# Yihan Zhang

*Academic Project Portfolio*

THE UNIVERSITY *of* NORTH CAROLINA *at* CHAPEL HILL

# Preface

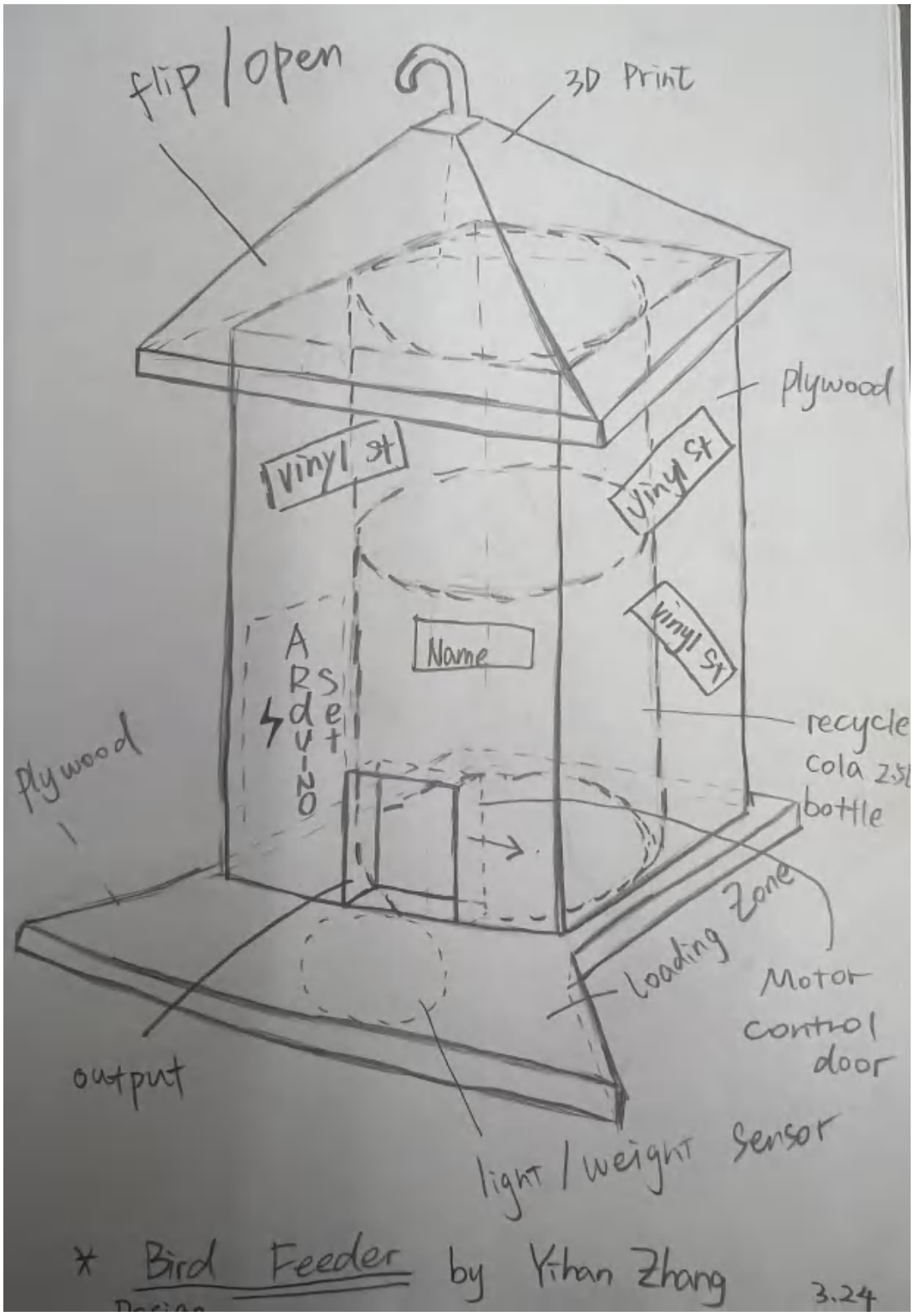
*This is **UNC student Yihan Zhang**'s Academic Project Portfolio*.....

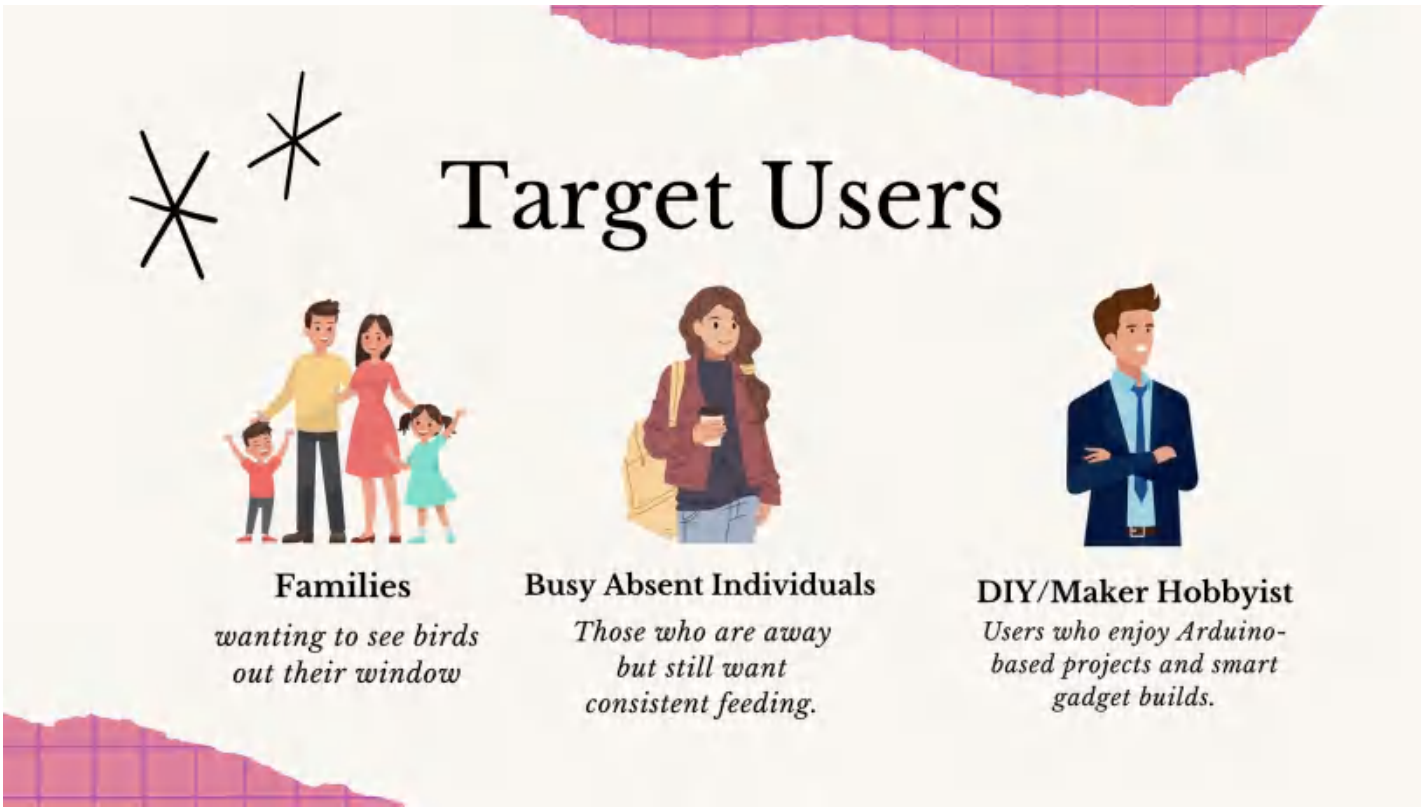
# Table of Contents


***SmartBird Feeder***

# 1

# Design Draft by Hand






**Title: Smart Bird Feeder System**
**Designer: Yihan Zhang**
**Type: Arduino-Based Interactive Device**

The Smart Bird Feeder is an environmentally friendly, Arduino-powered device designed to automate feeding for birds while preventing food theft by squirrels or larger animals. The system uses **dual-sensor logic:** a **photoresistor** determines if it's daytime, and a **pressure sensor** detects whether a lightweight bird—not a heavier intruder—has landed. Only when both conditions are met does the feeder release food, ensuring accurate and ethical feeding.

The prototype was built using over **90% recycled materials**, including a repurposed 2L bottle as the grain reservoir, reclaimed acrylic for the housing, and biodegradable 3D-printed parts. This not only reduces waste but highlights the project's commitment to **sustainability** and **functional prototyping**.

Originally developed for a class, the design has the potential for future upgrades such as **image-based species recognition (YOLOv8)** and **servo-controlled food release**. This project showcases my skills in **sensor integration, ecological design**, and **human-animal-environment interaction**, while opening avenues for future research into **system robustness** and **intelligent automation.**

Present Slides:
https://www.canva.com/design/DAGl2bXLSiQ/oDUs6aNdldxT9nmZ1U5fnQ/edit?utm_content=DAGl2bXLSiQ&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton

## 1. 3D-PRINT TOP LID, HOOK

Key Features...

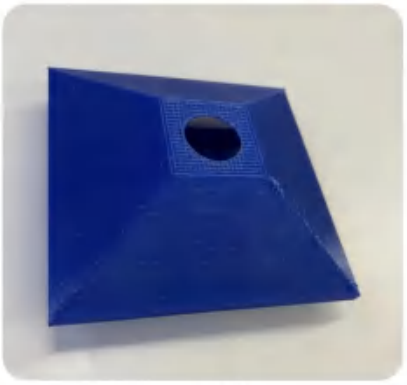
- Real house roof structure

Material: PET

Made by: 3D Printer Ultimaker S3

Hook

Funnal



Lid

## 4. PHOTORESIST & DOOR MECHANISM

```
void stopMotor();

const int photoresistorPin1 = A0;
const int photoresistorPin2 = A1;
const int greenLEDPin = 10;
const int redLEDPin = 11;
const int servoPin = 3;

Servo myServo;
const float threshold = 4;

const int stopPWM = 89;

bool hasRotatedForward = false;
bool waitingForLight = false;

void setup() {
  Serial.begin(9600);

  pinMode(greenLEDPin, OUTPUT);
  pinMode(redLEDPin, OUTPUT);
  digitalWrite(greenLEDPin, LOW);
  digitalWrite(redLEDPin, LOW);

  myServo.attach(servoPin);
  stopMotor();
  Serial.println("System Initialized - Yihao Zhang");
}
```

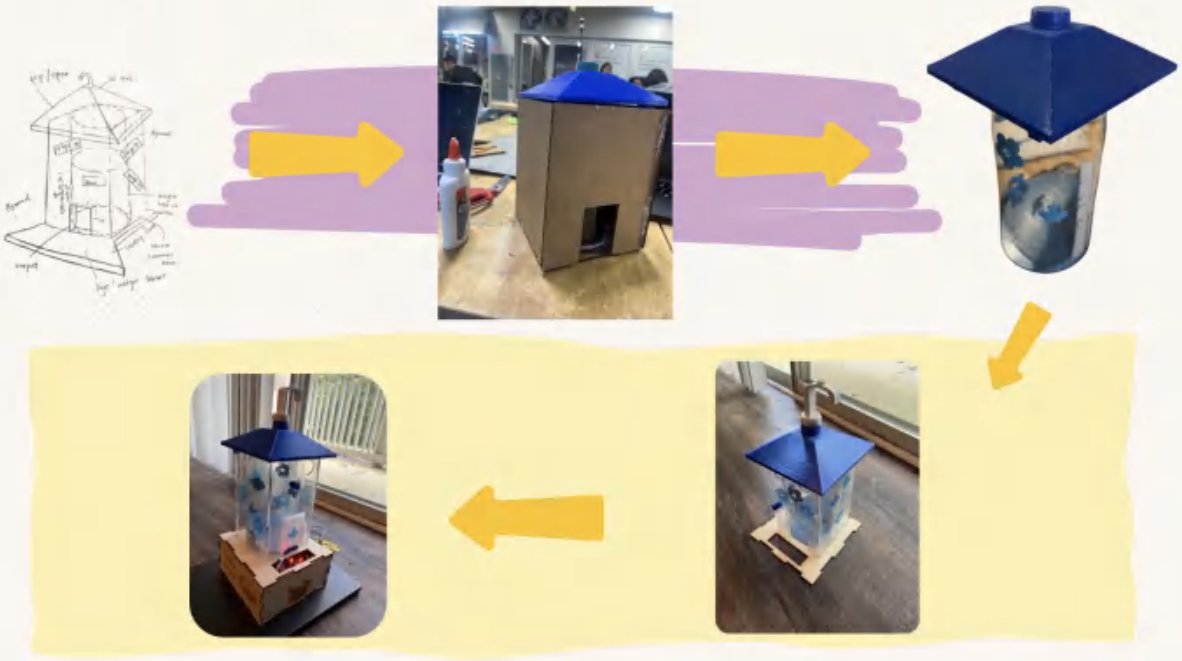
### KEY FEATURES

*Use Arduino Technology*
*Detect light & open the door and let the bird food goes out*

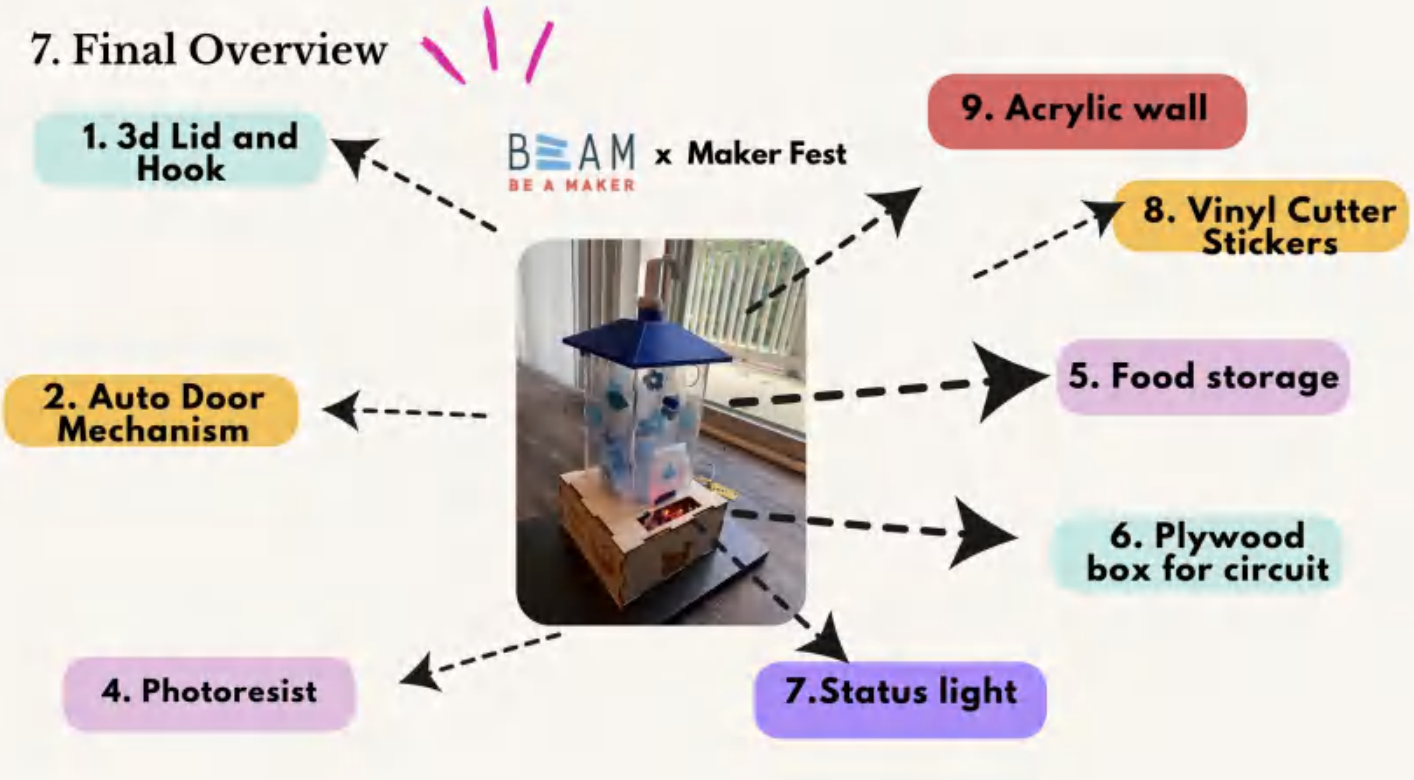
ELectronic parts (Arduino, FR90 servo, Photoresistor)

Made by: Assembling the circuit, adding FR90 (360)

## 6. Major Iterations



## 7. Final Overview



# I. Introduction

## A. Brief Product Description

A smart hanging bird feeder dispenses food only when a bird lands, using a weight sensor to prevent food from going bad and deter rodents and other pests from stealing food. The product will also include colors and patterns that attract birds to the feeder.awa

## B. Target User/Customer Description

- Families wanting to see birds out their window
- Bird watchers (can add specific food to attract certain birds)
- Busy or Frequently Absent Individuals: Those who are away or cannot attend daily but still want consistent feeding.
- DIY/Maker Hobbyists: Users who enjoy Arduino-based projects and smart gadget builds.
- Eco-Conscious Consumers: Users who want to reduce food/feed waste and minimize environmental impact
- Located in a region with a large quantity of birds

## C. Customer Needs and Wants

**1. Timed Feeding & Low Intervention**: Regular feeding during the day without constant user presence.

**2. Reliable Lid Protection**: Keeps feed dry, prevents rodents, and only opens when birds are present.

**3. Large Seed Capacity**: A 2L bottle reduces refilling frequency.

**4. Intelligent Sensing**: A weight sensor detects a bird's presence, triggering the servo lid.

**5. Easy Maintenance & Usability**: Easy to assemble, clean, and offers a creative DIY experience. Easy to refill.

**6. Attract Birds**: Using food, specific color and patterns, birds will flock to this feeder.

## D. Product Value Propositions

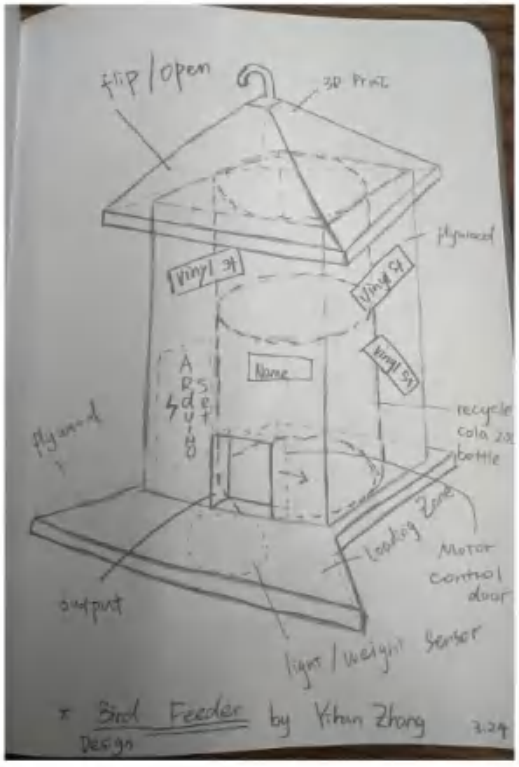
**1. Convenient Automation**: Frees users from daily visits, ensuring birds are fed regularly even when they're away.

**2. Feed-Saving Mechanism**: Only opens when birds arrive, minimizing waste and preventing pests.

**3. Flexible Scheduling & Sensor Trigger**: Arduino can be reprogrammed for different intervals or triggering conditions.

**4. Eco-Friendly Reuse**: A 2L soda bottle as the seed container is both cost-effective and sustainable.

**5. Customization Potential**: Users can upgrade or decorate via stickers, suitable for personal or educational purposes. (We will be using customizations that attract birds)

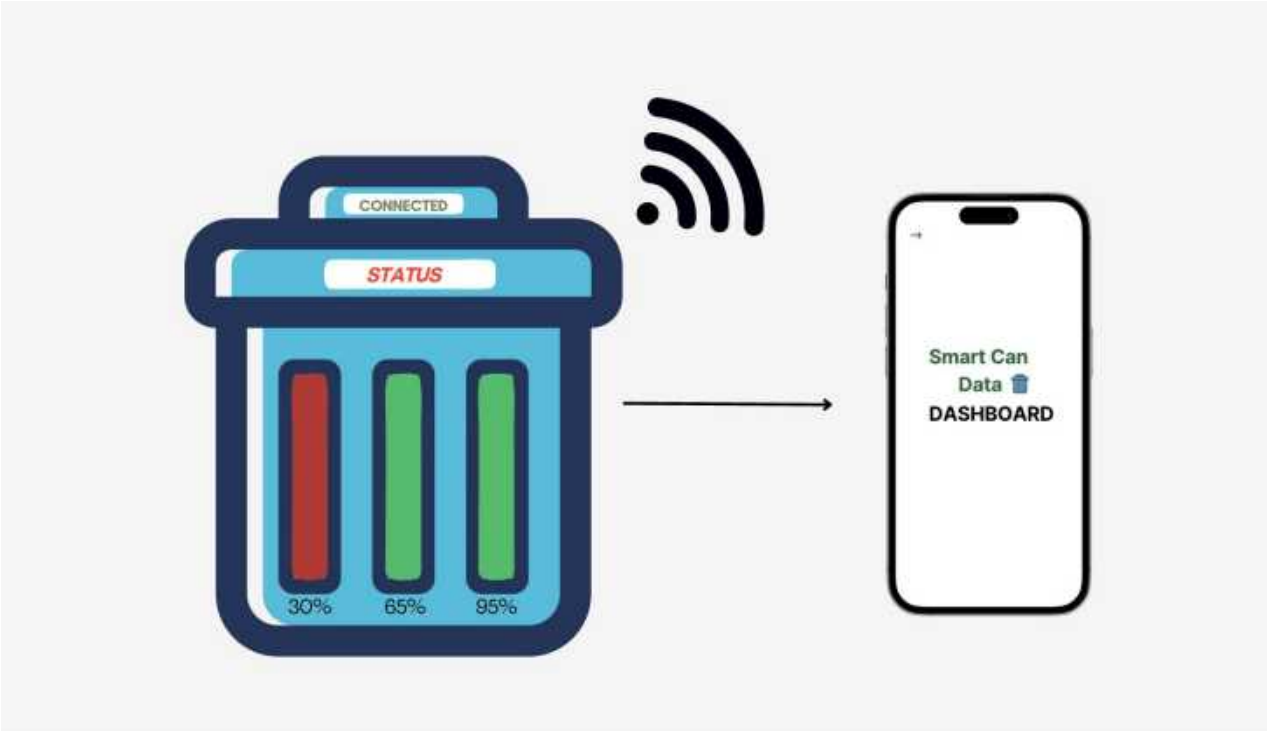



# *“Smart Can” Project*

# 2

# Problem Statement of SmartCan

*A peer in the class works at the student union as a housekeeping assistant as part of their workstudy. There are times where they get irritated because they need to aimlessly walk around trying to figure out which trashcans are full. Time is wasted and could clearly be more efficient. With technology available, we can use sensors regarding weight and ll lines to determine whether a trashcan is full or not. We can create a system where employees when emptying a trashcan updates a database that the trashcan is now empty and does not need to be taken care of anymore. An application can be created to house the functionality of such things. It would make the Union more efficient and able to focus on other housekeeping duties besides emptying trashcans which includes setting up events, keeping tables clean, and much more. I feel like there is a lot of potential with this in regards to improving housekeeping units throughout Carolina facilities.*




## SMART BINS, CLEAANER SPACES

**SmartCan transforms the way we clean by equipping each trash can with a sensor, optimizing waste collection . This innovation not only conserves resources but also saves valuable time for facility staff, improving efficiency.**

**SmartCan – Intelligent Public Waste Sorting Assistant**
SmartCan is a public waste-sorting assistant designed to improve recycling behavior through a combination of behavioral incentives, intuitive UI, and responsive hardware. The project originated from an everyday challenge: how to make waste sorting more engaging, accurate, and accessible in public spaces.

Key design highlights include:
**•Interactive UI with animated feedback to guide proper sorting**
**•Auditory and visual cues to enhance user engagement**
**•Sensor integration (e.g., proximity detection) for touchless interaction**
**•Modular structure optimized for rapid prototyping and field deployment**

The system was developed using Arduino microcontrollers, laser-cut enclosures, and a touchscreen interface to create an approachable, gamified sorting experience. The project emphasizes sustainability and public interaction, blending human-centered design with environmental impact.

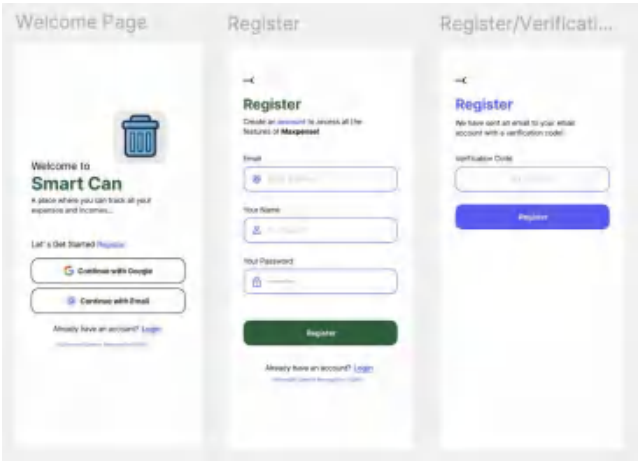
Through SmartCan, I explored how technology can subtly guide behavior in shared spaces. This project not only deepened my understanding of physical computing and UI/UX, but also demonstrated the power of small interventions in promoting civic habits.

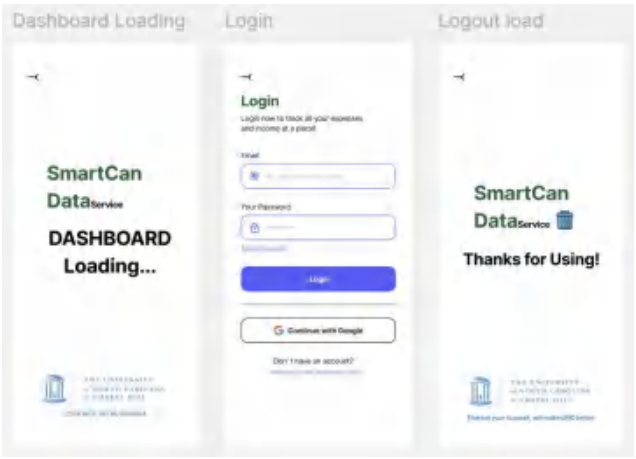
1. Video Present (by my teamate): https://drive.google.com/file/d/1u9LIlKw_rQLjnEOTz0LkGYq26AO5lW36/view?usp=sharing

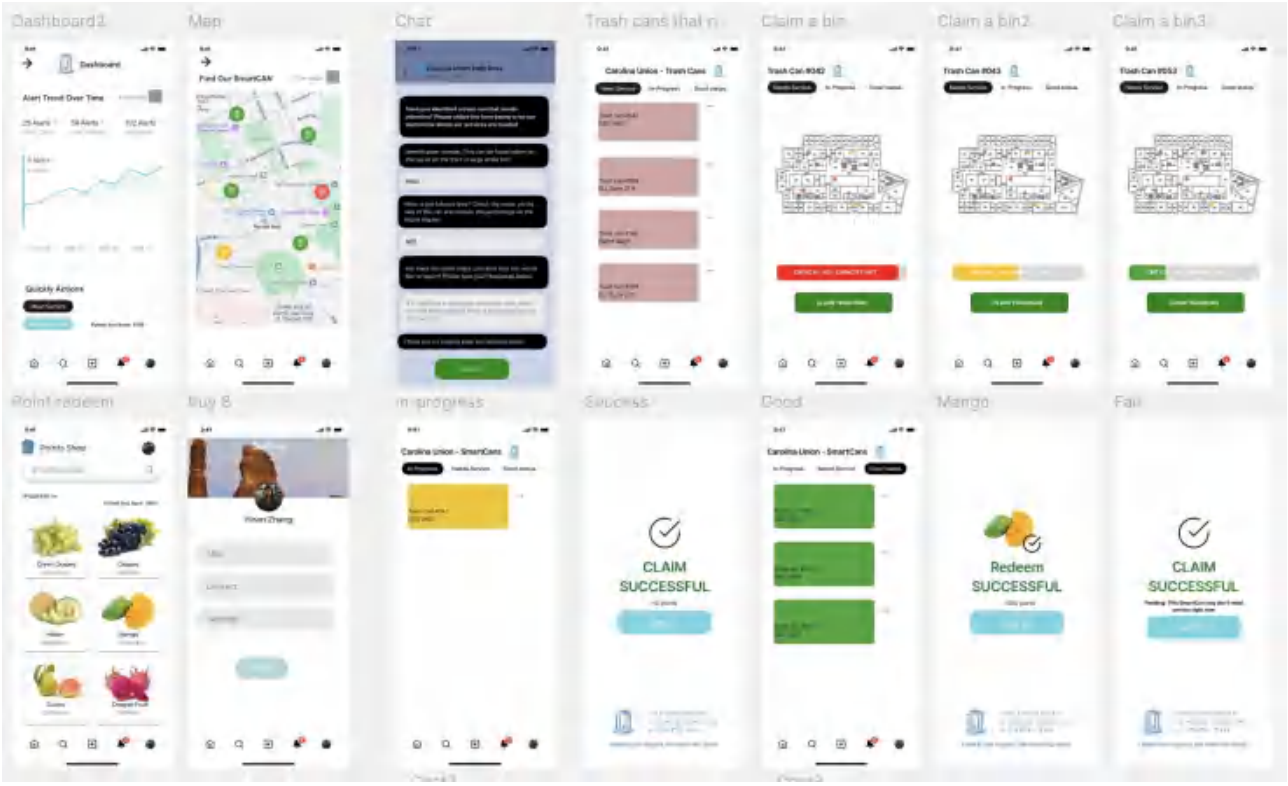
2. Slide Present: https://www.canva.com/design/DAGITfGR2q4/21nrPgkHa31oii2ZyjWe_Q/edit?utm_content=DAGITfGR2q4&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton

3.Wireframes: https://www.figma.com/proto/2xDEdNctryKHFfdE12Qlfk/SmartCAN?node-id=0-2&t=sP3IhO5JfyVHB5NR-1

https://www.figma.com/proto/2xDEdNctryKHFfdE12Qlfk/SmartCAN?node-id=50-11921&t=sP3IhO5JfyVHB5NR-1



# Market Validation & Business Strategy

- ***North America Smart Bin Market: $10.7M (2023) → $19.5M (2030) – CAGR 9.1%*** ***(Grand View Research)***
- ***Global Smart Waste Management: $3.52B (2024) → $9.01B (2033) – CAGR 11%*** ***(Straits Research)***
- ***Global Smart Trash Bin: $3.08B (2023) → $28.12B (2032) – CAGR 27.88%*** ***(Market Research Future)***

**Commercial Expansion:**

- *Target universities, malls, airports, hospitals*
- *Subscription SaaS model*
- *Add-on features: analytics, route optimization*

**Campus Integration:**

- *Pilot program at UNC Student Union*
- *Supports Green Office & Smart Campus initiatives*

**Gamified Reward System:**

- *Leaderboards for janitor performance*
- *Monthly "Green Hero" awards*
- *Use logs for HR evaluations*

# System Requirements

- Real-Time Monitoring: The system must provide real-time updates on the fill level and weight of trashcans to optimize collection efficiency.
- User-Friendly Design: The mobile/web application should have an intuitive interface that allows housekeeping staff to check bin statuses and update them easily when emptied.
- Reliable Data Transmission: Sensors must communicate data effectively via Wi-Fi or Bluetooth to a centralized database without frequent disconnections.
- Durability and Maintenance: Sensors and microcontrollers must withstand daily use in a high-traffic environment and require minimal maintenance.
- Security and Privacy: The system should protect user data and prevent unauthorized access to sensor readings and the application.

**Project Title:**

**SMARTCAN - Smarter Bins, Cleaner Spaces**

**Team Members:**

- **Yihan Zhang** – Lead Developer (App & Sensor Integration)
- **Phanisree Akshinthala** – UI/UX Designer & Requirements Lead
- **Emma Sutton** – Testing Lead & Documentation Specialist

**Proofreading Order:** Yihan → Emma → Phanisree

## 1. Problem Statement

At UNC's Student Union, janitorial staff waste valuable time checking trash cans manually—only to find many of them are not full and missing the ones that are. This inefficiency limits their ability to focus on other essential duties. SMARTCAN addresses this problem by embedding weight and fill-level sensors inside trash bins, which sync with a mobile/web app to display real-time bin statuses. Staff can then easily identify which bins need emptying and mark them as cleared.

## 2. Summary

SMARTCAN is a smart waste monitoring system that boosts operational efficiency. The system combines weight and infrared/ultrasonic sensors with a microcontroller and wireless module. Data is transmitted to a centralized cloud database and displayed in a simple, user-friendly app. This reduces labor waste, supports better resource planning, and enhances overall cleanliness.

## 3. Persona

**Name:** Celia Martin
**Occupation:** Carolina Union Maintenance Director
**About:** Celia lives in Durham, NC with her husband of 32 years, Charles. She has been working at the Carolina Union for 15 years and was promoted to Maintenance Director in 2017. Now, she manages a team of 25 maintenance workers that work tirelessly to keep the

Union up, running and clean. In the post-COVID world, her responsibilities have only multiplied. Her biggest pet peeve is inefficiency.

**Scenario:** Celia comes into work for a shift following a large-scale event at the Union. She needs to deploy her task force to the areas that were in use during the event. Ideally, she will be able to consult the sensor board from her SmartCan app. Using the workflow composed by this data, she sends three of her team members to assist.

**4. Work Plan**

| Task | Responsible Member | Timeline |
|---|---|---|
| Market Research | All Members | Week 1 |
| User Interviews & Requirements | Phanisree | Week 1–2 |
| UI/UX Mockups (Figma) | Phanisree | Week 3–4 |
| Sensor Prototyping | Yihan | Week 3–5 |
| App Development | Yihan | Week 5–10 |
| Internal Testing | Emma | Week 8–9 |
| External User Testing | Emma | Week 10–11 |
| Optimization & Debugging | Yihan + Emma | Week 12–13 |
| Final Integration & Report | All Members | Week 14 |

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**5. Market Research Summary**

- **North America Smart Garbage Bin Market**: Valued at USD 10.7 million in 2023 and expected to grow to USD 19.5 million by 2030 (CAGR 9.1%).
- **Global Smart Waste Management Market**: Valued at USD 3.52 billion in 2024, expected to reach USD 9.01 billion by 2033 (CAGR 11%).
- **Global Smart Trash Bin Market**: Valued at USD 3.08 billion in 2023, expected to reach USD 28.12 billion by 2032 (CAGR 27.88%).

These trends validate the need for SMARTCAN and its growth potential.

**6. Unit Cost Feasibility (Per Trash Bin)**

| Component | Quantity | Unit Cost ($) | Subtotal ($) |
|---|---|---|---|
| Trash Can Body (plastic/metal) | 1 | 30 | 30 |
| Weight Sensor | 1 | 10 | 10 |
| Ultrasonic Fill-Level Sensor | 1 | 15 | 15 |
| Microcontroller (e.g., Arduino) | 1 | 35 | 35 |
| Wireless Module (Wi-Fi/Bluetooth) | 1 | 10 | 10 |
| 3-Color LED Light | 1 | 5 | 5 |
| Voice Playback Module | 1 | 8 | 8 |
| Buttons (Status & Alert) | 2 | 2 | 4 |
| Power Supply (Battery or AC) | 1 | 10 | 10 |
| Software Integration & Setup | 1 | 50 | 50 |
| Packaging & Delivery | 1 | 10 | 10 |
| Warranty & Maintenance (1 year) | 1 | 10 | 10 |
| **Total per Unit** | - | - | **$197** |

**7. System Requirements**

1. Real-time bin status updates (weight + fill-level)
2. Simple and intuitive mobile/web interface
3. Reliable wireless transmission (Wi-Fi/Bluetooth)
4. Durable, low-maintenance sensor hardware
5. Privacy and role-based access to usage data

**8. End-User Questionnaire**

1. How do you currently determine which bins need emptying?

2. What are the biggest issues with that method?
3. How often do you check bins during a shift?
4. Would real-time alerts help? What type of alert would you prefer (visual/audio/vibration)?
5. Are there any other cleaning tasks that could benefit from similar technology?

**9. Prototype Structure & Interactions**

**A. Hardware Design (Trash Can)**

- Internal sensor measures fill level in 5 zones
- The external sensor measures total weight
- Voice module reads status aloud
- LED lights indicate fill level
- Button triggers alerts or manual status reporting

**B. App Dashboard**

- Displays floor plan and bin locations
- Color-coded status indicators
- Allows janitors to mark bins as emptied
- Records data for admin reporting

**10. Business & Sustainability Strategy**

**A. Commercial Expansion**

- Sell complete systems to universities, malls, airports, and hospitals
- Offer optional analytics and optimization features

- Subscription model for software support and updates

**B. Campus Integration**

- Pilot deployment at UNC
- Align with Smart Campus and sustainability goals
- Collaborate with student orgs for training and engagement

**C. Rewards & Gamification**

- Track staff performance via time logs and bin interactions
- Reward high performers with badges or recognition
- Provide performance data to HR for internal use

## 11. Conclusion

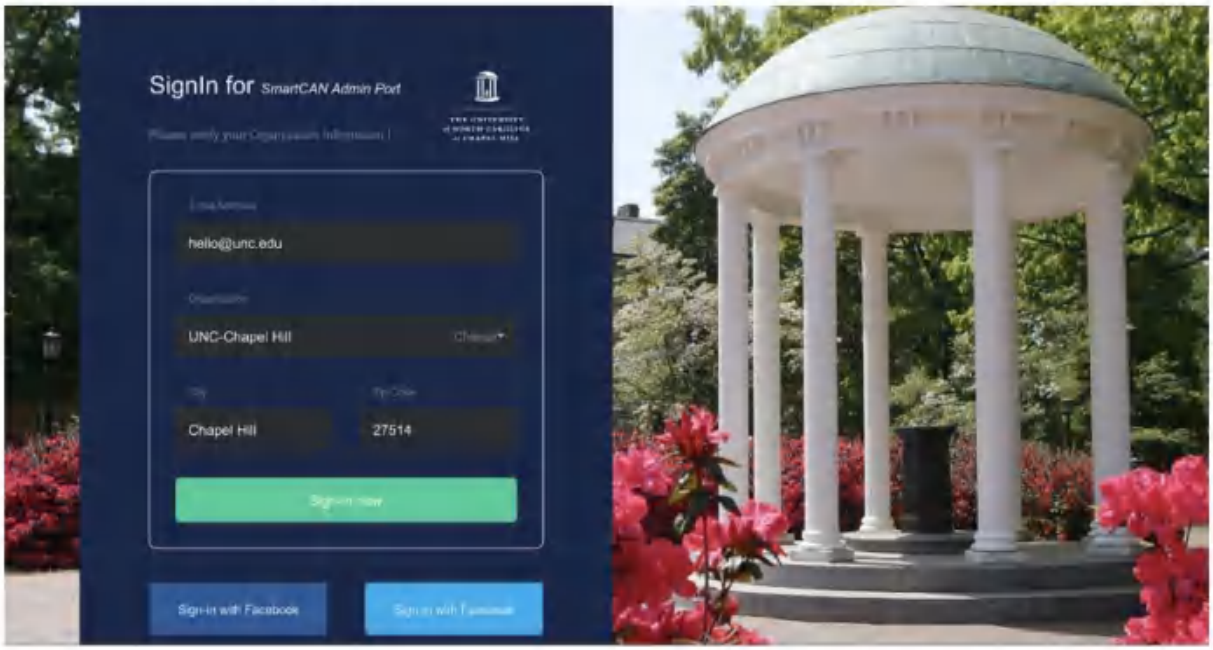
SMARTCAN exemplifies how simple innovations can make a lasting impact on operational efficiency, sustainability, and quality of life in shared campus spaces. By addressing a real pain point for UNC's janitorial staff, our team developed a responsive, sensor-driven waste management solution that reduces unnecessary labor, supports data-informed decision-making, and aligns with broader Smart Campus initiatives.

From ideation and research through to testing and integration, each phase of this project was shaped by user feedback, market viability, and technical feasibility. SMARTCAN is not just a prototype—it is a scalable and sustainable system ready to evolve alongside the growing demand for smart infrastructure in public and institutional settings.

We are proud of what we've built and excited by the potential for SMARTCAN to expand beyond campus use to commercial and public environments. With further refinement and integration of user feedback, this system is well-positioned for real-world deployment.

*Please refer to the following pages for a comprehensive look at our UI/UX design journey, including screenshots from our interactive Figma mockups.*

**Admin View Walk-through**




This is where an administrator or maintenance worker would sign into their own account.

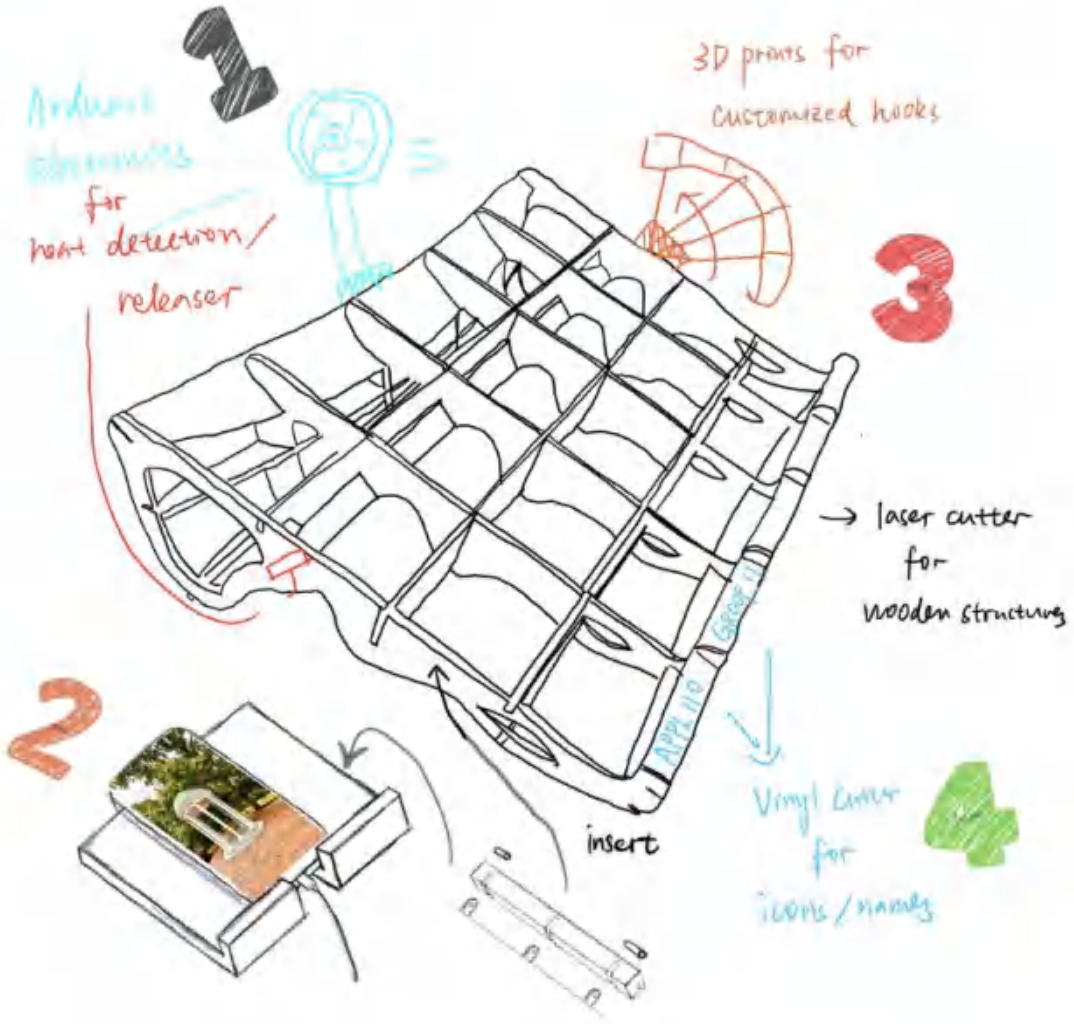

Once they have registered or signed in, they will be given access to their own dashboard, and depending on their administrative status, they will be able to see the entire building and statistics they manage.

Full file: https://docs.google.com/document/d/1KlSu1Fm-VyzzhLqNbTbrmWaBFshPcsSsvnZWJd7C-oI/edit?usp=sharing

*“Chill by U”*

# 3

# APPL 110 GP11 Sketch

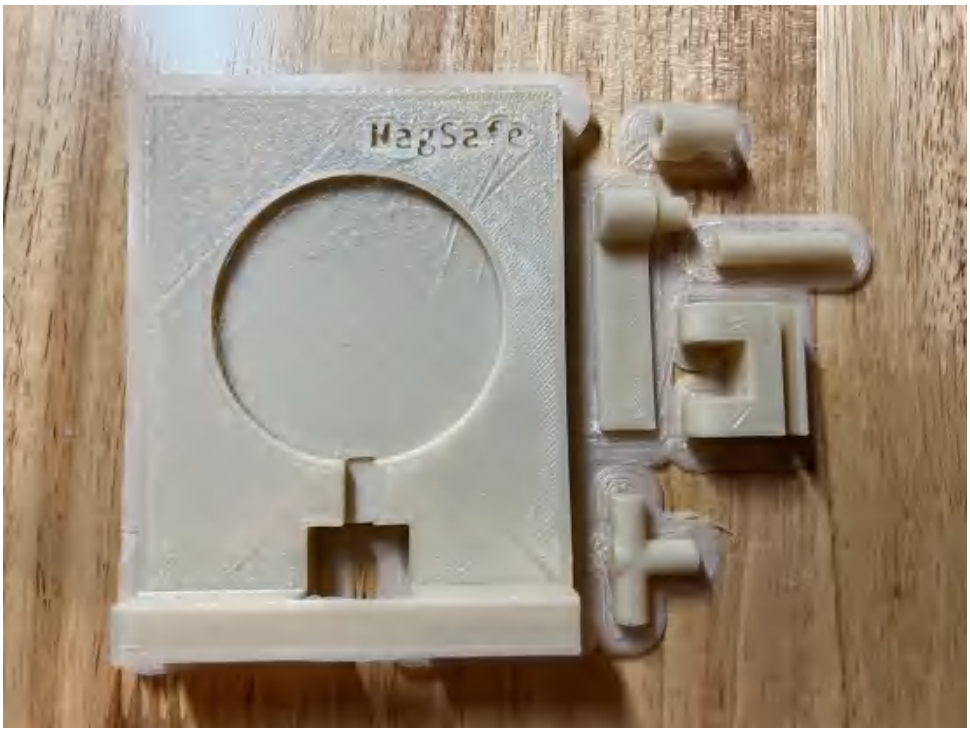



# Chill by "U"

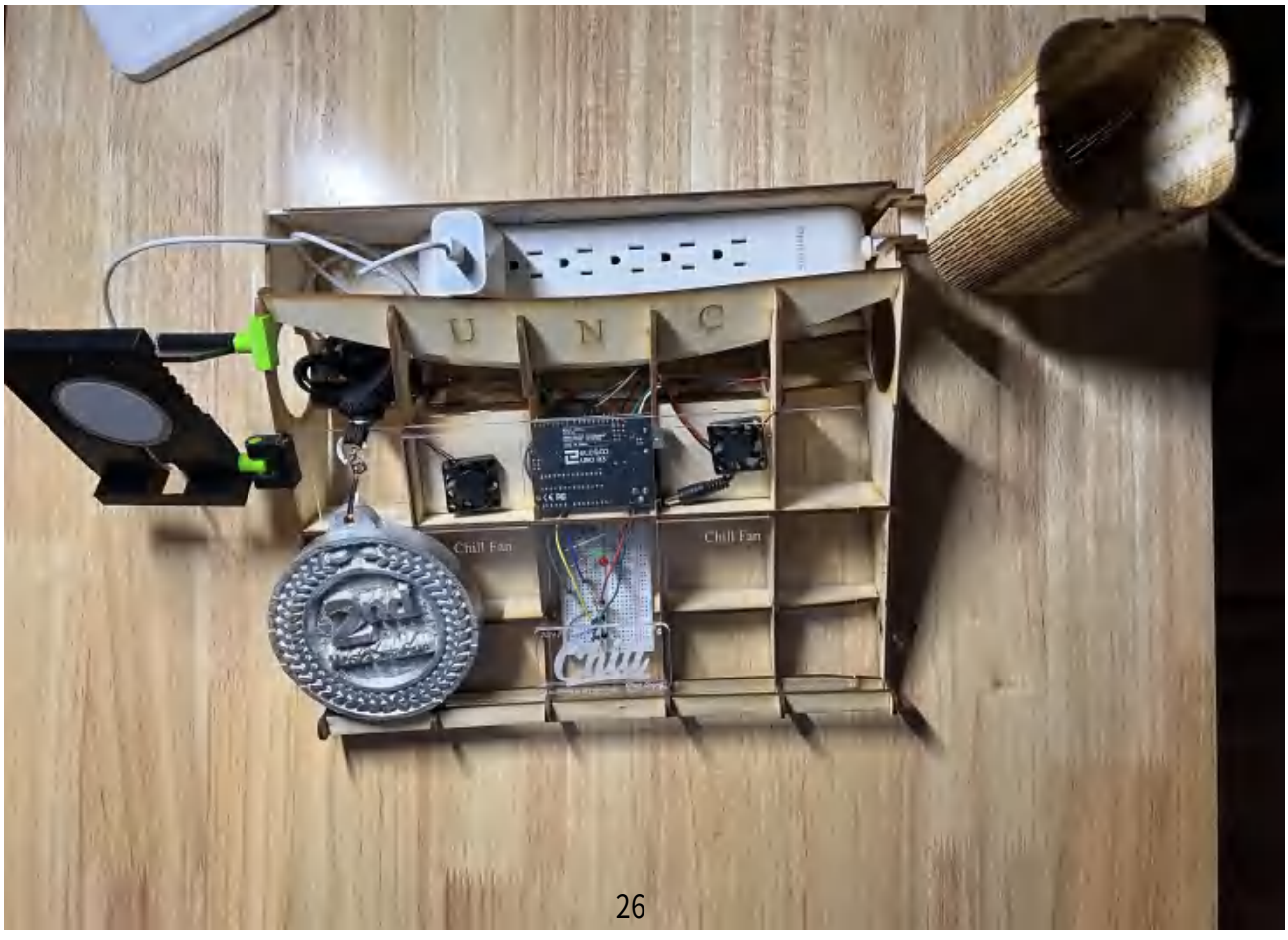
Sponsored by
BEAM
BE A MAKER

2024 Maker Fest

# *3D Print Part Prototype*




# *Final Prototype*



# *Plan & Price*

*Professional*

- Pro Laptop base
- One free Side Accessories
- Power module space
- Support extra circuit modules

From **28.99$**


*by "U"*

- All *Professional* configuration
- Customized accessories combination
- Customized electronics Mode
- Implement Your Own design
- One on one, unique

From **39.99$**

Present:

https://www.canva.com/design/DAGXf6OXt88/r4-a_kmvmrv5o9LK23VRaQ/edit?utm_content=DAGXf6OXt88&utm_campaign=designshare&utm_medium=link2&utm_source=sharebutton

## Conclusion & Future *Outlook!*

When our product is put to use in the real world.

1. I believe that our innovative project successfully achieved the initially analyzed set goals and effectively met the needs of the targeted user group.

2. improve portability
   enhance usability
   more versatile & affordable

**Seeking Partners | Investors**

(Make it more innovative together)

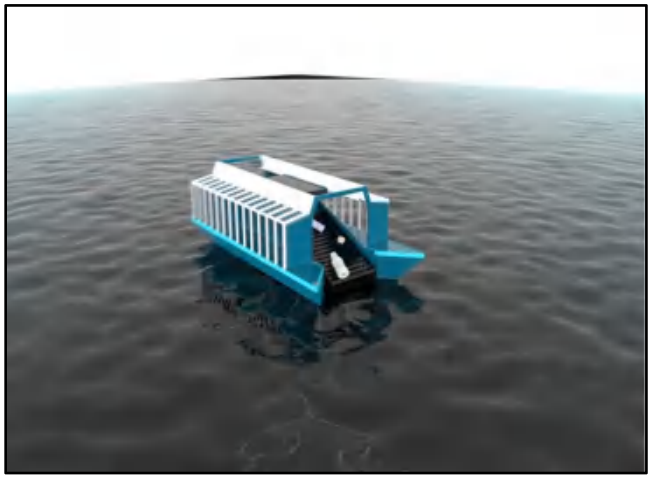
# Major Iterations

1.Laser cut Base

2. 3D Phone Holder with Magesafe

# *TEMPEST SCC*

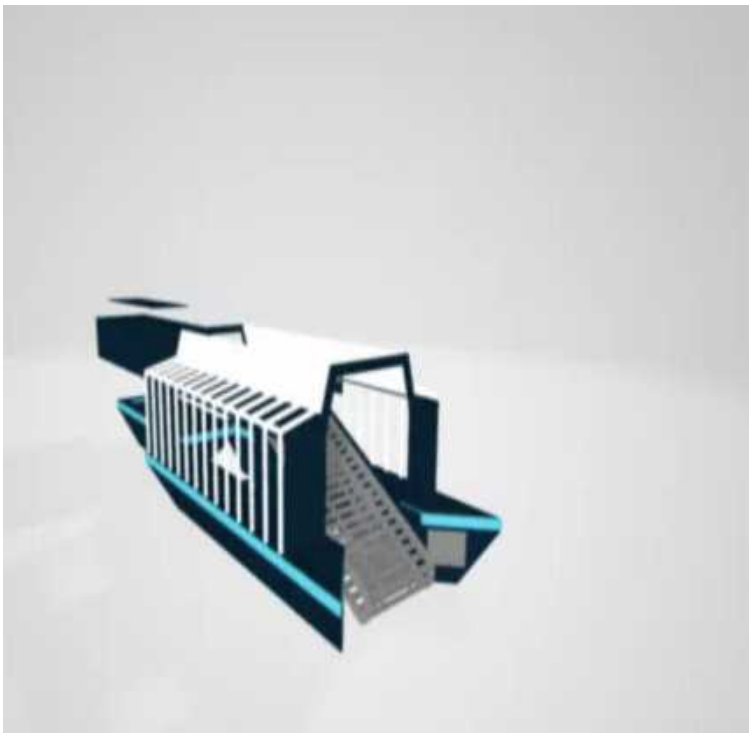
# 4

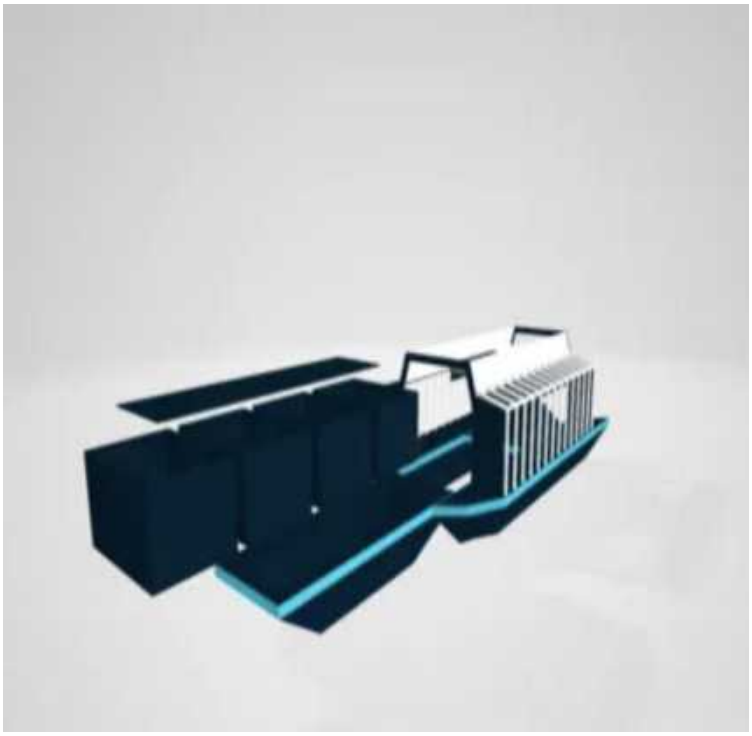



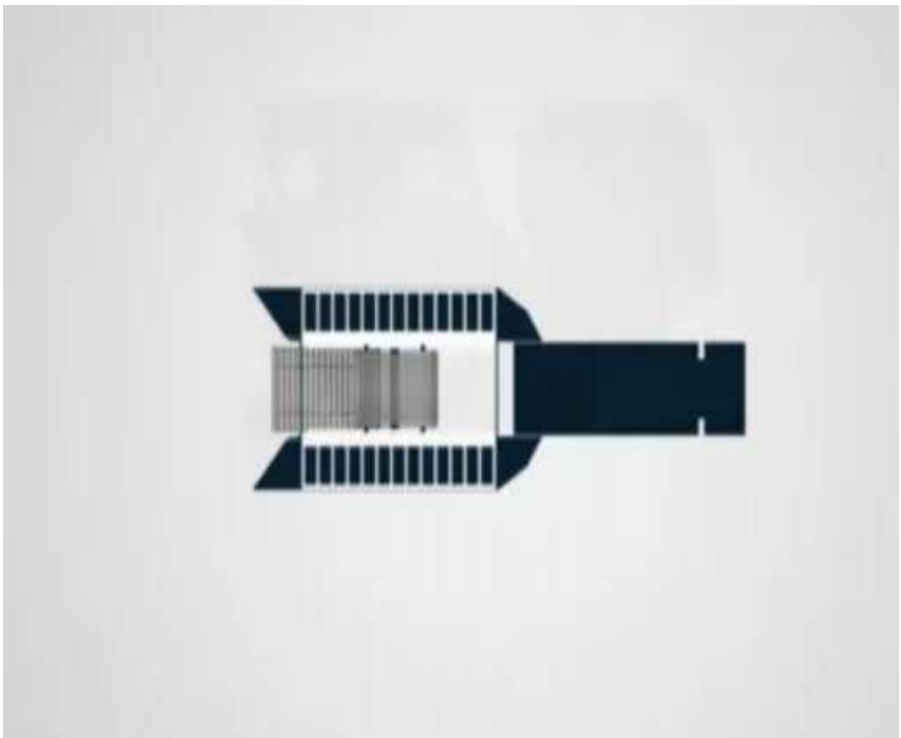

**Title:***WKU TEMPEST SCC*
**Date of completion:** *2022*
**Media type:** Environment protect solution with Interactive web-site
**Duration:** 30 *Days*
**Reference Website:** *https://wd27167994.fkguest.com/*
**Description:** *Garbage pollution impacts the water resources and surrounding environment. The pollution in the small waters like rivers and ponds threatens the human living environment, affecting the quality of living state and ecosystem. So, considering the importance of the environment and human health, the vessel is developed to clean garages efficiently.*

*The vessel is moved according to the set route and collects the garages in front of the vessel. Once the sensor at the front of the vessel detects something is stays still for more than 3 seconds, the state will be considered full and return to the original place. In addition, vessel can dive and clean garbage underwater. The garbage is stored in the storage bin. Also, User can control the vessel when needed.*

# 3D Model







# Internet User Experience Plan

**We have designed our web portal, which not only serves as a promotional tool but also makes it easier for visitors to understand the importance of protecting the environment and to increase their awareness of conservation.**

**Accordingly, we also released the first version of our WeChat app (WKU-specific version), which initially allows university students to experience protecting the school environment and at the same time to be aware of their environmental responsibilities, for which we also issued an incentive policy that allows users to receive certain prizes by posting information about environmental protection on campus.**


# Plan for cooperation with government departments

**We hope to increase the promotion and function improvement of our small program in the time to come, and at the same time introduce universities and communities to achieve the cleanup of small watershed ponds to create a comfortable environment.**

## Why Solve Plastic Pollution So Important

### Pressure of Over-exploitation

Life begins with water, human beings choose water to live, water resources have always been the basic natural resources and strategic economic resources of human beings, everywhere need sufficient, high-quality fresh water sources.

### Water Shortage Country 's Help

In the vast arid-semi-arid areas of North China and Northwest China, groundwater is often the main or even the only source of water supply.

### Solve the problem of groundwater over-exploitation

More than 50 cities in China have experienced different degrees of ground subsidence, and are mainly concentrated in the relatively densely populated central and eastern regions.

**Title of the proposed project :**

Garbage collection vessel

**Keywords**

Cleanup of garbage in water area, Plastic pollution, Garbage Collector, GPS

**Abstract**

Garbage pollution is caused by human activities. Garages are often not be cleaned in time and therefore accumulate in water areas, which causes severe water pollution and harms the local ecosystem. Many relevant equipments can collect garbage on the large waters, but a few are working on the small waters. In addition, it is a heavy workload to clean all the garages regularly by human resources. Hence, the article aims to develop a vessel that can automatically collect garages on the small waters and save human resources.

**Description**

Garbage pollution impacts the water resources and surrounding environment. The pollution in the small waters like rivers and ponds threatens the human living environment, affecting the quality of living state and ecosystem. So, considering the importance of the environment and human health, the vessel is developed to clean garages efficiently.

The vessel is moved according to the set route and collects the garages in front of the vessel. Once the sensor at the front of the vessel detects something is stays still for more than 3 seconds, the state will be considered full and return to the original place. In addition, vessel can dive and clean garbage underwater. The garbage is stored in the storage bin. Also, User can control the vessel when needed.

**Goals**

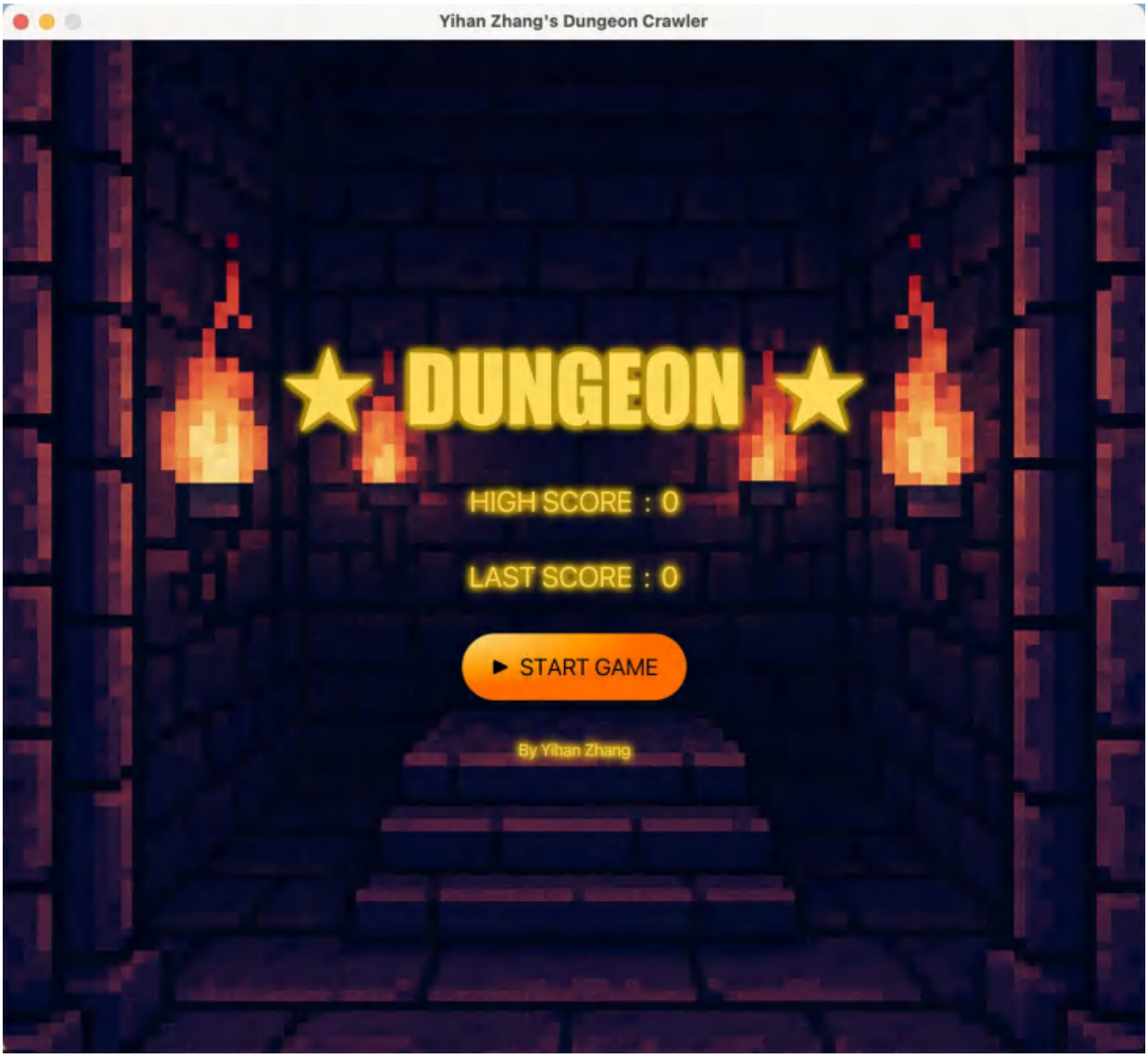
Hence, the article aims to develop a vessel that can automatically collect floating garages on the pond and save human resources.

**Methodology**

1. Doing research about relevant internet resources and articles for the types of garbage cleaning equipment and environment equipment.
2. Design the structure of engineering and model of the vessel, then test the model's capability and make changes accordingly.

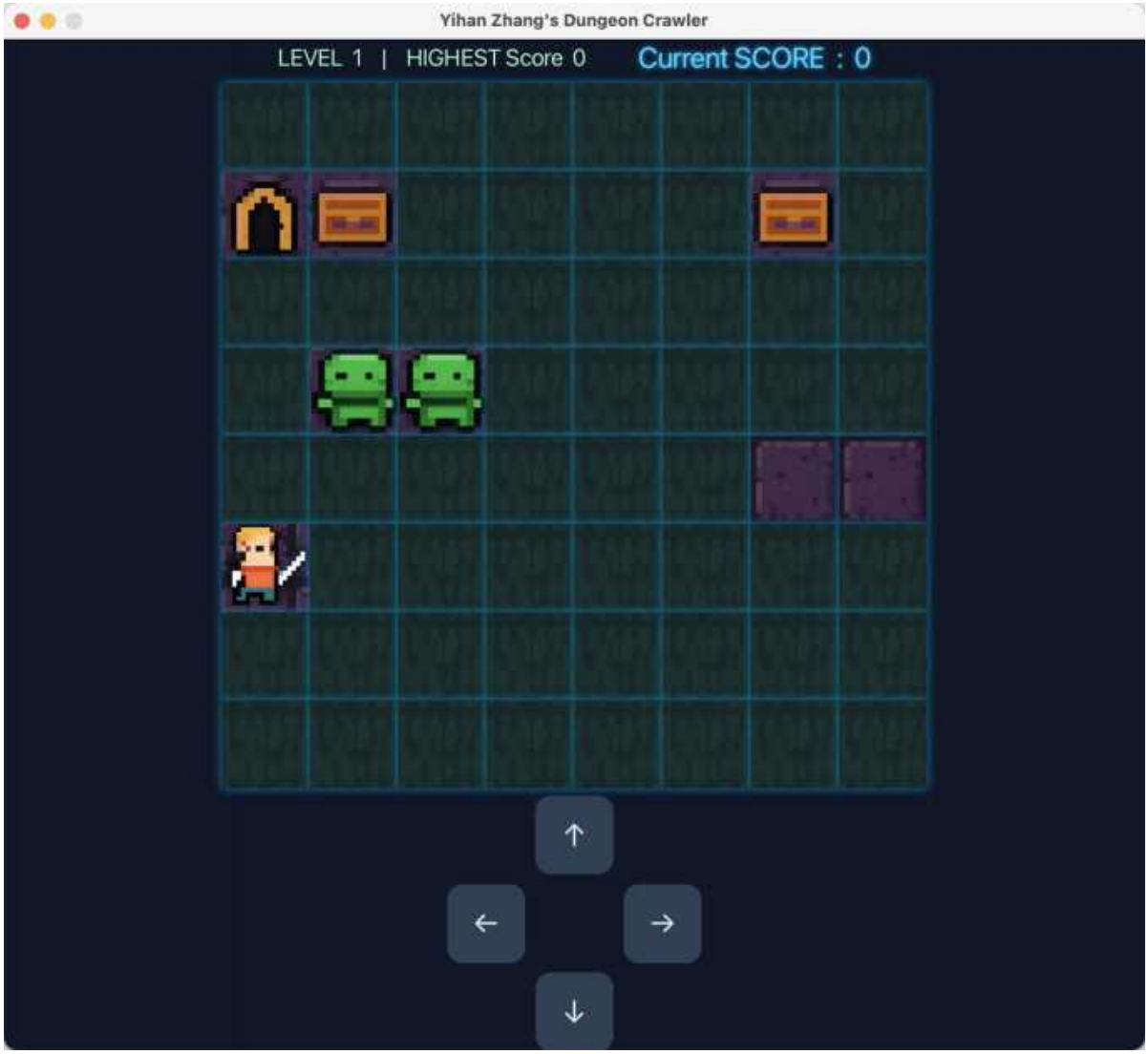
***Game “dungeon” (Java)***

# 5




**Project Title: Dungeon Escape**
Genre: 2D Top-Down Dungeon Adventure Game
Technologies: Java, JavaFX, OOP, MVC Architecture

**Description:**
Dungeon Escape is a Java-based 2D dungeon adventure game where players navigate through a maze-like environment filled with hidden keys, traps, doors, and enemies. The game emphasizes object-oriented programming principles and follows the Model-View-Controller (MVC) design pattern to ensure modular, scalable code architecture. Players must explore, collect keys, avoid hazards, and unlock doors to progress through increasingly challenging levels. The game includes customizable levels, enemy behavior logic, and real-time updates using JavaFX.

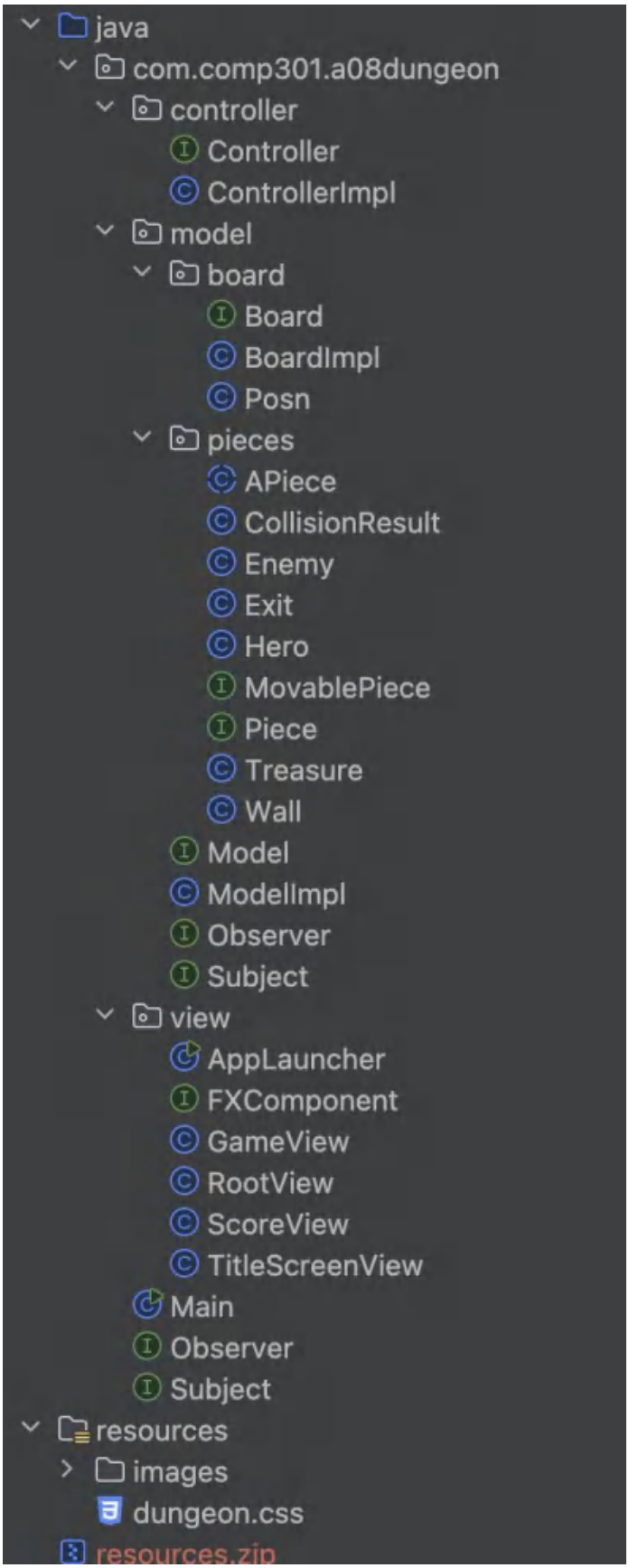



**Overview**
A fast-paced dungeon crawler where players collect treasure chests (+100 points), avoid deadly monsters, and reach the exit to advance through levels.

**How to Play**
•**Move:** W/A/S/D or Arrow Keys
•**Collect:** Walk into chests to earn points
•**Avoid:** Touching a monster ends the game
•**Goal:** Navigate the maze, grab chests, and reach the exit to progress

**Game Over:**
One touch from a monster = instant death. No second chances!

**"One path, one chance—grab the treasure, dodge the doom."**




Clone: https://github.com/COMP301-S25/dungeon-the-sequel-YihanZhang-UNC.git

# *Geography Analysis (GIS)*

# 6

# GEOG215 Final Project: Population Change and Unemployment

Yihan Zhang

2025-04-25

## Topic

This project examines the spatial relationship between annual population change (2023-2024) and unemployment rates across the United States. Specifically, the research explores how unemployment rates might correlate with demographic changes, including migration patterns and natural population growth.

## Data

We have three datasets:

1. Population Change Data ( `NST-EST2024-COMP.xlsx` ):
    - Format: Excel (.xlsx)
    - Variables of interest: State name, Total Population Change (2023-2024), Net Migration, Births, Deaths
    - Source: U.S. Census Bureau
2. Unemployment Rate Data ( `Over-the-Year Change in Unemployment Rates for States.xlsx` ):
    - Format: Excel (.xlsx)
    - Variables of interest: State name, unemployment rate
    - Source: U.S. Bureau of Labor Statistics (BLS)
3. Spatial Data ( `tl_2024_us_state.shp` ):
    - Format: Shapefile (.shp)
    - Extent: All U.S. states
    - Resolution: Polygon features
    - Source: U.S. Census Bureau (TIGER/Line Shapefile)

## Data Import and Preparation

```
# Import Population data
pop_data <- read_excel("/Users/zhayihan/Desktop/Resource/2025 Spring/GEOG 215/PROJ 2/NST-EST2024-COMP.xlsx", skip
= 9, col_names = c(
  "State", "Total_Pop_Change_2023_2024", "Natural_Change",
  "Births", "Deaths", "Net_Migration_Total", "International_Migration",
  "Domestic_Migration", "Total_Pop_Change_2020_2024",
  "Natural_Change_2020_2024", "Births_2020_2024", "Deaths_2020_2024",
  "Net_Migration_Total_2020_2024", "International_Migration_2020_2024",
  "Domestic_Migration_2020_2024"
)) %>%
  filter(!State %in% c("United States", "District of Columbia", "Puerto Rico")) %>%
  mutate(State = tolower(gsub("^\\.", "", State)))

# Import Unemployment data
unemp_data <- read_excel("/Users/zhayihan/Desktop/Resource/2025 Spring/GEOG 215/PROJ 2/Over-the-Year Change in Un
employment Rates for States.xlsx") %>%
  mutate(
    State = tolower(State),
    UnemploymentRate = `25rate`
  ) %>%
  select(State, UnemploymentRate)

# Import Spatial data
spatial_data <- st_read("/Users/zhayihan/Desktop/Resource/2025 Spring/GEOG 215/PROJ 2/tl_2024_us_state.shp") %>%
  st_transform(crs = 4326)
```

```
## Reading layer `tl_2024_us_state' from data source
##   `/Users/zhayihan/Desktop/Resource/2025 Spring/GEOG 215/PROJ 2/tl_2024_us_state.shp'
##   using driver `ESRI Shapefile'
## Simple feature collection with 56 features and 15 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: -179.2311 ymin: -14.60181 xmax: 179.8597 ymax: 71.43979
## Geodetic CRS:  NAD83
```

# Data Cleaning and Verification

```
state_data <- pop_data %>%
  inner_join(unemp_data, by = "State")

state_spatial <- spatial_data %>%
  mutate(NAME = tolower(NAME)) %>%
  inner_join(state_data, by = c("NAME" = "State"))

head(state_spatial)
```

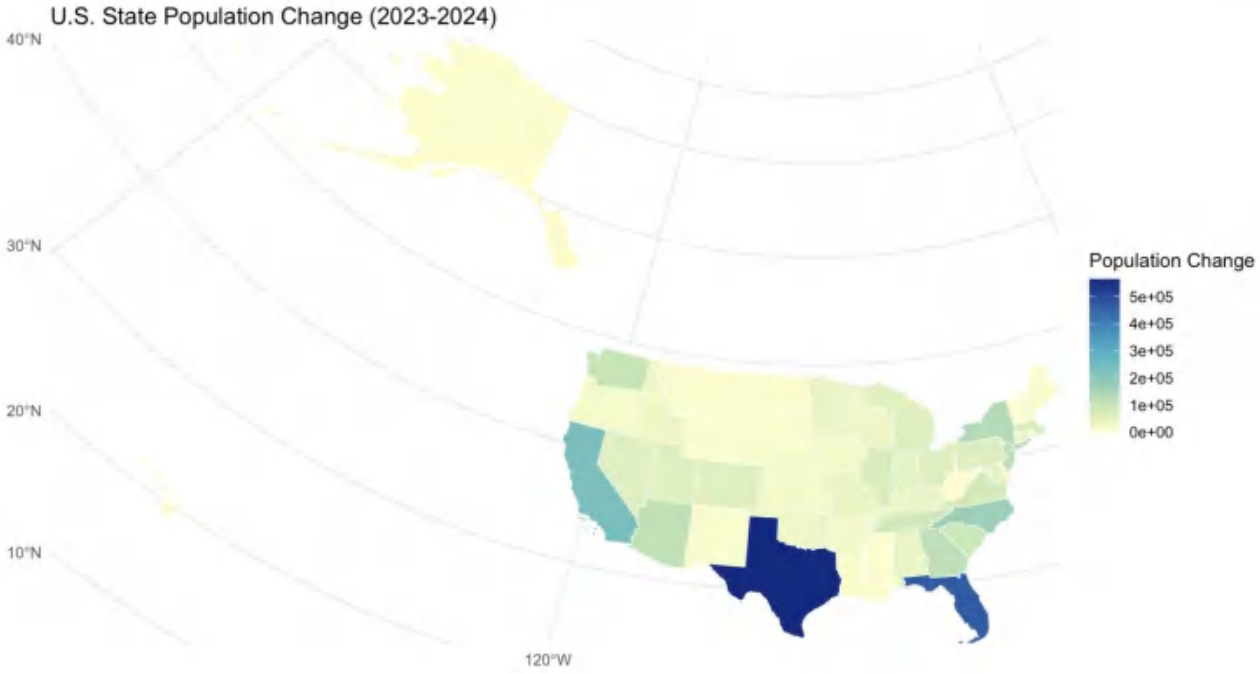
```
## Simple feature collection with 6 features and 30 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: -97.23909 ymin: 24.39631 xmax: -71.08857 ymax: 49.38448
## Geodetic CRS:  WGS 84
##   REGION DIVISION STATEFP  STATENS GEOID     GEOIDFQ STUSPS          NAME LSAD
## 1      3        5      54 01779805    54 0400000US54     WV west virginia   00
## 2      3        5      12 00294478    12 0400000US12     FL       florida   00
## 3      2        3      17 01779784    17 0400000US17     IL      illinois   00
## 4      2        4      27 00662849    27 0400000US27     MN     minnesota   00
## 5      3        5      24 01714934    24 0400000US24     MD      maryland   00
## 6      1        1      44 01219835    44 0400000US44     RI  rhode island   00
##   MTFCC FUNCSTAT        ALAND      AWATER    INTPTLAT     INTPTLON
## 1 G4000        A  62266513826   488918898 +38.6472854 -080.6183274
## 2 G4000        A 138965379385 45968913048 +28.3989775 -082.5143005
## 3 G4000        A 143778206717  6216848695 +40.1028754 -089.1526108
## 4 G4000        A 206244791203 18937236061 +46.3159573 -094.1996043
## 5 G4000        A  25151223822  6979843236 +38.9466584 -076.6744939
## 6 G4000        A   2677768885  1323681453 +41.5964850 -071.5264901
##   Total_Pop_Change_2023_2024 Natural_Change Births Deaths Net_Migration_Total
## 1                       -516          -7844  16680  24524                7361
## 2                     467347          -7321 220659 227980              475339
## 3                      67899          11012 125355 114343               56720
## 4                      40103          11780  61438  49658               28379
## 5                      46158          11604  65609  54005               34591
## 6                       8879           -362   9924  10286                9220
##   International_Migration Domestic_Migration Total_Pop_Change_2020_2024
## 1                    2841               4520                      -23757
## 2                  411322              64017                     1834023
## 3                  112955             -56235                     -111656
## 4                   29540              -1161                       86459
## 5                   53100             -18509                       81591
## 6                    9525               -305                       14954
##   Natural_Change_2020_2024 Births_2020_2024 Deaths_2020_2024
## 1                   -41824            71955            113779
## 2                  -102012           924877           1026889
## 3                    25566           547493            521927
## 4                    51570           268689            217119
## 5                    45443           286867            241424
## 6                    -3605            43009             46614
##   Net_Migration_Total_2020_2024 International_Migration_2020_2024
## 1                         17893                              7597
## 2                       1931865                           1059143
## 3                       -139399                            278657
## 4                         33161                             81091
## 5                         33748                            154183
## 6                         18240                             26871
##   Domestic_Migration_2020_2024 UnemploymentRate                       geometry
## 1                        10296              3.9 MULTIPOLYGON (((-77.75438 3...
## 2                       872722              3.6 MULTIPOLYGON (((-83.10874 2...
## 3                      -418056              4.8 MULTIPOLYGON (((-87.89243 3...
## 4                       -47930              3.0 MULTIPOLYGON (((-95.31991 4...
## 5                      -120435              3.0 MULTIPOLYGON (((-75.756 39....
## 6                        -8631              4.7 MULTIPOLYGON (((-71.67881 4...
```

# Quantitative Analysis Plan

The primary analysis involves examining spatial autocorrelation patterns and visualizing the spatial distribution of population changes and unemployment rates using both static ( `ggplot2` ) and interactive ( `leaflet` ) maps.

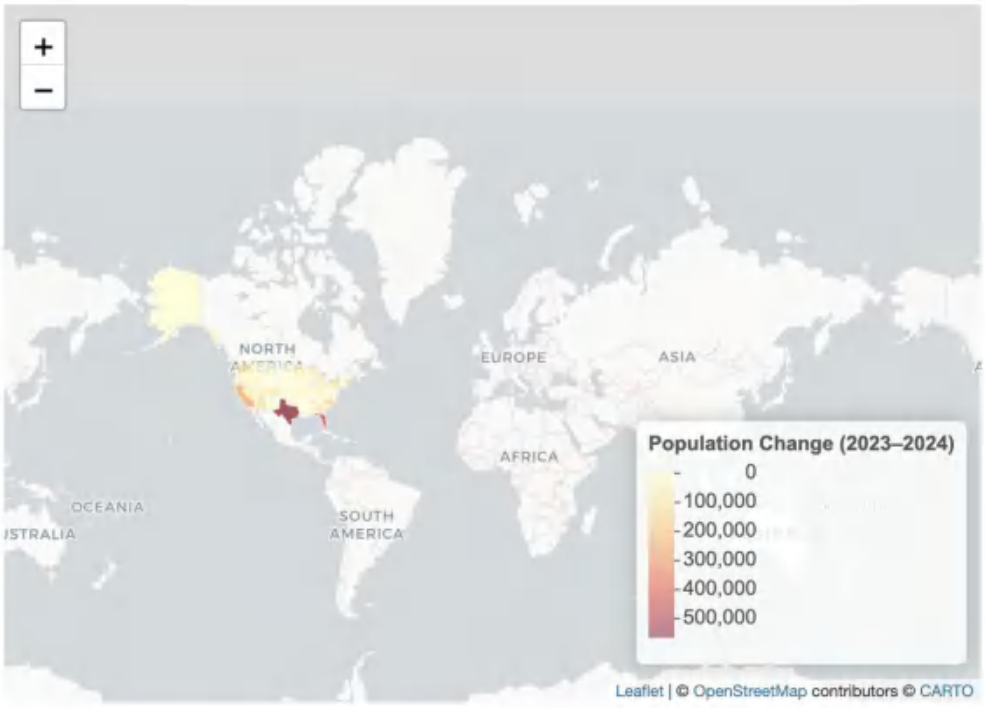
# Static Map

```
ggplot(state_spatial) +
  geom_sf(aes(fill = Total_Pop_Change_2023_2024), color = "white") +
  scale_fill_distiller(palette = "YlGnBu", direction = 1, name = "Population Change") +
  coord_sf(crs = st_crs(5070), expand = FALSE) +
  labs(title = "U.S. State Population Change (2023-2024)") +
  theme_minimal() +
  theme(aspect.ratio = 0.6)
```




# Interactive Leaflet Map

```
leaflet_map_data <- st_transform(state_spatial, crs = 4326)

pal <- colorNumeric(
  palette = "YlOrRd",
  domain = leaflet_map_data$Total_Pop_Change_2023_2024,
  na.color = "gray"
)

leaflet(leaflet_map_data) %>%
  addProviderTiles("CartoDB.Positron") %>%
  addPolygons(
    fillColor = ~pal(Total_Pop_Change_2023_2024),
    fillOpacity = 0.7,
    color = "white",
    weight = 1,
    popup = ~paste0(
      "<strong>", NAME, "</strong><br/>",
      "Population Change: ", Total_Pop_Change_2023_2024, "<br/>",
      "Unemployment Rate: ", UnemploymentRate, "%"
    )
  ) %>%
  addLegend(
    pal = pal,
    values = ~Total_Pop_Change_2023_2024,
    title = "Population Change (2023-2024)",
    position = "bottomright"
  )
```




# Global Spatial Autocorrelation (Moran's I)

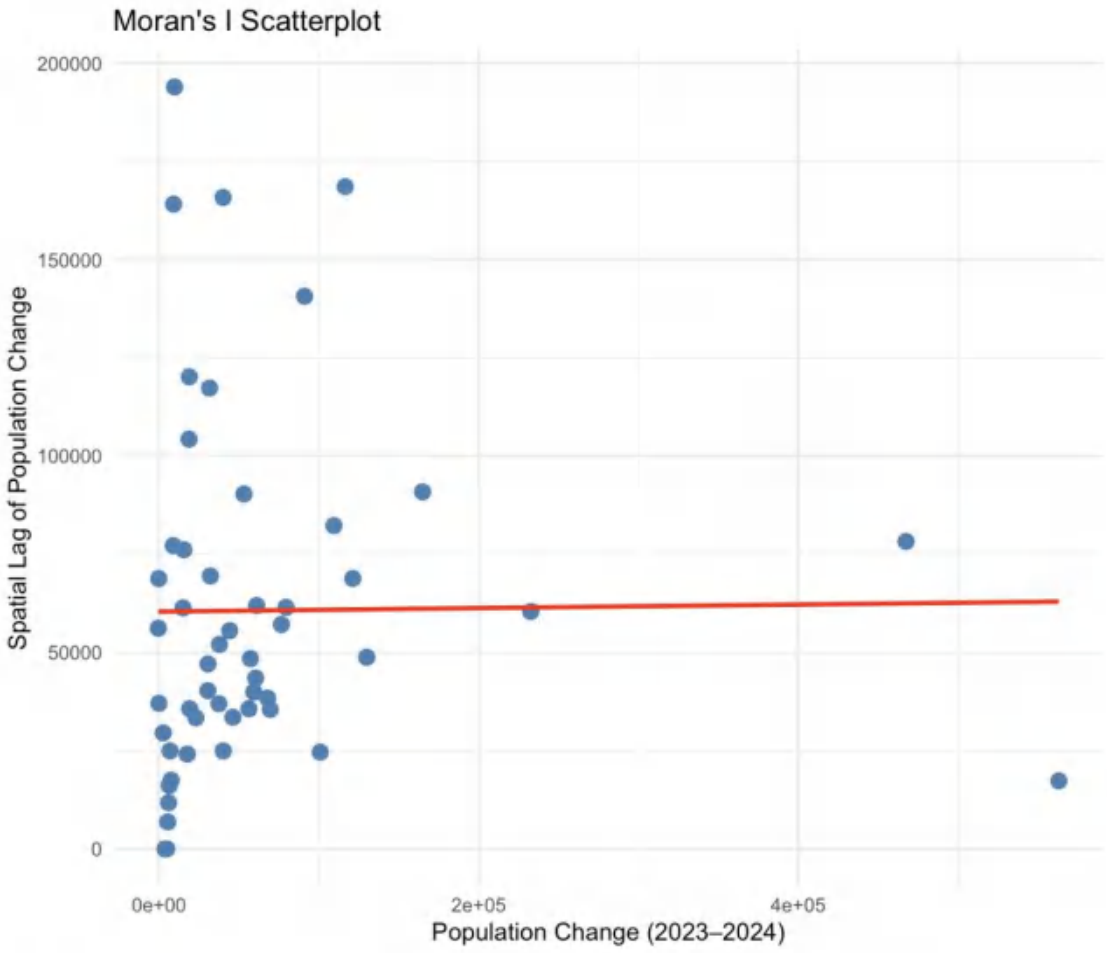
```
nb <- poly2nb(state_spatial)
listw <- nb2listw(nb, style = "W", zero.policy = TRUE)

# Moran's I test result
moran_result <- moran.test(state_spatial$Total_Pop_Change_2023_2024, listw, zero.policy = TRUE)
moran_result
```

```
##
##  Moran I test under randomisation
##
## data:  state_spatial$Total_Pop_Change_2023_2024
## weights: listw
## n reduced by no-neighbour observations
##
## Moran I statistic standard deviate = 0.13385, p-value = 0.4468
## alternative hypothesis: greater
## sample estimates:
## Moran I statistic       Expectation          Variance
##      -0.010123670      -0.020833333       0.006401638
```

```
# Create Moran scatterplot
lagged_values <- lag.listw(listw, state_spatial$Total_Pop_Change_2023_2024)
state_spatial$lagged <- lagged_values
```

# Moran Scatterplot

```
ggplot(state_spatial, aes(x = Total_Pop_Change_2023_2024, y = lagged)) +
  geom_point(color = "steelblue", size = 3) +
  geom_smooth(method = "lm", se = FALSE, color = "red") +
  labs(
    title = "Moran's I Scatterplot",
    x = "Population Change (2023–2024)",
    y = "Spatial Lag of Population Change"
  ) +
  theme_minimal()
```




# Interpretation

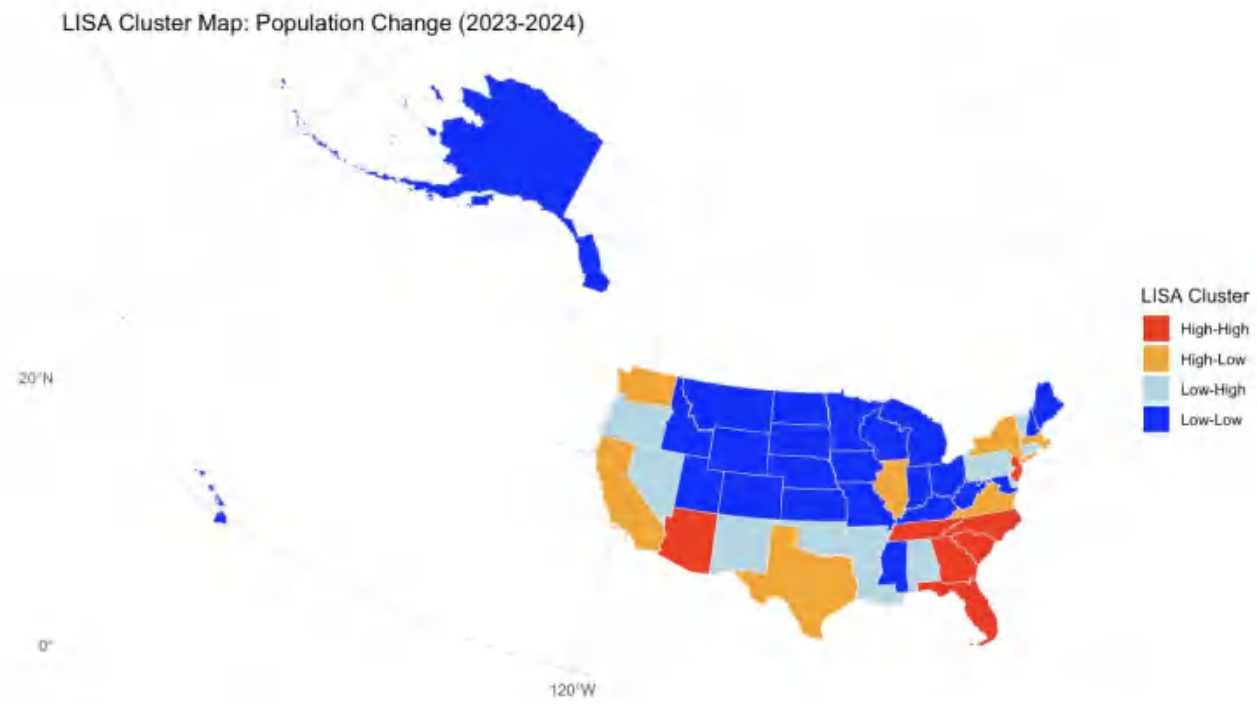
The Global Moran's I statistic for state-level population change between 2023 and 2024 was **–0.0101**, with a p-value of **0.4468**. This indicates **no significant spatial autocorrelation**, suggesting that population change is **not strongly clustered geographically** across U.S. states. In other words, states with high or low population change are **not significantly surrounded by other states with similar values**. This result is consistent with a more random spatial distribution pattern.

# Local Spatial Autocorrelation (LISA Analysis)

```
moran_local <- localmoran(state_spatial$Total_Pop_Change_2023_2024, listw, zero.policy = TRUE)

state_spatial$Ii <- moran_local[, 1]
state_spatial$quadrant <- NA
mean_pop <- mean(state_spatial$Total_Pop_Change_2023_2024, na.rm = TRUE)
mean_lag <- mean(lag.listw(listw, state_spatial$Total_Pop_Change_2023_2024), na.rm = TRUE)

# Determine quadrant
for (i in 1:nrow(state_spatial)) {
  x <- state_spatial$Total_Pop_Change_2023_2024[i] - mean_pop
  y <- lag.listw(listw, state_spatial$Total_Pop_Change_2023_2024)[i] - mean_lag
  if (x > 0 & y > 0) {
    state_spatial$quadrant[i] <- "High-High"
  } else if (x < 0 & y < 0) {
    state_spatial$quadrant[i] <- "Low-Low"
  } else if (x > 0 & y < 0) {
    state_spatial$quadrant[i] <- "High-Low"
  } else if (x < 0 & y > 0) {
    state_spatial$quadrant[i] <- "Low-High"
  } else {
    state_spatial$quadrant[i] <- NA
  }
}
```

# LISA Cluster Map

```
# Reproject to EPSG 5070 for better visual proportions
state_spatial_5070 <- st_transform(state_spatial, crs = 5070)

ggplot(state_spatial_5070) +
  geom_sf(aes(fill = quadrant), color = "white") +
  scale_fill_manual(
    name = "LISA Cluster",
    values = c("High-High" = "red", "Low-Low" = "blue", "High-Low" = "orange", "Low-High" = "lightblue"),
    na.value = "grey90"
  ) +
  labs(title = "LISA Cluster Map: Population Change (2023-2024)") +
  theme_minimal() +
  theme(aspect.ratio = 0.6)
```




# LISA Cluster Interpretation

The Local Indicators of Spatial Association (LISA) cluster map reveals spatial clustering patterns of population change across U.S. states from 2023 to 2024:

1.High-High (Red) clusters appear in southeastern states such as Florida, Georgia, and South Carolina, indicating states with high population change surrounded by similarly high-changing neighbors.

2.Low-Low (Blue) clusters dominate much of the central and northern U.S., including states like North Dakota, Iowa, and Montana, suggesting widespread regions with low population growth surrounded by low-growth neighbors.

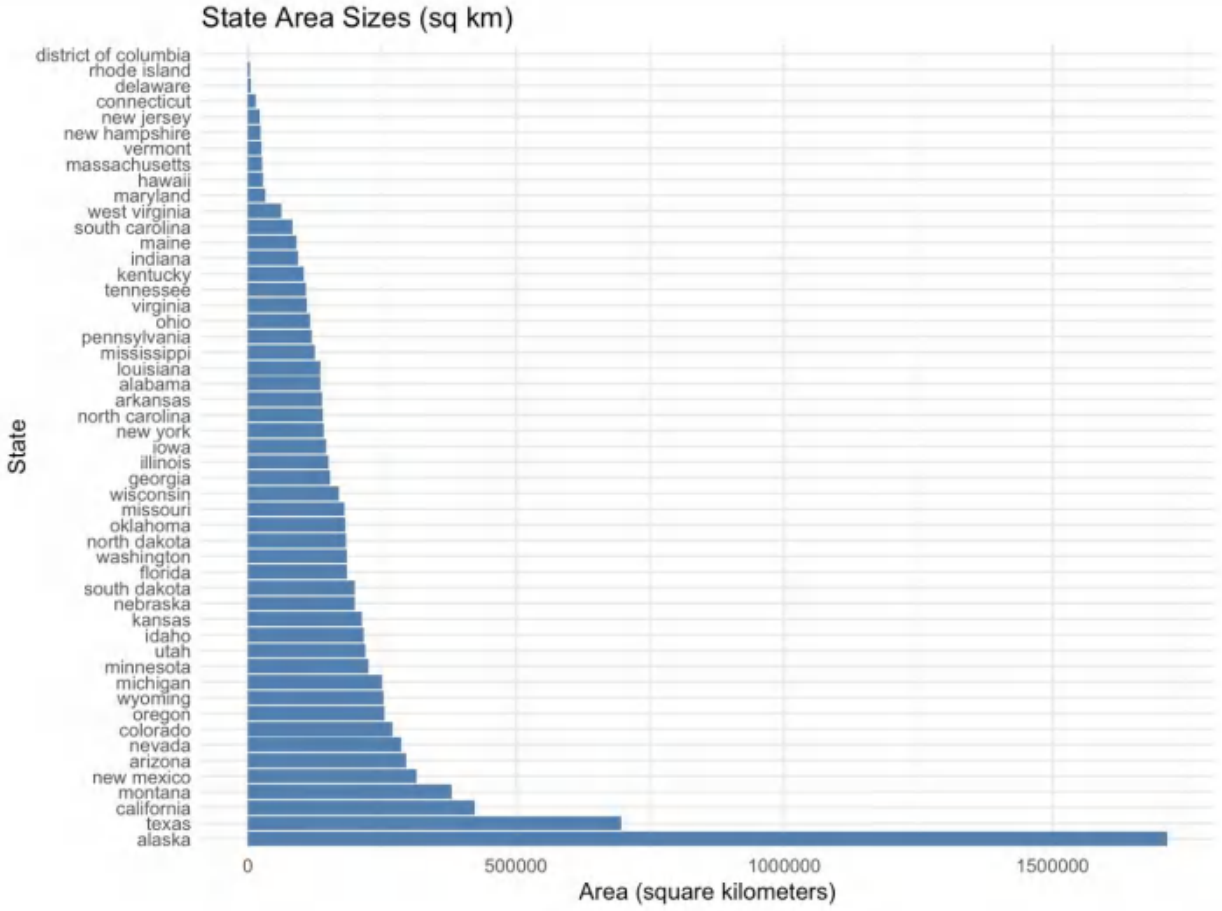
3.High-Low (Orange) clusters, such as Texas and California, suggest that these high-growth states are surrounded by states with relatively lower population change.

4.Low-High (Light Blue) clusters are less common but appear in states like Nevada and Arizona, where low population change occurs near high-growth areas.

This analysis highlights significant regional disparity in population dynamics. The southeast shows strong positive clustering (growth reinforcing growth), while central states are more stagnant. Such spatial patterns warrant further investigation into local economic, social, or environmental drivers of population movement.

# Landscape Metrics

```r
# Calculate state areas (as a proxy for landscape size)
state_spatial$area_sqkm <- as.numeric(st_area(state_spatial)) / 10^6

# Plot distribution of state areas
state_spatial %>%
  ggplot(aes(x = reorder(NAME, -area_sqkm), y = area_sqkm)) +
  geom_col(fill = "steelblue") +
  coord_flip() +
  labs(
    title = "State Area Sizes (sq km)",
    x = "State",
    y = "Area (square kilometers)"
  ) +
  theme_minimal()
```



# Limitations

The data used have certain limitations:

1.Spatial data includes broad Native areas, which might not perfectly match true state shapes, causing slight spatial distortion. 2.Unemployment data are state-level and mask intra-state variations. 3.Future analysis would benefit from finer-grained (county or city-level) datasets and multivariate spatial modeling.

# Conclusion

This project demonstrates how spatial data can be used to visualize and quantify geographic patterns in demographic and economic conditions. Our results suggest some degree of spatial clustering in population change, confirmed by Global Moran's I. The LISA analysis further identifies localized clusters of states with similar patterns. Future research should expand this analysis to smaller geographic units and incorporate spatial regression methods.

# Final Reflection

In this project, we utilized a systematic spatial analysis workflow—including attribute-spatial data integration, static and interactive mapping, and spatial autocorrelation analysis—to investigate how industrial presence may relate to public health disparities across U.S. states. Although the general structure mirrors common practices in spatial analysis (such as those examining population change or economic indicators), the datasets, research focus, and interpretations are entirely distinct.

Specifically, this project centers on environmental exposure as a key driver of health inequality, providing a novel perspective on spatial injustice. By linking facility density to health rankings, we highlight spatial patterns that suggest regions with more industrial activity may experience poorer health outcomes. This approach emphasizes both the power of geospatial methods and the importance of thoughtful topic selection in spatial inquiry.

Future research could enhance these findings by incorporating finer-scale county-level data, pollutant concentration metrics, or longitudinal health outcomes to better capture local environmental health dynamics.

***HealthMate App Rendering***

# 7

**HealthMate App Rendering**

HealthMate is an app for health and wellness that I specifically redesigned for older adults with mild to moderate hearing or vision impairments. The redesign came in response to a local clinic's request to assist their older clients in tracking their health metrics on a day-to-day basis—daily steps, blood pressure, along with medication reminders—and share that information securely with health providers. The clients largely live independently and are not familiar with technology, so the app needed to be intuitive, readable, and useable even for those with vision or hearing impairments.

The driving force behind my redesign is that most health tracking applications available today are not created with seniors or accessibility in mind. They are too full of complex features, have tiny text, and dense information displays. Such design pitfalls lead to frustration and may deter use, particularly for seniors with only essential functions in mind. I aimed to pare down the interface to its bare necessities, with all still maintaining a fluid experience and secure communication between physicians and patients.

To start the design process, I researched older adults' habits and needs as seniors interact with their phones. I discovered that seniors prefer large displays with high contrast, voice entry or text in place of typing, and simple navigation with few decision points. Seniors wish to have an app where they can monitor their vitals, receive pill reminders, and send questions to their doctor—all with simple taps. From this research, I gave high priority to four essential features in my wireframe design:

- **Daily pill reminders with alerts**
- **Step-counting and activity tracking basics**
- **Manual or device-based entry of key health information (weight, blood pressure, glucose)**
- **Secure messaging or straightforward data-sharing with consented-to health care providers**

Home section (wireframes 1–4) contains four modules for tracking data: body weight, heart rate, daily steps, and blood pressure. The screens are organized with large, clear numbers and high-contrast charts, enabling instant viewing of progress. The step screen, for example, comes with large, clear circular progress indication of steps taken vs. a target, where blood pressure comes with visual separation of systolic and diastolic over time.

The medication reminder screen (wireframe 5) is also structured for predictability and simplicity. Instead of exact times, it uses straightforward language such as "30min after meal," making it less dependent upon strict clock-bound schedules. Medications are also color coded with their respective hospital or prescription sources. A "favorite" function allows one to mark most essential medications.

Secure messaging functionality (6–7) accommodates both text and voice messages. Given how more seniors prefer speaking over typing, I built in recording and playing voice notes from physicians. The large bubble, readable time stamps, and sensible threading of messages in the chatting view facilitate return to previous talks with ease, as well as direct communication with assigned physicians.

In the account and settings section (wireframe 8), account settings, password change, font size adjustment, and ARS (Accessibility Response Settings) customization are available. This may involve activating

colorblind mode or adjusting touch target size. The settings menu contains all of these operations grouped in an organized manner to avoid cognitive load.

Accessibility in all screens was a major concern. Color contrast levels were also tested through accessibility contrast checkers to validate conformity. Meaninful text labels accompany all icons, and nothing important is conveyed through colour alone. The spacing of the elements in the UI was generous, with elements sized to handle shaking hands or impaired vision.

Besides accessibility, I also focused on navigation simplicity and flow. Each module is accessed from the bottom bar, with all detail screens having an explicit back button to go to the previous state. Every navigation path—from logging in, to seeing today's blood pressure, to responding to a doctor's message—is three clicks or less, and is intuitive.

In short, HealthMate aimed to combine simplicity with necessary functionality. It accommodates everyday self-tracking, medication compliance, and direct communication with health care professionals, without distraction or excessive complexity. With emphasis placed upon high legibility, intuitive interaction, and accessibility features, this redesign increases older users' access to mobile health care management. I think that HealthMate presents a practicable, sympathetic solution to the everyday problems many seniors encounter when trying to manage their health electronically.

**Description – Accessible Health Tracker App for Seniors**

HealthMate is a health and wellness app I redesigned specifically for older adults with mild to moderate vision or hearing impairments. Built upon insights from user research and a local clinic's request, the app focuses on simplifying digital health tracking through an intuitive, highly legible, and accessible interface.

Key features include:

- **Daily pill reminders with alerts**
- **Step tracking and vital data entry (e.g., weight, blood pressure, glucose)**
- **Voice-friendly secure messaging with physicians**
- **Accessible design with high contrast, large text, and minimal navigation steps**

The interface was developed using wireframes with user-centered modules, allowing older adults to independently track health data and communicate with doctors in just a few taps. Voice note support, simplified reminders, and ARS (Accessibility Response Settings) ensure inclusivity without overwhelming users.

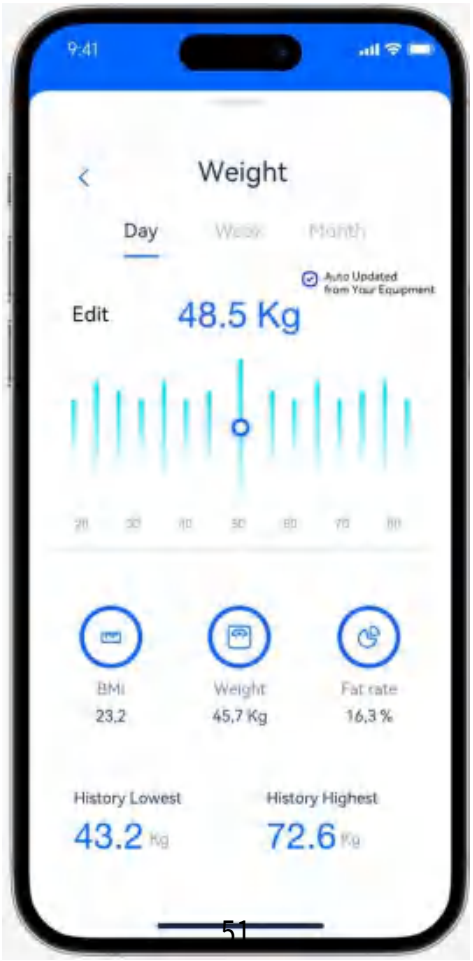
Through minimalism and thoughtful UX, HealthMate transforms mobile health apps into reliable companions for seniors, balancing clarity, care, and function.

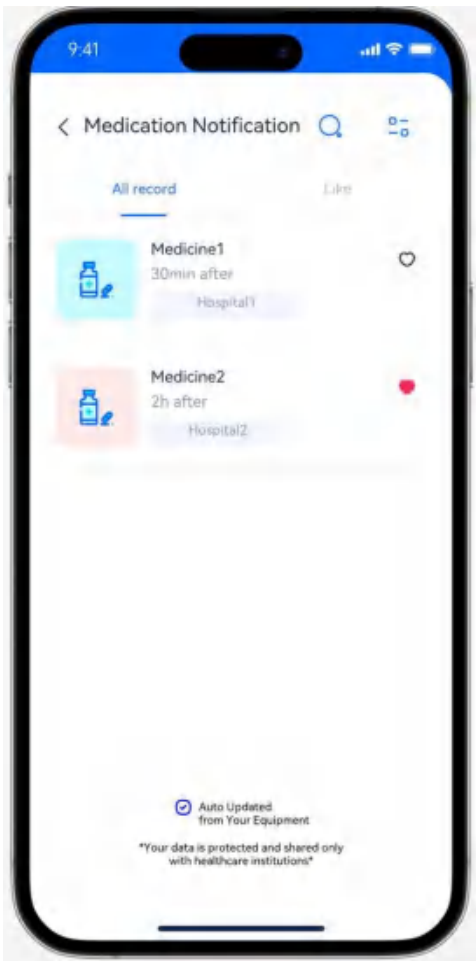

9:41
Health Data
Good Morning, User
Today's Health Data
Auto Updated from Your Equipment
Steps
7.384
Steps
63
Heart rate
86 bpm
Blood Pressure
222/185
mmHg

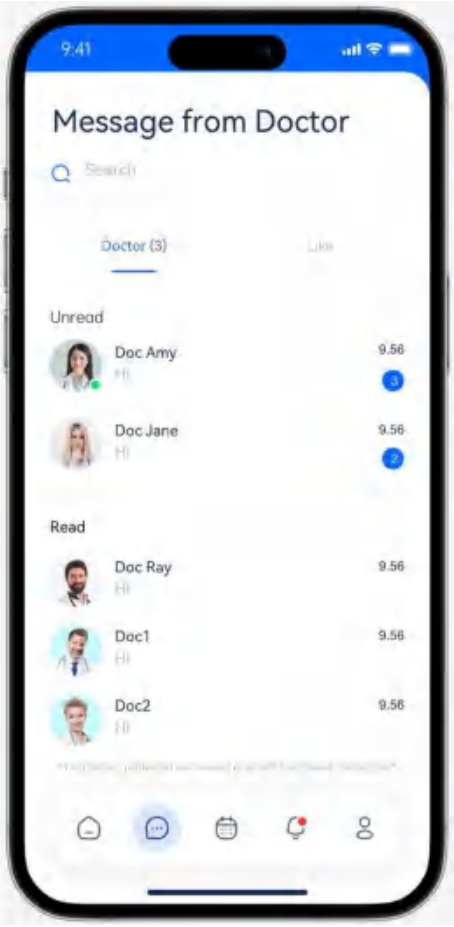

9:41
Dailey Steps
Day
Week
Month
Auto Updated from Your Equipment
7.384
Steps
Target 10,000
1.2 km
182 Kcal
1h40min

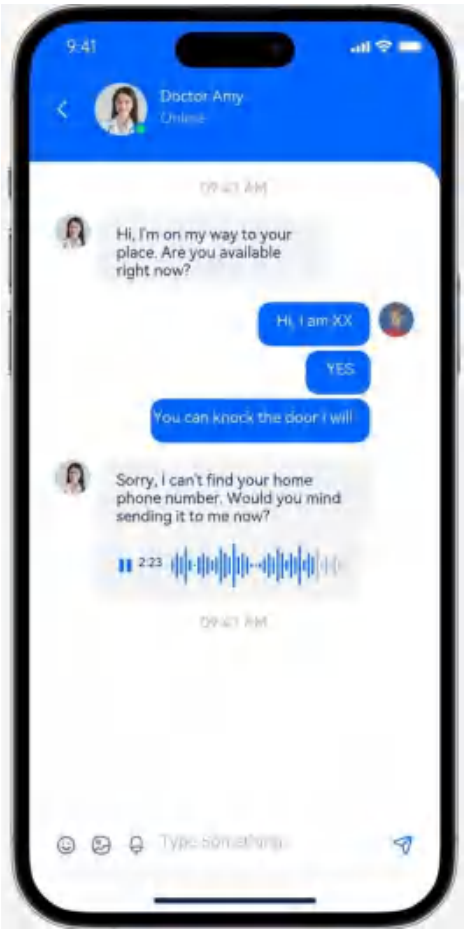

9:41
Heart Rate
Day
Today's Rate
Auto Updated from Your Equipment
Lowest
64 bpm
Highest
116 bpm
图表
140
120
100
80
60
6
8
10
12
14
16
18
20
Average rate
86 bpm
Active: 42%
Stays: 58%

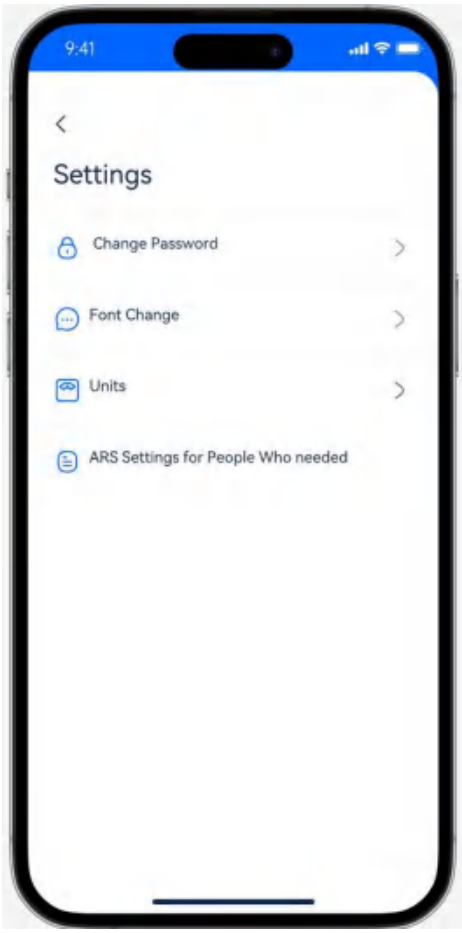

9:41
Blood Pressure
Day
Week
Month
Average Pressure
Auto Updated from Your Equipment
Systolic Pressure
144 mmHg
Diastolic Pressure
72 mmHg
图表
180
120
80
40
0
40
80
120
180
8
10
12
14
16
18
20

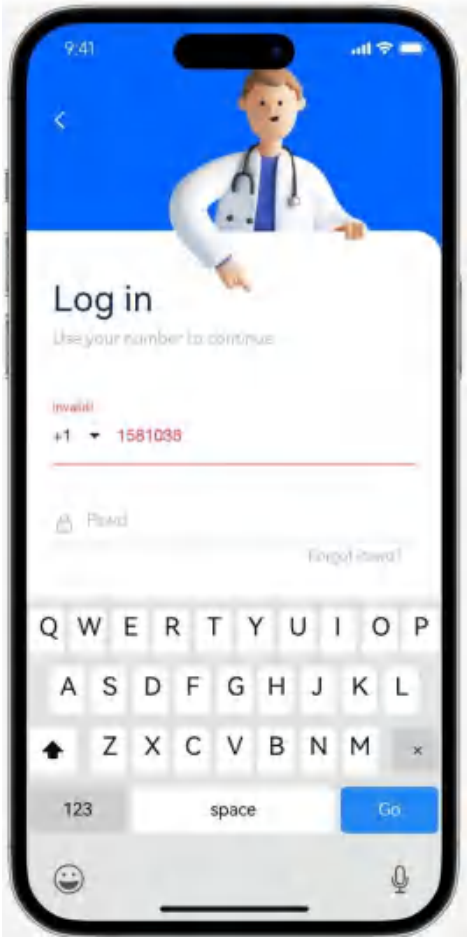

9:41
Weight
Day
Week
Month
Auto Updated from Your Equipment
Edit
48.5 Kg
BMI
23,2
Weight
45,7 Kg
Fat rate
16,3 %
History Lowest
43.2 Kg
History Highest
72.6 Kg

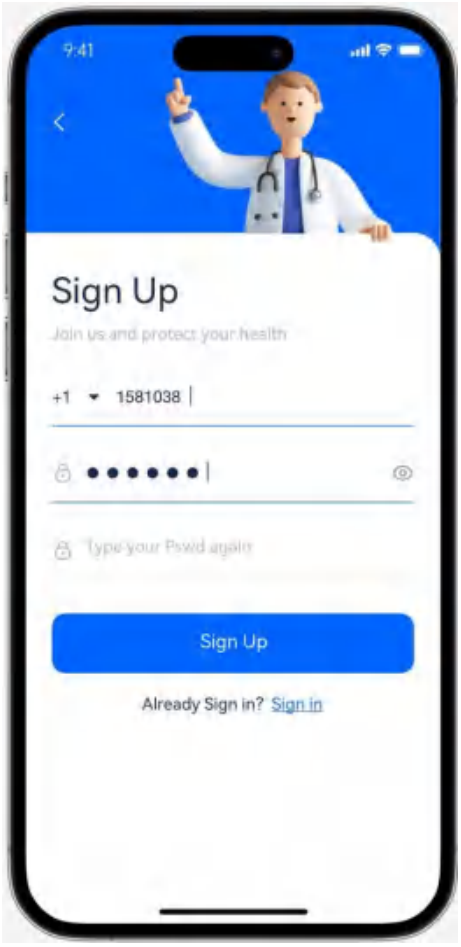

9:41
Medication Notification
All record
Medicine1
30min after
Hospital1
Medicine2
2h after
Hospital2
Auto Updated from Your Equipment
*Your data is protected and shared only with healthcare institutions*





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***Space, Place, and Inequality in the Global Coffee Trade (ArcGIS Blog) Part***

# 8

# Space, Place, and Inequality in the Global Coffee Trade

## Spatial and Place-Based Inequalities in Vietnam and Ethiopia's Coffee Industries

**Yihan Zhang | UNC - Chapel Hill | GEOG 130SM | Instructor: Georgina Gemayel**
**May 31, 2025**

### Introduction

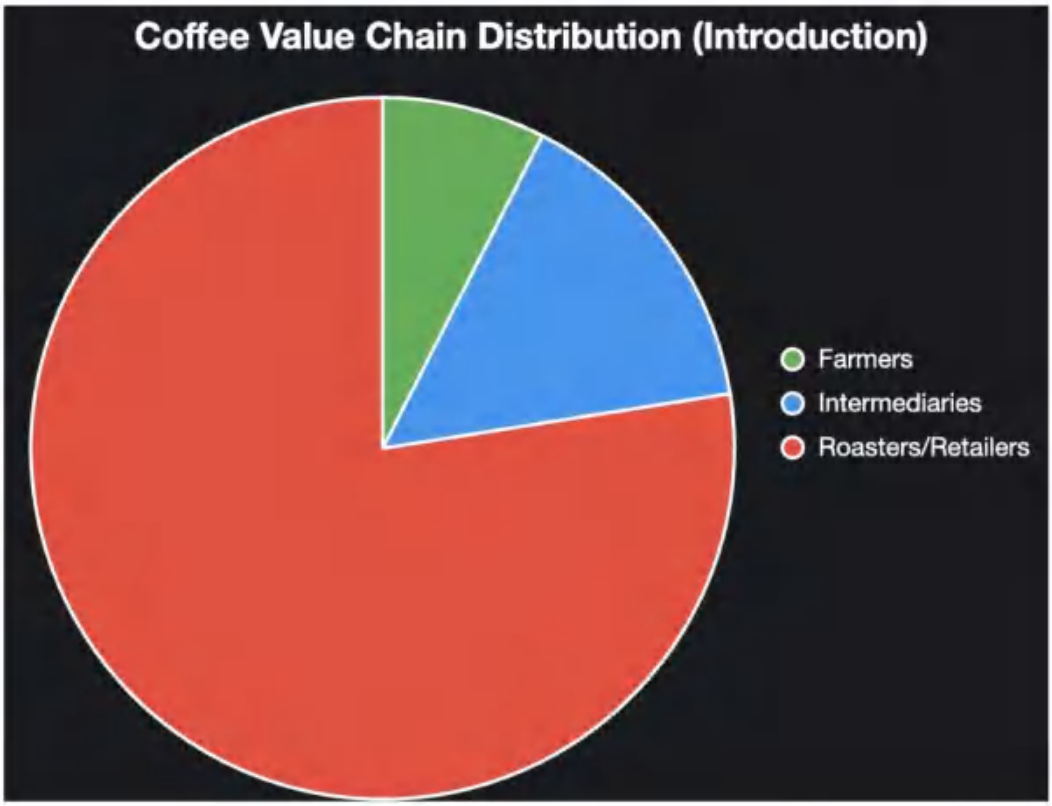
Each day, millions enjoy coffee with no knowledge of the intricate path of coffee beans from distant farms in their cups – a global commodity chain characterized by deep inequalities. Developing countries' smallholder farmers grow coffee, while processors, intermediary traders, and retailers take the lion's share of the profits (Global Coffee Platform, 2024). This ArcGIS Story Map examines how space (geographic and trade arrangements) and place (localized contexts) configure

development and inequality in the coffee industry, contrasting Vietnam, the second-largest producer in the world of robusta, with Ethiopia, Africa's leading producer of arabica. Vietnam exports around $5 billion, benefiting ~600,000 smallholders, while Ethiopia generates ~$1 billion, supporting ~15 million farmers (USDA Foreign Agricultural Service, 2025). Differences in their histories and geographies yield different outcomes.

The Starbucks we drink

We respond to the following questions: (1) What drives coffee development in place? (2) How does place produce inequality? (3) What constitutes development, and who satisfies people's demands? (4) What constitutes inequality, whose demands are unserved, and for what reasons? By examining colonial histories, land policies, and commerce regimes, we expose how spatial and place-related determinants shape beneficiaries. Development geography concepts –

Sheppard et al.'s (2009) geographies of colonies, Ferguson's (1990) anti-politics machine, and Allen and Thomas's (2000) critique of aid-marketism – explain entrenched inequalities and inform solutions. This Story Map applies static maps, images, charts in presenting historical origins, spatial forces, on-the-ground realities, and equitable solutions, culminating in lessons for global development.




| Value-chain segment | Vietnam Robusta | Ethiopia Arabica |
|---|---|---|
| Producer | 10 | 5 |
| Local traders | 20 | 25 |
| Exporters | 10 | 15 |
| Roasters/Brands | 35 | 35 |
| Retail | 25 | 20 |

Value Chain Share

## 1. Space and Development

### What is Space?

Space describes the geographical and relational structure of the production and trade of coffee, between producers in the Global South (such as Vietnam and Ethiopia) and consumers in the Global North. Colonial spatial relations, such as trade paths and plantations, produce long-term developmental imbalances by affecting infrastructure and access to the market (Sheppard et al., 2009).

### Vietnam: Space and Development

Vietnam's Central Highlands was a coffee hub during French colonisation in 1857, with plantations in the area of Đắk Lắk connected to ports through roads for Europe-bound exports (Nhung, 2022). Reforms since 1986's post-Đổi Mới further developed Vietnam as the world's second-largest coffee producer, with exports of ~$5 billion robusta a year (USDA Foreign Agricultural Service, 2025). Irrigation and road investments by the government of ~$1 billion greatly boosted yields (Solidaridad & BASIC, 2024). Proximity of Saigon's port facilitates smooth exports, as in contrast with land-locked areas. Land allocation, however, privileged ethnic Kinh settlers, who occupied highland lands, disenfranchising original habitants Montagnard, reproducing colonial spatial exclusion (Nhung, 2022). Resource allocation with bias of this sort propels development but mainly benefits Kinh groups.

Ethiopia: Space and Development

Ethiopia's coffee, produced in forested coffee-producing regions such as Sidamo, is exported through Djibouti, bringing in ~$1 billion annually (USDA Foreign Agricultural Service, 2025). Having evaded total European colonization, Ethiopia has no colonial infrastructure (e.g., railroads), and its landlocked topography raises the cost of transport (Global Coffee Platform, 2024). The Ethiopian Commodity Exchange (ECX), introduced in 2008, consolidates trade, maximizing quality but reducing farmers' market power (Global Coffee Platform, 2024). Weak rural infrastructure – scarcity of paved roads – limits access, discouraging reinvestment by the rural community

(World Bank, 2023). In contrast to Vietnam's concentrated model, Ethiopia's scattered production holds back economic advancement.


## Comparative Insights

Vietnam's access to ports and centralised production drive export expansion, while Ethiopia's isolation inhibits efficiency. Colonial heritage (Vietnam's infrastructure, Ethiopia's trade routes) and contemporary policies drive these patterns, with Vietnam's investments outpacing Ethiopia's infrastructure deficits.

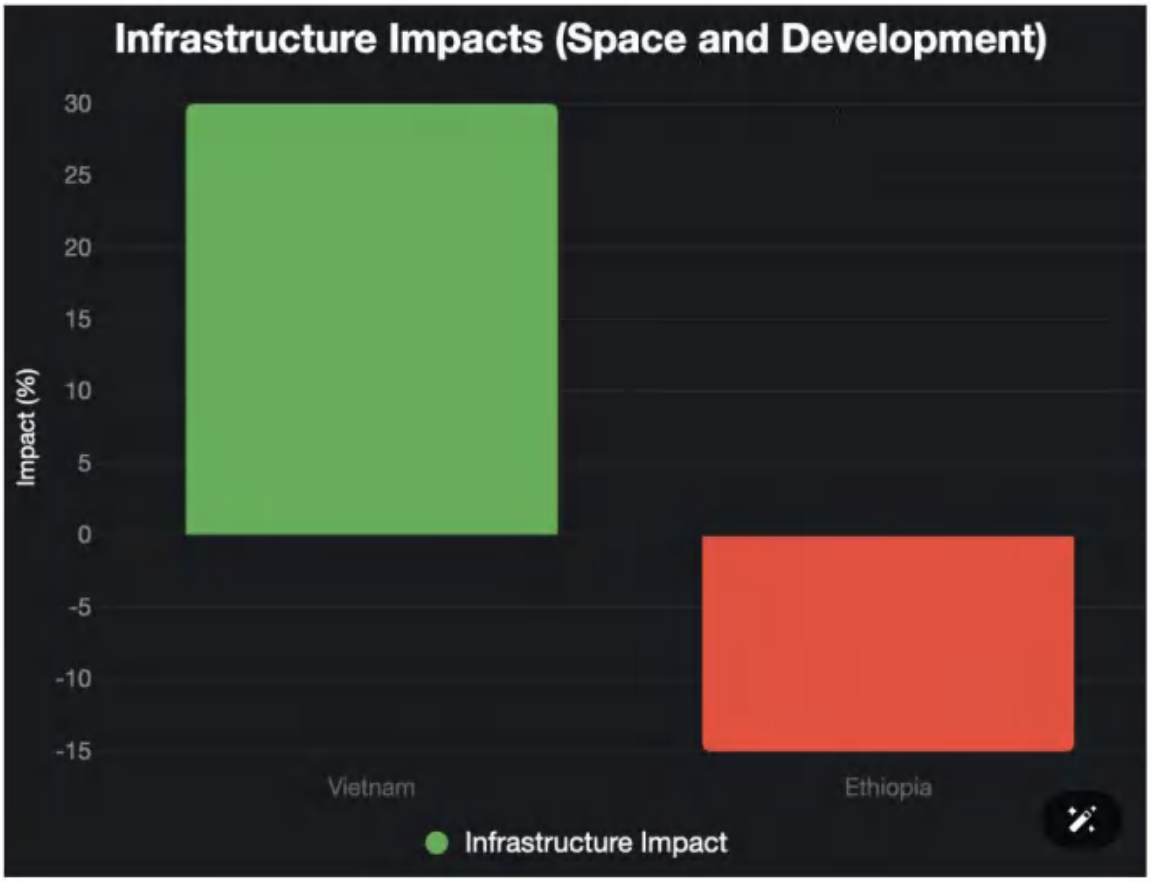



**Table 1 Space, Infrastructure & Cost Comparison**

| Indicator | Vietnam Central Highlands | Ethiopia Sidamo/Yirgacheffe |
|---|---|---|
| Annual yield (kg/ha) | 2700 | 550 |
| Distance farm→port (km) | 335 | 930 |
| Land transport cost (USD/kg) | 0.05 | 0.2 |
| Road & irrigation investment 2010-20 (USD bn | 1.0 | 0.3 |
| Irrigation coverage (%) | 78 % | 18 % |

## 2.Place and Inequality

### What is Place?

Place refers to localized contexts with their own historical and cultural features, creating inequality in terms of access to resources and power relations. Place-specific inequality corresponds to the geographies of colonization (Sheppard et al., 2009).

The Central Highlands' colonial plantations (1857) displaced Montagnards, rededicating lands for coffee (Nhung, 2022). Đôĩ Mơĩ distributed plots among Kinh immigrants, highly marginalizing Montagnards (Nhung, 2022). Ede households earn far less than Kinh farmers because of low capital and technological know-how, with larger holdings (Nhung, 2022). Montagnards are mainly laborers, mirroring ethnic inequality. 5-10% of retail prices are captured by smallholders, since 90% are green beans with value added overseas (Global Coffee Platform, 2024). State policies and global markets drive these disparities.


Vietnam Map

### Ethiopia: Place and Inequality

Sidamo smallholders, with ~90% of coffee from <2-hectare plots, experience widespread poverty as a result of low yields (300-600 kg/ha) and bad roads (World Bank, 2023). Urban Addis Ababa merchants capture more value, showcasing geographic inequality (Global Coffee Platform, 2024). Female cooperativists have less voice, mirroring gender inequality (World Bank, 2023). Specialty premiums ($4-5/pound) accrue for foreign roasters as a consequence of rural isolation (Global Coffee Platform, 2024). Elite historical dominance worsens inequalities in the area (World Bank, 2023).

### Comparative Insights

Vietnam's Highlands produce ethnic inequalities via migration policies, while Ethiopia's rural zones foster geographic and gender gaps. Colonial legacies and local policies, amplified by global markets, shape these disparities.


Full at: https://arcg.is/19CLjm0

***Photography Works***

# 9

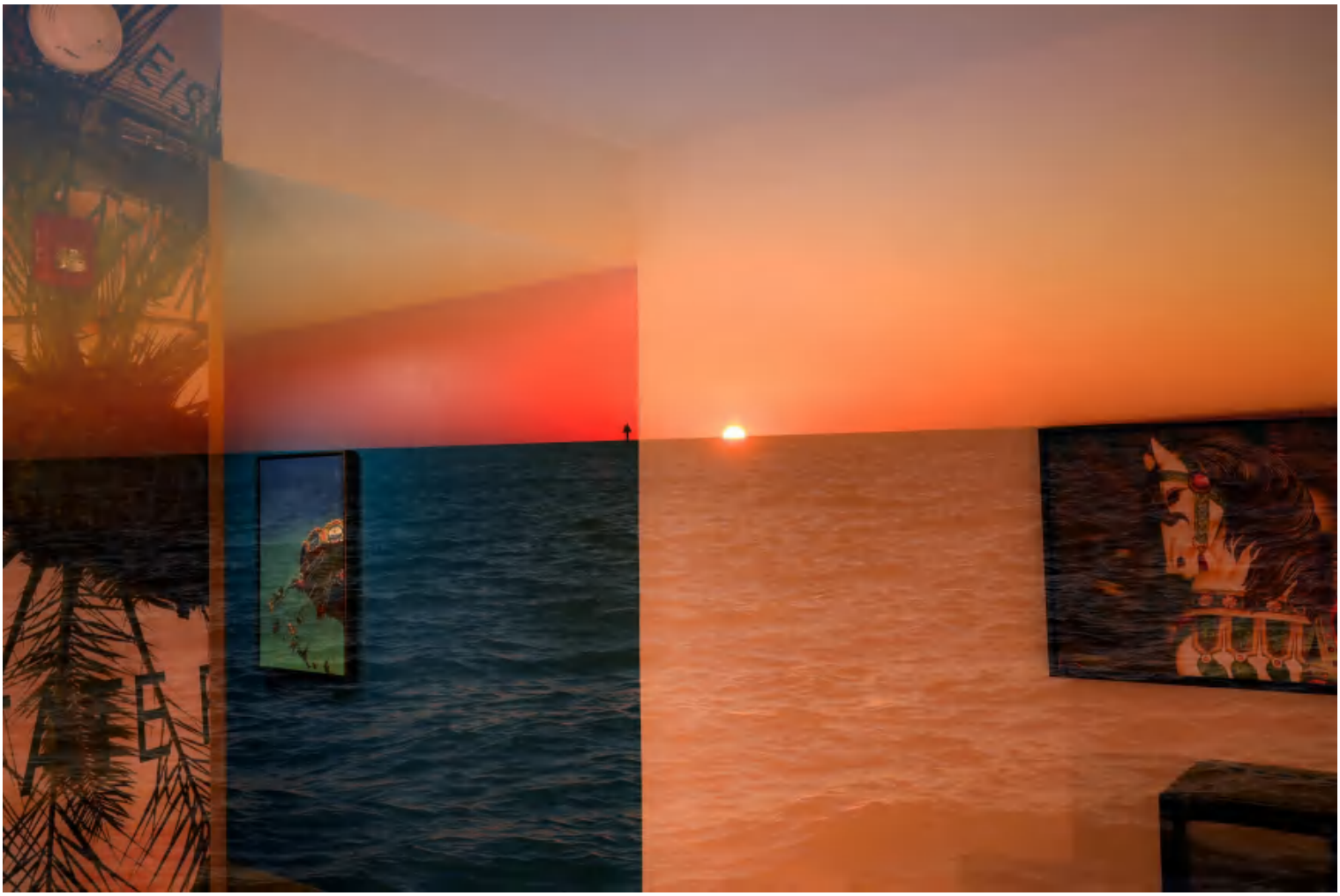
# *-Altered Landscape-*

## Project Statement

Here, I combine the visions I saw on my trip to Florida—the dolphins off the coast of Clearwater, the curvaceous causeway bridges, beachfront motels, and Siesta Beach's white, powdery sand and sunsets so full of color—with the wildlife and natural landscape of Jordan Lake. With double exposures, I combine these varied environments into new visual worlds, questioning how a landscape that is initially "non-altered" might be "altered," and how already "changed" scenes might be further highlighted or recreated.

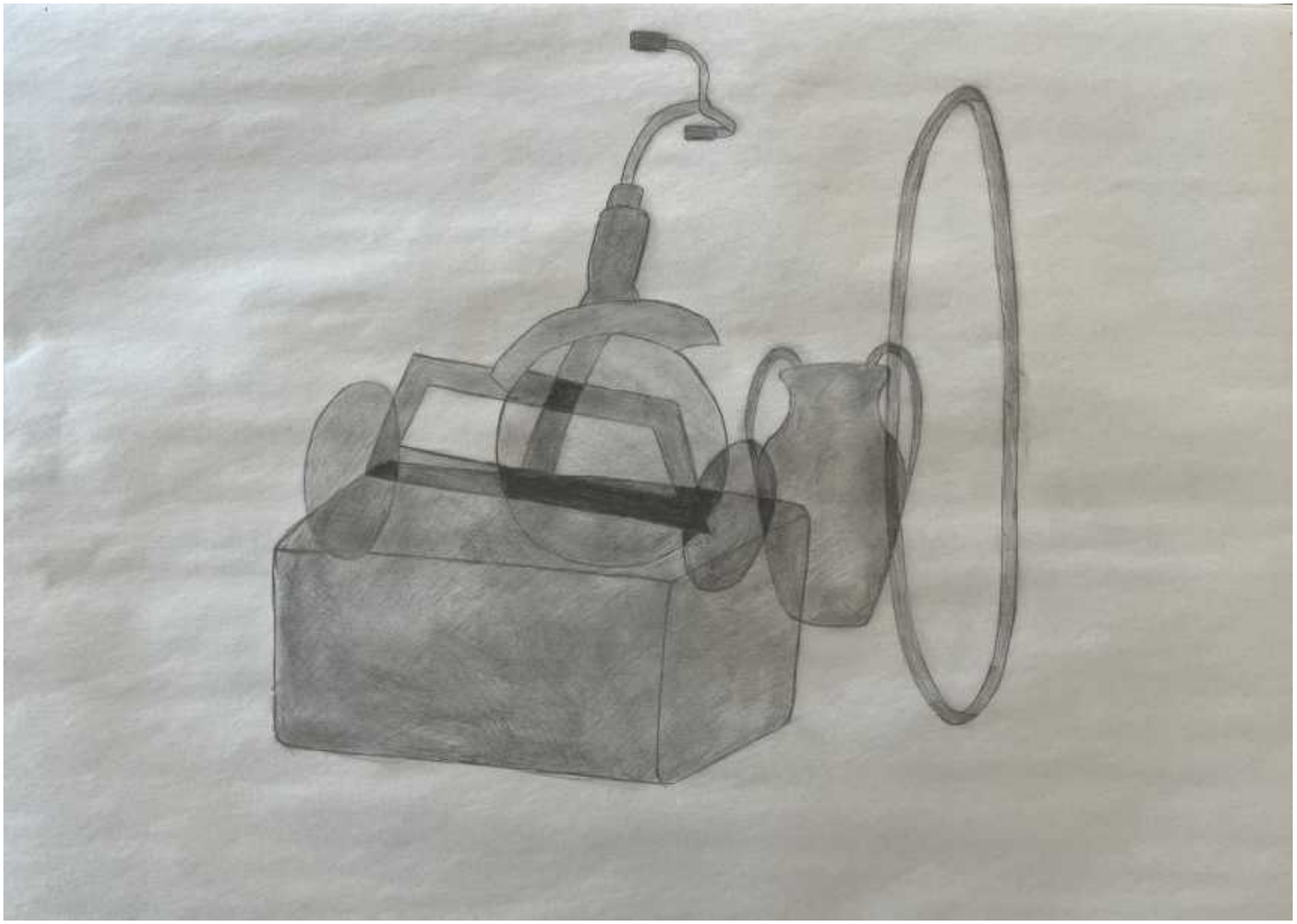
My aim is to get the viewer to reflect on the interaction between nature and the mark of humanity. In blending different times and places, I seek to reveal the quiet way in which we alter our environment—even as we marvel at its beauty. The otherworldly character of double exposure serves both to highlight the uniqueness of unmarred environments and the distinct character of those so influenced by the hand of humanity.

Ultimately, I hope that this work provokes a heightened awareness of the manner in which our activities continually remake the world around us. Whether capturing the serenity of Jordan Lake or the tourist beaches of Florida, these composite images point to the tenuous balance between unspoiled and modified environments. Placing these contrasting domains within the same visual field, I hope to stimulate reflection on the evolving dynamic between humankind and nature and our role individually in shaping the landscapes of our common future.



***Selected Drawing works***

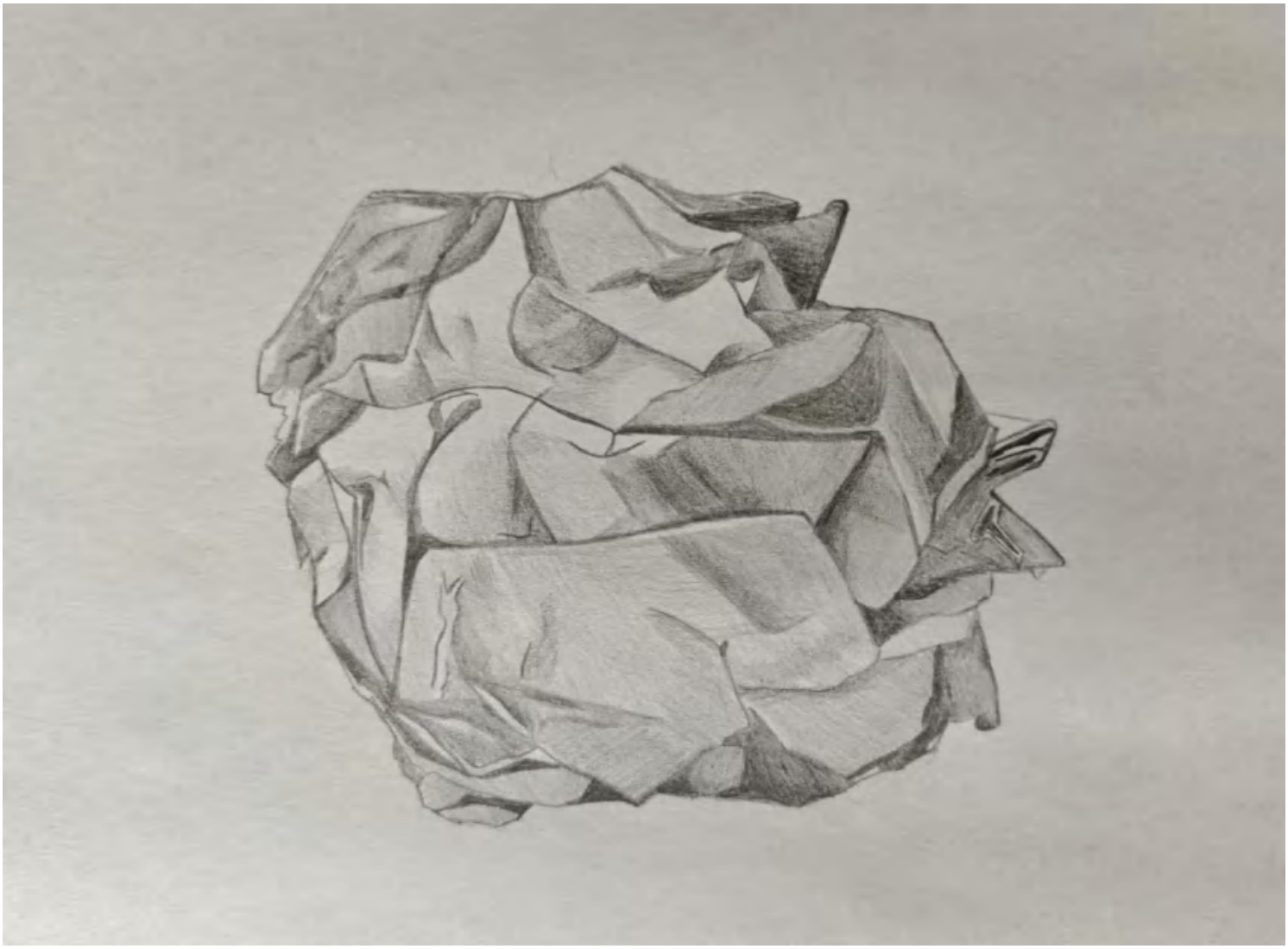
# 10



**Title: Layered Transparency**
**Medium: Graphite on Paper**
**Size: 18 x 24 in**
**Artist: Yihan Zhang**

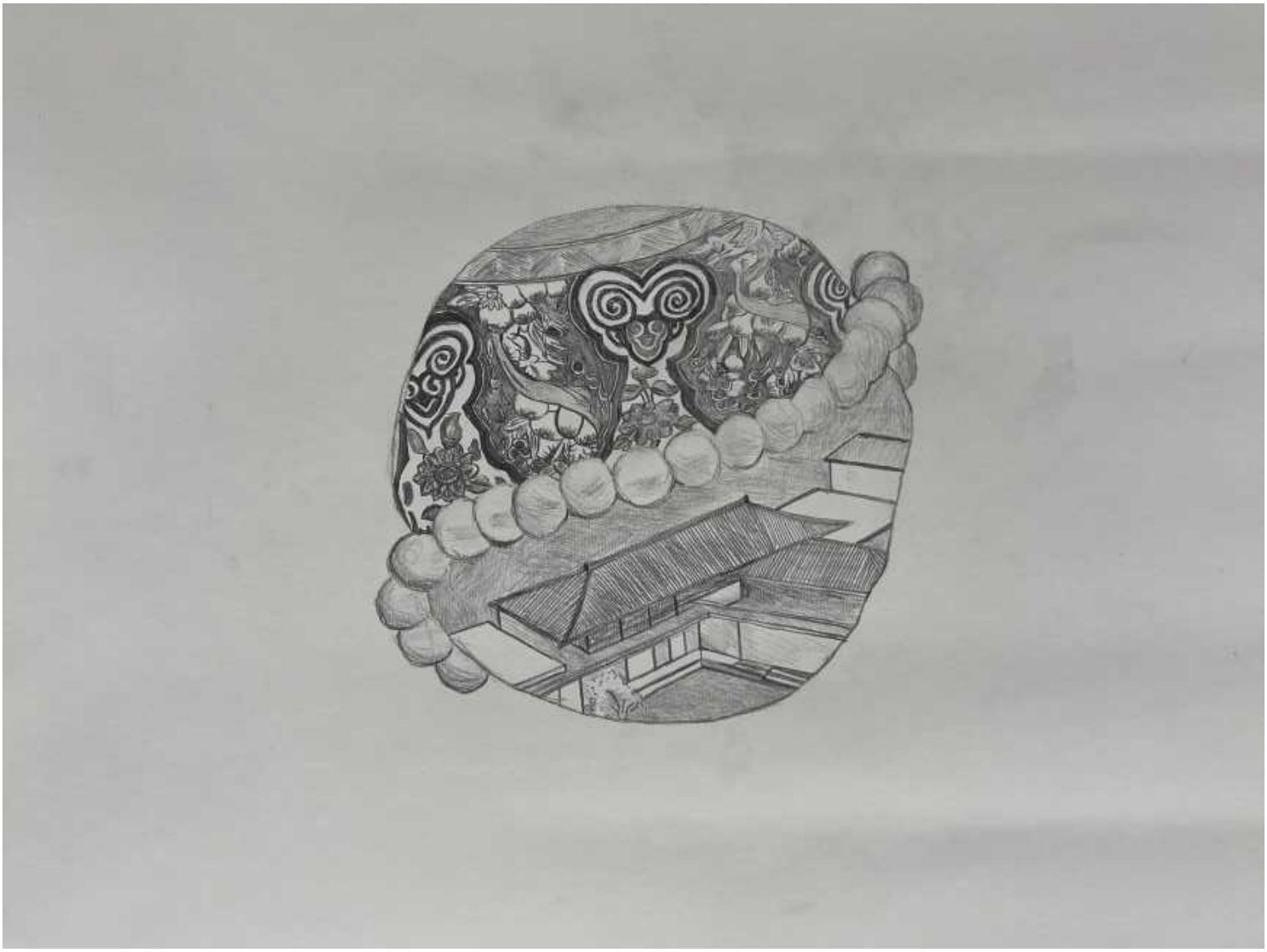
This graphite drawing explores the interplay of transparency, geometry, and spatial layering through the careful superimposition of everyday objects. Using overlapping ellipses, cylinders, and rectangular prisms, the composition creates a visual rhythm where solid and translucent forms interact within a shared space.

Through controlled shading and varied pencil pressure, the piece conveys depth, material weight, and surface qualities while maintaining a subtle tension between realism and abstraction. The overlapping contours invite the viewer to navigate multiple perspectives simultaneously—challenging perception and encouraging contemplation of how ordinary items can form complex visual relationships when reframed through structure and transparency.



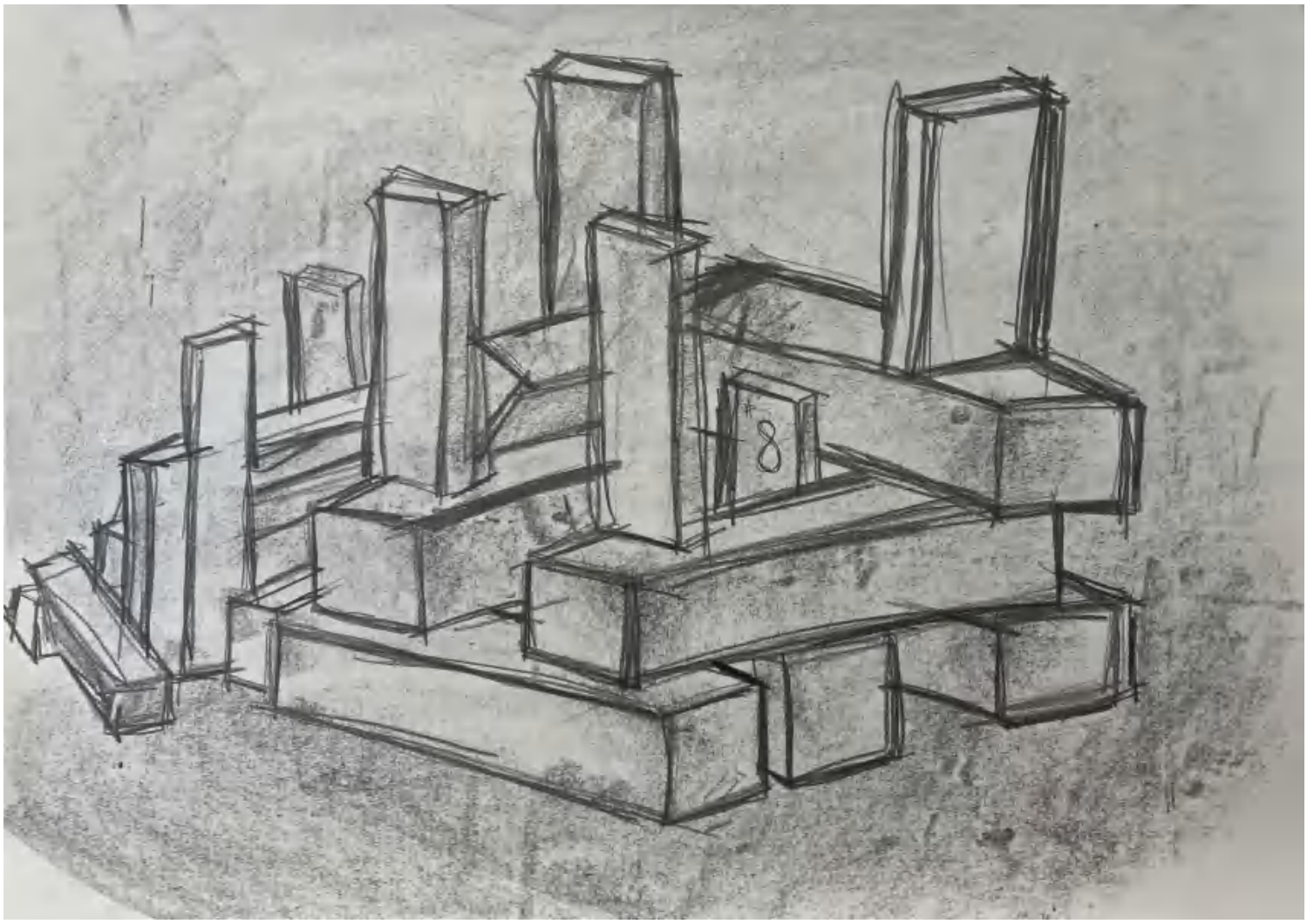
**Title: Crumpled Silence**
**Medium: Graphite on Paper**
**Size: 18 x 24 in**
**Artist: Yihan Zhang**
This graphite drawing captures the intricate geometry and tonal complexity of a single crumpled sheet of paper. What might appear as trash in everyday life becomes the subject of meditative observation and technical precision. Each fold, crease, and cast shadow is rendered with care, using controlled graphite gradients to evoke both texture and dimensionality.

The exercise challenges the viewer to reconsider the visual richness embedded in mundane objects. The interplay of light and shadow across the wrinkled surface creates a sculptural presence, suggesting form, fragility, and quiet resilience. In this still moment, the crushed paper becomes a symbol of transformation—where imperfection is both the subject and the aesthetic.



**Title: Cultural Stitch**
**Medium: Graphite and Ink on Paper**
**Size: 18 x 24 in**
**Artist: Yihan Zhang**
This drawing explores the fusion of cultural identity and contemporary form through the unexpected outline of a baseball—an iconic symbol of Western sports—wrapped with a string of pearls and filled with traditional Chinese imagery. The stitching curves of the ball frame intricate depictions of Chinese architectural motifs and decorative patterns, seamlessly juxtaposing the modern and the historical, the global and the local.

The pearl necklace, both ornamental and connective, functions as a boundary and a bridge. It ties together fragments of East Asian rooftops, lattice windows, and floral ornamentation, suggesting the artist's layered heritage and a dialogue between tradition and modernity. The circular shape also evokes wholeness, memory, and continuity, giving symbolic weight to what initially appears as a simple sports object.




**Title: Structure 8**
**Medium: Charcoal on Paper**sizes p
**Size: 18 x 24 in**
**Artist: Yihan Zhang**
This drawing presents a dynamic arrangement of geometric blocks rendered in bold charcoal lines, evoking the aesthetic of architectural ruins or a deconstructed cityscape. The composition emphaerspective and layering, with angular forms jutting into space and intersecting in unexpected ways. The number “8” placed at the center introduces a symbolic element—suggesting infinity, repetition, or a coded system within the otherwise abstract structure.

The textured background and rough shading add a sense of mass and depth, while also contrasting with the rigid edges of the forms. Through this work, the artist explores the relationship between space, structure, and imagined functionality, inviting viewers to interpret the drawing as both a spatial study and a metaphor for order and chaos.

**Title: Apple Study**
**Medium: Graphite on Paper**
**Size: 9 x 12 in**
**Artist: Yihan Zhang**
This graphite drawing serves as both a technical exercise and an artistic meditation on form. Using only pencil, I explored the interplay of light and shadow to render a simple apple with spatial depth and surface realism. Careful attention was paid to the subtle gradations of tone, reflected highlights, and the core shadow to create a strong three-dimensional effect.

Beyond technical observation, the work reflects my interest in finding quiet beauty in the mundane. By isolating an ordinary object against a blank background, I aimed to elevate its presence and invite viewers to pause and appreciate its form, weight, and texture—elements often overlooked in everyday life. This piece marks a foundational step in my artistic growth, where technique supports a minimalist yet intentional aesthetic.

**Title: Conan Fanart – Emotional Encounter**
**Medium: Pencil on Paper**
**Artist: Yihan Zhang**

This fanart is a hand-drawn tribute to Detective Conan, capturing an emotionally charged moment between Conan Edogawa and Ai Haibara. The piece emphasizes subtle tension and connection through close eye contact and gentle hand placement. Clean, confident lines and accurate character proportions reflect the artist's deep familiarity with anime aesthetics and storytelling.


Thank
you!