Easy Chair Final Report

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Contents

Poster


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EASY CHAIR
Made of bamboo:
Environmentally friendly, low cost,When discarded, bamboo will completely biodegrade in under a year.
Comfortable Memory Sponge Cushion:
Provides back support more in line with the human body curve
Only 27Kg:
The product is light and easy to install and move around the house
Structural safety:
stable center design, after many seat motion Angle test, strong bearing capacity
Power system
Big gear
Small gear
Moter

Initial concept

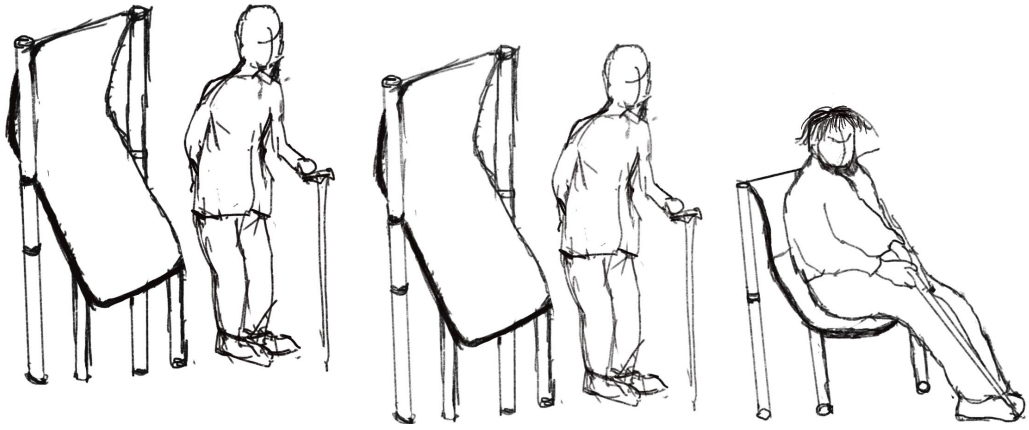
Why:This is a chair that helps the elderly to stand and sit, providing physical support for people with mobility problems

How:The user is aided by a specific structure and support that allows the seat to rotate around an origin

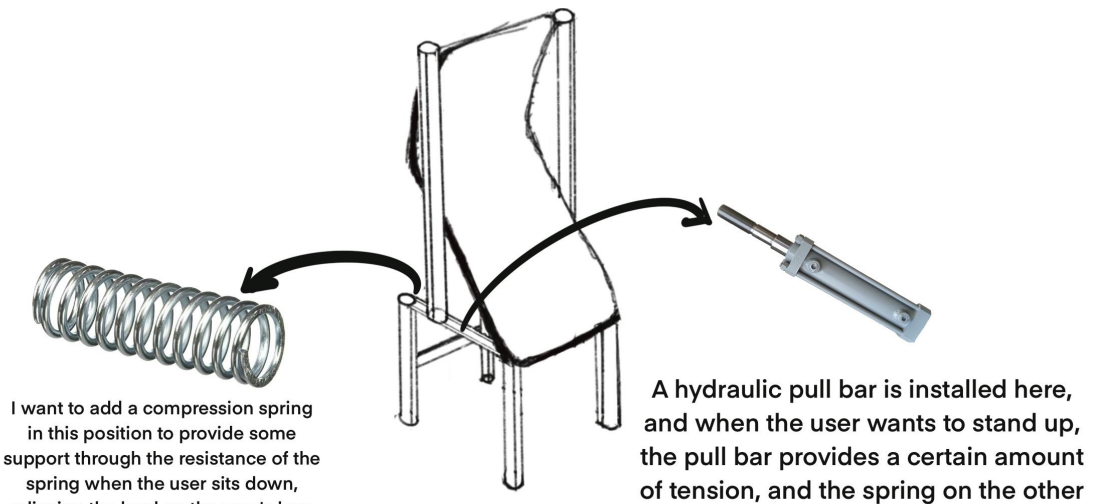
Who:Who weakness of the legs,stiffness in the back,poor balance,fear of falling

Where:In the home

When:All the time when the user needs a break



The motion of the chair

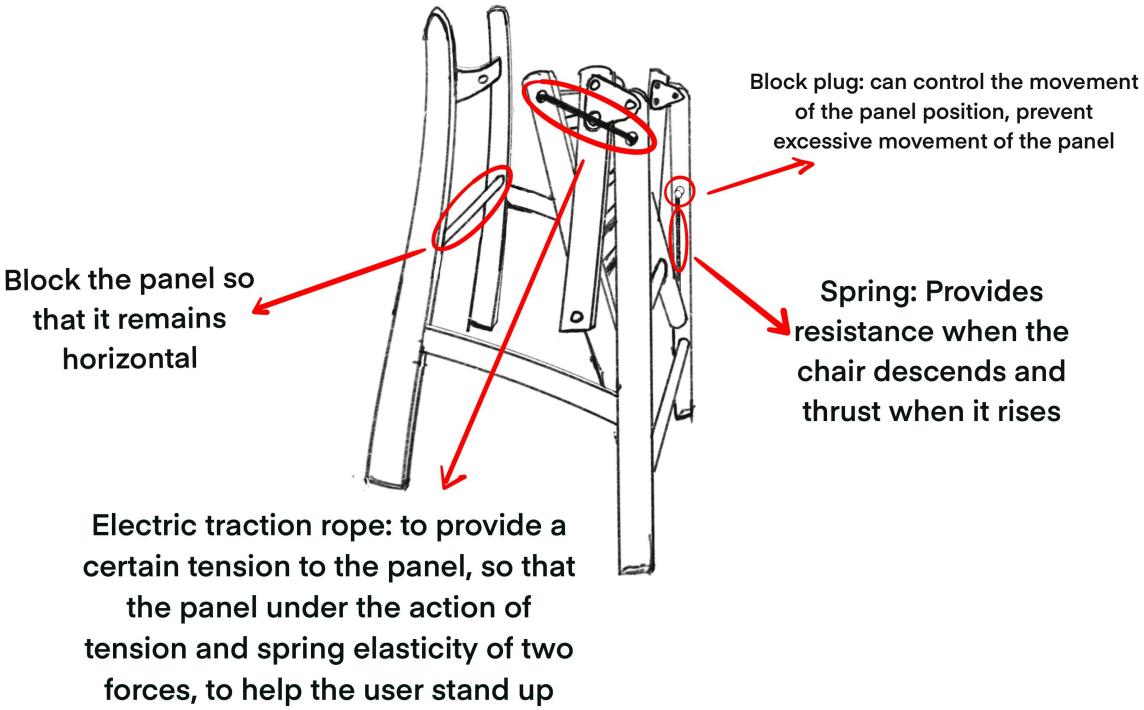


The second concept iteration

By observing the reverse motion of the chair, the structure of the product is further adjusted

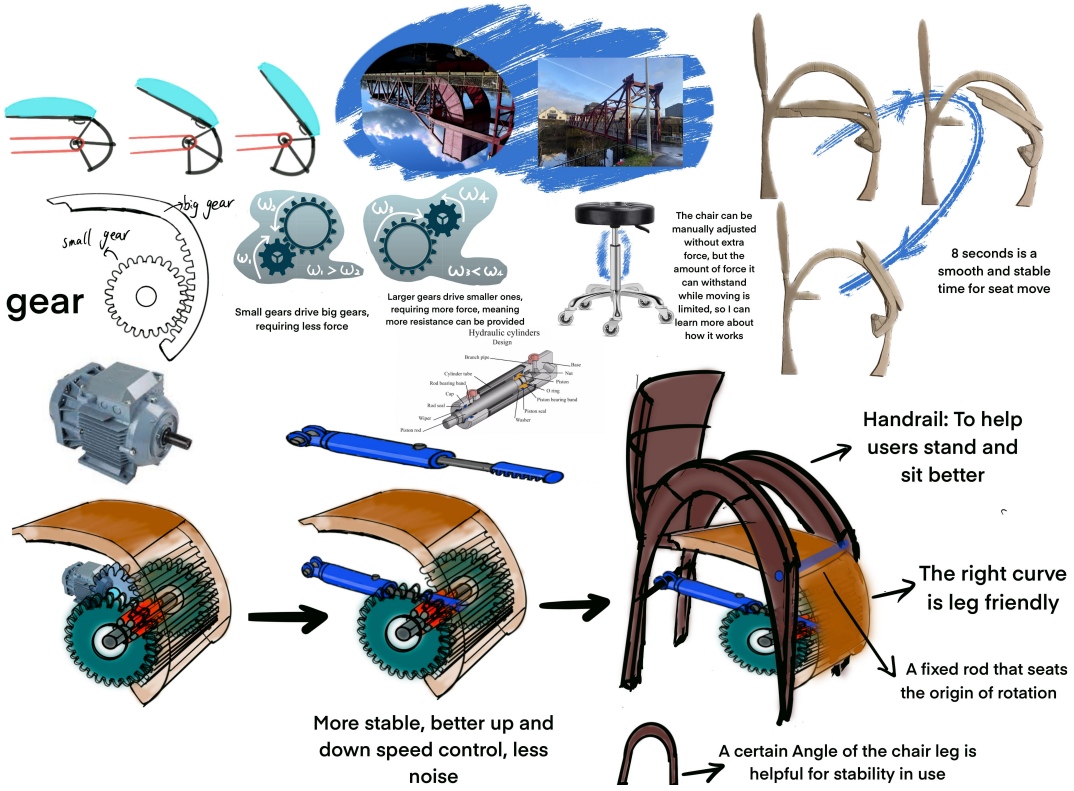
By repeatedly moving the panel to simulate the movement trajectory of the product, observe the resistance during movement, and observe which part of the product can provide resistance and tension to operate the product more effectively. I made some adjustments to the structure of the product

Product details



Third product iteration

By observing the structure of the bridge, the rotation of the deck is simulated and the special principle of the gear is substituted

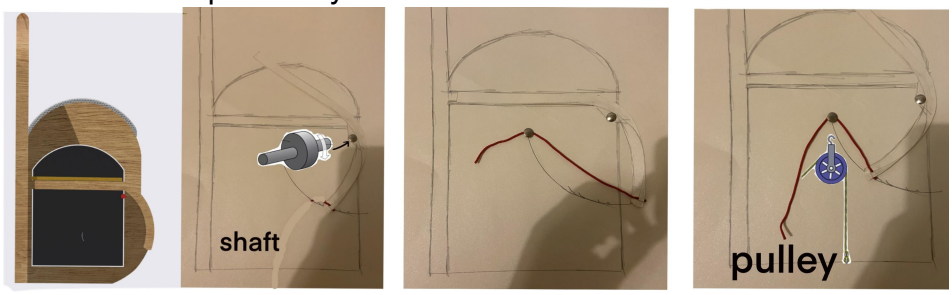


Brainstorming process

Ancient arched bridge is a better mechanical mechanism, but also a special aesthetic structure

Some sources of inspiration

Two different power systems



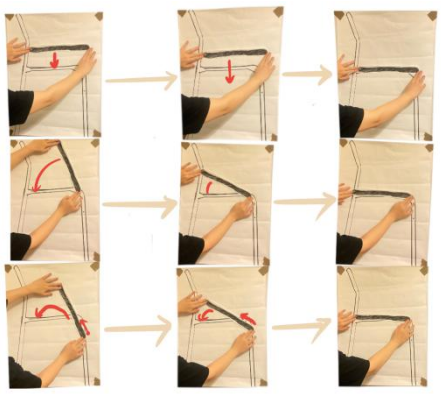
Gears system

Pulley system

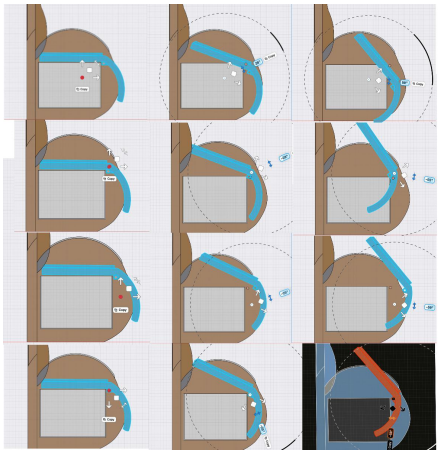
Test

The safety angle test of the chair

I tried to use the back side of the chair as a supporting panel for the user, and leaned against the wall to test which Angle would make the user feel more secure and maintain a better balance. The final result was 20 degrees



2D model is established to simulate the movement of seat in different ways

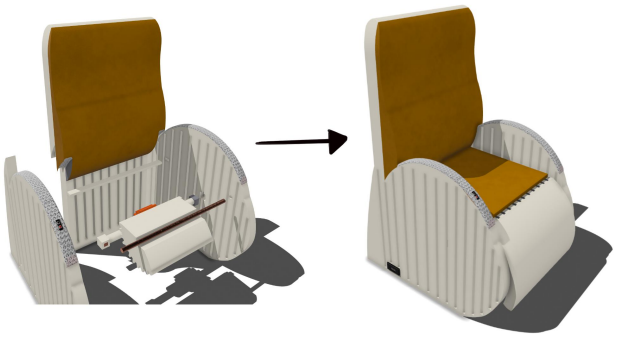


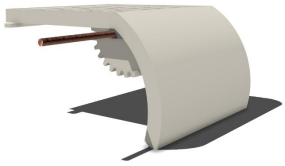
Use the software test the different rotation centers of the seat， the last one is suit.

Seat movement test :https://youtu.be/sDyuHSEbbDY
Gears system test:https://youtu.be/qeJdvYKzIz0
Pulley system test:https://youtu.be/h7-ndKBmOKs

3D model and Assembly

Very simple installation, can provide on-site installation service





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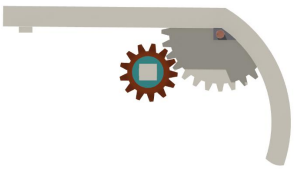

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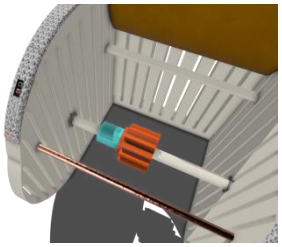

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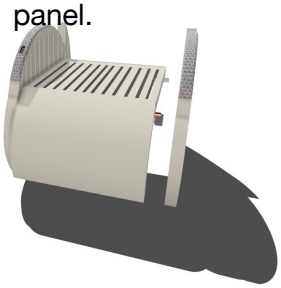
1:Insert the metal rod into the hole of the seat.

2:Place the gears system in the desired position.

3:Butt the board on the left side of the chair with the seat.

4:Insert the blocker, gears system, and metal rods into the reserved holes on the left panel.



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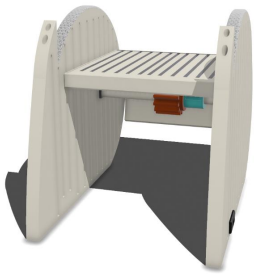

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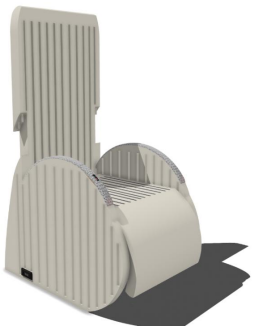

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5:Assemble the right board by aligning it with the seat.

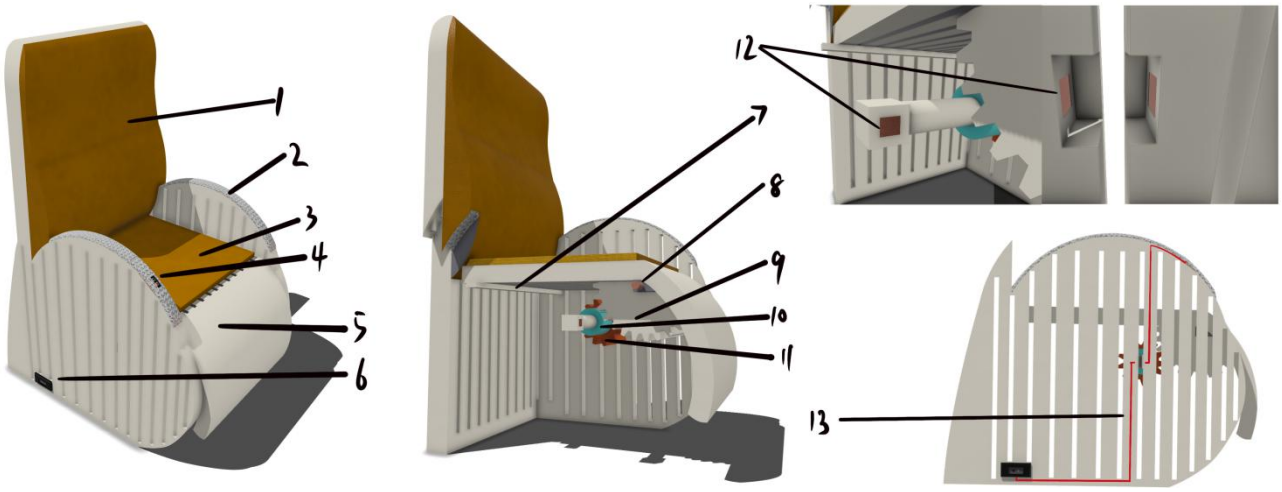
6:The two sides have been assembled.

7:Insert the back of the chair from the top down into the main part, securing it through the hollow connection.

8

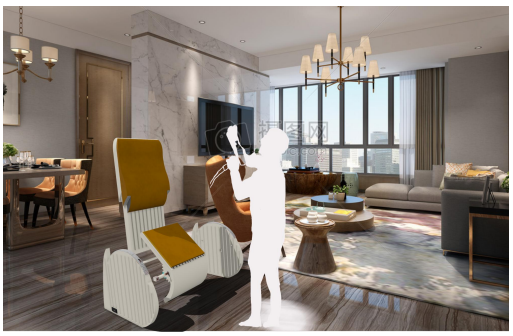
8:Arrange memory sponge cushions and cushions on the chair.

Final product and User journey



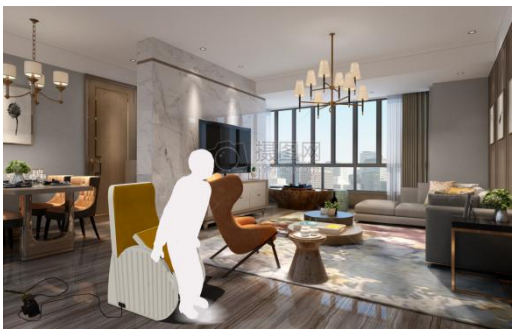
1: Memory sponge cushion. 2: Knitted handrail. 3: Leather cushion. 4: Control switch, control seat rise and fall. 5: Provide support for the legs after sitting down, and retract when the seat rises, which will not affect the standing of the user. 6: Power connection. 7: baffle to prevent seat from falling too much. 8: rotation axis, seat rotates with this as the origin. 9: Big gear, fixed under the seat, drive the seat rotation. 10: Motor, to provide power to pinion. 11: The small gear drives the big gear to rotate. 12: Metal sensor, transmission signal. 13: Inlaid in the left board inside the circuit, one end leads to the switch, a section is connected to the power socket.

Buy from Ikea



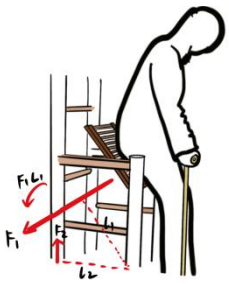
Assembly in home

Connect the power supply



Press the switch to control seat drop

Engineering Analysis



F2*L2=F1*L1

The bigger L2 is, the more force F1 can bear

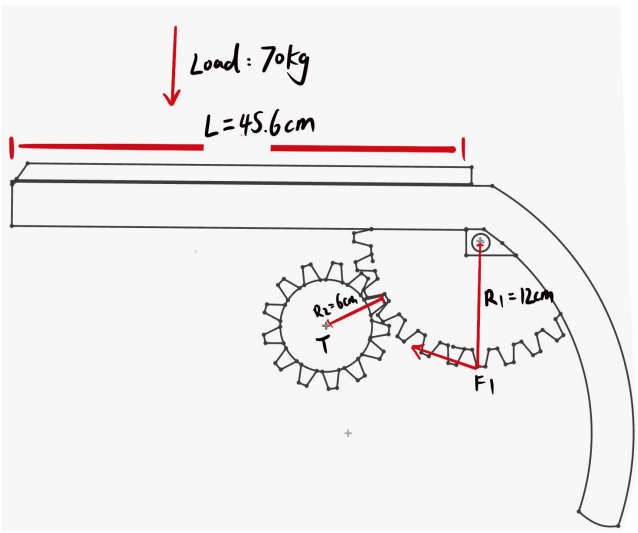
Improved leg Angle to prevent the chair from moving backwards or falling while in use

0N

4.4N

3N

Applying a weight to it, assuming human gravity, measured separately that with only one gear, the force required was 4.4N, reduced to 3N when a pinion was added.



Transmission ration: $i_{12} = \frac{n_1}{n_2} = \frac{z_1}{z_2} = \frac{10}{20} = 0.5$

$70kg \times 9.8 \approx 700N$

$F_1 \cdot R_1 = 700 \times L$

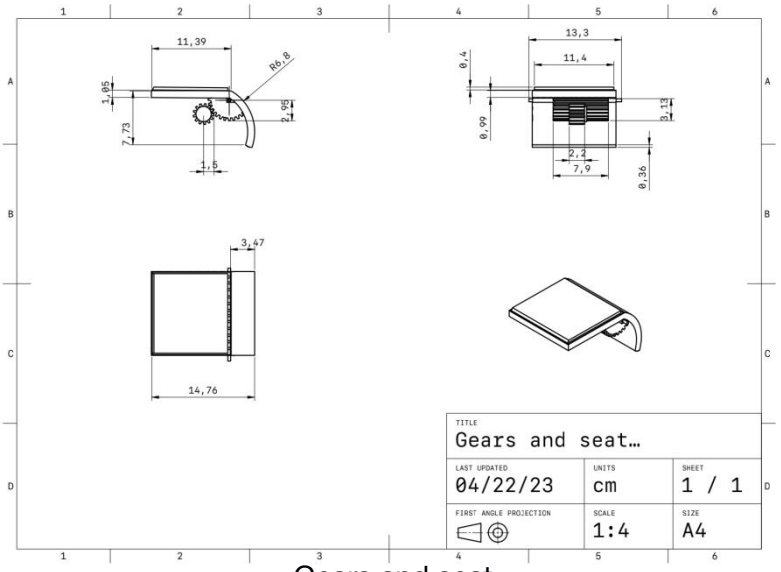
$\therefore F_1 = \frac{700N \cdot L}{R_1} = \frac{700N \cdot 0.456m}{0.12m} = 2660N$

$T = F_1 \cdot R_2 \approx 160N$

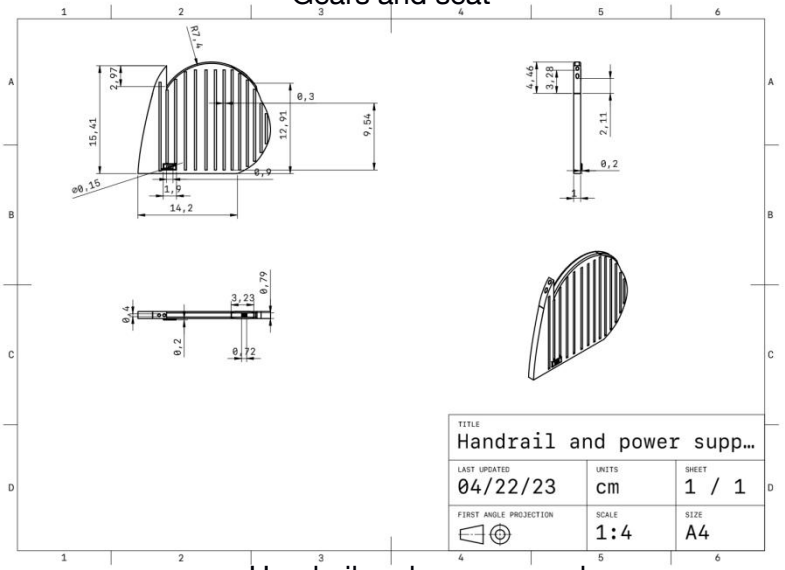
Assuming the user is 70kg, F1 is calculated to be 2660N at the big gear, which means that 2660 forces are acting on the outer end of the pinion, and the calculated torque of the pinion is 160N. That means a motor with 160N of torque is needed to make the chair work properly.

:Under the action of gear, the kinetic energy required by the system cannot be reduced, which is constant, but the torque can be reduced through different transmission ratios. Less torque means that the motor with lower power can be selected, reducing the cost and product weight.

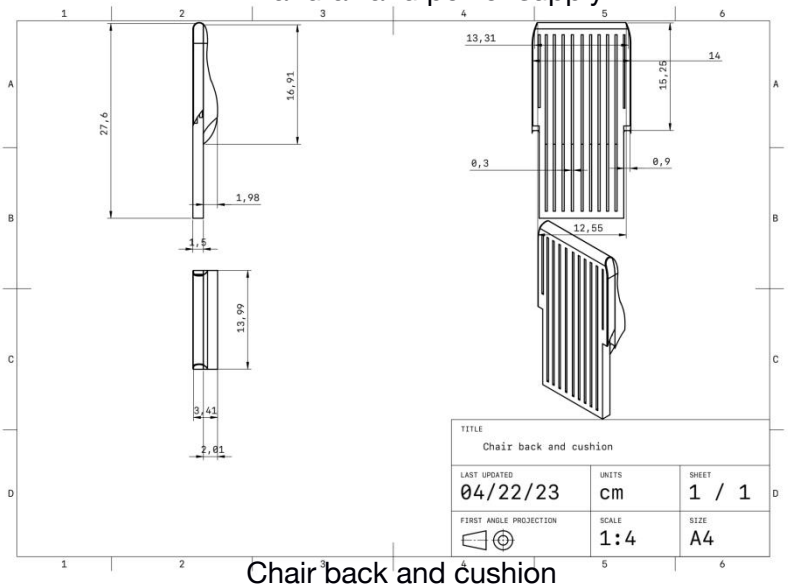
Engineering drawings



Gears and seat

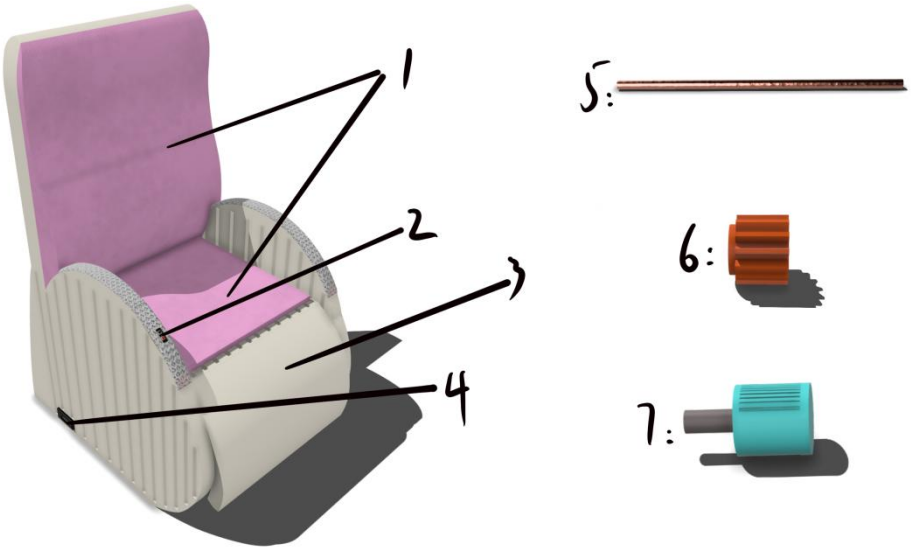


Handrail and power supply



Chair back and cushion

Related materials and cost calculation



	name	Material	Cost per unit	Cost per chair	Manufacture And cost	In total
1	cushion	Memory foam	1£/m^3	14+1.5=15.5£	Cutting 1£/unit	16.5£
2	switch	Polycarbonate Plastic	0.67/m^3£	0.5£	Injection molding 0.5£/unit	1£
3	Main body	bamboo	1.5£/kg	33Kg 50£	Cutting 3£/unit	53£
4	Power port	Polycarbonate Plastic	0.67/m^3£	0.8£	0.5£/unit	1.3£
5	Rotational bar	Steel	1.3£/kg	0.91kg/m^3 1.2£	Cutting 0.5£/unit	1.76£
6	Small gear	Steel	1.3£/kg	0.5kg/m^3 0.65£	Cutting 0.3£/unit	0.95£
7	Motor	200N motor	30£	30£		30£
8	In total					104.51£

Total weight of the chair:27Kg.

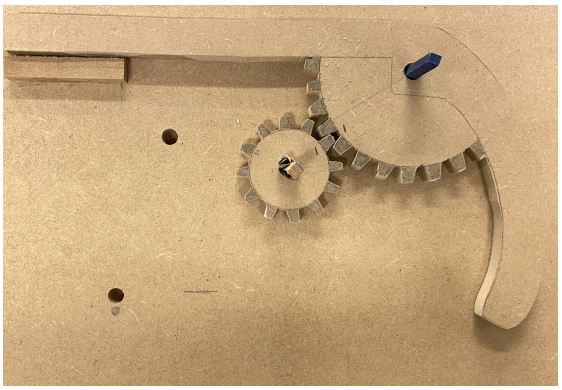
Bamboo:After a certain amount of hydrothermal carbonization treatment, it can effectively prevent moth and mildew. Moreover, the physical and mechanical properties of bamboo furniture after treatment are more excellent than that of wood furniture, and the bearing capacity is stronger. Therefore, if the bearing capacity of the two is comparable, the cost of bamboo furniture is much lower, and the weight of its furniture is lighter than that of wood furniture.

Physical prototypes

The seat down

The seat rise

In side view



gears system

Side view

Rear view