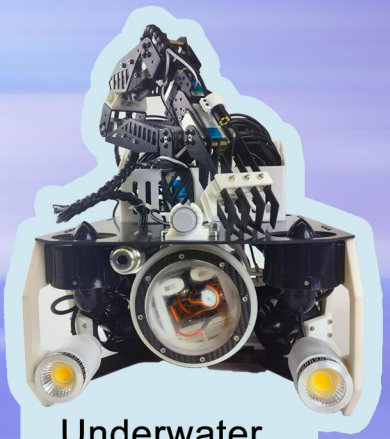
Ruilang Li

Porfolio

2023-2025

Projects



Underwater garbage cleaning robot 2024

Smart watering pot 2025

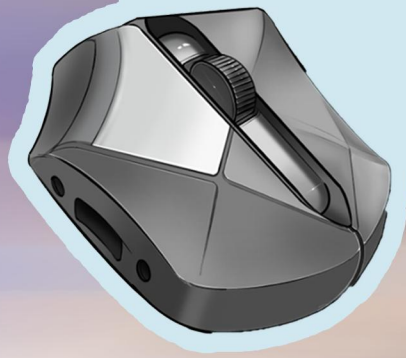
Bionic design of sneakers 2025

Concept Automotive 2024

3D-Printed Adaptive Assistive Devices 2023

Bridge Modeling & Structural Engineering Club 2024

Bluetooth head-phone-mouse design 2023



Underwater garbage cleaning robot

Marine One

Project Medium: 3D Pringting
Soildworks Arduino CNC Procreate

iENA China Region 2024
First Prize

Conrad Challenge China
2023-2024 Finalist

Designed and prototyped an autonomous underwater robot equipped with mechanical claws, environmental sensors（PH level, dissolved oxygen...）, and camera to automate hazardous tasks in aquaculture (e.g., net inspection, debris removal). Engineered pressure-resistant housing and real-time data transmission to reduce human diving needs.

Market pain point

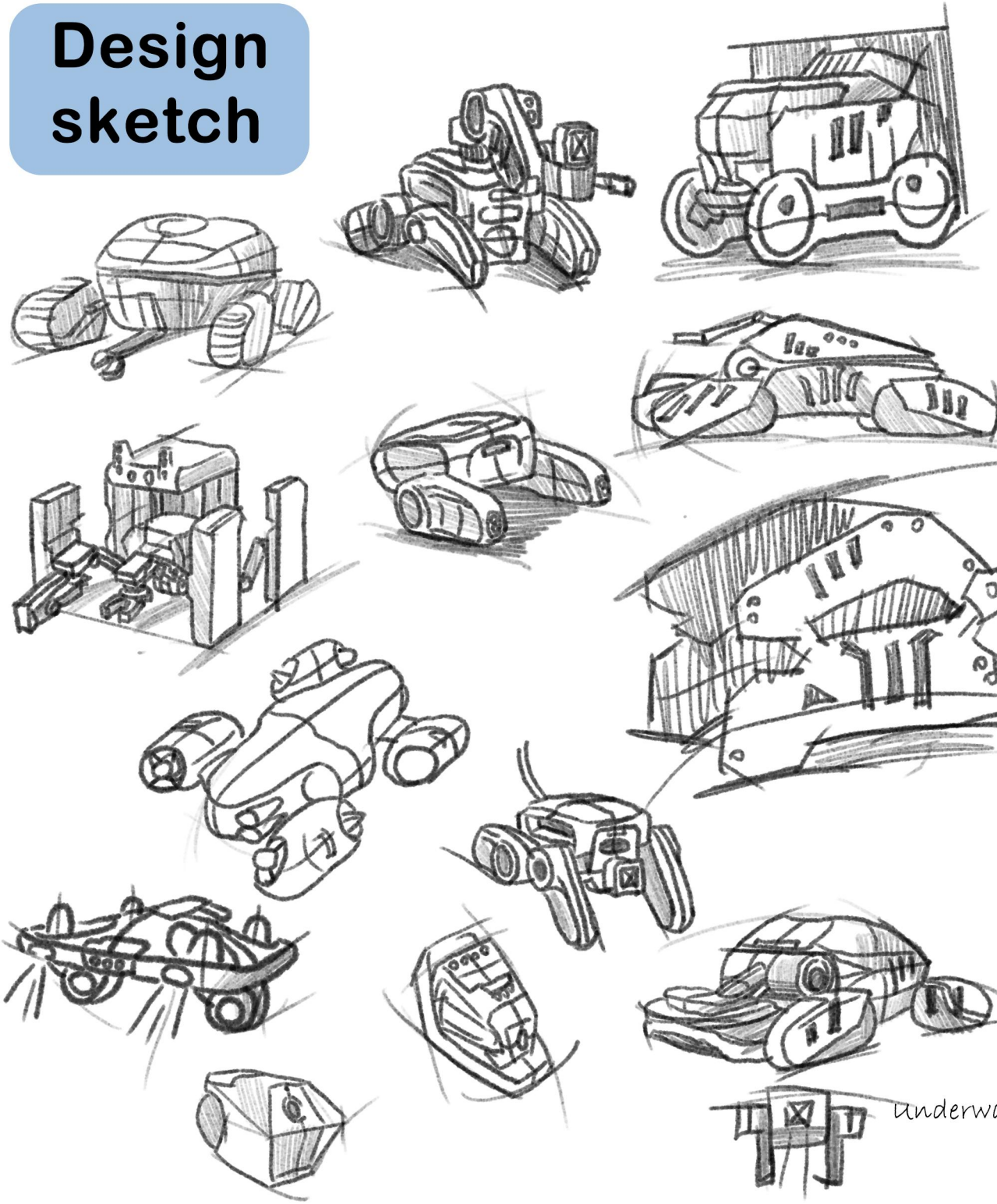
Low degree of automation

High labor cost

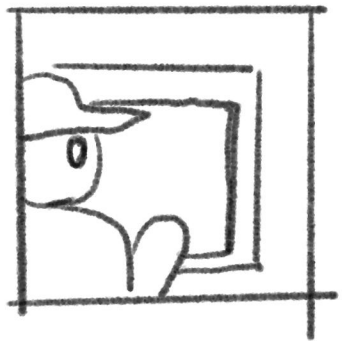
Security risk

Low efficiency

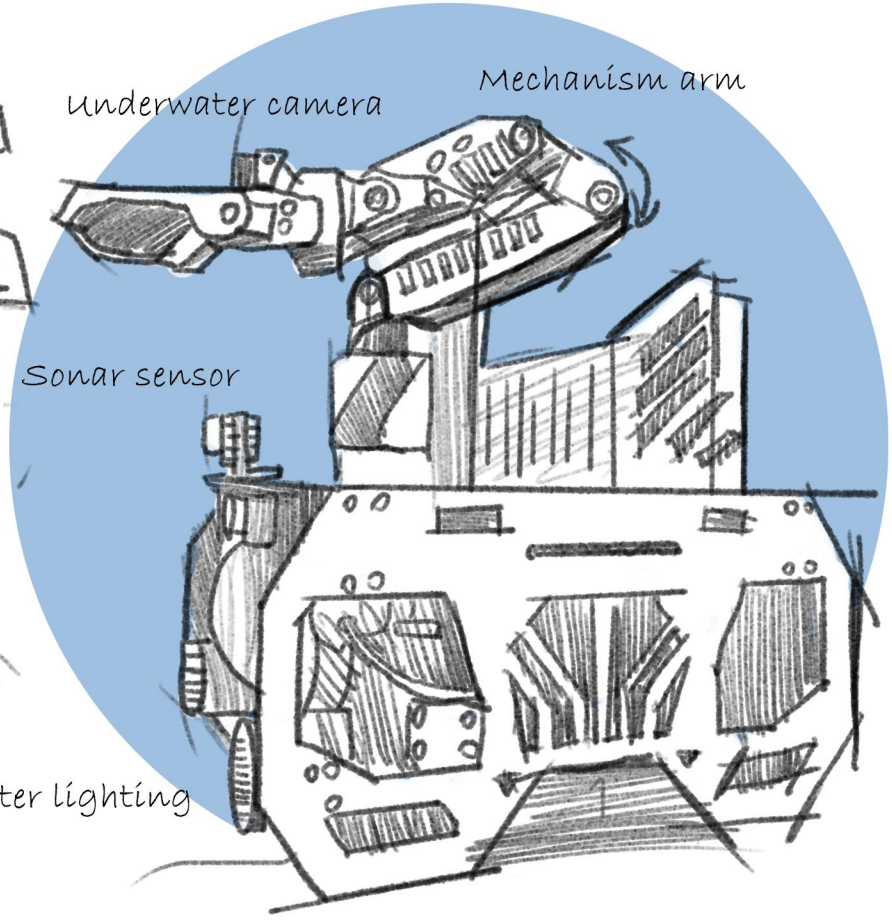
Design sketch



Underwater operations

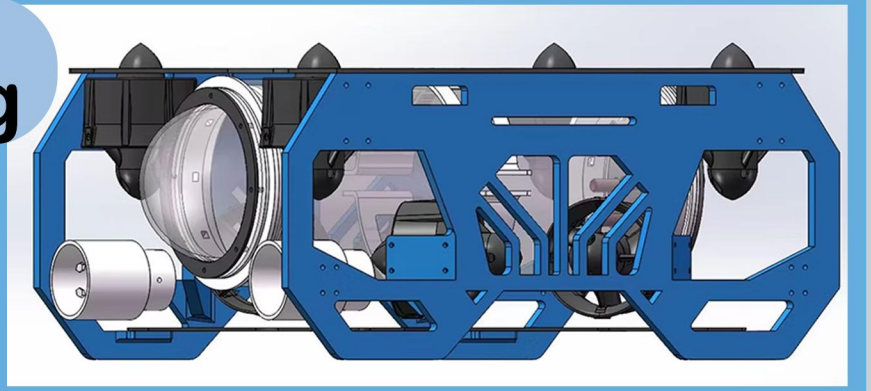


Remote operation from shore



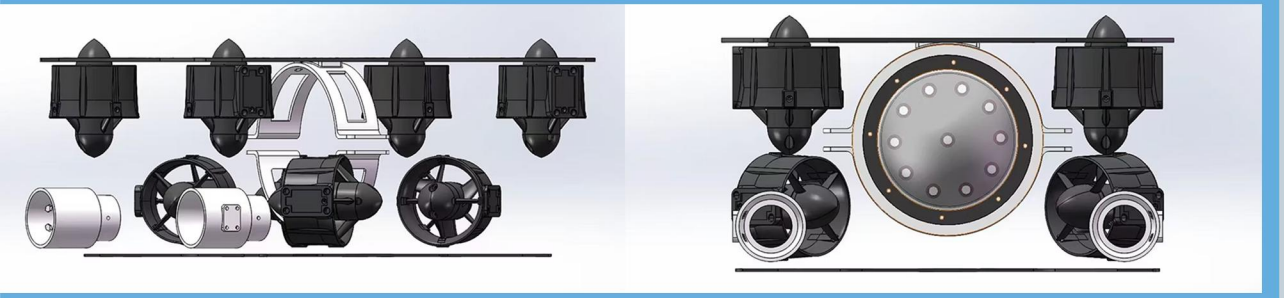
CAD modeling

Soilworks



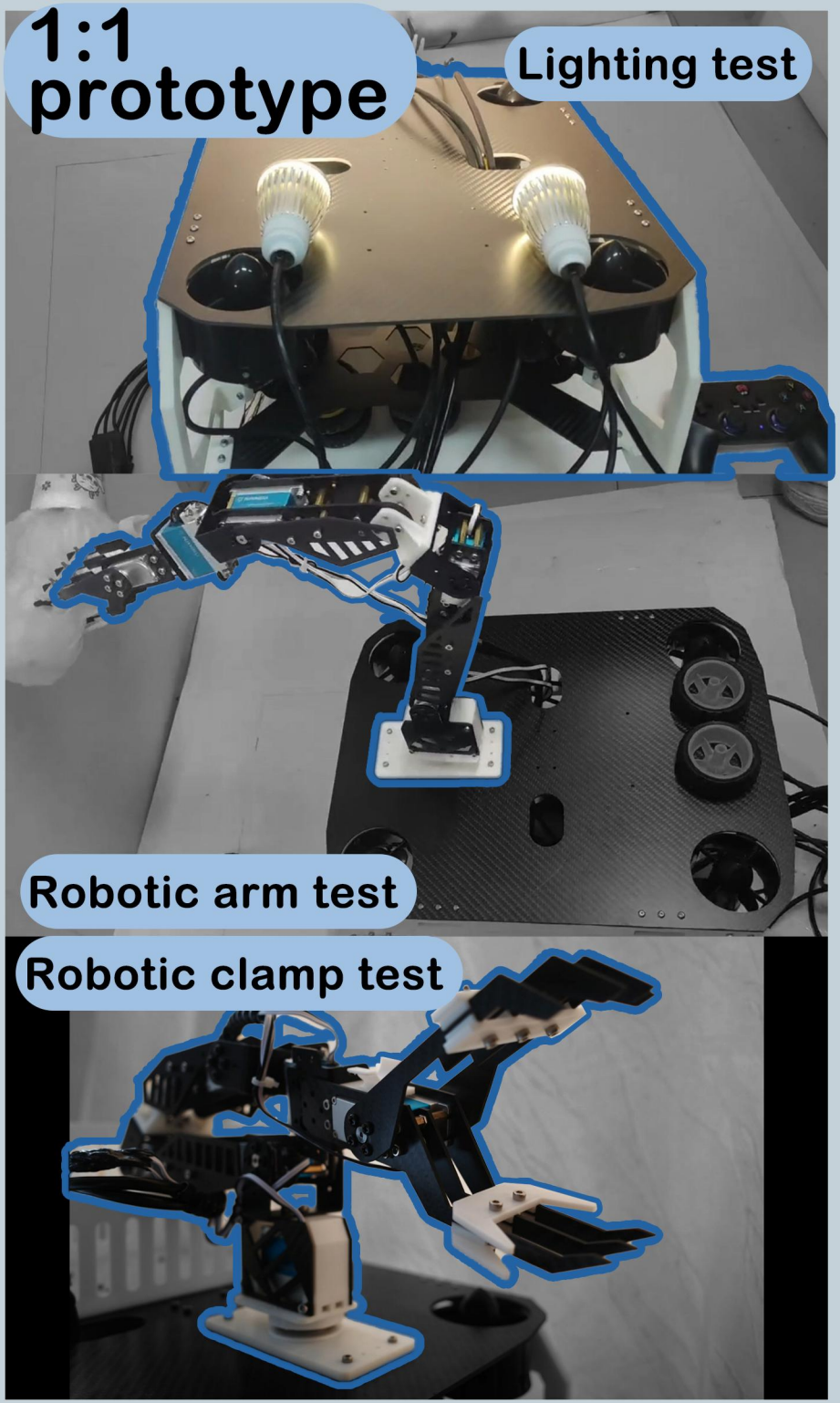
Robust structure

Propeller part



Prototype making

1:1 prototype

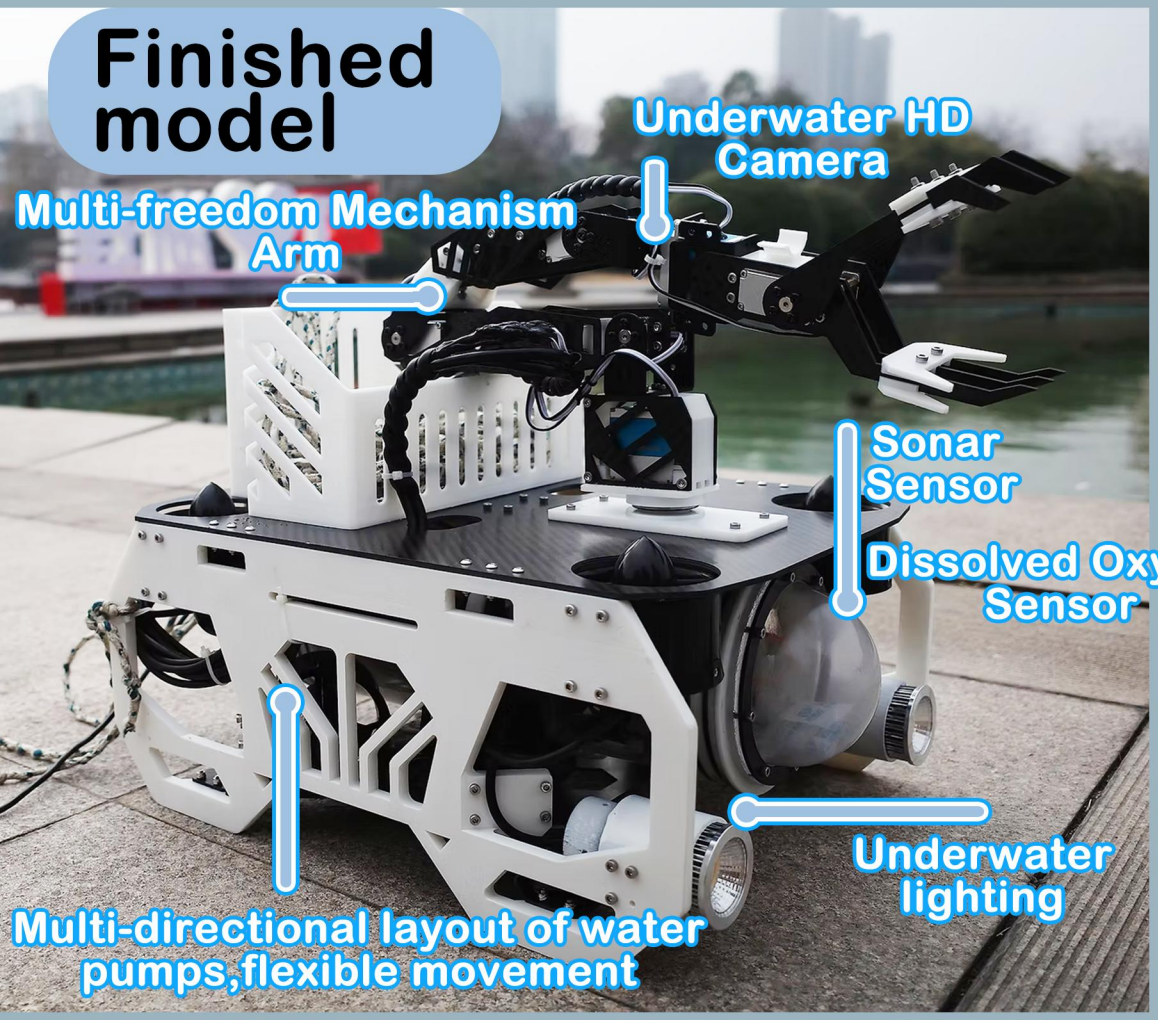


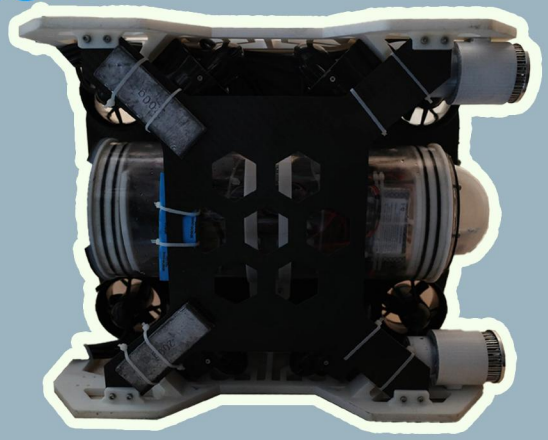
Lighting test

Robotic arm test

Robotic clamp test

Finished model





Bottom view

Field trials

Project video link: https://vimeo.com/1118042112

Field trials are crucial for understanding the robot's real-world performance and adaptation in complex marine conditions. Our innovations are validated through lab tests, field trials, and ongoing development, ensuring reliability and providing a foundation for continuous refinement.

3D-Printed Adaptive Assistive Devices

Project Medium: 3D Pringting
Soildworks Fusion360 CNC Procreate

Background

We interviewed more than ten individuals with upper-limb or single-arm disabilities to better understand their daily lives, hobbies, and needs.

Face to face interviews with disabled individuals in public welfare activities organized by the Disabled Persons' Federation

Through these interviews and research, we identified two major challenges in the daily lives of people with disabilities.

Cooking

Manicure

Insight

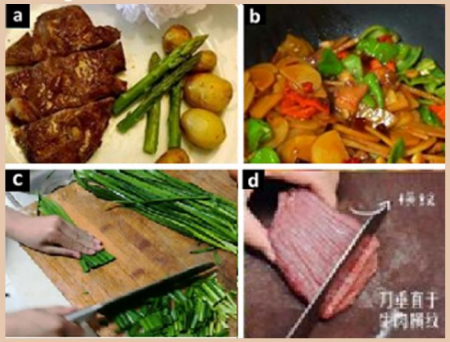
People with disabilities struggle to cook one-handed. Most aids need two hands; China lacks specialized tools, and foreign ones suit only coarse Western cutting, not Chinese fine cooking. Serving is also difficult： heavy pots and sticky dishes make the process slow and inefficient.

Comparison of Cooking Processes

Design development

Market research

Prepare dishes



(a) Western grilled dishes
(b) Chinese stir fried dishes
(c) Chinese sliced dishes
(d) Chinese sliced meat

The left cutter slices frozen meat (guillotine-style). The right presses tuber veggies (e.g., potatoes) & adjusts to slice/strip/shred with blade changes. Easy for able-bodied users, but these cutters require two hands, making them unsuitable for one-armed users.

Foreign vegetable cutters designed for one-armed users cut pieces too large for Chinese cooking.

lid opener

Most lid openers require two hands, making them difficult for people with upper-limb disabilities to use.

After finishing the dishes

A foreign charity showed a serving device for one-armed users, but it was bulky, impractical & never commercialized; no similar solution exists in China.

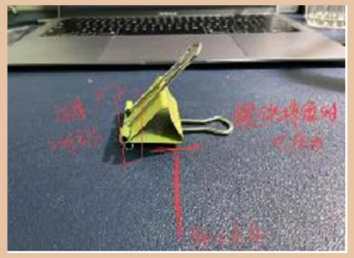
Manicure

Electric nail clippers still require two hands to operate.

Existing one-handed nail clippers remain unsuitable for people with disabilities.

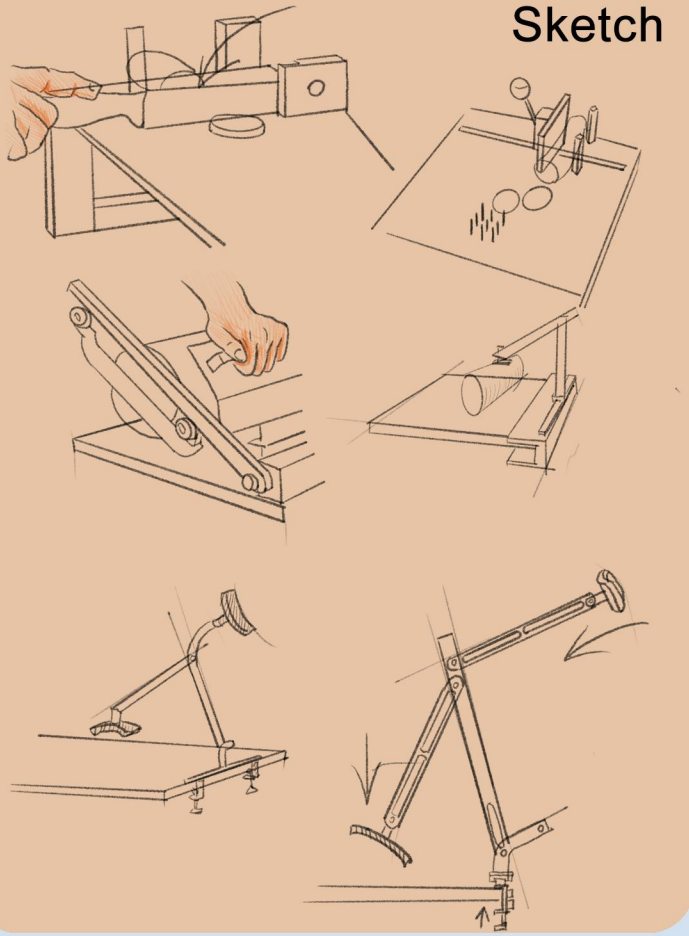
Design development

Food cutting aid for the disabled

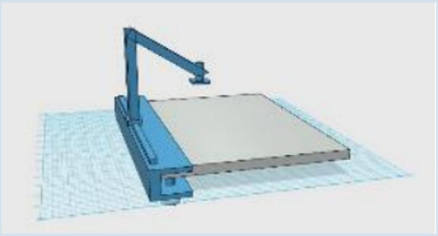


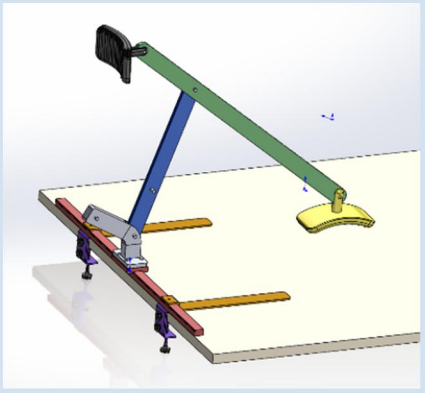
Design concept mechanical reference

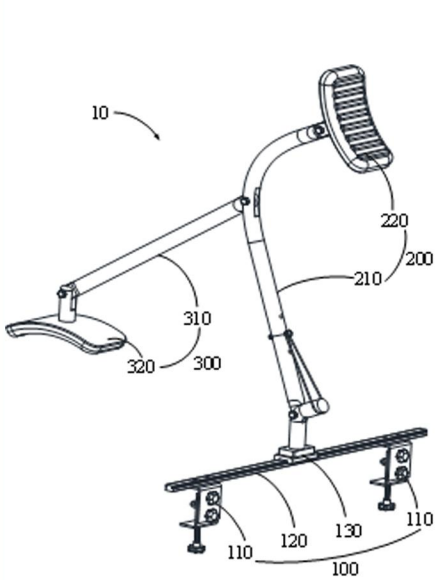
Sketch

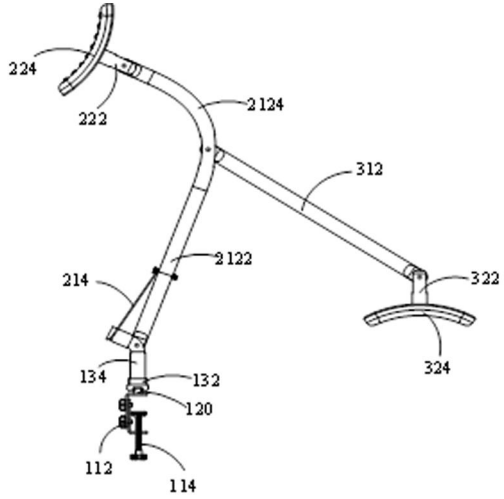


3D modeling iteration

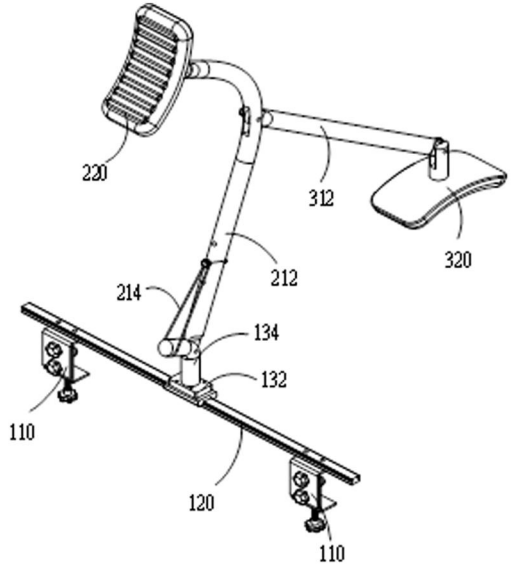








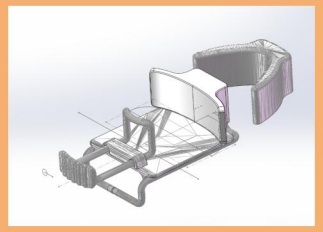
100-aid base 110-base clamping structure 112-U-shaped clamping plate 114-clamping screw120-base slide rail130-base support seat132-base block134-base support column200-pressing support structure210-support rod structure212-support rod body2122-support main rod2124- support top rod214-elastic connecting piece220-shoulder pressing seat222-pressing con necting seat224-arc-shaped pressing plate300-food pressing structure310-press- ing rod structure312-pressing oblique rod320-pressing head322-pressing head con- necting seat324-pressing head plate.

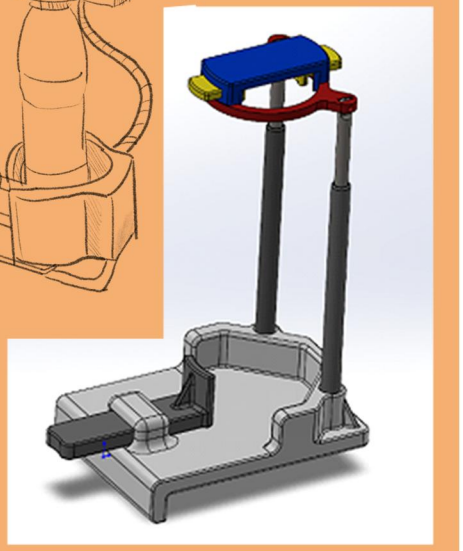


Design development

Bottle opener

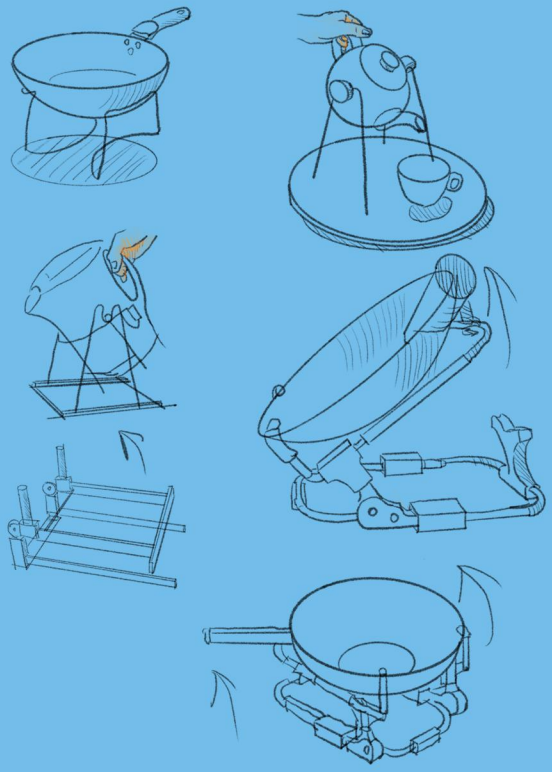
To open a bottle: put opener on table edge, push arm with body to fix bottle, clamp cap, rotate arm to unscrew.

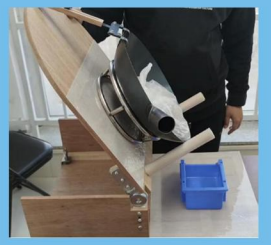


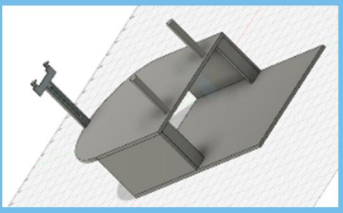


Software Modeling

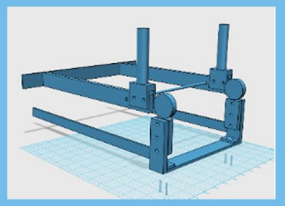
Food serving aid







1st serving adid:stable & hoverable, but big/heavy, non-foldable



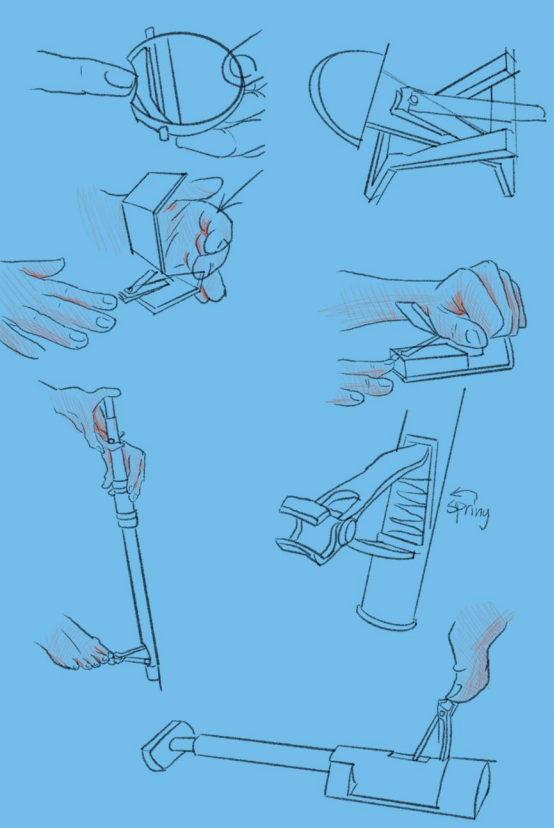
2nd serving aid model : metal frame lighter, fixed to table/wall, stabler

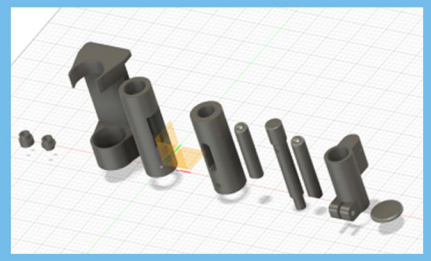
Software Modeling

3rd model improves 2nd: 3 posts fold, table-ware telescopes (balance, storage)

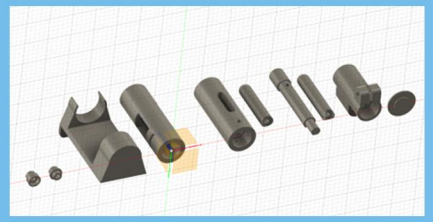
Design development

Nail clipper





Universal hand-foot nail clippers: adjust-able handle/angle, one-handed use, fit disabled with bent fingers



Software Modeling

3D printed prototype

Testing and feedback

Food cutting aid for the disabled

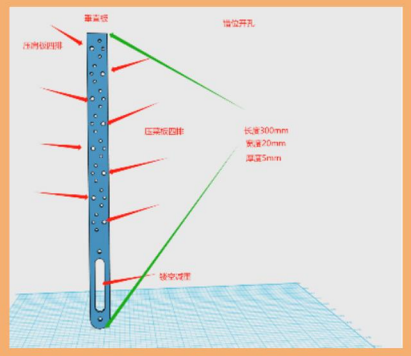
Food cutting test

We received valuable feedback regarding the adjustable heights of the shoulder plate and cutting board, as well as the one-button quick release of the cutting head, both of which we have optimized.

Testing and feedback

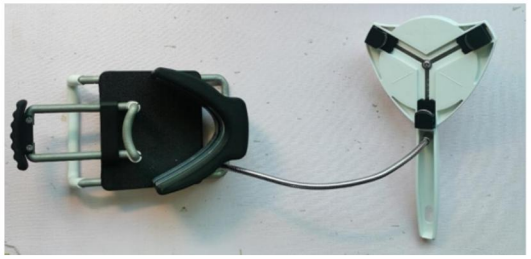
Food cutting aid for the disabled

To allow height adjustment of the vegetable cutter, we added a row of screw holes on the vertical support plate so the shoulder and pressing plates can be fixed at different levels. For quick release, we adapted a digital camera quick-release plate at the connection point, enabling simple one-click disassembly and installation.



The final design

Bottle opener



We invited several people with hand disabilities to test the device.

With the bottle opener, users could easily open common caps such as medicine bottles, water bottles, and jars.

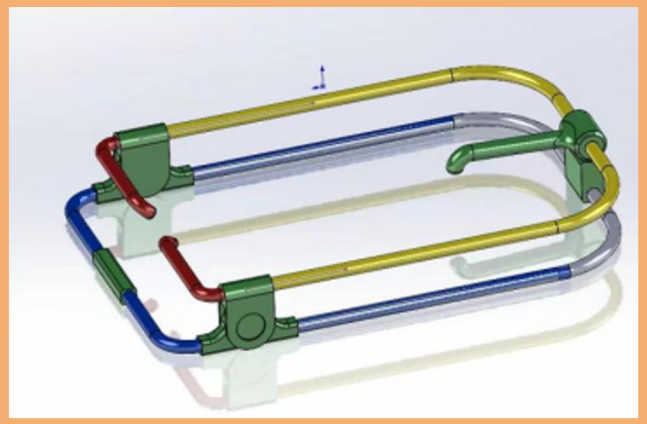
Nail clippers

After using our product, this disabled person was able to cut his own nails for the first time.

Adjustable length

Testing and feedback

Food serving aid



The model's feasibility was first verified through CNC machining (non-green parts shown) and 3D printing (green parts). Later, the 3D-printed sections were replaced with stainless steel to improve strength and durability.

1.More than ten people with disabilities tested the product, giving positive feedback and unanimous praise.
2.A patent application for this device was submitted and accepted.
3.To expand the solution, we plan to develop additional devices tailored to users' needs, such as tools for opening bottles, handling seasoning, and retrieving items.

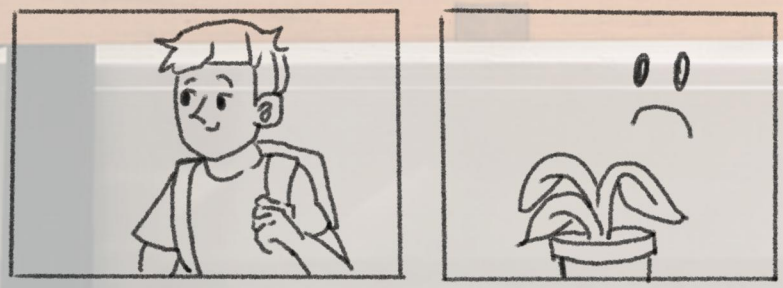
Project video link: https://vimeo.com/1117114401

Smart watering pot

Project Medium
Arduino
3D Printing
Rhino
Keyshot

Plant cultivation has always been a challenge for me, and I believe many others face similar difficulties.

No experience in judging moisture



Long-term travel, unable to water in time

Market Research

Drip Irrigation Bottle

Watering ✓

Soil moisture detection ✗

Soil Moisture Meter

Watering ✗

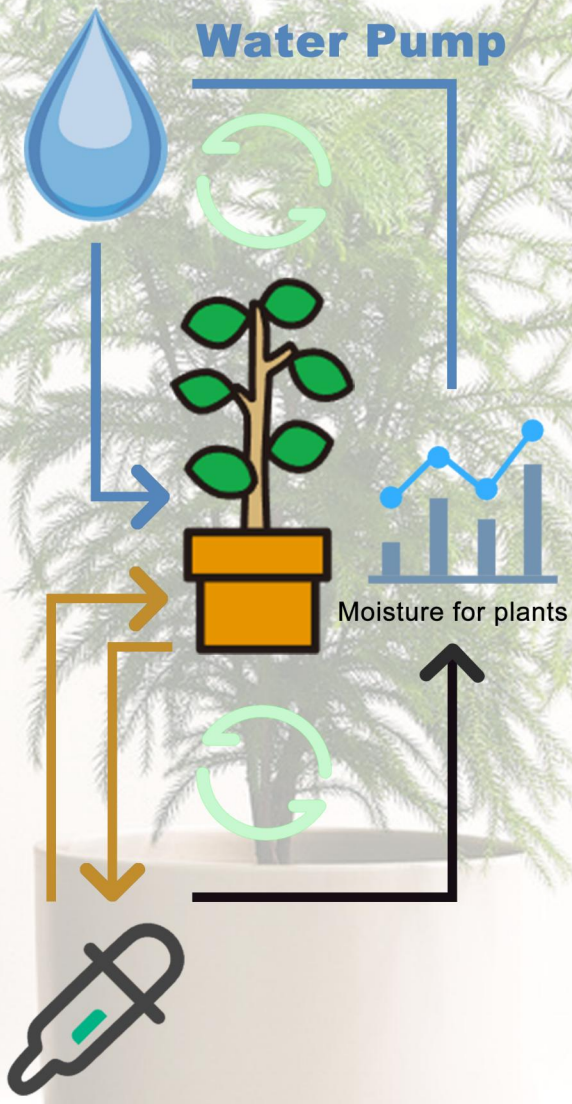
Soil moisture detection ✓

Smart Pet Planter

Watering ✗

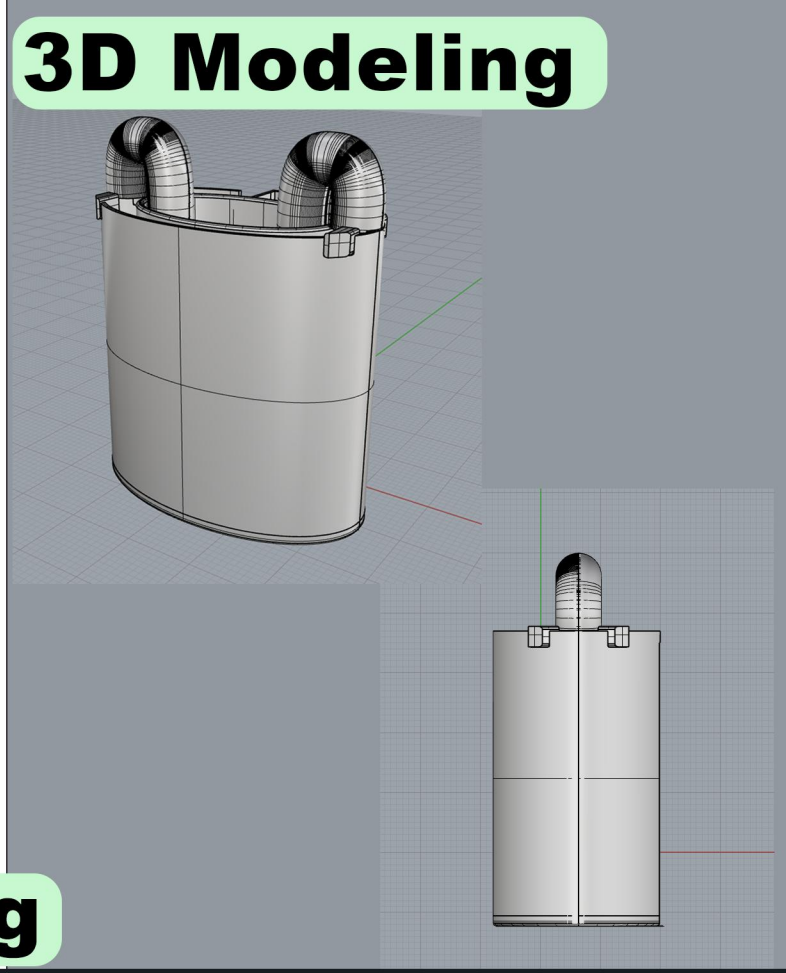
Soil moisture detection ✓

Design goals

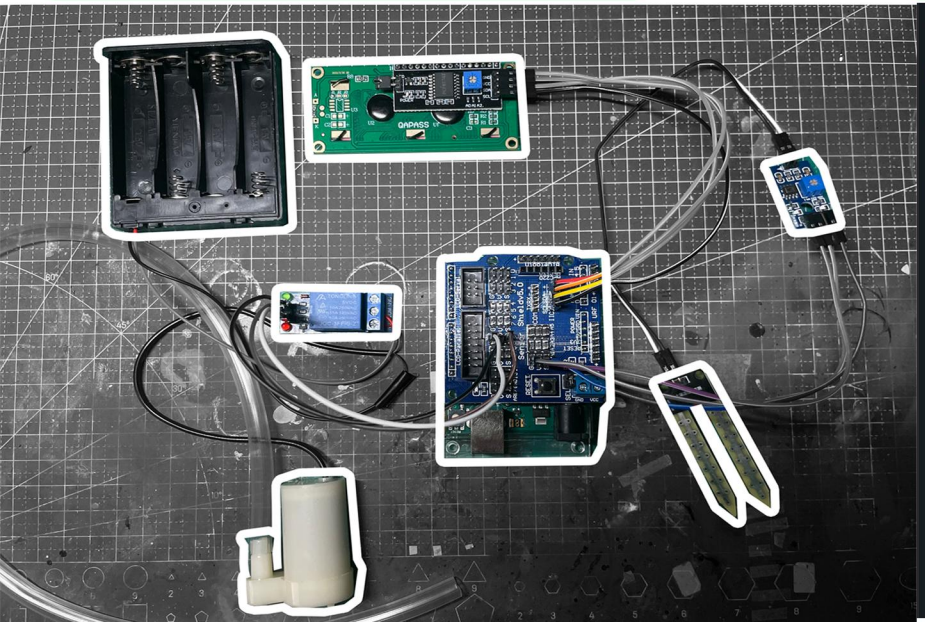


Pot Sketches

3D Modeling



Arduino Parts



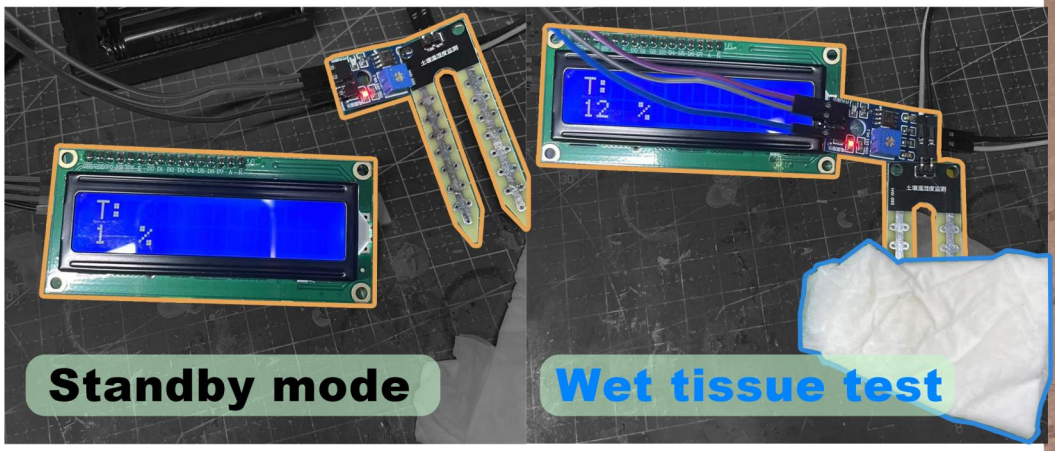
Code Writing

Arduino Uno

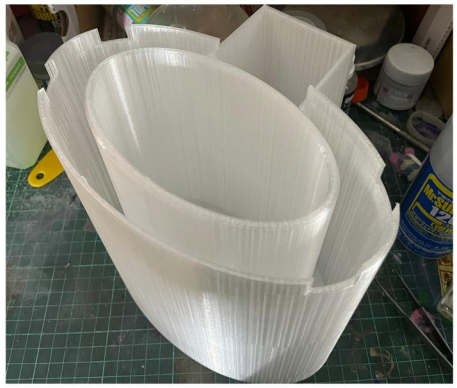
watering.ino

```
#include <LiquidCrystal_I2C.h>
#include <Wire.h>

LiquidCrystal_I2C mylcd(0x27, 16, 2); // Set the display address

void setup(){
  Serial.begin(9600); // Set baud rate to 9600
  mylcd.init(); // Initialize the display
  mylcd.backlight(); // Turn on the backlight
  pinMode(8, OUTPUT); // Set pin 8 (connected to relay) as an output
}

void loop(){
  mylcd.clear(); // Clear the screen
  mylcd.setCursor(0, 0); // Set the cursor at position 0, 0
  mylcd.print("T:"); // Display "T:"
  mylcd.setCursor(0, 1); // Set the cursor at position 0, 1
  mylcd.print(String(round(map(analogRead(A0), 0, 1023, 100, 0))) + String("  %")); // Map soil value from 0-1023 to 100-0 and display it
  delay(500); // Delay for 0.5 seconds
  if (analogRead(A0) < 1000) // If the value read from A0 is less than 100
  {
    digitalWrite(8, LOW); // Set pin 8 to LOW
  } else { // Otherwise
    digitalWrite(8, HIGH); // Set pin 8 to HIGH
  }
```

Moisture test

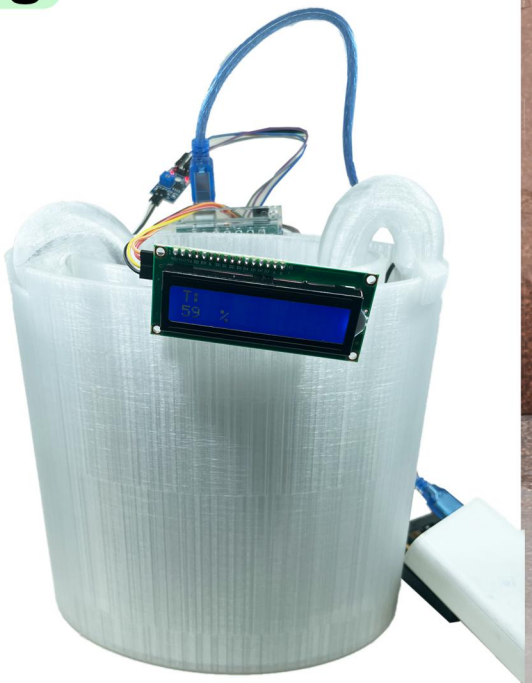


Prototype testing



1:1 FDM Printing

Soil moisture test



Printed pot integrates soil moisture detection with a water pump.

Rendering

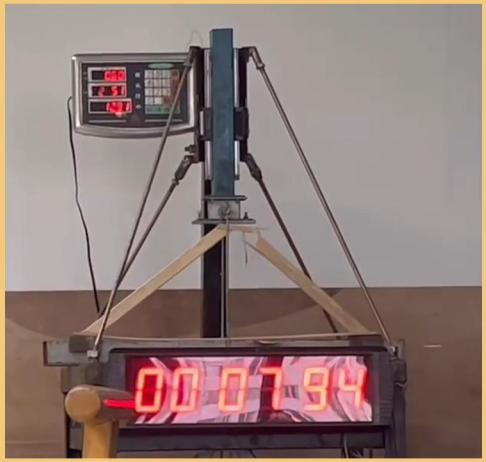
Designing Resilience:
A Journey in Bridge Modeling
&
Structural Exploration

Founder & President, Structural Engineering Club

Presenting bridge prototypes to younger students

I am working hard on a bridge model

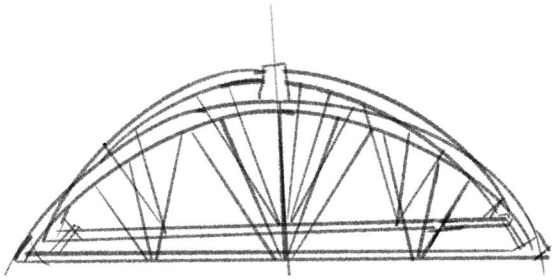
Bridge load test

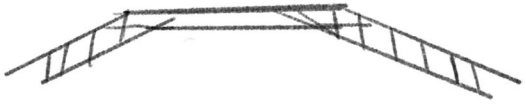


https://vimeo.com/1118665975

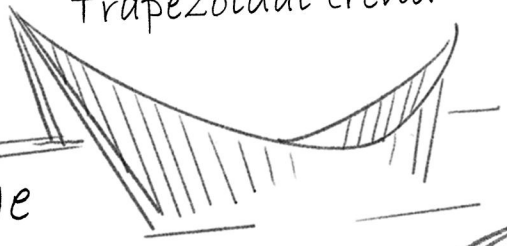
https://vimeo.com/1118662301

Design Ideation

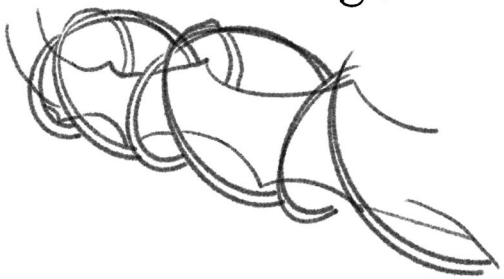


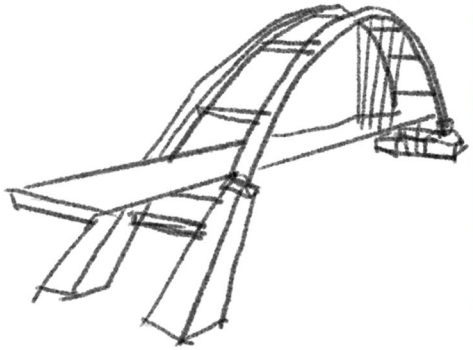


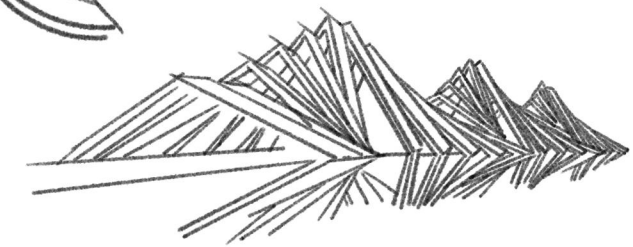
Trapezoidal trend

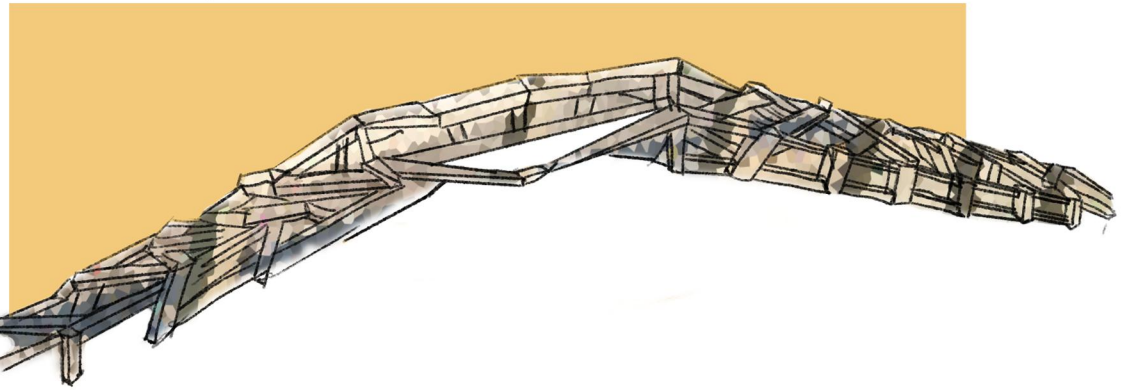


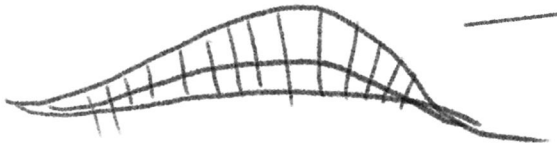
Ring Bridge

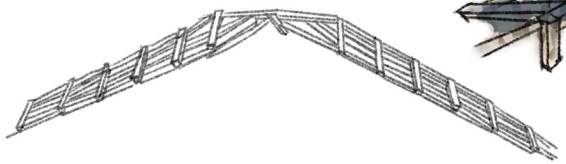




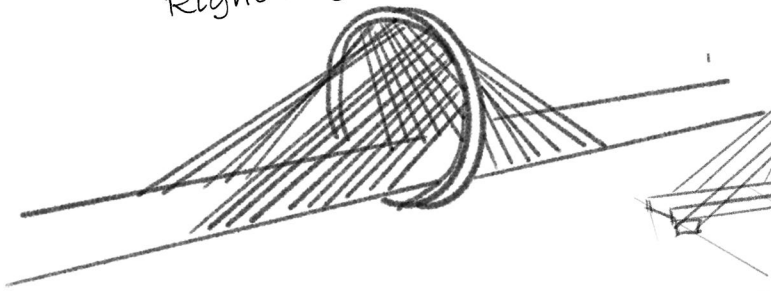


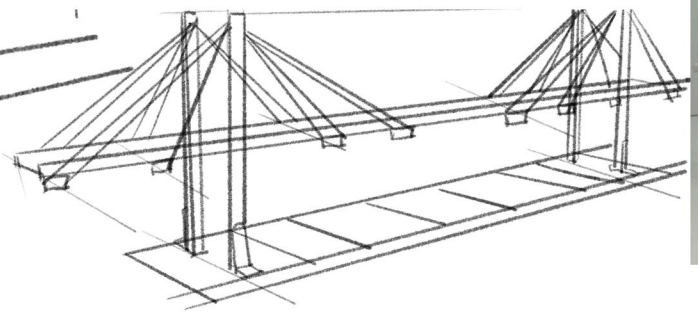


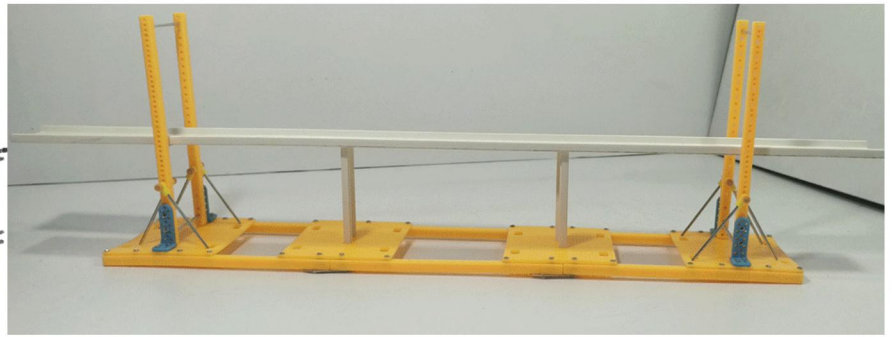




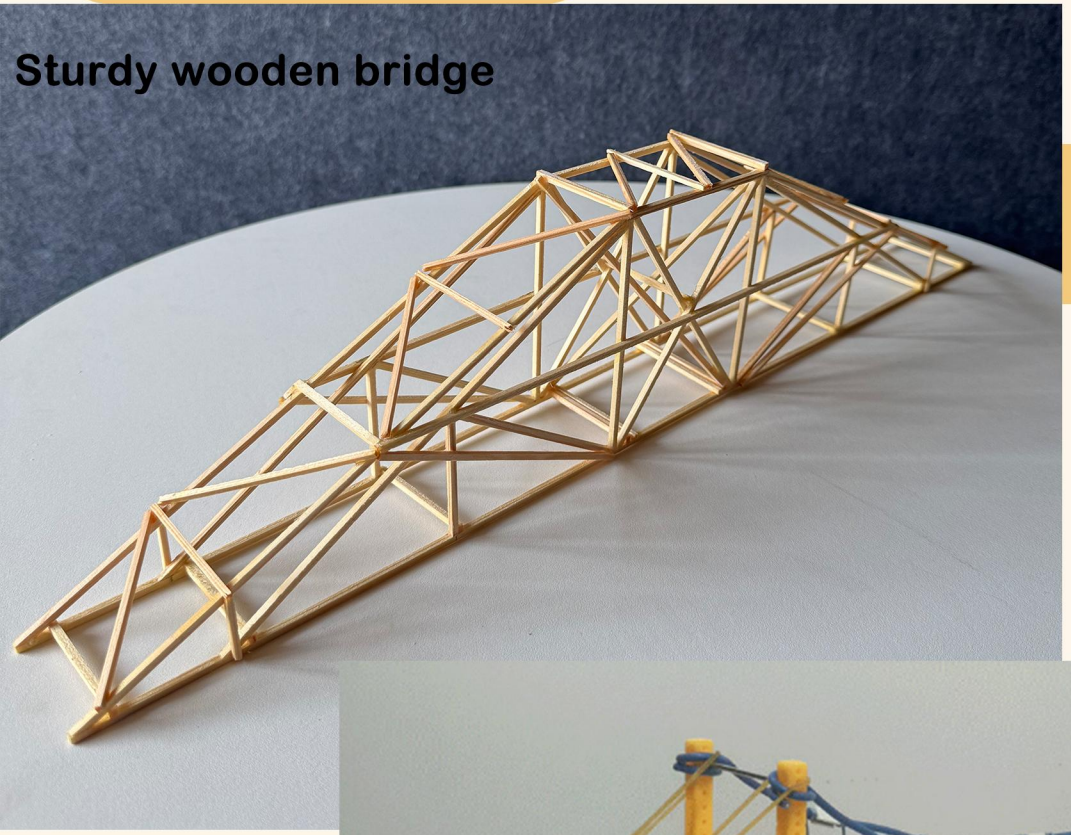
Right-angle bridge

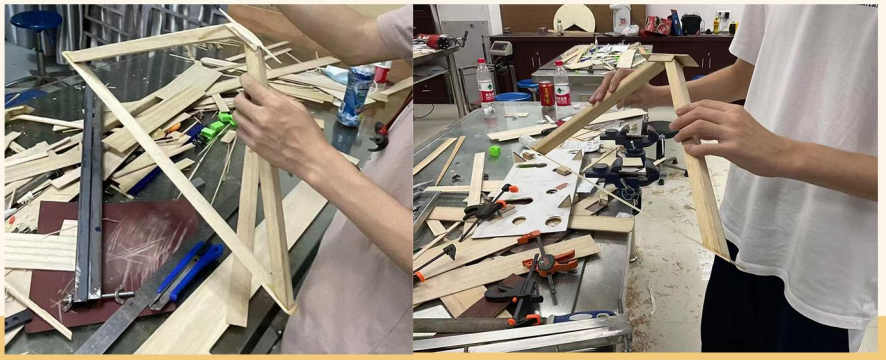


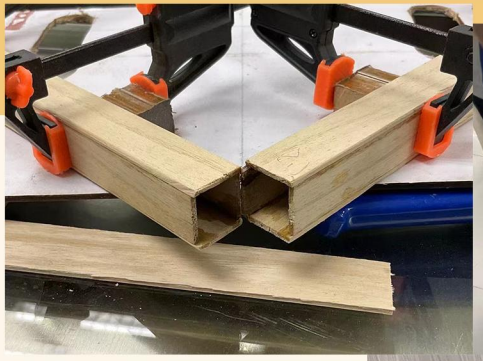




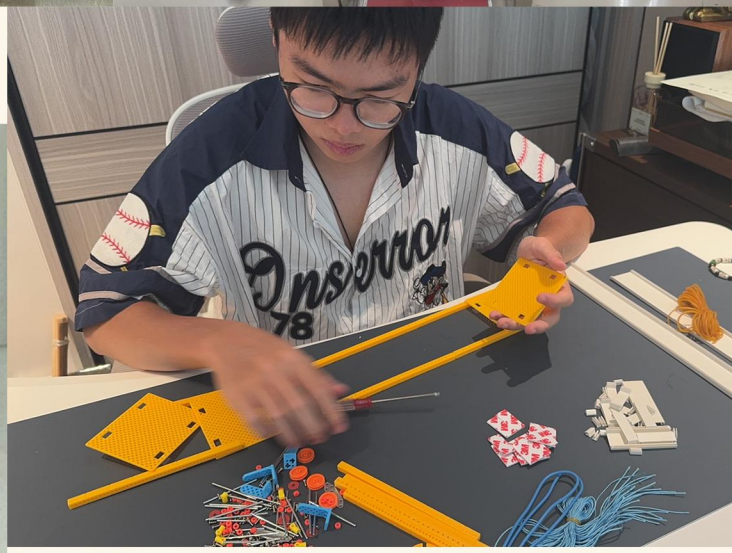
Outcomes







Stress testing

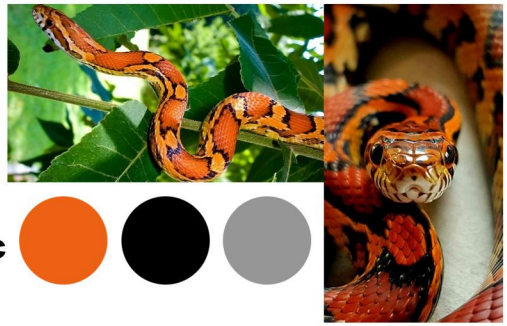


I combine a variety of materials to balance structural integrity with visual appeal.

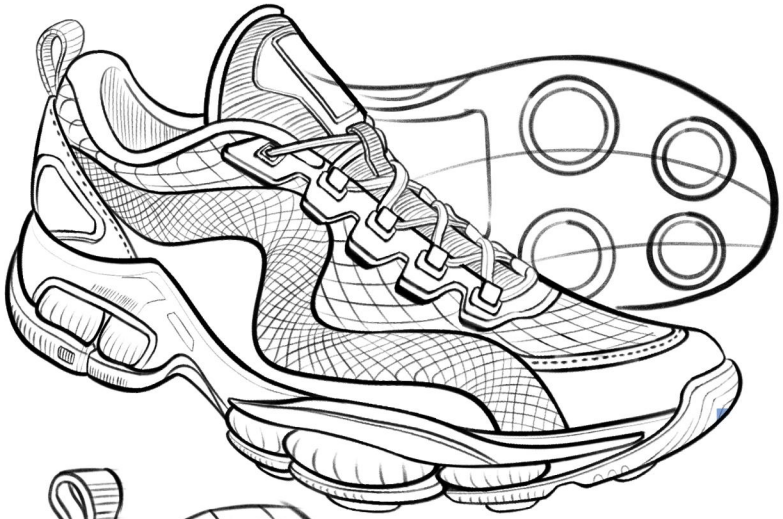
Sturdy acrylic bridge

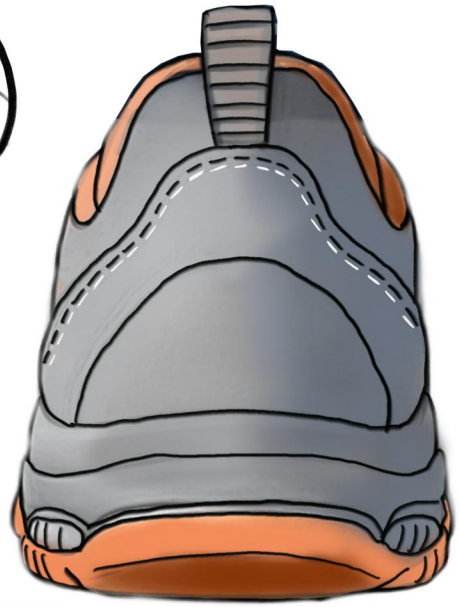
Sneakers

Bionic design of sneakers



Keywords: Flexible Agile Iconic

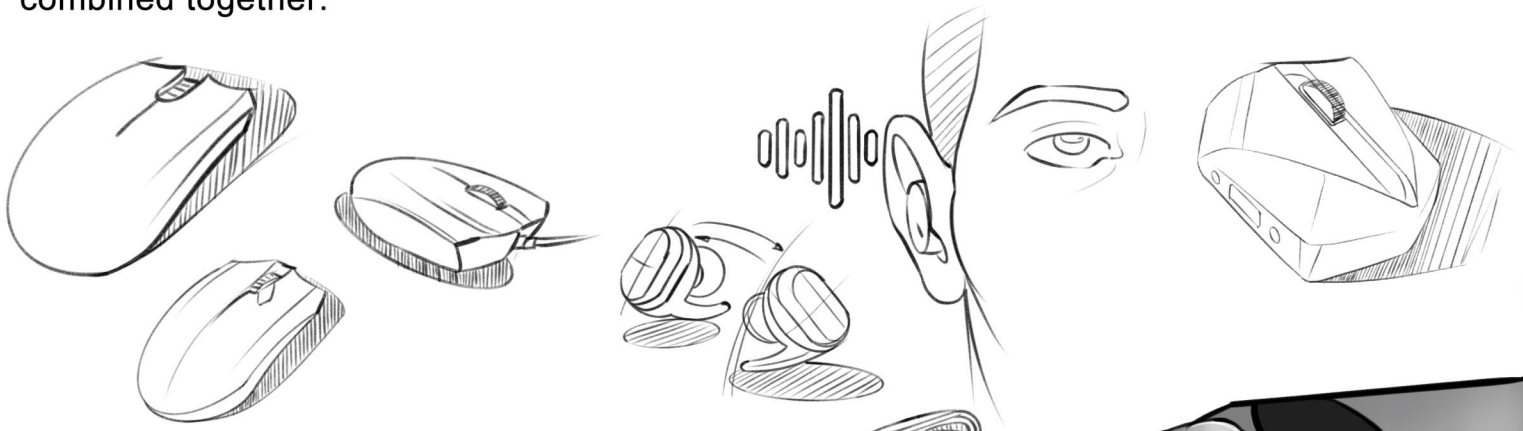


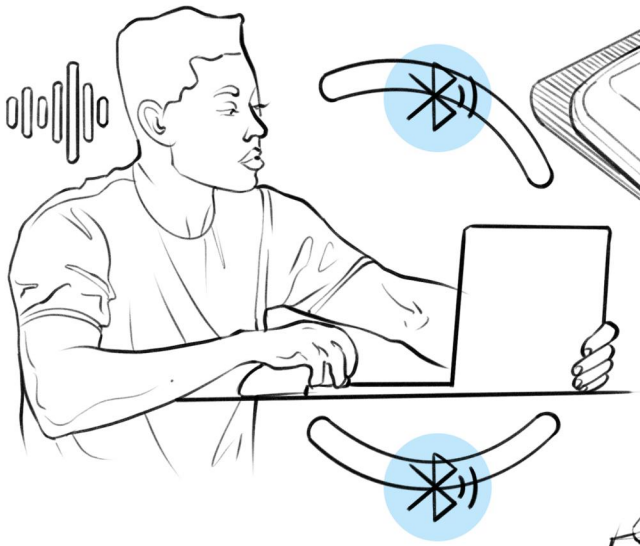


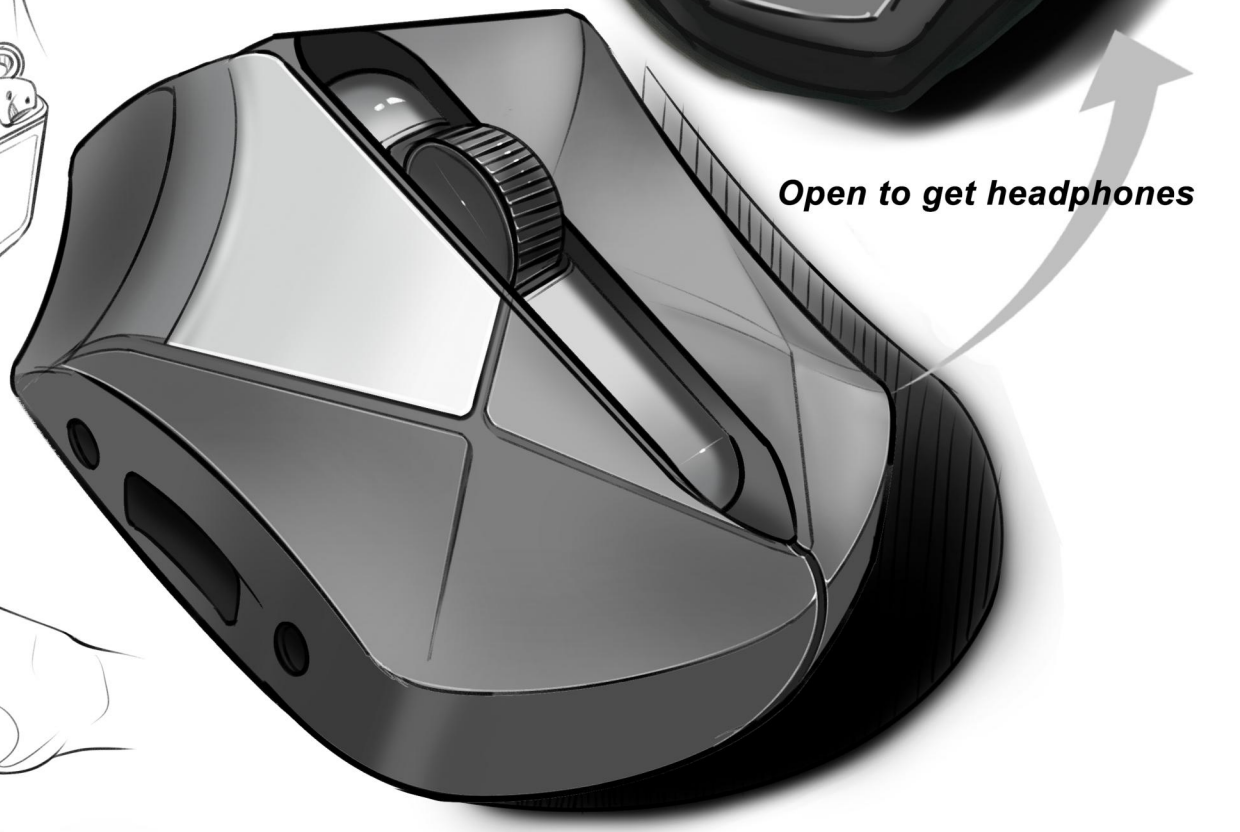
Bluetooth headphone-mouse design

Brief: Combine two products with similar usage scenarios.

I have observed that when we use laptops for remote classes or meetings, we need a Bluetooth mouse and wireless headphones (Charging Case) and these two products can be combined together.







Dyson Motorcycle

Concept Automotive

Extract elements
based on classic design