

DESIGN PROCESS SUMMARY | SEPTEMBER 2022

Modular Shared Vehicle Product Service System

With the rise of the sharing economy, the sharing car has gradually entered people's vision. However, it is rare for people to use shared cars in real life. After the survey, it was found that the utilization rate of shared cars is not high, because shared cars can not be used anytime and anywhere, and can not protect the privacy of users well. This vehicle aims at this problem, and designs a modular autonomous vehicle which combines the shared power unit and private cabin. It allows users to call a shared car at any time and enjoy their own private space.

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PRODUCT DESIGN ENGINEERING

**SCHOOL OF DESIGN
THE GLASGOW
SCHOOL OF ART**

CURRENT SITUATION

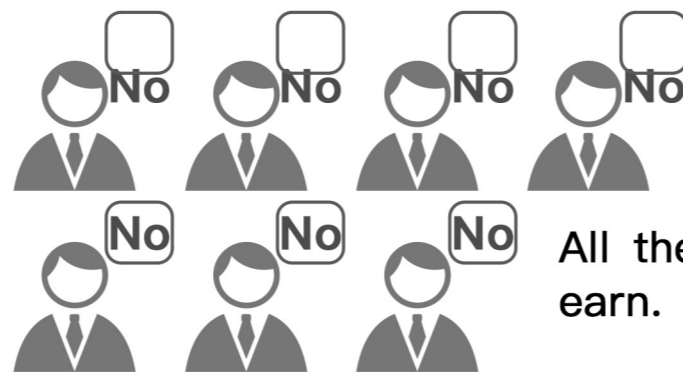
Field & online Research



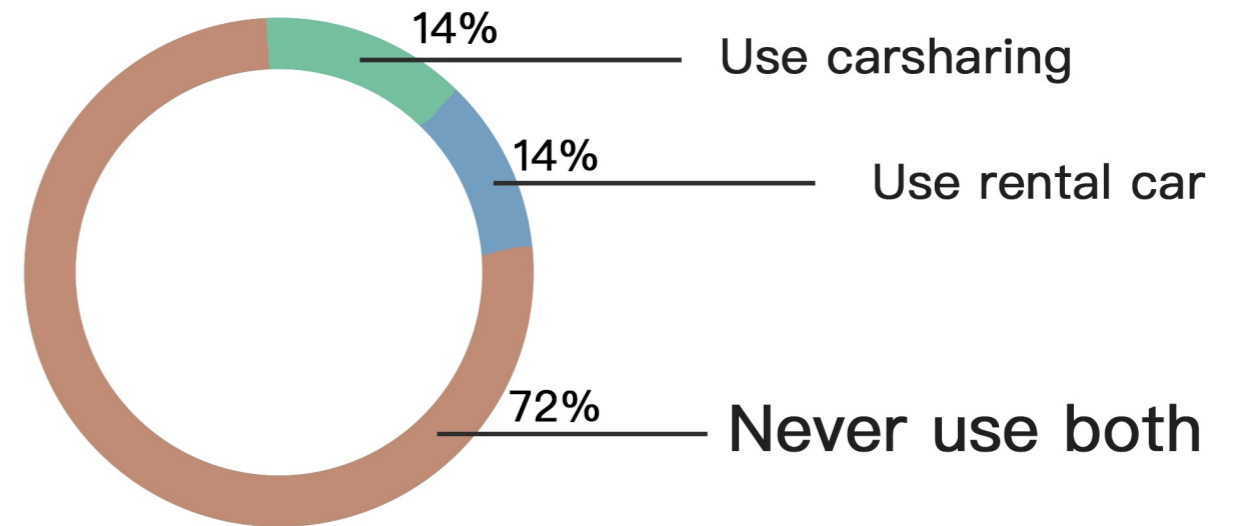
I observed the car sharing and bicycle sharing stations at the railway station and online. In both of two station, many vehicles are idle.

Interview

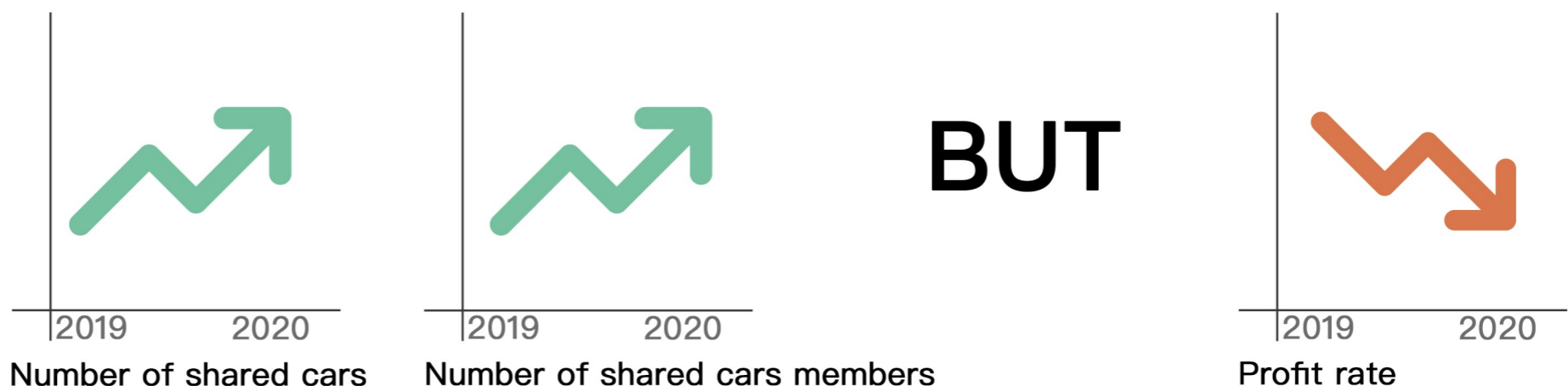
I interviewed seven travelers at the railway station and got information about their use of shared cars. It shows that most people used shared car.



All the interviewees were unwilling to share their private cars to earn.



Carsharing industry data



According to the recent industry data report, although the number and users of shared cars are increasing, the industry profit rate is decreasing, which indicates that the business of shared car service has not increased, that is, its utilization rate is at a low level.

PROBLEM

Research



Dash cam record that how people use the shared car in the journey



One user finish using, and the next user can enter the car immediately.



Record the users' location information

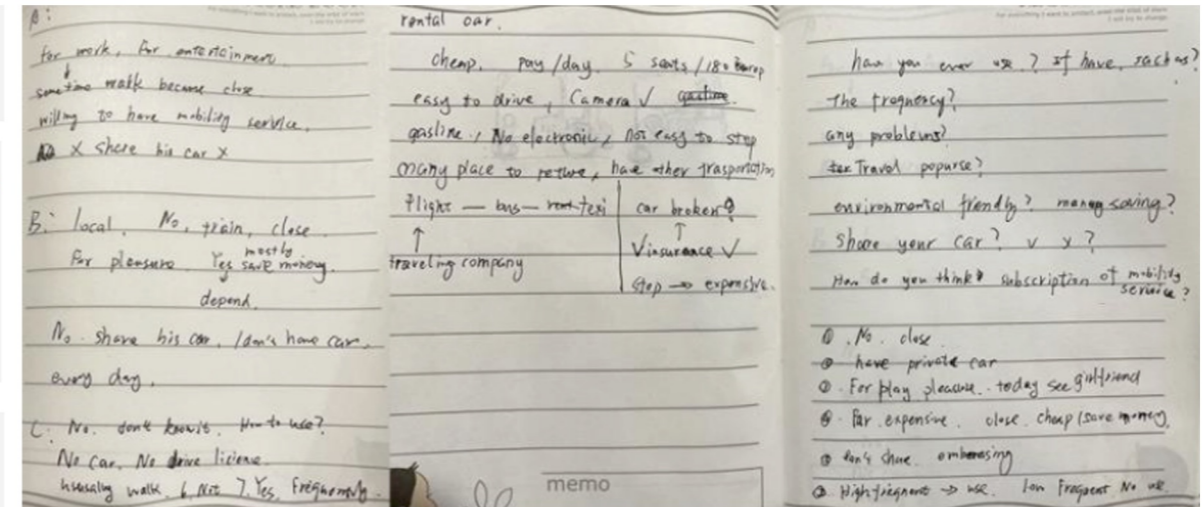
Interview

Have independent control

What do you think are the benefits of getting private ownership of cars

I can drive anytime, anywhere

My car gives me a sense of security



The Interviewees' dissatisfaction with car sharing is mainly reflected in:

1. People cannot use car whenever they want
2. Shared car cannot protect their privacy well, resulting in their insecurity

Decision Making

There are many solutions to the first problem, such as driverless cars. The second problem is rarely mentioned but users are very concerned about it. It even is the main reason why users refuse to use shared cars. Therefore, the project chooses the first problem as the target to solve.

Summary

Why does people give up to use the shared car?

Because shared car can not protect users' privacy well. It makes people feeling less sense of security.

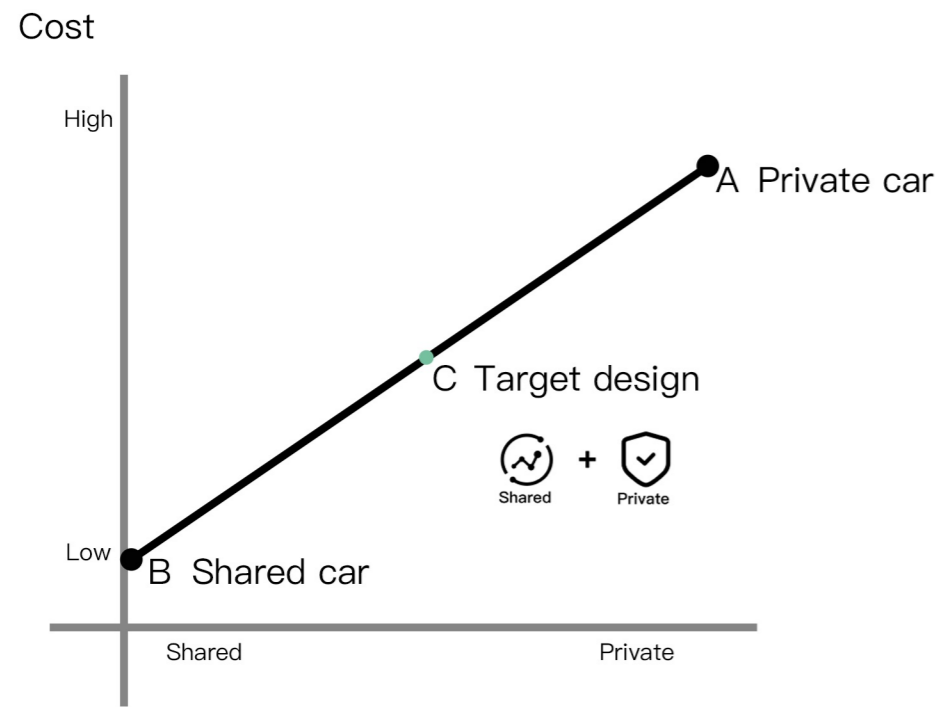
ANALYSIS & CONCEPT

Lecture review of Privacy

Privacy is the ability of individuals or groups to **isolate themselves or information** about themselves to selectively express themselves. When something is private to a person, it usually means that something is **special or sensitive** to them in nature.

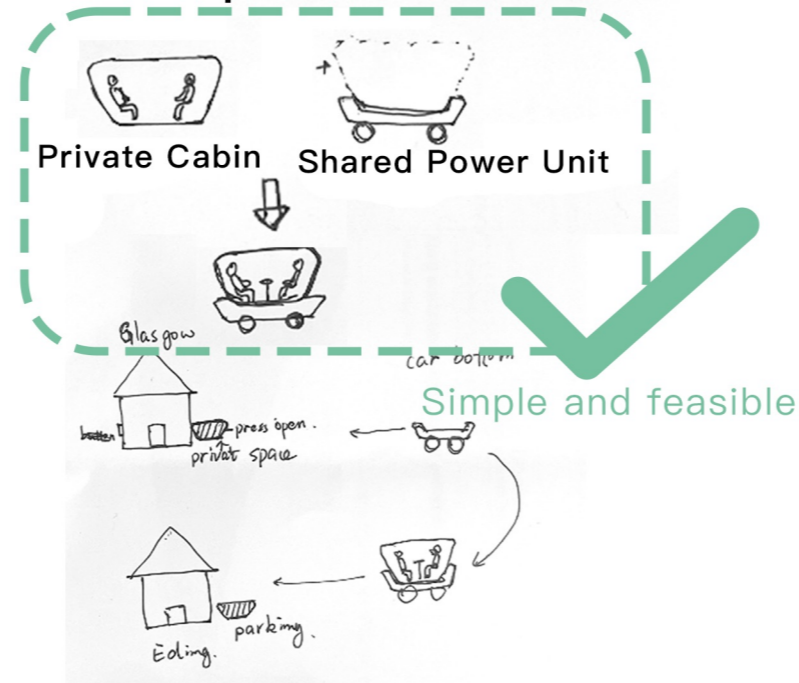
The United Nations defines the right to privacy as: no one's **private life, family, home and communication** shall be arbitrarily interfered with, and his honour and reputation shall not be attacked. Everyone has the right to legal protection against such interference or attack.

The researcher Singleton Solveig believes that privacy is "a condition for protecting others from **unnecessary access** by others – whether **physical access, personal information or attention**."



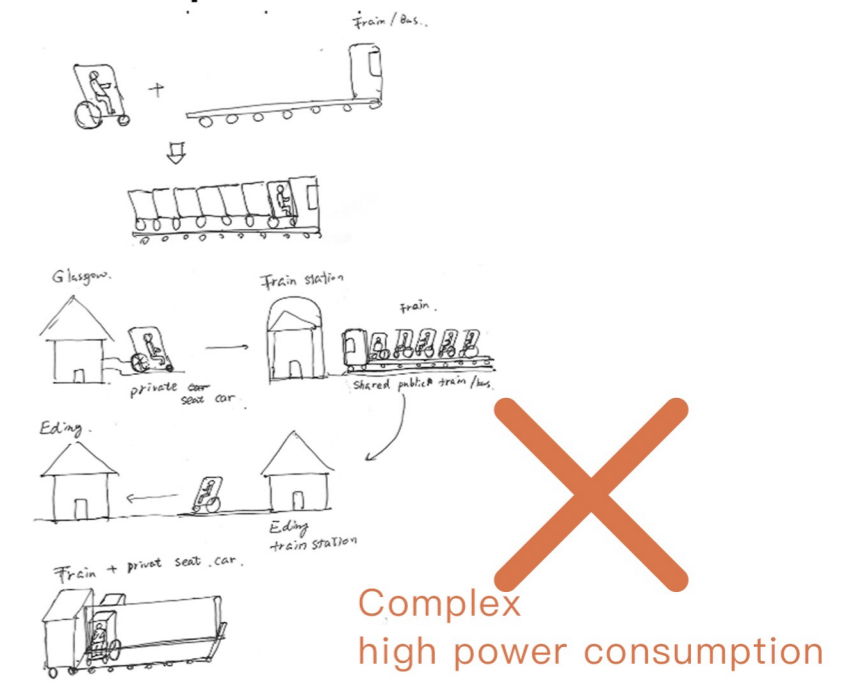
Sharing and privacy are contradictory words. Sharing means using a product in cooperation with others and reducing the cost of purchase and use; Private means paying more for a more private travel experience. Their relationship is shown in the figure below. The horizontal axis represents the privacy of the product, and the vertical axis represents the cost of the product. The private car is at point a in the upper right corner. Users need to spend more money to get a more private and safe travel experience. Sharing the car at point B in the lower left corner allows users to spend less money and gain the right to use the car at the expense of privacy. The goal of the project is defined at point in middle. Both privacy and low cost.

Concept 1 Modular Vehicle



The cabin and power unit are designed into two modules. The cabin is private, which can protect the privacy of users. The power unit is shared, which can save money and protect the environment.

Concept 2 Cabin Truck/Train

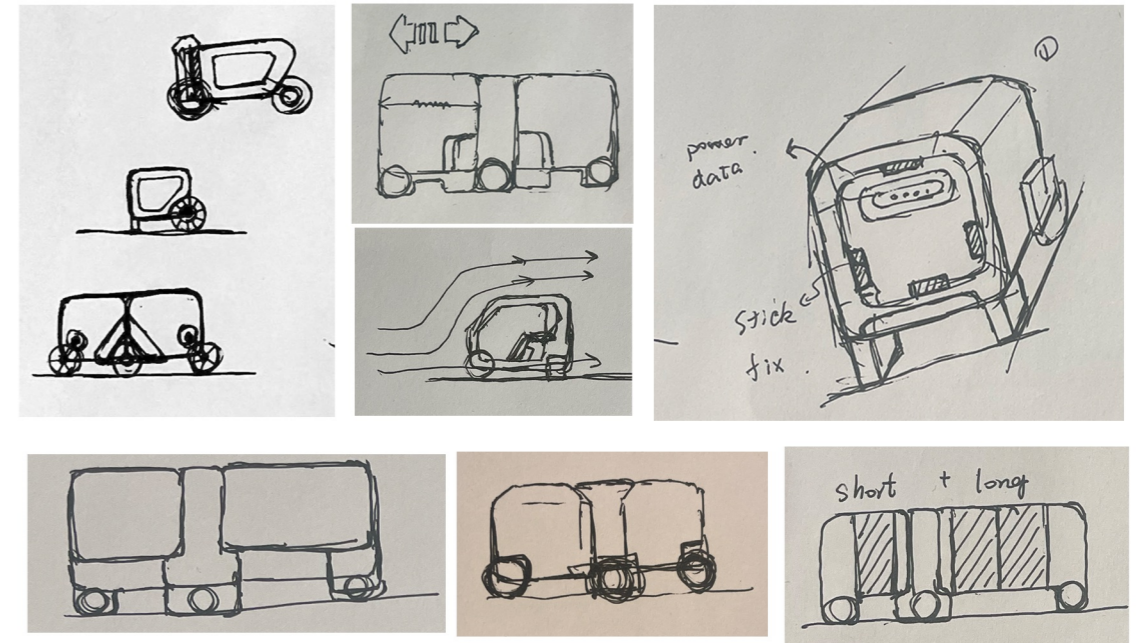


Private cars can connect to public transport. During the short journey, use a private car which protect privacy. During the long-distance journey, the cabin is merged with the truck or train, and the user is still in the car.

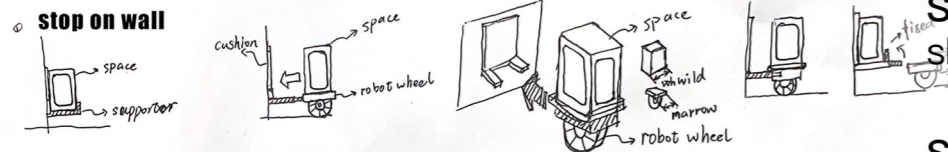
SKETCH



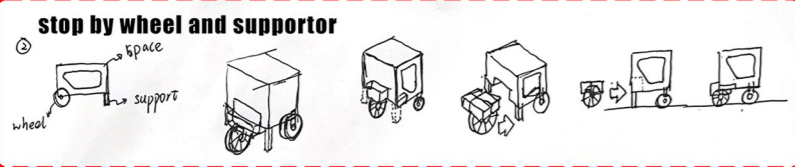
Referring to the existing modular products, the design of multi-functional vehicles can be realized. If privacy and sharing are regarded as two functional modules, they can also be shared and private at the same time with multi-functional modular design.



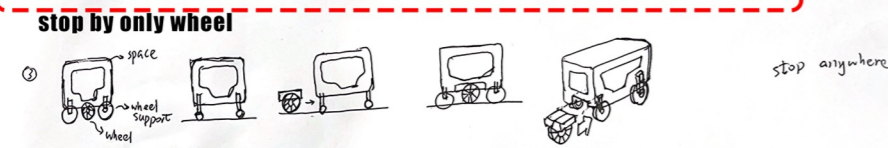
How it stop



Solution 1: It cannot stop on ground, should build special station.



Solution 2: It use two supportors and two wheels which can lower cost and it also can cooperate with the power

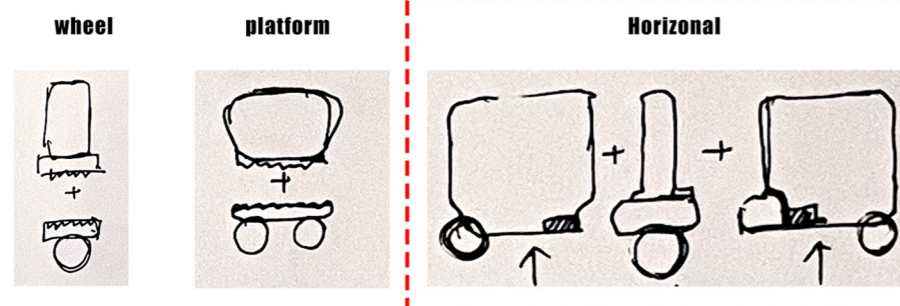


Solution 3: It use too much wheel and it is difficult to turn left and right. The control system would be very complicated

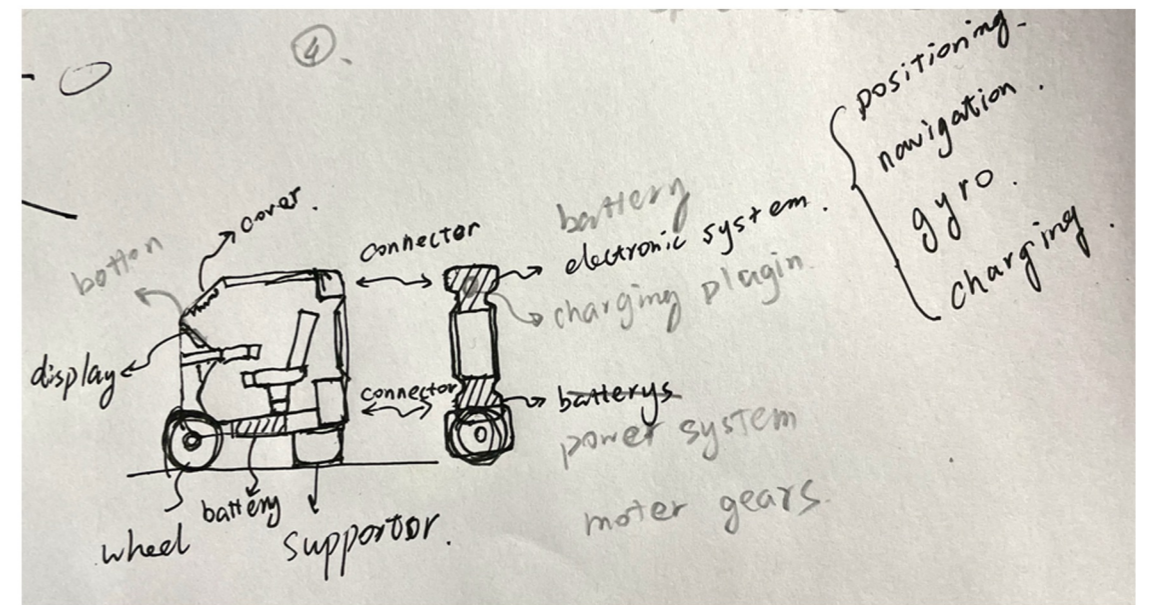
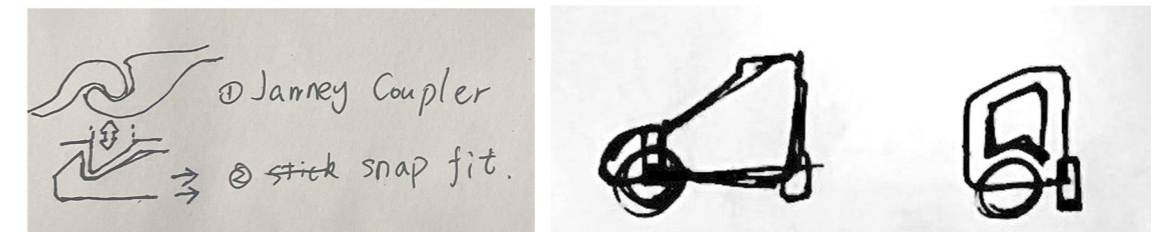


Solution 4: It use four supportors, in addition, it also need four wheels to run

How them connect

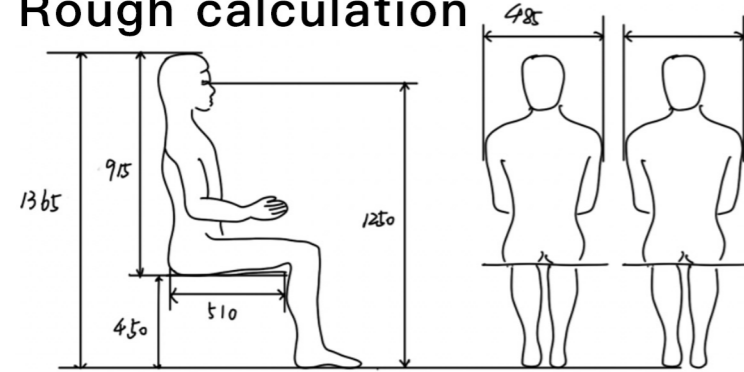


For the connection mode, I choose the horizontal connection method. In the whole process, It doesn't need to overcome gravity to do work, and unlike the vertical connection mode which need to design an additional lifting and landing system



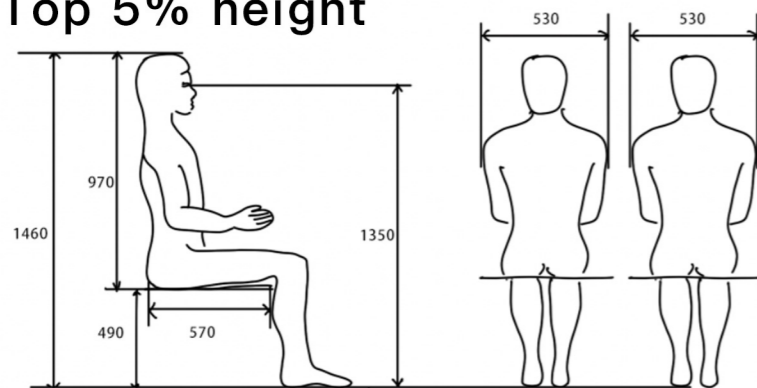
HUMAN FACTOR & TEST

Rough calculation



By referring to the average size of human when sitting in the ergonomic data, we can understand the approximate size of the car interior. Under this condition, the total height is 1365mm, the total width is 970mm, the total length is 510mm, and the seat height is 450mm.

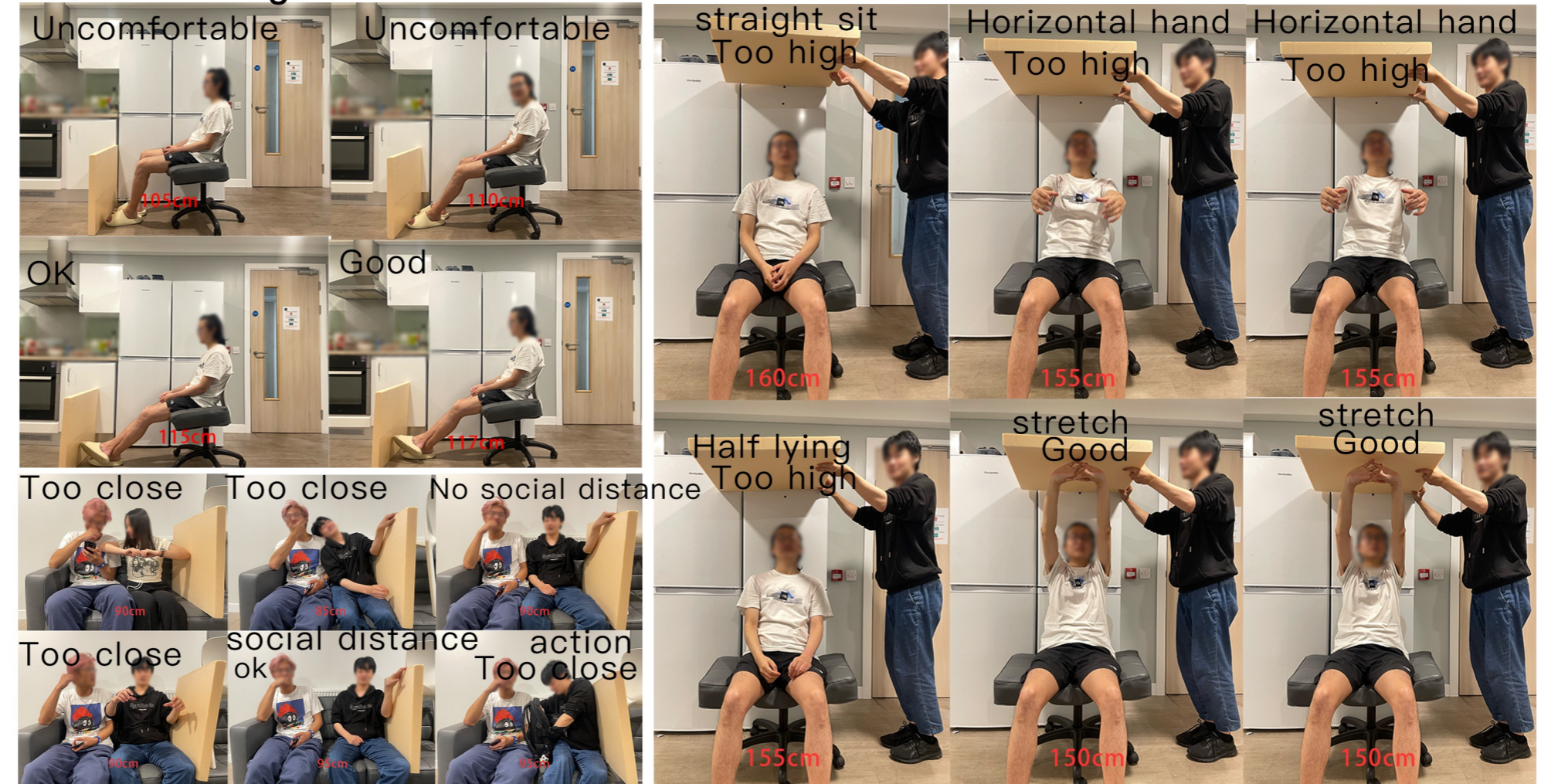
Top 5% height



Check the body size of the top 5% height when sitting down to understand the maximum size requirements of the car interior.

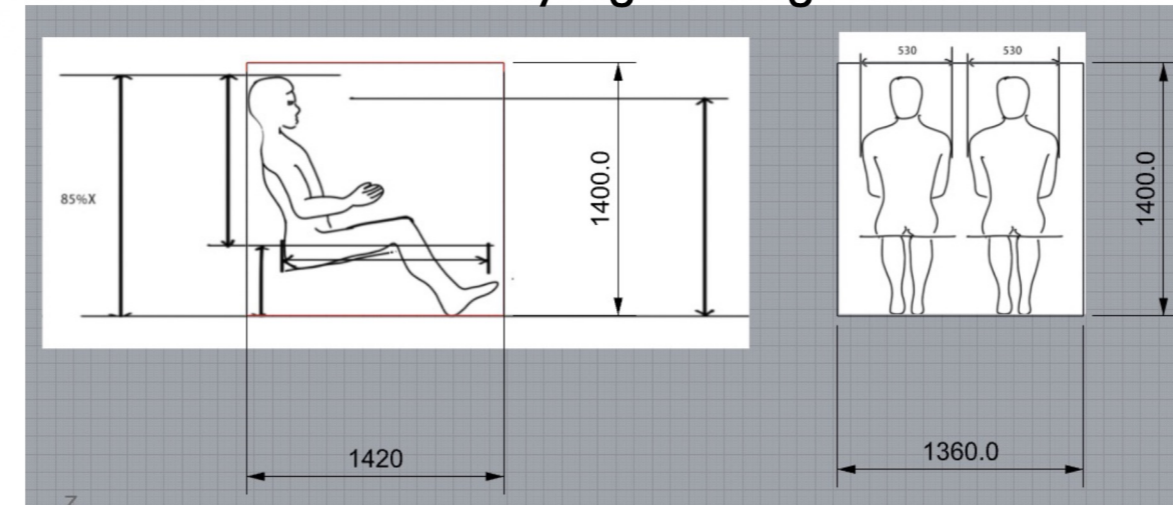
Under this condition, the total height is 1460mm, the total width is 1060mm, the total length is 570mm, and the seat height is 490mm.

Test of sitting size



Use the partition to test the comfortable length, width and height of people when sitting and standing, and the appropriate social distance.

Calculation of half-lying sitting size

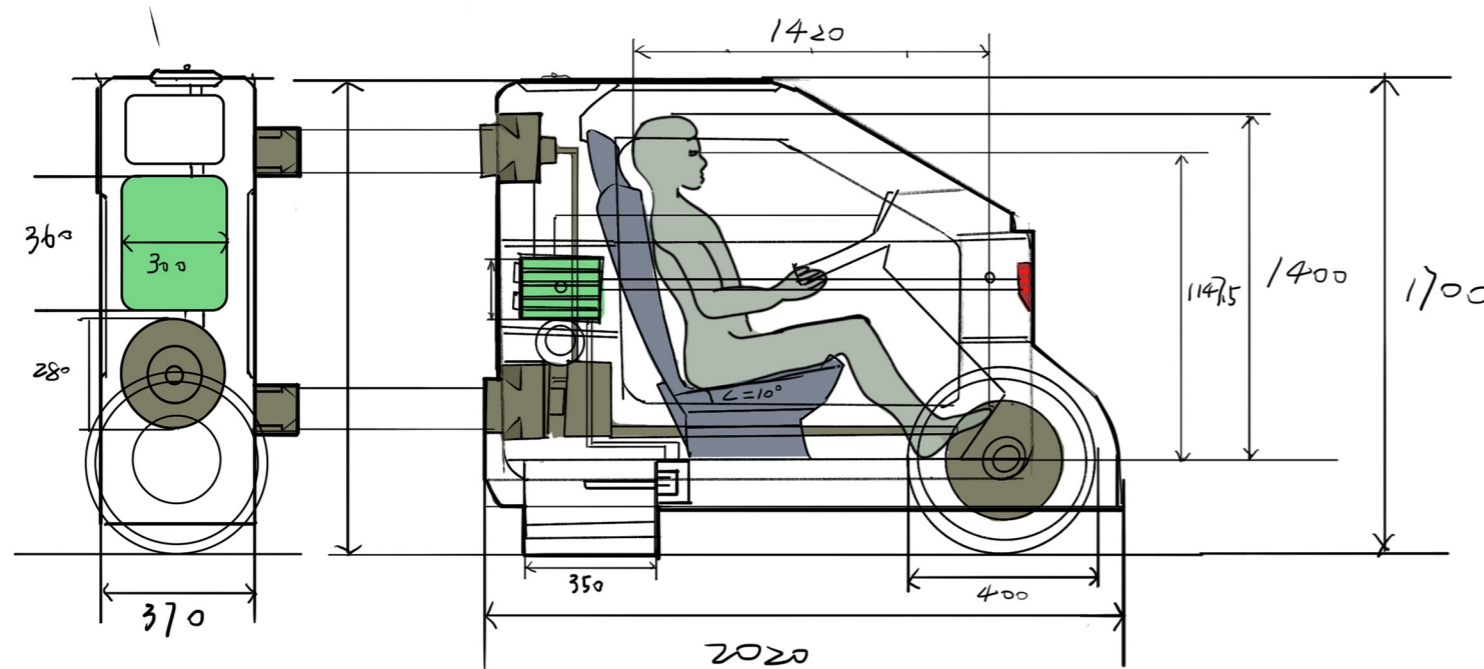


The sitting posture can often be half lying. Through the software, and it was found that the height related dimensions would be reduced if users half lying. The range of the occupied space of the two people at this time was obtained through the correction of the scale 82%.

Finally, I chose the space size of half lying pose: 1420mm * 1360mm * 1400mm.

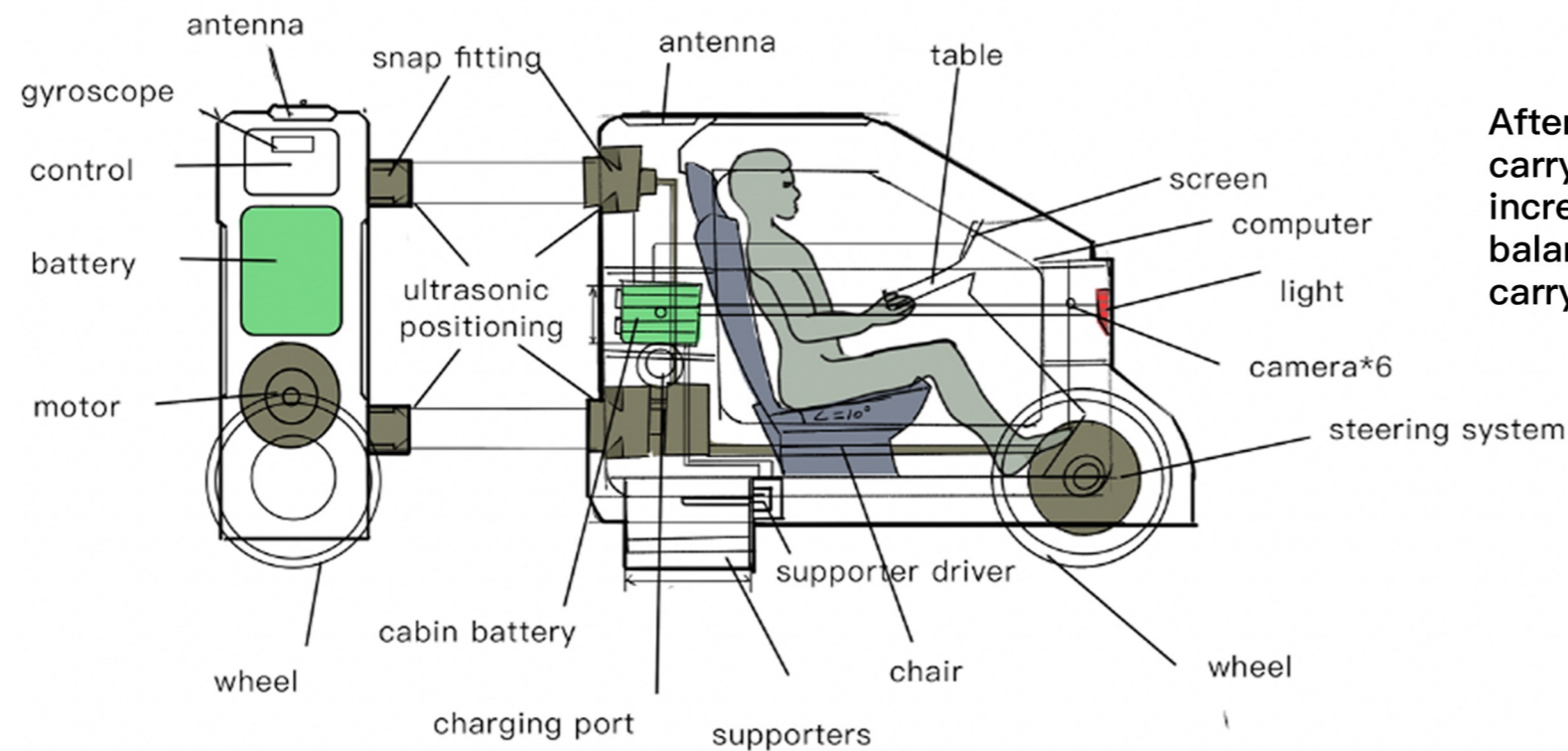
VEHICLE PACKAGING DRAWING

Vehicle Packaging Drawing



Refer to the size of the two seats vehicle to determine the thickness of the vehicle shell and the size specification of the tire. Finally, important dimensions are shown in the figure

Layout of component



After calculation, it is found that it is difficult for a power unit to carry two cabins for a long time. Increasing the battery will increase the overall mass and volume, reduce the flexibility and balance ability. Therefore, the function of one power unit carrying two cabins is canceled.

PROTOTYPE & TEST

1:1 Frame



Straight sit



Half-lying sit

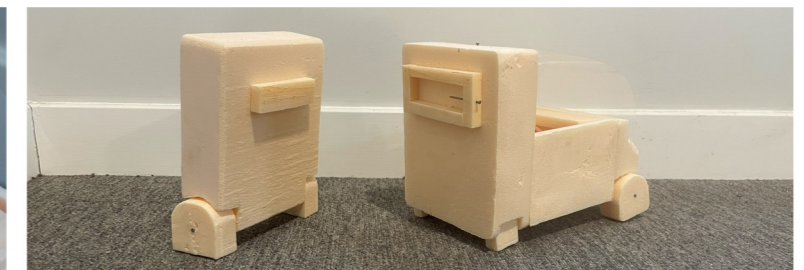
No matter what sitting posture, users can stretch out



I used foam board to make the interior space of the car in a scale of 1:1, and invited two adults to try and experience sitting inside

Feedback: they said that there was enough space inside, the body could lean back and lie half, and the legs could be fully extended. There is no uncomfortable feeling.

1:10 Prototype

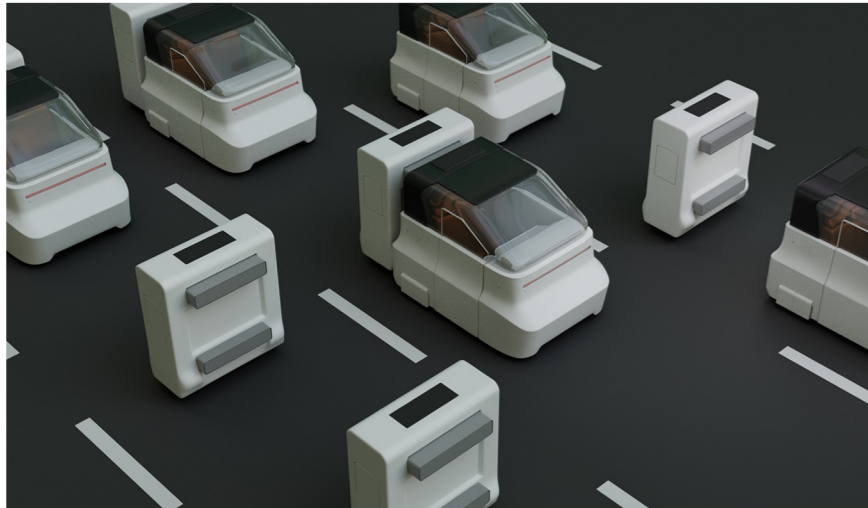


I made a 1:10 model to show the positions and proportions of seats, tables, passengers, connecting devices, batteries and power units.

The battery and engine system can be put into the vehicle and power unit according to the design size. But sometimes the user can't touch the position of the table, so I propose that the **table and chair can be designed to be adjustable.**

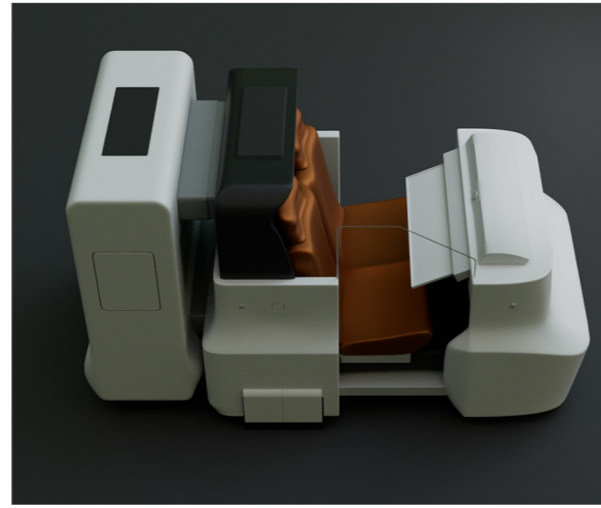
PRODUCT & USER JOURNEY

Scenario



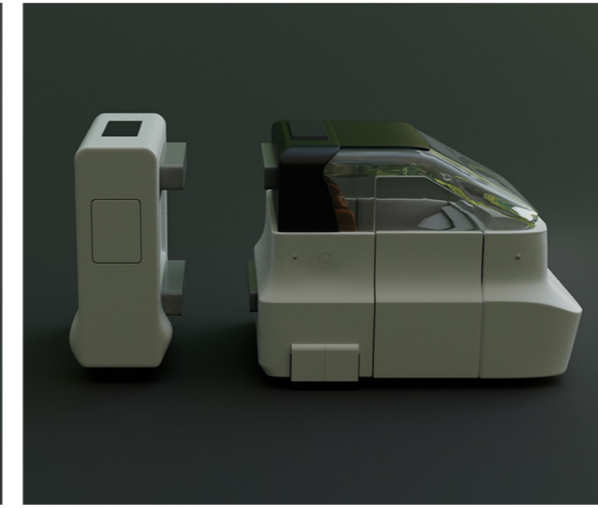
The power unit and the whole vehicle are self driving

Interior



There are adjustable seats in the car, so you can work and study inside

Connection



Ultrasonic precise positioning during connecting, more mature technology and less interference

- Money-saving
- Available at any time
- More privacy
- Sustainable

User journey



1 Private cabin stop in the parking lot



2 The user presses the button to call the power unit



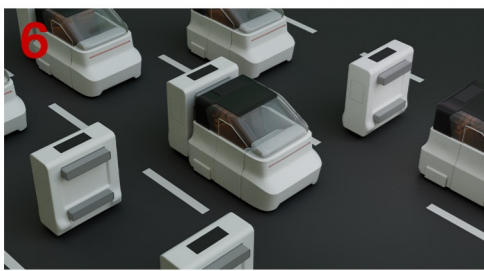
3 The power unit receives the call information and hurries to the user's location



4 Power unit arrives at the user's location



5 The position is adjusted by ultrasonic positioning and connected together.



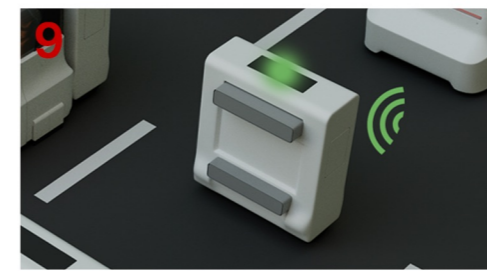
6 The car runs on the road and goes to its destination



7 The car arrived at its destination, and stop at a suitable place.



8 The power unit is separated from the cabin



9 The power unit continues to accept other tasks



10 When power reduced to 20%, the power unit will automatically go to the charging station

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REFLECTION

This is a vehicle design project, involving a wide range. In the design process, the focus of design has changed with deeper investigation. In this process, I found I should focus more on the specific needs of users—privacy. In addition, I realized the importance of finding design evidence. It is easy to make wrong decisions according to one's own experience and subjective judgment, therefore, these can not be used as design evidence. Only by truly understanding the user's status and objective facts we can design products that meet the needs.