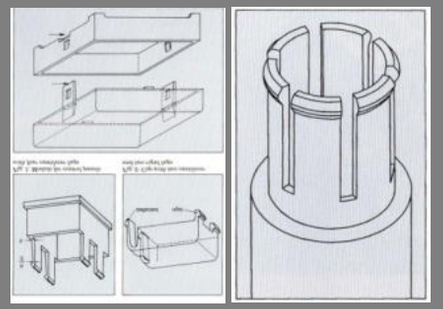
A snap-fit is a mechanical joint system where part-to-part attachment is accomplished with locating and locking features (constraint features) that are homogenous with one or the other of the components being joined.



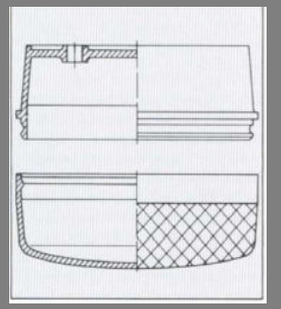
Types of snap joints

- Cantilever snap joints
- U-shaped snap joints
- Torsion snap joints
- Annular snap joints

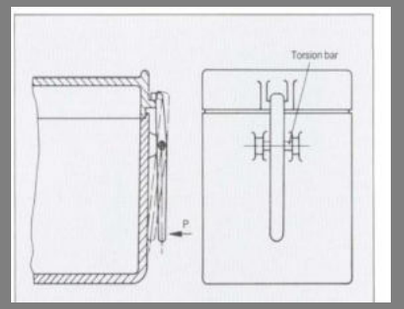
Cantilever snap joints

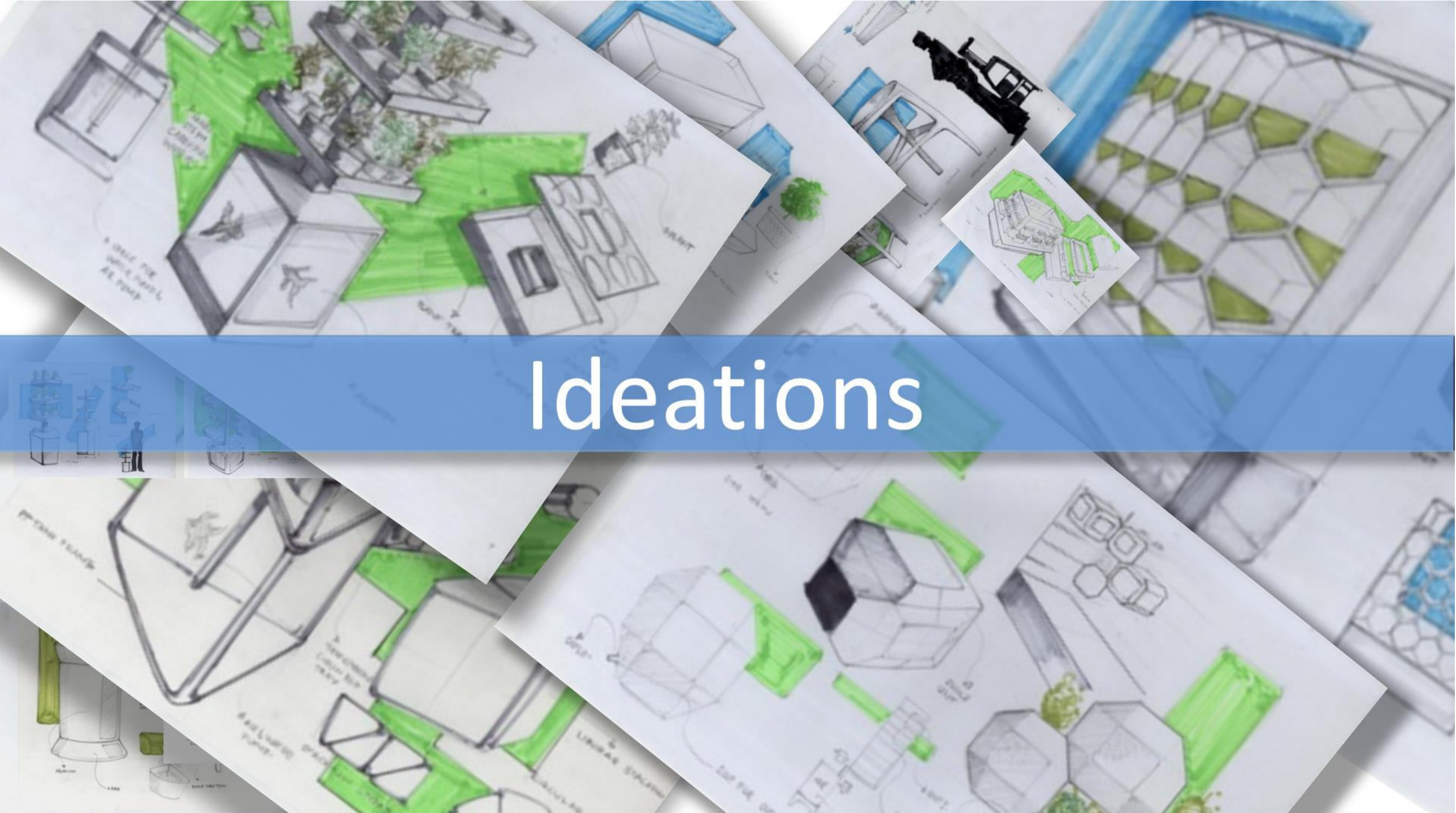


Annular snap joints



Torsion snap joints





Ideations

Directions

Upper plant system lower aquarium type

- Table top Aquaponics system
- Tower type aquaponics system
- Wall mountable aquaponics system

Upper aquarium and lower plant type

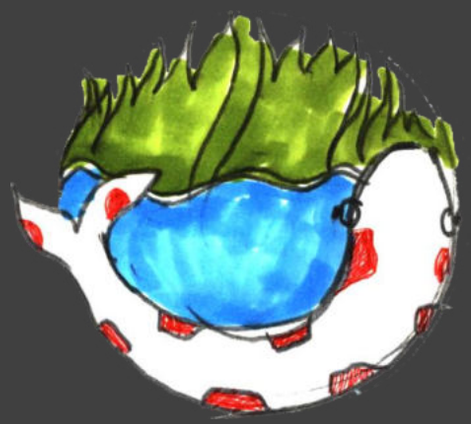
- Tower type aquaponics system

Aquarium surrounded by plant system type

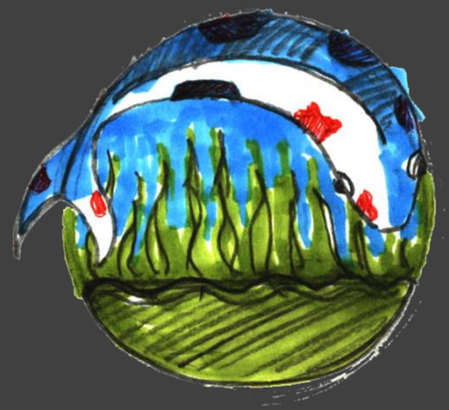
IDEA MAPPING

IDEATIONS

1. TABLE TOP
2. WALL MOUNTABLE
3. TOWER TYPE



A Upper plant system & lower aquarium type

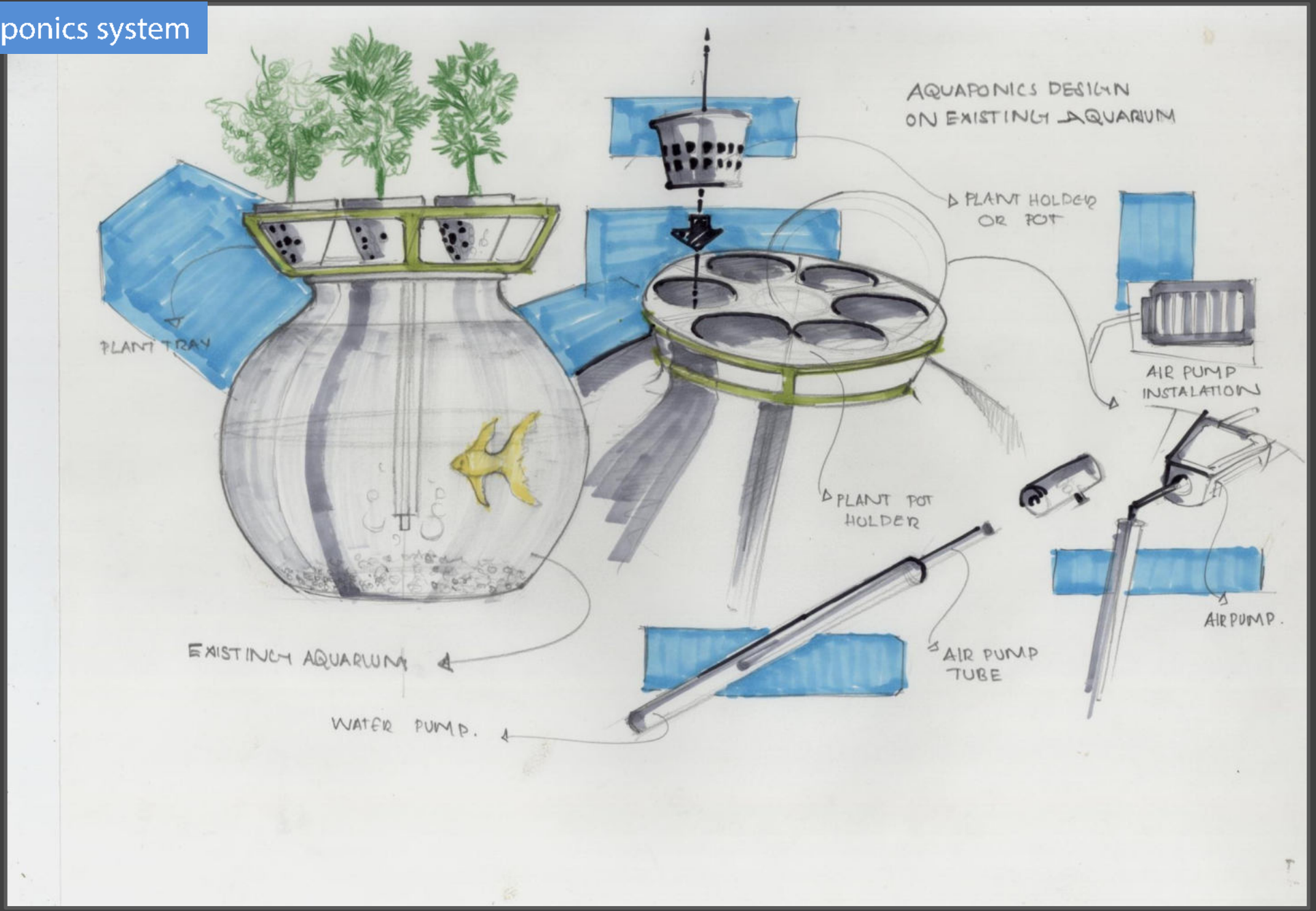


B Upper aquarium and lower plant type

C Aquarium surrounded by plant system type

Table top Aquaponics system

1A



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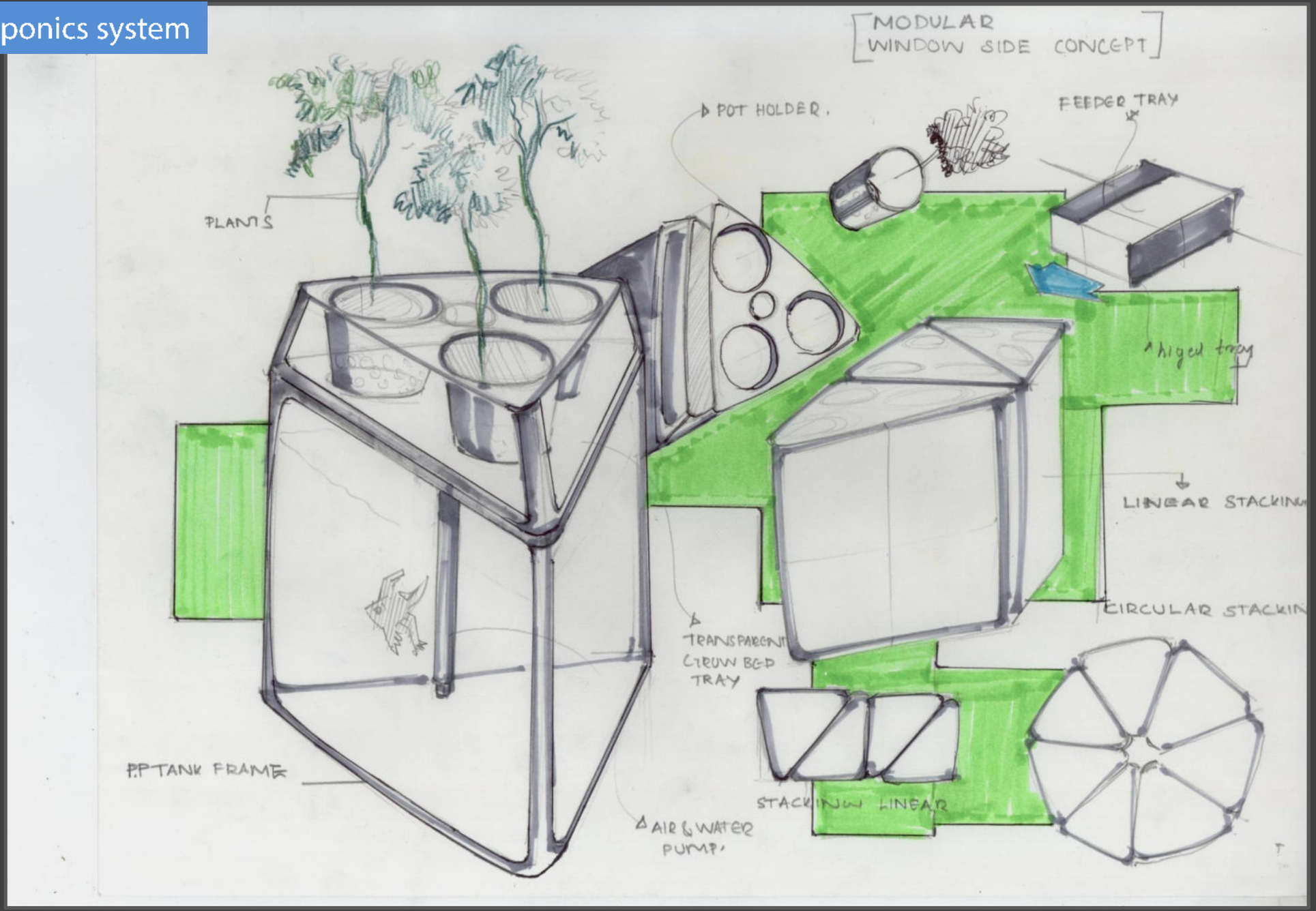

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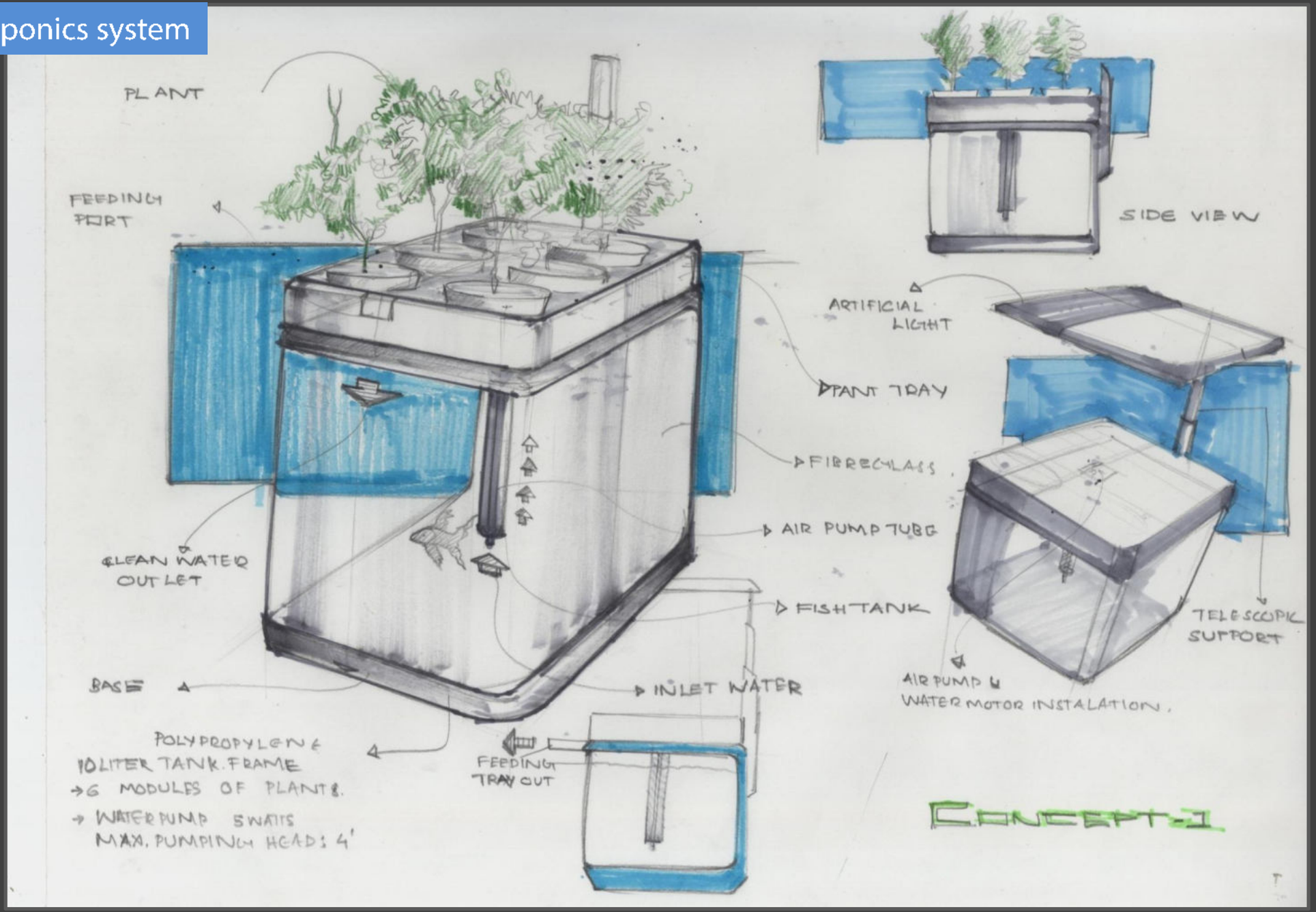

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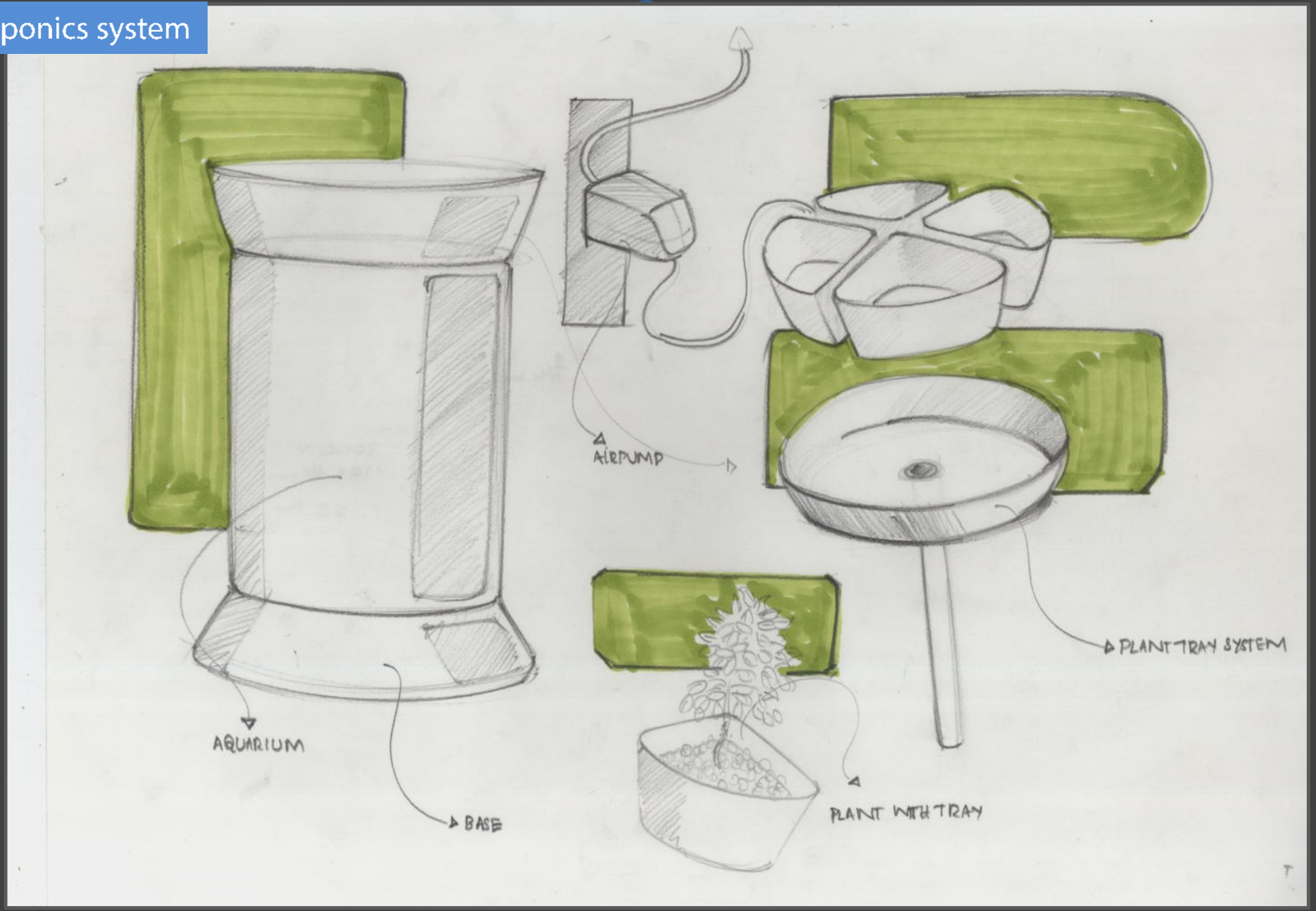

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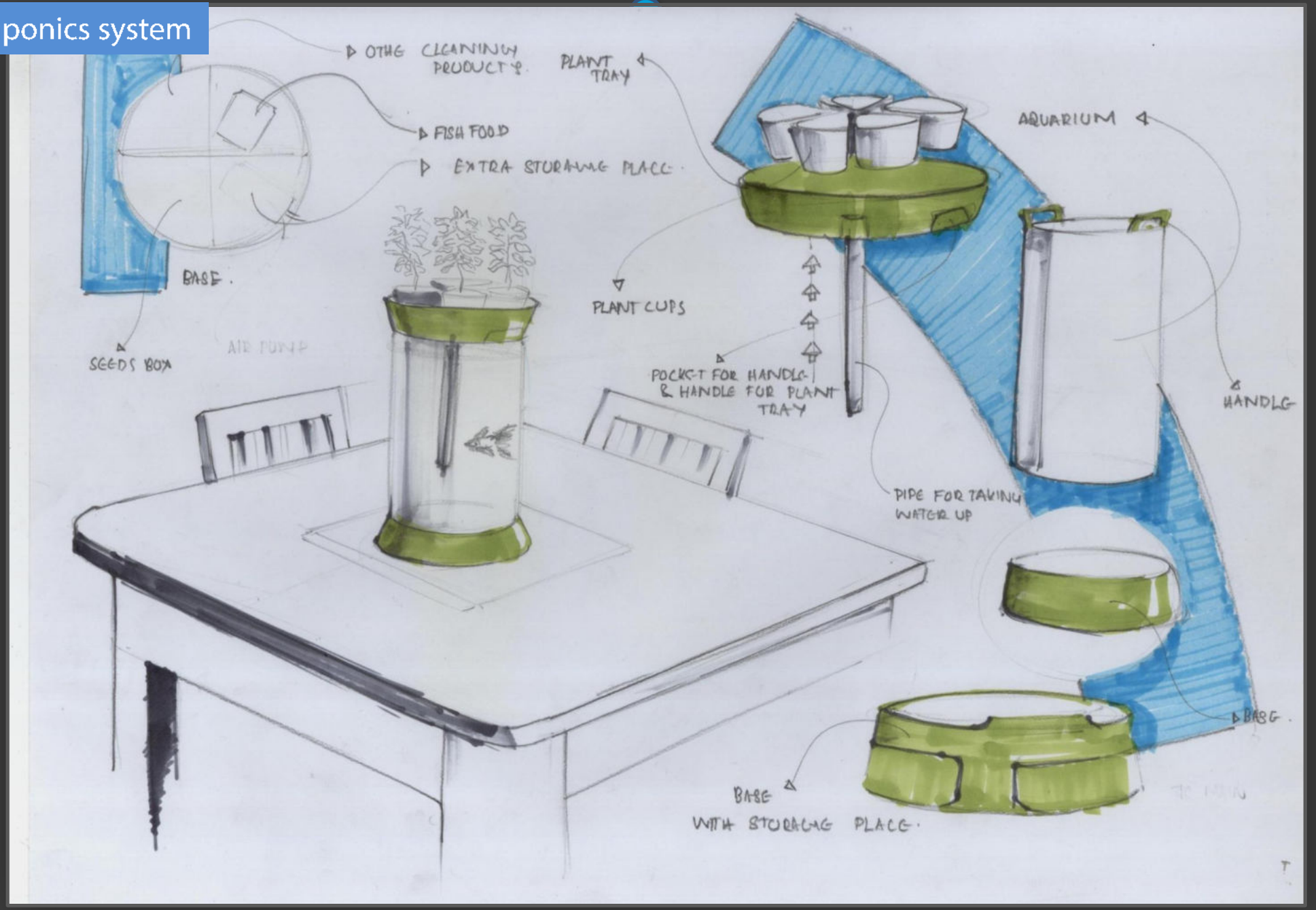
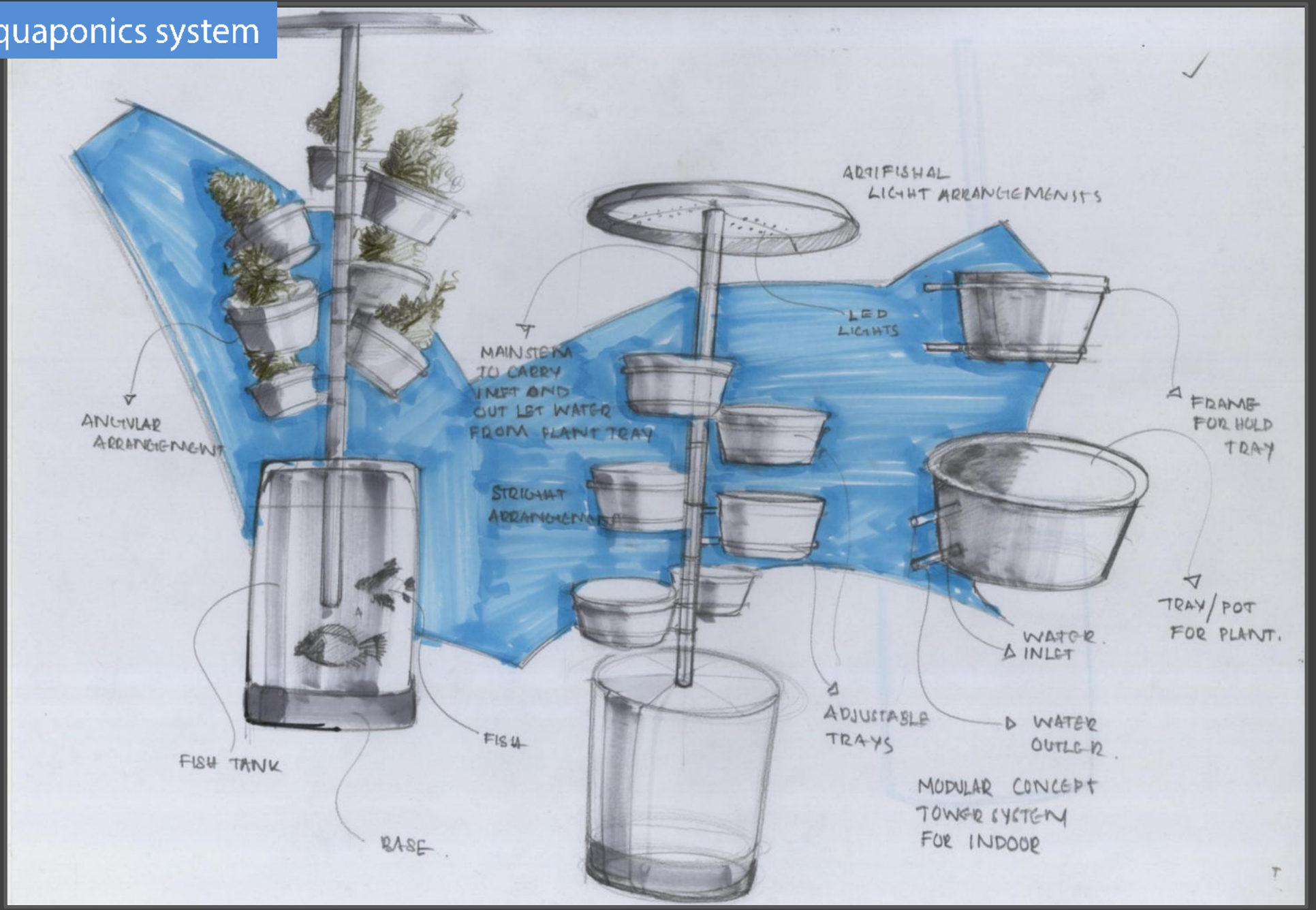
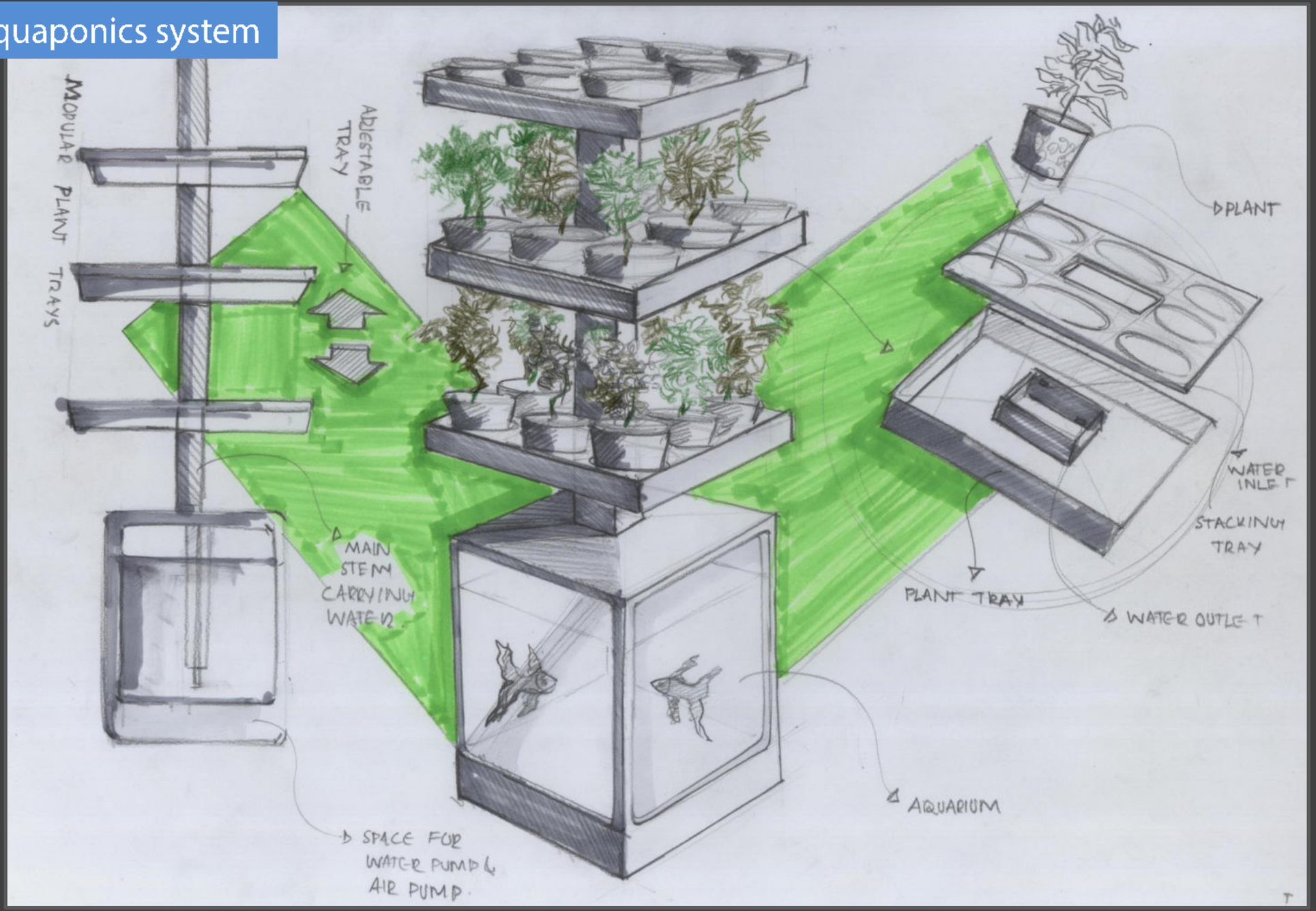


Tower type Aquaponics system



Tower type Aquaponics system

3A



Tower type Aquaponics system

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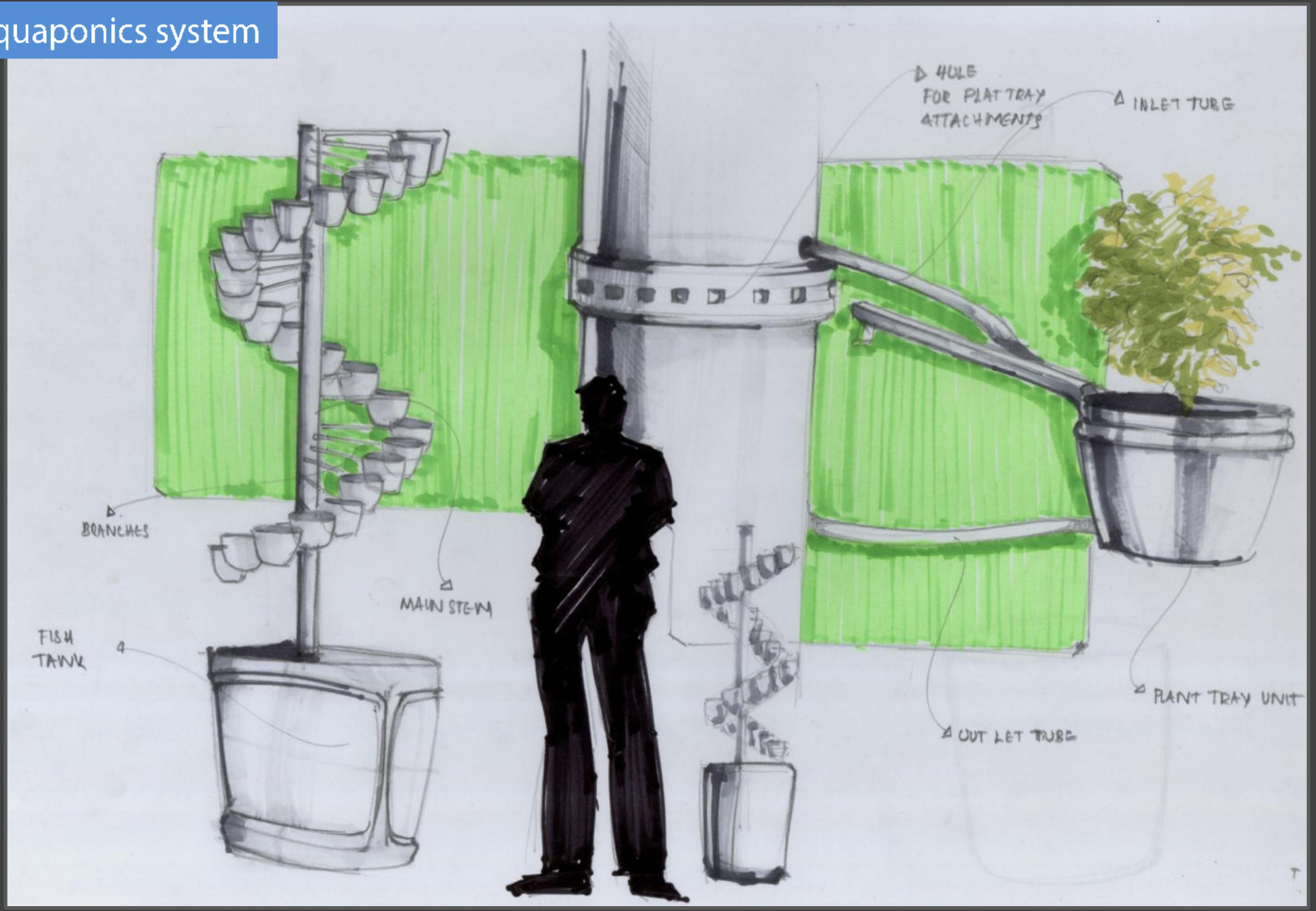

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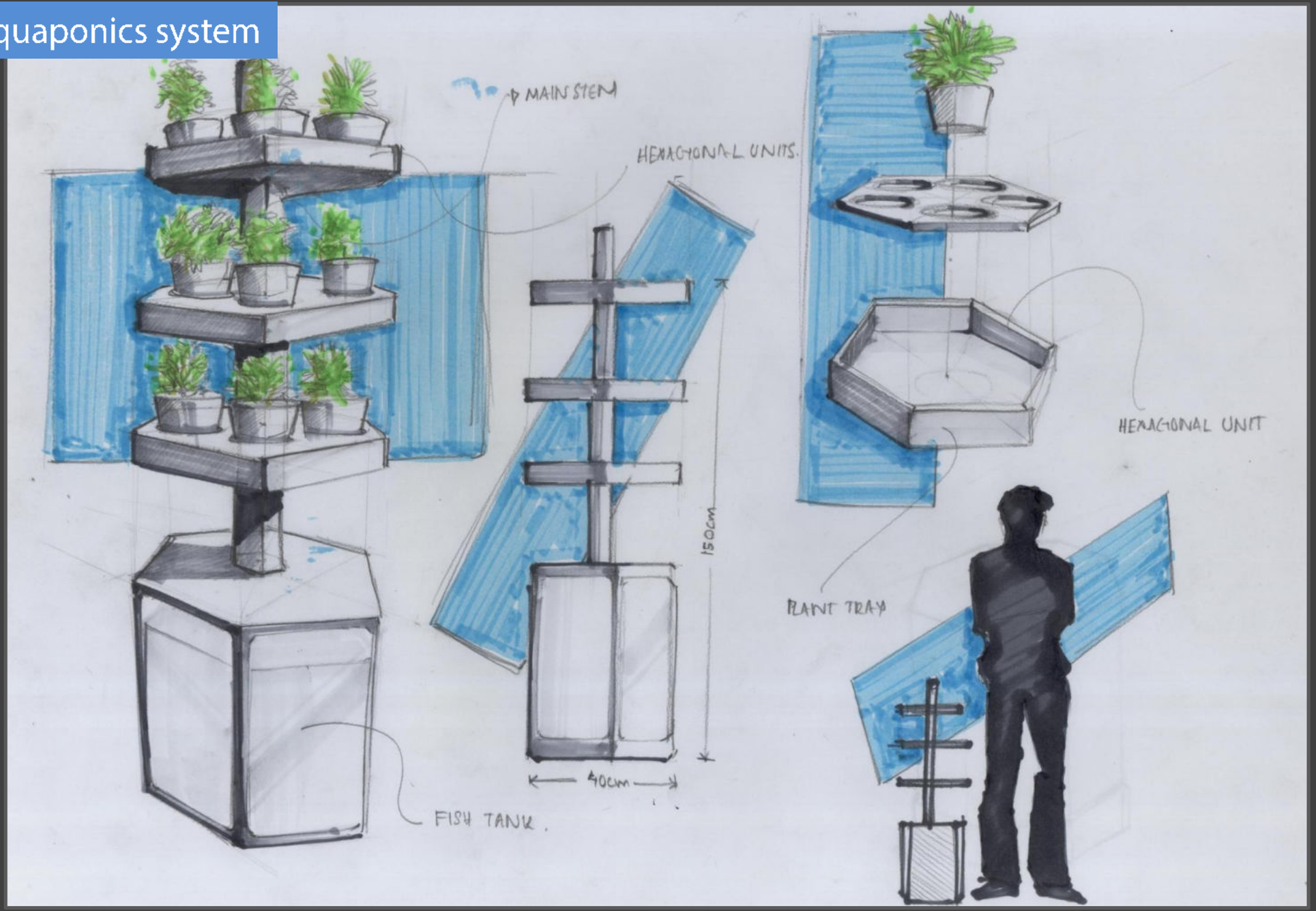

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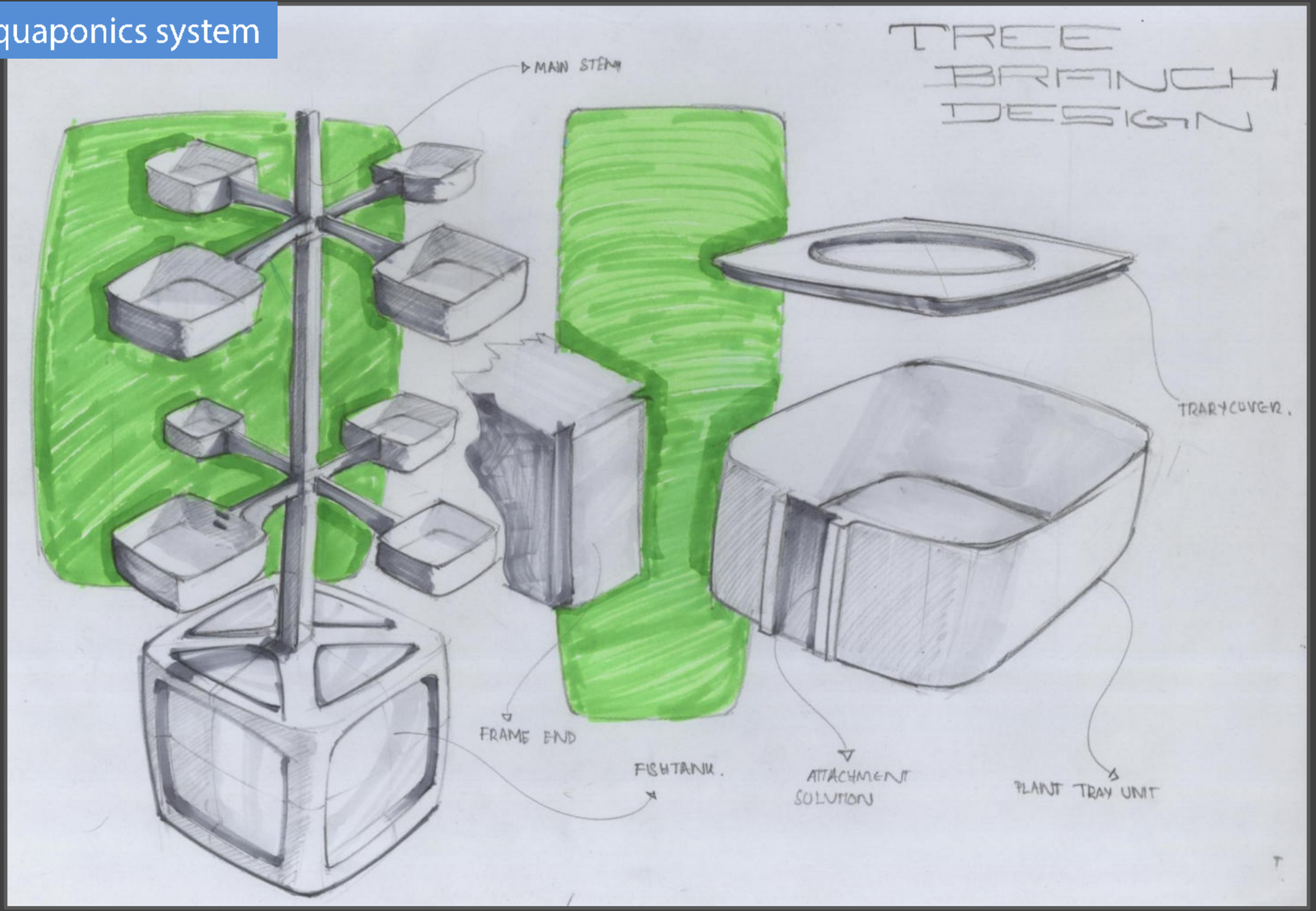

Tower type Aquaponics system

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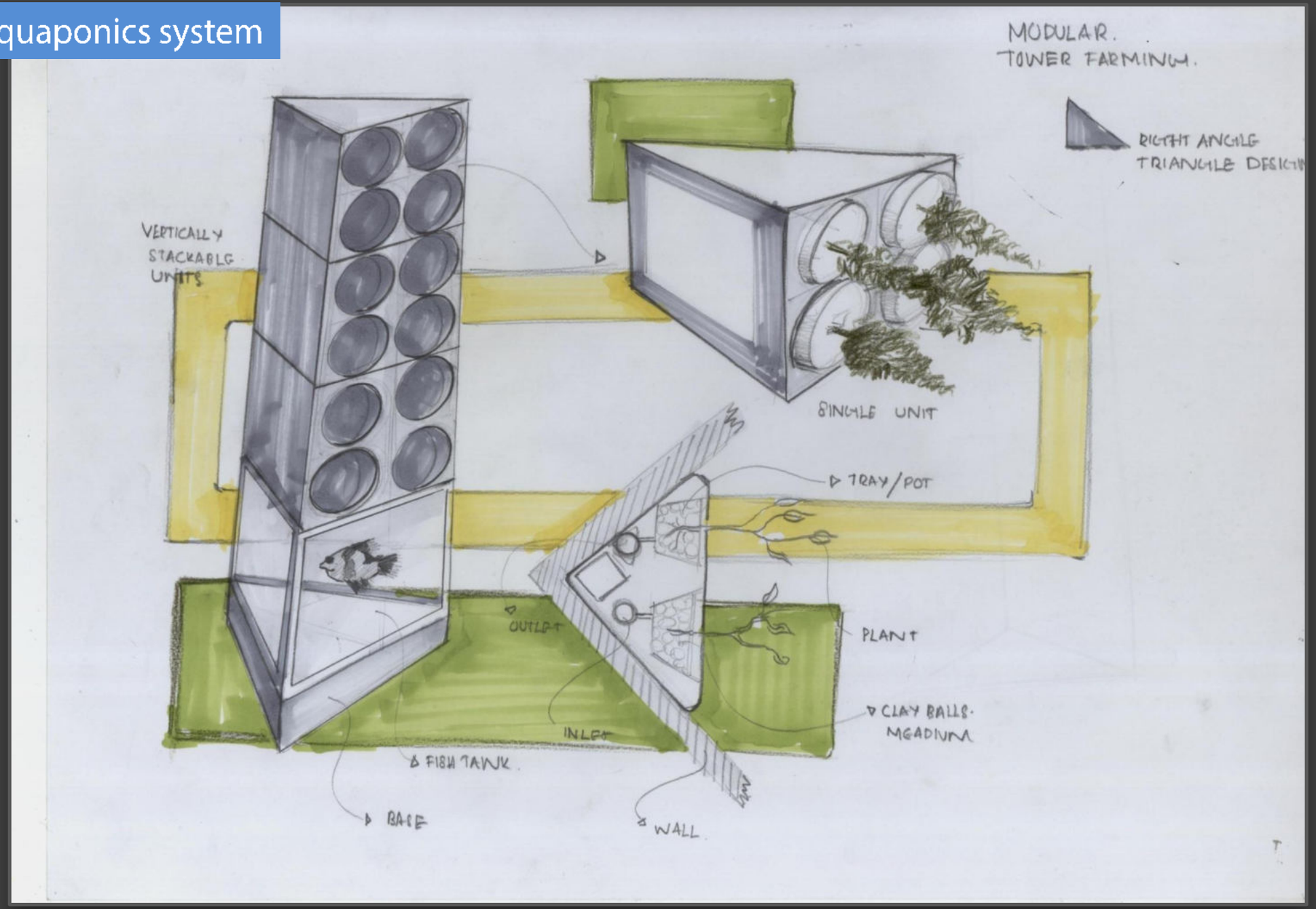
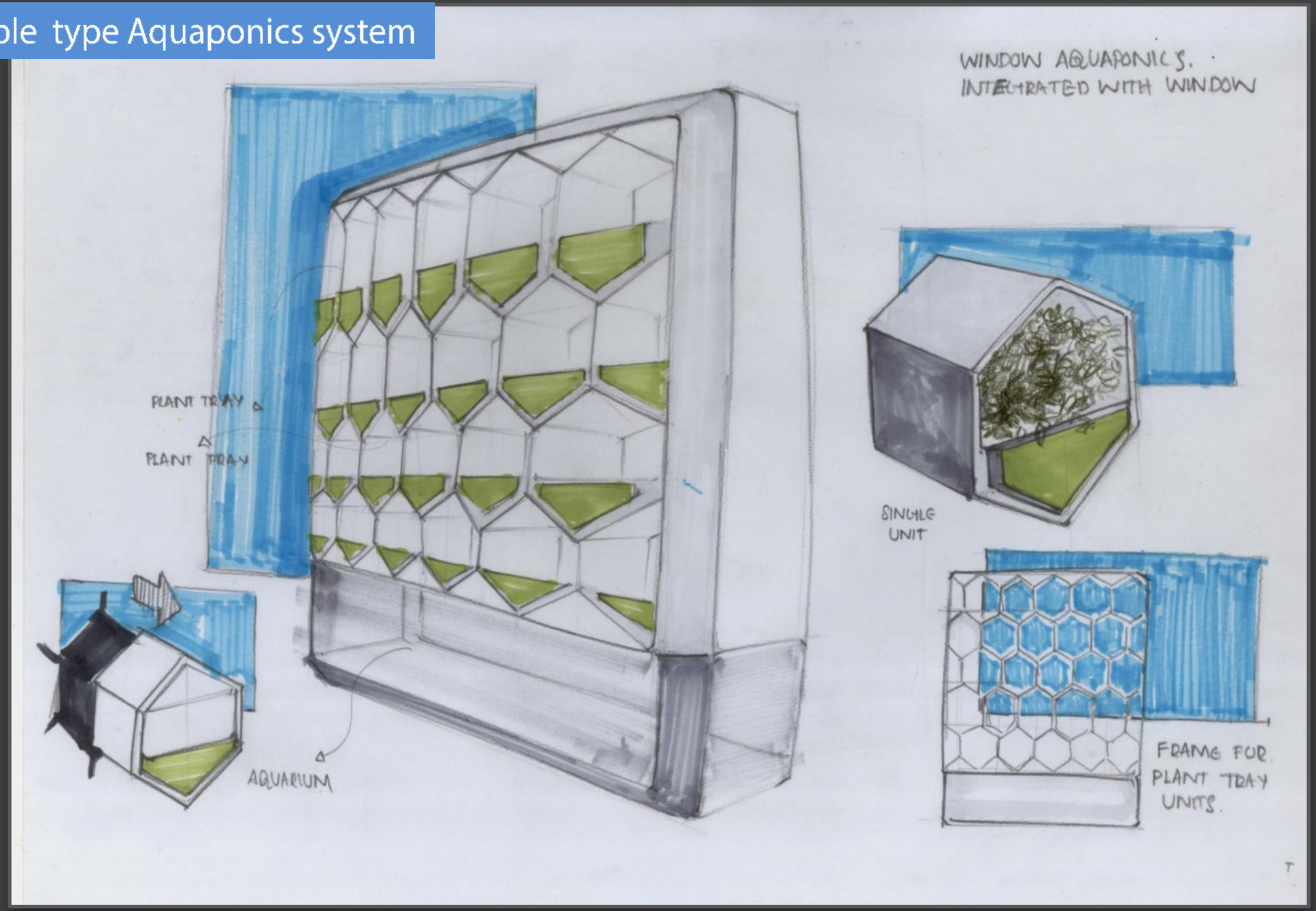


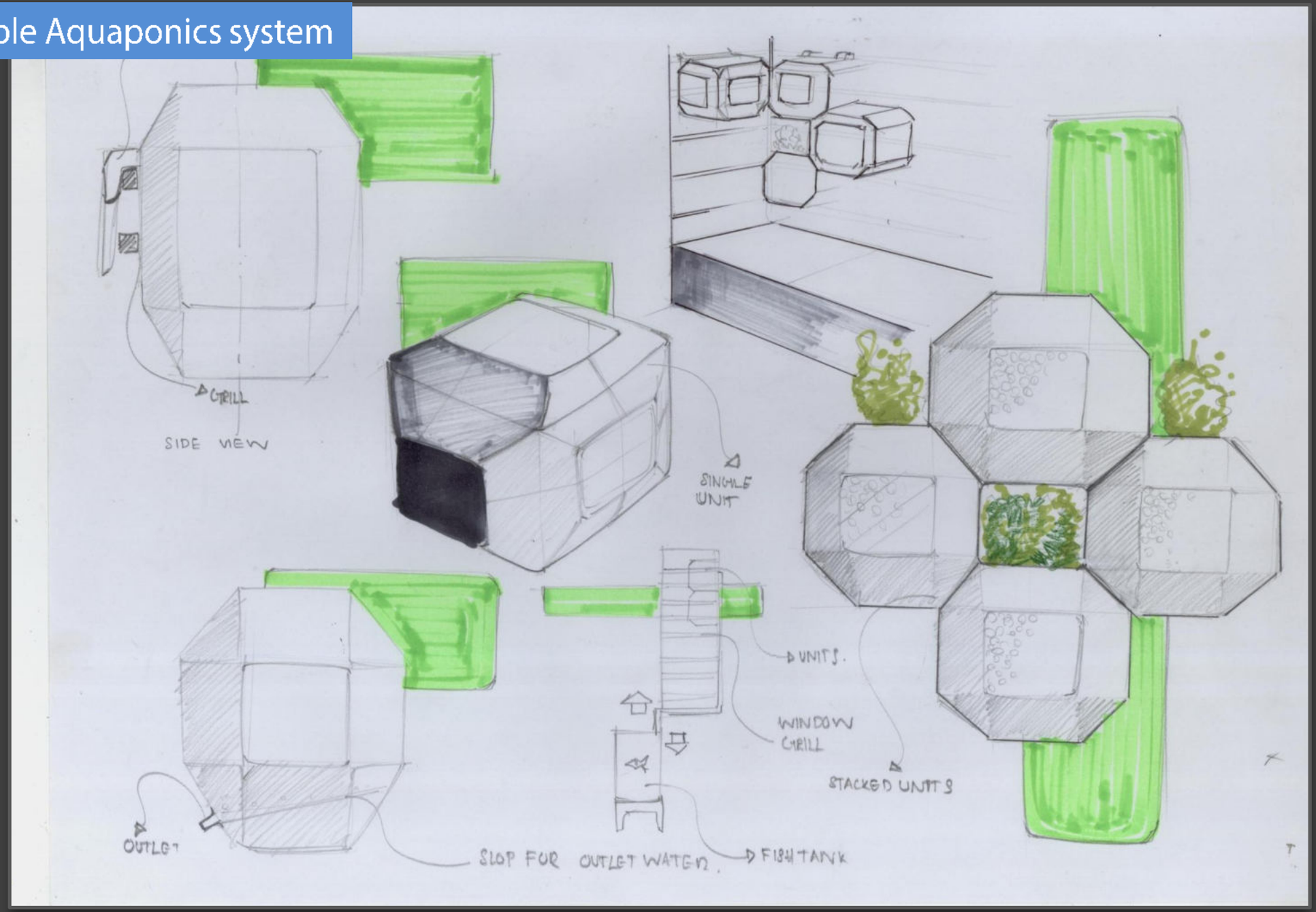
Wall mountable type Aquaponics system

2A



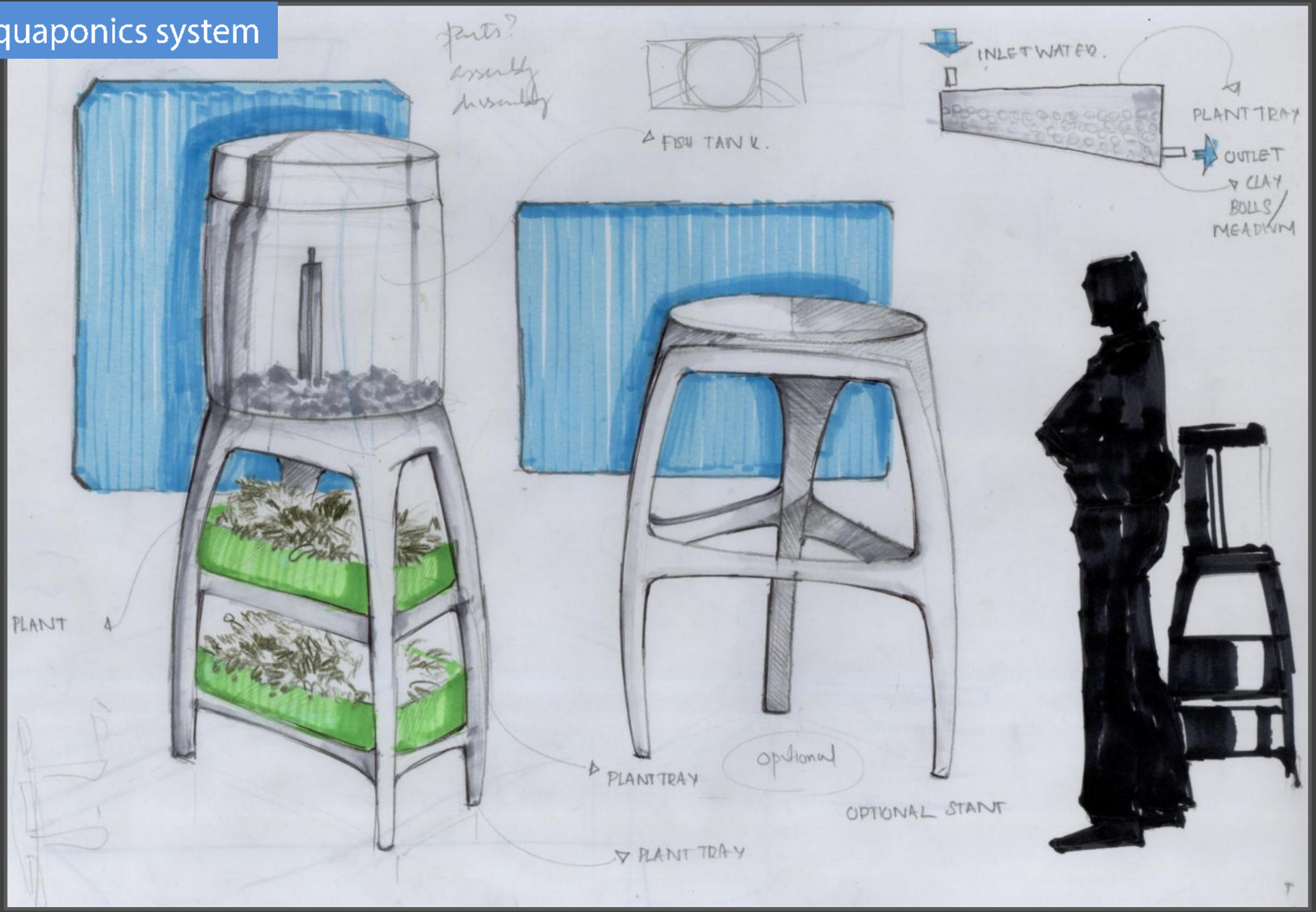
Wall mountable Aquaponics system

2A

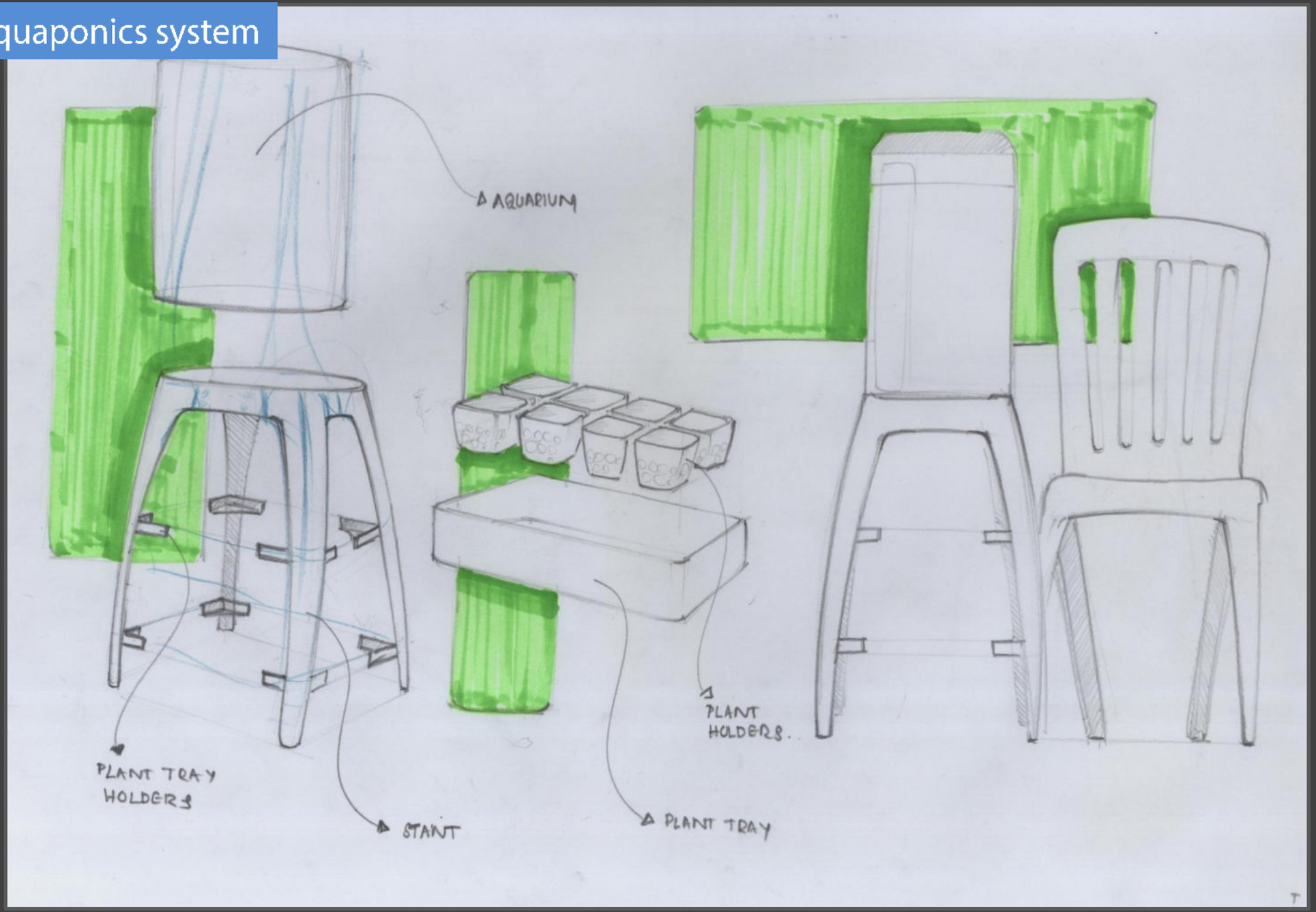


Tower type Aquaponics system

3B



Tower type Aquaponics system



Tower type Aquaponics system

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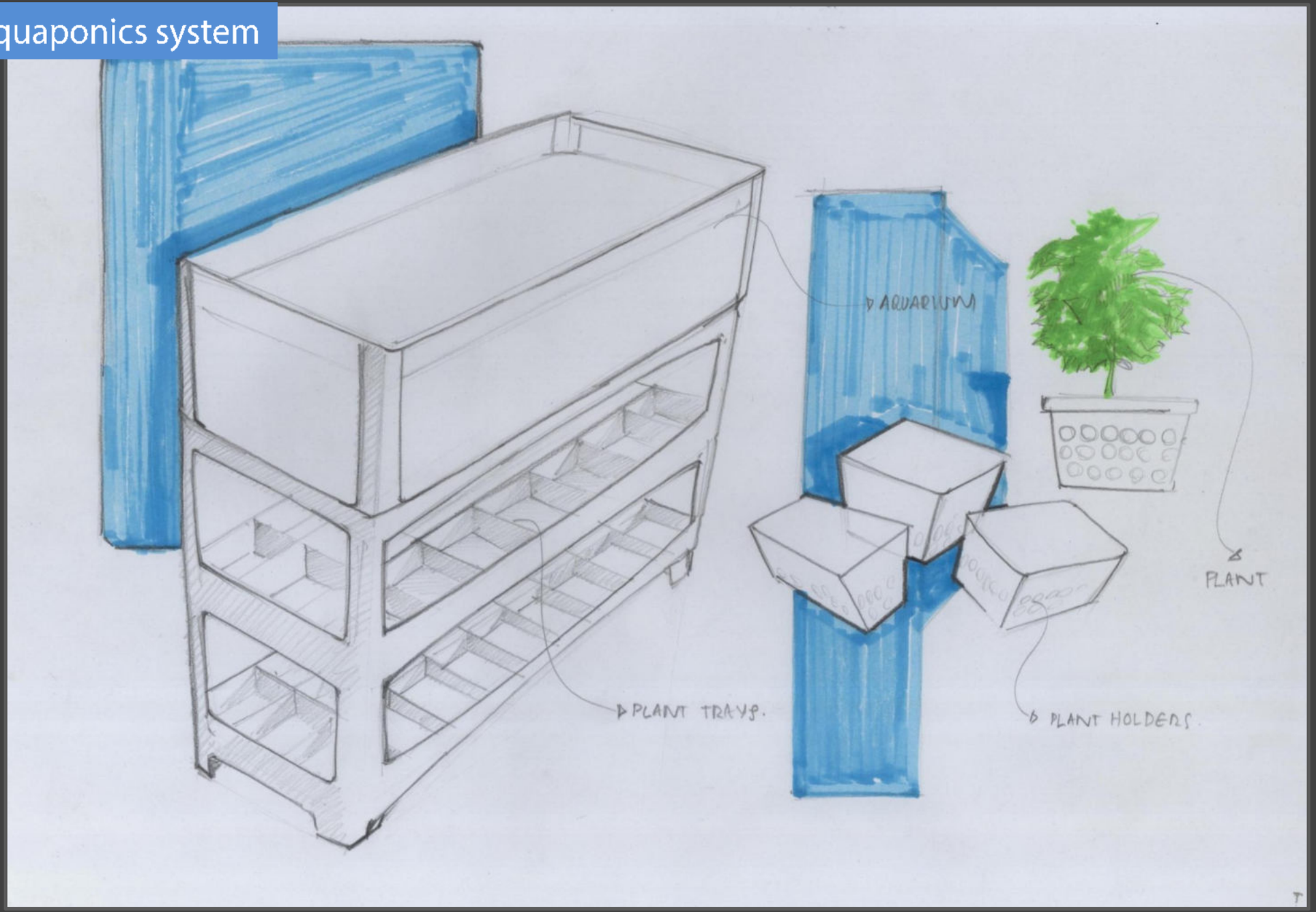
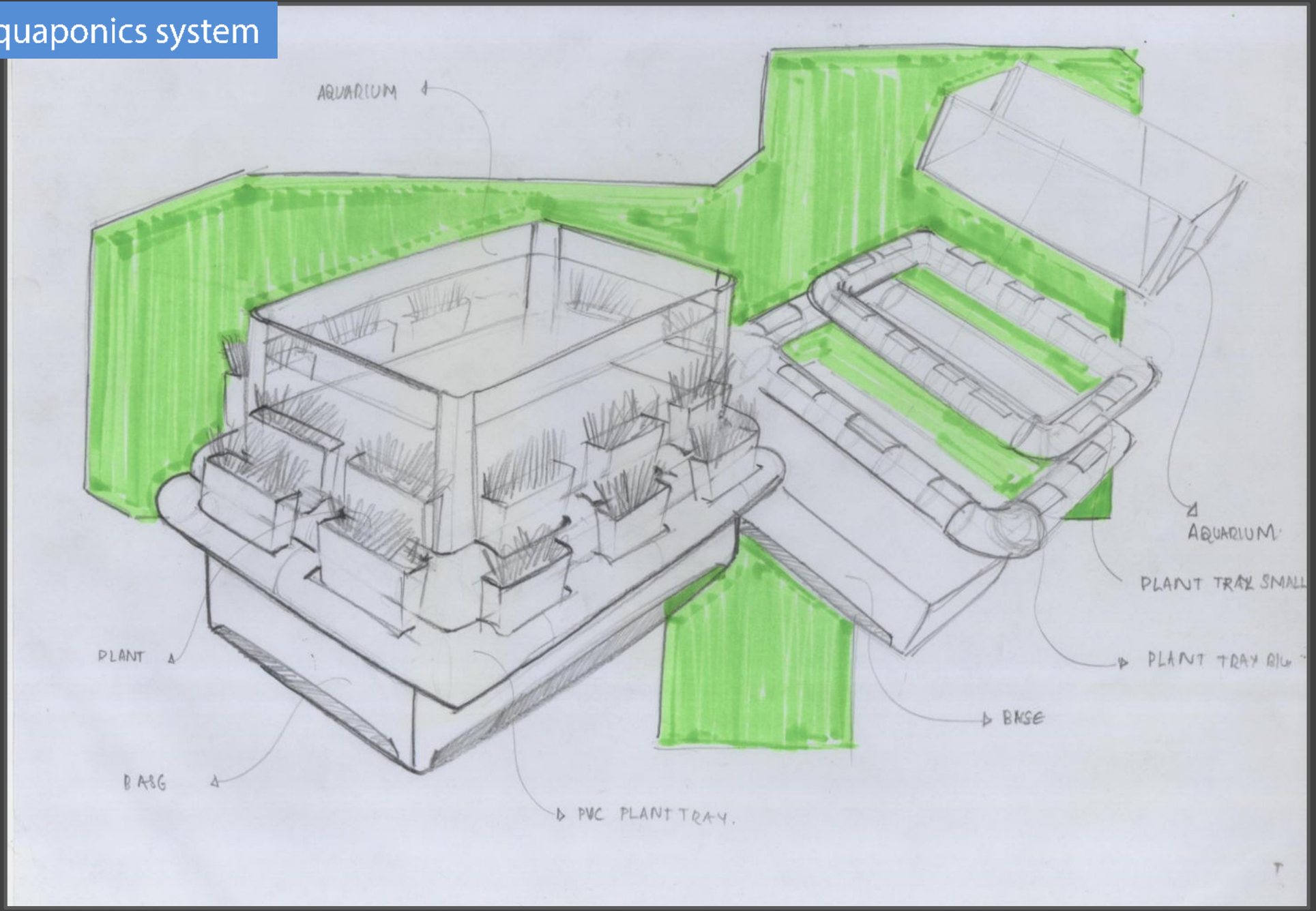


Tower type Aquaponics system

3C



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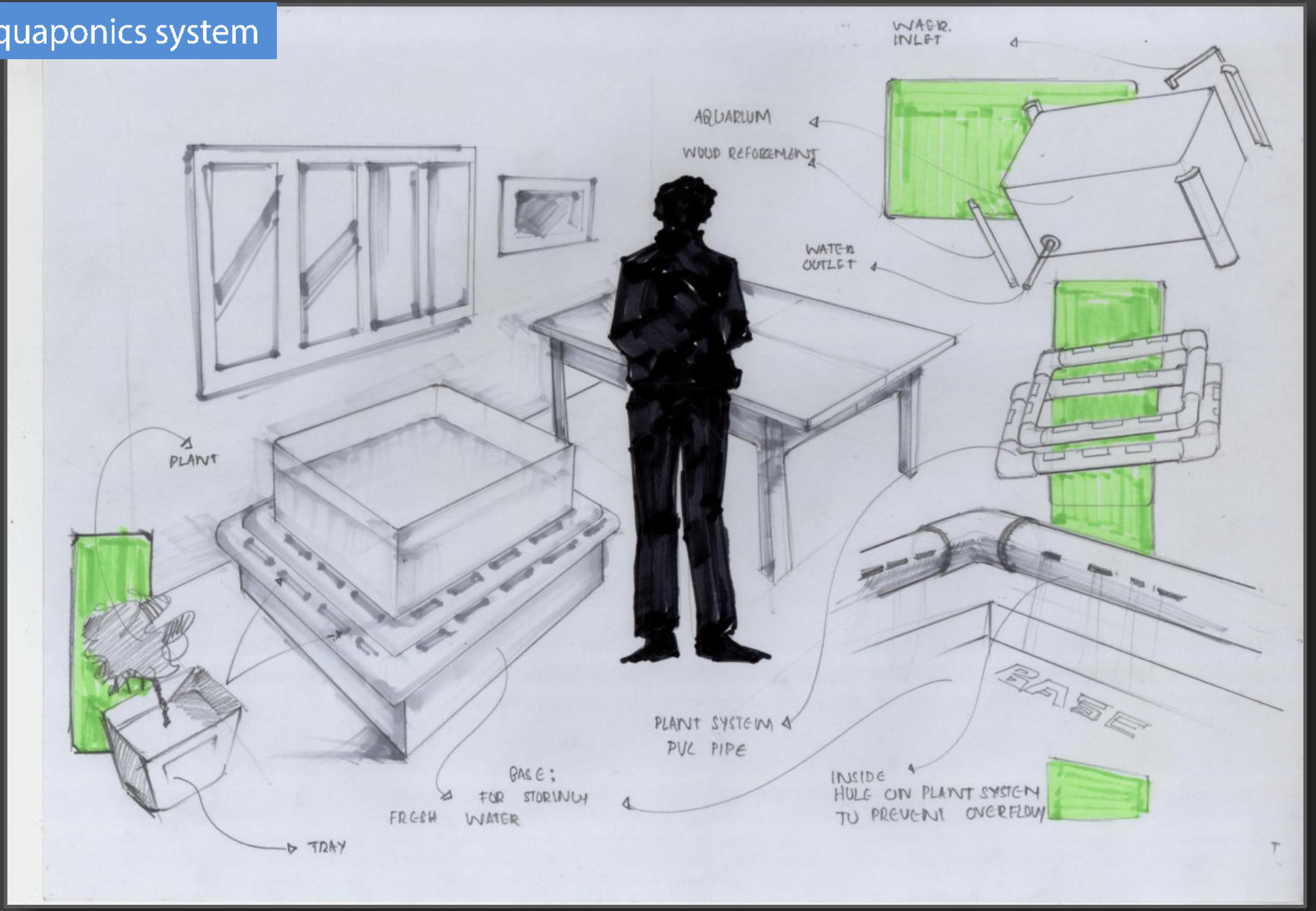
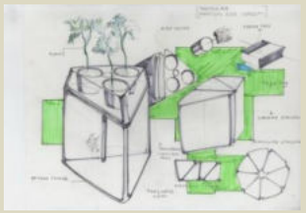
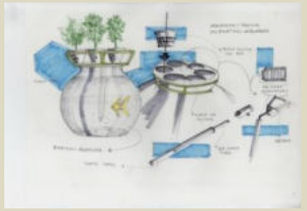
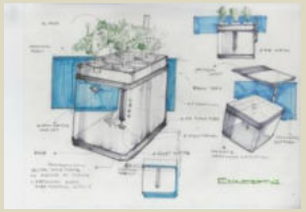


Overall view of Ideations

TABLE TOP

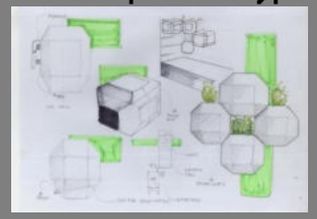
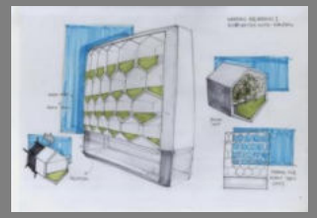
Upper plant system & lower aquarium type



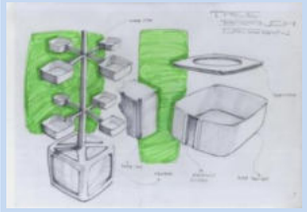
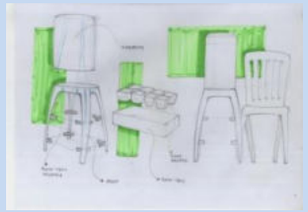
WALL MOUNTABLE

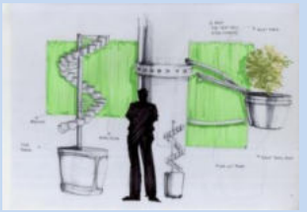
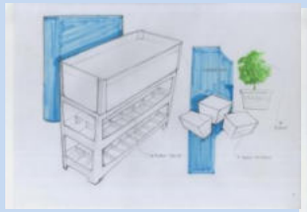
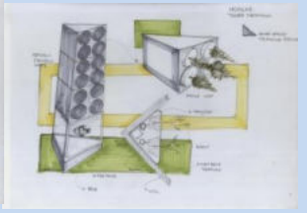
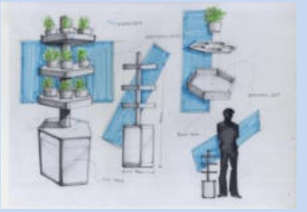
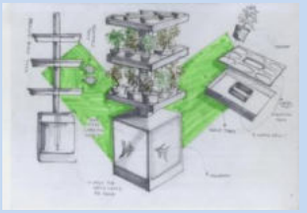
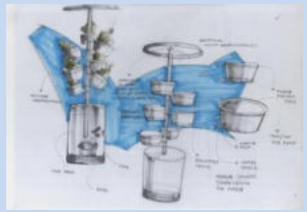
Upper plant system & lower aquarium type

TOWER TYPE

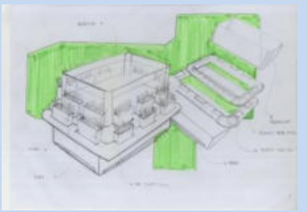
Upper plant system & lower aquarium type

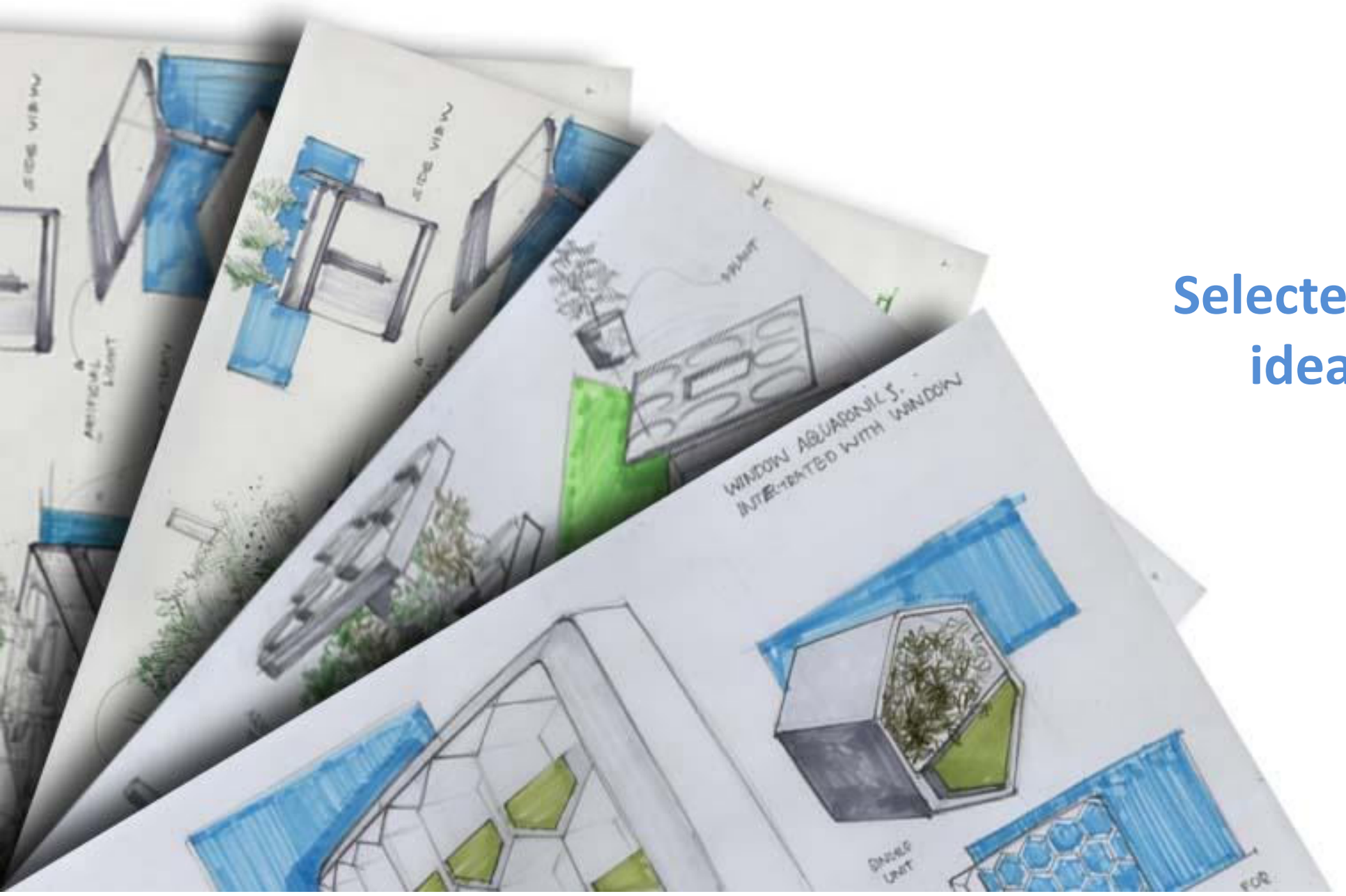



Upper aquarium and lower plant type

Aquarium surrounded by plant system type





Selected Ideations and idea evaluations

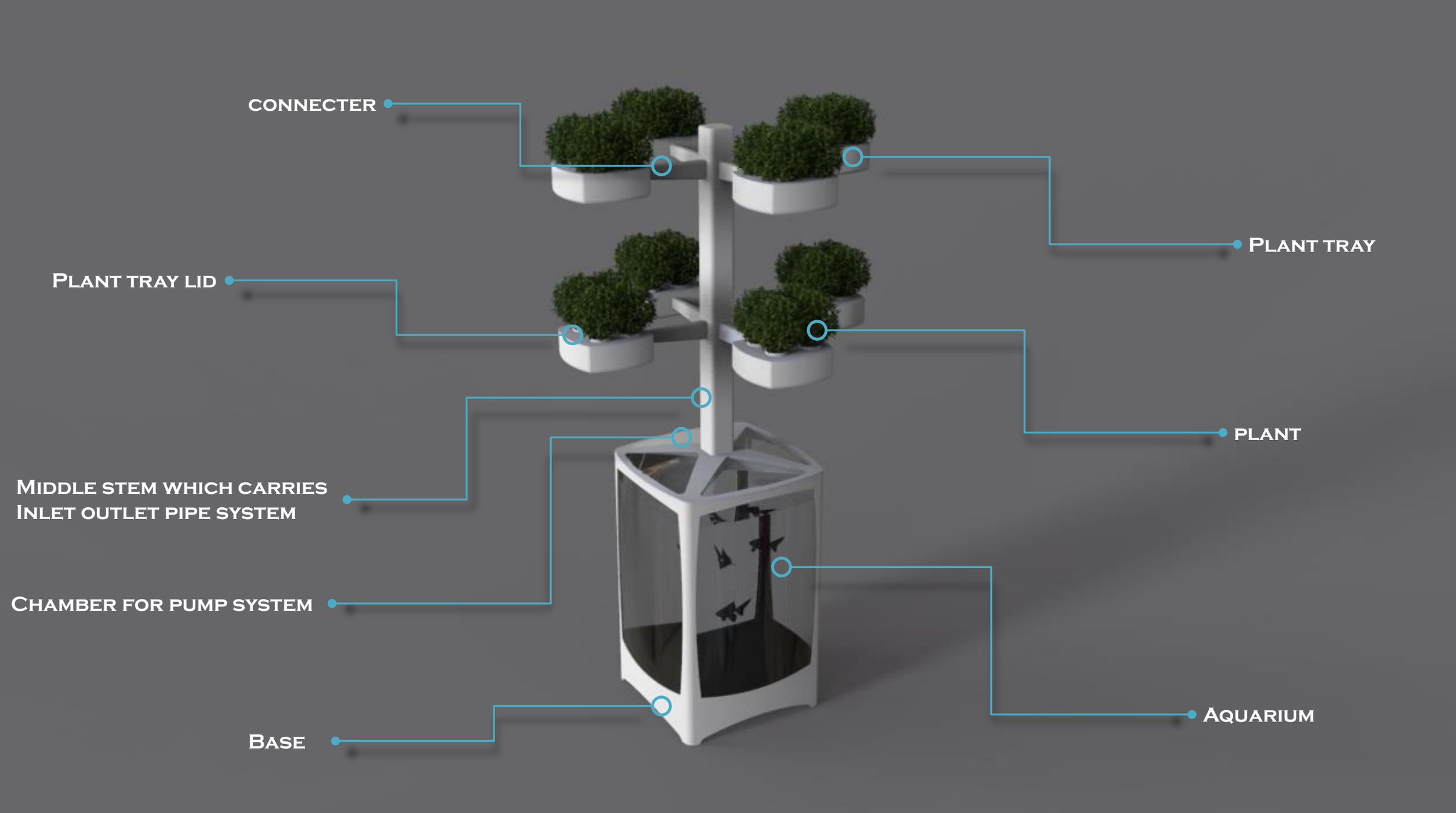
Idea-1

Advantages

- "Tree inside home" concept which can actually provide food
- Modular design which other parts can stack inside aquarium and transport easily, that is aquarium can act as a packaging of the product
- Medium scale Aquaponics system unlike table top system
- Form resembles the three which is more destressing
- Lower aquarium type design which is more stable than other Iterations
- Different trays for different type of plants
- Transparent aquarium top lid which provide more visibility into aquarium
- No need of extra duct for collecting fresh water
- More suitable to window side because plants gets more light and fishes gets less amount of light

Disadvantages

- Need more space to occupy
- Less visibility into aquarium than other concepts


CONNECTER
PLANT TRAY
PLANT TRAY LID
PLANT
MIDDLE STEM WHICH CARRIES
INLET OUTLET PIPE SYSTEM
CHAMBER FOR PUMP SYSTEM
AQUARIUM
BASE


Product in living room context

Idea-2

Advantages

- Upper Fish tank concept gives more visibility
- No obstacles on the fish tank which act as normal aquarium
- Collapsible design; so easy to transport and install
- Need less space than tower type design
- Keeps typicality in aquarium design
- Blend with other living room furniture

Disadvantages

- Need extra sump to collect fresh water
- Lesser stable as compare to bottom fish tank type
- Fishes gets more sunlight which is harmful
- Also the plants doesn’t get sufficient sunlight


Product in living room context

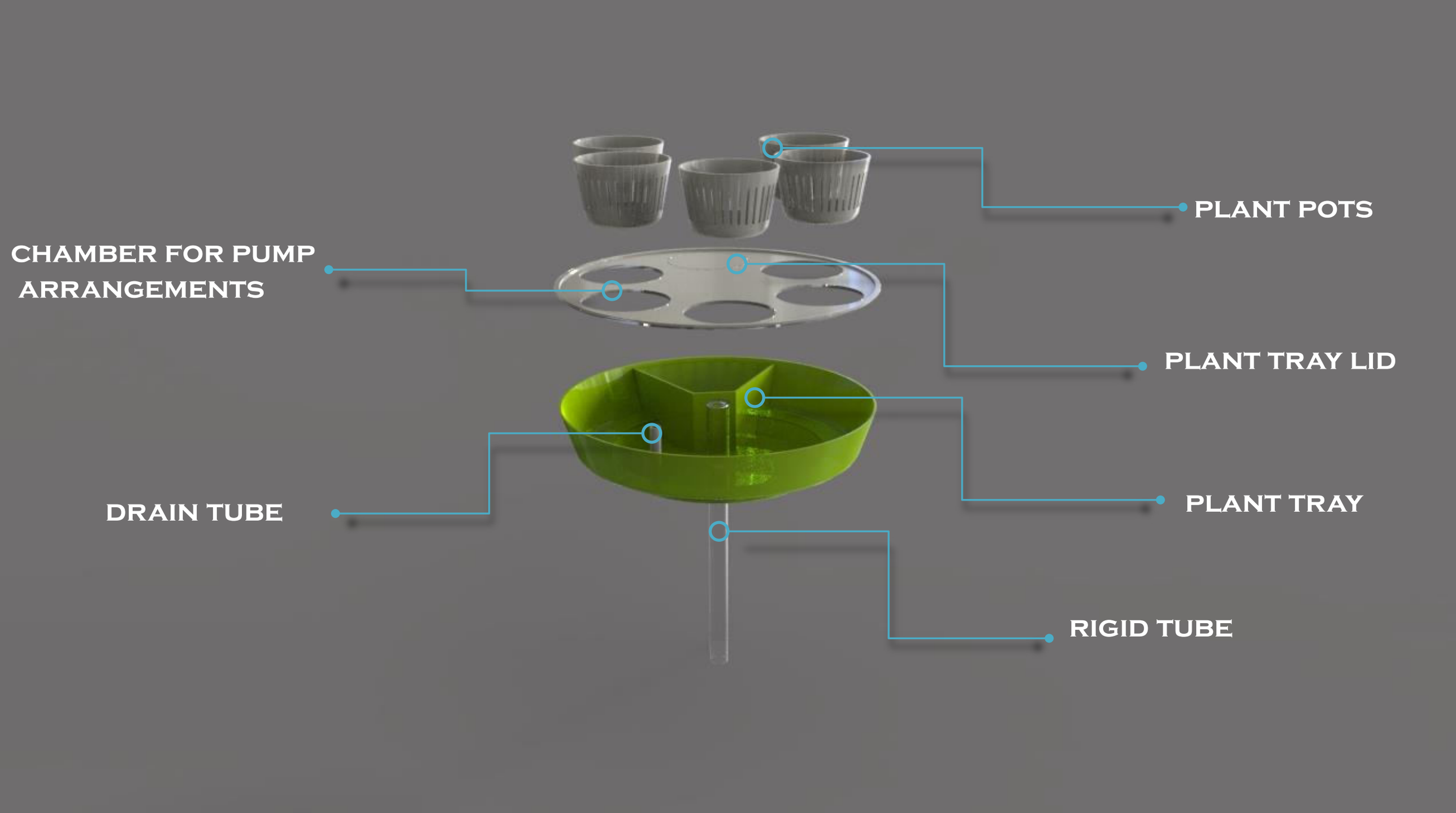
Idea-3

Advantages

- Plant system on existing aquarium
- Easy to install and transport
- Provide more visibility into aquarium
- Less number of components in the system
- More blend with kitchen and living room context
- No need of extra pump for circulating water

Disadvantages

- Less number of plants
- Limited number of fishes
- Distorted view of fishes

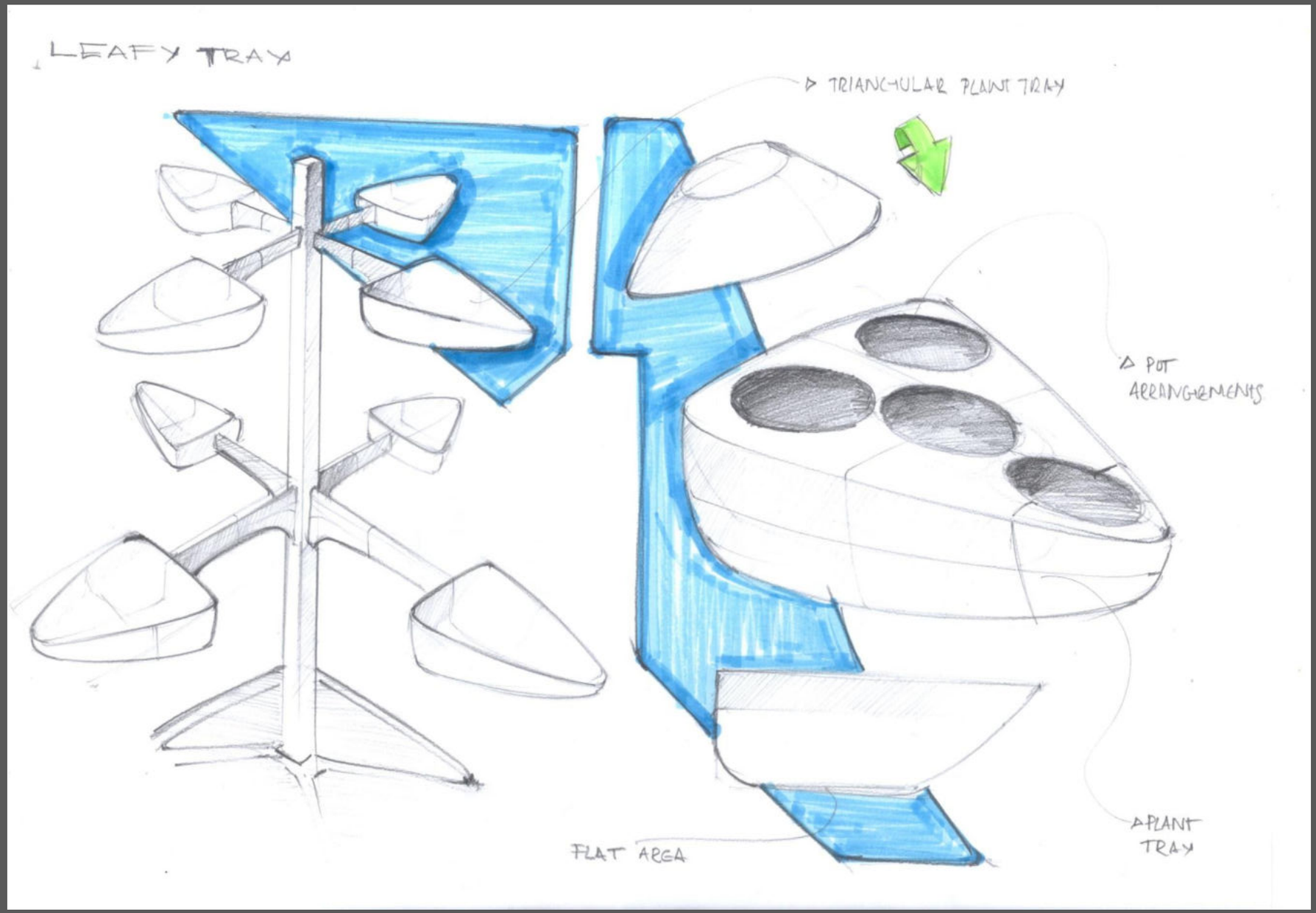

PLANT POTS
CHAMBER FOR PUMP ARRANGEMENTS
PLANT TRAY LID
PLANT TRAY
DRAIN TUBE
RIGID TUBE

Selected concept

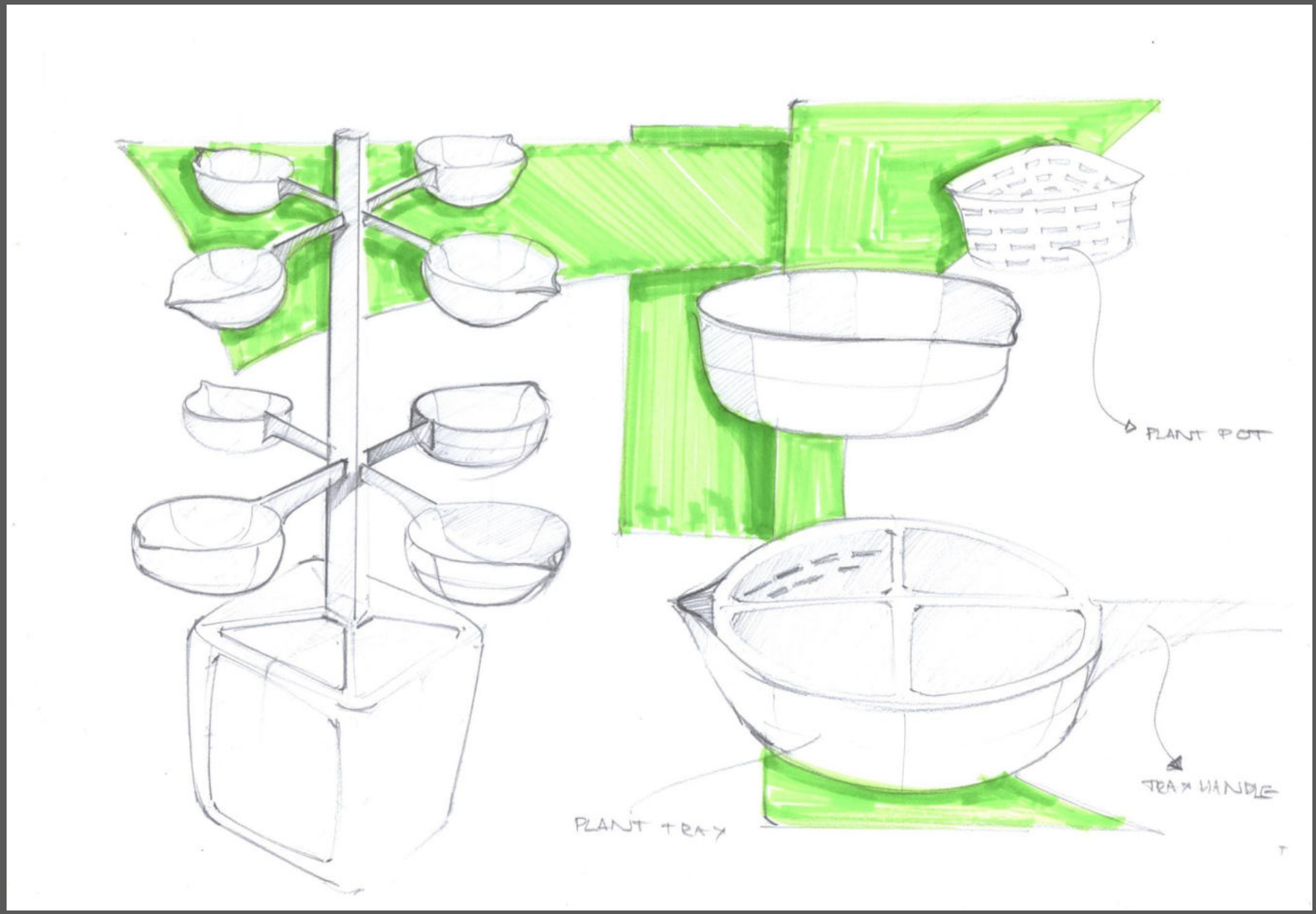
Why ?

- Growing more number of plants as compared to other concept
- More suitable to window side growing system
- More number of fish, more number of plants
- Easy to access plant system
- Separate tray for separate type of plants
- Collapsible kind of design, easy to transport
- Showing more integration of plant system and aqua system
- Resembling the tree, which is more inspirational
- Grab more attention as compared to other concept, so which is more promotional

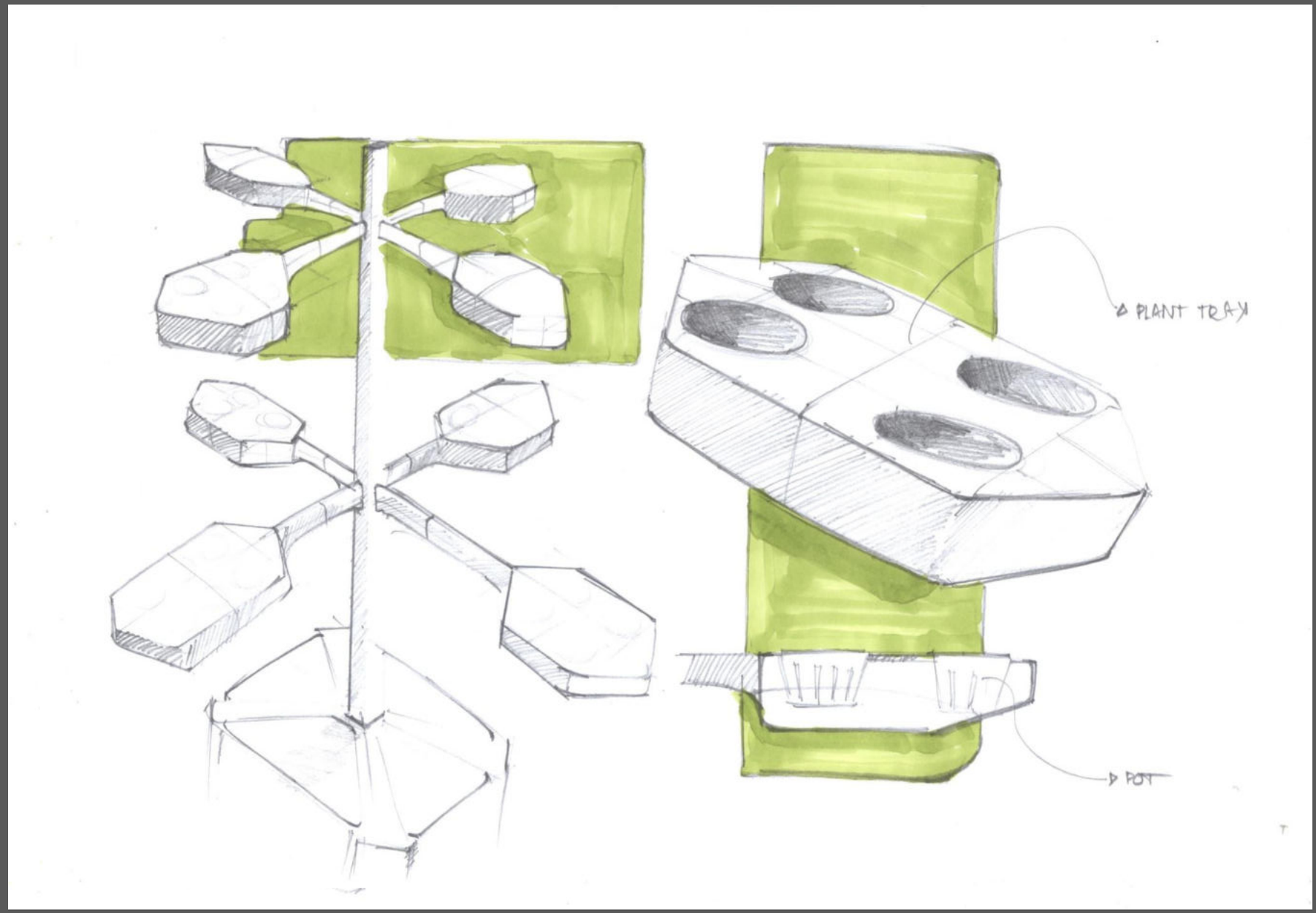
Final concept form exploration.1



Final concept form exploration.2

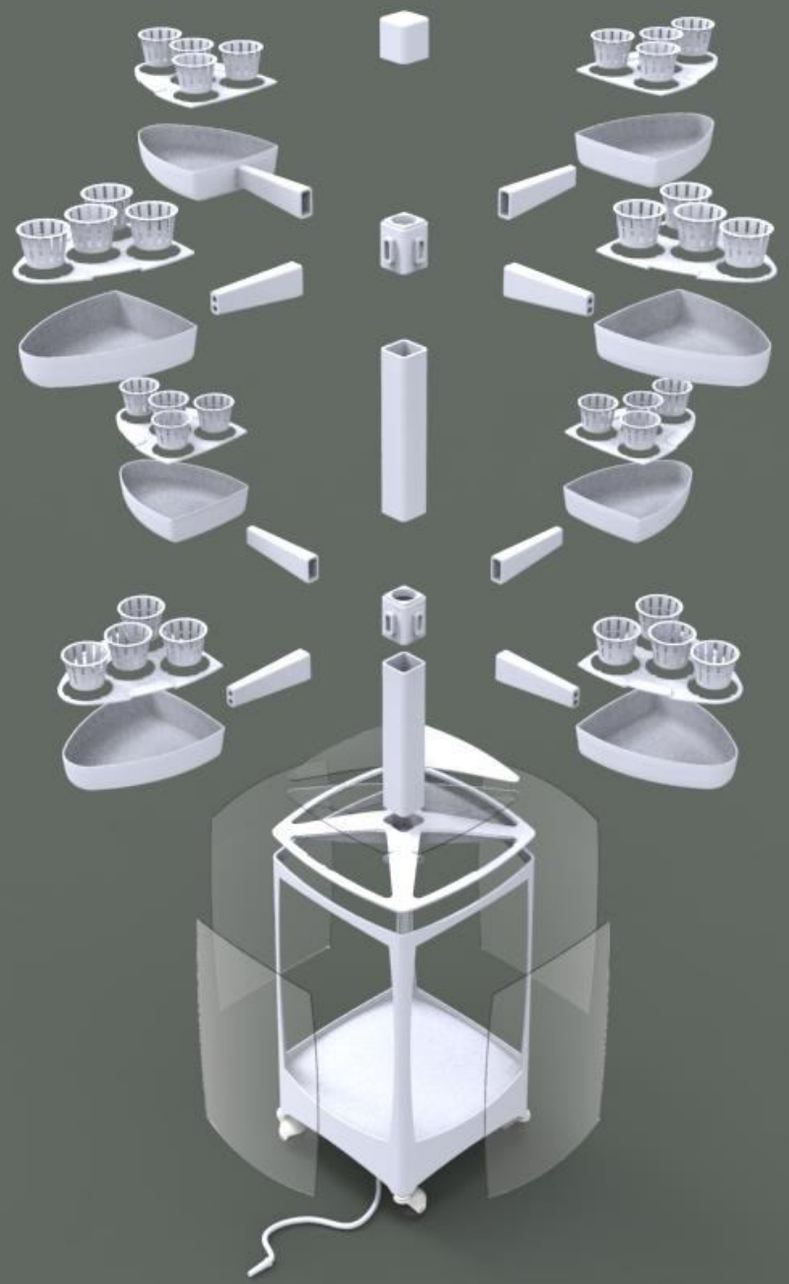


Final concept form exploration.3

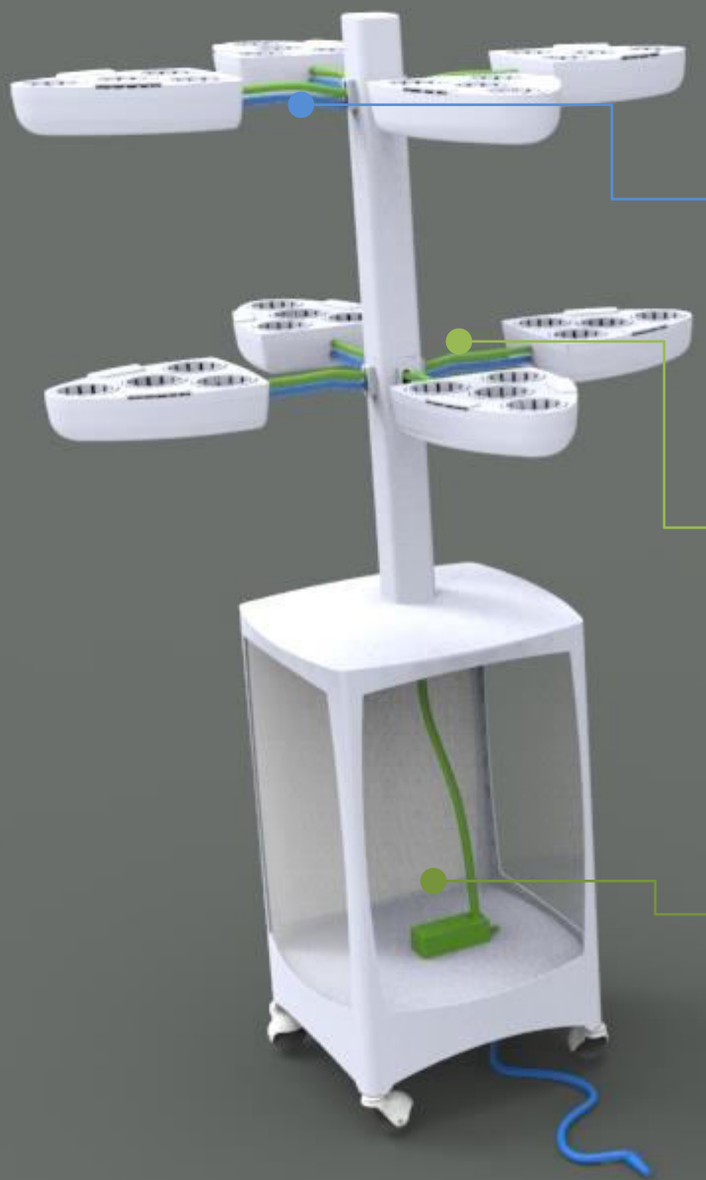


Final design

EXPLODED VIEW OF FINAL DESIGN



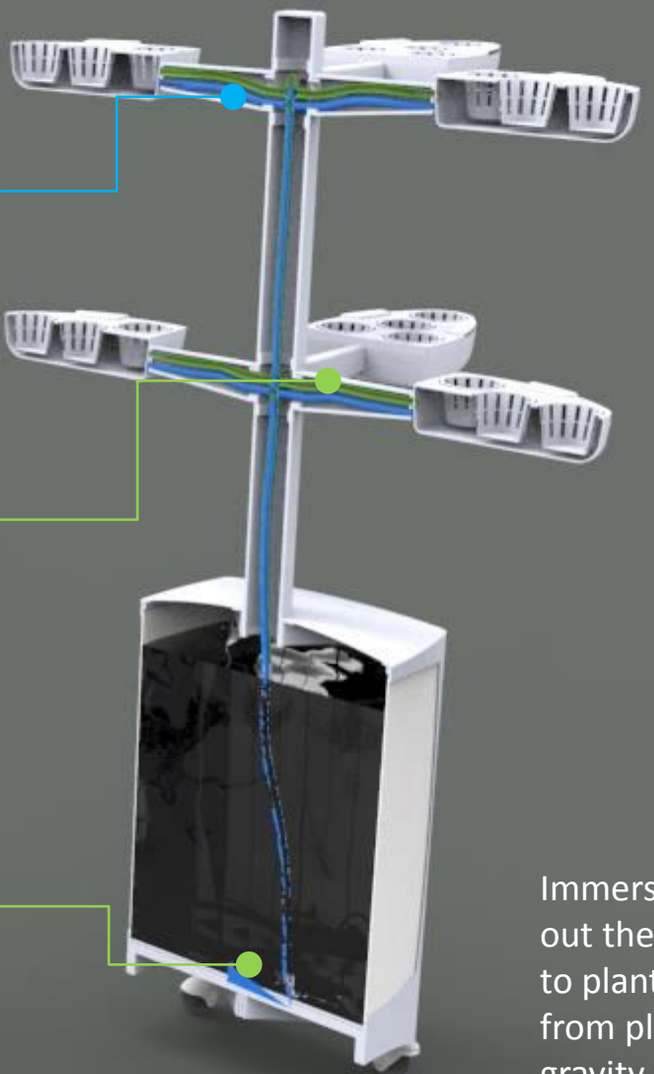
Pipe system



Outlet pipe

Inlet pipe

water pump

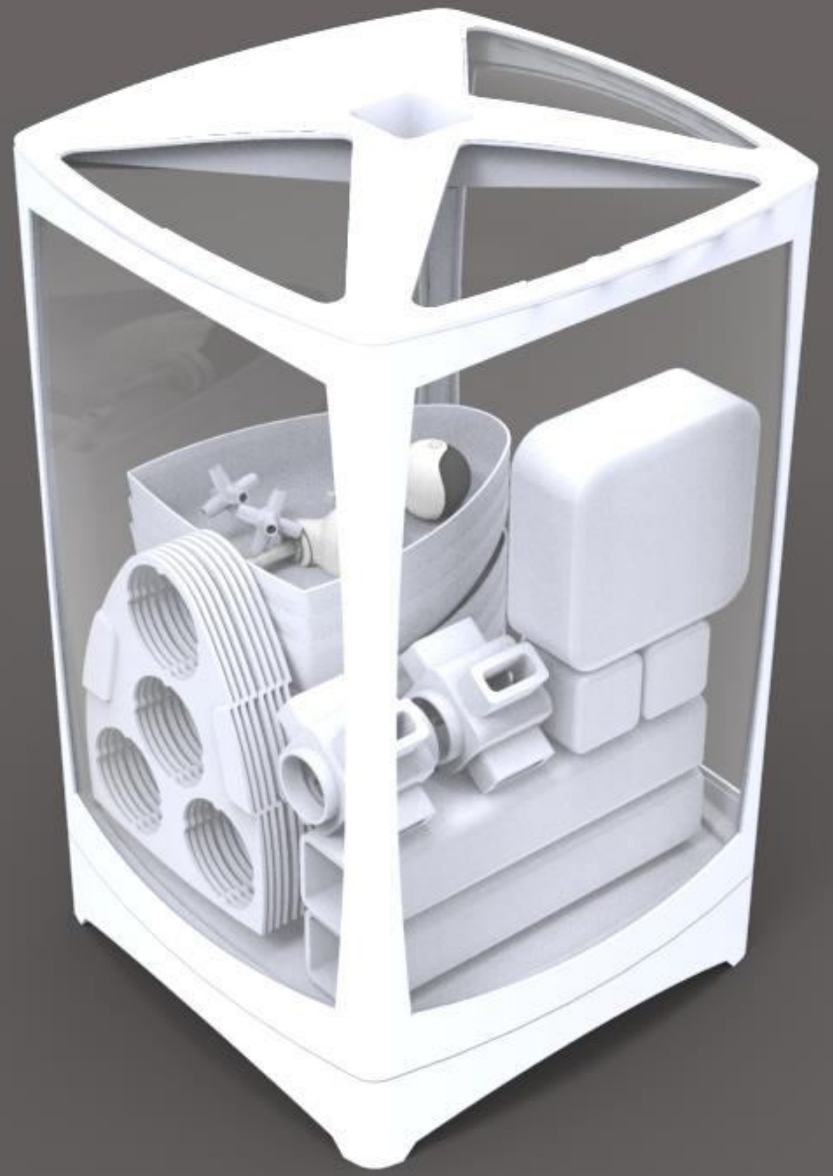


Immersed water pump pumps out the water from fish tank to plant trays. Excess water from plant trays drains out by gravity through out let pipe.

PACKAGING & TRANSPORTATION

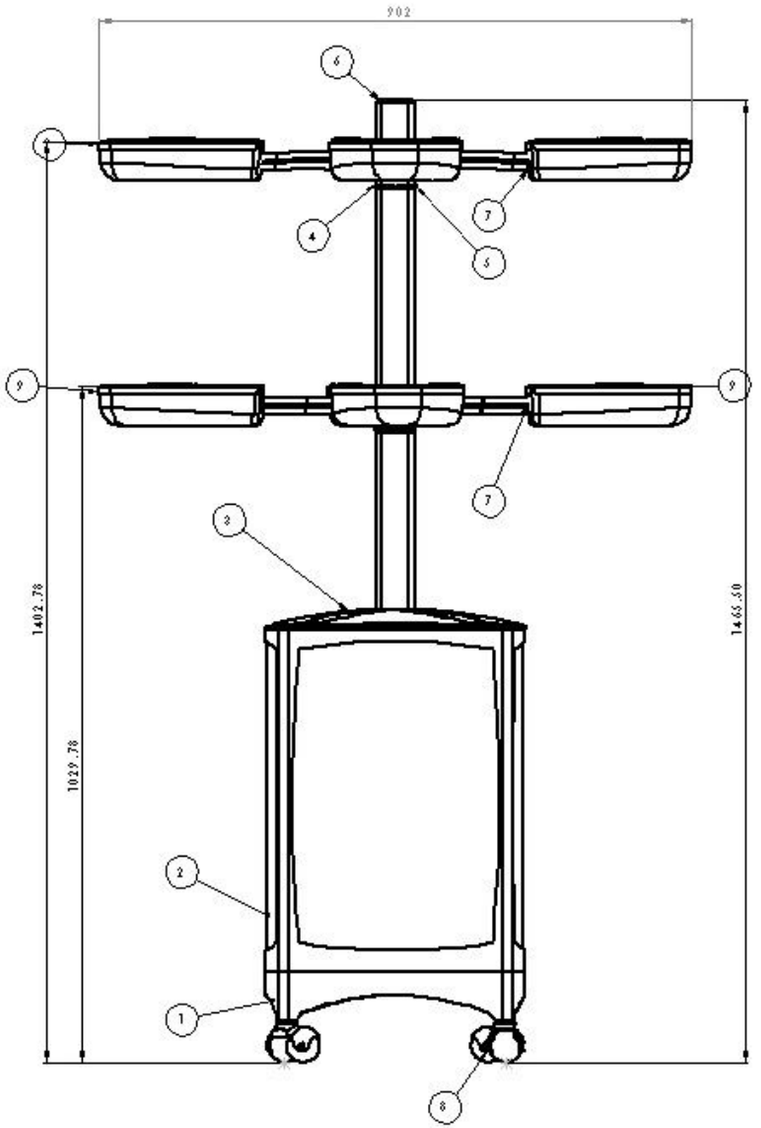
- The aquarium itself acts as the packaging for the whole product. This provides ease of transportation and handling.

- These parts are also made to stack on to each other



PRODUCT DIMENSION

& BILL OF MATERIAL

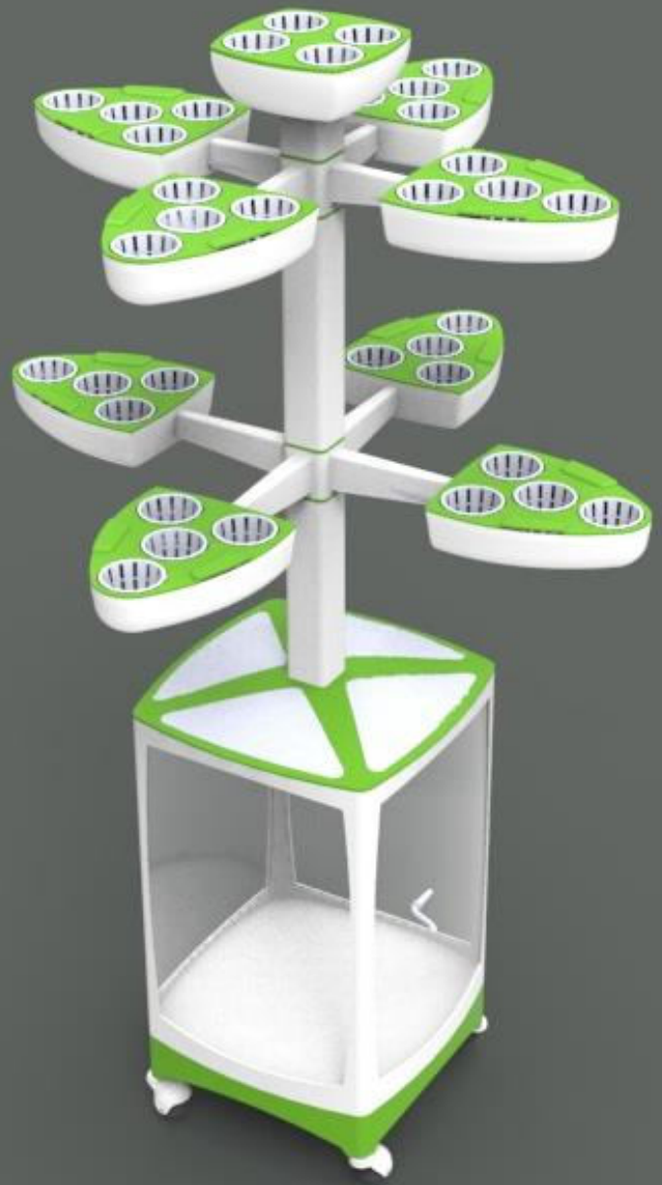


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	aquariumBASE		1
2	aquarium		1
3	aquarium_lid_		1
4	stemconnector_1		2
5	STEMASSY		2
6	TOP_LID_ASSY		1
7	pipe_assy		2
8	Caster Wheel	Brass Caste Wheel	4
9	Plant tray_assy		8

detail assy_4

A2

FINAL DESIGN ITERATION



This idea is generated on aesthetic perspective alone and this design iteration is without considering manufacturability.

MOCK UP MODEL

Components in the mock up model

Pipe reducer

Pipe

Clay pebbles

Plastic container

Pot

Water pump

Time lapse of plant growth

Day-2

Day-4

Day-6

Day-8

Finished mock up mode

The working model was set up on the bowel type aquarium, the other main components which are used for setting up the model was 1.5cm dia pipe, plastic container, pipe threaded reducer, rubber flanged connector, plastic pot, clay pebbles , seeds & water pump.

FINAL MODEL

Thank you