

# 04 CHILDREN'S LOWER LIMB REHABILITATION WALKER



## Key Words

Gamified Rehabilitation  
Interactive Projection  
Design For Kids

Walker is an essential product that most patients need to insist on for lower limb rehabilitation training. Existing lower limb rehabilitation walkers for children have problems such as single function, lack of interactivity, interest, sense of purpose, etc., which result in patients' low willingness to use and poor rehabilitation effects.

Re - Smart Walker adopts interactive projection technology, original multi-point support structure, and combines the needs of children, rehabilitation practitioners, family members to create a professional, intelligent and heart-warming "cool rehabilitation" for children. Re helps children to become heroes and restart their lives.



## Background

When I passed by the door of the rehabilitation room, I heard the **child crying** and found he was **unwilling to receive walk aid instrument**. However, there was **nothing** that the **family and nurses could do**.

Large demand of users

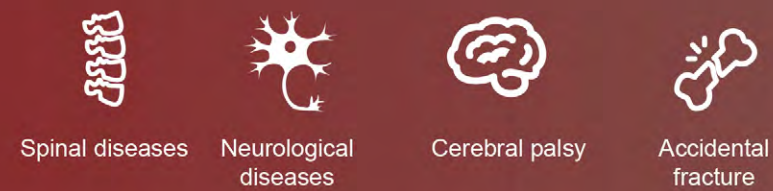
Physically disabled  
 > 24,000,000

2021 Physically disabled population

 > 5000000

2021 Physically disabled children

## Preliminary investigation



Low recovery rate of children

WHY?

**Poor**  
 Conservative treatment

Financial burden

**ICY**  
 Lack of security

Rehabilitation environment

**Boring**

Hard to insist

Rehabilitation equipment

**Desperate**

Escape training

Patient mentality

Lower limb rehabilitation process

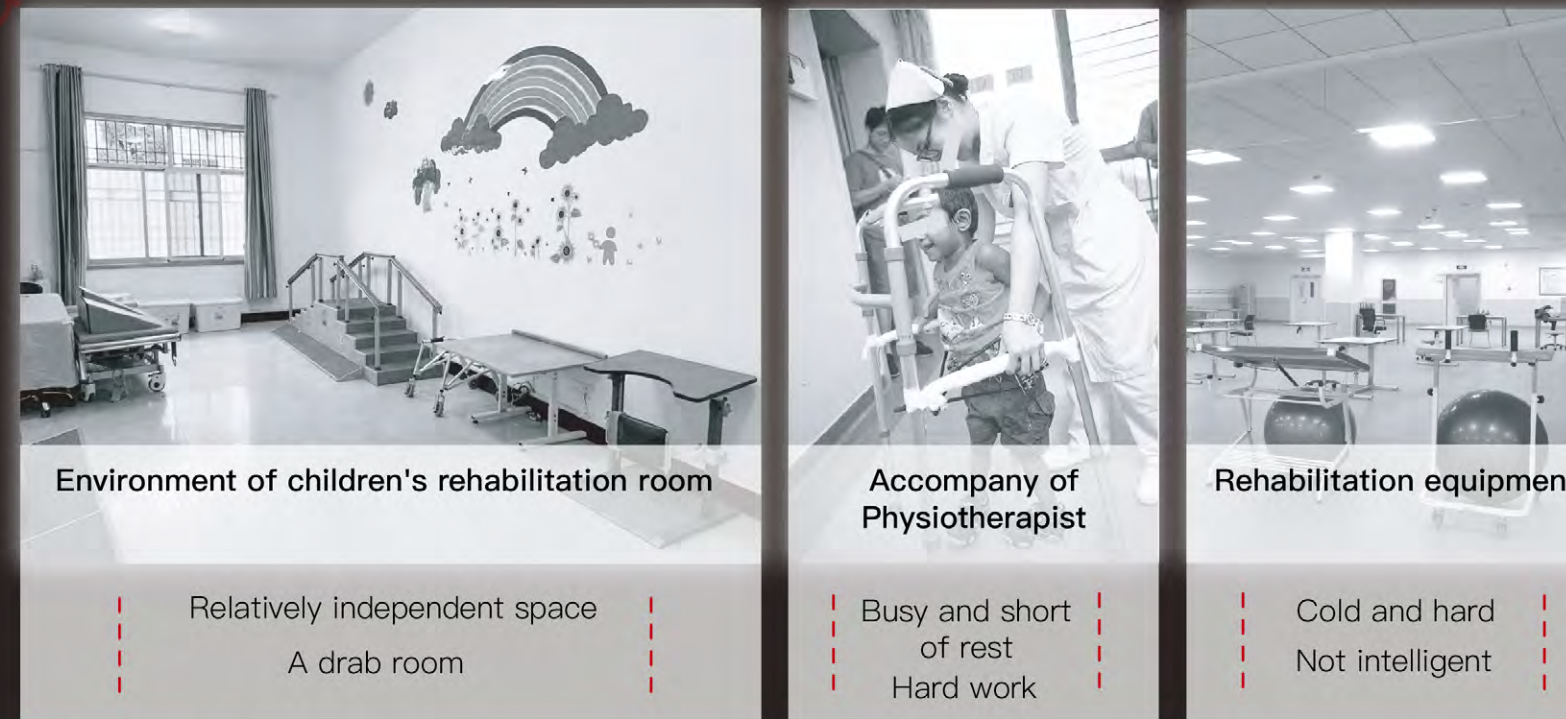
Leo Age 4  
 Cerebral palsy

Muscle strength level	0	1	2	3	4	5
Stage characteristics	Completely paralyzed	Slight muscle contraction	Move ✓ Lifted ✗	Lifted ✓ Resistance ✗	Weak muscle strength	Non-standard gait
Treatment methods	Electrical stimulation Acupuncture	Active exercise: translational movement	Resistance training	Increase resistance	Gait, leg control training	
Healing period (Month)				1	6	
Mood						

Difficult Recovery Process

## Field research

Shenzhen tongyixingkong children's rehabilitation center



Environment of children's rehabilitation room

Accompany of Physiotherapist

Rehabilitation equipment

Relatively independent space  
 A drab room

Busy and short of rest  
 Hard work

Cold and hard  
 Not intelligent

Conclusion:

The industry is sluggish, and the rehabilitation environment and equipment need to be improved

## Interview

Rehabilitation center of The University of Hong Kong Shenzhen Hospital

Patient A's mother



Only by **rewarding** children to play with mobile phones can they continue rehabilitation training. **I will play too when I am bored.**

Patient B's mother



Using **video and music** can divert their attention and make their rehabilitation training **less painful.**

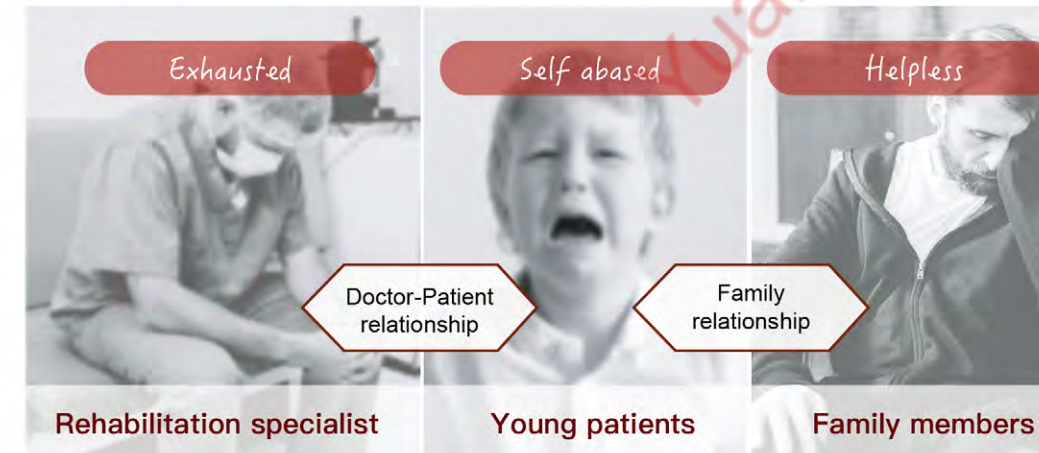
Observed phenomenon

Many patients and parents in the rehabilitation room were playing with mobile phones

Thoughts:  
 Can games be implanted in the rehabilitation industry?



## Stakeholder



Rehabilitation specialist

Young patients

Family members

## Persona

Name: Sara Age: 5 year-old  
 Role: Patients with mild cerebral palsy

Cognitive level:   
 Athletic ability: 

Pain points Requirement

- Painful recovery process → Better experience
- Self-abased → Self-confident
- Lonely → Make friends

"I just want to be normal and also help others"

Name: Nova Age: 35 year-old Role: Sara's mom  
 Situation:

- Quit job to take care of Sara
- Save money on food and expenses

Pain points Requirement

- Expensive rehabilitation costs → More cost-effective
- Tired accompanying process → Improve kid's willingness of self-rehabilitation
- Doctor-patient conflict → Keep good communication with doctors

"I won't overprotect her. I hope she can live independently and become a normal person"

Name: Lisa Age: 47 year-old Role: Rehabilitation specialist

Pain points Requirement

- Heavy workload → More intelligent system
- Poor work environment → More dynamic environment
- Too many patients → Try to supervise home rehabilitation remotely

"We are doing dirty and hard work, but wages are low. Resulting in a shortage of manpower"

# Why design walker?

## Walker is so useful

- Long time with patients: 1-5 months
- Large demand of users: Most are in level 4
- Helps strength from level 4 to level 5
- The final stage of rehabilitation for all patients

Traditional walking aids for children  
Only  
Adjustable height  
More color choices



# What elements users would like?

FEEL GOOD		FEEL BAD		Feature
	Games Praise Love	Superman Sense of accomplishment Help others	Unfair Cold Painful Boring Noisy Be ridiculed	No patience Sensitive Curiously
	Family harmony Save money Kid's progress	Long recovery process Indifference of medical staff Bad mood of kid		Product requirement Safe Easy to carry Easy storage
	Be trusted Professional rehabilitation advice Perfect medical system	Psychological pressure Depressing atmosphere (Affected by sad experiences of patients and their families)		

# Competitive product analysis

## 1. New design of walking aids

<p>Walking aids for children</p> <ul style="list-style-type: none"> <li>• Flexible modeling</li> <li>• Fold-able Portable</li> </ul>	<p>Fashion walking aids</p> <ul style="list-style-type: none"> <li>• Unique shape</li> <li>• Warm texture</li> <li>• Height adjustable</li> </ul>
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## 2. Situational rehabilitation design

Lower limb rehabilitation training instrument

- Play on screen or with VR
- Children don't want to wear VR glasses
- Direction and speed of foot control
- Not portable

## 3. Children's Hospital

<p>Cabirni children's hospital - Lumes</p>	<p>Great Ormont Street Hospital for children</p>
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- When the child touches the wall, animation appears on the wall, which effectively distracts the child's attention and makes the whole hospital full of vitality

# Function definition

## 01 Interactive projection games

Recovery process → Play an upgrade game

Professional and interesting training program	Facing difficulties and challenges
Be encouraged and rewarded	Brave spirit of adventure

## 02 Children's favorite styling

Boring rehabilitation equipment → Cool equipment that makes me stronger

Build confidence	<p>Textured frosted metal As powerful as Gundam Strawberry red with sweet feeling Blueberry blue with good feeling</p>
Easy to socialize	
Assisted living	

## 03 Interactive projection games

Cold and hard rehabilitation equipment → Warm and reliable friend

Support multi-point stress to avoid overwork injury

# User journey map

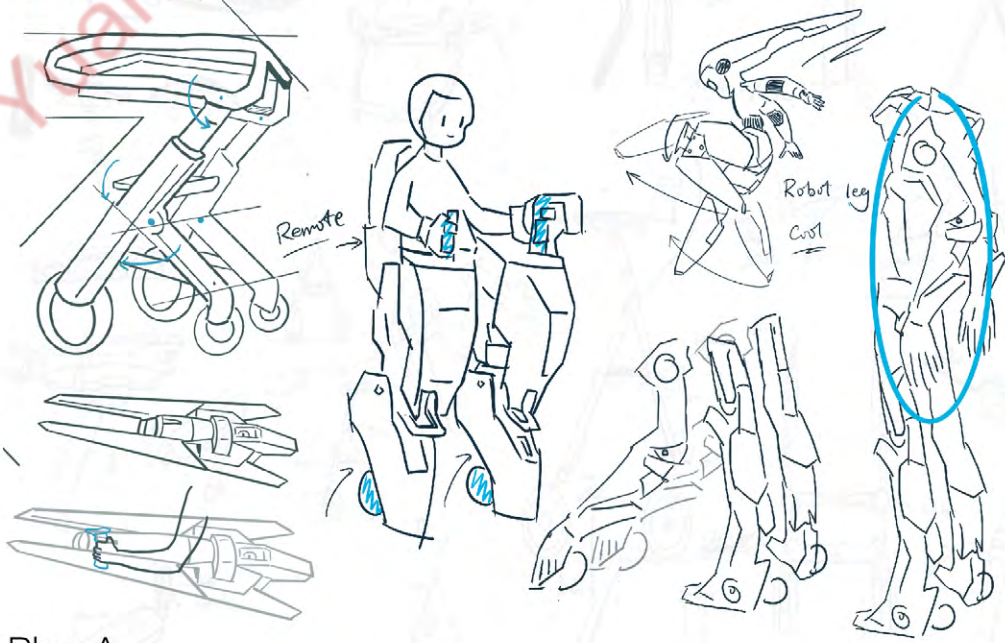
	Before	Using	After
<b>Young patient</b>		<ol style="list-style-type: none"> <li>1. Device startup: Say hello to the child</li> <li>2. Voice introduction where the child is, to today's game tasks and game-play</li> <li>3. The projection hits the ground where the child is, and the sensor is activated</li> <li>4. Children play games by controlling the movement of their legs</li> <li>5. Finish the game, trigger cool dynamic sound effects, and change the color of the lights on the device</li> </ol>	<ol style="list-style-type: none"> <li>3. Recommend new games suitable for children's individual abilities for doctors to choose</li> </ol>
<b>Rehabilitation specialist</b>	According to the platform data, select the appropriate training plan for the user	When the child's data is abnormal, the device will send a reminder that the child needs help to the rehabilitation specialist	1. The child's training data will be presented to the rehabilitation trainer and parents in a visual way
<b>Parents</b>	See the child's training reminder and detailed training plan on the app	Help children turn on the device (remote control possible)	2. Doctors and patients communicate in time on this platform
<b>Emotion</b>		Child use the new Walker training, interactive projection game is fun, others all think it's cool	Learn that the child has improved rehabilitation results and give encouragement and rewards to the child

Key Words : Gamification  
Interactive projection

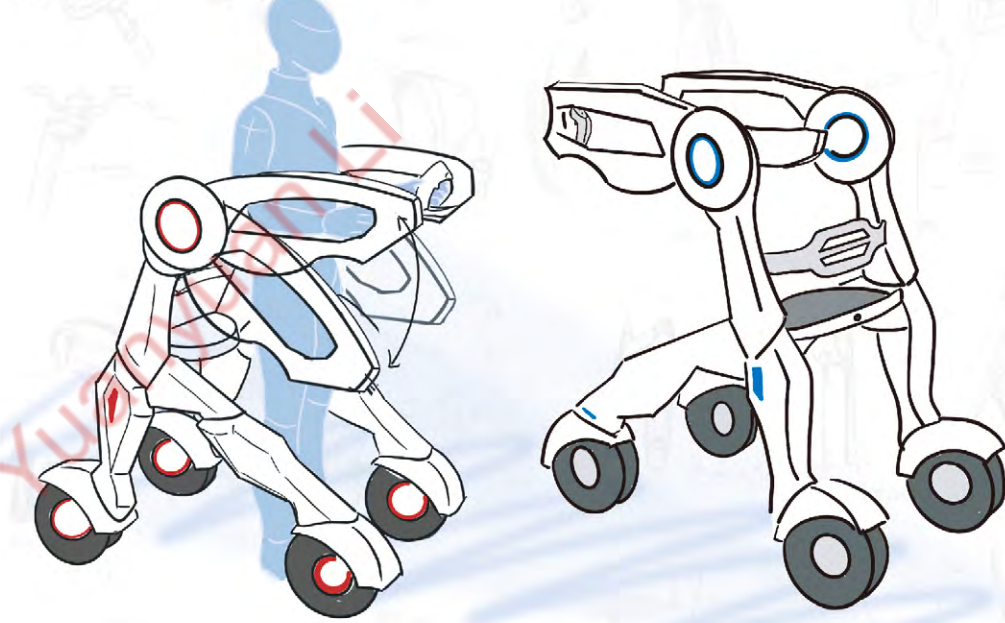
- Become hero
- Achievement visualization
- Sense of purpose
- Cost effective
- Improve the initiative of autonomous rehabilitation
- Intelligent action error correction
- Smart account binding
- Automatic matching of rehabilitation suggestions

## Sketches

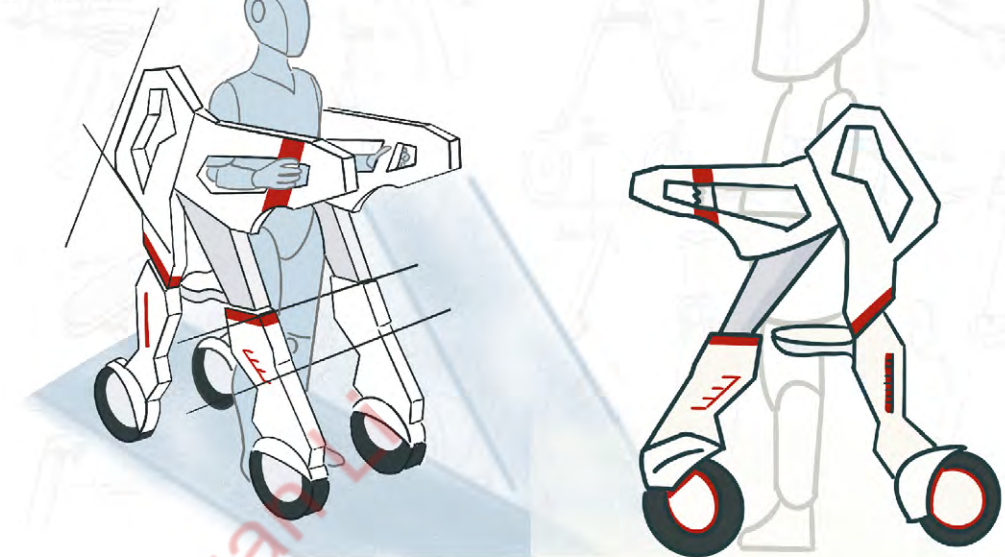
Inspiration hand painting



Plan A

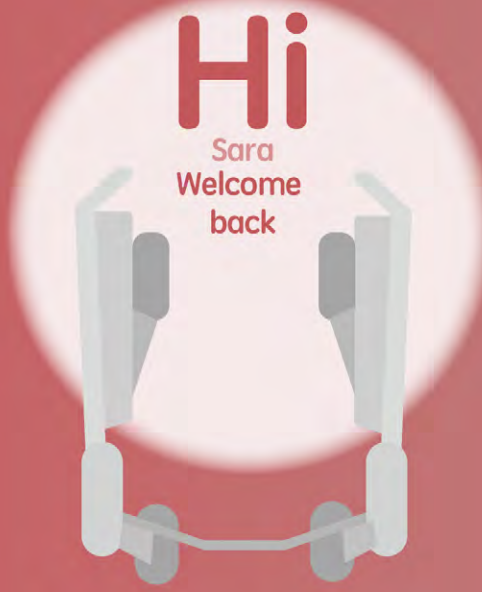


Plan B

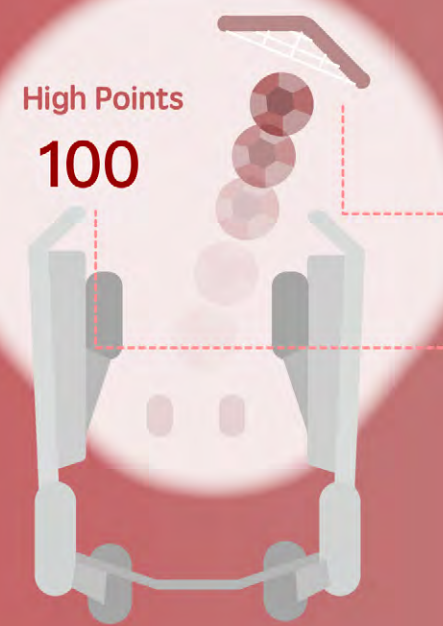


## Games design

Traditional rehabilitation process:  
In-situ leg exercises



High Points  
100

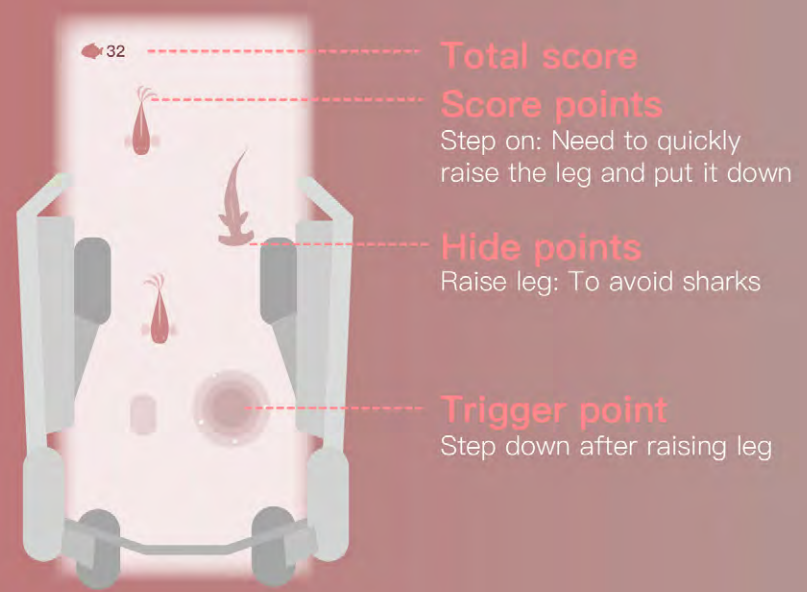


## Principle of ground interactive projection



Current application scenarios:  
exhibition halls,  
commercial spaces

## Fish game

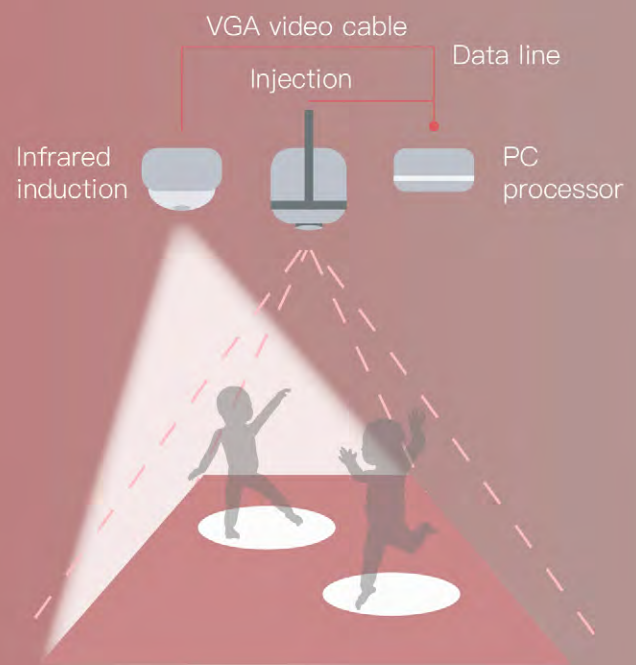


Traditional rehabilitation process:  
Control the direction of the legs

## Football game

Football gate  
Random occurrent:  
It will random appear anywhere

Total score



## Branding



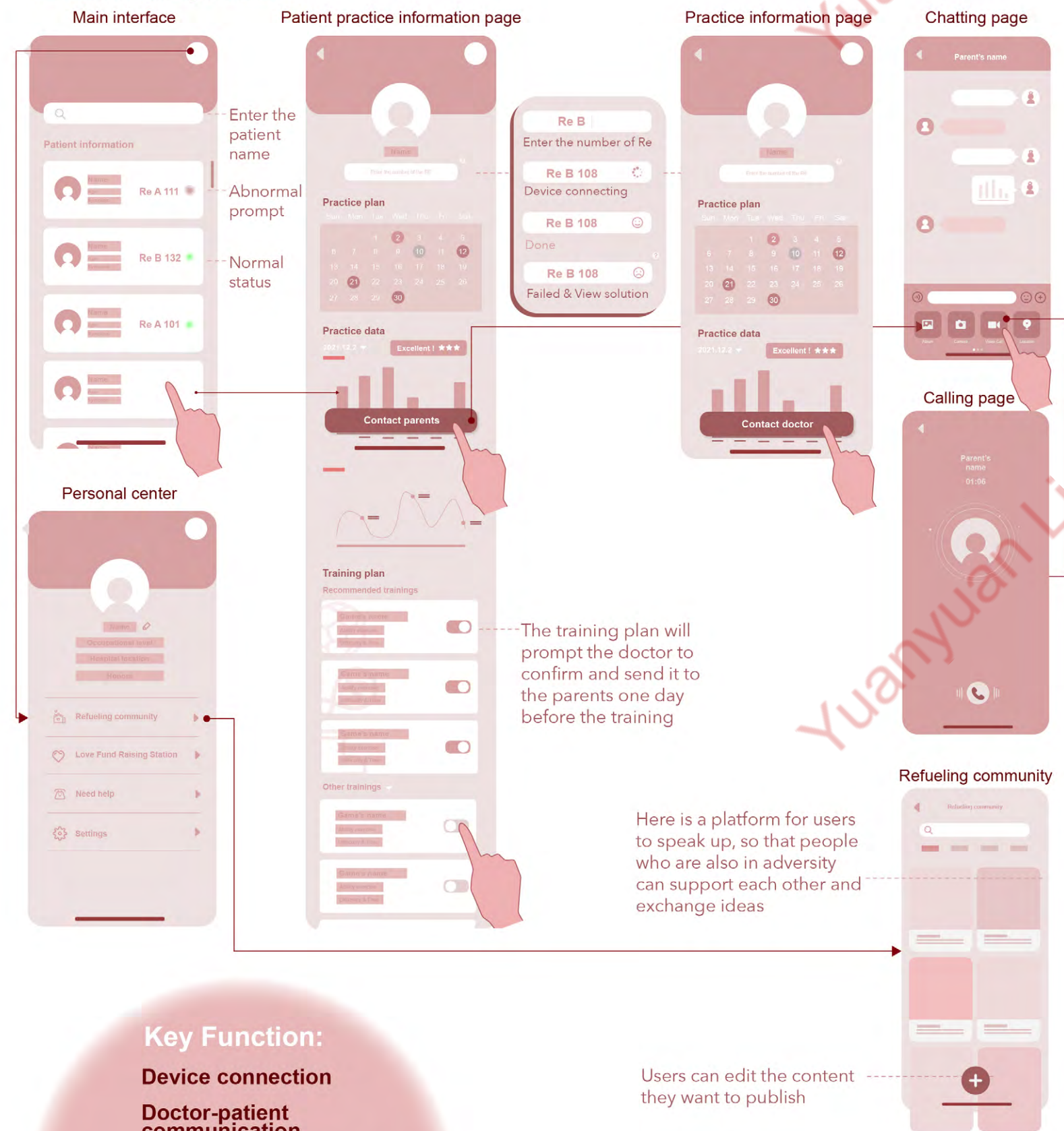
Rebirth and hope

Re stand Re cover Re start



## App design

Rehabilitation specialist



### Key Function:

- Device connection
- Doctor-patient communication
- Visualize training results
- Training recommendation
- Experience Sharing
- Fundraising

Here is a platform for users to speak up, so that people who are also in adversity can support each other and exchange ideas

Users can edit the content they want to publish

# Product structure



Movable hand support device with multiple stress points

Remote control intelligent handle

Braking: Pull back with both hands  
Rotation: Pull the lower switch with both hands  
Lifting: buckle in both hands  
Power on/off: long press of the round button

Built in mini projector

Folding leather seats

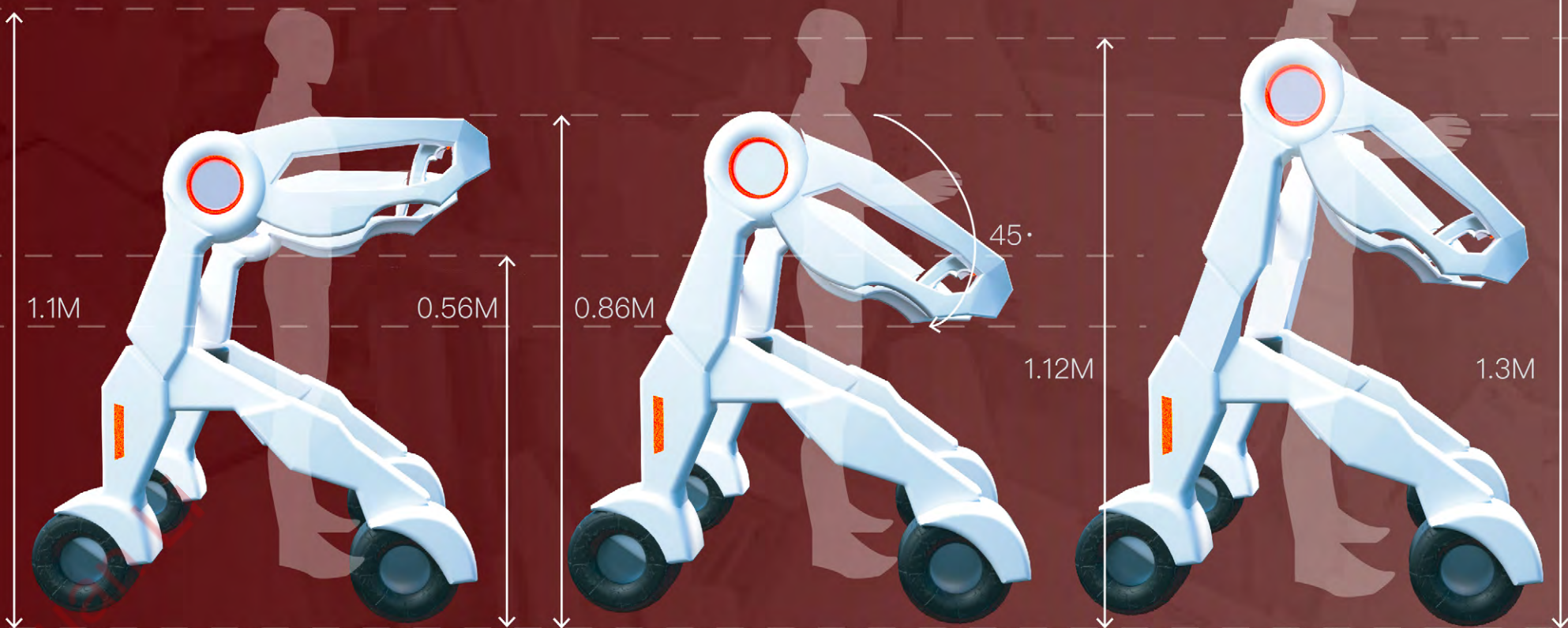
Infrared sensor

Fender

Anti skid belt brake universal wheel

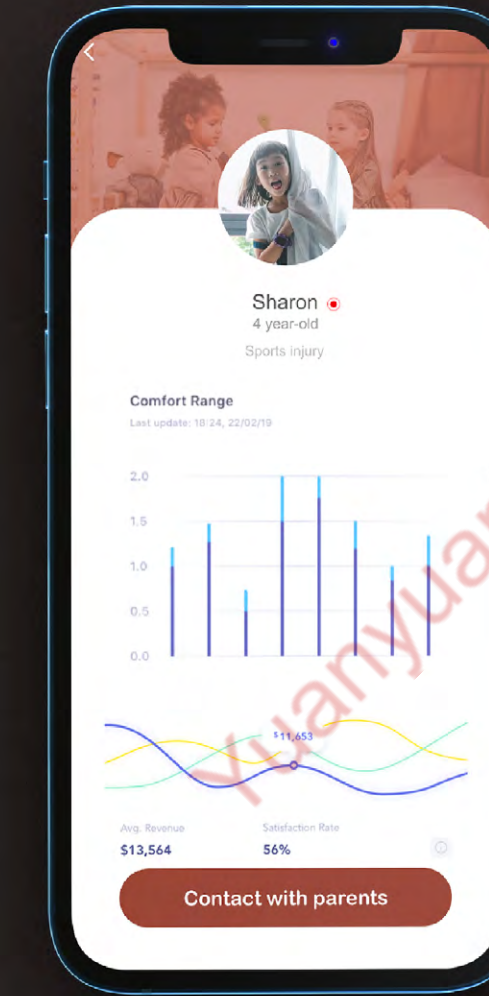
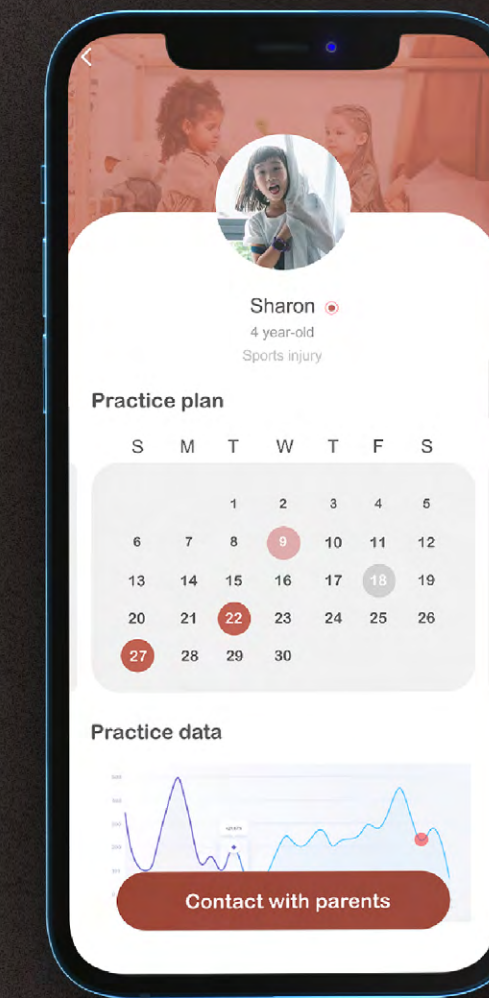
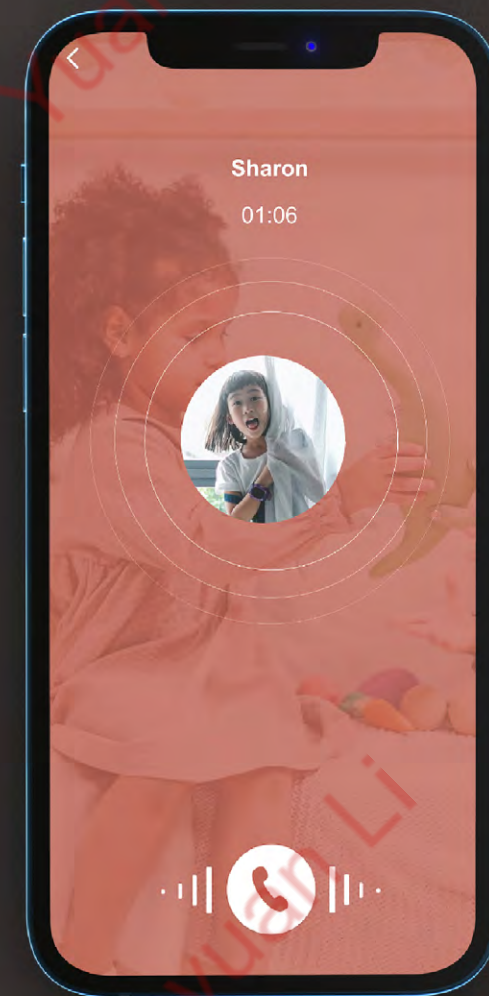
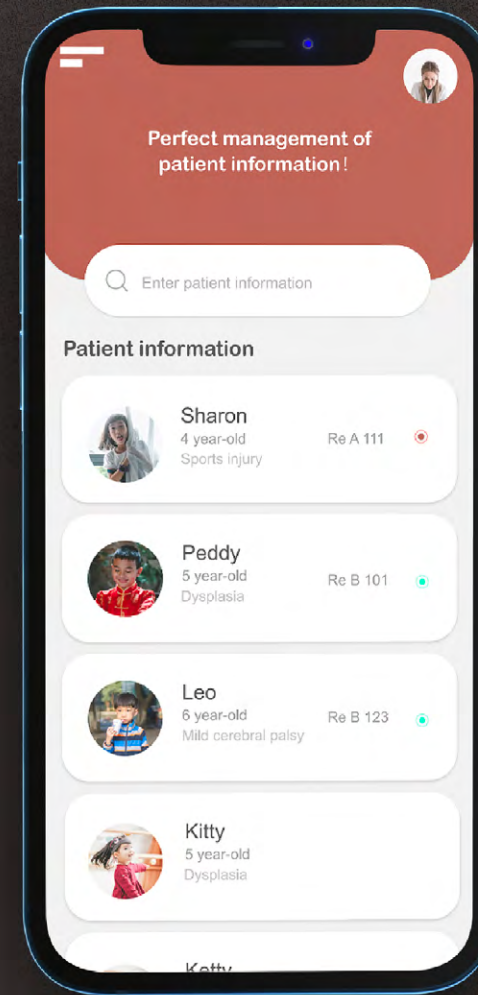
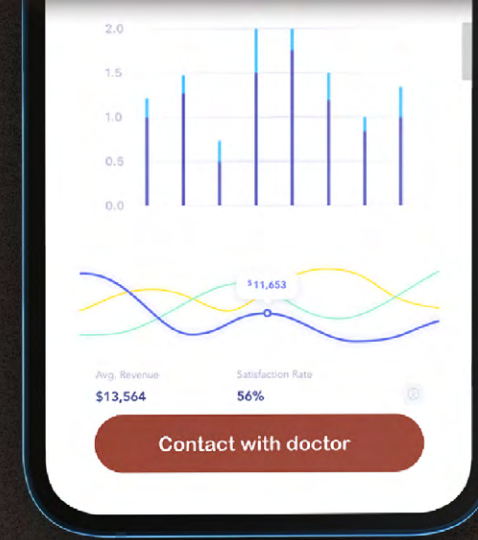
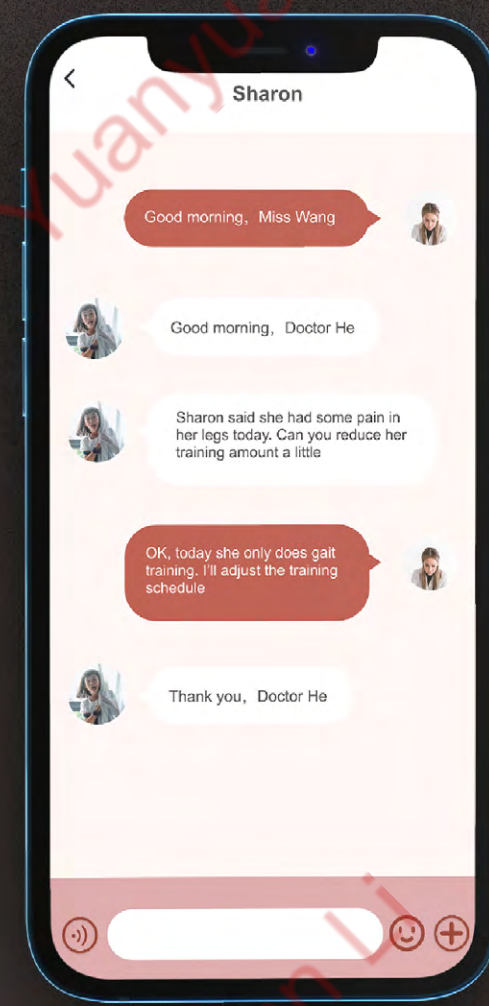
# Model

3D printing  
Painting and coloring  
Function simulation



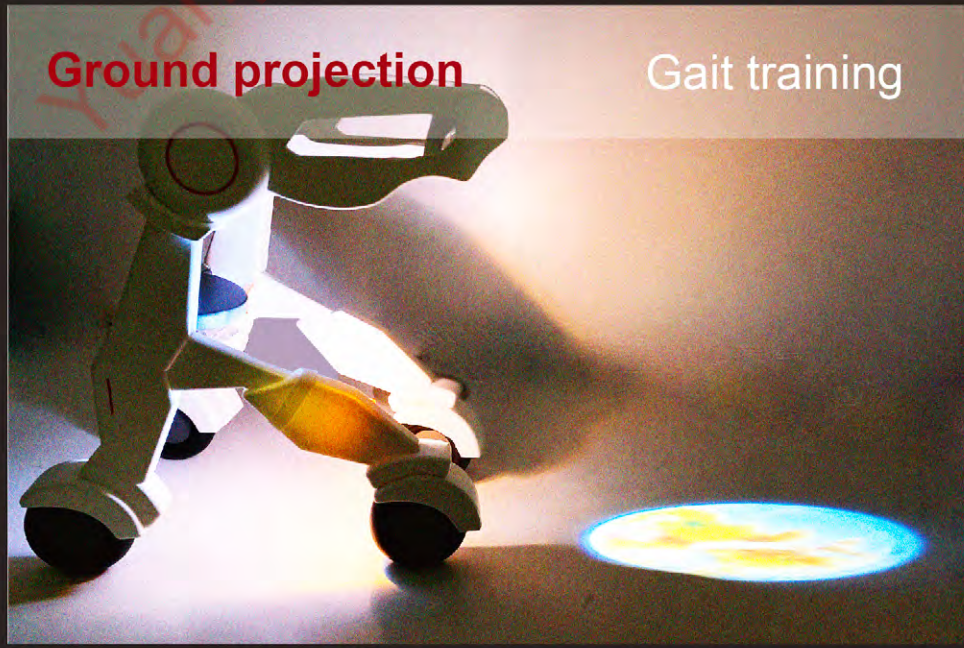
3 year-old

8 year-old

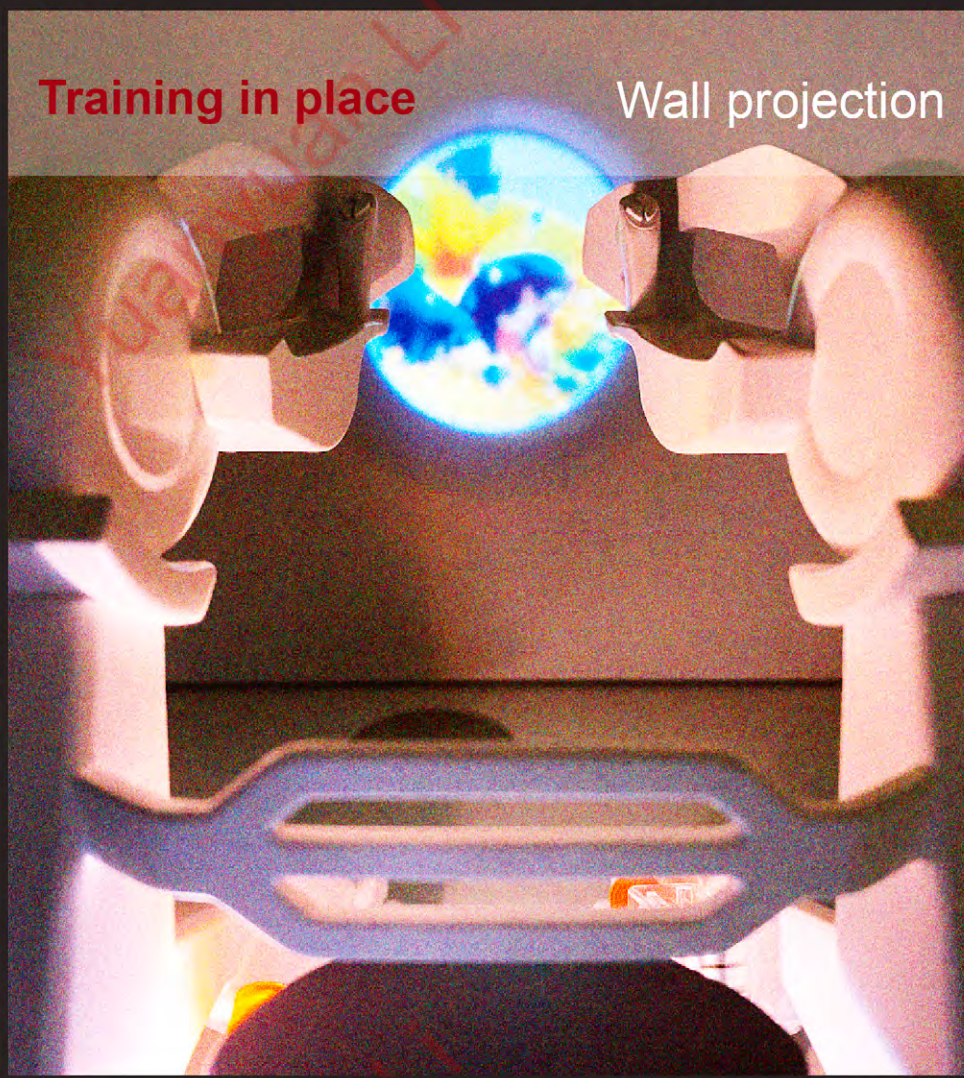


Make patients enjoy happy recovery anytime and anywhere

# Usability test: projection



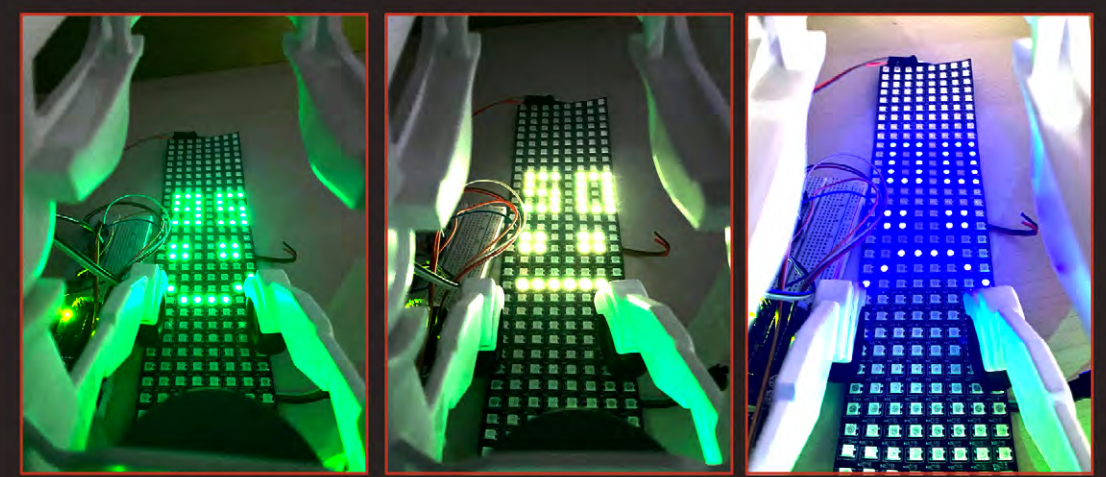
As the user moves forward, the projected content scrolls back and feeds back the user's actions in real time



According to the rehabilitation game content and instructions projected on the wall, users make corresponding actions

# Arduino demo (Fish game)

1 Game rules  
The user needs to lift the leg when the shark swims near the leg



Points: 60-100      30-60      0-30

2 Coding

```

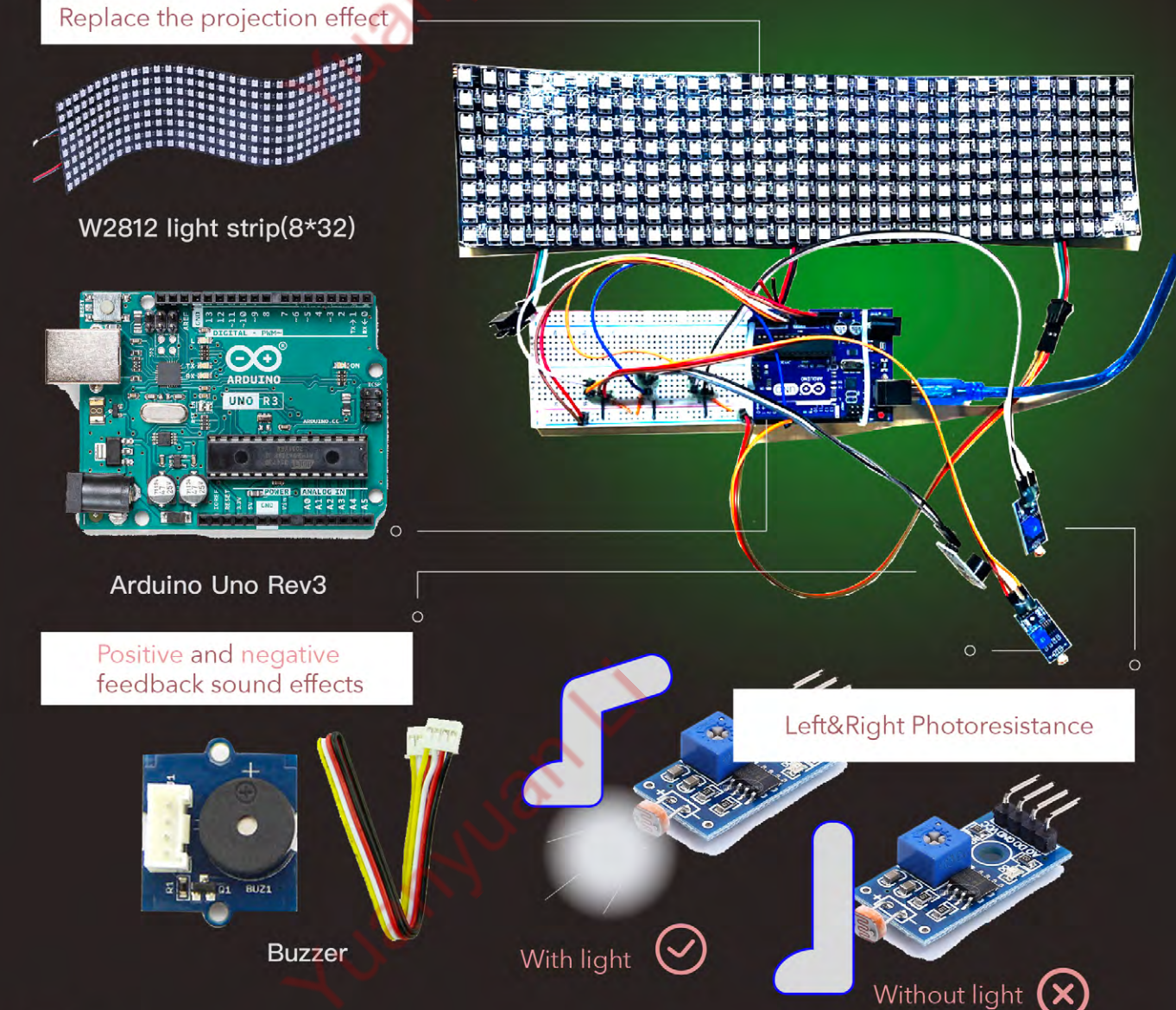
Control the motion of the shark
Control the light sensor
Score and emoji display
Control the result feedback

// SharkGame_V2.0
// ...
void setup() {
  Serial.begin(9600);
  pinMode(LED_PIN, OUTPUT);
  pinMode(LIGHT_SENSOR_PIN, INPUT);
  pinMode(BUZZER_PIN, OUTPUT);
}

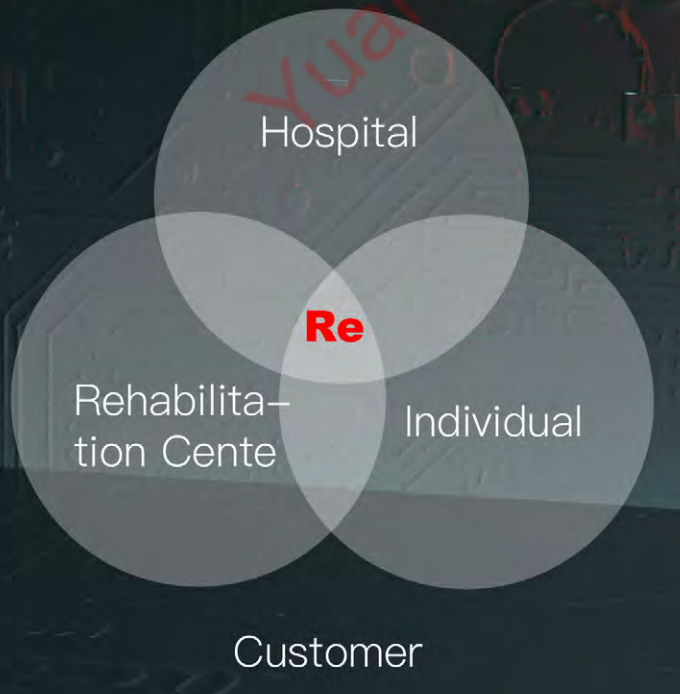
void loop() {
  // ...
  if (lightSensor == HIGH) {
    // ...
  }
  // ...
}
    
```


Click to see more

**vimeo** <https://vimeo.com/661850512>



# Training scene: The fish game



Click to watch Re's cool video 

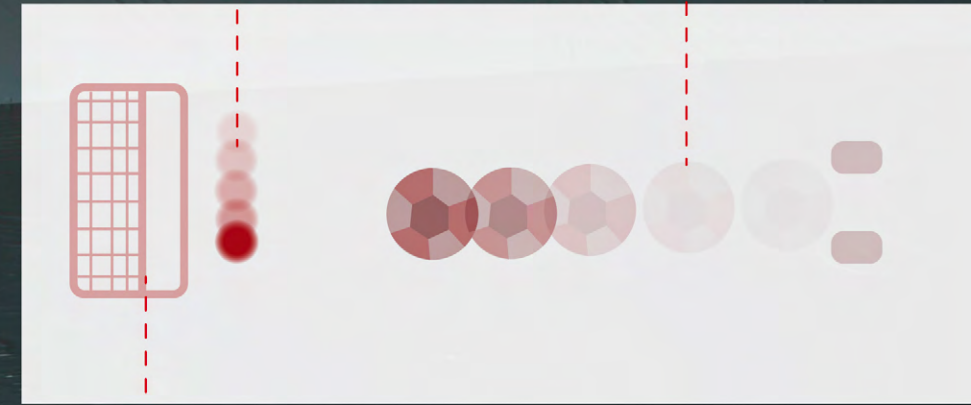
**vimeo** <https://vimeo.com/648956150>



## Training scene: The football game

1. Observe the position or trajectory of the goalkeeper

2. Kick the ball out at the right time



3. Kick the ball into the goal to get positive feedback

