

ENGR232 Design Proposal: Universally Accessible Gardens

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Overview

1. The Problem

- who does it effect

- why does it matter

2. What already exists

3. Criteria for design selection

4. Possible design ideas: growing mediums

5. Possible plants for growth and plant needs

The Problem

Current in-home (and in general) gardening options pose an accessibility issue due to cost, complexity, space, or climate.

Why is this a problem worth solving?

1. Not everyone has accessibility to fresh vegetables or is completely satisfied with the options at the local supermarket.

- Remote locations have high prices or little selection
 - Colder climates have extremely limited growing options
- Food coming from long distances is often preserved with chemicals
- Some people just enjoy growing their own foods



Arctic Bay: \$14.39

Atlantic Superstore: \$4.99



Arctic Bay: \$11.99

Atlantic Superstore: \$3.99

Price Comparison: Arctic Bay, Nunavut vs. Nova Scotia

Why does this matter? (continued)

2. There is an established demand for simple, at-home growing units

- AeroGrow, a publicly traded company that manufactures in-home garden systems, has a market cap of approximately **\$40 million** (updated Feb. 4th, 2020)





Something to consider...

What Already Exists?

- Fully Automated Enclosed
 - GroBox
 - GroboSolid
 - LEAF
- Automated Open
 - AeroGarden
- DIY

Fully Automated Enclosed Systems

- Terrarium
- Monitors air temperature, water temperature, humidity, pH level, water level
- Controls the lights, temperature, humidity, pH levels, nutrients and watering feeding
- Everything can be controlled or viewed from the app
- Dimensions: 27" W x 25" D x 62" H



LEAF

Fully Automated Cons

- Expensive
 - \$2500+
- Not worth it if you just want to grow a few plants during the year
- Limited number of pods
- Really large/ Need space
- Keeping it clean

AeroGarden

- Dimensions: 36" W x 12" D x 34" H
- Number of Plants: 24
- Enabled with Wi-Fi technology
 - Turning lights on and off from your phone from an app
 - Reminders on your phone for watering or feeding



AeroGarden Farm Plus
Hydroponic Garden, 24" Grow
Height, Black

★★★★☆ [24](#)

CDN\$899⁹⁵

AeroGarden Cons

- Expensive
- For larger plants, need constant grooming
- The pump is loud
- The pods are not reusable
- Expensive to keep buying the pods

DIY

- Complicated
- Often large and unsightly
- Labour intensive
- Needs constant monitoring
 - Check water, pH and nutrient levels
 - Inspect for disease and pests

Greenhouses?

- Ineffective during the winter
 - Cost
- Good location
 - Needs a lot of sunlight
- Need space
 - Can't be used in an apartment/city
- Light pollution
 - Equipped with lights
- Other issues
 - Pests, weeds, air circulation

Analysis of Designs

In order to aide in the choice of design, we developed a list of criteria and have weighted them in the following order:

- Accessibility
- Efficiency
- Complexity

Accessibility

- Focus on creating accessibility through affordability
- Low assembly costs leading to a lower sale price at a reasonable profit margin
- Keeping operation/maintenance costs low
- Functions year-round in all climates

Efficiency

- Doesn't take up too much space in home
- Maximizing production
- Power usage
- Water usage
- Climate control

Complexity

- Easy to assemble in home
- Easy to operate
- Maintenance is simple and straightforward

Possible Design Ideas:

Growing Mediums; Pros and Cons

Growing in Soil:

Pros:

Simple setup, no mechanical parts
Familiar to many people; approachable
More "forgiving" than hydroponic setups

Cons:

Inefficient compared to other growing mediums; requires more water, nutrients
May require the use of pesticides

Growing with Hydroponics:

In a hydroponic growing system, instead of being planted in soil the roots of the plant are suspended in a nutrient-water solution.



Growing with Hydroponics:

Pros:

Fast Growing

Water/Nutrient Efficient

Pest Resistant

Cons:

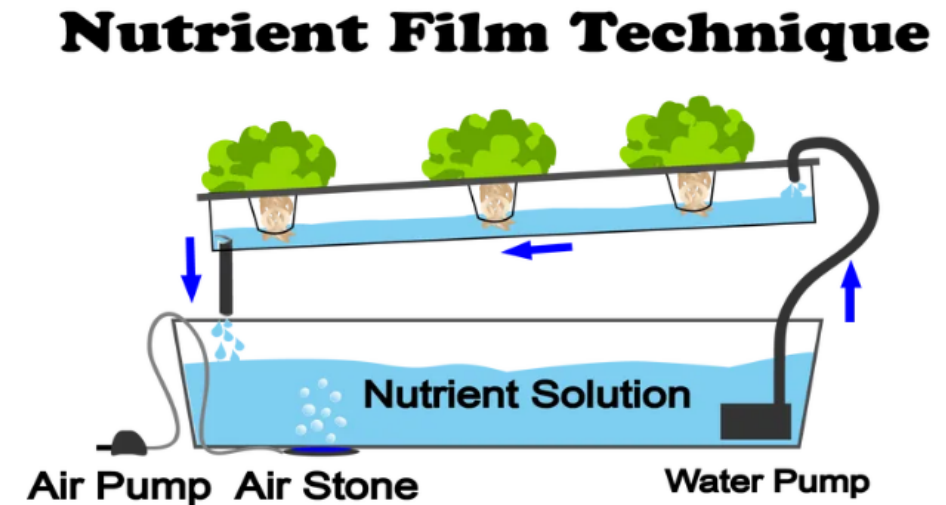
Added complexity; requires a pump, power supply, reservoir for nutrient solution

Crops can die quickly if the pump fails (power outage or mechanical failure)

Requires supervision if not effectively automated

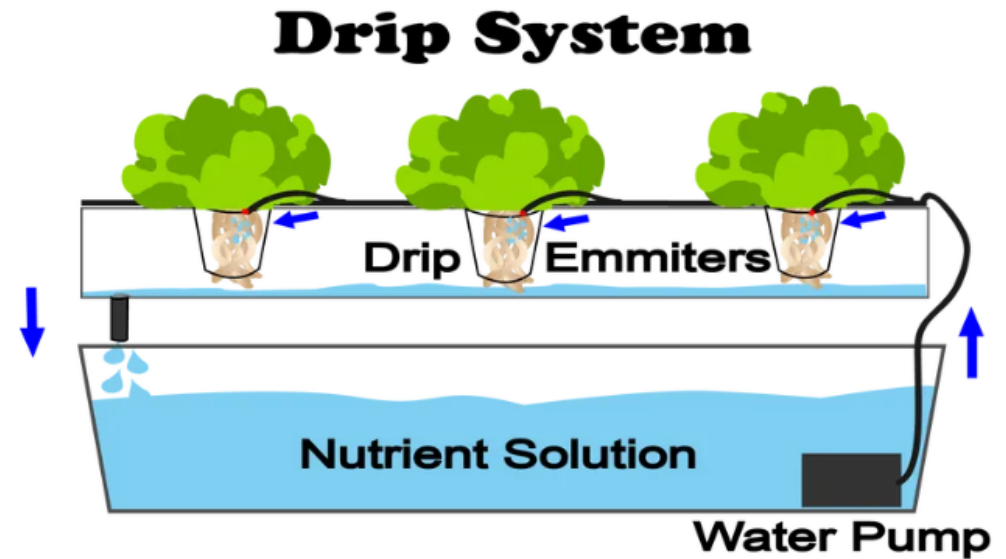
Types of Hydroponic Systems: Nutrient Film Technique

In a NFT (Nutrient Film Technique) hydroponic system aerated nutrient solution is pumped continuously from a reservoir through an elongated container in which the plants are set. The solution partially fills this container submerging the roots of the plants delivering nutrients and oxygen before draining back into the reservoir.



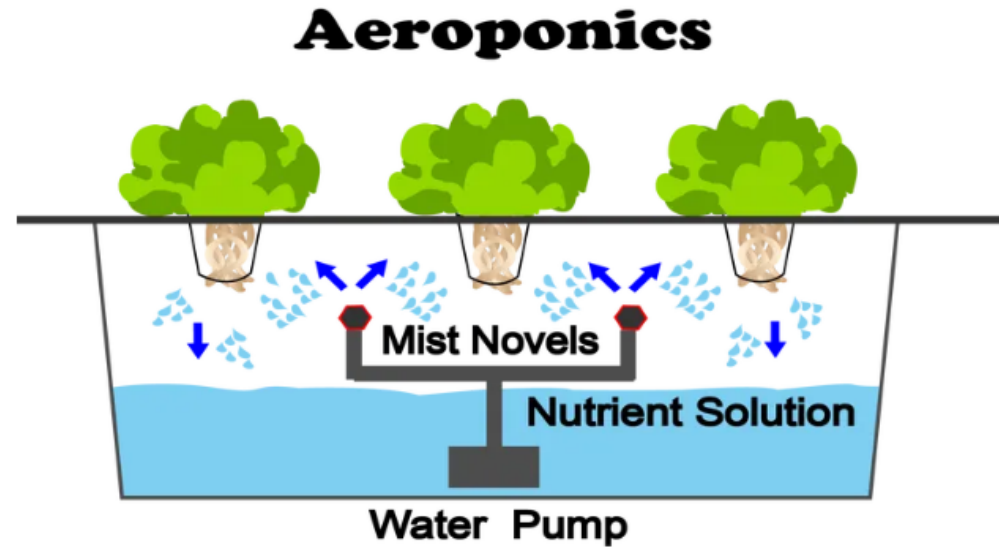
Types of Hydroponic Systems: Drip System

In a drip hydroponic system, nutrient solution is pumped continuously from a reservoir and continuously dripped at the base of each plant. The runoff water from the process is collected and drained back into the reservoir.



Growing with Aeroponics:

In an aeroponic growing system, the plants roots are left suspended in the air and sprayed with a nutrient solution.



Growing with Aeroponics:

Pros:

Extremely water and nutrient efficient

Faster growth and higher yield than with hydroponics

Space efficient

Cons:

Extremely sensitive system; roots dry out and die quickly if the nutrient spray is interrupted

Complicated, a lot that can go wrong

Growing Medium Analysis:

Based off the information and design criteria (accessability, efficiency, complexity) presented in the previous slides, we have chosen to design a hydroponic system.

We believe a hydroponic system maximizes efficiency without becoming too complex and inaccessible.

Plant Needs

- pH – A pH level of 6-6.5 must be maintained in the hydroponic solution
- Humidity – Around 50% (some plants require higher humidity), a house is generally 30-40% humid in the winter
- Nutrients – A hydroponic system requires a variety of nutrients that will be considered when making the solution
- Temperature – The recommended temperature to keep a hydroponic garden is 17.5 - 25 degrees Celsius, which is around room temperature
- Plant Size – Most plants that we are looking to include as an option for our garden grow to be around 1-2 feet high
- Duration of Growth – On average it takes around 2 months for most plants to be ready for harvest

Garden Options

- Leafy Greens: Lettuce, Spinach, Kale, Cabbage
- Herbs: Basil, Parsley, Cilantro, Mint
- Dwarf/Cherry Tomatoes
- Strawberries
- Mini Bell Peppers
- Celery

Conclusion

- The problem we found was that current indoor home growing options for personal produce are too expensive, too complicated, or climate dependent for many people to even bother trying to grow their own food.
- To solve this issue, we are looking at developing our own in-home garden. We hope to develop a hydroponic system that works year-round, is easier to use, and is affordable, so that anyone who wanted to could try and grow their own produce.

Questions?

References

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