2/1/2021 - Brainstorming
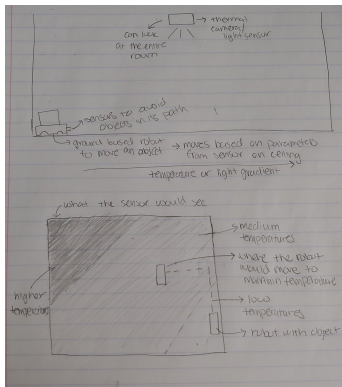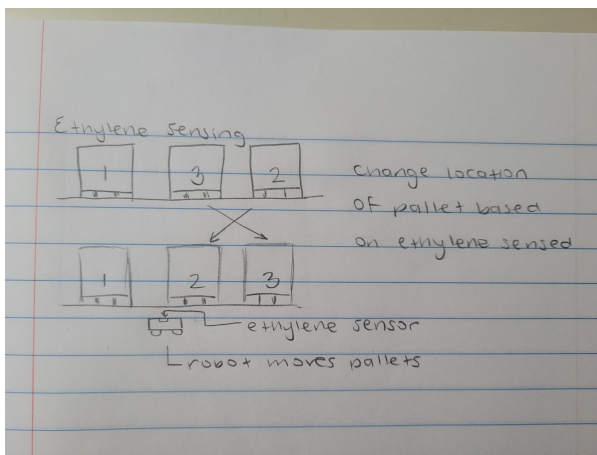
Topic: Autonomous Movement Robots

- Stats about food warehouse storage:
  https://www.newfoodmagazine.com/article/19306/temperature-control-strategies-for-smarter-energy-use-in-refrigerated-warehouses/
- Vaccine storage temperature guidelines:
  http://dhhr.wv.gov/oeps/immunization/providers/Documents/Section%207/storage%20and%20handling%20chart%20-%20temps%20recomm.pdf
- Coffee robot w/ ordering app
- Light-following robot stuff
  https://elnndccpro.wordpress.com/2016/07/22/light-following-robot-without-using-microcontroller/
- Cold Storage Warehouse problems:
  https://www.bahrns.com/blog/material-handling/7-problems-cold-storage-warehouses/
- Ethylene Sensor: https://www.strellabiotech.com/
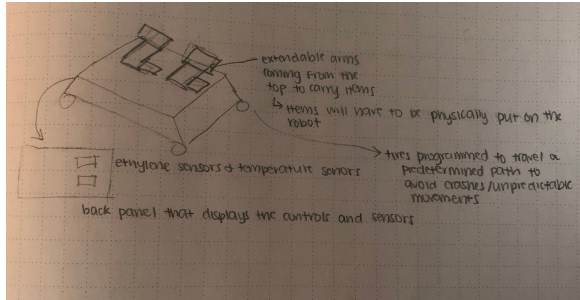
2/4/2021 - Brainstorming Sketches, Problem Statement

Veda:

Lena:

Mihika:

Problem Statement:
- Food waste
- Keeping warehouse foods good
- Based on temperature, light, concentration of ethylene in the air

Future Research:
- VEX VR to demonstrate robot movement → disk mover
- Research how food is stored in warehouses
- Research range of ethylene on ripening fruits

2/8/2021
- https://kids.frontiersin.org/article/10.3389/frym.2018.00016#:~:text=Ethylene%20action%20is%20inhibited%20by,by%20exposure%20to%20ethylene%20gas.
- https://www.mashed.com/230012/this-is-how-much-fruit-youre-throwing-away-each-year/
- https://en.reset.org/knowledge/global-food-waste-and-its-environmental-impact-09122018
- https://www.sciencedirect.com/science/article/pii/S0956053X18301946
    - Fresh fruit and vegetables contribute to almost 50% of food wasted by households.
- https://www.unenvironment.org/thinkeatsave/get-informed/worldwide-food-waste
    - "Fruits and vegetables, plus roots and tubers have the highest wastage rates of any food."
    - "Food loss and waste also amount to a major squandering of resources, including water, land, energy, labor, and capital, and needlessly produce greenhouse gas emissions, contributing to global warming and climate change."
    - "Even if just one-fourth of the food currently lost or wasted globally could be saved, it would be enough to feed 870 million hungry people in the world."
- https://www.usda.gov/foodwaste/faqs
- https://www.rts.com/resources/guides/food-waste-america/
- http://fao.org/save-food/resources/keyfindings/infographics/fruit/en/
- https://www.rts.com/resources/guides/food-waste-america/

Problem Statement:

Food waste contributes to massive amounts of water, energy, and economic waste. Every year, it produces 3.3 gigatons of greenhouse gases, which accelerate global warming and climate change rates. US households waste 80 billion pounds of food, 50% percent of which is spoiled fruits and vegetables. To solve this problem, we will design a container and an app that can control fruit ripening so that it will not rot before it is eaten.

The prototype will have 3D printed components and will be accompanied by an app to facilitate user interface with the container. The container will be equipped with ethylene sensors and a system that will control the amount of ethylene inside. The app will have a user-friendly interface that will allow the user to choose a day when they want to consume the fruit, and give them alerts about when they should eat their fruit.

First, we will work on creating CAD models of our prototype. Once we have refined those, we will create working illusions made of plastic containers, 3D printed parts, and sensors. We will use marvelapp.com to create the prototype of our app. Once we have our initial designs, we will get feedback from people who frequent grocery stores, such as parents, through a Google form, and iterate upon our designs.

What - 45% of fruits and vegetables are lost
Who - Households in the US waste on average 31.9% of the food they get, contributing to 3.3 gigatons of greenhouse gas emissions from food waste.
Where - American Households
When - when they eat and buy food, especially with healthier diets involving perishable foods
How many people - a lot

- 2 Minute Limit
- Problem Statement: Describe the problem you plan to address
- Idea: What will you make? How will you solve the problem?
- Plan: How will you bring your idea to life? (What will your prototype/working illusion be?)

- Figma vs Marvel?

Ethylene sensor placement
- Ethylene is lighter than air
  - Rises to the lid
- Ethylene sensor should be on the lid
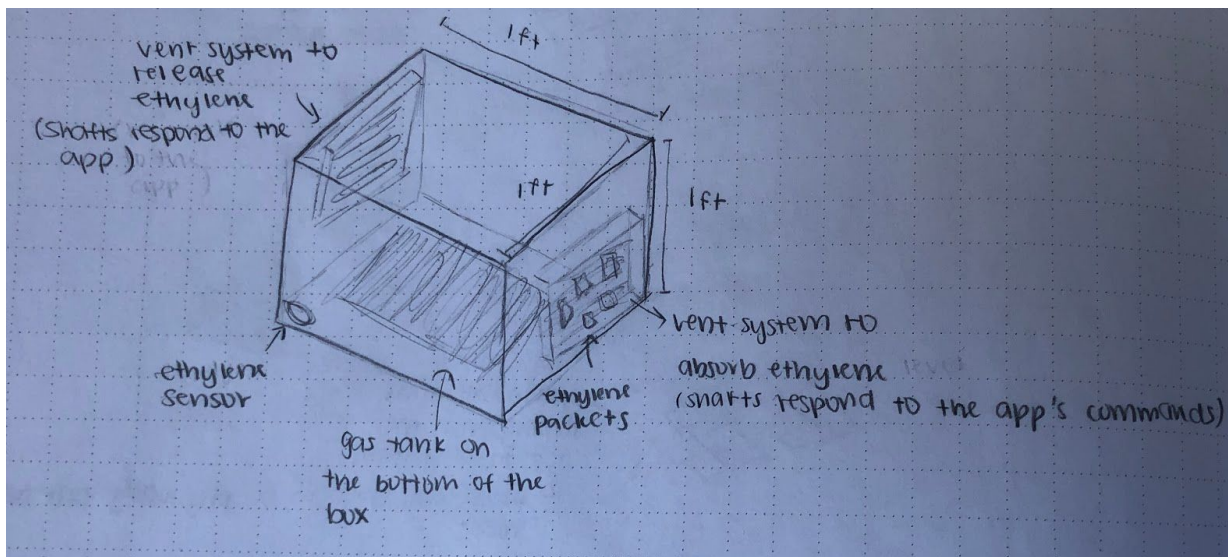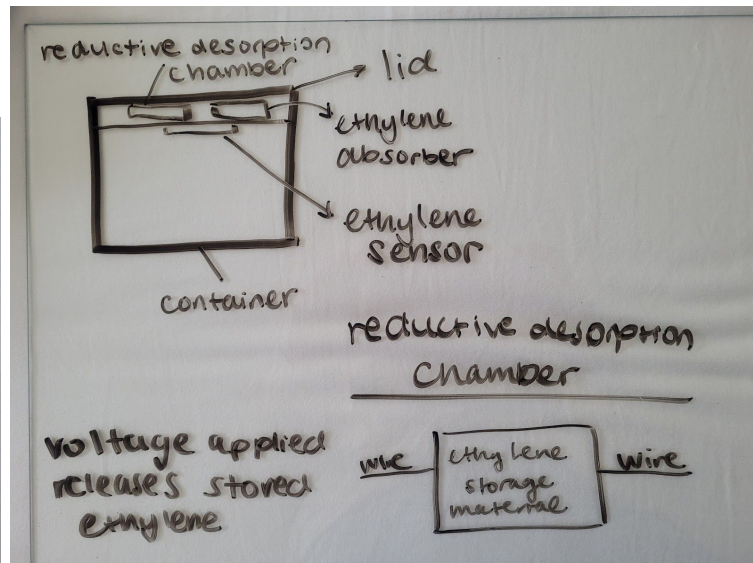
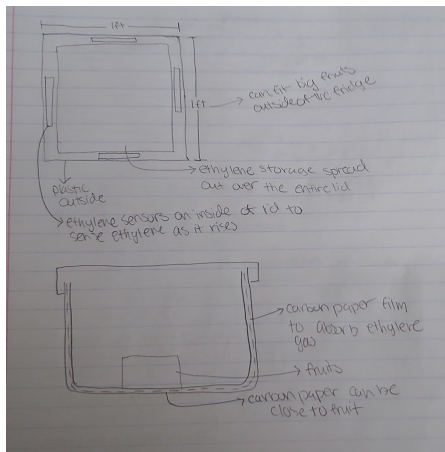**Ethylene gas tank/Ethylene Production**
- https://en.wikipedia.org/wiki/Desorption#Desorption_mechanisms
  - Desorption - process that reverses adsorption
  - Since ethylene is adsorbed to the substance we're using, this will release ethylene and ripen the fruits
  - Two options
    - Electrons in a vacuum
    - Apply a voltage to the material
  - Apply voltage to the material is more practical, vacuum electrons are not possible
- Pressurized gas cylinders
  - https://industry.airliquide.us/high-pressure-cylinders

Ethylene absorber
- Potassium permanganate AKA Purafil
  - Effective: Role of potassium permanganate ethylene on physicochemical properties, during storage of five different tomato cultivars.
  - Purafil: New Ethylene Absorbents: No Miracle Cure
  - Also, used to clean vegetables. However, very unsafe at high concentrations. https://oureverydaylife.com/303623-potassium-permanganate-to-wash-vegetables.html
- Activated Carbon:
  - BluApple example product: Potassium Permanganate to Wash Vegetables
  - Ethylene adsorption percentage of several activated carbon types: granular, powdered and fiber in 24 h time-course
- Zeolite: Ethylene adsorption onto natural and transition metal modified Chilean zeolite: An operando DRIFTS approach
  - Banana pouches: Ethylene Gas and Zeolite
  - https://www.answers.com/Q/How_do_you_build_an_ethylene_gas_absorber
  - the ethylene adsorption and removal capacity of palladium (Pd)–impregnated zeolite was far superior to potassium permanganate-based scavengers when used in low amounts at 20 ∘C and high relative humidity. Use of a Copper- and

Zinc-Modified Natural Zeolite to Improve Ethylene Removal and Postharvest Quality of Tomato Fruit
● Carbon dioxide slows effects of ethylene and ripening
    ○ https://www.critical-environment.com/rubberapplicationsb/monitoring-ethylene-c2h4-and-carbon-dioxide-co2-in-ripening-rooms-2684
●

Decision Matrix
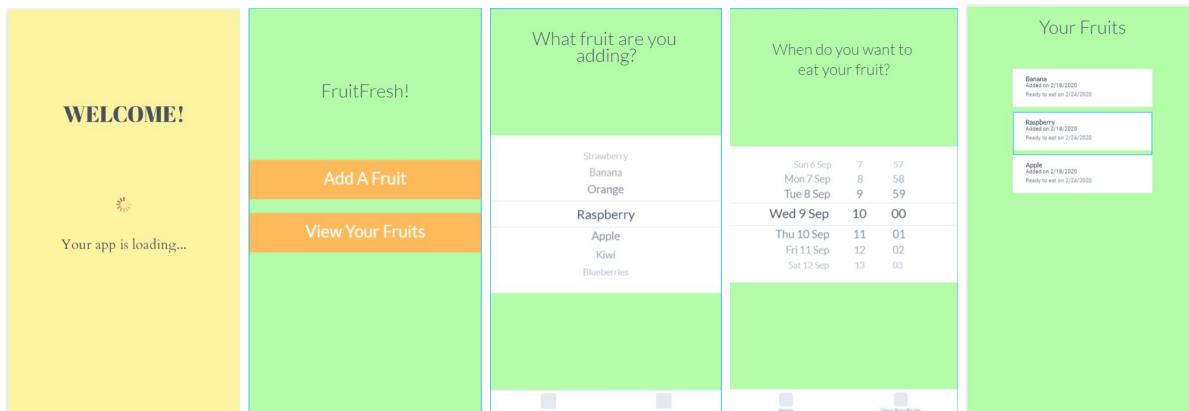https://docs.google.com/spreadsheets/d/19R6kBCwxAzPUUjuFxhNDJPdjwJci1I89tCZO56uKXJ4/edit?ts=60258dba#gid=0
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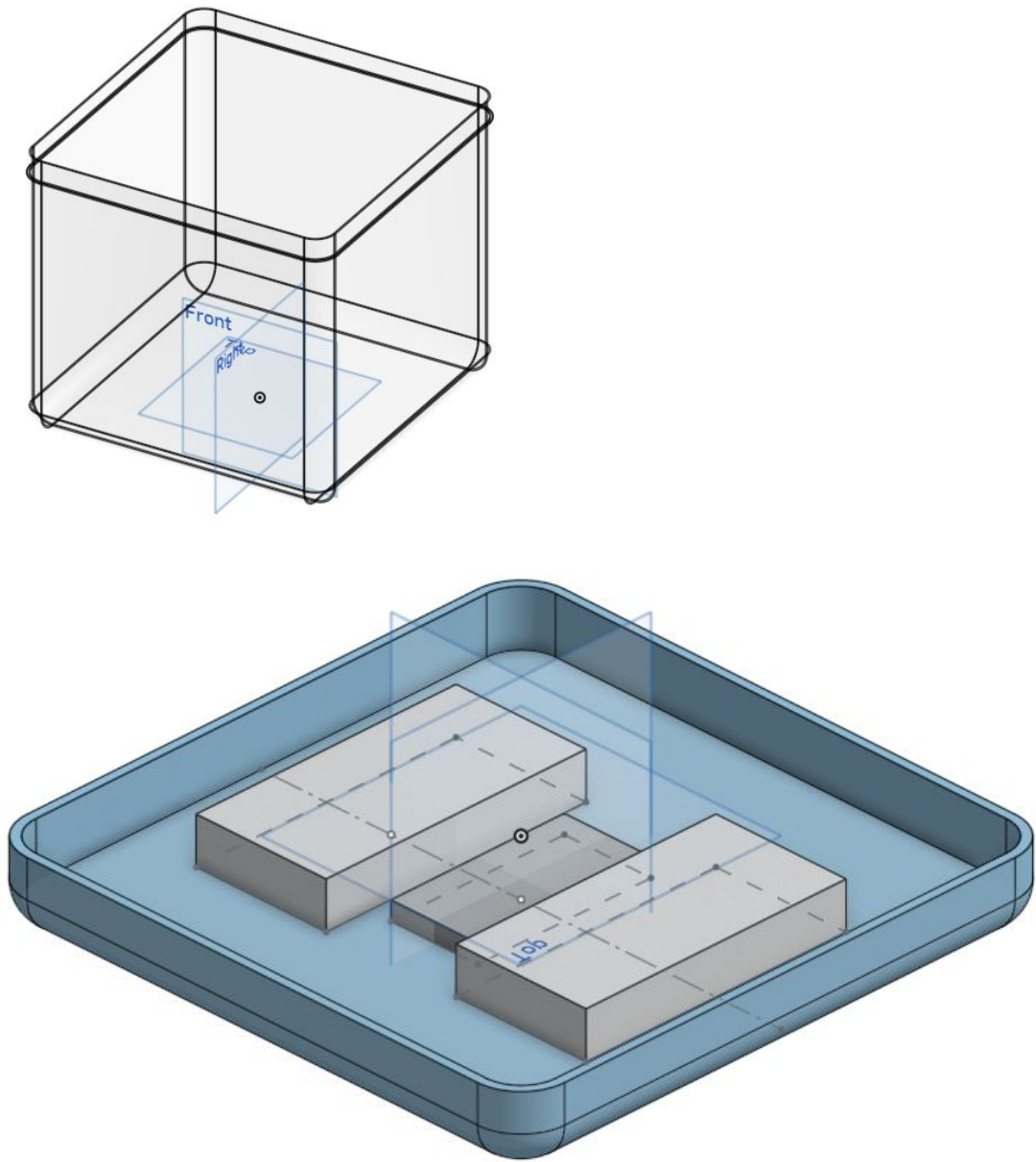https://aaps.onshape.com/documents/9b298c91797977ae8328e8ca/w/2b6cf7560fdde8ce9501151a/e/3cc9d1b564f81edc63112251
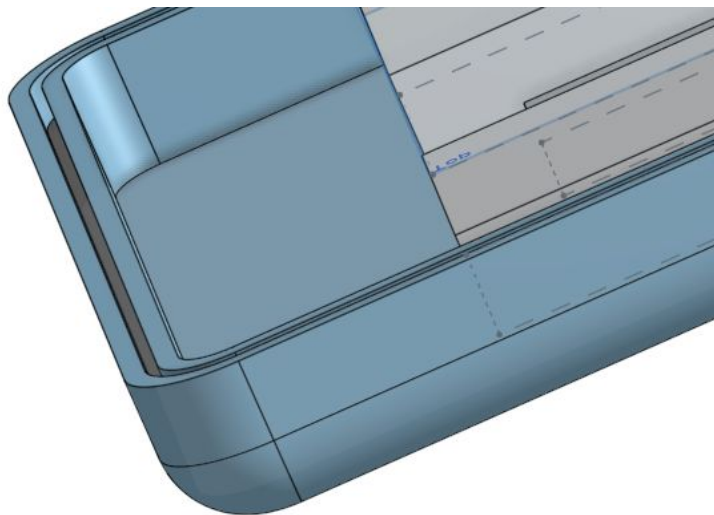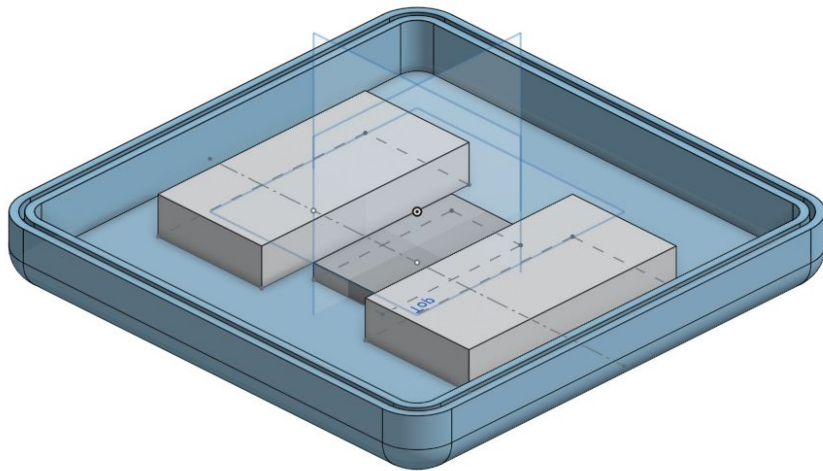
2/18/2021: Color Palettes for the App
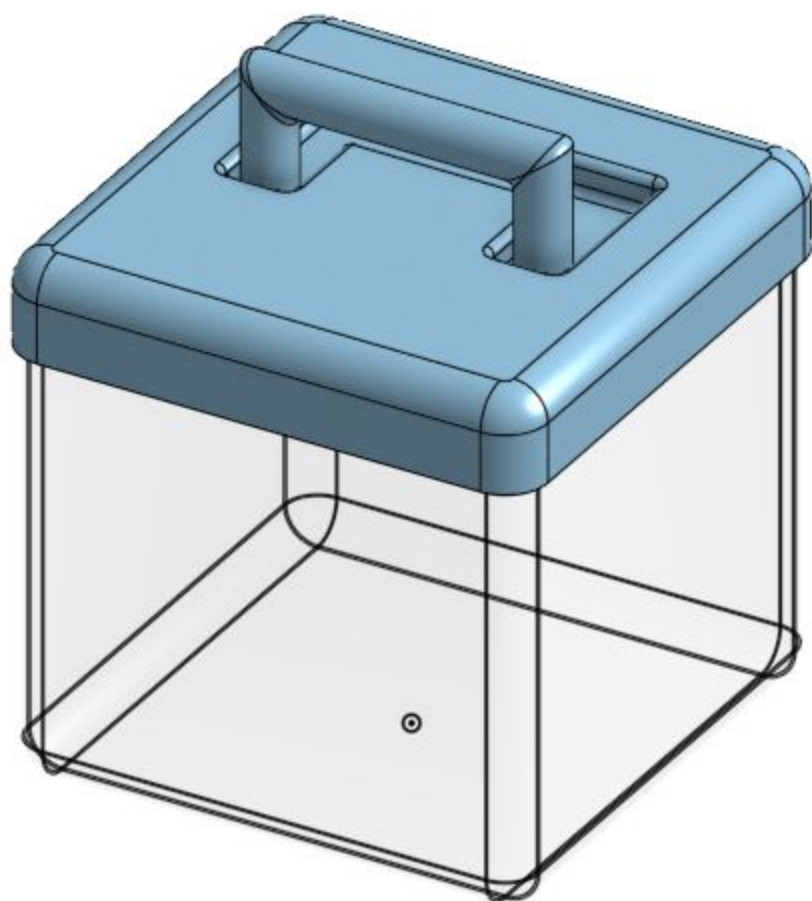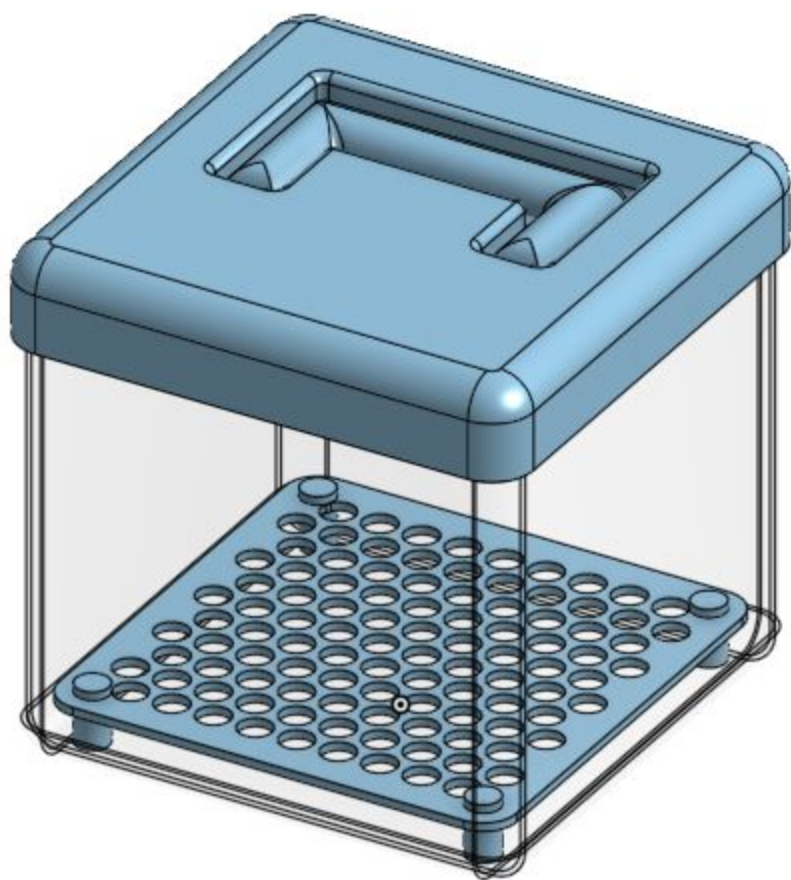
2/22/2021: Working on the App and CAD

WELCOME!

Your app is loading...

FruitFresh!

Add A Fruit

View Your Fruits

What fruit are you adding?

Strawberry
Banana
Orange
Raspberry
Apple
Kiwi
Blueberries

When do you want to eat your fruit?

Sun 6 Sep	7	57
Mon 7 Sep	8	58
Tue 8 Sep	9	59
Wed 9 Sep	10	00
Thu 10 Sep	11	01
Fri 11 Sep	12	02
Sat 12 Sep	13	03

Home   View Your Fruits

Your Fruits

Banana
Added on 2/18/2020
Ready to eat on 2/24/2020

Raspberry
Added on 2/18/2020
Ready to eat on 2/24/2020

Apple
Added on 2/18/2020
Ready to eat on 2/24/2020

CAD2:

CAD3:

Insert parts and assemblies
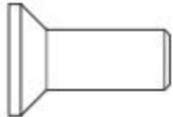
Current document	Other documents	Standard content

Standard	ISO ▼
Category	Bolts & screws ▼
Class	Socket head screws ▼
Component	Hex socket countersunk head screw ▼

Size	M5 ▼
Length	12 ▼
Thread length	12 ▼
Material	Stainless Steel ▼

Part number		Edit
Description	Hex socket countersunk head	

Insert

Prototype 1: