Generic Ag Lab
Semi-Finalist List
for
NASA HUNCH
Design and Prototyping 2021

Congratulations for being chosen as a Semi-Finalist for NASA HUNCH Design and Prototype 2021. Your design was chosen as a semi-finalist because you have a prototype that shows some or all of your idea, interesting/original ideas in your design, you did some valuable testing, and/or had some CAD designs that conveyed significant contributions. Despite the difficulties and not as many schools participating this year, I believe that HUNCH has received as good of quality of projects as ever. You should be very proud of your prototypes and ideas especially because of the difficulties surrounding this school year. Some schools have been out of class all year and others have been in class all year but students were being pulled out of class for weeks at a time. Some students were only able to work and build from home. One school was only able to work together on their project for 3 weeks before their CDR. Everyone should be commended on your resilience to finish your project and the great ideas and work you have put together in front of your own eyes. Prototyping and testing are the first steps in any engineering project and all of you have learned the value of it.

It is from the Semi-Finalist list that we will narrow down our choice for Finalists. We at HUNCH are very proud of how difficult you as students and teams have made it to choose which designs should go forward. **Congratulations!!!**

This list may be updated in the next day or two if we find we are missing a few team’s brochures.

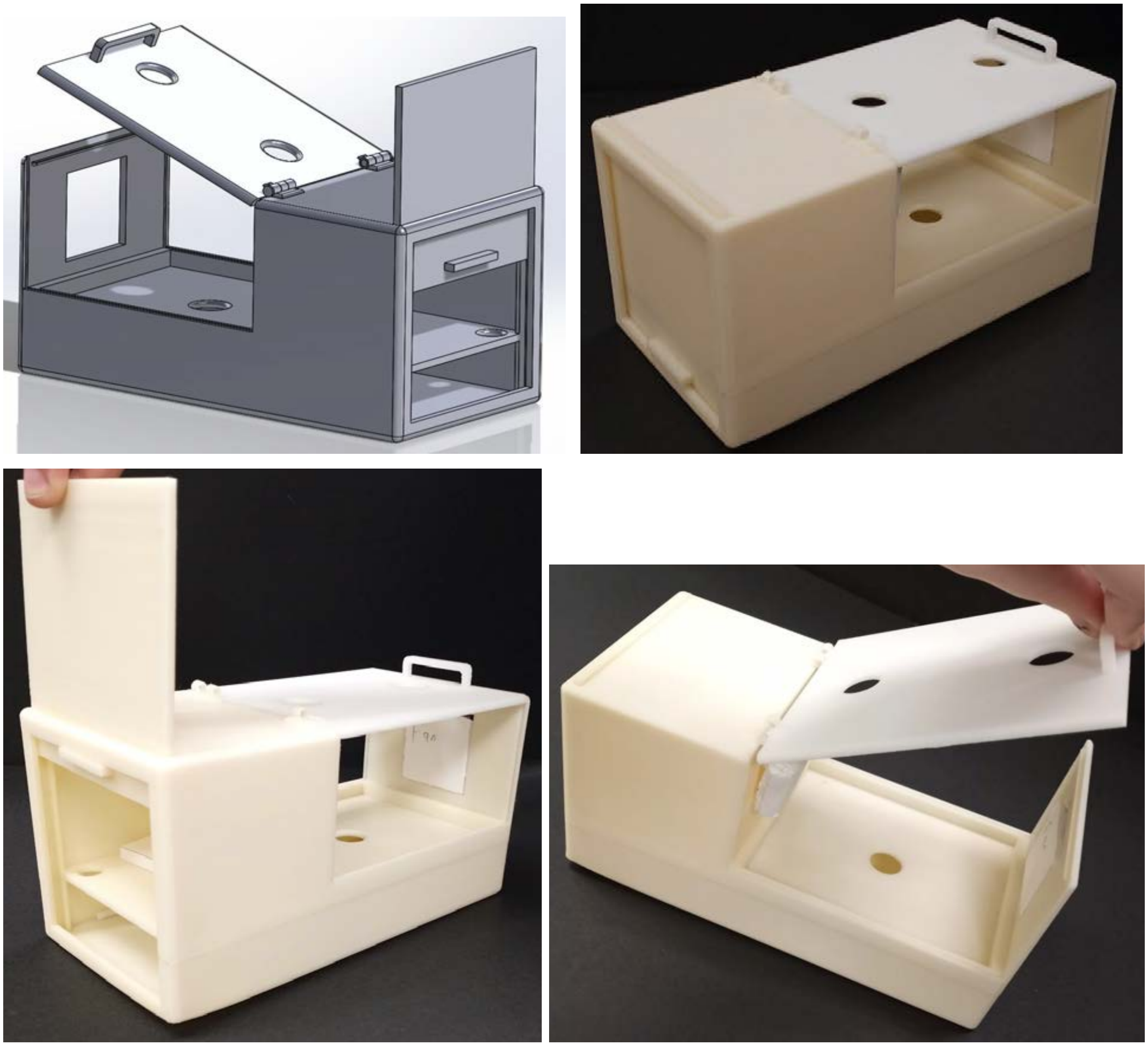
We expect to have the list for the Final Design Review in the next day or so as well.

Critical Design Review

Project: **Generic Agriculture Lab**
School: **Space Coast Jr/Sr High School**
Teacher: **Mr. Luis Reyes**
Team: **Kaya Peoples, Logan Terrones, Colin Wigle, Gabriel Spiegel**

Description:

Our prototype is a 10cm x10cm x 20cm box with room for a plant growth chamber, an air filtration system, a water pump, water reservoir, a fan and LED lights. We met all requirements of the project. The project is compact, fitting within the size specifications, and it will be low power. It also includes a video camera, 4 adjustable LED lights, an area to put a source of water, an area for an air filtration system and of course an area to grow a plant and soil, or whatever the user wants to use. We have a compact design that holds two separate areas, one for air and the other for water both easily accessible via a sliding door on the left side and a central chamber with a trapdoor built into the roof, providing easy access to the plant. There are slots cut into the front and back, enabling windows to be placed into the box, allowing for easy monitoring, aside from the interior camera that can record video and stream it remotely. We also have a full 3D model of our design that can be reproduced.Unfortunately, due to the nature of our project, we don't have any testing data, as that would require more time than we have, as well as a microgravity environment. However, we have reason to believe that the project will be successful and function sufficiently for the entirety of the 30 day mission it is designed for. Our documentation includes a 3D model printable with a 3D printer, as well as the specific components used for the lights, camera, water pump, fan, and computer. Furthermore, our 3D model contains all the necessary measurements to build the design, if another material is desired, making it very easy to reproduce. We created the design with the effect of microgravity in mind, but we do not have a way to test how well it will actually work in those conditions. The project also incorporates Commercial Off The Shelf (COTS) items that make it easier and more cost effective to produce. These items include the camera, computer board, fan, and LEDs.



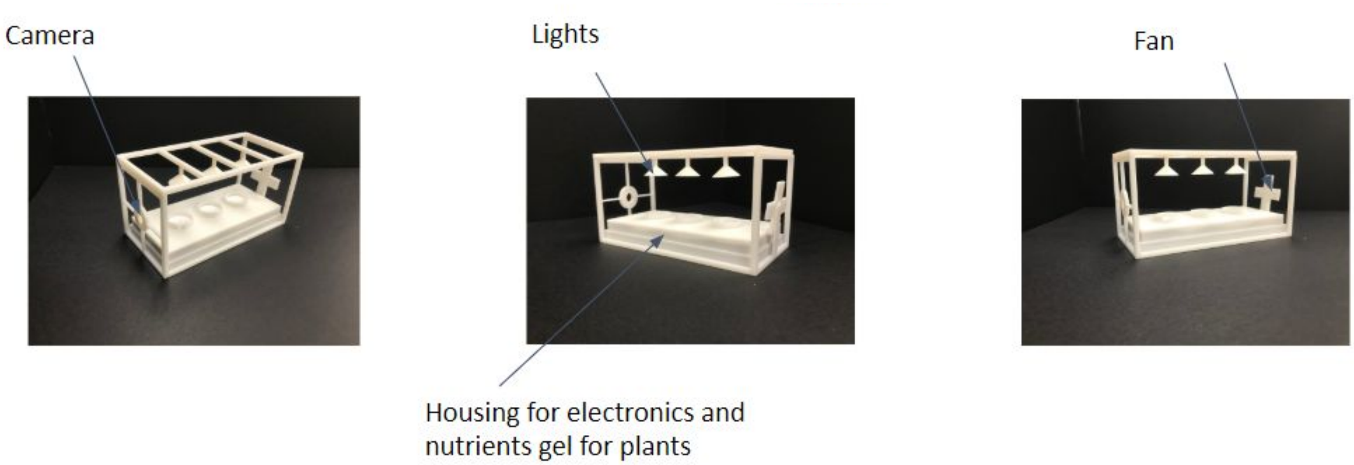
Critical Design Review

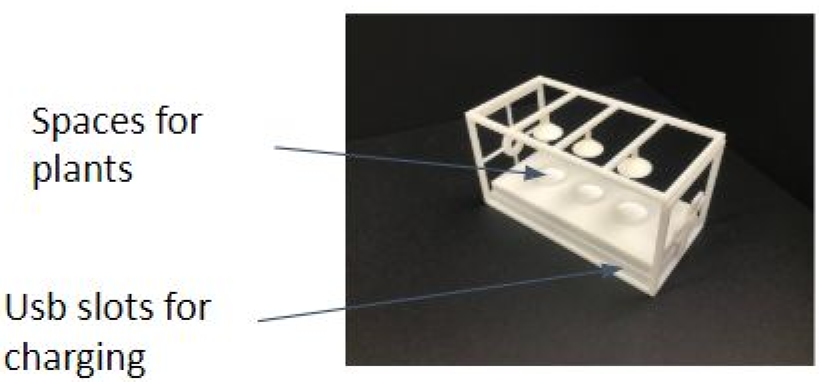
Project Title: **Generic Agriculture Lab for the ISS**
School Name: **Space Coast Jr/Sr High School**
Teacher: **Mr. Luis Reyes**
Team Member Names: **Lucas Johnson, Cody Coulter, Kaitlyn Davis, Shamar Washington, Jose Martinez**

Here is a bit of a walkthrough of our prototype/project. Directly above the base of our prototype, we have a USB port that provides power to both the fan on the left and the three artificial lights on the rack above the project(and/or Heat Lamps). We have a base that has pyramid-like corners going upwards to where the experiments are. Inside the three holes at the center of the prototype, would go the plants or experiments. Our project allows the idea of having access to see the plants as they grow not only through the camera but also all around the outside of our capsule. For our more visual people, there are pictures on the back of this document with labels pointing out where all aspects of our project are at.

Our project satisfies all of the requirements and constraints. One of the major requirements/ constraints was the size, we needed the lab to fit in a 10x10x20 locker, we managed this successfully. Our Prototype has a 3D design on Solidworks, Unfortunately we do not have all the parts (fan,camera,lights, etc.) due to funding. However, we had the opportunity to use our 3D printer at school to build the base and majority of our prototype with just a few Commercial Off the Shelf (COTS) items missing from the prototype. If we were to have access to those COTS items, we would simply attach them via epoxies, a type of “glue” used for structural, mechanical, electronic, and adhesive applications on spacecraft and satellites. We were unfortunately unable to get clear test data about our design since we were unable to make our product close enough to the final product that it would give a correct estimate whether or not our product works as intended. However, studies have shown that our plan on using our specific COTS items have worked effectively on plants and other experiments on the ISS. We used a 3D printer to build our prototype excluding a few COTS items.There are many complex dimensions throughout the drawing as you can see through our solidworks part and prototype. There would be too many dimensions to point out in this document to allow it to be perfectly replicated. Our project incorporates the awareness of the microgravity environment by having a water/fertilizer based gel to not only make sure that the plants are able to stay stationary but also have access to the basic necessities such as nutrients and water for the plant’s health. If you were to regularly water a plant in space like you were to water a plant on Earth, the water would fly everywhere. With our gel formula, it would stick to the plant and allow for it to get the nutrients that plant needs without it flying everywhere. Our design plans on using a fan,camera and some artificial lights as our Commercial Off the Shelf items(COTS). However, we were unable to put them in our prototype because our school can't afford all of the COTS items that are needed to fully have a functioning Nano-lab. Here's a link to all of the COTS items we would use in our finished prototype. https://www.sparkfun.com/wish_lists/161155

Photos





"Scientist investigate that which already is; Engineers create that which has never been."

School

STEM Academy of Lewisville

Contact Us

Generic Agriculture Lab

Why our product?

Our goal as a group was to make a compact but effective agriculture lab that could be used to grow plants on the ISS, and while we worked towards this goal, one of the main issues we faced was the need for an irrigation system. Designing an irrigation system that can work effectively in zero gravity is a major challenge, and as a result, we decided to look for unconventional means to solve our problem. Designing an effective irrigation system would require large amounts of time and resources, and it would also take up large amounts of limited space in our final product. We bypassed this step completely through the use of agar gel as a growth medium. This eliminated the need for a complex system to provide water to the plants, thereby saving time, resources, and space in the prototype. One of the other benefits of this change was that we reduced the risk of having a technical failure, as any irrigation system we would have developed would have been very complex, and our groups lack of experience would have made the final product prone to failure. It may not be the prettiest thing, but its revolutionary design allows for specifications to fit virtually every consumer's needs. The NanoLab will surely be a positive addition to any scientist's or agency's arsenal in discovering the wonders of space.

The Nanolab caters to agencies and individuals in need of an experimental planter by focusing on convenience and customization, and sets itself apart by featuring agar gel as a growth medium, hosting different light hues, and requiring little to no prior technical knowledge.

Our Team

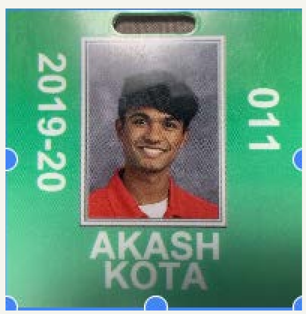
JOSHUA SAITO

Hi my name is Josh, I'm a senior at the STEM Academy of Lewisville. I enjoy fishing and camping.

ADRIAN GARCIA

Hi my name is Adrian, and I am a senior at the STEM Academy of Lewisville. I have a kidney transplant and I got it when I was 7 years old.

AKASH KOTA



Hi, I'm Akash! I'm a senior at the STEM Academy of Lewisville. I like to play soccer, and try new things.

YOANA SHOPOVA

Hello, my name is Yoana and I am a senior at the STEM Academy of Lewisville. I enjoy going on adventures and painting.

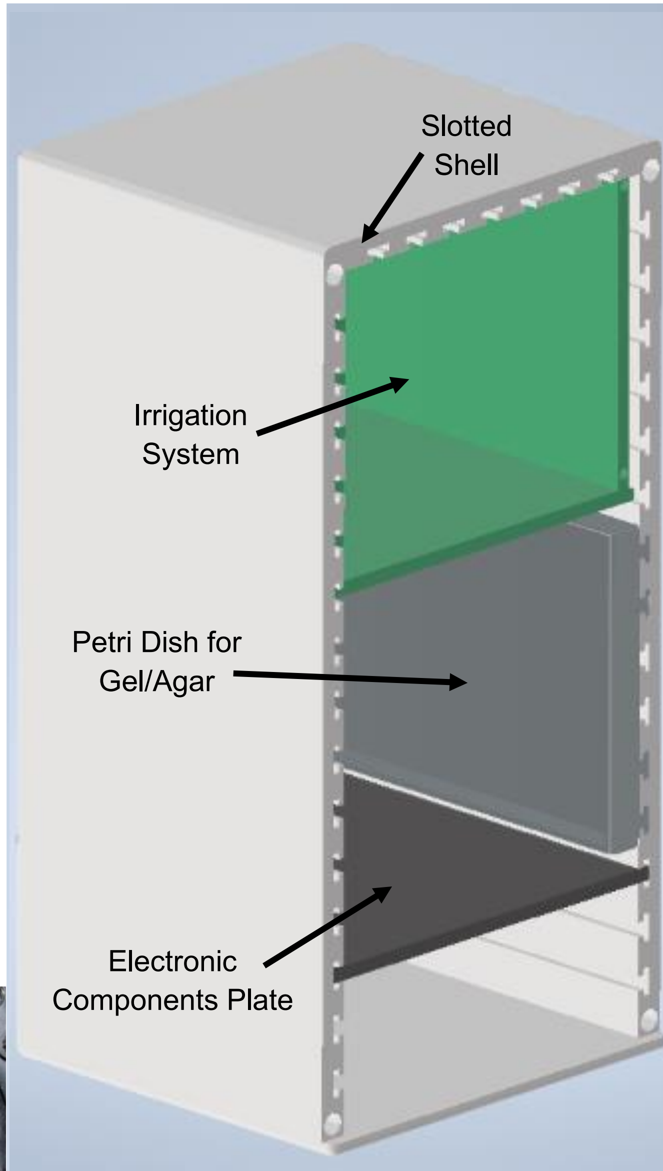
Features of our product

- Inner casing for holding agar gel
- Outer casing to keep everything contained and compact
- Agar gel for easy seed planting and zero maintenance
- Customizable lighting for experimentation and maximum efficiency
- A Camera with 64 GB of storage for all your testing needs

NANOLAB

Introduction to Nanolabs: Nanolabs are self-powered autonomous devices that are used for experiments and research on the International Space Station (ISS). The Nanolab we created specifies in agricultural research, creating a custamizable habitat for plants grown in microgravity to be researched. Although the technology for these labs already exist, the labs are often very specific and only compatable with the plant/experiment they were designed for.

Problem Statement: Our group is tasked to produce a Nanolab that can be used for a wide variety of agricultural experiments involving different plants, substrates, and variables on the ISS. As we continue to venture farther into space we need to become less reliant on Earth's resources. Furthering our knowledge of agriculture in microgravity through experiments utilizing a customizable nanolab will allow us to achieve this goal.



CONTACT INFORMATION

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CUSTOMIZABLE NANOLAB

CLEAR CREEK HIGH SCHOOL:
BRYAN LAM, DONOVAN LE, JACOB SALAZAR, KARINA NERENG

RMerritt1@ccisd.net

RESEARCH

- **Understanding the effects of fluid mechanics in microgravity**

  Water conforms to its surroundings. As it floats freely in microgravity, the surface tension attracts water molecules into sphere-like globs.

- **The germination of seeds in space**

  Plants have been found to be unaffected by the absence of gravity. The roots of plants are guided by nutrients, water, and avoiding direct contact from light.

- **Light frequencies favored by various species**

  Red light (640 to 680 nm) and Blue light (430 to 450 nm) are the primary frequencies desired by seedling and flowering plants. The duration of exposure must be easily adjustable due to the variation of species' preference

- **The application of gels and agar**

  Transparent gels and agar have been utilized historically for the visual studies of root growth. The nutrient rich substances will effectively replace water and maximize the effective space within the lab.

- **Effects of humidity and perspiration within a small environment**

  The environment of our experiment must be air-tight to ensure the preservation of the gases and humidity. Many plants can survive in an enclosed environment for years, as long as they are supplied with an appropriate cycle of light.

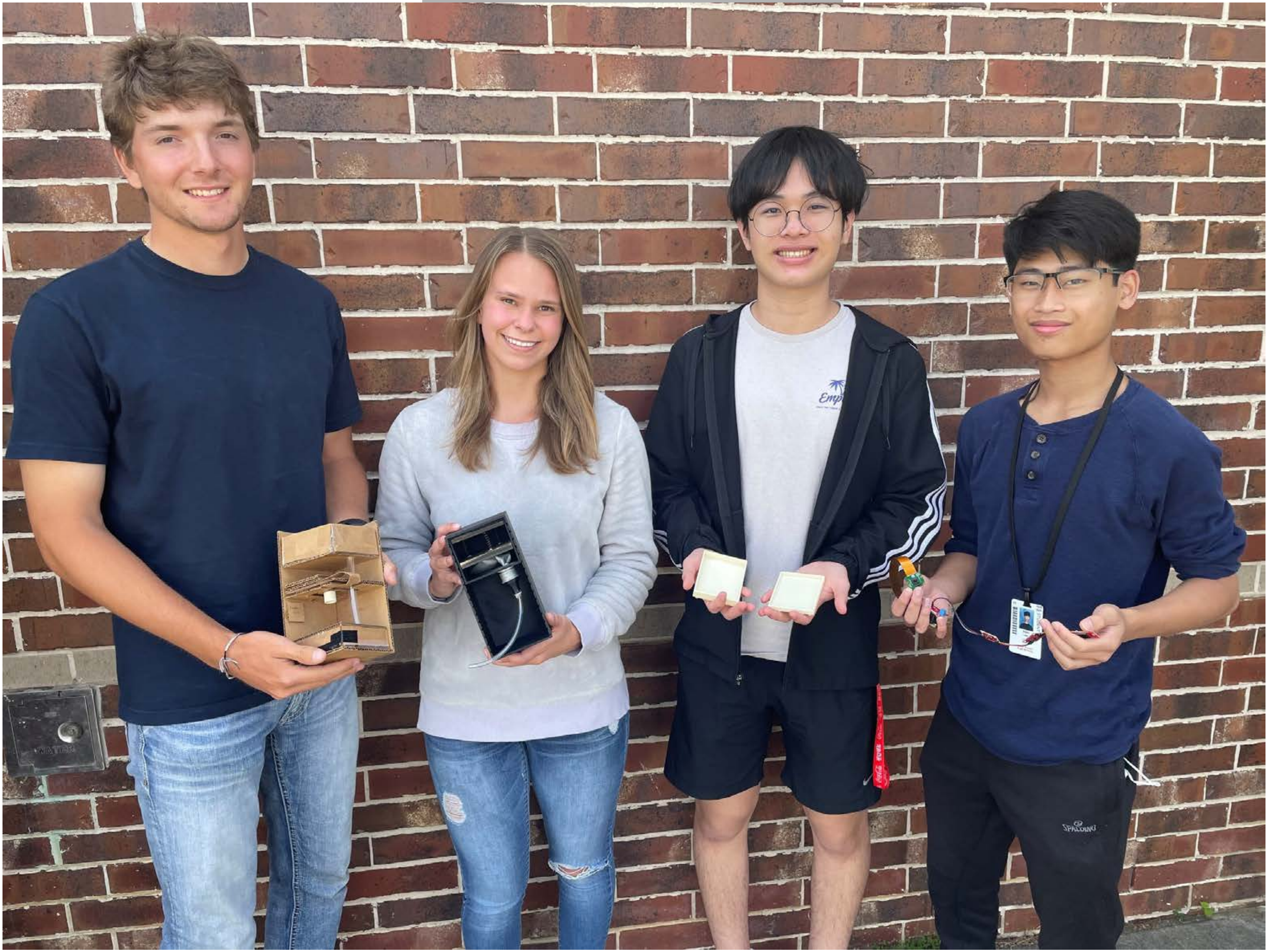
OUR IDEA

We created a slotted shell to allow for movement of the pieces to create a fully customizable experience. A plate containing the lab's electrical components fits into the slots and can be adjusted to increase space for either the plant itself or the irrigation system. If agar or a gel substance is used instead of a soil-like substrate, the irrigation system can be removed entirely leaving more room for the plants or additional components.The lab can support anywhere from 1-6 individual plants, each with its own plant pillow and irrigation hose if required.

ADDITIONAL INFO.

Irrigation: The irrigation system itself is made up of a box containing a durable bag filled with water and a plate resting on top of that bag held in place by tightly compressed springs. A valve on the side of the bag is then opened or closed to water the plant. When the valve is opened, the release in pressure allows the springs to decompress forcing the water down through the hose and into the chosen substrate.

Substrate: Substrate options include plant pillows, which are small packets containing clay substrate mixed with controlled-release fertilizer. The plant's seeds are then attached to germination wicks inside the pillow. Other options include agar or plant gel, which eliminates the need for fertilizer and irrigation as the required nutrients for the plant's survival are contained within the gel.



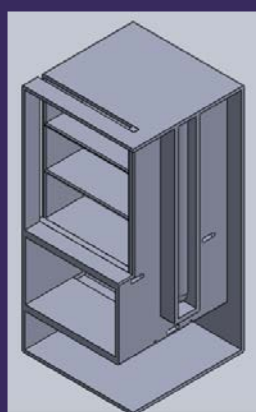
The Problem:

*Many people would like to fly a plant growth experiment to the ISS but get discouraged that they have to design the container as well as the experiment. By designing a **multipurpose botany lab**, NASA could encourage **more astrobotany experiments**.*

Design Factors:

*The NanoLab should be **versatile** enough to support **nearly all small growth and seed studies** with only minor adjustments. It should fit within a 10cm x 10cm x 20cm container and provide nutrient media, light, and air for a 30-day mission. It must contain an apparatus to collect data.*

Solution:



- Includes three chambers that are as similar as possible to each other in order that experimenters can vary the experimental variable while keeping all others constant

- Focused on simplicity

- Everything can be customized

- Two walls are removed for clarity in images

Team GARDEN

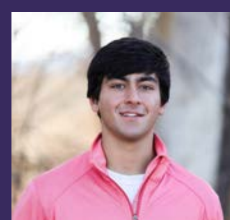
Logan Carlisle

Specialties:
-Mechanical
- Testing

Sean Carter

Specialties:
- CAD
- Design

Benjamin Fletcher



Specialties:
- Electronics
- Programming

Contact

Joel Bertelsen
jbertels@jeffco.k12.co.us

Chatfield Senior High School HUNCH Program

G.A.R.D.E.N

Generic Astrobotany Research Device for Engineering Nature

Safety and Accessibility Features

Water Safety

- Water tight bag that connects straight to pipe
- Water bag is in its own chamber away from the electronics

-Walls around pipe chamber prevent water leakage

-Entire water system is water tight- if the water chamber fails, the water still can't leave the GARDEN

Different Materials

-Any liquid can be used including gel, water, and any other form of watering substance.

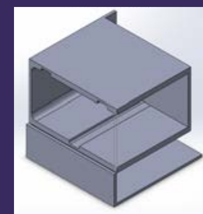
-Any soli can be used

Testing

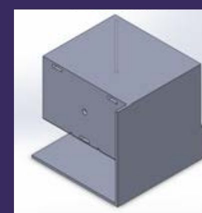
- We have tested the motor and the water chamber head. This test did not involve water or the water bag, only the water chamber head and the motor to pull it. This was a successful test seeing that the motor pulled the water chamber head smoothly. The next step is testing the motor with the water bag with water in it.

Components

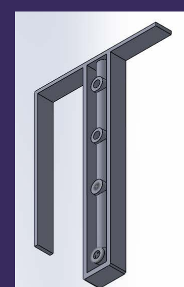
Water Chamber



- Where water is stored
- Water chamber head moves across the chamber and compresses the water bag to release water
- Motor in the bottom half drives this motion



Pipe Chamber



- Transports water from input to three growth chambers

Growth Chamber

- Three growth chambers get equal water distribution due to the low gravity environment
- One camera and LED system for all chambers
- Nutrient-rich soil in a

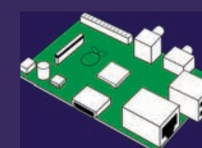
Electronics

Computer

-We decided to use the Raspberry Pi 4 because of the size, user interface, GPIO pins, and camera module.

-To code it we used python, because it is one of the easiest languages to understand.

-In the future we plan to use a GUI interface so customers can easily change variables to fit their experiment. (Variables include amount of time light is on, amount of water dispersed each day, and when the camera takes a picture).



Moving Forward

Full automation

-We are working towards full automation meaning the GARDEN will not need to be tampered with during the mission.

-This includes the motor, lights, and camera.

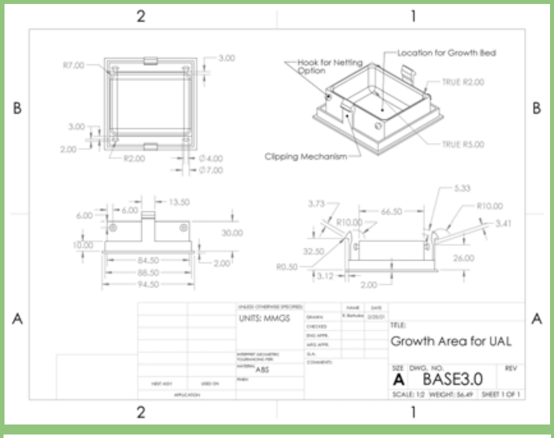
Water Testing

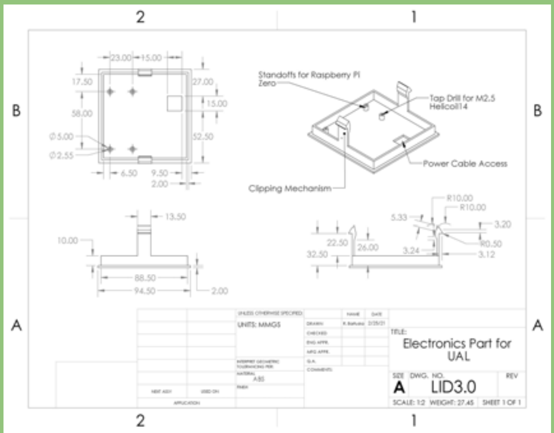
-We will be testing water in the water chamber and its functionality with the growth chamber

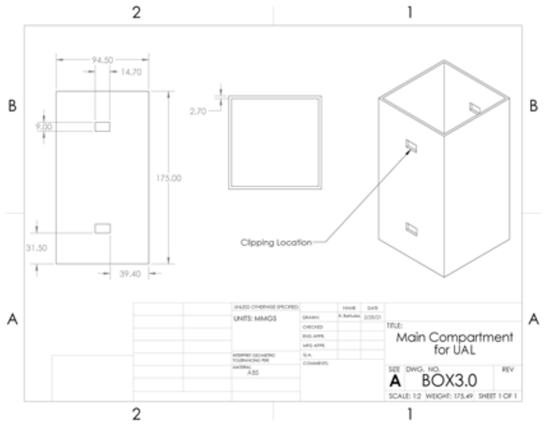
-Water circulation testing

Plant Growth Testing

CAD Drawings







Clipping Solution: To remove top or bottom pieces, simply squeeze in on the tab and slide the piece out. To secure back into the lab, simply slide the piece back in until it clips into place.

About Us

Riley Bartuska

Daniel Kobilan

Chatfield Senior High School
HUNCH Program
Littleton, CO

Instructor Contact:
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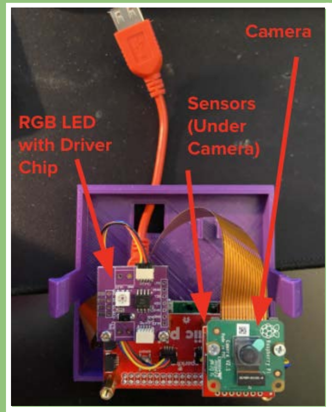
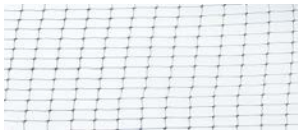
UAL

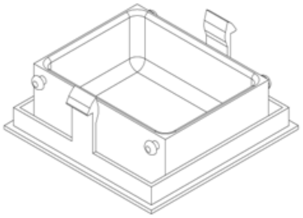
Universal Agriculture Lab



Growth Solution

- Growth area designed to accommodate already developed plant pillows used in NASA experiments.
- Plant pillows would need to be re-engineered to fit inside of 8.5cm x 6.7cm x 3cm growth area.
- Pillow will be secured with netting attached to 4 hooks on each corner of the growth area.





- Plant pillows such as those used in the Veggie experiment already aboard the ISS account for plant growth conditions within a zero gravity environment and account for needed watering techniques with mitigation of root rot.

Lights

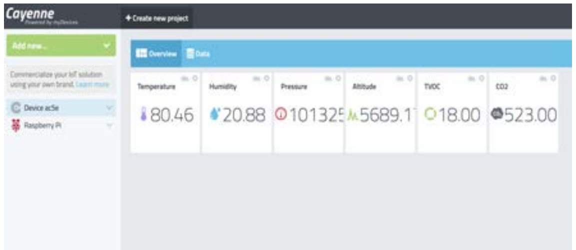
- Includes a ZIO RGB LED board with Qwiic connectors
- Works perfectly within the solderless ecosystem of the Qwiic pHAT
- Has programmable LED and ability to drive more LEDs
- In the future, the lab will use the APA102 interface and Python code on the Pi to customize color, time intervals, and intensity for the lights.

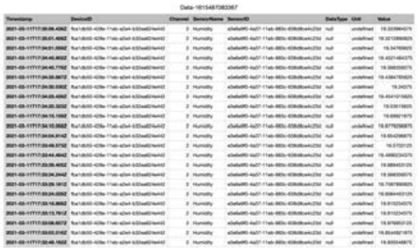
Camera

- Python code can be modified for more than 6,000 pictures taken on customizable time intervals
- Images are saved to Pi's SD card for later access.
- Each image is 476 kb, so 120 pictures would take up just 57.12 mb

Sensors

- Lab utilizes Sparkfun's environmental combo breakout (CCS811 & BME280)
- Able to monitor sensor data online from Cayenne (a server the Pi communicates with which includes a visual dashboard)
- Current sensors record temperature, humidity, pressure, altitude, TVOC, and CO2.
- Data can be accessed and viewed real time or stored and accessed later.





Stored Data

Problem Statement:

Many researchers, scientists, and universities desire to conduct experiments with agriculture and monitor plant growth in space on the International Space Station but lack an efficient, easy to modify, universal Nanolab that could store the experiment. These researchers as a result have to spend time and resources designing a lab because there is no universal starting point, instead of focusing on the experiment itself. Most labs are too expensive and not versatile enough for many researchers who wish to conduct experiments on the space station.

Design Solution:

We designed our prototype to be easily modified and universal for all types of experiments. We achieved this through the simplicity of the design and the variety of modifications available to researchers. Within our lab, plants are secured on the bottom piece and grow through the lab toward the lights, camera, and sensors. The lights, cameras, and sensors are all controlled by a Raspberry Pi utilizing Sparkfun's Qwiic ecosystem. The top and bottom pieces are intentionally independent to allow for one part of the experiment to be used without the need for the other. Top and bottom pieces are also easily removed and interchangeable on the top or the bottom of the lab without the need for screws thanks to our clipping solution for easy access. Soldering is not needed for all components.

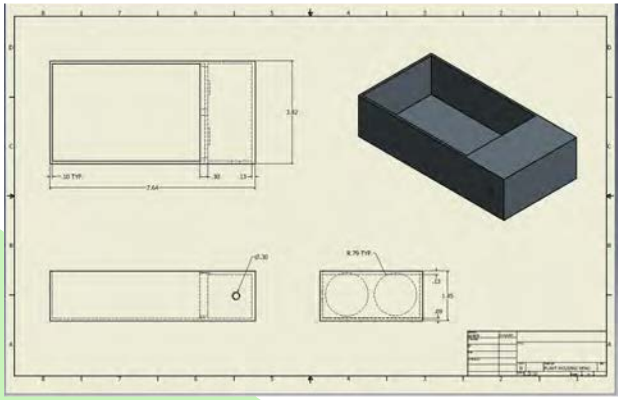
Researchers have the availability of adding more sensors and lights due to the extra Qwiic ports on the pHat and the light board, along with having an available USB power cable since our project currently only requires one. Our current lab setup is around $100 and integrates within the Nanolab shell from Nanoracks, but this price can fluctuate depending on modifications.

Future Improvements:

We plan on adding a plexiglass barrier in between electronics and plants, making code run immediately when the lab is plugged in, and adding a reflective material on the inside of the lab to improve lighting conditions and reflectivity.

Plant Housing

This section houses plants while adding an adequate position to receive light and be monitored by scientists and studiers alike who plan on monitoring it on a live basis, it also includes a hot-swap feature for easy and quick access, and a port to install more water.



About Us

Christian a Sophomore that aspires to work at Nasa one day he worked on many of the technical parts of this projects which include the software for the raspberry pi and how all wires and the fan design

Makayla is a sophomore at Bridgeland high school that plans to pursue geological engineering. She aided in the creation of the drawings along with the presentation aspects and was the primary creator of the plant box along with the ideas for it.

AG. NANO LAB

Space Agriculture

Contact Us

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AG. NANO LAB

Space Agriculture

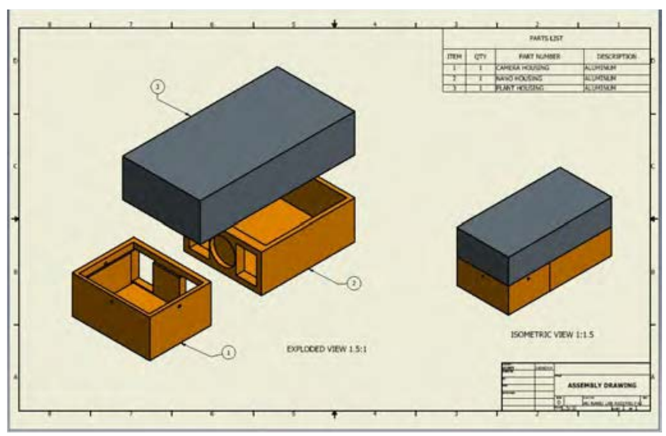
Makayla Pineda
Christian Nyambura

Prototype

Our prototype consists of four boxes that are modular so they can be taken apart and put back together easily. Three boxes consist of electronics while the fourth is plant housing. The main reason we changed this idea was that we discovered that a battery box along with the battery was not needed.

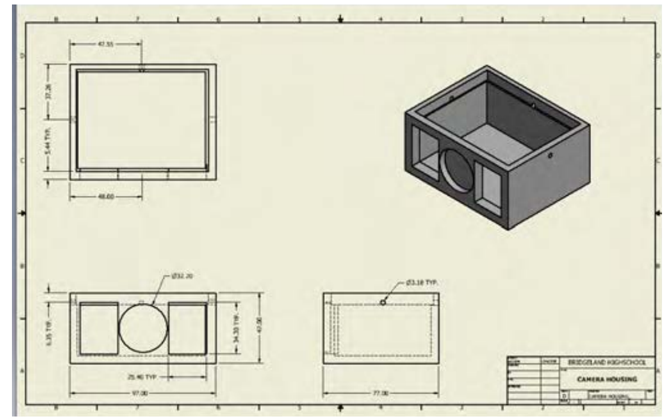
Our Design

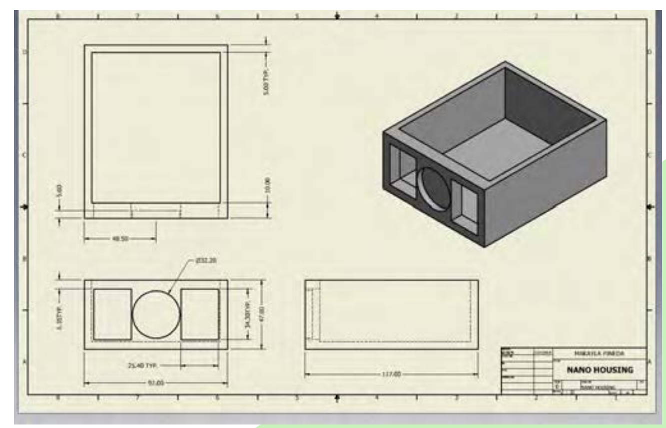
Our Final design consists of three modular boxes now instead of the four before, it has camera housing, nano housing, and plant housing which is the new box that has been substituted in. Alike before all the boxes are held together with magnets so they can be easily taken out and put back in for any reason. The boxes being facing into each other allows for airflow along with a clear view of the plants for the camera from its housing.



Electronics/Camera Housings

The electronics area(the orange boxes) had many hurdles to pass especially both the configuration and how they were going to be in contact / see the plants whilst also being able to get adequate sight and read tempuratures.





Agriculture Nano Lab

Tri-County Regional
Vocational Technical
High School
Frankllin, MA

Mrs. Magas

Sam Chalmers
Geneva McDonagh

Pros

- Versatile
- Made with awareness of microgravity
- Easy to use and manipulate to user's will
- Silent

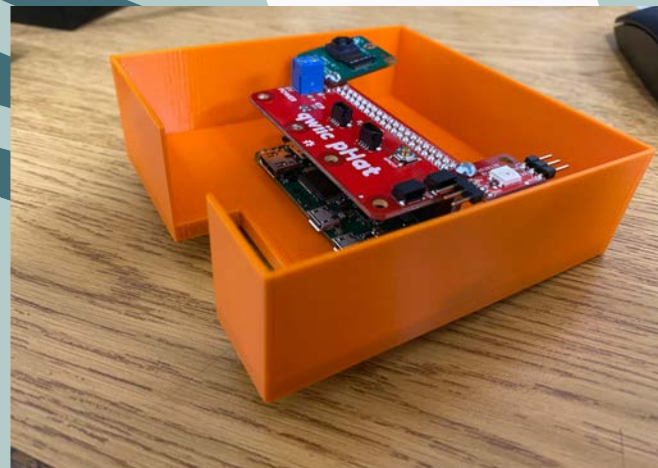
Cons

- Many components
- Each component is reliant on the rest

Images Captured

Design Components

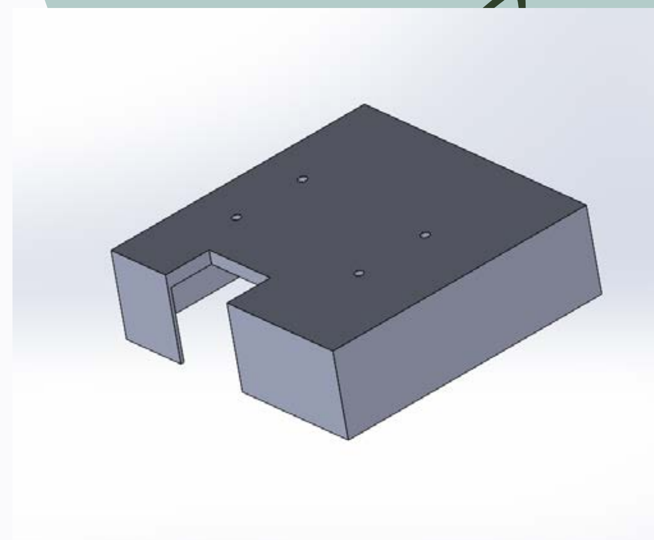
- Bag that can be removed, renewed and installed by user.
- Electronics compartment containing: camera, light, and environmental sensor, and a detachable pouch of silica gel.
- All components are removable and adjustable.
- Lid, keeping electronics and plants separate preventing excess moisture from damaging electronics.
- Plant growth compartment, with tabs to support lid.



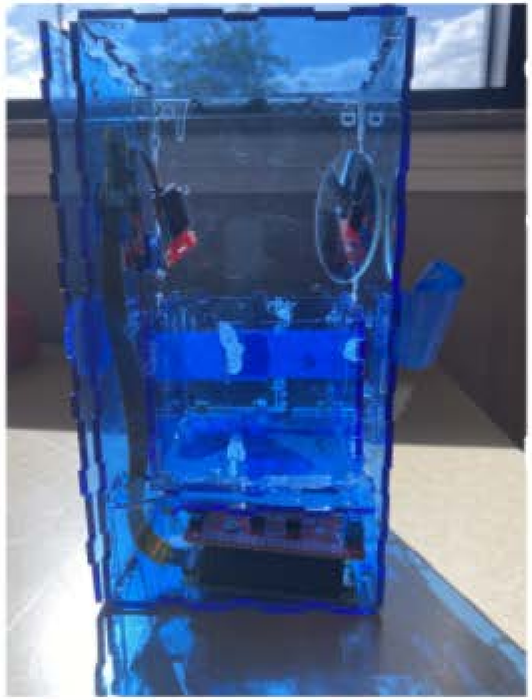
Electronics

Complete Design

CAD Model



TEAM



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Agricultural Nanolab

Agricultural Nano Lab

Cypress Springs High School

Industrial Technology

Engineering Design II

Cypress Fairbanks ISD

Cypress, Texas

NASA HUNCH PROGRAM

Team Name

Team members:

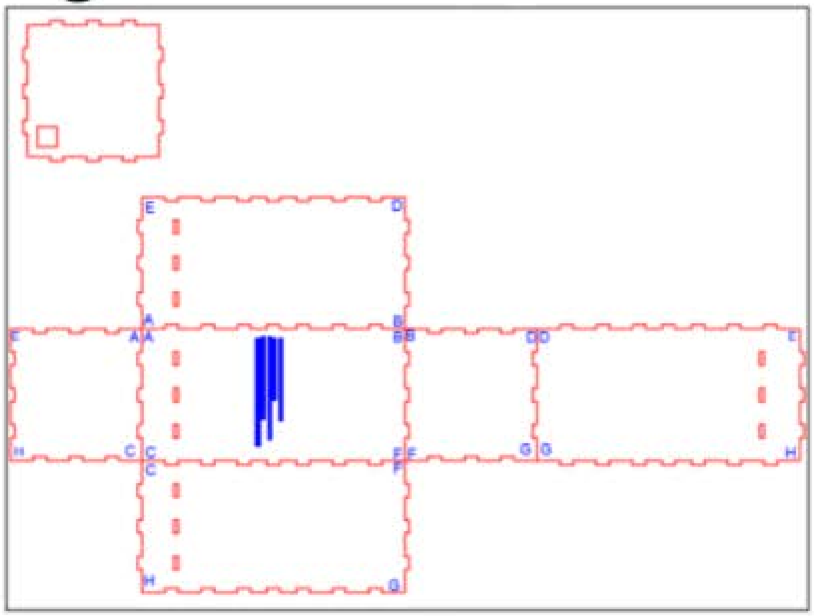
1. **Maria Fernanda Gutierrez**
2. **Aniya Pouncil**
3. **Ashnie Singh**

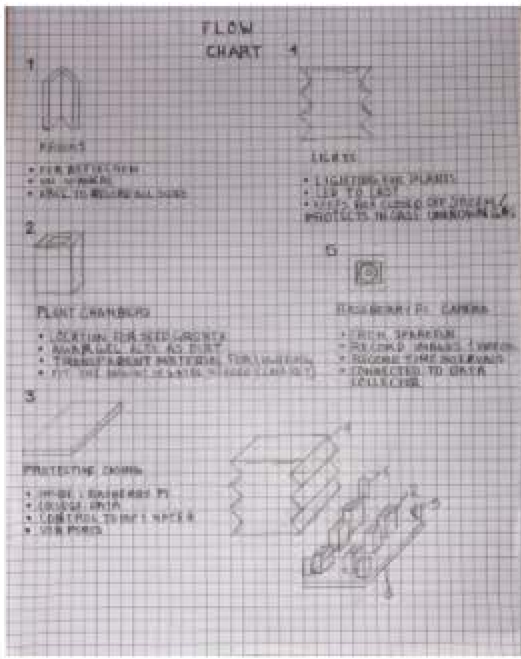
Instructor:

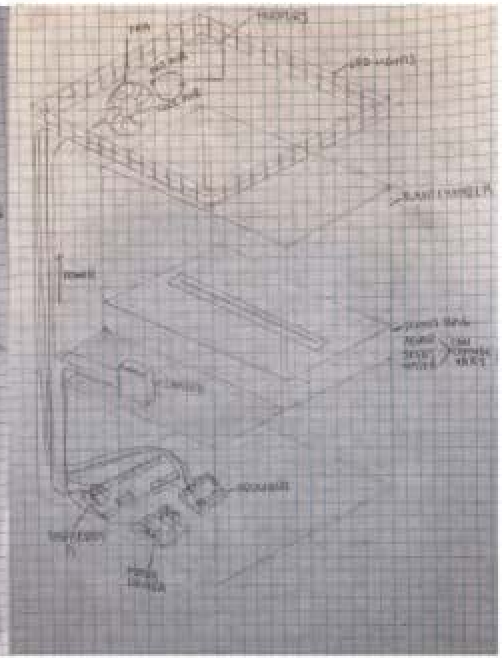
Steven Marcus

HUNCH Advisor/Mentor

Glen Johnson







GENERAL INFORMATION:

Agricultural nanolabs are small powered experiments that are sent to the ISS to conduct a variety of scientific experiments

OBJECTIVES:

The objective is to create an agricultural nano lab that is able to accommodate all researchers in personalizing their unique experiments

MATERIALS

Mirrors, Nano Box, Plant Chambers, Plant Pillow, Lights, Raspberry Pi Camera, Raspberry Pi, Protective Casing.

ISSUES

Nano labs are originally meant to to accommodate certain specific experiments and lack universality, which makes it hard for all researchers to conduct different types of experiments without changing the entire composition of the nanolab.

TECHNIQUES

-Experimentation, trial and error, and method testing

SOLUTIONS

-We are seeking advice from people with more knowledge on programming.

-We are conducting experiments to find the best possible position for the the parts of the nanolab.

PROBLEMS

-How do we program the Raspberry Pi?

-What is the best angle to fit the camera and mirrors?

-How will we attach our parts inside the nanolab?

CHALLENGES

-Figuring out how to water the plant in space.

-Figuring out the best medium for the plant bag.

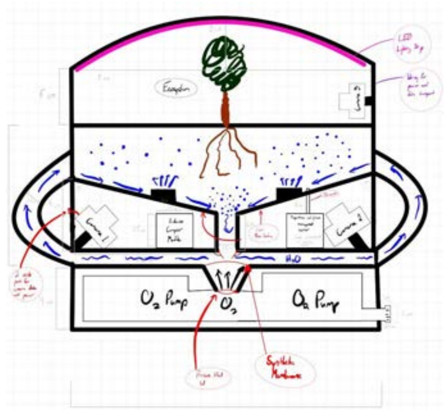
-Figuring out how much space should be dedicated to each part of the nanolab.

Aeroponics Prototype

Air and water pumped up into the roots

Unused water is recycled using a water concentration gradient

Use mylar to optimize lights



Contact us

Council Rock South

Sabrina Adler, Landon Hennicke, Demetra Kohart, Zach Miller,Kari Johnson, Isabella Francisco, Isabella Selekman,Melanie Loza, Emma Kaplan, Anvitha Naikoti

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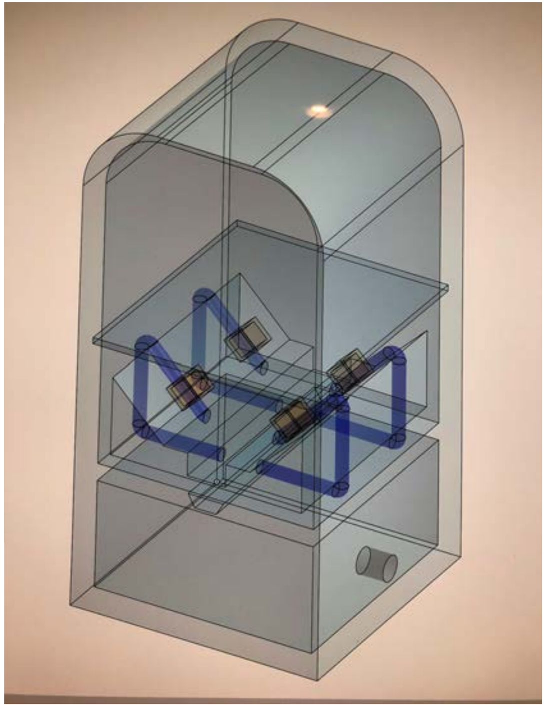
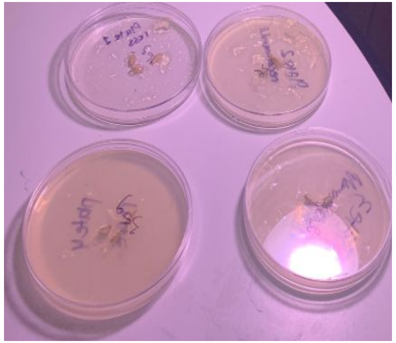
Instagram: @crsnasahunch

Generic Agriculture



Testing

Due to the lack of sterilization in the cucumber seeds, fungal growth had begun to emerge the 4th day, and continued to grow throughout the rest of the experiment.



Research

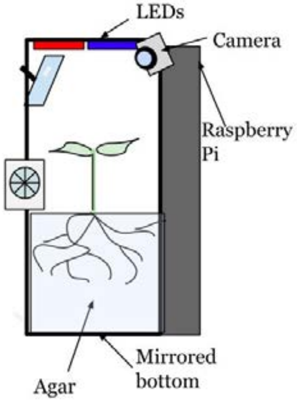
We researched previous experiments of plants growing in zero gravity and different methods of planting: Hydroponics, Plant Pillows, Horizontal Aeroponics, Vertical Aeroponics, Aeroponics, Oasis Foam, Agar, etc.

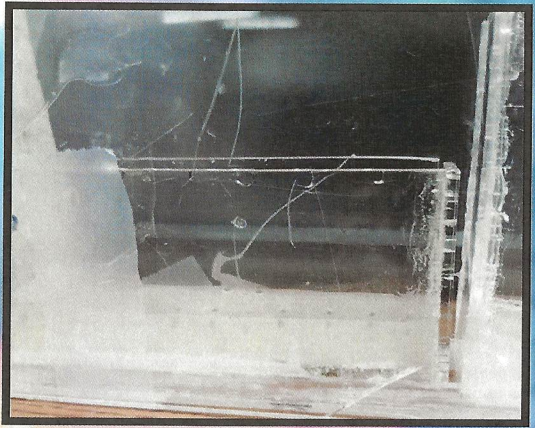
Agar Prototype

Plant roots grow into agar and absorb nutrients

No water or nutrients need to be added

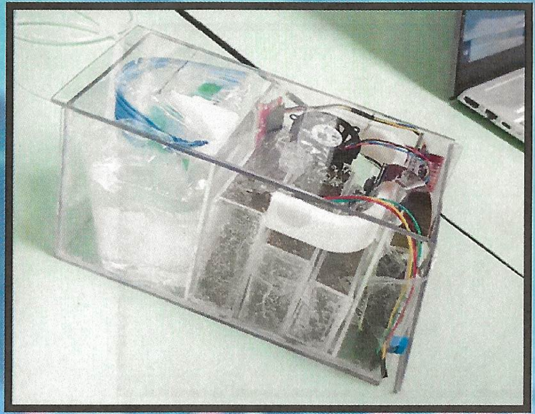
Fan allows aeration and circulation of air



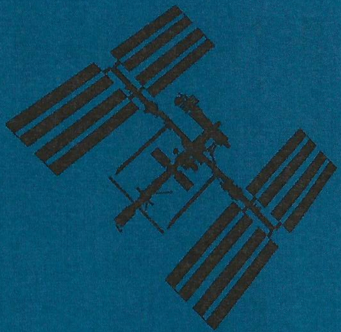


Above is a picture of one of our container during our agar experiment in which we tested our plant containers on agar, a substitute for water. We did this test to see how much of a problem mold would be and how efficient agar and our containers would be. Large amount of mold showed up by the end because we realized our water was the source. So we decided in the future small amounts of fungicide would be a good solution.

Container after mold above



Our product as of the preliminary review

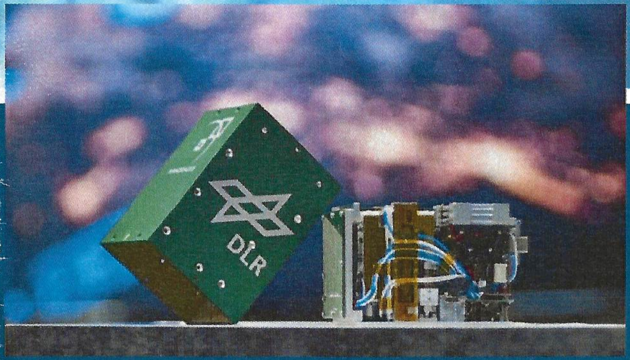


Cywoods NASA Hunch 2020-2021

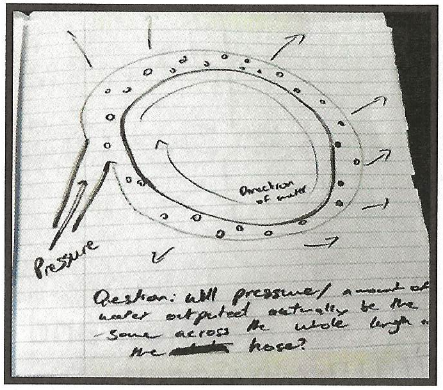
WILDCATS HUNCH High school students United with NASA to Create Hardware

Agricultural Nano-Lab for the ISS

By: Cole Matthew and Nicole Garcia

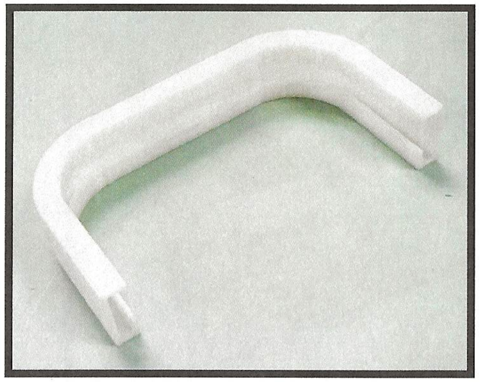


This is our Agricultural Lab! In short our product should let researchers/astronauts conduct 30 day experiments relating to plants on the International Space Station.

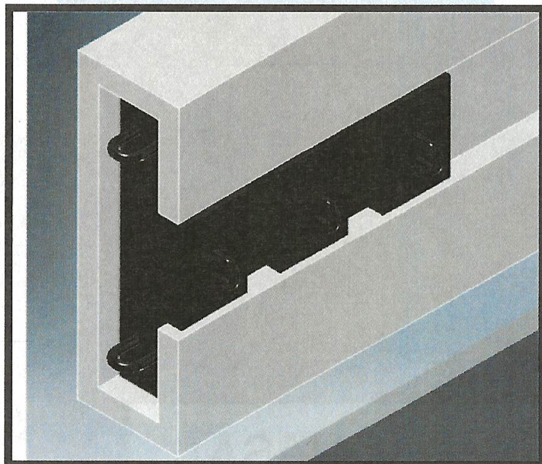


Above: Sketches of our first water system design involving a more pressure based system

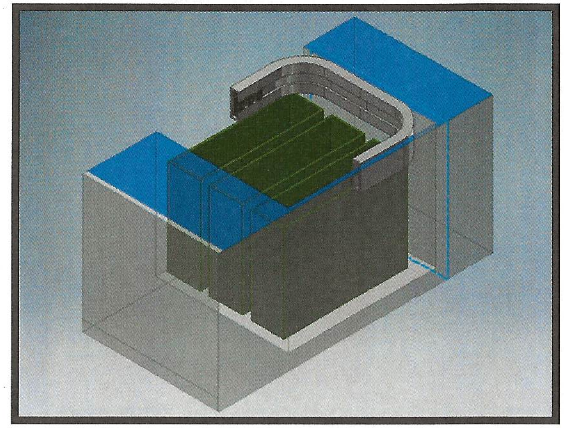
Above is a design for one of our final designs using a two plastic bags one used to store the water and the other would be squeezed via pump easily pushing the water out



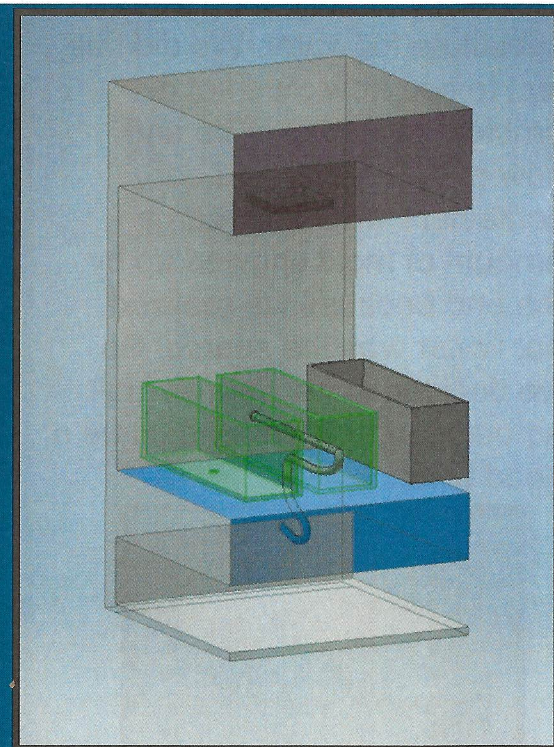
This is our camera track featured in our project which is one of our 3D printed parts with the purpose of positioning the camera



Sliding Pieces that connect the Raspberry Pi Camera to the track where scientists can position it in various locations



Initial 3-D Model



Final 3-D Model

Mission Statement

To create a universal, versatile Agricultural Nanolab that is designed and manufactured in a cost effective manner to alleviate the impediments faced by researchers, and efficiently facilitate a seed or small plant growth study in microgravity for all invested parties.

The task of developing a flight ready platform for an agricultural experiment in microgravity is a major deterrent for many research groups. Experimental designs can be costly, sometimes delaying proposed research for multiple years before reaching the launchpad.

DSEB^2

Glenelg High School

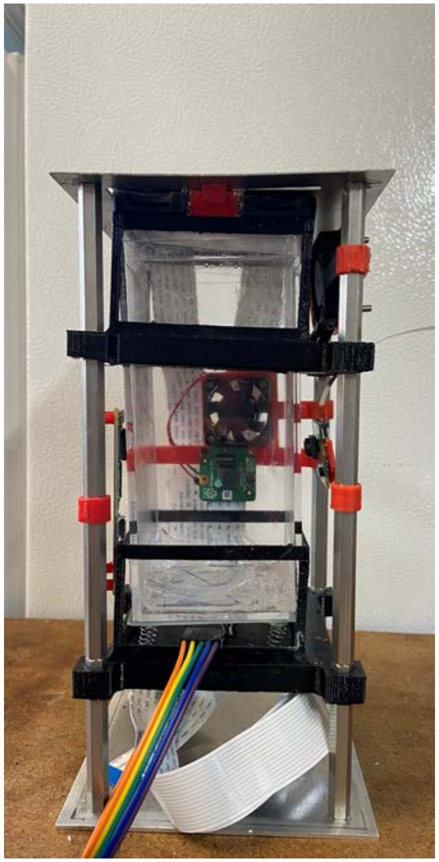
Derek Spratley

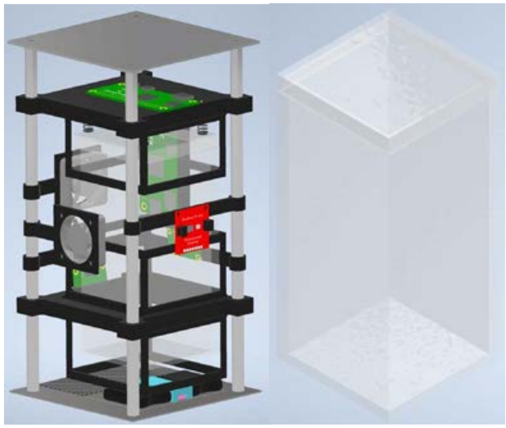
Ethan Barajas

Ethan Bomhardt

GHS AG NANOLAB TEAM

PROJECT PERSEPHONE:
Plant **E**xperiments **R**edefining **S**pace **E**xploration, **P**utting **H**umans **ON** **E**xoplanets.





Growth Chamber Design

Our Design uses a replaceable growth chamber that allows for the exchange of plant experimentation and the associated customized code without having to modify the NANOLAB. This permits researchers to send new experiments to the ISS at a fraction of the normal cost and in a more expeditious manner.

CAD Design

Our CAD Design allows for the electronics mounts to be customized. Researchers can use the same NANOLAB module as a reusable platform to accommodate experiment parameters specifically defined by them.

COST EFFECTIVENESS

NANOLAB With Growth Chamber and Outer Case:

2.631 lbs

Growth Chamber (Alone):

0.261 lbs

Average Gel Weight:

15 grams or ~.035 lbs

Cost per Pound to Ship:

$1500 w/ the SpaceX Falcon 9 Rocket

Cost for Full NANOLAB:

(2.631+.035)($1500) = $3999

Cost for Growth Chamber Only:

(.261+.035)($1500) = $444

FOR THE COST OF 1 FULL NANOLAB WE CAN CONDUCT ~9 FULL EXPERIMENTS WITH THE REPLACEABLE GROWTH CHAMBER SYSTEM.

THE REPLACEMENT GROWTH CHAMBER REDUCES COST BY

89%

Key Features

- Customizable Mounting Solutions
- Customizable Code and Growth Experiment Parameters
- Customizable Growth Medium and Environment
- Ease of Use
- Cost Effectiveness
- Reusability
- Accuracy of Operation and Data Collection
- Real Time Data and Images

Key Clients

- Students of all levels
- University Researchers
- Astronauts
- Plant Science Corporations
- Space Exploration Interests

Contact Us

Email:
ghs.agnanolab@gmail.com

HUNCH NANO LAB

WHO WE ARE

Teacher: Mr. Manske
School: East Troy High School, Wisconsin
Team Members: Connor L and Xabier B-H
Contact:connorlafreniere22@easttroy.k12.wi.us

AGRICULTURE LAB

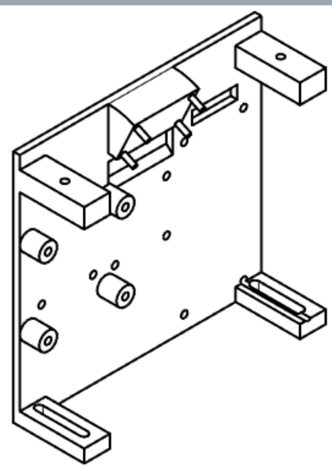
Our group has gone thorough several stages of research and experimentation to get to our current prototype. We began by asking questions about how the plant would grow and what the specific requirements for the lab were. We developed multiple CAD models and 3D-printed three prototypes. We also performed three growth experiments as well. Throughout this season we have broadened our understanding of the engineering and scientific process on our topic.

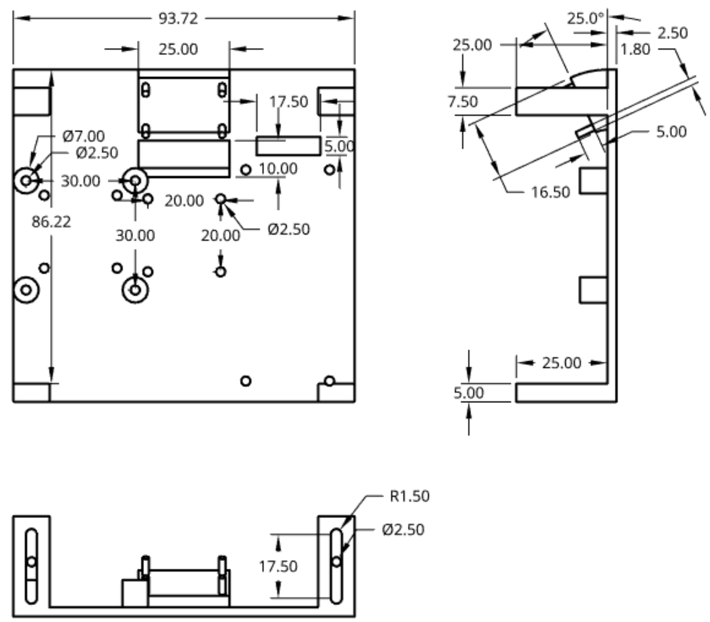
FUTURE PLANS

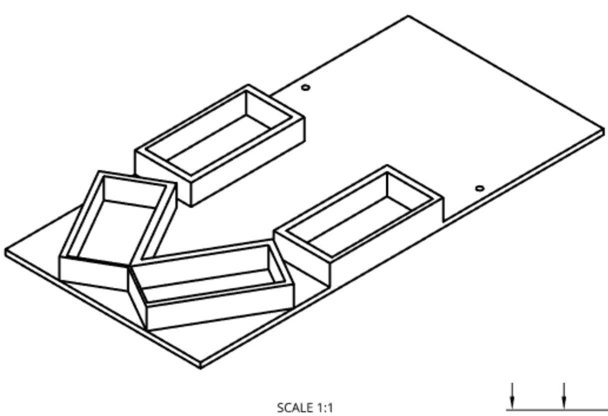
We plan to make improvements on the LED supports, the usability of our code, and better organize our electronics panel.

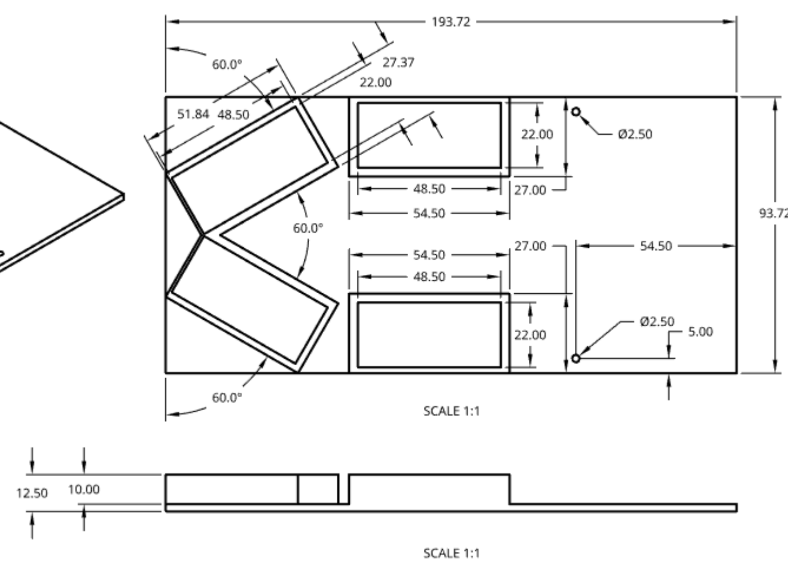
KEY FEATURES

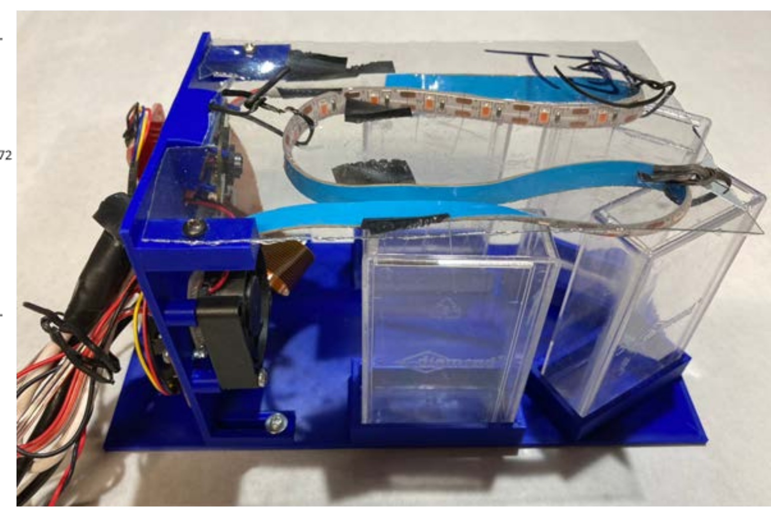
Our design features 4 separate growth chambers, allowing for separate experiments to be run simultaneously. We utilize a camera to record the sprouting of the captive seeds, an environmental sensor to record data in the lab, and a controller to independently change lights and circulation. We utilize both USB cables, one for power and another to allow data transfer for sensor logs.











Ag Nano lab Plant Growth Team

Wyoming Indian High School

Ethete, WY

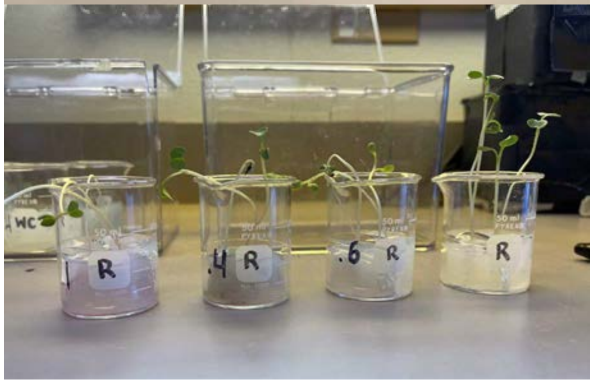
Scott Krassin

Margaret Friday, Arielle John, and Chaunte Redman

Astronauts need fresh food to be able to survive while researching for NASA. We did our part and accomplished to do three research projects which are growing radish seeds in different situations to see which would ultimately contribute to hopeful success.

Team Pictures:

Three images from our three experim

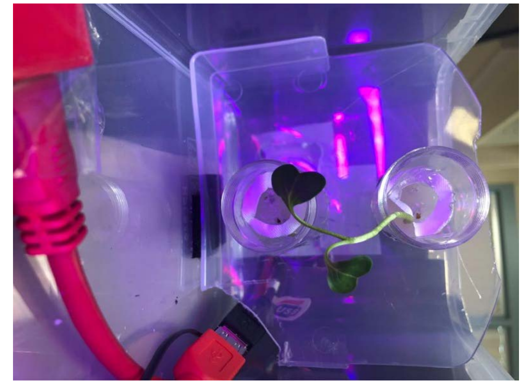


Images Capture

First experiment:

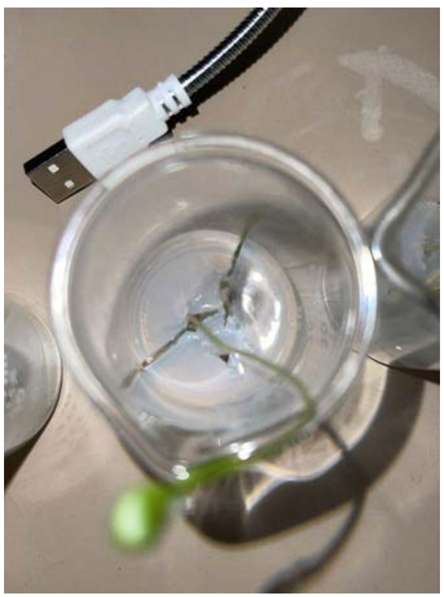
Second experiment:

Third experiment:



First result experiment:

Second results experiment:



0GORS Zero-G Organic Research Station

Team Information

School: Hickman High School

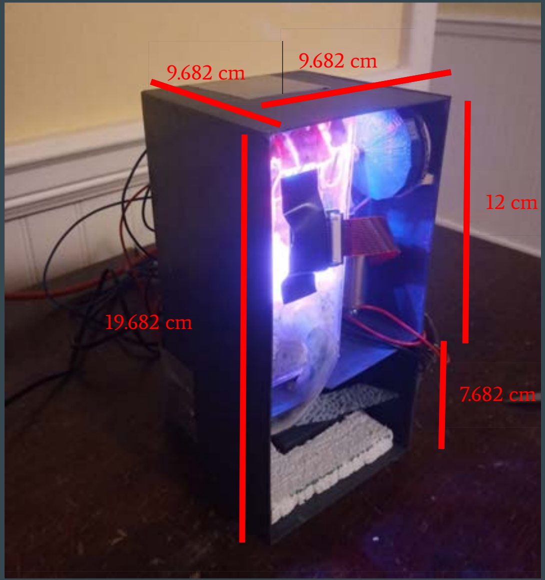
Location: Columbia, MO

Teacher: Matthew Leuchtmann

Team Members: Brady Lunceford, Alec Hume, Jonas Ferguson (left to right)

Key Factors

- Toggleable wicking system allows for steady, controllable flow.
- Our air control system allows for an inner chamber to be sealed and unsealed from the outer chamber. This allows for more accurate gas data and protects electronics from humid air (air output leads to moisture absorbing packet).
- Arduino for systems control while Raspi collects and processes data.



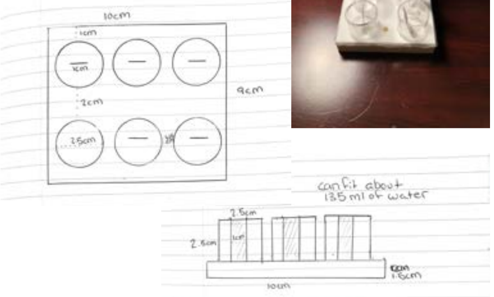
A part of our wiring is outside of the box so that the inside is easier to show off. The problem of bulky wiring would most likely be solved if this were created with NASA grade equipment.

Agricultural Nano Lab

School: The Fairport High School

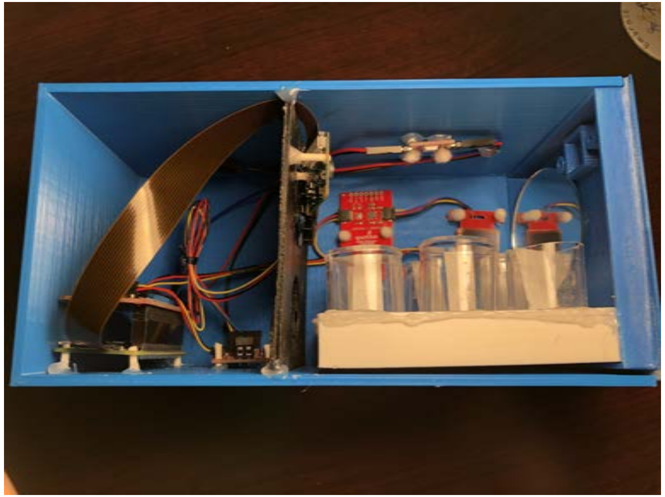
Teacher: Stornello, Himmelberg

Nanoracks

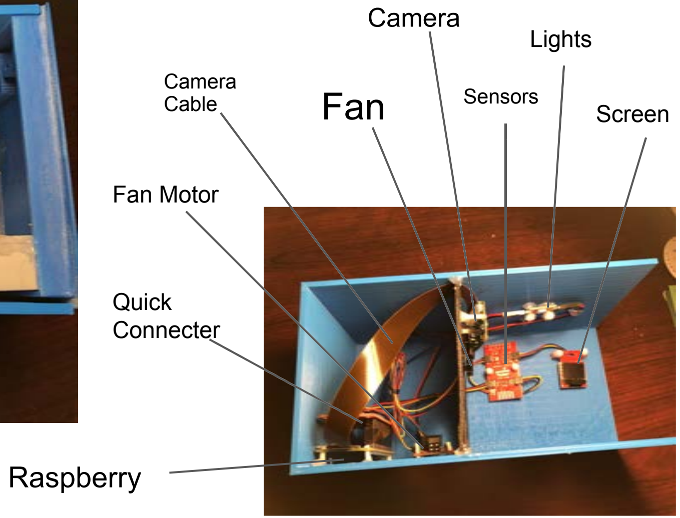


Our watering system is simple and easy to use. The plant wicks are made with filter paper with small pockets to hold the seeds and allow them to grow upwards towards the lights. The filter paper allows for transportation of water without electronics. The watering container, small white rectangle, can hold about 135 ml. The inside of the white box is lined with filter paper so the water can always be absorbed and get to the plants

Our Nano lab was designed to create a suitable environment for plants to grow in a zero gravity environment.



This is the electronics portion of our box. The camera is placed at an angle towards the mirror and the small screen so the pictures sent from the station can have all the data wanted in a simple picture. Plus, The fan wall allows for proper air circulation to the plants whenever needed.

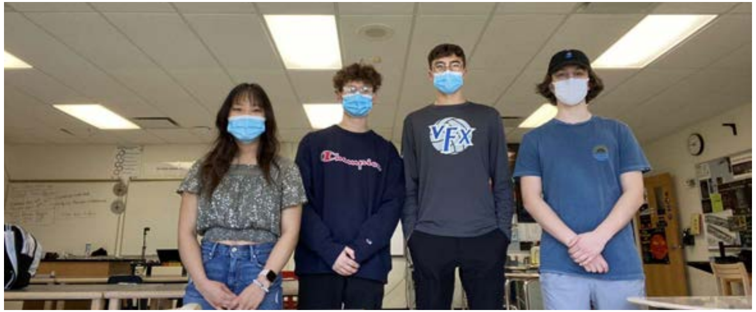


The team:

Aa Drew (Study Abroad)

Kenny Franko iv b

Aidan Kearney



de nna Cameron

Carter Dittman

Process

- Researched plants in space
- Found a suitable substrate
- Created a plausible watering system
- Placed electronics in an orderly fashion

Pros

- Simple, compact design
- Detachable watering system
- Electronics are placed to give all the data in a picture

Cons

- Have not reached the level of desired coding
- Humidity admitted by the plants is not accounted for
- Is not yet fully functioning
- Water is not fully enclosed but the idea is there

Future Designs

- Use silica beads to account for the humidity
- Use a dry fit material to keep the water enclosed while also allowing flowing air

NASA HUNCH: AGRICULTURE BOX

Middle Park High School

Drew Landy

Teacher: Mrs. Hargadine
carla.hargadine@egsd.org

Description

This is a computer automated lab set up for growing plants. Its design is made from three layers and a lid, also it features a wire protector to ensure that no water breaks the system.

First Time Set up: https://bit.ly/3dmlh43

Code: https://bit.ly/32funcq

Capillary Action

Cotton cheesecloth connects the water bag into the soil and by being woven throughout there will be equal distribution of water.

Capillary Action
Outside view

LID

- Light
    - Has ability to change wavelength of the outputted light using values of red, blue, and green.
- Camera
    - Small black square on photo

GROWTH LAYER

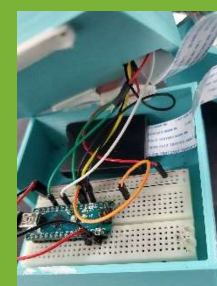
- Capillary tubes
    - Fed from Water Layer in through holes and then the cotton inside them is threaded through the soil (growth medium)
- Fan
    - There is a small fan that will help regulate internal temperature.
- Nylon Mesh
    - A surrounding bag to hold in the soil even tighter

WATER LAYER

- IV Bag
    - To create additional protection of water damage
- Cotton Cheesecloth
    - Threaded through IV bag to bring water into soil (growth medium
- Gaskets (not pictured)
    - Will allow the capillary tubes to be fed through but will not let soil into the water layer

COMPUTER LAYER

- Arduino
- SD card extender
- Programing in C



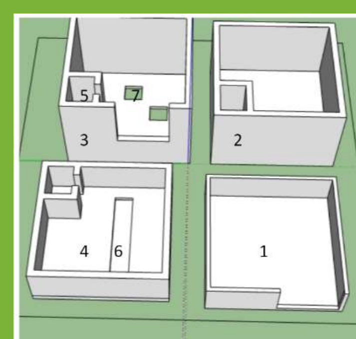


Image Reference:

1. Base / Computer Bay
2. Water Tank
3. Soil Tank
4. Top end / Light Bay
5. Wire Port
6. Light Strip Insert Bay
7. Capillary Action Access points