

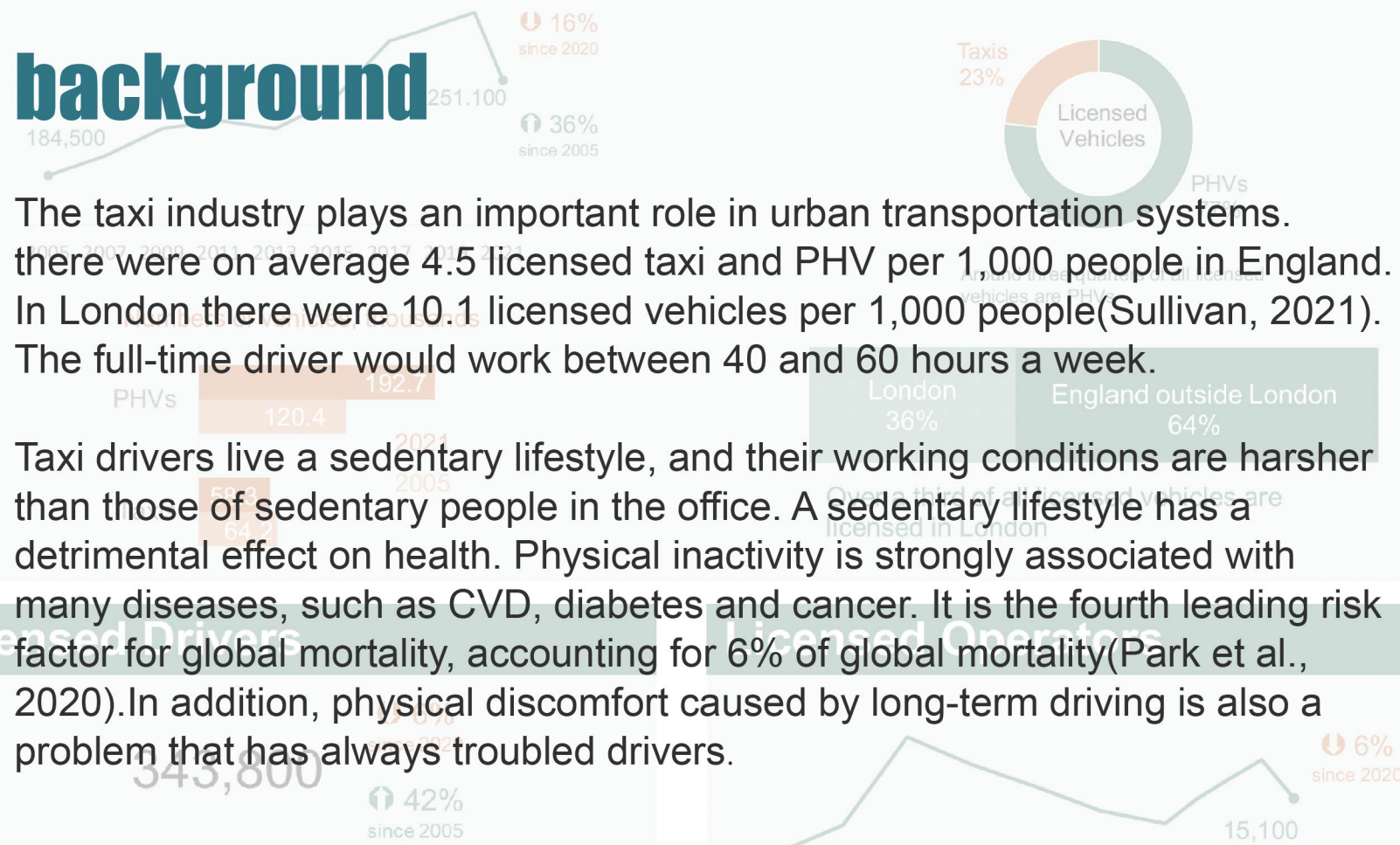
Healthy Driving

Mitigate drivers' health problems
from sedentary lifestyle

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Msc product design engineering



background



The taxi industry plays an important role in urban transportation systems. there were on average 4.5 licensed taxi and PHV per 1,000 people in England. In London there were 10.1 licensed vehicles per 1,000 people(Sullivan, 2021). The full-time driver would work between 40 and 60 hours a week.

Taxi drivers live a sedentary lifestyle, and their working conditions are harsher than those of sedentary people in the office. A sedentary lifestyle has a detrimental effect on health. Physical inactivity is strongly associated with many diseases, such as CVD, diabetes and cancer. It is the fourth leading risk factor for global mortality, accounting for 6% of global mortality(Park et al., 2020).In addition, physical discomfort caused by long-term driving is also a problem that has always troubled drivers.



refine problem

who — design for who

Target user group finally decide to be full-time taxi and Uber drivers. They play the same important role in the city transportation.

when — product using time

Drivers' working time is usually up to 10 hours a day which would be the product using time.

where — product using environment

Considering the driver's working environment, the product usage environment is designated near the driver's seat.

what — what to focus

This project focus on driver's health problem caused by a sedentary lifestyle. I intend to design a product that will encourage taxi drivers to pay attention to their health, change sedentary habits and relieve discomfort.

why — why this problem needs to be solved

Sedentary workstyles have a significant impact on driver health. Physical discomfort can also distract driving and may affect driving safety.



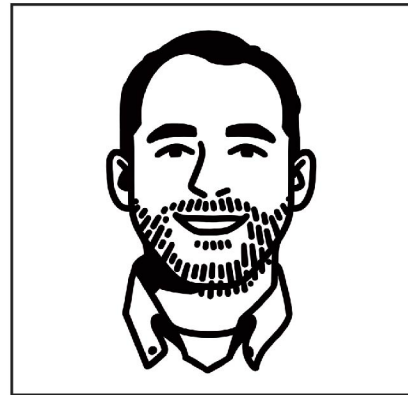
Interview



Jack used to be a **Uber driver for 4 years** and now he work as a Highland travel driver. Basically, he spends the whole working day in the car, because finding a **parking area** for activities is **not convenient**. he said many colleagues are **overweight** and have a big stomach. He doesn't think it is easy for them to **change the current lifestyle**.



Yang has **8 years full time** taxi driving experience. **He works in a small town** and not very busy, ususally works 7 hours a day. He always wait in a parking area, the waiting time sometimes up to half an hour, but he still **prefere to staying in the car** during the waiting time.



Bai is a taxi driver with **12 years experience**. He works **10 hours** each day from **Monday to Sunday**. The working time is driving on the way all the time because he need to find customers. He always feel unwell in the afternoon, **neck pain** is the worst. He doesn't use any body support product and he dosen't notice to keep the right driving posture.

Key findings



- The driver keep sitting in the car for several hours.
- Drivers always suffer from body pain.
- Some drivers drive with incorrect posture.
- Many drivers ignore chronic health problems from prolonged sitting.
- Inconvenient parking and busy earning money are the reasons why drivers are reluctant to get out of the car

Market analysis

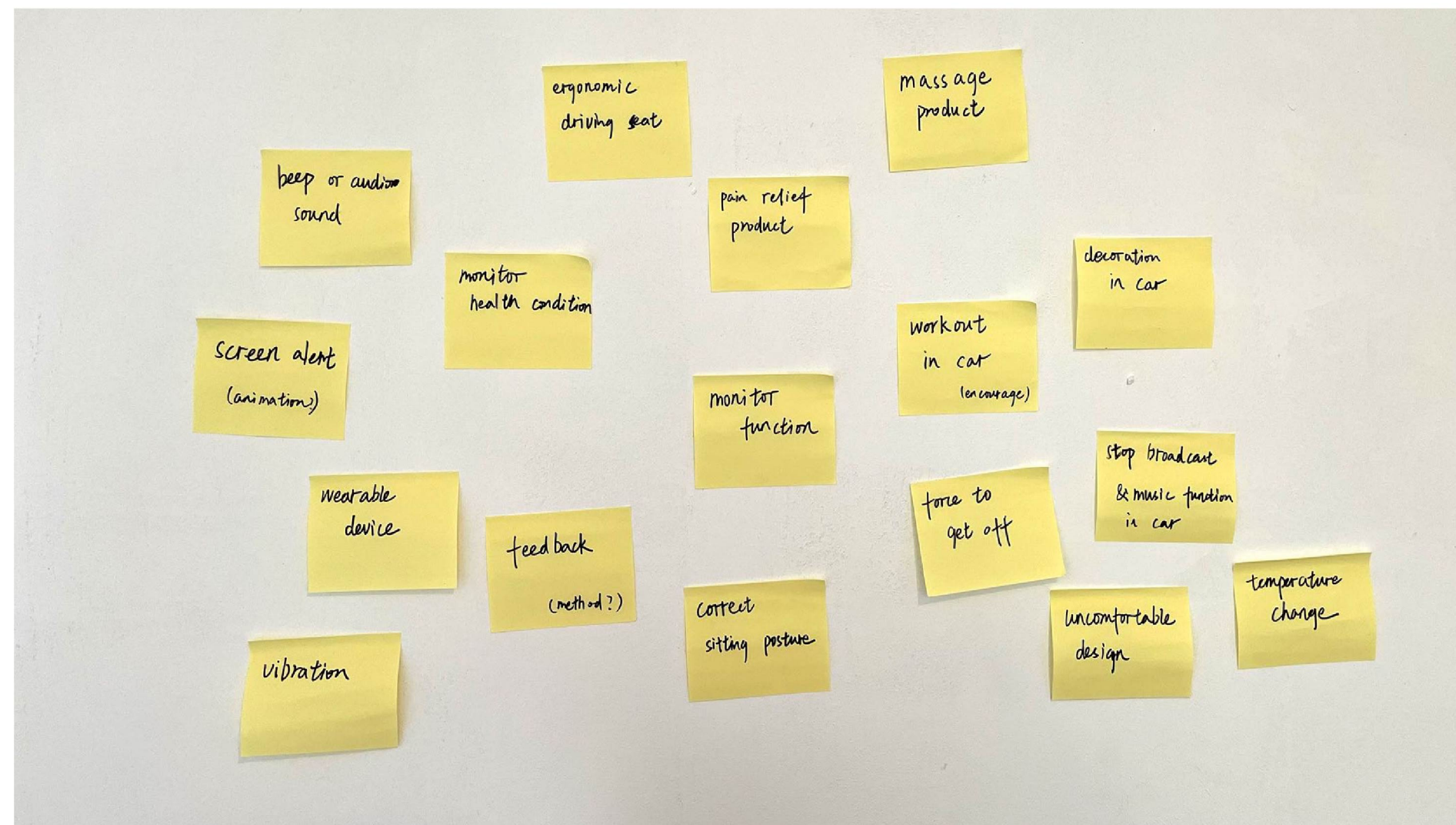
I did some research on existing product as reference and comparison. For solving sedentary problem, there are more products for the office sedentary group than for drivers. And the products are mainly to provide body support and some products can be used for heat therapy, or help people keep in good posture.



Design brainstorm

Combined with previous work key findings, I did some brainstorming on design ideas. The design ideas are posted on wall with sticky notes in order to extended thinking. The design directions tend to be as follows.

- uncomfortable design, promoting the driver to get out of the car.
- pain relief design, making driver more comfortable in the work environment.
- products that encourage drivers to exercise
- monitor driving and health product, then users will receive feedback.



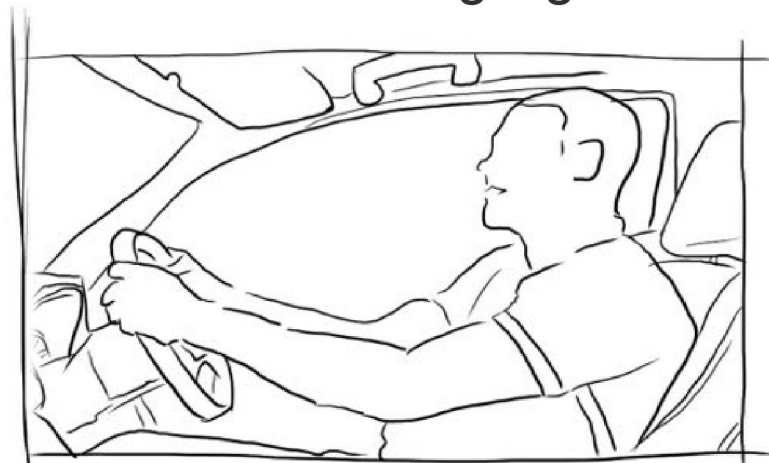
User profile



- User: Full time taxi and Uber driver
- Lifestyle: Have to sit in a car up to 10 hours everyday.
Reluctance to get off the car during short breaks.
- Pain point: Muscle soreness after driving for hours,
Inconvinent stopping the car stretch the body.
Hard to find products focus on driver health problem.

Problems storyboard

This storyboard shows a typical full time taxi driver's work journey based on previous research, observation and interview. It highlight drivers' unhealthy workstyle and pain points in the work.



1. Get up early, sitting in the car keep driving a whole morning until lunch time.



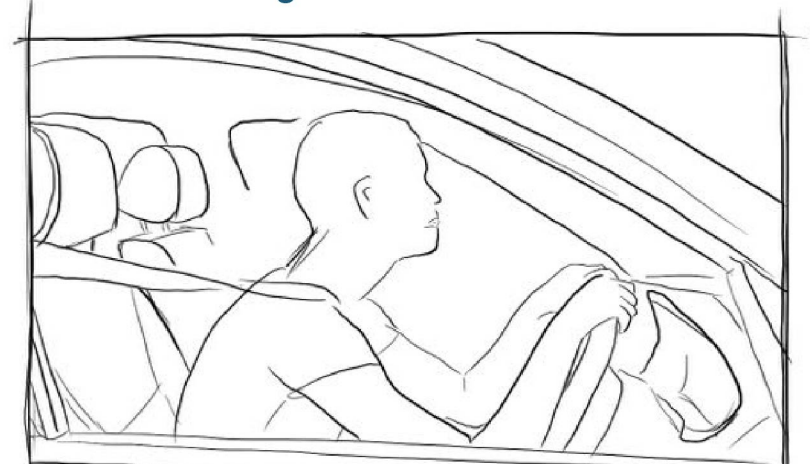
2. Take lunch in a hurry and most of the time eating in the car



3. Even in an unbusy time, playing on the phone in the car while waiting for customers.



4. Always feel uncomfortable in some body area after a few hours driving, but don't know how to relieve it.



5. Don't know the correct driving posture and have many bad driving habits.

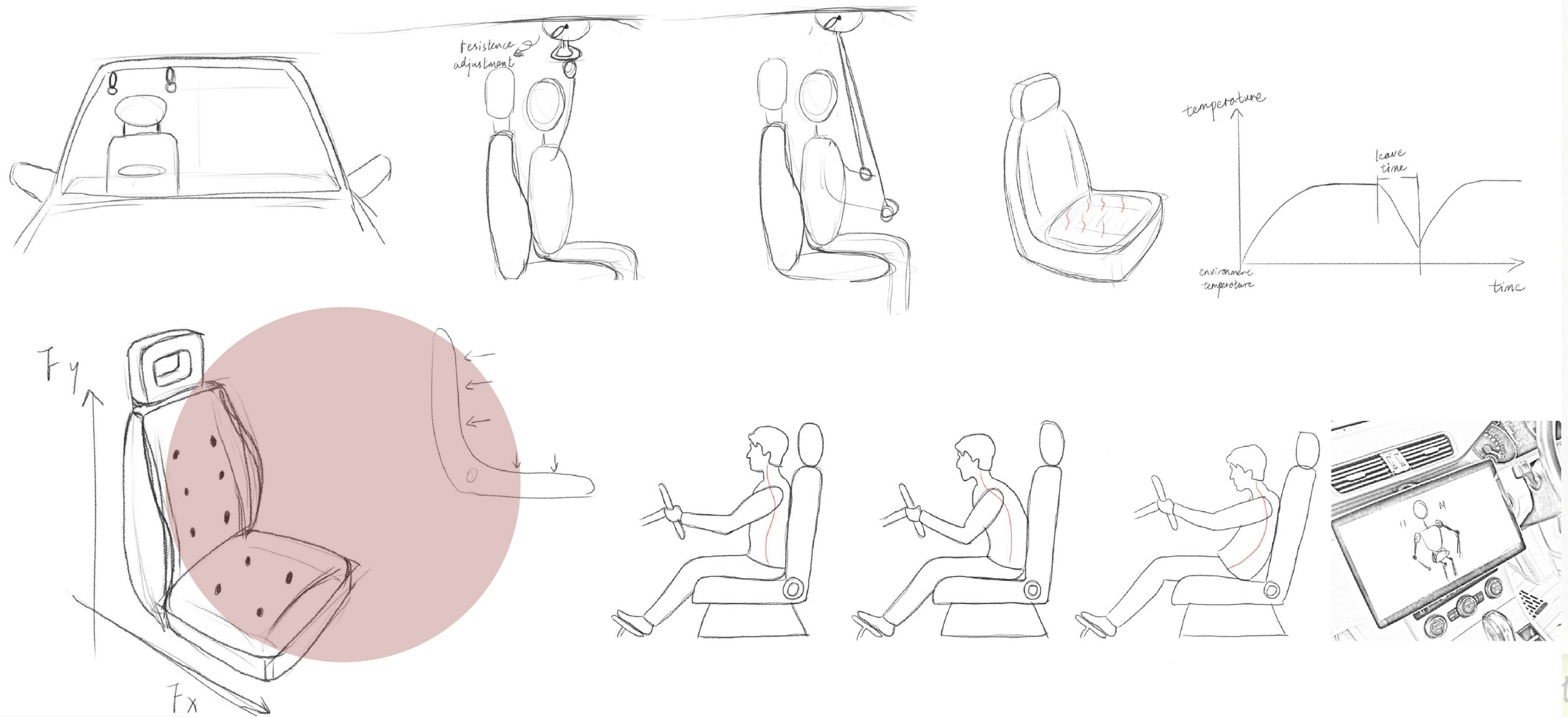


6. Lack of health awareness and exercise, only willing to rest after get off work.

Design evaluation

ergonomic

massage
products



Screen
(anima

vibration

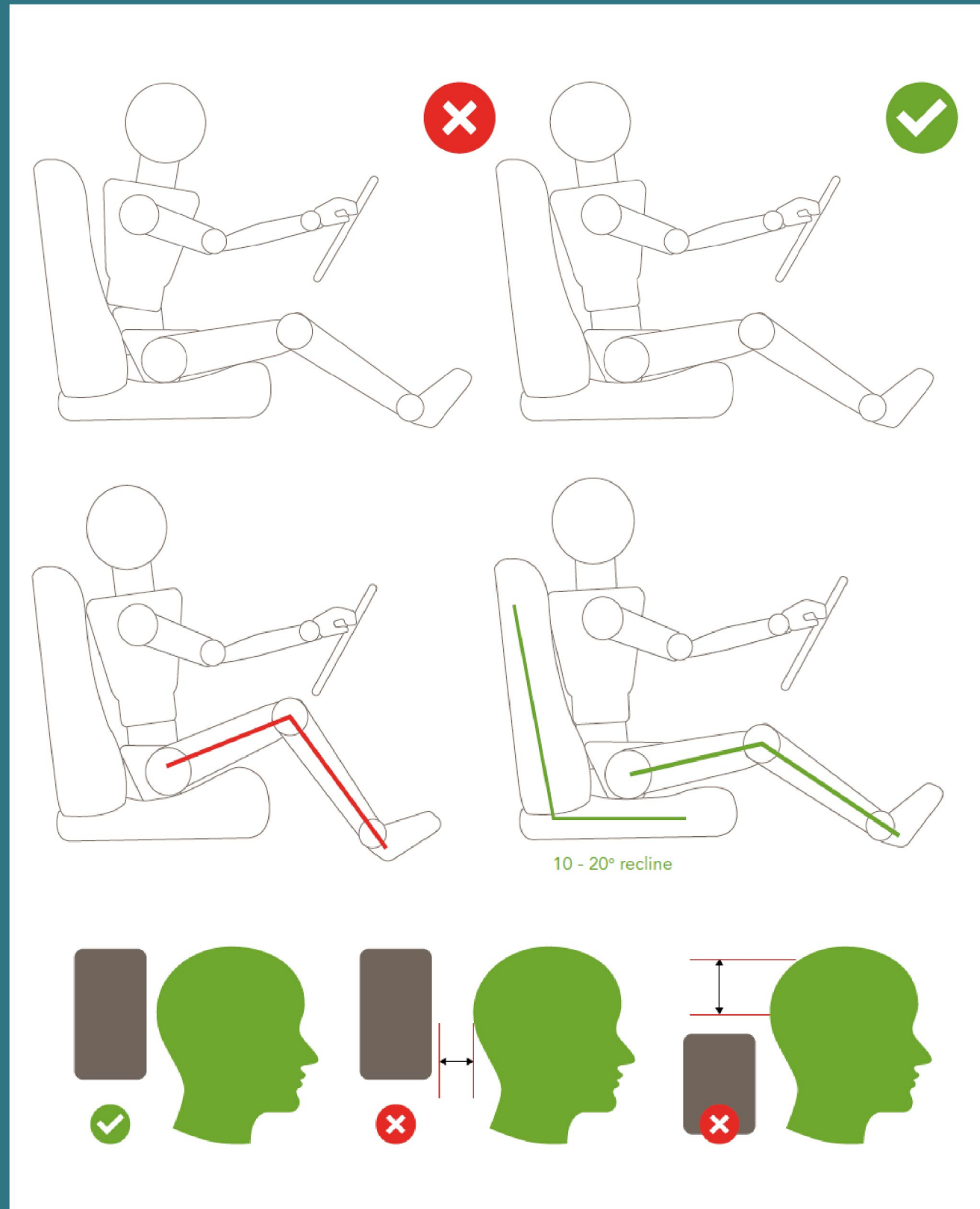
correct
sitting posture

uncomfortable

change
ture

The main causes affecting the driver's health are **sedentary habits** and **incorrect driving posture**, meanwhile considering the reasons of **driving safety** and **do not affect the profit of drivers**. I decide this project focus on driver's **behavior changes**. The final decision is to design a **seat cover** with **monitoring and reminder function** by establish the connection between user and product. Eight load cells are built into the seat cover, the driver's sitting posture and working time can be judged and reminded by reading the **weight distribution**.

correct driving posture



exercise in car



Then I did the research about the right sitting posture and how to adjust the driving seat. During research, I also find some useful in-car exercise can relieve muscle tension from prolonged driving.

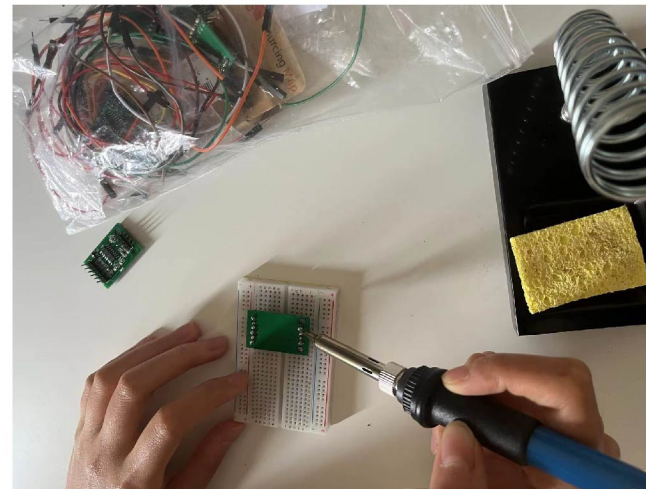
- Adjust the seat height up until the hips are at least as high as knees.
- Make sure the backs of knees do not touch the car seat bottom, as this is bad for the knees and circulation.
- Raise the inclination of the seat back to an angle of 100-110 degrees. This angle decreases the pressure on the discs in low back.
- Adjust the height of the headrest so it rests in the middle of the head.

Prototype making

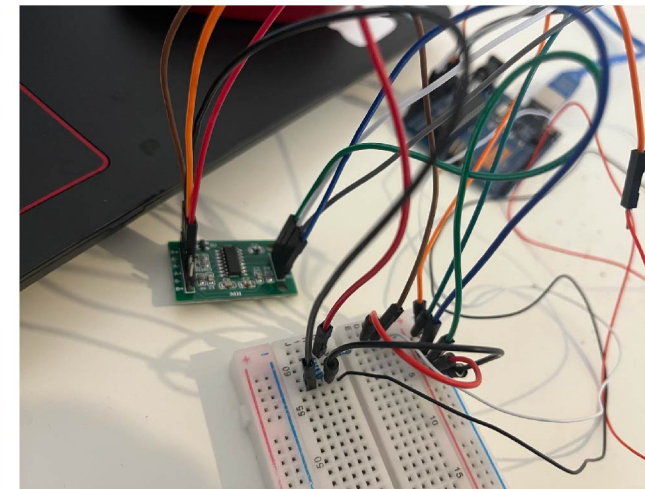
In this prototyping, I focused on the circuit that was for tested user data. Working details can be found in the technical report. Due to the connection problem, it is very hard making all sensors read weight stable.

The next step is collect user data after making the circuit available. In my expectation, I can divide users into several groups by weight difference, and each category gets a corresponding appropriate range of values. But in test stage, I found that the user data is full of diversity.

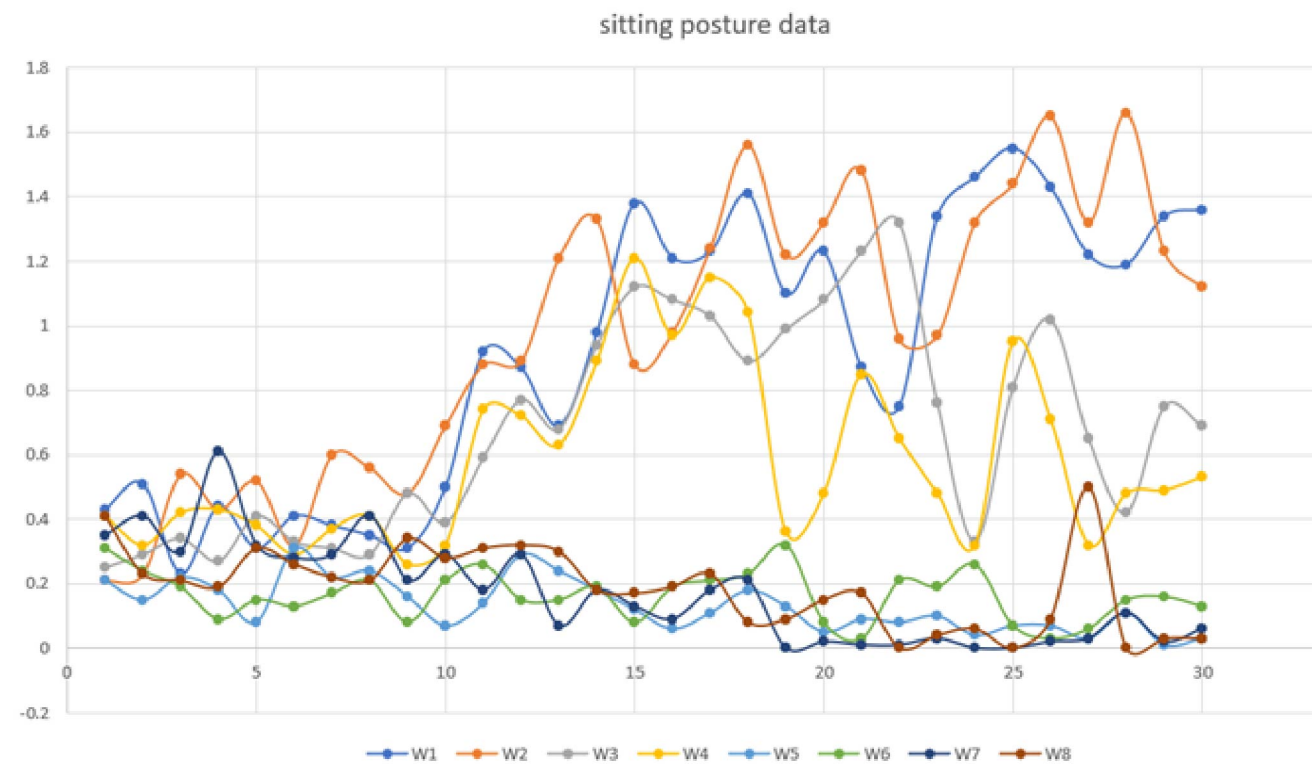
The product is not suitable for single division of the threshold range for different user group. The product should go through machine learning and collect a lot of user data to be able to calculate the appropriate range for each sensor. Each new user needs to be initialized so that the system can accept personal data and then process it according to the database to obtain the correct sitting posture monitoring system suitable for the individual.



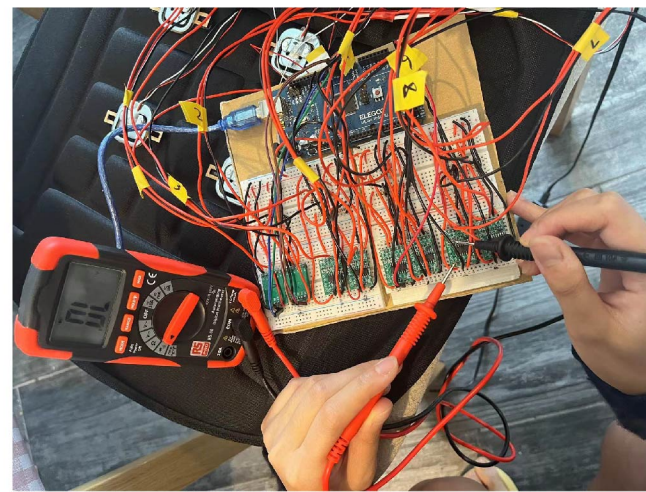
▲ soldering component



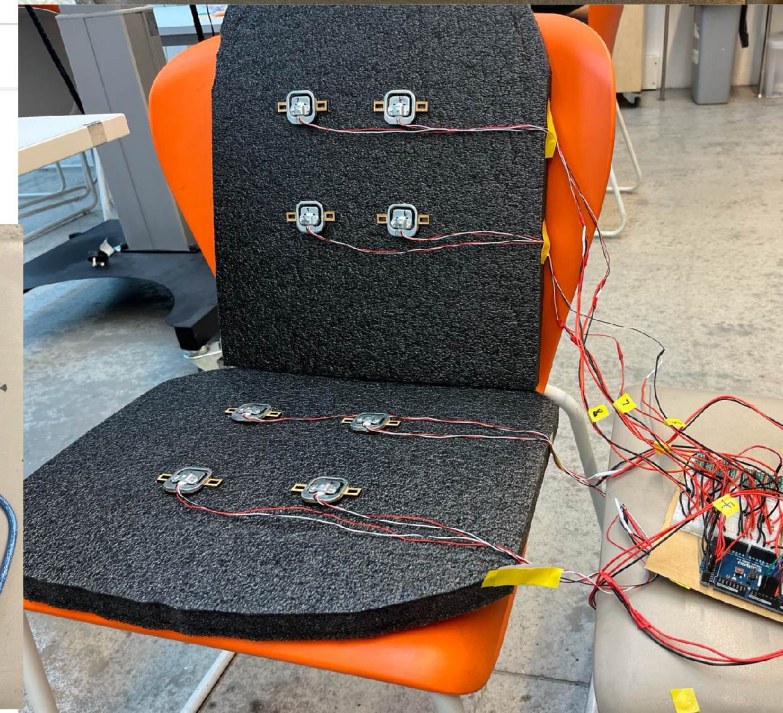
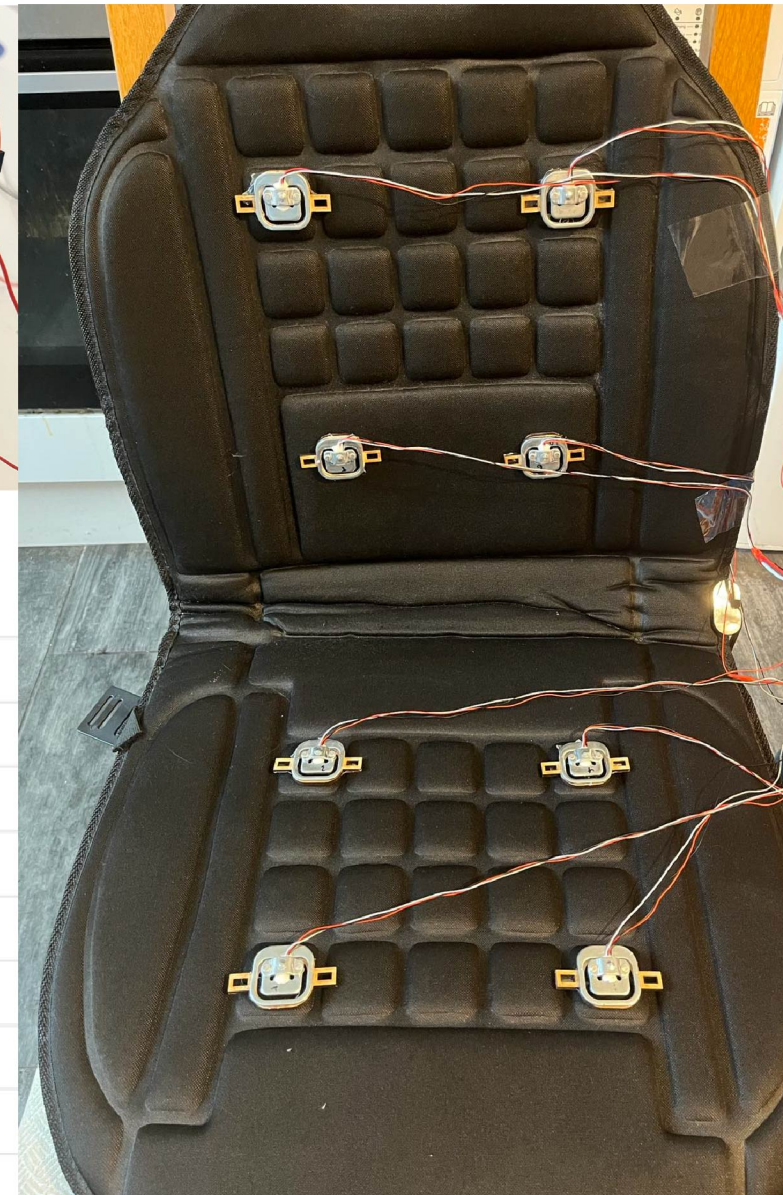
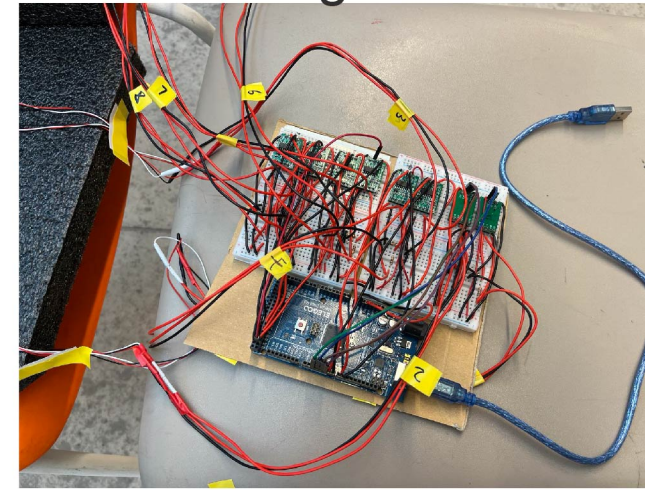
▲ sensor connection



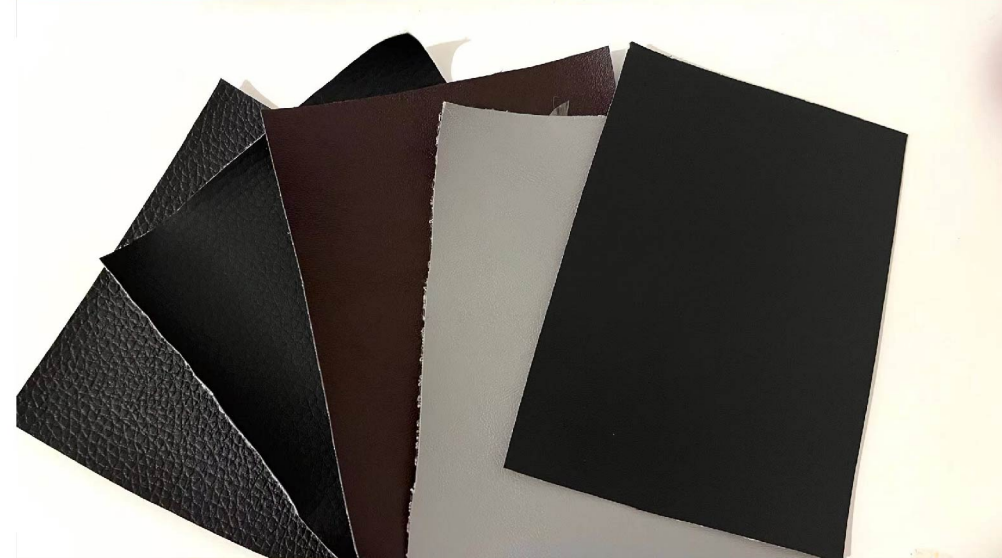
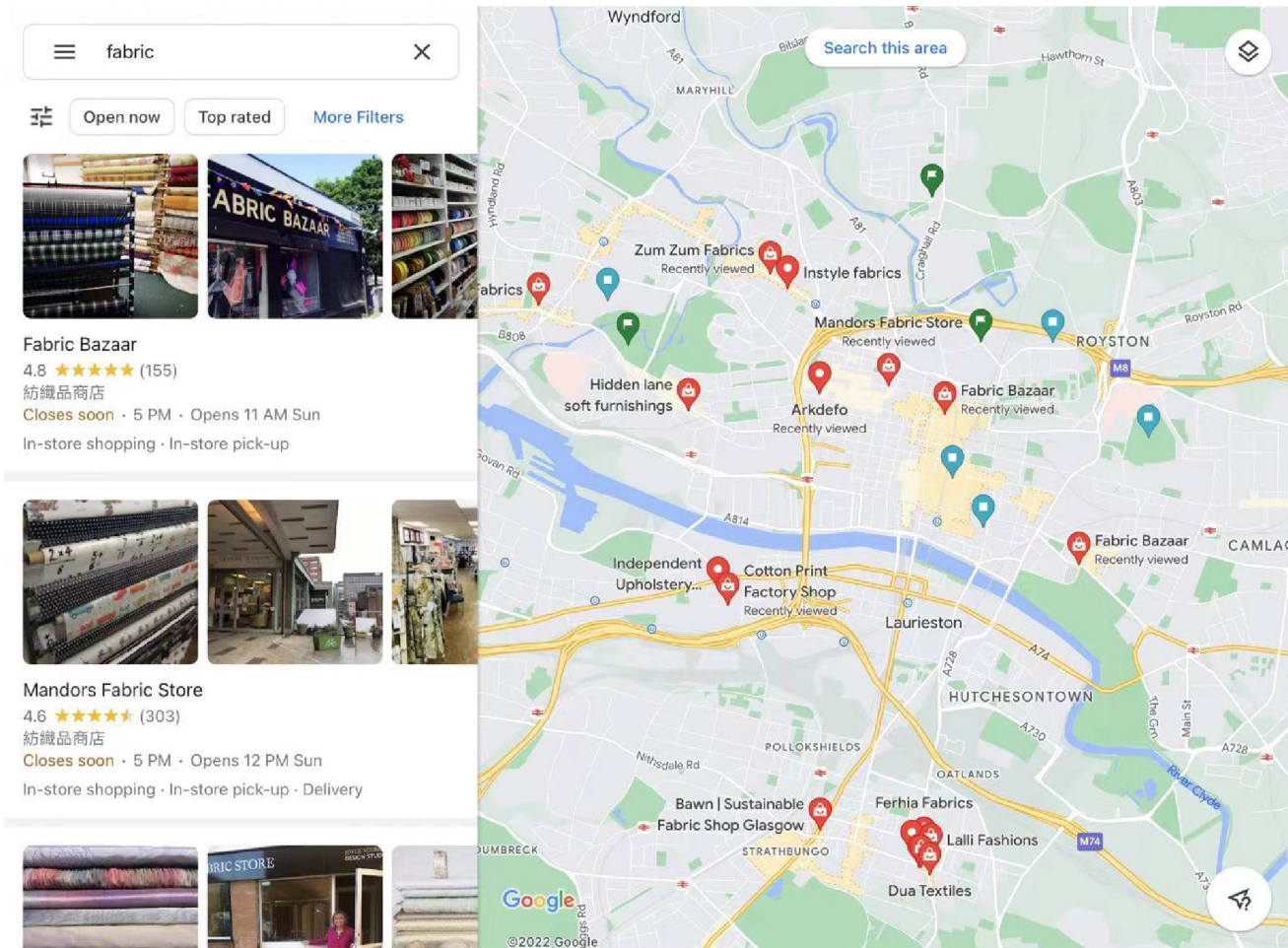
▼ connection detect



▼ numbering sensors



Material exploration



seat cover surface material requirements

- Waterproof
- Breathable
- Odor and Stain resistant
- Anti-slip
- High temperature resistant

By visiting fabric store in glasgow and searching material online. Combining price and user acceptance, choose artificial leather as the main material for the seat cover. Compared with genuine leather, artificial leather is a robust and easy-care alternative.



User journey

1



attach the seat cover to the driving seat

2



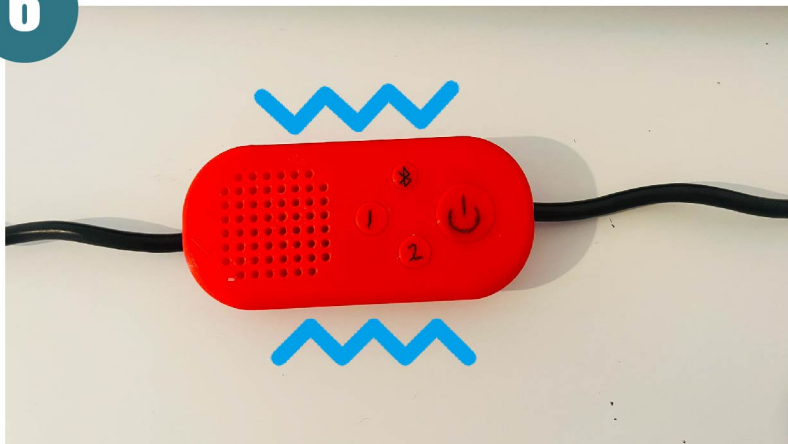
connect to the vehicle power

3



press the main button to turn on product

6



receive vibration reminder from controller

5



unconsciously driving in a bad posture.

4



adjust the seat position following the phone instruction.

7



go back to correct posture
stop the vibration

8



receive a audio break reminder after
a few hours sitting.

9



using fragmented time in a traffic jam
do stretch following phone instruction

Self-reflective

This three-month individual project which also the last project at the graduate phase made me feel a lot. Review the entire project process, start with the problem proposal, and gradually expand through user research, desk research. During research, there are some key findings help me to develop the design ideas. In the research stage, some key points to solve the problem will be found, and many design ideas will be generated at the same time. Then considering technical reasons, user needs, etc. to select an appropriate solution.

I also feel prototyping is an important step. In terms of my project. By making prototype, I found the hardness of materials has a big impact of my product and can arrange the sensors layout appropriately. Meanwhile, I feel that it is not easy to realize a real product from a design idea. Product design is inseparable from the support of technology, but also limited by technology. In many cases it does not work perfectly as initial expectation due to technical limitations.

The progress of this project also benefits from the learning of the first two stage. For technical part, the knowledge from microelectronic support me finish the testing circuit and thanks the help from my supervisor and workshop staff. For design process part, I learned how to start with finding a problem, narrow down to a specific user group and how to engage with user; find their problems and needs. Then keep developing and finish product details based on prototyping result and user feedback.

To conclude, I feel the progress of mine is the growth of design thinking; the ability to discover and solve problems; the learning ability to explore and develop the unknown area.

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