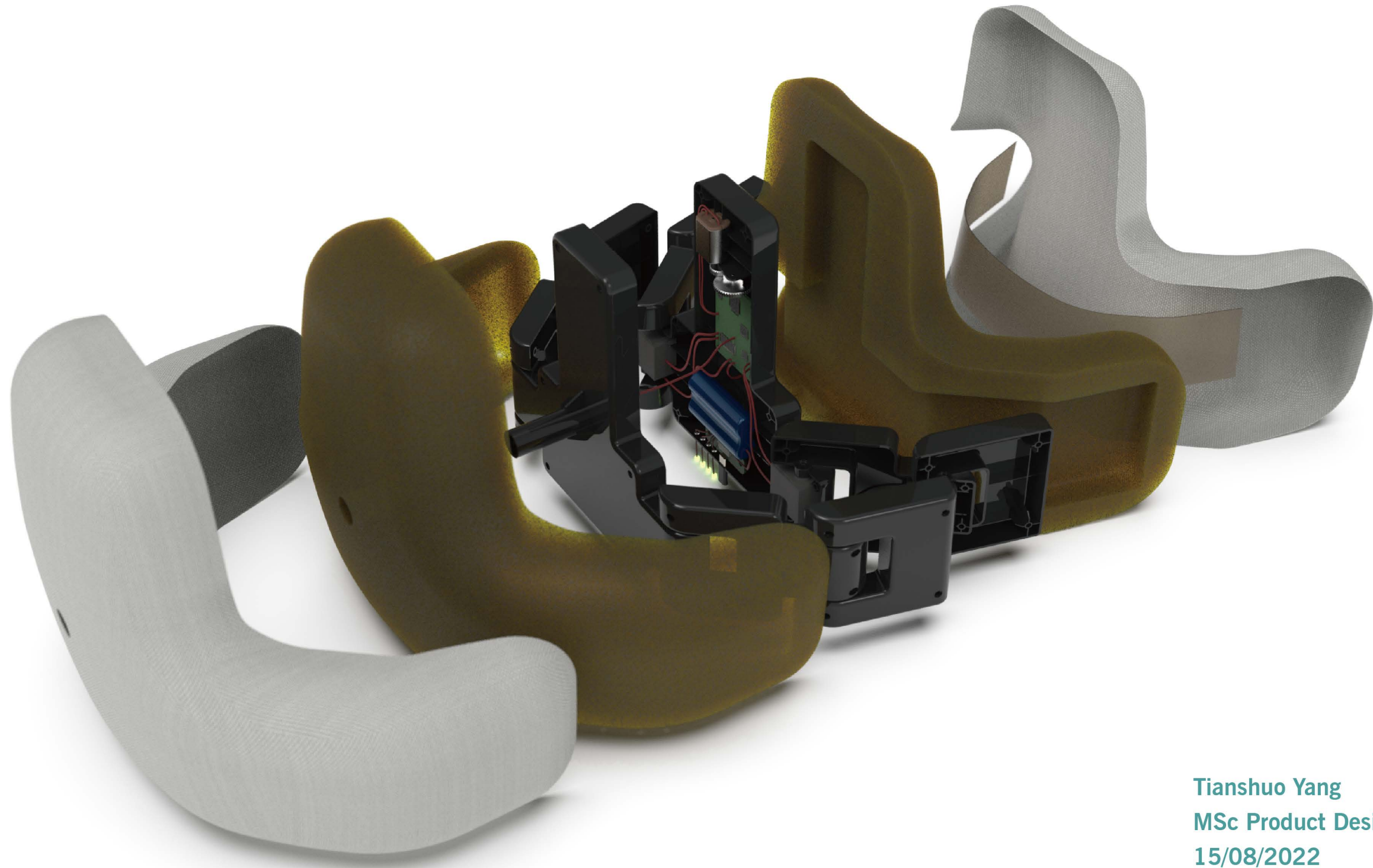


HUGGIN

Design to enhance people's emotional communication experience during the epidemic

— Transmit the hug over a distance



Tianshuo Yang
MSc Product Design Engineering
15/08/2022

GSA tutor: Stuart Baily
UOG supervisor: Kiran Ramesh

Background

COVID-19



fever



cough



headache



fatigue



loss of taste and smell

Coronavirus 2019 (COVID-19) is a pandemic that outbreak in 2020, and had great impact on people's life. The virus causes lung infection and produces a series of symptoms include fever, cough, headache, fatigue, loss of smell, and loss of taste (WHO). These symptoms will appear within 14 days after exposure to the virus (Wikipedia). So in many countries, people are required to quarantine for 14 days after they have symptoms. During this period, people are not allowed to go out.

Change in behaviours during and after the COVID-19



According to The Office for National Statistics (2021), people's behaviors have significantly changed during and after the outbreak of the COVID-19 pandemic. During the epidemic, people had to work, study, socialize, shop and entertainment online. Online communication makes people lack the opportunity to contact people. The data shows that people prefer real life and contact with people rather than staying home.

The Epidemic Situation in China



A COVID-19 outbreak in the city of Shanghai, China began on February 28, 2022, and ended on July 20, 2022 (Lianhe Zaobao, 2022). Shanghai Municipal People's Government adopt "area-separated and batch-separated control". In the mid and high-risk areas, people could not leave their communities and were home quarantined.

During this period, people live in a monotonous and narrow space, and their communication with family and friends has become an important part of regulating emotional state in life.

The outbreak of the pandemic in Shanghai has made me think a lot. People's communication was limited by distance. I hope to design a product that can enhance people's emotional communication experience in the pandemic era.

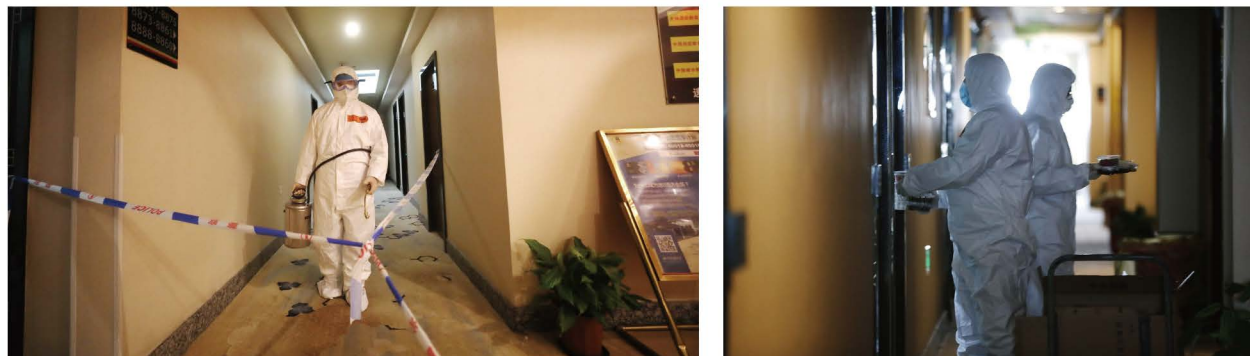
Define the problem



What is emotional communication

Emotional communication is a behavior that communicates an emotional state or attitude, which goes deeper than just being honest about your feelings. It could be **verbal or nonverbal**. For example, in daily life, eye contact, handshake, touching or hugging can convey different emotions to others. Due to the limitation of distance, people in quarantine can only communicate through the Internet.

What are the emotional communication barriers



“ During the isolation period every day, someone will regularly deliver meals on time. I have **no contact with others**, and there is a lack of communication. In most cases, I can only read books, watch TV dramas and have online communication. ”

“ Before isolation, I was accompanied by my husband, but after isolation, everything was done by myself. **Without the company of my husband, I was depressed.** ”

“ My girlfriend and I will **keep the phone on**, and then do our own things. In this way, I feel that she is accompanying me and eliminate the sense of distance ”

Communication methods (during quarantine)

Video Call

- + Video phone is the most direct and convenient way of remote communication
- It is not convenient for people to have a video call sometimes
- Too many video calls will invade personal space
- Net condition

Text Message

- + The text message can be received at any time
- Sometimes words can not accurately express users' emotions
- Text cannot express multi-dimensional information
- No physical feedback

Social media

- + Share daily life with other people
- No real time feedback
- More displays, less communication

All communication methods are online

There is no physical contact between people

Difficult to transmit subtle emotions

User research

User group

I interviewed many people with quarantine experience and summarized the requirements of different people from the interviews. The interviewees would communicate with different people during quarantine, such as family members, friends, spouses, and colleagues.



People communicate with their families **1-3** times a week about their conditions and with friends **2-4** times a week, mainly sharing social media content. In all relationships, couples have the highest communication frequency (**every day**), and the duration of the communication is **20-120 minutes**. So the user group I researched in depth is the **couple**.

What emotional communication can't be achieved during quarantine?

Physical Contact

handshake Shopping
Party Eat Together Hug Watching Films
Together

What kind of emotional tone do you want to have during communication?

Positive Emotion

Cosy Joyful Warm Satisfied
Safe Comfortable Happy

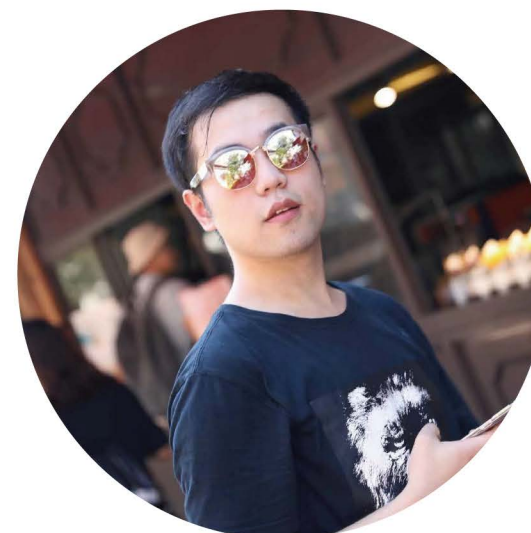
Persona



📍	Location: Hebei
👤	Occupation: Nurse
🕒	Quarantine time: 2 months

“ We can only make **video calls** during the quarantine, and the duration of each call is **more than two hours** ”

Zhou is a nurse. He works in a hospital in Hebei, China. A few months ago, he was required to do daily nucleic acid tests on quarantined patients in the hospital due to the pandemic outbreak. Policy factors made him **live in the hospital** and could not go home. He had a video call his girlfriend every day after work. When they did other things, they **kept their phones on**, and it seemed they were accompanying each other.








📍	Location: Beijing
👤	Occupation: Programmer
🕒	Quarantine time: 3 weeks

“ Although we were in the same city, we **cannot meet each other** during the pandemic outbreak. ”

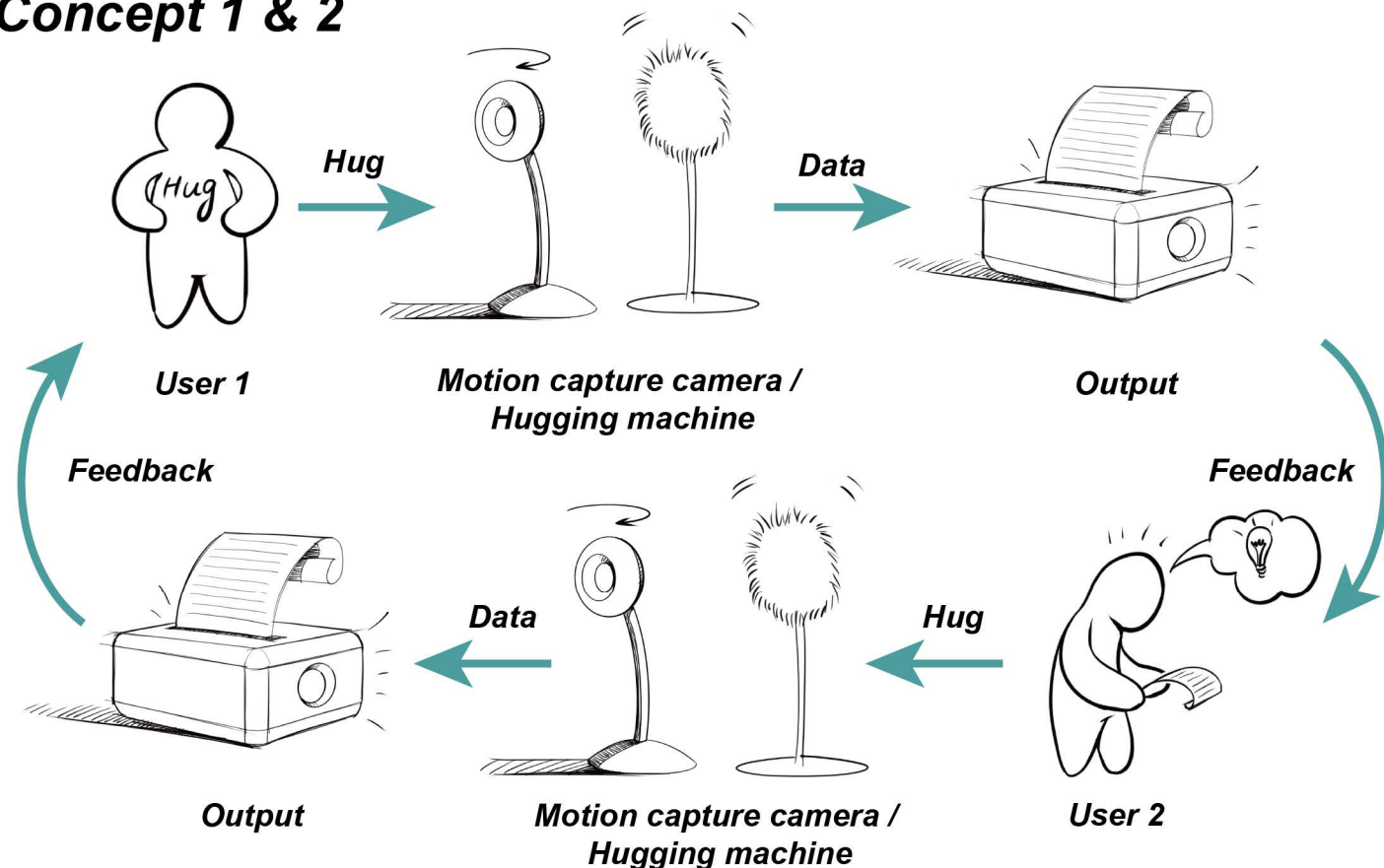
Li works in Beijing and his girlfriend studies at USTB. Due to the pandemic outbreak, Li had to **work at home**, while his girlfriend was not allowed to leave school. Before the pandemic, they ate together every night and went to the park after dinner. Now they can only communicate through video calls. They **watch movies or listen to music together online**. Doing the same thing together gives each other much support.

User Journey

TIME	7:00	9:00-16:00	16:00-20:00	20:00-22:00	22:30
EMOTIONS THOUGHTS	<p>“ Today is the third day of isolation. I hope the isolation will end as soon as possible ”</p>	<p>“ Life during quarantine alienated us a little, and we were all busy with our studies and work ”</p>	<p>“ Sometimes I forget to reply to messages when I am busy with my work ”</p>	<p>“ I feel very happy to be accompanied by each other ”</p>	<p>“ I miss the past days very much. We have more real contacts, which make our emotions comfortable ”</p>
ACTIONS					
ANALYSIS	<p>Nucleic acid test</p> <p>The daily nucleic acid test will make people feel anxious</p>	<p>Working / Study</p> <p>In the process of work or study, most interviewees said that they would only send text messages for brief communication. Most of the content of communication is their own state.</p>	<p>Rest</p> <p>Most users will spend time on TV or mobile phones during the rest. In the quarantine room, the user does not have much choice when they want to relax.</p>	<p>Video / Phone call</p> <p>Couples will make a video call, then watch movies and listen to music together online. They feel that they are accompanied in this process.</p>	<p>Go to bed</p> <p>Most users say that before going to bed is the loneliest moment of the day. At this moment, many people want someone to accompany them</p>
OPPORTUNITIES	<p>There is no emotional communication in this process. This design will focus on the emotional communication of close relationship</p>	<p>When people study and work in a narrow space, they will feel depressed.</p> <p>What if there is a product that shows the user's emotional state?</p>	<p>Before quarantine, people had real physical contact during emotional communication. (such as hugging, touching)</p> <p>What if we could do these over distance?</p>	<p>What if the couple could touch each other when they do things together online (listen to music, watch movies)?</p>	<p>When the couple hug, they can feel each other's heartbeat.</p> <p>What if we could transmit the heartbeat?</p>

Concept evaluation

Concept 1 & 2



The user scenario of concept 1 and 2 is **when the user is resting**. The concepts are based on motion capture cameras or pressure sensors. When the user hugs, the camera or pressure sensor will capture the user's action and send the data to another user.

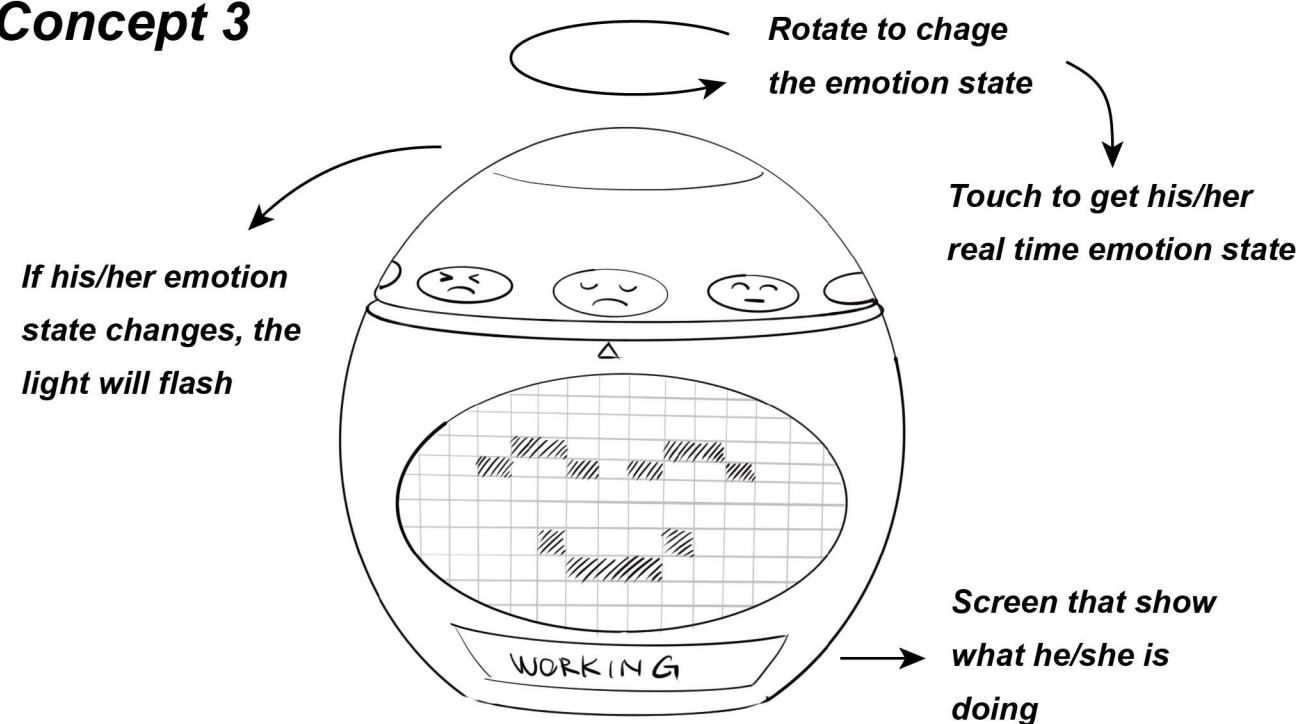
As for the feedback design, I investigated the works of Brendan Dawes and got some inspiration from them. The machine automatically plays music that conforms to emotion; the light behind flashes, and the printer print out words about positive emotions when the product received the data

● Evaluation

+ The concept gives users multi-dimensional feedback, which can express more delicate emotions than a video call or text message.

- Less physical feedback
- The interaction process is complex
- The form of feedback can be improved

Concept 3



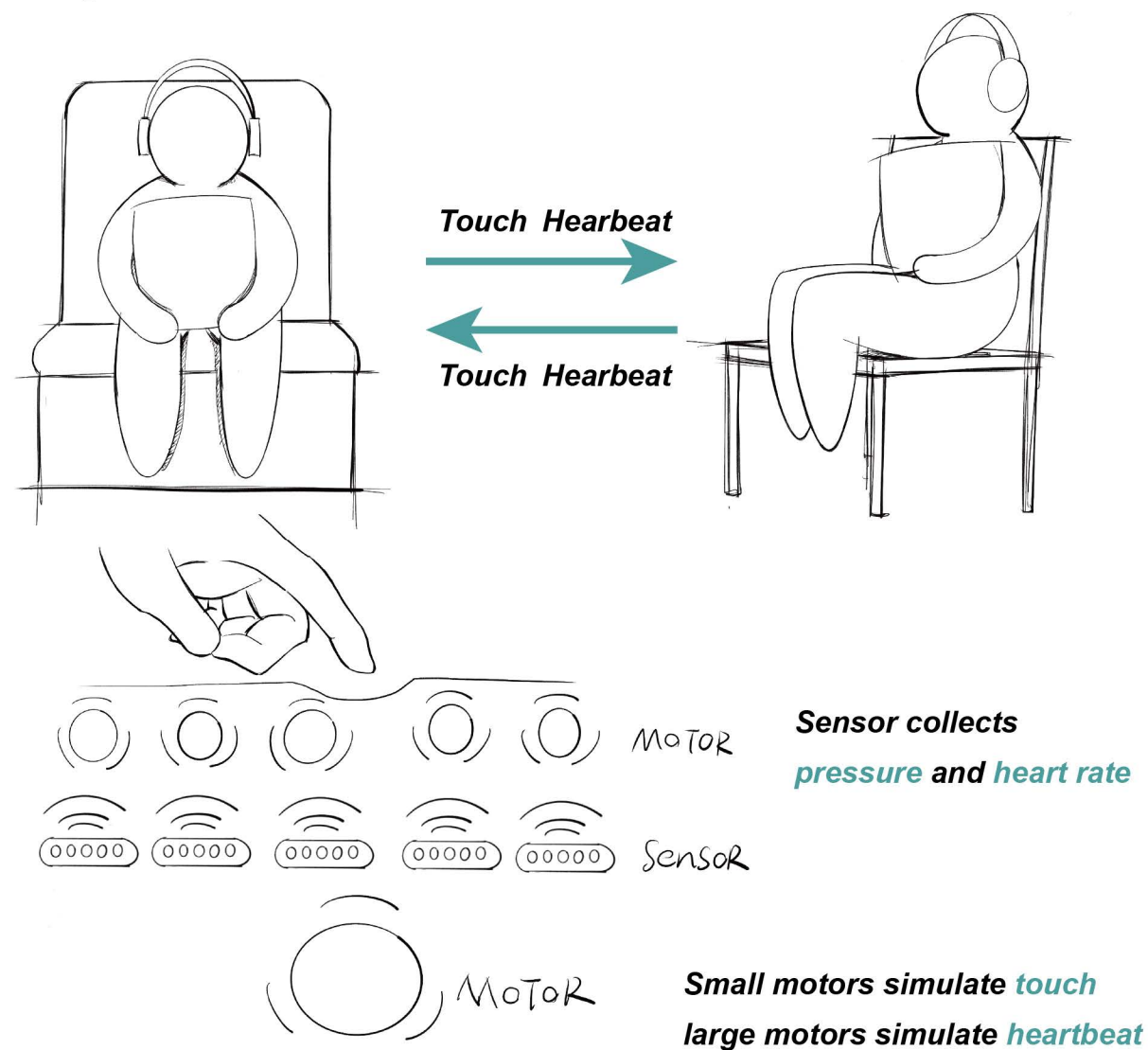
The user scenario of Concept 3 is **when the user is working or studying**. It shows emotional states to each other. When users want to express different emotions, they rotate the upper part, and another person's product will show different emojis. The lower part of the product can display the user's state, such as rest or work. This design is mainly for couples who want to know each other's state in their daily work and life.

● Evaluation

- Less physical feedback
- Emojis can't express all emotions and will lead to misunderstanding
- Not everyone wants to show their states all the time

Concept development

Concept 1 & 2

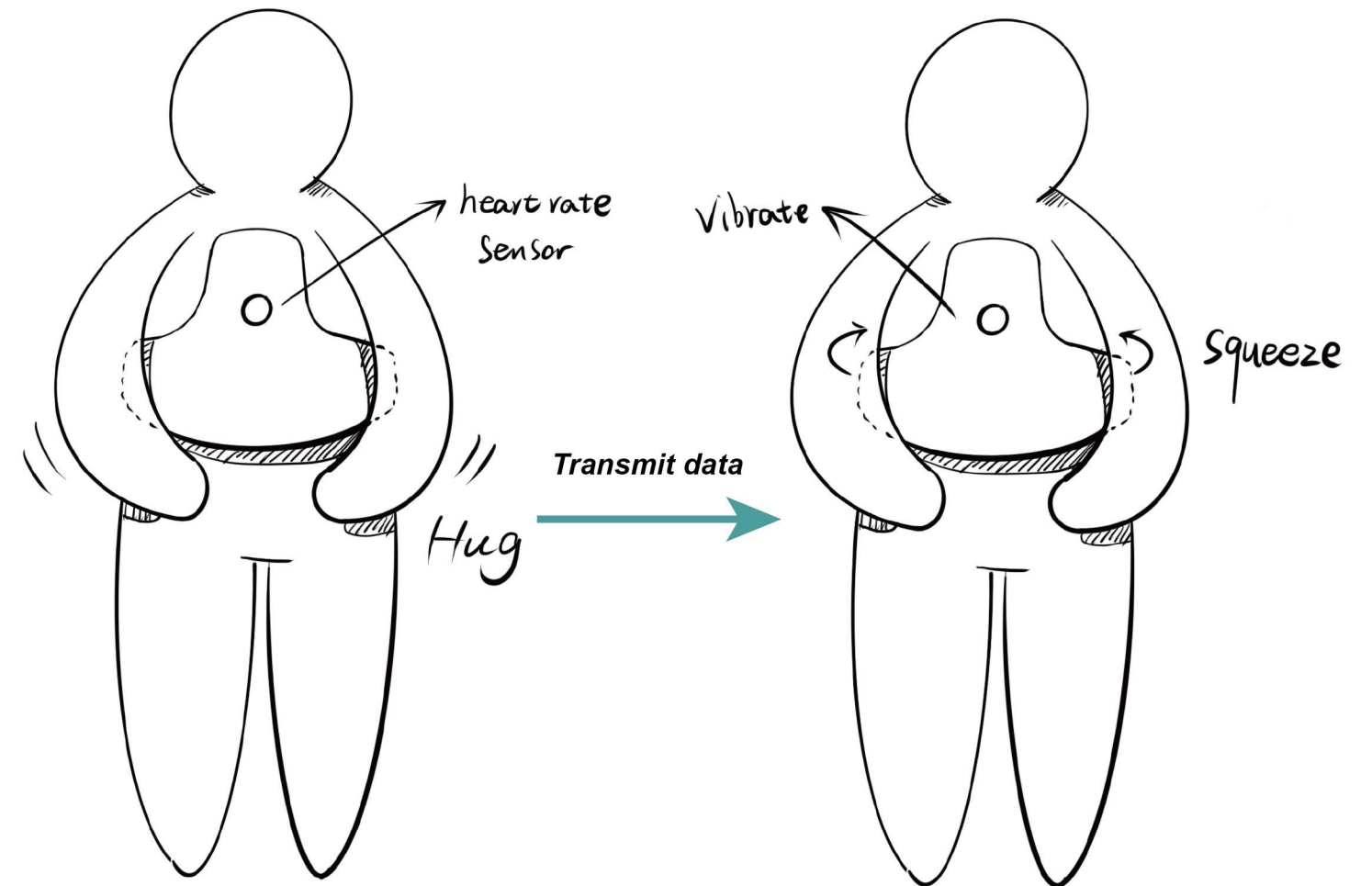


Concept 4 focuses on the user scenario of watching movies and listening to music together online. The product is like a pillow that conveys touch and heartbeat. It has two functions. One is transmitting touch; the other is transmitting heartbeat. It collects pressure and heart rate from the sensors and simulates them through the motors.

● Evaluation

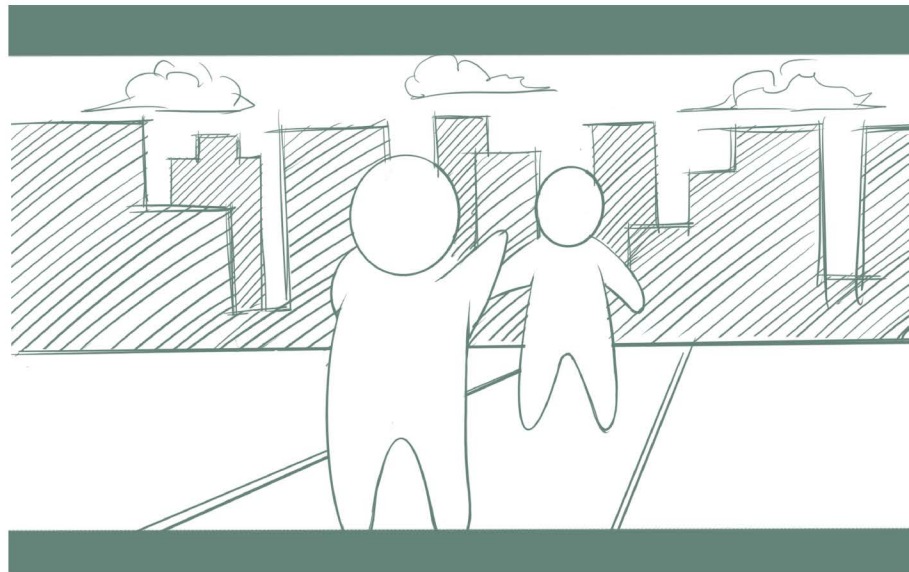
- + The product give the user direct physical feedback
- + The interaction process is simple and direct
- Haptic simulation is difficult to realize
- The shape of the product can be optimized

Final concept

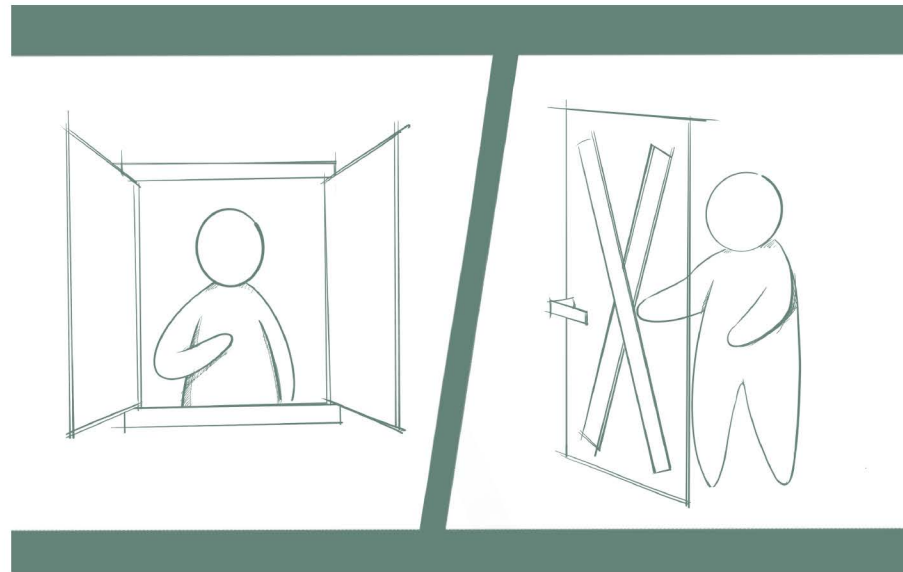


The final concept takes **hug** as the emotional communication method from **concept 2** and uses the idea of **transmitting heart beat** in **concept 4**. The product can convey the user's **hug, heartbeat, and breath** in the final concept. It squeezes through the arms on both sides so that users can truly feel each other's hug. Arms can also swing to simulate chest expansion and contraction during breathing. Heart rate is collected by sensors and simulated by vibrating motors.

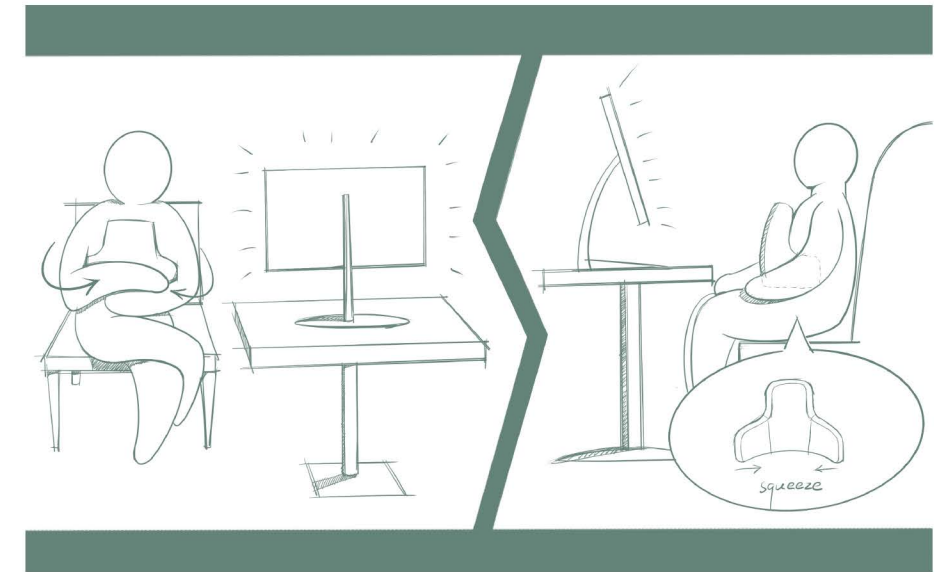
Story board



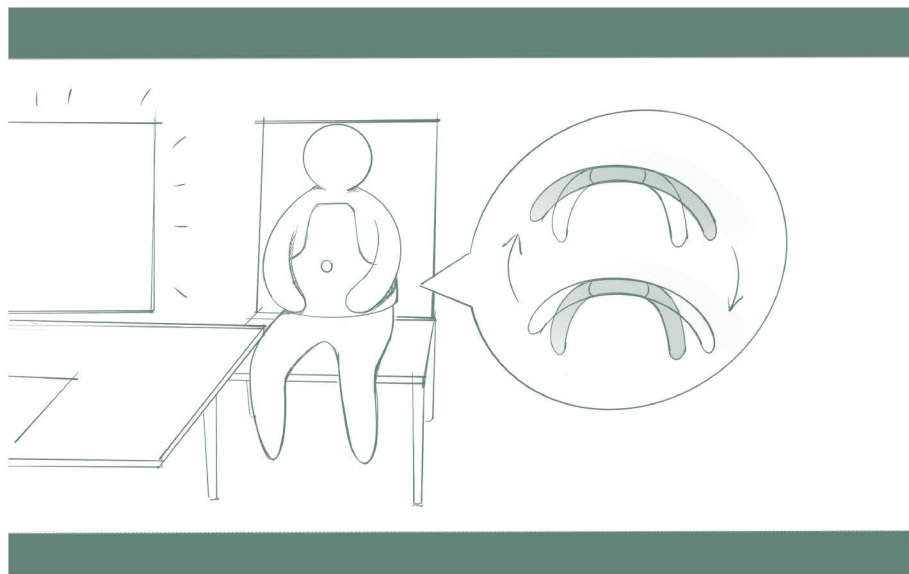
A and B are a **couple**. They will watch movies, shop, and eat together in their spare time. **Hugging** is the way they communicate their emotions when they meet. They live in the same city so they can meet at any time.



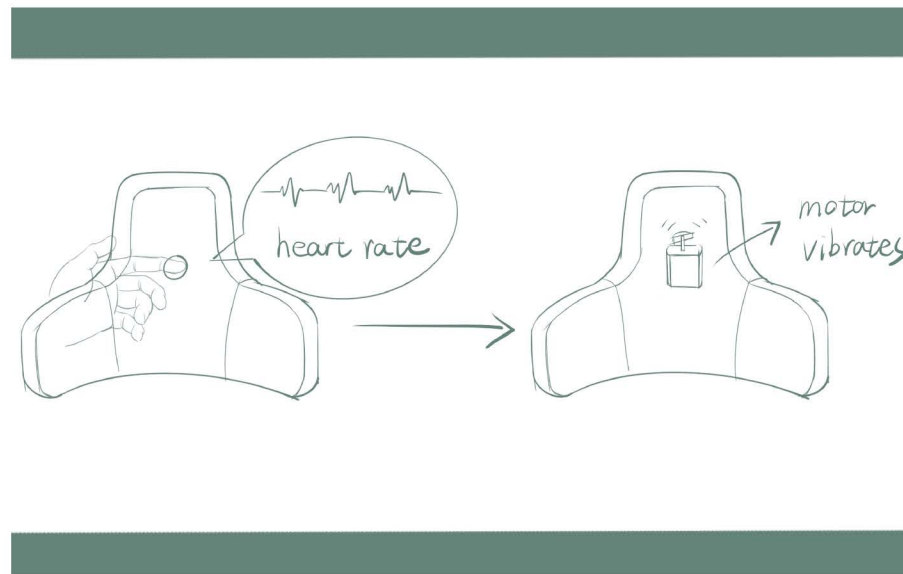
Due to the outbreak of the COVID pandemic, A and B were quarantined in **different communities**. All of their communication is online. They **can't touch each other**, and a simple hug is difficult for them.



Although they can't meet each other, they **do some things together online**, such as watching movies and listening to music, so it's like they are accompanying each other. A hugged the product. The pressure sensor of the product detected the hug and transmitted it to B's product. At this time, the arms of the product squeezed, and B felt A's hug.

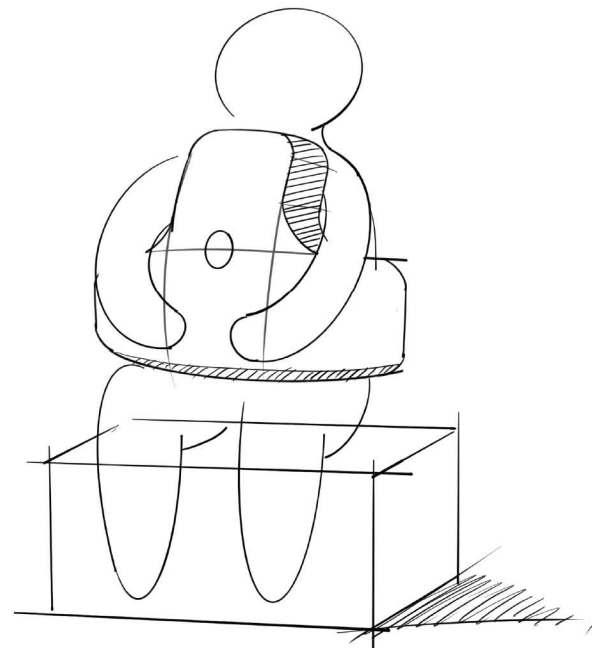
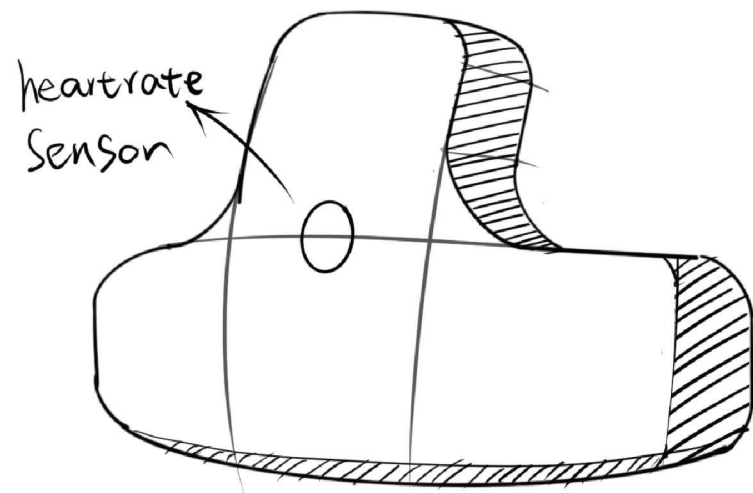
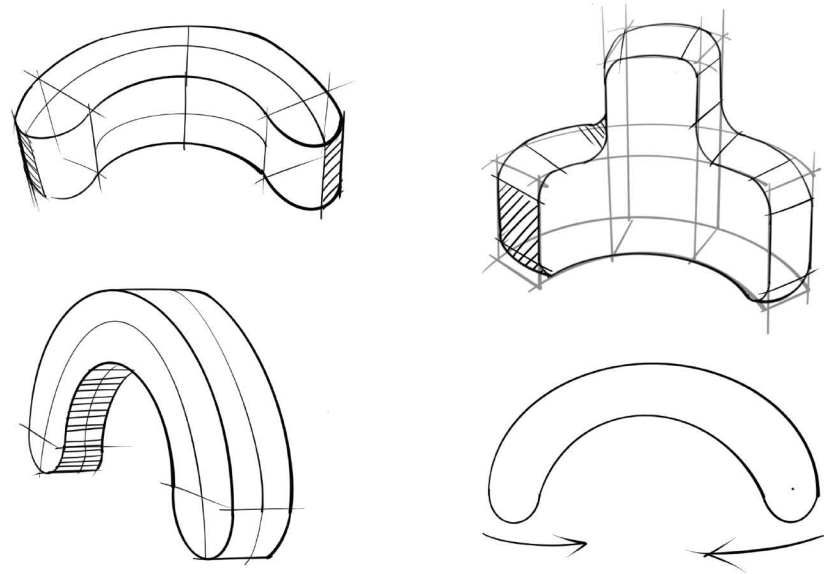


The arms of HUGGIN can **swing at different frequencies** according to different heart rates to simulate the expansion and contraction of the human chest. Hold this product, they can feel the breath and heartbeat of each other.

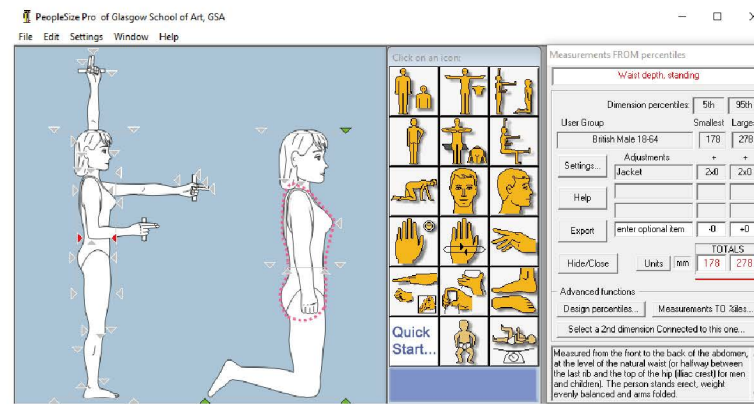


They put their fingers on the **heart rate sensor**, and the product vibrated, making them feel each other's heartbeat.

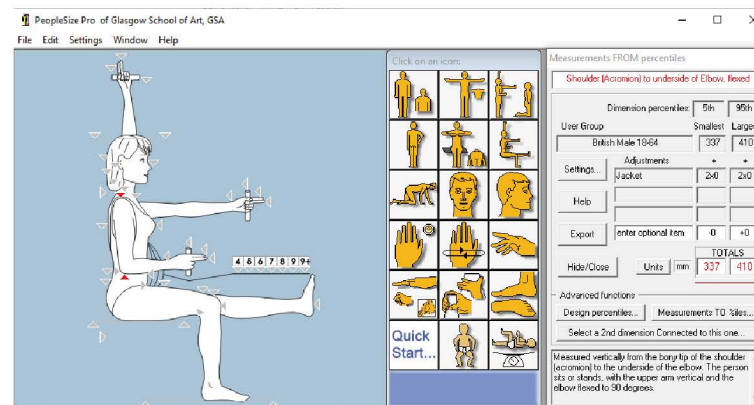
Initial Prototype



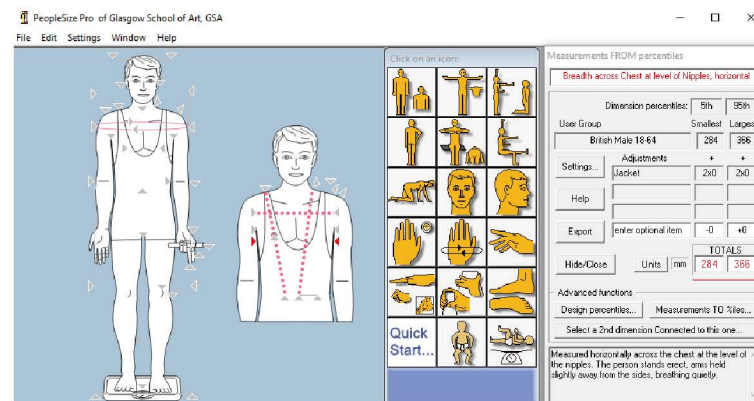
Anthropometry



In order to find the appropriate size of the product, anthropometry factors must be considered. The product arms should be shorter than the waist depth so that the arms will not conflict with the seatback.



The height of the product refers to the length from the shoulder to the elbow (Appearance B).



The internal width refers to the chest data.







Appearance A has a small volume, which is convenient in various environments. However, according to the feedback from the user test, appearance A cannot make the user genuinely feel hugged. Due to its small size, the battery capacity will be reduced.



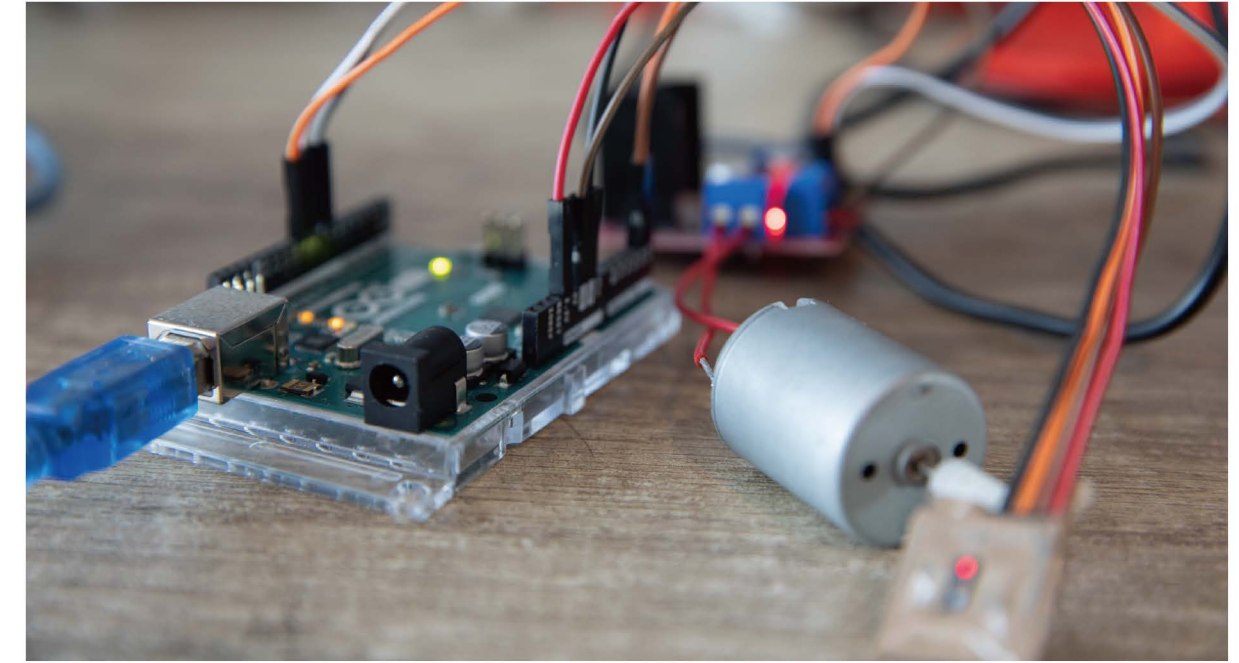
Appearance B is more like the upper part of the human body. According to user tests and feedback, most people think using appearance B is more like real hugging. Appearance B has a larger volume that could accommodate larger capacity batteries and higher power motors. However, it is heavier, which requires lighter product materials to optimize.

Interactive prototype

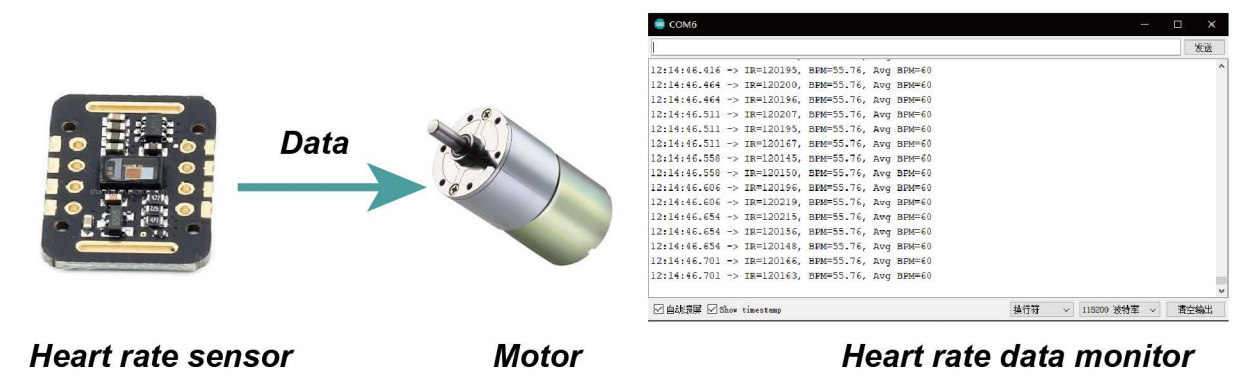
Main components

	<p>Voltage: 1.8-5v Temperature range: -40-85°C Function: Blood oxygen & Heart rate Size: 30*15*10mm (L*W*H) Power: Lower than 1w</p>	<p>The heartrate sensor is installed on the front of the product. When the user places his finger on the sensor, the heart rate will be detected and sent to another user's product. Max30102 is a biosensor that can detect the user's real-time heart rate and blood oxygen content, which is selected for this product.</p>
	<p>Type: DC motor Voltage: 9-12V Maximum speed: 2400rpm Size: 24*28mm Power: 12w</p>	<p>Heartbeat is an important part of this design. According to the calculation, the 12W motor can simulate the vibration caused by the heartbeat. The motor is connected with the reduction gear to drive the eccentric wheel to rotate and form vibration.</p>
	<p>Pressure range: 0.2-10kg Resistance range: 1K-10K ohm Voltage: 3.3-5v Rotation angle: 260°±20°</p>	<p>When we hug the pillow, the pillow will deform. The amount of deformation is related to the pressure of hugging. FSR402 is a thin film pressure sensor that could detect pressure.</p>
	<p>Voltage: 4.8-6v Temperature range: -25-70°C Weight: 45g No load: 0.13sec-0.17sec/60° Torque: 13kg/cm Size: 40.5*20*39.5mm (L*W*H)</p>	<p>When the user has different hugging pressures, the arms of the product should have different angles to give feedback to another user. The step motor can convert the electric pulse signal into angular rotation, so the product uses step motors to drive the arms.</p>

Arduino test

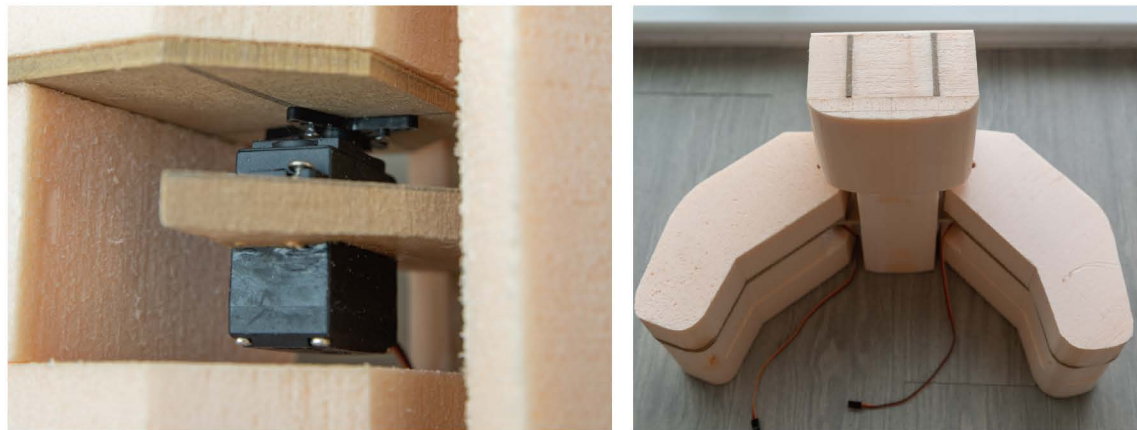
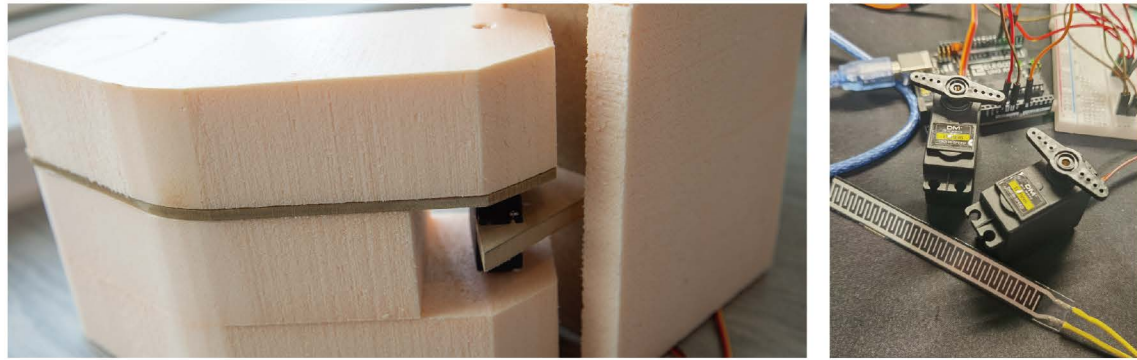


In order to make an interactive prototype, I used the Arduino platform for testing. The test mainly realizes two functions. The first is to control the step motor to rotate at different angles through the pressure sensor, and the second is to control the speed of the reduction motor through the heart rate sensor. To simplify the process, the following tests are completed on the same Arduino board (data transmission between different board is not included).

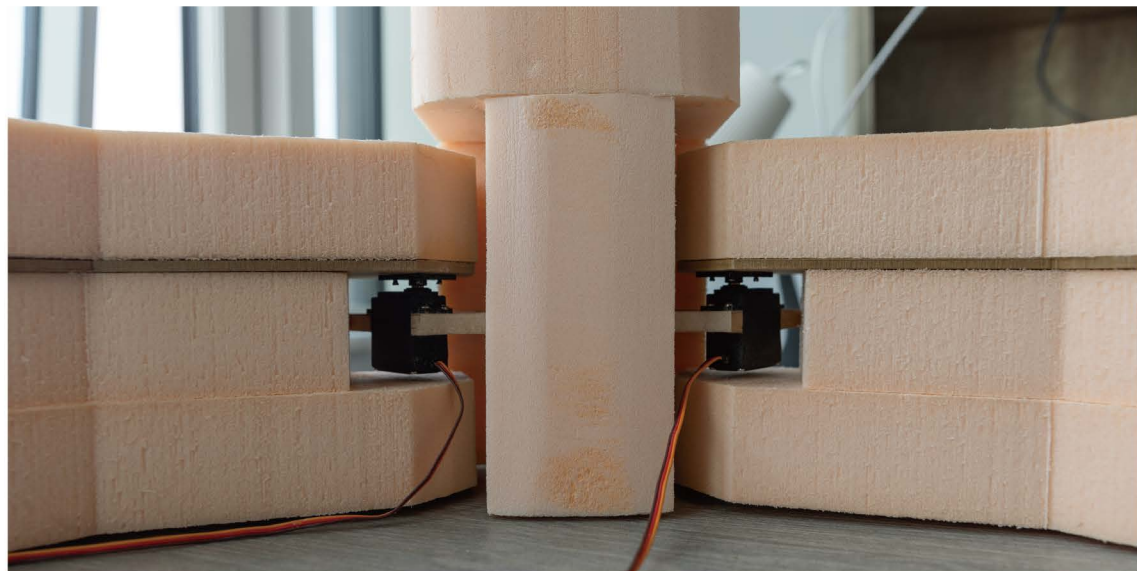


The data of the max30102 heart rate sensor is used to control the speed of the motor. When the heart rate increases, the motor speed becomes faster; when the heart rate decreases, the motor speed becomes slower. The speed regulation of the motor is realized by pulse width modulation (PWM).

Interactive prototype



The arms of the product are connected to the step motor, which will rotate at different angles when the user applies different pressure. The pressure data is collected by the FSR402 sensor.



The final interactive prototype is made based on the above research and testing. The material of the model is MDF board and foam. The arms of the product could squeeze to simulate hugging.

The difficulty of model making is how to combine foam with MDF board. As shown in the figure, the final solution is to make the MDF board as the skeleton and fix the step motor on it. The foam is cut into different shapes to fill the skeleton.

User testing



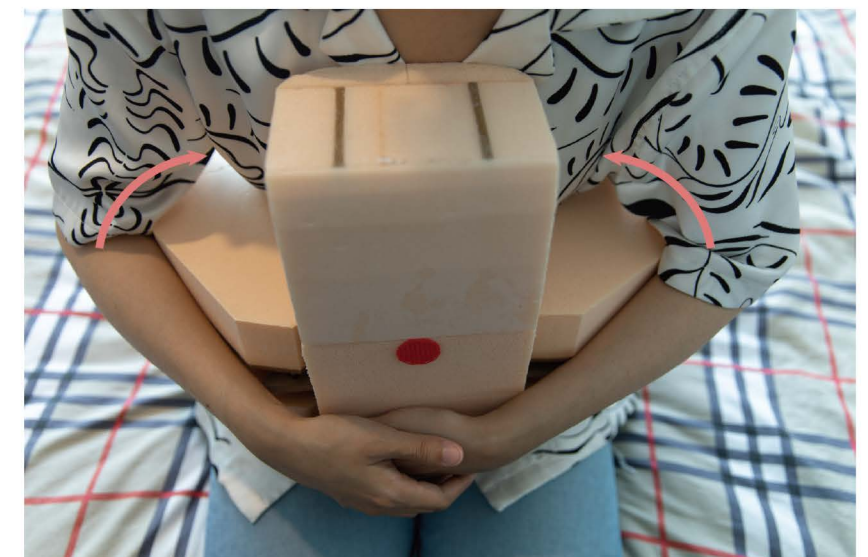
1 For the first time, the user need to adjust the angle of the arms according to his body shape. After that, the arm will automatically rotate to this angle to fit the user's body every time it is used.



3 Feeling the breath through the swing of the arms.

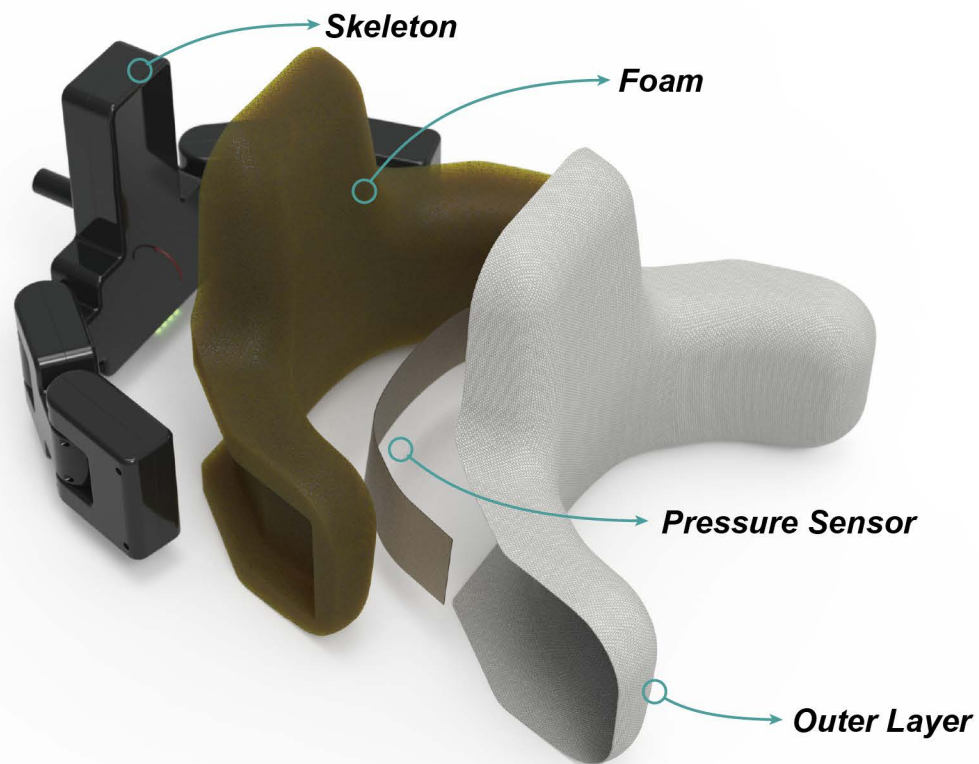


2 The user puts his hand on the heart rate sensor, and another user can feel his heartbeat

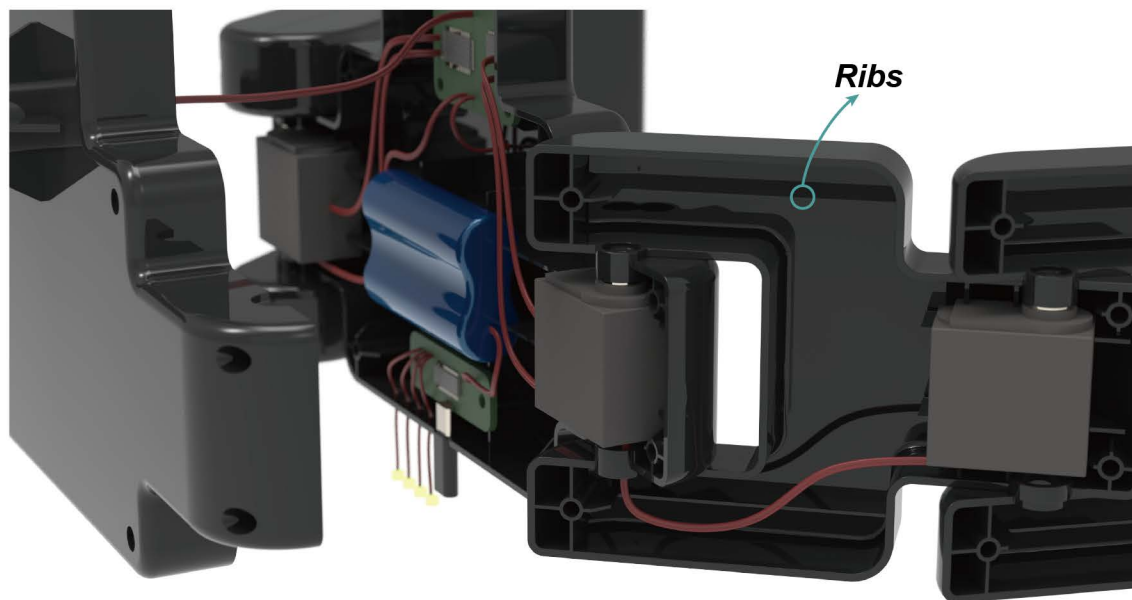


4 Transmitting hugs

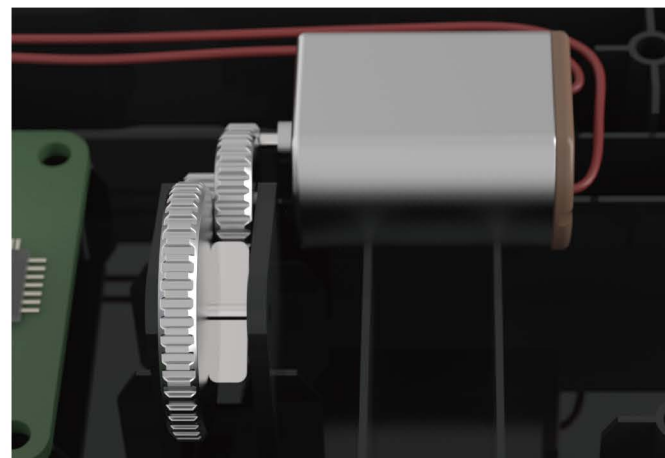
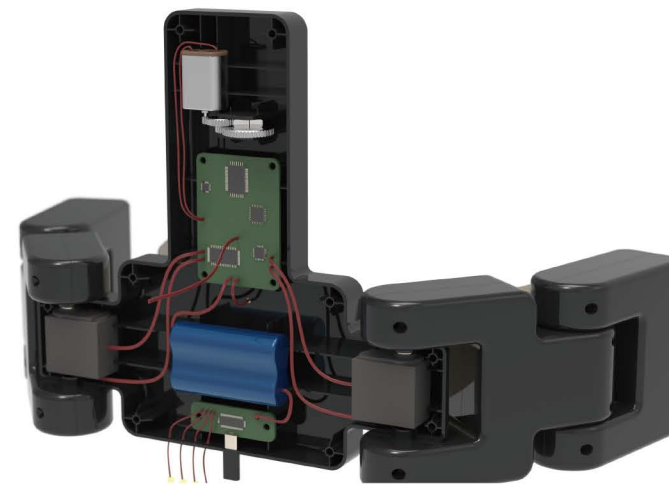
Final Product



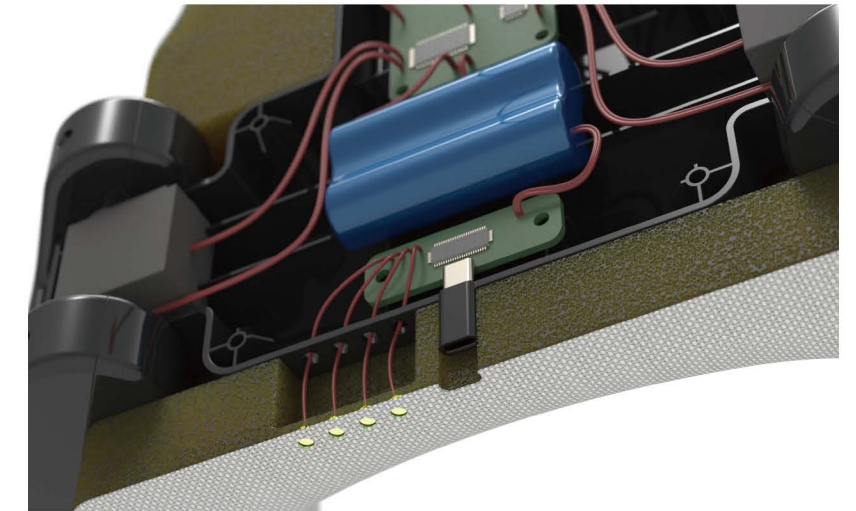
The main board, motor, and battery are all inside the skeleton. As shown in the figure, the skeleton is a plastic shell, two pieces of polyurethane foam are covered on it, and the outer layer is made of polyester. The pressure sensor is located between the outer layer and the foam.



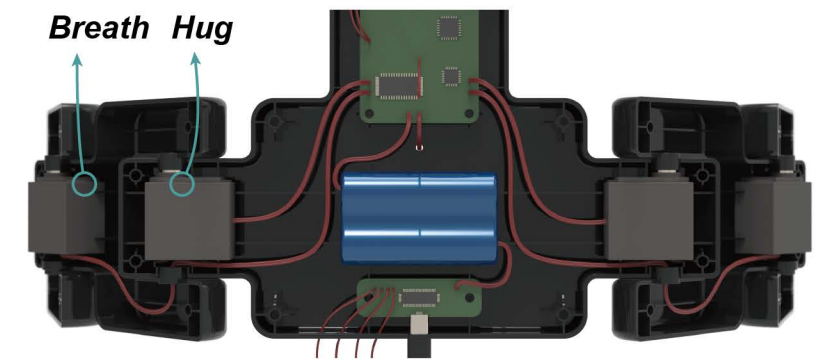
The manufacturing process of the plastic shell is injection molding, and the wall thickness is 2mm. Because the plane of the shell is too large, there are ribs inside, which can increase the strength and prevent the occurrence of distortion and fracture. The size of all screws is M4, which improves the convenience of maintenance. All screw holes have ribs with a thickness of 0.8mm.



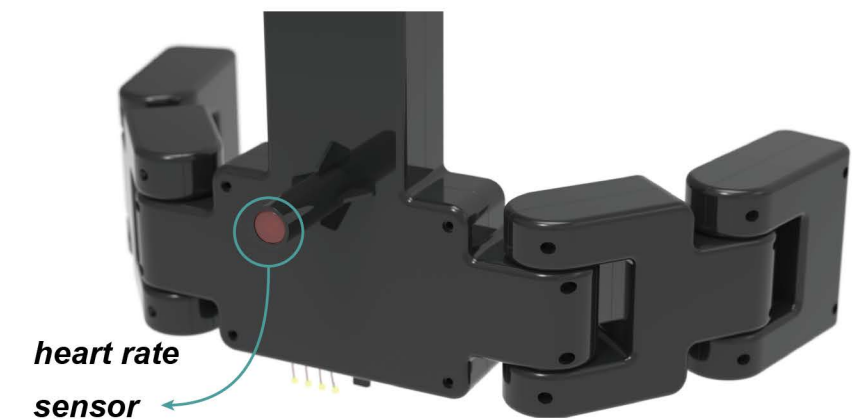
The motor is at the upper part of the product, which is close to the heart. The motor drives a set of reduction gears. Vibration is provided by the eccentric wheel on the gear.



The USB type c charging port is located at the bottom of the product. A power indicator is beside the charging port to display the current power. The product uses two 18650 batteries with a capacity of 6800mah.

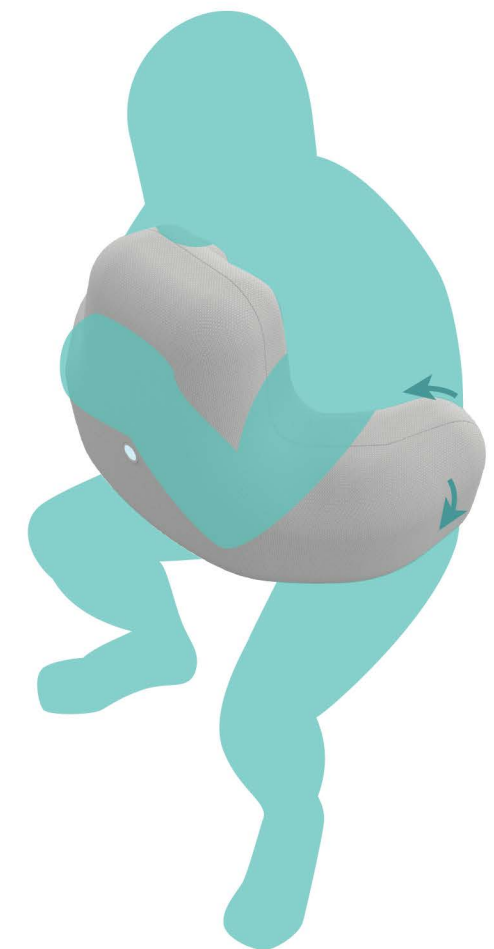
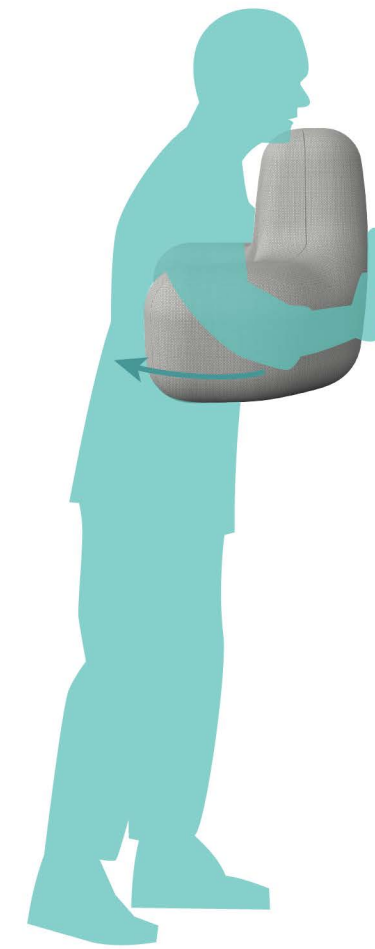
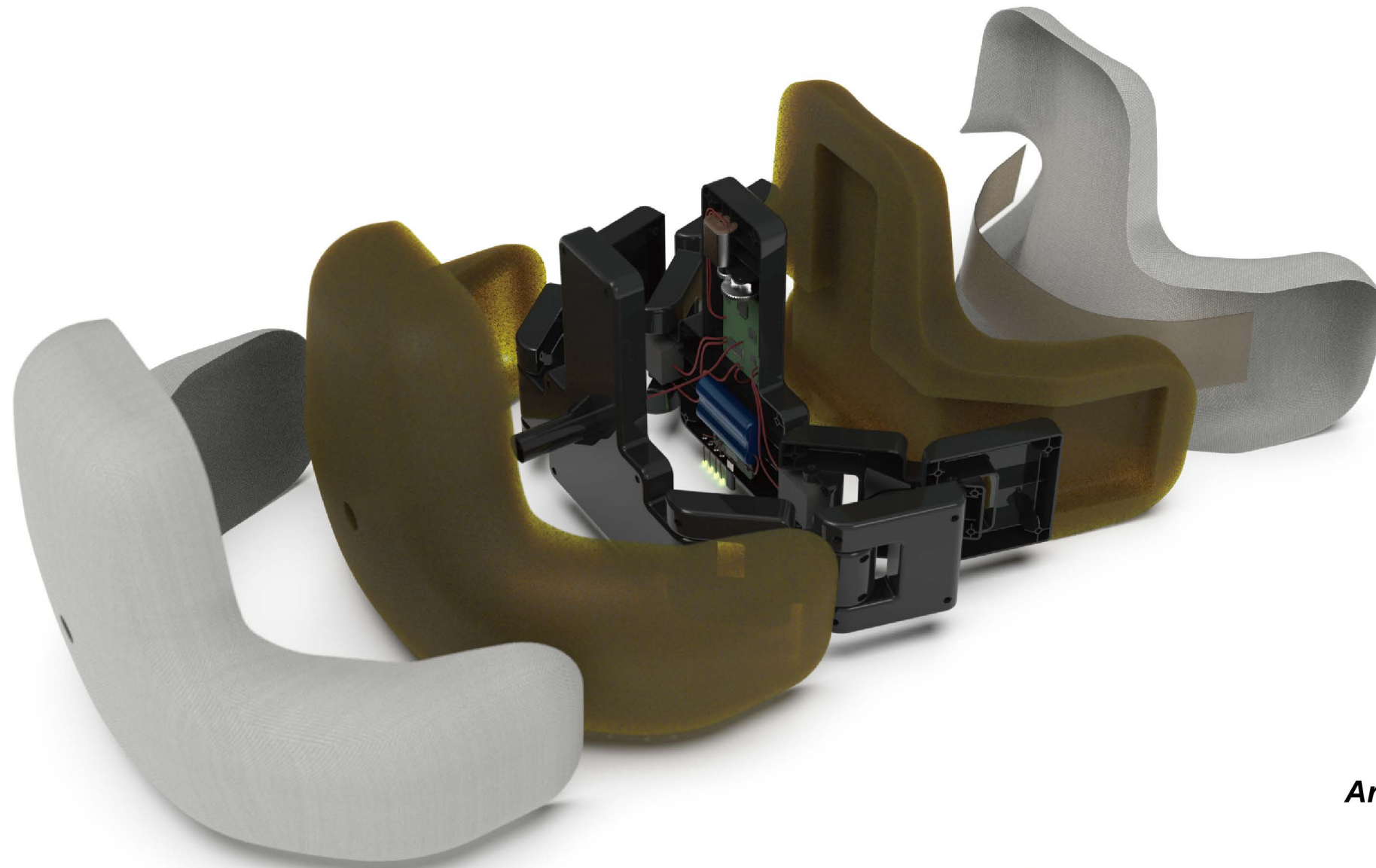


The two step motors near the main body are used to simulate the pressure during hugging, and the two step motors at the far end are used to simulate breathing by swinging. The motors are fixed on the shell by slot.



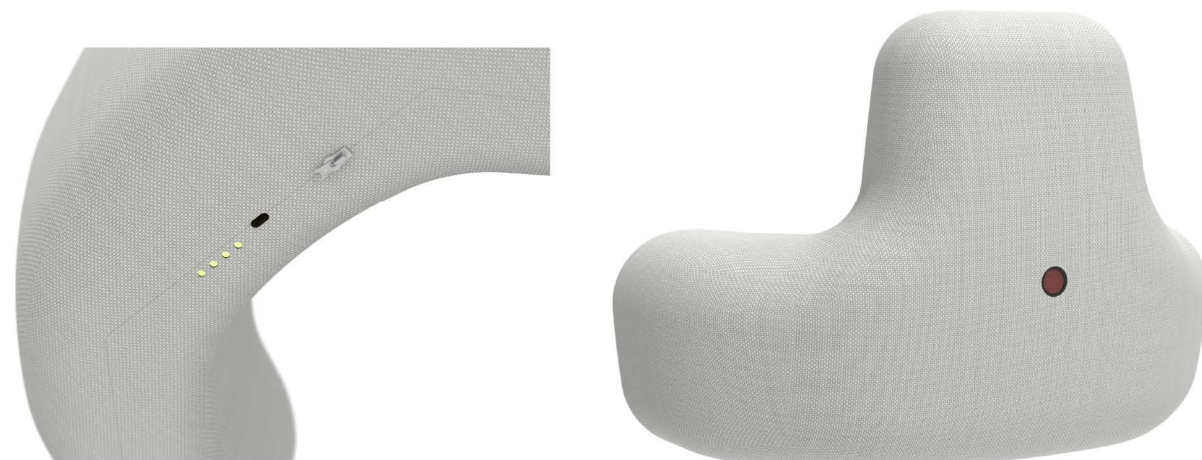
The heart rate sensor is installed on the outside of the product. The cylinder on the shell supports it, and the user needs to put his hand on the sensor when using it.

Final Product



Arms on sides squeeze

Arms on sides swings



References

- [1] WHO. Advice for the public: Coronavirus disease (COVID-19)[EB/OL]. [August 13, 2022]. <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public>.
- [2] Chen J. Shanghai epidemic continues to spread with more than 260 people infected within a week, and the effectiveness of "precision prevention and control" policy is concerned[N]. LianheZaobao, March 10, 2022.
- [3] The Office for National Statistics. Change in behaviours during and after the COVID-19[EB/OL]. [August 13, 2022]. <https://www.ons.gov.uk/peoplepopulationandcommunity/healthandsocialcare/healthanddw>
- [4] MY-THERAPIST. THE OVERWHELMING IMPORTANCE OF EMOTIONAL COMMUNICATION IN RELATIONSHIPS[EB/OL]. [August 13, 2022]. <https://mytherapistnc.org/blog/the-overwhelming-importance-of-emotional-communication-in-relationships>.