Portfolio

Haiqi Gong

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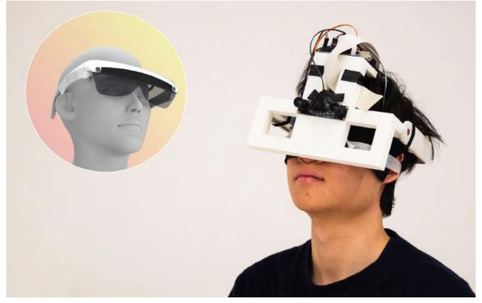
Table of Content

My personal website (roosterwho.com) includes a preview of selected works.
My itch home(https://roosterwho.itch.io/) includes my works of video games and game jams.
For the complete portfolio with detailed descriptions and additional works, please refer to this PDF.



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CyberSpirit

Embodied-Interactive Video Game

This Alt-Control game uses “mouse movement on the torso” as the core input. Players, as a CyberSpirit, scan and repair prosthetics across layers, uncovering the truth behind the damage.

The project explores accessible devices like a mouse and camera, combining motion capture with gamified mechanics for a new embodied gaming experience.

https://roosterwho.com/pages/works/cyberspirit.html

Walkthrough Video & Game Download Link

https://roosterwho.itch.io/cyberspirit

Public Page on ITCH.IO

Haiqi Gong

Group Project | Game Producer

- Unity Programming & Game Design
- Motion Capture Integration
- Art Direction
- Narrative Design
- UI/UX Design & Supervision
- Playtesting Analysis
- Prototype Development
- Exhibition Planning & Merchandise Development

Invited for WEPLAY EXPO

WePlay Culture Exhibition, one of China's largest gaming events, attracts over 15,000 attendees annually.

In 2024, it showcased 400+ games, including unreleased titles and exclusive previews, with significant international participation. Being featured in such a prestigious event highlights the exceptional quality and innovation of the work.

Using Mouse to Scan as Special Game Controller

Interaction - Game - Story

Embodied Interaction - Game Mechanic Integration

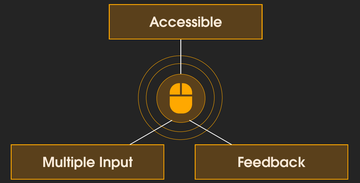
By using a special controller, players can experience multi-sensory input and output, gaining different levels of immersive experience throughout the game's progression on the physical sensory level, gameplay experience level, and narrative storytelling level.

Immersive Game Experience

	Device	Game	Story
Small Loop	Sensory Input/ Output	Mechanism Action Feedback	Metaphor Conveyance
Medium Loop	Multi-dimensional Interaction Logic	Core System Deepening	Story Unfolding
Large Loop	Accumulated Immersive Experience	Gameplay Emotional Development	Conflict and Climax Release

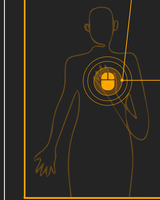
Accessible Hardware

The core input method involves "moving the mouse on the torso." A wireless mouse, as a common peripheral, provides adequate output for complex operations and supports a rich gaming system. Additionally, moving and pressing the mouse on the body offers diverse tactile feedback.



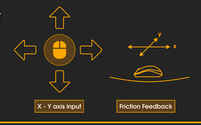
Mouse: Multiple input, tactile feedback

Multiple input modes using the body as an interface, offering tactile feedback without actuators.



Continuous Input

Moving on the torso provides continuous input, allowing for precise control with friction feedback.



Discrete Input

Pressing on the torso provides discrete input with pressure feedback.

Gameplay Posture

Stand at a distance for seamless mouse and camera interaction while reading the screen.

Art by @Chonium

Design Proposal

Gameplay: The core system, "Scan & Repair" lets players identify prosthetic errors and perform precision repairs, fully leveraging the unique features of mouse scanning.

Aesthetics: The cyberpunk style and post-human "prosthetic repair" narrative seamlessly align with the game's metaphorical elements.

Game Framework & Visual Experiment

Scan-Install View

Precision mini-games controlled by moving the mouse on the body.

Operating Table View

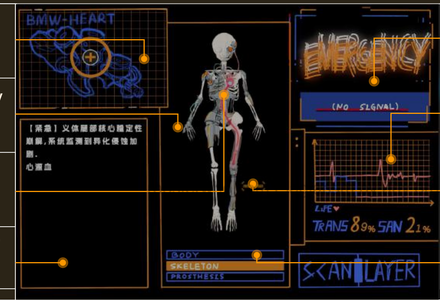
Character display with highlighted prosthetics.

Error Guidance

Indicates prosthetic errors and guides player actions.

Prosthetic Description View

Provides detailed prosthetic descriptions, advancing the narrative and storytelling.



Dialogue View

Displays character expressions, providing guidance and story direction.

Status Panel

Shows remaining resources, including health points.

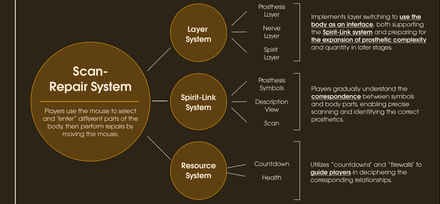
Scanner Mapping

Visualizes the mapping of the mouse between the player and the character's body.

Layer Switching

Displays the current layer and guides players to explore different layers.

System Diagram



Story

A ghost that can only possess prosthetics at night asks the player to repair a prosthetic engineer who created a mysterious machine. As the scan deepens, the engineer's body is gradually taken over by the ghost, and the player uncovers the truth behind "prosthetic repair"...

Developing the First Playable Prototype

Constrains: Technical Solution

Utilizing various techniques to align Alt-Control's core method with its key mechanics, guiding players to experience essential system and input-posture constraints.

Hybrid Constraints

Hard Constrain

Motion Capture

Guiding players to perform corresponding actions through **constraints** and **detection**.

Distance Control

Players must stand at a specific distance from the screen, as tracked by a camera, to enable gameplay.

Action Control

The camera detects specific hand positions on the torso and thighs, integrating with the Scan-Repair System.

Soft Constrain

Mouse Control Metaphor

Guiding players to perform corresponding actions through **storytelling** and **metaphors**.

"Surgery" Metaphor

Pressing the mouse serves as a narrative metaphor for "confirming repairs", creating desired pressure feedback.

"Scanning" Metaphor

Moving the mouse on the body mimics "scanning," providing expected friction feedback.

Motion Capture Pipeline

Python Launcher Logic

The OpenCV camera is launched via Python, with Mediapipe handling motion captures. Recognition data is sent to Unity via Socket as a Byte Stream, where a manager converts it into input data processed by the Input Manager.

Process Control
Unity Executable

Start Process

Camera
Open CV

Motion Capture Algorithm
Mediapipe & PoseDetector

Byte Stream Message
data = [bbox_xy, position, knee_in, hand_in, hand_y, hand_z]

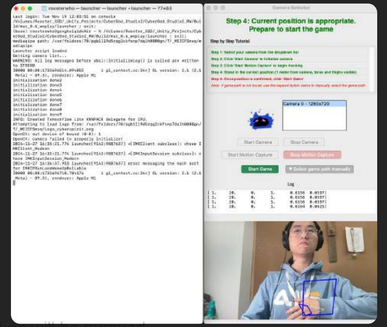
Unity Logic

UDP socket 127.0.0.1:5005

UDP Receiver
Singleton

Input Manager
Singleton

...

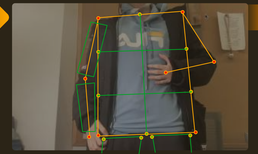


Pose Recognition Logic

- Detect skeletal poses and identify key structures.
- Extract a list of keypoints (imList) for further analysis.
- Extract bounding box information (bboxInfo) to define regions of interest.

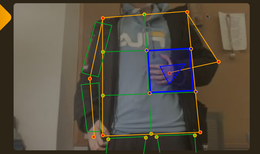
Keypoint Geometry Processing

- Calculate trisection points for finer pose segmentation.
- Generate polygonal regions based on keypoint arrangements.
- Generate regions using leg extension lines for advanced tracking.



Collision Detection Logic

- Calculate arm vector lengths to assess movement ranges.
- Draw collision boxes to map interactive areas.
- Detect intersection areas to evaluate collision accuracy.



First Playable Prototype with core system function

Complete core system functions, conduct playtests for a minimal medium loop (level) midway through development, and record feedback on metrics and player comprehension.

Prototype Screenshots

Minimal Game Loop

Scanning errors in the Spirit Layer ↔ **Repairing errors in the Prosthesis/Mechanical Layer**

Core Function Completion Status

Scan-Repair System

- Select prosthesis
- Repair prosthesis
- Repair UI and guidance
- More prosthesis types

Layer System

- Prosthesis Layer
- Nerve Layer
- Spirit Layer

Spirit-Link System

- Scan function
- Description view
- Prosthesis symbols

Resource System

- Countdown system
- Health system

Prototyping & Game Testing

First Playtest: Understanding Gameplay

#Player 01

- Frequent gamer, familiar with role-playing games.
- Knows project progress, hasn't played early versions.

Initially confused but understood the system after some time.

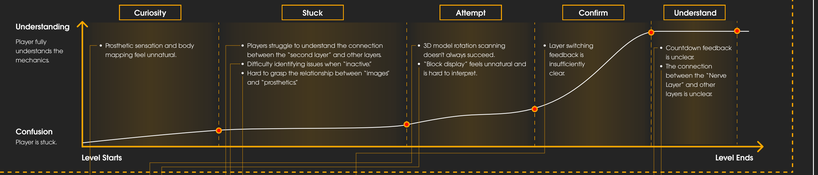
#Player 02

- Infrequent gamer, limited role-playing experience.
- Knows project progress, hasn't played early versions.

Displayed confusion, had difficulty progressing.

Player's Mastery of Game Mechanics - Learning Curve in a Level

Players perform guided playtests to observe their understanding of each system and identify obstacles as the gameplay progresses.



Scan-Repair System

Layer System

Spirit-Link System

Resource System

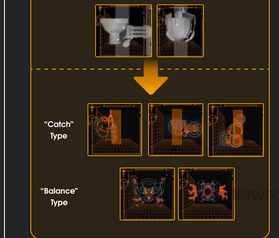
Revise the resource system UI.

Iteration

Add modules based on system components, refine the process through playtesting, and deliver complete content for four levels while ensuring user experience.

New Components

Additional prosthetics | New repair methods

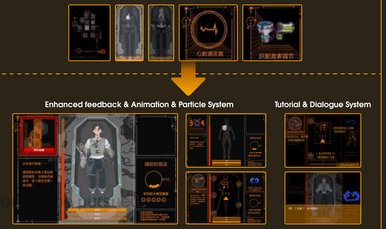


New Mechanics

"Double Error" | Health system

New UI and Visual Effects

Enhanced feedback | Tutorial for beginners | Dialogue System

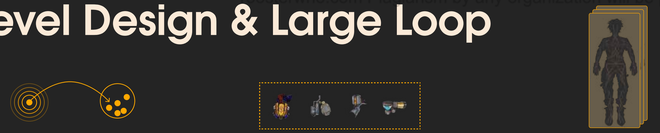


Second Playtest: Pace and Tutorial Design

Test the completeness of the tutorial and adjust level parameters to ensure the game's tempo and rhythm suit most players.

Level 1					Level 2				
5 Score	210s Time	5 Health	2 Prosthesis	Single Error Mechanism	15 Score	210s Time	5 Health	3 Prosthesis	Single Error Mechanism
Level 3					**Level 4**				
5 Score	210s Time	5 Health	4 Prosthesis	Double Error Mechanism	15 Score	210s Time	5 Health	5 Prosthesis	Double Error Mechanism

Level Design & Large Loop



Scan Body Errors → **Unlock Prosthesis** → **Unlock Layers**

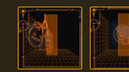
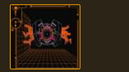
Level Flow

Scan (Spirit Layer)
Use the mouse to scan the body and identify damaged prosthetics.

Inspection (Mechanical Layer) (Nerve Layer) (Sequentially)
Scan the body with the mouse and click to access the corresponding prosthetic.

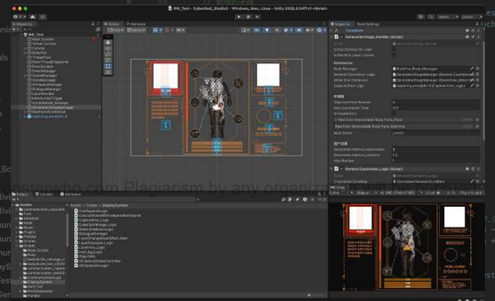
Prosthetic Repair Mini-Game
Scan the body with the mouse and click to repair

Find the Next Error
Locate enough errors within the time and health limits.

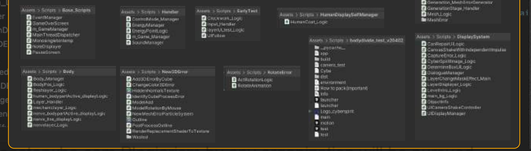
Level 1	Level 2	Level 3	Level 4
			
Familiarize with the special control system and understand the Scan-Repair System loop.	Ensure mastery of the Spirit-Link System, resource management, and objectives as challenges.	Introduce the new "Double Error" mechanic, enhancing the Layer System and adding new "Balance" components.	Confirm mastery of new mechanics, with resource management and objectives serving as challenges.

Exhibition & Display

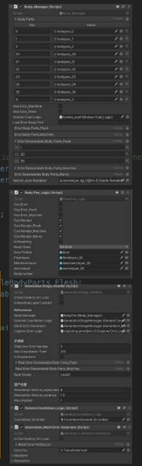
Unity Project



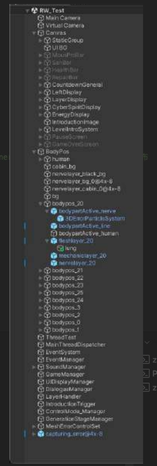
C# & Python Logics



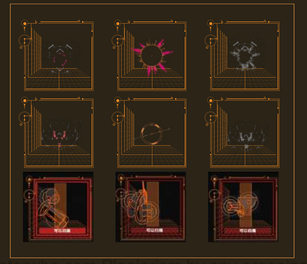
Level Managers



Hierarchy



Screenshots & Art Collection



Exhibition & Player Reaction

WePlay Game Exhibition

Official Selection for WePlay Craft 2024

This work is selected and exhibited at WePlay Exhibition in Shanghai, China at 2024.11.16 - 2024.11.17.

IRIS

AI-Empowered Embody Design for the Visually Impaired

Iris is a smart eyewear system designed primarily around tactile sensing to assist individuals with visual impairments in navigating their surroundings. Leveraging real-time navigation using computer vision and AI image recognition models, it provides users with directional guidance and obstacle avoidance through vibration feedback and voice prompts. Its core advantages lie in real-time, high precision, and AI-driven algorithms.

Haiqi Gong

Group Project | Designer

- Field Research
- Interviewing and Field Research
- Technical Solution Design
- Prototyping & Engineering
- Digital Model Designing

A' DESIGN AWARD WINNER

4.2 ★★★★★
A DESIGN AWARD WINNER 2024

IRON WINNER
A'DESIGN AWARD & COMPETITION
2024

This project (Design ID: #160148) was honored with the Iron Award at the A' Design Award and Competition, one of the world's largest and most prestigious design competitions. The award was officially conferred on April 15, 2024, in Milan, Italy.

Problem Defining and Research

Context

Over 1.1 billion people worldwide are affected by visual impairments, the vast majority of whom have a need for outdoor travel. They are facing all kinds of problems.

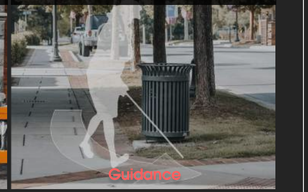
1.1 Billion Visually Disadvantages Globally

70 % Have needs to go outside alone

Walking Straight is not easy for them.

Obstacles everywhere.

Don't know when to turn.



Research: Interview

We conducted over five independent interviews with visually impaired individuals, volunteers, and charity managers, gathering first-hand research data. Additionally, we participated in volunteer activities assisting the visually impaired with travel, gaining deeper insights into their mobility needs.

INTERVIEWEE LIST

- Visually Impaired Voice Broadcaster
- Charity Manager
- Visually Impaired A Cappella Singer
- Blind Massage Therapist
- Library Public Activity Project Leader

CATAGORY

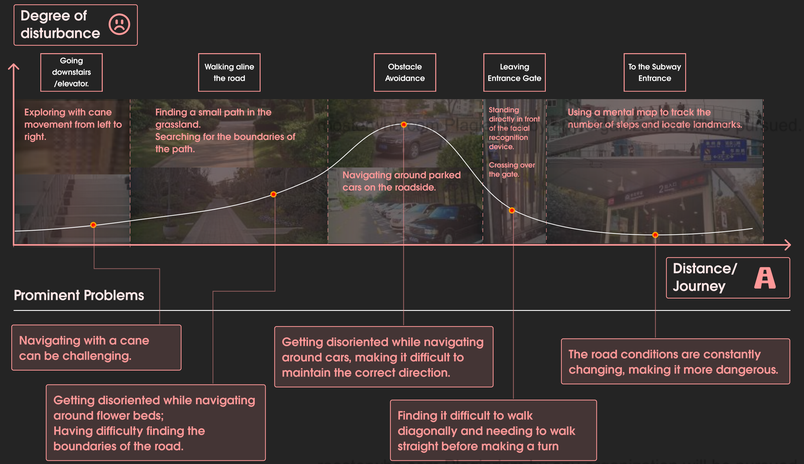
PROBLEM HIERARCHY

The primary issue lies in losing direction due to obstacle avoidance.

User Journey

We analyzed the potential issues and obstacles that blind urban residents might encounter on their commute from home to work.

Even on familiar routes, such as the path from a residential area to a subway station, losing direction due to randomly appearing obstacles is quite frequent, and the types of objects causing disruption are diverse.



Technical Exploration

Technical Solution

By using video input and computer vision technology to process incoming information, the system provides support for obstacle avoidance and navigation for blind individuals. It layers the output information through vibration and voice prompts, offering a natural interactive experience for the blind.

Computer Vision + Sensor

Identify objects and distances using binocular cameras and image segmentation algorithms. TOF and wide-angle lenses provide more precise distance measurements, enabling quick and accurate object recognition and distance calculation.

- Vibration: Indicates distance and direction
- Voice Guidance: Announces the type of obstacle

Discrete module testing

Camera Experiment

The capability of capturing road data using a camera, enabling road edge detection was successfully validated.

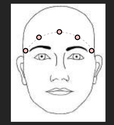
Camera Installation

Edge Detection

Vibration Experiment

To validate the resolution and comfort of the vibration module at different positions, tests were conducted on the installation locations and quantity of vibration modules.

 # Experiment 1



On the forehead, evenly distribute 5 vibration elements indicating left 90°, left 45°, straight ahead, right 45°, right 90°

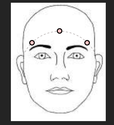
Accuracy ●●●●○

Participants find it difficult to distinguish between 45° and 90°.

Comfort ●●○○○

Participants reported experiencing pain in the temples after prolonged exposure to vibrations.

 # Experiment 2



On the forehead, evenly distribute 3 vibration elements indicating left 60°, straight ahead, right 60°.

Accuracy ●●●●●

There is a higher level of distinction for straight ahead, right, and left.

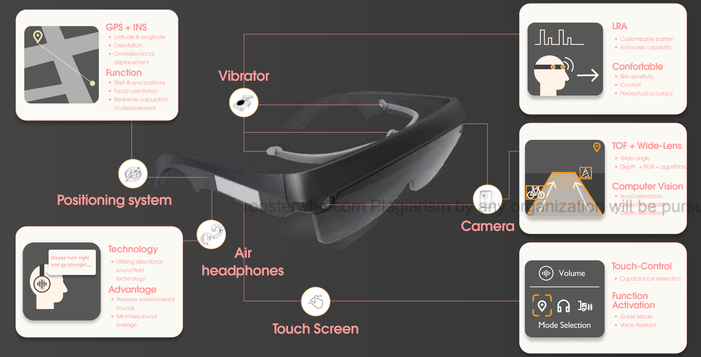
Comfort ●●●●●

Participants reported: better than Experiment 1

Final Design

We finalized the technical solution and interaction design, along with their correspondences to different scenarios.

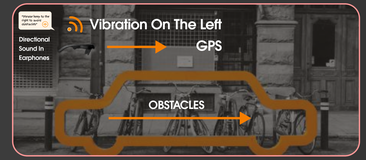
Product Function



Scenario

Different scenarios, with varying output and interaction levels.

- Direction Guidance
- Destination Location
- Obstacle Warning

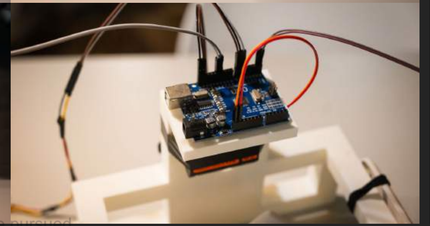


Prototyping & User Testing

Prototyping

Using 3D printing technology, Arduino, and sensor components, along with a simple prototype model made with a headgear, to test functionality.



Testing

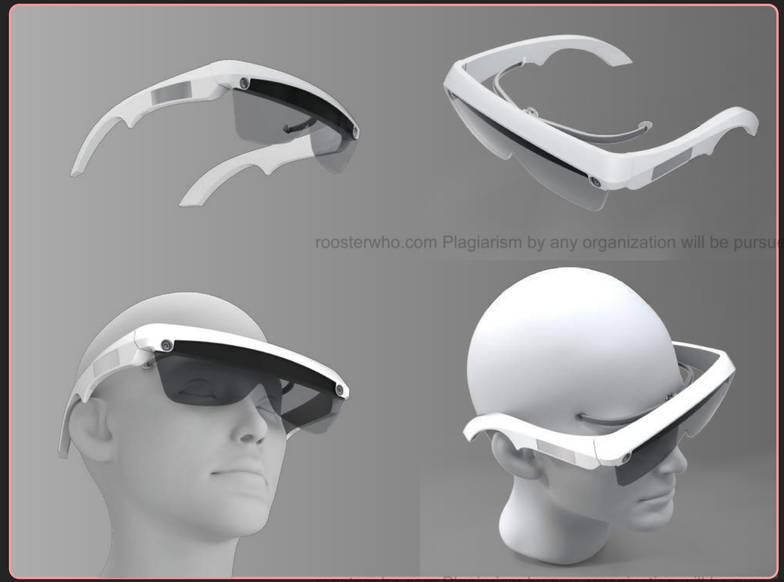
Based on different modules, multiple user tests were conducted in both real-world and laboratory environments, including overall system user testing.






Final Rendering

The product's form and details were finalized.



CapFlow

In-Car Interactive Entertainment System

In the future of autonomous driving, in-car entertainment experiences will undergo new changes. We have created a new interactive entertainment game system, CapFlow, where users interact with the external scenery by "turning" a special handle, exploring the interesting stories behind the scenery, and re-establishing a connection between people and the often-overlooked surroundings during their journey.

Haiqi Gong

Group Project | Designer

- Unity Programming & Game Design
- Concept Research
- Arduino Input Integration with Unity
- System Design & Engineering
- Contribute to Installation Assembly and Prototype Testing

https://roosterwho.com/pages/works/capflow.html

Video & Gallery

MUSE DESIGN AWARD WINNER

This project has been honored with the Silver Award in the 2024 MUSE Design Awards, recognizing its innovative approach to in-car entertainment and user experience design.

Concept Research & Design

Inspiration

In the rush of our journeys, what landscapes and potential connections or stories have we missed?

"What about the silent majority who prefer to experience wildflowers the way General Motors intended – by whizzing past them in a fast, comfortable automobile? How are nature-loving-from-a-distance drivers supposed to learn the names and habits of the wildflowers as they speed blissfully past them at 65 (85?) miles per hour?"

——Chris Helzer, A Field Guide to Roadside Wildflowers At Full Speed

What we need is, “An Constructing Perspective”

Through the “Constructing Perspective”, we will recapture the missed scenes based on our true needs, create our own travel moments, and rediscover the joy of everyday life.

Design Concept

We decompress the compressed scenery.

The Core fun of the game is to discover and to connect with the outside scenery.

We've designed an in-car 'roaming' game via **the combination of hardware and software**. The game encourages players to look for scenery outside the window and capture it to interact with inside the car with a Story-driven feedback. The goal is to help people enjoy personalized viewing and roaming, and to construct their own travel moments.

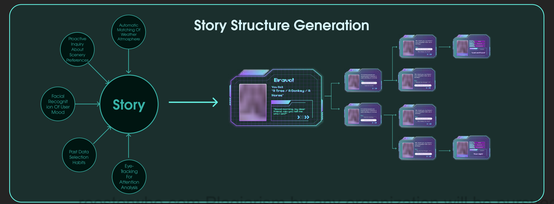
INTERACTIVE STORY | CONTROLLER | MULTI-SENSORY EXPERIENCE

Technical Solution

In the era of autonomous driving, with highly advanced artificial intelligence, we can use computer image segmentation technology and generative AI technology to identify the objects users want to "focus" on and generate corresponding story sequences to create a unique personal experience.

Story-Game Generation

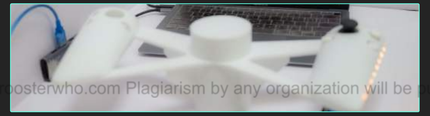
Collect diverse user data to ultimately design a story sequence that best fits the user experience and the current atmosphere, creating an adaptive interactive experience.



Iteration & Prototyping

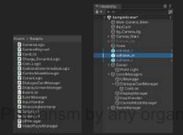
First Prototype: MR + Controller

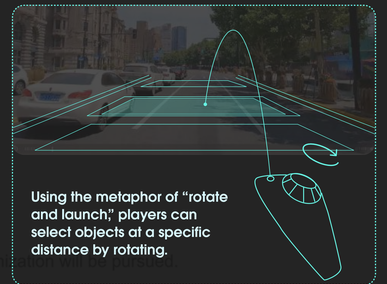
We first used a virtual environment (Unity3D) and a 3D-printed controller to test whether the hardware and software guidance could enable players to interact with the scenery outside the window. **Initially, we used a detachable handle and handle buttons for control**, but found that it lacked effective interaction and selection with the external scenery.



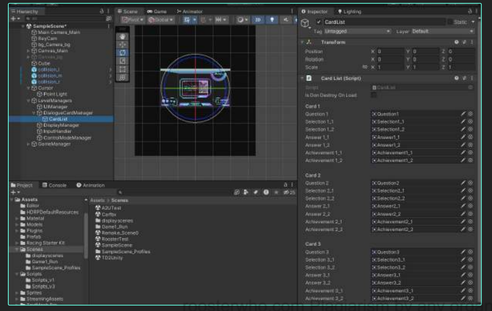
Final Prototyping: Rotation Control

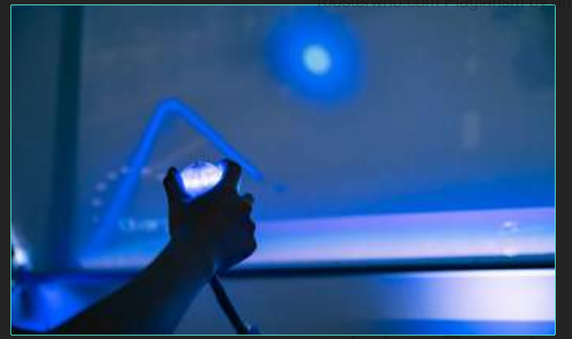
We updated the controller design. **Using a ratchet and custom damping,** we created a controller that allows players to select objects outside the window through rotation.
Subsequently, I built the Unity scene, using real-world settings as the background and Unity UI as the interface. We conducted experiments and tests by projecting this setup into a real tower-top scene. This iteration provided a more natural operation, with improved synergy between hardware and software for a better user experience.





Using the metaphor of “rotate and launch,” players can select objects at a specific distance by rotating.





Spikey

Designing Embodied-AI's Form for Uncanny Cuteness

"Uncanny Cuteness" navigates between the familiar and the unfamiliar, possessing the power to alter environments and contexts.

We aim to create an artificial being with "cuteness" at its core, using knitted yarn to explore the outcomes of this concept's interaction with humans in different contexts.

Video & Gallery
https://roosterwho.com/pages/works/spikey.html

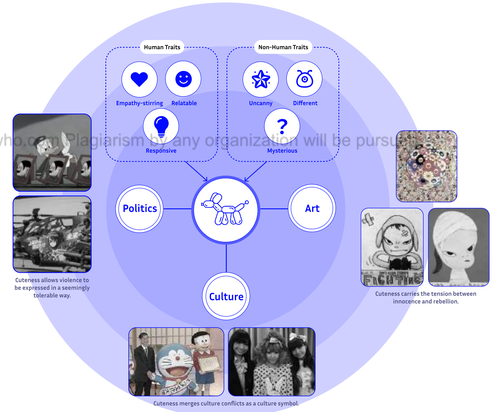
Haiqi Gong
Group Project | Designer

Concept Research
Interaction Design & Realization
Engineering & Prototyping

Cuteness has Power!

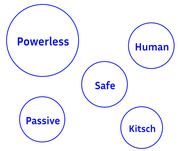
Powerful and Powerless

"Cuteness" is a dialectical embodiment of both.



Simultaneously possessing both **human traits and non-human traits**, cuteness can always **forcibly update the context**, regardless of the original situation, evoking concern through its relatable attributes while intervening with its non-human mysterious effects.

Embracing Uncanny Cuteness



"Part of what makes Cute compelling is that in so many instances, it places **side by side the strangely familiar and unfamiliar**, which can seem to evoke each other, to oscillate between each other, without coming to rest in a settled relationship."

——Simon May, *The Power of Cute*

Sweet, Infantile — *Uncanny, Rebellious*

Pre-modern
(15th century to 1910s)

APPEALING The natural and delicate imagery is often appealing and is frequently regarded as content suitable for middle-class consumption.

MYSTERIOUS The pre-modern imagination of deformities in nature and mysterious forces was all carried through cute imagery.

Modern
(1910s to 2000s)

SUGARY The advent of mass media and war, on one hand, has turned sugary cuteness into a means of soothing people and political propaganda.

EXPRESSIVE On the other hand, artists use cuteness as a way to express their serious positions in a seemingly harmless manner.

Post-modern
(1950s til today)

KITSCH After the war, sugary cute imagery became a representative of kitsch and consumerism.

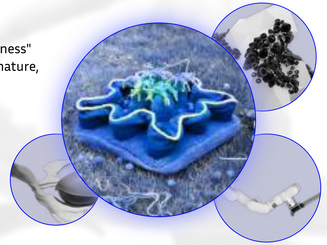
DIVERSITY The rise of pluralism allows people to seek identity and bridge cultural gaps through the consumption of diverse cute symbols.

Referencing Simon May's *The Power of Cute*. The original text does not include my specific expressions.

Cuteness as An Attitude towards Embodied AI

Context: Artificial beings in the future city

We believe that in the future of artificial intelligence, artificial beings will be a new presence in urban life. Unlike highly efficient but aggressive synthetic beings, or minimalist yet lifeless intelligent machines, "cuteness" can represent an organic, independent, and unique perspective, serving as a new force for communicating nature, technology, and society within the city.



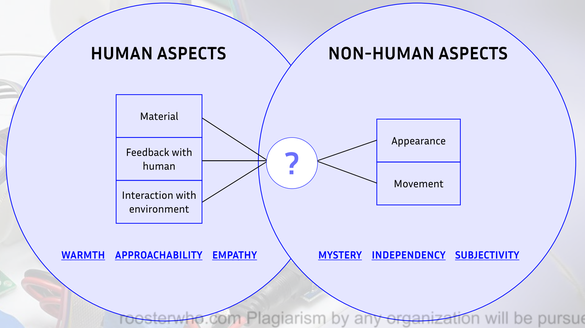
MYSTERIOUS	***ORGANIC***	Cuteness shares the same mystery as nature, allowing it to blend with the natural world.
EXPRESSIVE	***INDEPENDENT***	Cuteness is expressive, giving it an independent sense as a being.
DIVERSITY	***UNIQUE***	Cuteness embraces diversity, making it a unique form of artificial life.

Objective

Designing an artificial being for "uncanny cuteness"

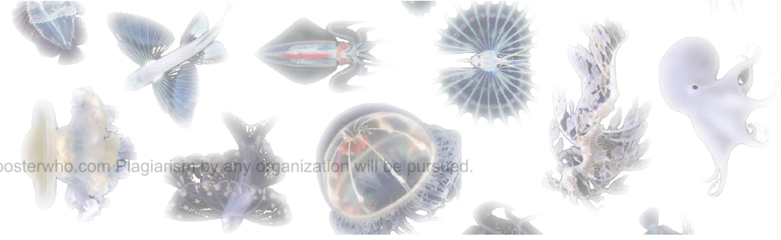
We aim to create a new future artificial being called "***Spikey***," centered around "uncanny cuteness."

It will embody warmth, approachability, and empathy through its feedback, interaction with the environment, and the use of warm materials.
At the same time, its peculiar appearance and autonomous movement will reflect its mysterious, independent, and subjective aspects.



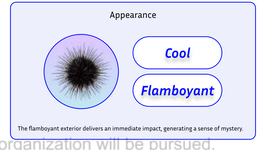
Exploring the form

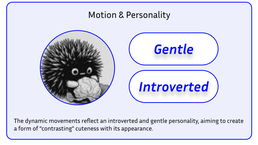
Inspirations



Spikey is inspired by marine life.

Marine creatures often have unusual appearances that can evoke curiosity and a sense of mystery, even today. Additionally, most marine organisms exhibit interesting and lively movements that foster empathy. Drawing inspiration from marine life, we began to explore the form and dynamics of *Spikey*.

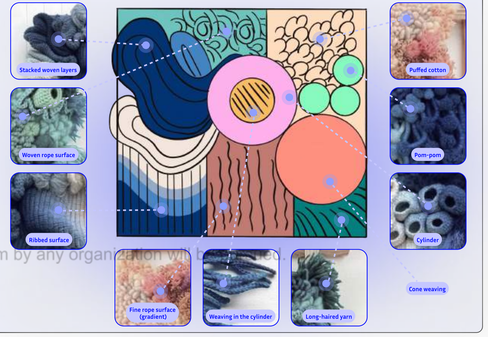




Form Exploration

CMF Exploration

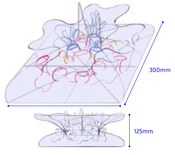
We aim to use different woven materials that, while ensuring softness and familiarity, also create a rich, layered, and dynamic texture reminiscent of marine life.



Morphological Exploration

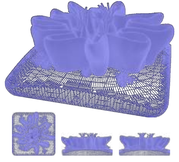
From sketching to 3D modeling and then to physical printing, we employed various tools to first confirm the approximate dimensions, then explore the morphology of important features. Subsequently, we printed it out to examine its proportional relationships in the real physical world and under light and shadow, in order to determine its morphology.

Sketch: Approximate Dimensions



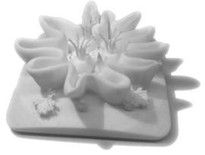
During the sketching phase, we outlined the approximate dimensions, proportions, and components of Spikey.

Digital Model: Specify Features



In the digital modeling stage, we refined our ideas and specified the essential features of its shape.

3D-Printed Scaled Model: Overall Proportions Testing



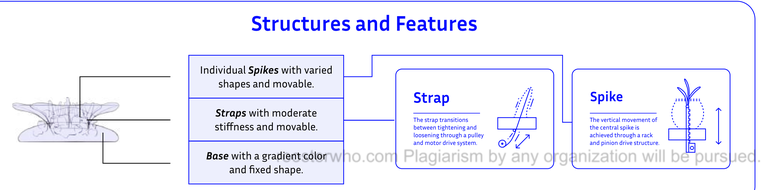
After printing a scaled model, we observed whether the overall proportions and spacing of its various parts were harmonious.

Final Design Structure

Defining Features

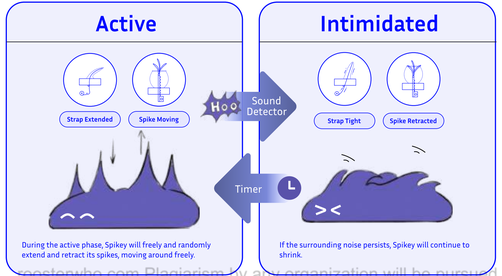
We designed two states for Spikey: when in the "Active" state, it moves freely and exuberantly, but once it experiences external disturbances, it becomes "intimidated" and shrinks away, becoming motionless. This transition is reflected in its structure through the mechanical changes in the strap and spikes.

Structures and Features



Dynamic Design

We designed two states for Spikey: when in the "Active" state, it moves freely and exuberantly, but once it experiences external disturbances, it becomes "intimidated" and shrinks away, becoming motionless.

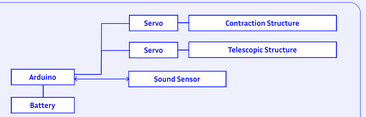


Prototyping

During the prototype development process, we first designed the overall layout and connection logic, then conducted experiments and built it step by step, ultimately refining *Spikey* into a fully functional model during the assembly and debugging phase.

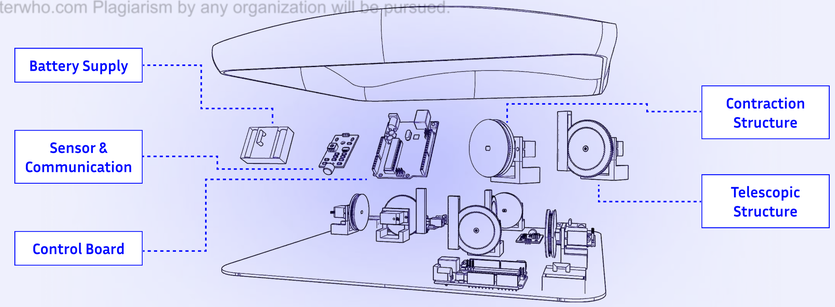
Circuit Layout

We used a standalone Arduino for processing, an external sound sensor for input, and two power modules as actuators, all connected as independent modules.



Structure Layout

We arranged the independent modules symmetrically on the base, confirming the general layout in the 3D model. At this point, we began experimenting, focusing on physical assembly and corresponding adjustments.



Model Fabrication

Through a series of steps, I gradually tested the performance of each module, then progressively integrated them with the appearance and materials, and finally assembled everything together.

Principle Testing

By 3D printing the drawstring structure and using KT boards to simulate the dimensions of the sides, we gained an approximate understanding of the proportions and range that the drawstring structure can manipulate.

Sound Module Testing

The sound module can recognize the intensity of external sounds and provide feedback on "activation status." By carefully adjusting the potentiometer, we ensured that Spikey can accurately perceive when there is noise in the environment that could "intimidate" it.

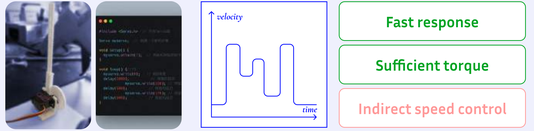
Mechanical Module Selection

Through testing different modules with varying principles, we ultimately chose a servo motor as Spikey's power structure due to its suitable accuracy, control, size, and speed.

Electromagnetic telescopic rod: Complex structure, large size.

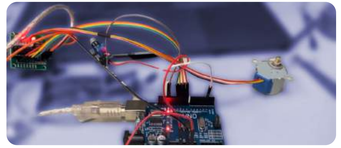
Final Selection: Servo

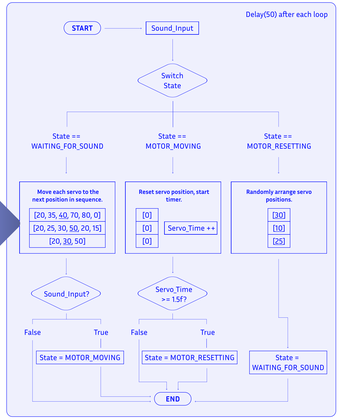
Final Selection: Servo



C++ Code Development

After assembling the input and output devices, I wrote a state machine to control the input and output sequences, as well as the looping control logic.

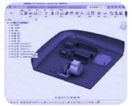




CMF Prototype

We first customized each material in small sizes to observe the combination relationships and overall expressiveness, followed by further confirmation of the surface material processes.

Structural Modeling



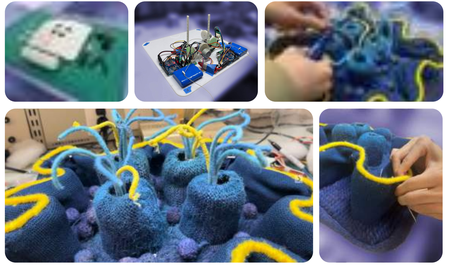
In Fusion 360, we modeled each mechanical structure and its modular relationships in preparation for printing and testing.

Making Minimal Viable Prototype

We constructed a complete module (one-quarter of the overall design) to ensure that the knitted surface operates in conjunction with the motor's drive and sound signal input, resulting in a cohesive effect.

Printing and Assembly

We printed the outer shell, adhered the mechanical structure to the base, manually installed the knitted surface, and shaped the understandable structure for final assembly.



In Different Scenarios

Cuteness changes context.

The “cuteness” of Spikey, as an artificial being, grants it the potential to navigate conflicts and harmonize in various environments. Whether it evokes feelings of cuteness, mystery, and blending within nature, or presents a gentle and concerned demeanor in a future filled with more aggressive artificial beings, Spikey stands out. In cold, artificial surroundings, it brings a unique liveliness through its cuteness. In each environment, cuteness reshapes the atmosphere between the surroundings and people with its own nature.

With Nature	
With Aggressive Artificial Beings	
In Artificial Environments	

WaterChessBoard

Designing a Game for Cross-Species Communication

This project utilizes an 8x8 flip-dot chessboard powered by Conway's Game of Life to balance resource demands between AI and plants. Through integrated modules for logic computation, data handling, and MQTT communication, it offers a tangible, interactive solution for exploring non-human resource allocation.

Haiqi Gong

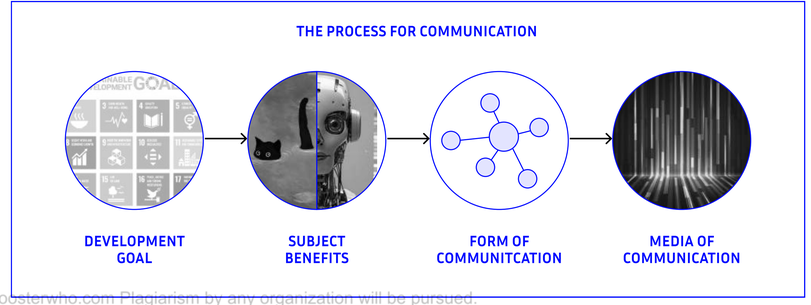
Solo Project | Designer

Concept Research
Interaction Design & Realization
Engineering & Prototyping

Communication For Non-Human Subjects

Framework for communication

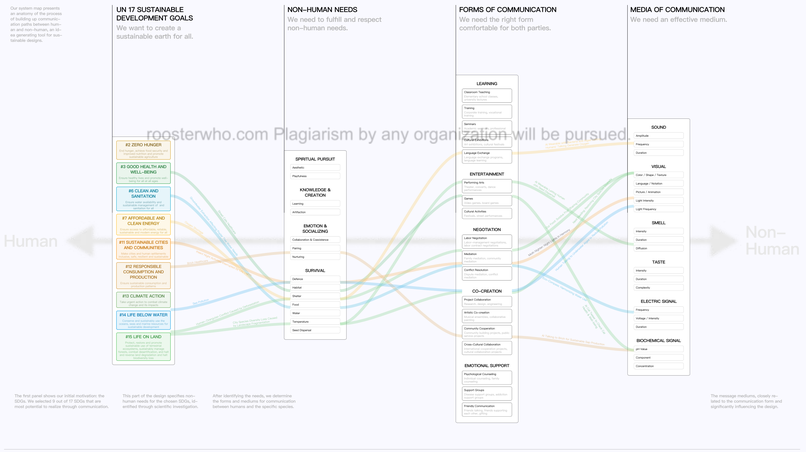
From a post-anthropocentric perspective, human development goals must align with the objectives of non-human entities. Within a specific communication framework, information is conveyed through a tangible medium. This framework represents a complete communication process.



System Map

Human ↔ Non-Human Communication

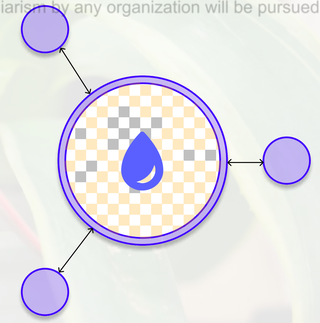
System Map



Objective

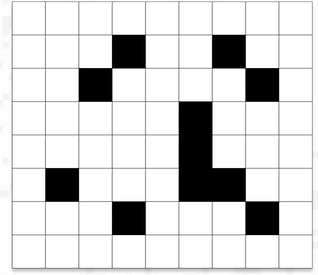
AI-powered chessboard to balance water usage

I plan to develop an AI-powered chessboard to balance water usage between AI systems for cooling and plants for growth. Each entity is represented on the board, where their resource demands are expressed and resolved. Using machine learning, the AI identifies these needs and allocates resources accordingly, facilitating communication between non-human entities.



Inspirations

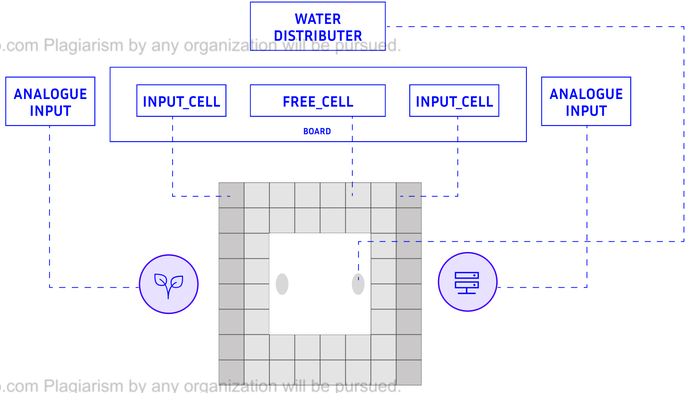
I use Conway's Game of Life as the input format, where simple input data evolves through conflicts to generate diverse information while preserving the original structure. The core concept lies in two entities resolving resource conflicts through a chessboard game, effectively embodying this idea.



Designing and Initial Testing

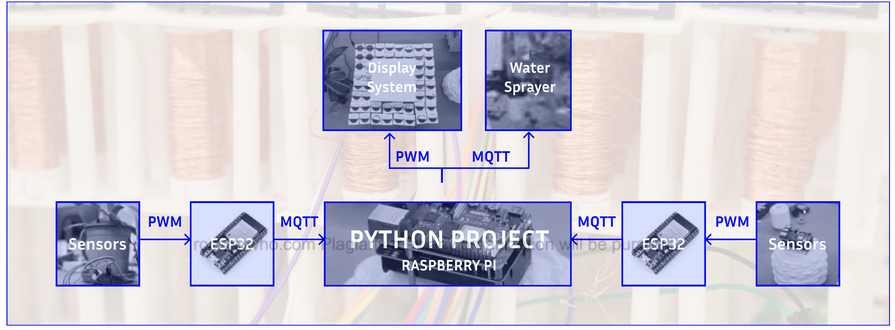
Design Proposal: Physical Computing

I use a physical computing device with an 8x8 chessboard displaying 0s and 1s. Sensors in plants and AI systems provide input on factors like humidity and soil moisture to assess water needs. The chessboard's state then guides a water distributor to allocate resources.



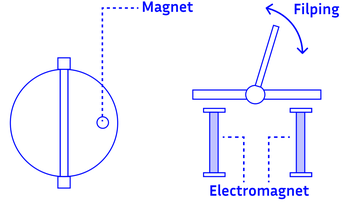
Physical Computing Technical Framework

Implementing physical computation through a centralized connection structure.



Display Hardware Design

Using flip-dot technology, colored plastic pieces are flipped by electromagnets to display information, enabling a physical visualization of the chessboard's state.

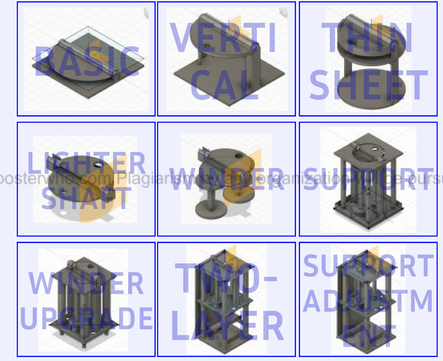


Display Hardware Initial Testing

After more than 34 iterations, the 3D model and technical solution for the Flip-Dot were finalized.

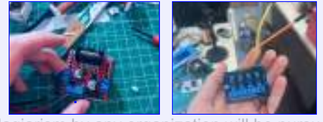
Flip-Dot 3D Printing Test

Flip-Dot Digital Structure Improvement



Electromagnet Material & Voltage Test

H-Bridge Circuit Test

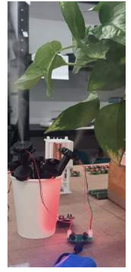


Prototyping: Coding and Engineering

Analogue Sensor & Acuter Logic

Using PlatformIO to control sensors and actuators.

- Soil Sensor
- Spray Logic
- Temperature and Humidity Sensor



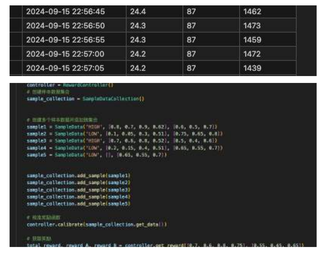
Code Design

PYTHON Engineering

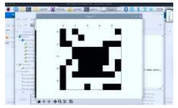
- Calculation Logic Module
- Display System Module
- Register Control Module
- Data Processing Module

Data Processing (Calibration & Reward)

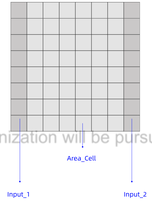
2024-09-15 22:56:45	24.4	87	1462
2024-09-15 22:56:50	24.3	87	1473
2024-09-15 22:56:55	24.3	87	1459
2024-09-15 22:57:00	24.2	87	1472
2024-09-15 22:57:05	24.2	87	1439



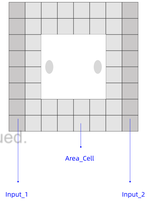
Display & Calculation Logic



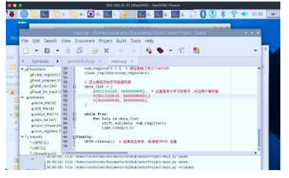
Calculation Layout



Display Layout

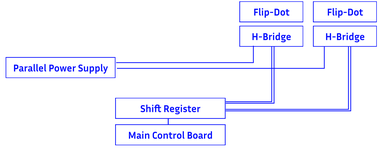


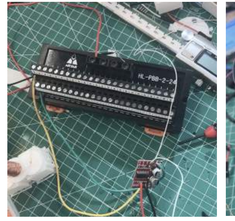
Register Control Logic



Circuit Design

Using an independent power supply, cascaded shift registers, and H-Bridge flipping to simultaneously control 48 Flip-Dots.





Assembly

Circuit and 3D-Printed Parts' Assembly Process

Gallery and Process