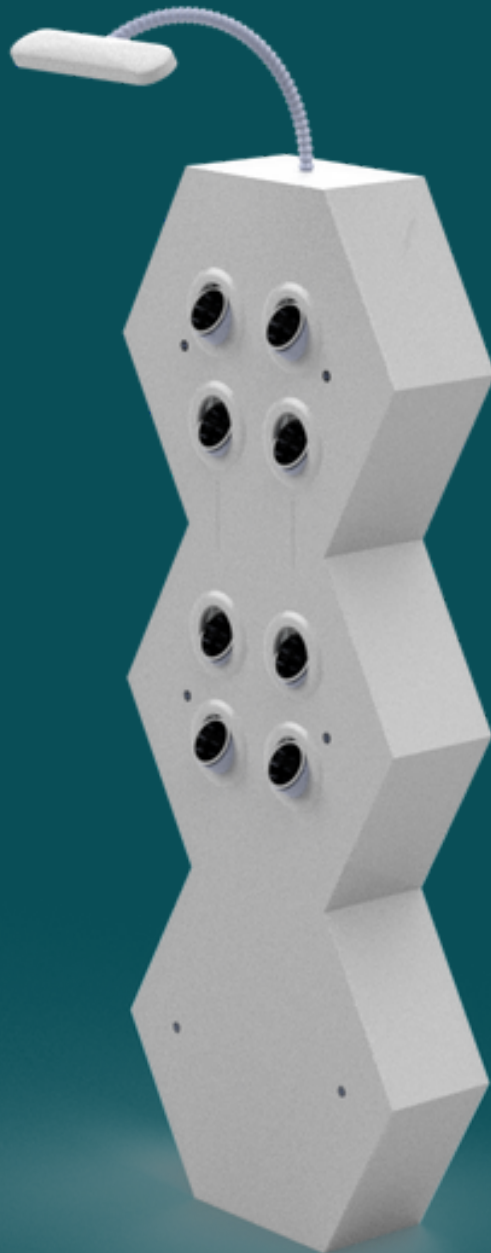




H.EX

# The H.EX Garden

By Hydroponics Excellence LLC



# H.EX Problem Statement

Produce sold in grocery stores and supermarkets lose 50% of their nutrients during transportation, and contain alarming levels of chemicals and pesticides. By growing your own food, you can save money while enjoying fresher, tastier, and healthier produce. So why is it then that less than half of the US population grows their own food? Our research indicates that the three main barriers stopping many from gardening are time, space, and knowledge. The H.EX Garden makes it possible for more people to grow their own food, by removing the need for outdoor space, minimizing user input, and requiring no previous gardening knowledge.

## The Team

Hydroponics Excellence is a team of seven engineers dedicated to engineering for social innovation. Among the team there is a shared interest in nutrition and health, and we all love a nice home cooked meal. We are designing the H.EX Garden because we have felt the need for it ourselves and we want to share our solution with everyone.



# H.EX Background & Summary

## What are Hydroponics?

Hydroponics is a soilless gardening method where plants are grown in a water and nutrient solution. H.EX has designed a vertical drip system that routinely showers plant roots with a steady supply of nutrient solution.

## Why Hydroponics?

By growing plants hydroponically, we address the three barriers mentioned. Remembering to water your plants everyday can be stressful. Our irrigation system is fully automated, and simply requires you to fill up the reservoir once it's empty. The H.EX Garden is also fully enclosed and is meant to be indoors, not requiring you to have access to a sunny outdoor space. Your new garden will also alert you if there is an imbalance in the system through its array of sensors that connect to your phone.



## Design Basis

We chose the hexagonal, wall-mounted design for form and function, allowing for a modular system that will surely be a conversation starter with your guests. With adjustable light and pump cycles, our system is flexible and can nurture a variety of plant species to fit your every need. Further testing and research will be conducted so that we can provide you with a database that will optimize the growth and health of each plant you grow in our system.



## —The Alpha Prototype:

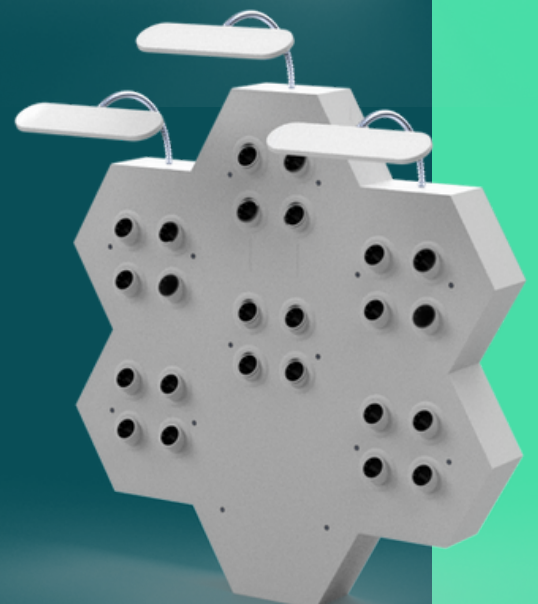
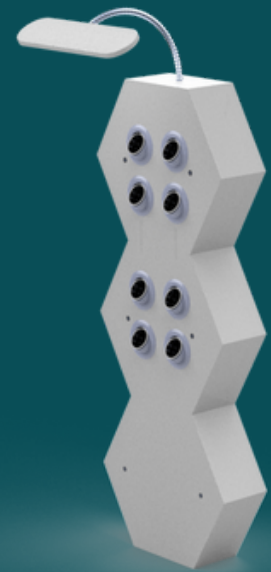
The alpha prototype was designed for the purpose of conducting functionality tests on. It does not match the form factor of the production design, and yet informs the design with the data collected from it. We grew two rounds of produce with this design and measured water quality, water consumption, and plant health.

## —The Beta Prototype:

The beta prototype was designed to be an accurate representation of the production design. The challenge came from also designing it to be manufacturable in the idea forge machine shop. It also boasts improved functionality over the alpha prototype in terms of lighting and water circulation, with the added function of app connectivity.

## —Production Design:

The production design is largely similar to the design of the beta prototype, but altered to be compatible with the process of plastic injection molding. This would be the ideal process for manufacturing at scale, as the incremental cost would be incredibly low. Unfortunately, this requires an initial tooling cost of ~\$100,000.



# H.EX The H.EX Garden Prototype

The H.EX Garden can be easily installed to your wall via french cleats, making it on display and out of the way. It provides automated lighting and water circulation cycles to ensure optimal growing conditions. Via app connectivity, the user can adjust settings to their liking and receive updates when they need to perform system or plant maintenance. The current prototype can house up to eight plants at a time. It has been designed to allow attachment of one auxiliary unit per side, each of which would increase the plant capacity by eight. These auxiliary units would connect to the central electronics and water circulation system. This prototype has established that the core functionalities of the production model are compatible with its sleek form factor. It has also demonstrated structural integrity, and the team learned a great deal constructing it.

## Prototype Trial Assembly



<b>Use Case 1</b>	<b>Grow Spinach</b>
<b>Actor</b>	<b>Urban Resident</b>
<b>Use Case Overview</b>	<p>The resident plants seedlings in the provided net pots. They then fill the reservoir with water and nutrient solution. They open their H.EX app on their phone and select that they are starting a grow cycle of spinach. The resident fills up the reservoir with fresh water and nutrients every two weeks. As soon as six weeks, they begin to harvest their spinach. They continue to harvest their same spinach plant for two months.</p>
<b>Alternative Flow 1</b>	<p>The resident notices the Spinach isn't growing. They increase the light cycle on their phone as directed by the app.</p>
<b>Alternative Flow 2</b>	<p>The resident sees spots on the spinach leaves. They increase the amount of nutrients in the solution as directed by the app.</p>
<b>Cleaning the H.EX Garden</b>	<p>The resident has been running their system for six months. They remove their plants from the system and empty the reservoir. They fill the reservoir with vinegar and run the system for an hour. They empty the reservoir, return the plants to the system, and refill the reservoir with water and nutrients.</p>



# H.EX Mobile App

The current prototype can connect to an app which can control lighting and water circulation cycles, as well as monitor water level and nutrient solution concentration. For the production model, the app will have an improved user interface design shown below.



The app will facilitate the user's interaction with their H.EX Garden and the produce it yields. Through the app, the user can monitor growing conditions and receive instructions on how and when to trim and harvest their plants. They can also receive recommendations on plants to grow based off of liked recipes as well as recipe recommendations based off of plants that they are growing. When paying for a premium version of the app, the user gains access to additional features including access to more sensor data, weekly recipe recommendations, and AI image processing to assess plant health.



# H.EX Revenue Streams

We plan to generate revenue through a variety of streams. The primary source of income will be selling the H.EX Garden, our base unit, for \$450. Additional auxiliary units will be sold for \$150 apiece. These sales will occur online through Amazon so that H.EX can take advantage of their delivery infrastructure.



The next revenue stream will be a subscription service that is offered to consumers for automatic refills of their supplies including seedlings, nutrient solutions, and pH control solutions. The subscription will be sold in six-month increments at a cost of \$49.99 to the user. As part of the marketing strategy, a free six-month subscription will be offered as the reward for the referral program. Users can refer themselves to purchase auxiliary units, incentivizing them to upgrade their system.

Also available to the user will be a premium version of the app. This premium version, described on page 6, will have a monthly cost of \$4.99. This is where H.EX can expect to have the highest profit margins, and so a large percentage of the research and development budget will go towards optimizing these features.



# Revenue Projection



For this revenue projection, we assumed direct costs to be \$175 per unit, fixed annual costs to be \$424,000, and initial tooling costs to be \$100,000. The fixed annual costs include warehouse rent, salaries, and marketing. Direct costs account for labor and materials. One final assumption made was a 6% commission to Amazon for each unit sold. With these assumptions, we predict we will be able to break even early into our second year, and by the end of year four have over \$6 million in gross profits.

## Competition matrix

Shown below is the competition matrix. H.EX solves the Time, Space, and Knowledge problem better than anyone.

				
Space Saving	✓	✗	✗	✗
App	✓	✗	✓	✓
Modular	✓	✗	✗	✓
Point Program	✓	✗	✗	✗

# H.EX Conclusion

The H.EX Garden was designed to make growing your own produce more accessible to people who live in urban environments. It saves space, requires minimal effort from the user, and connects to an app that can instruct the user on all facets of plant care.



The Beta Prototype offers as close of a representation of the form and function of the production model as was possible given the time constraints and capabilities of the machine shop where it was manufactured. The user interface and capabilities of the app are currently limited, but act as a proof of concept for how the H.EX Garden can work cohesively with a mobile app. The team at H.EX is proud to have designed and manufactured a prototype that is representative of the H.EX Garden idea, and we are confident in the viability of the business. In the future, data will need to be collected to optimize the features of the proposed app. A test engineer and app developer would need to be hired to accomplish this.