

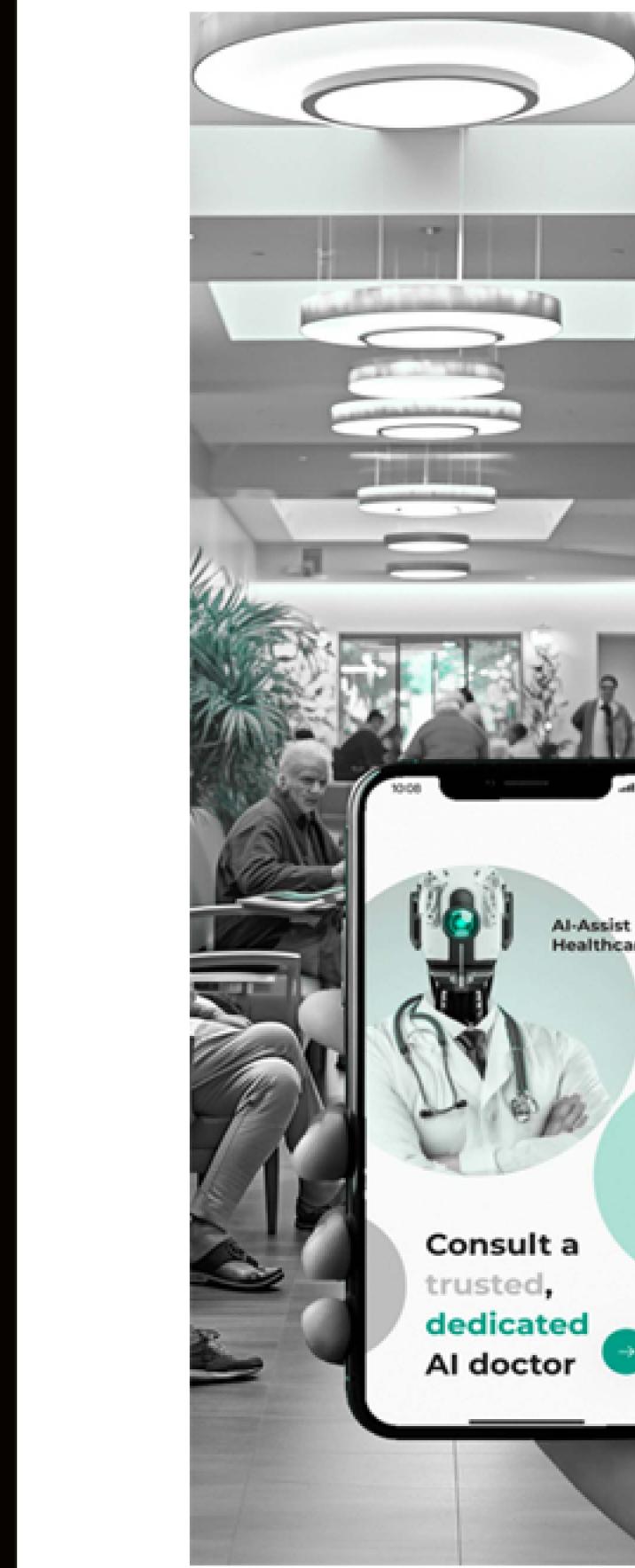
# PORTFOLIO

ZHUOYANG.PEI

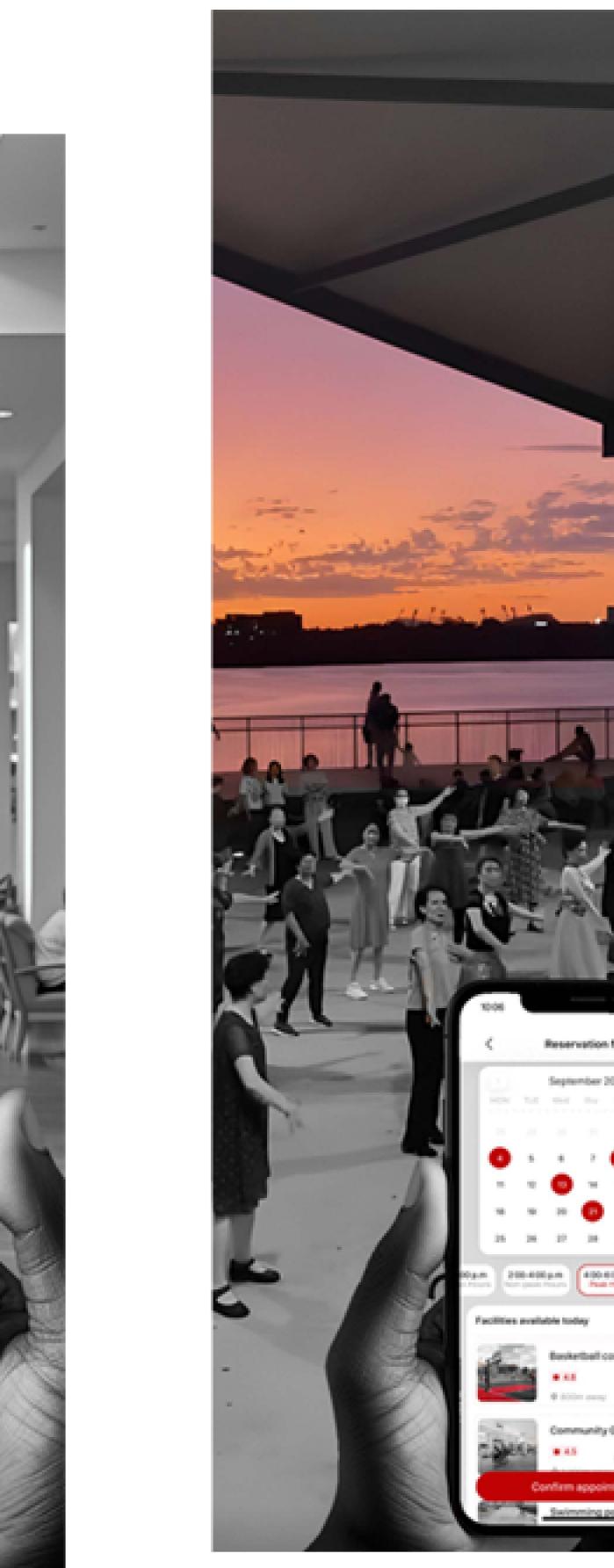
SELECT WORK

2022-2023

**AI-Assist Healthcare**  
UI & UX | Individual Project  
2023.07 - 2023.11



**Community-Shared Space**  
UI & UX | Service Design  
Individual Project  
2023.05-2023.08



**Bee - Harvest**

Product Design | UI & UX  
Individual Project  
2022.09-2023.01



**Allihiies Biopharmaceuticals Research Center**

Architecture | Product Design

Individual Project

2022.09-2023.01



## Other Work

Several Individual Architecture Projects  
2022-2023



# PROJECT 1

## AI-Assist Healthcare

-A patient-focused app that uses artificial intelligence and natural language processing to simplify and enhance the healthcare experience.

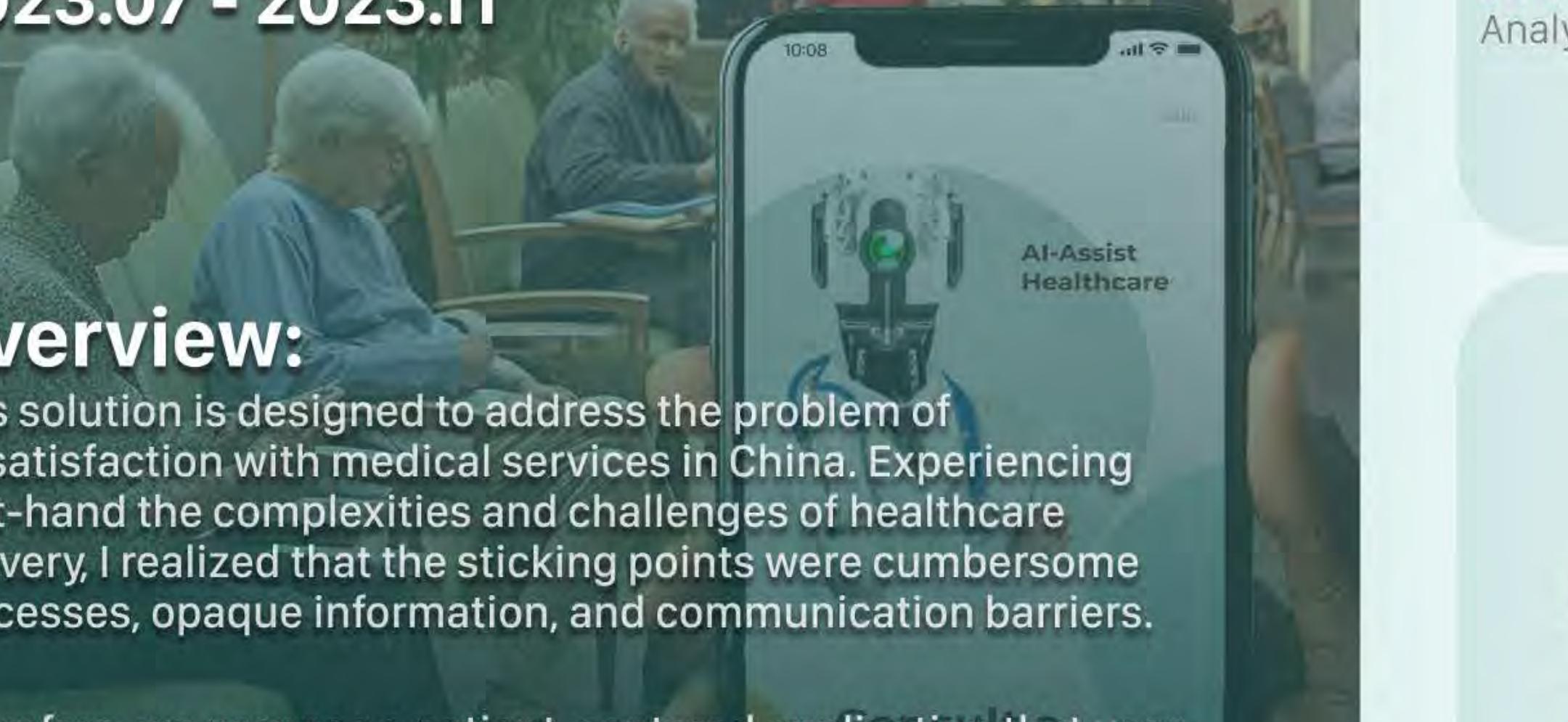
### UI & UX | Individual Project

2023.07 - 2023.11

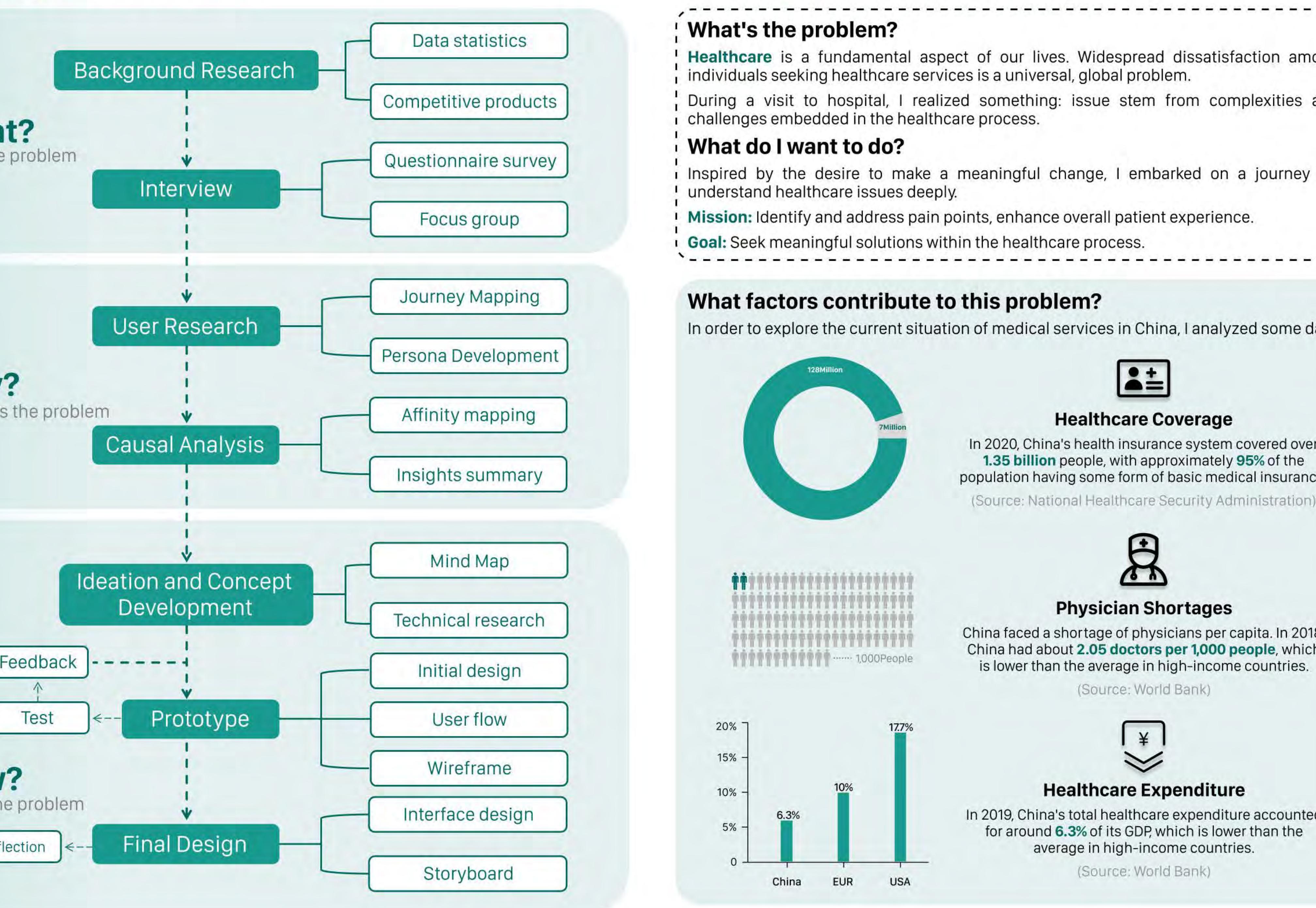
#### Overview:

This solution is designed to address the problem of dissatisfaction with medical services in China. Experiencing first-hand the complexities and challenges of healthcare delivery, I realized that the sticking points were cumbersome processes, opaque information, and communication barriers.

Therefore, we propose a patient-centered application that uses artificial intelligence and natural language processing technology to simplify medical processes, provide transparent medical information, promote natural language communication, and achieve personalized user experiences, aiming to create a more intuitive, transparent and smooth communication medical experience.



## Design Process



## Background Research

### What's the problem?

**Healthcare** is a fundamental aspect of our lives. Widespread dissatisfaction among individuals seeking healthcare services is a universal, global problem.

During a visit to hospital, I realized something: issue stem from complexities and challenges embedded in the healthcare process.

### What do I want to do?

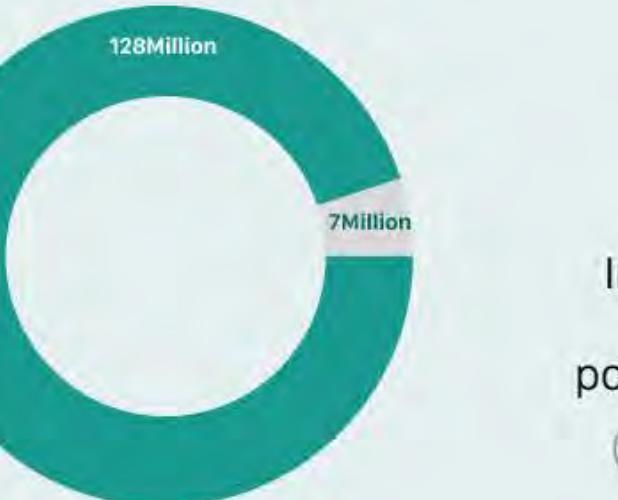
Inspired by the desire to make a meaningful change, I embarked on a journey to understand healthcare issues deeply.

**Mission:** Identify and address pain points, enhance overall patient experience.

**Goal:** Seek meaningful solutions within the healthcare process.

### What factors contribute to this problem?

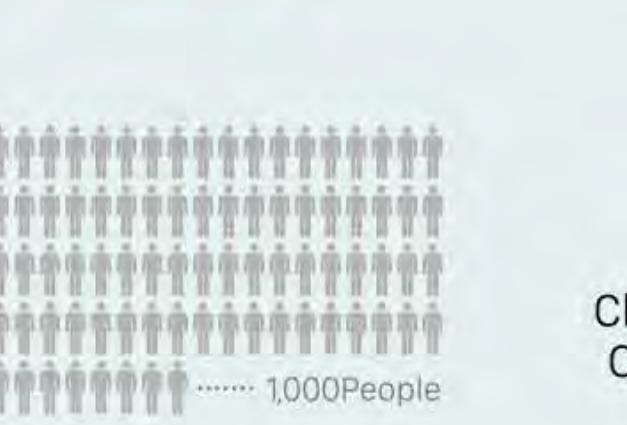
In order to explore the current situation of medical services in China, I analyzed some data:



#### Healthcare Coverage

In 2020, China's health insurance system covered over **1.35 billion** people, with approximately **95%** of the population having some form of basic medical insurance.

(Source: National Healthcare Security Administration)



#### Physician Shortages

China faced a shortage of physicians per capita. In 2018, China had about **2.05 doctors per 1,000 people**, which is lower than the average in high-income countries.

(Source: World Bank)

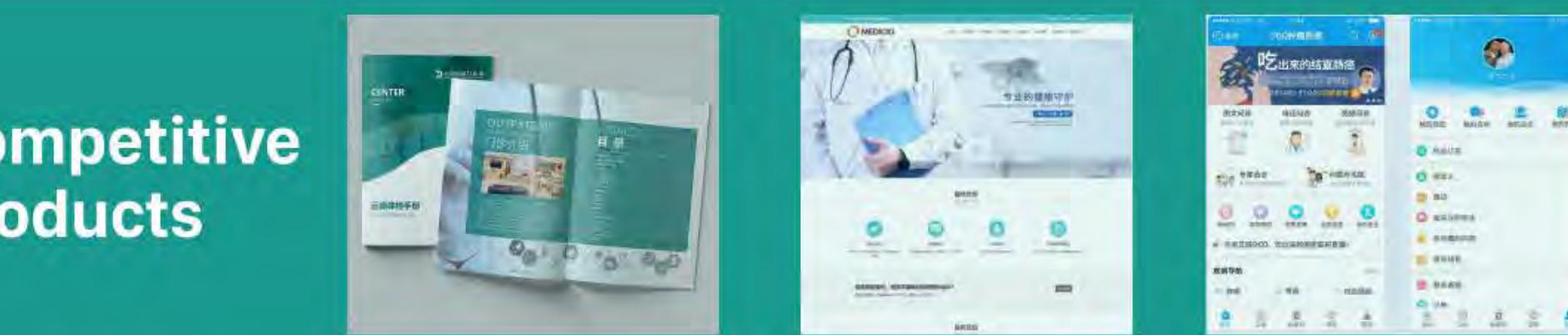


#### Healthcare Expenditure

In 2019, China's total healthcare expenditure accounted for around **6.3%** of its GDP, which is lower than the average in high-income countries.

(Source: World Bank)

### Competitive Products



Aspect	Hospital Guidance Manual	Hospital Official Website	Hospital App
<b>Function</b>			
Accessibility and Convenience	✗	✓	✓
Provides Current Information	✗	✓	✓
User-Friendly Navigation	✗	✓	✓
Offers Real-time Updates	✗	✓	✓
Enables Appointment Booking	✗	✗	✓
Facilitates Health Records	✗	✗	✓
<b>Merits and Demerits</b>		Easy to keep, High acceptance, Everyone can use it Non-interactive, Non-reusable	Timely response Modernization Not smart enough Unfriendly to the someone
		Informative	Narrow applicability

### What phenomena exacerbate the problem?

#### Difficulty in Registration and Waiting

- Shortage of healthcare providers and facilities leads to high demand for limited appointments.
- Limited slots result in challenges in registering for appointments and long waiting times.



- Patients with non-urgent concerns may rush to emergency rooms due to a lack of guidance and health knowledge.
- Registration errors leading to time and manpower wastage.



- Individuals with chronic conditions require ongoing care and periodic hospital visits, contributing to crowded hospitals.
- By the end of 2020, China had over 260 million people aged 60 or older, making up nearly 18.7% of the total population.

### Background Research Summary

Extensive research has confirmed the objective situation of **insufficient medical resources**, and the solution to medical resource waste is **comprehensive healthcare applications**.

- The app guides patients through the entire healthcare journey, addressing needs before, during, and after diagnosis and treatment.
- Primary goal: Improve patient experience, reduce strain on hospital resources, and optimize resource utilization for both patients and healthcare institutions.

# Interview

## Questionnaire

**Q1** On a scale of 1 to 5, **how often** do you visit the hospital for healthcare services? (1 being rarely, 5 being frequently)



This question helps gauge the user's familiarity with hospital processes and the potential relevance of the app to their needs.

**Q2** How comfortable are you with using **digital health tools (like mobile apps)** to manage your healthcare? (1 being very comfortable, 5 being not comfortable at all)



This question assesses the user's readiness and familiarity with technology, helping design an app that aligns with their tech-savviness.

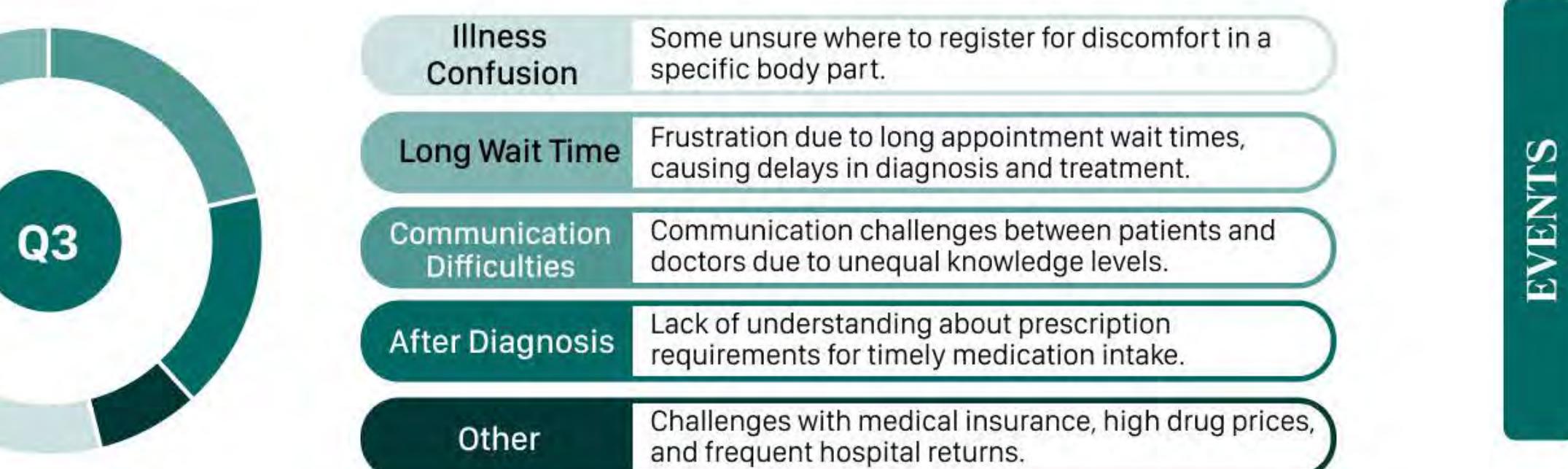
## Focus Group

Professional doctors work longer hours in hospitals and have effective understanding of the common difficulties faced by patients. So I formed a focus group for doctors to discuss the essence of the problem.



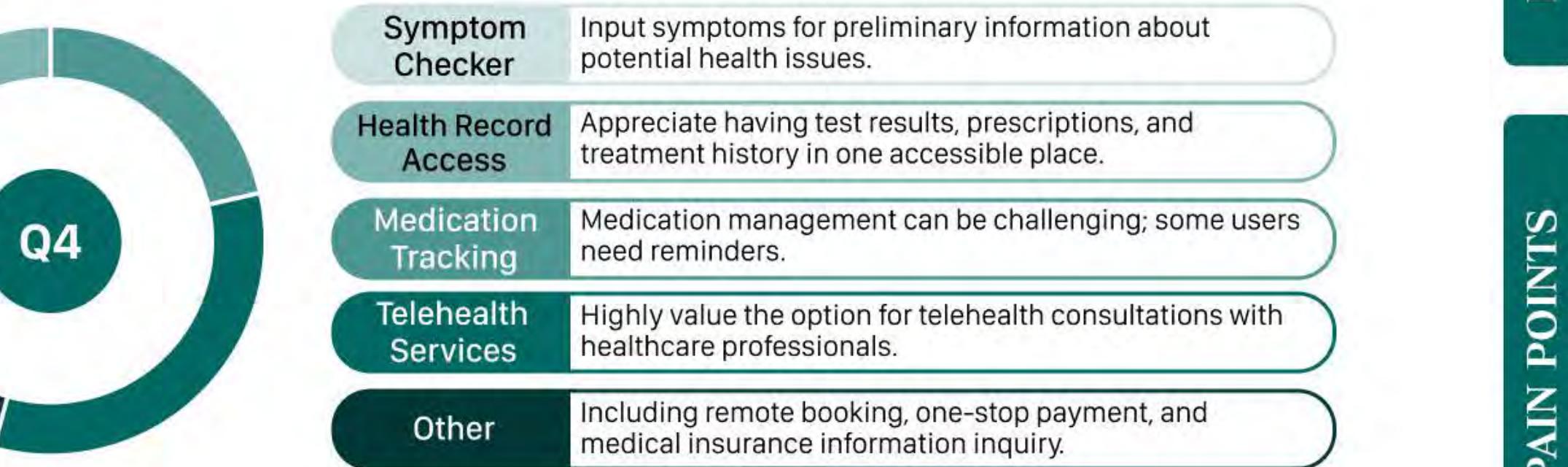
**Q3** What **challenges or pain points** have you experienced during a healthcare services?

This question encourages users to share specific issues they've encountered, providing valuable insights into areas where the app can improve their experience.



**Q4** What **features or functionalities** would you find most helpful in an app to enhance your healthcare experience?

This multiple choice question allows users to indicate their preferences for app features.



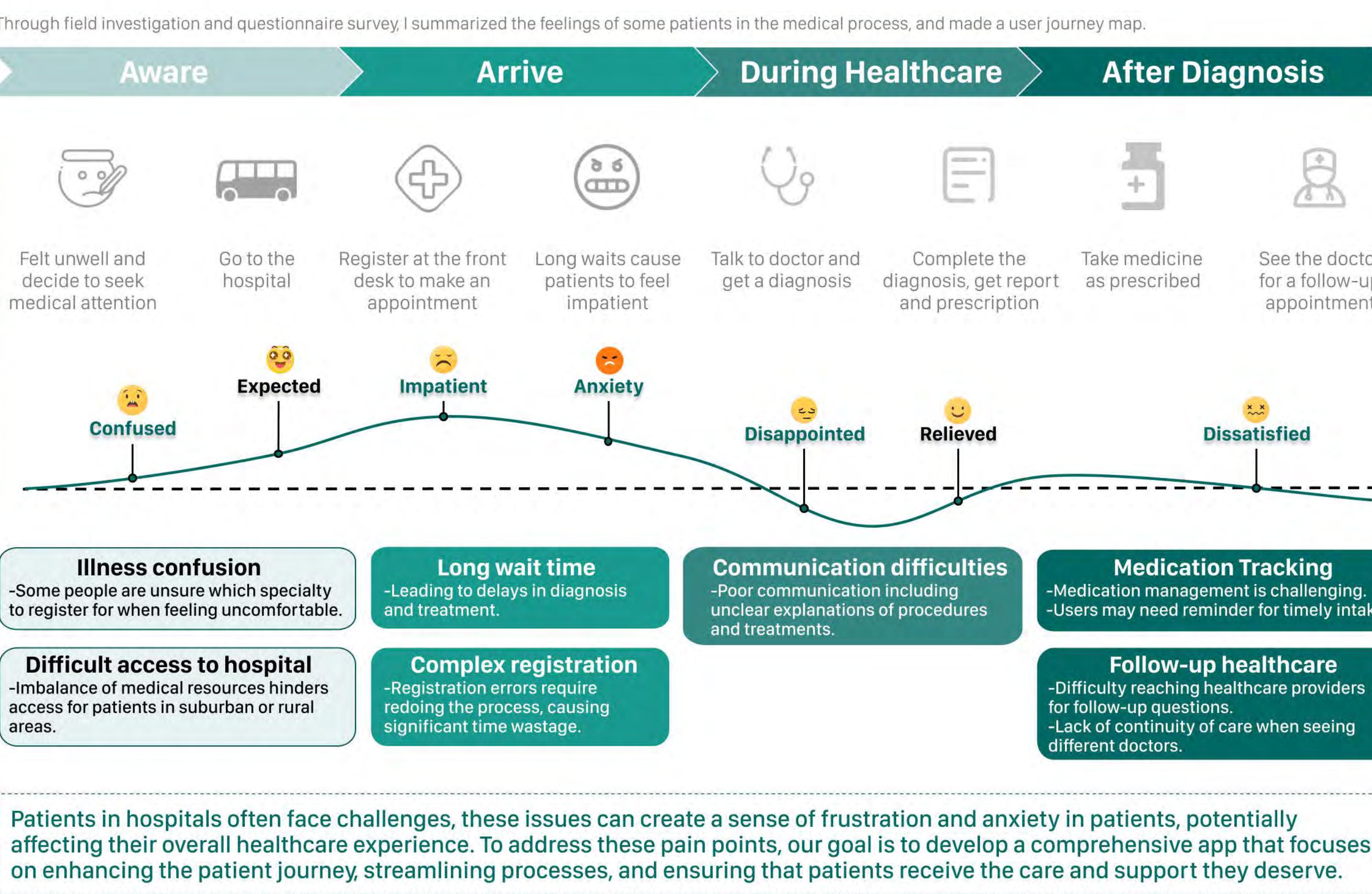
## Interview Summary

The research results show that:

- Fewer people frequently visit hospitals, and the majority are not familiar with hospital procedures.
- Participants had different comfort levels with digital tools, but most were accepting.
- There are various common challenges to reporting.
- The interviewees expressed a strong desire for some application features.

# User Journey Map

## Patient's Experience



# Persona



**Name:** Jenny  
**Age:** 69  
**Occupation:** Retired



**Frustrations:** Struggles with technology, complex medical jargon, challenge of long-term adherence to medication and limited travel mobility due to age-related issues.



**Name:** Lisa  
**Age:** 24  
**Occupation:** Architect



**Frustrations:** May feel overwhelmed by work responsibilities, long hours, and limited time for healthcare appointments and complicated healthcare processes.

## Goals

- Health Maintenance,
- Family Connection,
- Enjoying Retirement,
- Simplified Healthcare
- Quality Time with Family & Friends
- Technology for Health Support

## Spare Time

As a retiree, She has more spare time in retirement, making her willing to engage in activities that improve her health and overall well-being.

## Hospital Familiarity

She is somewhat familiar with hospitals due to her age and potential healthcare needs. However, she may be intimidated by complex hospital processes.

## Technology Readiness

She is less tech-savvy and may need support in using digital tools. While she's open to learning, her adoption of technology may be slower due to generational gaps.

**Frustrations:** Struggles with technology, complex medical jargon, challenge of long-term adherence to medication and limited travel mobility due to age-related issues.

## Goals

- Efficiency,
- Convenience,
- Telemedicine

## Spare Time

She has limited spare time As a busy architect, due to a demanding career, making her highly value efficiency and convenience in healthcare.

## Hospital Familiarity

She is generally less familiar with hospitals, as she's likely been relatively healthy and had fewer interactions with healthcare facilities.

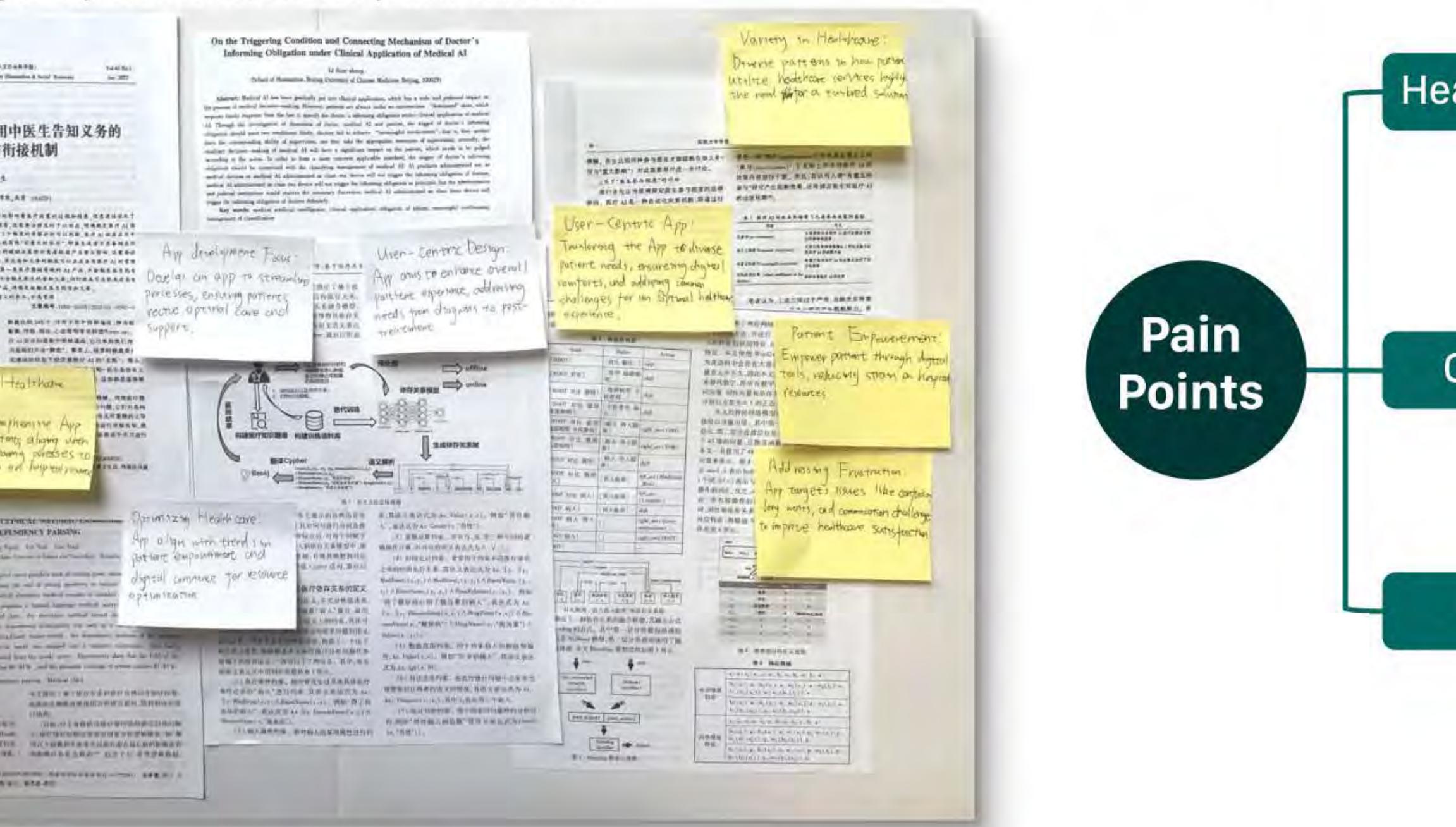
## Technology Readiness

She is tech-savvy and comfortable with digital tools. She expects fast, user-friendly, and mobile solutions to accommodate her busy lifestyle.

**Frustrations:** May feel overwhelmed by work responsibilities, long hours, and limited time for healthcare appointments and complicated healthcare processes.

# Affinity Mapping

Based on the interviews and research completed before and the paper data collected, I made affinity mapping to explore the next development direction.



# Insights Summary

## Background Research:

The healthcare app project aims to guide patients through their healthcare journey, improving the overall experience and optimizing hospital resources. This aligns with the trend of patient empowerment and digital transformation in healthcare.

## Interview Summary:

Patients have diverse healthcare utilization patterns and varying comfort levels with digital tools. Challenges include long wait times, communication issues, and illness confusion. Desired app features align with patient empowerment and digitalization trends.

## Patient's Experience:

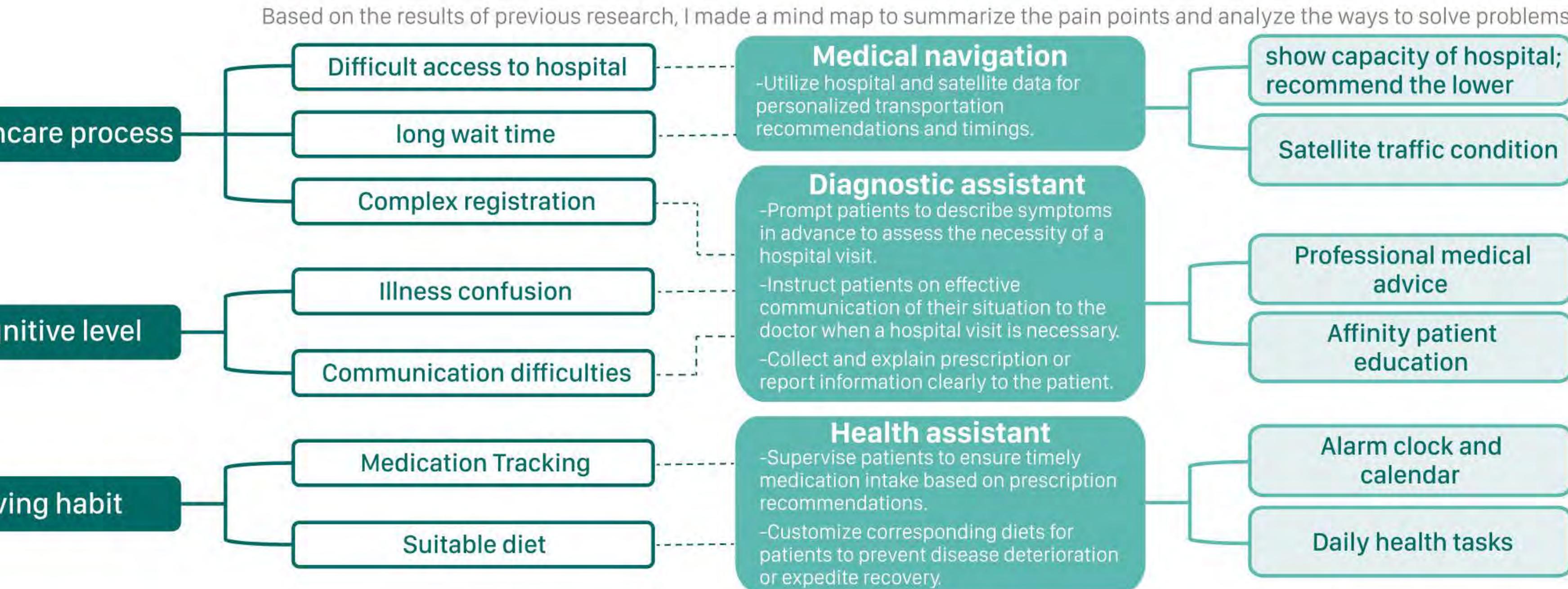
Patients encounter pain points like illness confusion, complex registration, and limited follow-up support, affecting their healthcare experience. The project strives to streamline processes, ensuring patients receive the care they need.

## Final Summary:

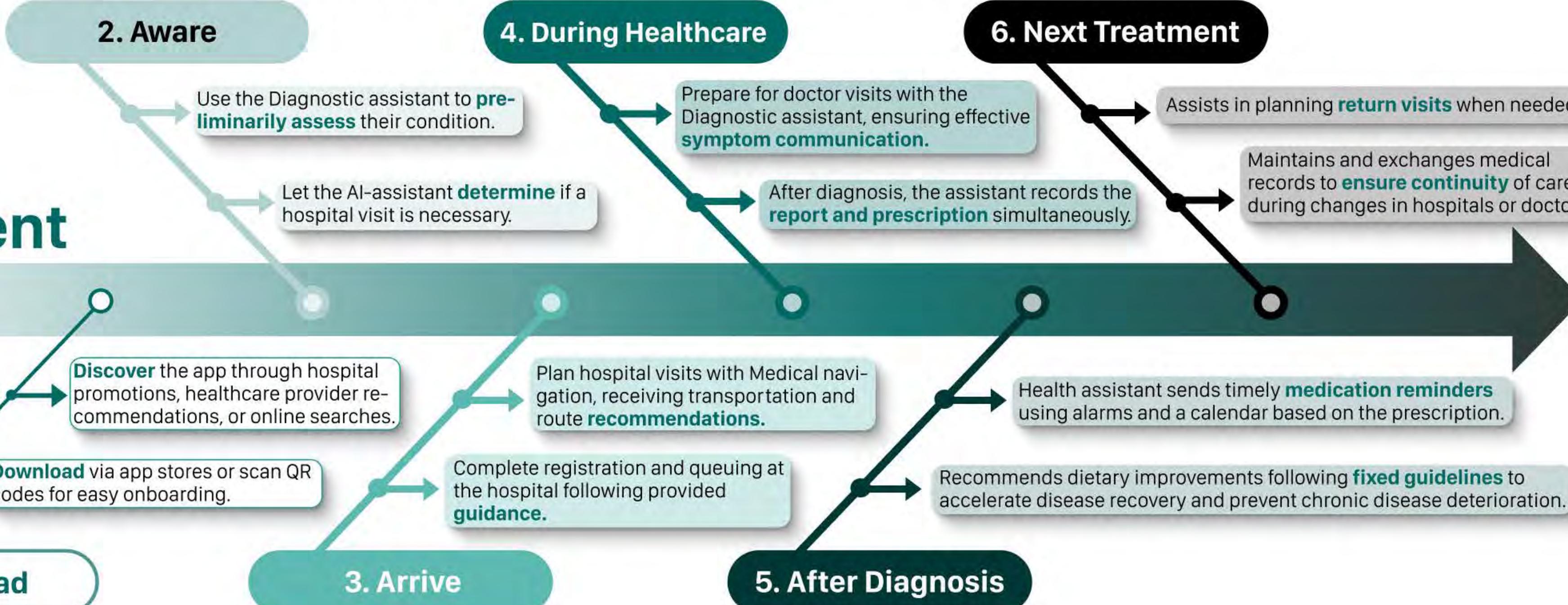
Extensive research has revealed the need for a healthcare app to guide patients through their healthcare journey, addressing diverse user experiences and challenges. The app aims to streamline processes, improve the patient journey.

# Ideation

## Mind Map



After summarizing the ways needed to solve the problem, I planned the functional development at different stages.



# Technical Research



## Secondary Research: Medical use of NLP AI technology

An American mother sought ChatGPT's help in diagnosing her son's mysterious pain, baffling medical professionals. Through an in-depth conversation with the AI, she provided detailed information about her son's symptoms and medical history. ChatGPT suggested a rare disorder, previously unconsidered. This insight led to further testing and confirmed diagnosis, highlighting AI's valuable role in healthcare.

Source form: <https://www.today.com/health/mom-chatgpt-diagnosis-pain-rcna101843>

## 1-So, What is NLP?

Natural Language Processing (NLP) is a branch of artificial intelligence (AI) that focuses on the interaction between computers and human language. It enables computers to understand, interpret, and generate human language in a valuable way.

## 2-Common applications of NLP



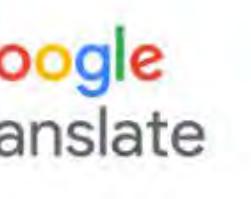
### ChatGPT (OpenAI)

-ChatGPT is an AI language model for various applications.



### Siri (Apple)

-Siri is Apple's voice activated digital assistant, integrated into iOS devices.



### Google Translate (Google)

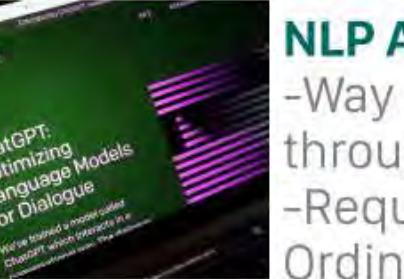
-Google Translate is a multi-lingual translation service.

## 3-The main difference between original AI technology and NLP



### Original AI technology

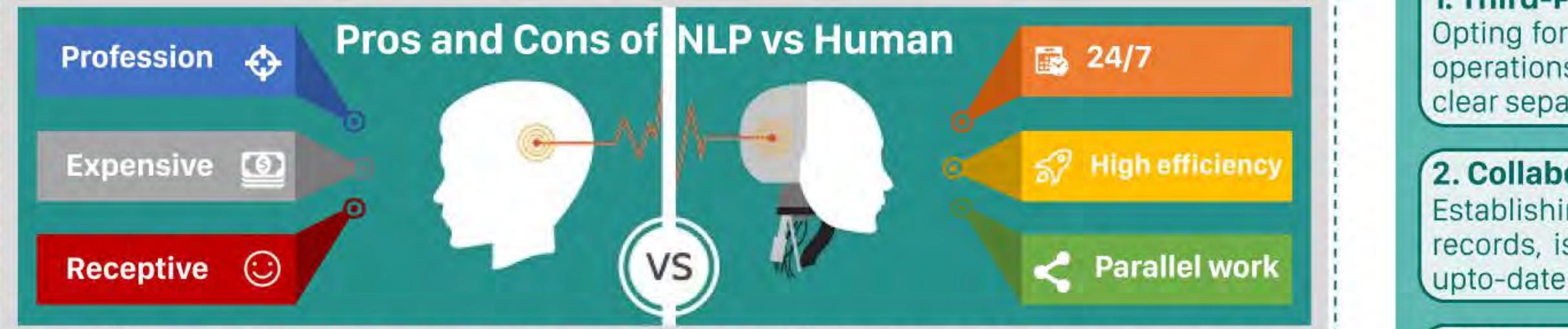
-Way to interact with ai: through code  
-Requirements for users: Proficient in programming



### NLP AI technology

-Way to interact with ai: through natural language  
-Requirements for users: Ordinary people

## 4-Why do we definitely need NLP?



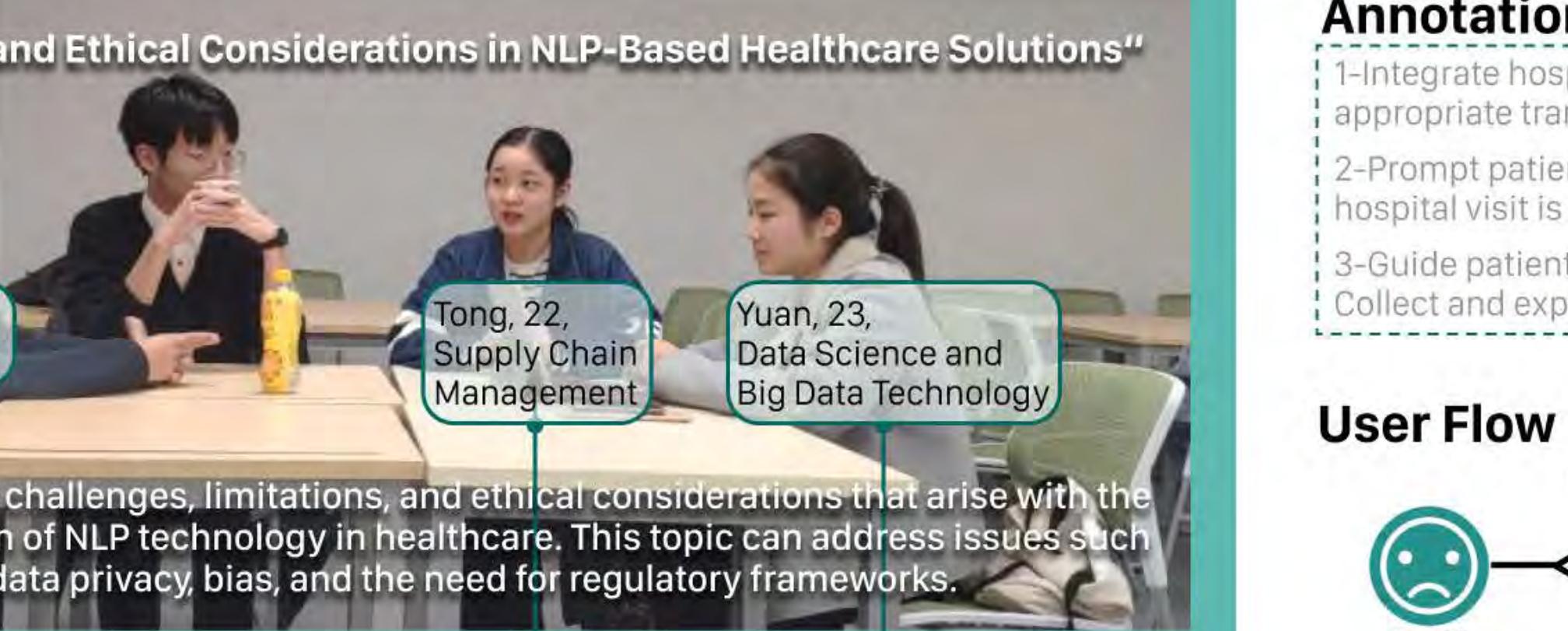
NLP offers **cost-effective, round -the-clock** support, whereas one-to-one human labor can be expensive and unavailable 24/7. While NLP technology may have limitations, it's capable of handling routine tasks and providing quick solutions. Moreover, it can scale to serve a large user base efficiently.

## The Value Proposition Canvas

For	-Hospitals benefit from streamlined patient care. -Patients experience personalized guidance.
Wants	-Patients seek simplified healthcare processes, instant symptom assessment, and effective communication with healthcare providers.
(Our)	-Our AI language model technology delivers accuracy in symptom analysis. -It streamlines healthcare processes and personalizes patient care.
Unlike	-Unlike traditional methods, our technology provides 24/7 support, reducing response times and costs, ensuring precise symptom analysis.
By	Mobile terminal      Cloud      Hospital Database

## CO-WORKER

Based on the controversial use of AI language models in the medical field, I conducted co-worker interdisciplinary research with friends from other majors.



### 1. Third-Party Recommendation Model:

Opting for a third-party recommendation role, as opposed to direct involvement in hospital operations, diagnosis, and treatment processes, is the prudent approach. This ensures a clear separation of responsibilities and reduces potential ethical and liability concerns.

### 2. Collaboration with Hospitals for Data Access:

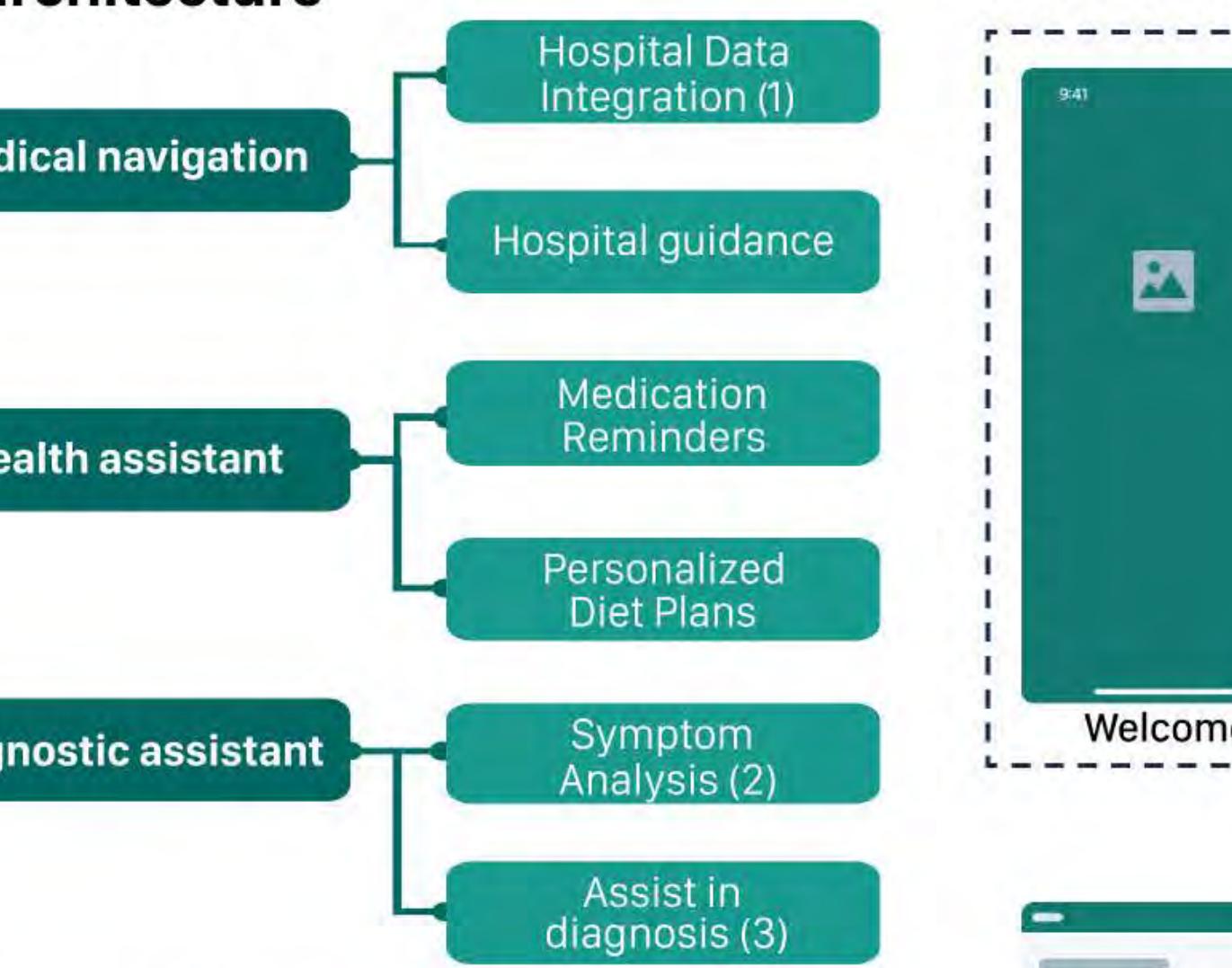
Establishing cooperative relationships with hospitals for data access, including medical records, is essential. This collaboration ensures that the app operates with accurate and up-to-date patient information, enhancing its effectiveness.

### 3. Transparency and Explainability:

To build trust and ensure ethical use of NLP technology in healthcare, transparency and explainability of algorithms are crucial. Patients have the right to understand how their data is being used, the decision-making process, and any potential biases.

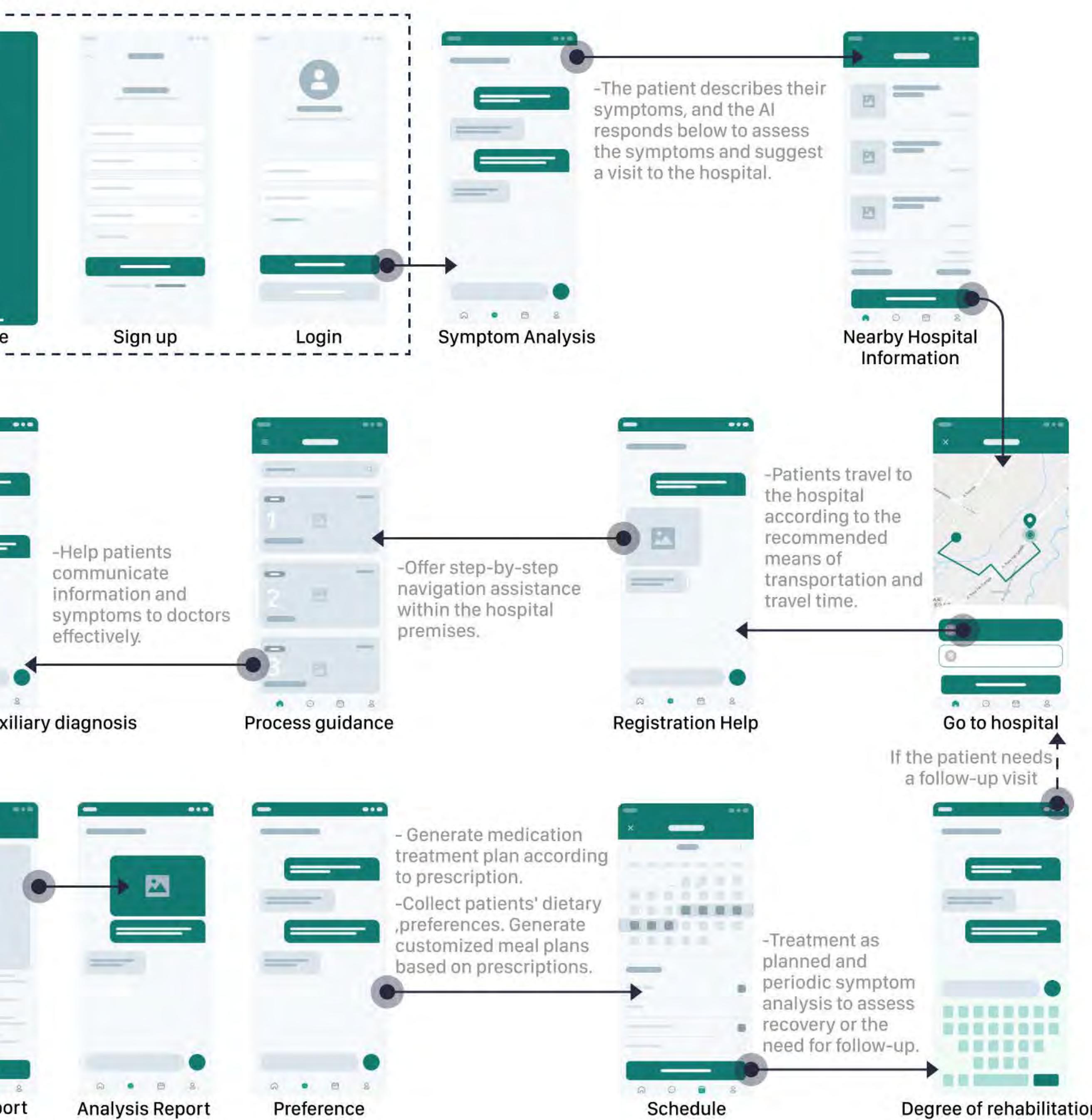
# Initial Design

## Information architecture



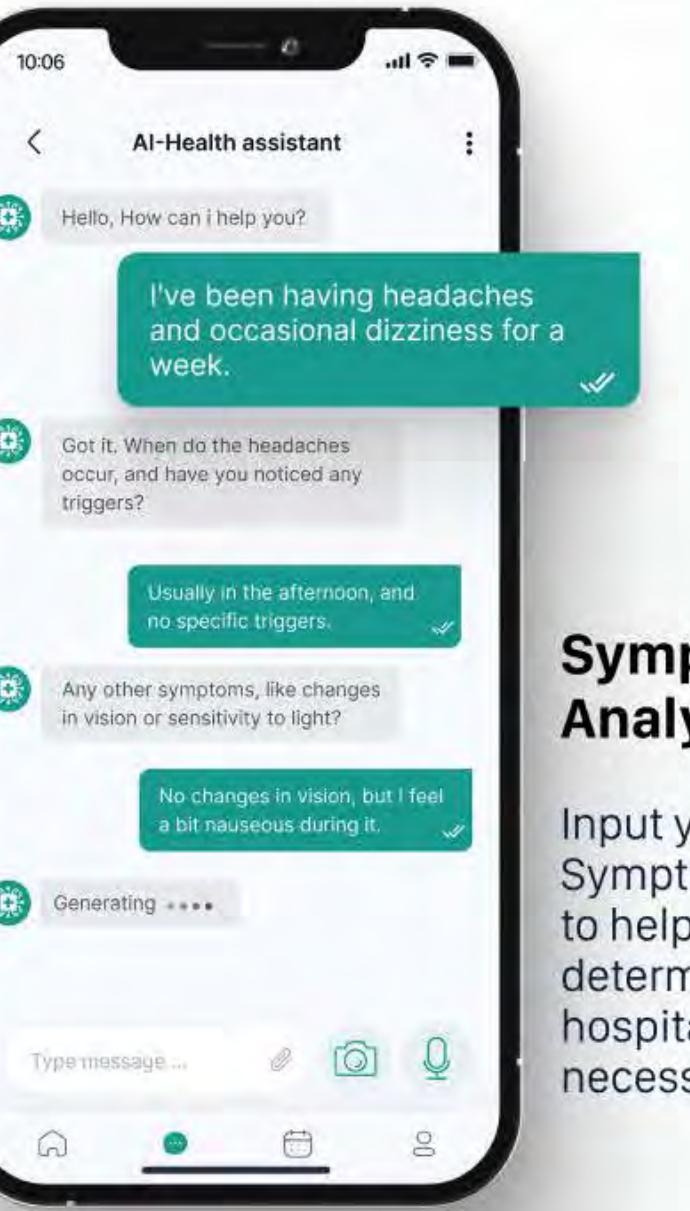
# Lofi

## Wireframe



# Final Design

4 key functions

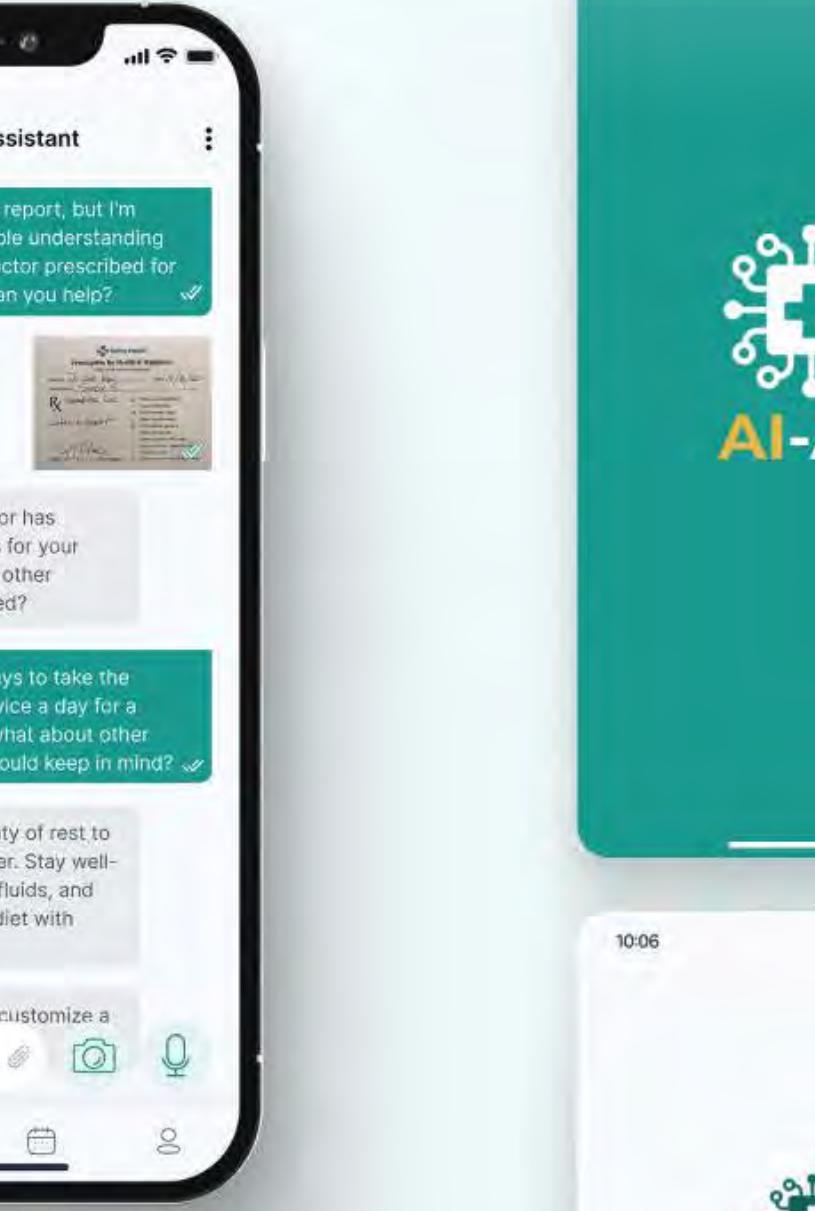


## Prescription Interpretation

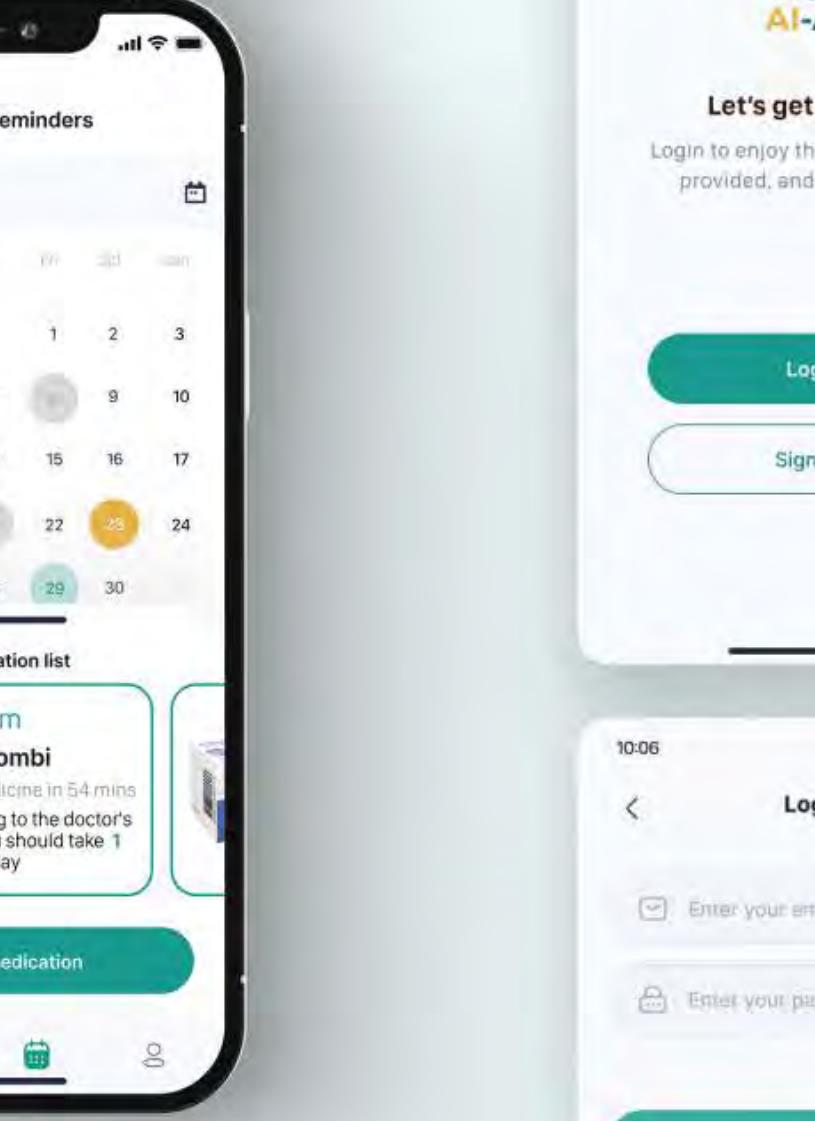
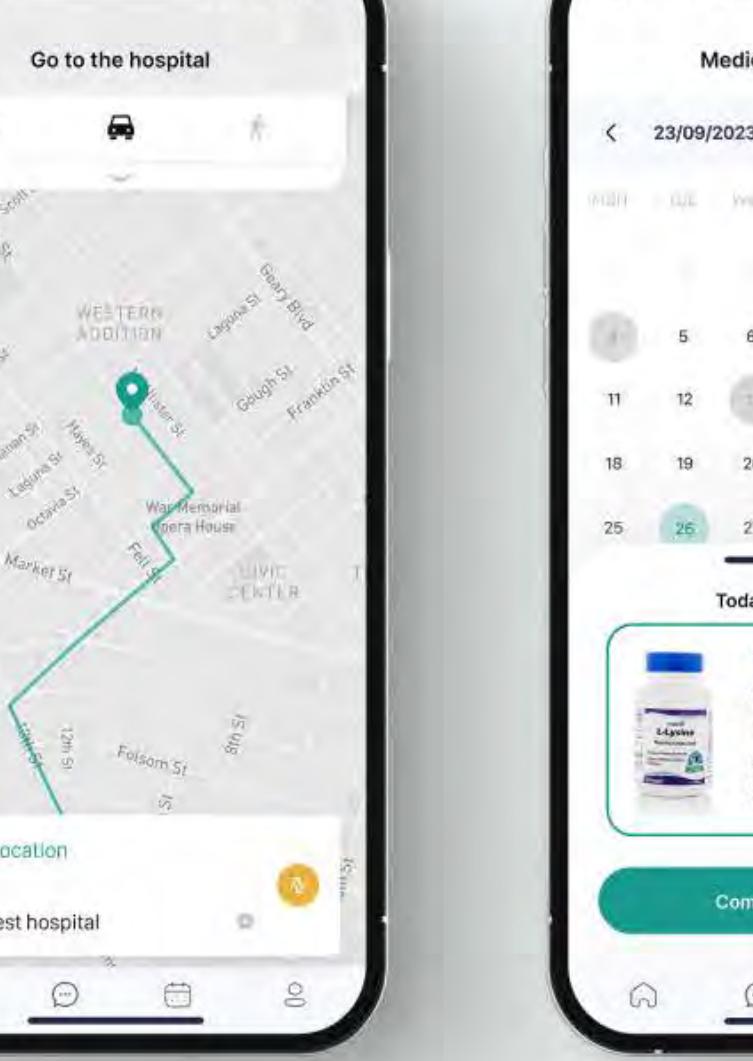
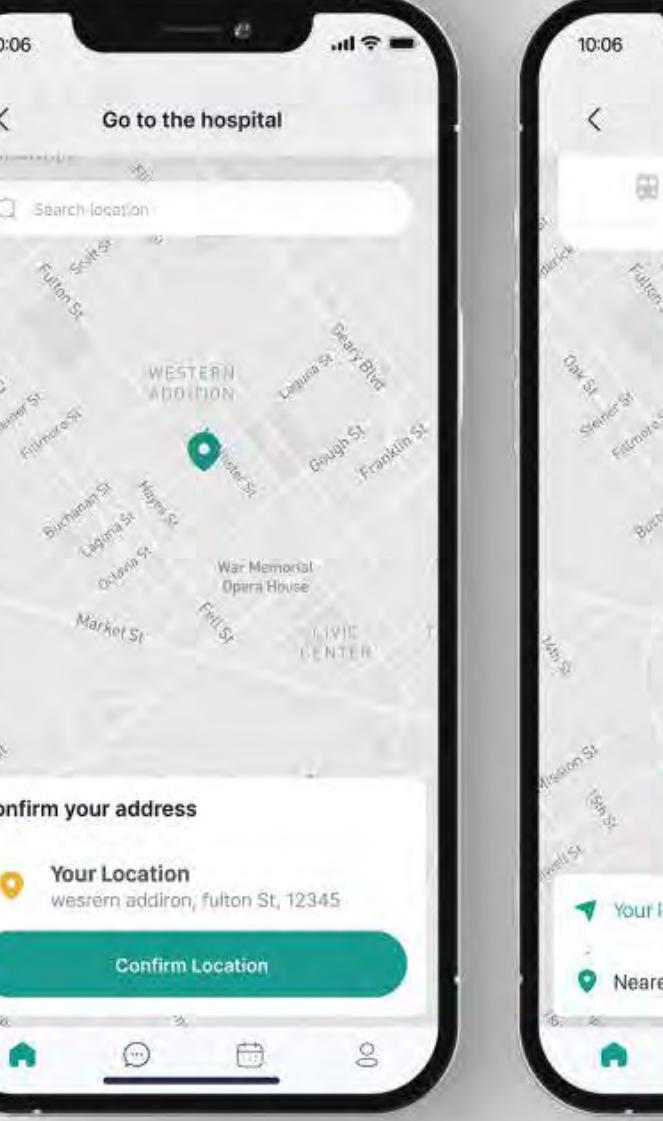
rehabilitation planed by AI through image interpretation

## Symptom Analysis

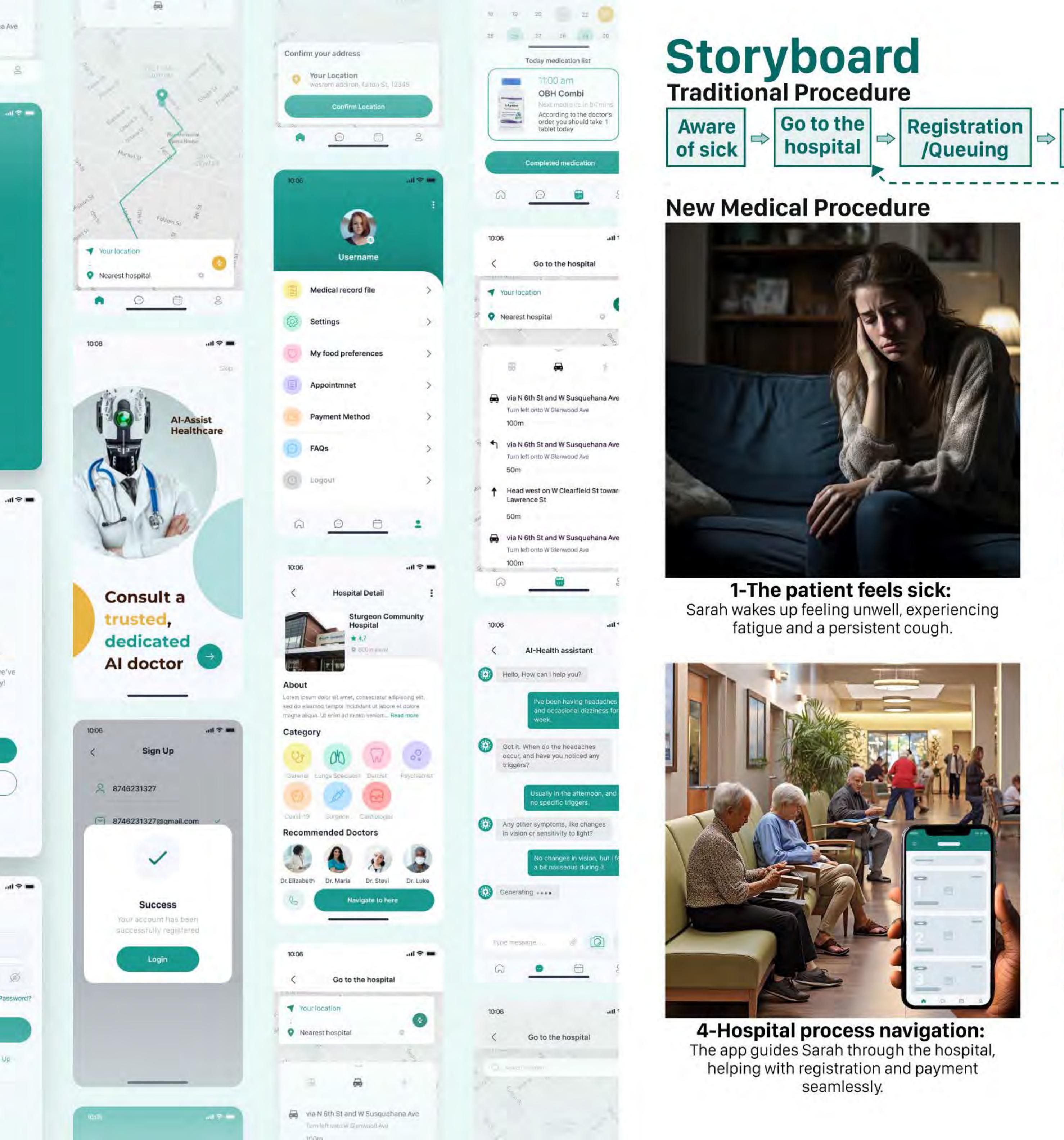
Input your Symptom and let AI to help you to determine if a hospital visit is necessary.



**Hospital navigation**  
Find the nearest hospital for you



**Medication Reminder**  
Send timely reminders and monitor adherence.

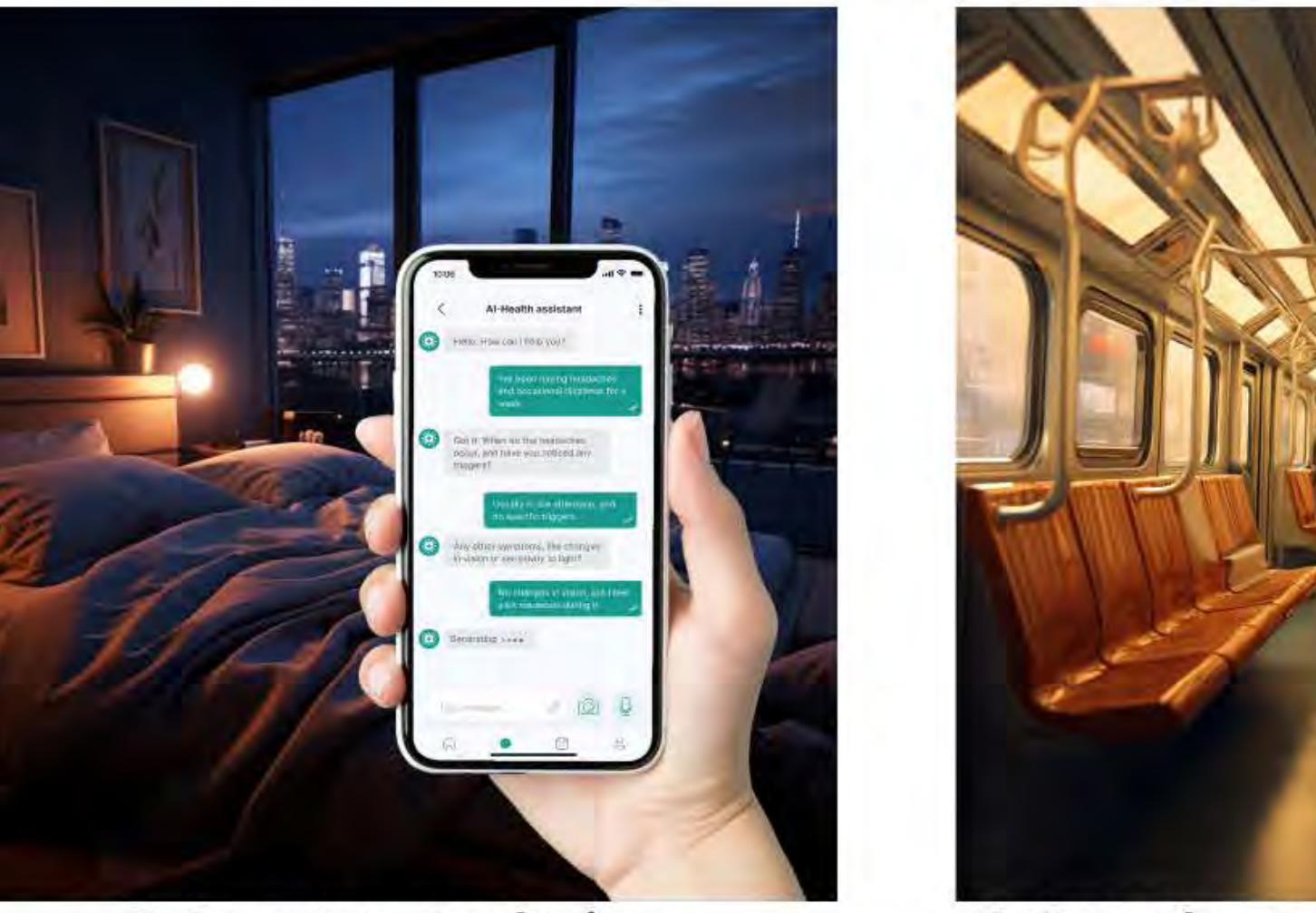


# Storyboard

Traditional Procedure



New Medical Procedure



# Expectation

Deficiency:

AI technology is not mature:

There might be instances where the AI, especially in symptom analysis, could misinterpret user inputs, leading to inaccurate recommendations.

Social environment and acceptance:

Considering that residents in different regions have different stereotypes about AI and different receptivity to new things, the adoption rate in small cities may be lower than in big cities.

## Possible Limitation:

**Accessibility Concerns:**  
The app's effectiveness could be constrained by accessibility challenges, particularly for users with limited technological literacy or those with disabilities.

**Data Privacy:**  
Despite efforts, there could be concerns regarding data privacy necessitating robust measures to ensure the secure handling of sensitive health information.

**Limited Offline Functionality:**  
The app may be dependent on constant internet connectivity, posing challenges for users in areas with poor network coverage.

## Future improvement

**Expanded Features:**  
Anticipate future expansions, incorporating additional features such as telehealth consultations or integration with wearables, enhancing the app's versatility and user benefits.

**Community Engagement:**  
Anticipate fostering a user community to provide insights, share experiences, and contribute to the app's growth, creating a collaborative healthcare platform.

**Iterative Updates:**  
Expect ongoing updates to address identified issues and integrate user suggestions, ensuring a responsive and evolving application.

-The drawings on storyboard part are co-create with Midjourney.

## PROJECT 2

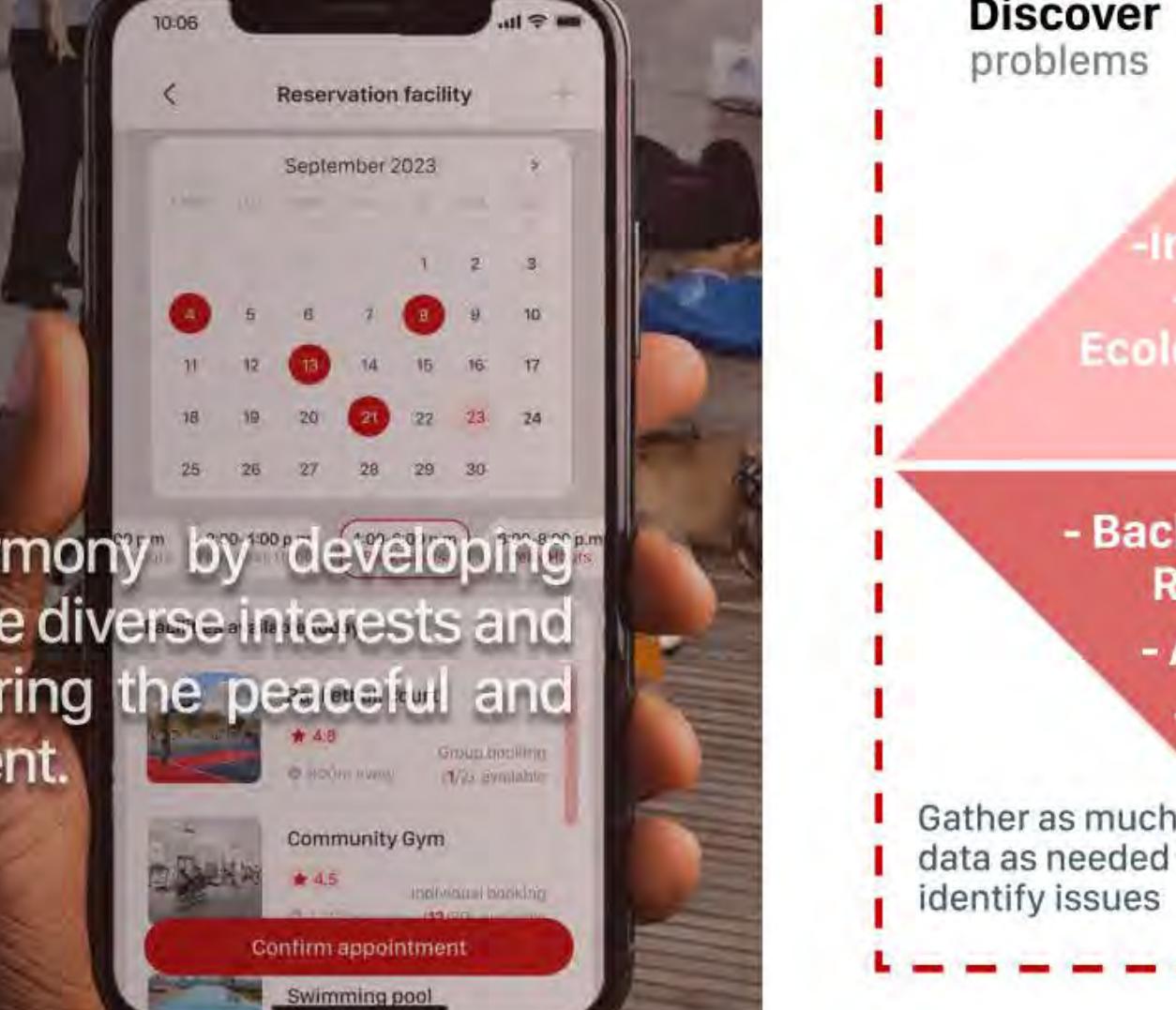
# Community-Shared Space

-A service based on time and space planning to improve the exercise experience and field utilization of community residents during peak exercise periods.

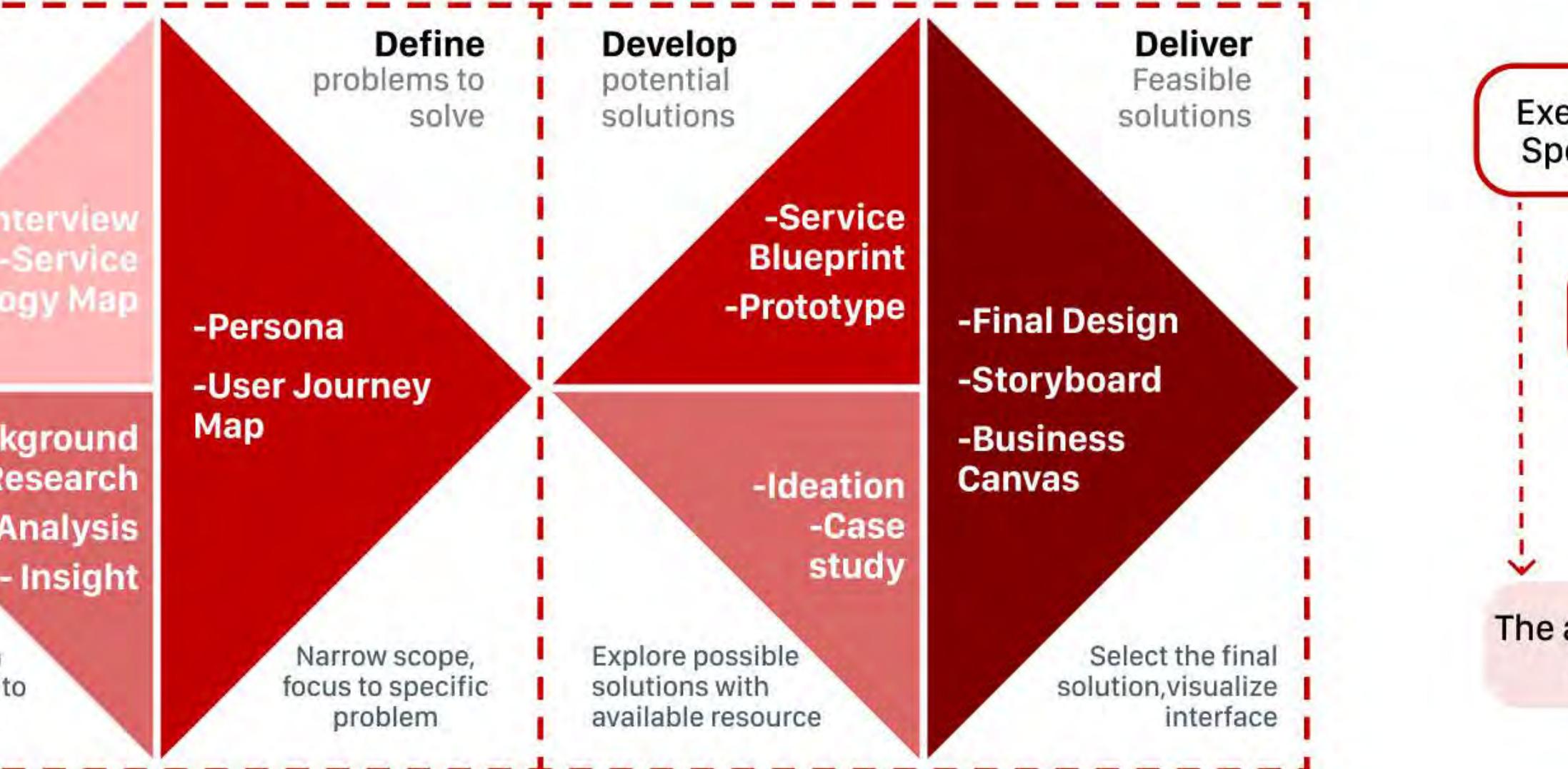
UI & UX | Service Design  
Individual Project  
2023.05 - 2023.08

## Overview:

We aim to foster coexistence and harmony by developing innovative solutions that accommodate the diverse interests and traditions of different groups while ensuring the peaceful and equitable use of public space and equipment.



## Design Process



## Background

Why did I choose this topic?

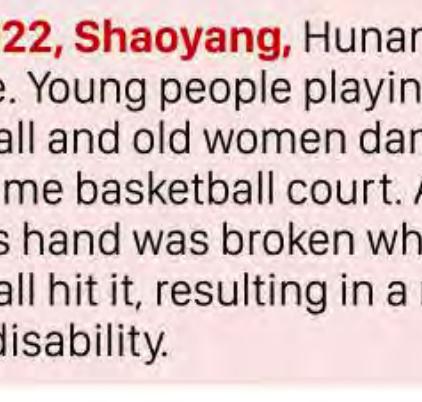


### My Experience: Community facility conflict

A few months ago, I witnessed a clash in our community involving two distinct groups. On one side were the "square dance aunties," who are mainly a group of middle-aged and elderly people who dance square dancing together in their spare time after retirement. On the other side were young basketball players who are mostly young people such as students. They quarreled over the right to use public space, and even escalated into a physical fight.

### Secondary Research

I wonder if this phenomenon was widespread and found many similar news.



**June 2022, Shaoyang, Hunan Province.** Young people playing basketball and old women dancing in the same basketball court. A woman's hand was broken when a basketball hit it, resulting in a ninth degree disability.



**Yingkou, Liaoning Province, June 2021.** In order to occupy the basketball court as a venue for square dancing, they destroyed the basketball court's basket and other facilities, and clashed with the groundskeeper.



In **June 2017**, a dispute erupted at a **Luoyang Wangcheng Park** basketball court over space for square dancing. Initially, elderly individuals, around 70 years old, requested the court for square dancing, and young basketball players graciously yielded. However, a subsequent altercation ensued when a group of middle-aged women claimed the territory, leading to a heated verbal exchange escalating into physical conflict among the three parties.

## Preliminary Analysis

### Conflict and Differences

#### Square dancer

45 - 65

Square dancer are typically middle-aged women



#### Volume

Square dance music is often played at high volumes, which can disturb those seeking a quiet basketball game.

#### Basketball enthusiasts

15 - 25

Basketball enthusiasts are predominantly younger individuals



#### Duration

Square dance routines can be lengthy, occupying the court for extended periods, limiting access for basketball players.



#### Danger

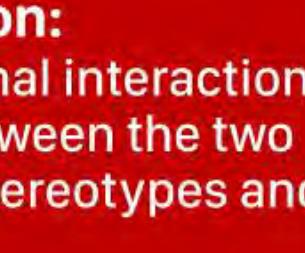
Basketball is a very physical sport that can cause injuries to those around them. Someone may be injured by a basketball, causing conflict between the two groups.

These generational differences can lead to misunderstandings and conflicts.

### Factors that induce conflict

#### Limited Interaction:

There may be minimal interaction or communication between the two groups, leading to stereotypes and misconceptions.



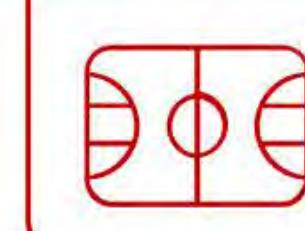
#### Time Conflicts:

The conflict intensifies because both groups prefer using the courts during peak hours, leading to scheduling clashes.



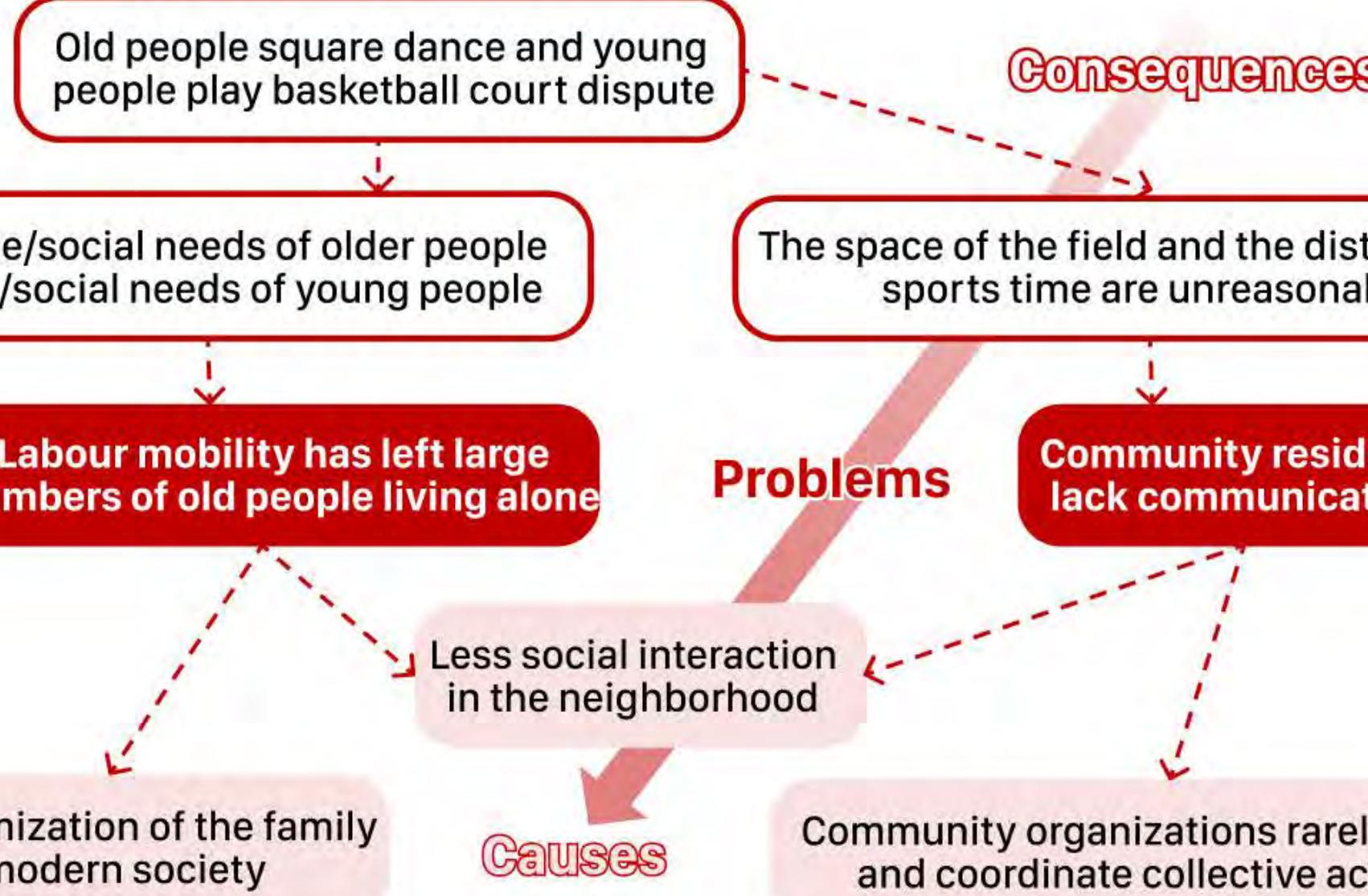
#### Absence of Platform:

Without a platform for dialogue or conflict resolution, disputes escalate.



**Physical Space:** Both square dance aunties and basketball enthusiasts require access to public basketball courts, which are often limited in number within urban areas.

## Further Analysis



# Interview

## Questionnaire

### Q1 Age:



### Q2 Shared Space Usage:

Do you regularly use the **community basketball courts** for physical activities?

Yes       No

If yes, what is your **preferred activity** in this shared space?

Basketball     Square dancing     Other

### Q3 Conflict and Interaction:

Have you ever witnessed **conflicts or tensions** between square dance r and basketball enthusiasts in shared space?

Yes       No

If yes, how would you **describe these conflicts?**

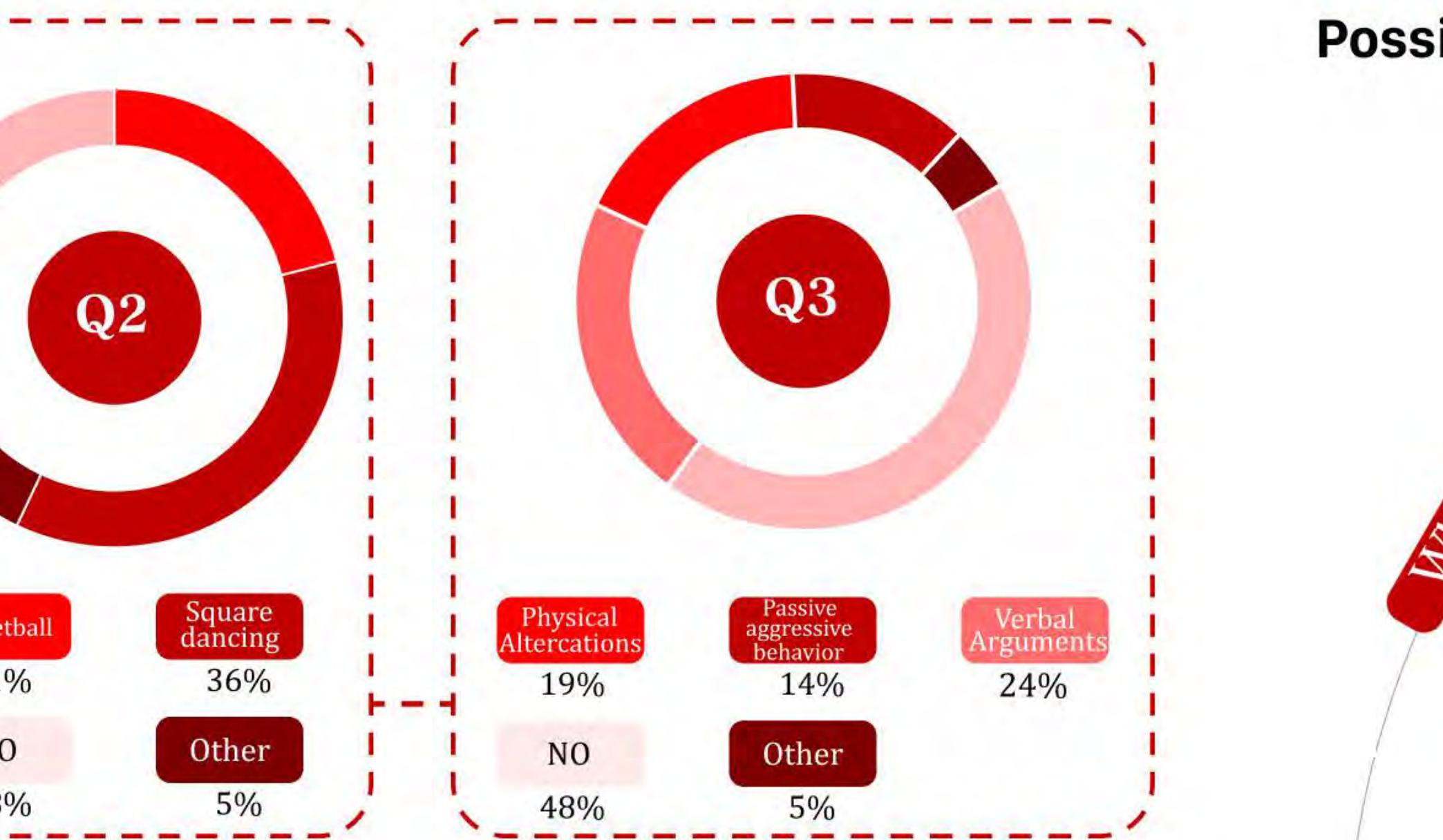
Verbal arguments     Physical altercations  
 Passive -aggressive behavior     Other

### Q4 Communication and Resolution:

Would you support the introduction of a **digital platform or App** to schedule and manage shared space usage?

Yes     Unsure     No

58%    6%    36%



### Q5 Preferences and Solutions:

What solution do you think would **best address** the conflict between square dance aunties and basketball enthusiasts?



### Summary

**Q1:** There are more elderly people in the community than young people, especially the middle-agedand elderly people who are keen on square dancing.

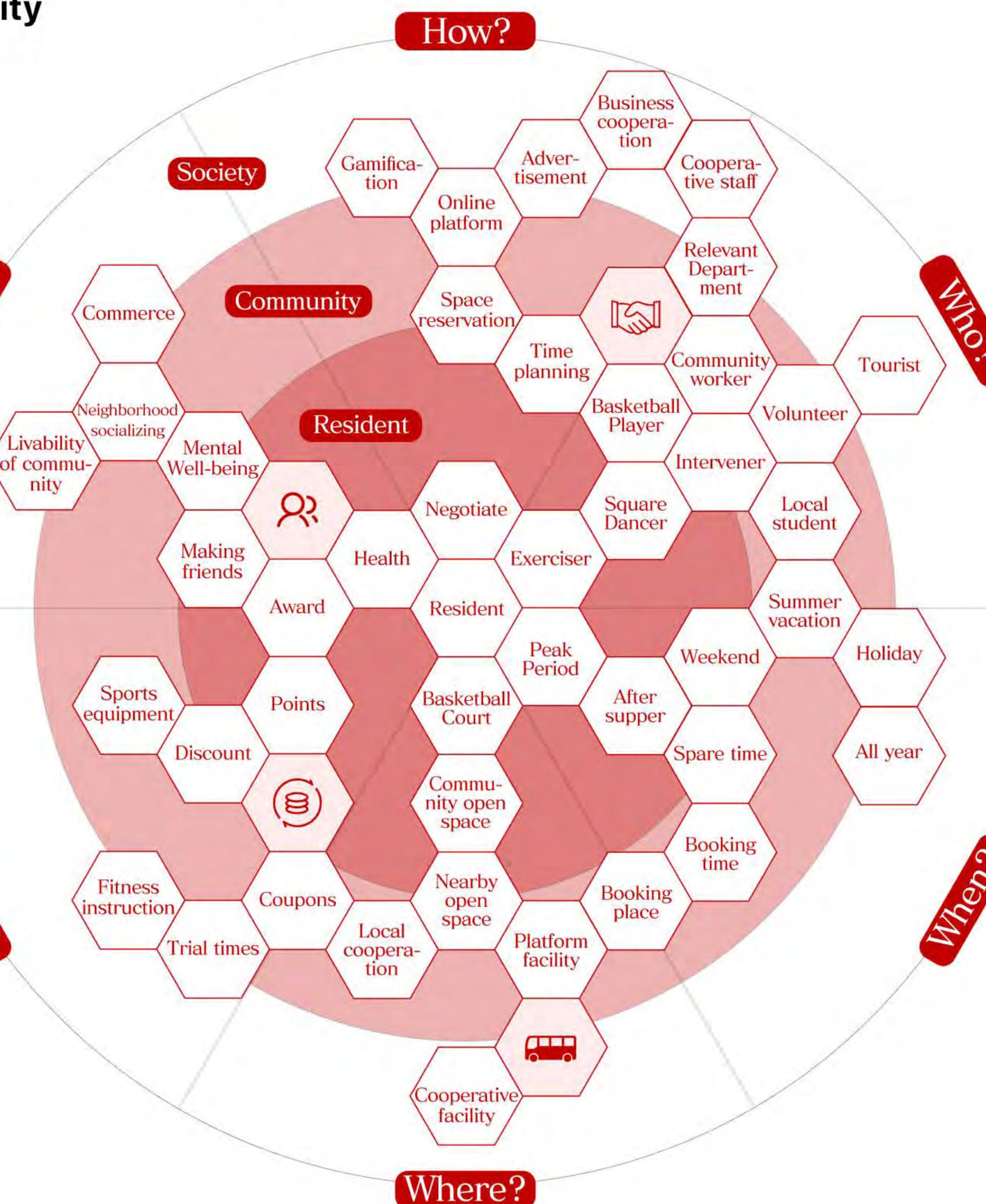
**Q2:** Square dancing has more supporters than basketball and needs more space.

**Q3:** More than half of residents have seen some degree of conflict between the two groups, and more than a third have witnessed Physical altercations between the two sides.

**Q4:** Most people support the use of digital platforms or apps to resolve community conflicts. Interview results reflect community members' eagerness for communication improvement and digital platform to mitigate conflicts.

# Service Ecology Map

## Possibility



# Persona

## Background:

**Lao Zhang** is a retired individual living in a close-knit community. He has two adult children who are workers, living in different cities. Since his children are away Zhang often feels lonely and seeks opportunities to socialize and stay active within his community. He values his independence and wants to maintain a healthy and fulfilling lifestyle.



### Name:

Lao Zhang

### Age:

67

### Occupation:

Retired

### Goals and Needs:



### Information



### Physical Fitness



## Background:

**Xiao Zhao** recently moved to the city for a job opportunity as a software engineer. He is originally from a small town and is adjusting to the bustling city life. Being new to the area, Xiao Zhao is looking to build a social network, explore his surroundings, and maintain a healthy lifestyle.

### Name:

Xiao Zhao

### Age:

26

### Occupation:

Software Engineer

### Goals and Needs:



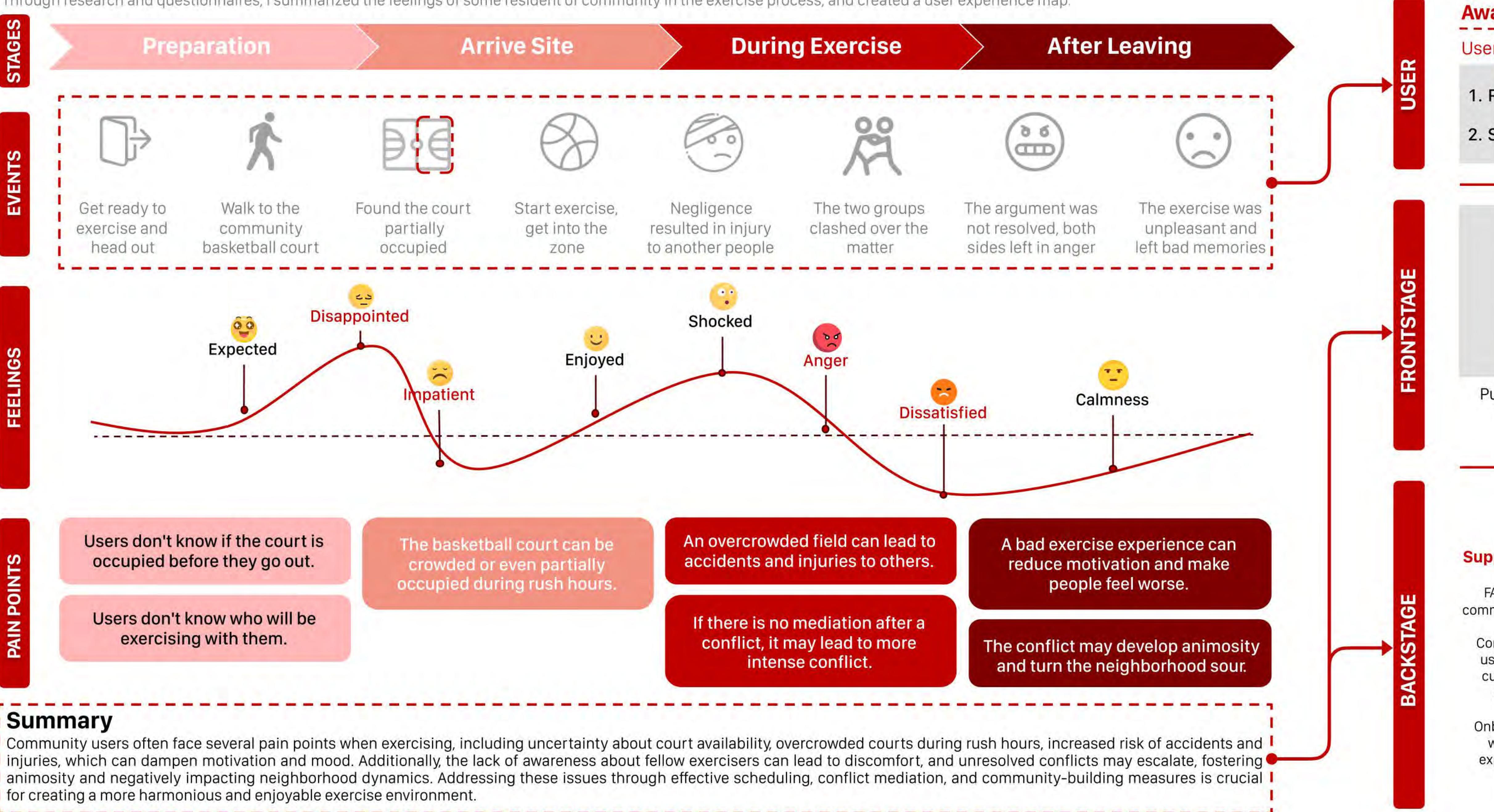
### Information



# User Journey Map

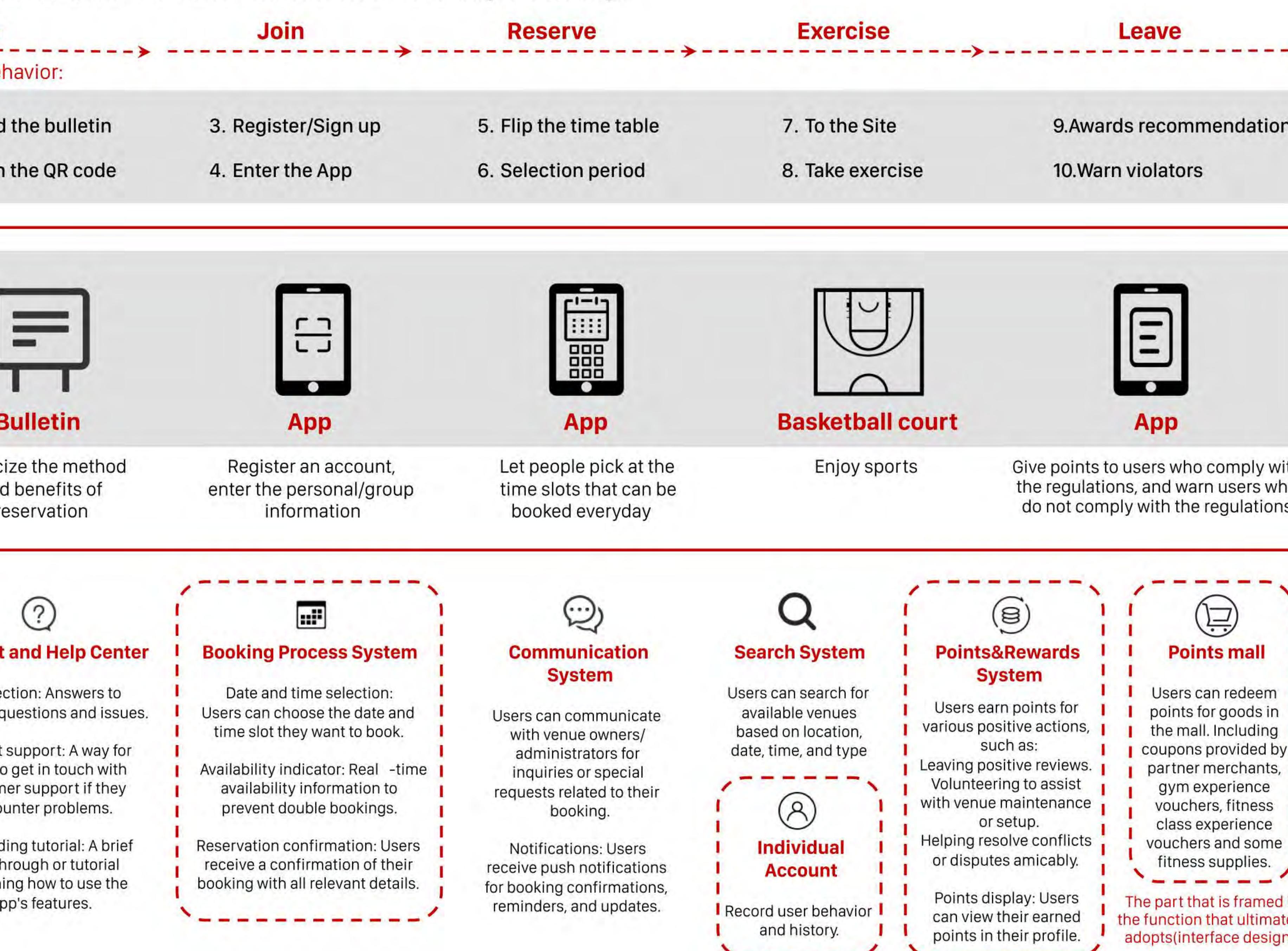
## Residents' Experience

Through research and questionnaires, I summarized the feelings of some resident of community in the exercise process, and created a user experience map.



# Service Blueprint

Based on the research done, determine what services users need on the frontstage and backstage.



# Ideation

## Mind Map



# Case Study

Based on the research of some existing community space utilization solutions and some cross-domain analysis, I summarized several common solutions.



### IDEA 1 - Dividing public Spaces by lines

**Case:** Gridgrounds (Amsterdam)

**Designer:** Openfabric & Dmau

The proposal 'Gridgrounds' creates an elongated public square of 88m x 17m. The grid is made visual and tangible through the white marking - lines running through the space. Dividing groups by lines is the simplest solution, and the cost is low but it depends on the public morality of the residents.

**Renovation cost:**

**Available space:**

**Improved security:**



### IDEA 2 - Modular flexible facility

**Case:** Cricket Netting,

**Designer:** STUART CANVAS GROUP

The retractable net system uses retractable nets to separate basketball courts. It is installed at both ends of the basketball court, splitting the basketball court in half from the middle. It is usually put away, and when it is put down, it can divide the basketball court into two fields.

**Renovation cost:**

**Available space:**

**Improved security:**



### IDEA 3 - Expansion of steel structure

**Case:** spark pavilion (Shenzhen)

**Designer:** ATMOPERATION

Under a limited budget, the use of steel to enclose the basketball court can create a safe semiindoor sports space at a lower cost.

Direct space segmentation can effectively ensure that different Spaces are used for different groups, but the disadvantage is that each group can only use half of the space.

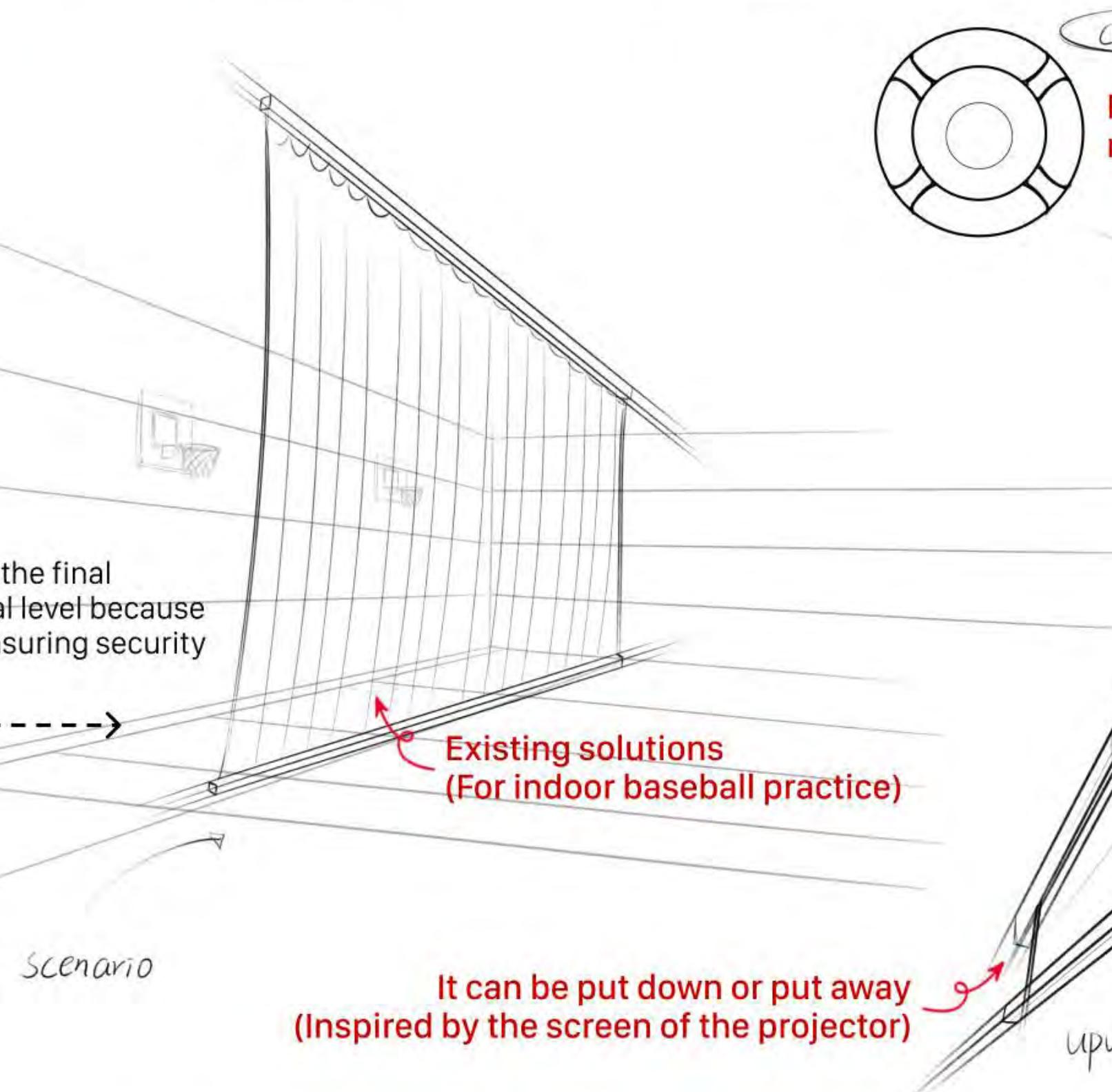
**Renovation cost:**

**Available space:**

**Improved security:**

# Concept Development

Through hand-drawn sketches and expansive thinking manuscripts, the existing solution is further optimized to better meet the needs of the project.



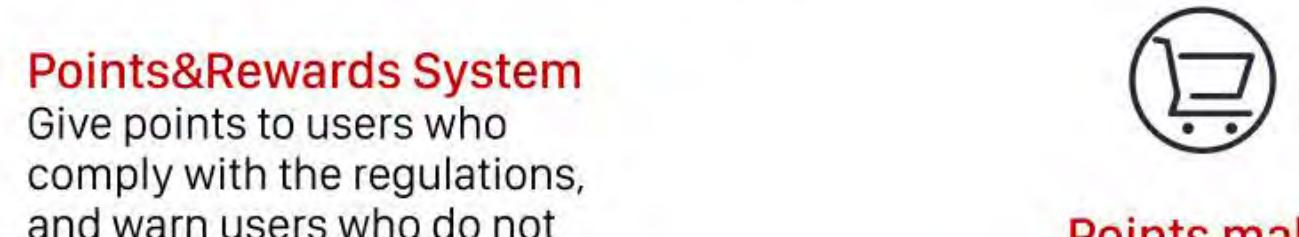
**Rolled up by motor control**



**Digital platform**  
Access to facilities can be booked in advance through the online platform



**Points mall**  
Users can redeem points for goods in the mall.



**Points&Rewards System**  
Give points to users who comply with the regulations, and warn users who do not comply with the regulations

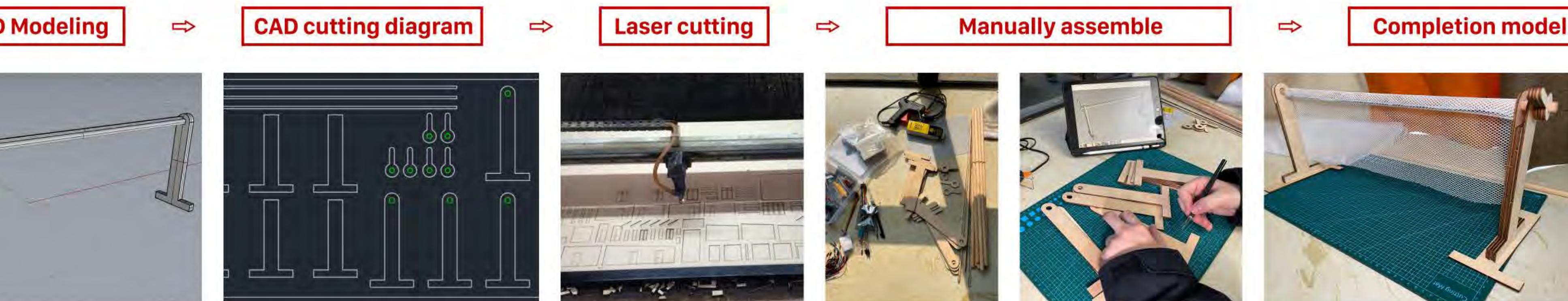


**Community Calendar:**  
Create a shared community calendar accessible through an app. Users can input their planned activities, allowing others to see and plan around them, fostering a sense of collaboration and understanding among diverse user groups.

**Incentivized Off-Peak Usage:**  
Encourage users to engage in activities during off-peak hours by offering enhanced rewards or discounts during those times. This not only eases congestion during peak hours but also promotes a more evenly distributed use of the venue.

### MOCK - UP (Physical Model Process)

The testing, iteration and improvement of the prototype have been completed from the manuscript to the 3d model, and only need to be made according to the final 3d model.



# LOFI Wireframe

Registration /Login

Select facility

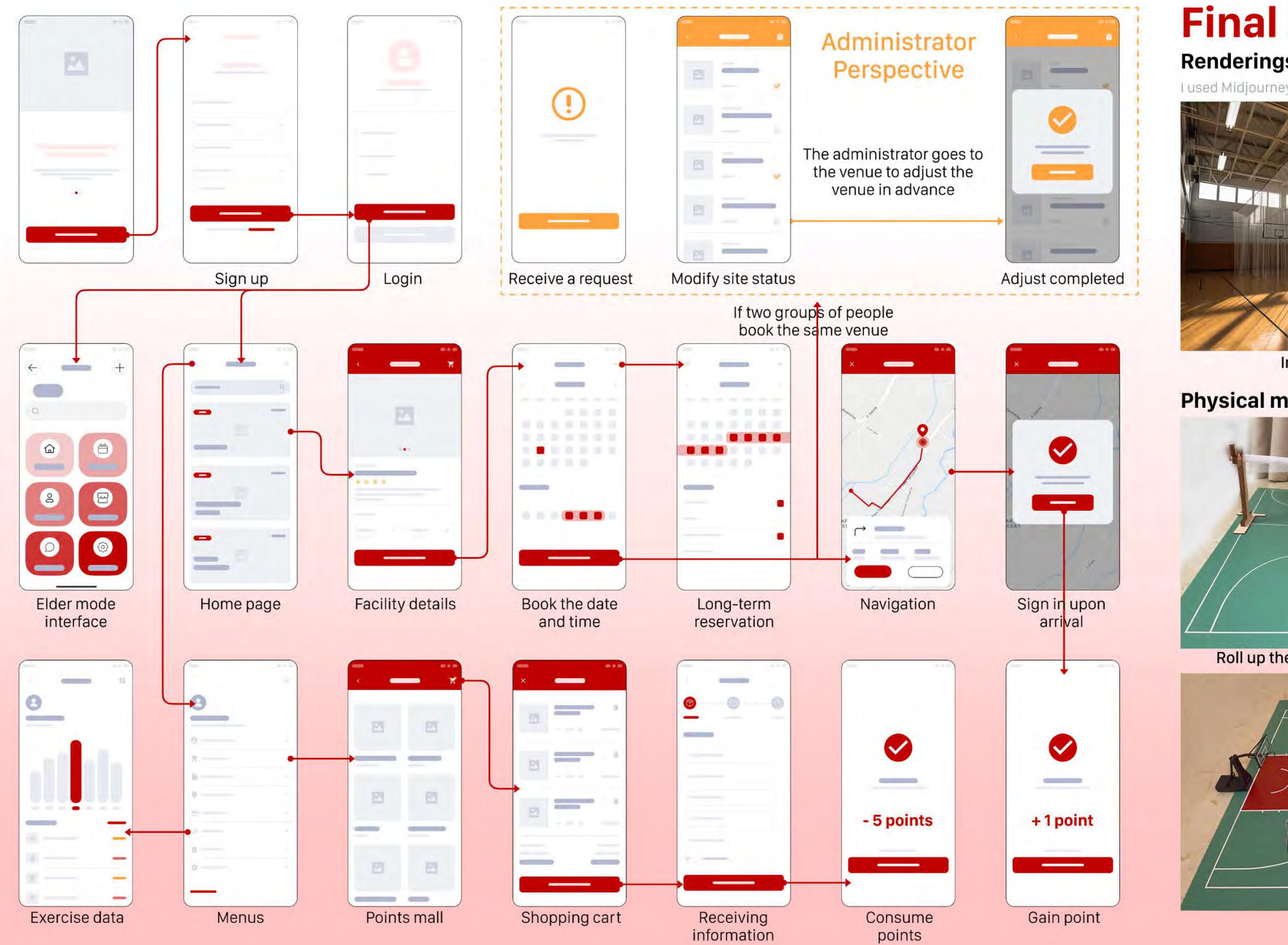
Scheduled time

Go to the facility

Enjoy exercise

Gain points

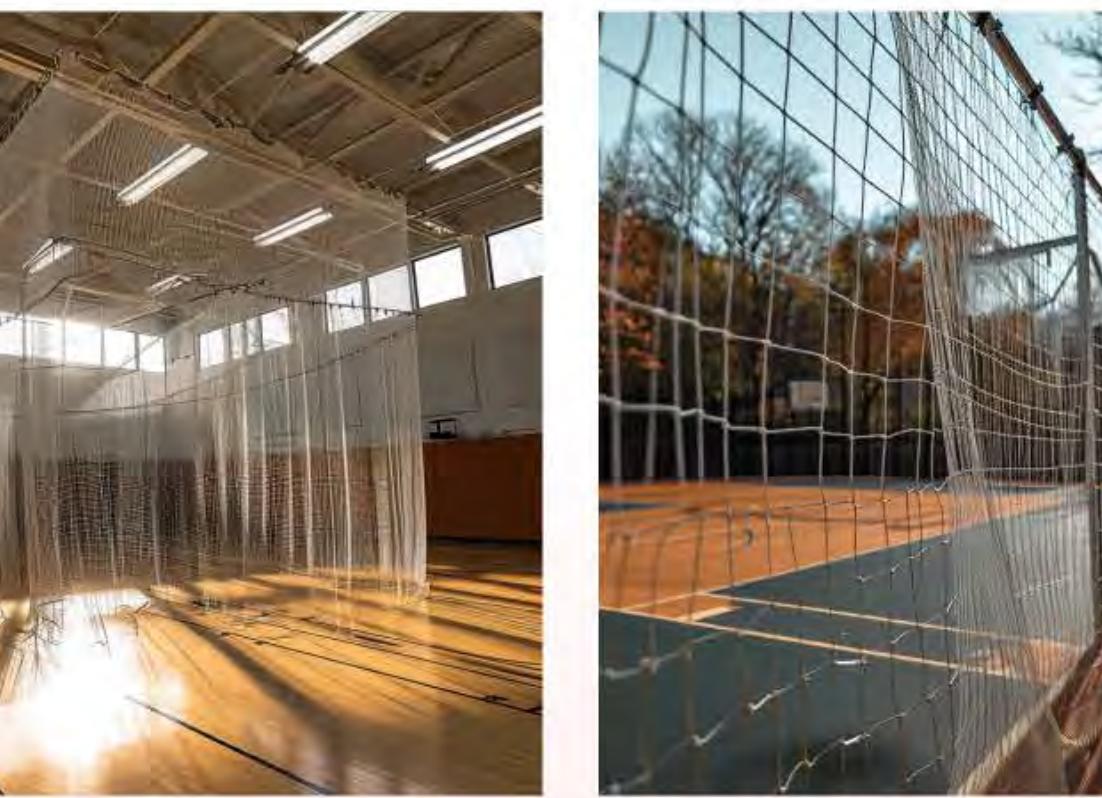
Use Points for prizes



# Final Design

## Renderings

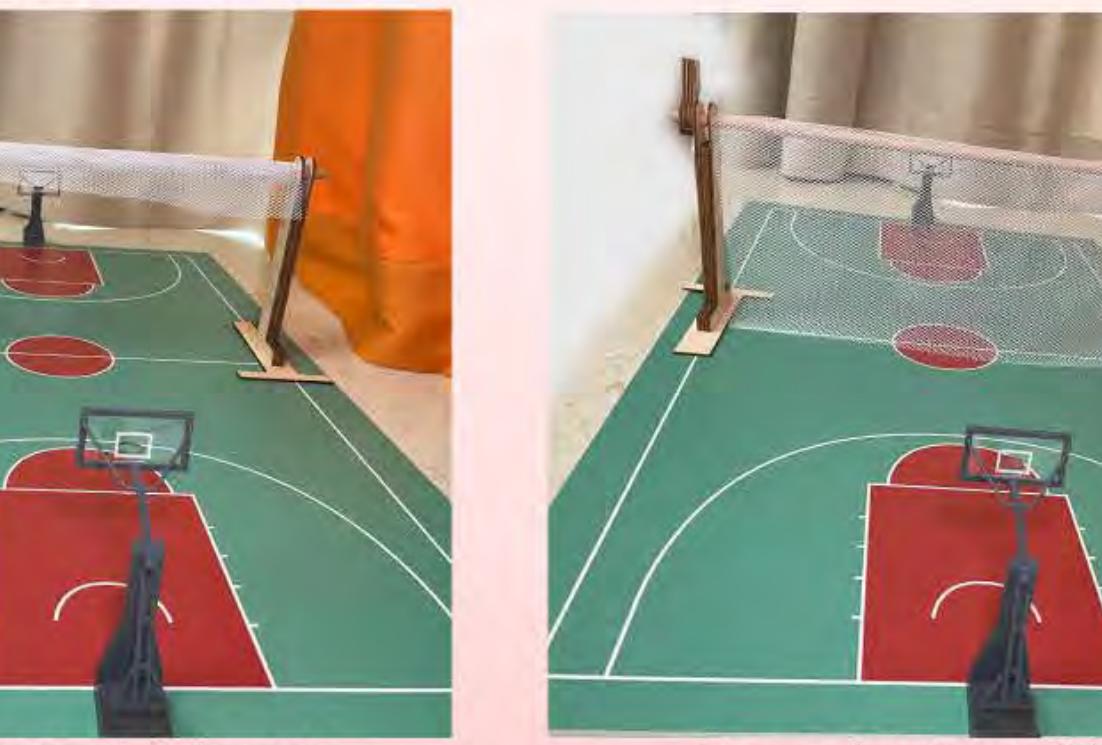
I used Midjourney to beautify the renderings to achieve photorealism.



Physical model  
Indoor venue



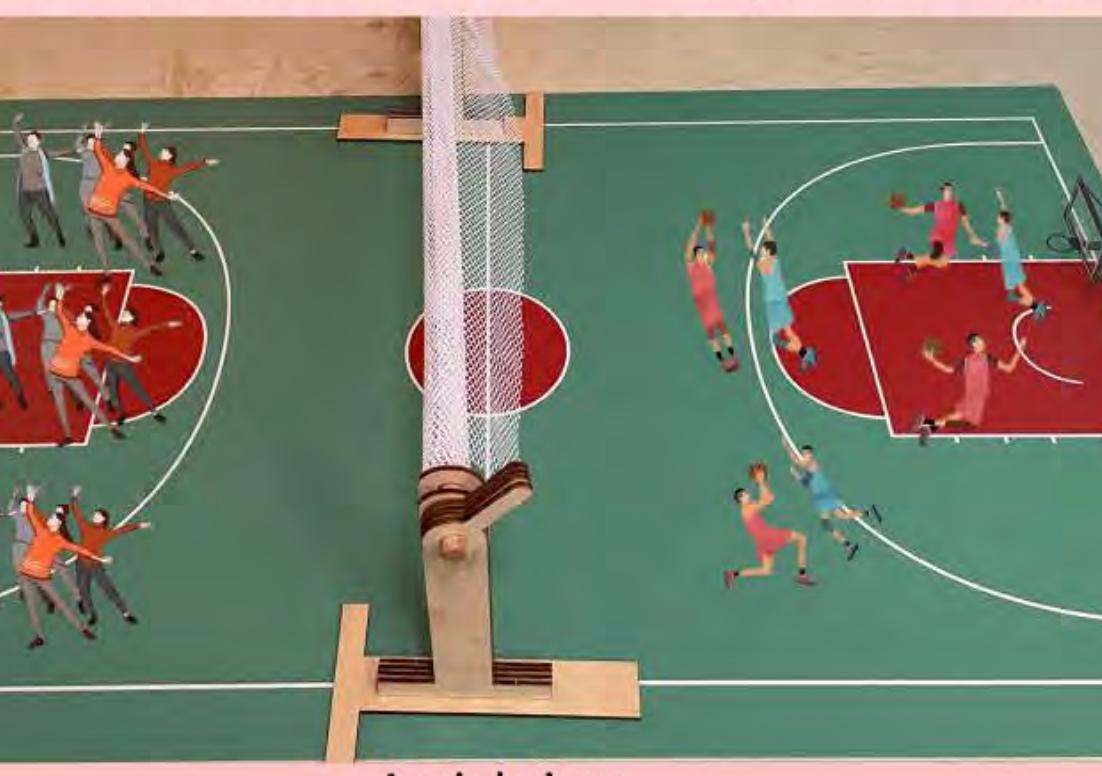
Outdoor venue



Roll up the retractable nets



Expand retractable nets



Aerial view

# HIFI Interface design

## Typography

San Francisco

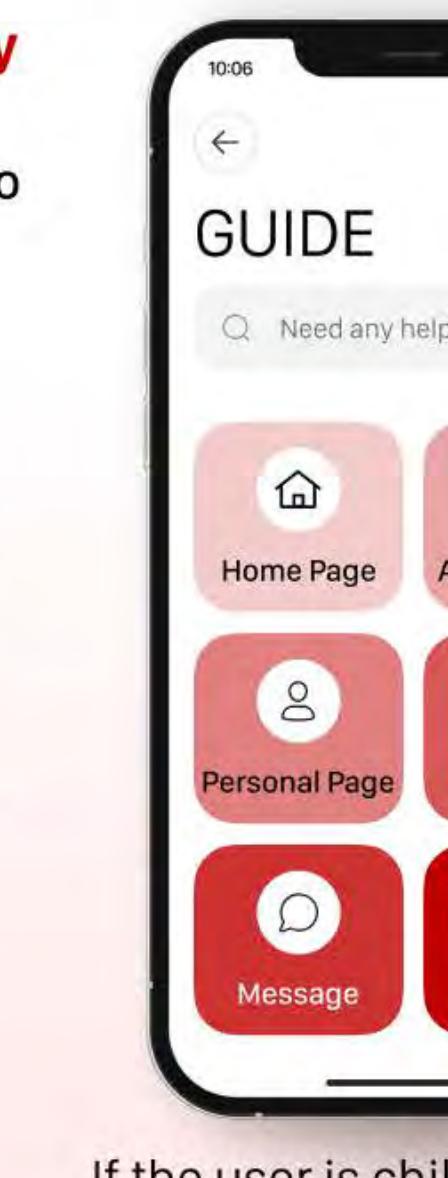
## Color

C00000

FFEBEC

D65959

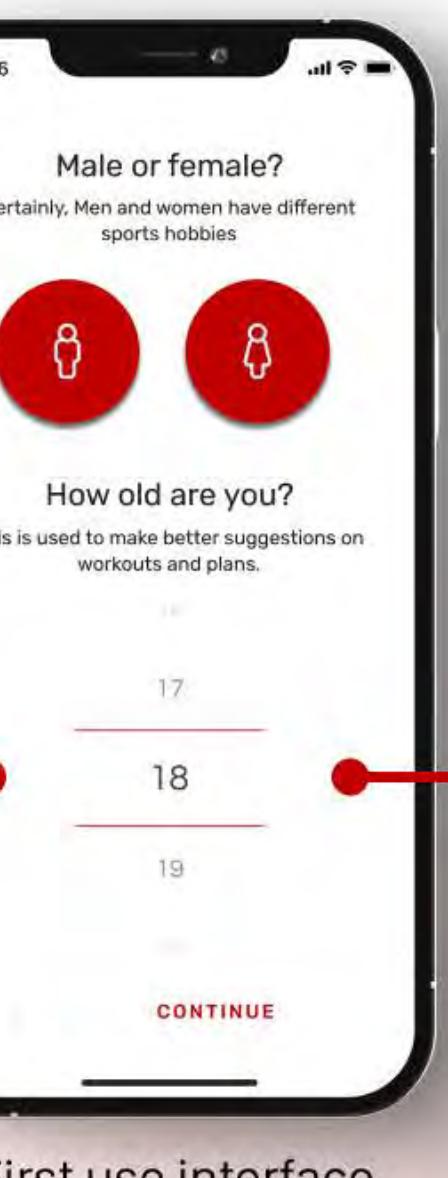
FFFFFF



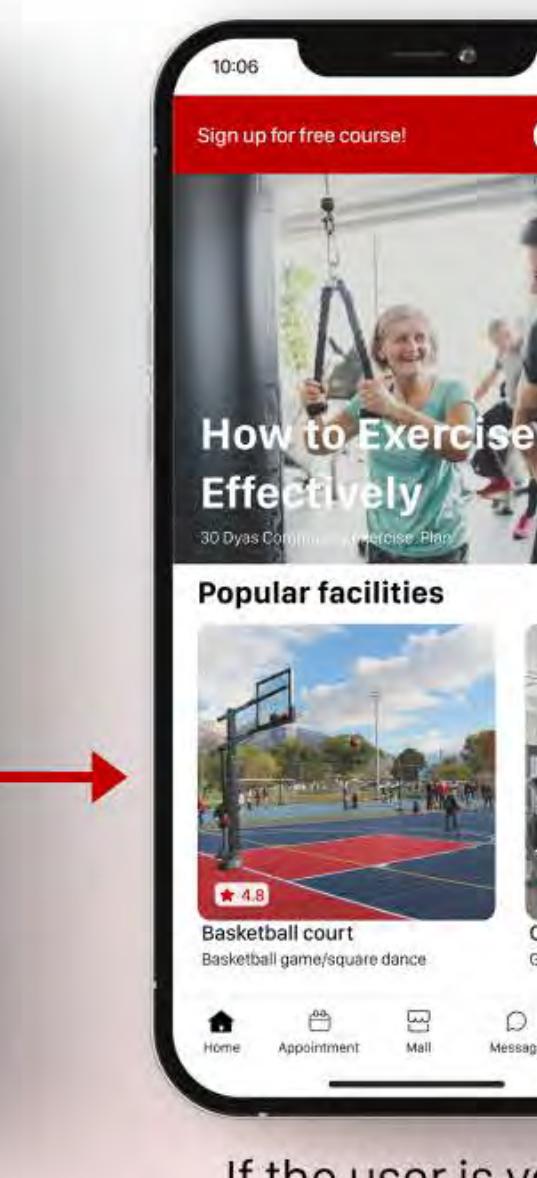
CONTINUE



If the user is children or aged (not good with smartphones)



If the user is young (good with smartphones)



15 metres Take a right on Tsun Yuen street

## Reserve a facility:

- Use the app to choose available facility and enter the number of people.
- Groundskeeper assigns appropriate space based on daily bookings and your group size.

## Long-term reservation

- Apply for a long-term reservation for recurring activities (e.g., weekly basketball or daily square dance).
- Avoid the need for separate applications each time.

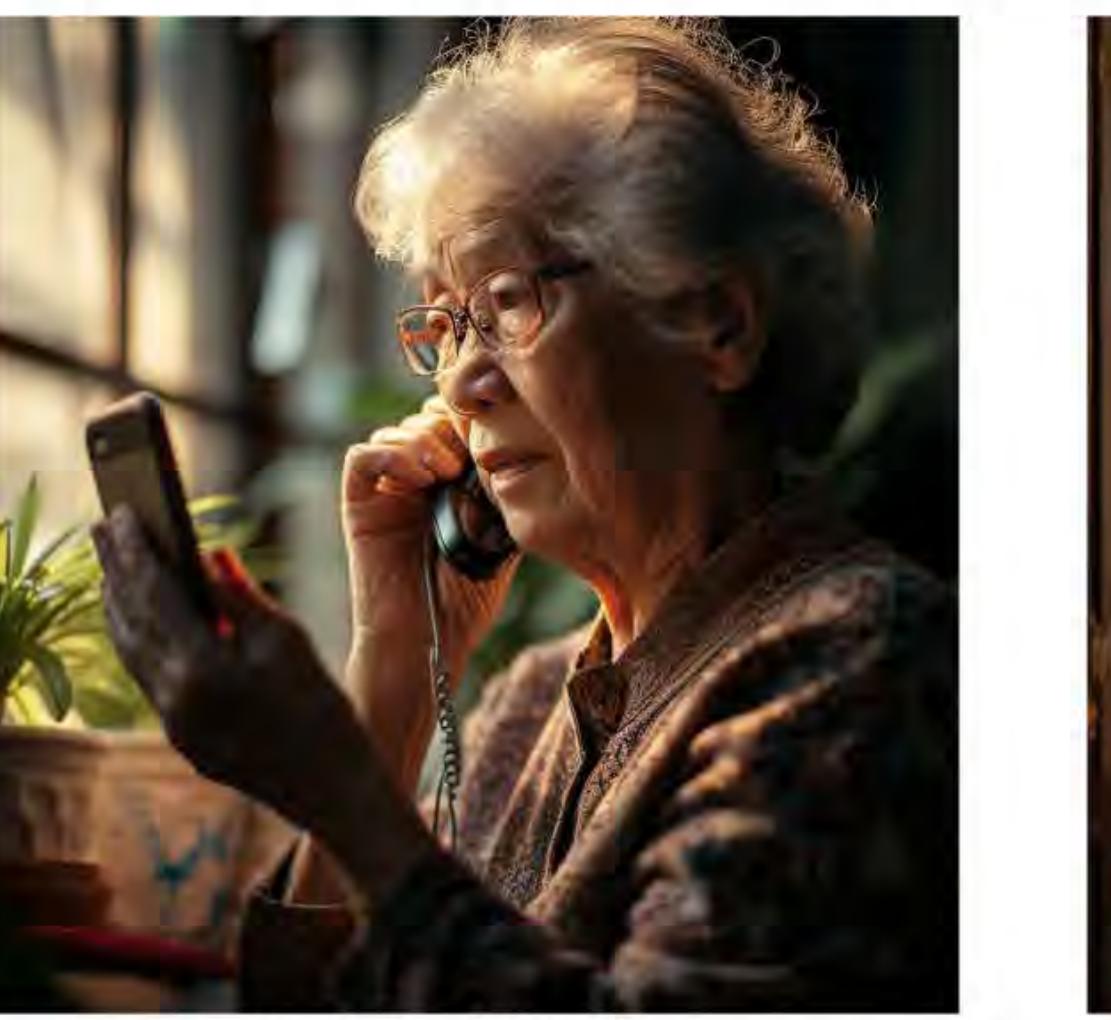
## Go to the site

- Receive reminders to set out before the appointment time.
- Accurate community navigation provided for timely arrival, especially for new residents.

# Story Board

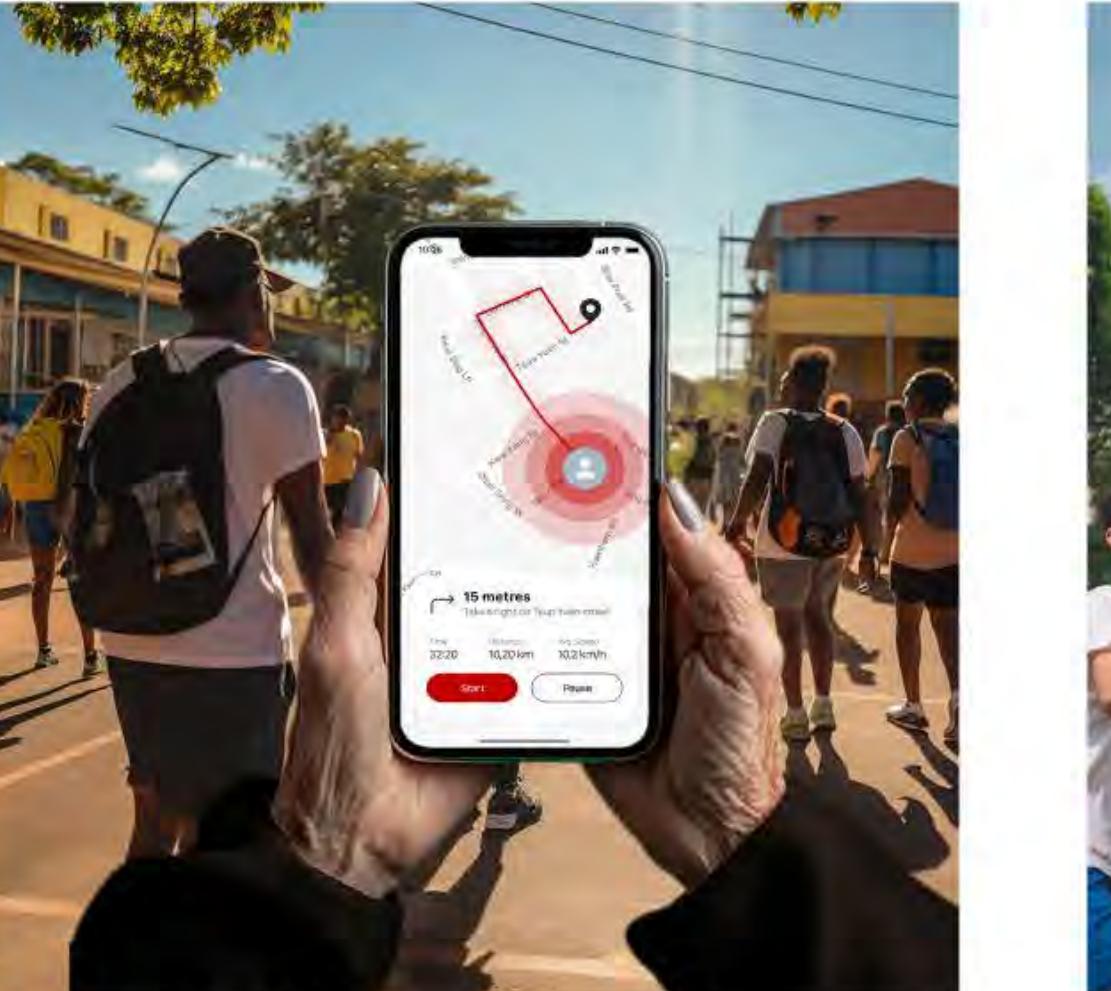
## New public space use procedure

I used Midjourney to transform the manuscript into photo to more accurately illustrate my design intention.



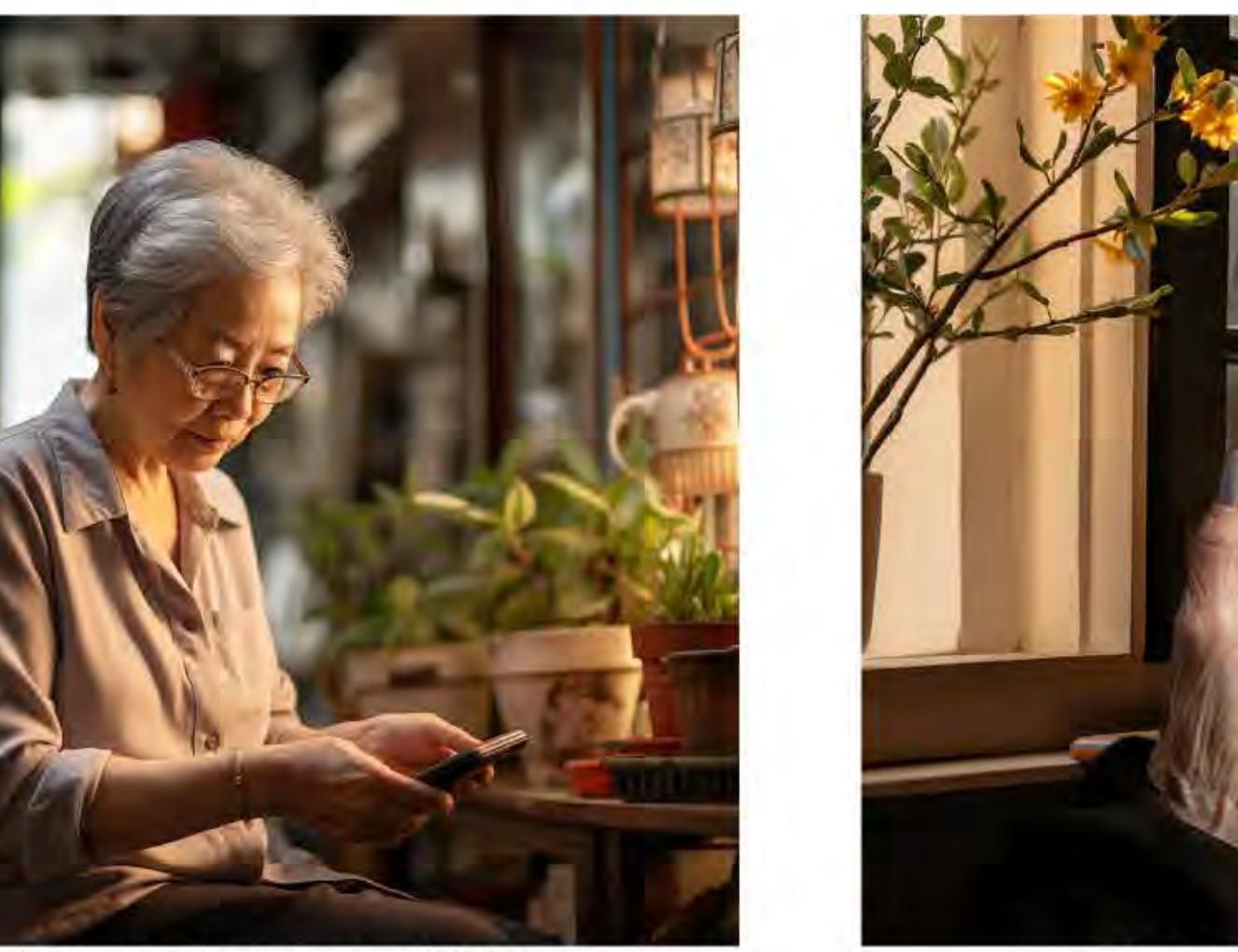
### Contact friends:

The old woman has the idea of wanting to exercise in her spare time today, and calls her friends in advance to ask if they are free.



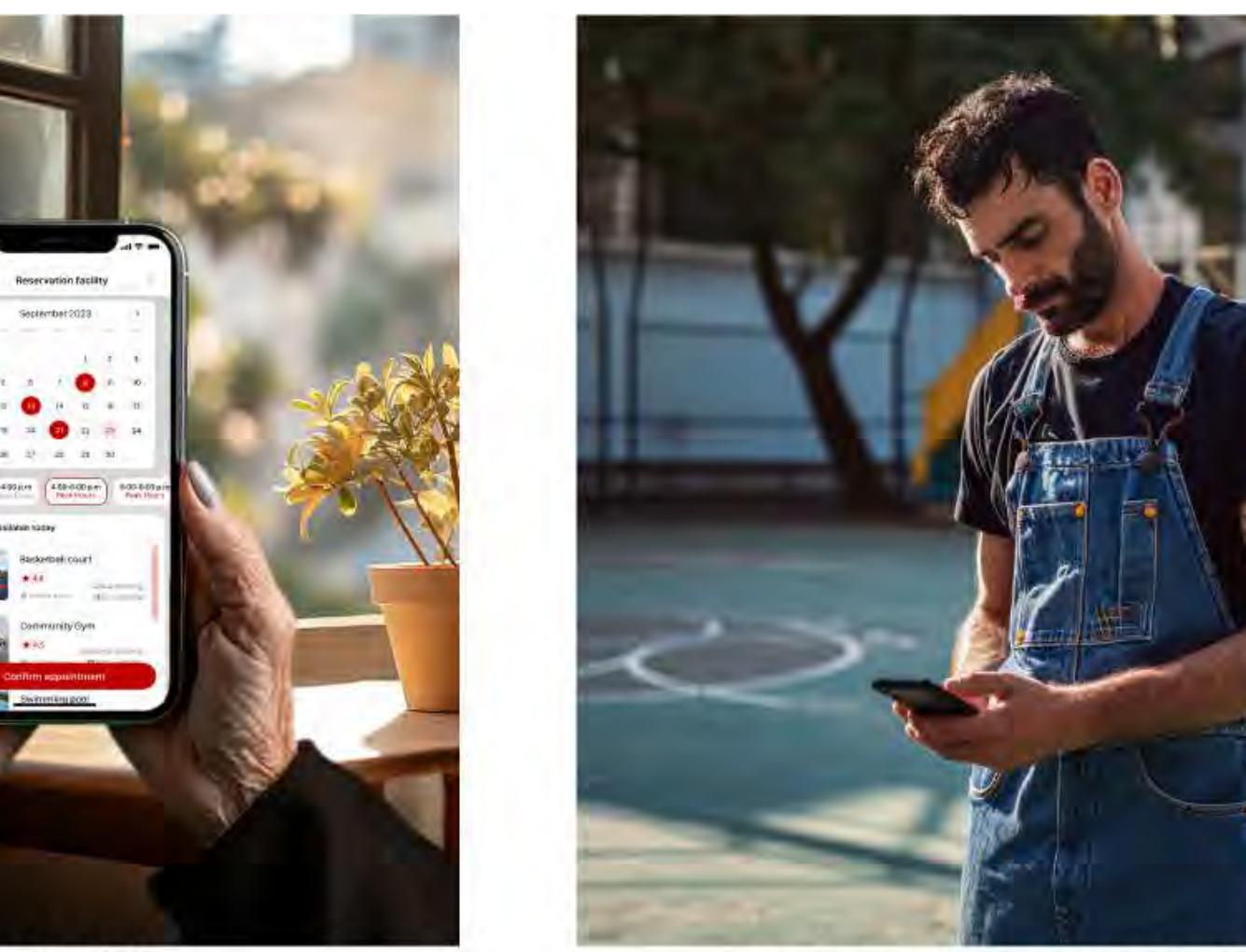
### Access to Facilities:

Follow the navigation directions to her scheduled basketball court.



### View available facilities:

Use the app to find out what facilities are available.



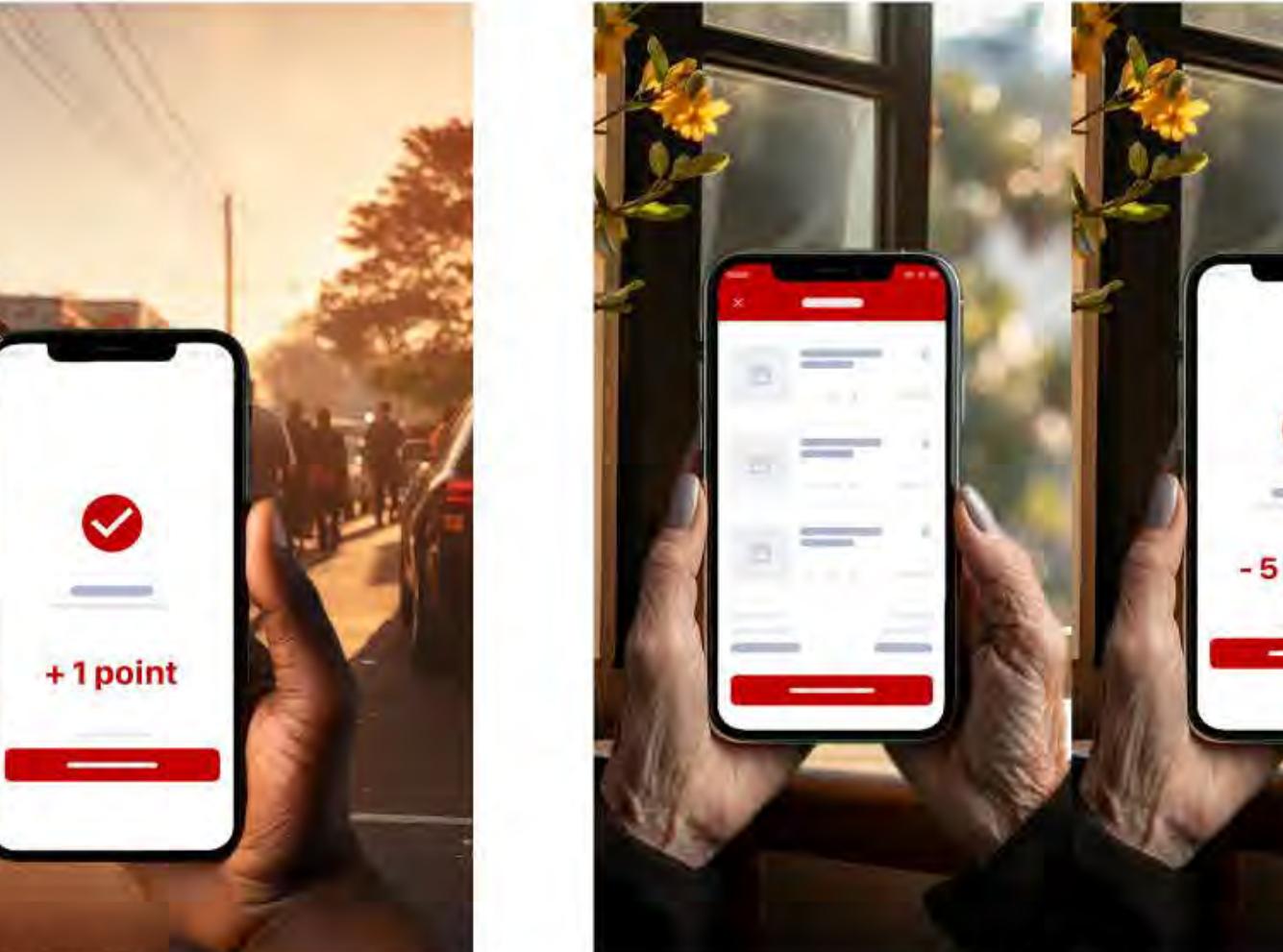
### Reserve a facility:

Use the app to choose available facility and enter the number of people.



### Adjust the venue layout:

The administrator found that two groups of people would be using the basketball court today, so he adjust the facilities in advance and divided the basketball court into two halves.



### Enjoy exercise:

Two groups of people enjoy exercise in their respective halves, while the administrator alerts them when time is up.



### Earned points:

After returning home from exercise, users who arrive at the venue in time and successfully complete the exercise without conflict with others will be awarded points.



### Redeem gift:

Points can be redeemed for prizes in the mall, such as vouchers, coupons and merchandise offered by partner merchants.

# Expectation

## Deficiency:

### Limited Community Representation:



The project lacks broad community representation in design, potentially excluding certain user groups.

### Sustainability Challenges:



If the project doesn't address long-term financial sustainability, relying heavily on external funding.

### Possible Limitation:

#### • Resistance to Change:

Possible resistance from users accustomed to traditional methods, impacting the adoption of new scheduling systems(online platform).

#### • Technological Accessibility:

Potential challenges if community members have limited access to technology or low digital literacy.(Such as old people and children)

### Future improvement

#### • Accessible User Training Programs:

Implement user-friendly training programs to enhance digital literacy and promote broader adoption of the scheduling platform.

#### • Community Engagement:

Anticipate fostering a user community to provide insights, share experiences, and contribute to the app's growth.

#### • Expand Offline Support Services:

Increase offline support services to aid users who may face challenges with the online platform or prefer traditional communication methods.

# Business Canvas

## Key Partners

- Community Facilities Management
- Local Sports Businesses
- Community Groups
- Community worker

## Key Activities

- Management of Community Facilities
- Coordination of Activity Scheduling
- Regular User Feedback and Needs Assessment

## Value Propositions

Value Delivered to the Customer:

- Efficient and Conflict-Resolving Scheduling: Resolving conflicting activities between different sports groups through optimized scheduling.
- Inclusive Community Spaces: Providing a user-friendly platform that promotes inclusivity and encourages community members to share communal spaces.
- Enhanced Community Engagement: Creating a positive and engaging environment for community members to participate in activities.

## Key Resources

- Community Facilities: Spaces suitable for basketball and dance activities.
- Technology Infrastructure: For managing and optimizing scheduling, possibly including the mobile app.
- Personnel: Staff for facility management and coordination, including offline personnel for venue sharing.
- Community Partnerships: Collaborations with local businesses, community
- Marketing and Promotion: Resources for promoting the services and engaging the community.

## Customer Relationships

Responsive Service: Community members would expect a responsive and supportive relationship, particularly in addressing scheduling concerns and feedback.

Transparent Communication: Open and transparent communication regarding facility availability, scheduling changes, and any community engagement events.

## Customer Segments

For whom are we creating value:

- Community members
- Both young and older individuals engaged in basketball or dance activities

## Channels

Online Platform: User-friendly website or mobile app.

## Community Events

In-person gatherings and meetings.

## Social Media

Platforms for updates and engagement.

## Local Media

Newspapers, bulletins, and flyers.

## Cost Structure

Site renovation costs (through community fundraising if possible)

Facility maintenance and management costs

Technology infrastructure and app development costs

Personnel and staffing costs

Marketing and promotion costs

## Revenue Streams

Local advertising(sports)

Partnerships with Local Businesses (if applicable)

Sponsorships for Community Events

Training or Workshop

## \$

# PROJECT 3

## Bee - Harvest

-An automatic picking system, mainly designed for breadfruit trees, coconut trees, such as high growth, picking difficult, high yield, picking efficiency is low, high economic value of fruit tree crop picking.

**Product Design | UI & UX Group Project**  
2023.09 - 2023.12

### Team Contribution:

In our two-person team, I was responsible for all the research analysis and UI production, including logic and typography. I was also involved in the iterative design of the final product. Another team member was responsible for sketching, creating the final model, and producing renderings.

### Overview:

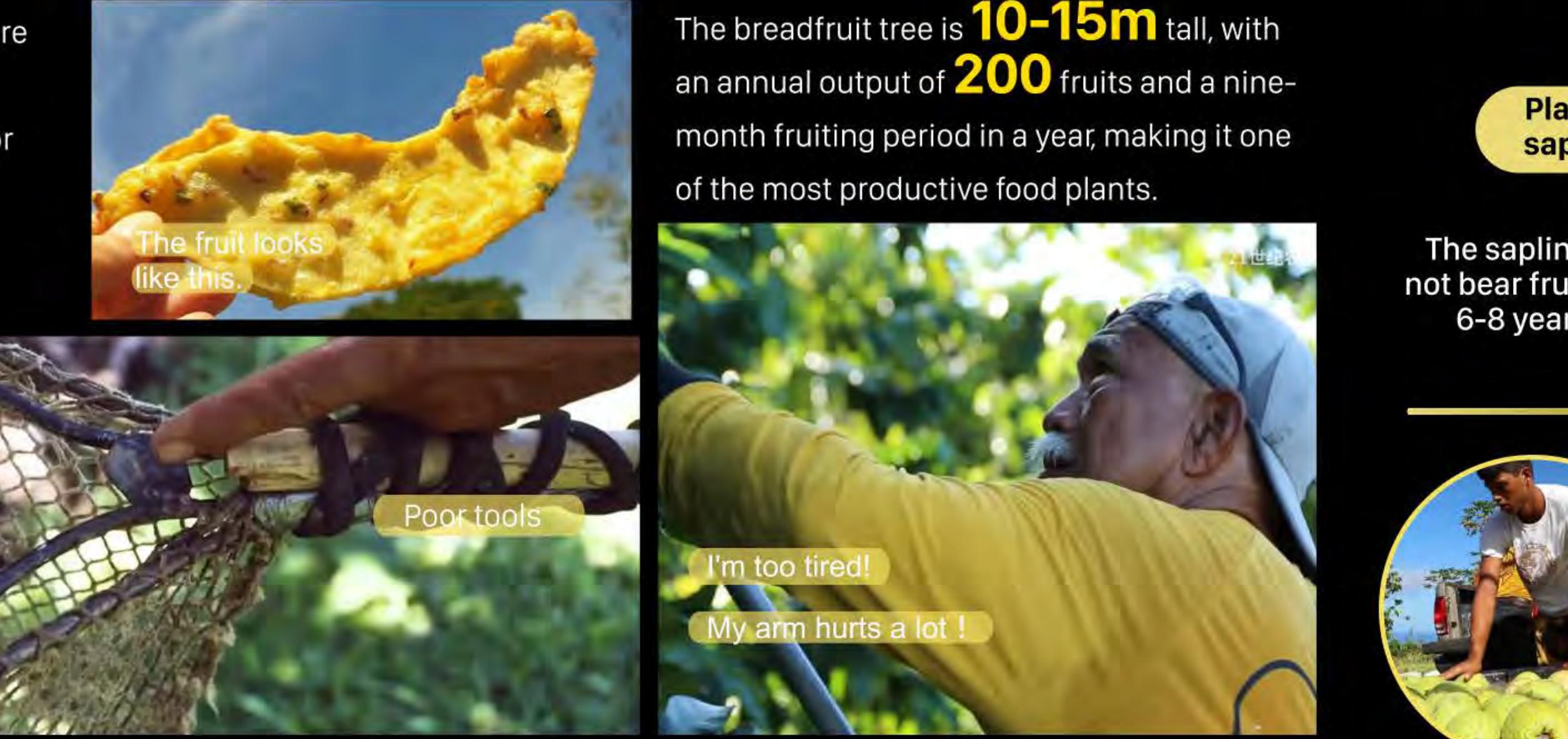
The project holds great promise for tropical regions where breadfruit is a major source of economic growth. With the gradually developed UAV planting and cultivation technology, the whole process of agricultural planting to harvest can be automated.



## Background

### What is breadfruit? Why do I care about it?

Breadfruit is relatively rare in our lives, but it is a **Staple Food** for many people living in tropical regions.



The tools for picking breadfruit are **simple** and rely solely on the arm strength of workers. Prolonged use can easily cause **muscle and bone damage** to workers.

### Development Trends of China's Breadfruit agriculture

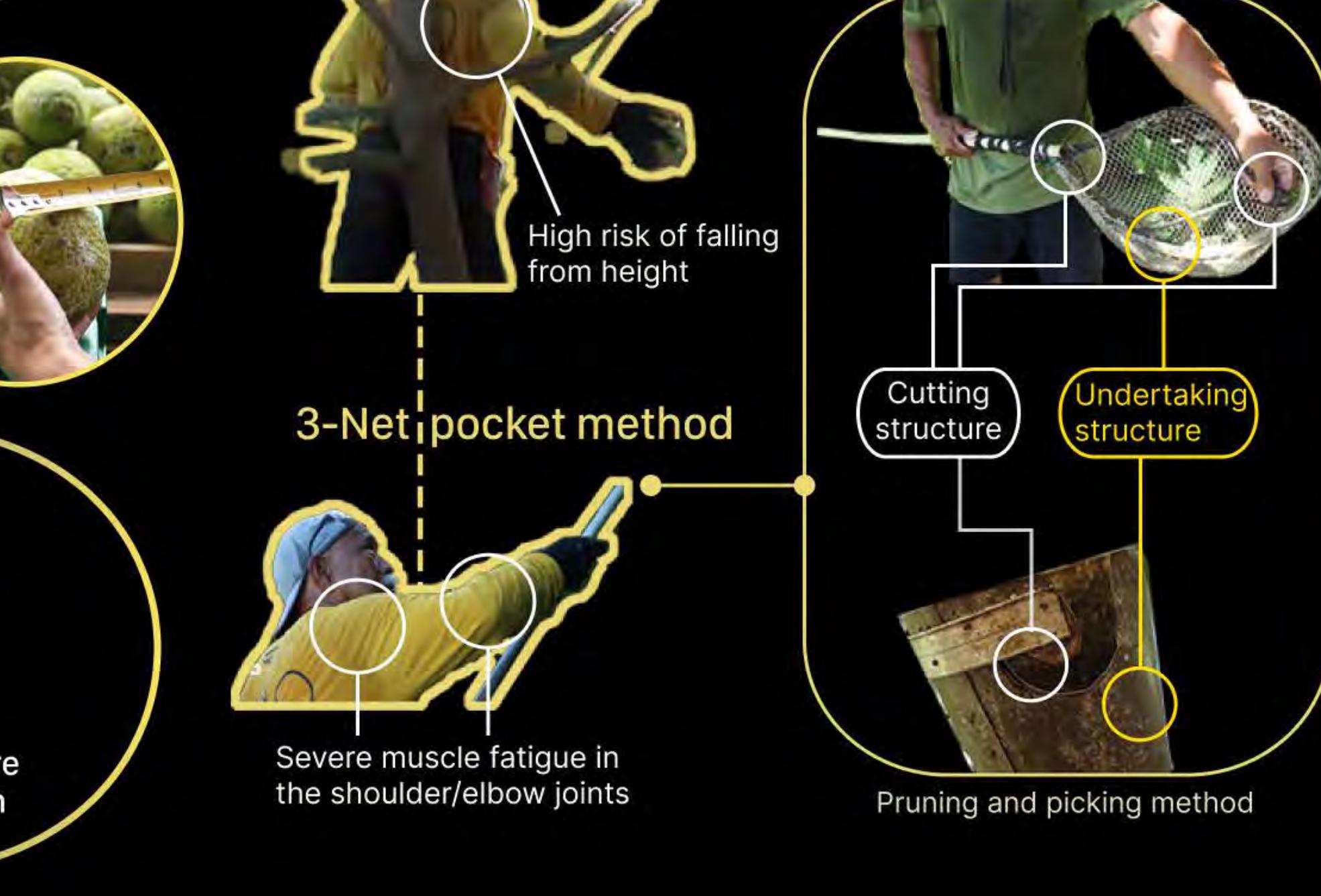
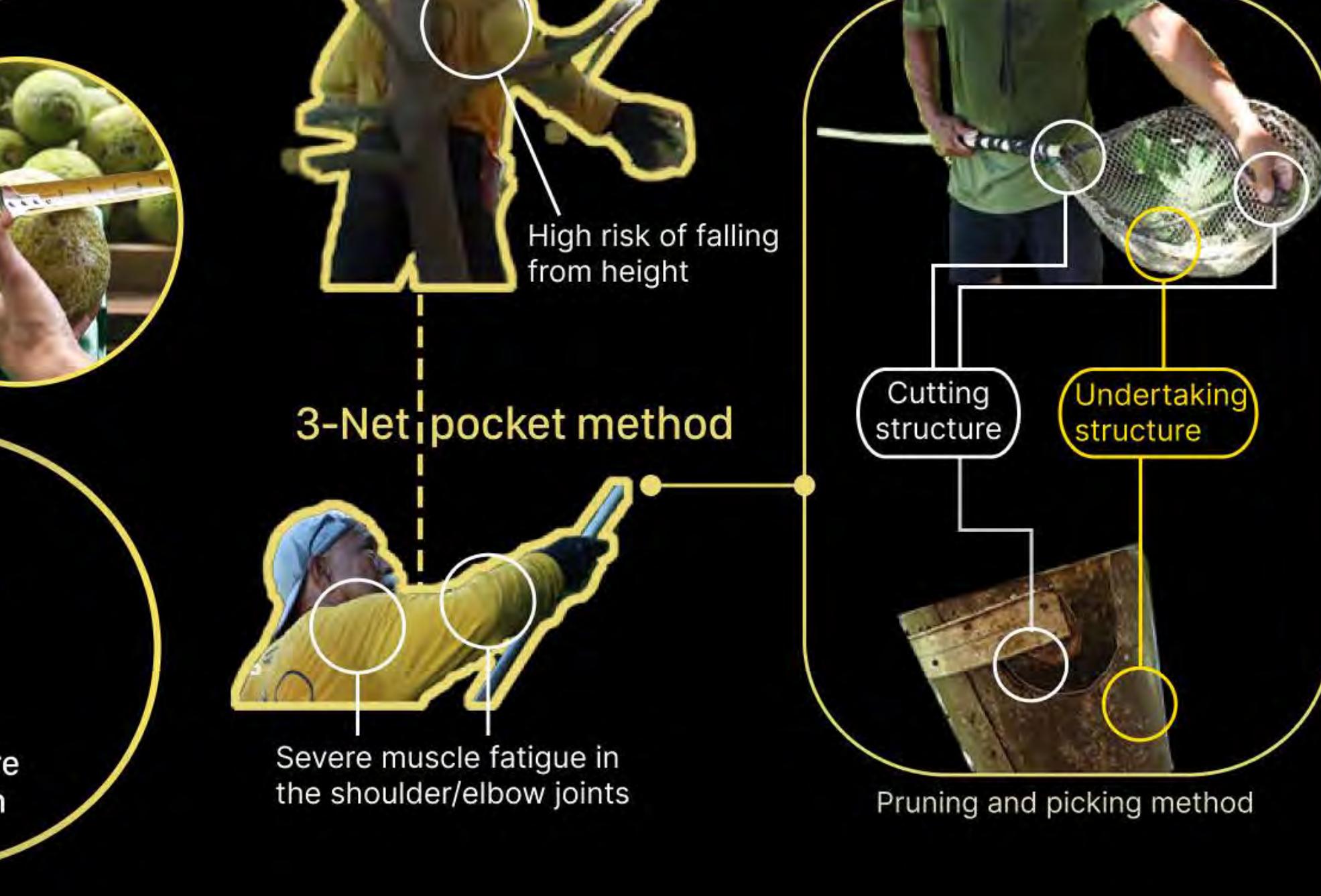
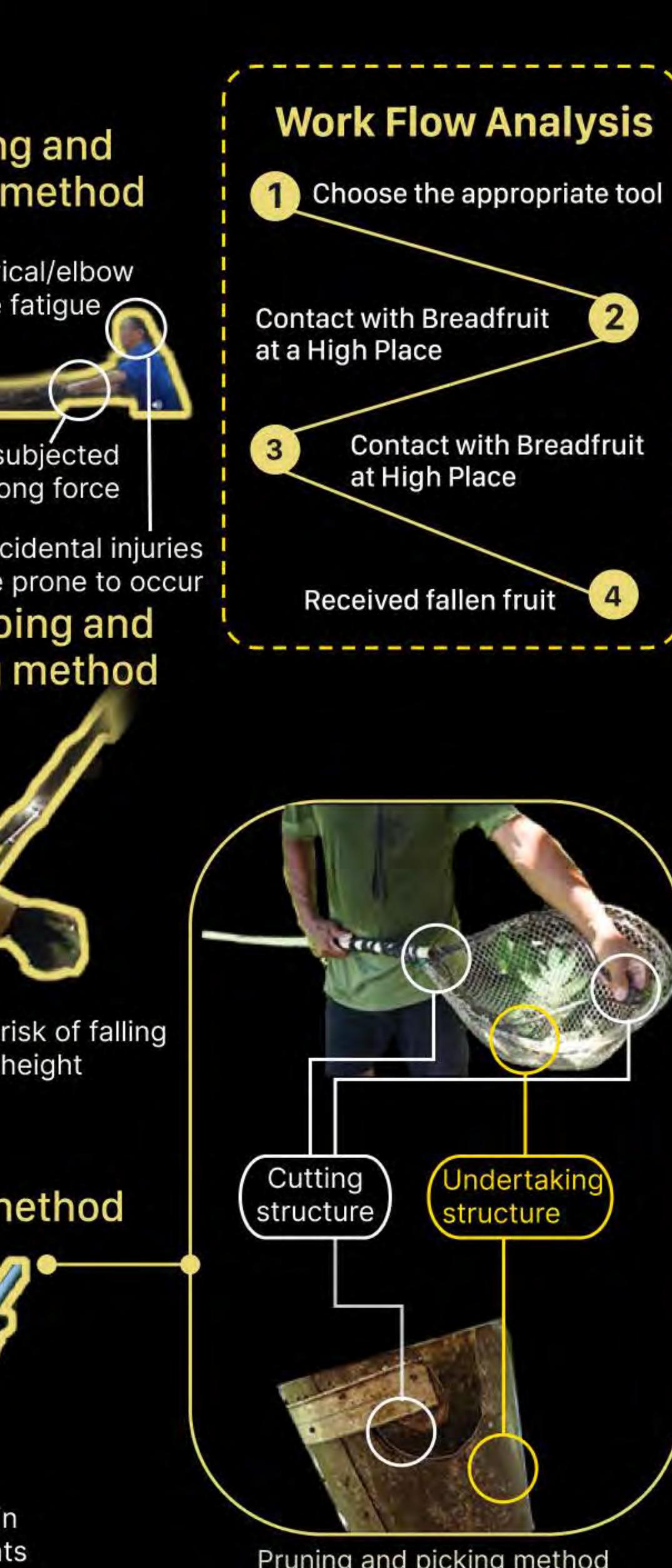
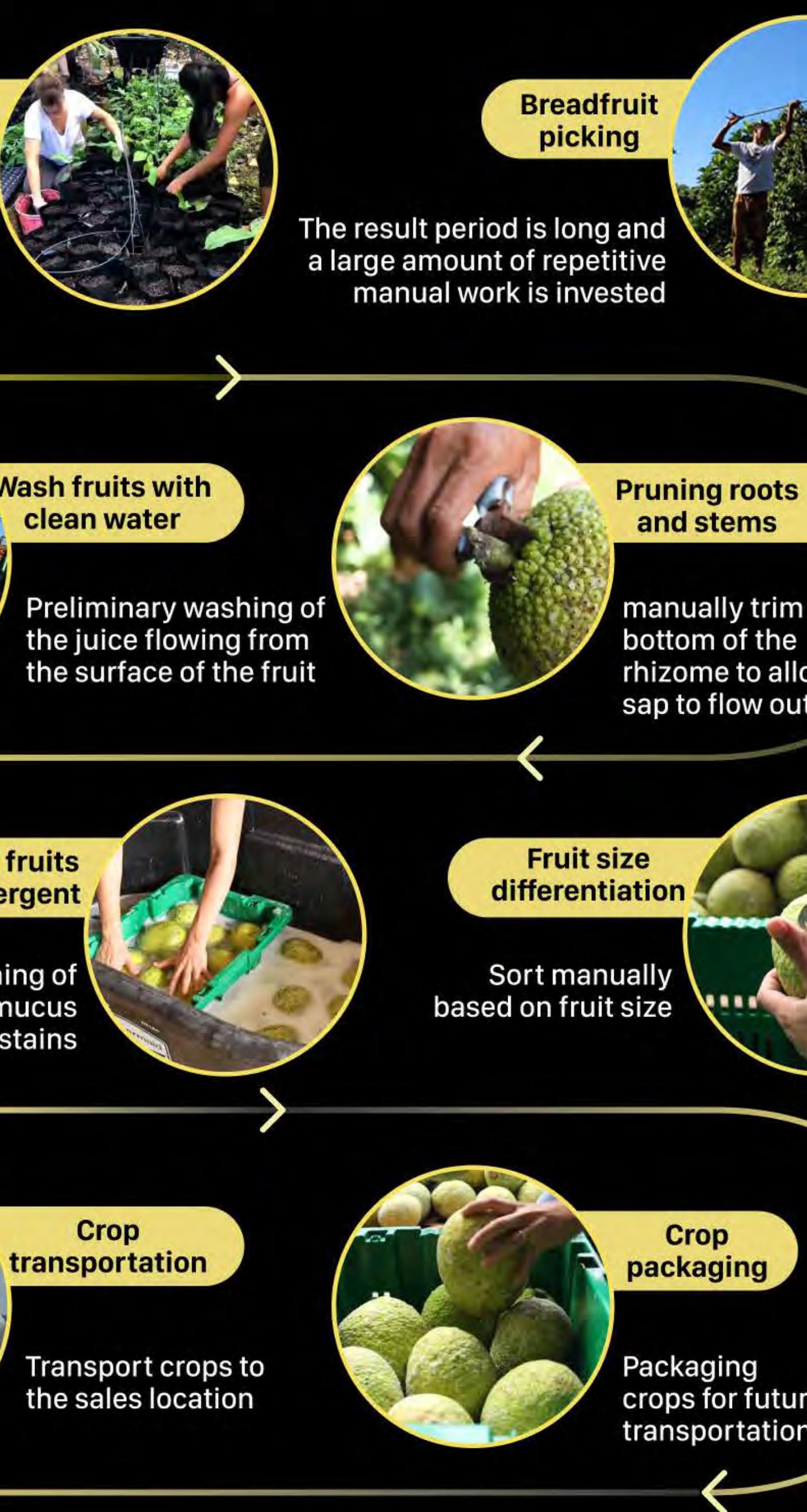
It is present in approximately 90 countries in South and Southeast Asia, the Pacific, the Caribbean, Central America and Africa.



In Xiaoguan Village, Nanqiao Town, Wanning, Hainan Province, since 2020, breadfruit has been developed as a collective economic industry of the village, and 800 plants have been planted in the village. More than 10 years of well-managed trees, can produce hundreds of results, considerable yield.

## Field Research

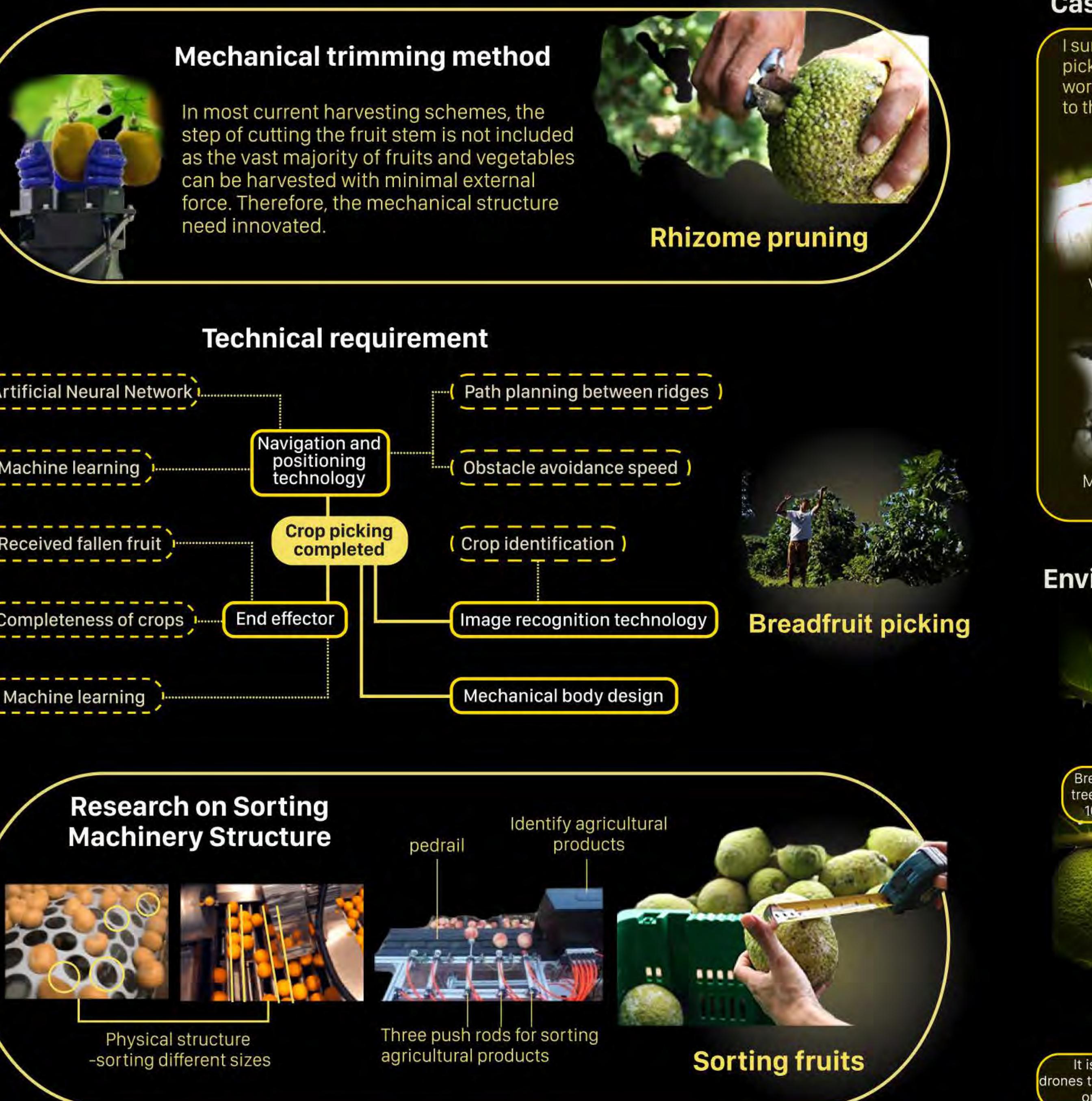
### The Planting Process of Breadfruit



# Design Opportunities



# Institutional Research



## Case study of mechanized picking

I summarized the cases of common mechanized picking methods, and substituted them into the working environment to study which were adapted to the environment.

Abundant, US

Sweeper, Netherlands

Vacuum Suction

Nova, China

A robotic arm with sensors

Tevé Aerobotics, Israel

Cutting rhizomes + Ground operation vehicle pick-up

Mechanical Claw Obtaining Fruit

High altitude collection

High altitude picking

circular saw blade

Aerial ropeway

Ground track

Intelligent weighing

Animal biomimetic

Wire saw

scissors

Mechanical collaboration

spider biomimetic

Bee biomimetic

Mechanical gripper grasping

Rhizome cutting

Mechanical Claw Grasping Crops

+ Cutting Roots and Stems with Small Saw Blades

Container sorting of crops

The mechanical arm places the crop into the container

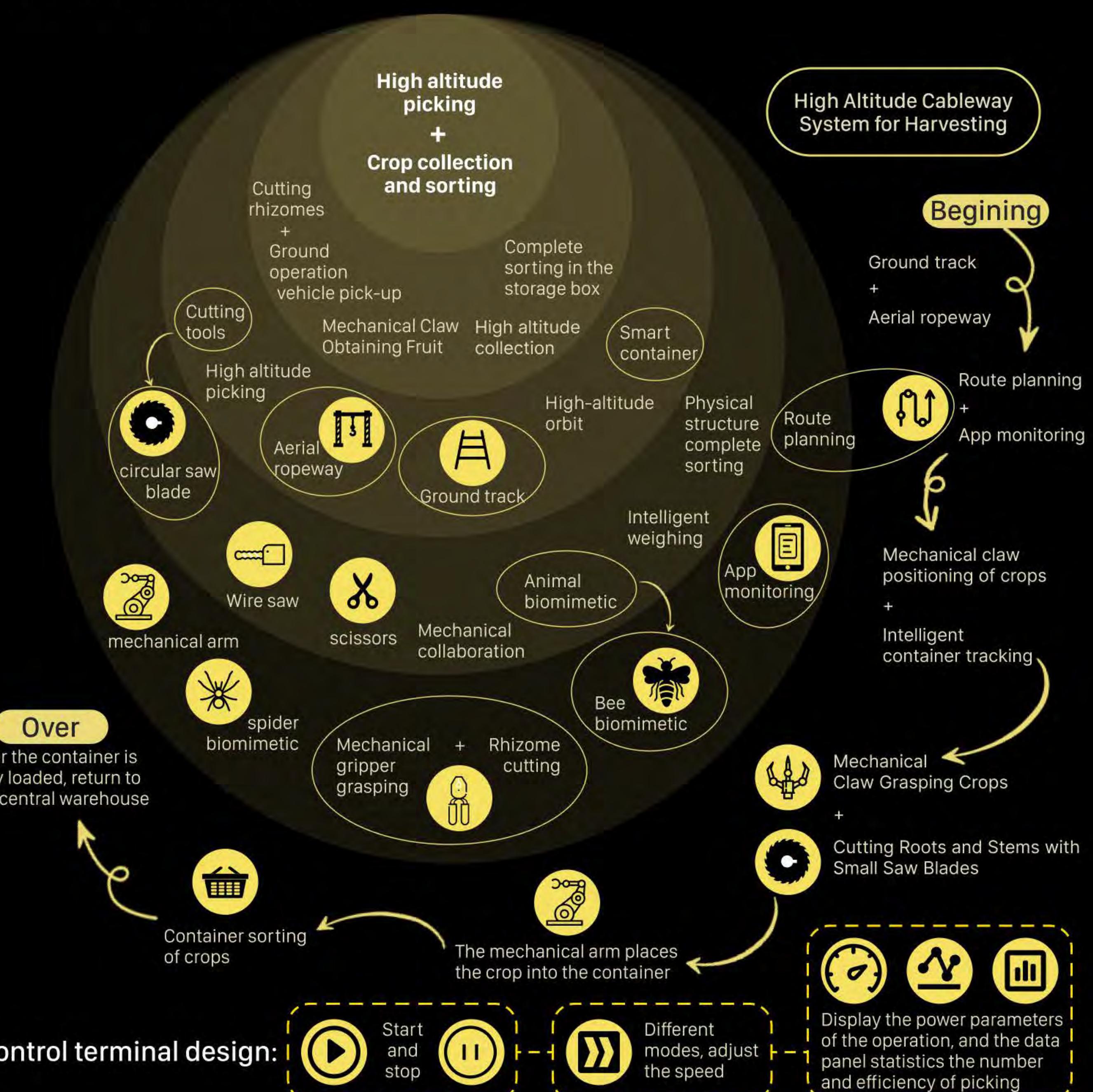
Start and stop

Different modes, adjust the speed

Display the power parameters of the operation, and the data panel statistics the number and efficiency of picking

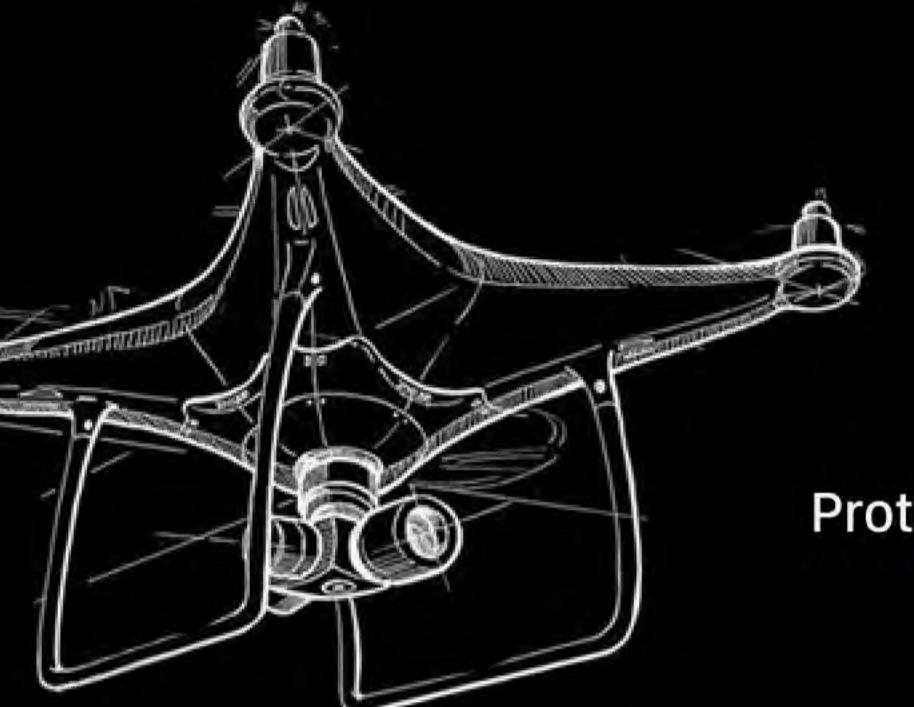
# Mind Mapping

From requirements to design

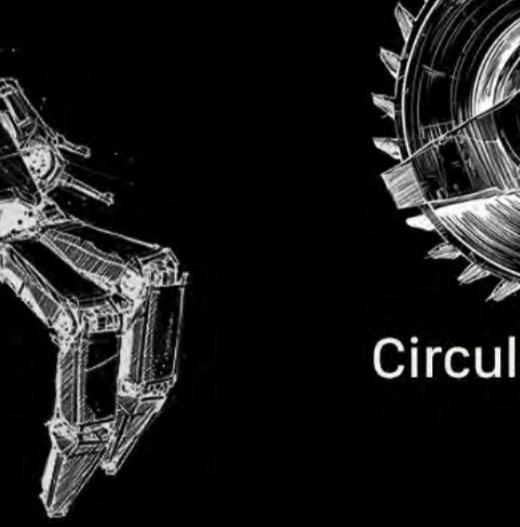


# Concept Development

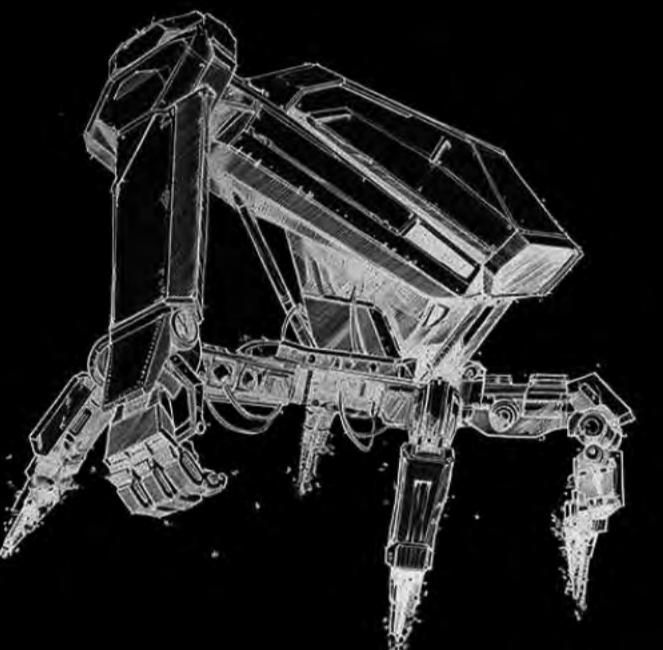
Ideation and sketch



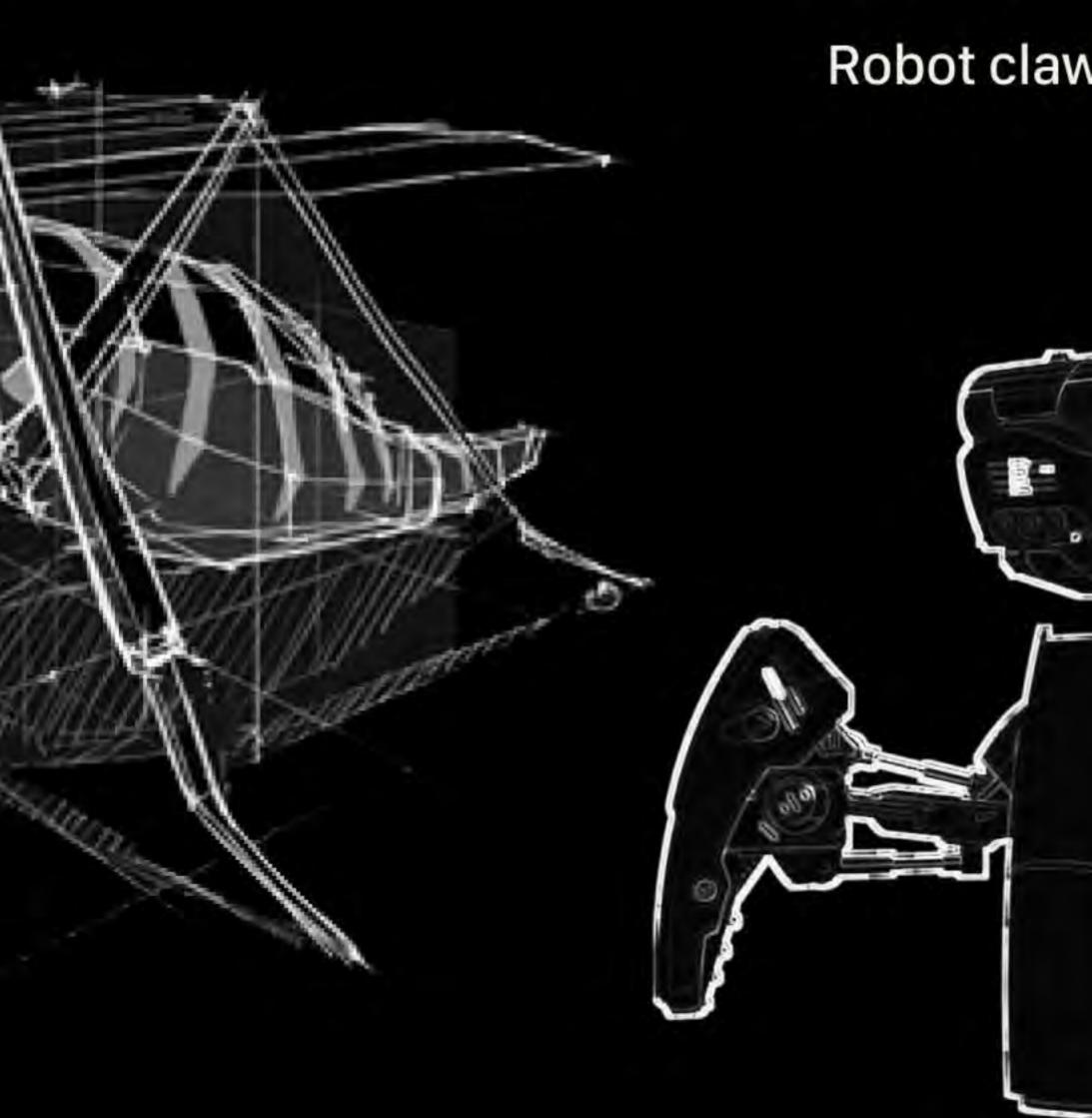
Prototype shaped like drone



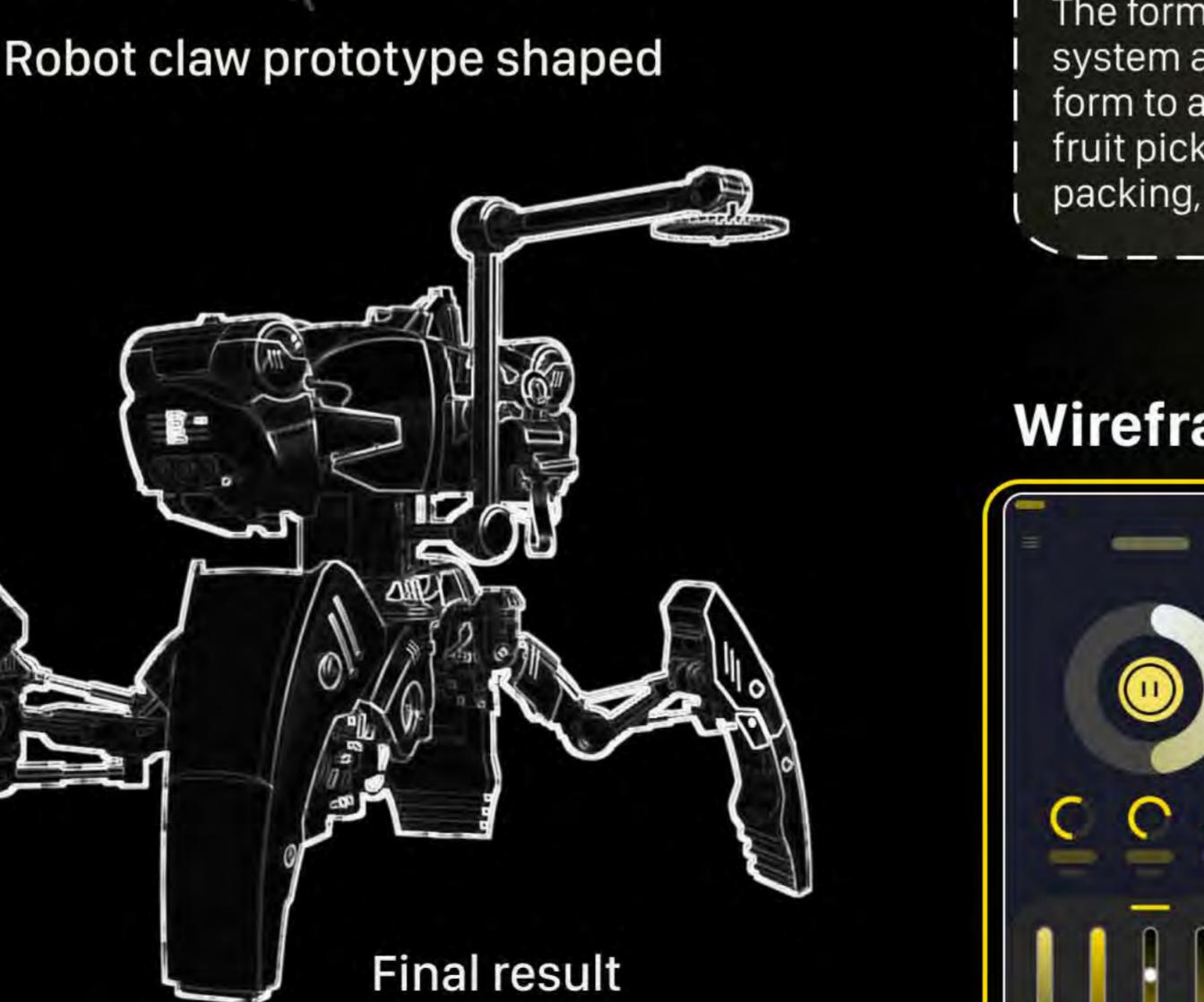
Circular saw blade



Mechanical claw gripper grasping



Bionics prototype  
(Bee, Spider)



Final result

# System Process

Deduction of system plan

## Picking subsystem

### Fruit picking

Robotic arm

Elevated track operation

Positioning Crops Over the Sky

Descending and grasping + cutting stems

Ascend and search for crop collection platforms

Collaborate with the mechanical claw to approach it

Enter the entry to the harvest warehouse

The formation of the entire picking system adopts a reverse thinking form to achieve the ultimate goal of fruit picking, sorting, collection, packing, and transportation

## Collection subsystem

### Fruit collection

Harvest warehouse

Follow the track and move together

By tilting the angle and Complete sorting of warehouse opening size

Descend after reaching the maximum load-bearing limit

Lower the bottom to 10cm from the vertical height of the container

The bottom rotates open and the fruit falls into the container

Move a specific distance and then replace the next batch of containers

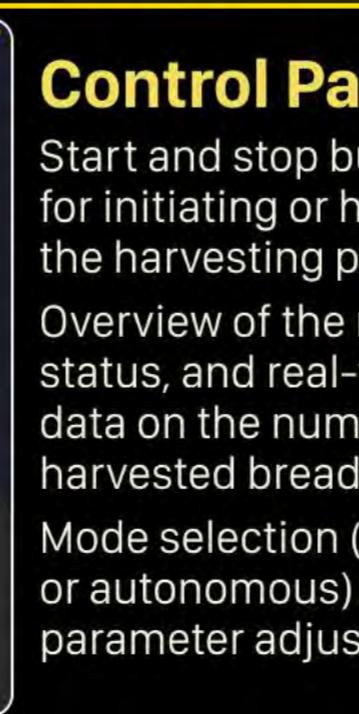
## Transportation subsystem

### Fruit transportation

Conveyor belt

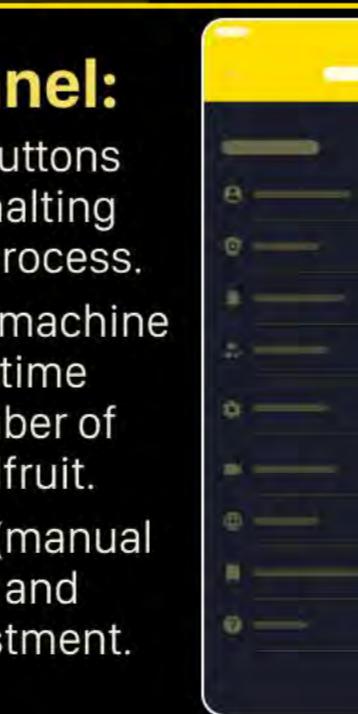
Follow the track and move together

## Wireframe of Control system



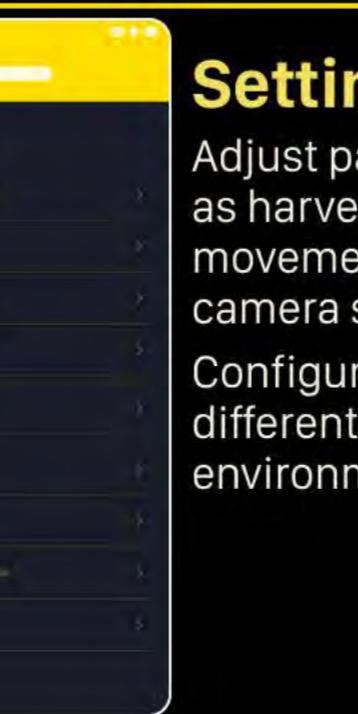
### Control Panel:

Start and stop buttons for initiating or halting the harvesting process. Overview of the machine status, and real-time data on the number of harvested breadfruit. Mode selection (manual or autonomous) and parameter adjustment.



### Settings:

Adjust parameters such as harvesting speed, movement precision, and camera sensitivity. Configuration options for different orchard environments.

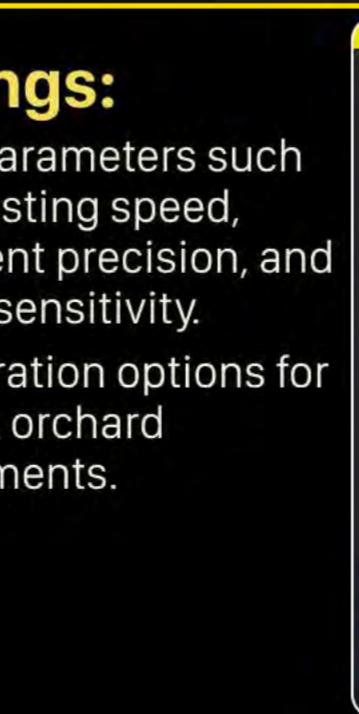


### Real-time monitoring:

-Map: Displays harvested areas and total work areas.

-Camera Feed:

Live video feed from the machine's onboard cameras for real-time monitoring.

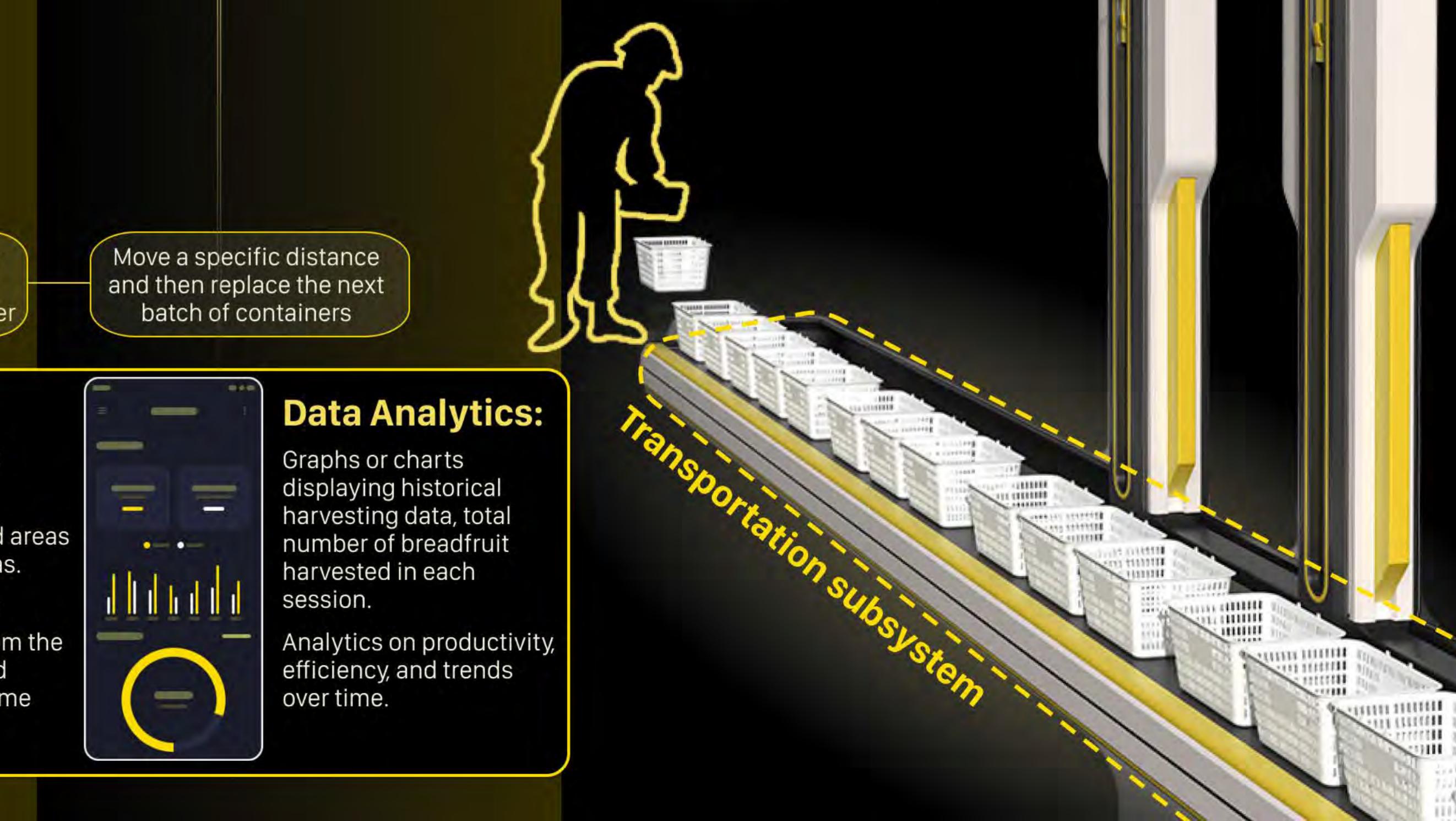


### Data Analytics:

Graphs or charts displaying historical harvesting data, total number of breadfruit harvested in each session.

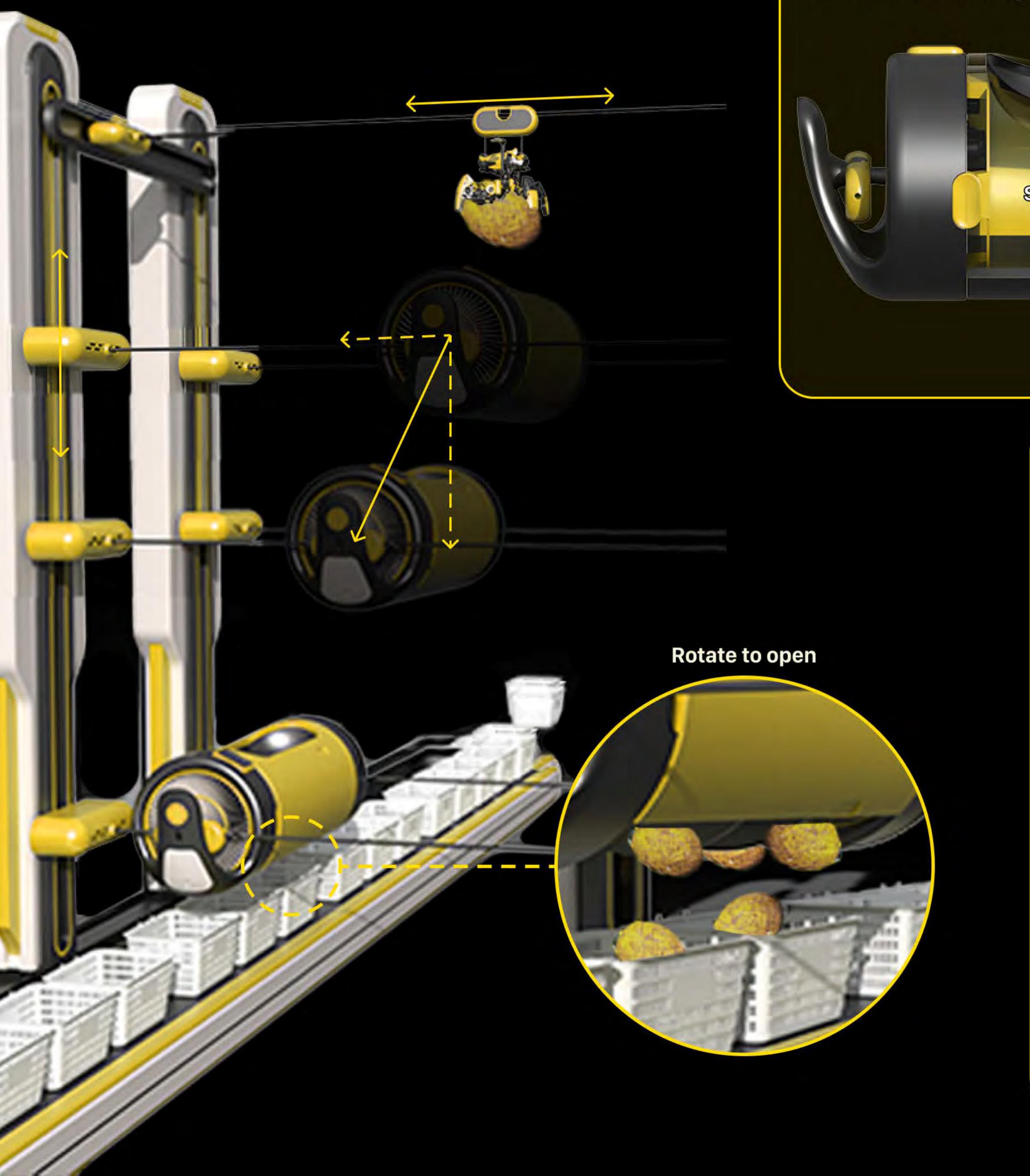
-

Analytics on productivity, efficiency, and trends over time.

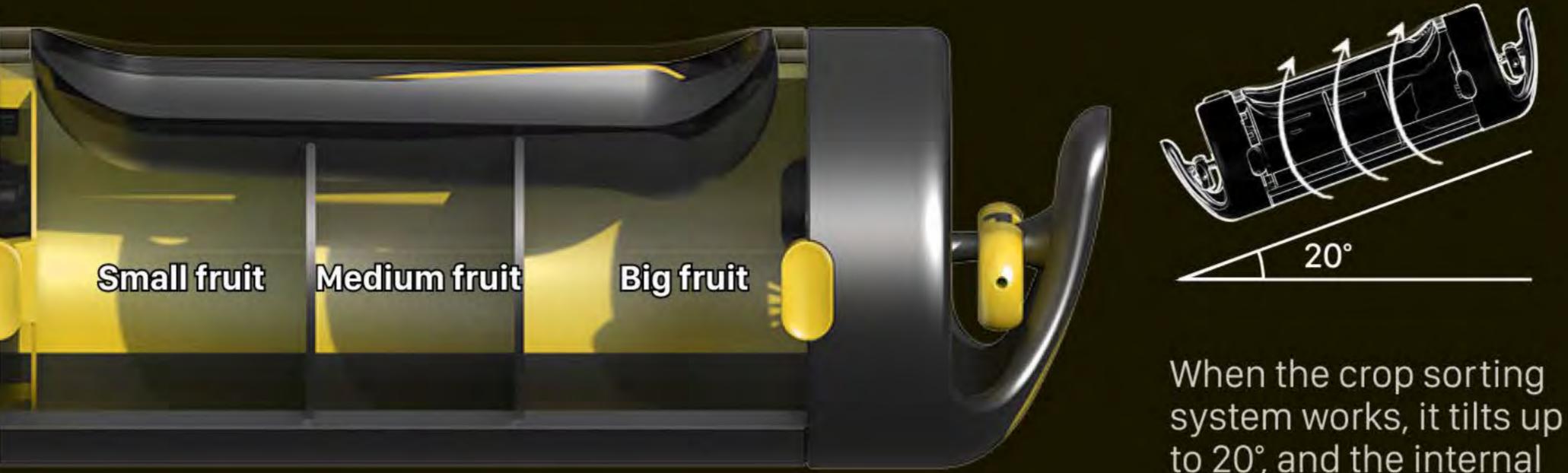


# Final Design

## System operation



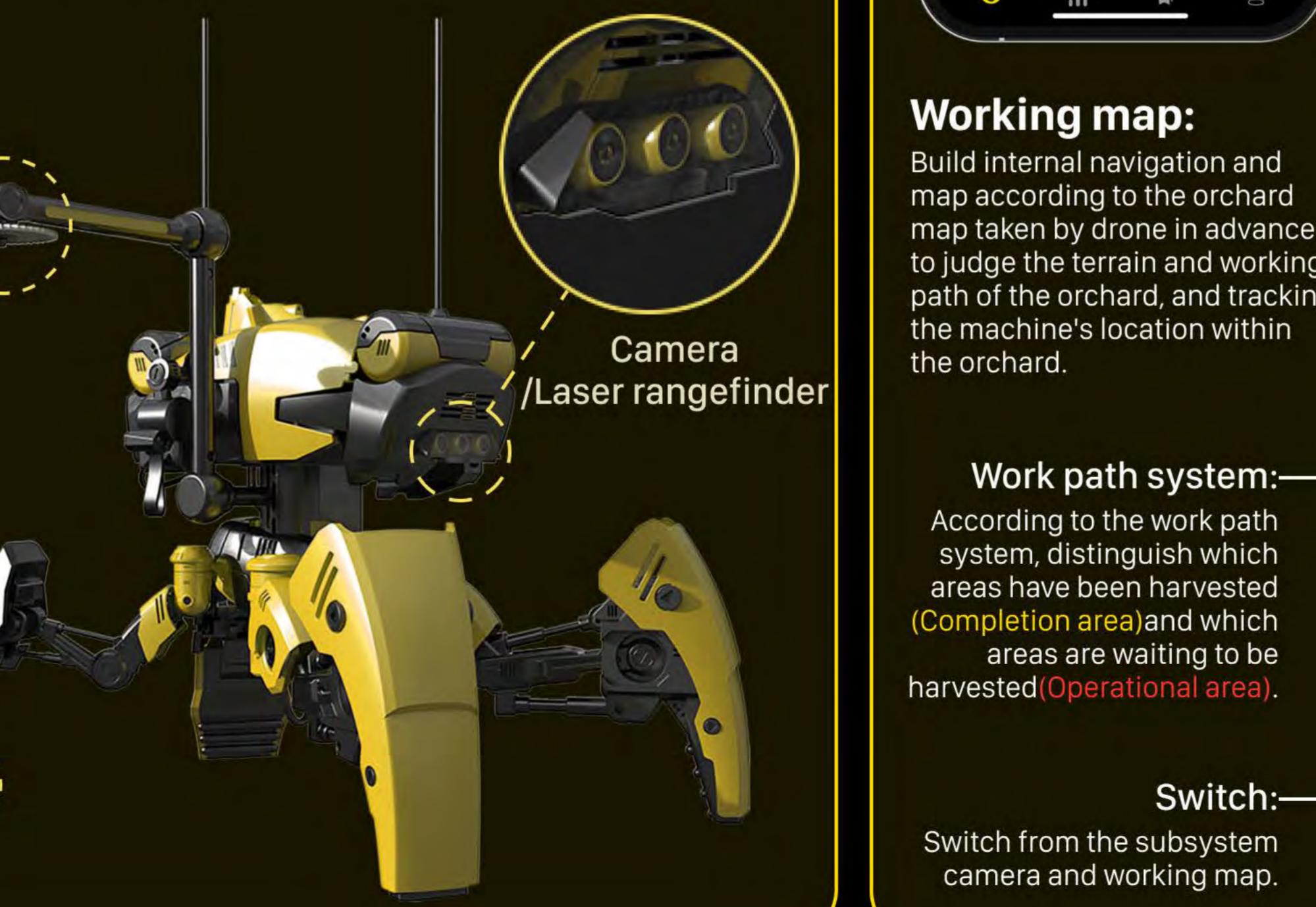
### Collection subsystem - Sorting function



Crop sorting structure

When the crop sorting system works, it tilts up to 20°, and the internal silos constantly rotate around the central axis of the cylinder.

### Picking subsystem - Design details



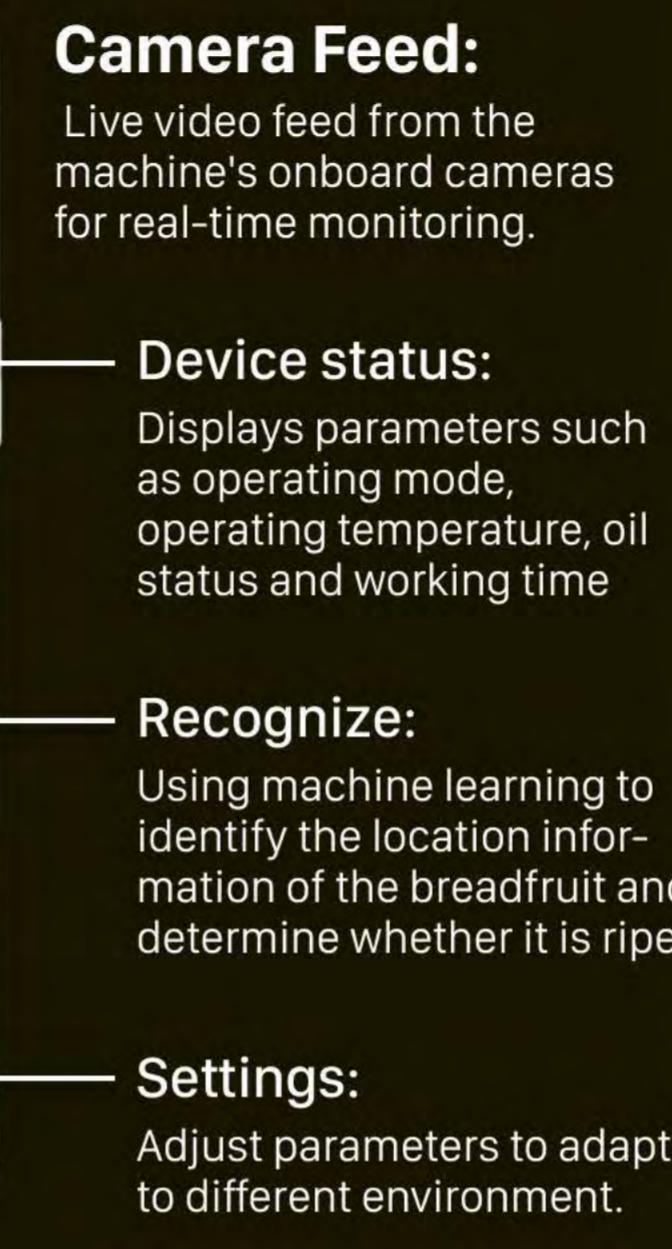
Rotate to open

Circular saw blade

Camera /Laser rangefinder

Non-slip gasket

# Hifi



### Camera Feed:

Live video feed from the machine's onboard cameras for real-time monitoring.

### Device status:

Displays parameters such as operating mode, operating temperature, oil status and working time

### Recognize:

Using machine learning to identify the location information of the breadfruit and determine whether it is ripe.

### Settings:

Adjust parameters to adapt to different environment.

### Working map:

Build internal navigation and map according to the orchard map taken by drone in advance to judge the terrain and working path of the orchard, and tracking the machine's location within the orchard.

### Work path system:

According to the work path system, distinguish which areas have been harvested (Completion area) and which areas are waiting to be harvested (Operational area).

### Switch:

Switch from the subsystem camera and working map.



# Working Scene Rendering



# PROJECT 4

## Allihies Biopharmaceuticals Research Center

-A biochemical research centre in Ireland, a public building designed to respond to the outbreak and create a good working environment for researchers.

Architecture Individual Project  
2022.09 - 2023.01

### Overview:

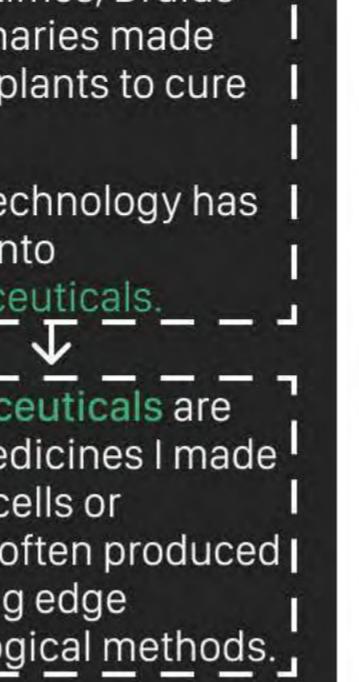
The design concept of Allihies biopharmaceuticals research center is influenced by traditional Irish culture and classical architecture, but its goal is modern and global: to respond to the threat of an outbreak and reduce the risk of disease. So I made the fortress a manifesto of the building, hoping that it would protect people's health.

## Background

In recent years, the Covid-19 has had a tremendous impact on all countries in the world. This also brings greater demand for drug research and production.

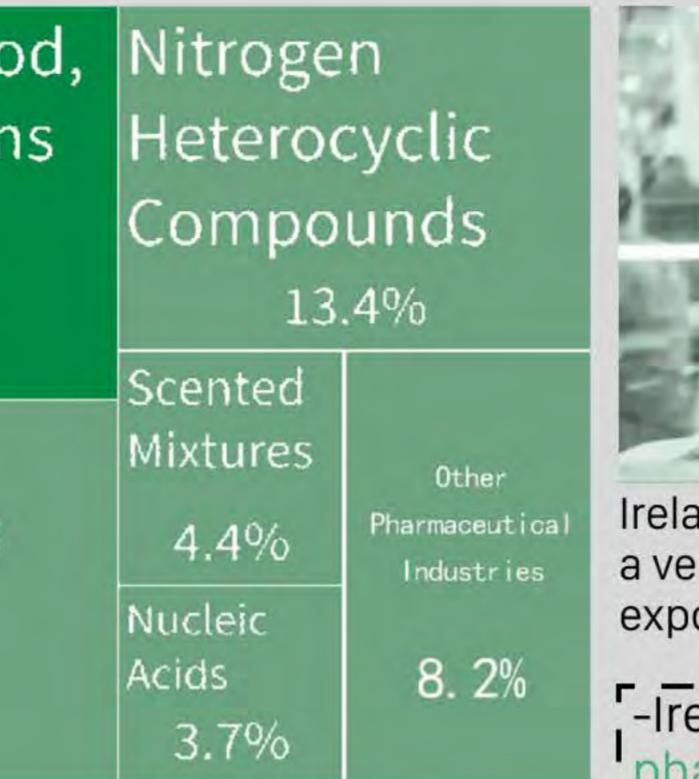
In the other hand, the situation of epidemic control in Ireland shows that independent islands have natural advantages in epidemic control.

Date from: <https://www.healthmap.org/covid-19>



-In ancient times, Druids and missionaries made herbs from plants to cure patients.  
Now, this technology has developed into biopharmaceuticals.

Biopharmaceuticals are complex medicines made from living cells or organisms, often produced using cutting edge biotechnological methods.



All other exports  
37%

Ireland's pharmaceutical industry is a very developed pillar industry, the export volume in the world's top 5.  
Ireland has a well-developed pharmaceutical industry  
New drugs are needed to fight infectious diseases  
Ireland needs to build a new medical research institute.  
Biopharmaceuticals would be a good subject for research.



Dublin

Allihies

112km

## Why in Allihies?

1. Biopharmaceutical research institutes (above level three) should be kept away from large populated cities

2. The institute needs to be far away from airports or seaports

3. Institute Building requirements:  
① Independent buildings,  
② away from urban areas,  
③ 1.5 times the height of adjacent buildings(at least 20meters).

Allihies are far from big cities and ports

Small population and few people come here

Rich animal and plant resources

Allihies is a suitable site for a medical research centre

## Design Process

### Background & analysis

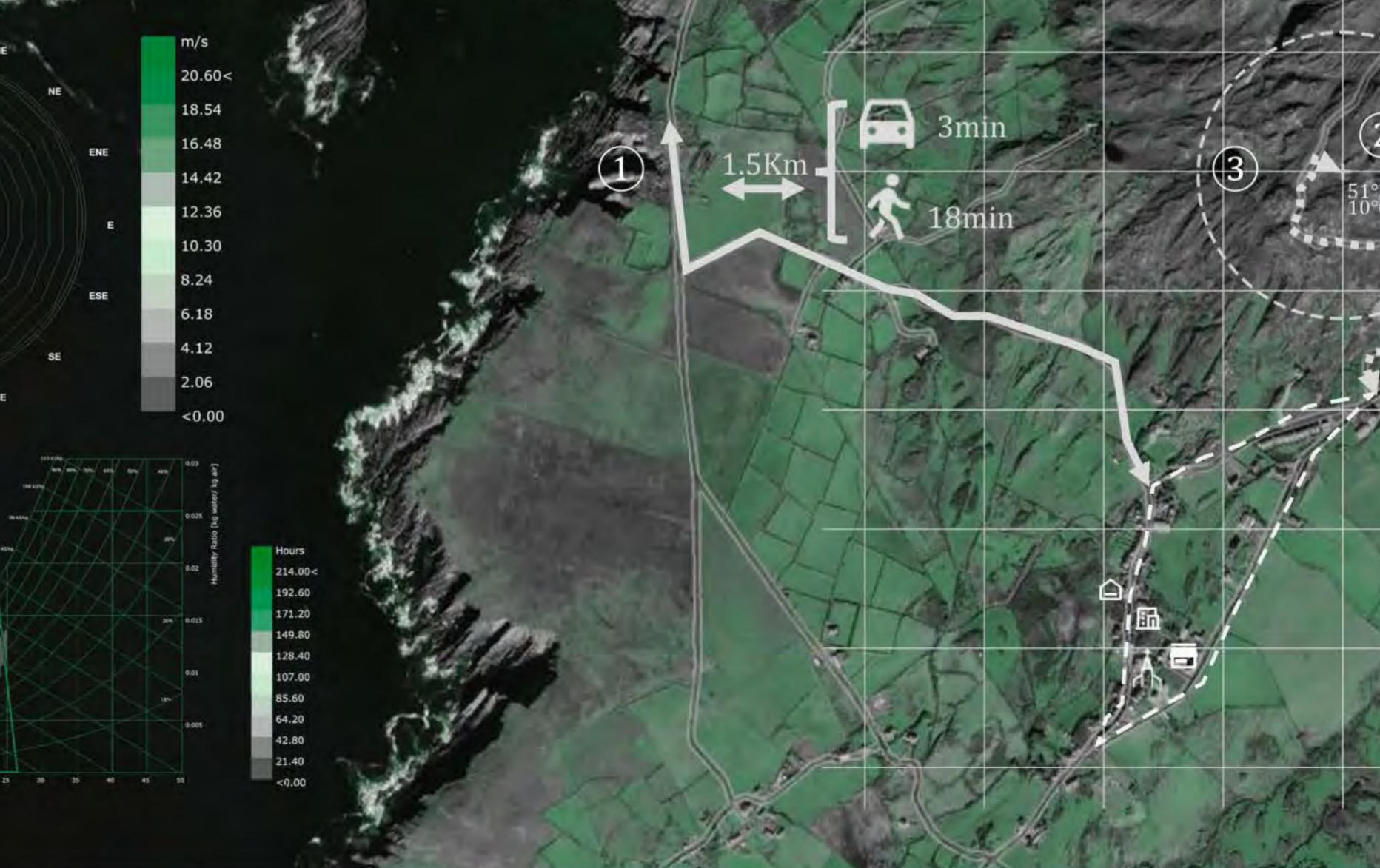
- Analysis of historical background
- Industry analysis of Ireland
- Allihies comprehensive analysis and Irish policy needs
- Location analysis
- Visual field analysis
- Site Analysis

### Design development

#### Final results and technical details

- Rendergraph
- Sign and symbol
- Casetudy
- user demand analysis
- facades design processe
- Spatial planning
- Process model and Prototyping
- Concept development
- Support structure iteration
- facade details
- Physical model process

## Location Analysis



### Allihies



Church



Hotel



Pub



Emporium



①

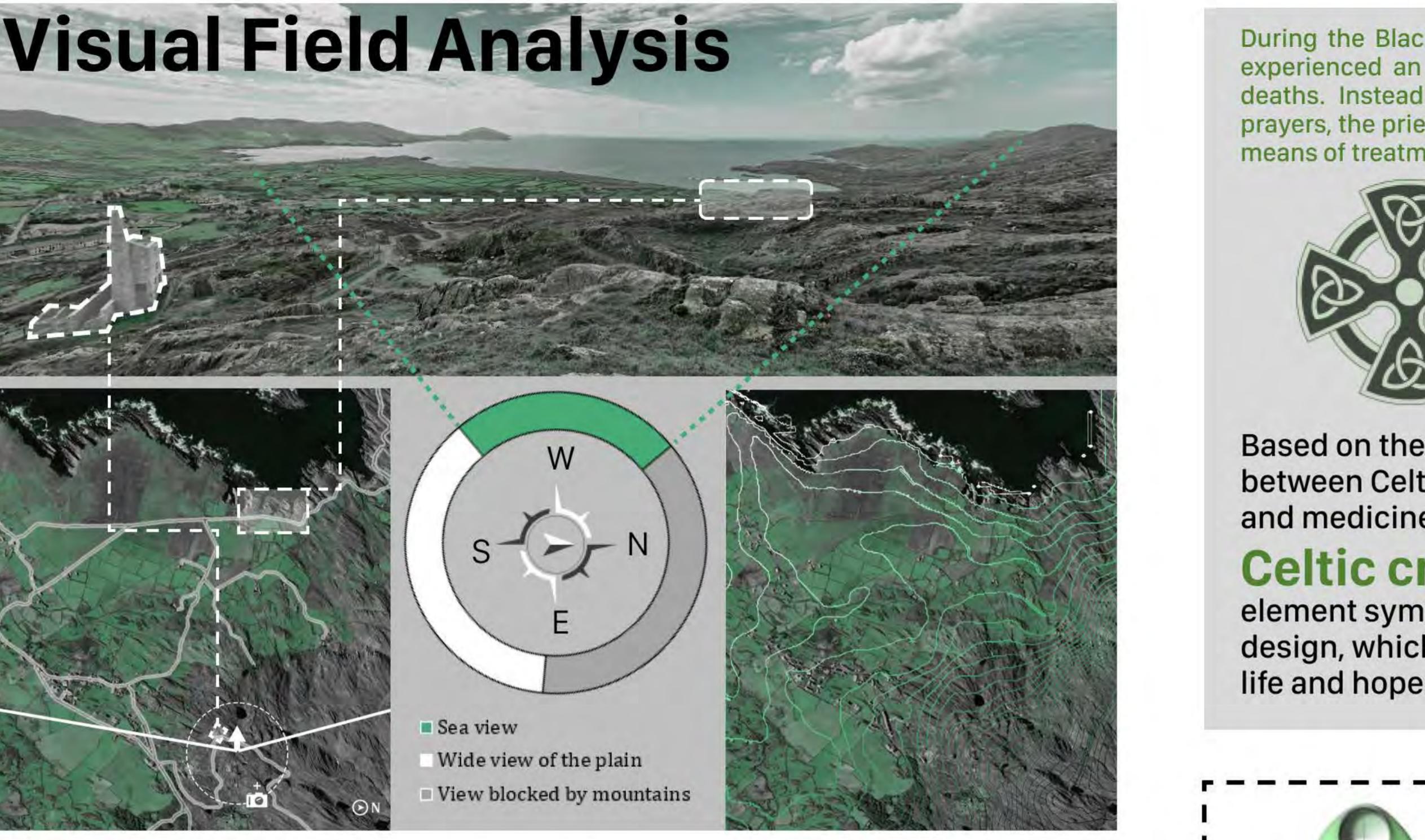


②

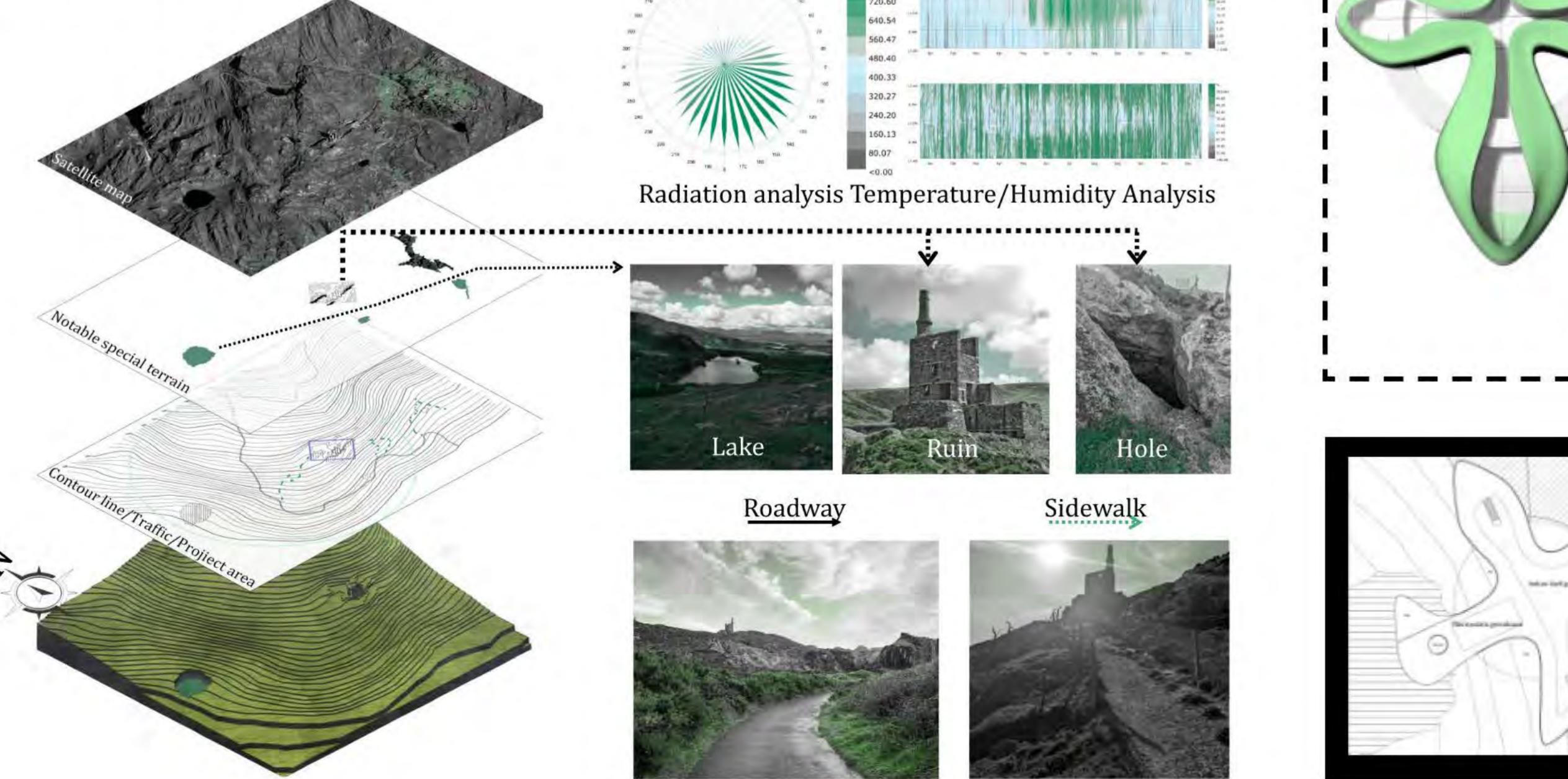


③

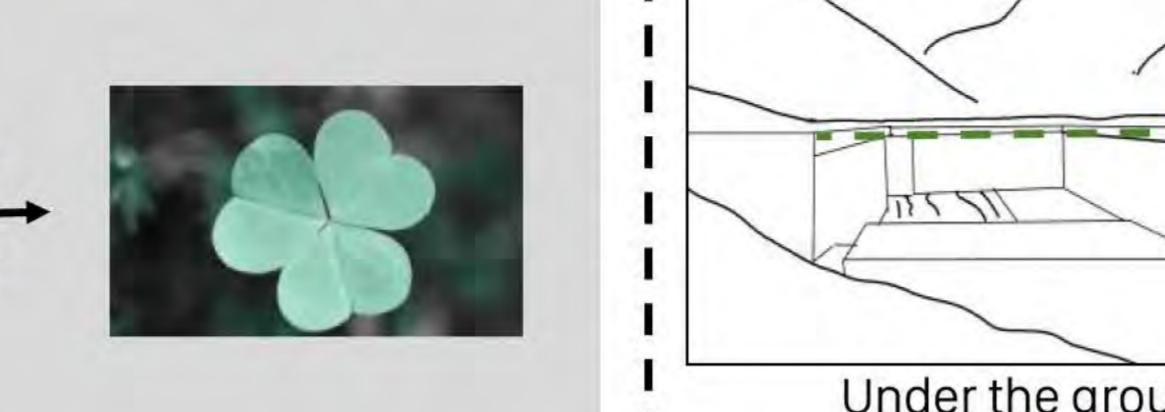
# Visual Field Analysis



## Site Analysis

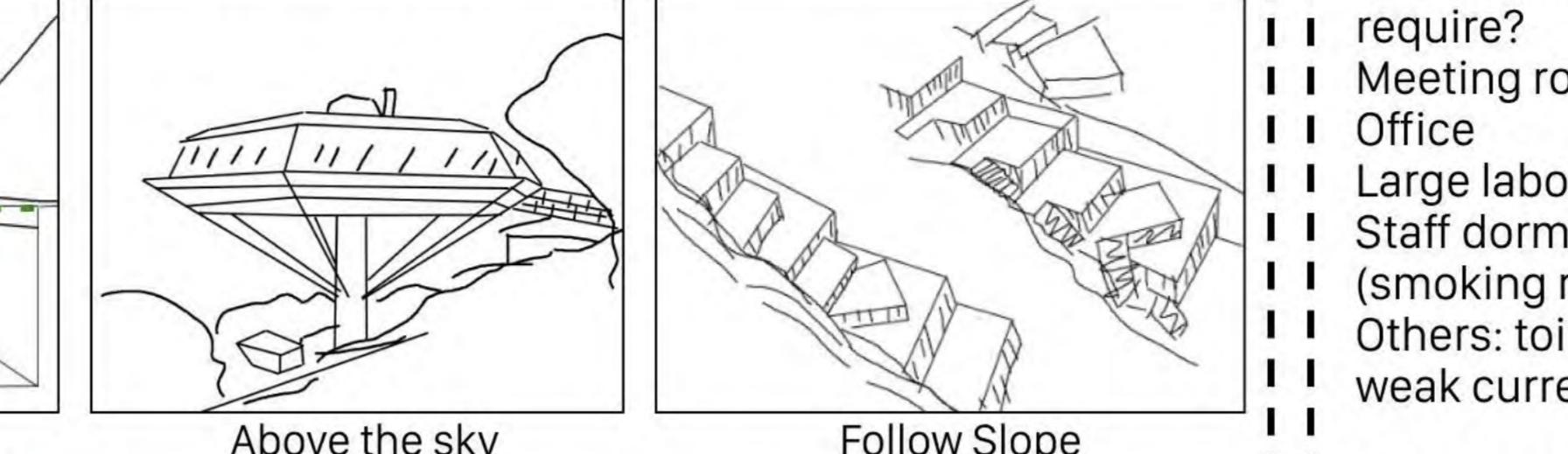


During the Black Death in Europe, western Ireland experienced an unusual rarity with minimal mass deaths. Instead of relying on traditional Catholic prayers, the priests opted for vinegar and herbs as a means of treatment.



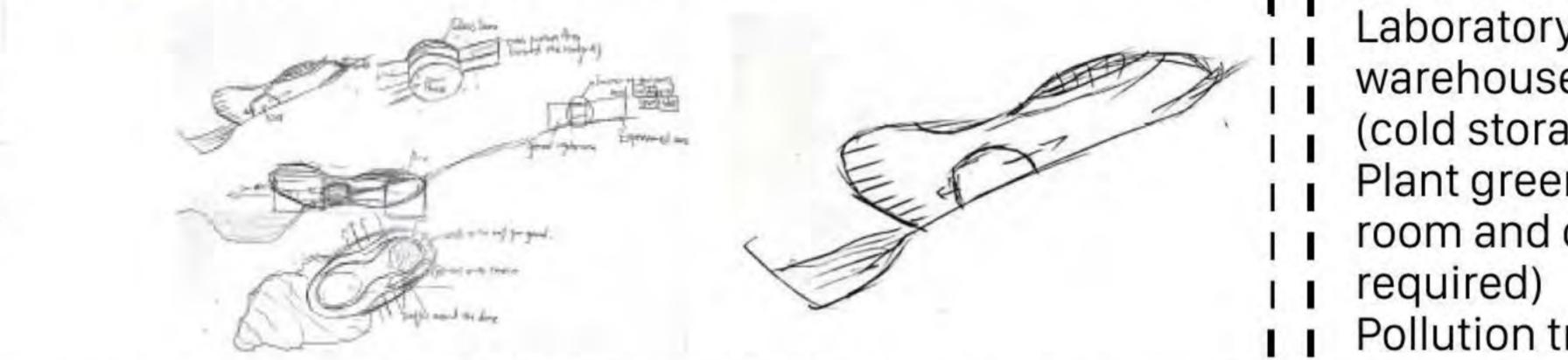
Based on the association between Celtic Christianity and medicine, I chose the **Celtic cross** as the element symbol of the design, which symbolizes life and hope.

The Therme Vals, Peter Zumthor  
Malin "Chemosphere" Residence, John Lautner  
Tolo House, Alvaro Leite Siza Vieira



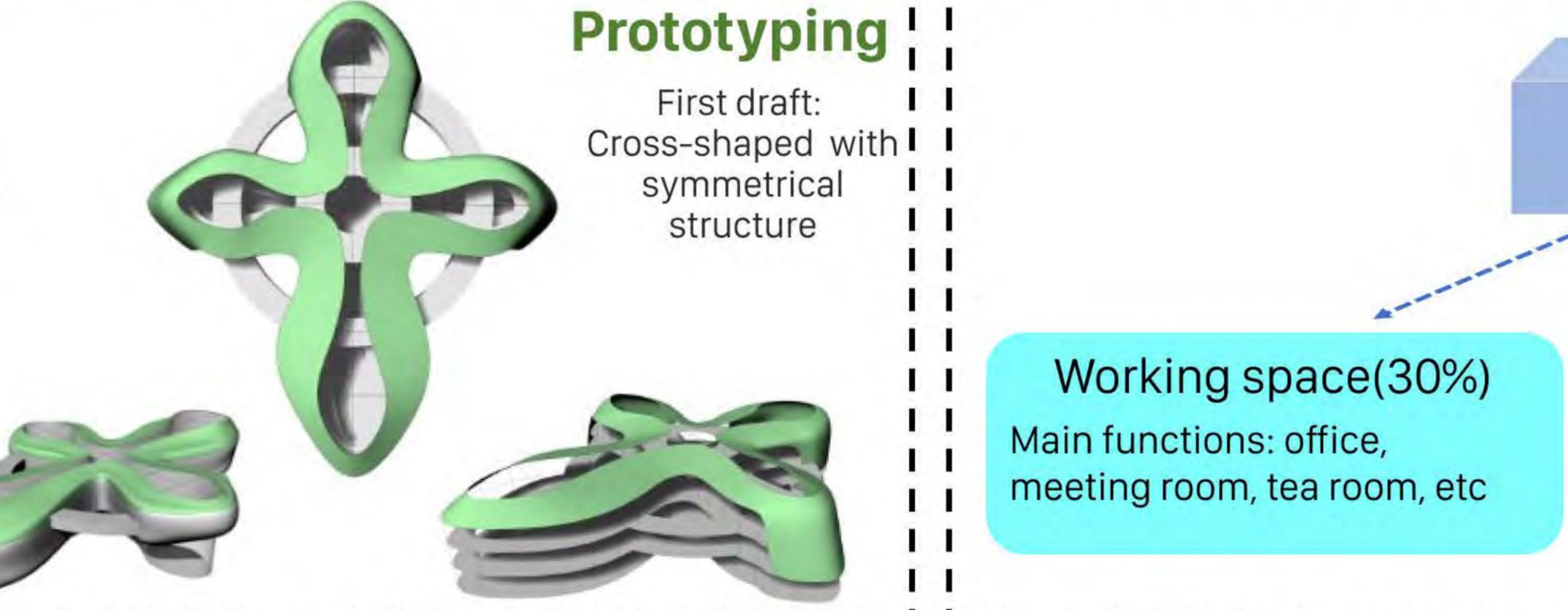
Under the ground  
Above the sky  
Follow Slope

Through **Casestudy**, I tried to find suitable terrain solutions

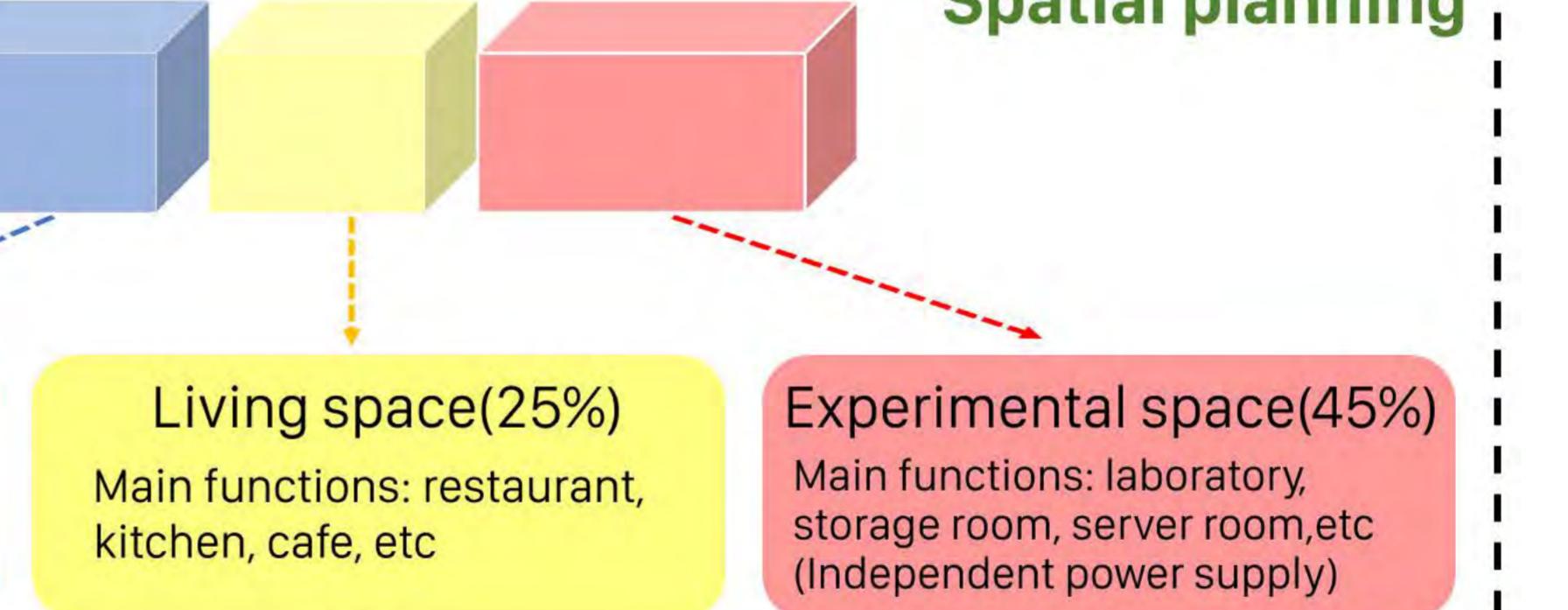


## Prototyping

First draft:  
Cross-shaped with symmetrical structure



## Spatial planning



Working space(30%)  
Main functions: office, meeting room, tea room, etc

Living space(25%)  
Main functions: restaurant, kitchen, cafe, etc

Experimental space(45%)  
Main functions: laboratory, storage room, server room, etc (Independent power supply)



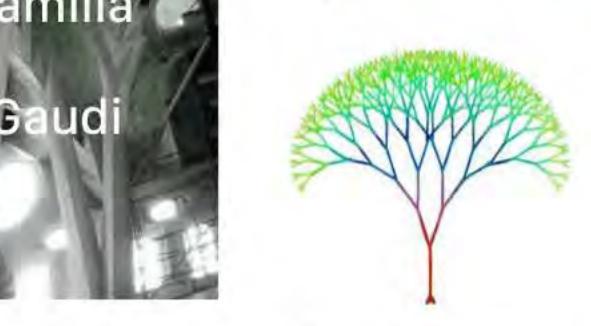
## Prototype iteration

Improved result:  
asymmetric plane

# Concept Development



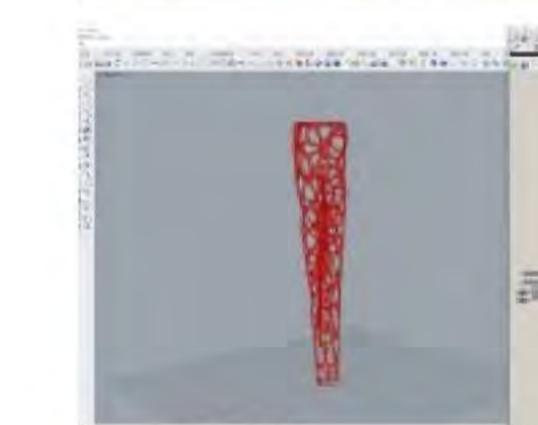
**Tree & fractal geometry**



This unique support structure is based on mechanical analysis of the building and is an application of early architectural bionics and fractal geometry. His design inspired me.



**Application of Bionics:**  
Based on the research theme of biopharmaceutical, a set of unique support system is designed based on the structure and morphology of mycelia of fungi.



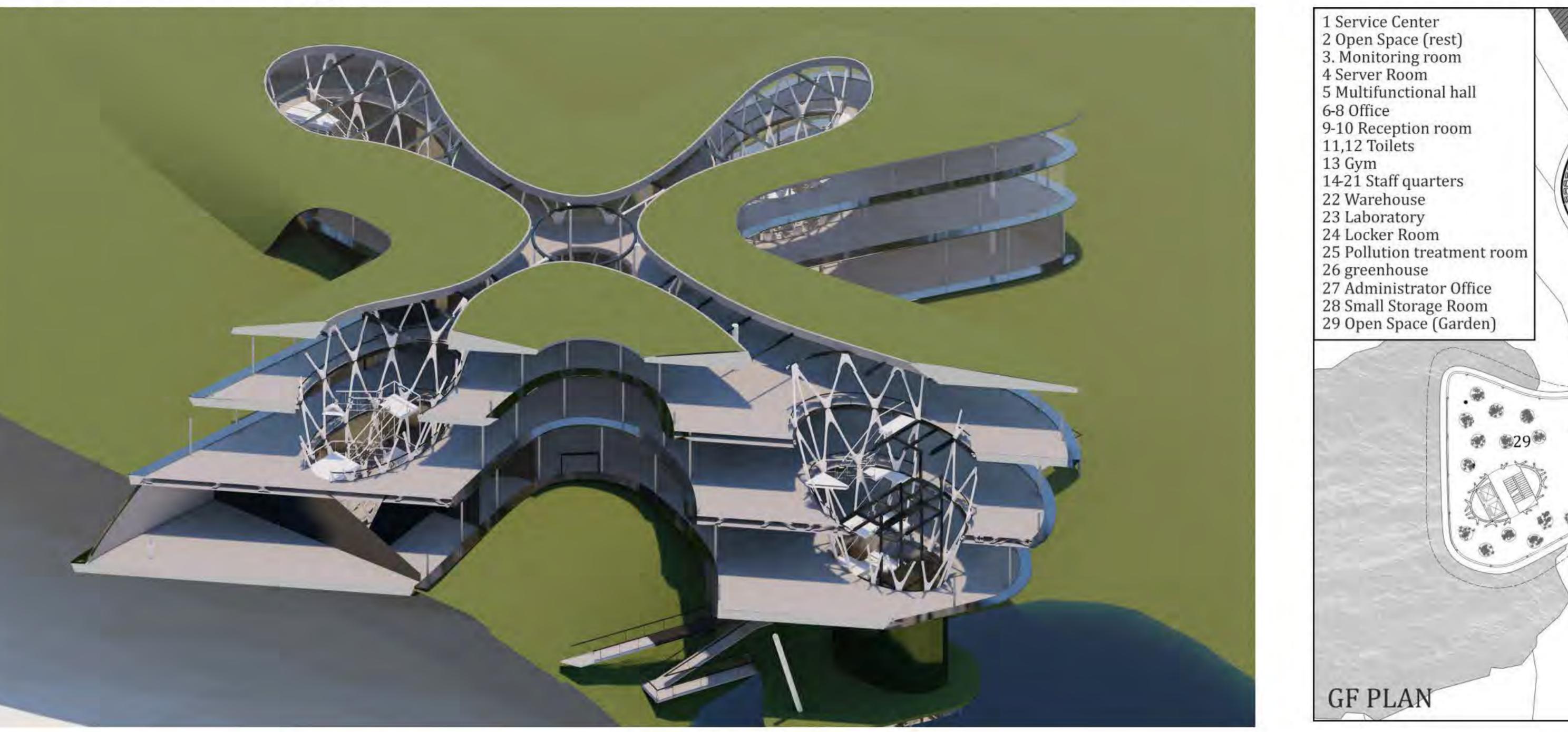
Test the strength of different structures in grasshopper



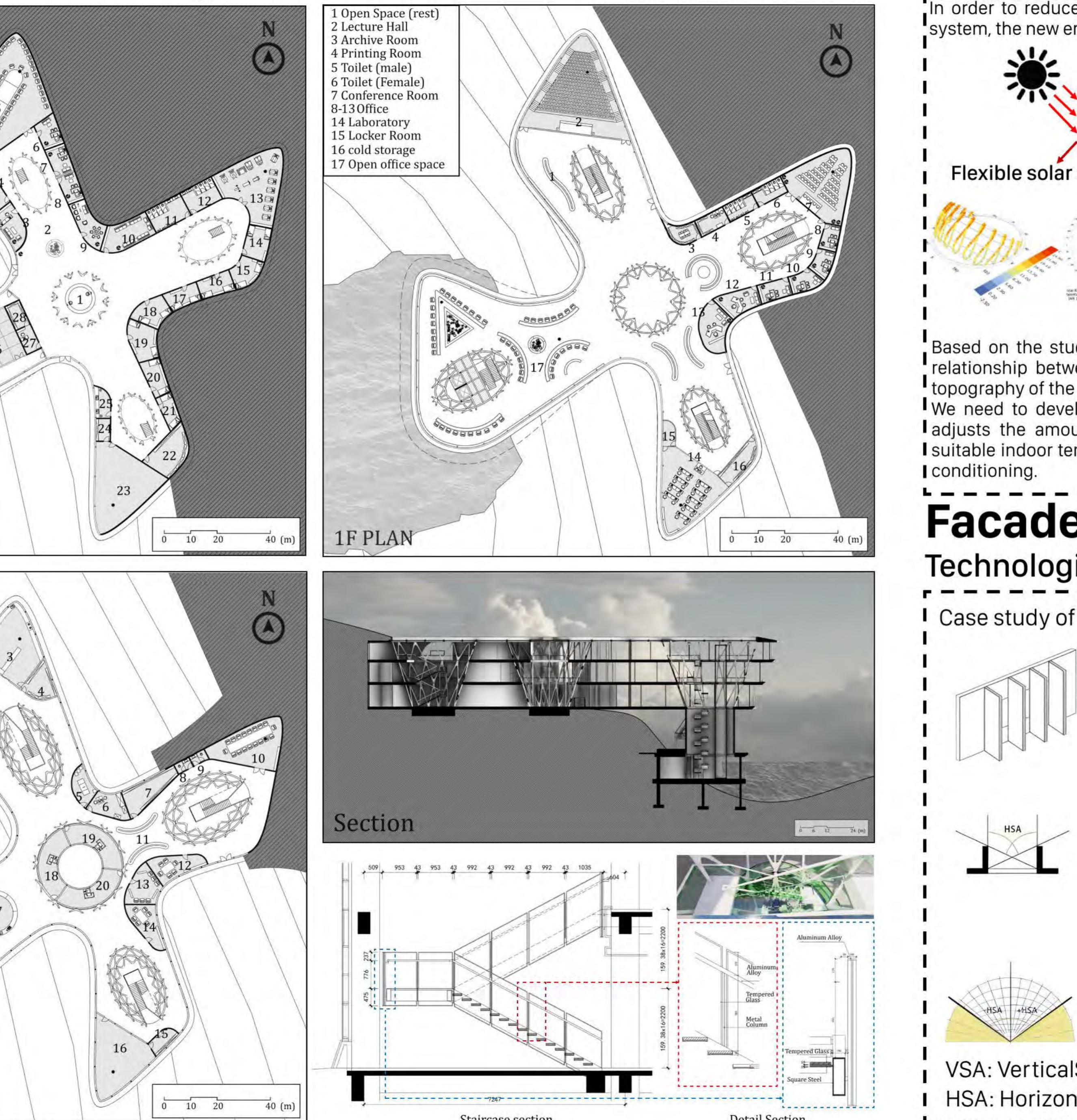
Support Parts Resin (3D printing)

Physical model of the final result

# Final Design



# Technical Drawing



# Facade Requirement

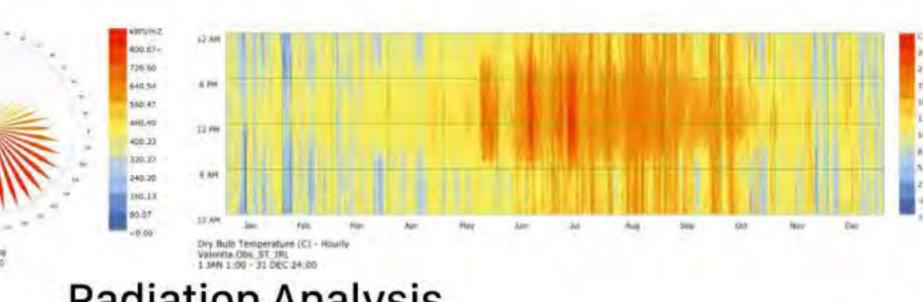
In order to reduce the energy consumption of the air conditioning system, the new envelope needs to have the following two functions:



Flexible solar reflection



Adjust indoor temperature



Radiation Analysis

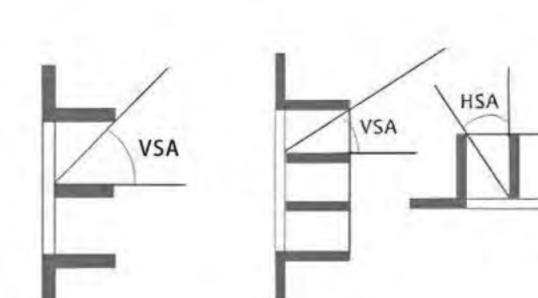
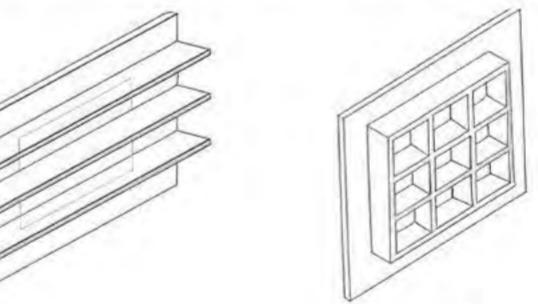
Based on the study of the light received by the building and the relationship between the distribution of the curtain wall and the topography of the building itself, we came to our conclusion.

We need to develop an adjustable sunshade facade system that adjusts the amount of sunlight entering the room to achieve a suitable indoor temperature and save energy consumption from air conditioning.

# Facade Idea Process

Technological facade design strategy

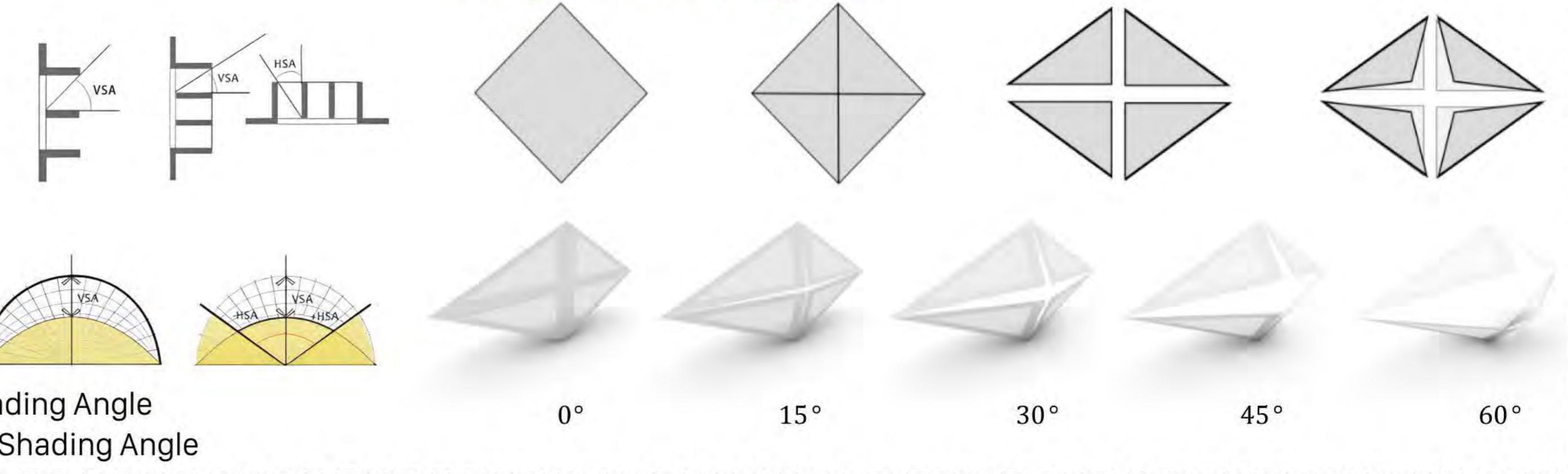
Case study of three different shading modes



Facade Prototyping

The four blades open and close around the center of the device, with their respective edges as the rotation axes. The Device is used for wall surfaces that are frequently exposed to direct sunlight.

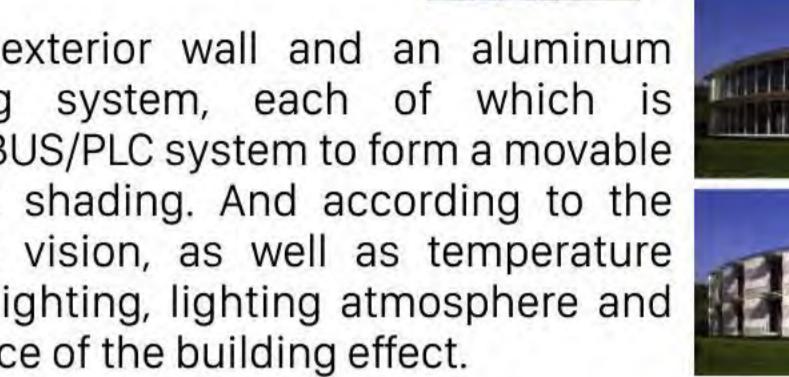
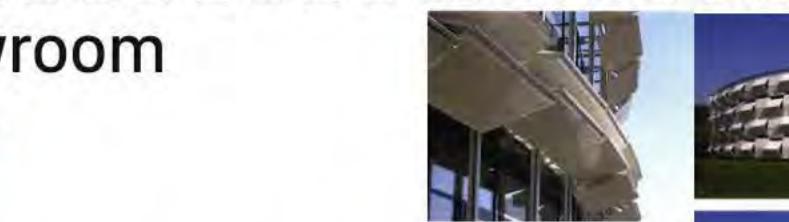
# Inspiration: Origami



# Case Study

## Kiefer Technic Showroom

Ernst Giselbrecht + Partner  
ZT GmbH, Austria, Styria



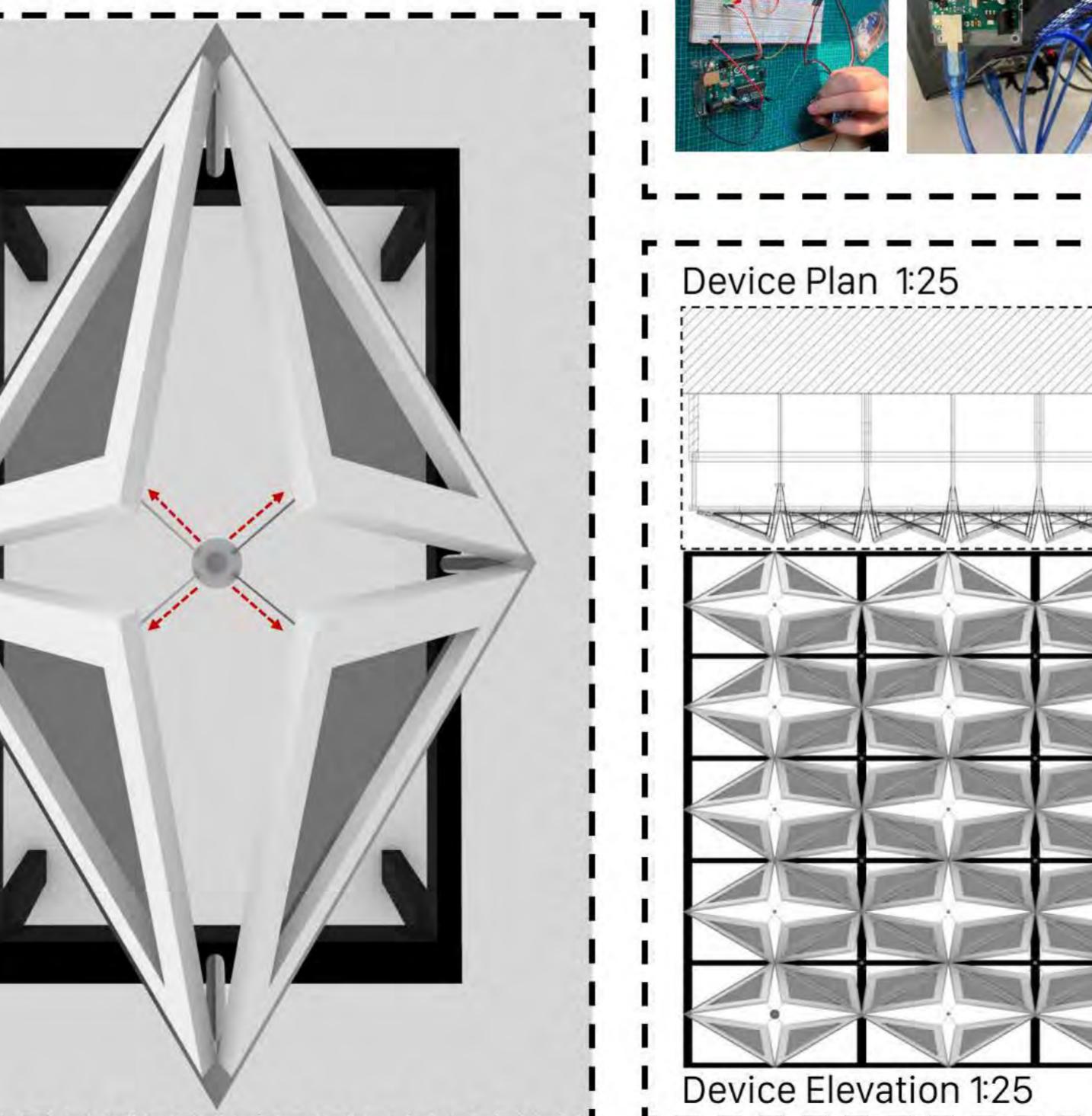
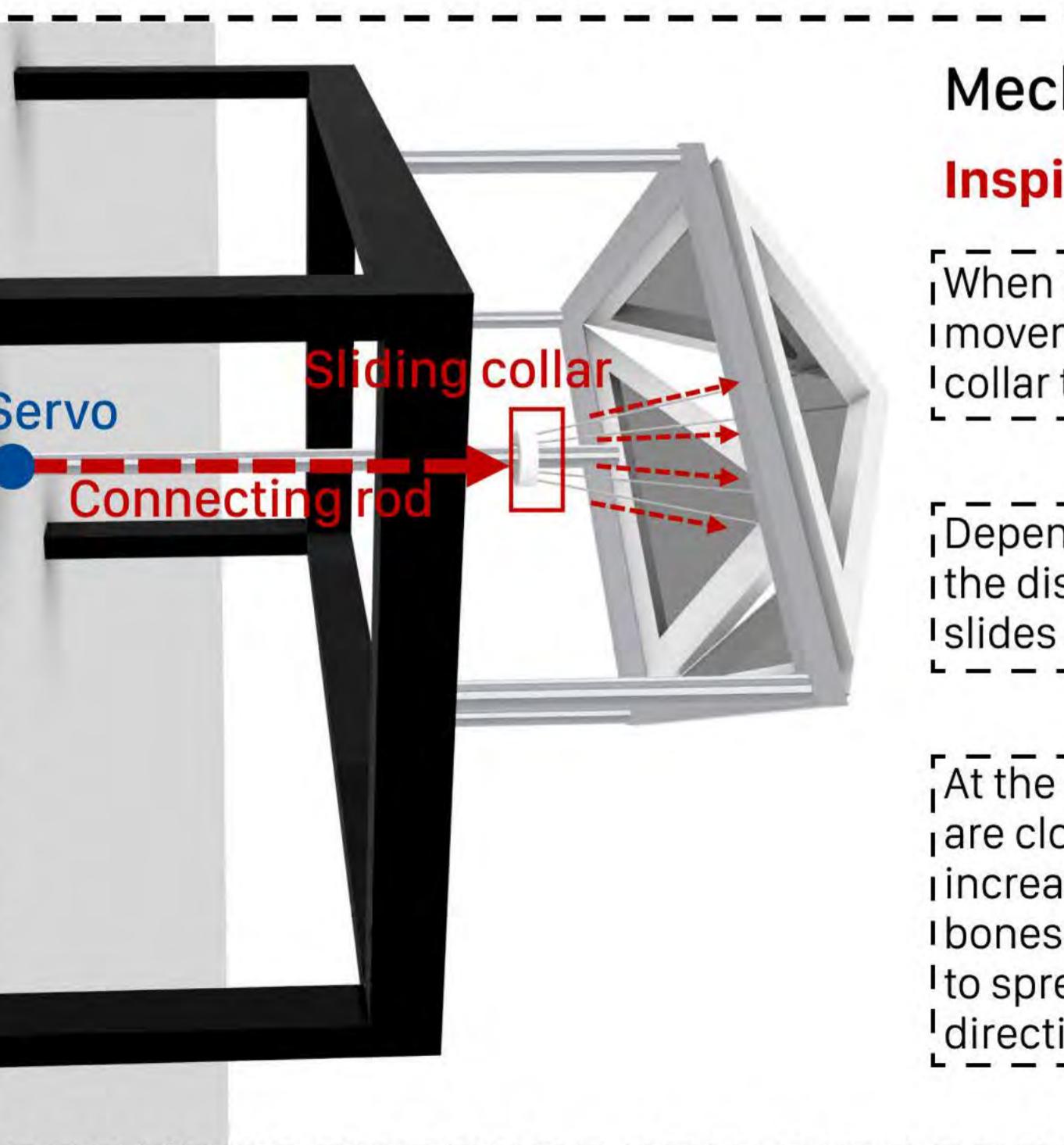
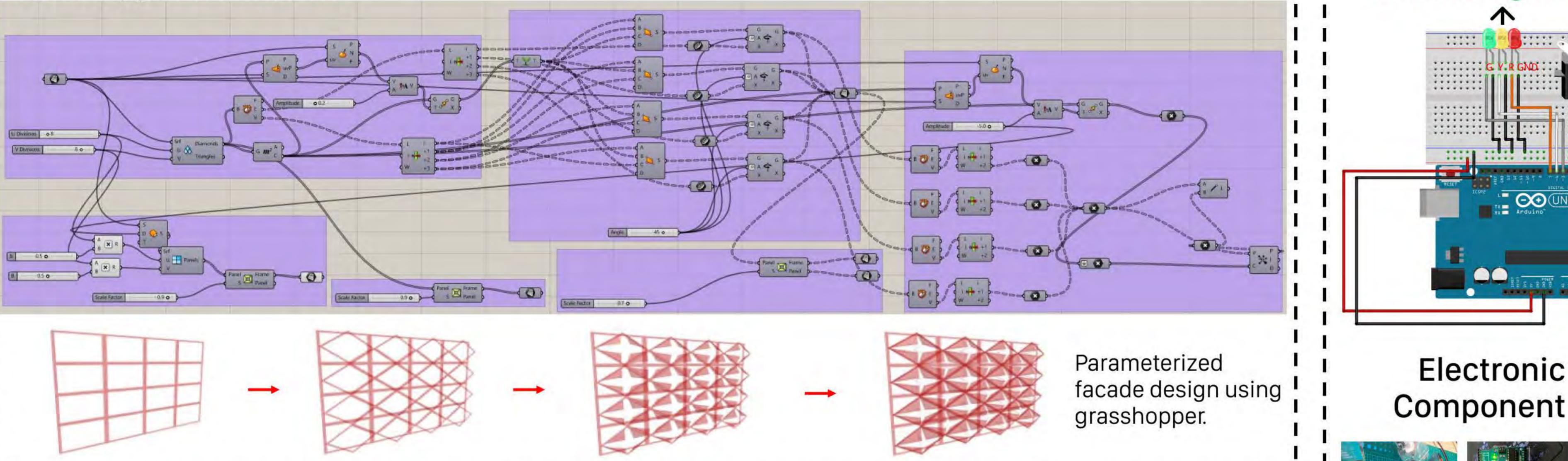
## SDU University of Southern Denmark Campus Kolding

Henning Larsen Kolding, Denmark,  
Gronborg

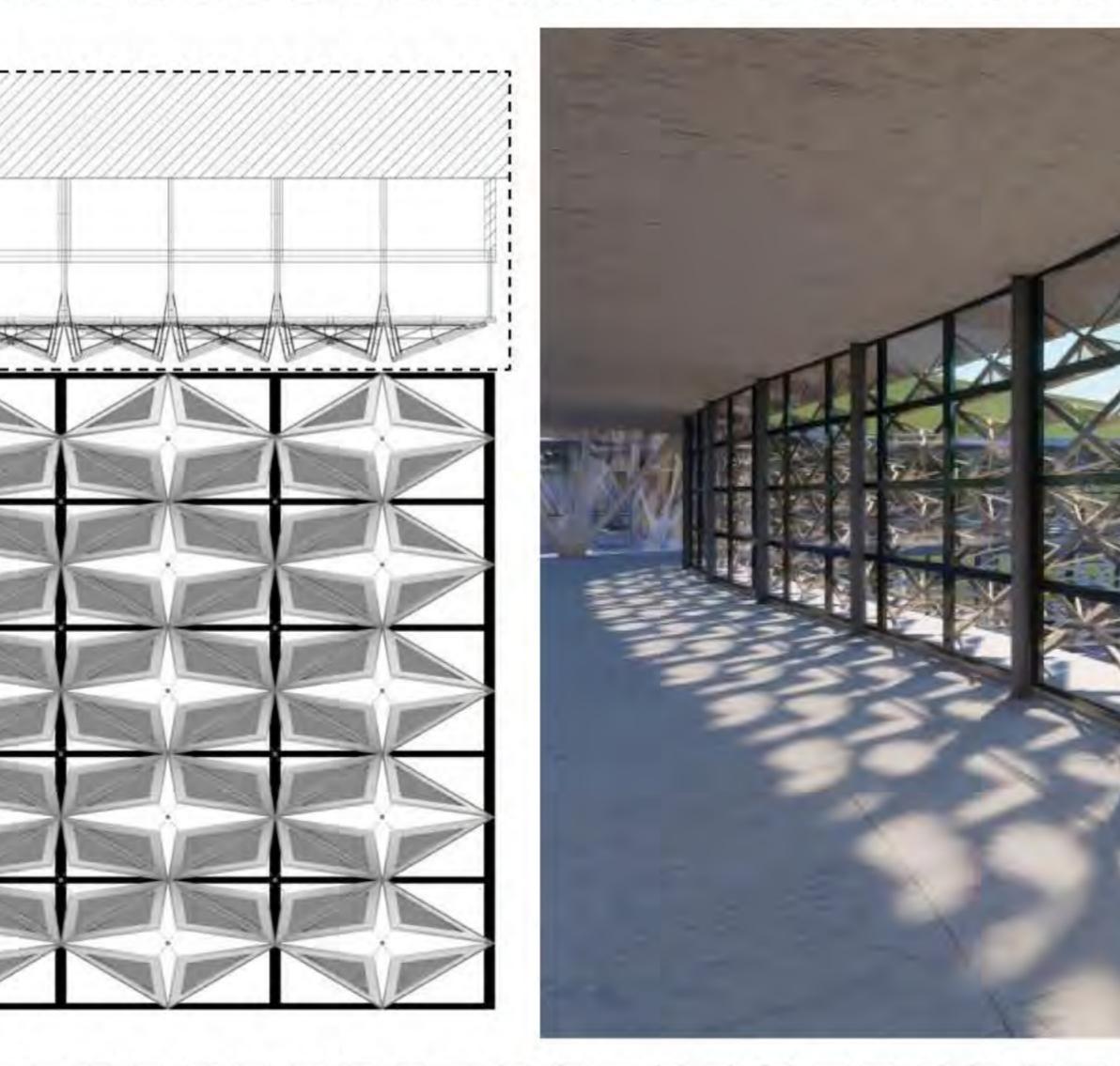
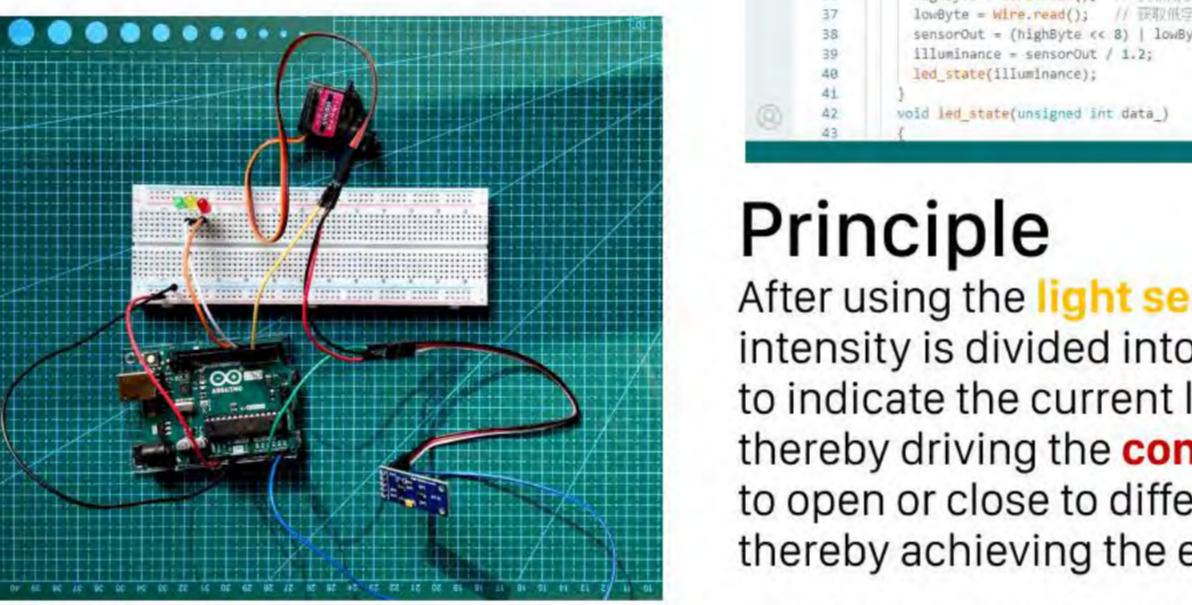
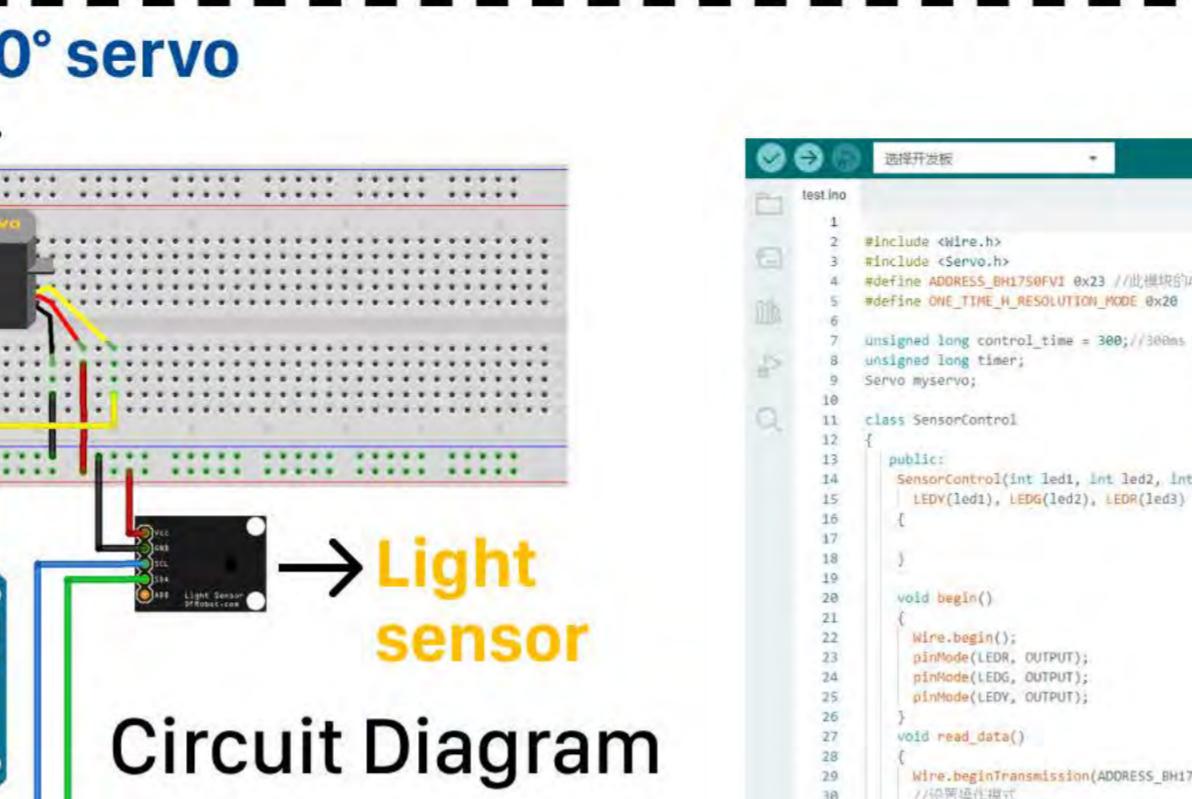
With its triangular shape, Kolding Campus will create a significant new landmark in Kolding. The facade's triangular perforated metal sunshades comprise a total of 1600 panels. Sensors monitor heat and light levels around the building, allowing vertical panels to move from closed to half-open to fully open. Even when fully closed, a certain amount of natural light is able to illuminate the chamber through a customized circular hole pattern.

# Facade Prototyping

## Grasshopper Definition



# Arduino Process

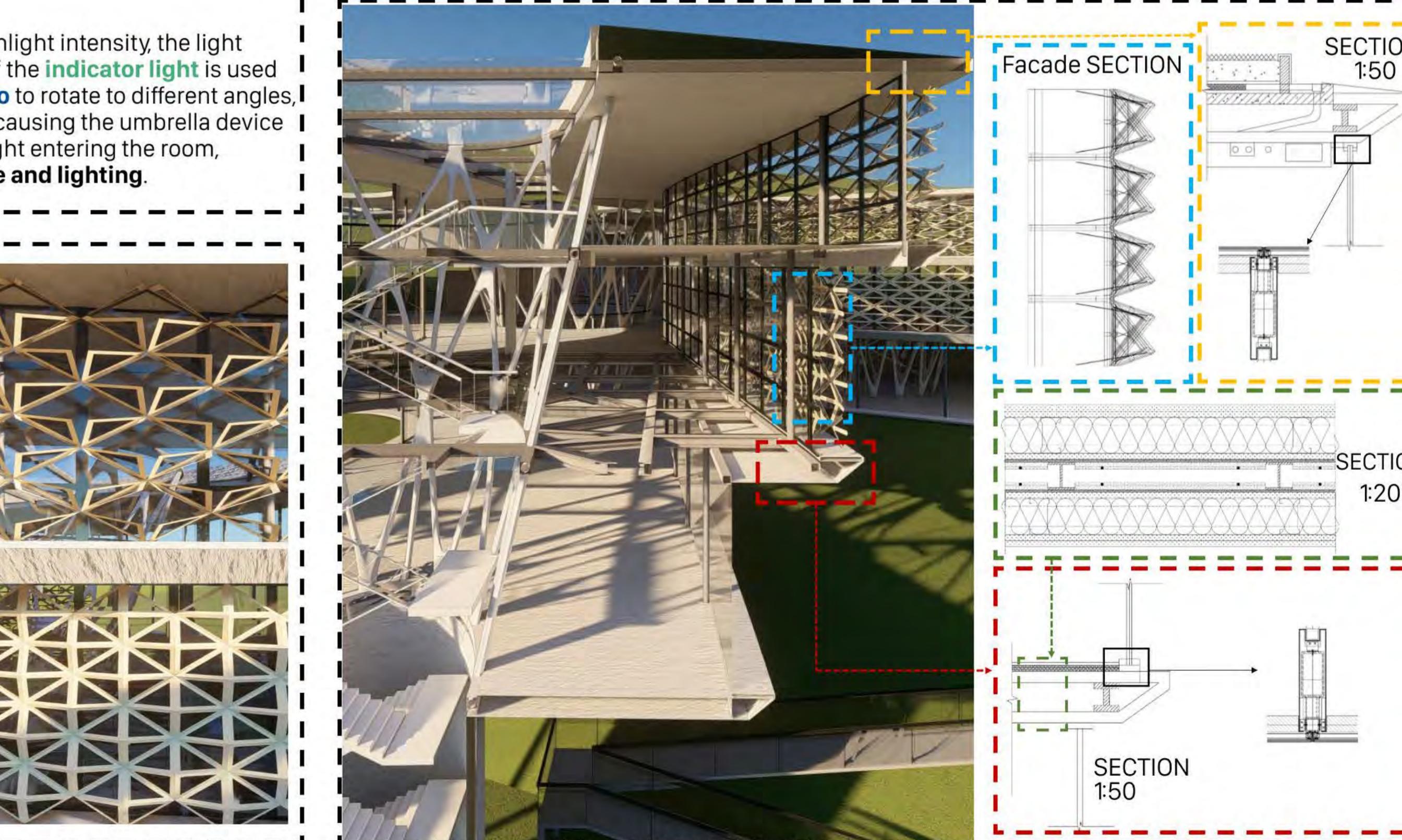


# Final Facade Design

## Components and Materials



## Technical Drawing



## Arduino IDE Coding

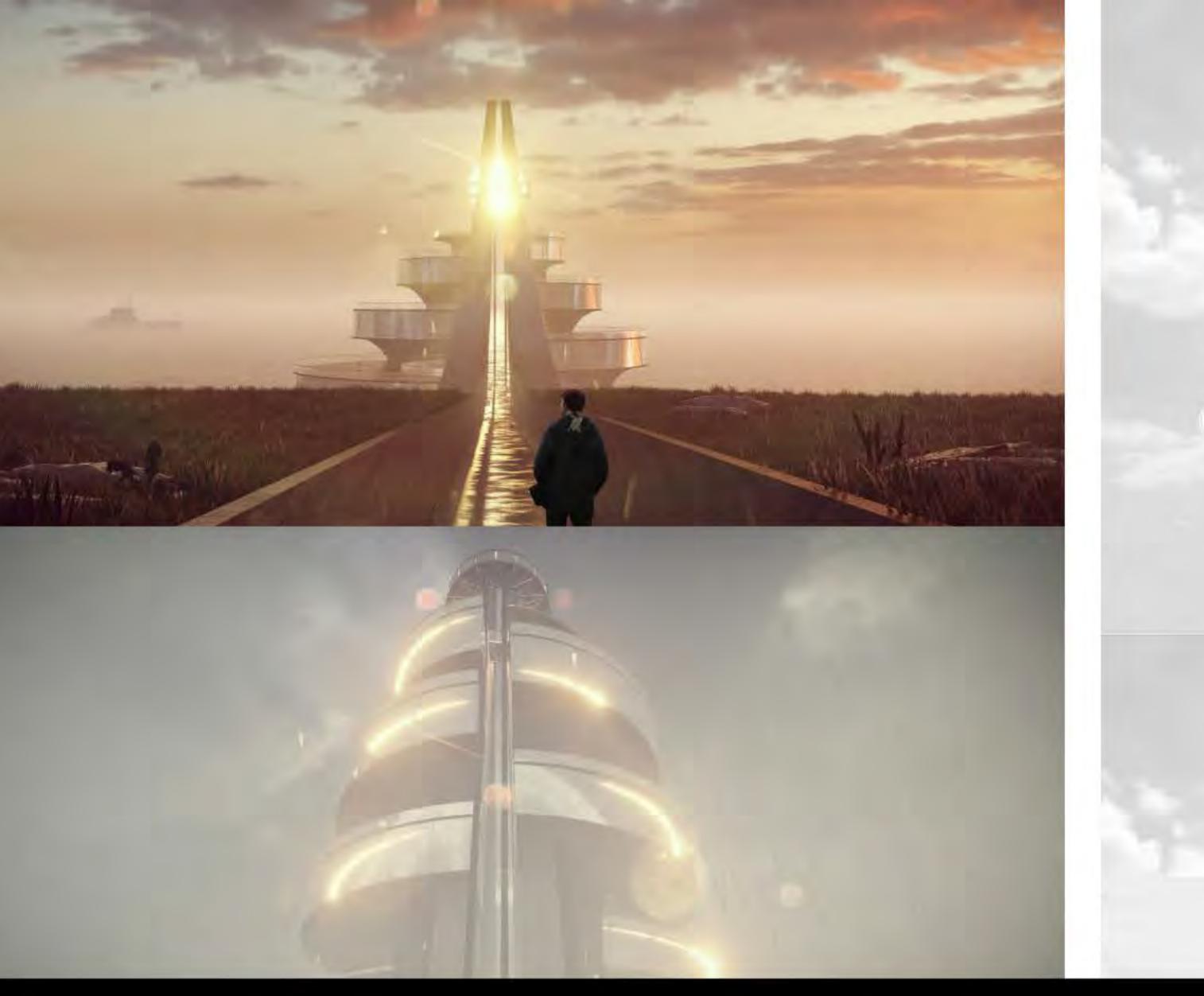
```

unsigned int illuminance = 0;
int LEDx, LEDy, Servo;
int lower, upper;
Servo myServo;
long control_time = 300 / 1000; //控制时长
long long control_time_2 = 300 / 1000; //控制时长
SensorControl control(6, 5, 7);
void setup() {
    myServo.attach(7);
    Serial.begin(9600);
    timer = millis();
    delay(100);
}
void set_light_range(int min_, int max_) {
    lower = min_;
    upper = max_;
}
void set_servo_range(int min_, int max_) {
    servo_lower = min_;
    servo_upper = max_;
}
void loop() {
    if ((millis() - timer) >= control_time) {
        control.read_data();
        if (control.read_data() == 1) {
            return;
        }
        servonext = (millis() - timer) / control_time;
        if (servonext < 0) {
            servonext = 0;
        }
        if (servonext > 1) {
            servonext = 1;
        }
        myServo.write(servonext);
        delay(100);
    }
    read_data();
}
void read_data() {
    wire.beginTransmission(ADDRESS_BH1750FVI);
    wire.write(ONE_TIME_RESOLUTION_P000);
    wire.endTransmission();
    unsigned int illuminance = wire.read();
    if (illuminance < 1000) {
        illuminance = 1000;
    }
    Serial.print(" lux = ");
    Serial.print(illuminance);
    Serial.print(" servo = ");
    Serial.print(servonext);
    Serial.print(" control.get_light_value() = ");
    Serial.print(control.get_light_value());
    Serial.print(" servonext = ");
    Serial.println(servonext);
    delay(1000);
}
void set_state(unsigned int data_) {
    if (data_ < lower) {
        servonext = 0;
    } else if (data_ > upper) {
        servonext = 1;
    } else {
        servonext = (data_ - lower) / (upper - lower);
    }
    myServo.write(servonext);
    delay(100);
}

```

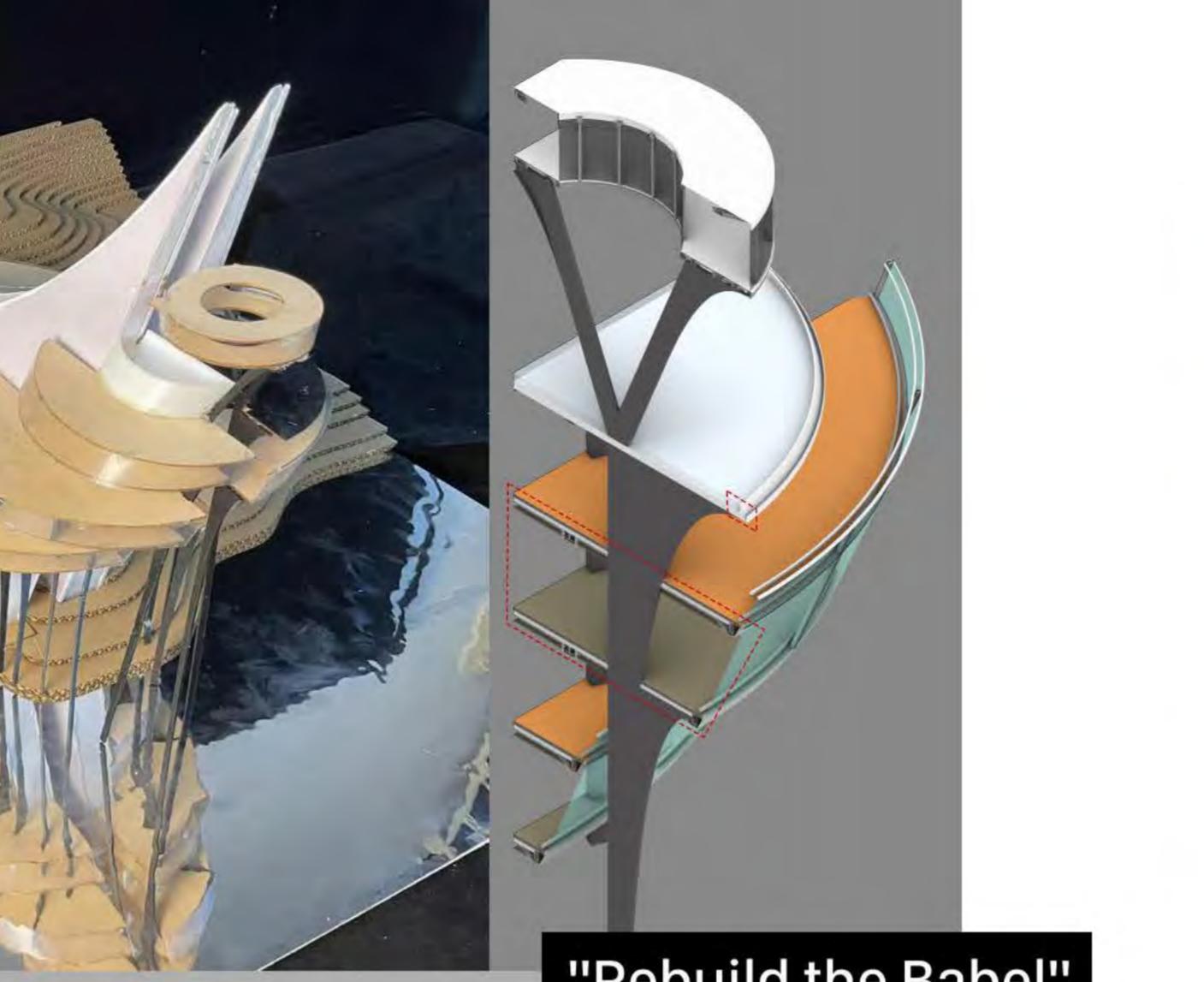
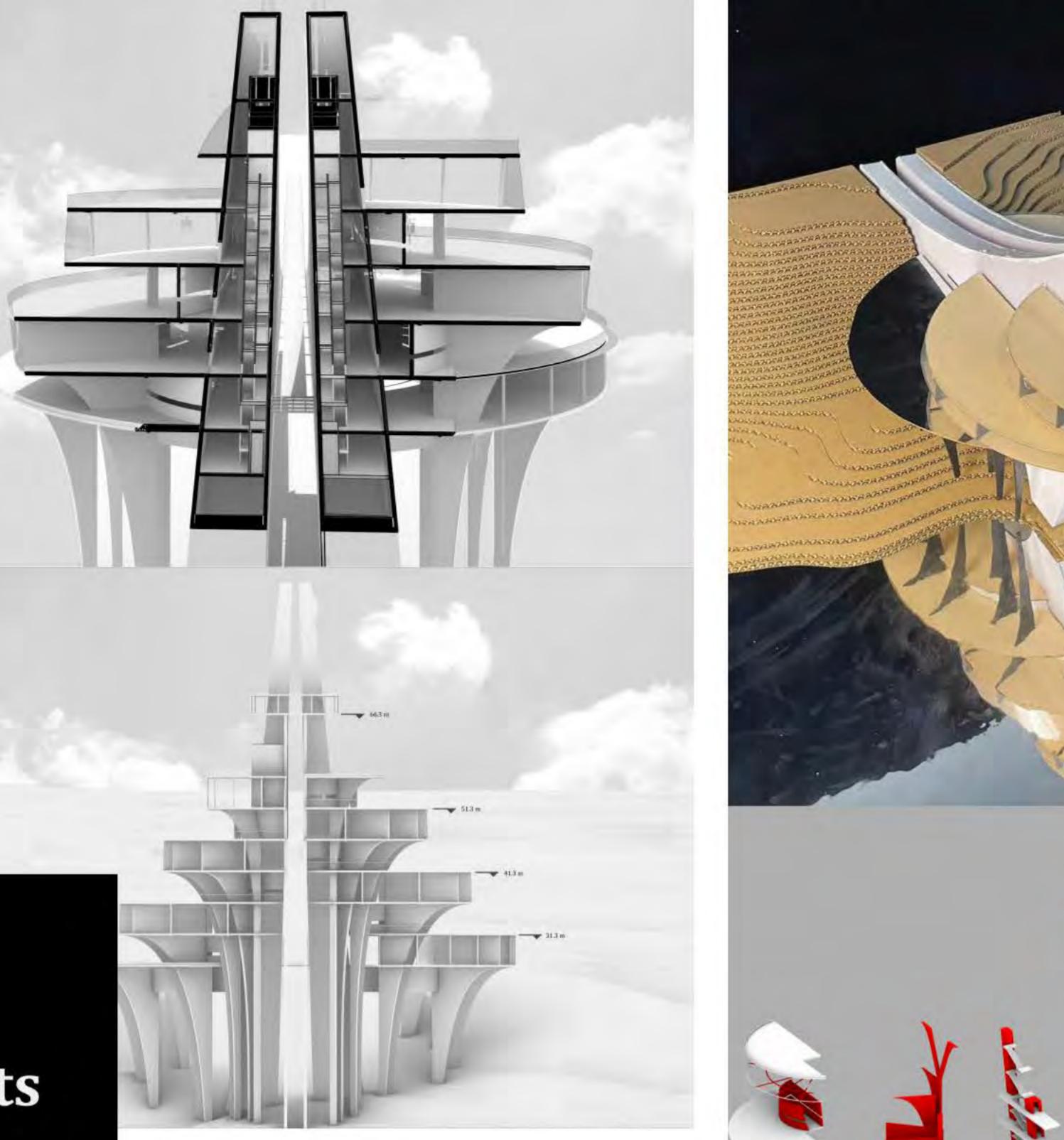
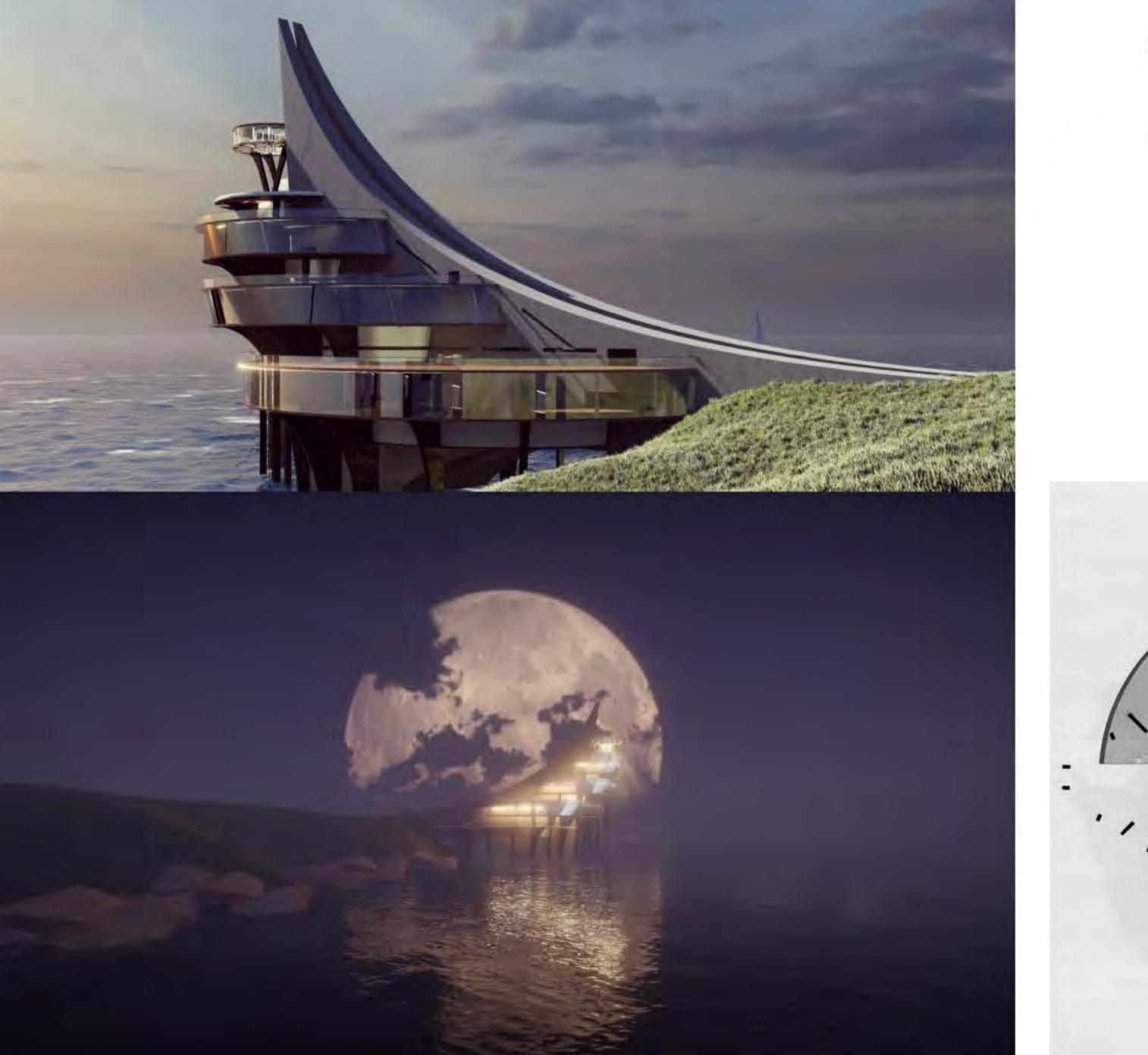
## Principle

After using the **light sensor** to obtain the parameters of the sunlight intensity, the light intensity is divided into several different levels, and the color of the **indicator light** is used to indicate the current level. Different levels will cause the **servo** to rotate to different angles, thereby driving the **connecting rod** in the mechanical device, causing the umbrella device to open or close to different degrees, ultimately affecting the light entering the room, thereby achieving the effect of **regulating indoor temperature and lighting**.

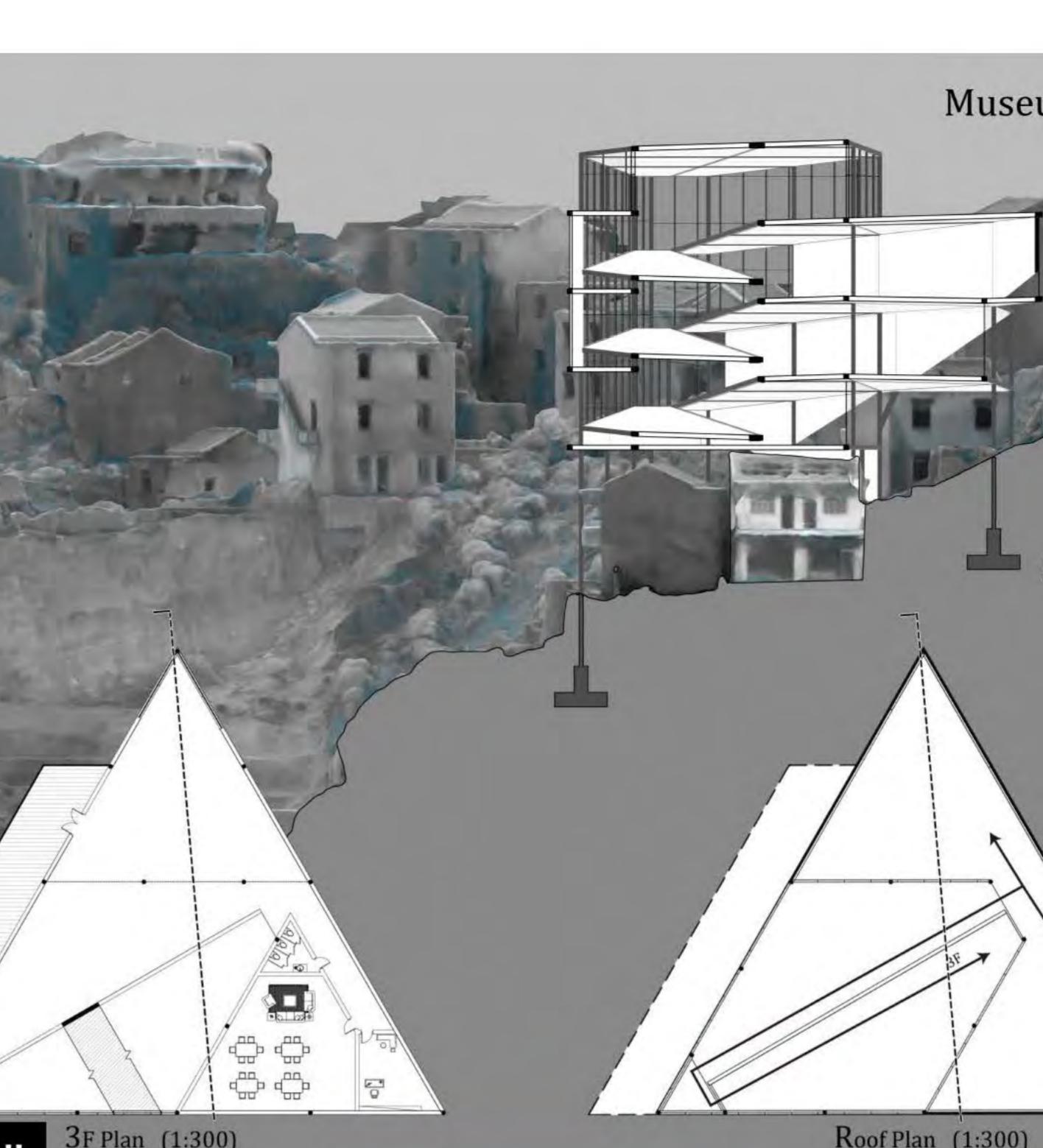
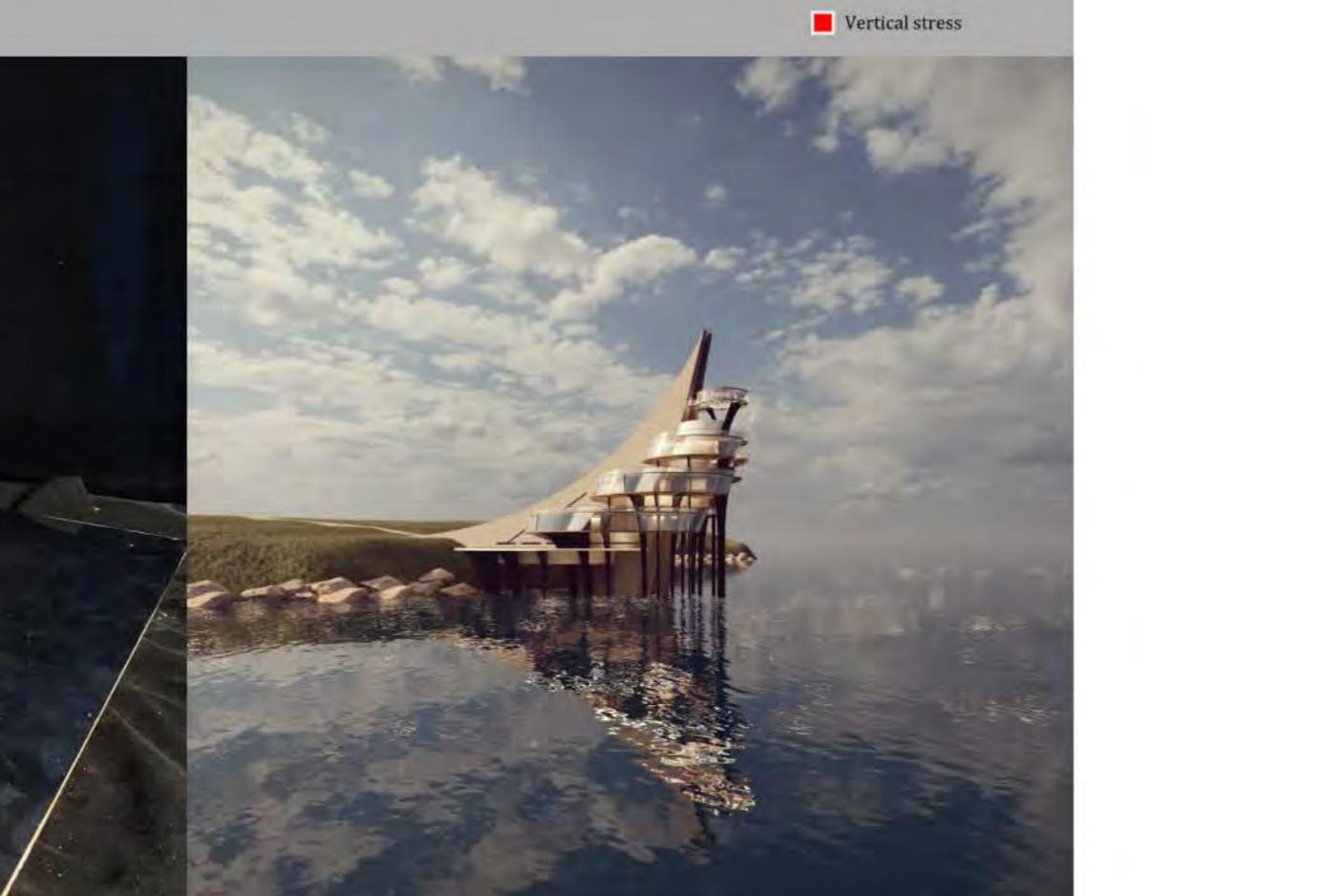
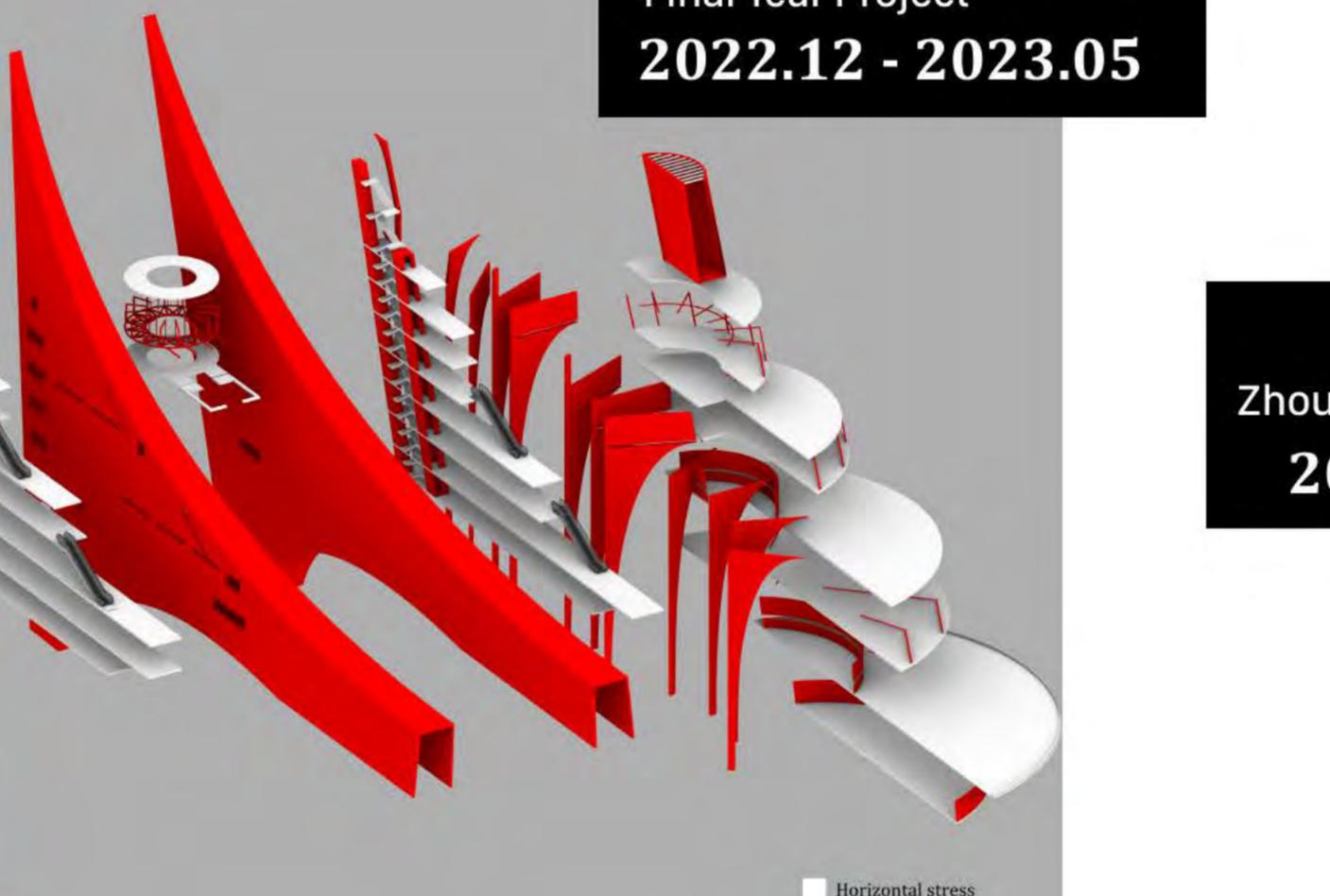


# OTHER WORK

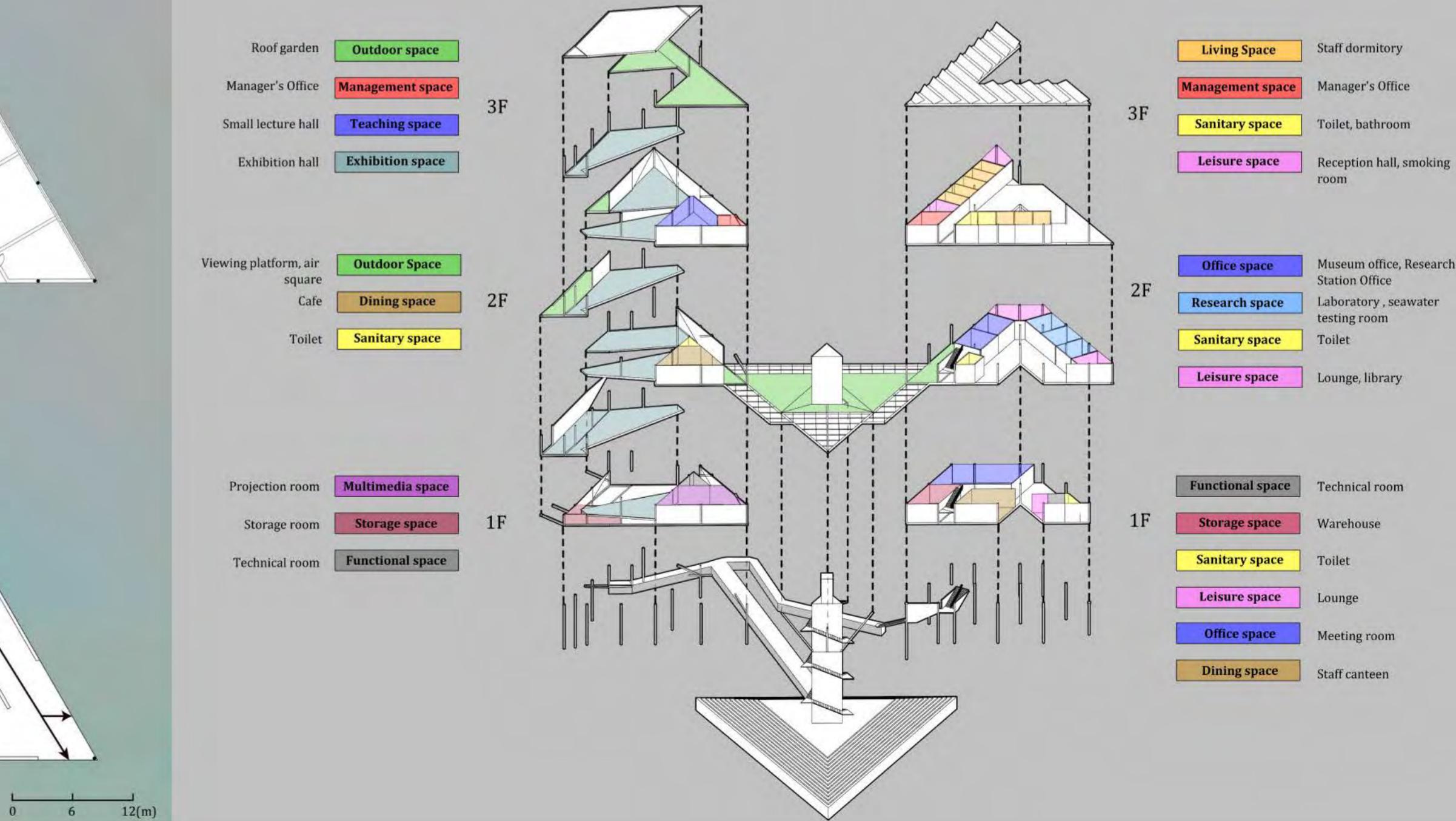
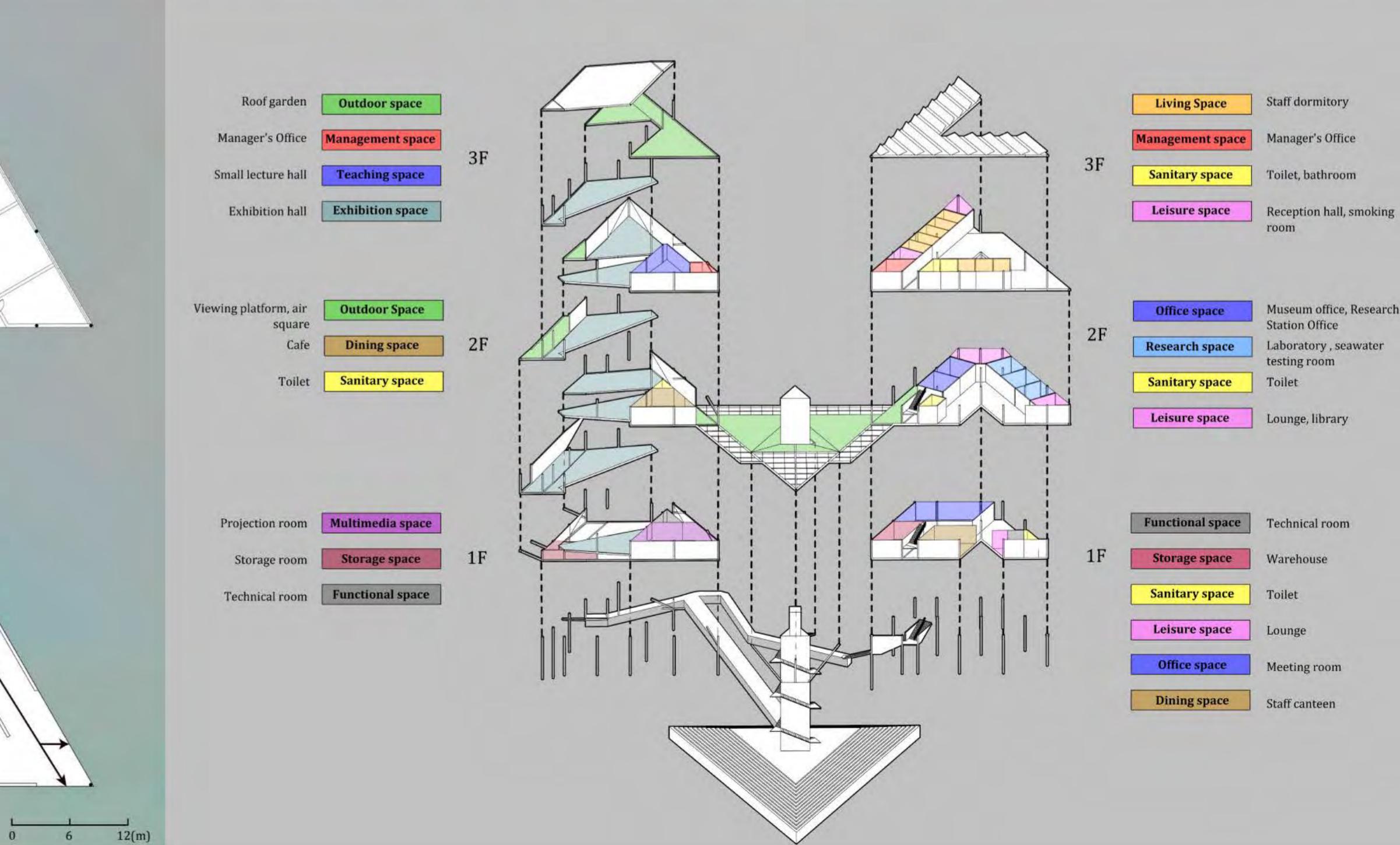
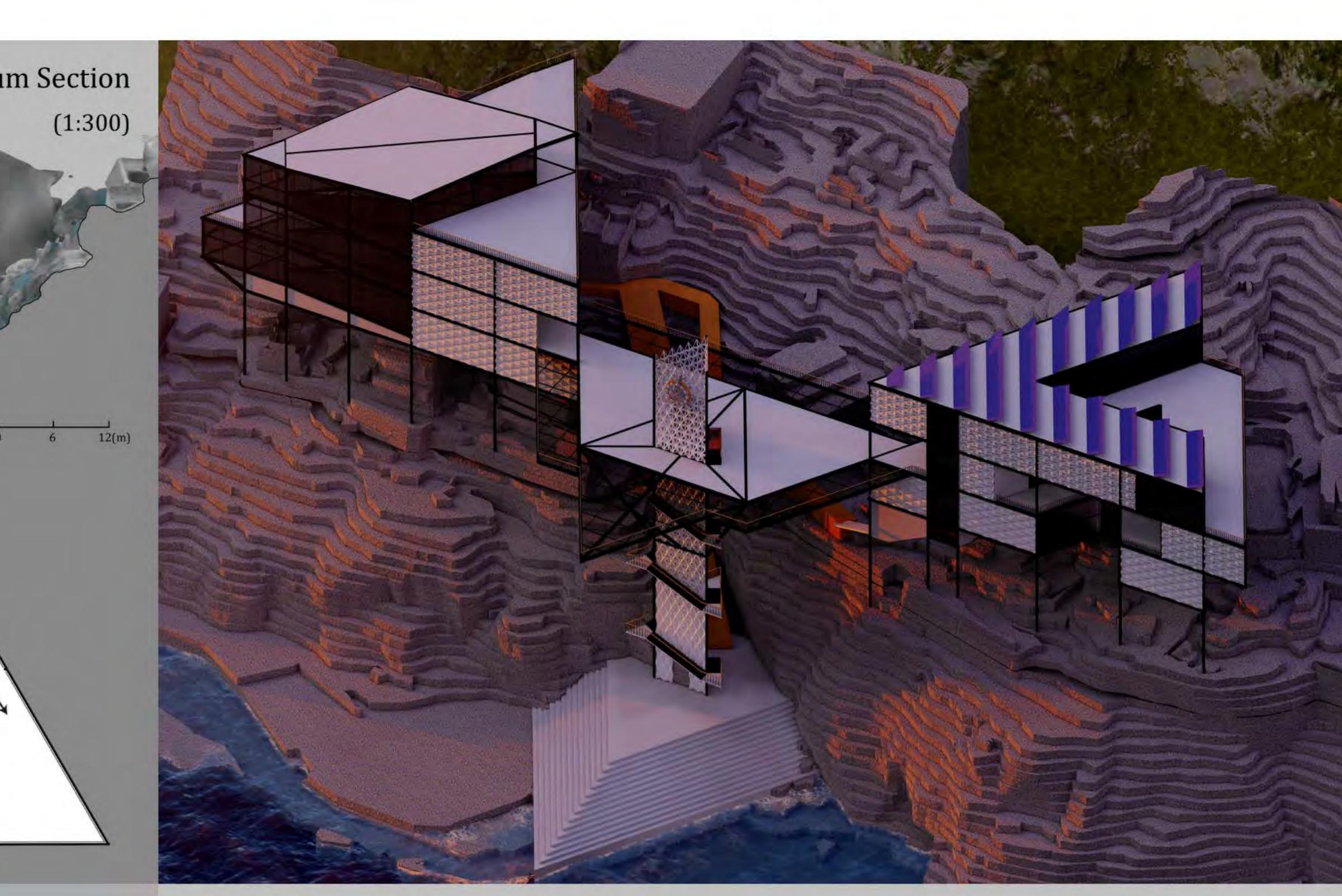
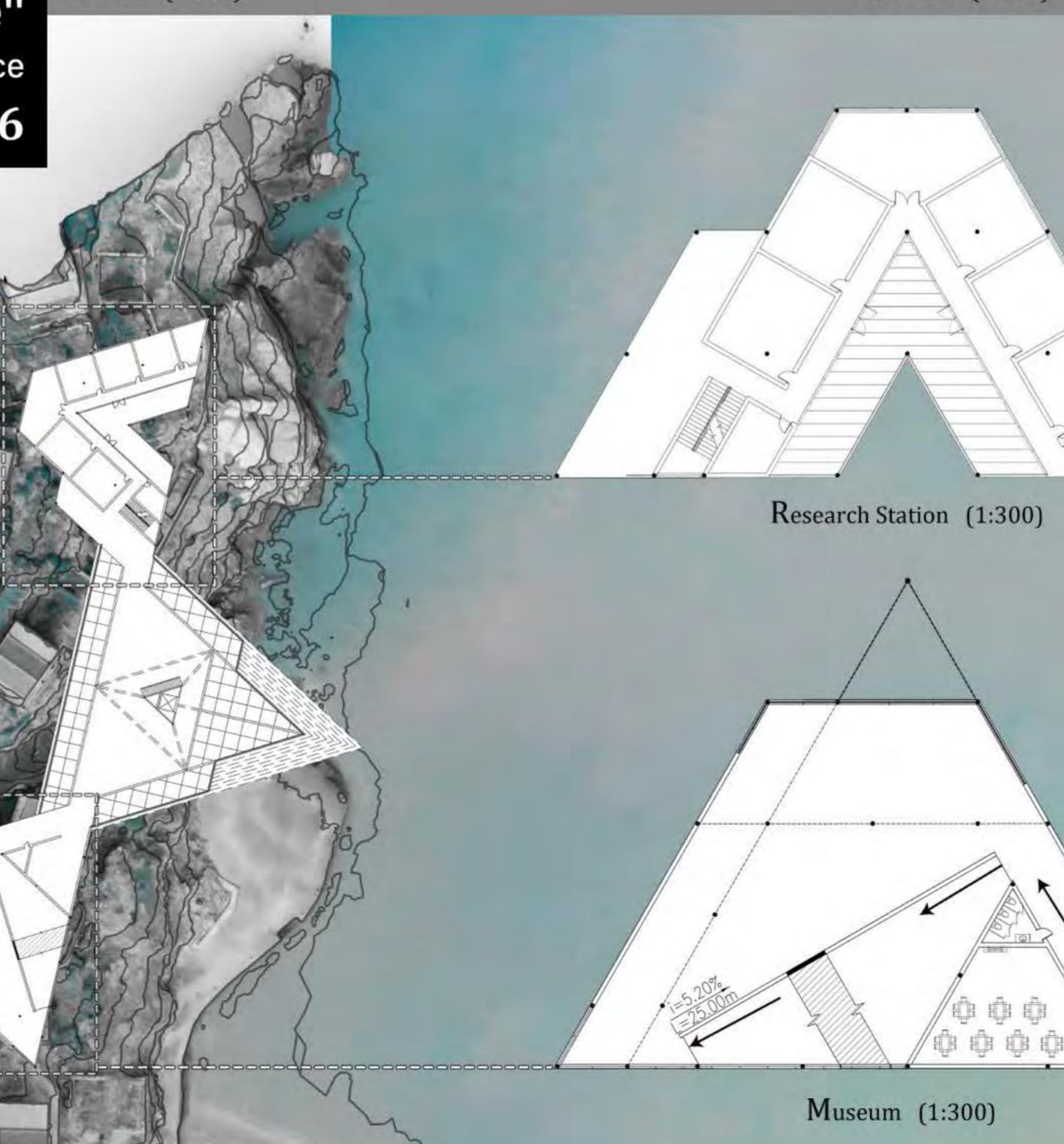
Several Individual Architecture Projects  
2022 - 2023

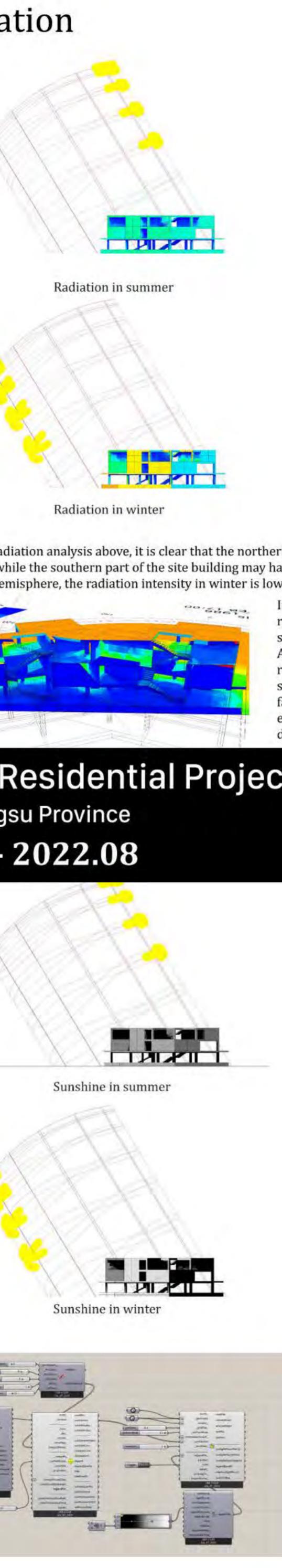
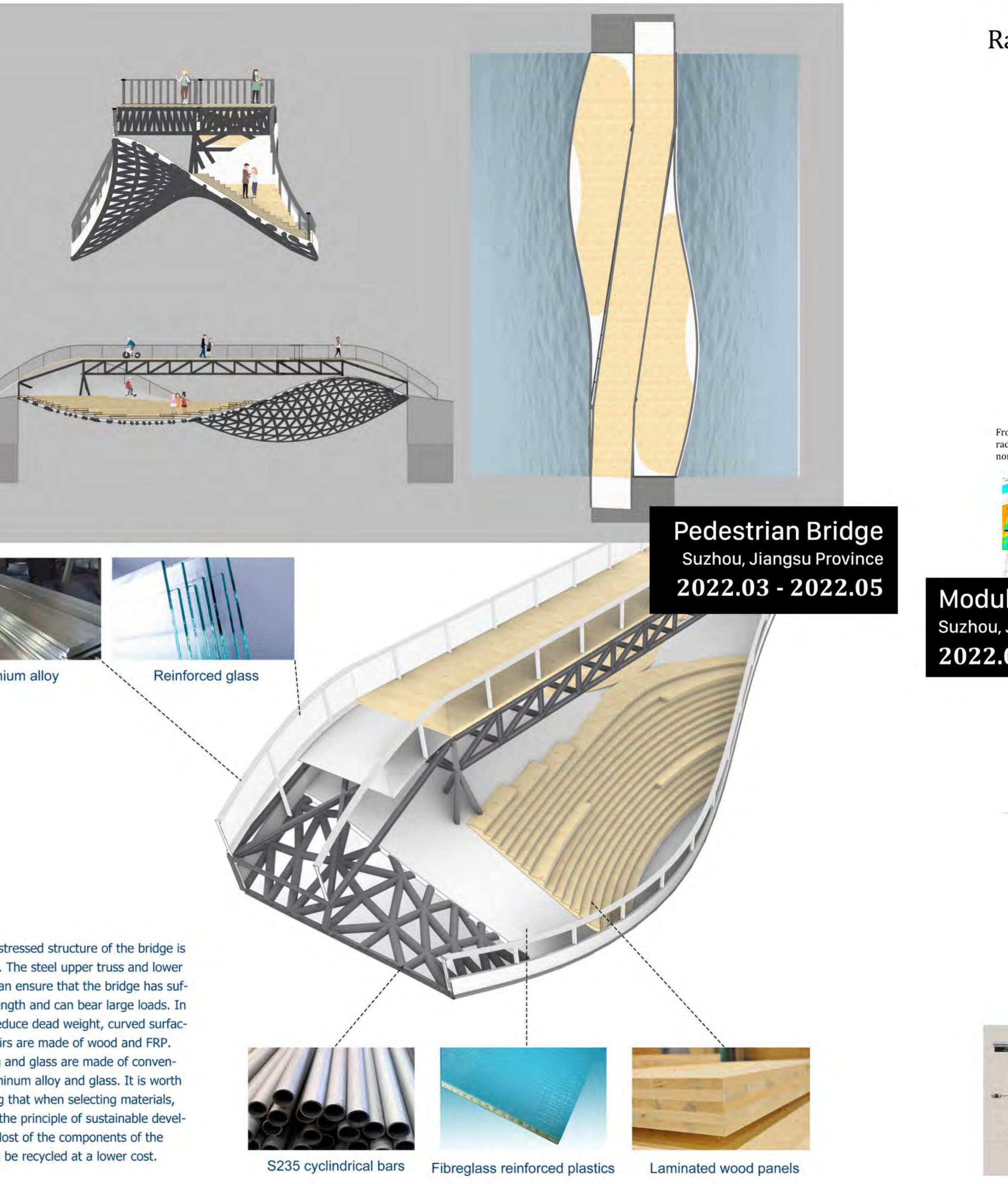


"Rebuild the Babel"  
-Final Year Project  
2022.12 - 2023.05



"Lighthouse"  
Zhoushan, Zhejiang Province  
2022.02 - 2022.06





## Modular Residential Project

Suzhou, Jiangsu Province

2022.06 - 2022.08

