

PORTFOLIO

LIN JIAKANG

CONTENTS

01



SKI-GUARD

CONCEPTUAL PRODUCT DESIGN
SERVICE DESIGN
APP DESIGN

02



NEURON-HEAL

MEDICAL PRODUCT DESIGN
VR DESIGN

03



FAMILYFIT HEAVEN

SERVICE DESIGN
INTERACTION DESIGN

04



PAWLINK

CONCEPTUAL PRODUCT DESIGN
PROGRAMMING DESIGN

- SkiSafe Rescue System is an innovative safety solution for skiers, combining cutting-edge technology with rapid emergency response. It integrates an information platform, a smart helmet, and a rescue drone to create a comprehensive safety net for users on the slopes.

- The smart helmet monitors the skier's movement and physiological data in real time, detecting potential falls or health risks. When danger is imminent, the helmet automatically triggers the drone for immediate action.

- The rescue drone is launched automatically, hovers over the skier, and transmits critical information such as location and status to the rescue station. This system ensures a faster response, improving skier safety and reducing the risk of prolonged injuries.

APP

DRONE

HELMET

SKI-GUARD

A SAFETY SOLUTION FOR SKIERS



INSPIRATION



As an experienced skier, my journey on the slopes has revealed critical safety gaps in the sport I love. Encountering emergencies, witnessing accidents, and observing the challenges faced by fellow skiers, I've realized the need for enhanced safety measures. My experiences, ranging from thrilling downhill runs to navigating risky terrains, have taught me the importance of preparedness and immediate response in crisis situations. It's these insights from my skiing adventures that have inspired me to contribute to the skiing community in a meaningful way.

15 years
Skateboarding
experience

04 years
Skiing experience

01 years
Professional
ski training



BACKGROUND



SKIWELT, AN INTERNATIONALLY RENOWNED SKI RESORT, ATTRACTS THOUSANDS OF SKIING ENTHUSIASTS EACH YEAR. HOWEVER, DURING MY RECENT VISIT, I IDENTIFIED SEVERAL SAFETY HAZARDS AND ISSUES THAT NOT ONLY AFFECT THE EXPERIENCE OF SKIERS

THE ISSUE

Delayed Rescue Response: In remote areas, the time taken for the rescue team to reach the scene can be prolonged in case of accidents.

Weak Mobile Network Signals: Some areas have poor cellphone reception, which could pose difficulties in contacting the outside world during emergencies.



SKIING



INJURED



RESCUE

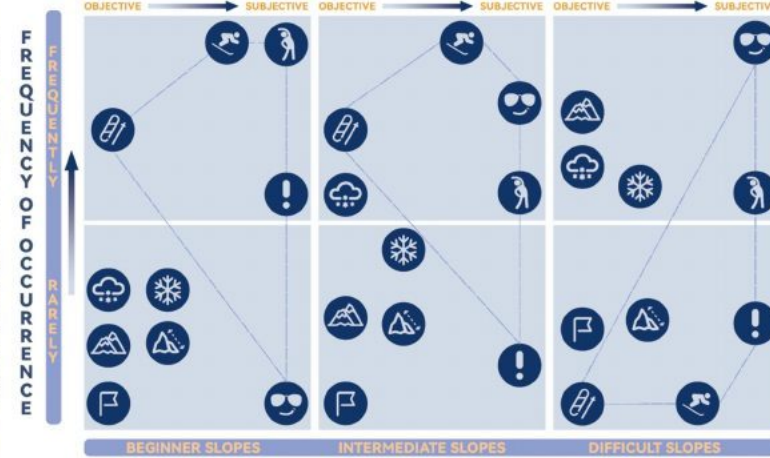
FILED RESEARCH

SKI RESORT SITE ANALYSIS



- Topographic map of ski area and historical accident reports used to identify dangerous terrain and accident prone areas.
- Ski area layout and operational data to confirm the location of crowding points, rest points and first aid points.
- Ski Resort Safety Protocol and Risk Assessment Report: Provides an official assessment and recommendation of hazard points and safety facilities.
- First aid facilities and emergency response plans: Know the location of first aid points and emergency treatment procedures.

FACTORS OF INJURY IN SKIING



CONCLUSIONS

- **THE PRIMARY FACTORS CAUSING INJURIES AMONG SKIERS ARE HUMAN FACTORS.** These factors are prevalent across all types of slopes but are especially evident on beginner and intermediate slopes. However, despite human factors being the main cause, **UNAVOIDABLE NATURAL AND ENVIRONMENTAL FACTORS OFTEN PUT SKIERS IN EXTREMELY DANGEROUS SITUATIONS.**
- **FOR EXAMPLE, NATURAL FACTORS SUCH AS WEATHER CHANGES AND SNOW QUALITY VARIATIONS CAN SUDDENLY OCCUR DURING SKIING, AFFECTING THE SKIER'S VISIBILITY AND CONTROL, THUS INCREASING THE RISK OF INJURY.**
- **AFTER A SKIER IS INJURED, THESE DANGERS DO NOT IMMEDIATELY DISAPPEAR.** DURING THE WAIT FOR RESCUE, NATURAL AND ENVIRONMENTAL FACTORS CAN CONTINUE TO POSE ONGOING THREATS TO THE INJURED INDIVIDUAL.

PERSONAL FACTORS

- **Overconfidence:** Skiers may overestimate their skill levels, try ski trails doesn't suit your skills.
- **Breaking the rules:** Ignore the safety rules and instructions of the ski resort.
- **Lack of equipment:** Improper use or inadequate equipment.
- **Insufficient warm-up:** Lack of proper warm-up exercises increases the risk of muscle and joint injuries.
- **Poor skiing skills:** Improper technical execution.

NATURAL FACTORS

- **Weather changes:** Mutation of weather conditions, such as visibility, blizzards, increase the risk of skiing.
- **Snow quality changes:** Types of snow changes, such as ice, the loose snow, and so on, affect the stability of the ski and controlling.

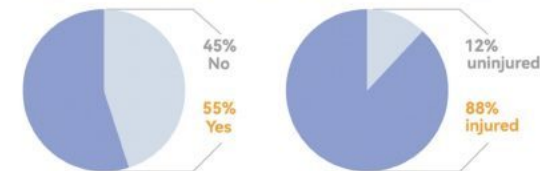
SKI RESORT FACTORS

- **Piste problem:** There are ice, rocks or other obstacles on the piste that have not been removed in time.
- **Piste defects:** The design of ski runs is not reasonable.
- **Identification Problem:** The difficulty and direction of the piste were not clear.

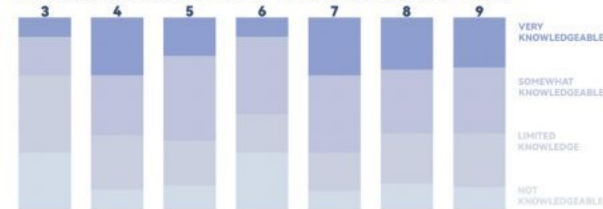
PROBLEM ANALYSIS

QUESTIONNAIRE

I interviewed 100 skiers, and that's the data I got from my interviews



1 Have you ever had a serious injury while skiing? 2 Have you ever been injured while skiing?



- 3 Do you know what to do before skiing (warm-up exercises, equipment checks, etc)?
- 4 Do you know how to save yourself while skiing (e.g. after a fall, avoid avalanches, etc)?
- 5 How well do you know the common hazards in skiing (e.g. falls, collisions, avalanches, etc)?
- 6 Do you know the basic safety rules to follow when skiing (such as avoidance rules, speed control, etc)?
- 7 How well do you know the weather changes you may experience while skiing (e.g. snowstorms, high winds, etc)?
- 8 How well do you know the first aid conditions you may encounter while skiing (e.g. fractures, sprains, hypothermia, etc)?
- 9 Are you aware of the safety facilities and first aid services provided by the ski resort (e.g. first aid stations, rescue numbers, etc)?

INJURY SITE ANALYSIS OF SKIING

Injury data were derived from questionnaires



CONCLUSIONS

- **THE SURVEY REVEALS THAT MOST SKIERS DO NOT HAVE A HIGH LEVEL OF SAFETY AWARENESS, CONTRIBUTING TO AN INCREASED RISK DURING SKIING.**
- **MANY SKIERS LACK SUFFICIENT KNOWLEDGE ABOUT WARM-UP EXERCISES, SELF-RESCUE TECHNIQUES, COMMON HAZARDS, SAFETY RULES, WEATHER CHANGES, FIRST AID CONDITIONS, AND THE AVAILABILITY OF SAFETY FACILITIES AND SERVICES AT SKI RESORTS. THIS LACK OF AWARENESS EXACERBATES THE INHERENT RISKS ASSOCIATED WITH SKIING, LEADING TO A HIGHER LIKELIHOOD OF ACCIDENTS AND INJURIES.**

INTERVIEW

AGE:22
SIMON WANG
1 YEARS OF SKIING EXPERIENCE
BEGINNER

"I learned the hard way about the importance of skiing within my limits after a knee injury on the slopes. This experience taught me to never overestimate my abilities, to always be cautious, and to equip myself with safety knowledge and essentials like a phone and first aid supplies for emergencies."

AGE:51
ETHAN
22 YEARS OF SKIING EXPERIENCE
FORMER COACH

"Even though I've been skiing for years, I vividly recall dislocating my shoulder due to an accidental collision, despite my expertise. This incident at age 40 taught me the importance of respecting the mountain, always being prepared for emergencies, and the necessity of safety training, no matter your skill level."

AGE:47
EMILY LI
10 YEARS OF SKIING EXPERIENCE
SKIERS

"The most harrowing experience I've had wasn't my own injury, but witnessing my child's accident on the slopes. Thanks to my decade of skiing, I was able to quickly assess the situation and provide immediate assistance to get my child out of harm's way, highlighting the importance of experience and quick thinking in preventing more serious consequences."

AGE:29
DANIEL
15 YEARS OF SKIING EXPERIENCE
COACH

"One of my most intense experiences was participating in a rescue operation where two skiers had collided at high speed on the mountain, both suffering fractures. The situation required swift action to stabilize and safely transport them for medical attention. This incident underscored the critical importance of safety awareness and emergency preparedness in skiing."

PAIN POINT

HIGH RISK

Skiing is a high-risk sport, and skiers are susceptible to injuries due to the high velocity and the condition of the snow on the ski slopes.

HIGH INJURY RATE

Skiing requires high levels of physical coordination and control. Beginners and inexperienced skiers are particularly prone to injuries.

DIFFICULT RESCUE

High altitudes and adverse weather conditions hinder rescue teams from reaching the scene quickly. Additionally, inadequate communication and equipment further delay rescue efforts.

POOR PROTECTION

Skiers often lack adequate protective measures, such as proper safety equipment and first aid knowledge.

DESIGN CONCEPT

WEARABLE DEVICE

- Motion and Physiological Monitoring:** The helmet is embedded with high-precision sensors that track both the skier's movements and physiological signs (e.g., heart rate, temperature), detecting any abnormal patterns that might indicate danger.
- Automatic Emergency Activation:** When the helmet detects an imminent fall or critical physiological changes, it automatically triggers the drone and sends data to the app, initiating the rescue process.
- Lightweight and Comfortable Design:** The helmet must be lightweight and ergonomic, ensuring comfort and ease of movement, while maintaining durability and protection for the user in case of impact.



INTELLIGENT DRONE

- Autonomous Deployment:** The drone is designed to launch automatically when triggered by the smart helmet's detection of a potential fall, reducing response time without needing manual intervention.
- Hovering and Real-Time Surveillance:** Once deployed, the drone hovers over the skier's location, providing a constant visual feed and transmitting vital data, such as location and condition, back to the rescue team.
- Durable and Weather-Resistant:** The drone is designed to operate in extreme skiing environments, with the ability to handle cold weather, wind, and snow, ensuring functionality in harsh conditions.



INTEGRATED PLATFORM

- Real-Time Monitoring and Data Display:** The app tracks and shows live data on the skier's location, motion, and physiological conditions. It ensures that skiers and rescue teams have access to up-to-the-minute information.
- Remote Communication and Alerts:** It provides seamless connectivity between the skier and the rescue station, sending automated alerts when abnormal activity or an accident is detected, ensuring timely intervention.
- Personalized Recommendations and Risk Warnings:** Through data analysis, the app gives users personalized skiing advice and proactive risk warnings based on factors such as weather conditions, terrain difficulty, and user health status.



DESIGN PHILOSOPHY

THIS SKI RESCUE SYSTEM ENHANCES SKIER SAFETY BY INTEGRATING AN INFORMATION PLATFORM, DRONE, AND SMART HELMET, PROVIDING REAL-TIME MONITORING, AUTOMATIC ALERTS, AND RAPID RESPONSE THROUGH SEAMLESS COLLABORATION.

KEY REQUIREMENTS:

- RAPID RESPONSE:** THE PRODUCT SHOULD ENABLE USERS TO SEND OUT A DISTRESS SIGNAL IMMEDIATELY UPON INJURY.
- ACCURATE LOCATION:** ENSURE THAT RESCUERS CAN QUICKLY AND ACCURATELY LOCATE THE INJURED PARTY.
- EASE OF USE:** THE PRODUCT SHOULD BE DESIGNED TO BE INTUITIVE AND EASY TO USE IN EMERGENCY SITUATIONS.
- EMOTIONAL CONSIDERATION:** THE PRODUCT AND SERVICE SHOULD TAKE INTO ACCOUNT THE PANIC AND DISTRESS USERS MAY FEEL AFTER INJURY, SIMPLIFYING THE RESCUE PROCESS TO ALLEVIATE THEIR PSYCHOLOGICAL BURDEN.

INTEGRATED PLATFORM

HEALTH MONITORING



PHYSIOLOGICAL SENSOR FEEDBACK
DYNAMIC CONNECTION & SYNCHRONIZATION
PERSONAL HEALTH & PERFORMANCE ANALYSIS

REAL-TIME FEEDBACK



STATUS TRACKING & HISTORICAL TRENDS
BEHAVIORAL PATTERN ANALYSIS
SAFETY BOUNDARY ALERTS

SAFETY PROMPTS



ACTIVITY LEVEL RECOMMENDATIONS
SMART REST ALERTS
SAFETY MODE DYNAMIC ADJUSTMENT

HEALTH ADVISORY



CUSTOMIZED EXERCISE PLANS
PERSONAL CARE & PREVENTION TIPS
HEALTH REPORTS & OPTIMIZATION RECOMMENDATIONS

WEARABLE DEVICE

SEAMLESS CONNECTIVITY: ENSURES CONTINUOUS COMMUNICATION WITH THE PLATFORM FOR REAL-TIME HEALTH AND LOCATION UPDATES.

CRITICAL ALERTS: AUTOMATICALLY SIGNALS THE UAV AND PLATFORM IN CASE OF AN EMERGENCY OR SEVERE INJURY.

SENSOR INTEGRATION: MONITORS PHYSIOLOGICAL DATA AND ENVIRONMENTAL CONDITIONS, SUPPORTING PROACTIVE SAFETY MEASURES.

INTELLIGENT DRONE

RAPID DEPLOYMENT: ACTIVATES AND NAVIGATES TO THE EMERGENCY SITE UPON RECEIVING ALERTS FROM THE WEARABLE DEVICE.

PRECISE LOCATING: UTILIZES ADVANCED TECHNOLOGY FOR ACCURATE POSITIONING TO STREAMLINE RESCUE OPERATIONS.

AERIAL SUPPORT: PROVIDES AN OVERHEAD VIEW AND DELIVERS FIRST AID SUPPLIES TO THE ACCIDENT LOCATION.

TECHINICAL RESEARCH

WEARABLE DEVICE



ACCELEROMETER GYROSCOPE

Real-time monitoring of the skier's motion state, providing data on speed and direction. Detecting falls and accidents, using sudden changes in acceleration and angular velocity to identify falls and trigger emergency responses.



HEART RATE SENSOR

Real-time monitoring of the skier's vital signs, helping assess physical condition and prevent health issues. Detecting emergencies, triggering alarms and rescue responses promptly.



BLOOD OXYGEN SENSOR

Real-time monitoring of the skier's blood oxygen saturation, helping assess respiratory and circulatory status, preventing health issues. Detecting health abnormalities, triggering alarms and rescue responses promptly.

MO 415 SERIES ACCELEROMETER GYROSCOPE

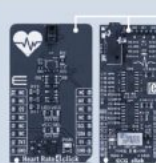


APPLICATION
Measures acceleration and angular velocity to determine the skier's motion trajectory and posture changes.
Analyzes sudden changes in acceleration and abnormal posture changes to determine if the skier has fallen.
Combined with a GPS module to provide accurate location information.



WORKING PRINCIPLE

The MO 415 series gyroscope accelerometer precisely monitors the helmet's motion state and posture changes by measuring acceleration and angular velocity.



WORKING PRINCIPLE

The ECG sensor detects the skier's heart electrical activity through electrodes, recording detailed ECG data; the heart rate sensor uses photoplethysmography (PPG) to measure heart rate in real-time by detecting changes in blood flow. Used together, these sensors monitor the skier's heart health and exercise intensity in real-time.

HEART RATE AND ECG SENSORS

APPLICATION
Measures heart rate by detecting changes in blood flow.
Detects the heart's electrical activity through electrode patches, providing more detailed heart rate and ECG data.
By analyzing ECG data, it can detect serious issues like arrhythmia or cardiac arrest, triggering emergency rescue in a timely manner.



WORKING PRINCIPLE

The blood oxygen sensor uses photodetection technology (such as a pulse oximeter) to emit light through the skin and blood vessels, detecting changes in blood oxygen levels to measure blood oxygen saturation.

BLOOD OXYGEN SENSORS

APPLICATION
The blood oxygen sensor in the ski helmet monitors the skier's blood oxygen saturation, ensuring their health during intense physical activity and in high-altitude environments, providing timely health feedback.

INTELLIGENT DRONE



CAMERA MODULE

This camera module is specially designed for use in cold, snowy environments. With its low-temperature stability, waterproofing, and adaptability to high light conditions, it ensures clear, uninterrupted image capture even in harsh climates.



FLAPPING-WING MECHANISM

The flapping-wing mechanism mimics the natural wing movements of birds, converting motor rotation into synchronized flapping. This system consumes less energy, making it ideal for snow-laden, windy conditions often found in cold environments. Unlike conventional drones with exposed rotors, this enclosed wing design reduces the chances of ice formation.

THE CAMERA MODULE

Low-Temperature Stability: The module is designed to operate reliably in low temperatures, minimizing malfunction risks.
Waterproof and Dustproof: It has waterproof and dustproof features, ideal for snow-covered or wet environments.
High Light Adaptability: The module handles strong light reflections in snow and high-brightness scenarios, delivering clear image quality.

Low Power Consumption: Low power consumption extends drone flight time in cold environments.
Wireless Connectivity: Wi-Fi and Bluetooth support remote data transmission and monitoring in snowy conditions.
Compact and Lightweight: Its compact design improves drone endurance and stability in snowy environments.

ADVANTAGE

Real-Time Image Transmission: Integrated with chips and circuit boards, it allows real-time image transmission for remote control and monitoring of the drone.
Environmental Sensing and Navigation: It aids in environmental perception for path planning and obstacle detection.



RASPBERRY PI ZERO W

Image Processing and Real-Time Data Transmission: It processes images and transmits data in real-time via Wi-Fi.
Autonomous Navigation and Sensor Integration: It integrates with sensors for autonomous flight and path planning.

FLAPPING-WING DRONE MECHANISM

FLAPPING MECHANISM

The flapping mechanism converts motor rotation into reciprocal wing movements, mimicking bird or insect flapping. Arrows in the diagram show the direction of wing motion, demonstrating how energy is transferred from the motor for synchronized wing flapping.



MOTOR FUNCTION

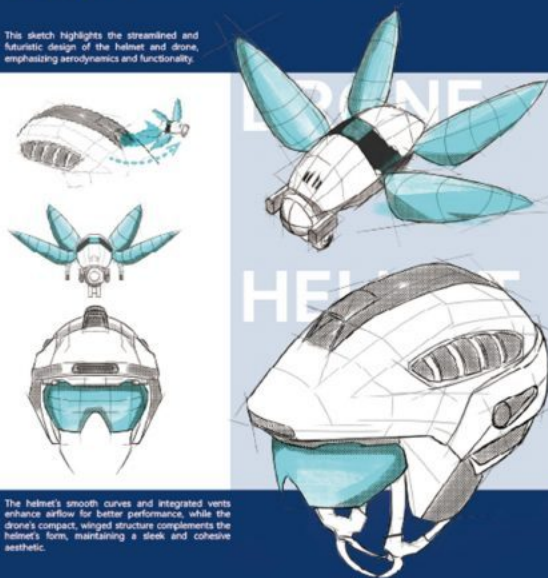
The motor generates torque and rotation, powering the wings through the shaft. The arrows around the motor illustrate its rotational direction and how the energy drives the flapping motion.

ADVANTAGE

The natural flight mechanics of flapping wings, mimicking birds or insects, can lead to lower energy consumption, especially in windy or turbulent conditions often encountered in snowy environments. This makes them more efficient in maintaining stable flight in challenging weather.

Conventional drones with exposed rotors are prone to ice accumulation on the blades in freezing temperatures. The enclosed or semi-enclosed wing structure of flapping drones reduces the chances of ice forming, allowing them to operate more reliably in cold, snowy conditions.

This sketch highlights the streamlined and futuristic design of the helmet and drone, emphasizing aerodynamics and functionality.

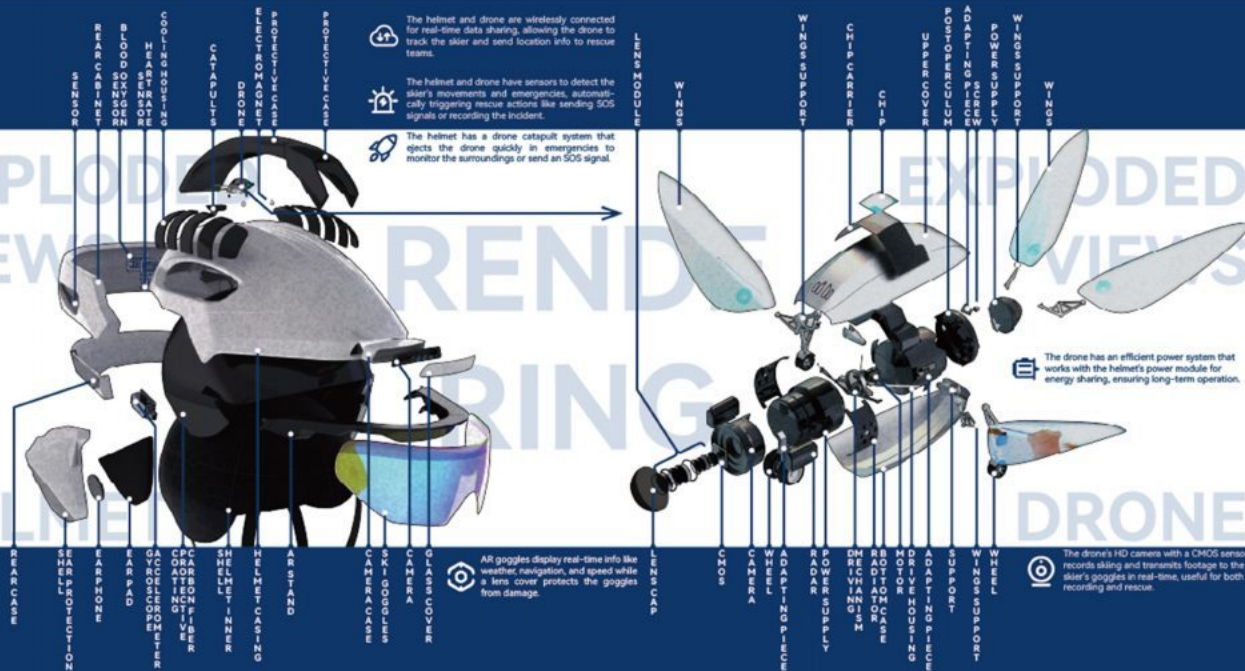


The helmet's smooth curves and integrated vents enhance airflow for better performance, while the drone's compact, winged structure complements the helmet's form, maintaining a sleek and cohesive aesthetic.

The helmet and drone are wirelessly connected for real-time data sharing, allowing the drone to track the skier and send location info to rescue teams.

 The helmet and drone have sensors to detect the skier's movements and emergencies, automatically triggering rescue actions like sending SOS signals or recording the incident.

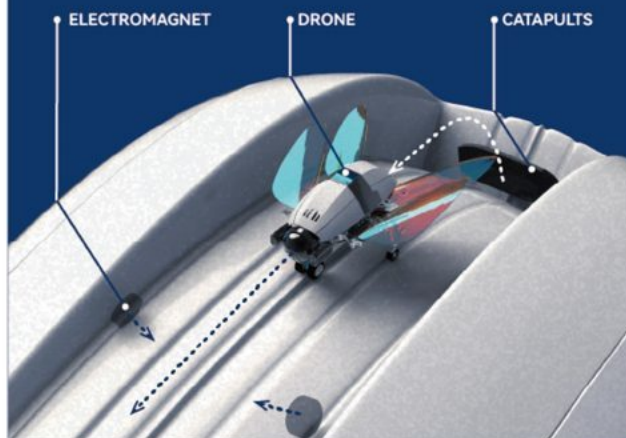
 The helmet has a drone catapult system that ejects the drone quickly in emergencies to monitor the surroundings or send an SOS signal.



 The drone has an efficient power system that works with the helmet's power module for energy sharing, ensuring long-term operation

 The drone's HD camera with a CMOS sensor records skiing and transmits footage to the skier's goggles in real-time, useful for both recording and rescue.

THIS LAUNCH MECHANISM UTILIZES A DUAL-POWER SYSTEM. THE SPRING SYSTEM AT THE BACK PROVIDES THE DRONE WITH INITIAL VELOCITY, WHILE THE ELECTROMAGNET AT THE FRONT ACCELERATES IT, ENSURING THE DRONE QUICKLY EXITS THE HELMET AND ACHIEVES STABLE FLIGHT. THE SPRING MECHANISM RAPIDLY INITIATES THE DRONE IN EMERGENCIES, AND THE ELECTROMAGNETIC ACCELERATOR FURTHER BOOSTS ITS SPEED AND STABILITY, ALLOWING FOR QUICK DEPLOYMENT IN VARIOUS WEATHER AND TERRAIN CONDITIONS.



```

graph TD
    Home[Home page] --> Dietary[Dietary Information]
    Home --> Help[How to help]
    Home --> Weather[Weather information]
    Home --> Consult[Consult]

    Dietary --> DietStatus[Dietary status]
    Dietary --> DietStatusDetails[Dietary status details]
    Dietary --> ConnectionStatus[Connection status]
    Dietary --> Battery[Battery]

    Help --> CancelRescue[Cancel rescue]
    Help --> ContactDoctor[Contact the doctor]
    Help --> ConfirmedRescue[Confirmed rescue]
    Help --> ContactRescue[Contact rescue]
    Help --> LocationInfo[Location information]

    Weather --> WeatherInfo[Weather information]
    Weather --> AirTemp[Air temperature]
    Weather --> WeatherDetail[Weather detail]
    Weather --> WeatherForecast[Weather forecast]

    Consult --> BasicInfo[Basic information]
    Consult --> DietStatus2[Dietary status]
    Consult --> DietStatusDetails2[Dietary status details]
    Consult --> DietStatus3[Dietary status]
    Consult --> DietStatus4[Dietary status]

    Map[Map] --> MyRecord[My record]
    Map --> SearchBar[Search bar]

    MyRecord --> CheckRecord[Check the record]
    MyRecord --> Start[Start]
    MyRecord --> EndRecord[End record]
    MyRecord --> Details1[Details]

    SearchBar --> Search[Search]
    SearchBar --> Navigation[Navigation]

    MedicalCare[Medical care] --> Beds[Beds]
    MedicalCare --> Doctor[Doctor]

    Beds --> Bedroom[Bedroom]
    Beds --> Kitchen[Kitchen]
    Beds --> Bathroom[Bathroom]
    Beds --> CNS[CNS]

    Doctor --> Doctor2[Doctor]
    Doctor --> Chat[Chat]

    Profile[Profile] --> PersonalInfo[Personal information]
    Profile --> Settings[Settings]
    Profile --> ExtendedInfo[Extended information]

    PersonalInfo --> HeadPortrait[Head portrait]
    PersonalInfo --> RealEnergyHistory[Real energy history]
    PersonalInfo --> Name[Name]
    PersonalInfo --> BitingYears[Biting years]
    PersonalInfo --> BloodType[Blood type]

    Settings --> Account[Account]
    Settings --> Password[Password]
    Settings --> EmergencyContact[Emergency contact]
    Settings --> EmailAddress[Email address]
    Settings --> Quit[Quit]

    ExtendedInfo --> MyDiet[My diet]
    ExtendedInfo --> Club[Club]
    ExtendedInfo --> Study[Study]
    ExtendedInfo --> Contact[Contact]
  
```

- MAIN PAGE
- PRIMARY INTERFACE
- SECONDARY INTERFACE
- TERTIARY INTERFACE

THE INFORMATION ARCHITECTURE IS DESIGNED TO PROVIDE COMPREHENSIVE SUPPORT AND A CONVENIENT USER EXPERIENCE IN SKIING AND RELATED ACTIVITIES BY INTEGRATING DEVICE MONITORING, EMERGENCY ASSISTANCE, WEATHER FORECASTING, MEDICAL CARE, SKIING RECORDS, AND PERSONAL PROFILE MANAGEMENT THROUGH A SIMPLE INTERFACE AND CLEAR HIERARCHICAL STRUCTURE.

INTERFACE



USER TESTING

- THE TESTING OF THE SKI APP PROTOTYPE REVEALED SEVERAL ISSUES, SUCH AS COMPLEX NAVIGATION LEVELS, CUMBERSOME EMERGENCY RESCUE OPERATIONS, AND OVERLY TECHNICAL MEDICAL GUIDANCE.
- USER FEEDBACK SUGGESTED SIMPLIFYING THE INTERFACE NAVIGATION, ADDING A PROMINENT EMERGENCY SOS BUTTON, PROVIDING A SIMPLIFIED VERSION OF FIRST AID GUIDANCE, AND IMPROVING THE PERSONAL INFORMATION MANAGEMENT PROCESS.
- OVERALL, USERS FOUND THE DESIGN PROTOTYPE TO BE REASONABLE, BUT IT NEEDS OPTIMIZATION TO ENHANCE USER EXPERIENCE AND FUNCTIONALITY.

HOMEPAGE



FUNCTION

SKI RESCUE APP HOMEPAGE DISPLAYS KEY INFORMATION SUCH AS DRONE BATTERY STATUS, DEVICE SLEEP MODE, AND DRONE STABILITY, HELPING USERS MONITOR EQUIPMENT PERFORMANCE IN REAL-TIME. THE LOWER SECTION PROVIDES SKI RESORT WEATHER FORECASTS AND SNOW ACCUMULATION DATA, MAKING IT EASIER FOR USERS TO ASSESS SKI CONDITIONS.

CONSULT

ADDITIONALLY, IT INCLUDES CONSULTATION CONTENT ON SKIING TIPS AND RESORT RECOMMENDATIONS TO HELP USERS PLAN THEIR TRIPS. THE SOS EMERGENCY BUTTON IS LOCATED AT THE BOTTOM FOR QUICK ACCESS IN URGENT SITUATIONS. THE DESIGN IS SIMPLE AND INTUITIVE, HIGHLIGHTING ESSENTIAL INFORMATION AND ENHANCING USER EFFICIENCY AND SAFETY.

EMERGENCY HELP



SUBPAGE-SKI MAP



THE SKI MAP SUBPAGE OFFERS AN INTERACTIVE AND DETAILED MAP OF THE SKI AREA, ALLOWING USERS TO TRACK THEIR CURRENT POSITION, EXPLORE DIFFERENT ROUTES, AND FIND NEARBY FACILITIES. IT ENHANCES NAVIGATION AND ENSURES USERS CAN EASILY LOCATE THE BEST SLOPES AND SAFETY POINTS.

THE EMERGENCY HELP FEATURE PROVIDES QUICK ACCESS TO IMMEDIATE ASSISTANCE IN CASE OF AN ACCIDENT. WITH A SINGLE TAP, USERS CAN ALERT RESCUE TEAMS AND SHARE THEIR LOCATION, ENSURING RAPID RESPONSE DURING CRITICAL SITUATIONS ON THE SLOPES.

THE SNOWGUARD APP FEATURES A USER-FRIENDLY INTERFACE DESIGNED FOR SEAMLESS NAVIGATION. IT INTEGRATES REAL-TIME WEATHER UPDATES, BATTERY AND MOTION MONITORING, MEDICAL SUPPORT, AND SNOW CONDITIONS, ALL TAILORED TO ENSURE A SAFE AND ENJOYABLE SKIING EXPERIENCE.

SNOW GUARD



WORK FLOW



THE SKIER USES THE APP'S MAP AND ACTIVITY TRACKING FEATURES TO VIEW THEIR ROUTE AND LOG SKIING DATA.



THE SKIER WEARS THE HELMET, AND THE SENSORS BEGIN MONITORING THEIR MOVEMENTS AND SURROUNDINGS.



WHEN THE HELMET SENSORS DETECT AN ABNORMAL EVENT, THE RESCUE PROCESS IS AUTOMATICALLY TRIGGERED.



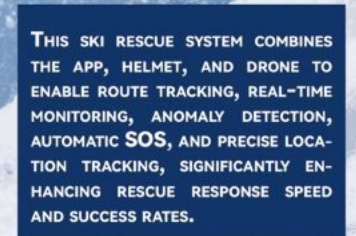
THE HELMET EJECTS THE DRONE, WHICH TAKES OFF AND TRACKS THE SKIER'S LOCATION.



THE DRONE STRAMS REAL-TIME FOOTAGE OF THE SKIER'S SURROUNDINGS, PROVIDING THE RESCUE TEAM WITH SITUATIONAL AWARENESS.



THE DRONE TRANSMITS THE SKIER'S REAL-TIME LOCATION AND FOOTAGE OF THEIR INJURY TO THE RESCUE TEAM TO ENSURE A SWIFT RESPONSE.



THE RESCUE TEAM ARRIVES PROMPTLY BASED ON THE DRONE'S LOCATION DATA AND PERFORMS THE RESCUE.



THE RESCUE TEAM ARRIVES PROMPTLY BASED ON THE DRONE'S LOCATION DATA AND PERFORMS THE RESCUE.

- This project integrates cutting-edge technologies—Virtual Reality (VR), Transcranial Magnetic Stimulation (TMS), and Electroencephalography (EEG)—to create an advanced therapeutic solution for PTSD and trauma recovery.

- Using VR for immersive exposure therapy, TMS to stimulate neural circuits, and EEG to monitor real-time brain activity, the system provides a personalized, multi-modal approach to healing.

- By combining these technologies, the project aims to enhance emotional processing, reduce traumatic symptoms, and promote deeper, lasting recovery.

TMS

EEG

VR

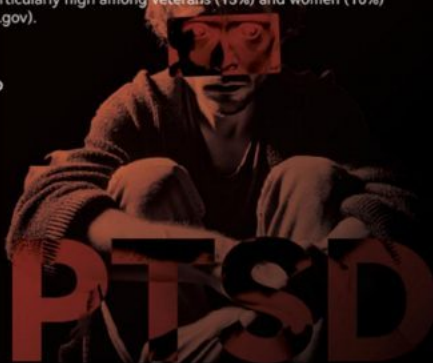
NEURO-HEAL

A NEXT-GEN PTSD THERAPY

INSPIRATION

Post-Traumatic Stress Disorder (PTSD) affects millions globally, with about 3.9% of the population (312 million people) experiencing it at some point (WHO). In the U.S., around 8 million adults suffer from PTSD annually, representing about 5% of the population (Recovery Village). The prevalence is particularly high among veterans (13%) and women (10%) (SingleCare; VA.gov).

1 in 26 people
suffer from PTSD



BACKGROUND



MOTIVATION

PTSD affects many people worldwide, and current treatments have significant shortcomings, such as medication side effects, long durations, high costs, and poor patient adherence. Therefore, designing an innovative product to comprehensively address these issues is crucial.

GOAL

- Patients need personalized, diverse treatment options, real-time feedback, and convenient self-management tools, while also being highly concerned about privacy and data security.
- Understanding these needs, we designed a multifunctional, personalized, convenient, and secure medical device to help PTSD patients better manage and alleviate their symptoms, thereby improving their quality of life.



CONVENIENCE



REAL TIME



SAFETY

The estimated number of people with PTSD worldwide is
312.000.000

INVESTIGATION

The characteristics of PTSD are divided into psychological and physiological characteristics



TREATMENT METHODS ANALYSIS

I investigated current treatment conditions for PTSD patients

PSYCHOLOGICAL



- **CBT:** CBT helps reduce PTSD symptoms by changing thought patterns and behaviors, including exposure therapy and cognitive processing therapy
- **EMDR:** Guides patients to recall traumatic events while performing eye movements or other bilateral stimulation to reprocess traumatic memories

PHYSIOLOGICAL



- **Antidepressants:** Selective serotonin reuptake inhibitors (SSRIs) and serotonin-norepinephrine reuptake inhibitors (SNRIs) are common treatments for PTSD, including Prozac, Zoloft, and Effexor
- **Anti-anxiety Medications:** Benzodiazepines (e.g., alprazolam and diazepam) are used for short-term relief of severe anxiety symptoms

QUESTIONNAIRE

I sent a questionnaire survey to 1,000 PTSD patients, and these are the challenges they face under current treatment conditions.

MEDICATION SIDE EFFECTS



CHRONIC PAIN



SLEEP DISORDERS



COGNITIVE DYSFUNCTION



ABANDONING THERAPY MIDWAY



EMOTIONAL STRESS



CONCLUSION

Current PTSD treatment methods exhibit significant shortcomings in both psychological and physiological aspects, particularly in the areas of medication side effects, chronic pain, sleep disorders, cognitive impairment, treatment dropout, and emotional stress. While existing psychological treatment methods (such as CBT and EMDR) and physiological treatment methods (such as antidepressants and anti-anxiety medications) provide some relief, they do not fully address the challenges faced by patients.

? Based on the current research, I have understood the difficulties faced by these patients, but I need to gain a deeper understanding of their needs.

INTERVIEW

To design innovative products and understand the challenges and needs of patients under current treatment methods, I conducted in-depth interviews with PTSD patients and doctors.

PATIENT

MR. ZHANG

- 2 years (PTSD)
- 35 years old
- Car accident
- Software engineer

MISS ANNA

- 1 year (PTSD)
- 24 years old
- Violent incident
- Graphic designer

MR. CARLOS

- 8 year
- 38 years old
- Master degree
- Therapist

THERAPIST

Feelings: Two years ago, I had a serious car accident and developed PTSD. Medication and CBT help, but progress is slow and effects are unstable.

Challenges: Medication side effects are severe, causing dizziness, nausea, and weight gain. I also suffer from headaches, insomnia, and nightmares.

Needs: I hope future treatments can monitor my physiological state in real-time, provide personalized plans without side effects, be comfortable to use at home.

Feelings: After a violent incident, I was diagnosed with PTSD, and EMDR therapy has brought some improvement.

Challenges: The side effects of medication are not very strong, but I still feel physical tension and stress, especially since my sleep issues are not fully resolved.

Needs: I hope future treatments can better address my individual needs, providing both immediate relief and long-term support, bringing more hope to my life.

Feelings: PTSD treatments work, but progress is slow, especially when patients expect quick results.

Challenges: Side effects from medication and lack of long-term support are major issues, leading to relapses for many patients.

Needs: I hope future treatments will be more personalized, offer long-term support, and have fewer side effects.

SUMMARY

PTSD patients face severe challenges in treatment effectiveness, emotion management, social functioning, and quality of life



MEDICAL

- Unstable treatment effective
- Medication side effects
- Sleep disorders



PSYCHOLOGICAL

- Difficulty managing emotions
- Constant anxiety and fear
- Unmet personalized needs



SOCIAL

- Impaired social functioning
- Lack of support systems
- Social isolation



QUALITY OF LIFE

- Low quality of life
- Physical discomfort
- High psychological stress

DESIGN DEFINITION

DESIGN OBJECTIVES

The design objectives are to develop a treatment device that can consistently alleviate PTSD symptoms, improve emotion management, enhance quality of life, strengthen social function, and be easy to use.

- Improve Treatment Effectiveness
- Enhance Emotion Management
- Enhance Quality of Life
- Strengthen Social Function
- Ensure Ease of Use

The design principles are to provide a personalized, non-invasive, comfortable, easy-to-use treatment solution with real-time monitoring and feedback, and continuous psychological support.

DESIGN PRINCIPLES

- Personalization
- Non-Invasive and Comfortable
- Ease of Use
- Real-Time Monitoring
- Psychological Support



Comprehensive Treatment: Integrate physiological and psychological treatment methods to provide a holistic treatment plan.



Personalized Support: Use AI technology to provide personalized treatment plans based on the patient's specific needs and feedback.



Ease of Use: Design a simple and intuitive interface, making the device easy for patients to operate independently at home.



Real-Time Monitoring: Equip with sensors to monitor physiological indicators in real-time, dynamically adjusting the treatment plan.



Non-Invasive Comfort: Use ergonomic design to ensure the device is comfortable to wear and can be used at home.



Continuous Support: Incorporate voice guidance, encouragement prompts, and virtual therapists to provide continuous support.

SYSTEM FLOW DESIGN

How to treat PTSD from both physical and psychological aspects



TECHNICAL RESEARCH

How to achieve the desired results today?

HOW CAN THE PATIENT'S SYMPTOMS BE IMPROVED PSYCHOLOGICALLY?

EMDR

EMDR uses bilateral stimulation to help patients process traumatic memories.



LIMITATIONS OF EMDR



HOW TO USE TECHNOLOGY TO CHANGE THE EXISTING SITUATION

HARDWARE



SOFTWARE

- VIVESENSE** and **Dolby**
- Using VIVE Sense allows for advanced eye tracking and real-time data capture, making it ideal for creating an immersive and responsive VR-based EMDR therapy system.
- Dolby surround sound simulates more realistic audio, providing patients with more precise bilateral stimulation.

POTENTIAL SOLUTIONS

VR-EMDR

Using VR technology in combination with EMDR treatment allows patients to experience professional EMDR treatment without leaving their homes.

How Combining VR and EMDR Achieves Synergistic Results

$$\text{VR} + \text{EMDR} = ?$$

- Enhanced Immersion**
- VR increases patient engagement and emotional processing by creating a fully immersive environment for EMDR therapy.
- Controlled Exposure**
- VR provides a safe and controlled space for gradual trauma exposure, making EMDR more effective.
- Personalized Experience**
- VR customizes therapy to fit the patient's specific trauma, making EMDR more impactful.
- Real-Time Feedback**
- VR allows for immediate adjustments based on patient responses, improving the effectiveness of EMDR.
- Increased Accessibility**
- VR makes EMDR more flexible and accessible, increasing treatment adherence.

TECHNICAL RESEARCH How to achieve the desired results today?

HOW CAN THE PATIENT'S SYMPTOMS BE IMPROVED PHYSIOLOGICALLY?



TMS DEVICE CLOUDTMS COIL

Transcranial Magnetic Stimulation (TMS) is a non-invasive technique that uses magnetic fields to stimulate specific areas of the brain, primarily aimed at modulating neural activity.

GOAL

To achieve the goals of *non-invasive treatment*, I employ Transcranial Magnetic Stimulation (TMS) technology, which can exert a therapeutic effect on the patient's brain to a certain degree. Compared to alternative treatment modalities, this approach is associated with minimal side effects.

EEG DEVICE EMOTIV EPOC X

The EPOC X EEG device is a wireless brain-wave sensor with 14-channel EEG capabilities, designed for precise and real-time measurement of neural activity in various applications.

GOAL

To facilitate *real-time monitoring* of the patient's health status by both the therapist and the patient during treatment, the application of EEG technology aligns seamlessly with my objectives.

SOFTWARE

node

A server-side Javascript environment used to run local servers and process EEG data before transmitting it.

EMOTIV LABS

Software for capturing, processing, and managing EEG data from the Emotiv EPOC device.

WebGL

For creating web-based interfaces that handle the visualization and user interaction with EEG data.

LOGIC OF HEALING

- Delta Waves (0.5-4 Hz): Delta waves are the slowest brainwaves, linked to deep sleep and physical healing.
- Theta Waves (4-8 Hz): Theta waves are associated with light sleep, meditation, and emotional sensitivity.
- Beta Waves (12-30 Hz): Beta waves are fast brainwaves linked to focus, problem-solving, and alertness.

1 DATA COLLECTION BEFORE HEALING

The patient's brain wave data is gathered to assess their symptoms and formulate an appropriate treatment plan.



EEG CHANNEL DATA

DELTA

In PTSD patients, Delta waves are reduced, reflecting difficulties in achieving deep relaxation.

THETA

PTSD patients show elevated theta waves, reflecting heightened anxiety and emotional distress.

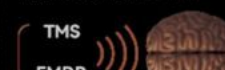
BETA

Increased Beta wave activity in PTSD patients signifies hypervigilance and heightened alertness.



2 START HEALING

Approach patient care from both physical and psychological dimensions



DELTA

Delta waves gradually increase, indicating improved relaxation and deeper sleep potential.

THETA

Theta waves decrease, reflecting reduced anxiety and emotional stress.

BETA

Beta waves normalize, reducing hypervigilance and improving focus.



3 END OF HEALING

The EEG re-evaluates the patient's brain activity upon completion of treatment.



DELTA

Substantially increased, suggesting improved relaxation and deeper sleep potential.

THETA

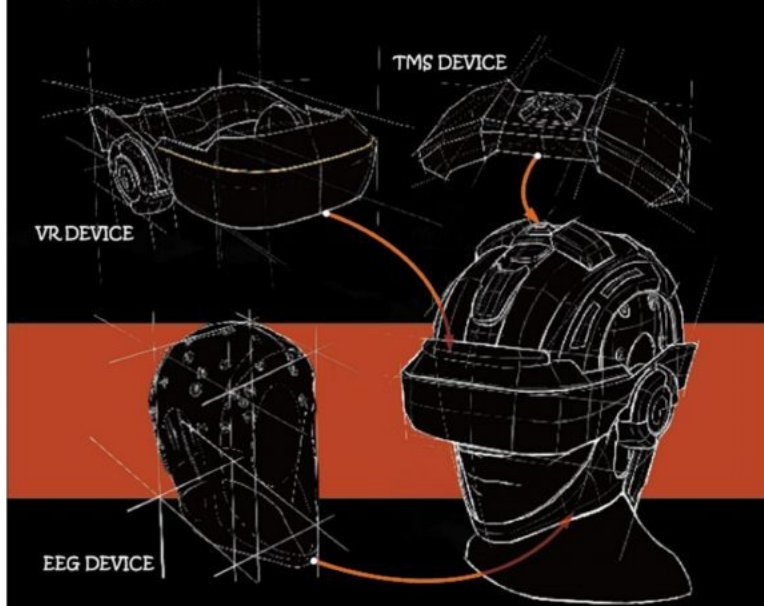
Significantly decreased, indicating reduced anxiety and emotional stress.

BETA

Gradually normalized, reducing hypervigilance and improving focus and clarity.



SKETCH Healing device modeling ideation

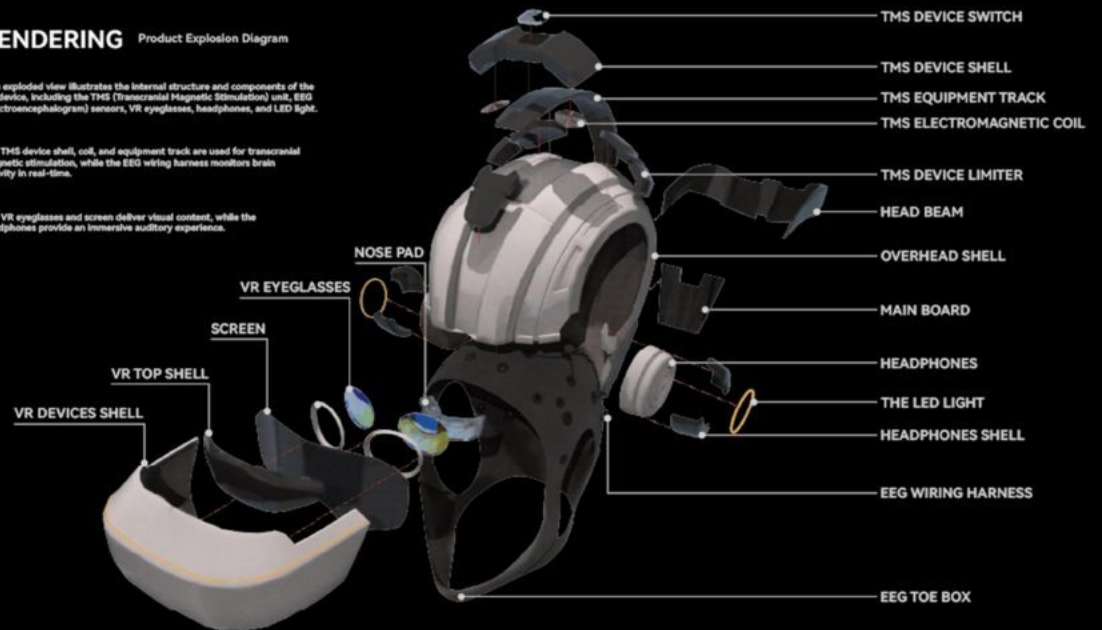


RENDERING Product Explosion Diagram

This exploded view illustrates the internal structure and components of the VR device, including the TMS (Transcranial Magnetic Stimulation) unit, EEG (Electroencephalogram) sensors, VR eyeglasses, headphones, and LED light.

The TMS device shell, coil, and equipment track are used for transcranial magnetic stimulation, while the EEG wiring harness monitors brain activity in real-time.

The VR eyeglasses and screen deliver visual content, while the headphones provide an immersive auditory experience.



HEALING FLOW How to use this device for healing



TMS HEALING

During the eye movement tracking phase, TMS is introduced to target specific brain areas involved in trauma and emotional regulation. This stimulation helps enhance the brain's ability to reprocess traumatic memories, making the EMDR treatment more effective and promoting deeper healing.

EEG MONITORING

EEG is used throughout the session to monitor brainwave activity and emotional states in real-time. This data helps track the user's response to the therapy, providing feedback to adjust treatment intensity and measure the progress in processing traumatic memories, ensuring a personalized healing experience.

SUMMARY

- This healing flow integrates VR-EMDR with TMS and EEG technologies for personalized trauma treatment.
- TMS enhances brain function during eye movement tracking, while EEG monitors emotional and brainwave responses in real-time.
- The session ends with a mental assessment, relaxation, and suggestions for continued emotional well-being.

INTERACTIVE LOGIC TEST



The home screen allows users to monitor their overall healing progress, emotional status, therapy phases, and data visualization, giving a comprehensive overview of their treatment effectiveness.

Offers real-time therapy monitoring, allowing users to track live data such as heart rate and emotional fluctuations, with access to various treatment plans and meditation exercises.

PROTOTYPE



INTERFACE



I randomly selected a few people to test my interaction logic. After a short introduction, users can get started quickly. Some people responded that they wanted to add a search bar to the doctor's screen.

- **Introduction:** FamilyFit Haven promotes family health and bonding by offering a safe, inclusive gym where parents and children build lifelong fitness habits together.
- **Interactive Warm-Up Games:** Interactive warm-up games engage all ages, improving coordination and focus while fostering parent-child collaboration.
- **Purpose-Driven Spaces:** The gym features age-specific areas and shared activities, ensuring holistic fitness experiences for preschoolers, school-age children, teens, and their families.

GYM

PARENT-CHILD

INTERACT

FAMILYFIT HAVEN

A SHARED JOURNEY OF HEALTH, FUN, AND BONDING



INSPIRATION

In daily observations, many parents wish to bring their children along when working out at the gym, but due to safety and management policies, children are often not allowed inside. This creates a dilemma for both parents and gyms: parents must choose between exercising and looking after their kids, while gyms struggle to balance member demands with safety regulations.



This situation highlights a gap in meeting parent-child interaction needs in fitness spaces. Designing a gym space that accommodates both parents and children would not only allow parents to balance fitness and family time but also offer communities a healthy, interactive activity option for families.

BACKGROUND

After the pandemic, people have placed an unprecedented emphasis on physical health, with fitness becoming a vital part of everyday life. Statistics show a steady growth in the global fitness population, and demand for community gyms has significantly increased.

POST-PANDEMIC



As awareness of family health and parent-child interaction grows, more families aspire to achieve both wellness and closer relationships through fitness. Joint parent-child workouts benefit children's physical development, boost social skills, and foster a sense of belonging within the family.

RESEARCH

- In 2018 and 2019, the number of global fitness club members stood at approximately 160 million and 184.6 million, respectively.
- In 2020, due to the impact of the COVID-19 pandemic, the membership of fitness clubs declined to around 151 million.
- From 2021 to 2023, the fitness population gradually recovered and grew, reaching 172 million, 193 million, and 215 million, respectively.
- Forecast for 2024 and 2025: It is projected that the number of global fitness club members will reach 233 million in 2024 and 255 million in 2025.



Note: Data sourced from: The Global Health & Fitness Industry Report (PerfectGym), industry analyses and market research during the pandemic (Health & Fitness Association), with forecast data based on current market growth trends and industry prediction models (Global Wellness Institute).

To assess whether current gym design meets parent-child fitness needs, identify pain points, and inform design improvements.



After conducting field research and identifying the current situation, I need to determine the demand for this service by collecting data and conducting secondary research. I will use online surveys to assess the number of health-conscious families interested in fitness.

250MILLION

50MILLION

2MILLION

Note: Data sourced from: PerfectGym's Global Health & Fitness Industry Report, pandemic-era analyses by the Health & Fitness Association, and market forecasts by the Global Wellness Institute.

To investigate and validate demand for family-friendly gym features, I distributed 100 surveys for data support.

PARENT-CHILD EXERCISE WILLINGNESS



GYM FREQUENCY



REACTION 1



SUMMARY

WHAT ARE YOUR SUGGESTIONS FOR A FAMILY-FRIENDLY GYM?



To verify the feasibility of the family-friendly gym design, I interviewed two relevant user representatives:

COACH WANG | FITNESS INSTRUCTOR



"Parents often bring their kids to the gym, but the current layout and facilities aren't designed with children in mind. A dedicated, safe area for kids would allow parents to fully engage in their workouts without worry."

In order to better the service process design the gym, I have to understand the existing gym universal service process



DESIGN CONCEPT

MODULAR ZONES & ACTIVITIES

- Design age-appropriate spaces: soft-climbing walls for toddlers, balance beams for young children.
- Provide diverse group fitness activities, tailored for families to build connections and improve fitness.
- Create multi-purpose areas where families can exercise together while ensuring safety and supervision.



INTERACTIVE TRAINING GAME SYSTEM

- Integrate a camera-enabled screen with motion capture for training games.
- Offer simple, engaging games like Pac-Man motion games.
- Tailor game difficulty to children's motor skills for inclusivity.



PRINCIPLES

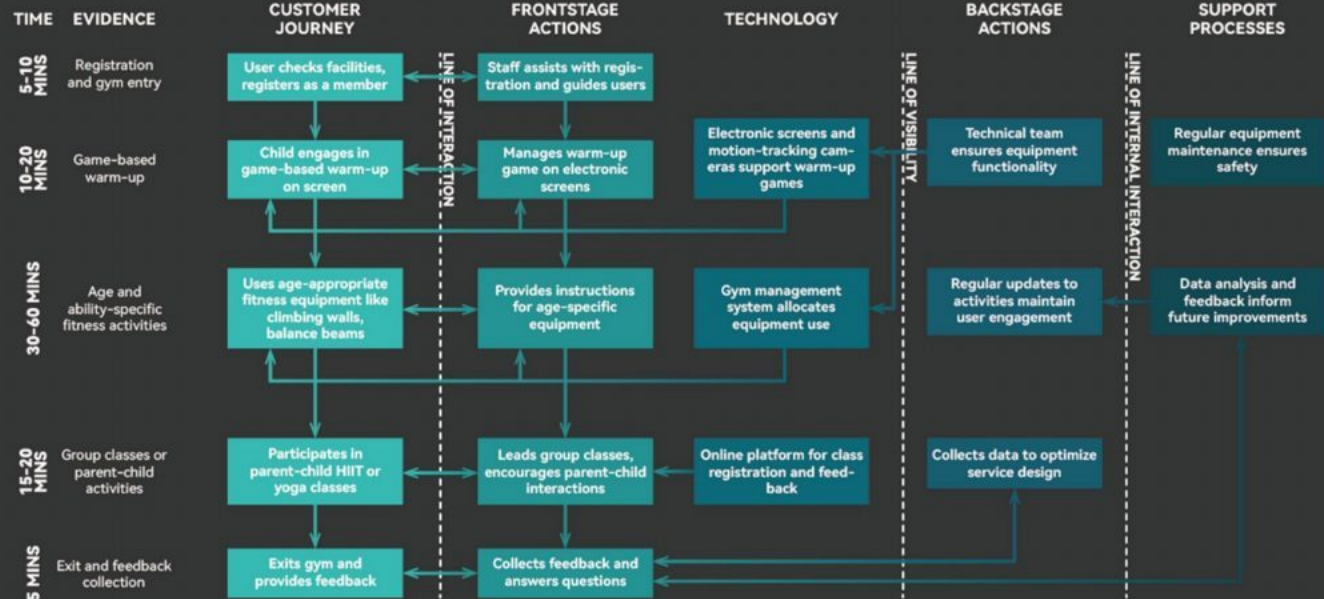
Fun and Engagement: Make exercise enjoyable for both children and parents through playful activities.

Safety First: Design safe zones and ensure proper monitoring of children in all areas.

Adaptability: Offer flexible programs tailored to different family needs and children's abilities.

SERVICE BLUEPRINT

In order to improve the customer service experience, I made a service blueprint for the all-round experience process from registration to feedback.



INTERACTIVE GAME DESIGN

In order to design a game with a training warm-up effect, I had to explain the technology, the operating mode, and the interface.

HARDWARE

- DISPLAY SCREEN**
Used to capture the player's movements and feed them back to the system in real time.
- CAMERA**
The large screen displays the game footage and provides clear visual feedback.
- MOTION SENSOR DEVICES**
Infrared sensors are used to enhance the accuracy of motion capture.

SOFTWARE

- MOTION TRACKING AND RECOGNITION**
- COMPUTER VISION ALGORITHMS**
Use OpenCV tools to identify and track key points of the human body.

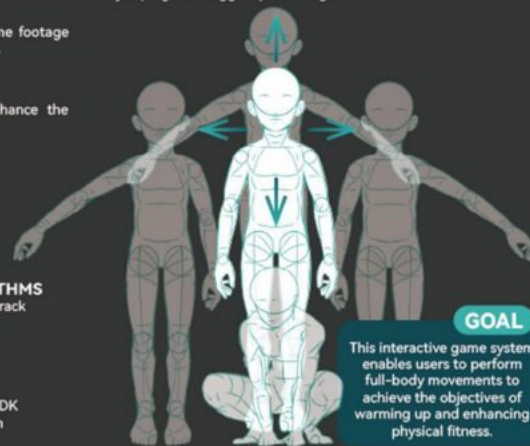
KINECT

SKELETON TRACKING
The depth camera combined with Azure Kinect DK development kit was used to realize 3D skeleton recognition and motion tracking.

OPERATING MODE

Body Movement Control: Players control the in-game character's direction by moving their body left, right, forward, or backward.

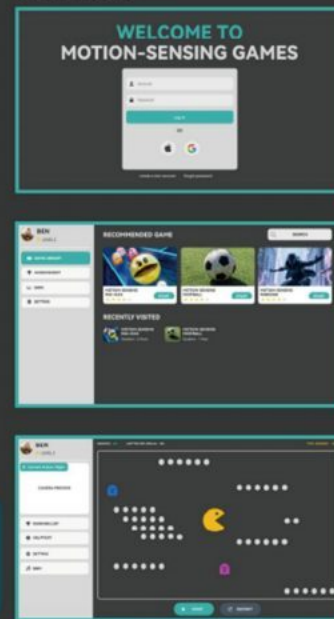
Body Motion Interactions: Specific motions (e.g., squatting or jumping) can trigger special in-game functions.



GOAL

This interactive game system enables users to perform full-body movements to achieve the objectives of warming up and enhancing physical fitness.

INTERFACE



STEP 1 LOGIN

Quickly access the game by registering, logging in directly, or using Apple ID or Google Account for a seamless start.

STEP 2 SETTINGS

Customize your experience by adjusting game difficulty, sound levels, and motion tracking for smooth and precise gameplay.

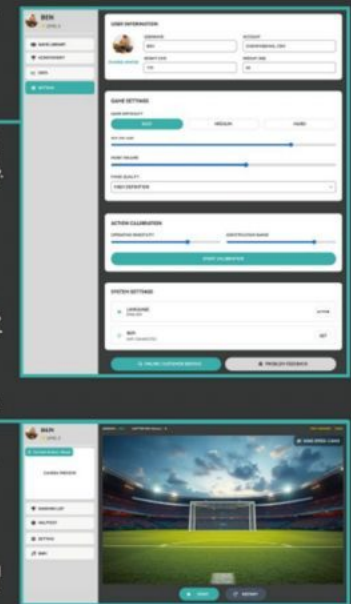
STEP 3 SELECT A GAME

Browse the game library, preview options, and choose a mode that suits your preference and play style.

STEP 4 START THE GAME

Begin playing with real-time motion tracking—move up, down, left, or right, and trigger actions through body gestures for an immersive experience.

The Pac-Man game is mainly played by moving from side to side, and the football game is more played by trunk movement.



SCENE RENDERING

To express the design concept of each area in the parent-child gym and demonstrating how the space can satisfy the requirements of different age groups and family members.

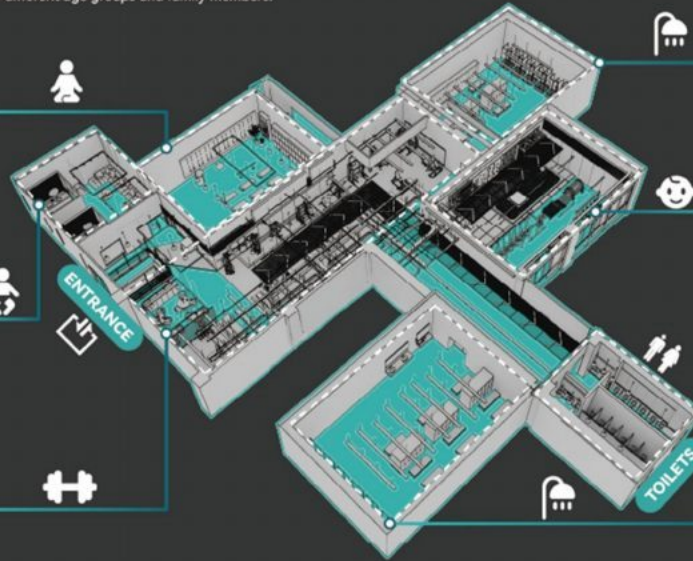
- This **yoga room** features an interactive warm-up game screen. Parents can bring their children here for warm-up activities.
- It's also suitable for parent-child group classes, with children of appropriate ages participating alongside their parents.



- The **baby care room** is designed for parents to care for their young children after work.
- It includes a shower room for parents to help their children bathe and dress after exercise.



- The **fitness area** is designed for teens and adults to work out together.
- It includes treadmills, elliptical machine, spinning bikes, and a variety of strength training machines.



CHILDREN'S PLAY AREA



- The **children's play area** is designed to allow younger children to exercise and play with their parents, and contains two plates, a climbing wall and balancing facilities.
- The balancing facility area contains two balancing challenges for children with different exercise levels.
- There are 13 routes in the climbing area, the routes at both ends are easier, the routes in the middle are more difficult, parents need to choose routes for different children according to their athletic ability.

CHILDREN'S CLIMBING AREA



SHOWER ROOM



- The shower room is designed for teenagers and adults, who can change and shower here after the workout.

WORKFLOW DESIGN

I categorized users into three distinct groups and delineated the patterns of movement and interaction for each group within the gym.

1 YOGA ROOM

- Participate in parent-child yoga classes for flexibility and bonding, with interactive warm-up games.

2 CHILDREN'S CLIMBING AREA

- Engage in activities like balancing on beams and simple climbing challenges, supervised by parents.

3 BABY CARE ROOM

- For bathing, dressing, and relaxation after exercise.

4 ENTRANCE

GOALS

- Develop basic motor skills through balancing activities and simple climbing challenges.
- Strengthen relationships through shared yoga sessions and interactive games.

1 YOGA ROOM

- Play interactive warm-up games and join parent-child yoga or fitness sessions.

2 CHILDREN'S CLIMBING AREA

- Challenge themselves with 13 climbing routes of varying difficulty. Parents guide suitable routes.
- Continue balancing activities and other challenges.

3 SHOWER ROOM

- Clean up and change after activities.

4 ENTRANCE

GOALS

- Enhance strength, coordination, and flexibility through climbing challenges and balancing activities.
- Encourage children to overcome challenges on the climbing routes and develop independence.

1 YOGA ROOM

- Play interactive warm-up games and join yoga sessions for flexibility, relaxation, and stress relief.

2 FITNESS AREA

- Use equipment for cardio and strength training, working out independently or with friends.

3 SHOWER ROOM

- Independently use for hygiene after exercising.

4 ENTRANCE

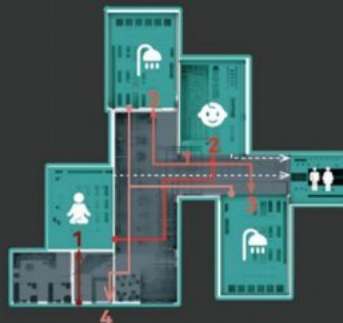
GOALS

- Develop cardiovascular endurance and muscle strength through fitness equipment and workouts.
- Promote stress relief and relaxation through yoga sessions, fostering physical and mental balance.

PRESCHOOL CHILDREN AGE: 3~6



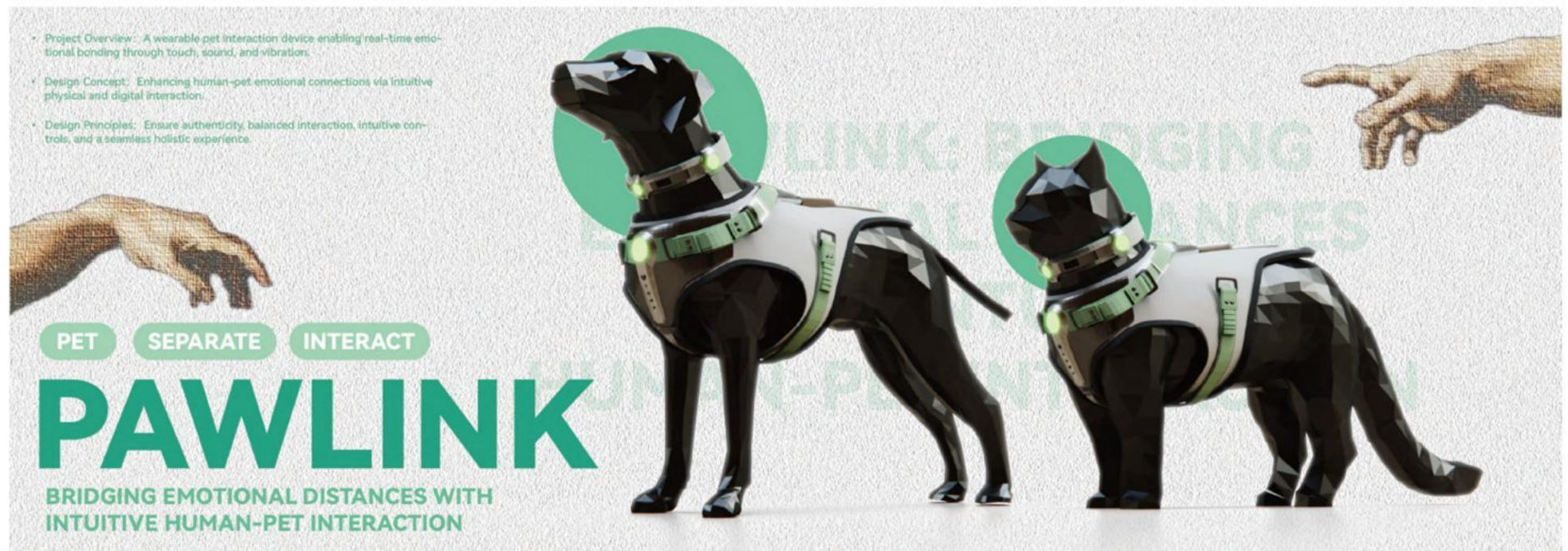
SCHOOL-AGE CHILDREN AGE: 7~12



TEENAGER AGE: 13~18



- **Project Overview:** A wearable pet interaction device enabling real-time emotional bonding through touch, sound, and vibration.
- **Design Concept:** Enhancing human-pet emotional connections via intuitive physical and digital interaction.
- **Design Principles:** Ensure authenticity, balanced interaction, intuitive controls, and a seamless holistic experience.



INSPIRATION

EMOTIONAL NEEDS

Many people need to be away from their pets for long periods due to studies or work, leading to a sense of emotional loss and loneliness. The experience of being apart from one's pet drives a desire for a way to "touch" the pet, providing emotional comfort.



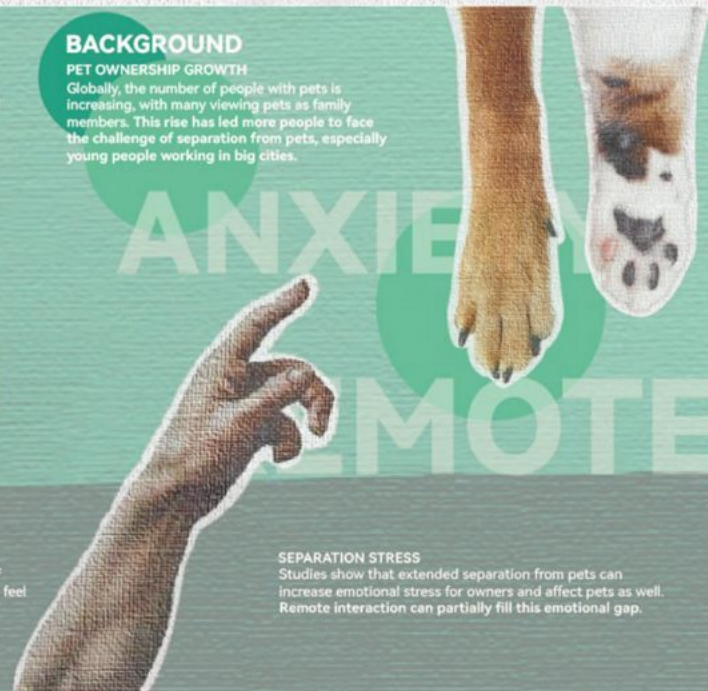
REMOTE INTERACTION

Video calls somewhat bridge the distance between people and pets, but the lack of touch leaves the experience incomplete. By using remote tactile sensors, users can feel their touch being "transmitted" to the pet, as if the pet were right beside them.

BACKGROUND

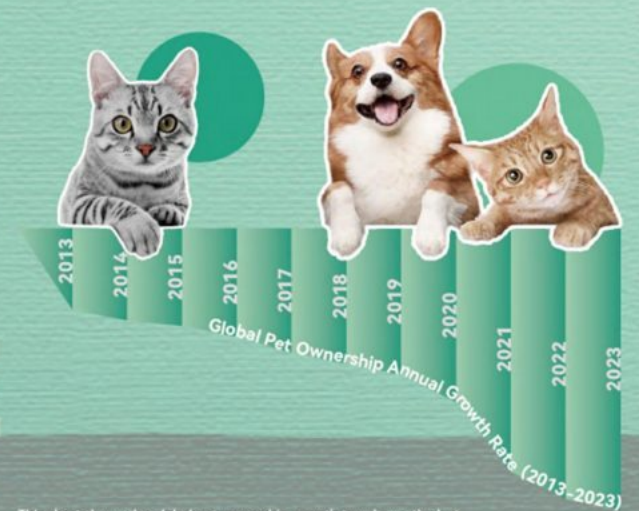
PET OWNERSHIP GROWTH

Globally, the number of people with pets is increasing, with many viewing pets as family members. This rise has led more people to face the challenge of separation from pets, especially young people working in big cities.



SEPARATION STRESS

Studies show that extended separation from pets can increase emotional stress for owners and affect pets as well. Remote interaction can partially fill this emotional gap.



This chart shows the global pet ownership growth trend over the last decade, with a noticeable increase during the pandemic in 2020, indicating a rise in pet ownership driven by companionship needs during isolation.

Data Sources: Sample data for demonstration Recommended actual data sources: Euromonitor, American Pet Products Association (APPA), and global market research institutions.

FOCUS GROUP

To understand who requires such a product and to materialize the concept of the design, I invited six users with pet ownership experience to conduct a focus group.

RESEARCH OBJECTIVE

Explore users' emotional needs and experience expectations for remote pet interaction products, identifying user groups with high demand for the product to better understand the target audience and areas for improvement.



CONCLUSIONS

SIGNIFICANT EMOTIONAL NEEDS

Users have a deep desire to maintain emotional connections with their pets.

INCOMPLETE CURRENT EXPERIENCE

Existing methods like video calls fall short, lacking tactile and real-time interaction.

INTEREST IN NEW FEATURES

Tactile feedback and sound transmission are widely sought by users, believed to ease loneliness due to pet separation.

HIGH-DEMAND USER GROUPS

Busy professionals, frequent business travelers, and international students are the primary users needing this product.

CONVENIENCE AND APPLICABILITY

Users want a convenient and portable product design suitable for use during work, travel, and other situations.

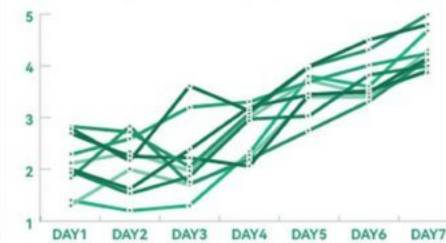
QUESTIONNAIRE

To understand users' emotional needs when separated from pets and validate the potential effects of remote interaction devices in alleviating loneliness and anxiety.



WEEKLY EMOTIONAL RELIEF INDEX WITH DOWNWARD TREND FOR 10 PARTICIPANTS

The chart demonstrates the gradual decline in emotions of 10 users over a seven-day period after being separated from their pets.



OPEN-ENDED QUESTION

Drawing upon the feedback from 50 users regarding these two questions, I have extracted key terms to generate this word cloud visualization.

- Did you use any strategies to manage your emotions while away from your pet?
- Do you have suggestions for improving mood during pet separation?

SUMMARY

USER AGE DISTRIBUTION

Mainly aged 18-35, indicating young adults' need for emotional connection with pets.

PET TYPE

Primarily cats and dogs, highlighting high demand for interactions with these pets.

IMPACT OF SEPARATION

4-14 days of separation is more likely to cause emotional fluctuations.

EMOTIONAL TREND

Significant mood drop in first 3 days, followed by 4-day recovery, indicates need for emotional support.

COPING STRATEGIES

Users employ meditation, videos, etc., reflecting diverse emotional relief needs.

OPEN-ENDED FEEDBACK

Users hope to enhance emotional connection through sound, VR, and other methods.



INTERVIEW

To gain a deeper understanding of users' emotional and functional needs when their pets are separated, I interviewed three users.

INTERNATIONAL STUDENT

PROFILE

"I'm Ze Liu, 21, studying abroad in the UK. Back home, we have a golden retriever, Ball, who has been with us since I was a kid."

NEEDS

"I want a way to stay connected with Ball while abroad, especially being able to 'feel' and interact with him as if I were there."

STAY-AT-HOME MOM

PROFILE

"I'm Xiaohui Zhou, 35, a full-time mom with two kids and a border collie, Doudou. We got Doudou as a companion for my eldest child."

NEEDS

"During family trips, we leave Doudou at a pet care center. I want a way for my kids and me to 'touch' him remotely and feel connected."

YOUNG PROFESSIONAL LIVING ALONE

PROFILE

"I'm Ran Li, 28, single, working in a tech company. I live alone in a small apartment in a big city and have a cat, Orange, to keep me company."

NEEDS

"When I travel for work or stay late at the office, I want a way to interact with Orange, especially to 'touch' him, so he knows I'm there."



PAIN POINTS

EMOTIONAL DISCONNECT

Video calls are insufficient to create a sense of closeness with pets.

LACK OF TANGIBLE INTERACTION

Users cannot touch or comfort their pets remotely, increasing emotional distance.

PET WELL-BEING CONCERNS

Pets may feel lonely or neglected when separated from their owners.

IMPERSONAL REMOTE SOLUTIONS

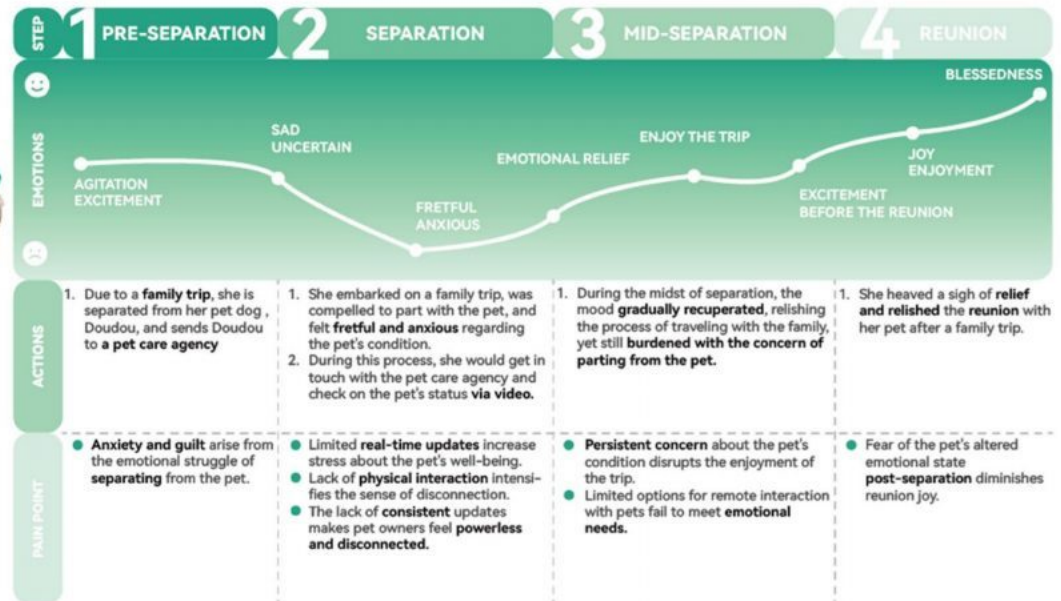
Videos and updates from caregivers or pet centers feel mechanical and impersonal.

SEPARATION ANXIETY

Users feel helpless and anxious about not being there for their pets.

USER JOURNEY MAP

To better understand user needs and pain points regarding pet separation, I interviewed Xiaohui Zhou about her experience during a family trip.



DESIGN CONCEPT

WEARABLE INTERACTION DEVICE

GOAL

Create a device for real-time human-pet interaction using touch, sound, and vibration.

PURPOSE

- Enhance the emotional connection between users and their pets despite physical distance.
- Provide a seamless, intuitive interaction experience supported by wearable technology.

INFORMATION PLATFORM

GOAL

Serve as an auxiliary platform to track, manage, and optimize interaction between humans and pets.

FEATURES

- Human device sends signals via touchpoints.
- Pet device responds with sound and vibration for closeness.
- Video call enables visual connection.

FEATURES

- Synchronize data from wearable devices to monitor usage patterns and emotional trends.
- Provide interaction suggestions and analytics to enhance user experience.

PRINCIPLE

EMOTIONAL AUTHENTICITY

Ensure the device fosters genuine emotional connection between humans and pets without overstimulation.

BALANCED INTERACTION

Combine physical (touch, vibration, sound) and digital (video, app) elements to create a seamless user experience.

USER INTUITION

Make interaction intuitive with simple touch-based controls and clear feedback for both users and pets.

HOLISTIC EXPERIENCE

Integrate the wearable device and app into a cohesive system that supports video calls, activity monitoring, and feedback loops.

TECHNICAL RESEARCH

How to achieve the desired effects today?

PRESSURE SENSOR

PURPOSE

- Detects user's touch strength on the device.
- Generates feedback signals to simulate emotional connections with a pet.

FUNCTIONALITY

- Measures force or pressure applied on its surface.
- Provides accurate data about the interaction strength.

MAIN BOARD

PURPOSE

- Central system for data collection and transmission.
- Ensures data synchronization and real-time processing for seamless interaction.

FUNCTIONALITY

- Central processing unit that integrates data from all sensors.
- Capable of wireless communication for signal transmission.

SOUND SENSOR

PURPOSE

- Captures user voice or commands and transmits to the pet.
- Senses pet's vocal emotional feedback for user insights.

FUNCTIONALITY

- Captures ambient audio signals.
- Detects sound levels and frequencies in the environment.

MP3 MODULE

PURPOSE

- Enables real-time recording and playback of user voice.
- Enhances pet's voice recognition with high-quality audio restoration.

FUNCTIONALITY

- Supports audio input, playback, and signal processing.
- Customizable for different audio quality needs.

HEART RATE SENSOR

PURPOSE

- Tracks pet's heart rate variations.
- Reflects pet's emotional states (e.g., tension, excitement).

FUNCTIONALITY

- Monitors heart rate using hemoglobin oxygen saturation.
- Provides real-time biological data.

VIBRATION MOTOR

PURPOSE

- Provides touch or comfort feedback to the pet.
- Simulates real interactions and allows users to perceive pet activity.

FUNCTIONALITY

- Converts electronic signals into vibration feedback.
- Provides varying levels of vibration intensity.

EMOTION AND INTERACTION

- Most components focus on enhancing the emotional bond and realistic interaction between user and pet (Pressure Sensor, Vibration Motor).

BIOMETRIC AND EMOTIONAL INSIGHTS

- Sensors like Heart Rate and Sound capture and reflect pet's emotional states, enriching the user experience.

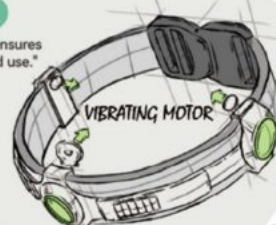
DATA PROCESSING

- Core elements like the Main Board ensure seamless real-time feedback.

SKETCH

PET COLLAR

"A lightweight structure ensures comfort during prolonged use."



HEART RATE SENSOR

- Heart rate sensors monitor pet emotions and adapt interactions accordingly.

SOUND SENSOR

- Sound sensors detect pet vocalizations to analyze their emotions.

VIBRATING MOTOR

PET VEST

"Flexible design adapts to different pet sizes for universal usability."

RENDERING

Show the exploded view of the pet collar and vest



PET COLLAR

- COLLAR BUCKLE
- BELT
- TRIM STRIP
- OUTER SHELL
- VIBRATING MOTOR
- HEART RATE SENSOR
- STICKER
- SOUND SENSOR
- OUTER SHELL
- RING
- STATUS LAMP

- STATUS LAMP
- TOUCH TABLET
- RING
- OUTER SHELL
- BATTERY
- MAIN BOARD
- VIBRATING MOTOR

- PET VEST
- BELT
- BUCKLE
- BUTTON

PET VEST

SENSORS

The smart pet collar and vest combine advanced sensors and ergonomic design to monitor emotions, provide tactile feedback, and ensure comfort for seamless human-pet interaction.

HARDWARE DESIGN

HARDWARE CONNECTION DIAGRAM AND INTERACTION LOGIC

The connection mode and interaction logic of pet and client hardware are shown to intuitively reflect the working principle and function realization of the system.



USB-C

PET TERMINAL

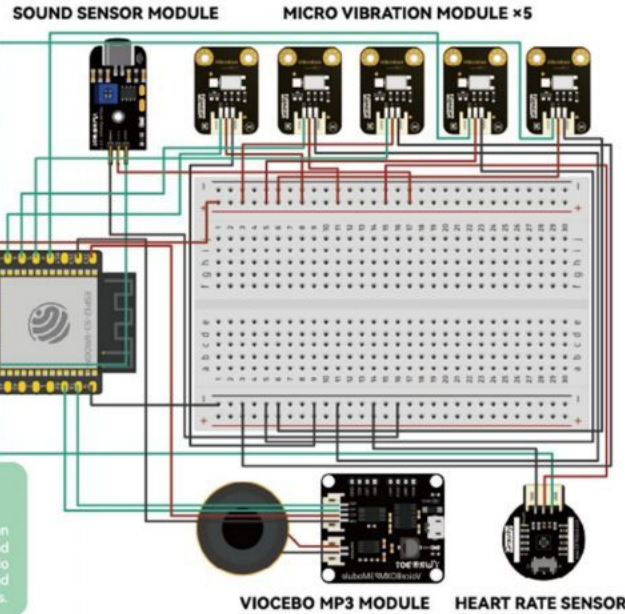
ESP32-S3-WROOM-1

WORKING PRINCIPLE

The system detects the pet's emotional state through the heart rate and sound sensors. In case of abnormal emotions, it sends alerts to the user terminal, triggers vibration modules to simulate stroking, and plays the owner's voice for immediate comfort.

HARDWARE SETUP

The pet terminal hardware includes an ESP32 controller, heart rate sensor, sound sensor, vibration modules, and an audio module for efficient data collection and real-time analysis of pet emotional states.



USER TERMINAL

USB-C

ESP32-S3-WROOM-1

VOLTAGE CONVERSION MODULE

PRESSURE SENSOR

WORKING PRINCIPLE

Users can input commands via the pressure sensor module, triggering the pet terminal to perform stroking actions, enabling remote interaction.

HARDWARE SETUP

The user terminal consists of an ESP32 board, a pressure film sensor, and a linear voltage regulator module to detect user pressure input.

CODING | ARDUINO

1 LOAD DATABASE

Loads required libraries or databases for enabling program functionality.

2 WIFI CONFIGURATION

Configures Wi-Fi settings for network connectivity using predefined credentials.

3 PROGRAM INITIALIZATION

Initializes communication protocols and prepares the user terminal for data exchange.

4 DATA READING AND CONNECTION

Reads user inputs from sensors and sends data to the pet terminal.

1 ENVIRONMENT CONFIGURATION

Sets up the software environment by loading necessary libraries.

2 HARDWARE ENVIRONMENT CONFIGURATION

Initializes hardware components, including heart rate and vibration sensors.

3 CORRELATION FUNCTION SPECIFICATION

Prepares the pet terminal for operation, verifying hardware readiness.

4 PROGRAM INITIALIZATION

Defines functions for analyzing sensor data to interpret pet behavior.

5 THE LOOP FUNCTION EXECUTES THE JUDGMENT COMMAND

Monitors pet status in real-time and triggers corresponding responses.

6 MP3 PLAYER

Activates vibration modules to calm the pet during stress events.

7 TRIGGER VIBRATION FUNCTION

Plays pre-recorded sounds or music to comfort the pet.

8 SEND DATA TO THE SERVER

Transmits pet emotional data to the server for remote monitoring.

PROTOTYPING



Finishing electronic components



Stick hook and loop fastener



Sticking electronic components



Connect these lines



Configure programming content



Client connection testing



WEAR A PET PROTOTYPE AND VERIFY FEASIBILITY

SUMMARY

- Key functions include securing electronic components, establishing connectivity, configuring interaction logic, and testing real-world usability.
- The final step confirms the device's feasibility in creating effective sensory feedback for pets.

SUMMARY

- The user terminal and pet terminal work together to create an interactive system.
- The user terminal focuses on setting up network configurations, initializing the program, and facilitating data transfer to the pet terminal.
- Meanwhile, the pet terminal processes environmental data, monitors the pet's emotional state, and triggers appropriate responses such as vibration or sound playback.

PROTOTYPE

This prototype provides pet status monitoring, remote interaction, and device management through the Home, Pet Details, Message Center, Settings, and subpages.



USER TESTING



VERIFY CONTENT

The user test validated the app's efficiency and logic, focusing on data readability, 3D interaction intuitiveness, navigation clarity, and notification effectiveness. Metrics like task completion and user satisfaction confirmed the design's feasibility.

CONTENT OPTIMIZATION

Improvements included optimized navigation, added guidance, and enhanced feedback, boosting usability and emotional connection. High completion rates and positive feedback further proved the app's effective interaction logic.

PET DETAILS PAGE

INTERACTION AREA



Number of Interactions: 18
Different Striking Positions Trigger Different Interactions

EMOTIONAL TREND



BASIC INFORMATION

BREED: GOLDEN RETRIEVER
GENDER: MALE DOG
DATE OF BIRTH: JANUARY 15, 2020
WEIGHT: 28KG

DEVICE STATUS

SHIRT COLLAR: CONNECTED
SURVEILLANCE CAMERA: ONLINE
GPS: NORMAL

INTERACT

Users can tap or swipe the model to pet the pet, and the vibrating motor of the smart vest the pet wears will vibrate individually or continuously to simulate the feeling of touch-ing

PET'S STATUS

This page provides a comprehensive overview of the pet's status, including interaction counts, emotional trends, and visual analytics.

INFORMATION

It also displays essential pet information and device status, ensuring users stay informed about their pet's well-being and device performance.



Subpages support functions like **Video Calls** for real-time communication, **Device Details** for status monitoring, **Interaction Records** for tracking activities, and **Monitoring Information** to oversee pet health and safety.



The app's main interfaces include a **Home** page for real-time pet health updates and quick interactions, a **Message Center** for notifications and activity logs, and **Settings** for managing profiles and preferences.

WORKFLOW

STEP 1 PET DEVICE SETUP

- Caretaker or household member places the device on the pet securely.
- Ensures the device is activated and ready for interaction.

STEP 5 USER ADJUSTS INTERACTION MODE

- Based on live feedback, the user adjusts settings (e.g., vibration intensity or switching modes) via the app.
- Ensures a personalized and adaptive interaction.

STEP 2 HUMAN-PET INTERACTION

- If the pet shows significant emotional changes, the device sends a request to the user through the app.
- The user, prompted by the device or of their own volition, opens the app to initiate interaction.

STEP 3

PET DEVICE ACTIVATES

- Sensors detect the request and activate functions like vibration motors and speakers.
- The device delivers tactile or auditory feedback to the pet.

STEP 4 PET DATA CAPTURED

- Sensors collect data such as heart rate and emotional responses.
- Real-time data is transmitted back to the app for analysis.

STEP 6 INTERACTION SUMMARY AND RECORD

- The app generates a summary of the session, including interaction duration, activity data, and emotional insights.