

WOOJAE KANG

I am an interaction designer based on product design, particularly drawn to physical interactions, such as those experienced during physical activities. I want to provide a vivid and natural user experience while using the tangible product. For that I'm highly enthusiastic about exploring daily interactions like pushing buttons, lift boxes, etc. Additionally, I often adjust the responsiveness and sensitivity of electronic devices, express speed through color, and provide auditory feedback. By utilizing synesthetic expressions, I hope to share users with new and immersive experiences.

My work involves exploring user-centered design thinking and conducting user research, based on experience during physics major and knowledge in electronics, various technologies, physics, and engineering.

In the current era where virtual and physical realities intertwine, such as with XR, specialized products designed to specific situations are emerging beyond just smartphones. Physical interaction experiences are being realized through a variety of devices like Google Glass and smartwatches. I would like to share and communicate the experiences I enjoy through tangible interaction products which are specialized in certain contexts.

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EXPERIENCE

JAN 2024 - JUN 2024
SUWON, KOR

RFFL Design studio Industrial designer
Ai generating architecture concept rendering.
Series of products for TheWaveTalk water Turbidity Meter.
Custom 3D printing path for lamp shade.

MAR 2023 - SEP 2023
COPENHAGEN, DK

Johannes Torpe Studio Industrial designer Intern
New series of high-end refrigerators for Haier.
New series of lighting products for Leucos.
Bathroom products for Copenhagen Bath.

SEP 2020 - JUN 2022
LONDON, UK

Royal College of Art(RCA)
MA Design Product, Platform : Design through Making

APR 2020 - AUG 2020
SEOUL, KOR

HealthyBros. product designer
Design new home gym equipment.
Test and further develop existing home gym products.

SEP 2018 - NOV 2018
BARCELONA, ES

Fablab Barcelona Intern in education department
Maintain and operate machines:CNC, 3d print, laser cut.
Design and create display panel for Science Museum.

DEC 2017 - MAR 2018
DAEJEON, KOR

Kaist 'My design lab' X 'Sherpa' Intern
'My design lab' in prof Dannie Saakes, KAIST Korea
Design home cultivator. Making quick real size mock-ups and prototype.

JUL 2014 - APR 2016
HONGCHEON, KOR

Military service in Republic of Korea Army
Tank mechanic, Rank : Sergeant

FEB 2011 - FEB 2014
DAEJEON, KOR

Korea Advanced Institute of Science and Technology (KAIST)
PHYSICS MAJOR



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S - DUMBBELL

Many people have come to understand the importance of proper exercise form and targeting the right muscles, but many still don't know the importance of exercise tempo.

According to research "Muscle Fiber Type Transitions with Exercise Training: Shifting Perspectives" by Plotkin**, ratio of muscle twitch types developed can vary depending on the speed and method of training, even with the same exercise. Therefore, it is crucial to maintain a consistent exercise tempo depending on the user's goal. However, many people focus only on correct form and overlook the importance of maintaining a consistent rhythm. To address this, S-dumbbell focuses on providing feedback on the user's exercise tempo through visual and auditory stimuli, to which people are highly responsive.

**Plotkin, D. L., Roberts, M. D., Haun, C. T., & Schoenfeld, B. J. Muscle Fiber Type Transitions with Exercise Training: Shifting Perspectives. *Sports*, 9(9), 127, 2021

YEAR
2018 MAR - MAY

SOLO PROJECT

CATEGORY
EXERCISE DUMBBELL

MATERIAL
PLASTIC, LED STRIP, GYRO SENSOR

ROLE
DESIGNER, DATA ANALYSIS



as stated in Behm, D., and Sale, D.G.'s "Velocity Specificity of Resistance Training"**, "Resistance training at a specific speed will exhibit optimal gains at a similar testing speed with decreasing improvement as the testing speed deviates farther from the training speed."

SMART DUMBBELL is a speed detector that helps user's exercise tempo. Using vision interaction to indicate current speed of movement.

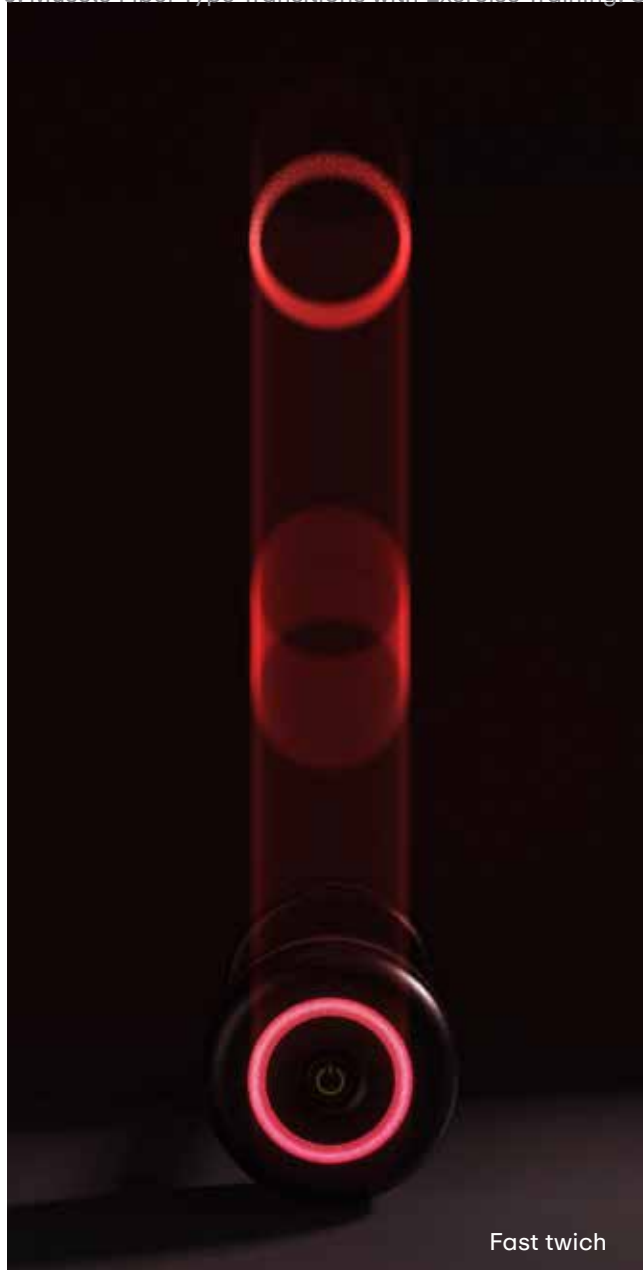
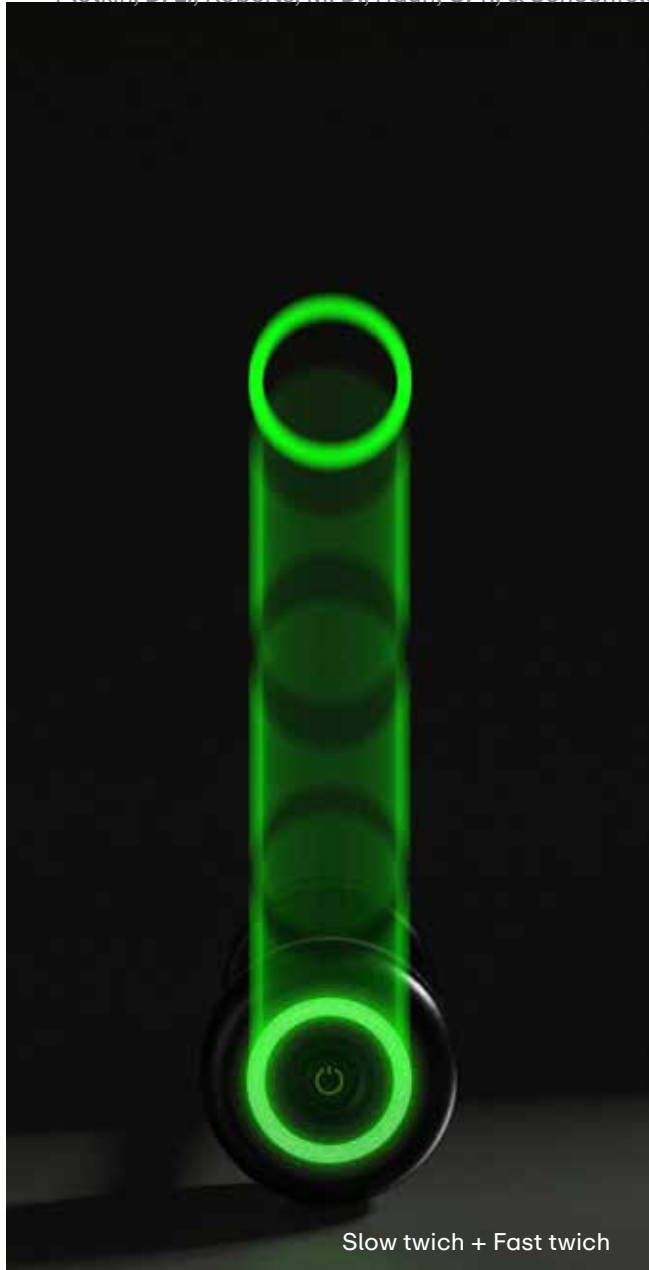
**Behm, D., and Sale, D.G. Velocity Specificity of Resistance Training, Sports Medicine, July 1993, 15(6):374-88.



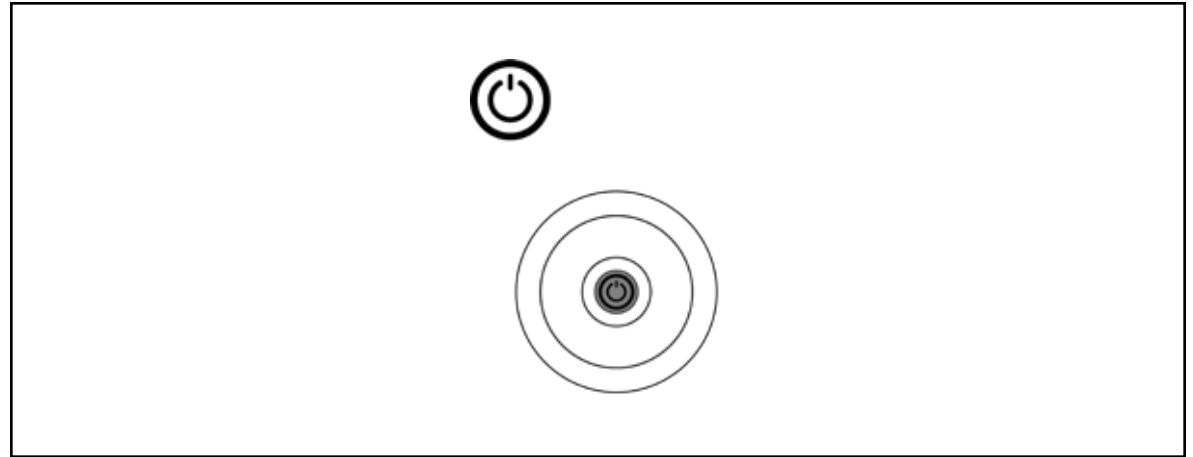
↓ Depend on exercise tempo, target muscle grows up in different type.**

The S-dumbbell changes color based on the speed of movement. The color of the dumbbell remains constant during the same tempo. Users will naturally exercise at a consistent speed if they keep the color steady during workout. Also they can notice whether they are maintaining a constant speed through a sound alarm.

**Plotkin, D. L., Roberts, M. D., Haun, C. T., & Schoenfeld, B. J. Muscle Fiber Type Transitions with Exercise Training: Shifting Perspectives. Sports, 9(9), 127, 2021

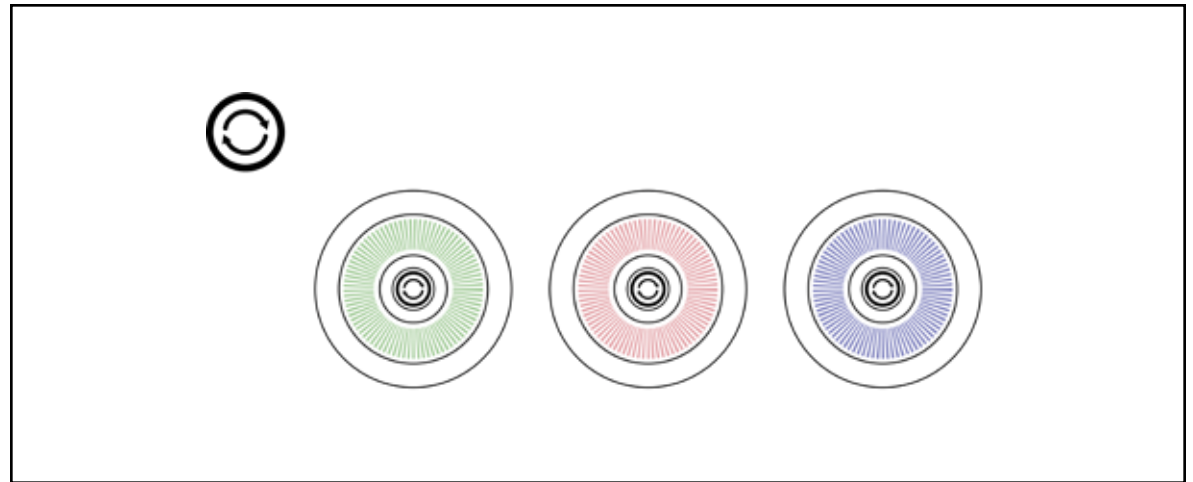


1. Press power switch long to turn on SMART DUMBBELL

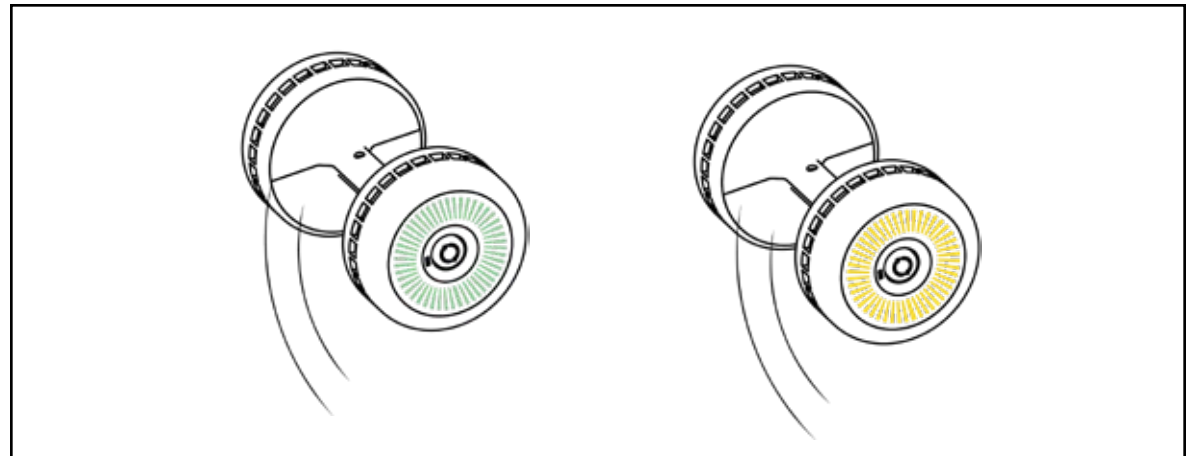


2. Select color that match your focus.

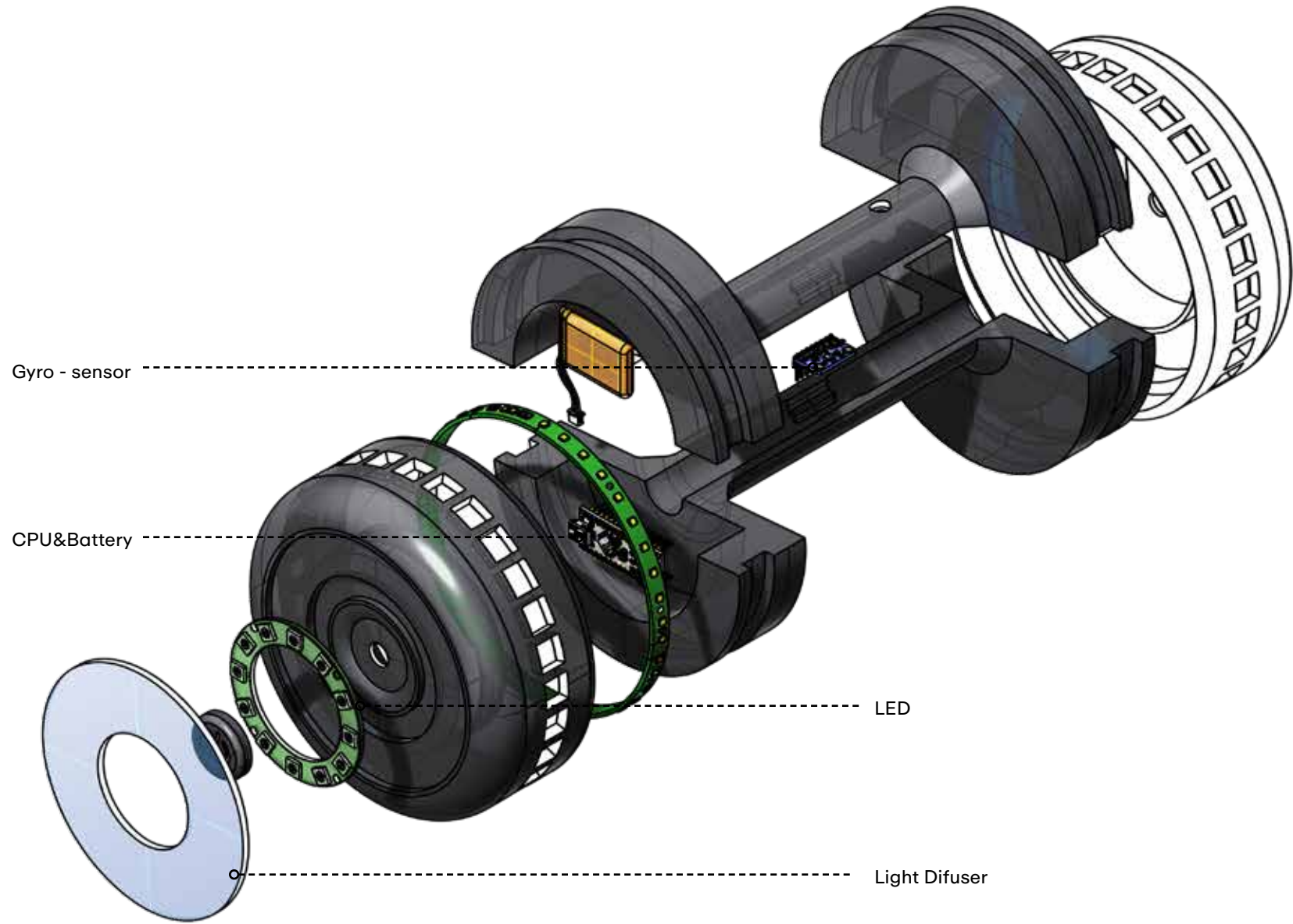
- Green - Balance (wrestling, bodybuilding)
- Blue - Strength (marathon, lead climbing)
- Red - Power (sprinting)

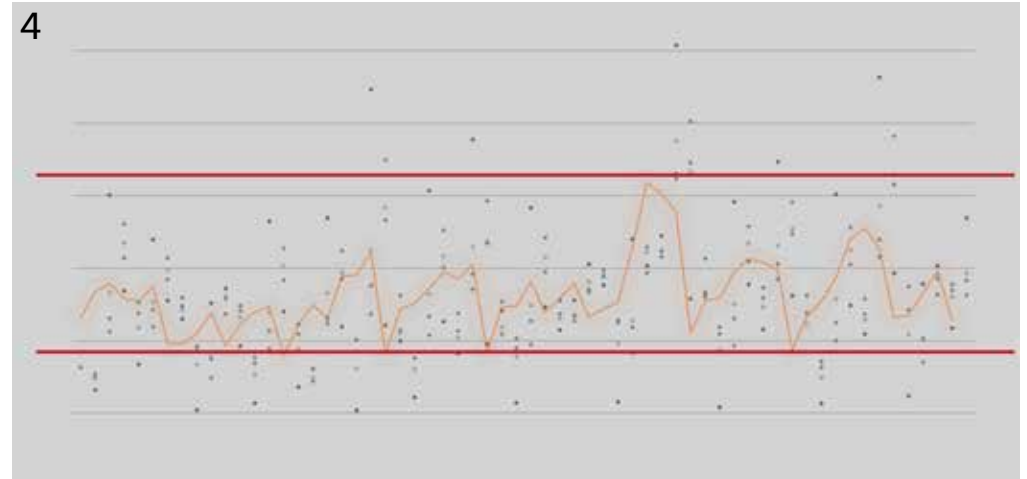
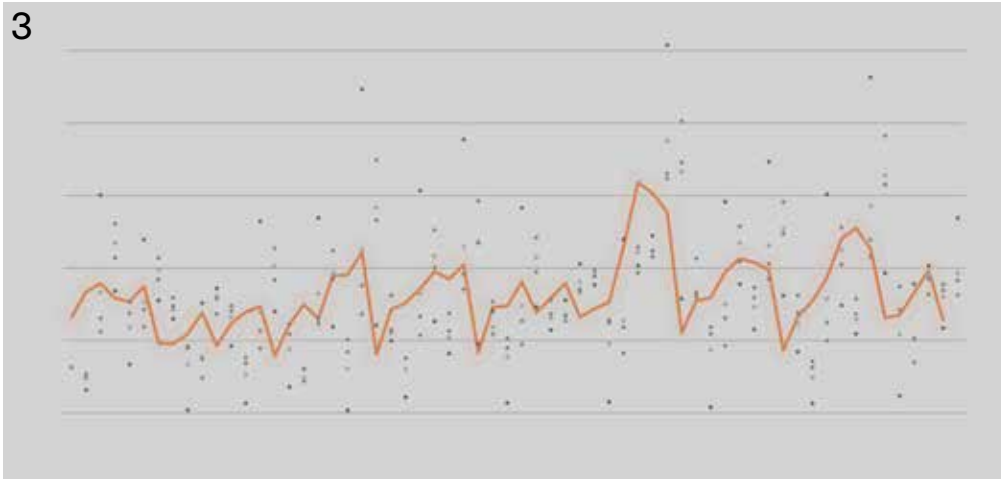
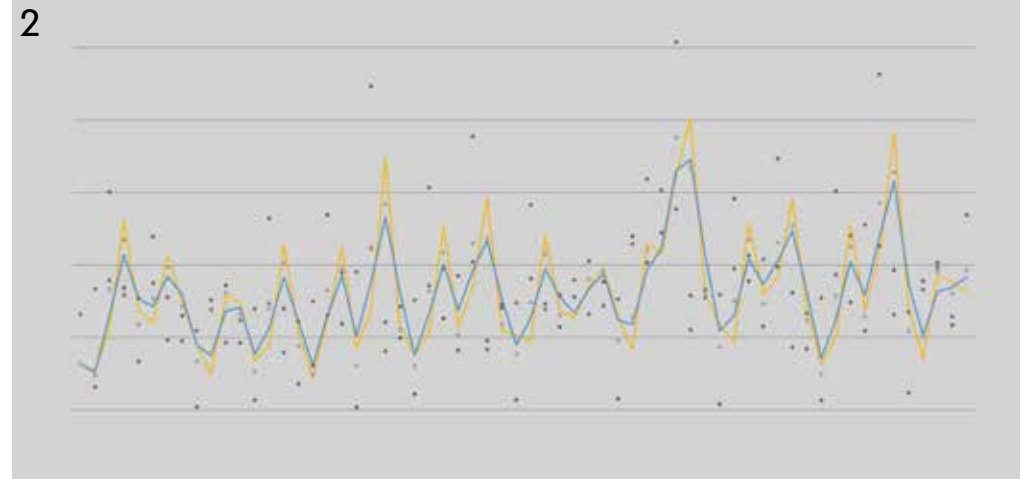
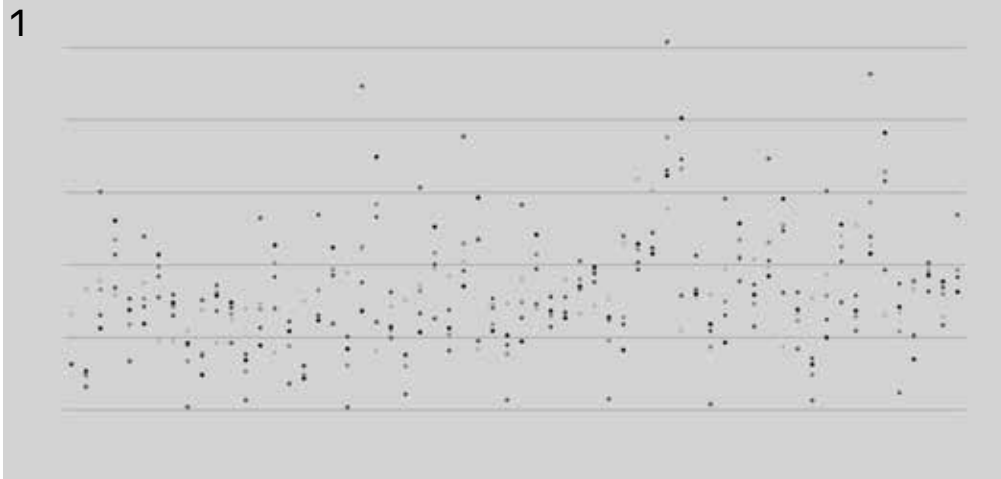


3. If you move in wrong speed, yellow light turns on.



The S-dumbbell acts as an assistant trainer, helping you exercise at a consistent tempo, which will greatly aid in improving your desired workout performance.





To obtain accurate exercise tempo data, I collected and analyzed the movement of professional sports trainers and used the average to set the exercise tempo.

Since electronic sensor always has noise, it is important to find way to smoothing raw data.

To catch noise from raw data and make bound of graph, I used two different smoothing. This algorithm will apply to raw data on dumbbell to prevent noise error.

1. Collect raw speed data.

2. Use 'Moving Average Smoothig' to reduce noise.

$$S_t = (X_t + X_{t-1} + X_{t-2}) / 3$$

3. Use 'Exponential Smoothig' to get bound of data

4. Find Maximum and Minimum speed value

$$S_0 = X_0$$

$$S_t = a * X_t + (1-a) * S_{t-1} \quad \{t > 0, 0 < a < 1\}$$

↑ First mock-up which contain sensor and led light.

Helping collect raw data from sport trainer.

↓ Final prototype

Working video

<https://youtu.be/2nYzlasPjbU>





BUTTON GAME

Sport climbing is a young sport, officially included in the Olympics starting with the Tokyo 2020 Games, and continuously evolving. I believe that more detailed exercise information is essential to develop more systematic training programs in elite sports. Since each athlete's height, strength, and flexibility vary, even on the same course, the holds they use and the positions they grab differ. Therefore, systematically recording is crucial. Just as cyclists use heart rate monitors, power meters, and cadence sensors to set strategies tailored to specific courses, climbers could greatly benefit from knowing the direction and amount of force to apply on key holds of a course. BUTTON GAME can provide this information which would help in formulating more structured strategies on different courses. Additionally, based on their body type and climbing style, climbers could get recommendations on better holds and optimal directions of force by BUTTON GAME like data analysis assistance.

YEAR
2022 JAN - JUN

SOLO PROJECT

CATEGORY
SMART SPORT CLIMBING DEVICE

MATERIAL
PLASTIC, LED STRIP, PRESSURE SENSOR, METAL

ROLE
DESIGNER

SHOW
2022 RCA GRADUCATION SHOW, 2022 WIP SHOW



↓ In Climbing, a same course can be solved in various way and skills.
Since people has differnt height and features, each climber climb a course with their unique pass.





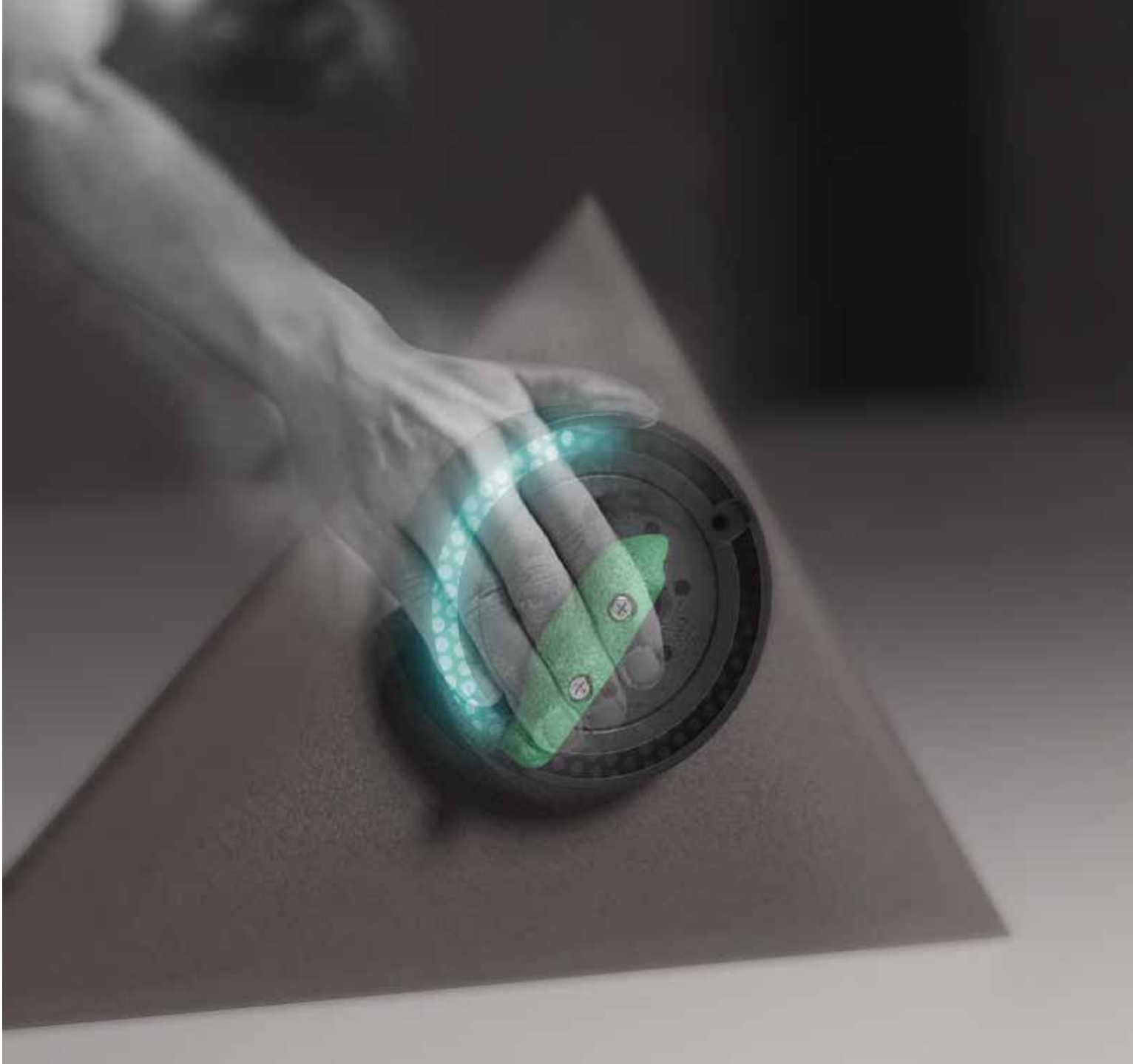
BUTTONGAME is a climbing assistant
, which detects force on a holder.

LED light glow to direction of force.
Color show how much power on the holder.

Strong - Red

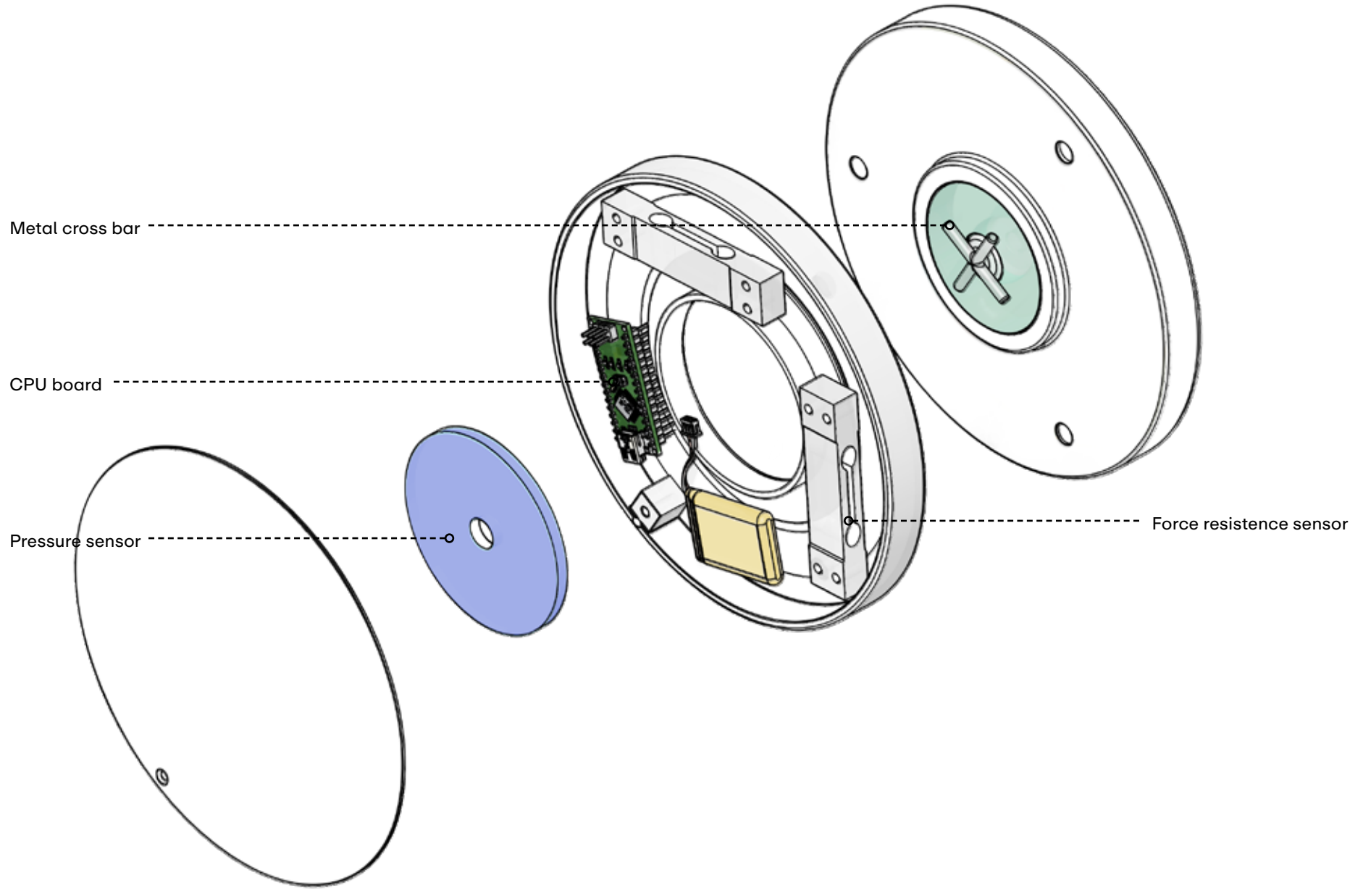
Middle - Green

Small - Blue



← Middle force pulling left.

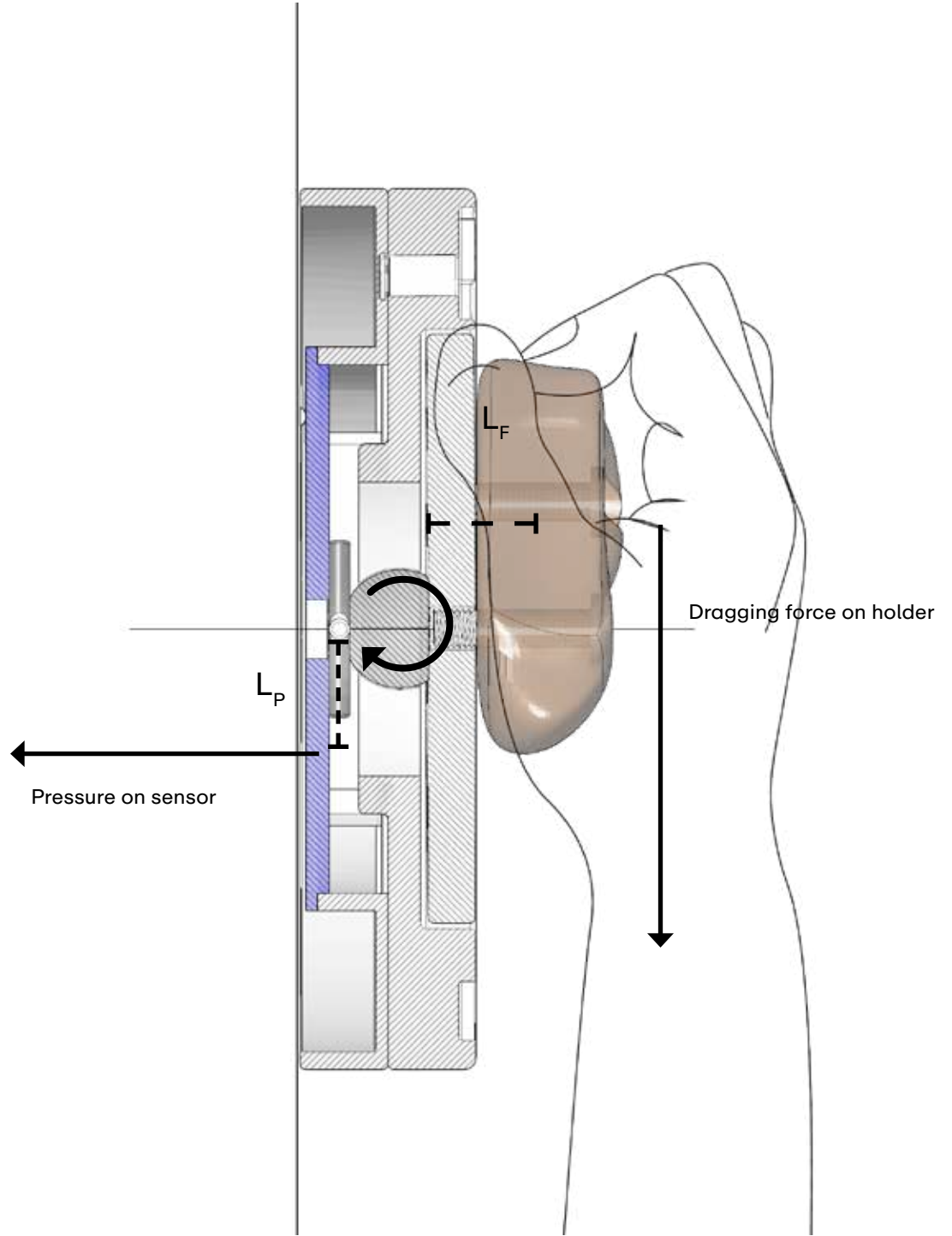
The Button Game provides systematic training programs through precise data feedback to climbers and helps build proper strategies for each diverse course.



→ How to detect force on holder

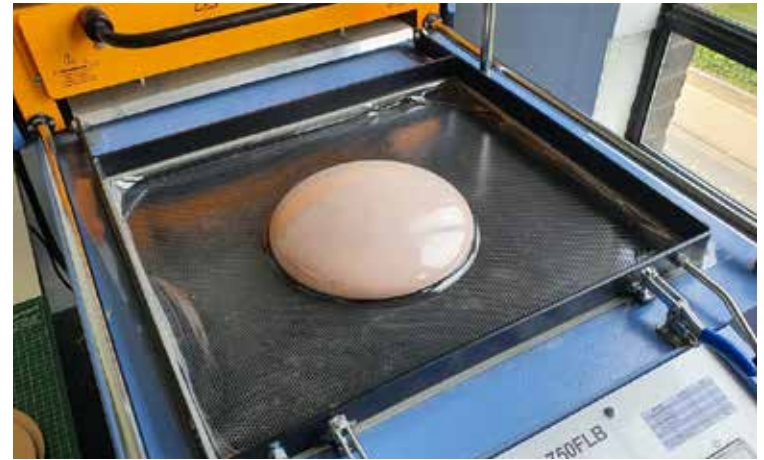
When force apply to holder, pressure create on pressure sensor.

$$\text{Pressure on sensor} * L_p = \text{Dragging force} * L_f$$





↑ Interview with manager at Castle climbing in London



↑ Vacuum forming the button

↓ Quick mock-up buttons

To understand the kind of feedback needed, I brought mock-ups to the climbing gym and conducted various tests with climbers. Initially, we focused on how the large button's shape could be utilized in climbing, concentrating on the tactile sensation of pressing the button. Later, our focus shifted to the responsiveness when gripping, the mechanism for measuring force, and how to show feedback. To achieve this, I focused on minimizing data noise and determining the optimal placement of LEDs so they wouldn't obstruct the climber's view while holding the grip.

RE-ADAPT

After COVID-19, the importance of indoor ventilation and air cleanliness in public facilities has been highlighted. This will also become a crucial factor in the interiors of shared autonomous vehicles in the future. Vehicle interiors face multiple air pollution issues, including seat dust, bacteria, and harmful substances from interior materials.** To combat this, RE-ADAPT prioritize seat and air cleanliness, along with frequent ventilation.

Airplane ventilation systems maintain fresh air by introducing fresh air from above and expelling exhaled air and dust through the floor. This one-way airflow creates an air curtain effect, reducing the risk of indoor infection transmission compared to other enclosed spaces. By applying this airplane ventilation system to car interiors, RE-ADAPT created an airflow system that moves from top to bottom, sending dust and particles to the floor. This not only cleans the air but also allows for the automatic cleaning of vehicle seats. RE-ADAPT propose this efficient and low-infection risk cleaning system for vehicle interiors.

**Hoehn, Rebecca M. and Jahl, Lydia G. and Herkert, Nicholas J. and Hoffman, Kate and Soehl, Anna and Diamond, Miriam L. and Blum, Arlene and Stapleton, Heather M.(2024). Flame Retardant Exposure in Vehicles Is Influenced by Use in Seat Foam and Temperature, Environmental Science & Technology 58, 8825-8834, 2024

YEAR

2021 OCT - 2022 JAN

CLIENT

SPARKLING HACKATHON, RCA&BP

CATEGORY

AUTOMATIC CLEANING FOR SELF-DRIVING CAR

MATERIAL

PLASTIC, TPU, CHEMICAL FABRIC

ROLE

DESIGNER, ENGINEER

AWARD

BPXRCA SPARKLING CHALLENGE 2ND PLACE



↓ Hygiene issue arise in sharing auto-driving like interior air, seats



Air circulation system
Clean air, dust, trash all in one-way air flow

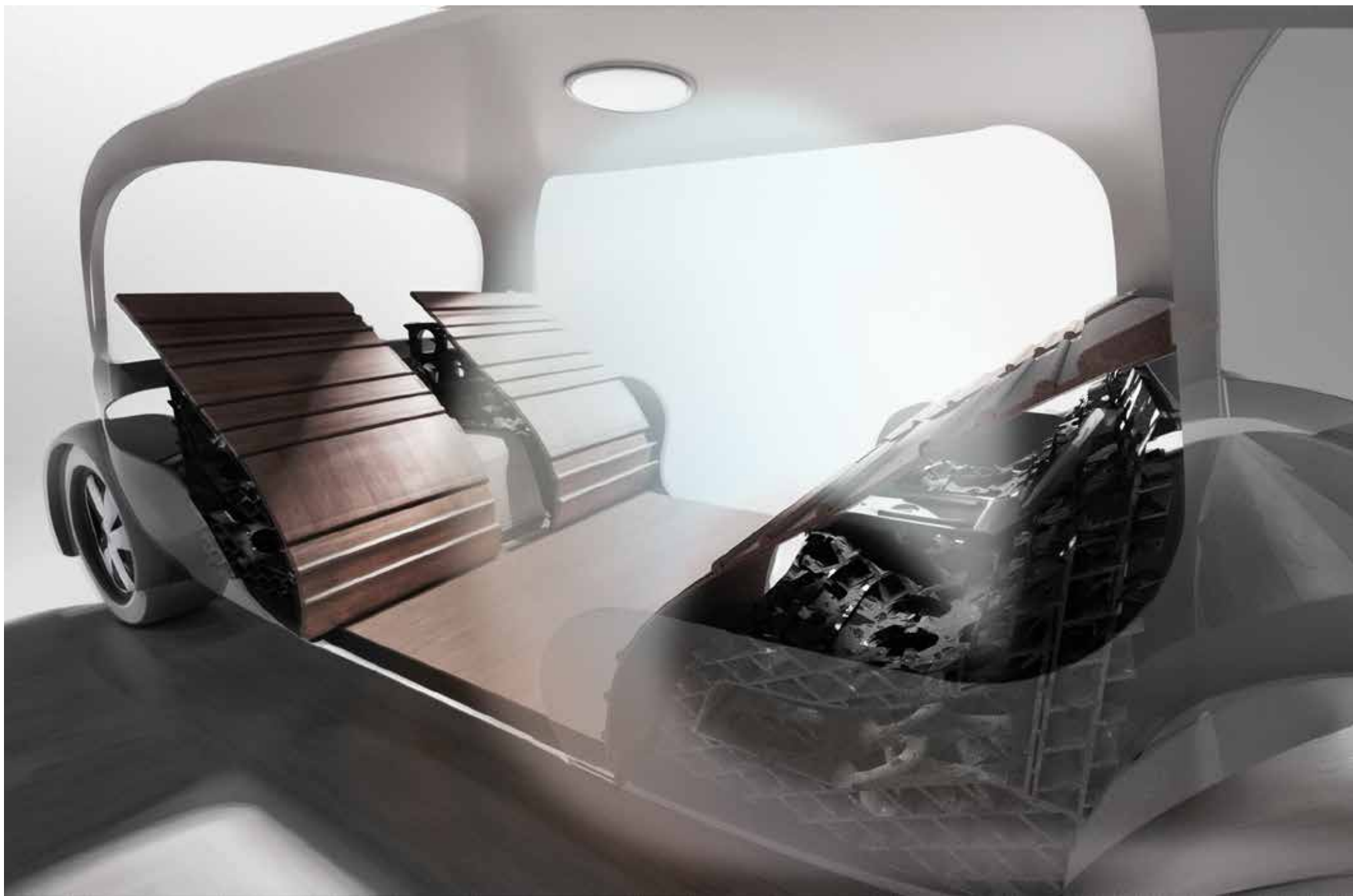


Airplane ventilation systems maintain fresh air by introducing fresh air from above and expelling exhaled air and dust through the floor. This one-way airflow creates an air curtain effect, reducing the risk of indoor infection transmission compared to other enclosed spaces.



air curtain effect

↓ Blow up seat during air celaning process



↑ Robot cleaner clean floor.
Collect remaning dust and rubbsih

↓ UV light sanitize overall interior of car.



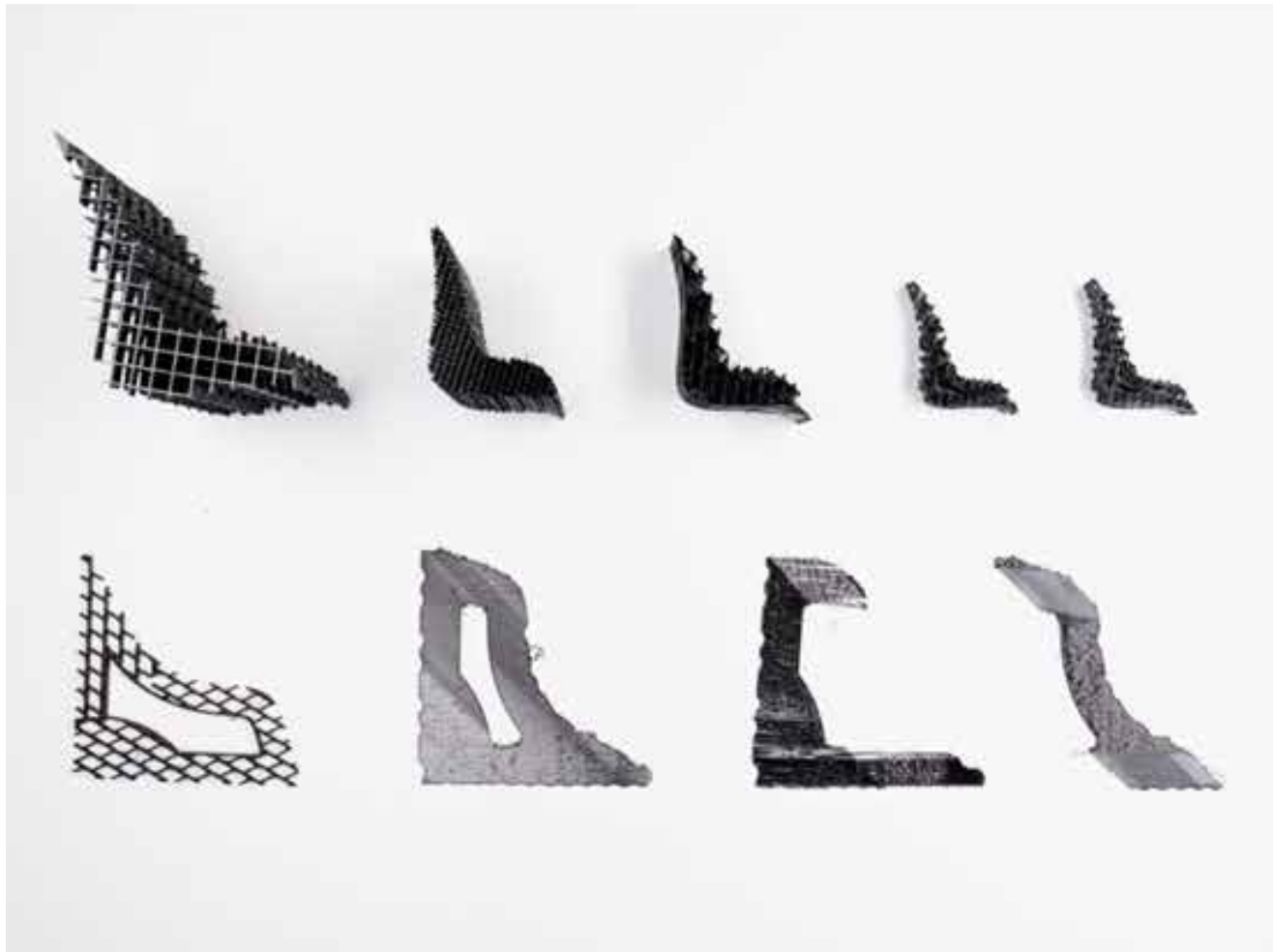
↓ Quick changing seats; easy to clean by replacing into a clean seat



← Structure mock-ups development

→ Car seat prototype small scale

testing video links : youtu.be/SwLmUQSM60w



← Old chemical fabric to recycle

↓ Melt fabric into plastic filament

→ Test fabric and filament



SWIMMING OCTOPUS

This project aimed to utilize engineering knowledge to create organic movements in a desired context. Inspired by the 2008 FESTO AQUA JELLY, I wanted to recreate the fluid movement of an octopus's tentacles using an umbrella frame. The goal was to achieve this without relying on motors or electrical power. A similar reference is the 2017 SONY TOIO robotic cube papercraft. Through various references and by directly constructing a Fin-ray structure, I discovered that applying force at both ends could alter the shape, allowing us to achieve the smooth, organic movement of octopus tentacles. With many tests to find the proper path of motion, we could create octopus swimming motion with an umbrella frame.

Similarly, in 2022, the Hyundai Commission by Anicka Yi at Tate Modern, titled "In Love With the World," utilized the same structure to express movement.

You can find the overall process on here
<https://youtu.be/rpJZgj6f44s>

YEAR
2017 OCT - DEC

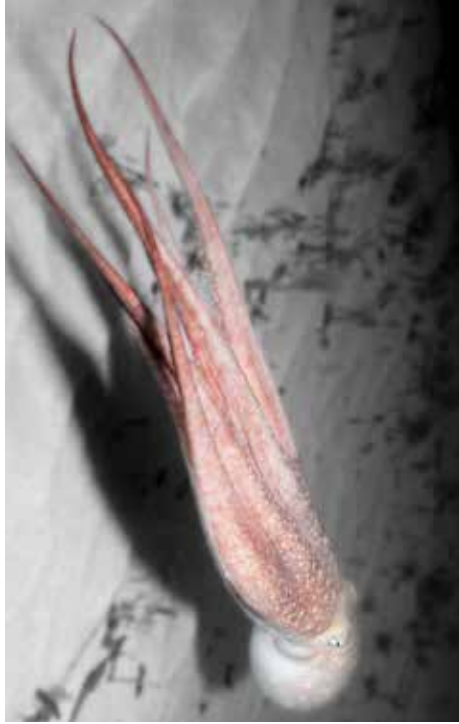
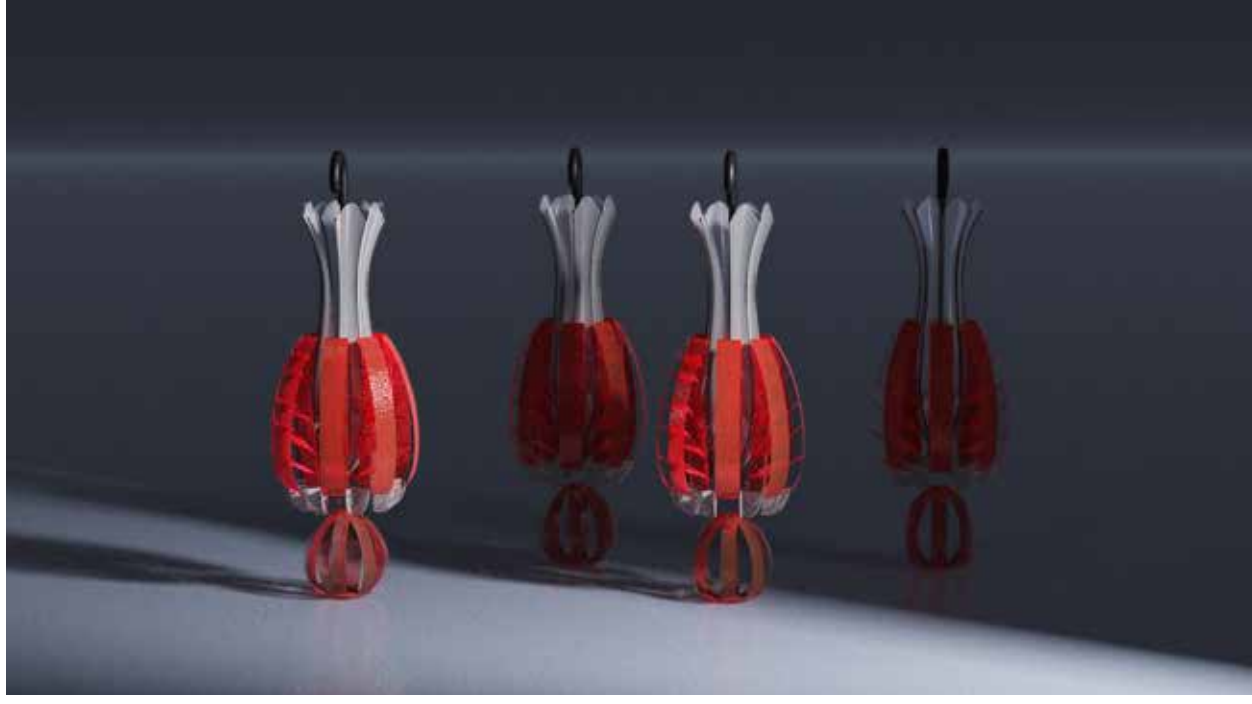
GROUP PROJECT

CATEGORY
SMART SPORT CLIMBING DEVICE

MATERIAL
PLASTIC, PLA

ROLE
DESIGNER, ENGINEERING RESEARCH, PHYSICAL STRUCTURE BUILDING





Swimming Octopus is an umbrella which mimic flexible motion of octopus leg.

In raining day, you can see octopus is swimming in the rain.



← Prototype of SWIMMING OCTOPUS

→ Swimming motion

<https://youtu.be/5AN49-7mV2Y>

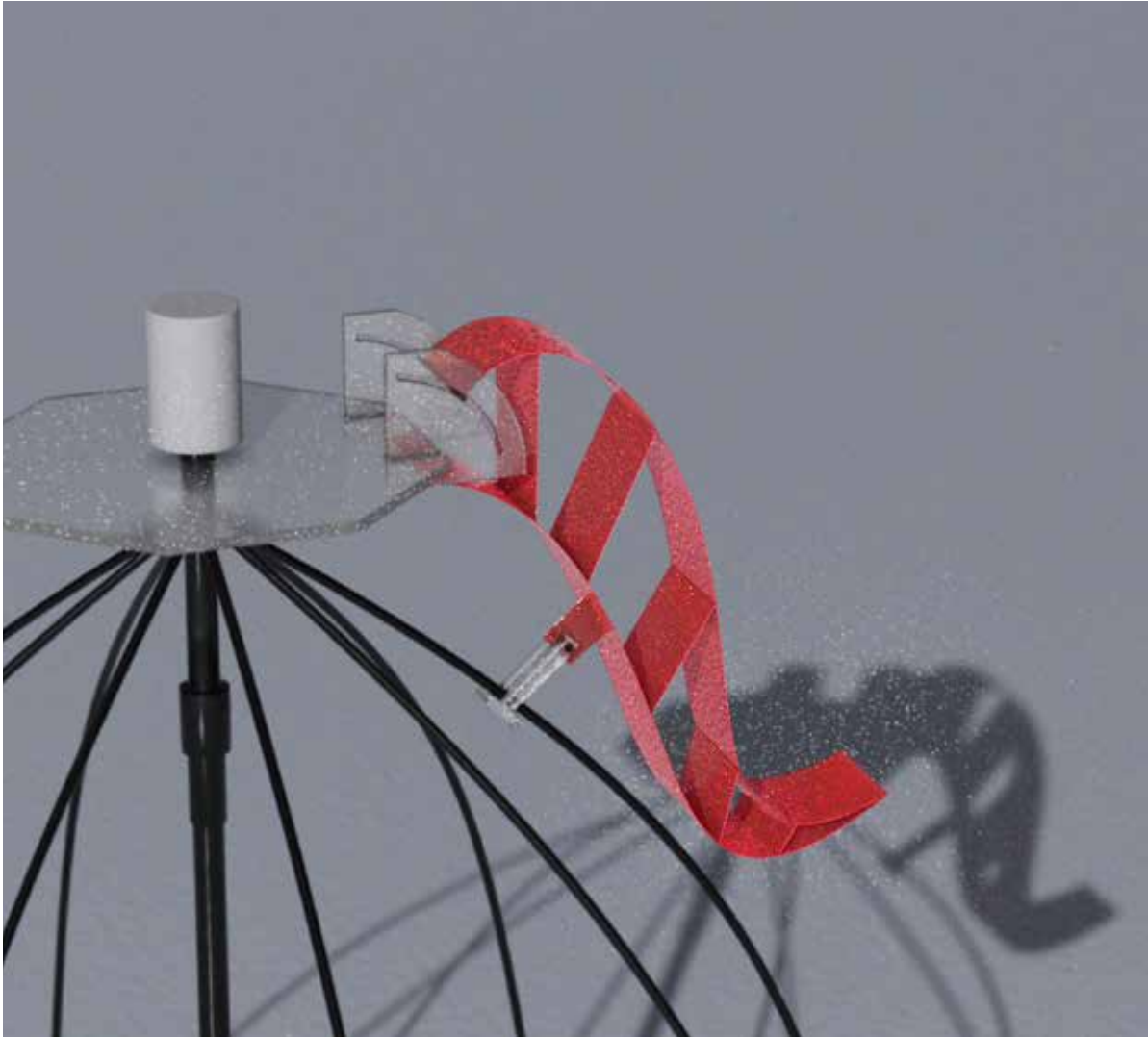
↓ Octopus leg details



← Fin-ray structure from robot arm.

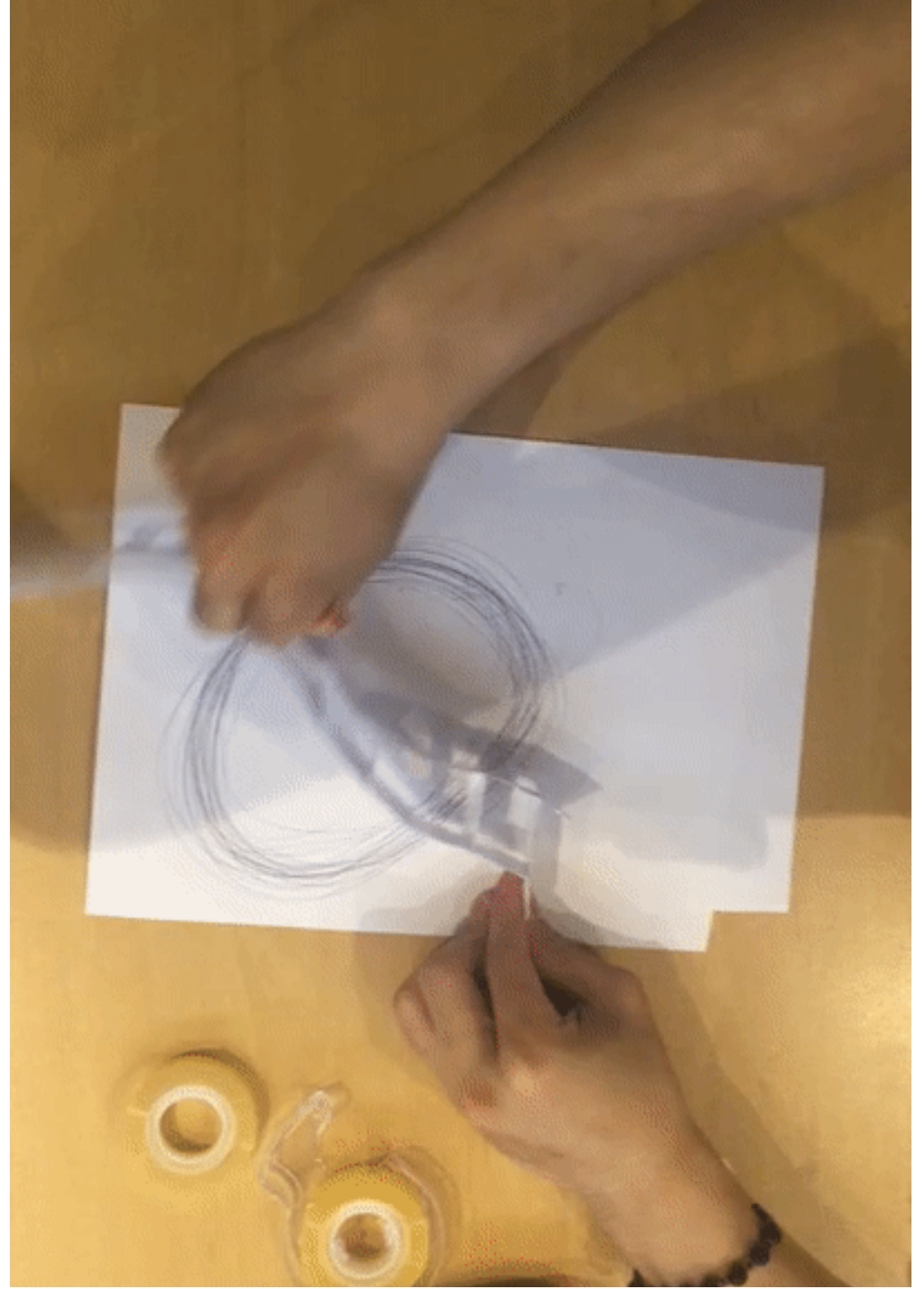
→ Finding right length and structure with paper mock-ups.

Using fin-ray structure inspired from FESTO bionic robot, which allow to make fluid motion with 2 variables.



↘ Finding path of variable motion that looks like leg movement

→ Tracking motion by pen on paper



AQUANTENNA

AQUANTENNA is a water quality sensor designed for swimming pools. Paired with The Wave Talk's advanced water quality detection sensor, it ensures clean water quality with minimal maintenance fees.

To measure water quality, a chamber to hold water and a reflector for the laser are required. Initially, including an internal chamber and reflector resulted in a bulky design that lacked a sleek appearance. Considering AQUANTENNA would be attached to the pool wall, we decided to use the pool wall as the reflector, allowing the laser to be directed straight at it. This innovation eliminated the need for an internal chamber and reflector, resulting in a much cleaner and more streamlined design. The overall shape, reminiscent of a water droplet, symbolizes pure and clean water.

The upper section of the Aquantenna houses an antenna that connects to the home's Wi-Fi, providing users with real-time updates on the pool's water quality. Through a mobile app, users can monitor their pool's water quality from anywhere.

YEAR
2024 MAR

CLIENT
THE WAVE TALK

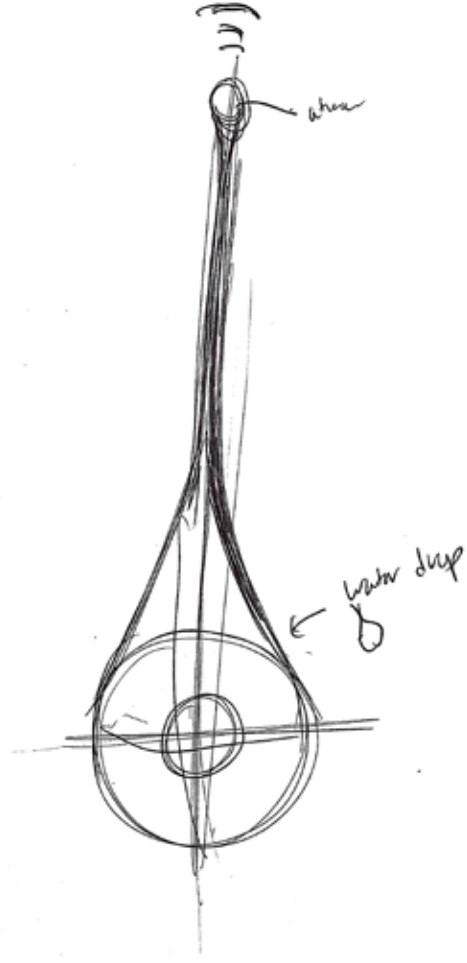
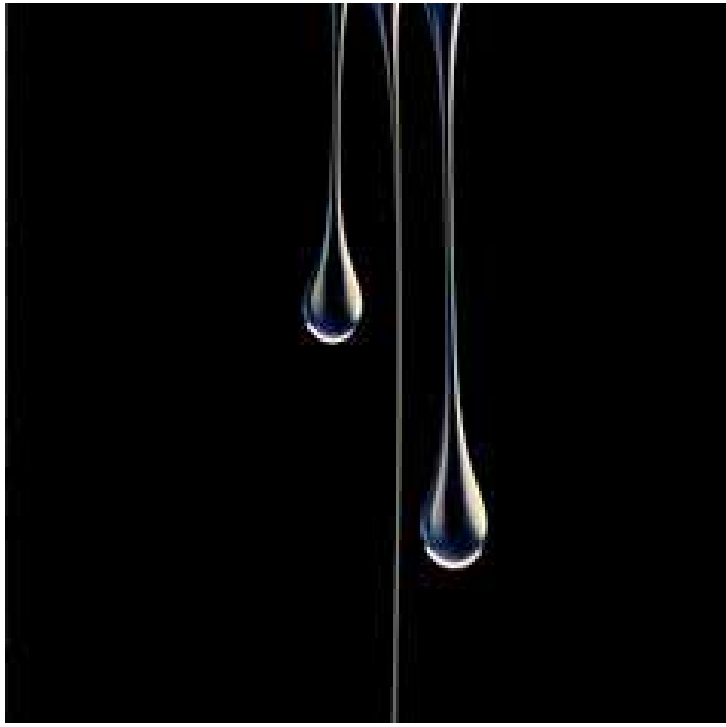
CATEGORY
SWIMMING POOL EQUIPMENT

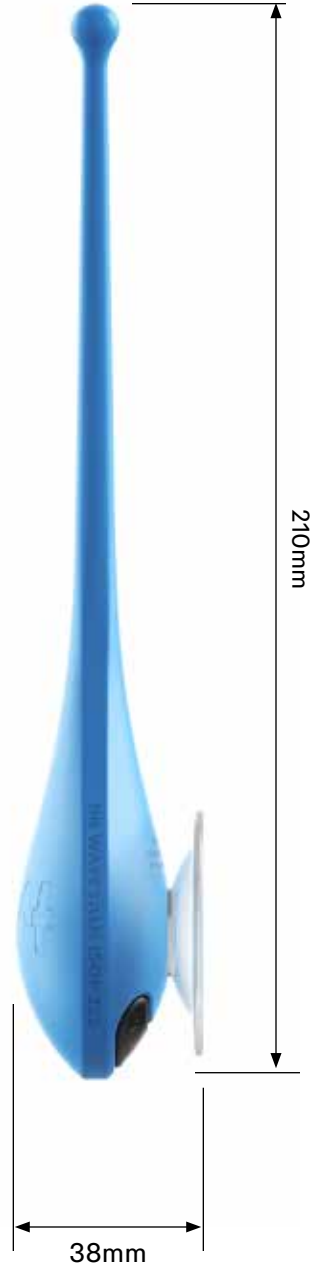
MATERIAL
SILICONE

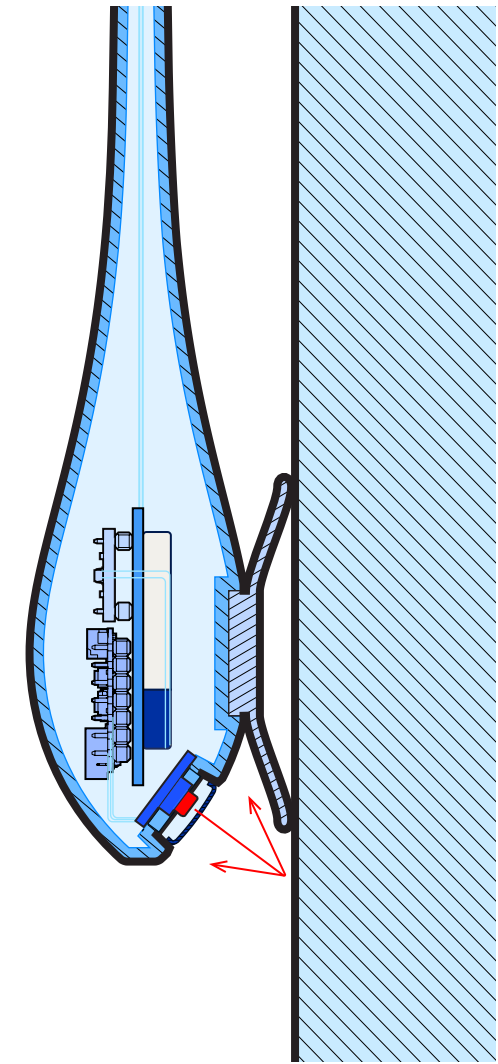
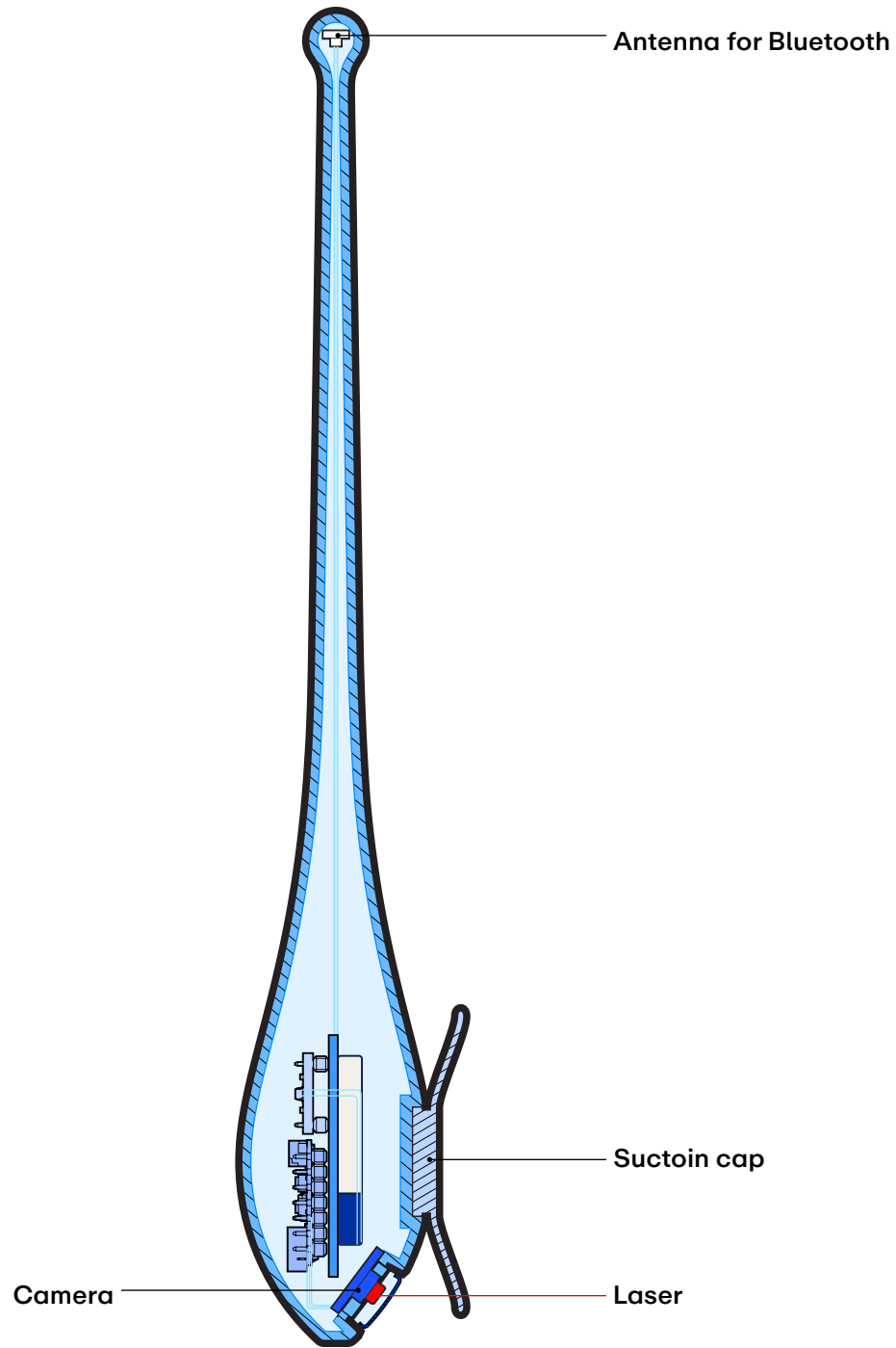
ROLE
DESIGNER



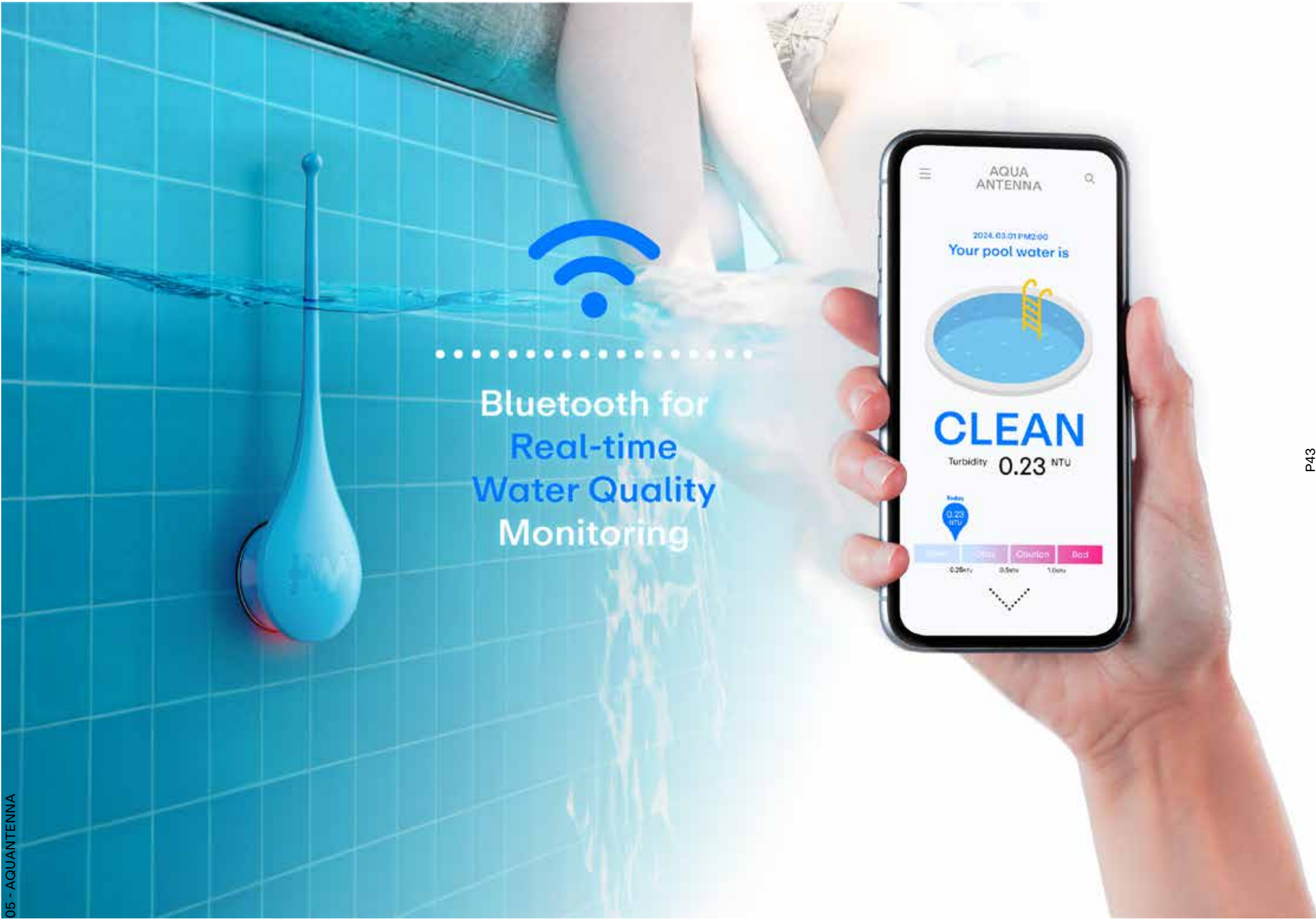
AQUANTENNA | Aqua + Antenna
Real-time Water Quality Monitoring
for Swimming Pool & Spa







Laser reflection on wall scattering



Bluetooth for
Real-time
Water Quality
Monitoring

AQUA ANTENNA

2024.03.01 PM2:00

Your pool water is

CLEAN

Turbidity 0.23 NTU

0.23 NTU

0.25ntu 0.5ntu 1.0ntu

POPUPLAB

FABLAB BCN needed a portable toolbox for children's education that could be easily transported by car. The studio mainly used plywood due to its availability and ease of use by cnc. Therefore, we decided to create a versatile toolbox made from lightweight and sturdy plywood, ensuring it was safe for children and usable in various situations.

The design focused on child safety by incorporating rounded corners. To enhance the production efficiency of these rounded corners, I used vacuum forming, allowing to produce the boxes from a single mold. Additionally, I repurposed the pin holes used for securing the vacuum-formed shapes into sliding slits, increasing both production efficiency and versatility.

Inspired by pegboards, the toolbox's identity centers around the box and slit holes. The hole sizes were matched to standard wood nail sizes, simplifying the sourcing of fastening materials. Overall, POPUPLAB is both functional and easy to produce, making it an ideal solution for versatile educational settings.

YEAR
2018 OCT - NOV

FABLAB BCN EDUCATION DEPARTMENT

SOLO PROJECT

CATEGORY
MULTI TOOL BOX

MATERIAL
BENT PLYWOOD,

ROLE
DESIGNER, MAKER



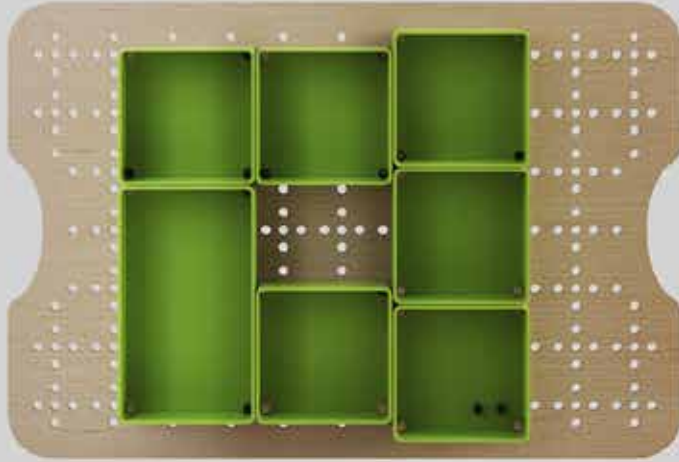
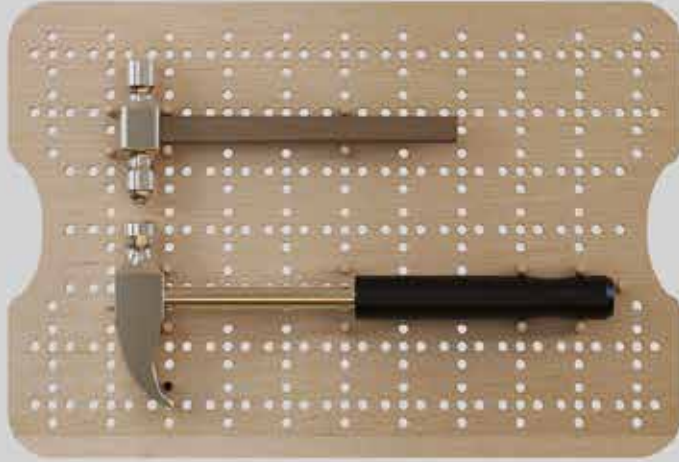
Portable tool box for children's education which requires various tools by different topics.
Stackable box with rounded edge preventing injuries for children.





Horizontal and vertical drawers used in different scenarios.

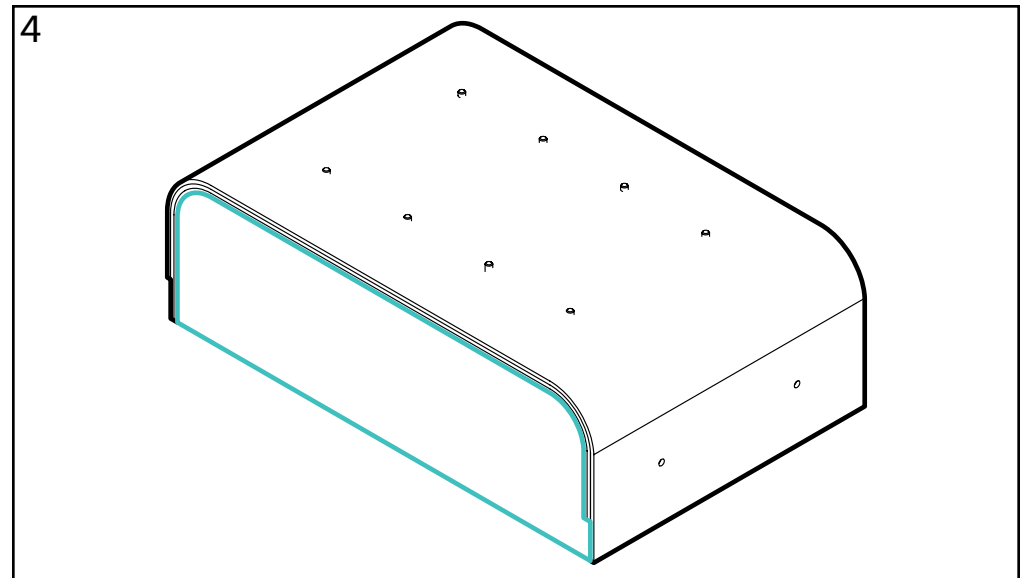
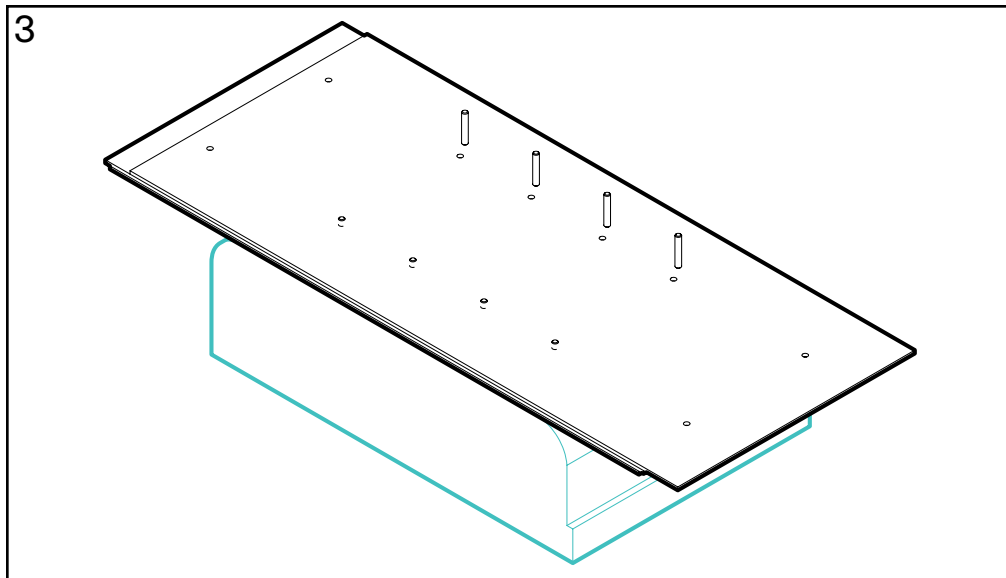
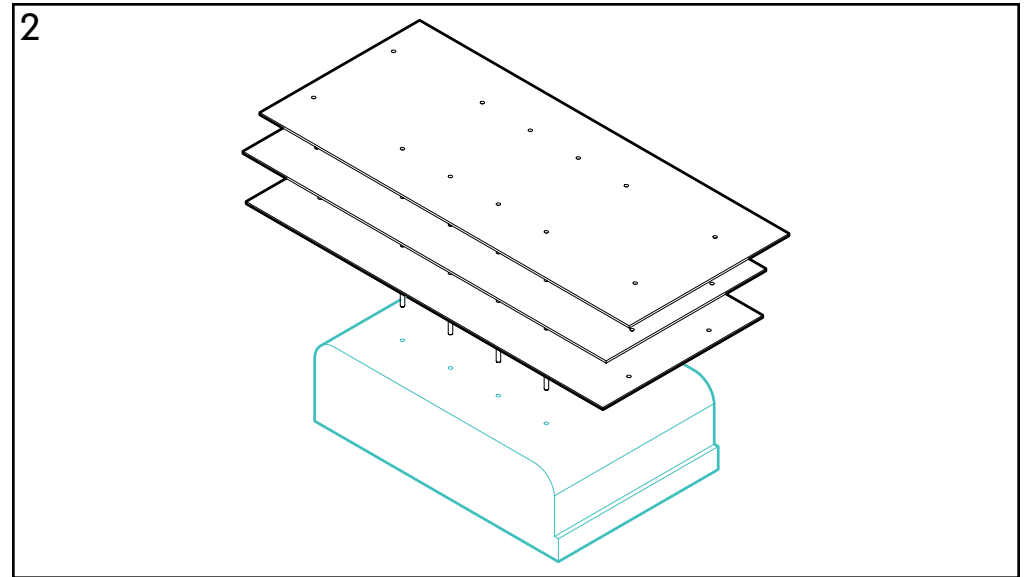
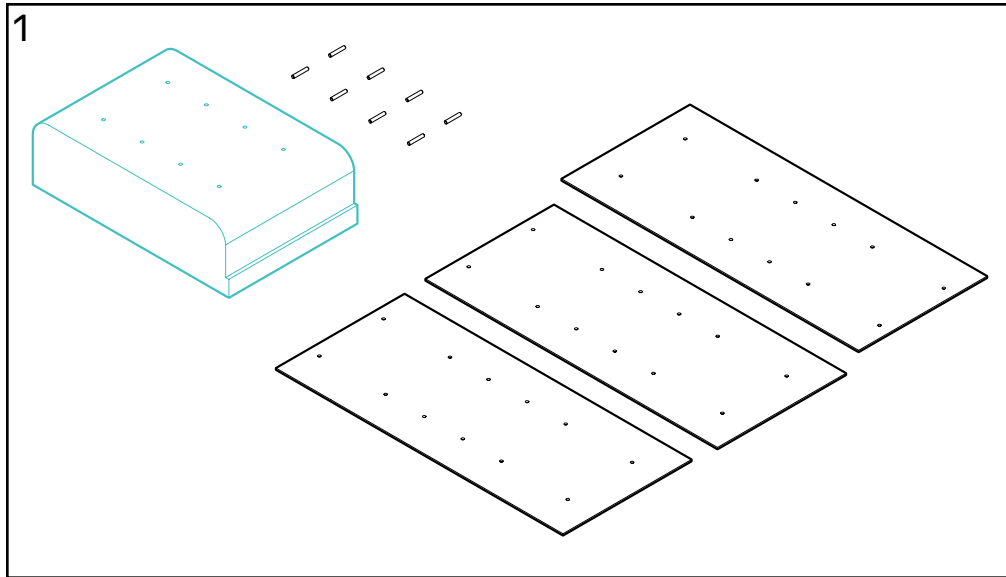
Inspired by pegboard, they allow for various tools to be securely fixed in place using wood nails and hooks.



Considering mass production, I designed the box structure symmetrically to facilitate large-scale manufacturing using a single mold. The production use vacuum forming and bent plywood.

Reuse the holes used to secure the mold into positions for wall sliders, enhancing both functionality and efficiency.





1. Prepare mold, 3 bending plywood, wood nails

2. Stack 3 different plywood in order. Glue between plywood

3. Pin wood nails on mold and plywood.

4. Vacuum forming to press plywood on mold.

↑ Vacuum forming process

↓ POPUPLAB 3D print version



ROLLE

After learning about the sculptural genre of Tensegrity, I thought it was one of the best ways to show the characteristics of strings. As dynamics was my favorite subject while majoring in physics, I wanted to maximize its potential. By leveraging the characteristics of strings, which can exhibit both flexibility and rigidity depending on tension, and their continuous length property, I designed an adjustable-height stand, ROLLE.

For string adjustment, I drew inspiration from the BOA shoe lacing system and reinforced this with a bolt and thread mechanism. To keep the structure as simple as possible, I used three sticks with a central holding structure.

This design allows for the creation of simple, functional furniture using readily available materials from the local area. By applying this concept, it is possible to create stools, tables, and other furniture with continuously adjustable height through a unique experience with ROLLE.

YEAR

2019 MAY - DEC

SOLO PROJECT

CATEGORY

STOOL

MATERIAL

PLASTIC, BIRCH PLYWOOD, 1MM WIRE, 8MM BOLT&NUT

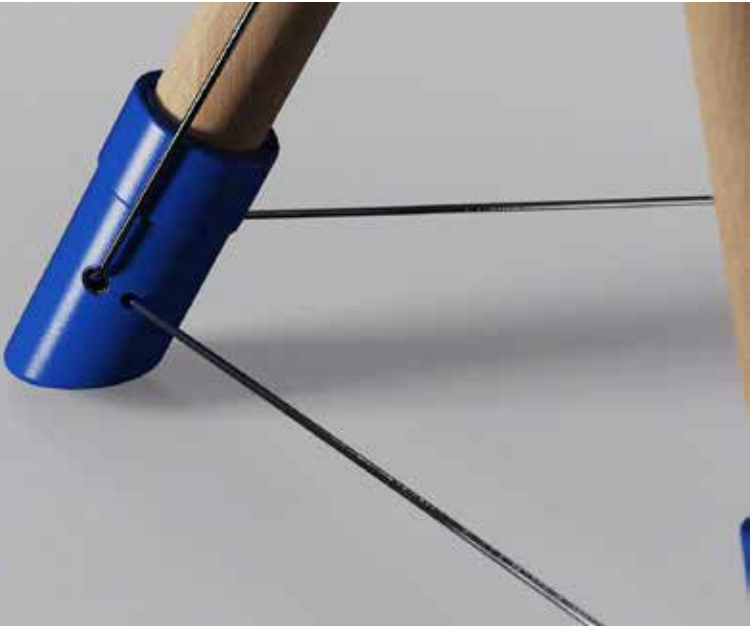
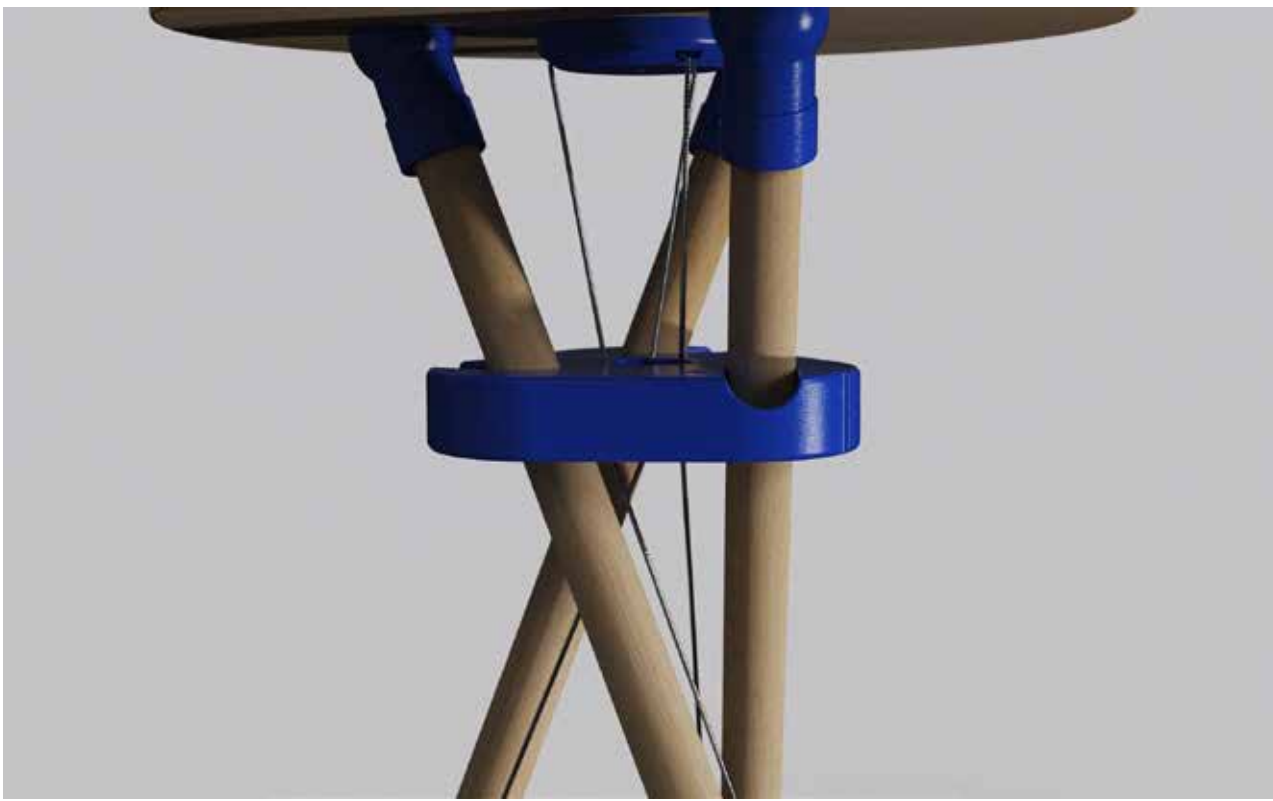
ROLE

DESIGNER

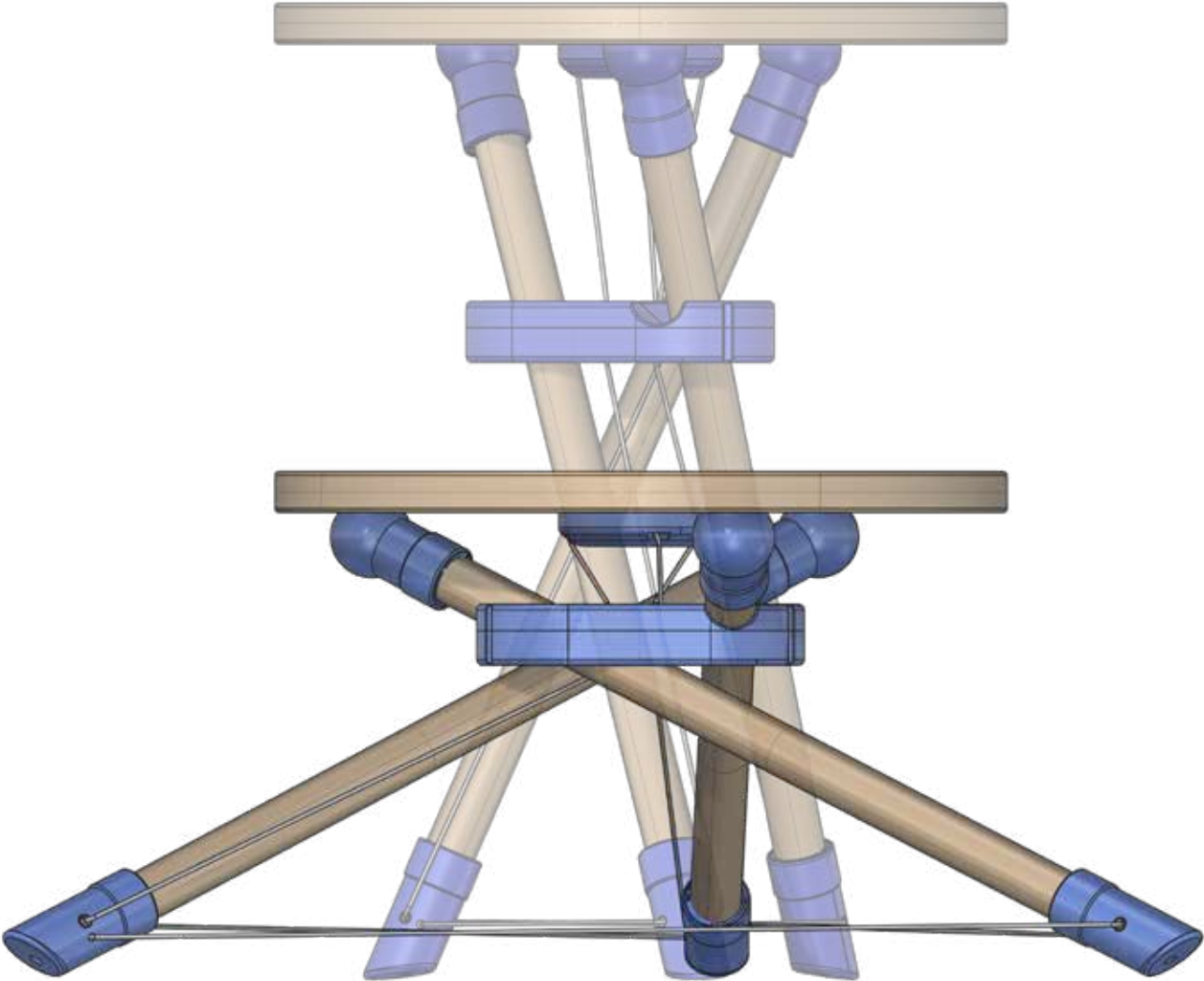
SHOW

2019 SEOUL DESIGN FESTIVAL

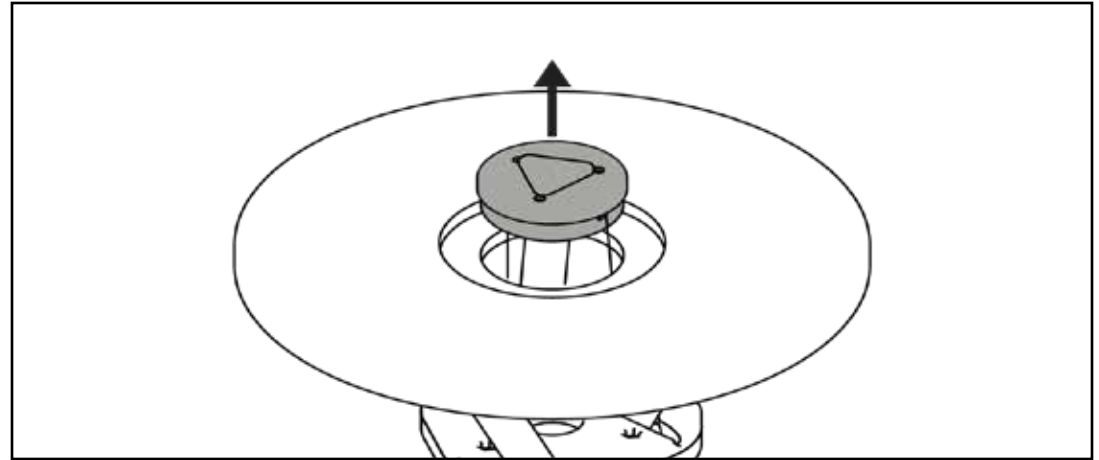




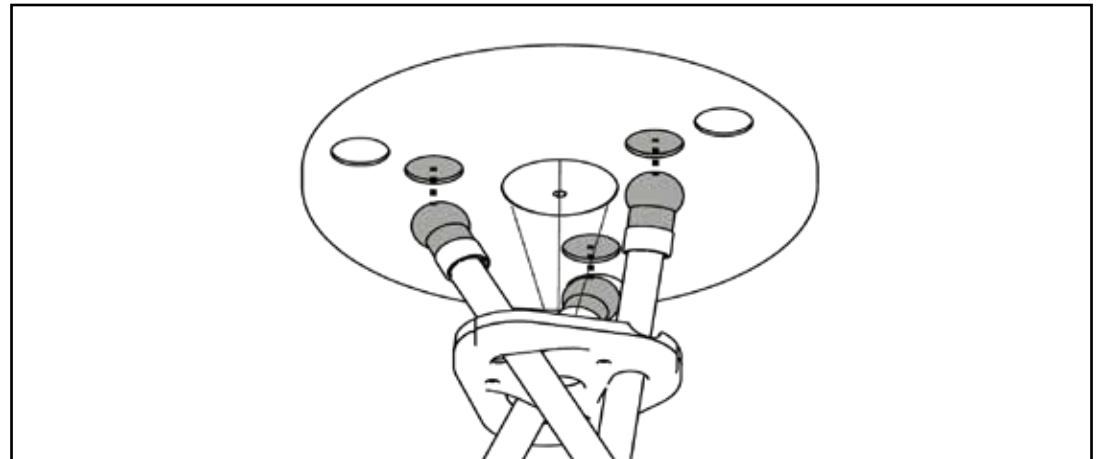
Rolle is a stool which can change height continuously by string.
Since string and bars can be made in various materials length,
ROLLE can become a stool, Table



1. Pull out Wire cap

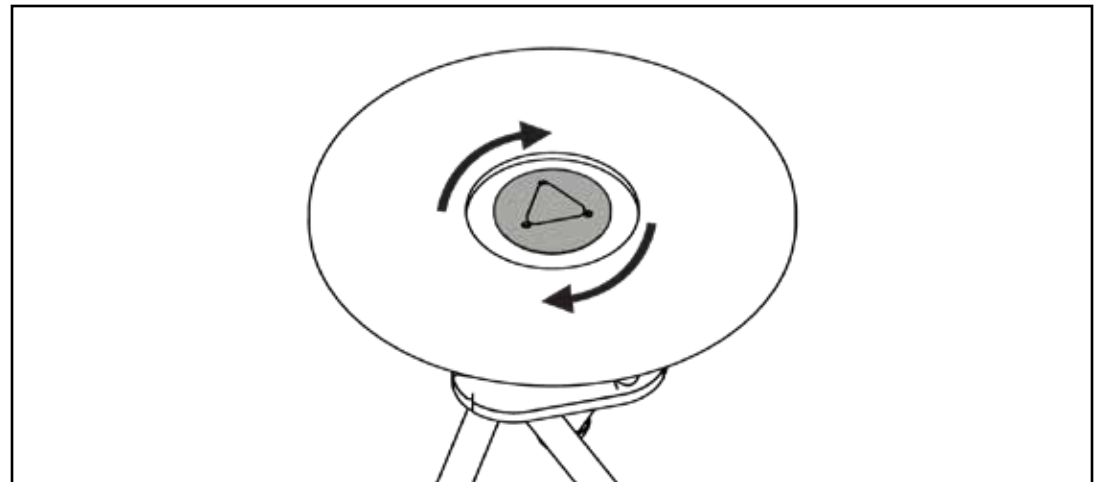


2. Change position of leggs that user want.
wider - low height, narrow - tall height

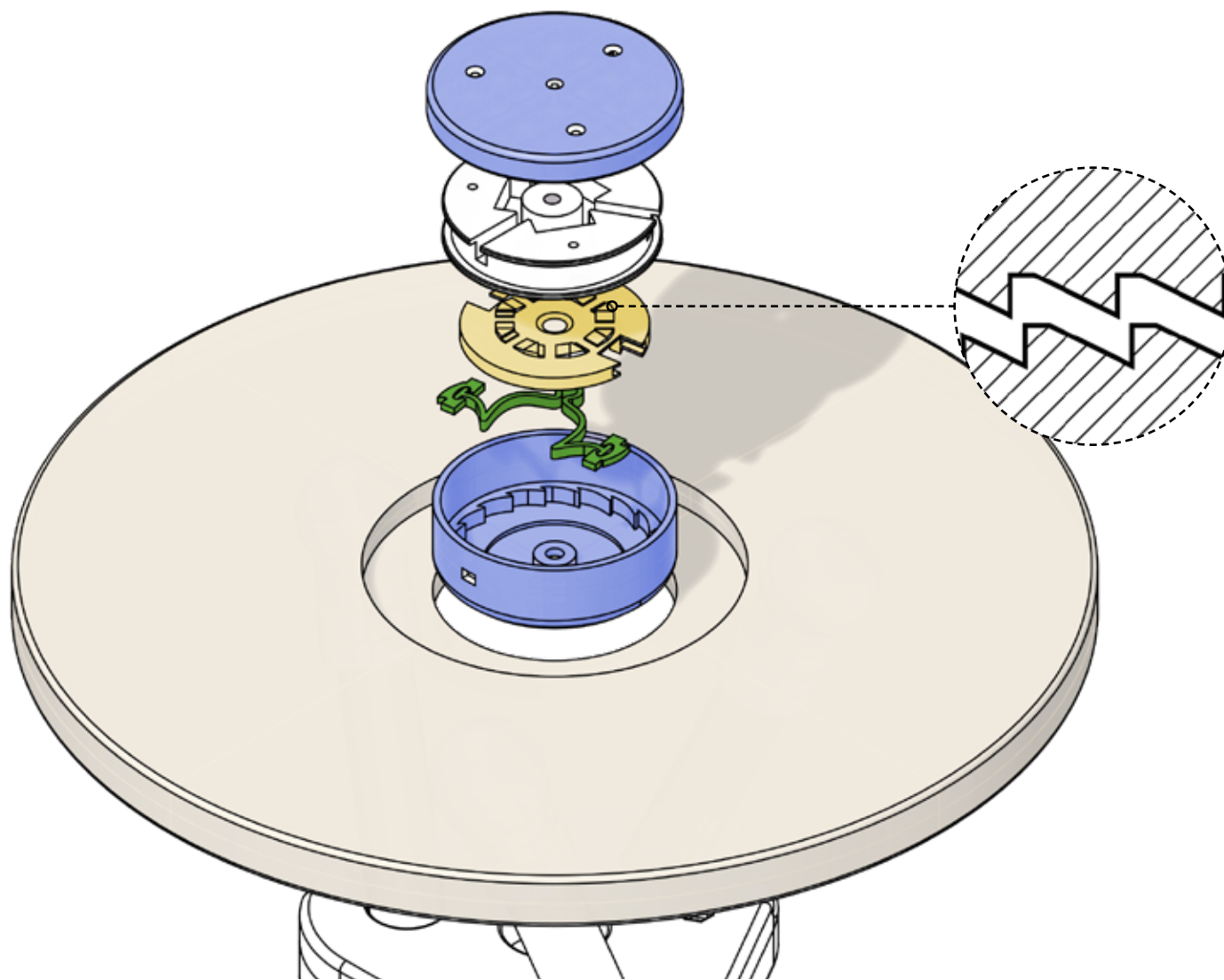


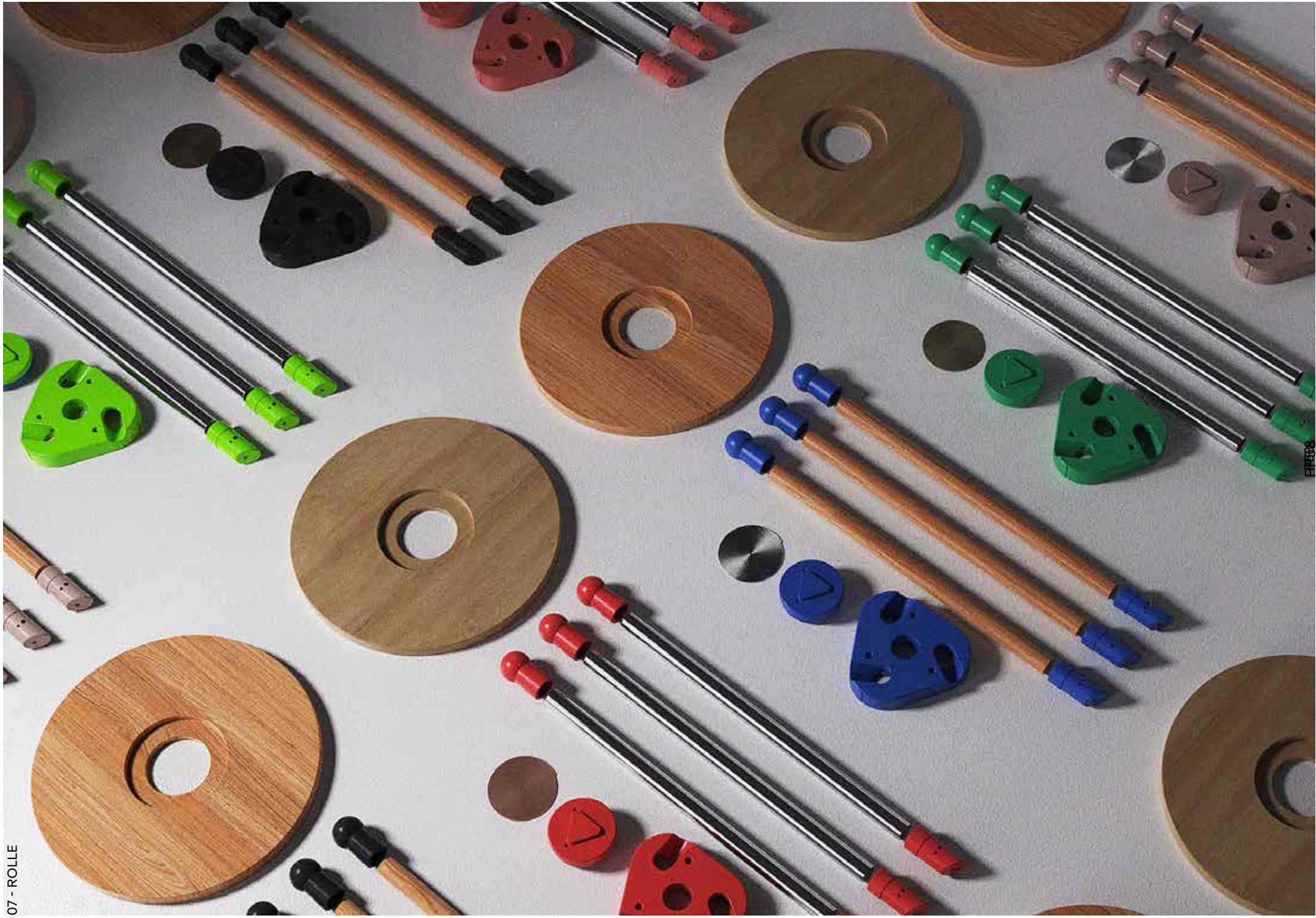
3. Twist wire cap until tighten wire.

How to assemble ROLLE in video
<https://youtu.be/LweAz8qWdWI>



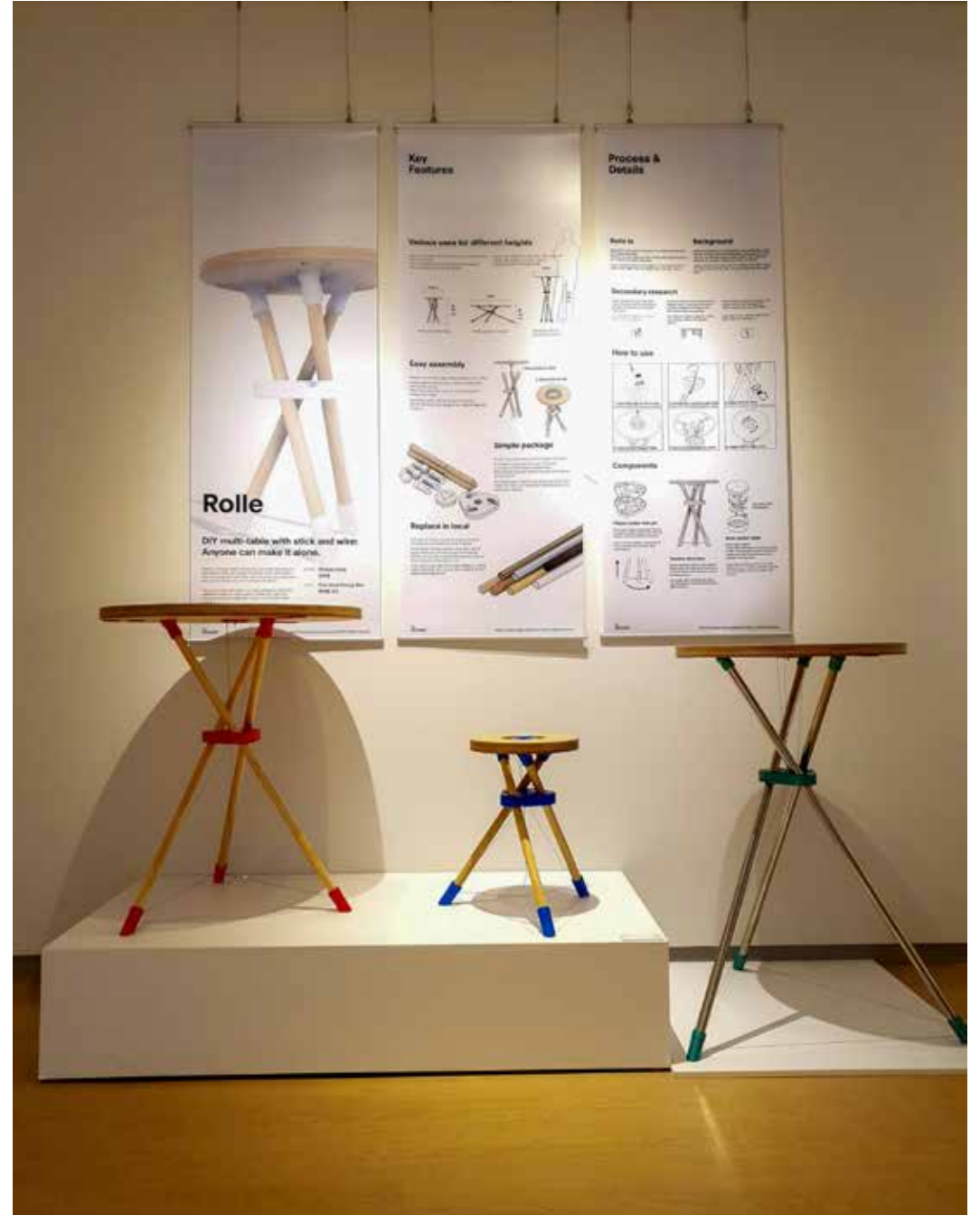
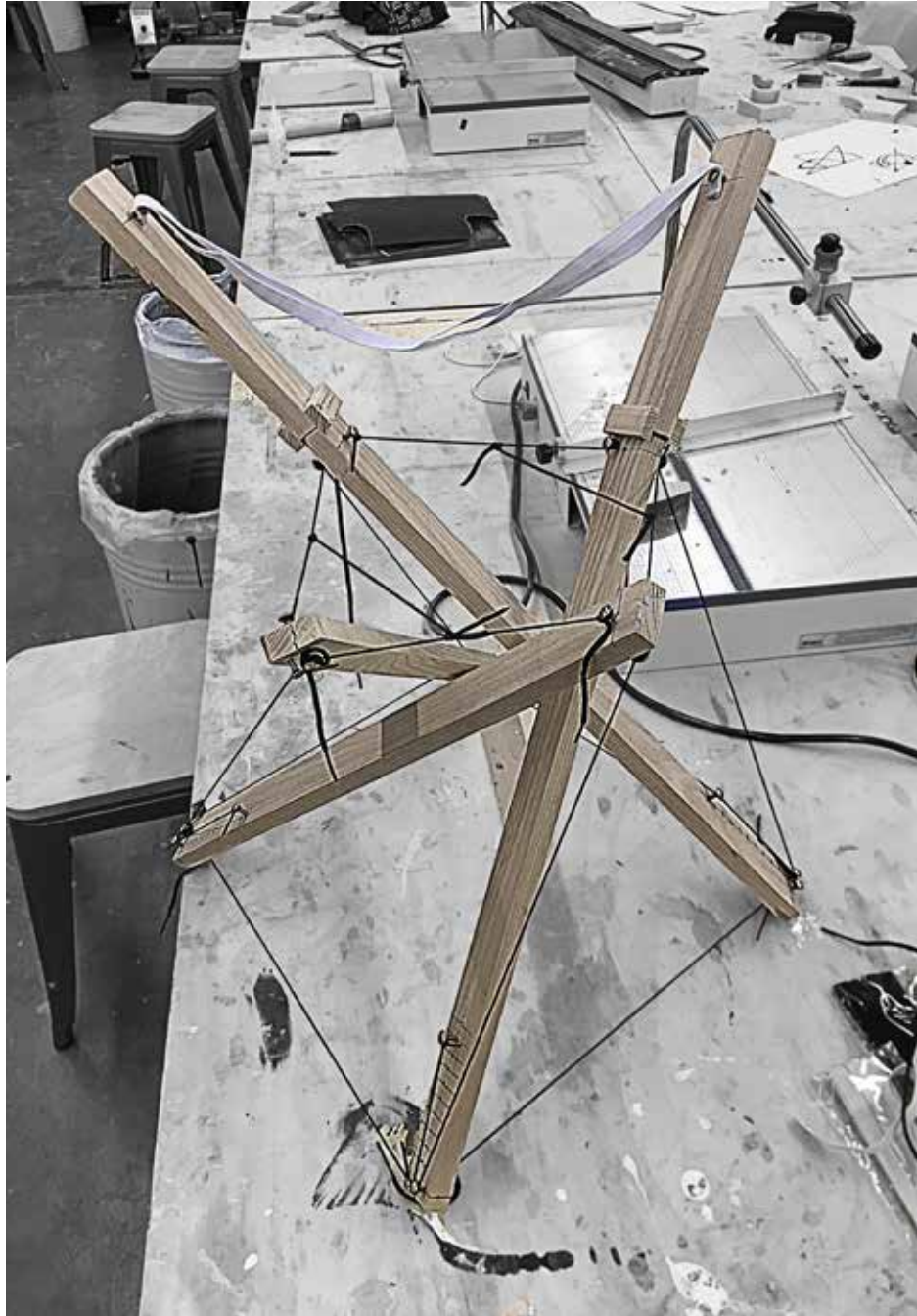
↓ Easy unlock system - inspired from BOA system on shoe lace





↘ First rough mock-up sketch

→ First rough mock-up sketch



SINGLE PATH 3D PRINT

SING PATH 3D PRINT is an ongoing project aimed at creating unique lampshades using a 3D printer. This project presented two main challenges: designing a unique 3D print path and fine-tuning the appropriate temperature, material amount, and speed for printing.

I believe that creating a custom 3D printing path can be considered a modern craft, as it requires precise control over speed, filament amount, and temperature, similar to how baking fine ceramics involves finding the right temperature, amount of porcelain glaze, and other factors.

To create the custom G-code I desired, I used Grasshopper in Rhino 3D. I researched how to apply my desired pattern shapes to specific forms within Grasshopper. Through extensive testing, I identified the optimal temperature, speed, and material amount to consistently produce high-quality results. It was crucial to use a single 3D printer throughout the process because different printers and materials demand varying speeds, temperatures, and material amounts.

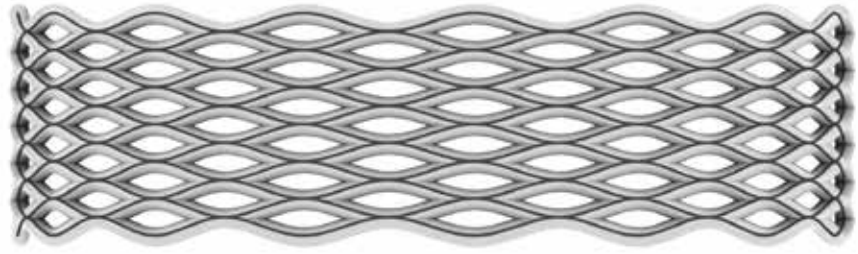
YEAR
2024 JAN - CURRENT

ON GOING PROJECT

CATEGORY
3D PRINTING, GRASSHOPPER

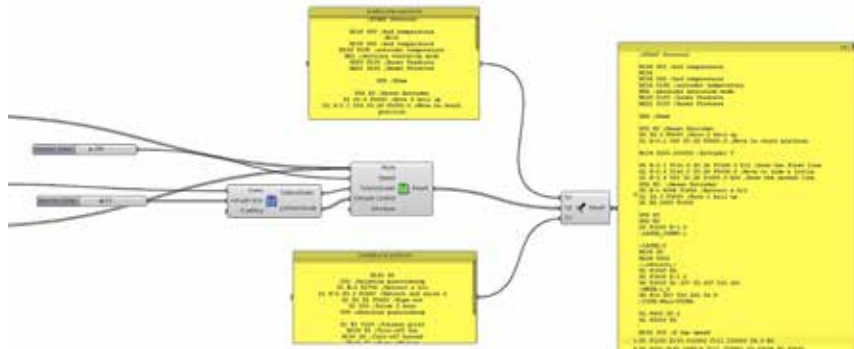
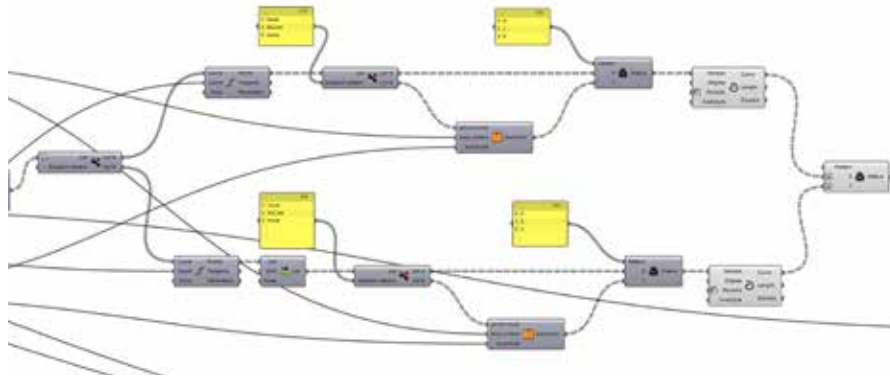
MATERIAL
PLA

ROLE
DESIGNER, ENGINEER



→ Weaving pattern 3D printing lamp cap

↓ Weaving logic in Grasshopper, Rhino 3D
Using Grasshopper to make personal g-code





← Textile looking 3D printing
lamp cap

→ Flexible feature





← Vertical printing with single path
It was difficult to find proper speed and temperature
to print overhang structure with out any support.

THANK YOU FOR WATCHING

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