

PROJECTS

#01



Piiiiick

Mixed Reality Game
Extended Reality/User Experience/Interface Design

#02



Fairsight

AI bias detection of digital products
Interface Design/User Experience/Artificial Intelligence

#03



Coral Securer

Sensory compensation human-computer interaction products for deaf children

Product Design/Interface Design/System Design/Programming

#04



Almour

Sensory compensation human-computer interaction products for deaf children

Human-computer interaction/Augmented Reality/Arduino Prototype

#05



Eco-Collie

EcoReWild's Innovative Approach to Sustainable Grassland Restoration

System Design/Product Design/Economy



piiiick online

01 Mixed Reality Game

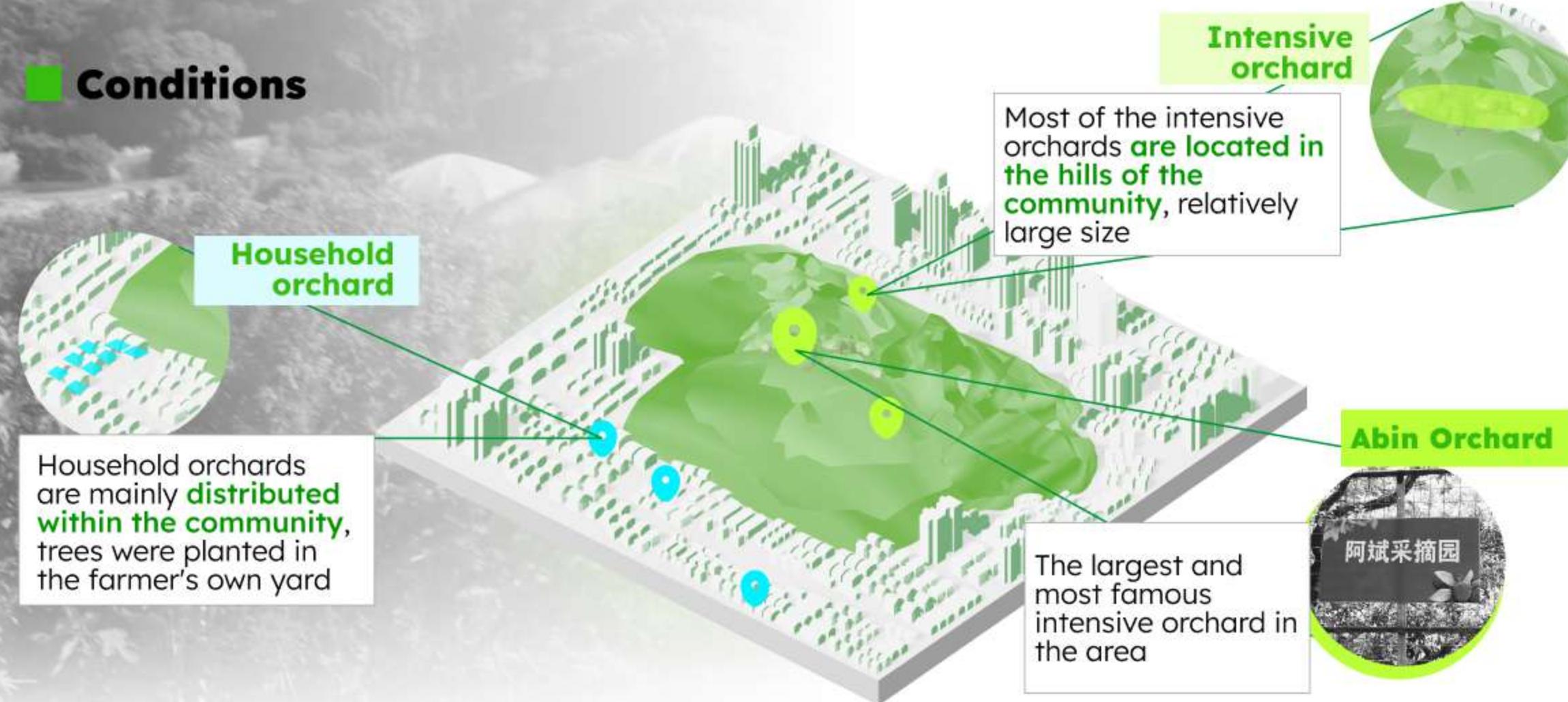
One spring, I went to the Big Float community to do some research. And chose Abin orchard for design. As a way to solve problems, mr Games are very suitable as a link between human and nature.

I developed a mr demo of the orchard and decided on the form of the game based on how the user would interact. This project was the beginning of my understanding of virtual reality and game interaction, and it is also my favorite project

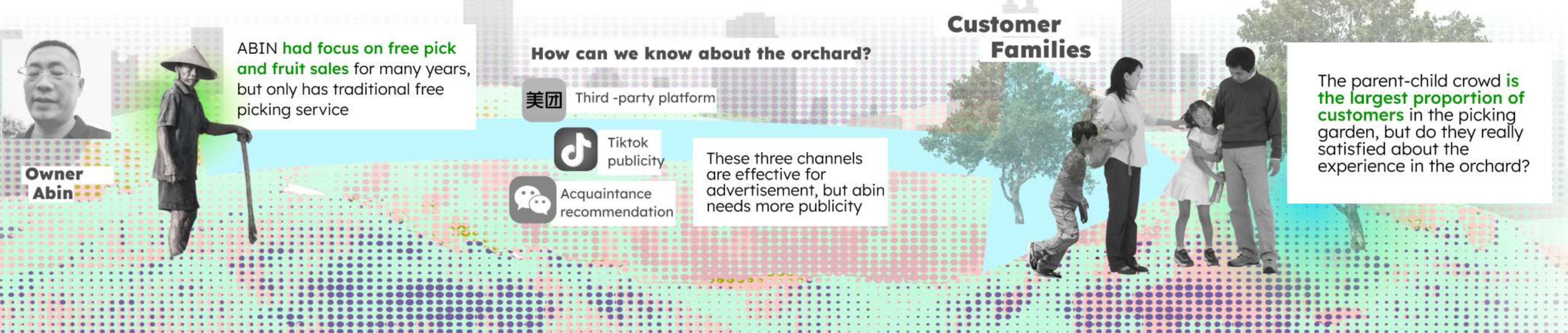
MR Design
Interaction Design
User Experience Design

Time: 2023.3-2023.12
Individual Projects

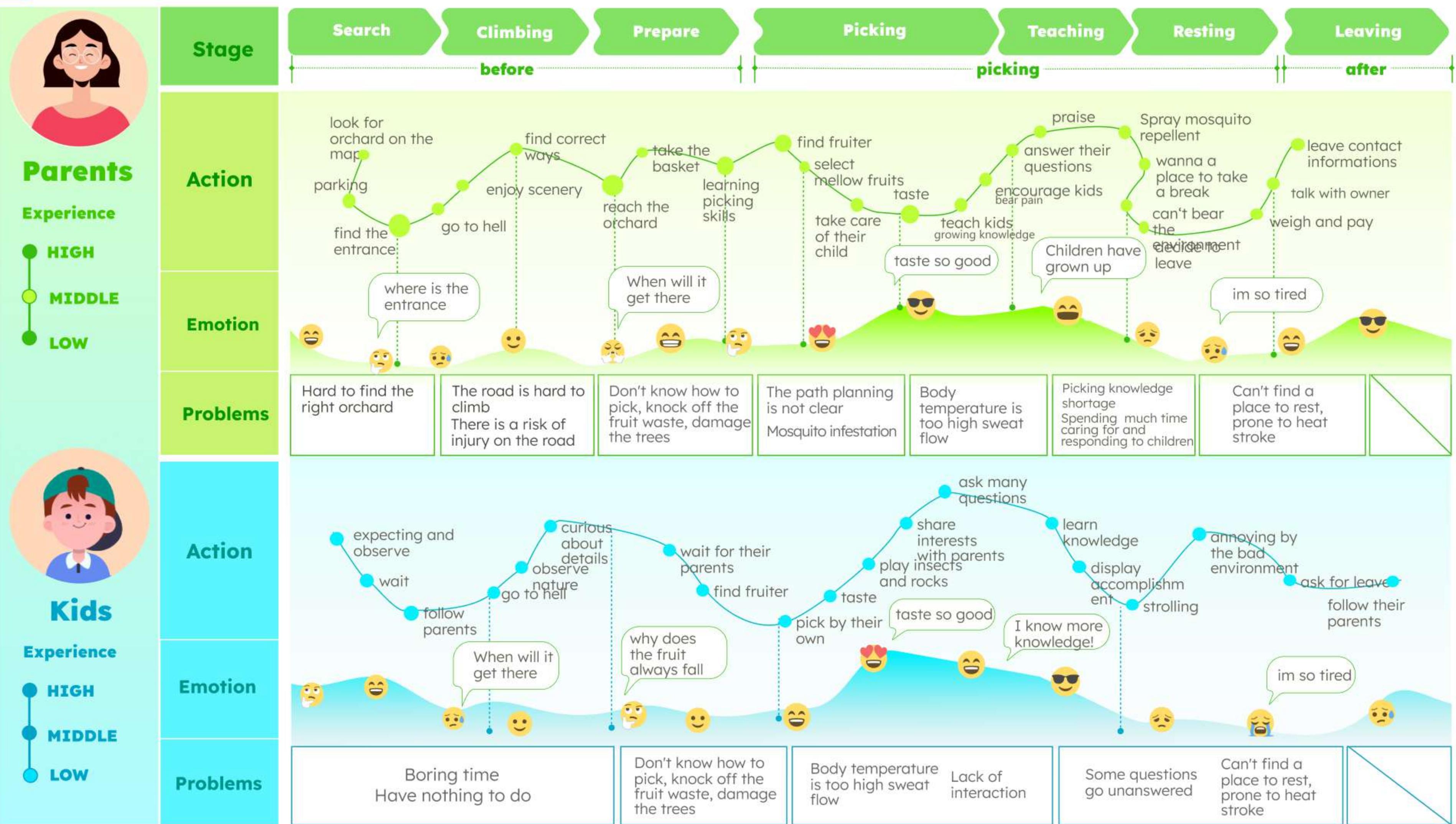
Behind our school, The Big Float community, which are famous for free pick, now has recession of development.



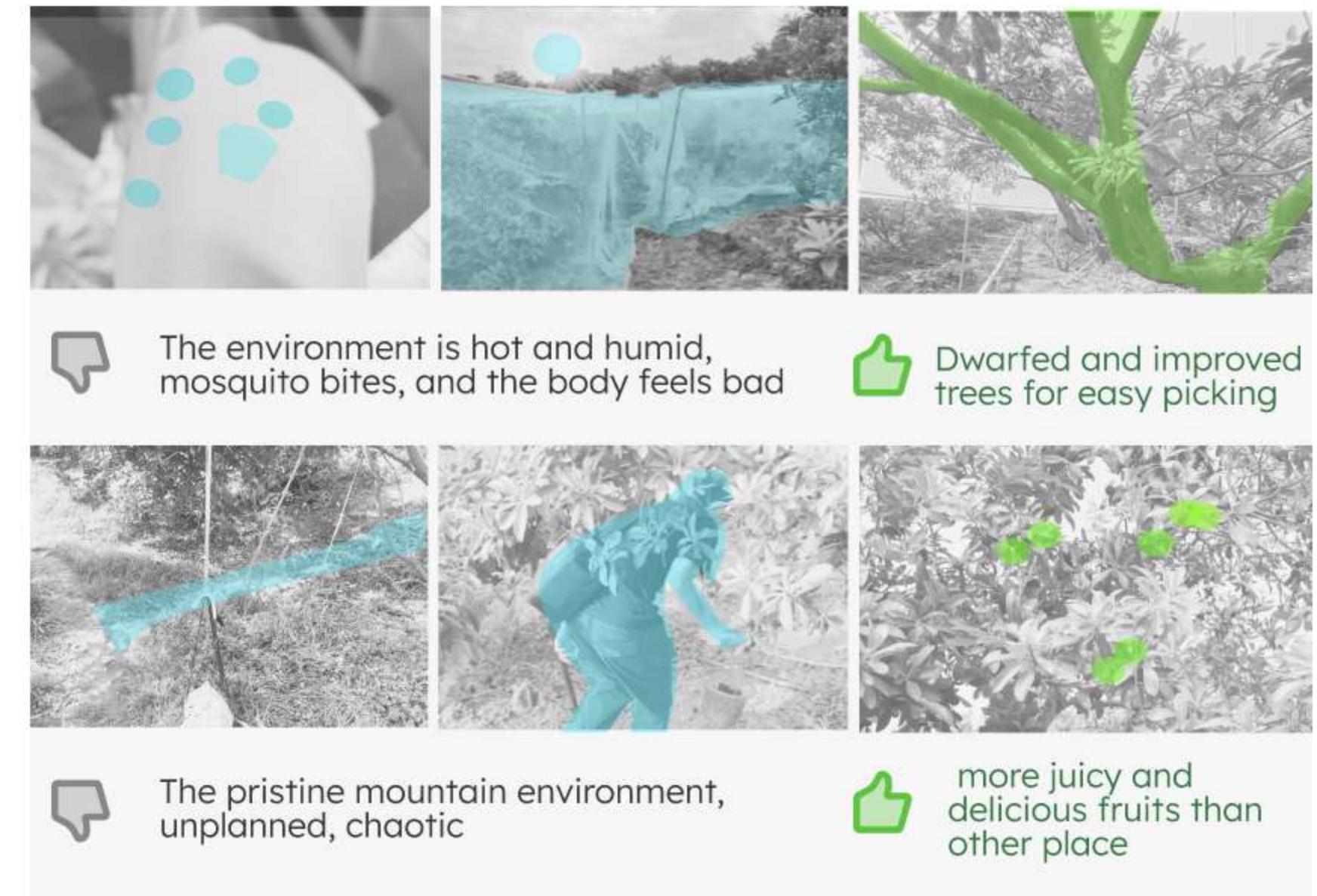
Existing business model of Abin



USER JOURNEY MAP



Field Research



RESEARCH

Interview

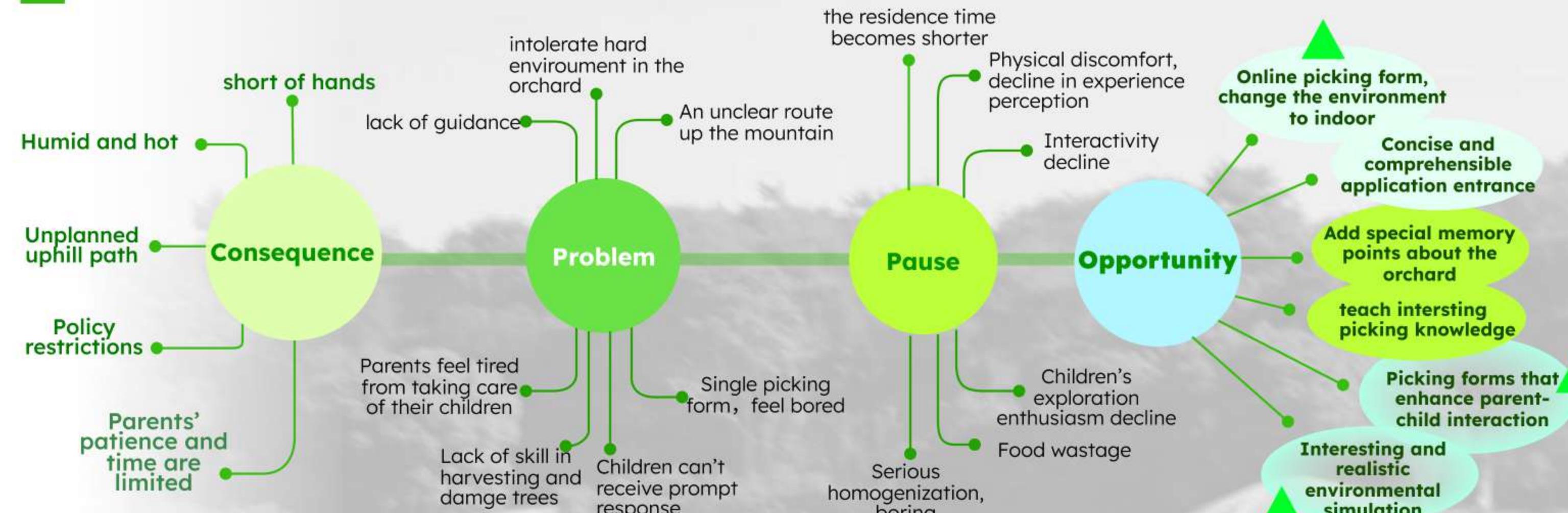
In order to learn more about the experience at Abin Orchard, we interviewed several visitors who have picked fruit at Abin Orchard for their experience. The following is the framework for setting the interview questions



We interviewed five families, and here we selected the most representative three individuals. Their expectations were also highlighted.



PROBLEM TREE

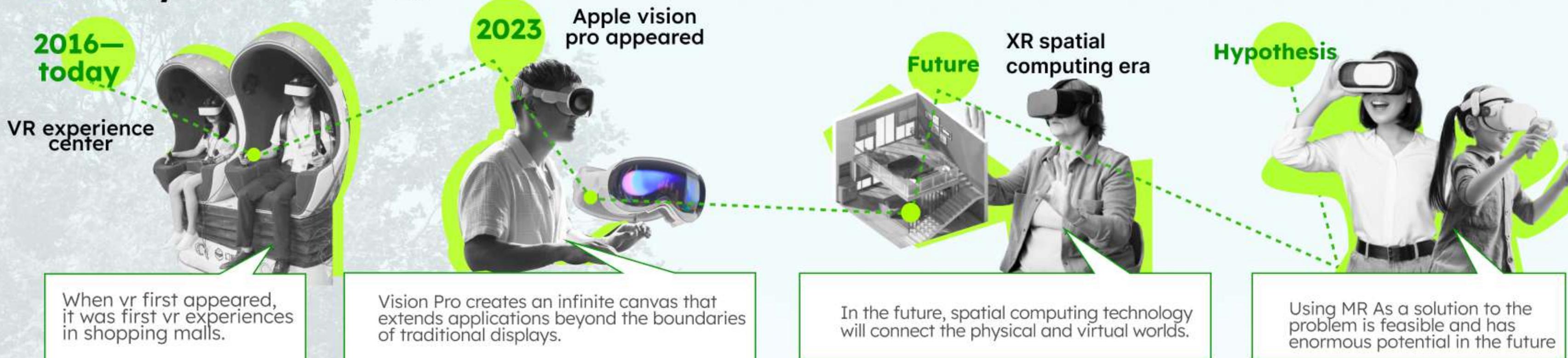


Characteristics parent-child interaction in picking



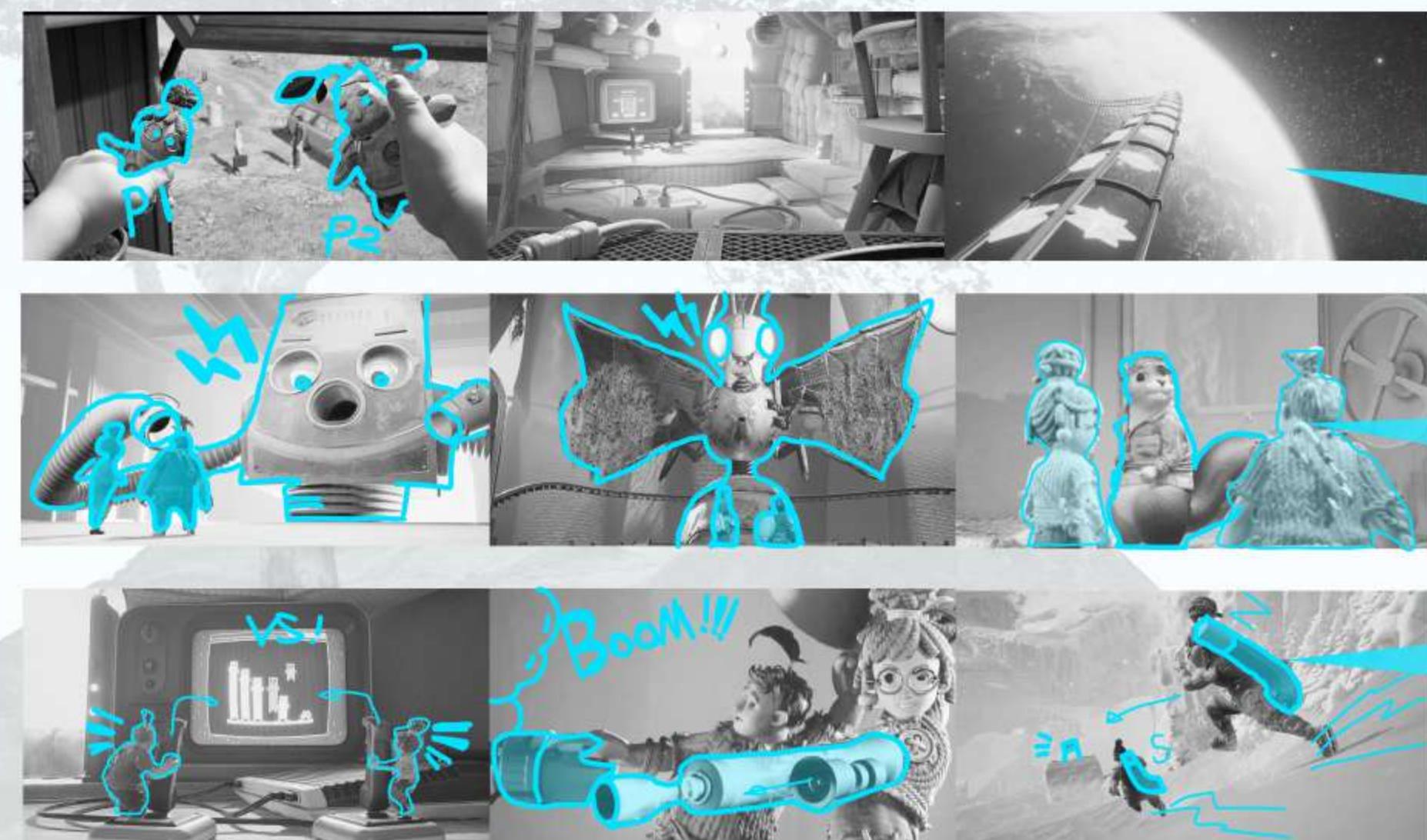
IDEATION

History and future of MR



CASE STUDY

IT TAKES TWO



Insight

Through the comparison and exploration of the game, it absorbs the construction of the game form of interaction between two people

Scenes with different themes connected to the real scene

Different NPCs for each level, Guide or challenge

Two people cooperate or compete while engaging both parties

Problems Statement

Competitor



Currently, In the other picking gardens, you can not only pick fruits but also find facilities such as **farmhouse entertainment** and various **parent-child recreational activities**,such as reading and painting.

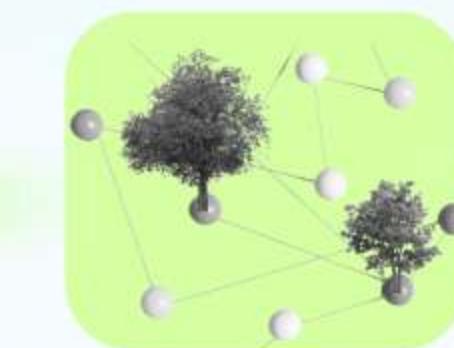
Abin's expectations



Therefore, Abin hopes to improve this situation, focusing on the following three aspects:



improve the experience



pluralistic development



Multiple income

CONCEPT DEVELOPMENT

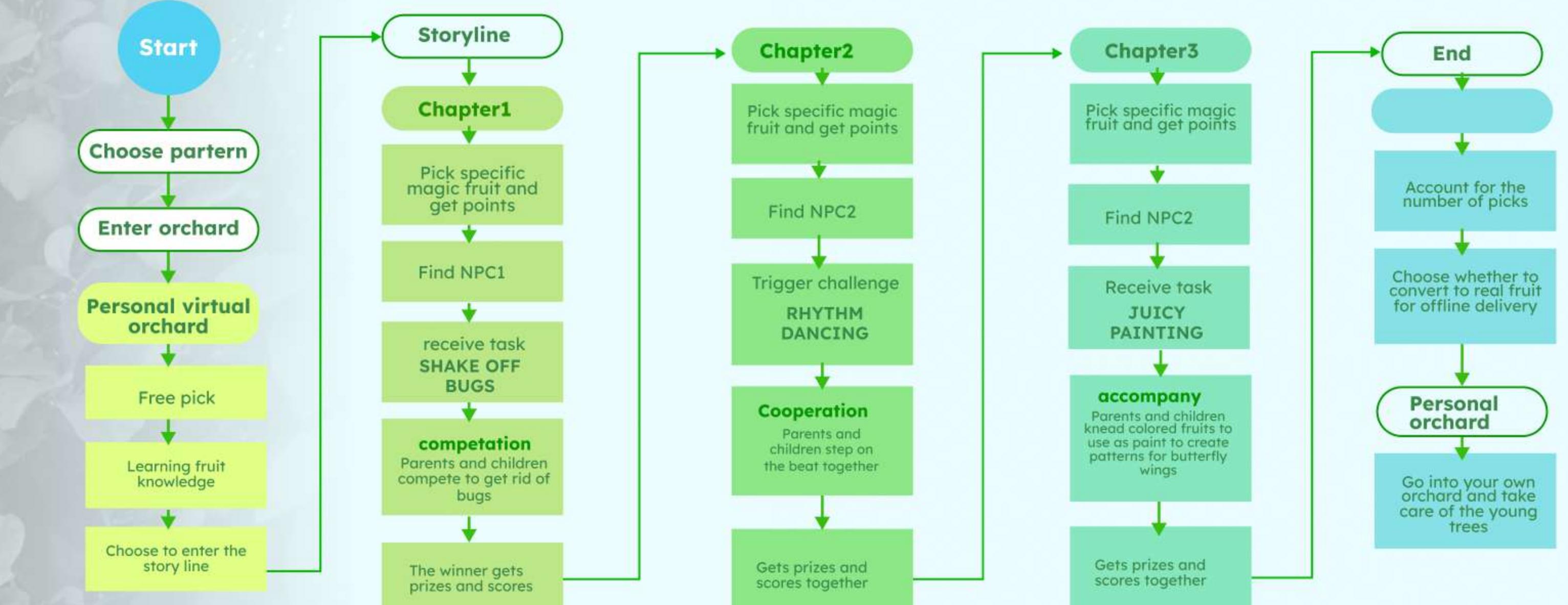
Mind Map

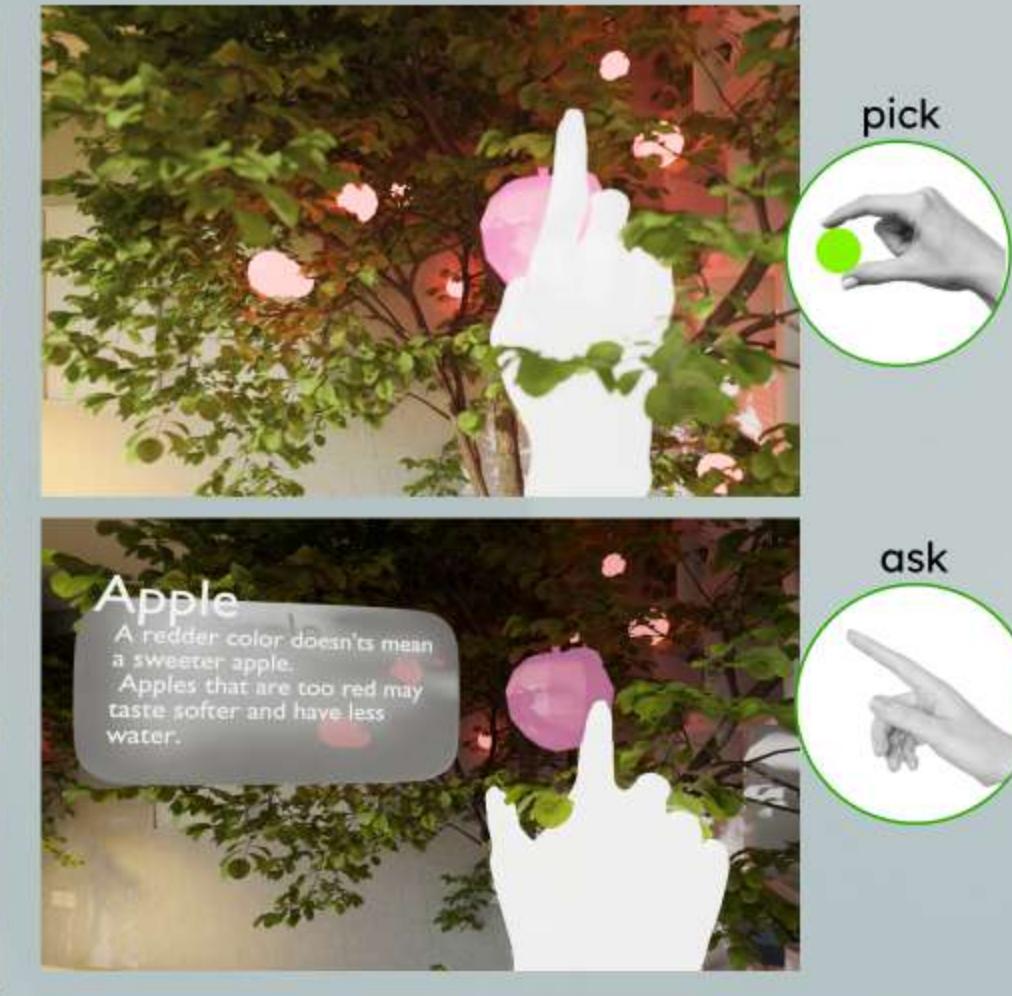


Scene concept



Game Flow





Rhythm game cooperation

The npc in Scene 2, is a musician. Inspiration is exhausted, and he needs players to help him complete new music creation and provide new musical note inspiration



Motor play competition

Players need to shake off the bugs. Parents and children compete to see who shakes off the most bugs

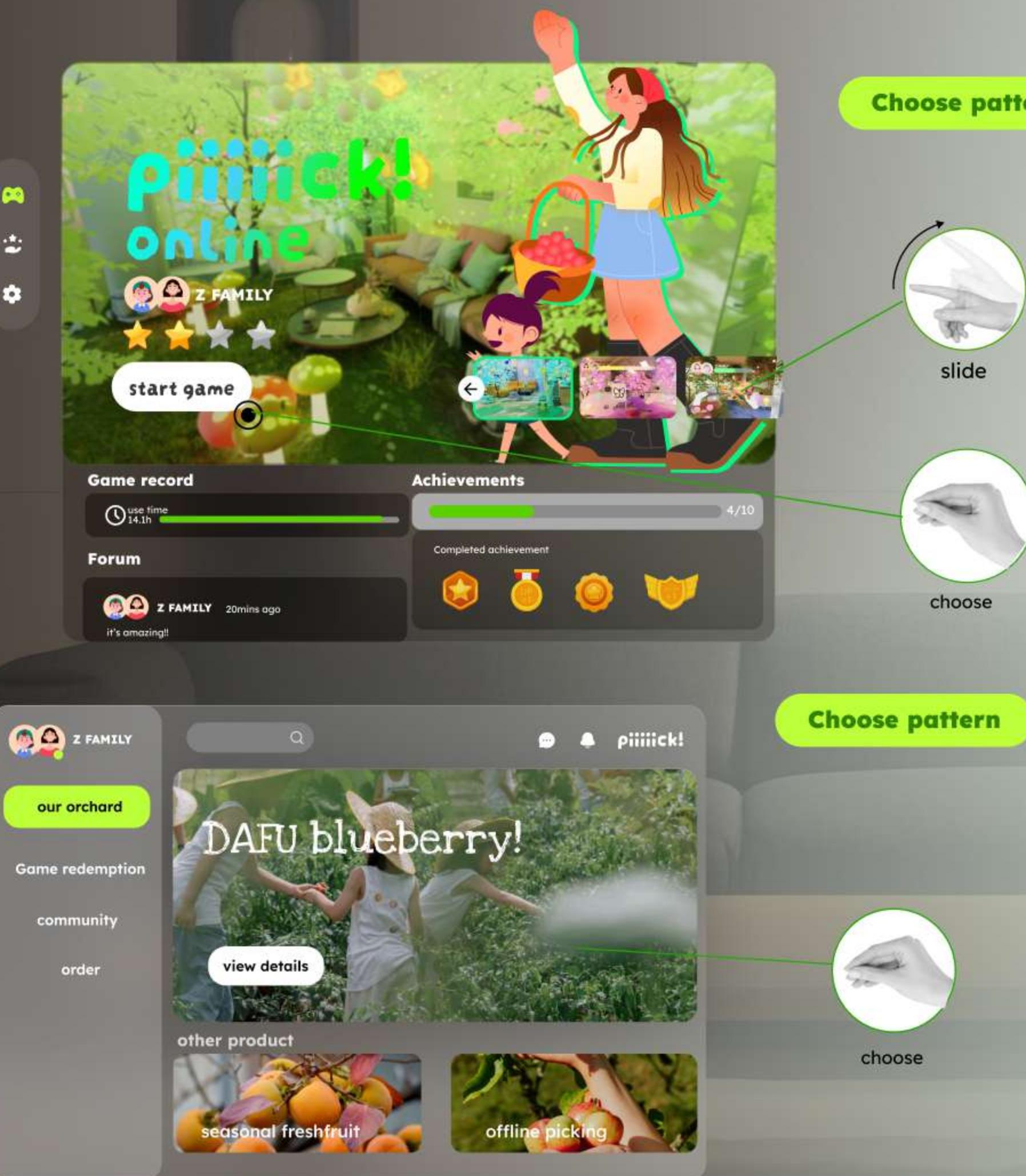


creative game creation

Players need to pick colorful fruits, turn them into paint, and draw a new wing for the npc on the drawing board



INTERFACE

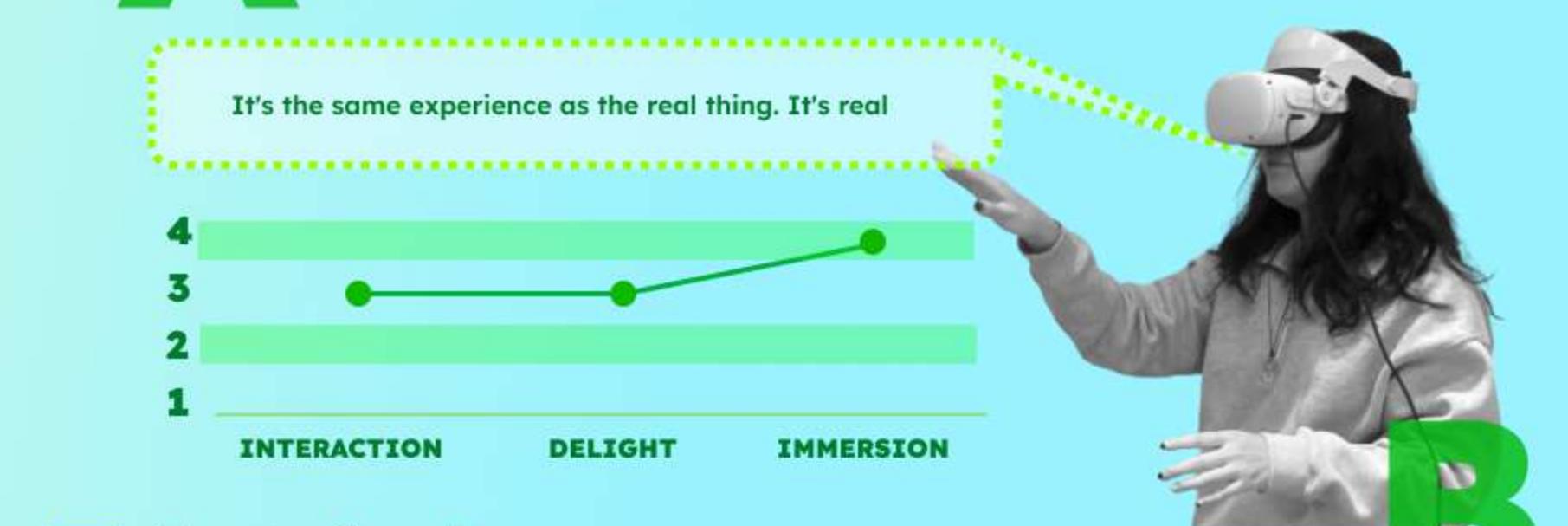
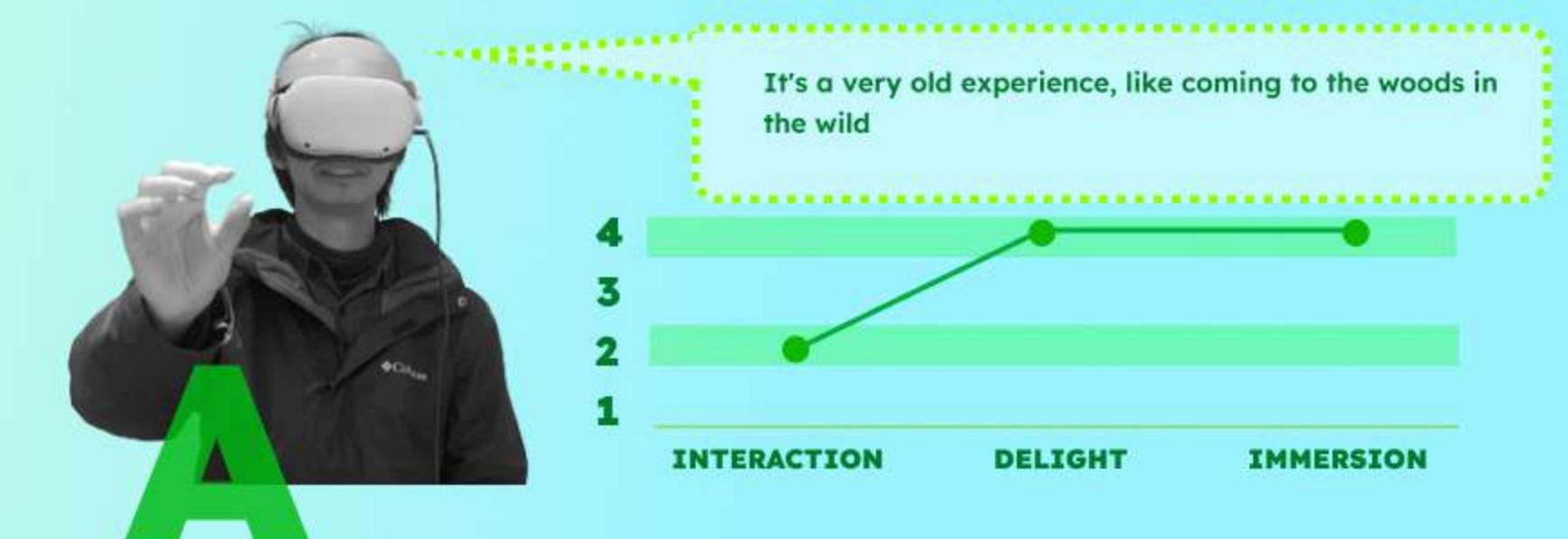


USER EXPERIENCE TEST

Unity demo



User Feedback



Part of code

```

// Unity C# script example
using System.Collections;
using System.Collections.Generic;
using UnityEngine;

public class BasketController : MonoBehaviour
{
    public void PickFruit()
    {
        // Logic to handle picking fruit
    }

    public void DrawWing()
    {
        // Logic to handle drawing wing
    }
}

```

Fairsight

02 AI bias detection of digital products

In an age where digital content is ubiquitous, discerning bias—both human and algorithmic—becomes paramount.

Our platform, Fairsight, delves into this challenge, offering users more than just search results. It evaluates content for biases, bringing to light not only the inherent prejudices in information but also potential skewing by AI algorithms.

Artificial Intelligence
User interface Design
Interaction Design

Time: 2023.8-2023.10
Individual Projects



Project Context

AI Bias and Impact

AI bias can significantly impact society by maintaining systemic prejudices found in historical data. If not addressed, these biases can skew decision-making, reinforce discriminatory practices and denying equal opportunities based on race, gender, or socio-economic background. Here are two examples:

Disproportionate Misidentification:

according to the NIST research that evaluated facial-recognition algorithms from around 100 developers, the algorithms falsely identified African-American and Asian faces 10 to 100 times more than Caucasian faces.

The probability of being identified incorrectly :



Women Punishment

In Amazon's recruitment tool, an AI system trained on resumes predominantly submitted by men, women were penalized for terms like 'women's chess club captain' and preferred candidates without such terms, leading to a gender-biased selection.



How it affects candidate rankings:

- 1 Words that contain the word "female."
- 2 Choose verbs with a masculine bent
- 3 Graduates of women's colleges were downgraded

It's unclear how many minority groups have actually been affected by ai. In the future, people with backgrounds that do not meet the standards of the general public are likely to be affected by ai algorithms

AI Misinformation Bias: Challenges of the Future's Primary Content Creator

2023

Today, AI is transforming the digital realm, creatively generating content ranging from news articles to visual arts, influencing our online interactions in innovative ways

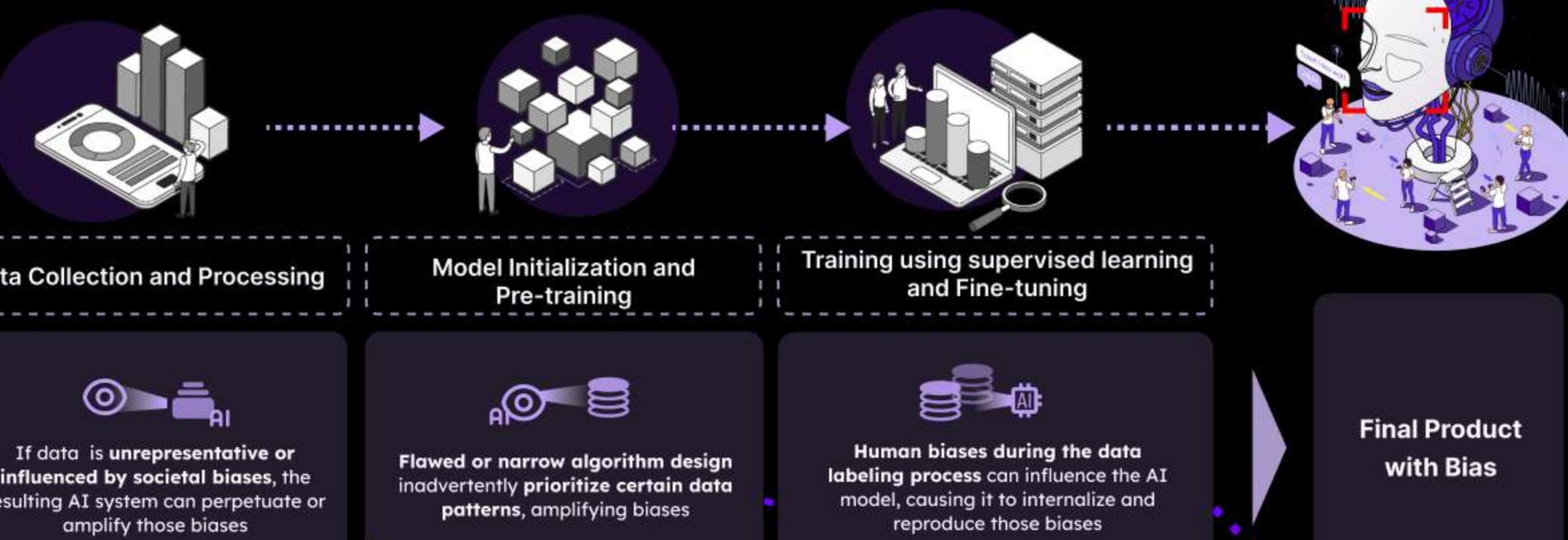
2033 and the future

In the near future, AI is going to become the main producer of our digital content, significantly influencing how we perceive and interact with the world.

RISK

As AI assumes a dominant role in digital content creation, the risk of **Misinformation Bias**—where AI perpetuates and amplifies discriminatory or skewed information—grows, potentially warping public perceptions and influencing societal beliefs.

How Was AI Bias Formed



Past, Present, and Future of AI Misinformation Bias: Bild Example

Germany's top newspaper, Bild, considered adopting AI to replace certain editorial roles, sparking concerns about journalistic accuracy and AI's potential biases.

PAST

Before AI
Human editors meticulously shaped and ensured accurate news stories

NOW

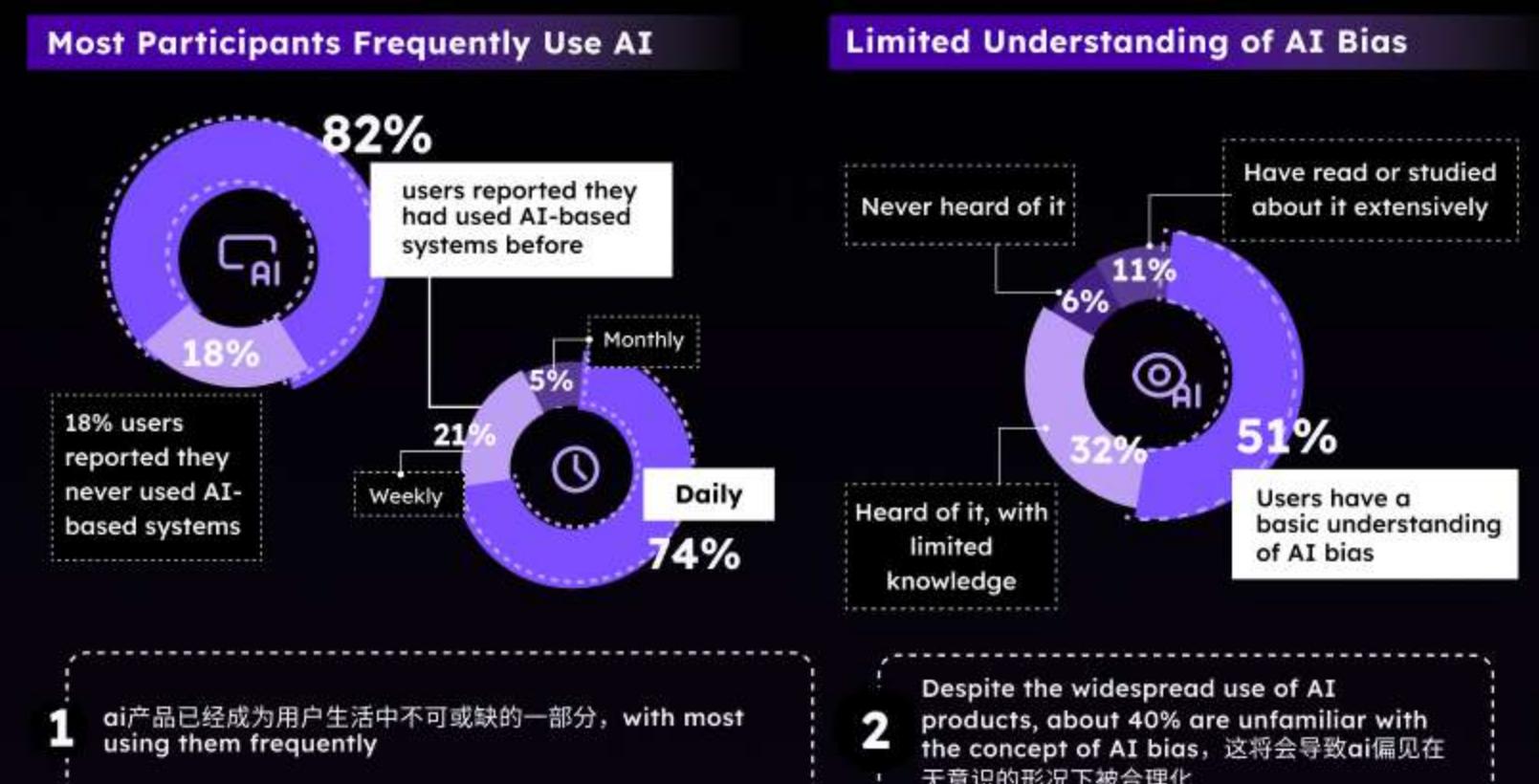
With AI
Bild's AI adoption in editorial process highlighted risks of misinformation, underscoring the challenges of automating content creation tasks

FUTURE

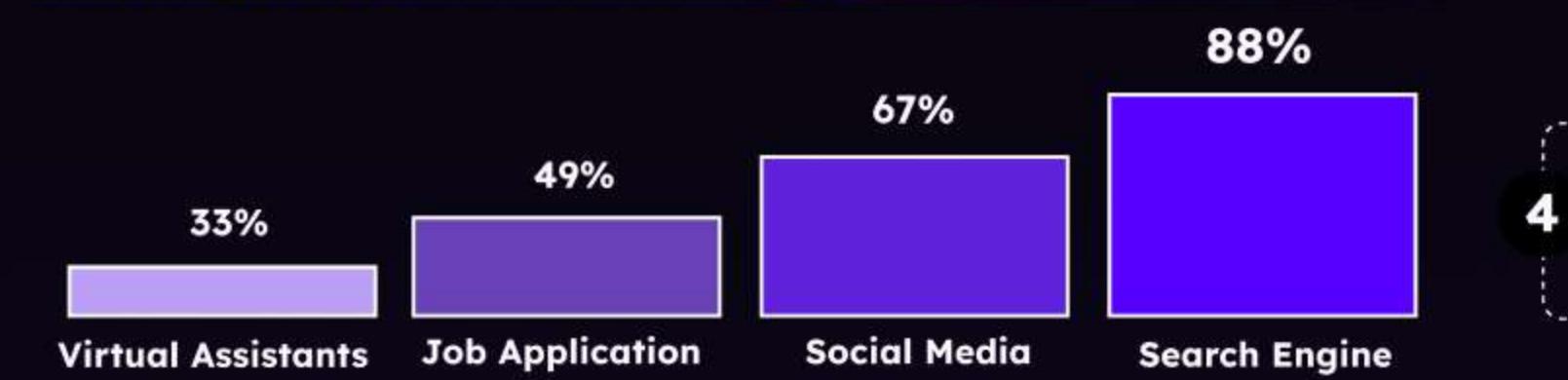
The Future of AI Bias
As AI progressively dominates creative tasks, society might confront amplified existing social biases and widespread misinformation, reshaping public perception and trust

User Research

User Survey



Search engines: top platform for information gathering



Expert Perspective



Need for Interdisciplinary Research and Ethical Education on AI Practitioners: A call for sociologists to collaborate with computer scientists, ethicists, and other professionals to holistically study and address the challenges posed by AI

Interview



Goal: To utilize AI-powered tools for study and job search
Challenge: Has noticed certain biases in search engine autocomplete suggestions that don't align with her search intent
Quote: "I felt like the algorithm was typecasting me based on gender stereotypes instead of my needs."

Goal: Wants to contribute to the development of unbiased AI systems

Challenge: Worried about the societal impacts of unchecked AI systems

Quote: "Fixing AI bias isn't a one-size-fits-all deal. It's a team effort — collaboration between tech experts, ethicists, and sociologists is crucial."

Ideation

Brainstorming

Hypothesis A
Diminish bias during the **data collection stage of AI products**

Solution 1: Create a clean database/a bias detection tool for AI practitioners, cutting prejudice from the data collection phase of AI model development

Pros: Provide AI experts access to bias-free data

Cons: Using a 'clean' database may cause overconfidence and skipped evaluations

Hypothesis B
Minimize pre-existing biases among AI developers

Solution 2: Create educational resources to improve ethical training for AI practitioners

Pros: Boost AI practitioners' ethics knowledge to avoid personal bias in tasks like data labeling

Cons: Education resource effectiveness varies; some lack practicality for AI practitioners

Hypothesis C
Reduce the negative impact of existing AI bias on the broader community

Solution 3: Increase people's awareness of AI ethics by detecting and visualizing existing AI bias in search engines

Pros: By making people more aware of AI biases, they can make more informed decisions and use caution when interacting with AI systems

Cons: Over-highlighting biases might make the public overly wary or skeptical of all AI technologies, even those that are relatively unbiased (good or bad)

Given our project timeline, we prioritized **Solution 3**, focusing on raising AI ethics awareness using detections and visualizations of AI generated biases in search engine. While Solutions 1 & 2 address broader issues, effectively tackling them would require in-depth insights from AI practitioners about their development workflows.

Design Requirements

HMW: minimize the negative effects of AI-driven bias and misinformation for users of search engines, considering the increasing influence of AI on future search results?

Requirement 1: Design should detect and visualize detailed bias metrics for users

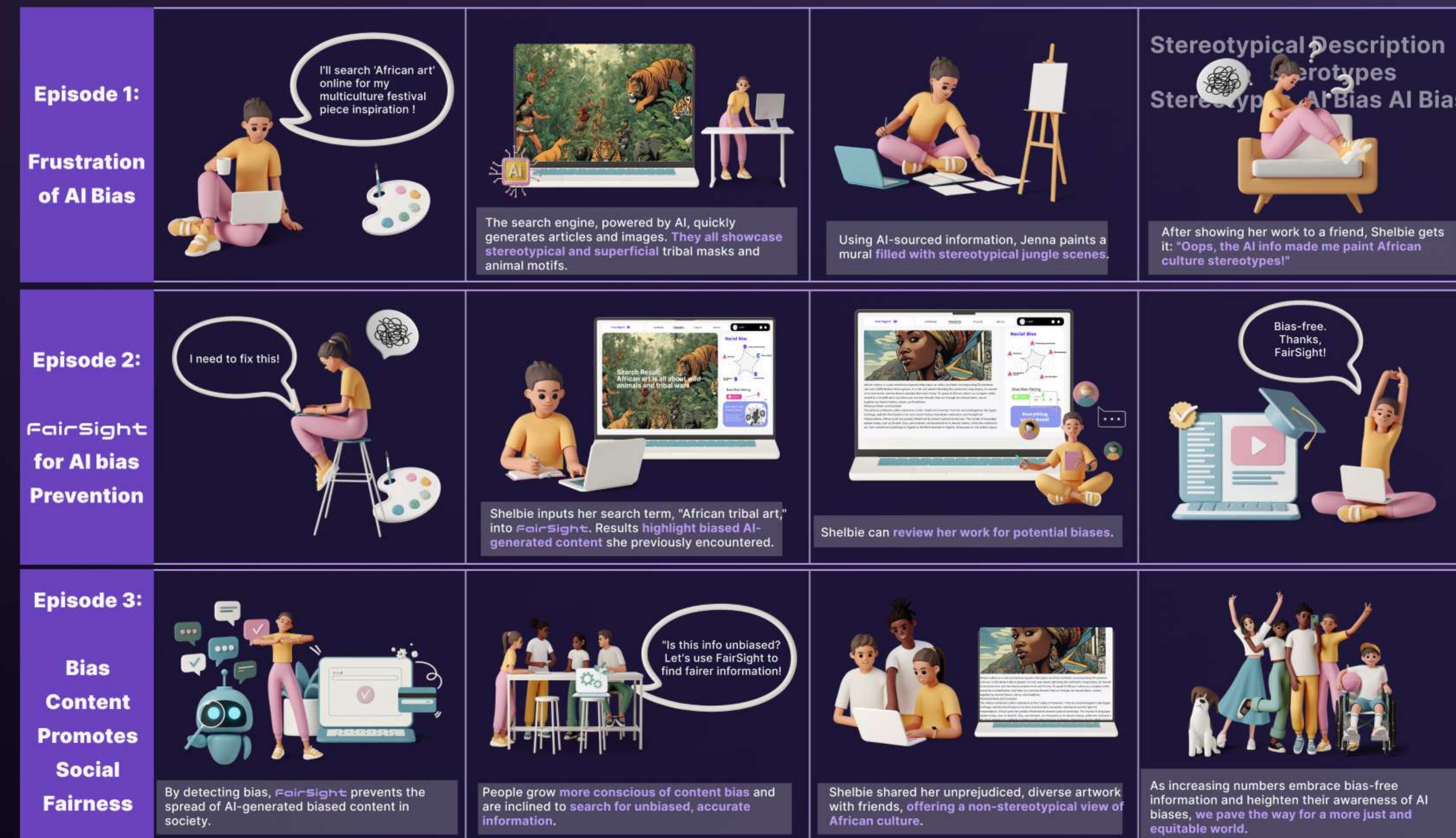
Requirement 2: Design should ensure users to access to unbiased, diverse information

Requirement 3: Design should alert users of high-bias content

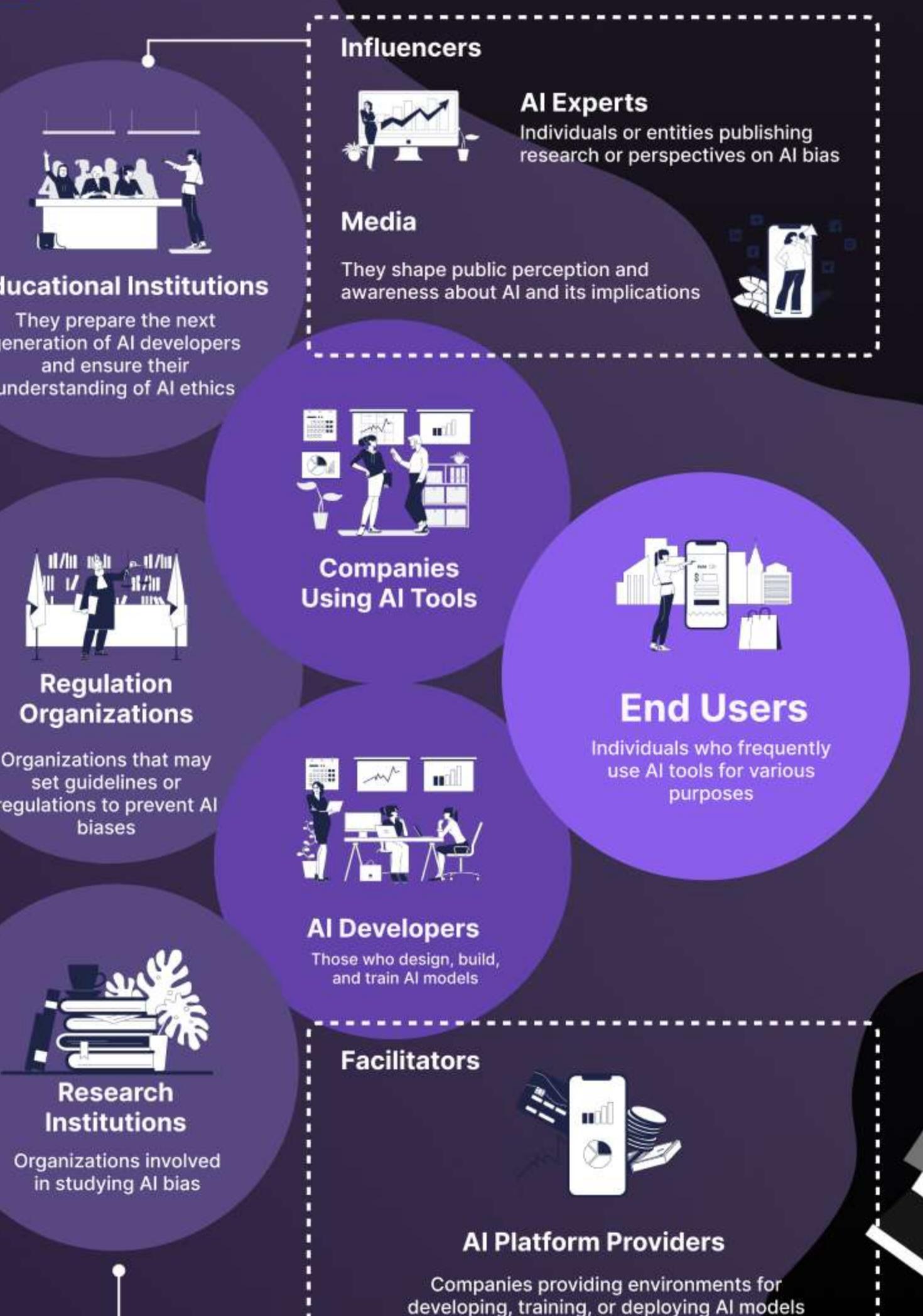
Requirement 4: Design should let users assess their own content for biases

Storyboard

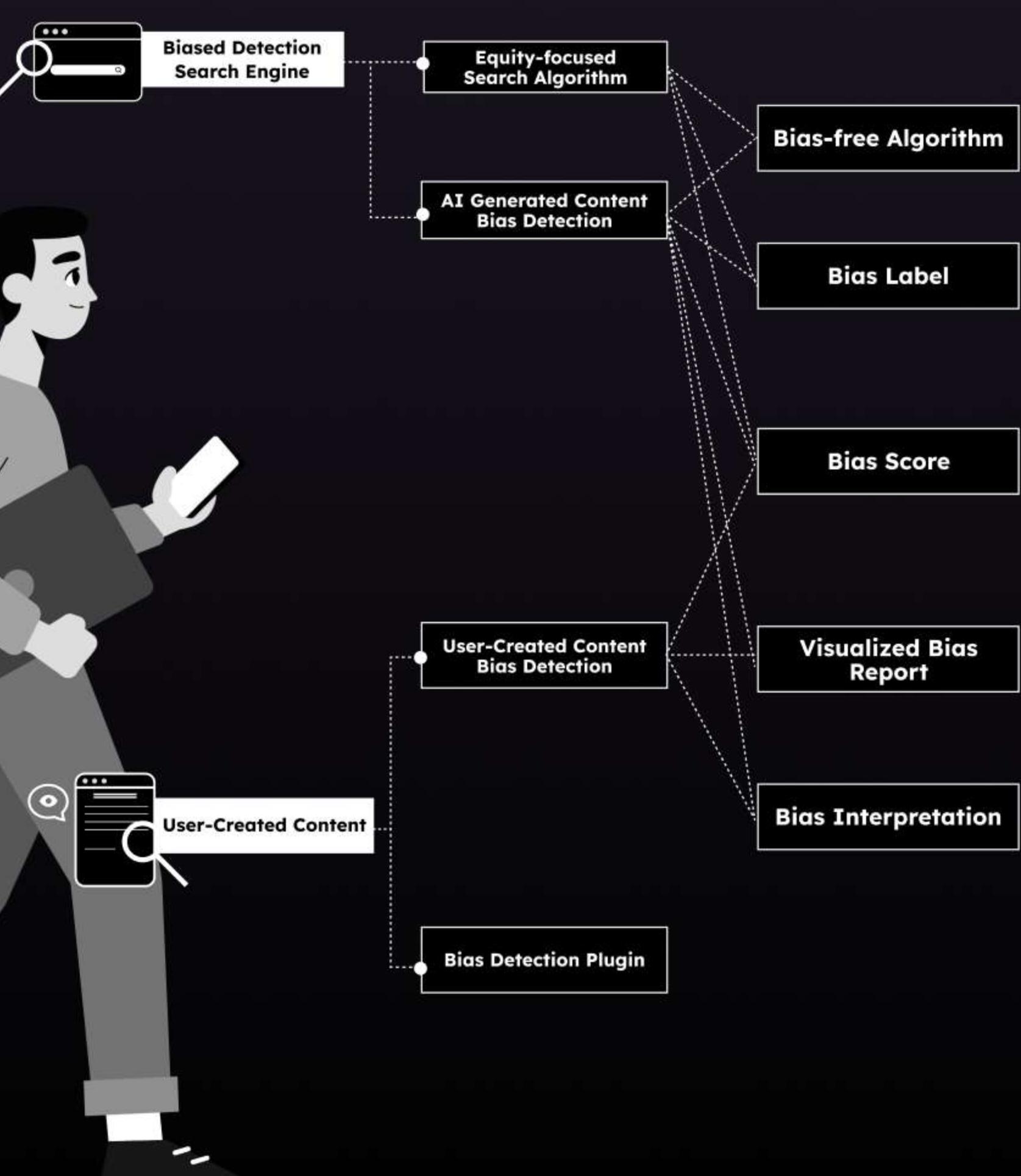
Story Background: By 2030, AI generates most online content. Shelbie, a college student gathers information online for her multicultural festival painting



Stakeholder Map

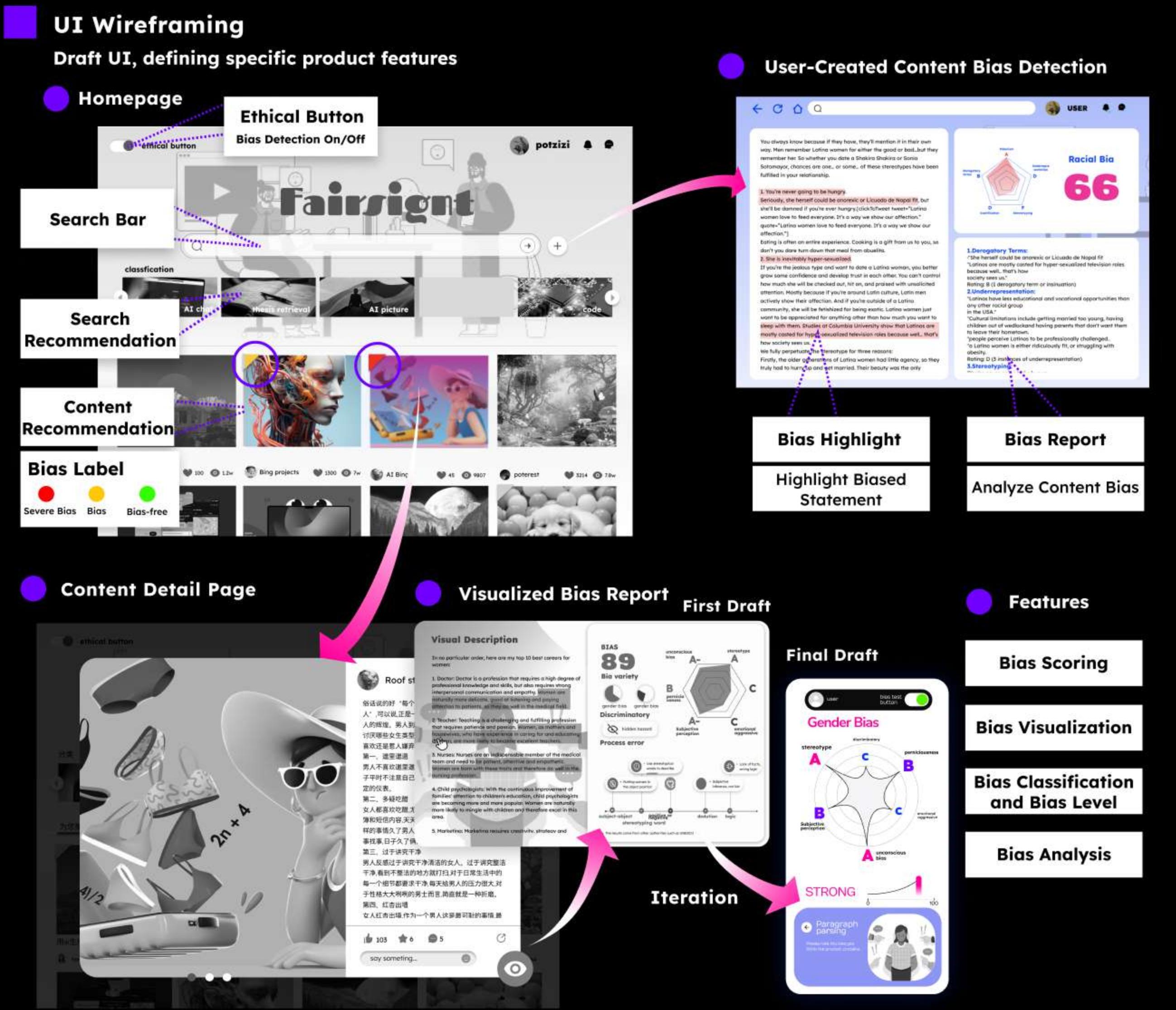
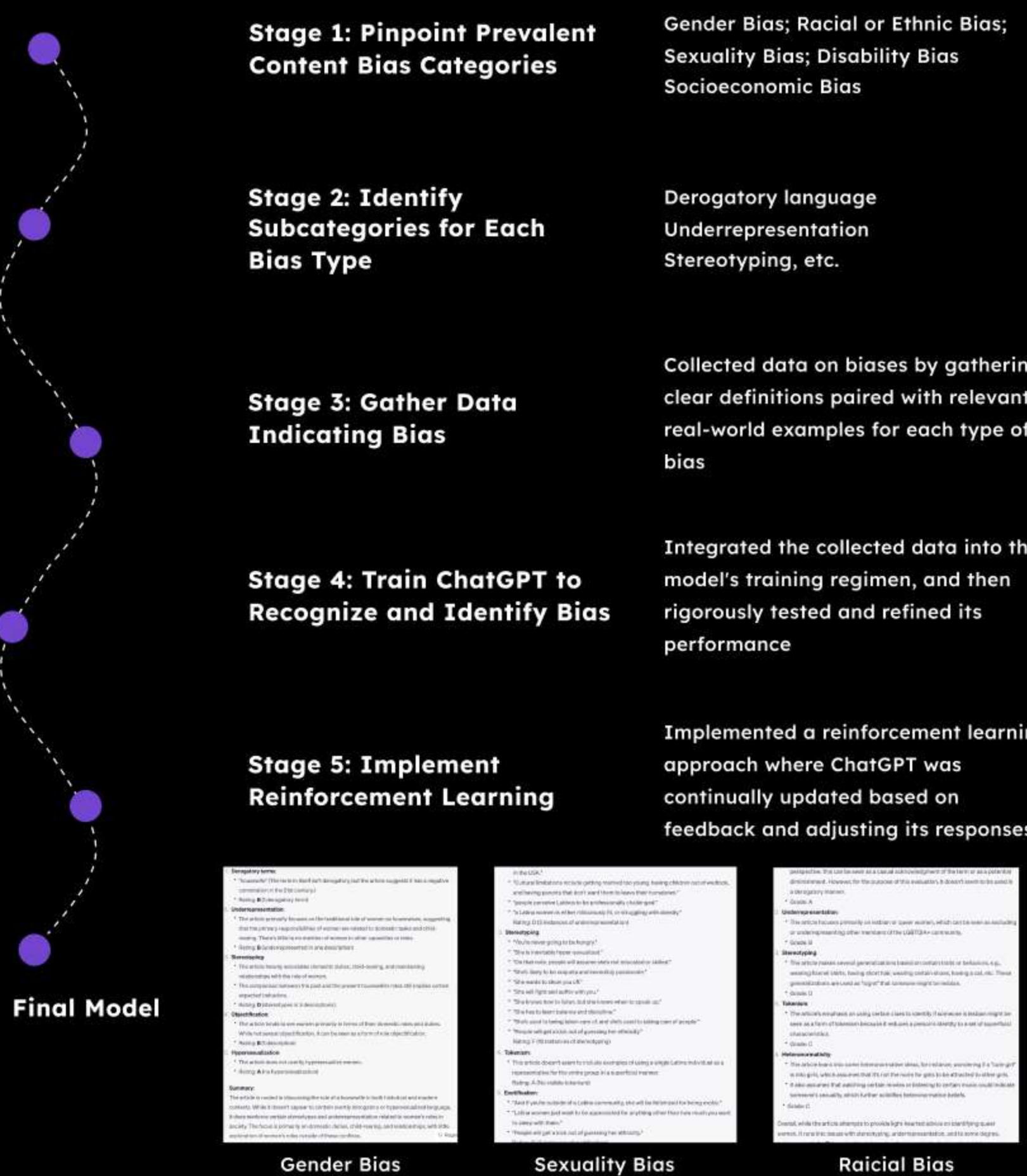


Work Flow



Design process

Developing Fine-tuned Content Bias Detection Model



User Testing

UI designer Simon



User Feedback 1:

From an engineer's perspective, FairSight is not only feasible but also a necessity. In a future where AI largely creates online information, tools like FairSight are crucial in ensuring that the content is unbiased and just.

Potential Issues

- Some interface features are unclear and hard to find after tasks are assigned
- The bias information tags are imprecisely positioned, complicating the assessment of the associated bias level

Solution 1:

- Place primary functions in the center
- Use more distinct colors for differentiation

Solution 2:

- Reduce text descriptions, visualize quantitative information

User Feedback 2:

FairSight really opens my eyes to the biases that exist in AI generated content. When I use this tool it helps me notice the micro-discriminations that I might otherwise miss. I think it has the potential to become an educational tool that helps children identify and prevent the use of biased information.

Potential Issues

- Scoring as a form of measurement is too direct and can be confusing for the users
- Is the AI not sufficiently objective?

Solution 3:

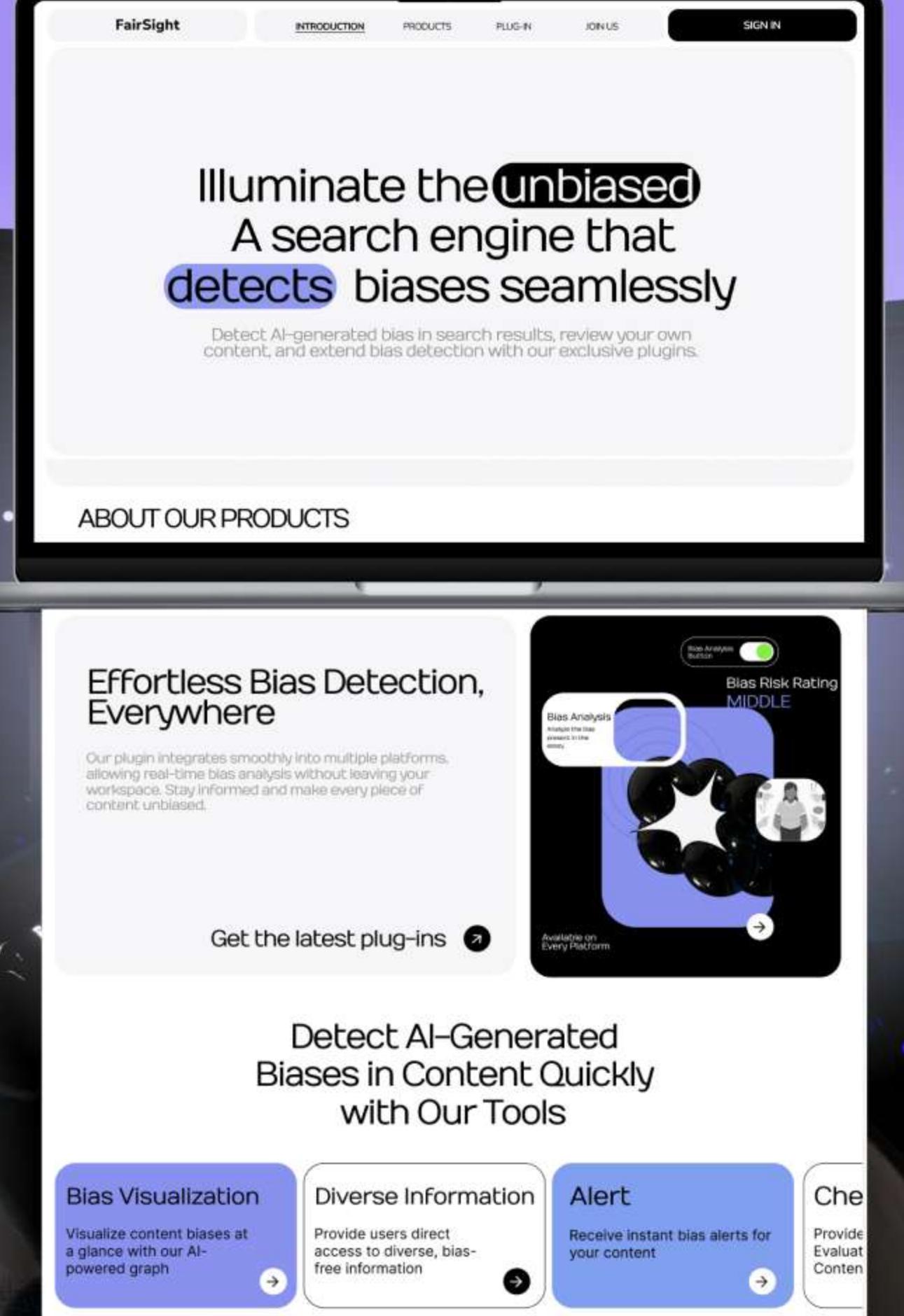
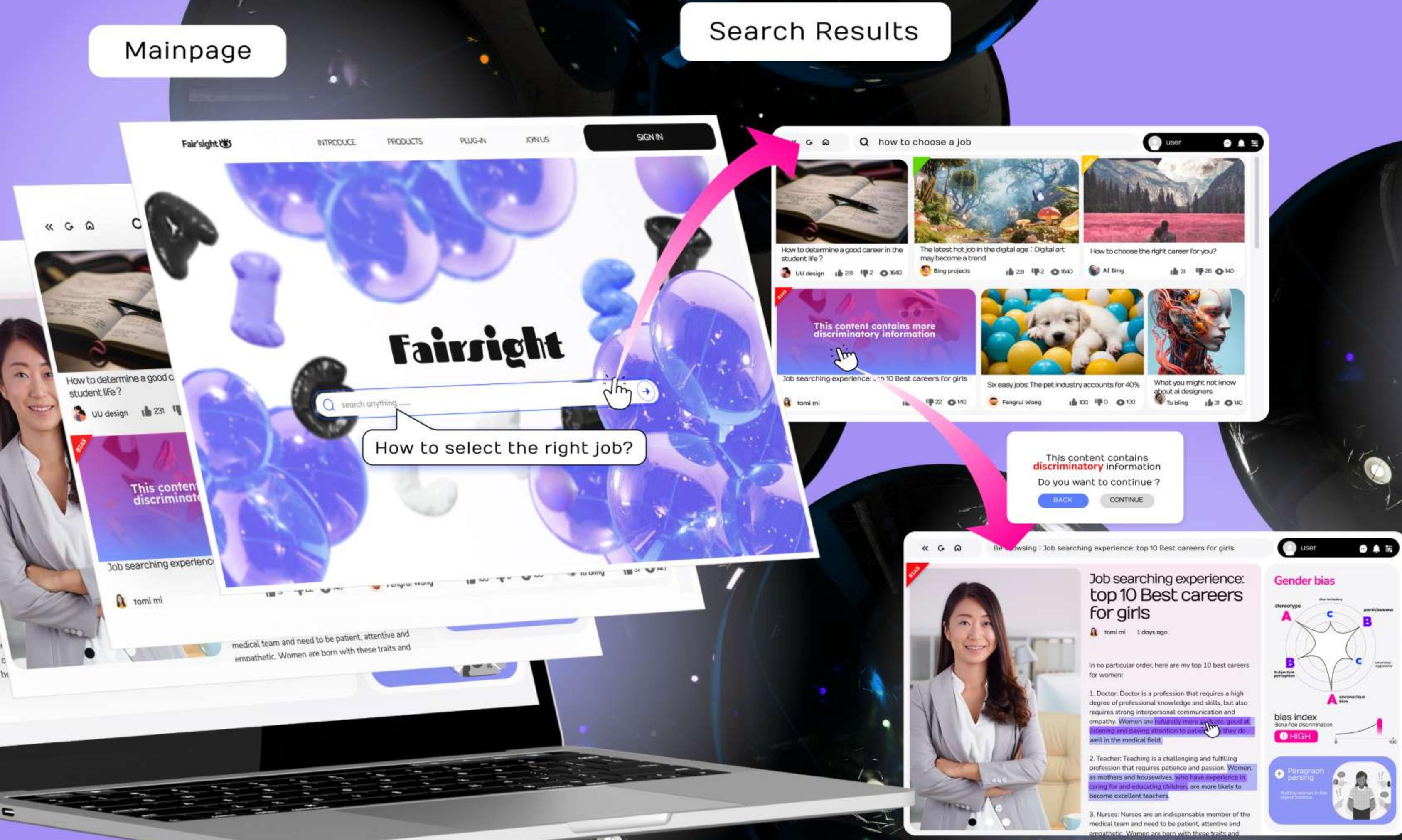
- Use bias level instead of quantitative scoring

Solution 4:

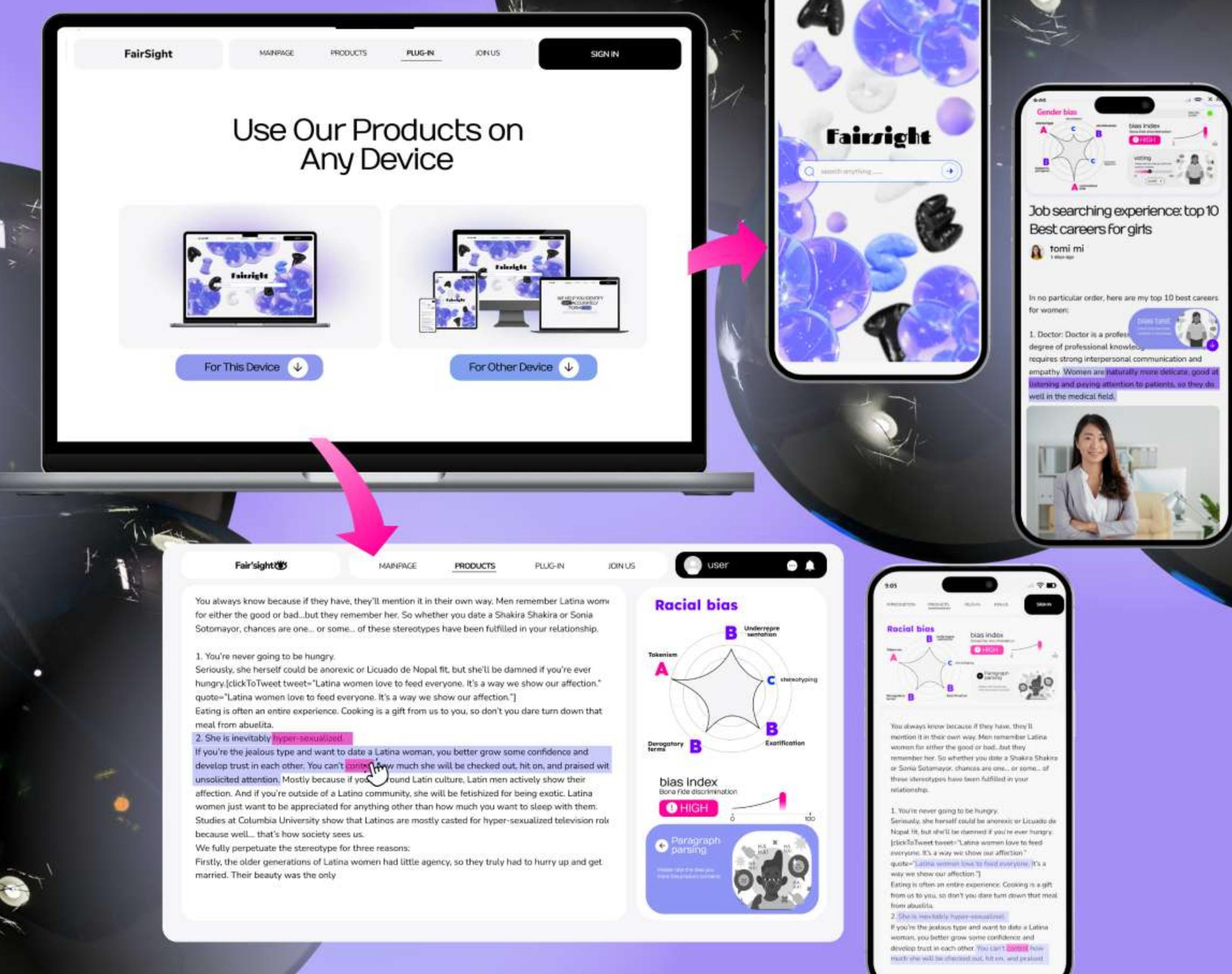
- Use annotations or Q&A sections to demonstrate the legitimacy and training process of the AI-generated mockup for bias detection

Final Design

Introduction

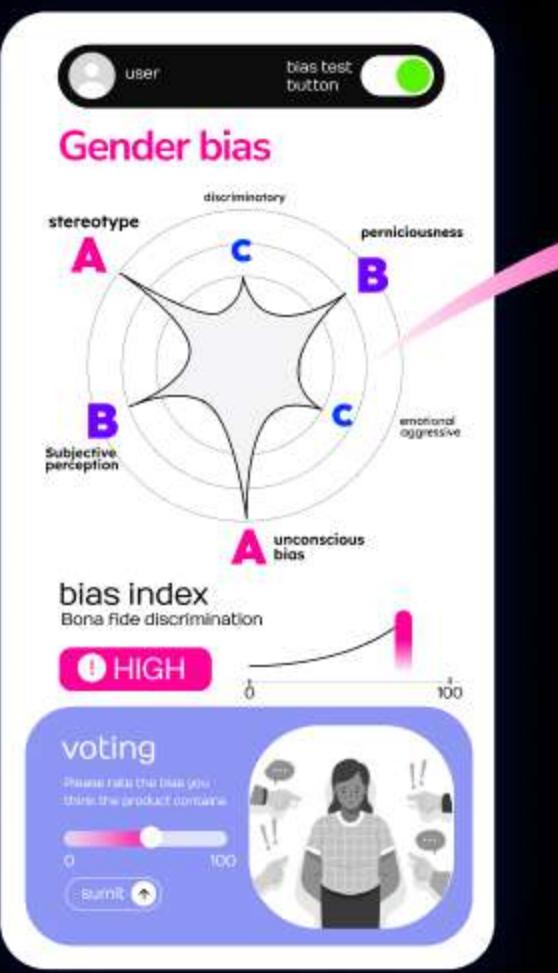


Products

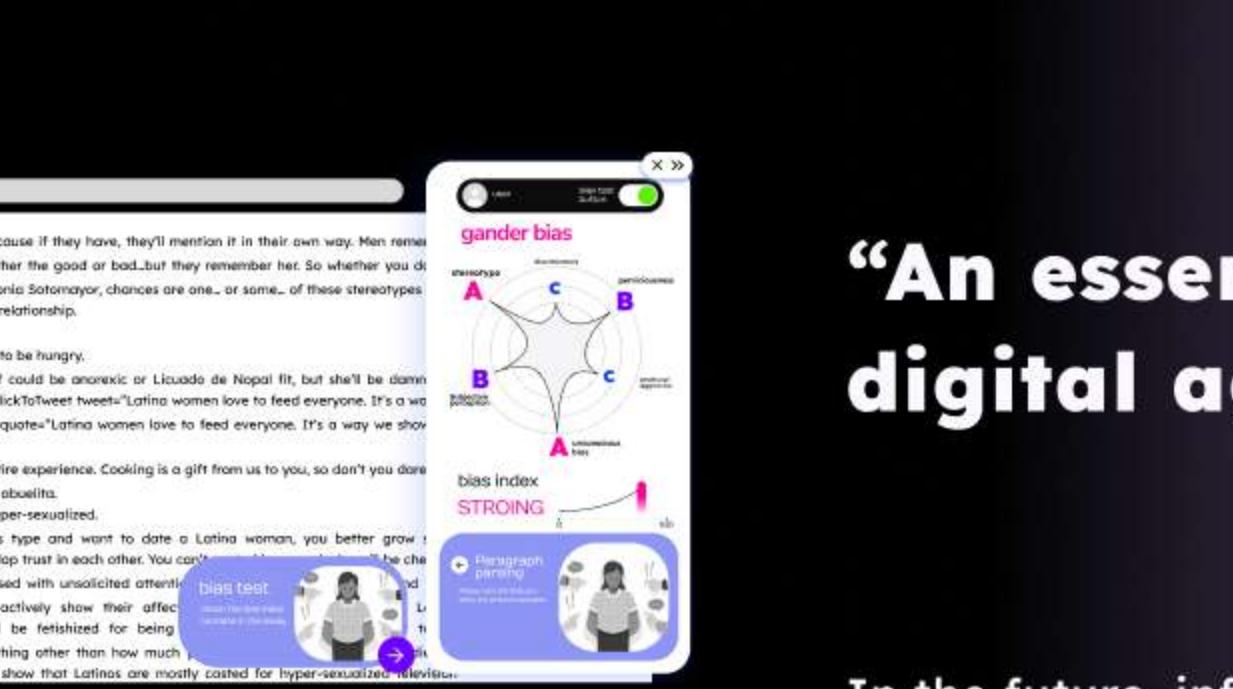


■ Plugin

Web Plugin

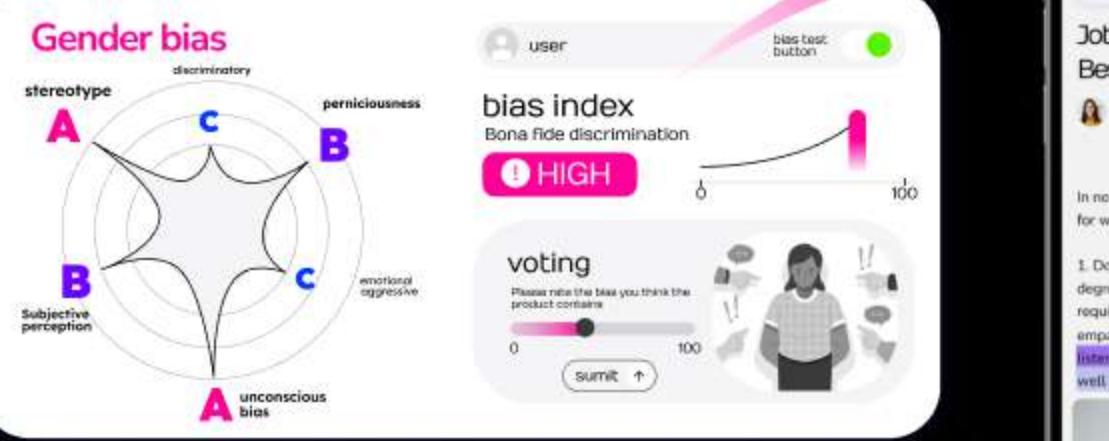


加电脑的mockup

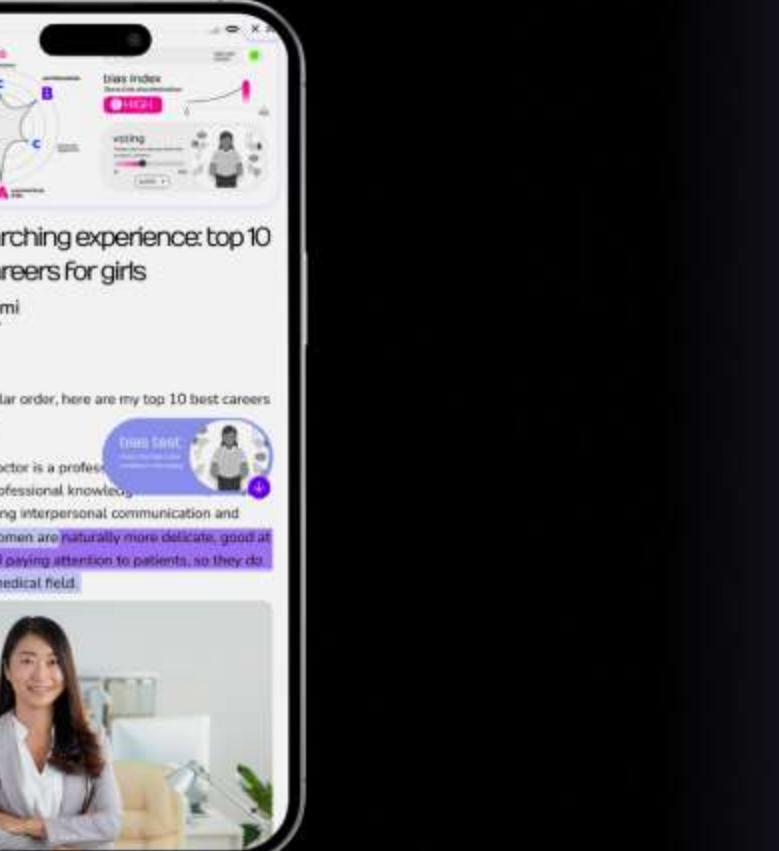


Our product can be placed on any website as a web plugin

Device Plugin



When activated on mobile devices, the plugin will appear above the text



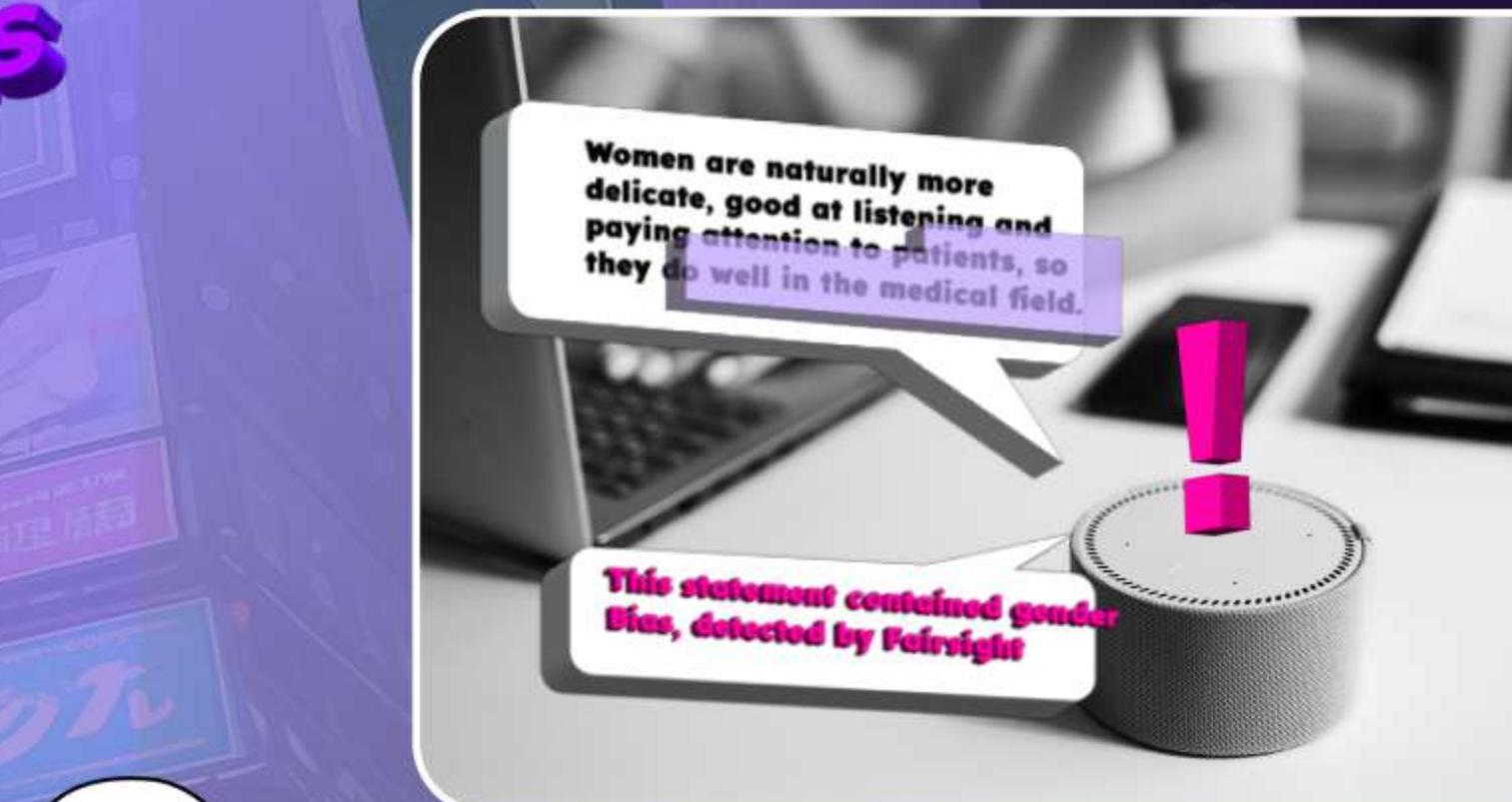
■ Future-AR visual

"An essential safeguard in the digital age"

In the future, information displays will be ubiquitous. Virtual reality displays and the Internet of Things may become trends. Our product, poised for future integration, will add value to upcoming devices, ensuring user protection



■ Voice Recognition Detection



■ Educational Products





BACKGROUND



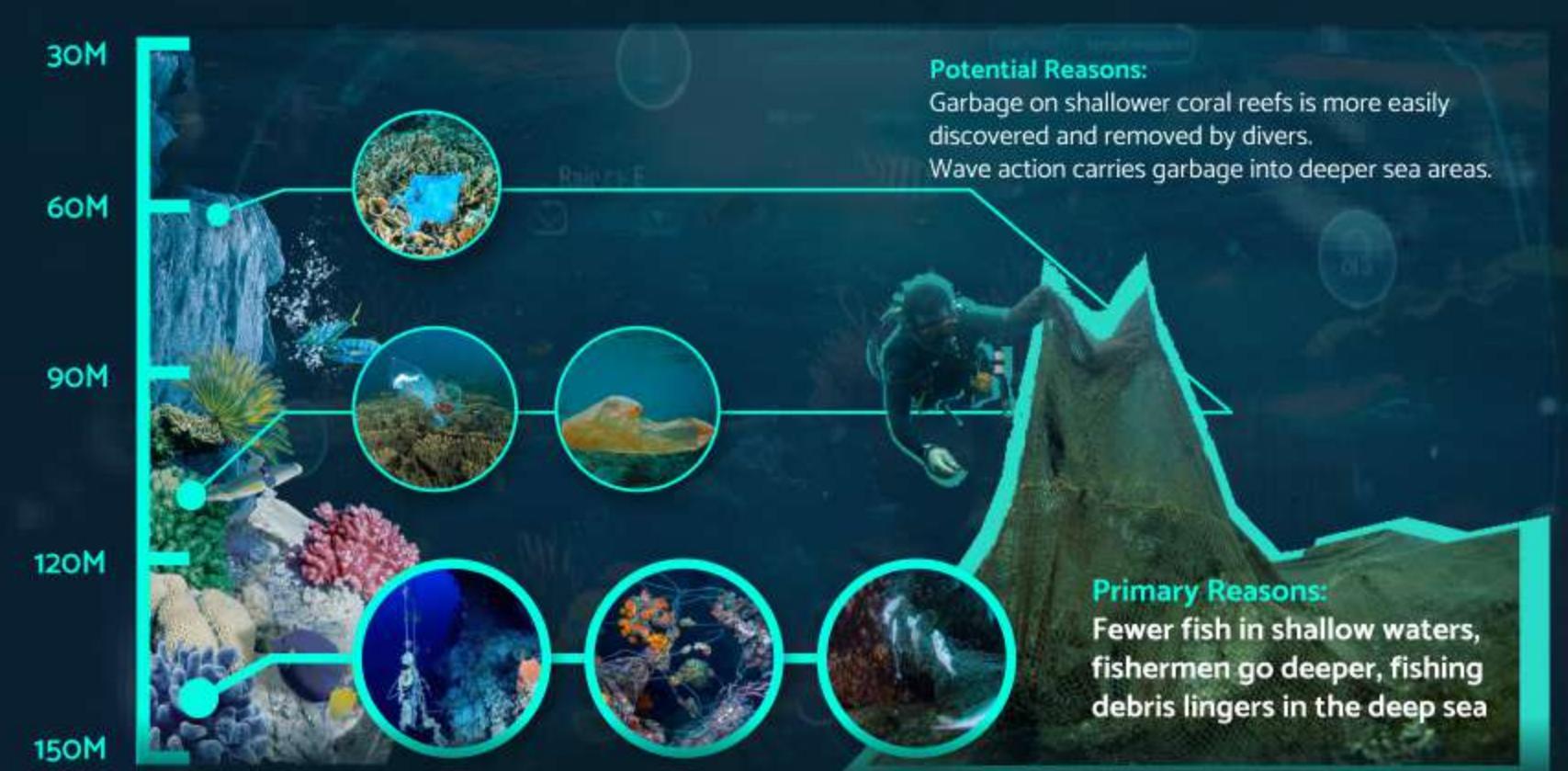
“Oxford University marine biologist Paris Stefanoudis emphasizes the need to **expand the depth of marine conservation areas**, including mesophotic coral reefs, and to update international agreements to **combat plastic pollution** at its source. **”**

— “Plastic Pollution on Coral Reefs Worldwide” – in the journal “Nature”

STATES

Marine biologist Paris Stefanoudis led a team of researchers to survey and analyze **85 coral reefs** in areas ranging from 30 meters to 150 meters below the ocean's surface. The results showed that the **amount of garbage on coral reefs increases with the depth of the seawater**.

DEEPER WATERS, GREATER CORAL REEF GARBAGE (below the ocean's surface)



DETAIL

FISHING GEAR IS THE PRIMARY SOURCE OF POLLUTION

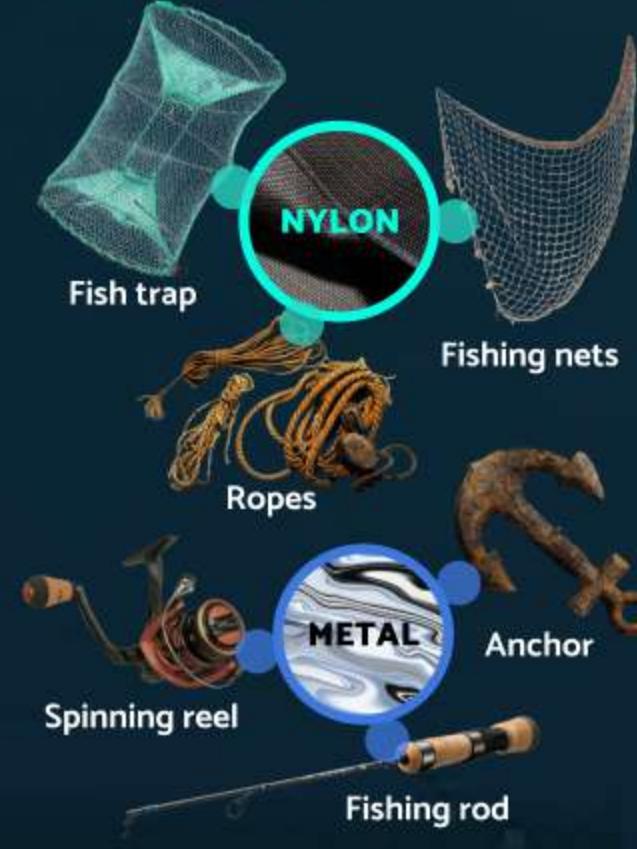


ALMOST ENTIRELY LARGE PLASTIC DEBRIS



Of all the garbage fragments, 88% are large plastics larger than five centimeters.

FISHING GEAR KIND

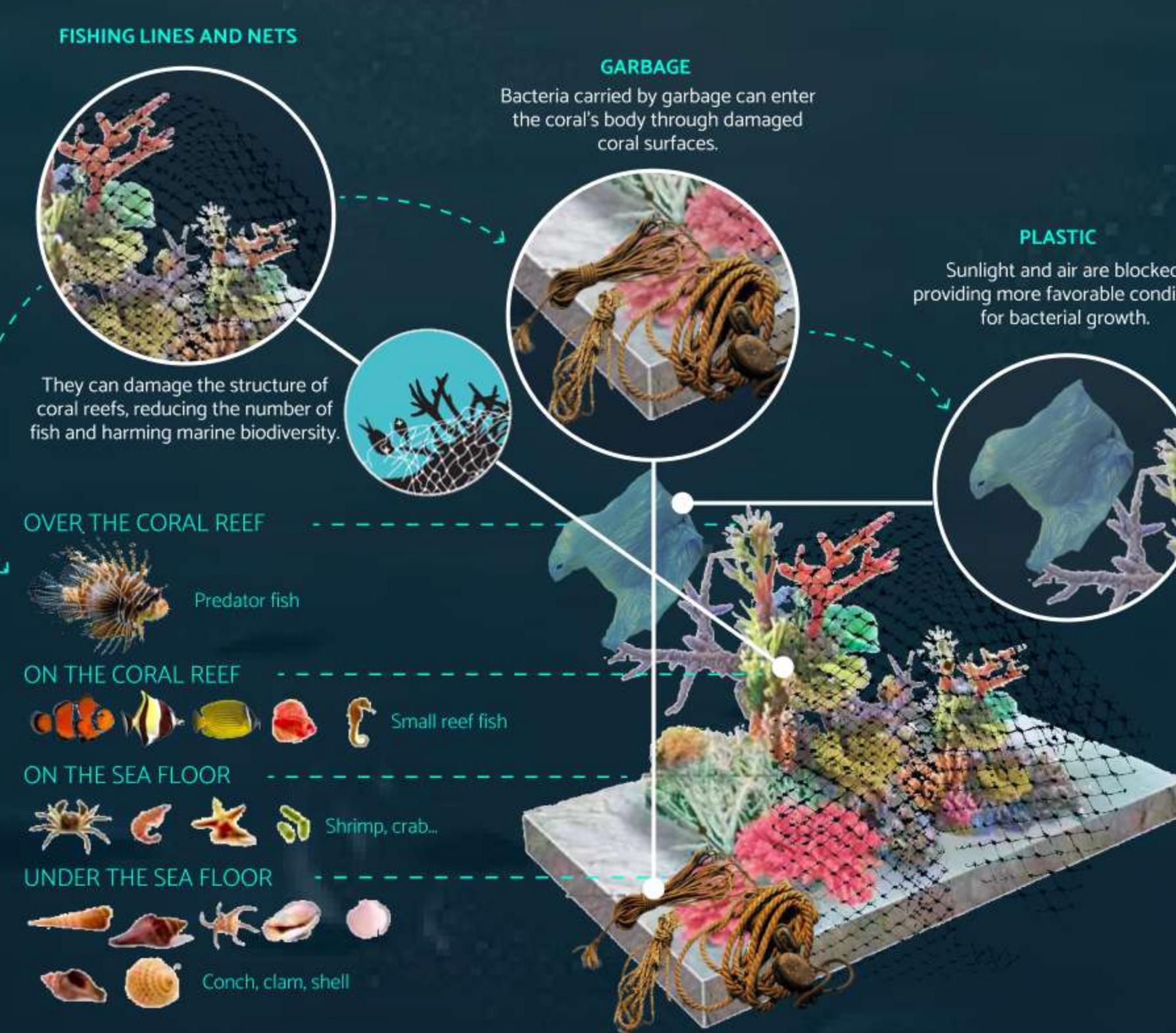


SIZE

	SMALL	MEDIUM	LARGE
ROPE	2MM~20MM~50MM 150MM~300MM		
FISH TRAP	1X1FOOT~5X5FOOT		
FISHING NETS	6FOOT~12FOOT		
SPINNING REEL	3X3FOOT~50X50FOOT		
FISHING ROD			
ANCHOR	12POUNDS~5TONS		

DAMAGE

TRANSMIT DISEASES, LEADING TO CORAL DEATH, AND HARMING MARINE BIODIVERSITY



CHALLENGE

Due to the difficulty in studying deep-sea coral reefs, they are rarely included in conservation efforts, management objectives, and discussions.



Conventional marine waste management measures often fail to reduce fishing gear debris.

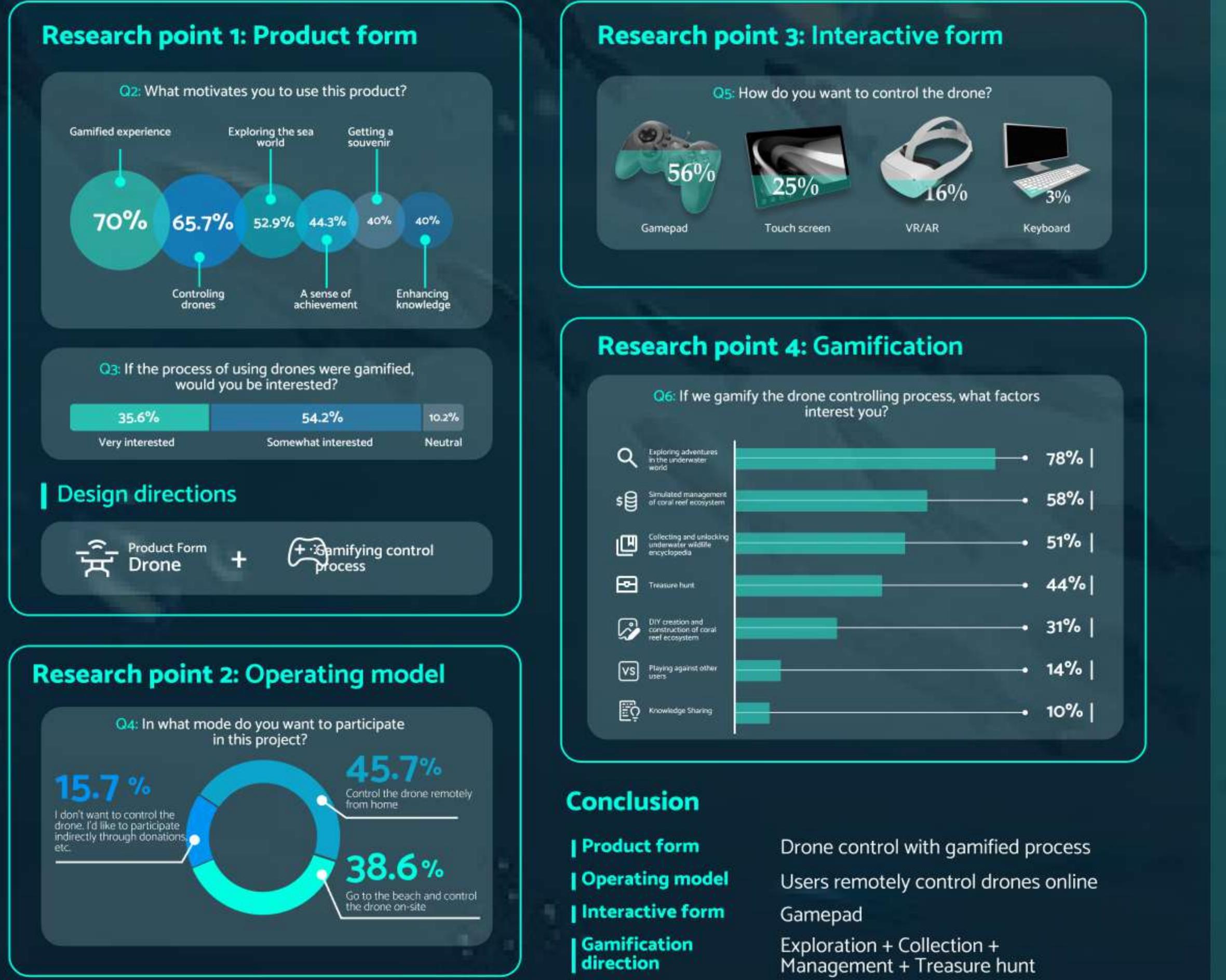
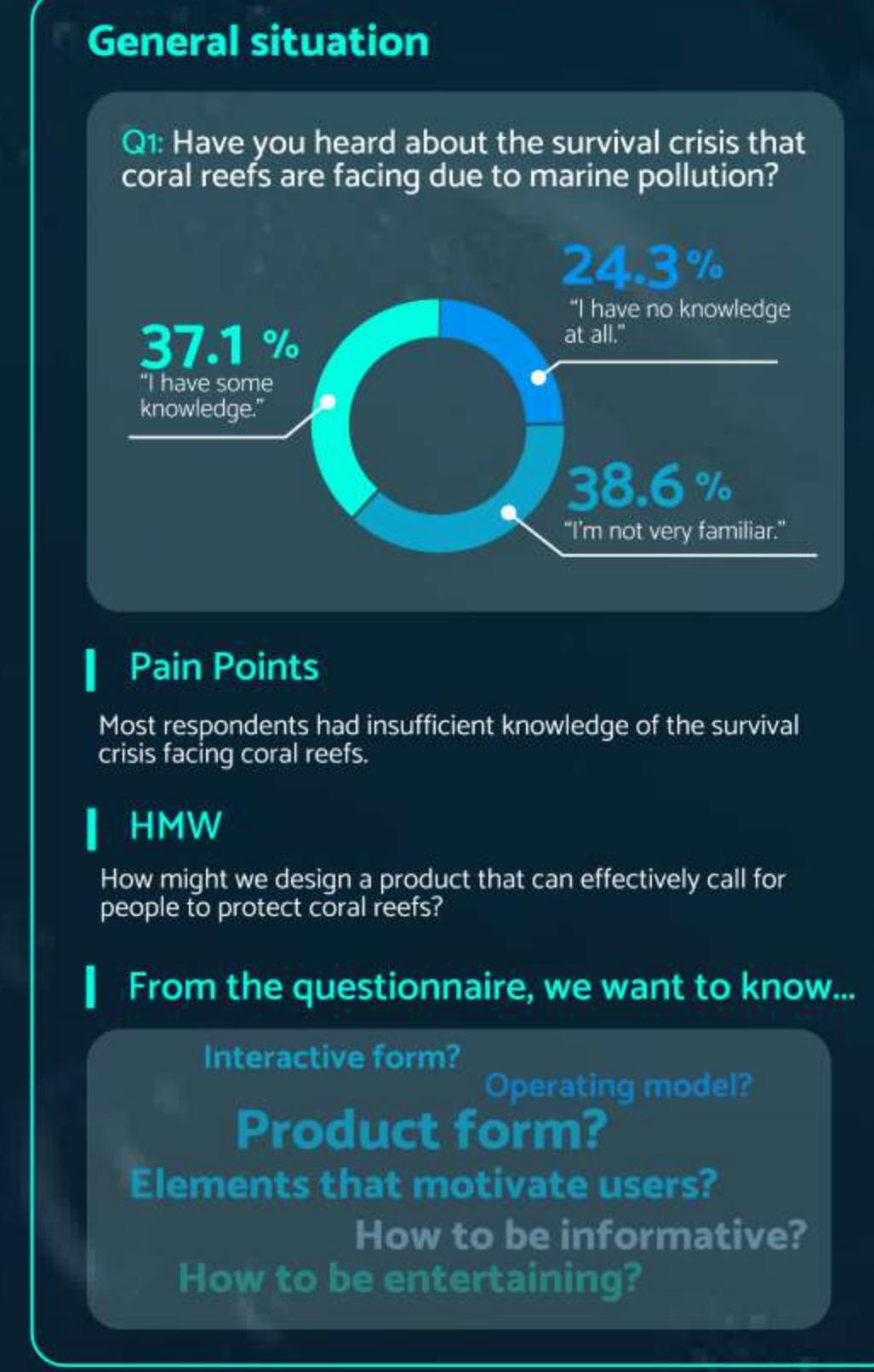


DESIGN GOALS

Design a product capable of collecting deep-sea coral reef-related fishing gear debris while raising public awareness and concern about coral reef litter.

QUESTIONNAIRE

In order to better determine the design direction of the product that can effectively encourage people to protect coral reefs, we designed and distributed questionnaires and collected 70 samples.



INSPIRATION



Introduction: This is a device designed for simulating the experience of flying an aircraft. It typically includes a cockpit, a model of aircraft controls, and a large screen for displaying the simulated flight.

Advantages: It provides a safe environment for pilots and aviation professionals to enhance their aircraft operation skills without real flight risks. It also allows practice of response strategies in the event of errors and emergencies.

- IMPLICATION:**
- Through Simulated Game To Enhance User Skill
 - Prevent Causing Harm To Corals During Hands-On Operation
 - Makes Users More Effective
 - Fosters A Sense Of Responsibility For The Marine Ecosystem
 - Gain An Understanding Of The Importance Of Coral Reef Protection



Introduction: This is a marine garbage collection machine consisting of a combination of four different robots, including an unmanned surface vessel, an observation robot, a collection robot, and an aerial drone.

Advantages: It leverages the capabilities of multiple robots, enabling both independent and cooperative work, which significantly enhances garbage collection efficiency in challenging marine environments.

- IMPLICATION:**
- Controlled By A Combination Of Various Machines
 - Users Only Control The Machine Responsible For Garbage Collection Other Control Machines Are Managed By Technical Personnel

IDEA

Based on user research, we have found that the majority of people are highly interested in coral reef conservation and deep-sea exploration. They also prefer to interact using gaming tools like controllers. Therefore, we are planning to create a device that can collect underwater coral reef debris. We will offer users an innovative way to use a gaming controller to maneuver the machine and collect coral reef garbage in the deep sea.



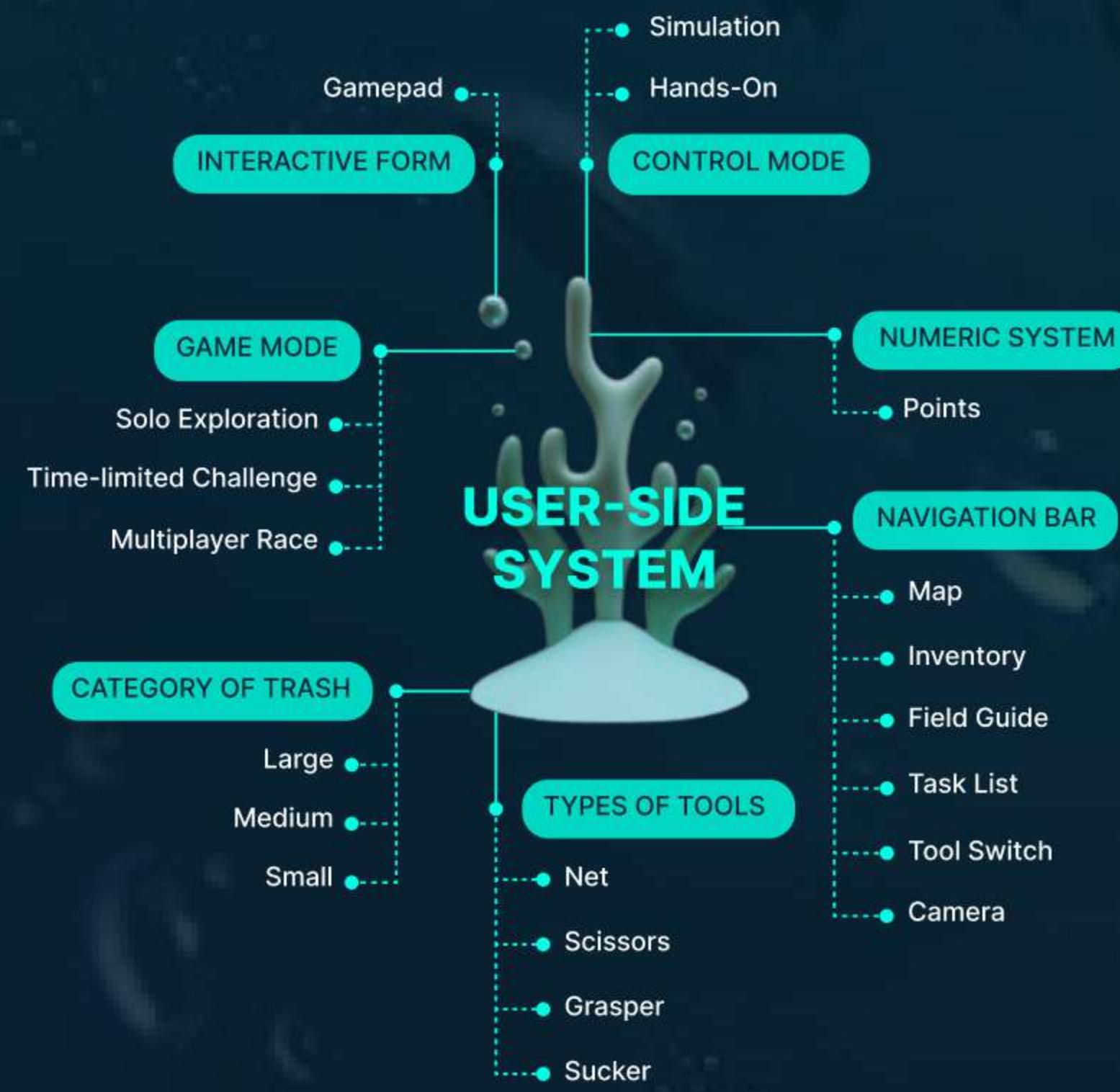
CONCEPTION

Product Components



USER-SIDE SYSTEM DESIGN

Based on desk research and field research, we decided to gamify the process of controlling drones to enhance engagement. We established a comprehensive user-side system and considered how user interactions could be adapted for gamepads.



UX FLOW

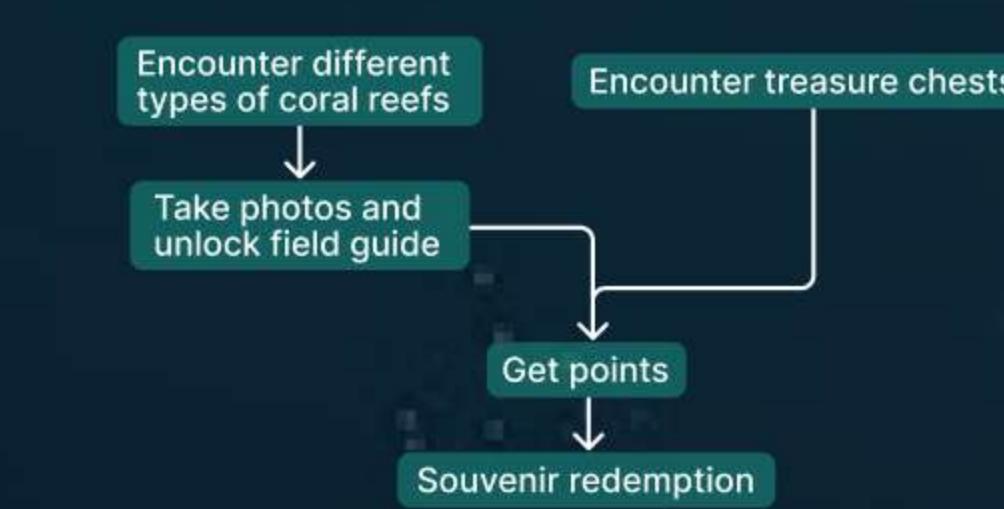
Introduction



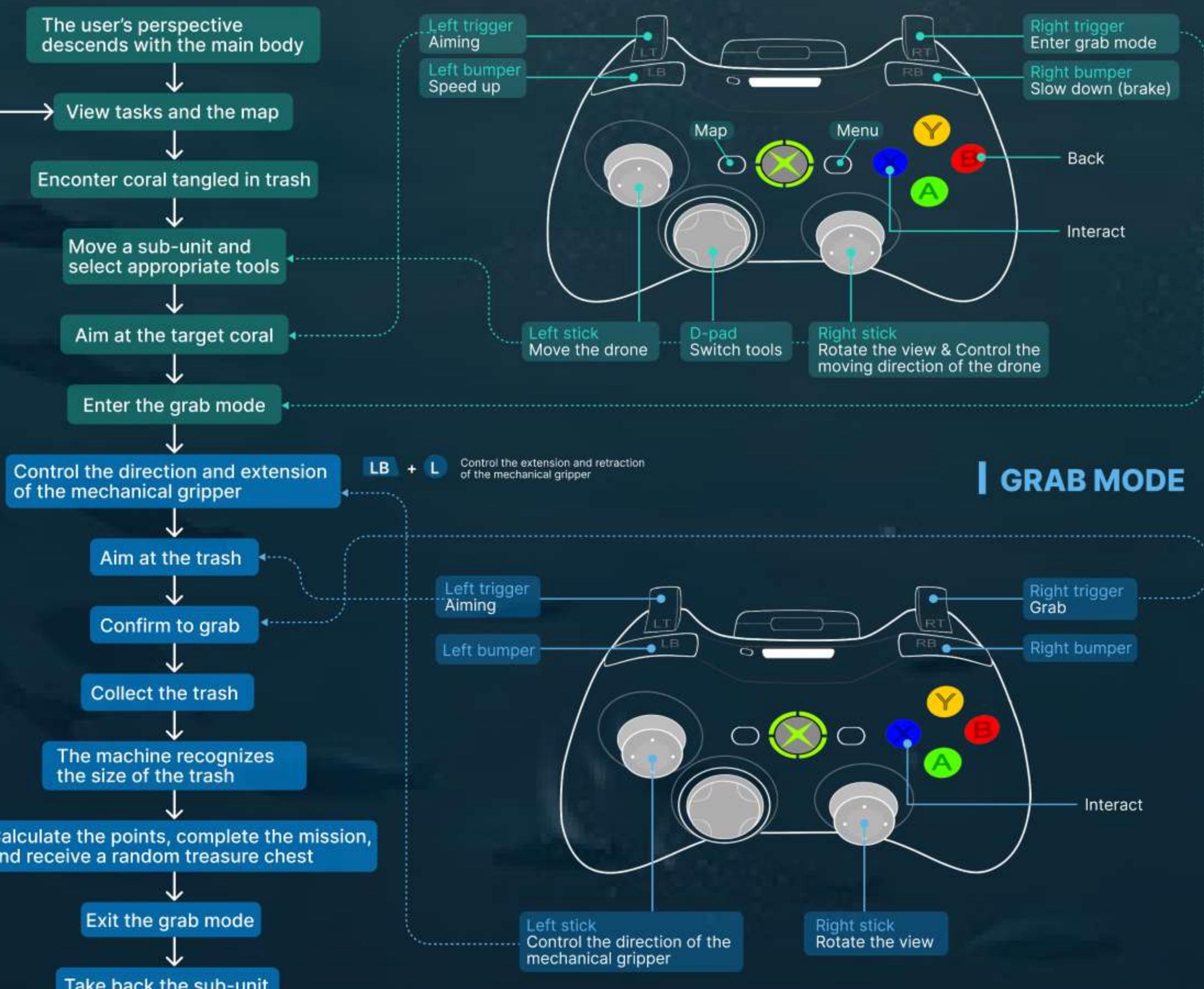
Users are tasked with controlling underwater drone and cleaning up the trash around the coral reefs. After the machine recognizes the size of the trash, the user can accumulate the corresponding points.

At the same time, users will also encounter treasure chests in the process of ocean exploration, and they can also get points by opening them. Subsequently, these points can be exchanged for souvenirs.

Detailed flow 1 UNDERWATER EXPLORATION



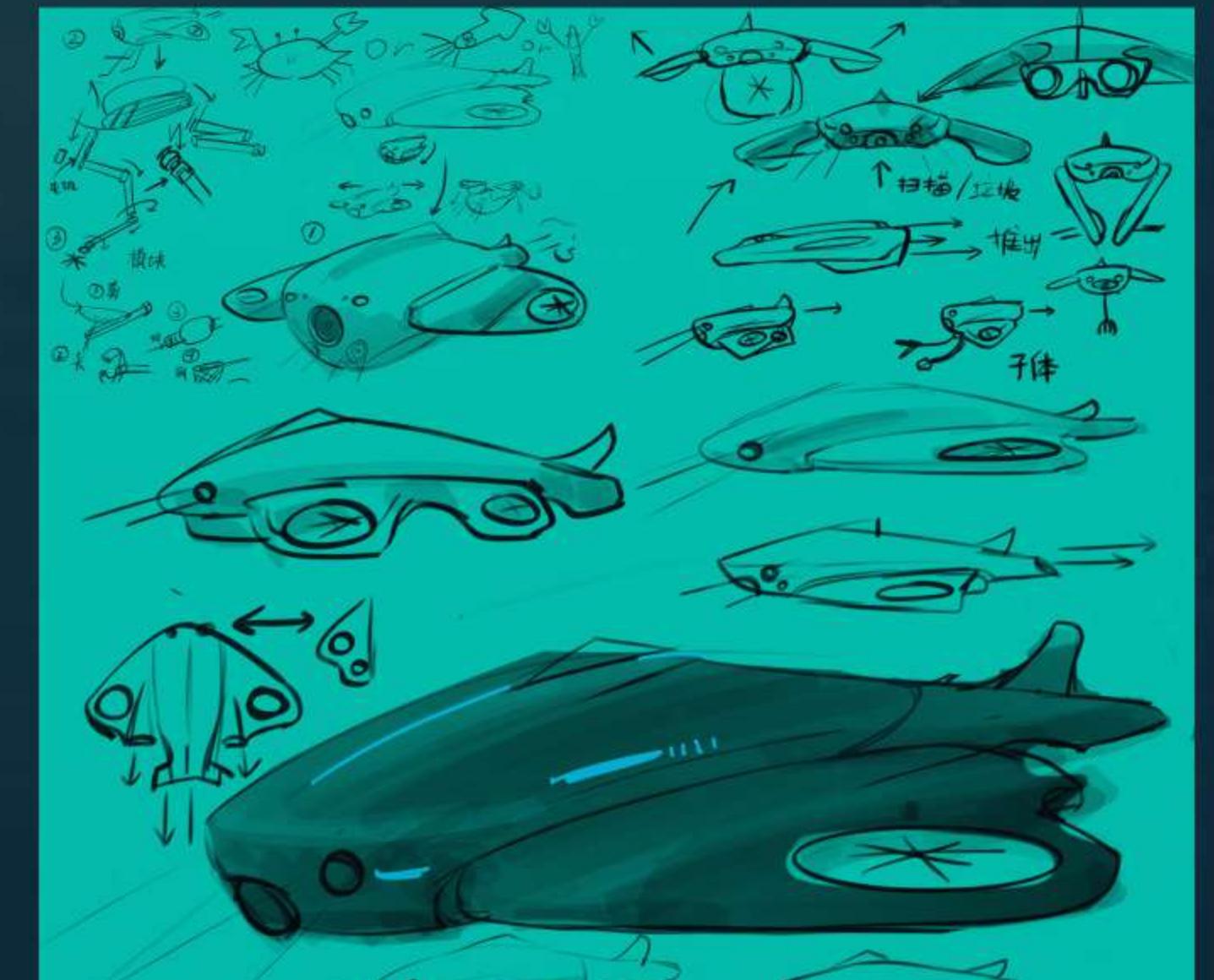
Detailed flow 2 DRONE CONTROL



GRAB MODE



DRAFT AND UI



PRODUCT

Our Products Are Divided Into Two Categories, Parent Products And Child Products. The Parent Product Carries The Child Product To The Designated Coral Reef Location, And At The Same Time Assumes The Role Of Garbage Collection



Start With Professionals, Find Coral Reef Areas With A Lot Of Marine Debris, Drop Children To Clean Up, And Provide A Place For Garbage Recycling

Put In The Sea



Carry The Child



Release The Child



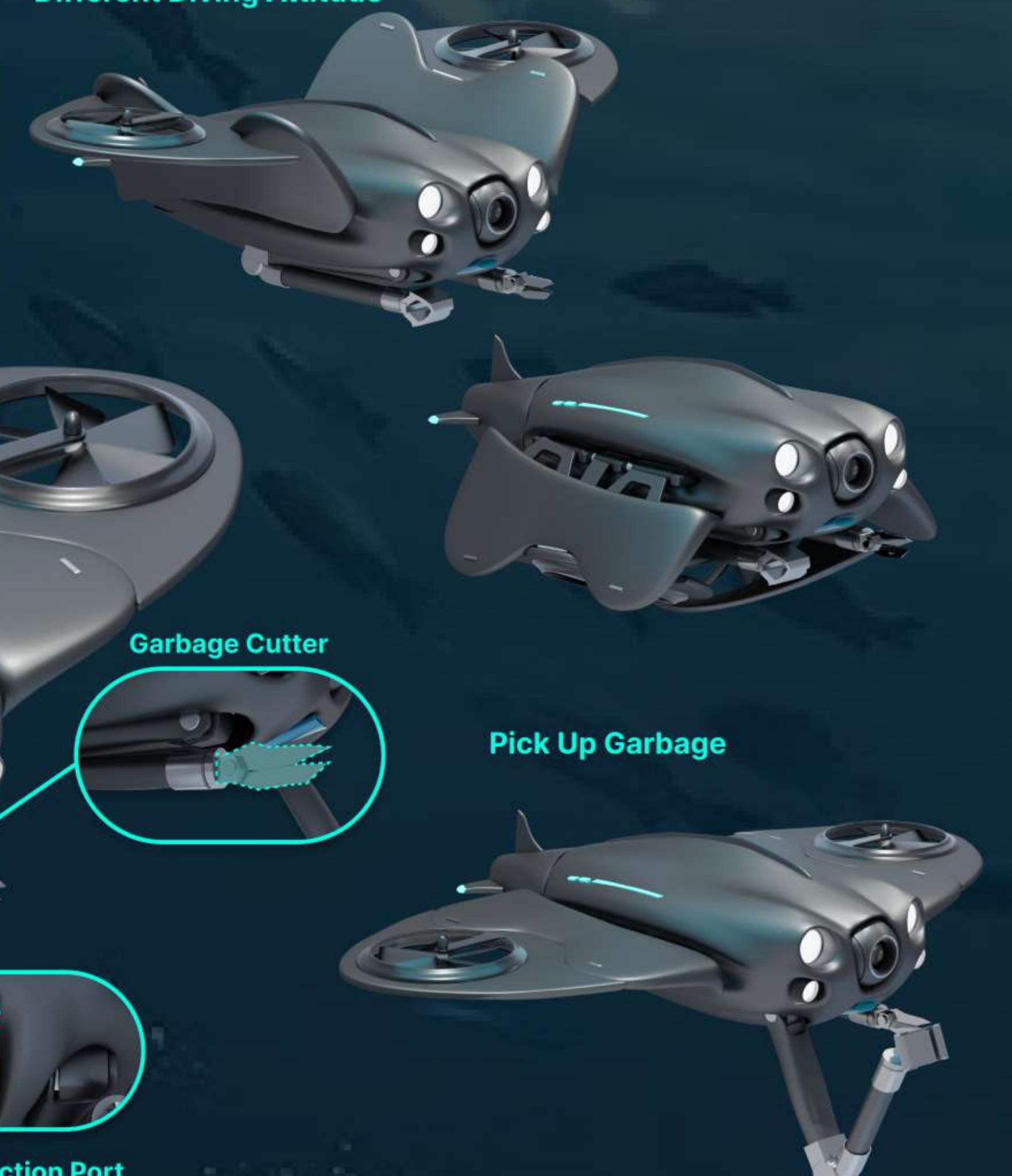
Release The Garbage Collection



Recycle



Different Diving Attitude



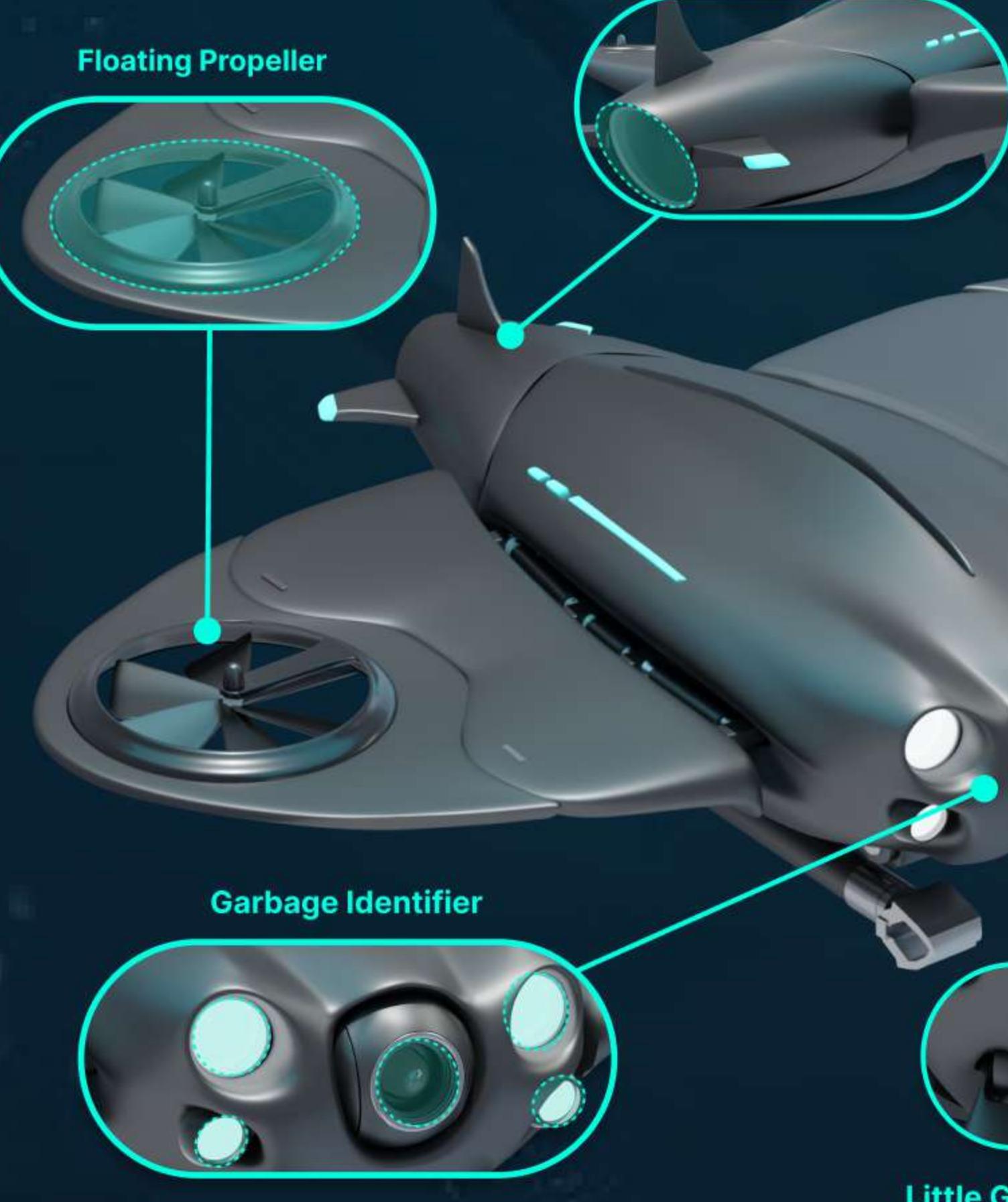
Pick Up Garbage



Garbage Cutter

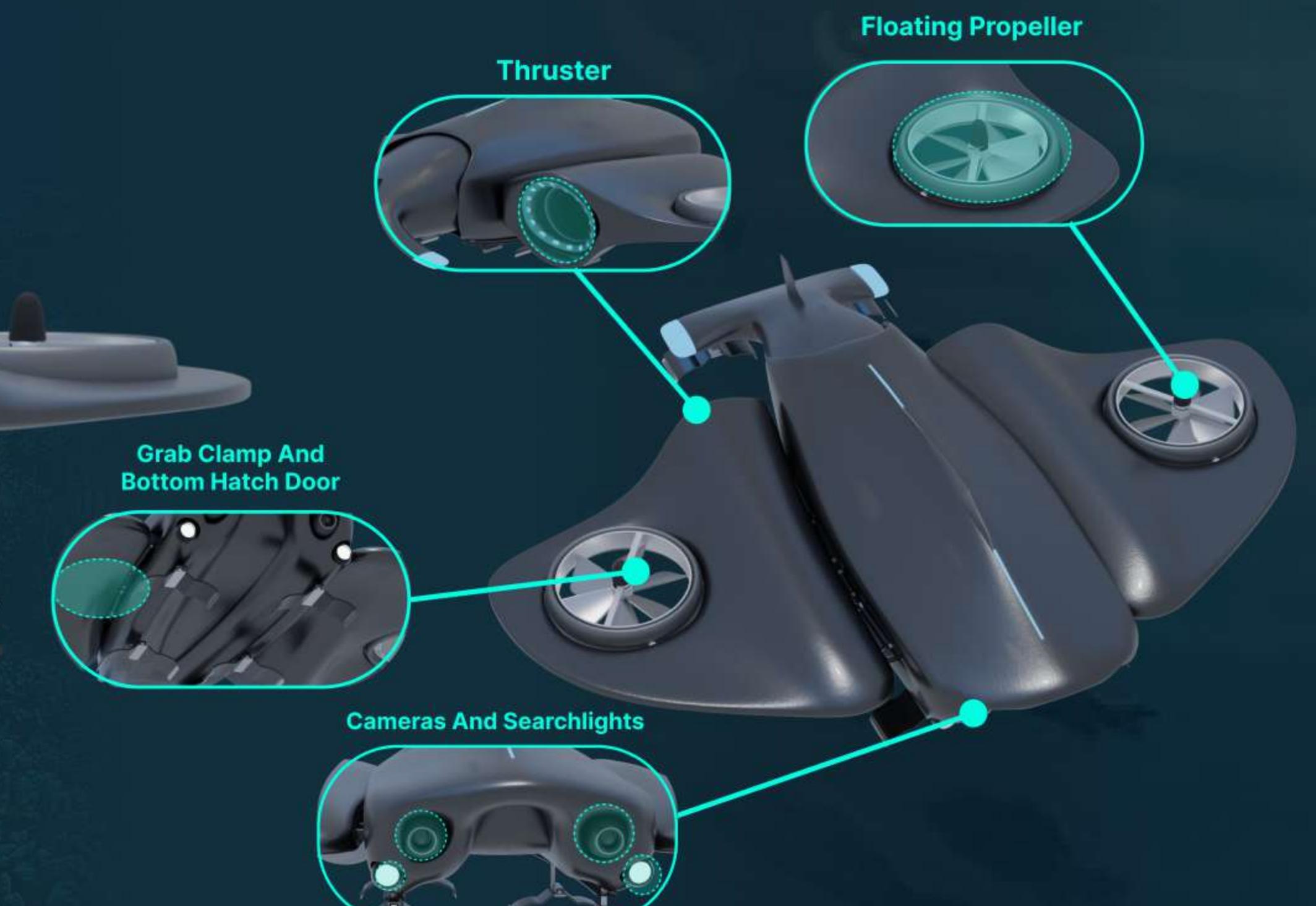


Garbage Identifier



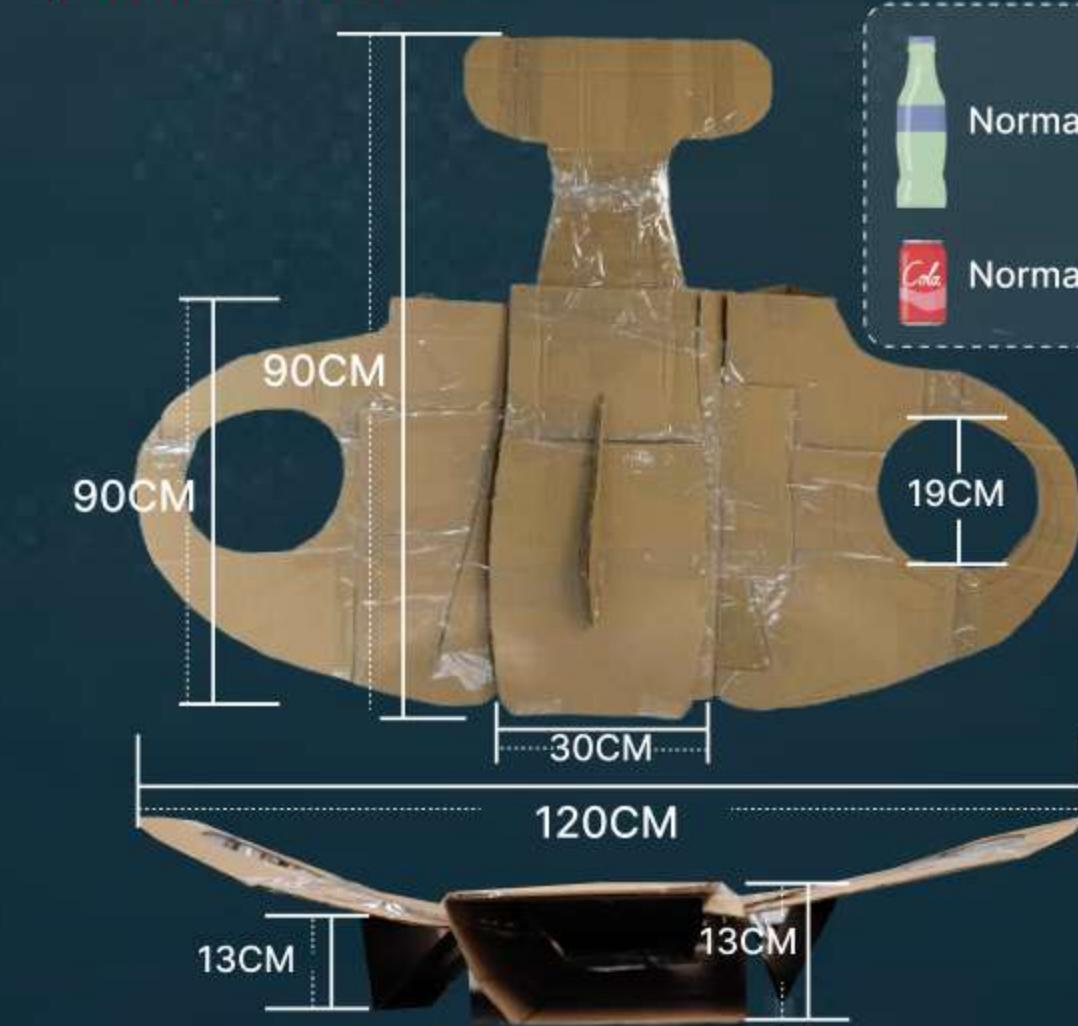
MAIN BODY

MAIN BODY



PROTOTYPE

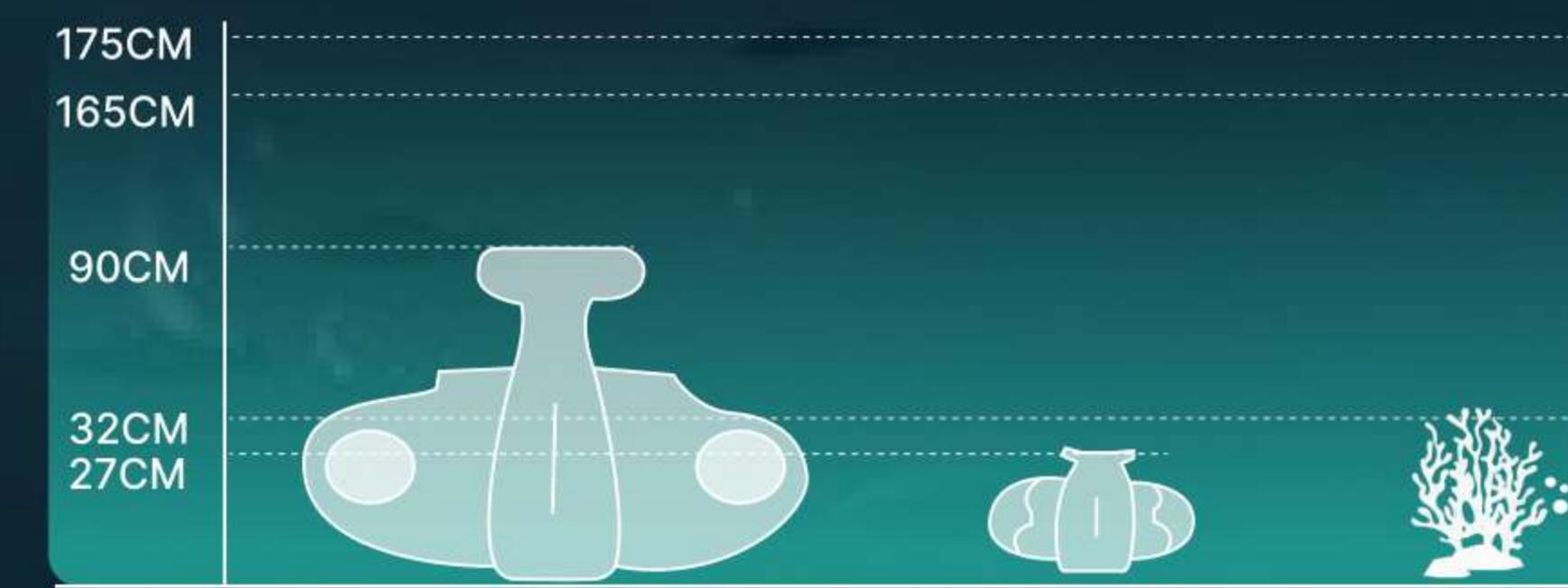
MAIN BODY SIZE



SUB-UNIT SIZE

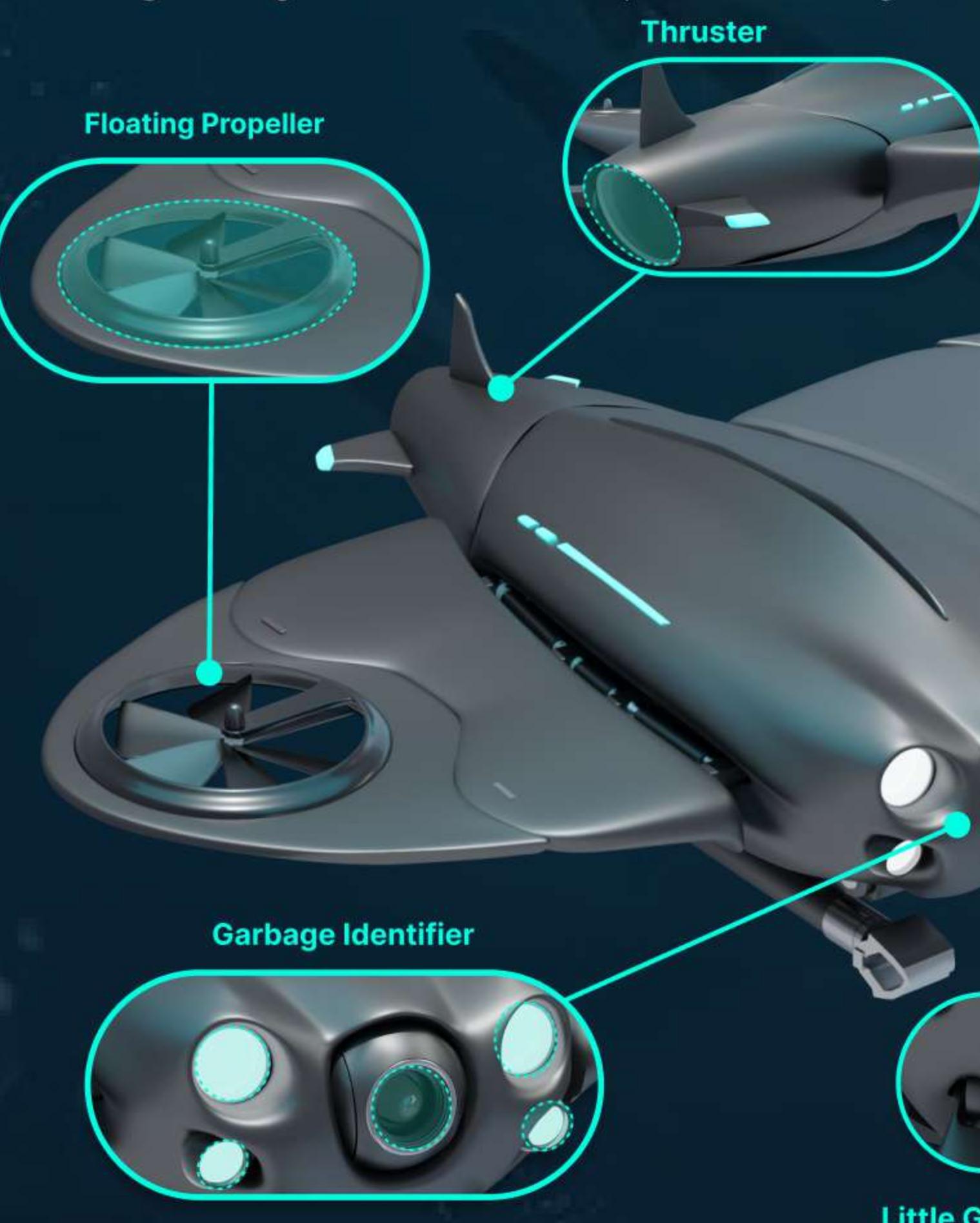


HUMAN-MACHINE DIMENSION



SUB-UNIT

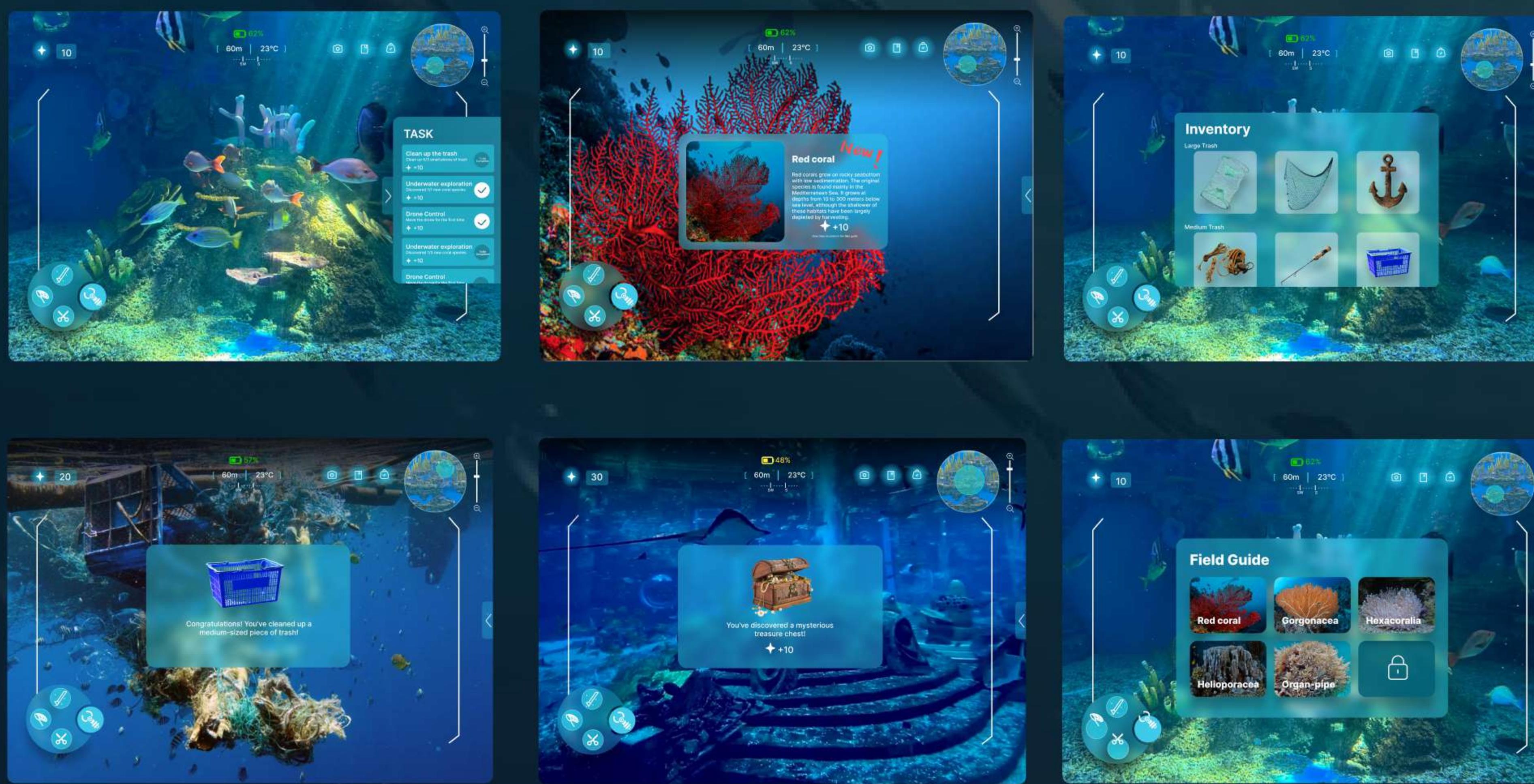
The Child Product, As A Machine That Dives Down To The Coral Reef, Has Three Garbage Picking Parts That Can Pick Up Different Garbage.



USER-SIDE CONTROL



UI



FUNCTION TEST



In the process of underwater garbage collection, the underwater drone needs to accurately identify garbage to avoid harming coral reefs and underwater organisms. For this purpose, we have established an underwater **image recognition system** using **Python** to identify garbage.

RESULTS OF RECOGNITION

Main function for model training

```
def main():
    # Set environment variables
    os.environ['TF_CPP_MIN_LOG_LEVEL'] = '2'
    os.environ['CUDA_VISIBLE_DEVICES'] = '-1'

    # Load dataset
    dataset = datasets.COCO(root='data/coco')
    dataset.download_and_load()

    # Preprocess
    dataset.set_transform(transforms.Compose([
        transforms.Resize(256),
        transforms.CenterCrop(224),
        transforms.ToTensor(),
        transforms.Normalize([0.485, 0.45, 0.406], [0.229, 0.224, 0.225])
    ]))

    # Create data loader
    data_loader = torch.utils.data.DataLoader(
        dataset,
        batch_size=16,
        num_workers=4,
        pin_memory=True
    )
```

Main function for model testing

```
def test(model, device):
    model.eval()
    model.load_state_dict(torch.load('model.pt'))
    model.to(device)

    # Load test images
    test_dir = Path('data/test')
    test_images = [test_dir / f for f in os.listdir(test_dir) if f.endswith('.jpg')]

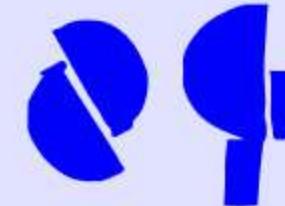
    # Process images
    for image in test_images:
        img = Image.open(image)
        img = transform(img)
        img = img.unsqueeze(0).to(device)

        # Predict
        outputs = model(img)
        _, predicted = outputs.max(1)
```


SERVICE PROCESS



ALMOUR



Sensory compensation human-computer interaction products for deaf children



From the perspective of deaf children, the world is voiceless, and they therefore lack an important way of perceiving the world. Our design uses the combination of touch and vision through sensory compensation, so that deaf children can receive sound and perceive the world.

Human-computer interaction
Augmented Reality
Arduino Prototype

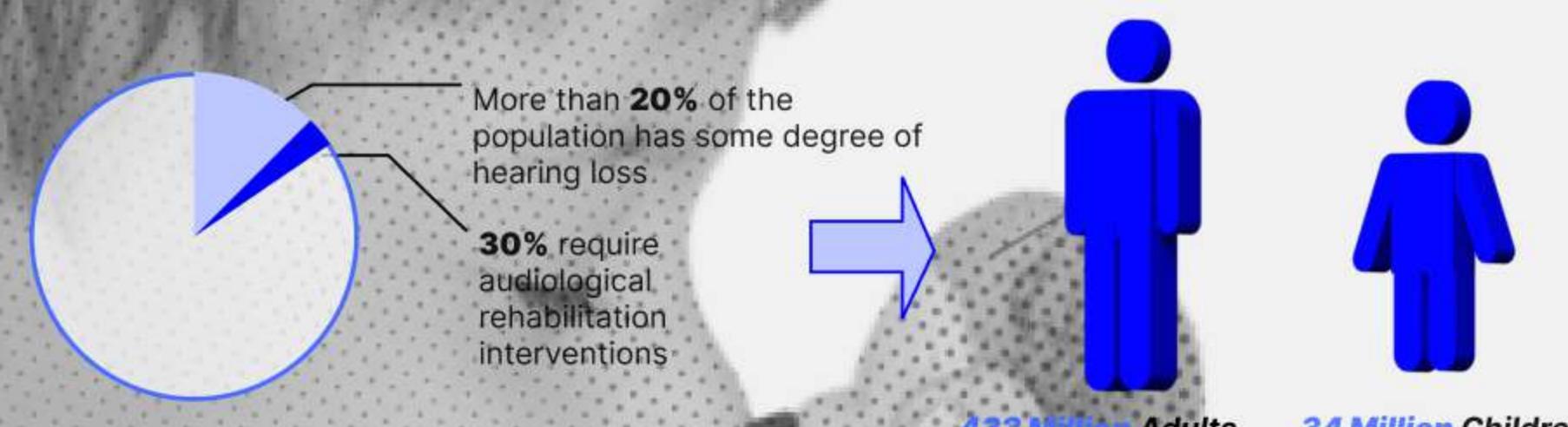
Time: 2023.11-2023.12
Cooperative Project
Team Member: Yuchen Zhai, Jiayi Xue
Tutor: Yaya

My Part:
Research
Prototype
Product Design
AR Visual

BACKGROUND

Status Of The Hearing-Impaired Population

Globally, more than **1.5 billion people** have some degree of hearing loss, and at least **466 million** people are in need of hearing rehabilitation interventions; this includes about **432 million adults** and about **34 million children**.



Difficulties In The Development Of Social Interaction And Cognitive Functions Of Preschool DHH Children

Children with Deaf and Hard of Hearing (DHH) experience language and academic delays, and they also exhibit significant delays in interacting with others and in understanding others' perspectives.

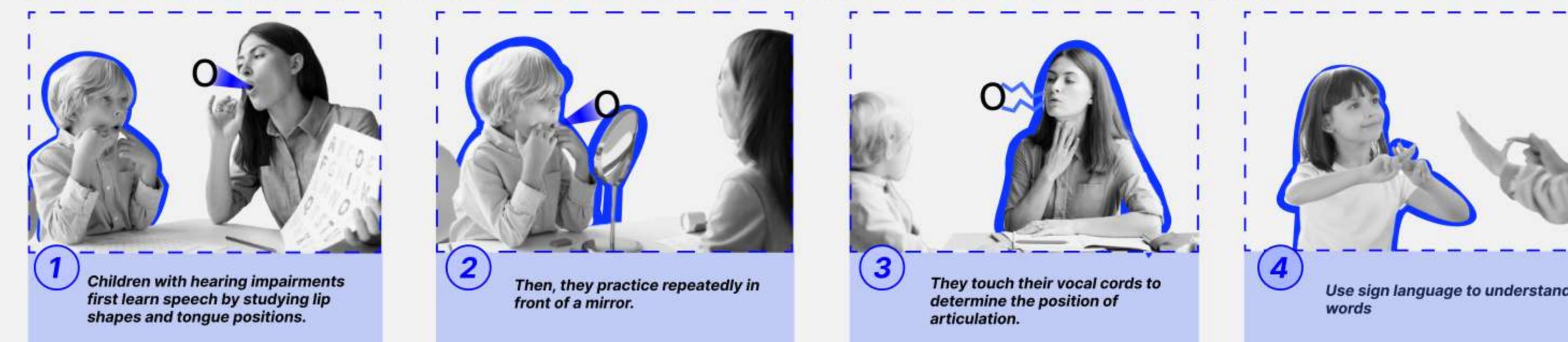


If children with hearing impairments do not receive appropriate training in the early stages, they will be unable to effectively integrate into society and realize their full potential in the future.

The Distinct Perceptual Abilities Of DHH Children Compared To Those Of Typical Children.

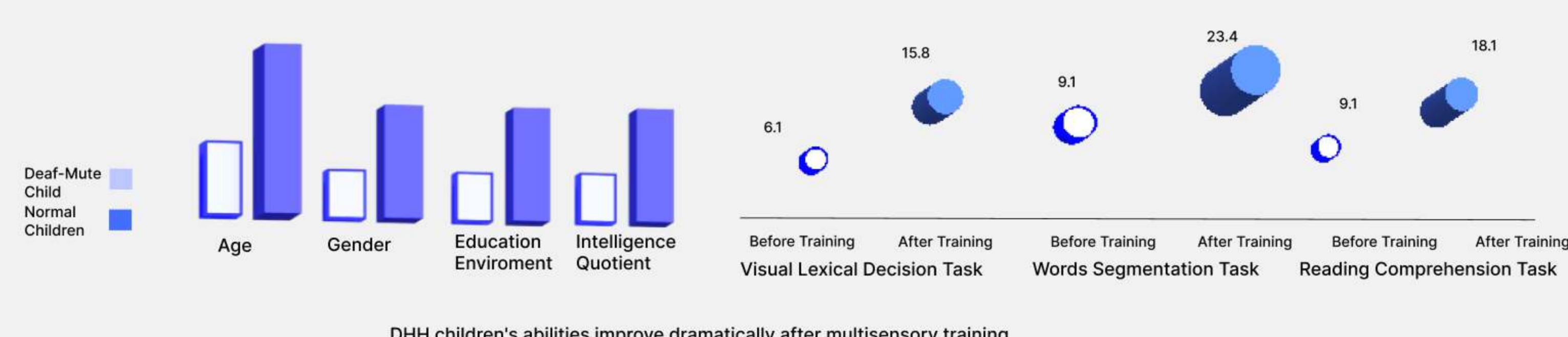
Research indicates that individuals deprived of hearing from a young age can develop **phonological knowledge**. Deaf-mute children's reading may be influenced by a phonological pathway that relies on phonetic representations of words formed without auditory input, utilizing **multimodal language aspects**. Phonetic representations in deaf-mute individuals are believed to evolve not only from auditory stimuli but also from visual and kinesthetic information gathered through **lip-reading, spelling, articulation, lip movement imitation** (articulatory feedback), and **sign language finger spelling (gestures)**.

Furthermore, the **phonetic representations** of words in these individuals might be **augmented via alternative non-acoustic information channels**. For instance, **vibrotactile information** from spoken words, like the vibrotactile stimulus patterns of word sounds, can provide insights into their **phonetic structures**.

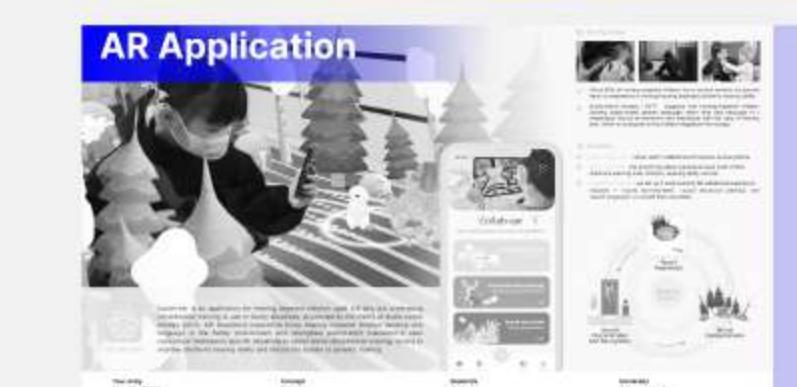


Multi-Sensory Stimulation For Children's Cognitive Development

For deaf-mute children aged 6 to 10, a novel multisensory training program integrating visual, kinesthetic, and vibrotactile information can effectively improve the phonological recording ability for reading isolated words as well as the syntactic processing capabilities essential for reading comprehension.



Cases Study



Collab-ear is a smartphone app tailored for 3-6 year-olds with hearing impairments in rehabilitation. Utilizing Auditory-Verbal Therapy (AVT) principles, it combines situational AR experiences to help these children develop spoken language at home and strengthen parent-child interactions.



This is a picture book designed for children with hearing impairments, using images of animals combined with sounds to help the child understand and recognize them.

Problems

1 The importance of other senses such as tactile perception in the learning process of people with hearing impairments has been overlooked.

2

Parents face immense educational pressures.

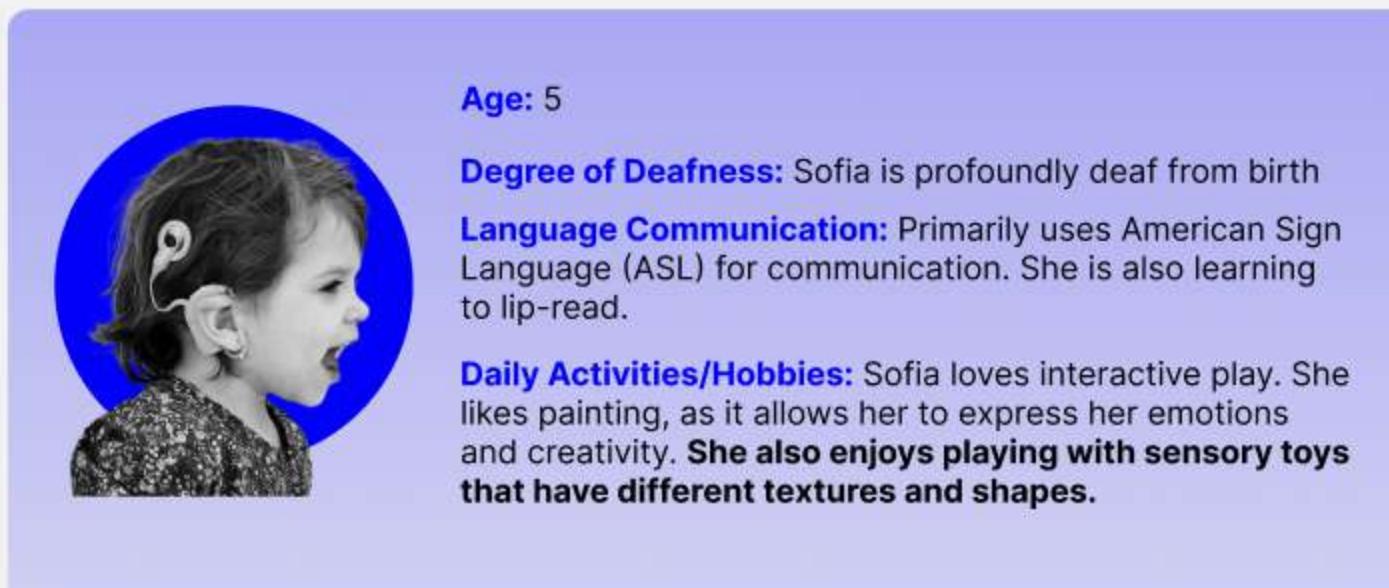
How Might We

This can be explained by the **compensation hypothesis theory**: Compared to individuals with normal hearing, the loss of auditory function prevents people with hearing impairments from accessing a certain amount of sound information, leading them to rely more on other senses. Therefore, their visual and tactile senses, to some extent, compensate for their auditory deficiencies.



RESEARCH

Sophia's Frustrations

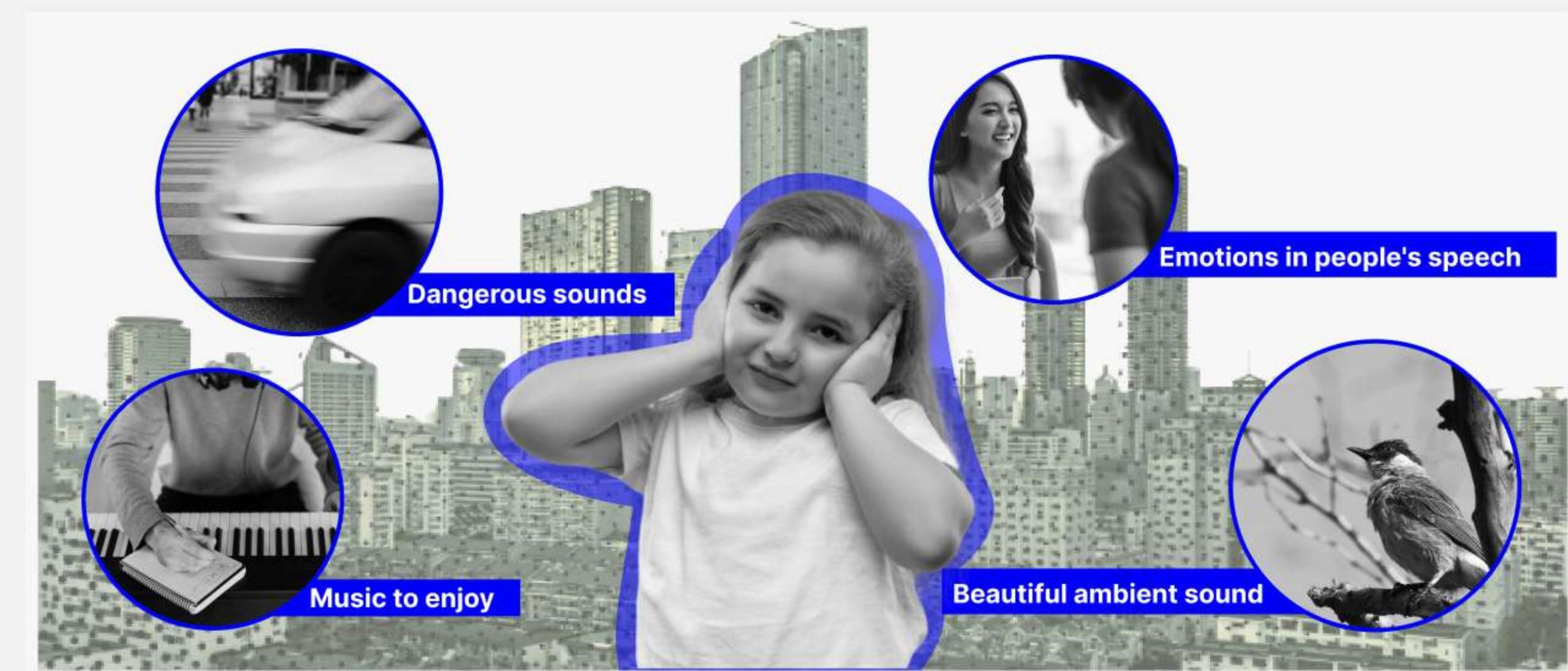


- Frustrations:**
- Environmental Navigation: Loud environments or places with a lot of visual stimuli can be overwhelming, as she relies heavily on her visual sense.
 - Communication: Sofia often feels frustrated when people speak to her without using ASL or when they don't maintain eye contact, making lip-reading difficult.
 - Social Interaction: She sometimes feels isolated in groups of hearing children who don't understand ASL.

- Fears and Wants:**
- Fears: Sofia is afraid of being misunderstood or not being able to communicate her needs effectively.
 - Wants: She wants to feel included and understood by her peers and adults. She also wishes for more interactive and visual learning tools that help her to experience the world.

- Family Concerns and Pressures:**
- Long-Term Independence: Looking towards the future, there is a concern about Sofia's independence as she grows up. Her parents hope to equip her with all the necessary skills and confidence to navigate a predominantly hearing world.
 - Educational Development: There is a constant concern about whether Sofia is receiving adequate educational support at her preschool. Her parents want to ensure she has access to the best resources and learning tools tailored for deaf children.
 - Health and Safety: There is an added layer of concern for Sofia's safety, particularly in situations where being able to hear is typically crucial, like crossing the road or responding to alarms.

Inability To Understand The Pain Points Of Ambient Sound



Which Sense Of Touch Can Be Perceived And Connected

Kinesthetic Perception:

- Force:** Perception of external or internal forces by the body.
- Torque:** Rotational force felt by joints during movement.
- Position:** The relative location of different body parts in space.
- Speed and Angular Velocity:** The velocity and rotational speed of body parts.

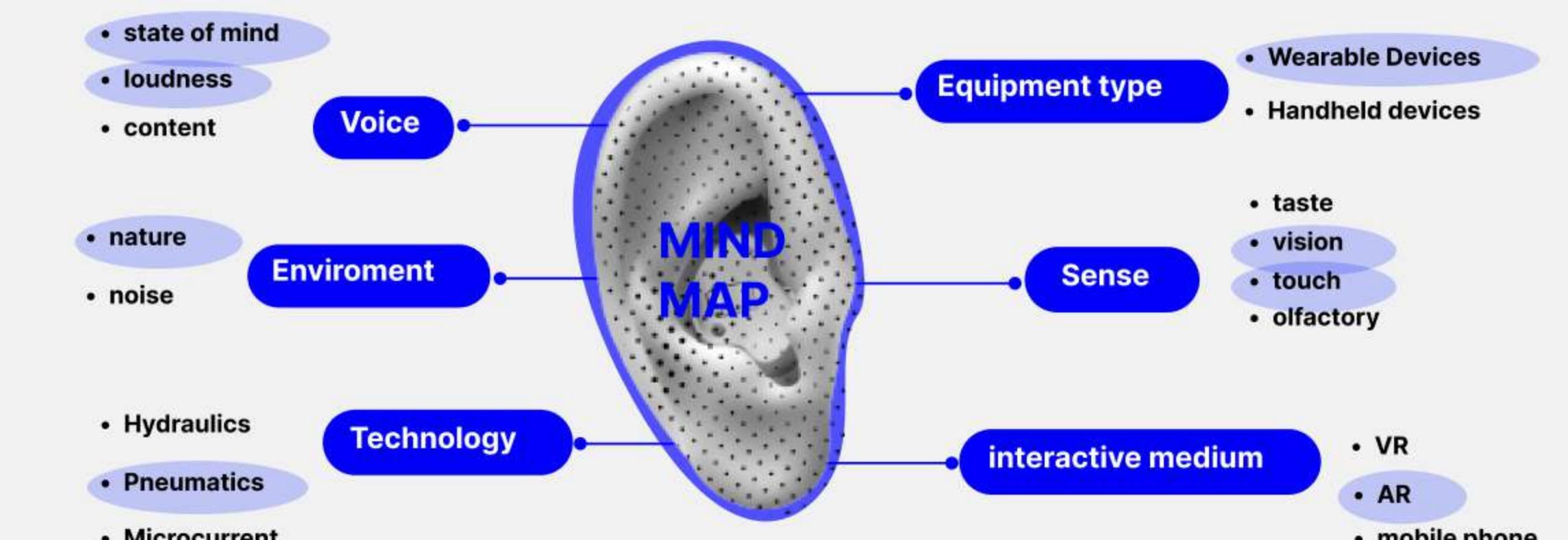
Cutaneous Sensation:

- Static Pressure:** Continuous pressure applied to the skin.
- Vibration:** Rapid fluctuations in pressure.
- Friction and Surface Texture:** Perception of rough or smooth surfaces.
- Skin Stretch:** The sensation of skin being stretched or compressed.
- Three-Dimensional Shape:** Perceiving the shape of objects through touch.
- Thermal and Pain Sensation:** Sensing changes in temperature and experiencing pain.

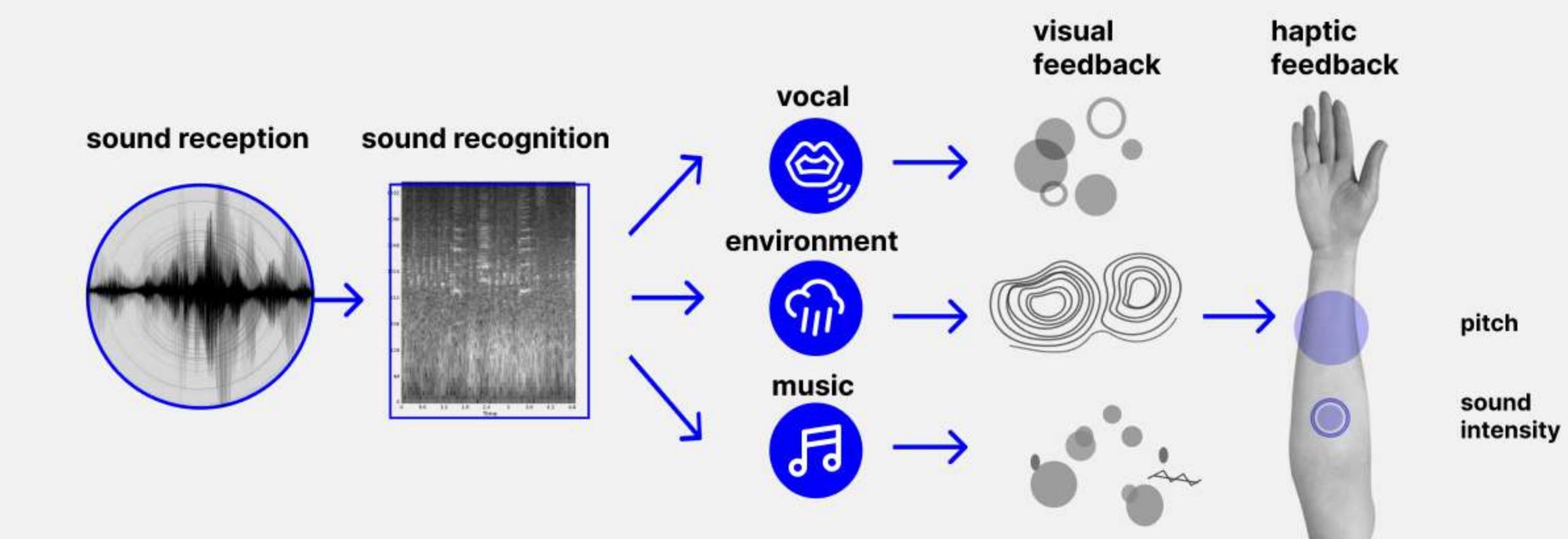
IDEATION

Mind Map

Through brainstorming, we identified the product to be made and the features to be included on the product as well as the form of interaction



Design Concept



TECHNICAL RESEARCH

Dataset

• Variegation

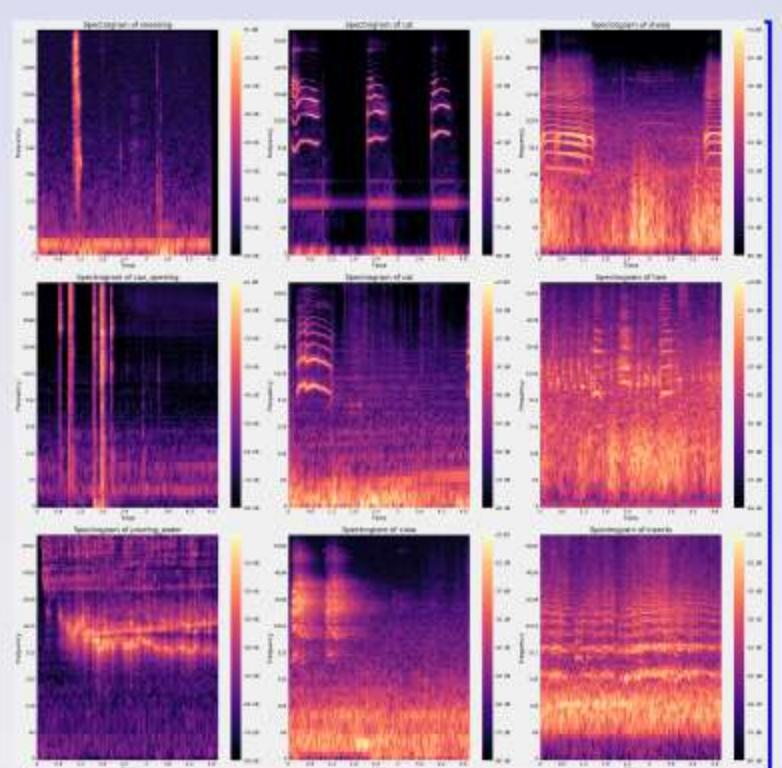
ESP-50 dataset contains 50 different categories of environmental sounds, such as **animal sounds**, **natural sounds**, and **artificial sounds**. This diversity allows the model to learn and recognise sounds from a variety of environments, thus providing a richer perceptual experience for deaf children.

• Edge Computing

The audio files in the ESP-50 dataset have relatively short durations, making them suitable for real-time processing on **resource-constrained edge devices**. Fast and efficient sound recognition is critical for providing timely haptic feedback.

• Data Annotation

Each audio sample in the dataset is accurately labelled with its category, which is essential for training the sound recognition model. Accurate labelling improves the accuracy of the model in recognising different sounds.



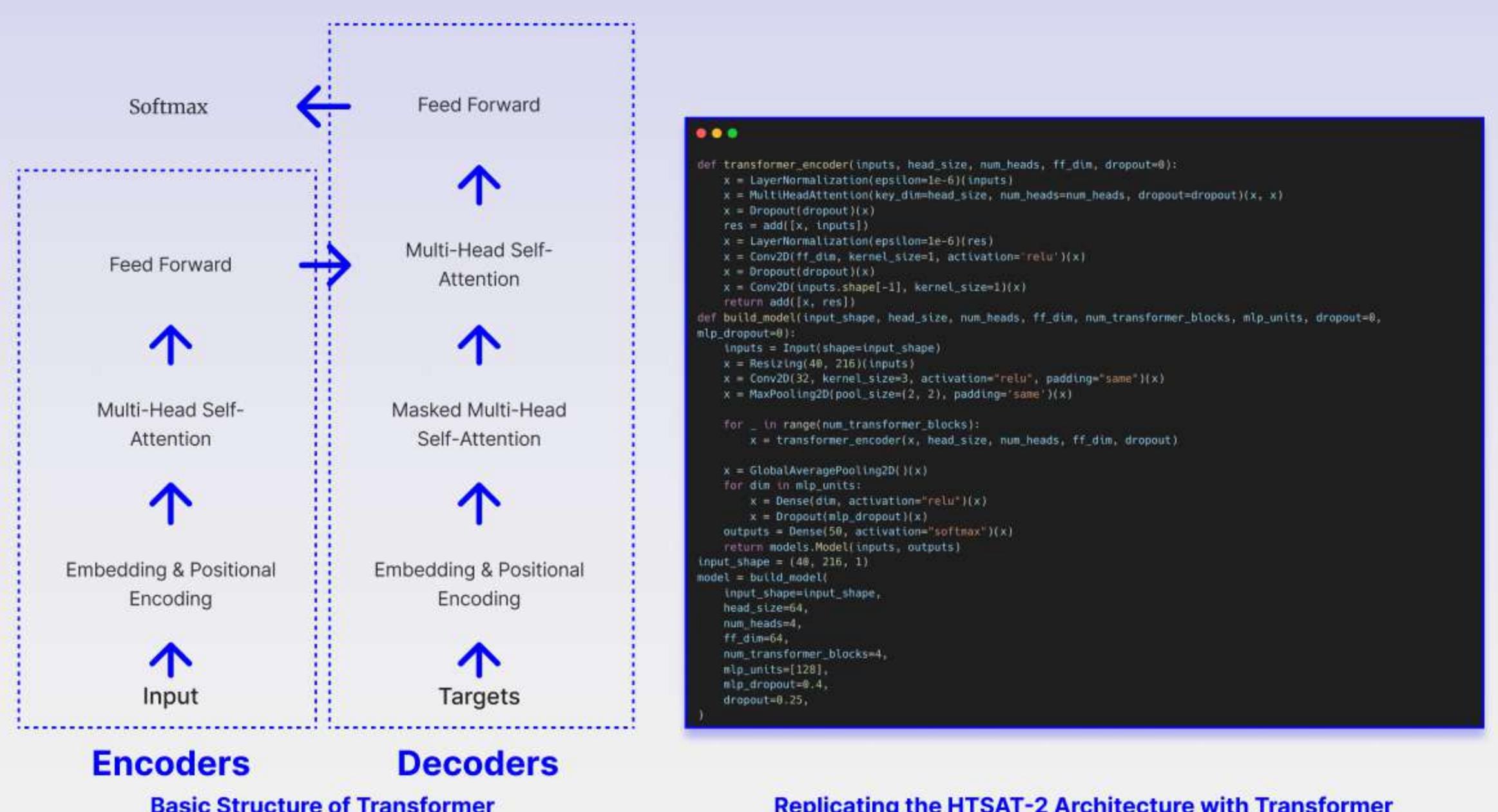
STFT Data Visualisation

Algorithm

According to the research, the **HTSAT-22** model performs very well on the ESP-50 dataset, and we summarise the key features of the **HTSAT-22** architecture:

- Parallel Processing
- Transformer Structure
- Multi-task Learning
- Integration with GPT2
- Self-Supervised Learning

HTSAT-22 demonstrates superior performance on a wide range of audio tasks through its multi-task training, the application of the Transformer architecture, and its combination with GPT2. Together, these features enable HTSAT-22 to achieve superior performance in a variety of domains such as audio classification, audio captioning, and retrieval. Its capabilities come from its effective handling of time dependencies in audio data and its deep understanding of speech and audio content. Its performance on the test set was **98.5%**.

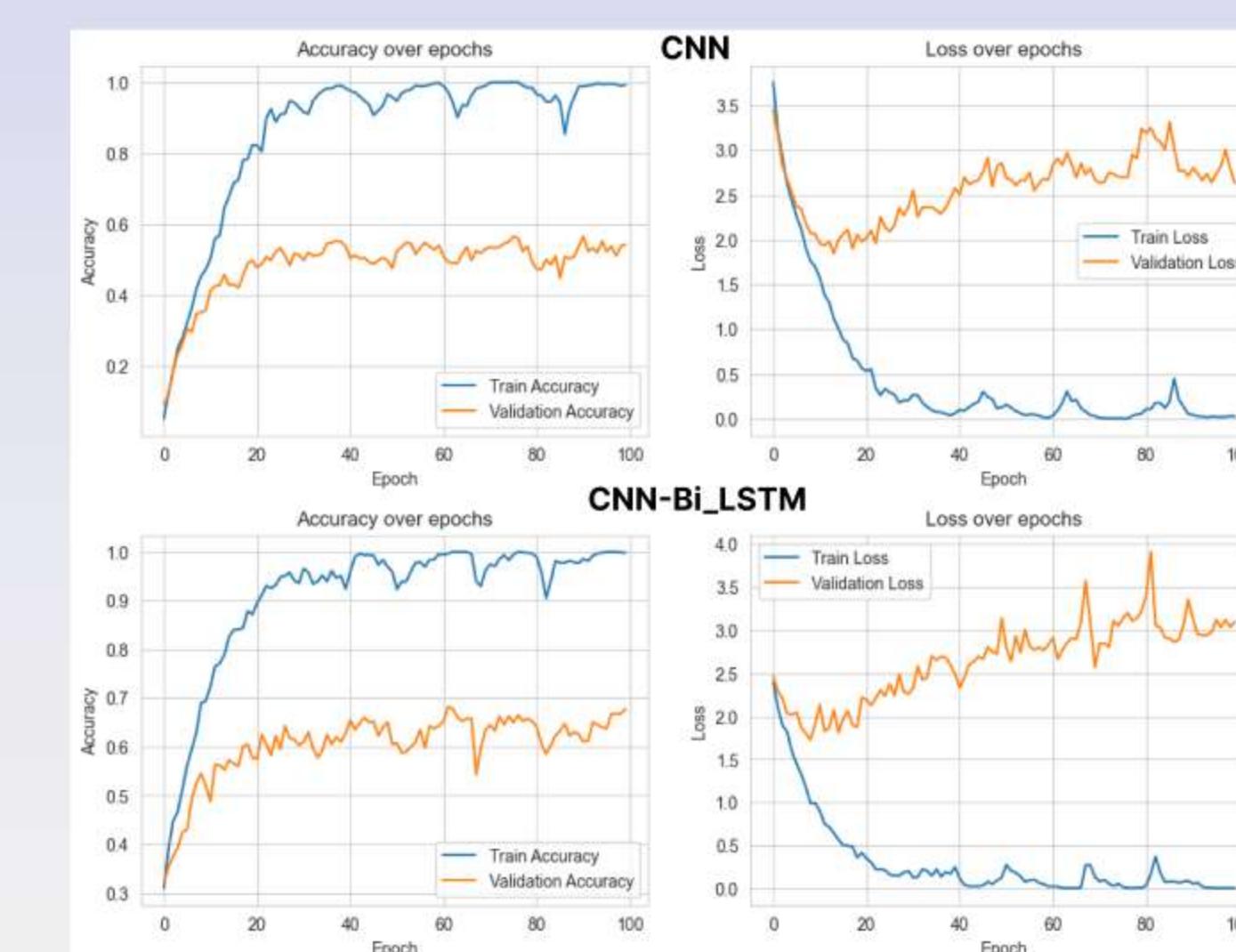


Basic Structure of Transformer

Replicating the HTSAT-2 Architecture with Transformer

We performed performance comparisons with **CNN** and **CNN-Bi_LSTM** using **HTSAT-22**.

The HTSAT-22 model outperforms traditional CNN and CNN-RNN models mainly due to its **Transformer-based architecture**, which is able to capture long-term dependencies more efficiently and provide richer feature representations through the **self-attention mechanism**. In addition, its **multi-task learning capability** enhances generalisation performance, enabling the model to handle many different types of audio data. Compared to RNN, Transformer's parallel processing capabilities and efficient use of computational resources make training more efficient, especially when using hardware such as **GPUs** and **TPUs**.



Test Set Score

98.5%

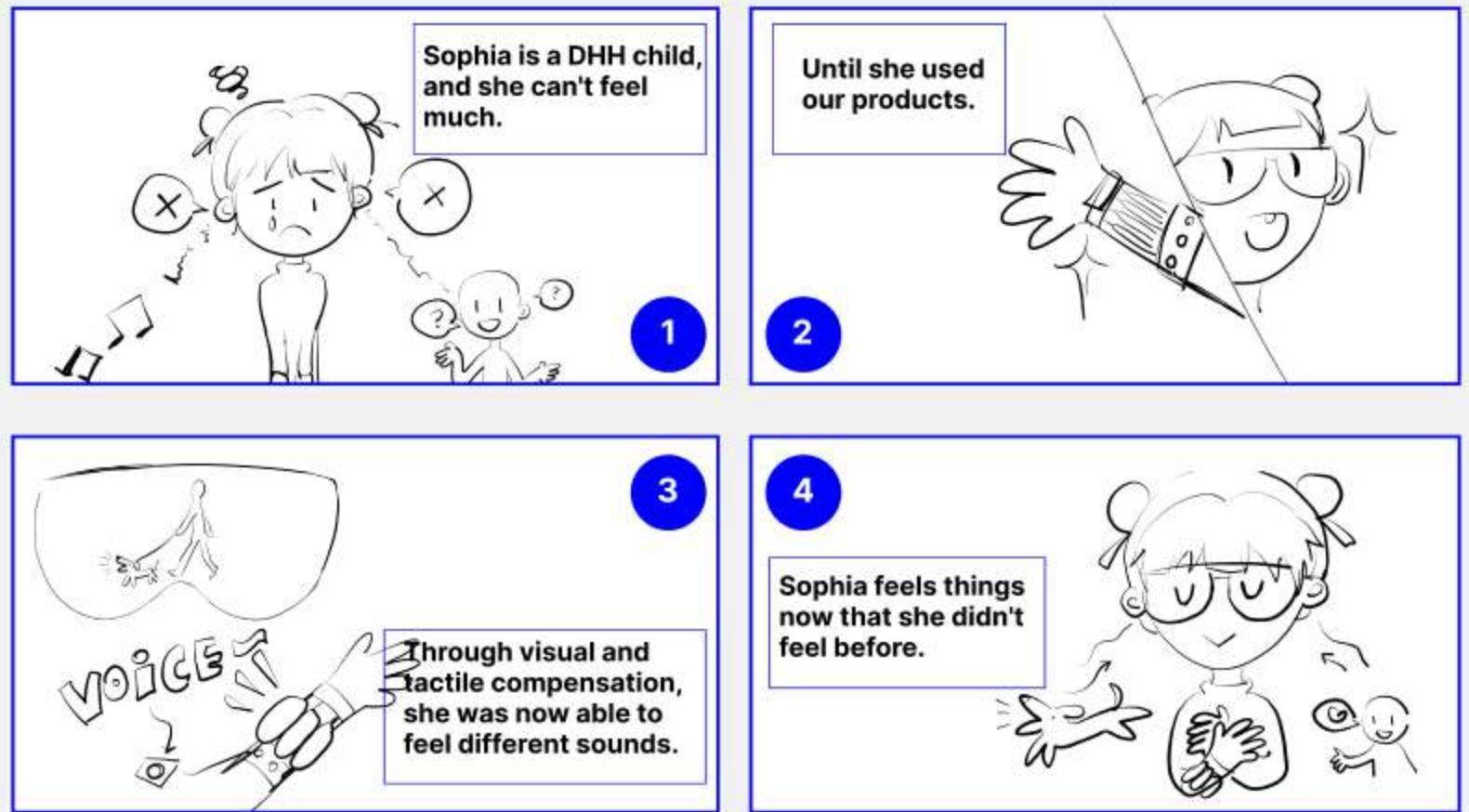
Test Set Score

67.75%

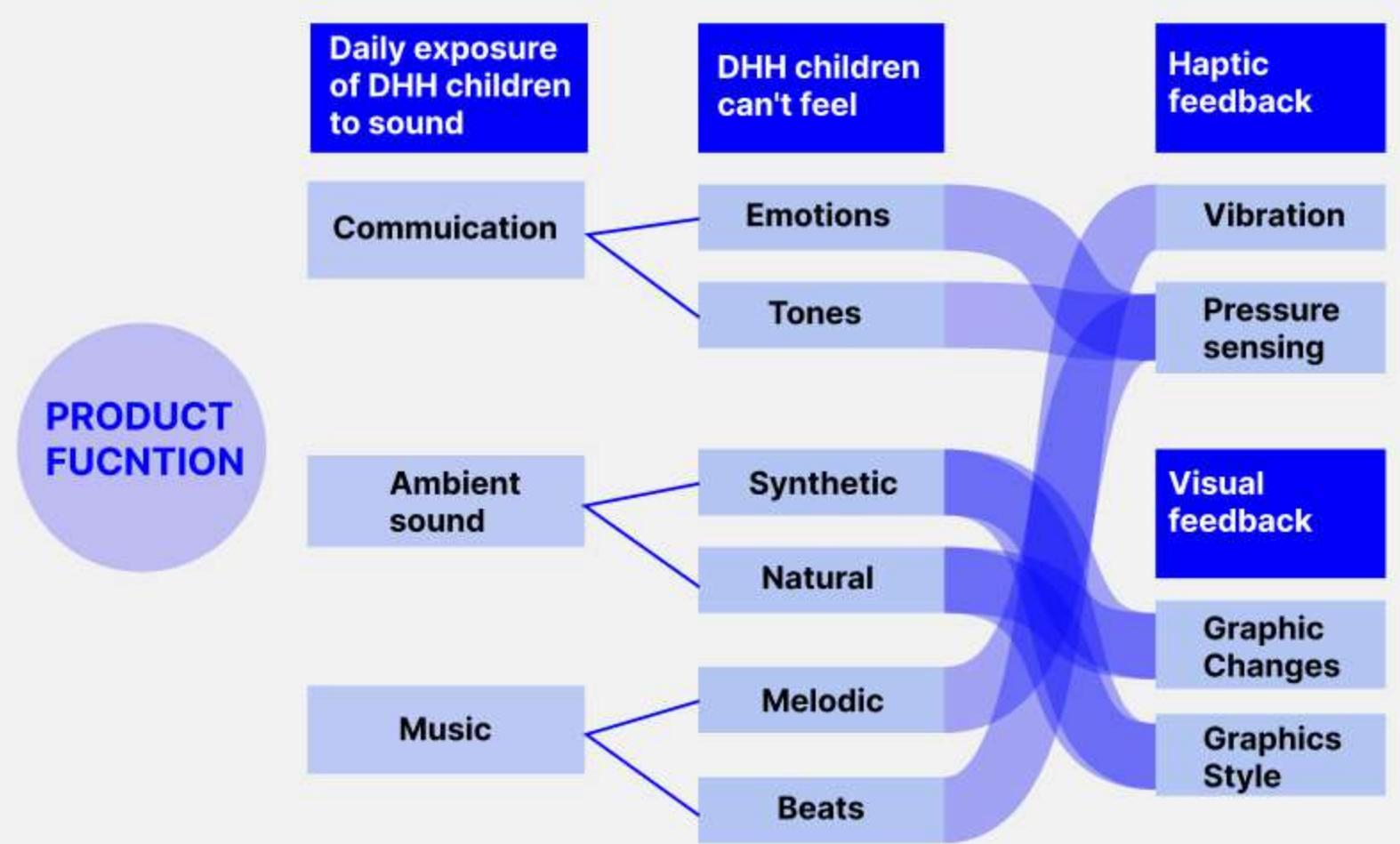
Test Set Score

54.25%

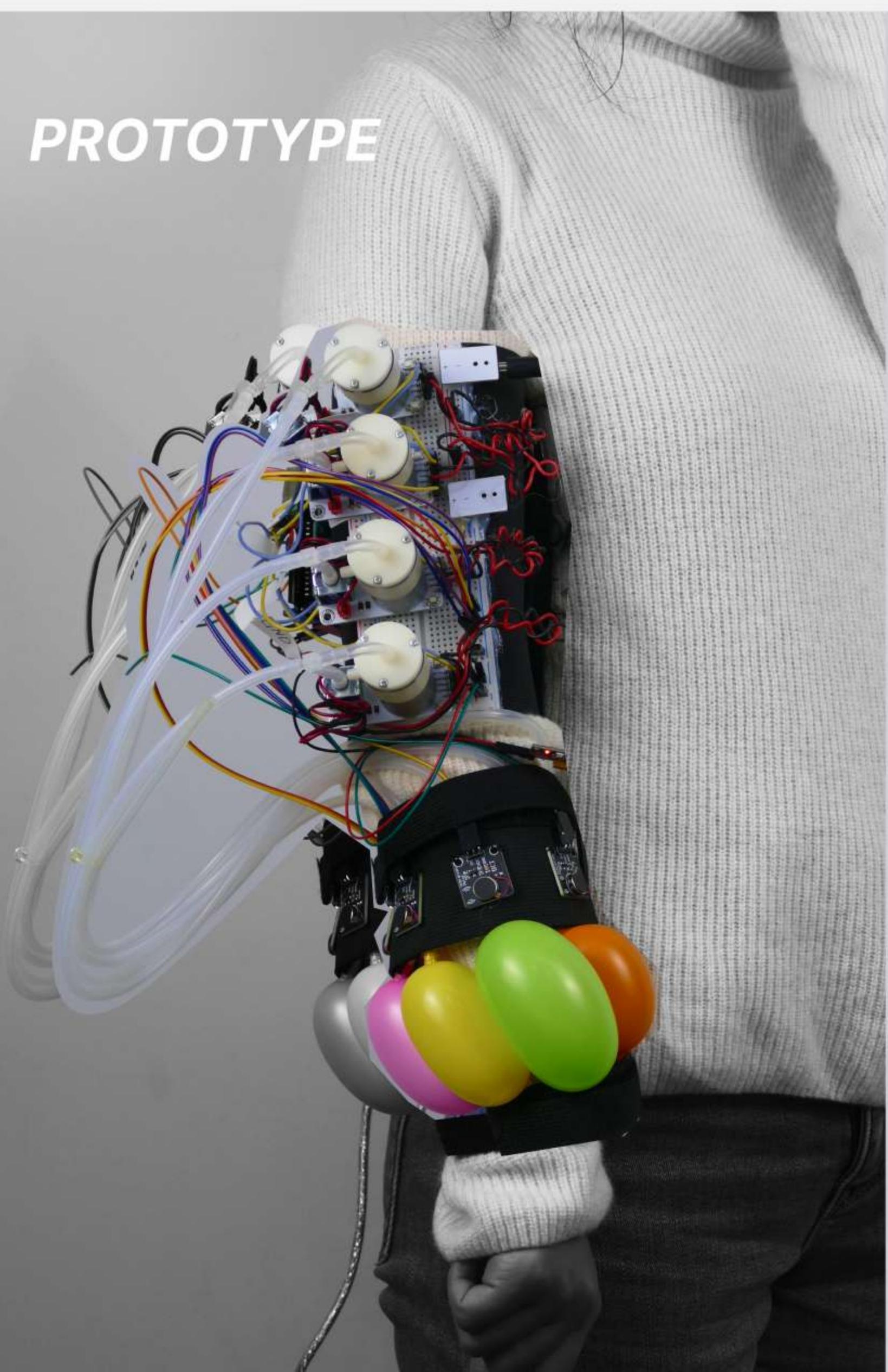
STORY BOARD



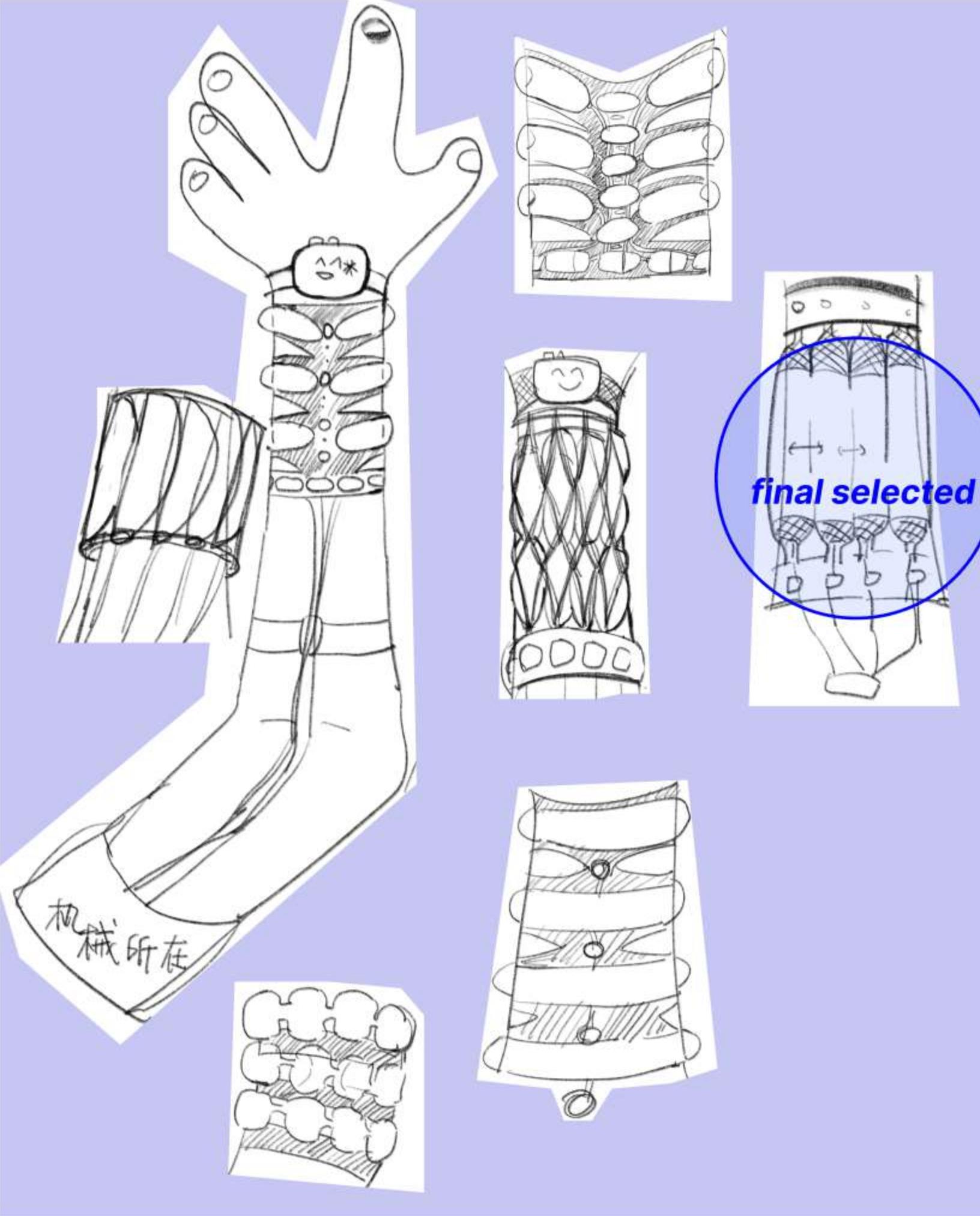
WORK FLOW



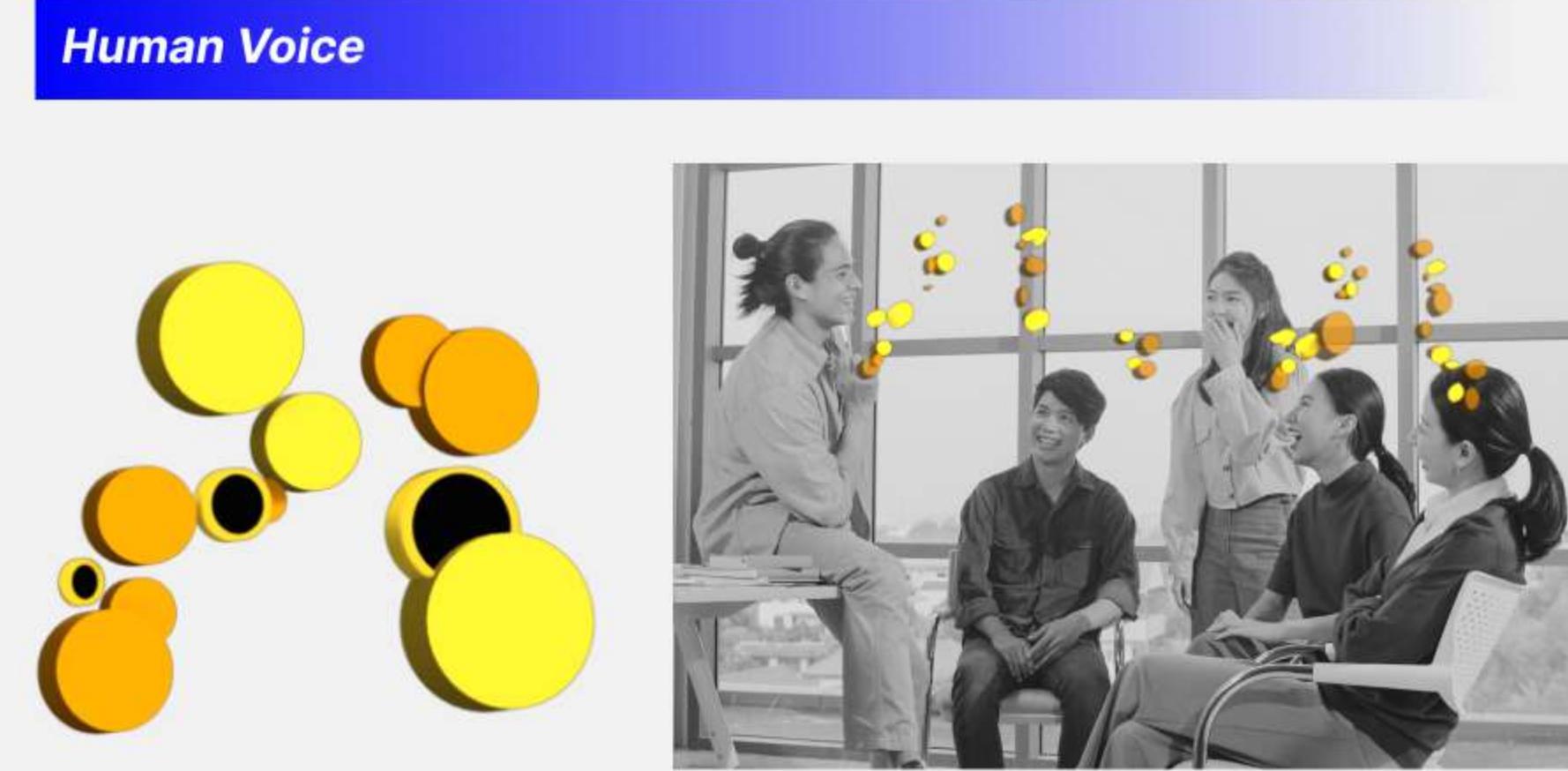
PROTOTYPE



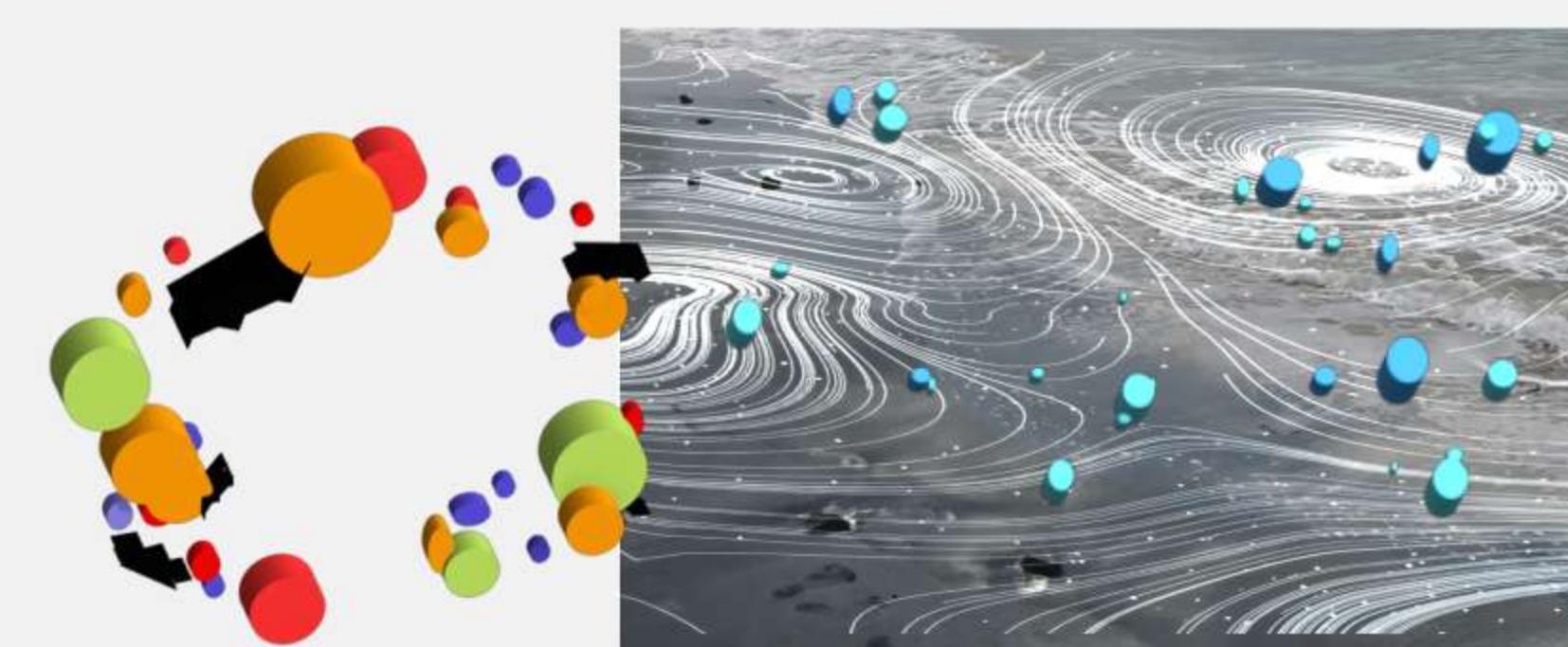
DRAFT DEDUCTION



AR DESIGN



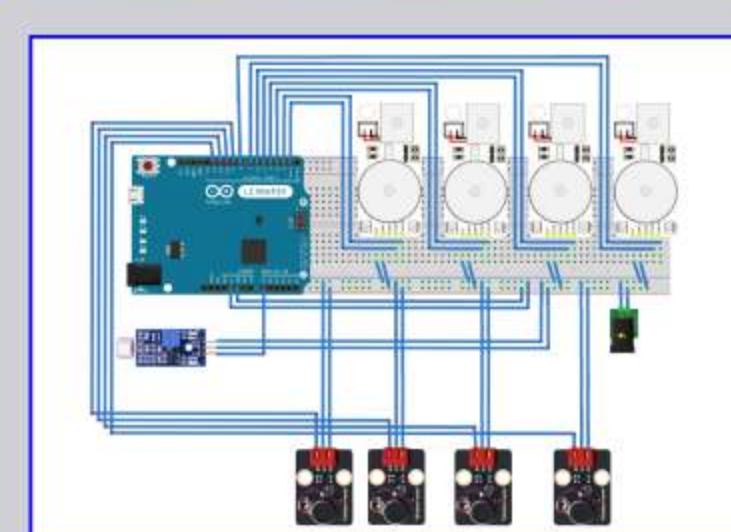
Music



Modeling & Testing



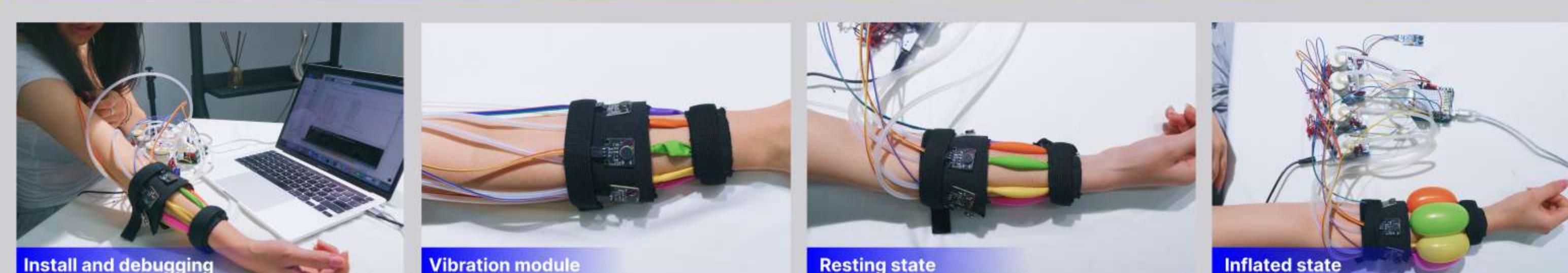
Circuit Board



Part Of The Code

```
// -----  
const int motor = 3; //  
  
void setup() {  
    Serial.begin(9600);  
    pinMode(motor, OUTPUT);  
    pinMode(airPumpPin, OUTPUT);  
    pinMode(airValvePin, OUTPUT);  
    digitalWrite(airPumpPin, airPumpOFF);  
    digitalWrite(airValvePin, airValveON);  
    //analogWrite(airPumpPin, 0);  
    //analogWrite(airValvePin, 255);  
    // ----- 声音传感器 -----  
    // 声音检测应放在下面，最小值 和 最大值  
    startMillis = millis();  
    while (millis() - startMillis < acquisitionTime) {  
        int sample = analogRead(soundPin);  
        if (sample > signalMax) {  
            signalMax = sample;  
        }  
        else if (sample < signalMin) {  
            signalMin = sample;  
        }  
    }  
}  
  
void loop() {  
    if (millis() - getDataTime >= getIntervalTime) {  
        getDataTime = millis();  
        getAirflowChange();  
        if (airflowValue >= setAirflowData) {  
            digitalWrite(motor, HIGH);  
            digitalWrite(airPumpPin, airPumpON);  
            digitalWrite(airValvePin, airValveOFF);  
        } else {  
            digitalWrite(motor, LOW);  
            digitalWrite(airPumpPin, airPumpOFF);  
            digitalWrite(airValvePin, airValveON);  
        }  
    }  
}  
// loop回话号  
}
```

Wearability Test



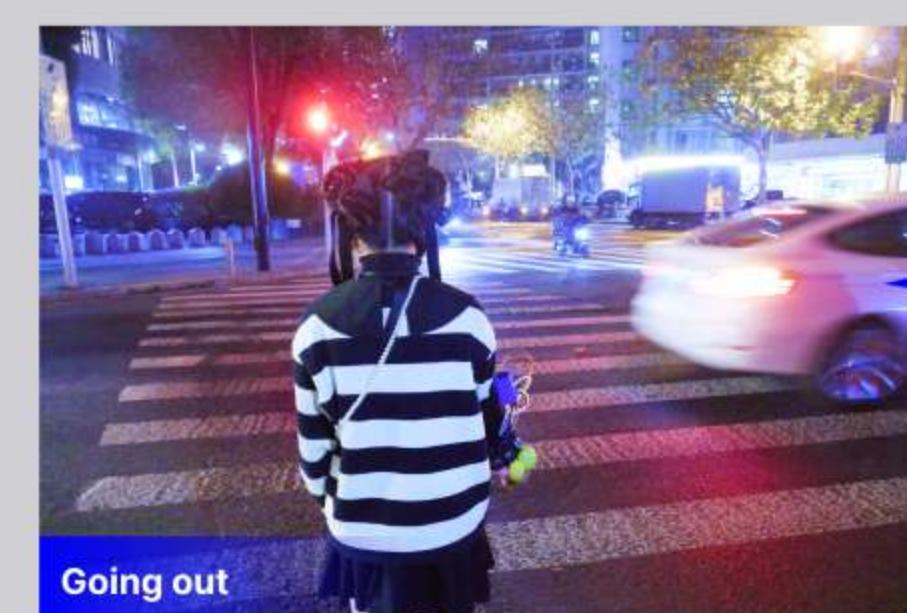
User Feedback



Too bulky to wear.



Need for a deeper understanding of child psychology.



Positioning may not be appropriate for children and needs to be readjusted.

Eco-Collie

O3 EcoReWild Pasture Regeneration System Product

EcoReWild Pasture Regeneration project focuses on sustainable grassland ecosystem restoration through a central AI rewilding approach, drone-based environmental data collection, and collaborative efforts with robotic dogs. Leveraging advanced technology, we not only intelligently plan grazing routes but also use robotic dogs for seeding, achieving a more comprehensive grassland recovery. Simultaneously, we monitor grassland recovery with drones and tailor restoration plans based on surveillance data, ensuring the health and balance of the ecosystem.

System Design
Interactive Design
Product Design

Time: 2023.11-2024.01
Interdisciplinary Collaborative Projects
Team Member: Yuchen Zhai, Weiqin Zhou, Ying Chen
Tutor: Estel Fu

My Part:
Research
Product Design
System Design

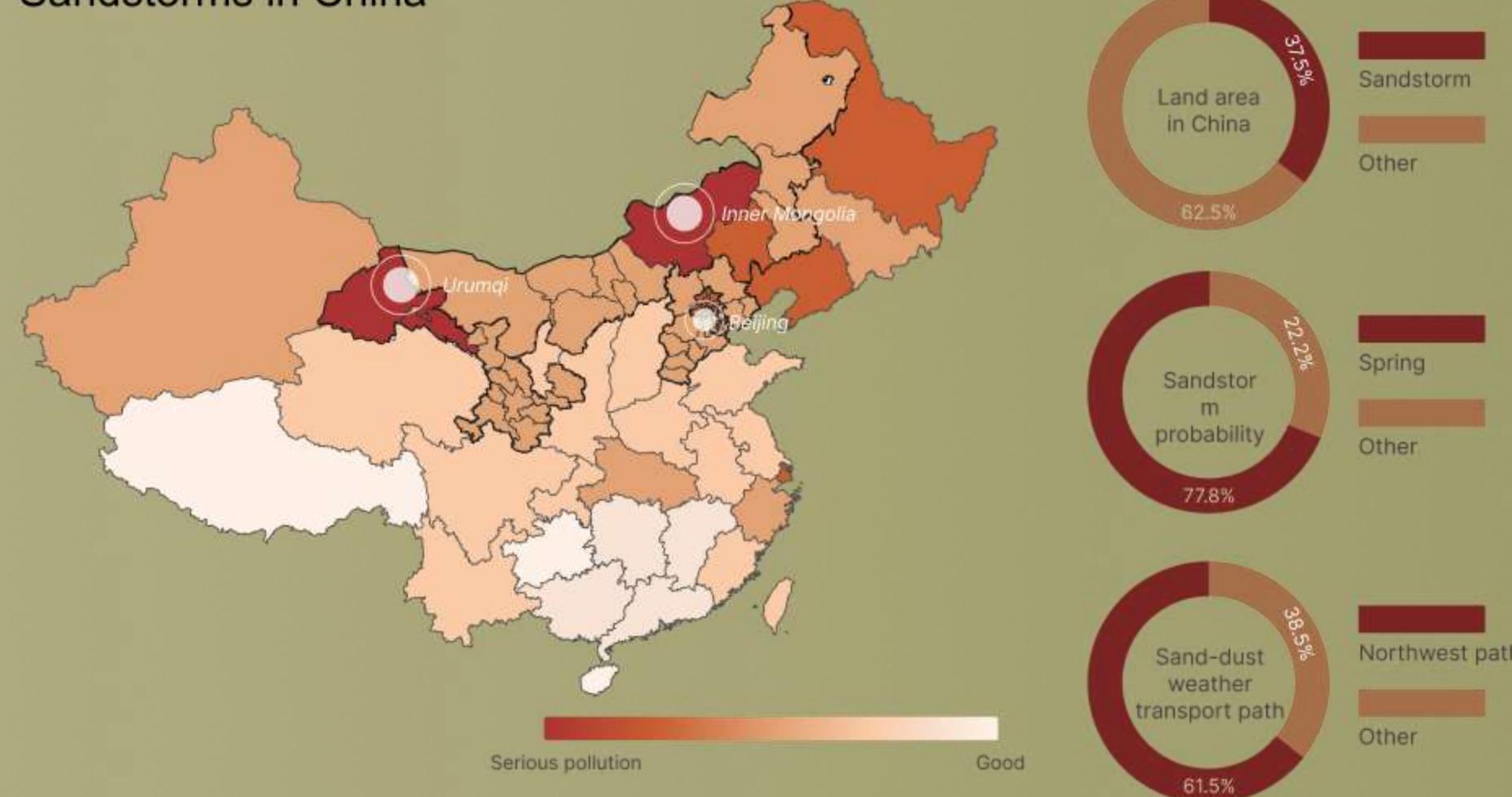
Background

The areas and causes of sand-dust weather in China in recent years

In recent years, the number of sandstorms in China has increased year by year, and each time the main area of impact is concentrated in almost the same area. Nearly 80% of China's annual sandstorms occur in spring.

Meteorological data show that in the past year, China's Inner Mongolia, Gansu, Hohhot, Shijiazhuang, Beijing, Tianjin and other places suffered from the control of sandstorms, Beijing is frequently affected by sandstorms, yellow sand in the sky, serious air pollution, for the people's production, life and work has brought great inconvenience.

Sandstorms in China



Major dust weather affected areas



Research

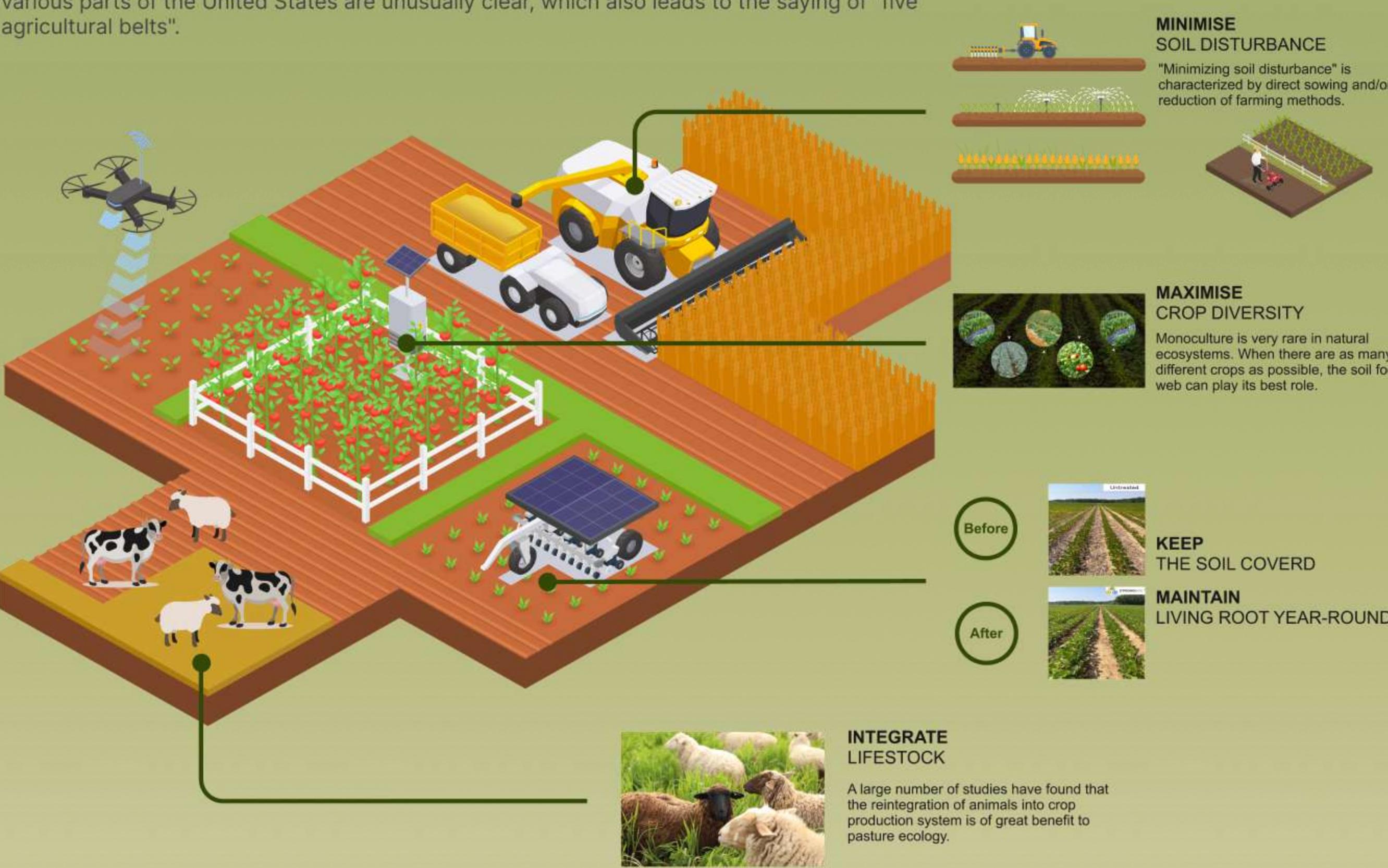
China policy support

China plain is limited, and the arable area is also limited.

- Grassland public ownership
- Expand the use of grassland grazing
- Multi-type grassland management mode
- Government regulation
- Adhere to the principle of environmental protection

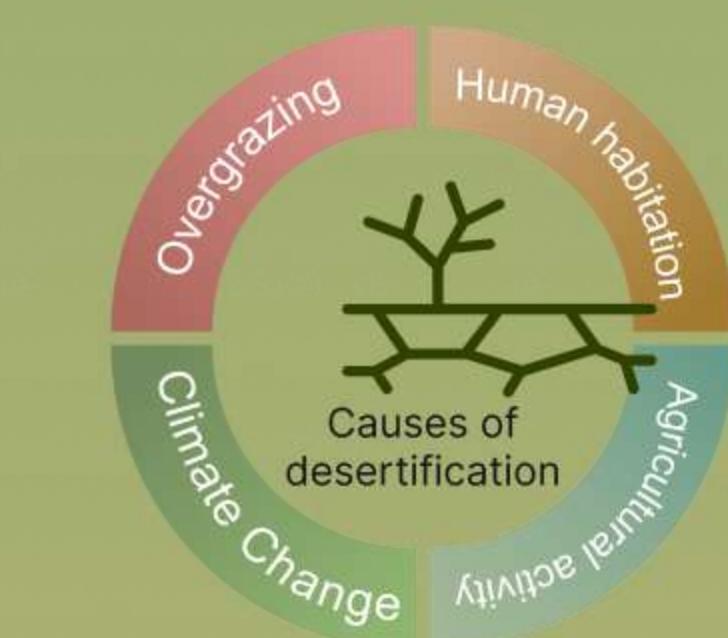
American policy support

As a country with a large area of high-quality plains for farming, the natural conditions in various parts of the United States are unusually clear, which also leads to the saying of "five agricultural belts".



Expert Insight

Causes of global desertification



Overgrazing is one of the main causes of desertification, along with agricultural activities, the expansion of human settlements and climate change.



Engineering measure



Mechanization



Biological measure



Means of governance



Inherent problem



Planting helpful plants will destroy the original plant structure and reduce the local biodiversity.

Protection is greater than reconstruction. The original is better than the reconstructed one.

It is impossible to rotate grazing as in the historical period, but only open zoning rotation grazing.

Herdsman Voice

Eldengtei 65

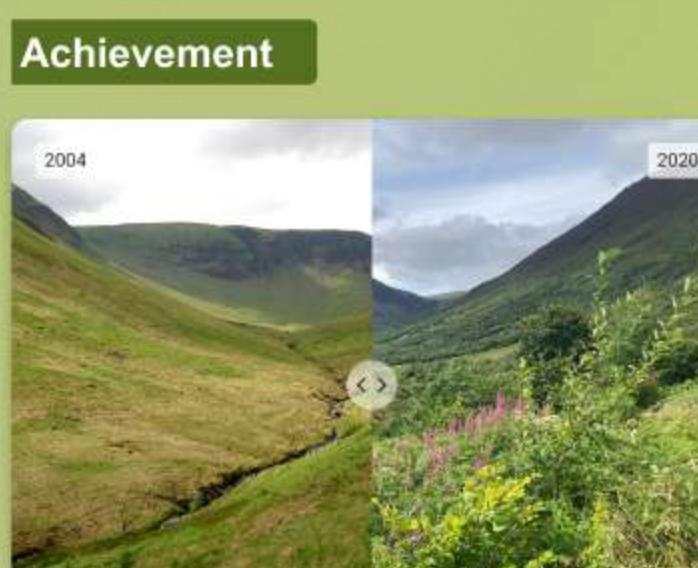
Our hope is not only policy orientation, but also to solve the problem as fundamentally as possible from practical actions, and to put it in place to help solve the grazing problem.



Case Study

British Carrifran Valley Revegetation Project

Reason	For hundreds of years, overgrazing by sheep and grazing on grass land led to land degradation.
Target	Poverty of local residents. Arouse homesickness Restore local grassland ecology Drive local economic development
Measure	Build fences to isolate herders' animals manually. According to different altitudes, planned afforestation will be carried out.



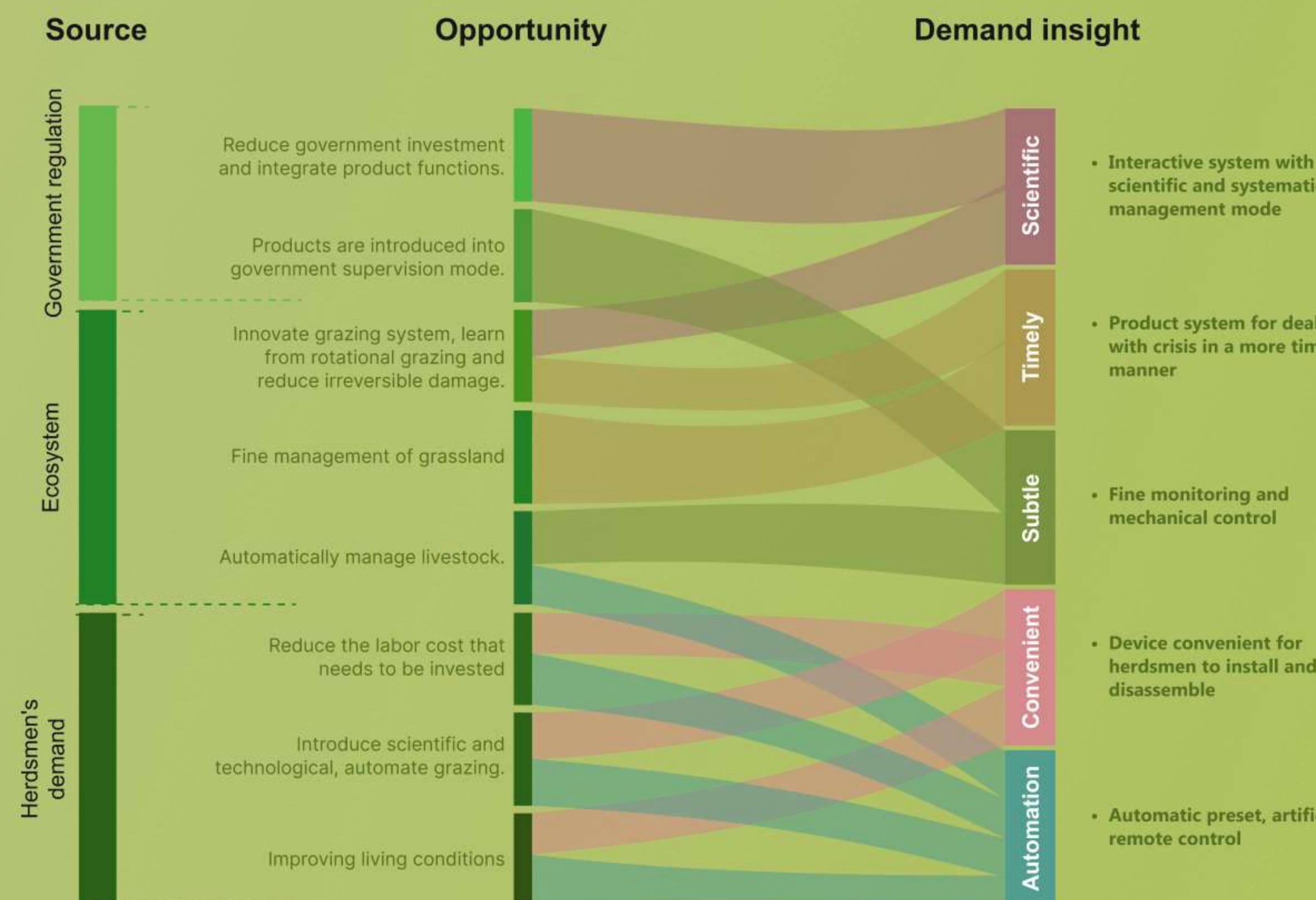
New Zealand "Air Shepherd Dog" Program

Reason	Too many sheep and too few herders.
Target	Save time for herders. Solve the traffic problem of herders running around different mountain slopes.
Measure	Use drones instead of shepherds to graze. Use special music to help drive away sheep. Through the mutual recognition between the head sheep and the drone, the sheep can run with the drone.



Various countries and regions have launched targeted measures according to different local ecological environment, policies, goal orientation and other factors.

Opportunity point



The scene is public grassland and individual contracted land facing potential desertification problems.

Realize professional, interactive and mechanized monitoring and planning grazing products.

Users are herders who contract grassland.

Control of grassland plants by changing grazing methods.

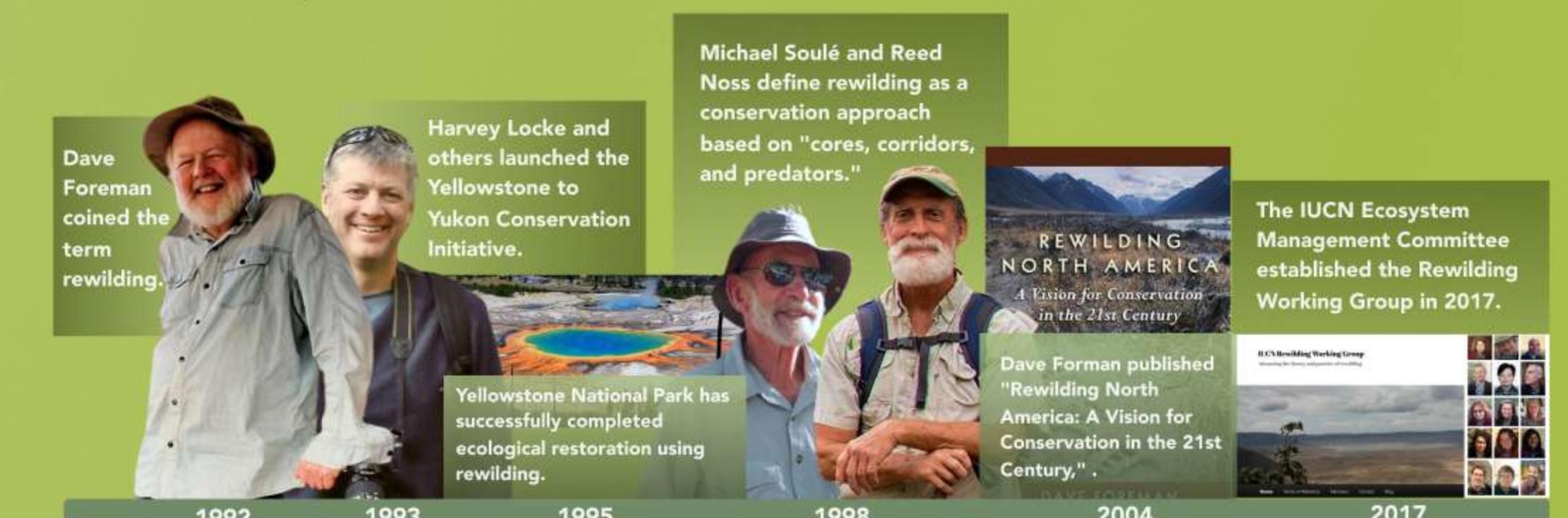
Main strategy

Envision "rewilding" as the main strategy to solve the main problem

About rewilding

"Rewilding" is an ecological concept and nature conservation method that aims to restore and rebuild the ecological functions of natural ecosystems, enhance biodiversity, ecological resilience and ecosystem services, while mitigating the impact of human activities on the natural environment.

The development



Why is rewilding

(1) In line with the principles advocated by the World United Nations for ecological restoration

(2) A method that is relatively mature and can be adapted to local conditions according to the landscape conditions in different regions.

(3) Continuous recovery activities

(4) Minimize interference to grassland, achieve ecological restoration to the greatest extent, and promote natural and human benefits

Our Goal



Solve the original problems of the pasture and restore the ecology

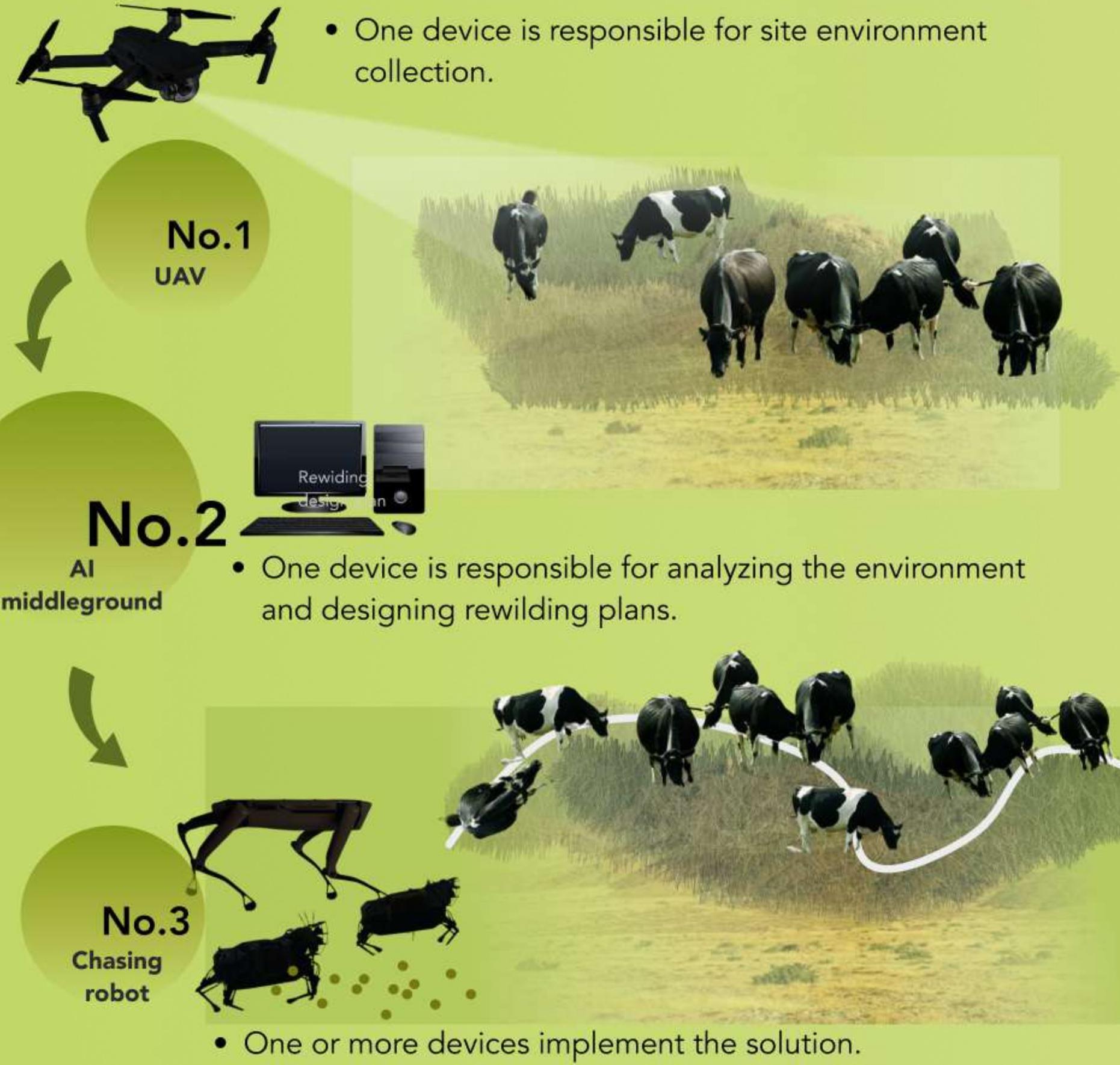


Plan subsequent nomadic routes and continue regeneration

Solution

How to achieve rewilding

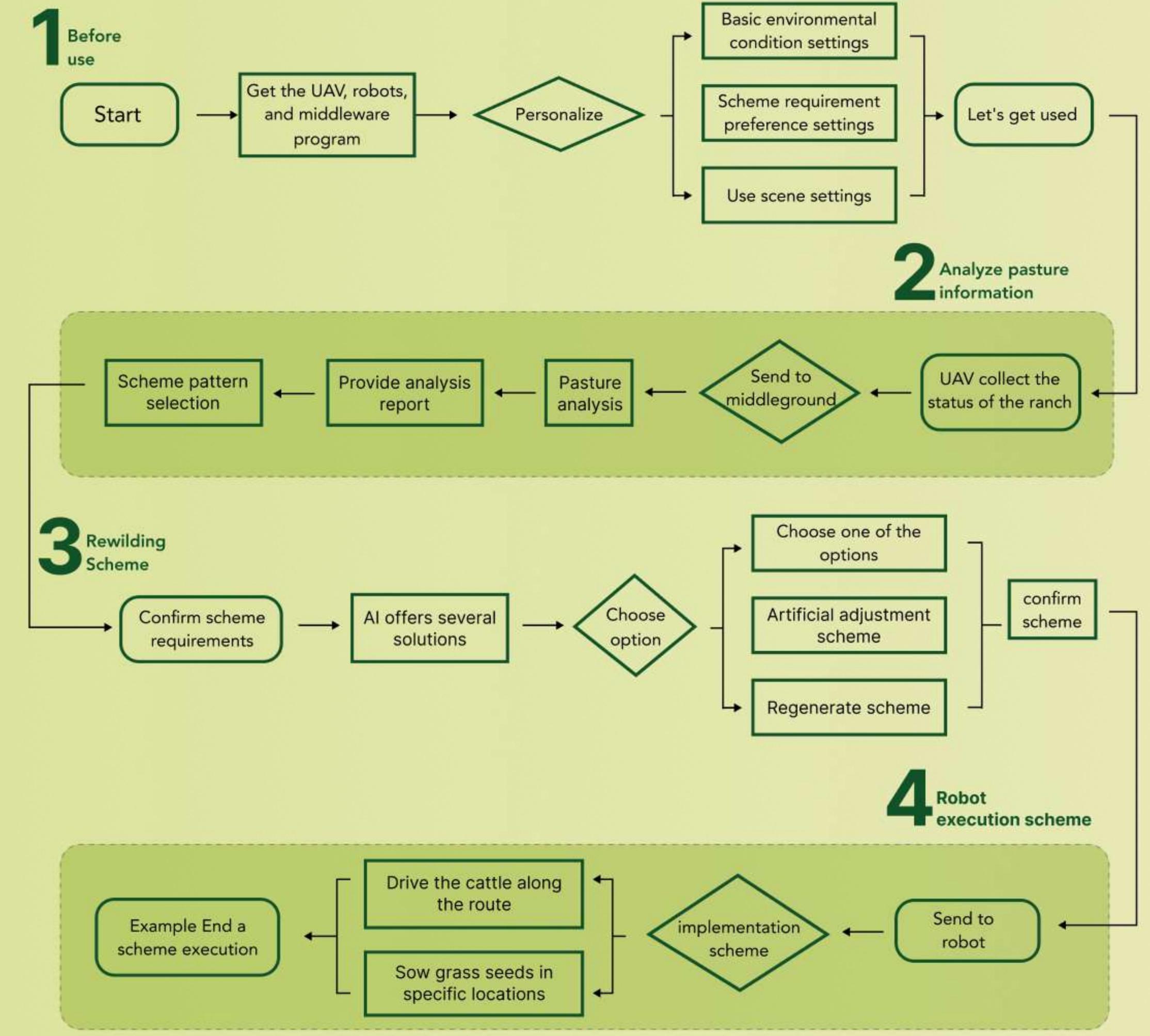
We need a complete **system** to realize the design and implementation of rewilding plans.



Technical support



User flow



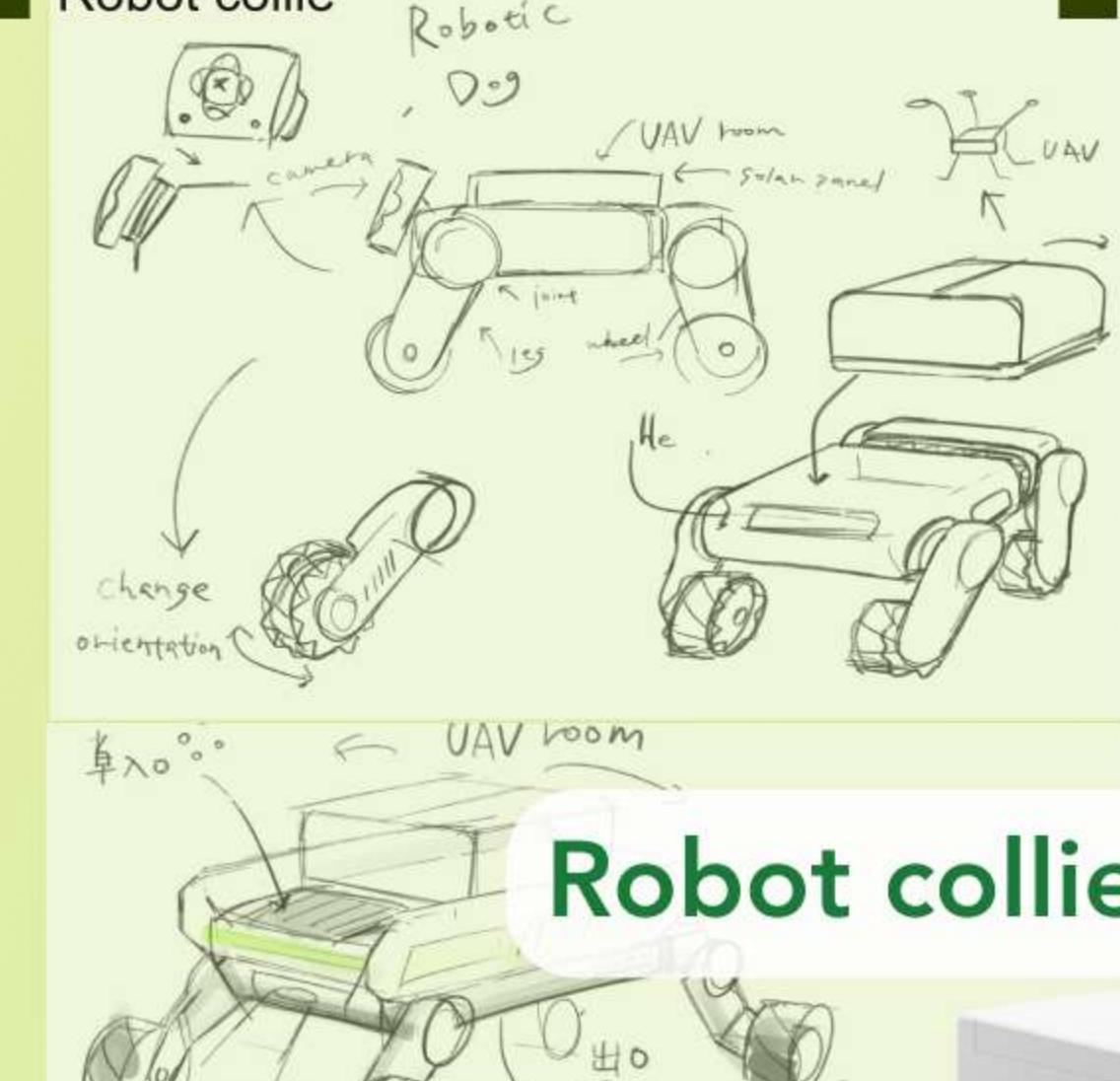
AI middleground

Design rewilding scheme



Product Design

Robot collie



Robot collie



Drones

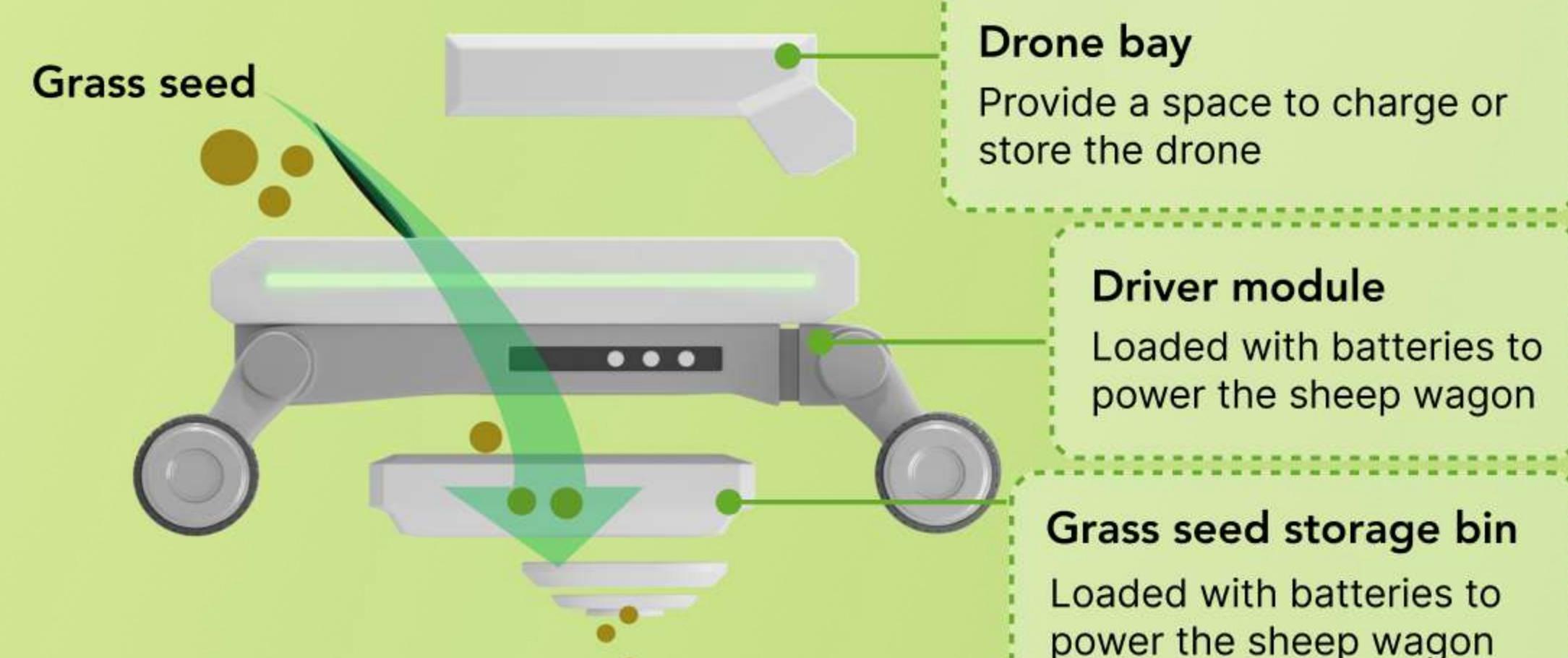


UAV

The selected drone is chosen from products already on the market, with DJI brand as the representative.

Function

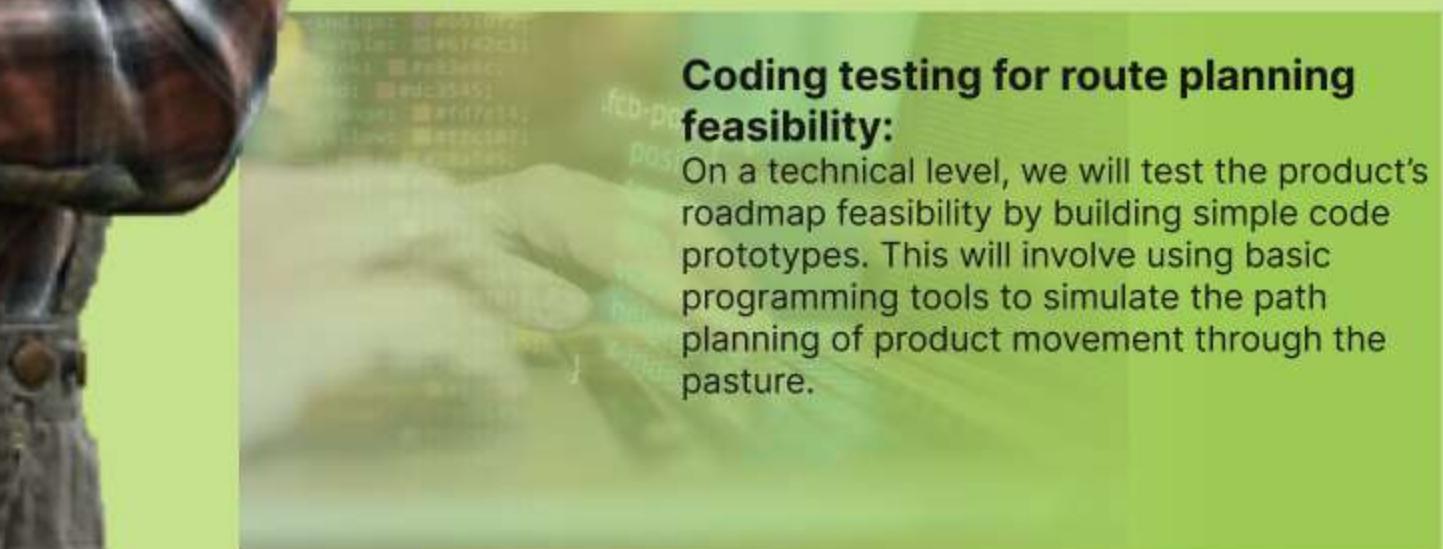
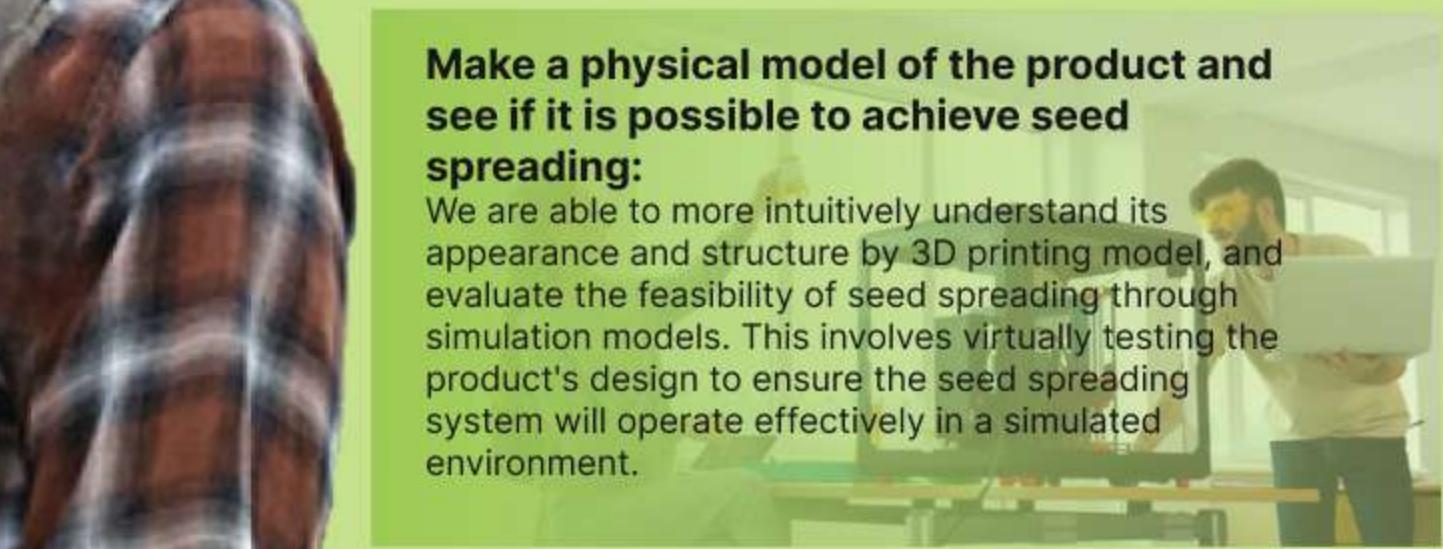
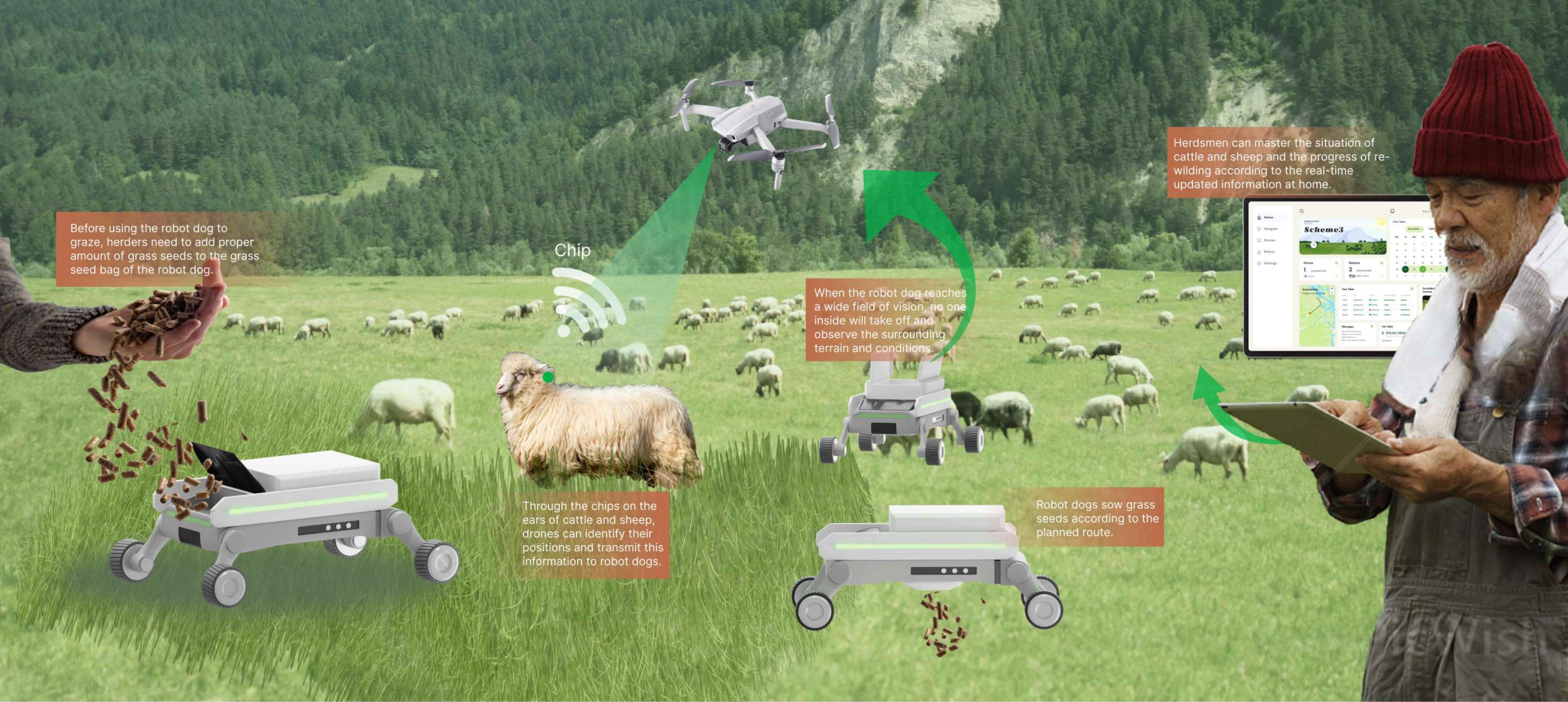
Exploded diagram of the product: divided into three layers of structure, respectively provide different functions of rewilding



Details



Future planning



OTHER WORKS

WOMEN Interactive Installation And Product Design



Vigorously fight against discrimination against women in sacrificial activities.
Designed menstrual cups, sanitary napkins in the shape of sacrificial products, and women's contextual soap

School Project
Team Member: Yuchen Zhai Wanyou Zhang
My Part: Research/Installation Design/Product Design
Time: 2022.11-2022.12
Tutor: Yumei Dong

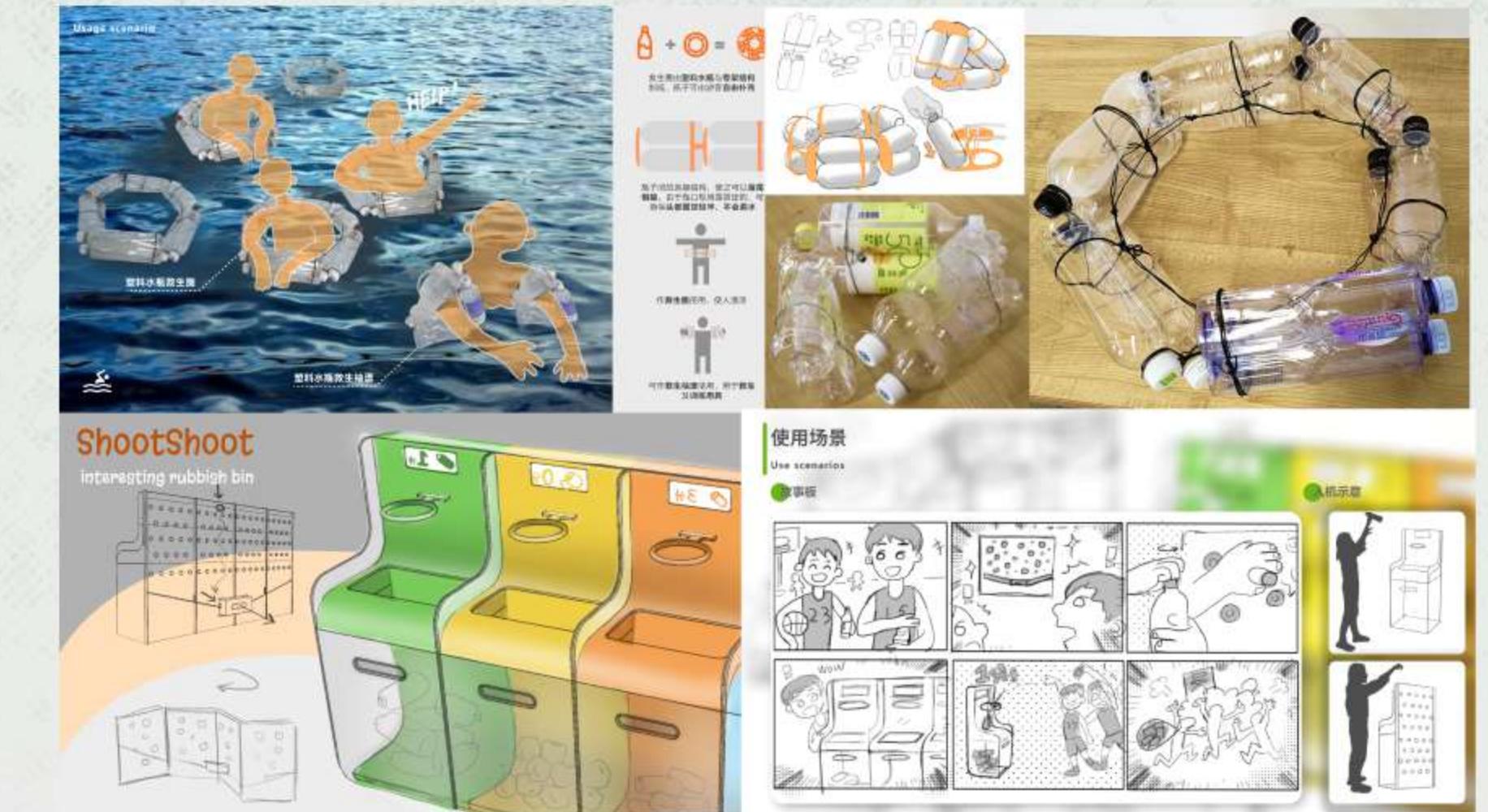
WUXI City Urban Renewal System Design



The Urban Renewal Planning Of Wuxi Rice Market, How To Transform The City Corner While Preserving The Fireworks?

School Project
Team Member: Zhongle Wenhao Zhu Zhenxiang Pan
Yuchen Zhai
My Part: Research/System Design/Visual Design
Time: 2023.5-2023.6
Tutor: Caoming

Trash Recycling Sustainable Design



A Product That Can Connect Life Rings Together And A Gamified Trash Can To Improve Garbage Recycling And Garbage Sorting, Respectively

School Project
Team Member: Yuchen Zhai Yifan Zhang Fanke Linhan Zhang
My Part: Research/Prototype/Product Design
Time: 2023.3-2023.5
Tutor: Miaosen Gong Mingshan Zhang

OTHER WORKS

YONGHE Brand Innovation

Brand Design



Yonghe King's Brand Renewal Plan, Update Vi Vision And Store Visual Design

School Project
Team Member: Yuchen Zhai Yifan Zhang Fanke Linhao Cai Linhan Zhang
My Part: Research/Visual Design
Time: 2022.10-2022.12
Tutor: Weiwei Feng

Chinese Solar Term-Spring

Service Design



As For The Service Design Combining Food Education Research And Chinese Solar Terms, Interactive Devices Corresponding To Solar Terms Were Designed At Each Stage

School Project
Team Member: Yuchen Zhai Ziqi Yue Shuyi Deng
My Part: Research/Service Design/Product Design
Time: 2023.5-2023.6
Tutor: Miaosen Gong

Product Semantic Design

Product Design

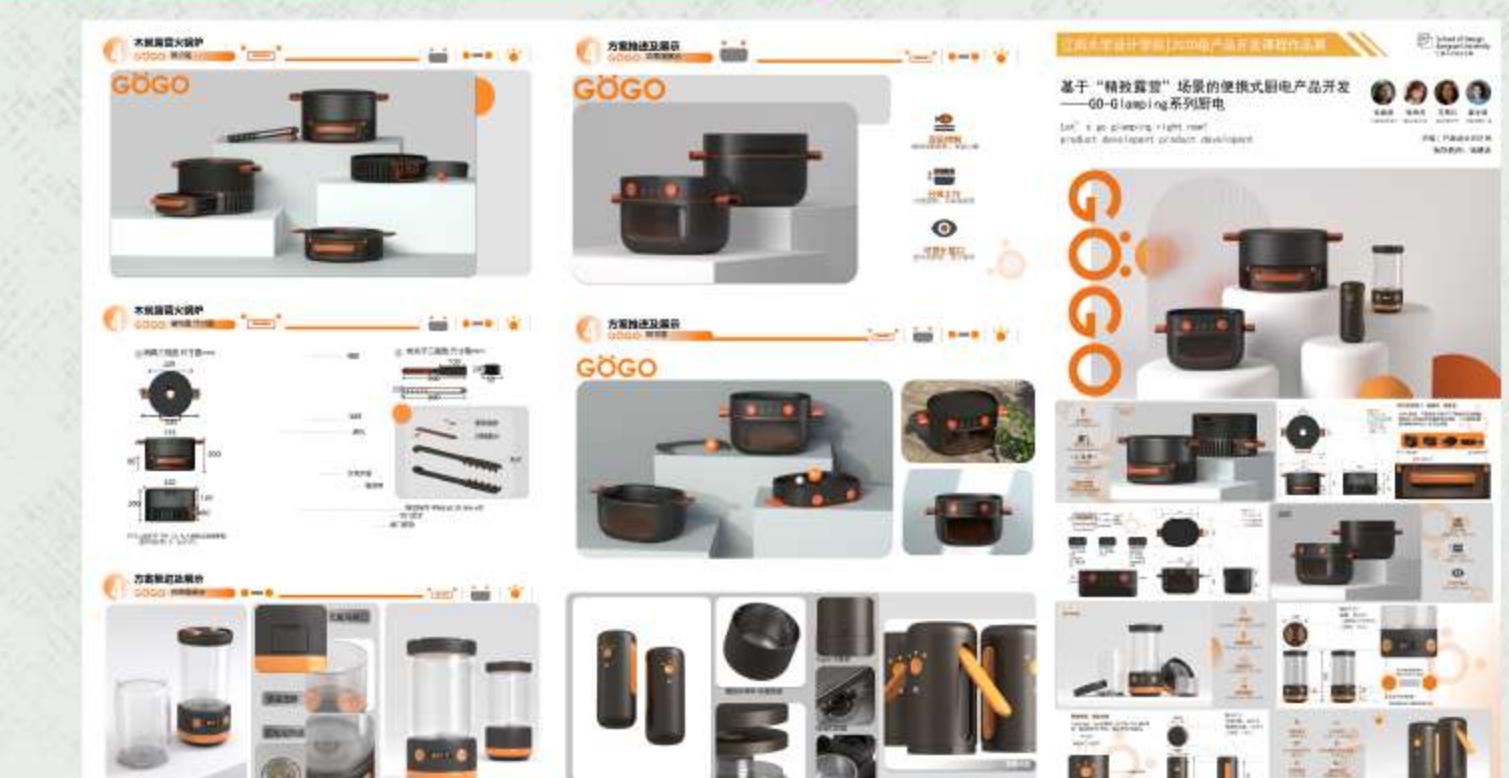


With The Chinese Traditional Drum Shape As A Reference, Some Series Of Products Semantic Design

School Project
Team Member: Yuchen Zhai Yifan Zhang Fanke Linhan Zhang
My Part: Research/Product Design
Time: 2022.11-2022.12
Tutor: Chenxiang

Camping Kitchenware Design

Product Design



Design Of Small Household Appliances In The Camping Scene

School Project
Team Member: Yuchen Zhai Wanyou Zhang Yuhong Feng Xiaofang Zhang
My Part: Research/Product Design
Time: 2022.9-2022.11
Tutor: Xiaobo Qian