



**Phase III Final Model**  
DSID-130 Sustainable Design

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# Design brief

The goal for this project was to find a product from the existing market, and redesign this product that minimizing its impact on the environment by decrease it's environmental impact factor by 50%.



# Inspiration



Product Name: LEAF Transparent Face Mask

- Product Name: CIVILITY Face Mask

- Product Name: CLIU Face Mask

- Product Name: VINTA ACTIVE//SHIELD - Full Respirator Mask

# Design prompt

Due to the COVID-19 pandemic, with the shortage of PPE across the medical industry. As PPE becomes part of our everyday lifestyles, to design a better PPE that help improve and prolong the use of individual PPE is essential.



# Persona



*"Professional recommendation, service, and a warm smile are keys of my job."*

## Jack Jones

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### Background

Age: 25

Gender: Male

Career: Restaurant worker

Education: Bachelor in Business Administration

Location: Manhattan, New York

Income: \$3000/per month

Jack is currently a restaurant waiter in Downtown Manhattan, New York. Recently, restaurants in New York City were permitted to reopen for indoor dining. Jack and other employees are required to wear face coverings at all time. Jack can be stressed sometimes because being a restaurant waiter, it is important to communicate with customers and have a warm smile.

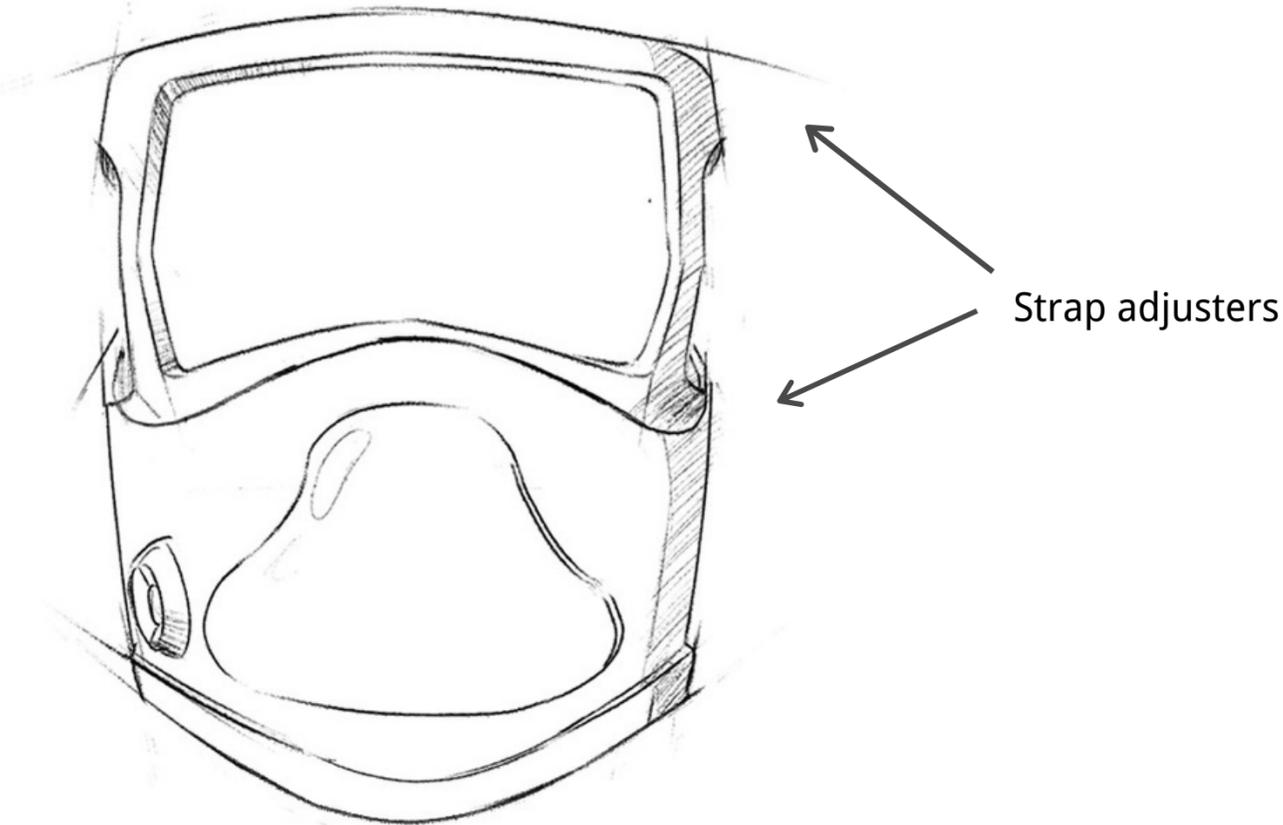
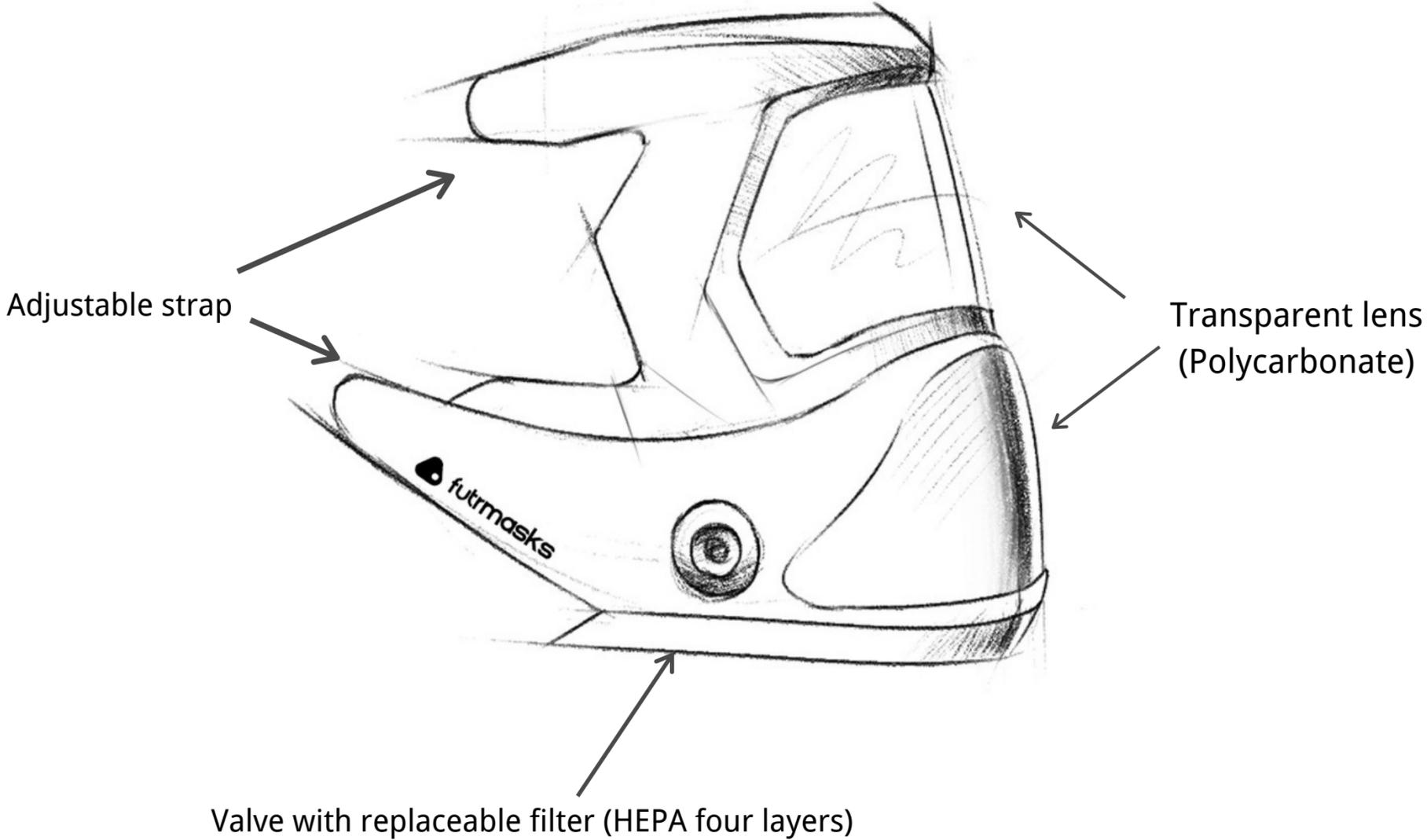
# Problem and goal

- Communication was biggest concern for people who work in public places or people with disability because they couldn't express their emotions under the mask.
- CDC recommend using eye protection in close proximity situations to prevent from spreading of COVID-19. Goggles do not cover the nose and mouth. Face shields have large gaps below and alongside the face. Don't using it as a substitute for masks.
- Design for inclusivity by using different mask size to fits different face sizes.
- A lightweight, comfortable and reusable mask but still address sustainability.
- Design for sustainability is the goal for this class, but at the same time, keep realistic on my design because the mask need to reach a certain level of protection, N95 or better rating.



# Final concept

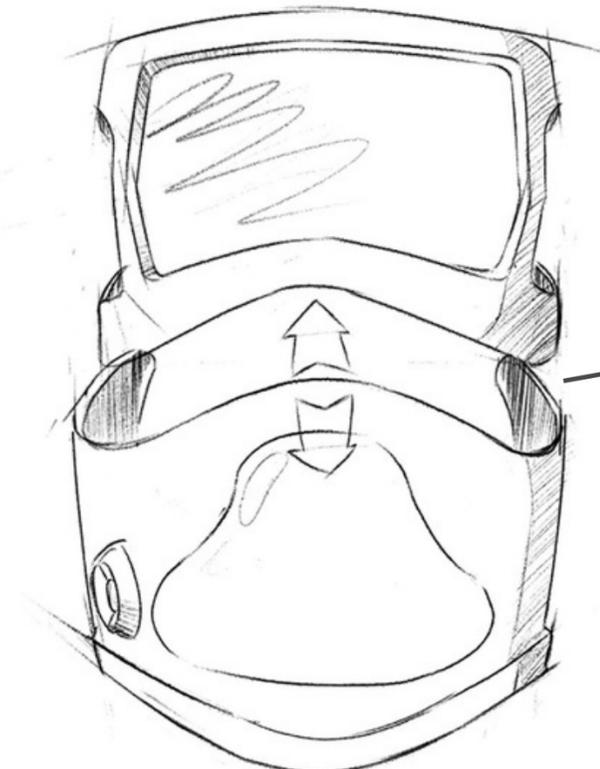
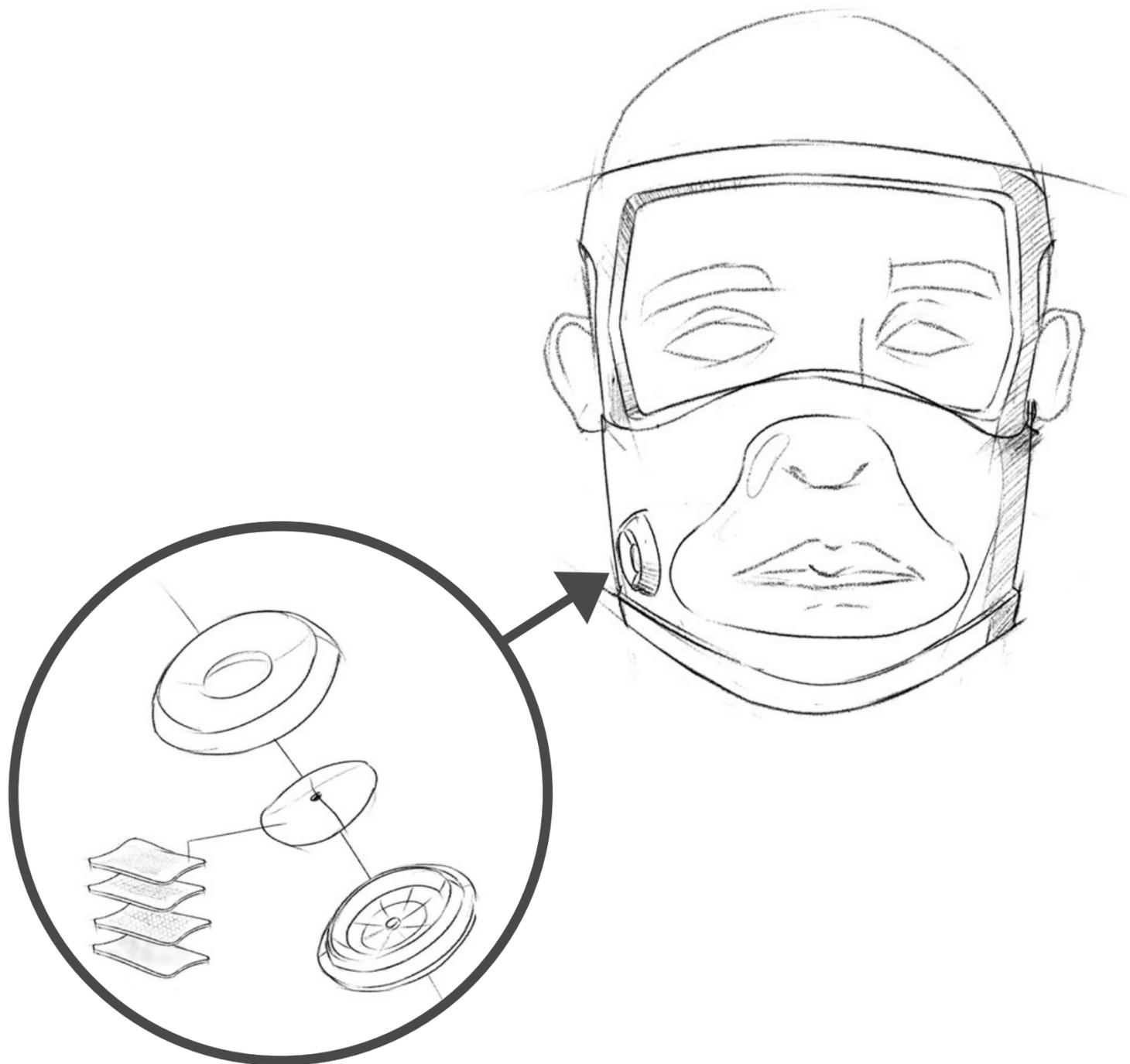
- 1.1 Rethink how to provide the benefit
- 2.5 Use renewable resources
- 8.4 Use recyclable non-toxic materials



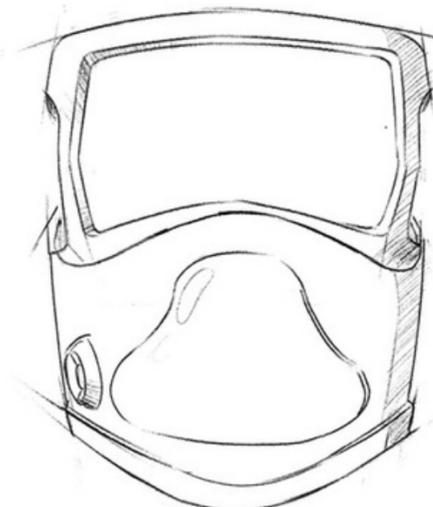
- 1X Mask frame
- 1X Goggles frame
- 1X Transparent shield on mask
- 1X Transparent visor on goggle
- 2X Strap(Adjustable)
- 2X Strap adjusters
- 1X Valve
- 1X Filter (4 layers)

# Design details

1.5 Share among multiple users  
8.2 Design for fast manual or automated disassembly



Magnetized  
two separate components



Large

Medium

Small

# Package/Distribution

1.3 Provide product as service

4.4 Use lowest-impact transport system

4.2 Reduce Product and packaging volume

6.3 Design for Re-use and exchange of products

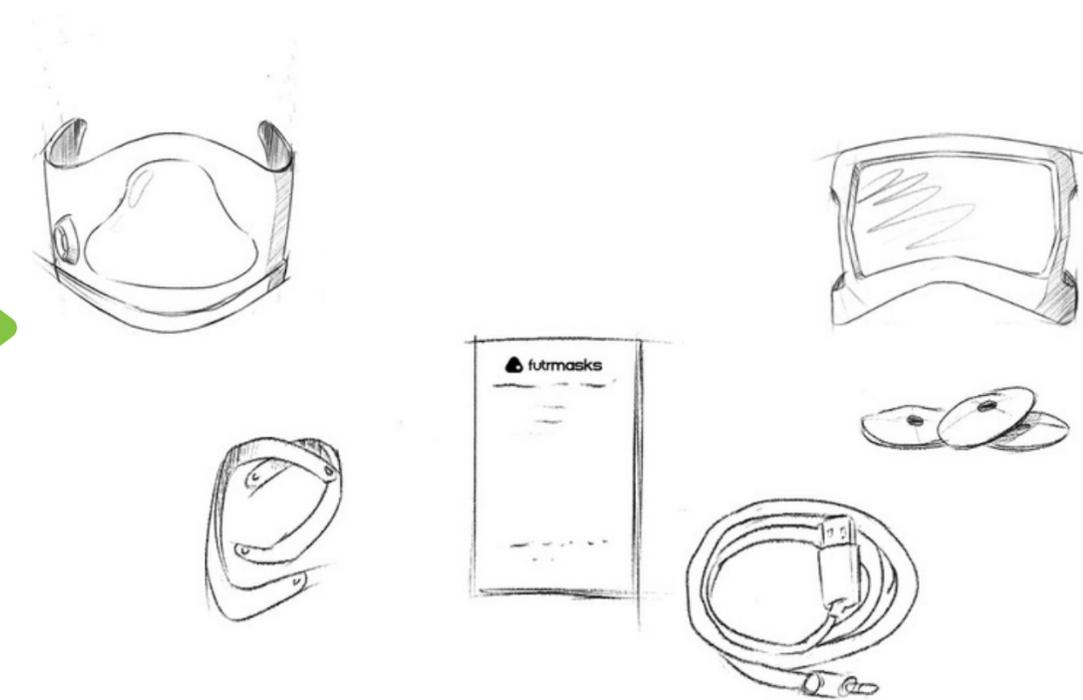
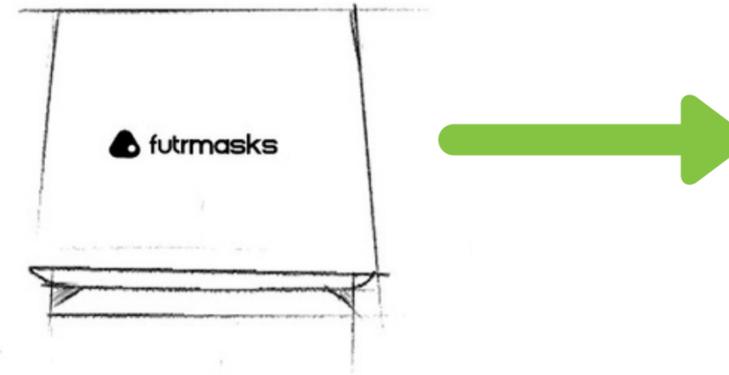
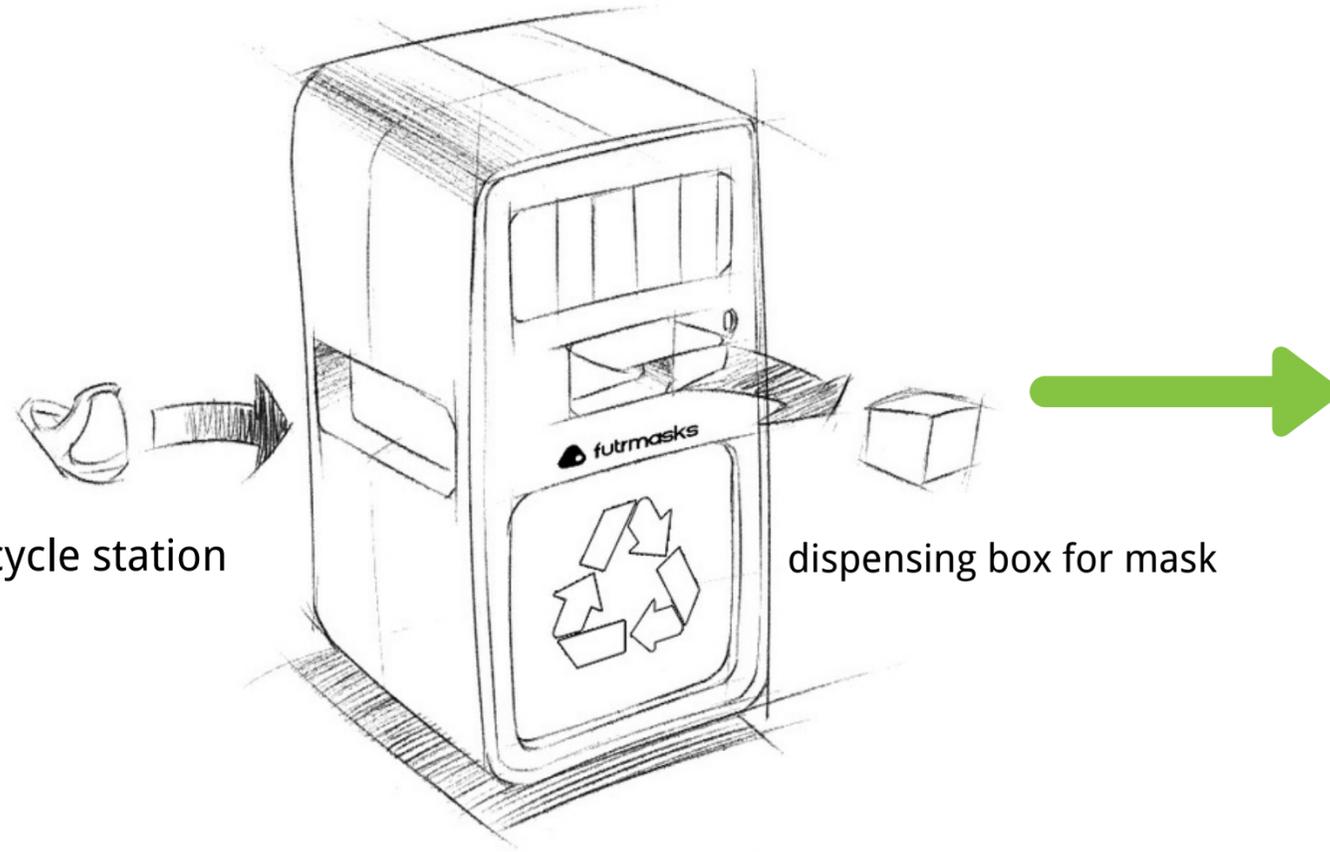
4.3 Develop reusable packaging systems

8.3 Design recycling business mo

## Step 1: Distribution

## Step 2: Package

## Step 3: What is in the box?



Vending machine idea reduced distribution impact by using lowest-impact transport system

A reusable packaging system that has a built in UV-C light to kill the virus and bacteria.

- 1X Mask part
- 1X Goggles part
- 2X Strap(Adjustable)
- 1X Filter replacement
- 1X USB charging cable( To charge the storage box)
- 1X Manual guide

# Impact factors comparison

## Original mask

### Total Impact / Lifetime

Materials	1.6182408
Processes	0.0982828
End of Life	0.204369
Transportation	0.00542547

1.926318076

### Lifetime hours

Wear-out Life	10
Hours used per year	3650
Total lifetime hours	36500

### Impact /Hour

0.00005277583769

Total parts: 23

VS

## Final mask

### Total Impact / Lifetime

Materials	0.396154
Processes	0.133562
End of Life	0.063822
Transportation	0.00244619

0.5959841908

### Lifetime hours

Wear-out Life	10
Hours used per year	3650
Total lifetime hours	36500

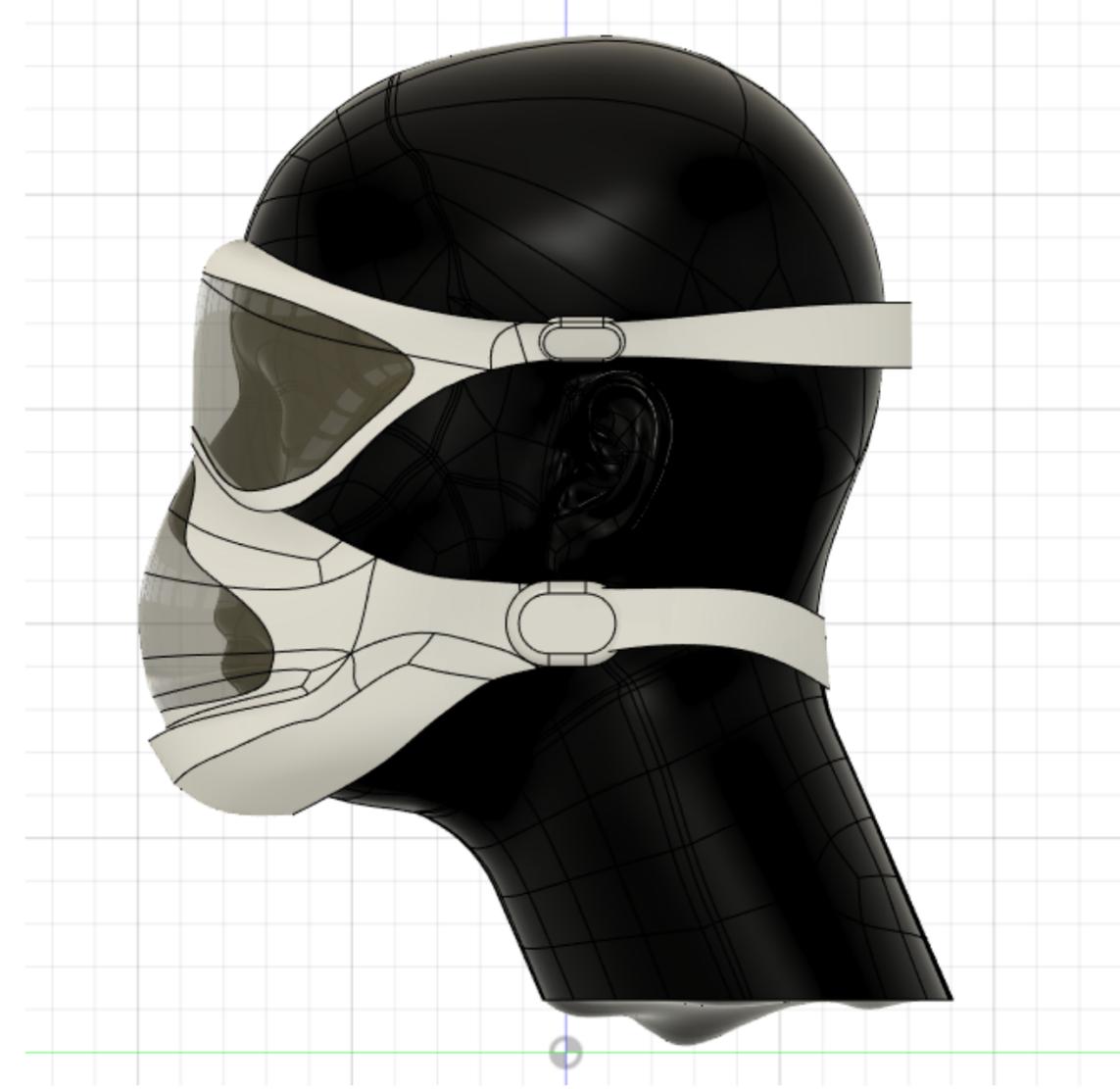
### Impact /Hour

0.00001632833399

Total parts: 12

Decrease the impact factor by 69.06%

# Fusion model



I have been playing around with the free form tool for my mask, I think it's very challenging because once you click ok, there is no turning back for free form tool. You have to be very careful for your every step. I built a few different models as experiments, and finally got this shape, and still not very happy about it. For generative design, I plan to use generative design on my breathing valve or filter, because it is a more complicated structure.

# Render



# Material Research

MC Numb	Category	Material Image	Material Name	Manufacturer Name	Description
574101	Polymers		CleanEffects™	TRANE	Filtration media that is able to filter air significantly better than a HEPA device. This extruded polymer honeycomb is coated with a conductive layer that attracts dust particles that have been charged using a corona field. The spacing of the holes is only 0.08 in (2
799701	Naturals		Ever Bamboo	Ever Bamboo Inc.	Bamboo charcoal powder and granules that are integrated into different formats. This material is produced from rapidly growing moso bamboo located in Southeast Asia. Due to the growth characteristics of this bamboo, millions of tiny
707211	Polymers		Fidlock® Hook 4C	Fidlock GmbH	Compact, lightweight magnetic fasteners with secure snap functionality to ensure a continuously strong locking force for 'self-closing' bags. They can be simply attached to the ends of the relevant straps, allowing the straps to be adjusted according to the

512816	Process		InFoam	Covestro LLC (Formerly	A novel production process to alter the properties of flexible foam. By injecting a hardening material, the company can create complex geometries inside the foam. Parametric modeling software is used to generate the desired structures and to inject the
781604	Polymers		INTEGRATED ELA	Janisset SAS (JTTI)	Elastic yarns that are woven directly into the fabric to create elastic and non-elastic sections at custom intervals using special weaving techniques. The fabrics are made with 100% nylon or polyester and elastomer yarns, and are woven to
595801	Polymers		premium memory	GF. Manufacturing Co.	Open cell foams that have shape memory. These polyurethane (PU) foams recover from compression at rates that largely depend on their temperature. Their characteristically slow recovery is the result of an upward shift in their glass transition temperature

I did some research on material connection, I found some interesting material for the mask filter, strap, and memory foam.

# Moving forward

For next phase, I will explore more about generative design. I will need to do more research on the materials and technology. I am think to incorporate some of the technology such as microphone, or Bluetooth. I think that from the concept to a complete mask, a lot of research and sketches needs to be done. Since all the research is done online, there is no physical model for research, I don't know if the strap and the mask are comfortable enough and or whether the mask has reached a certain level of protection.

## Things to consider...

- Built in microphone
- Bluetooth
- Glasses friendly
- Anti-fog
- Customization
- Storage case with built in UV-C light