PO RT FO LIO

TSENG YUMING

◇ CONTENT

01.
TRANSFORMABLE
WHEEL

02.
PAPERFUGE

03.
AURAFIT

04.
SCRIPT MODE
OSMO POCKET

05.
M&M SHOOTING
MACHINE

06.
FORM STUDIO
METAL WASHER

07.
MOTION STUDIO
YEAR 2020

08.
WEB CODING

TRANSFORMABLE WHEEL

ROBOTICS | CODING | MECHANICAL ENGINEERING | INDUSTRIAL DESIGN

6 MONTHS

INTRO / Equipment and vehicles are widely used during the search and rescue. Featured with the active transformable wheels, the robotic vehicle can operate in extreme environment and overcome various obstructs. In the project, force analysis is included to optimize the design of the mechanism. Suitable materials are selected for different parts of the vehicle.
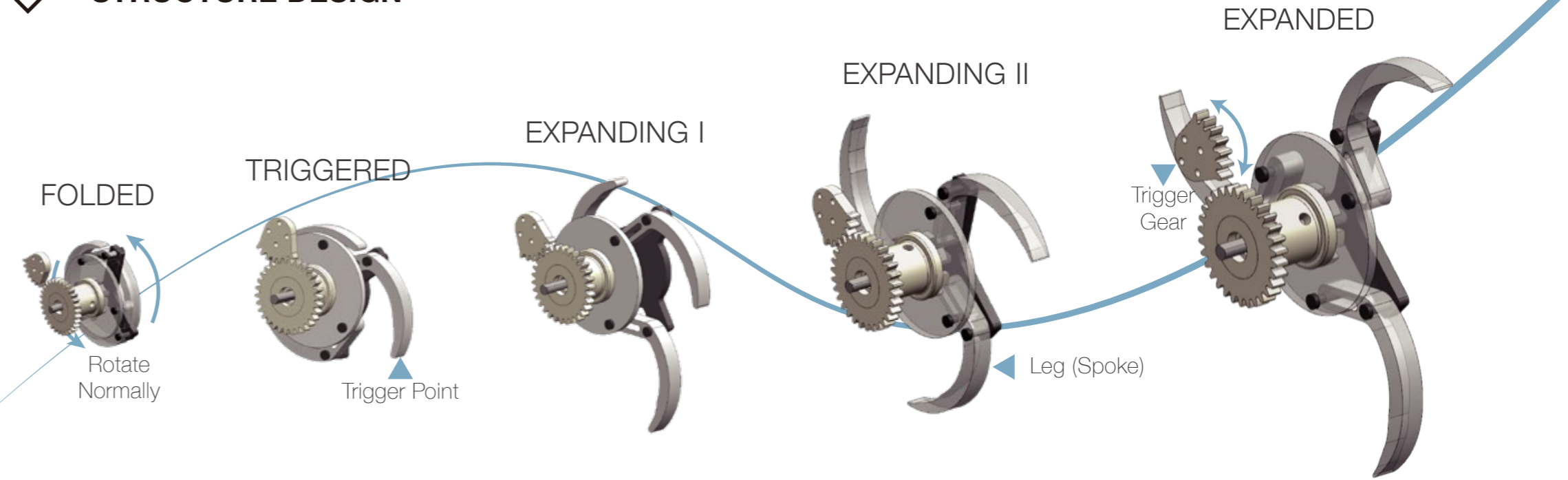
Deformation Mechanism

Simple structures are not performing well for complicated situations. Deformation resolve the problems with **lower space-consumption** and less materials. In daily life, deformation appears ubiquitously such as umbrellas, three-wheel trolley and even animals, like octopus. Inspired by these, more and more inventions which can **expand and shrink** easily are designed to help people with work and **emergencies**.

EXPANDED

EXPANDING II

EXPANDING I

TRIGGERED

FOLDED

Rotate Normally

Trigger Point

Leg (Spoke)

Trigger Gear

TRANSFORMATION

The main mechanism of the wheel can be divieded into four processes: **folded, triggerd, expanding and expended**. When the wheel is folded, the vehicle drives just like a normal one. When it occurs an obstacle, one of the leg will be triggered. As the motor continue to rotate, the entire wheel will be expanded till **fully expansion**.

The **trigger gear** will rotate automatically when the wheel is expending to maintain a **robust, strong and stable** mechanical structure.

◇ MATERIAL

Nylon Powder + 3D Printing

The connecting gear is highly customized, which need 3d-printing techniques. In addition, the nylon powder can provide sufficient strength for the gear while rotating.

EXPLOSION PLOT

Metal

Screws, rods and other connecting components are made of metal including iron and aluminum alloy. These parts require huge strength and stiffness.

Carbon Fiber

The spokes require large strength during the transformation. The shear force of the screw will destroy the component easily if the material is too weak.
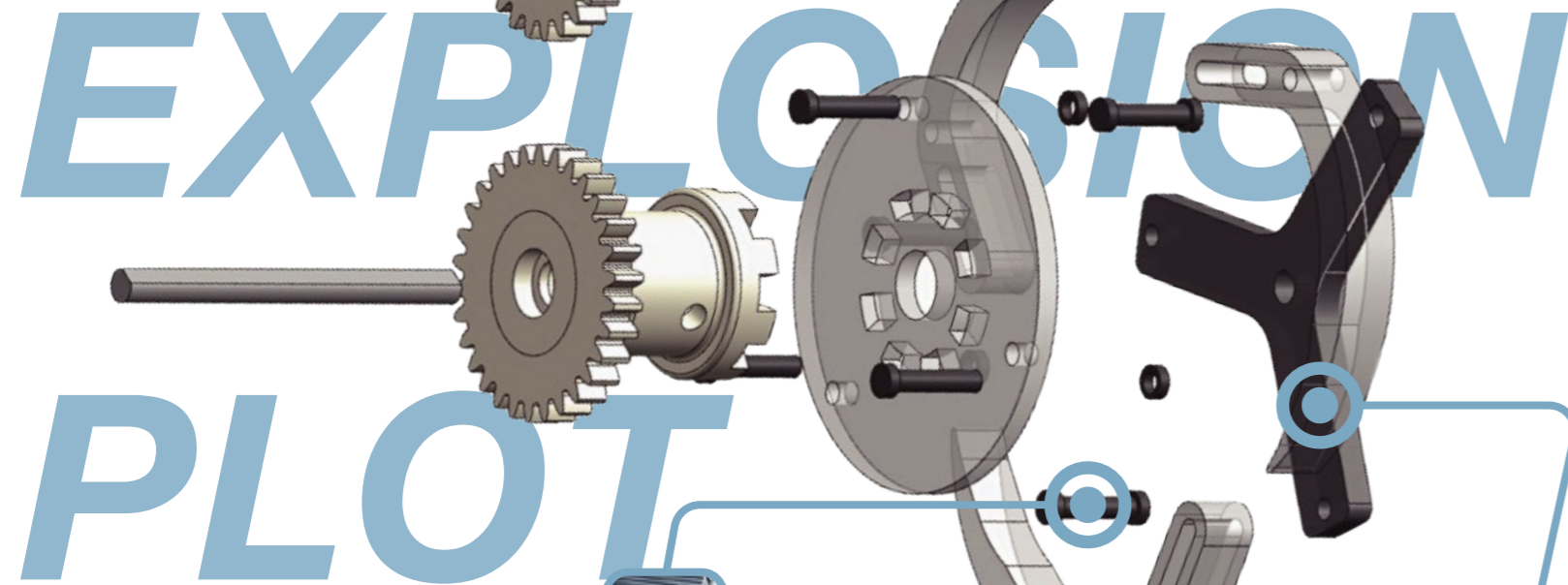
◇ ENGINEERING / CALCULATION

According to the theory of **Mechanical Mechanics**, force and torque are analyzed under different conditions. It proves that three spokes are **the most stable structure** for this sort of vehicle robotics.

ANALYSIS

The portion bearing highest stress and force is **strengthened** with stronger material. The other parts are replaced with **recyclable and light material** to reduce pressure.
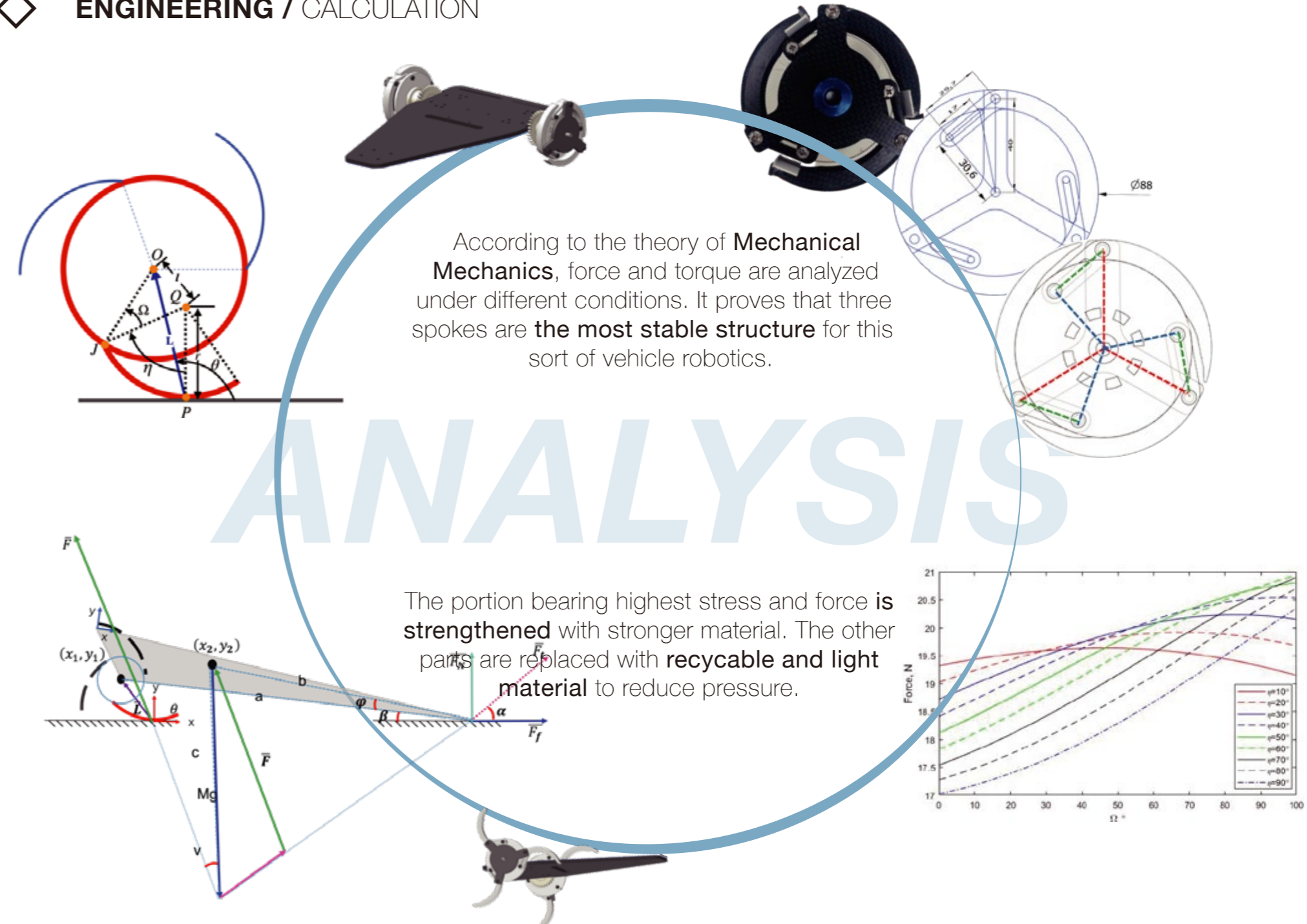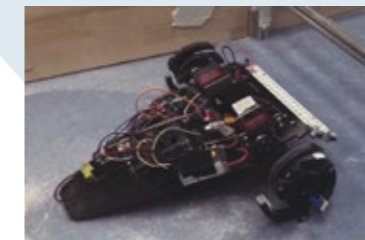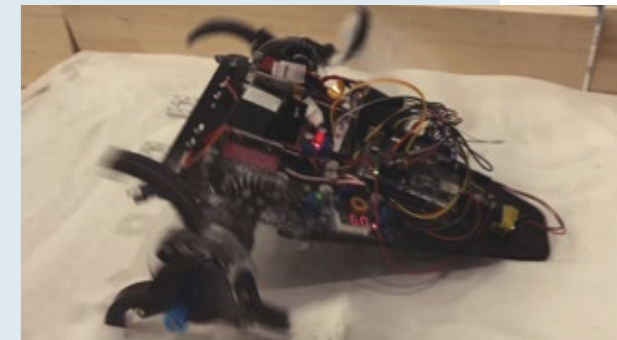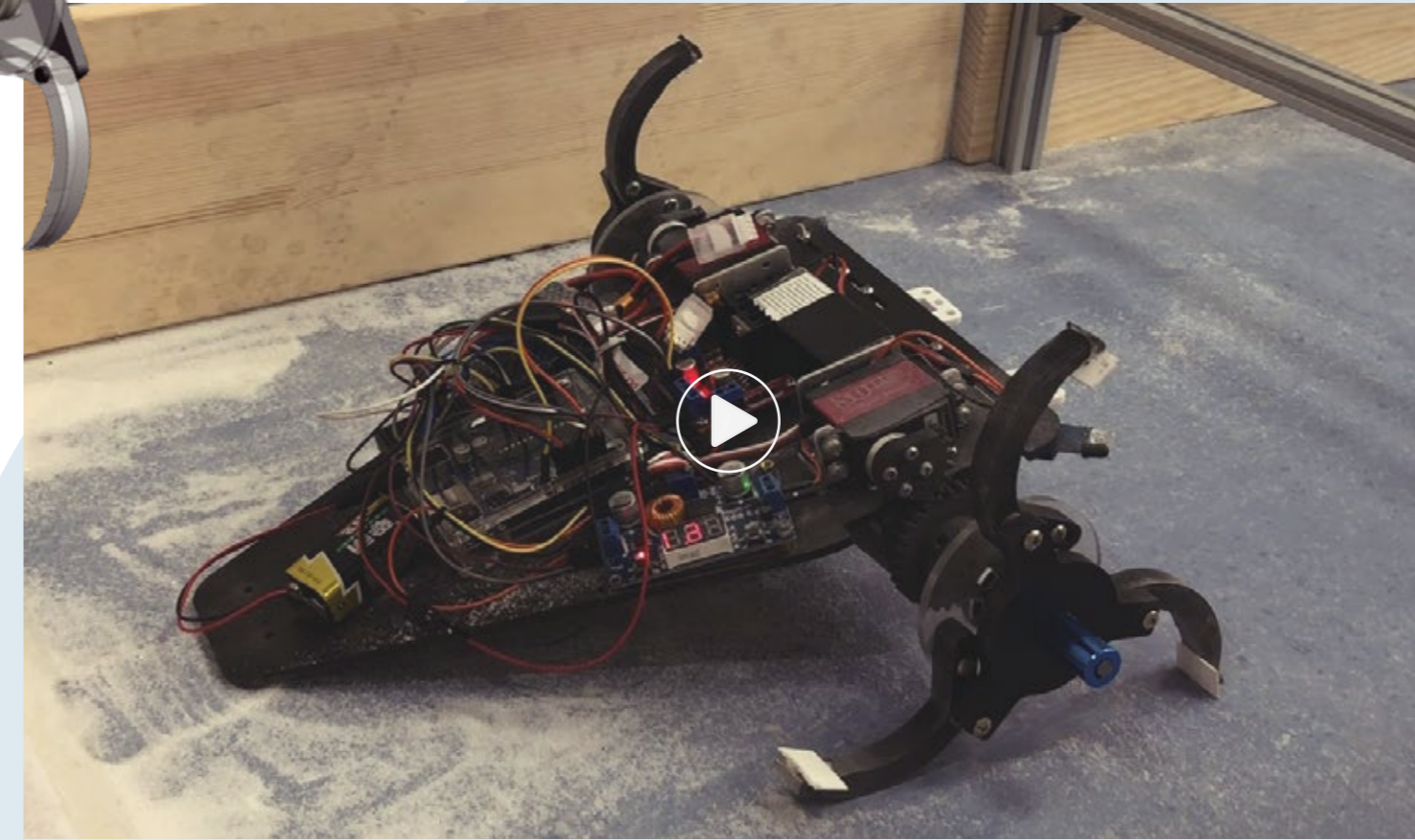
TRANSFORM

EXPANSION

ROBOTICS / TRANSFORMABLE WHEEL, 2018 SUMMER
INSTRUCTOR / PROF. JAEHYUNG JOSHUA JU
**VIDEO URL** / https://youtu.be/Kj5_wO8aApc

PAPERFUGE

COMMUNITY | ENVIRONMENT | INTERACTIVE DESIGN | INDUSTRIAL DESIGN

3 MONTHS

INTRO / Integrated on a single piece of cardboard, paperfuge is easy for patients to install, and help people to centrifuge the blood by themselves after phlebotomization. Compare to the standard procedures done by the machine, the operation for the paperfuge is funny, time-saving and environmentally friendly. It assists poverty areas in improving medicine condition and reducing economic pressure.

◇ **DESIGN SKETCH**

Cardboard

Cotton Rope

Stainless Steel

I   II   III
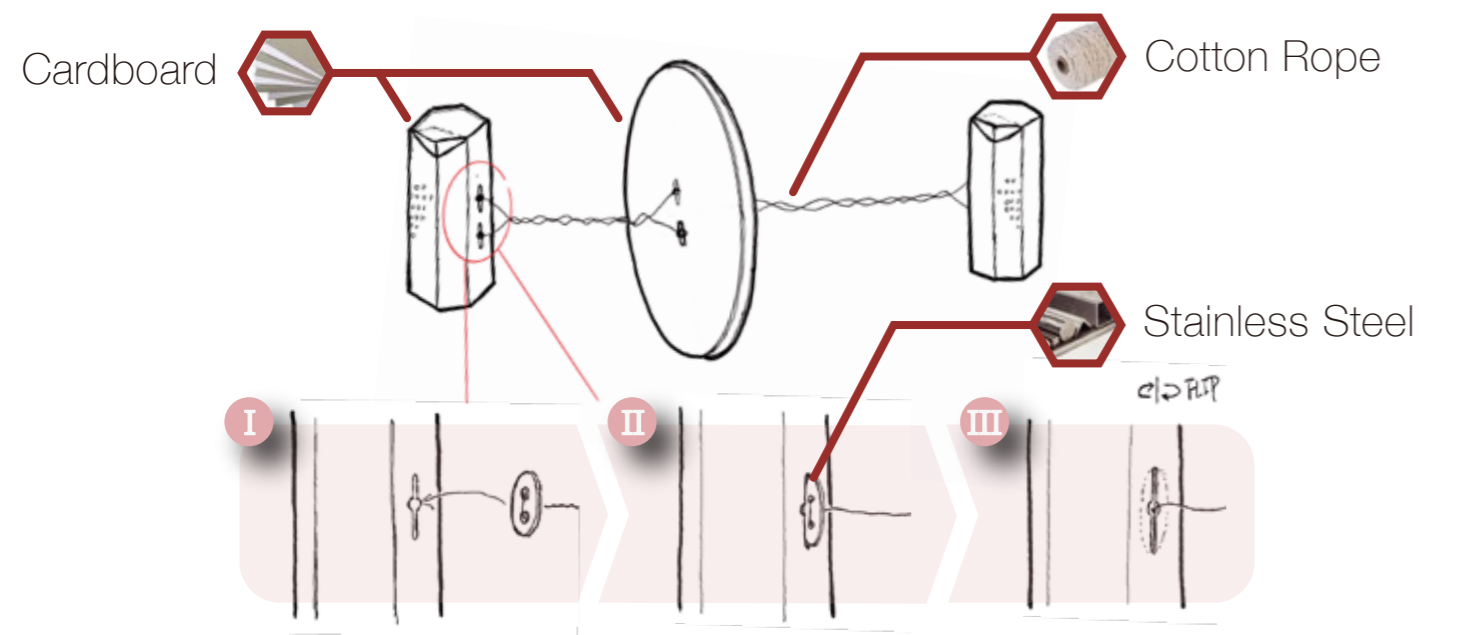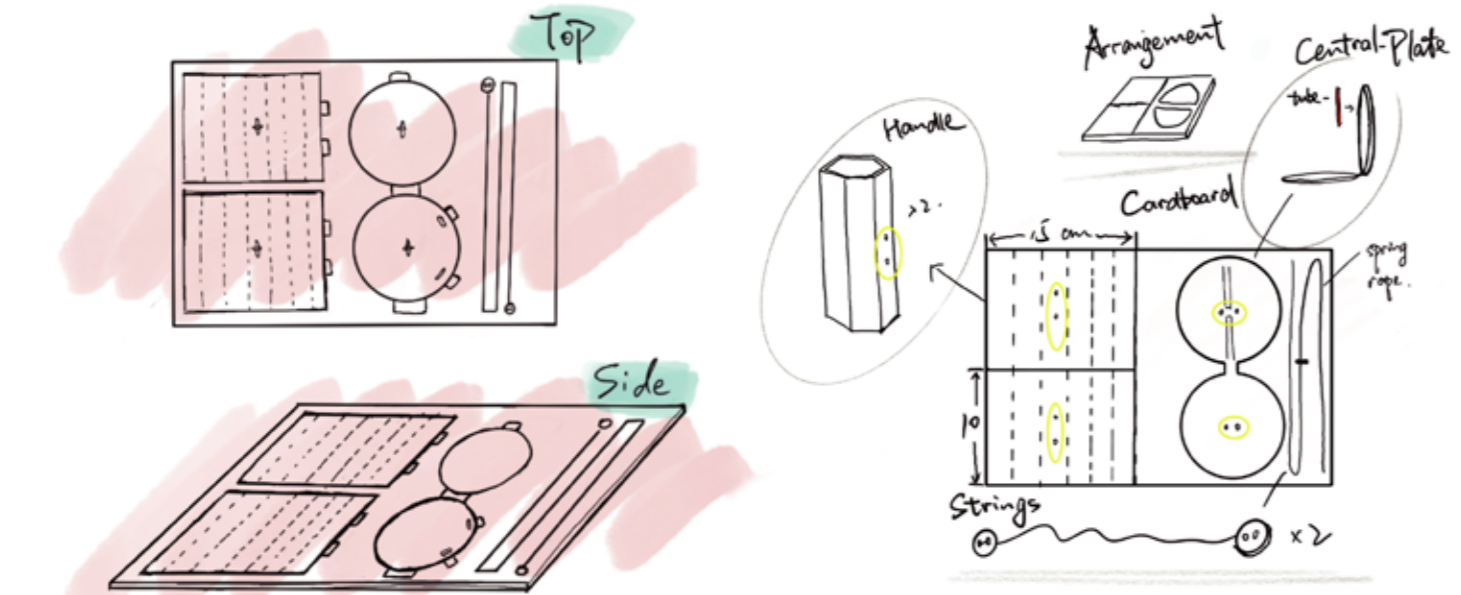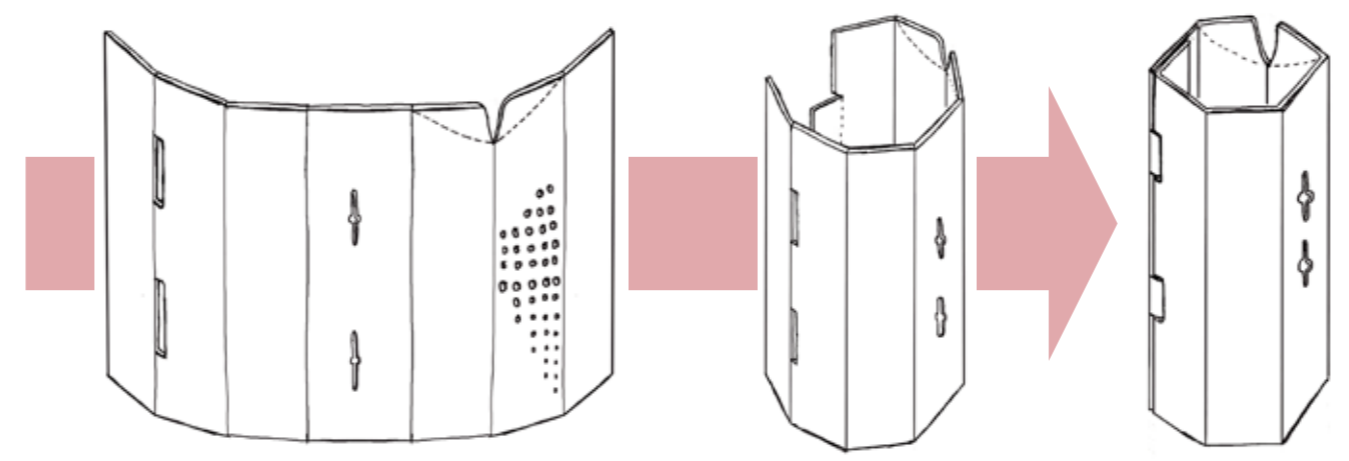
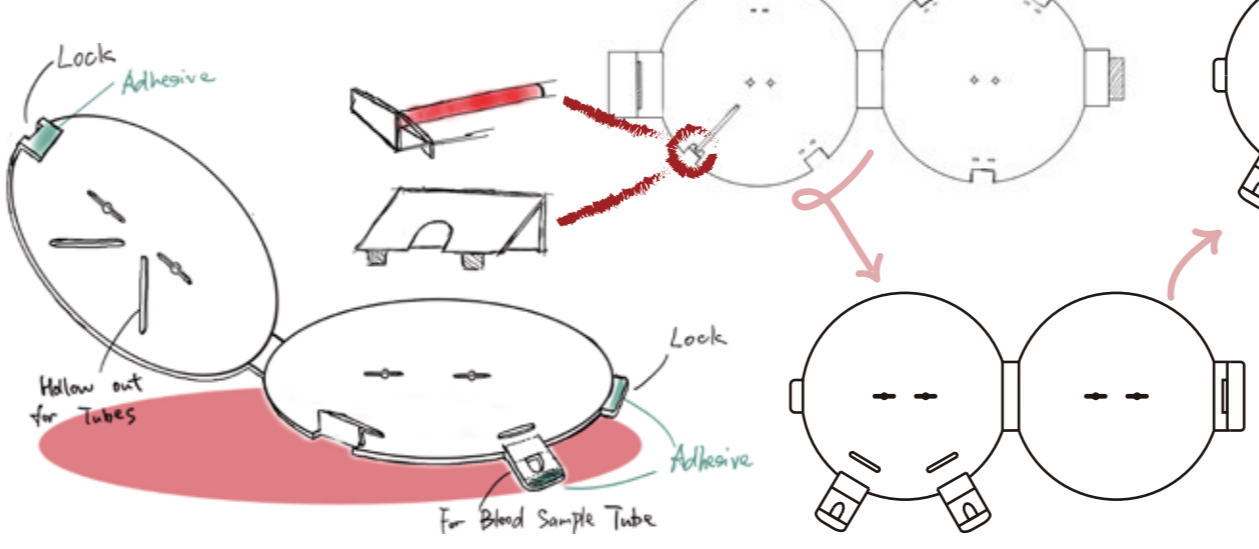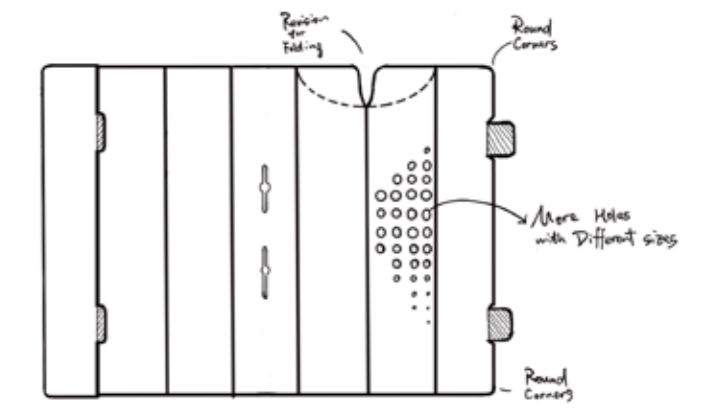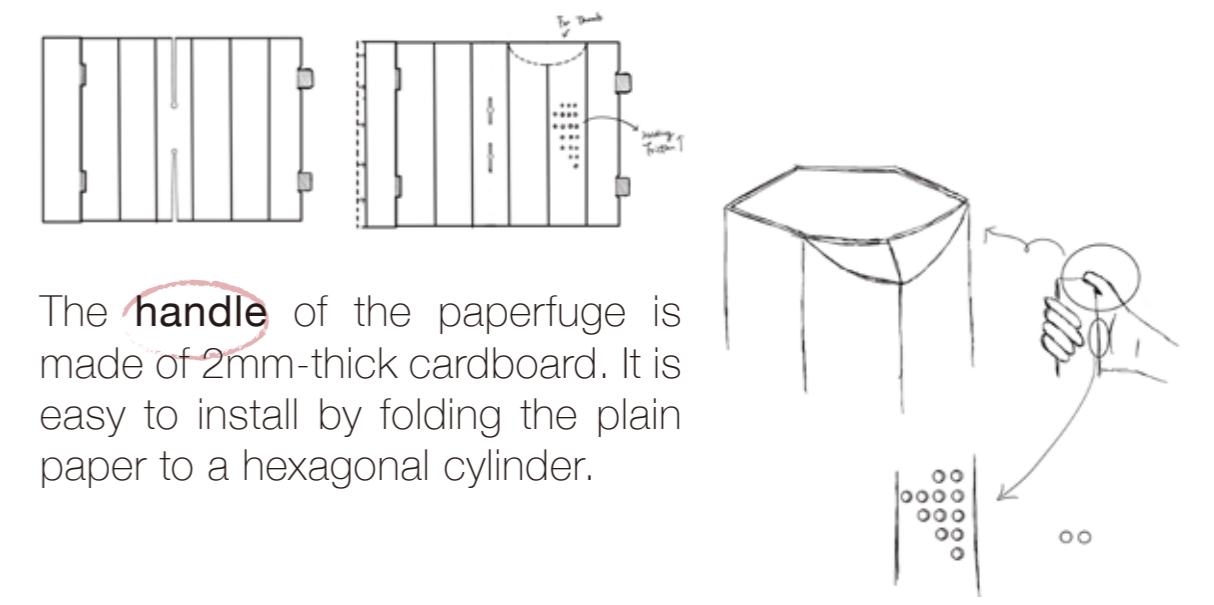## Handle

The **handle** of the paperfuge is made of 2mm-thick cardboard. It is easy to install by folding the plain paper to a hexagonal cylinder.
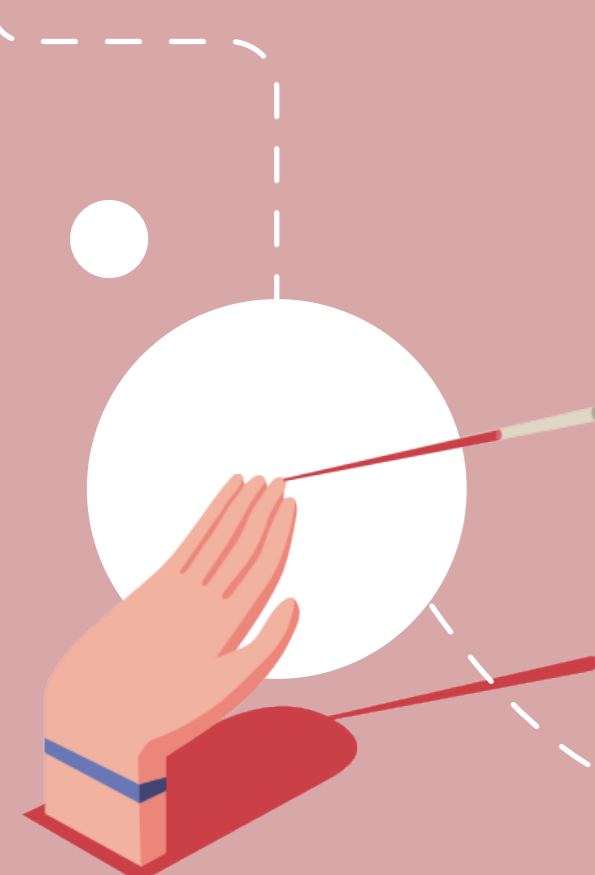
Central Plate

The **central plate** can contain four blood sample tubes maximumly. To increase the stability of the device, adhesive tape is placed on the paper lock parts.
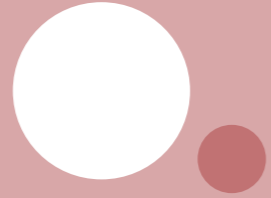
◇ **STORYLINE**

The working process of the paperfuge can be mainly separated into four steps, which are **phlebotomizing, assembling, centrifuging and collecting**.

III. Centrifuge

Thirdly, after the installation, patients start to centrifuge their blood with the equipment for 2-3 minutes. To visualize the progress, part of the paper could be **transparent** to see different layers of the blood.

Plasma
55% of the blood

Buffy Coat
<1% of the blood

Erythrocytes
45% of the blood

I. Phlebotomize

Firstly, use capillary or other tools to draw the blood samples and store in the tubes. The **cleanliness** of the tube is crucial for all the patients as well as doctors.
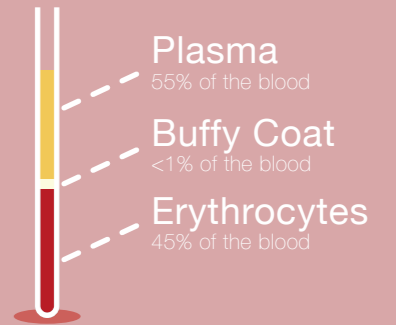
II. Assemble

Secondly, put all the blood sample into the slots on the paperfuge. The sealing of the tubes and the **simplicity** of assembling is important.
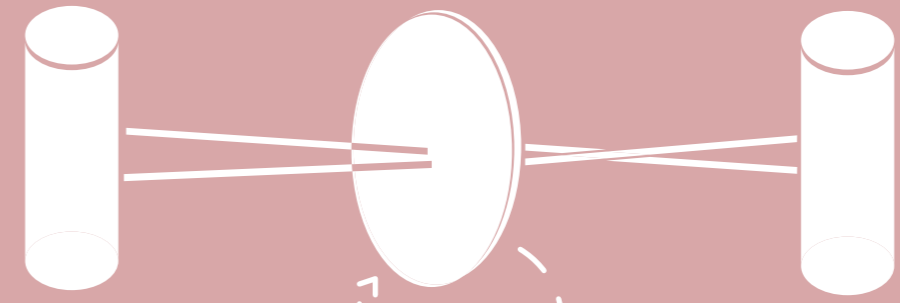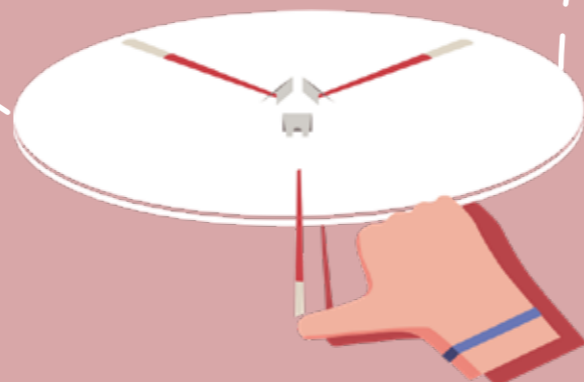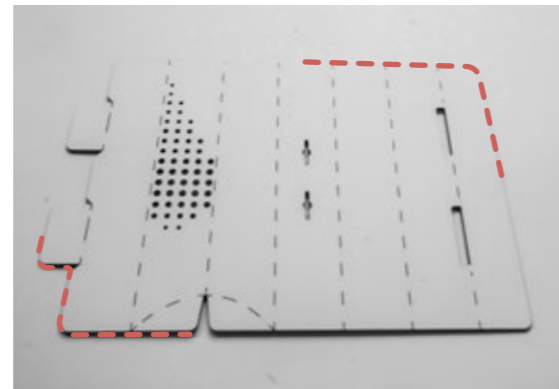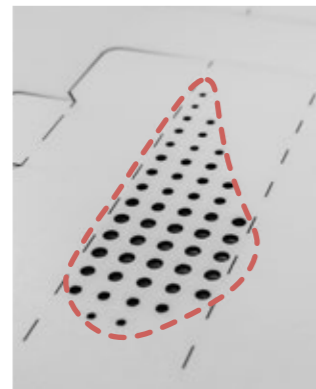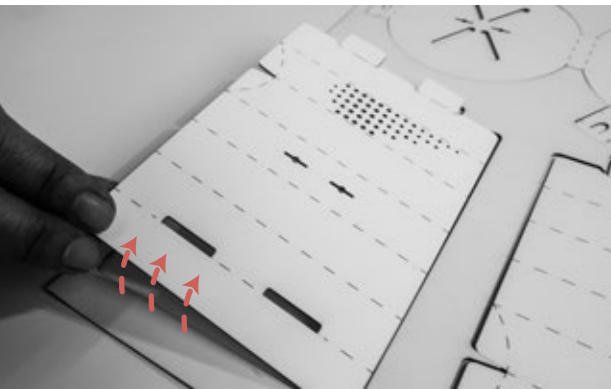
IV. Collect

Finally, the blood samples are ready for further examination. The entire equipment should be **recyclable** and the collecting process should be convenient.

◇ FINAL DESIGN

The paperfuge is integrated on **a single piece of recycable cardboard**. Easy to carry, assemble and discard. Most importantly, it is **ultra-low-cost** that people in poverty area could afford.
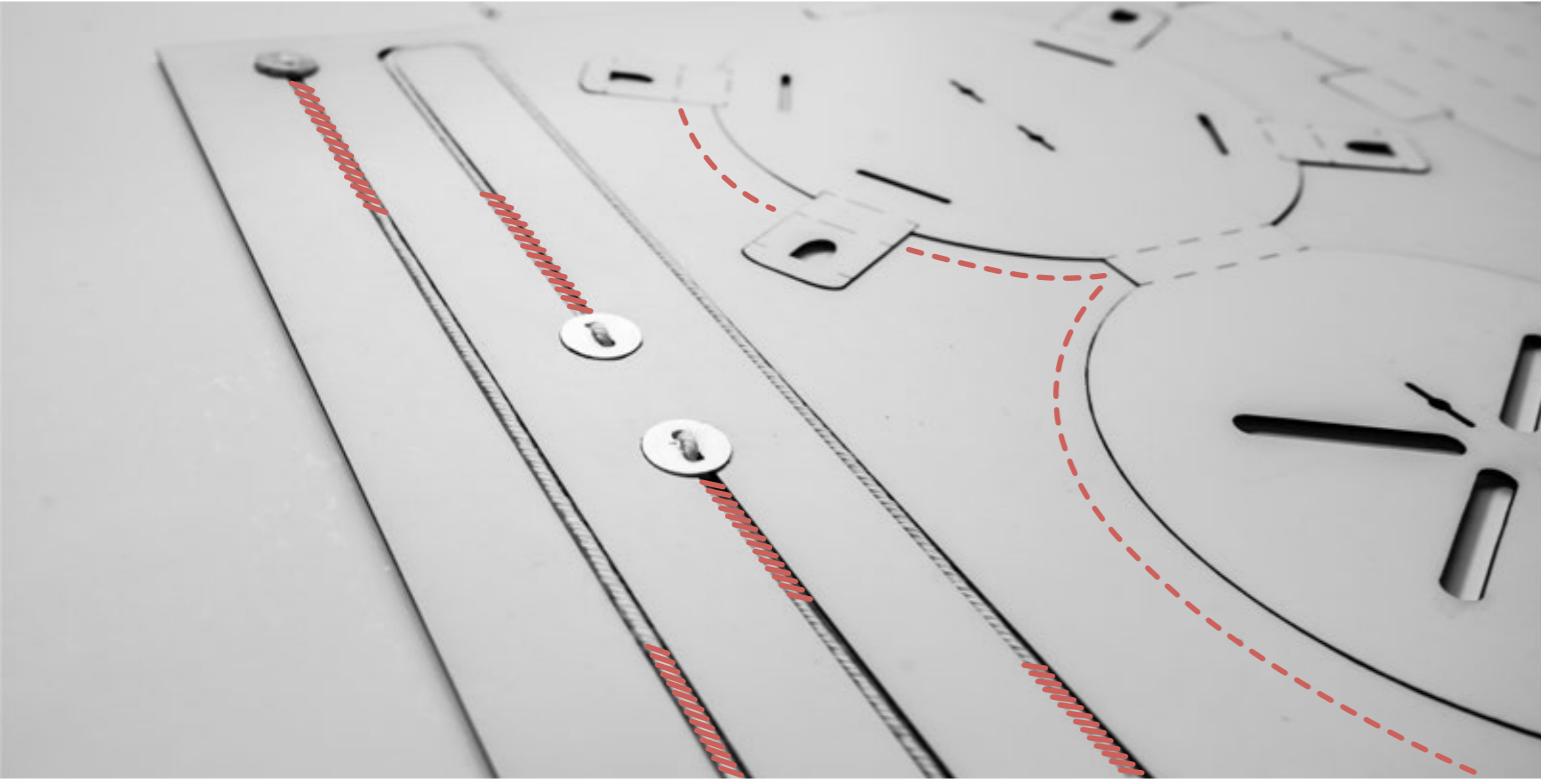
The holes are designed according to **ergonomics** for easy holding.
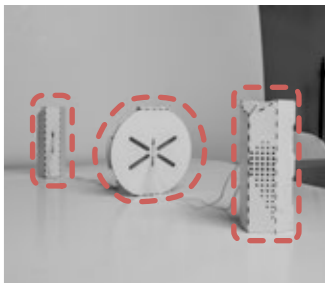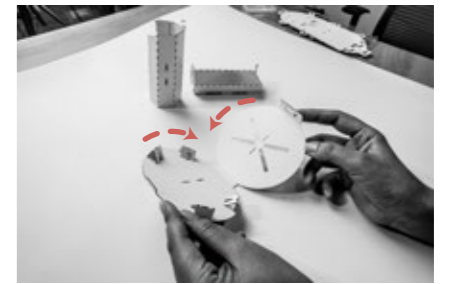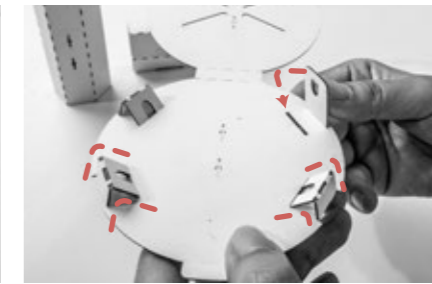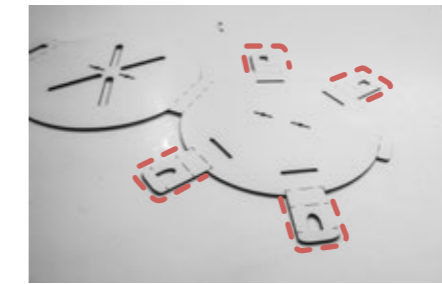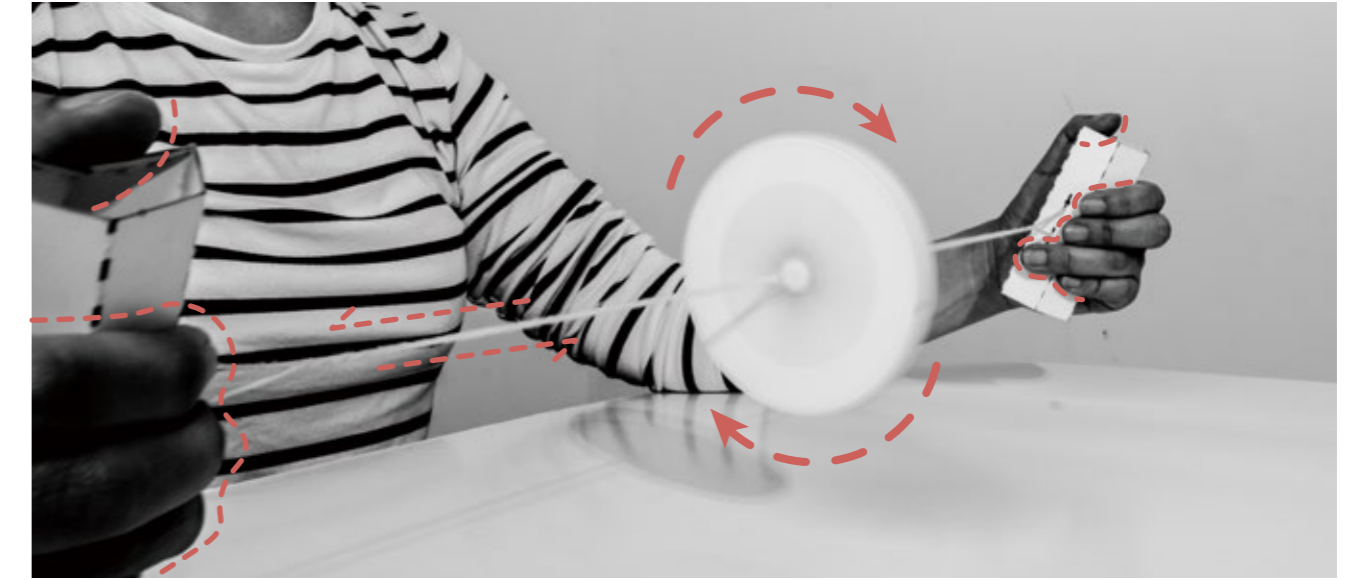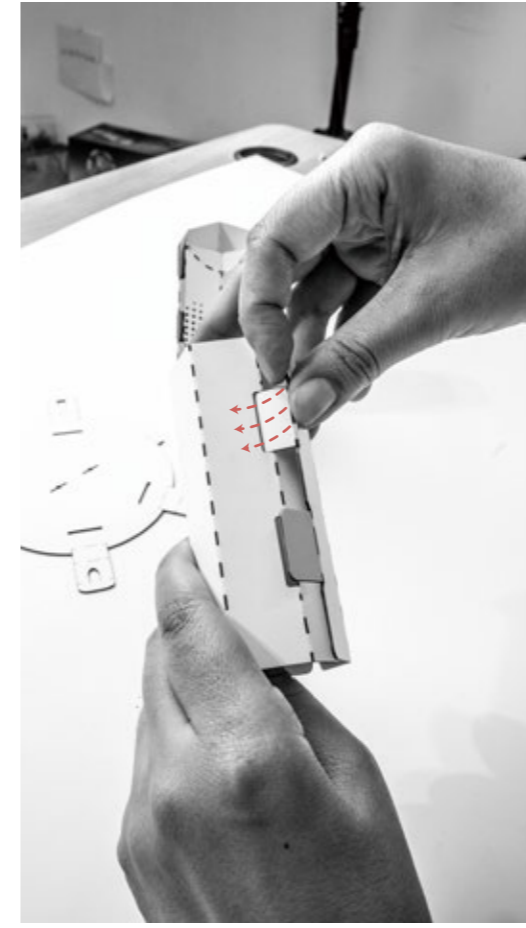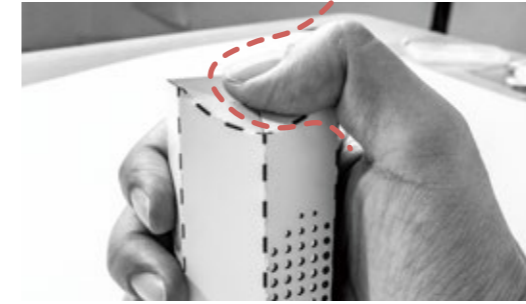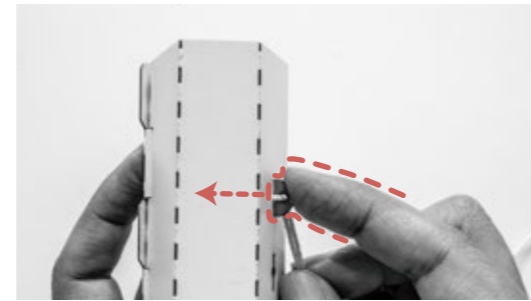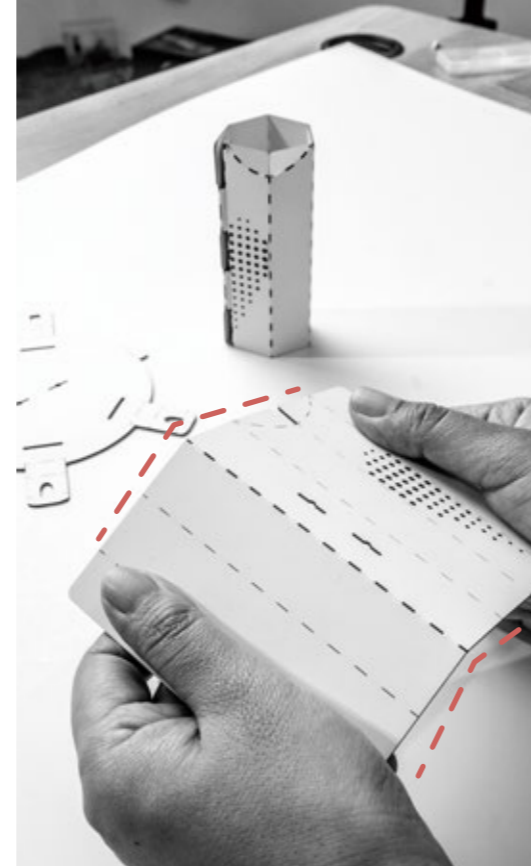
For each Paperfuge, it can contain **four blood tubes** for testing. The blood can be separated **in 1.5 minutes** with high revolution speed.

The **fun** of interacting with the blood centrifuge process will **relieve patients' negative emotion**, especially for childeren. Parents benefit as well.

AURAFIT

MARKET RESEARCH | INTERACTIVE DESIGN | PRODUCT DESIGN

5 MONTHS

INTRO / During the pandemic, people's way of workout changes. The gym has become a confined space susceptible to infection and online workout becomes a new alternative. AuraFit is a comprehensive system designed for people to solve the pain points while exercising at home. Market research dominants this project. From primary to secondary research, to Ethnography, the design strictly follows the market research results.

Maria Allan | Businesswoman, 27 yrs

> *During the Covid-19, I started trying home fitness. I was satisfied with the convenience, fesability and diversity. However, the quality of the online teaching and modes are still not perfect.*

Online Survey x50
Take the form of online questionnaire through Google form, we collected 50 responses from different people ranging from 17 to 65 years old. The results help better understand users attitude towards online fitness quantitatively.

Interview x(10+2)
10 normal interviews on people who daily workout and 2 in-depth interviews on professional trainer and physical therapist to understand the fitness field under the influence of Covid-19.

Ethnography x2
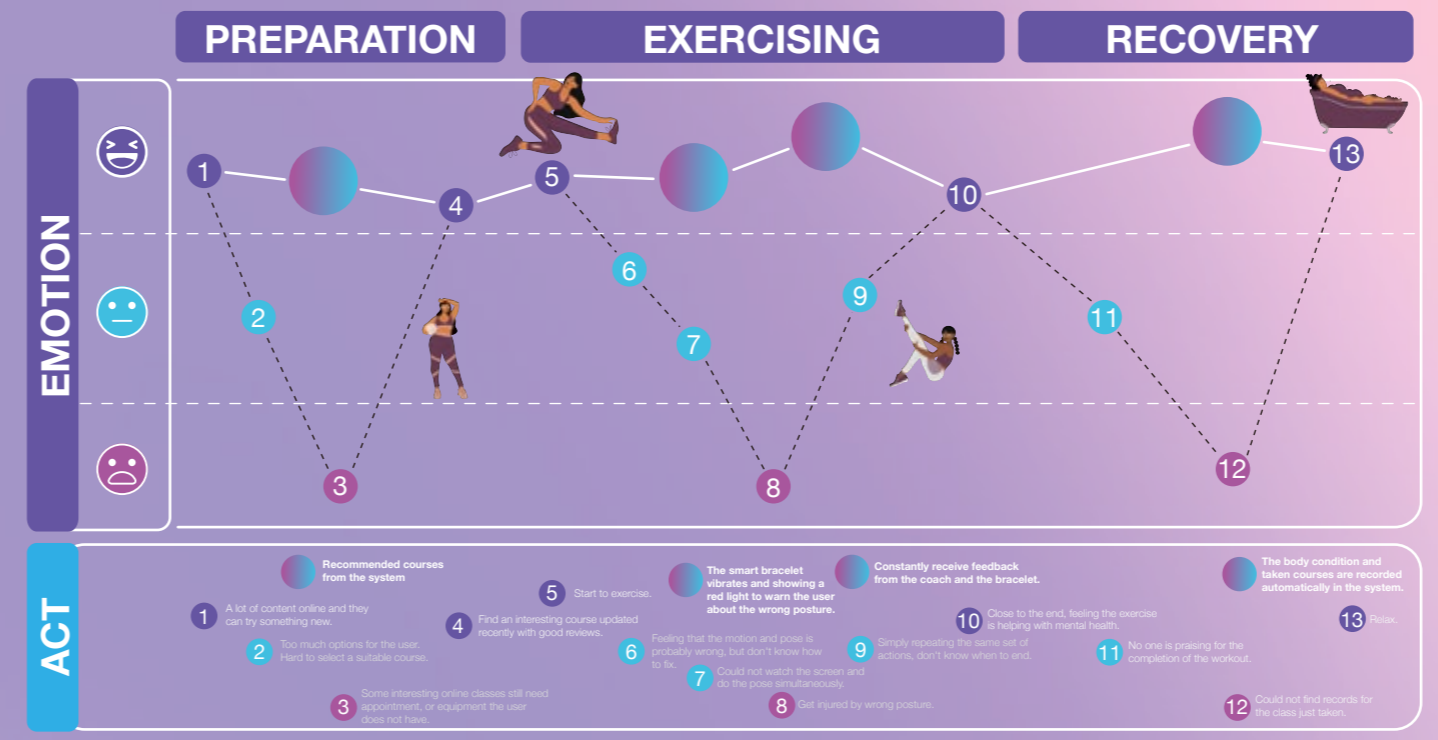Self-oriented experiment to simulate the senario of online fitness at home and figure out the pain points. By playing the role of trainer and trainee, get comprehensive understanding of the workout processes of learning and teaching through the Internet.
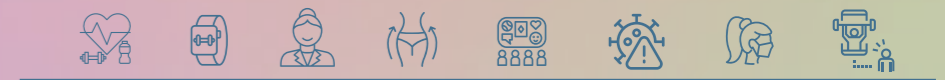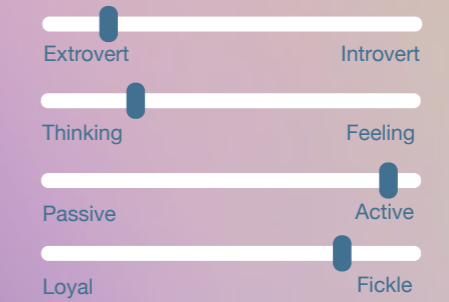
PREPARATION EXERCISING RECOVERY

EMOTION

ACT

1. Recommended courses from the system
   A lot of content online and they can try something new.
2. Too much options for the user. Hard to select a suitable course.
3. Some interesting online classes still need appointment, or equipment the user does not have.
4. Find an interesting course updated recently with good reviews.
5. Start to exercise.
6. Feeling that the motion and pose is probable wrong, but don't know how to fix.
7. Could not watch the screen and do the posture simultaneously.
8. Get bored by wrong posture.
9. Simply repeating the same set of actions, don't know when to end.
10. Close to the end, feeling the exercise is helping with mental health.
11. Be one is pushing for the completion of the workout.
12. Could not find records for the class just taken.
13. [Done]

The smart bracelet vibrates and showing a red light to warn the user about the wrong posture.

Constantly receive feedback from the coach and the bracelet.

The body condition and taken courses are recorded automatically in the system.

Home Fitness Equipment Growing Trend 2020 - 2021

Global Home Fitness Equiptment Market 2016 - 2026

U.S. Fitness App Market Size by Type 2020 - 2026 (USD Million)
- Activity Tracking
- Diet & Nutrition
- Exercise & Weight Loss

Online Fitness Courses, Classes, and Subscriptions 2020 vs 2021
- 2020
- 2021
- Percentage Increase

An Online Fitness Class or Fitness Video
- Men
- Women
- Ages 19-29
- 30-49
- 50-64
- 65+
- HS or less
- Some College
- College+
- Rural
- Suburban
- Urban

Watched Livestreamed Concert or a Play Online
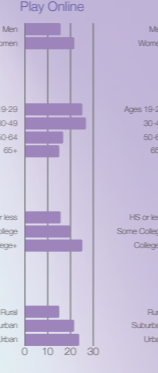
A Virtual Party or Social Gathering Online with Friends & Family

68.2% of the people will get back to gym because of the inefficiency of online fitness
- 20.5% Online & Gym
- 11.3% Online
- 68.2% Gym
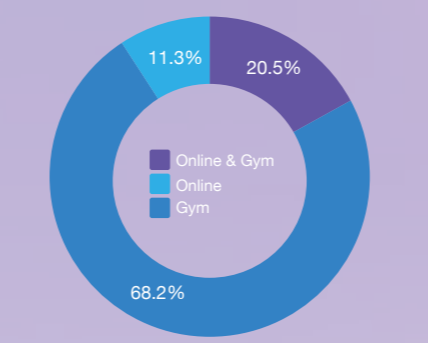
79.1% of the people are willing to spend more than $500 monthly on fitness
- 7% >$501
- 11.6% $301-$500
- 79.1% $101-$300
- <$100

Personality

Extrovert — Introvert
Thinking — Feeling
Passive — Active
Loyal — Fickle

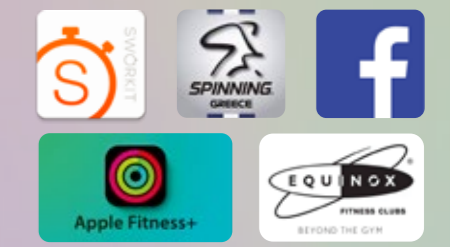|	
AGE	27
OCCUPATION	Program Manager
STATUS	Single
LOCATION	San Francisco
ARCHETYPE	The Communicator
TIER	Workout Amatuer

Communicative   Hardworking
Subhealth   High-Efficient

Bio
Maria is a young businesswoman, working in the financial industry. She is very well-educated and earns over $75k annually. She hope that she could keep fit and make some friends through the workouts. During Covid, she started to work out at home. She was surprised by the variety of the online courses and the convenience. Nevertheless, she still want to have some customized options for the courses. In addition, lack of physical instruction, Maria worries about the accuracy of the movement as well as injury. Maria likes to make friends. Partners during the workout will also motivate her. Sadly, home fitness do not meet her needs.
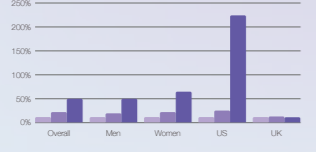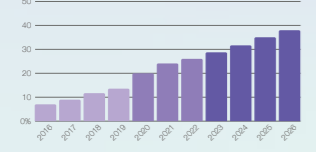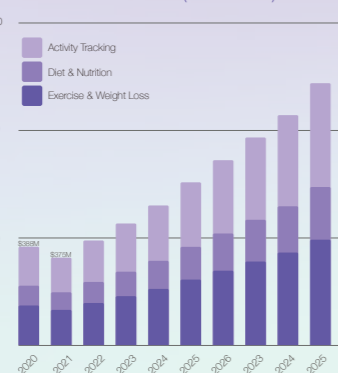
Brands

AuraFit is a comprehensive system helping to improve the user experience of the online workout. The system contains a pair of smart bracelets and a software app.

The AuraFit Bracelets can remind users whether they are in the correct fitness position. If no, thei will vibrate accordingly.

The system contains various functions including A.I. courses recommendation, body condition recording, daily plan and the information about the bracelets.

AuraFit Software

AuraFit Bracelets

Correct Position

Wrong Position

Light Mode
Dark Mode

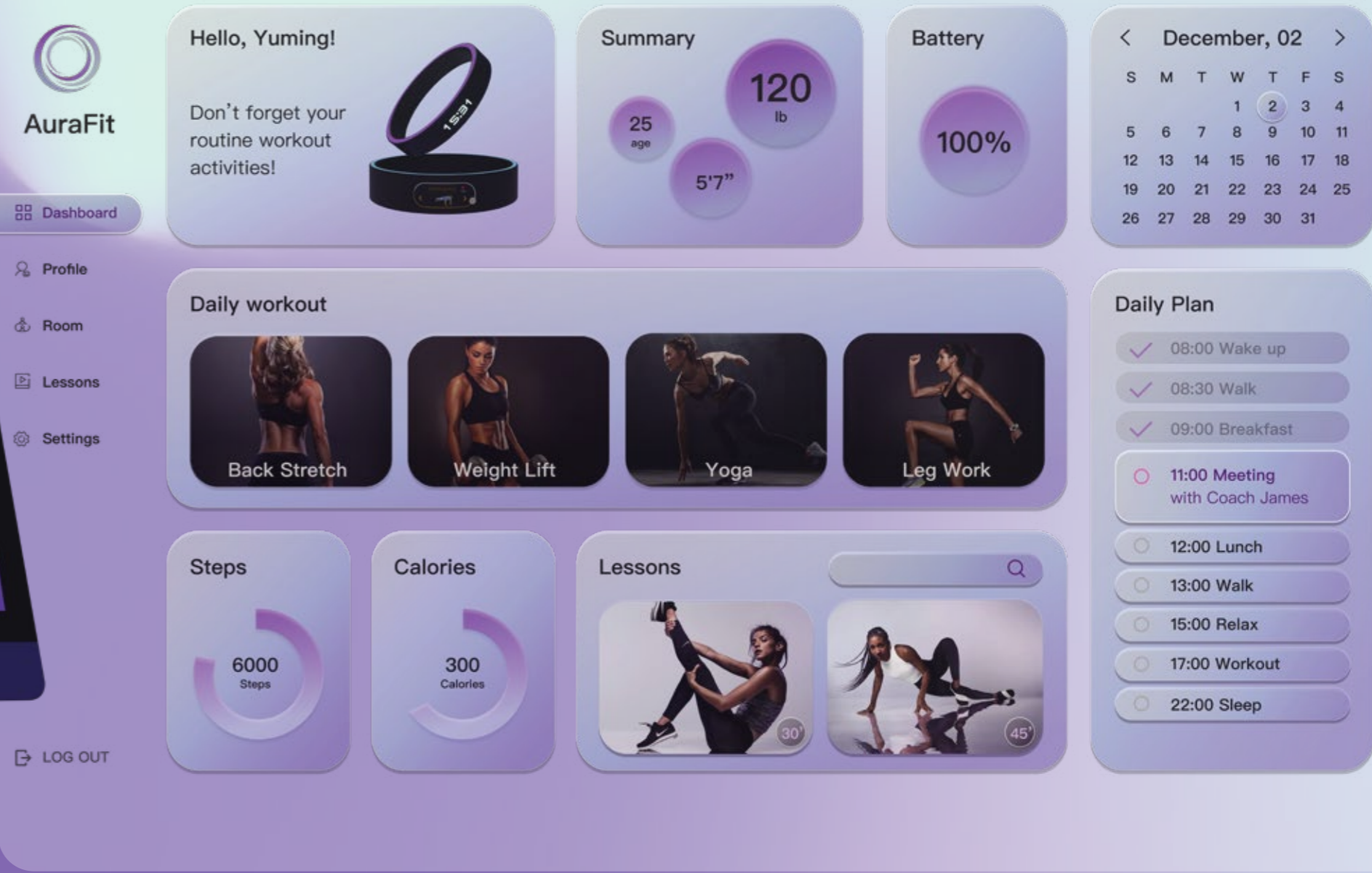Two modes are designed. Through research, people work out in a very wide range of time, and different modes can be better adapted to a larger group of users.

AuraFit

- Dashboard
- Profile
- Room
- Lessons
- Settings

LOG OUT

Hello, Yuming!
Don't forget your routine workout activities!

Summary
25 age 120 lb 5'7"

Battery
100%

December, 02
S	M	T	W	T	F	S
				1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31

Daily workout
Back Stretch | Weight Lift | Yoga | Leg Work

Steps
6000 Steps

Calories
300 Calories

Lessons

Daily Plan
- ✓ 08:00 Wake up
- ✓ 08:30 Walk
- ✓ 09:00 Breakfast
- ○ 11:00 Meeting with Coach James
- ○ 12:00 Lunch
- ○ 13:00 Walk
- ○ 15:00 Relax
- ○ 17:00 Workout
- ○ 22:00 Sleep

SCRIPT MODE - OSMO POCKET

INTERACTIVE DESIGN | UI/UX

4 MONTHS

INTRO / Osmo Pocket is a popular portable camera for photography enthusiasts. However, the mobile app is not compatible with the device due to the lack of certain functions. By developing the script mode, users can customized the shooting script in advance. In addition, the easy editing and sharing process help the amateurs to obtain a sense of accomplishment from successful shoots.

STABLE

Gimbal
Electronic
Optical

Gimbal / Physical structure for stablization. No image quality sacrafice or screen cropping. Used for professional shooting devices for both photos and videos.

Optical: Computer algorithms for photo stablization. This method will increase motion blur and sacrafice image quality under low light conditions.

Electronic: Computer algorithms for video stablization. The screen will be cropped and only used for video.

Pros
&
Cons

Portable
Tiny Screen
Multi-Mode
Hard to Edit

Pros

Portable size   **Panoramic mode**   **Landscape mode**   Take and shoot   **Tracking mode**

Cons

Tiny screen   **Hard to edit**   Weak focus system   **Unfriendly to new users**   Heat generation

If I have a specific **shooting script**, I would definitely go with the Osmo Pocket because of his good image quality and light weight.

I will bring both my phone and Osmo pocket if I can. I will use Pocket for shooting because I can **save the battery** of my phone.
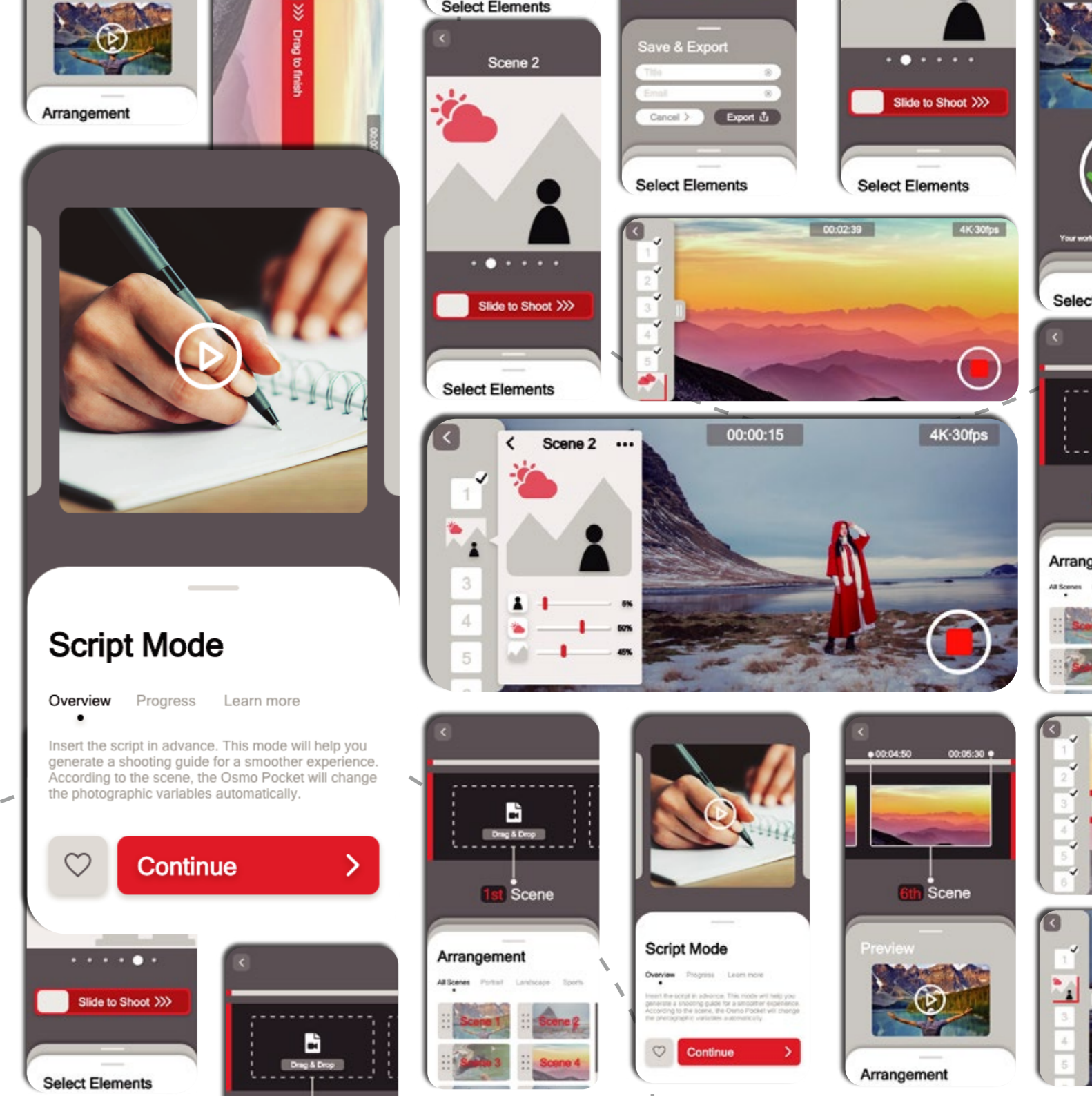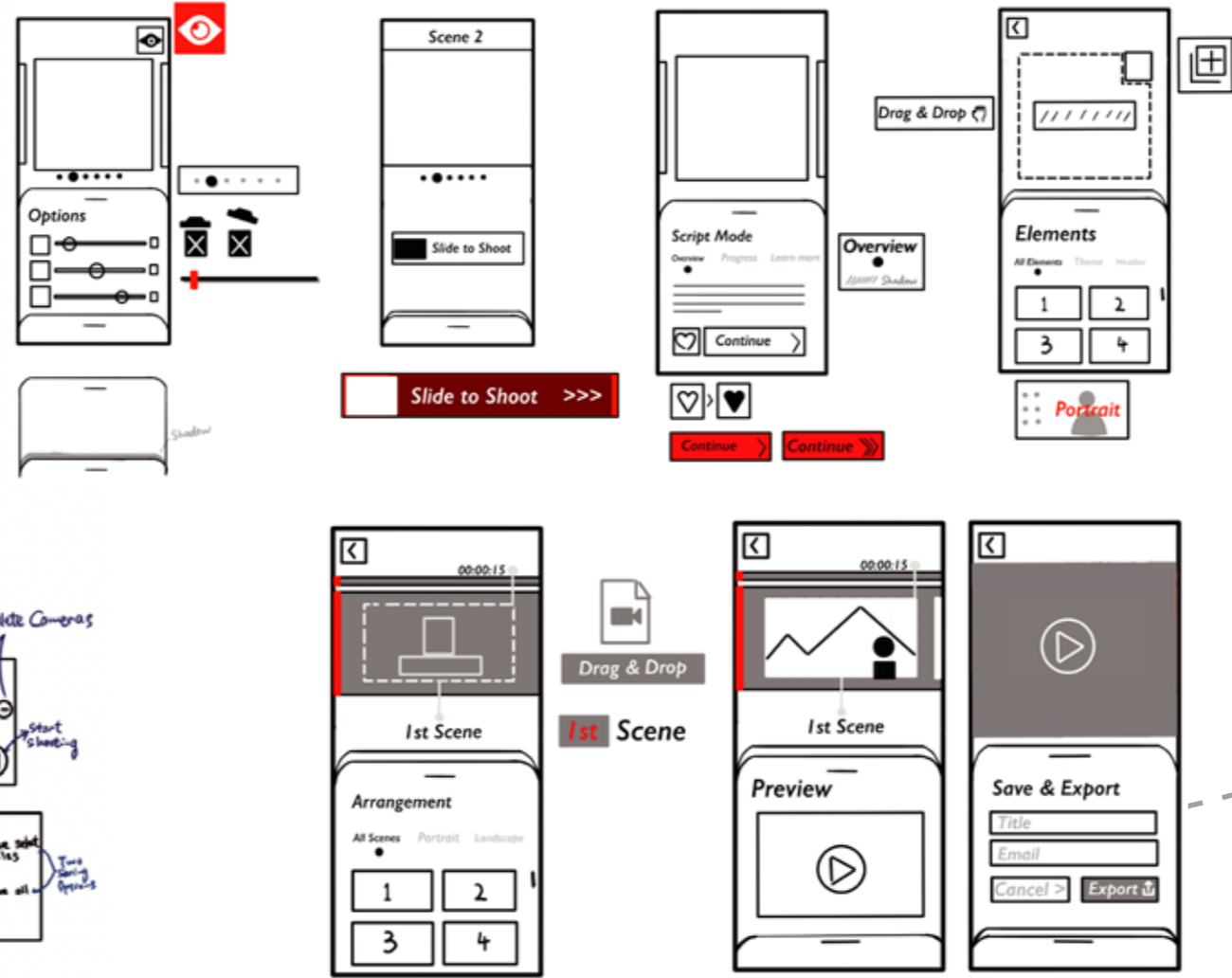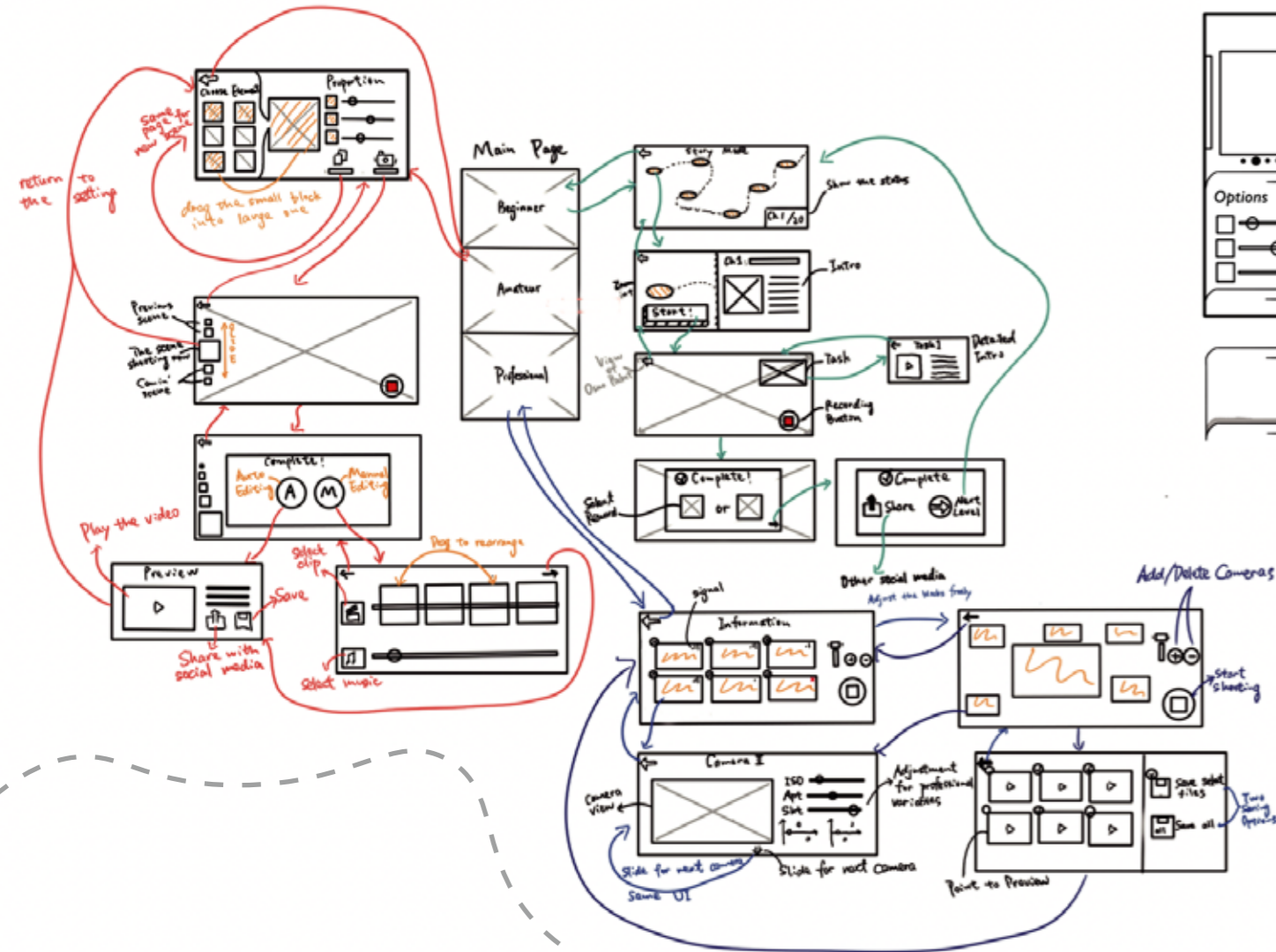
I wish there could be a simple and **auto editing mode** after I take a shot. Video is much more complicated to edit than photos.

People who are not good with electronic products tend to refuse Osmo Pocket. They are **afraid of learning new technology**.

DESIGN / FLOWCHART & SKETCH & INTERFACE

Script Mode

Overview   Progress   Learn more

Insert the script in advance. This mode will help you generate a shooting guide for a smoother experience. According to the scene, the Osmo Pocket will change the photographic variables automatically.

Continue

◇ **Final Product**

SCRIPT IMPORT

This mode is designed for amateur users. He/She can import the shooting script in advance through **graphic interface**. By adjusting the proportion of the element in every piece of the shooting script, one can have a customized plan that help improve the final work.

Script Mode

Overview   Progress   Learn more

Insert the script in advance. This mode will help you generate a shooting guide for a smoother experience. According to the scene, the Osmo Pocket will change the photographic variables automatically.

♡   **Continue**   ›

SHOOTING INTERFACE

In this interface, a side bar can be scratched and shown. The user can see the **thumbnails of the script and details** of them if clicked. This help the user to recap the memory and follow the script they wrote in advance.

EDITING & SHARING

After finishing shooting, a simple **editing mode** can be used for quick adjustment. The user can switch the sequence of the footage and preview the work. Finally, the completed work can be shared through **social network and saved in the local files** according to the needs.

M&M SHOOTING MACHINE

ROBOTICS | CODING | INTERACTIVE DESIGN | FUN DESIGN

2 MONTHS

INTRO / The most interesting project I have ever made. Design doesn't have to be serious all the time. The M&M Shooting Machine applies various techniques including coding, modeling, 3D printing, manufacture, and electronics. The machine can automatically reload chocolate beans, detect people in front of it by the ultrasonic sensor, and shoot. People can have fun catching the beans with their mouths.
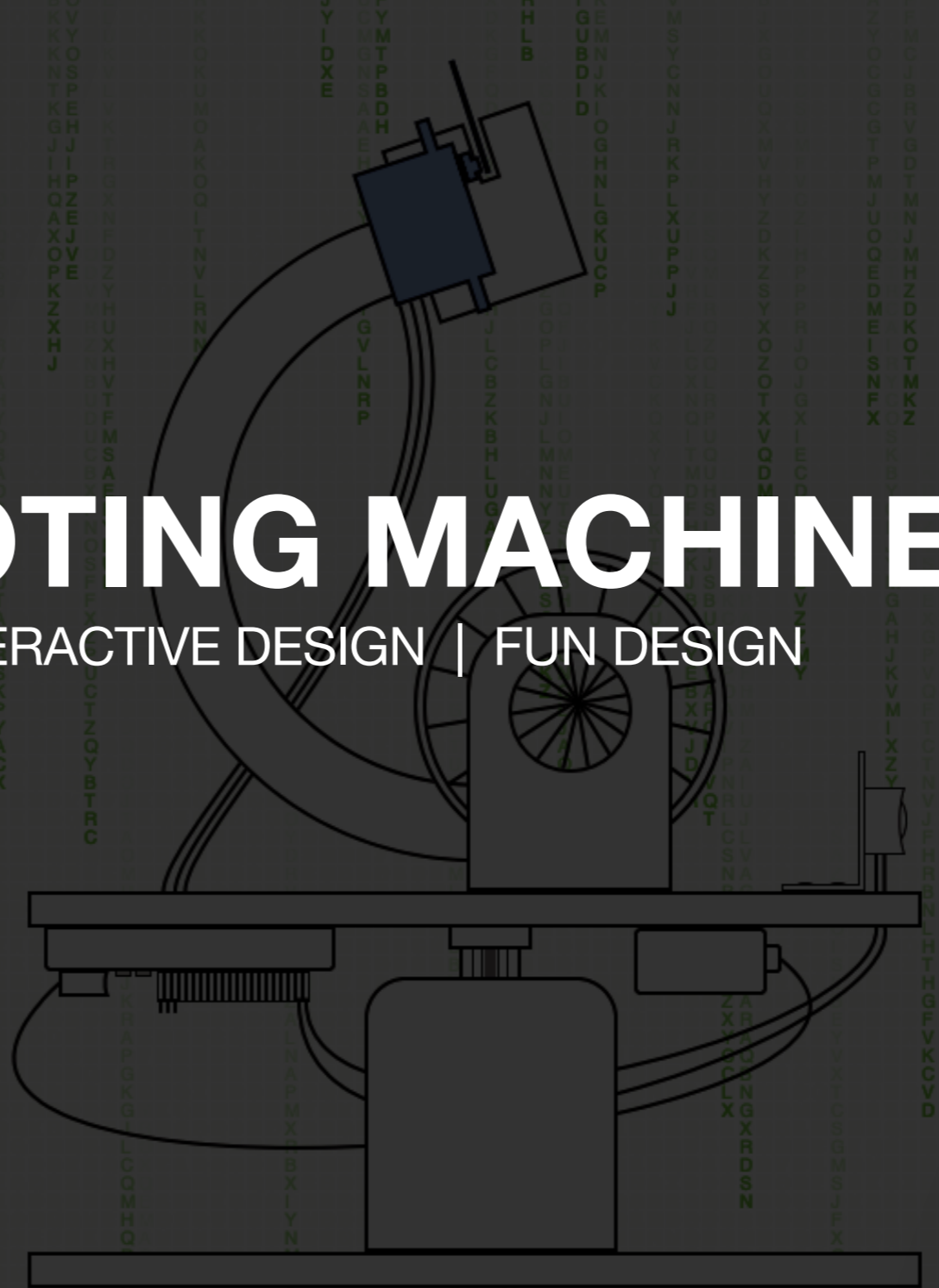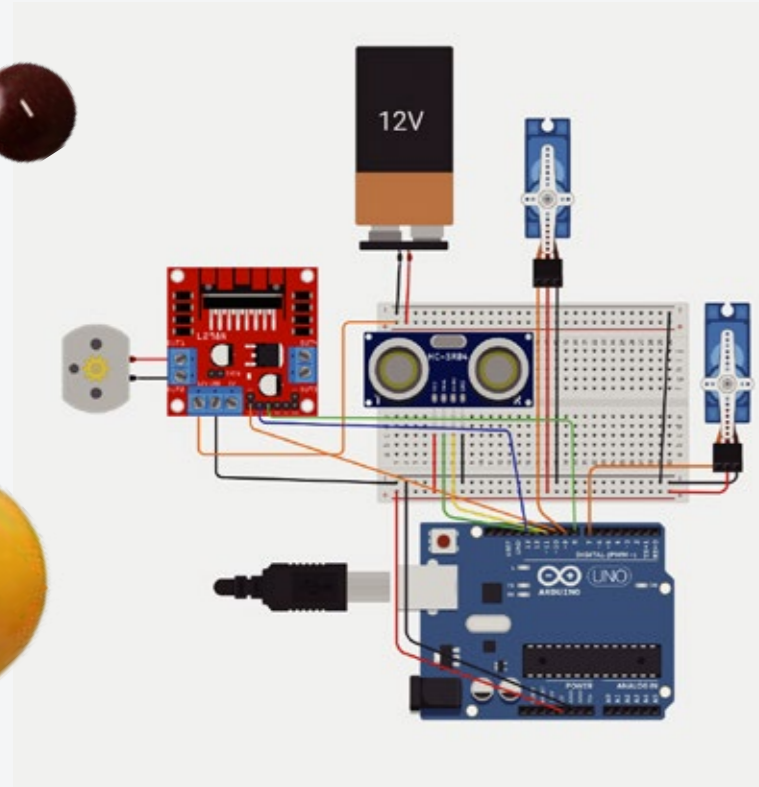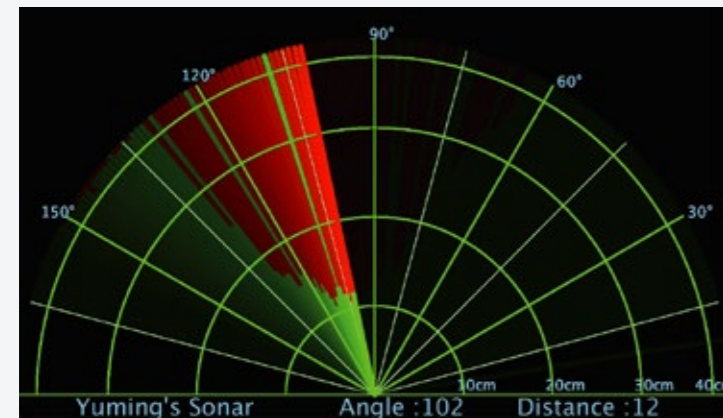
ARDUINO / WIRING

The entire system is built based on the Arduino, combining with a ultra-sonic sensor to detect the person in front, two servos to rotate the plate and control the entrance of the chocolate beans, a motor to shoot the M&Ms and a 12v battery to supply the power.

PROCESSING / RADAR

The feedback of the ultrasonic sensor will be shown on the screen by Processing program. It can demonstrate the angle and distance of the detected obstacles.
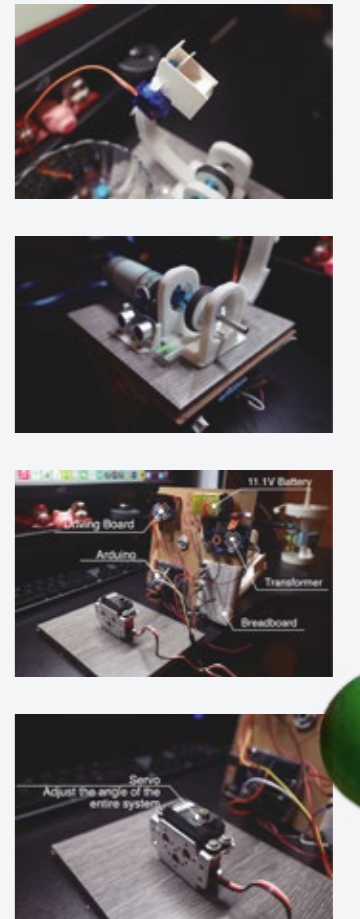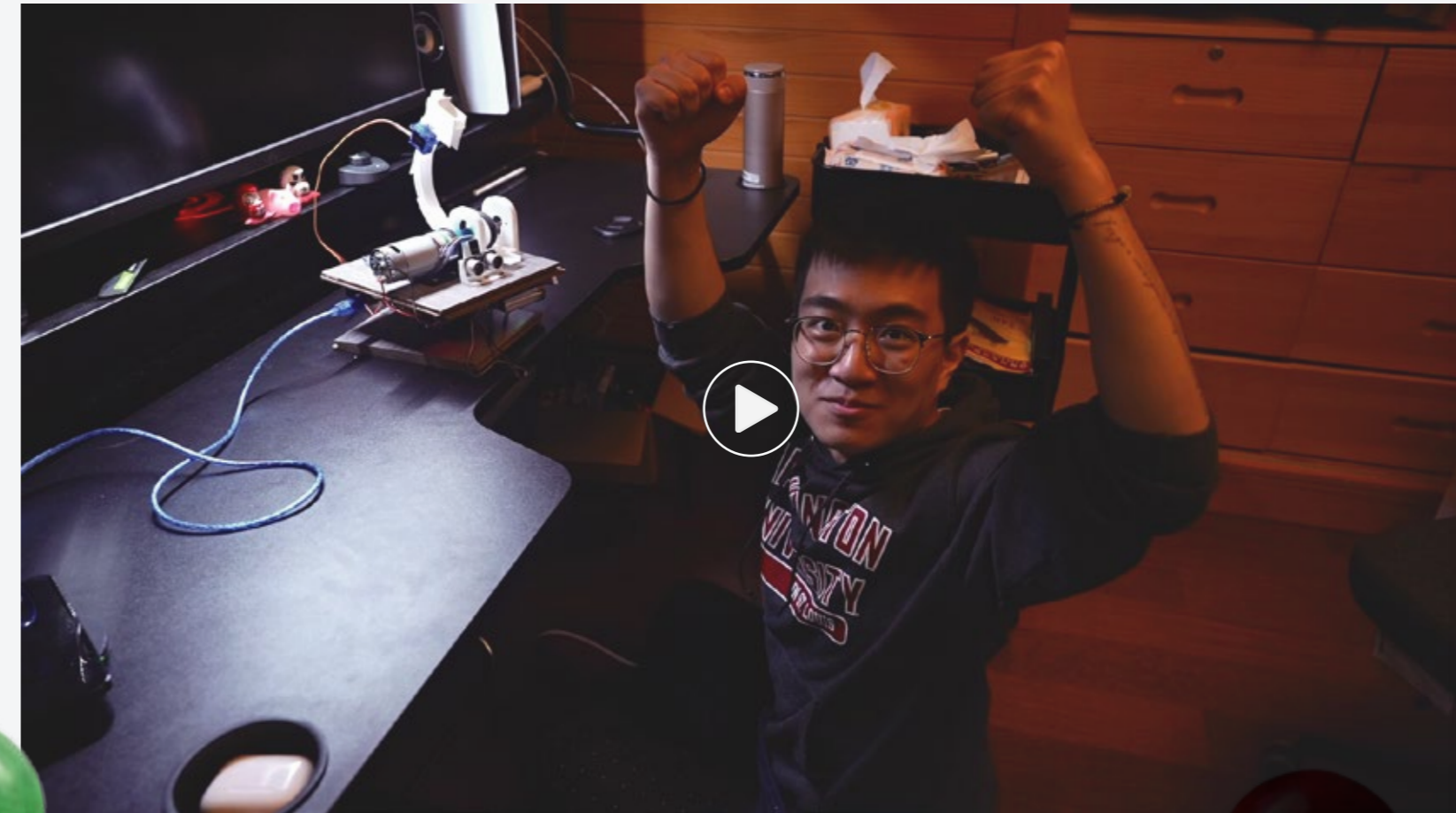
ROBOTICS / YEAR 2021, 2021SPRING
INSTRUCTOR / PROF. SUDHANSHU TEWARI
VIDEO URL / https://youtu.be/R_3Aet9g2YY

FORM STUDIO - METAL WASHER

CREATIVE THINKING | PHOTOGRAPHY | MATERIAL

5 MONTHS

INTRO / The form of an object is often not as simple as one might think. A metal washer as the object in this project shows distinctive forms under different light, speed, and coverings. Combining the Arduino and the camera, I captured the dance of light on the surface of the metal, intricate, beautiful, and fascinating.
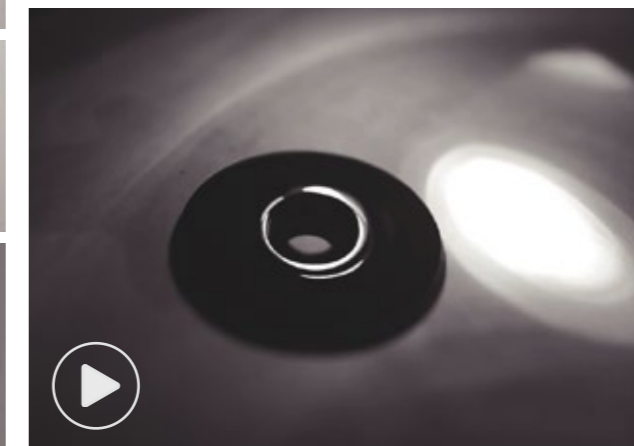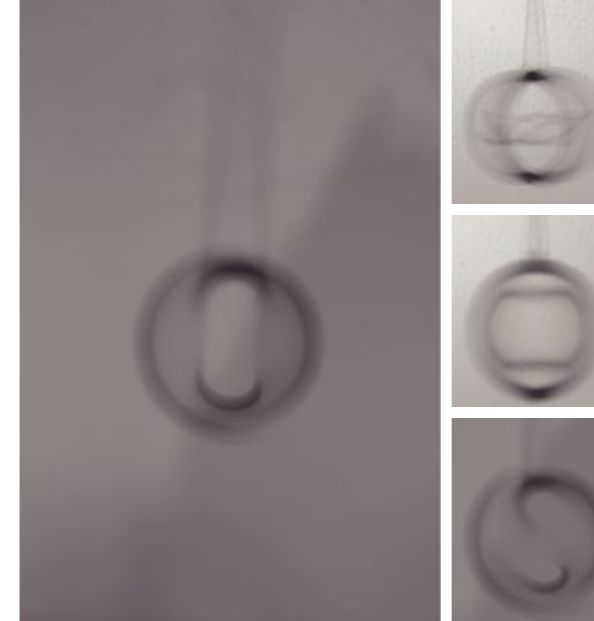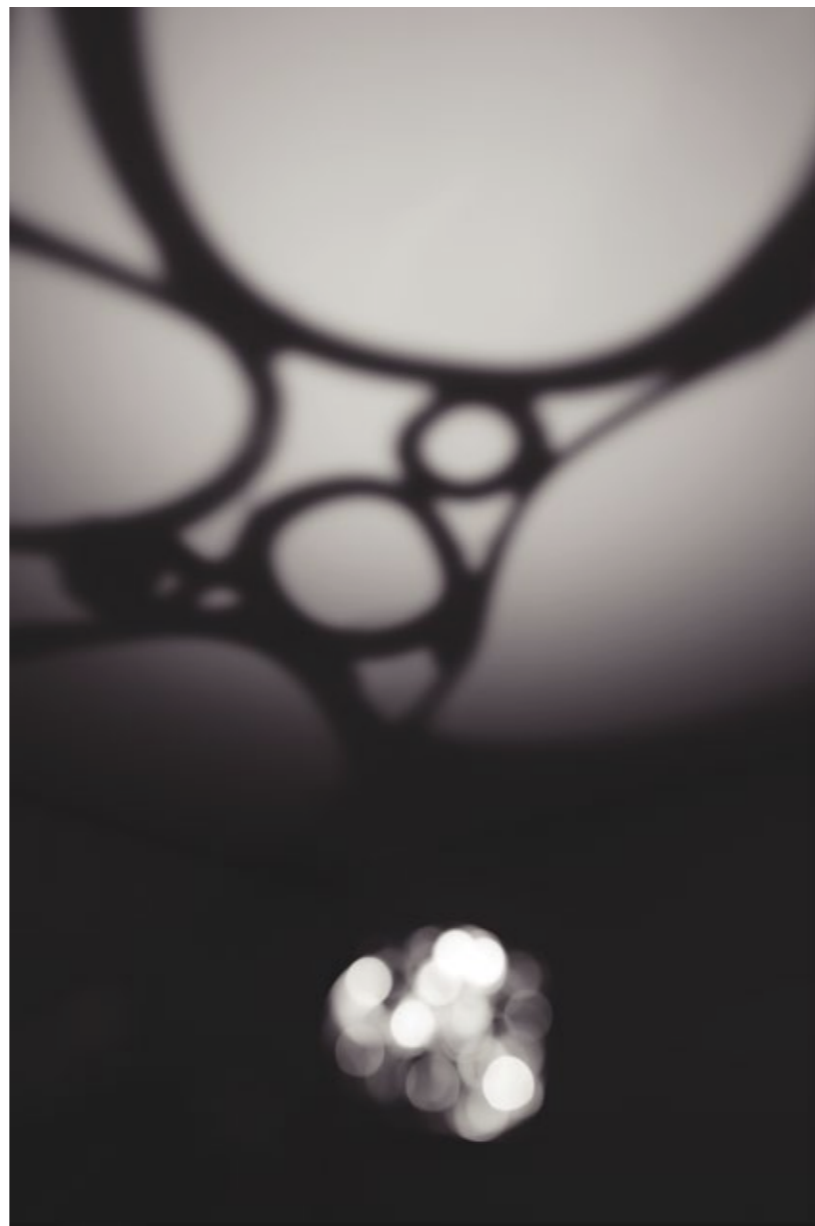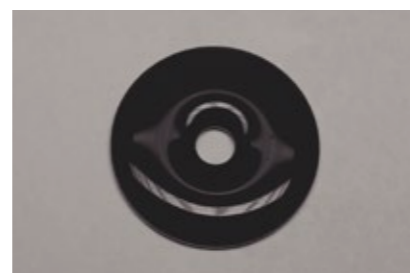
◇ **CONTENT /** SELECTED PICTURES

FORM STUDIO / METAL WASHER, 2021FALL
INSTRUCTOR / PROF. MATHEW JOHNSON
VIDEO CLIP / https://youtu.be/HcQWmRP4SRw

MOTION STUDIO - YEAR 2020

PHOTOGRAPHY | CINEMATOGRAPHY | CREATIVE THINKING

3 MONTHS

INTRO / What if we want to dig deep into people's thoughts about something? Drawing sometimes brings up subconscious ideas onto the paper. Through Motion Studio - Year 2020, I spent 3 months interviewing 8 people about their views on 2020 by drawing pictures. Everyone comes up with a different painting that contains their own stories.
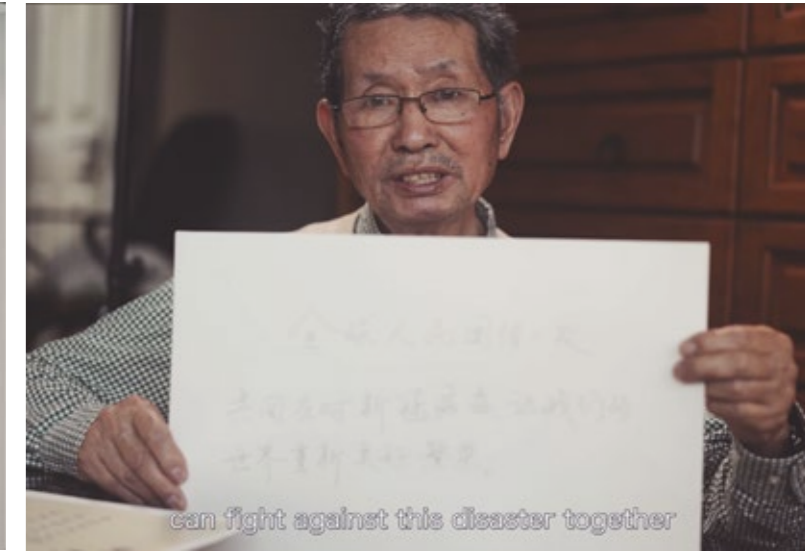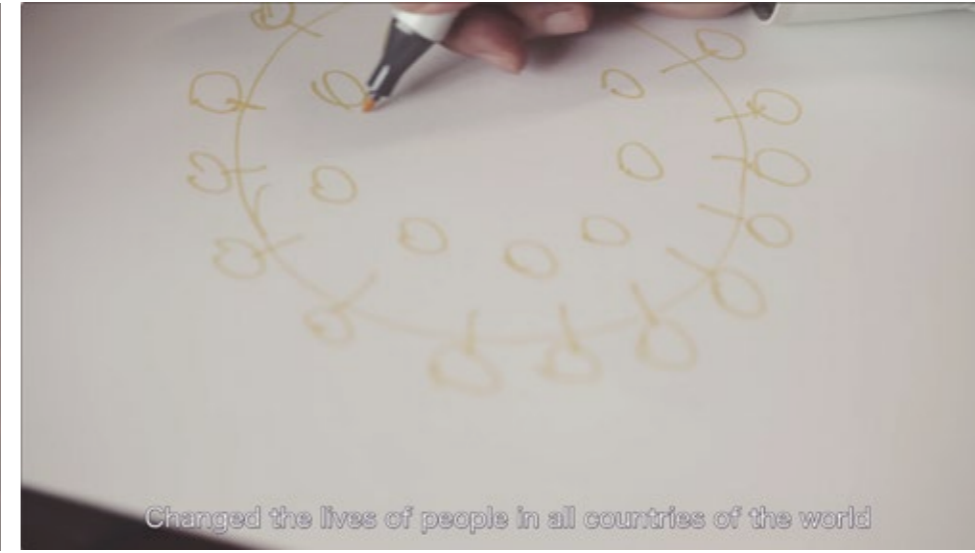
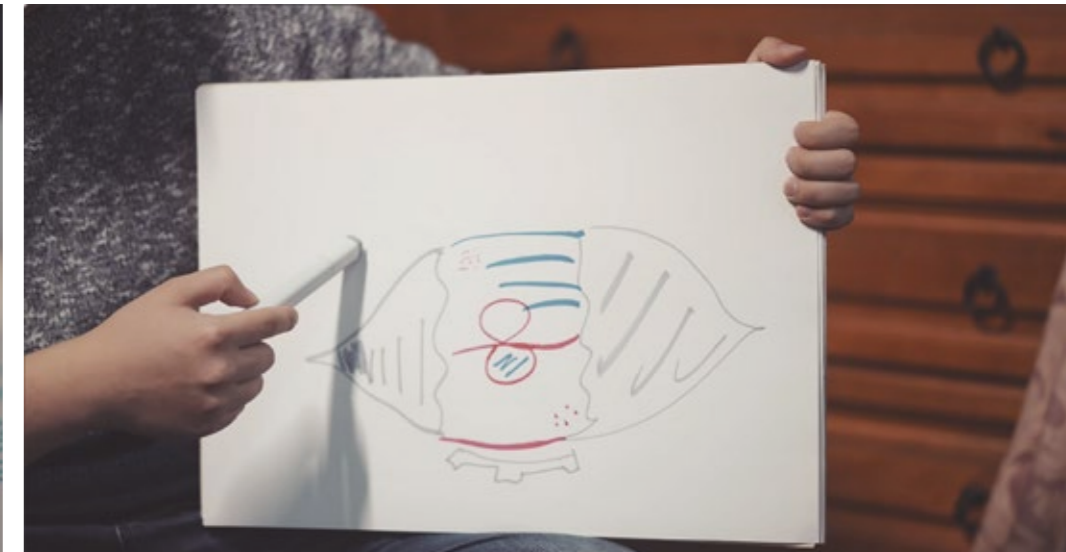**MOTION STUDIO /** YEAR 2020, 2020FALL
INSTRUCTOR / PROF. EMMA BERLINER
VIDEO URL / https://youtu.be/lVHOgOHEQeA

YEAR OF 2020

because of the epidemic.

Changed the lives of people in all countries of the world

can fight against this disaster together

no airline can fly normally

WEB CODING

## WEB DESIGN | INTERACTIVE DESIGN | CODING

10 MONTHS

INTRO / A series of web-based projects including typography, interviews, interactive games, graphic design and so on. All the pages are coded with HTML/CSS/Javascript individually. As a designer, coding is a crucial techniques to realize design ideas. Visit the webpage to see interesting projects with more details.
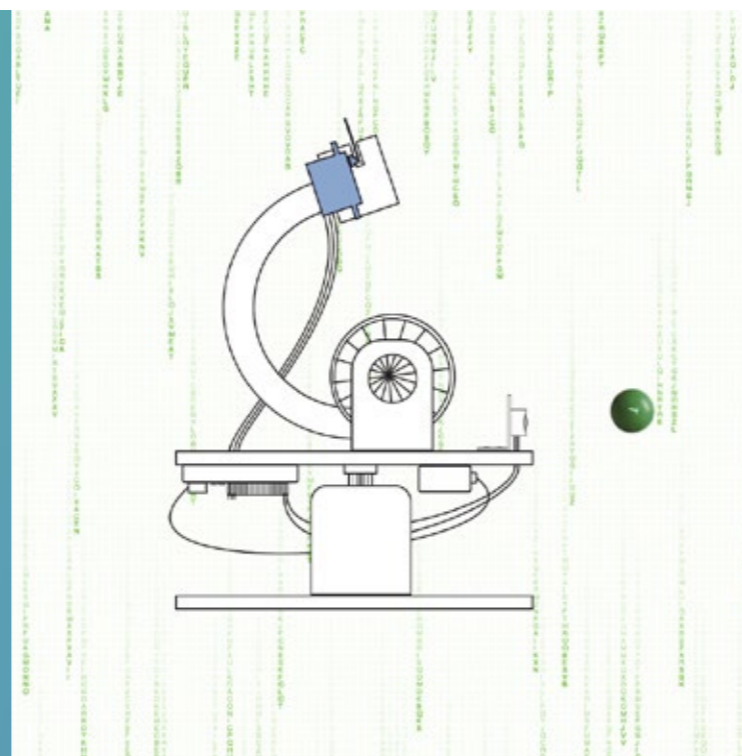
TYPOGRAPHY

Inspired by carvation painting in antiquity, the typography simulate the shadow of the notch under the sunlight, combining with the CSS animation
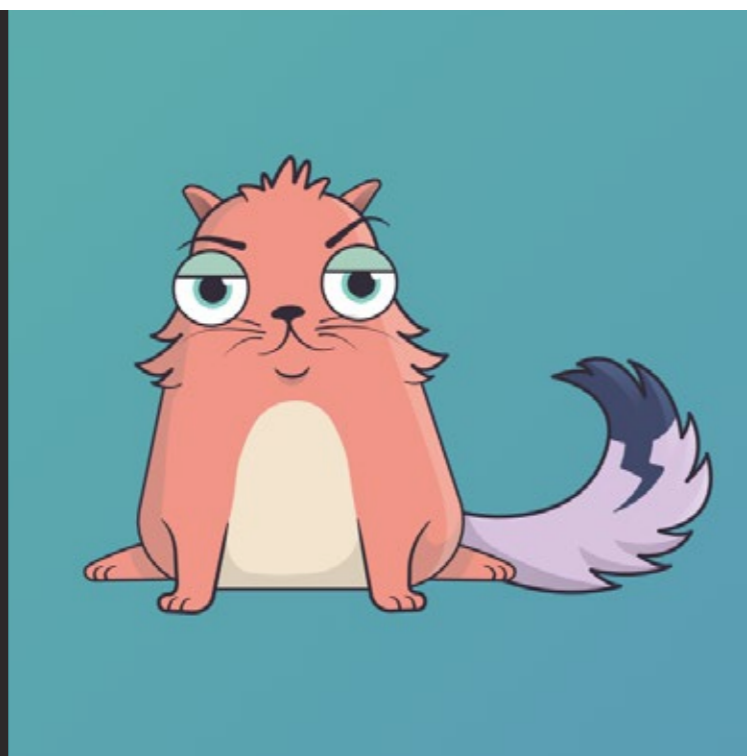
CRYPTOKITTIES

Explore the combination of different body parts of the CryptoKitties. Discover the playability and design ideas behind NFTs.
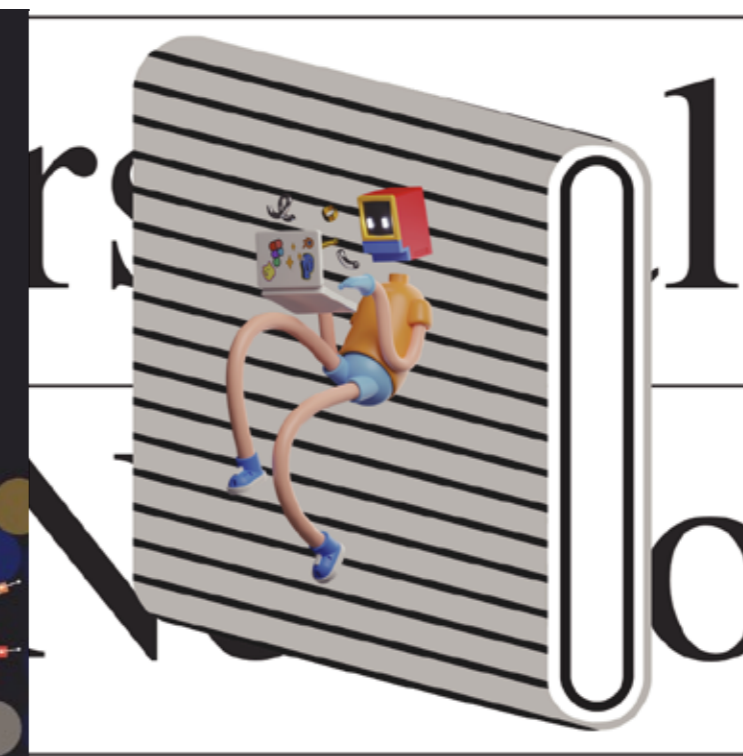
SCREENSAVER

The screensaver version of the M&M shooting machine with Matrix-style background. Find the keyword hidden behind the beans.

SITE CLOCK

An interactive web-based clock. Discover the way to recognize the time on the screen. The project reveals the idea of touching the intangible time.

INTERVIEWS

Interviews with AR/VR artist H.C. Dunaway Smith and electrical engineer Yuchan Tseng. Reading their response about the boundary between art and engineering.

HOMEPAGE

This site contains five interesting exercises and six informative projects. All of the sites are written and built by Yuming independently.