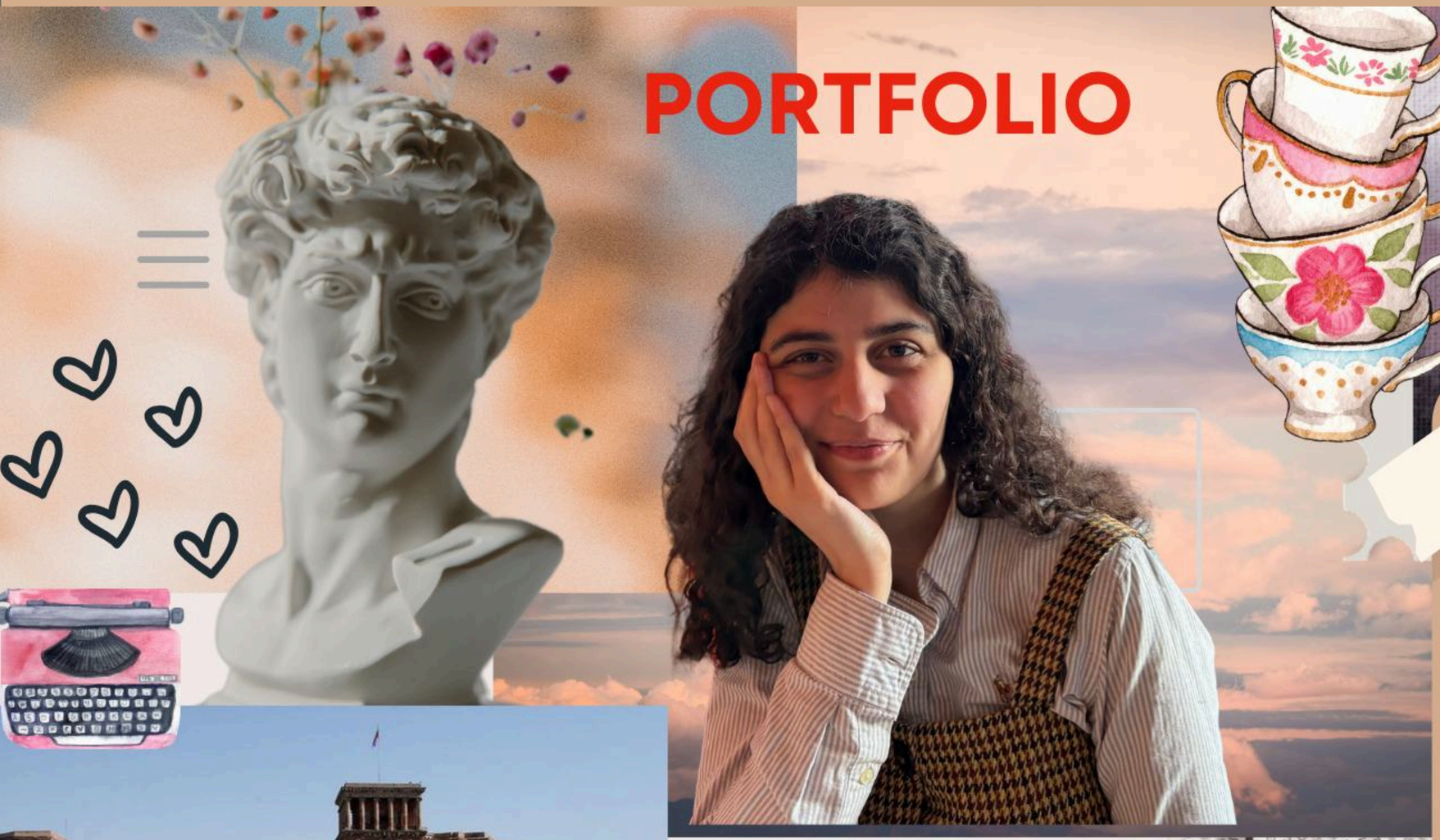
PORTFOLIO



LILI MKRTCHYAN

INFORMATION SCIENCE
&
COGNITIVE SCIENCE

Programming Languages

Python · Java · JavaScript · PHP · R · Arduino · TypeScript · HTML/CSS

Software

Canva · Adobe inDesign · Fusion 360 · Inkscape · Figma

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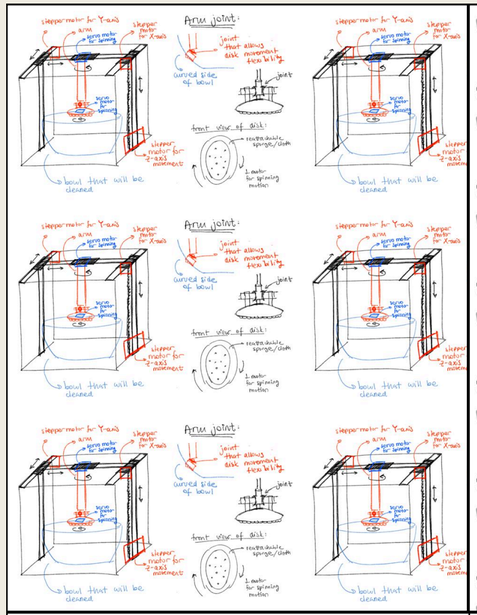
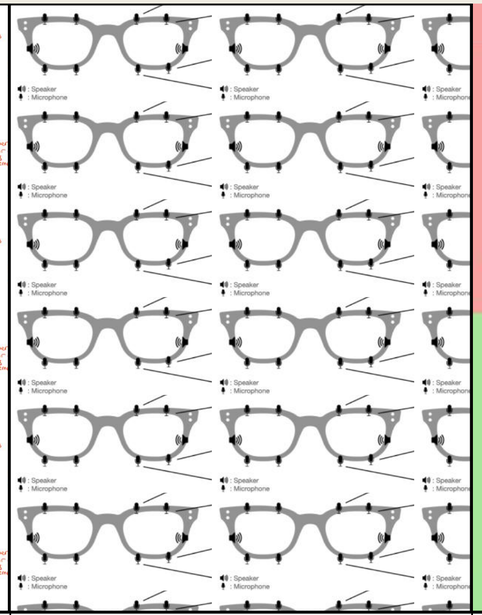


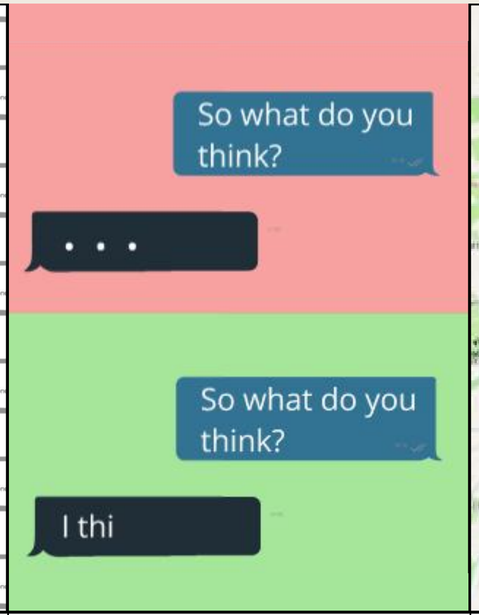
01

CubeScrub



02

SciFi Lab

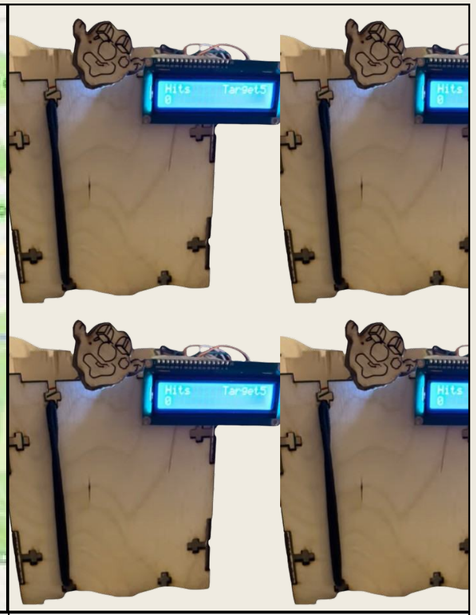


03

Telegram LiveChat

04

FringeEasy



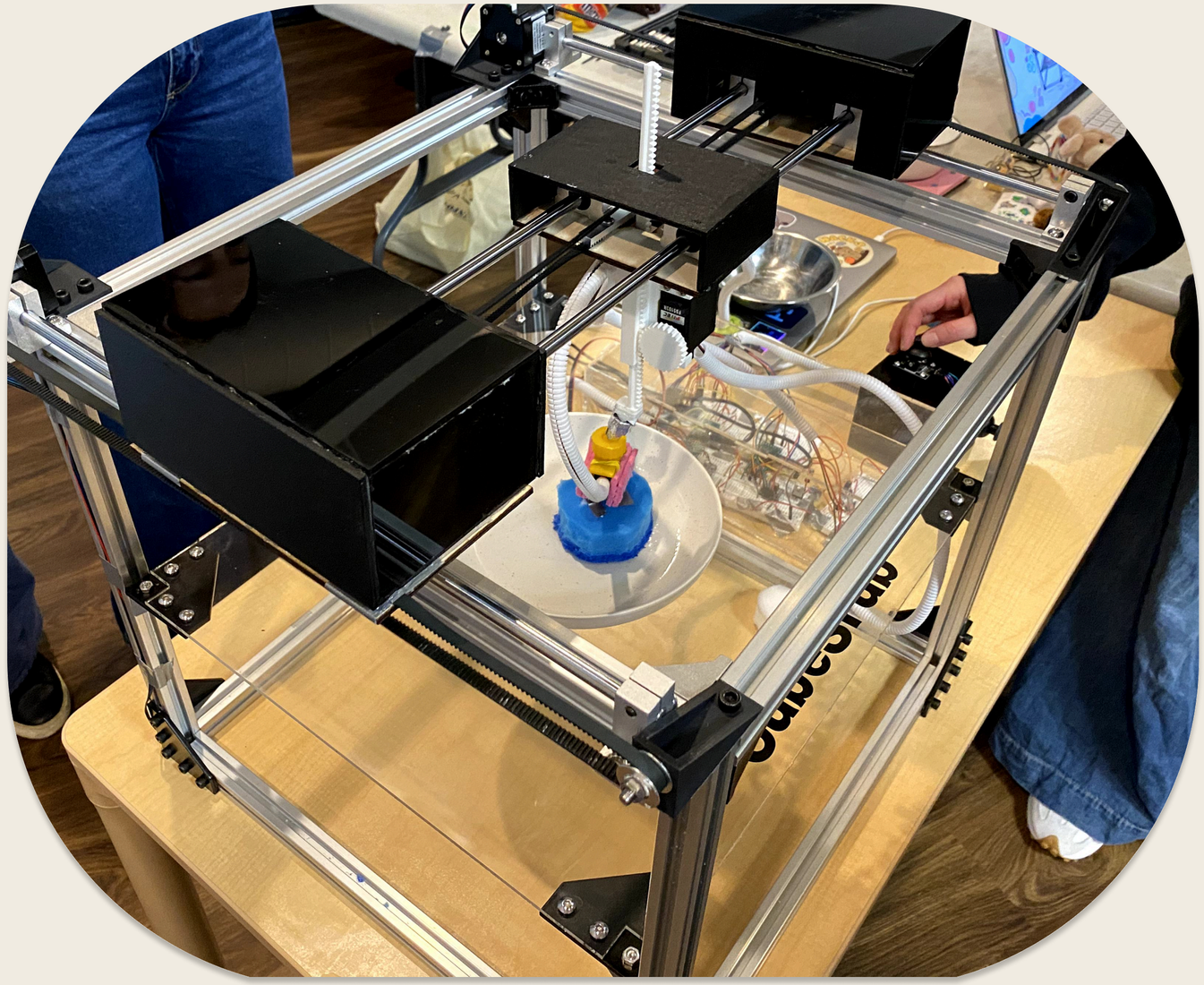
05

Hardware Design

CubeScrub

A compact robotic arm designed for efficient gentle cleaning.

TEAM	Lili, Michelle, Marie
DURATION	4 Months
TERM	Fall 2024
CONTEXT	Intro to Rapid Prototyping and Physical Computing



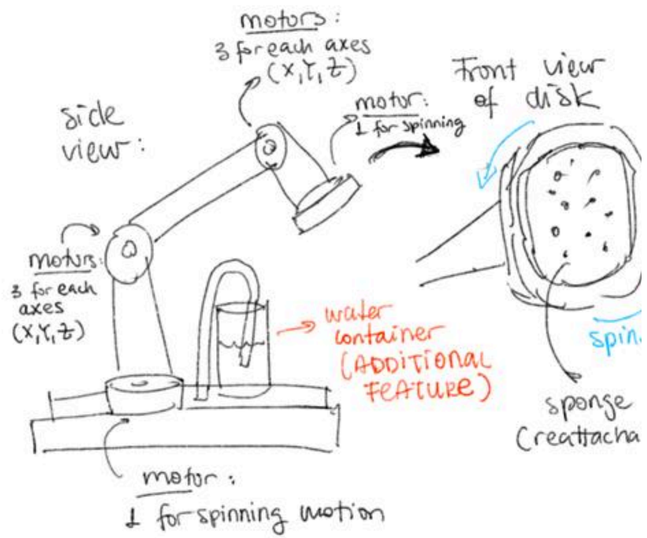
Concept

BASIC FUNCTIONS

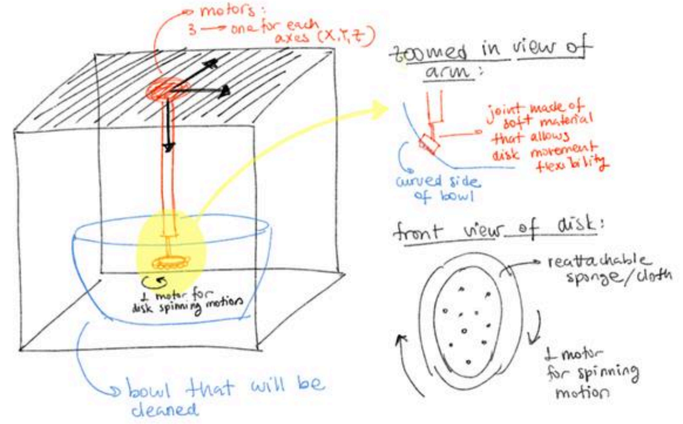
Movement Cleaning Cleaning arm that moves

1	Highly flexible in 3D movement. Visually intuitive as it resembles a human arm.	Unintuitive for kids' manual control since there are many moving parts.
2	Lightweight robotic arm - Eliminates concerns about structural instability.	Requires a flexible mechanism for z-axis extension and several motors to enable it.
3	Distributes the motor weight onto the wall tracks instead of the robotic arm.	Significant weight on Z-axis tracks due to X and Y axis relying on it.

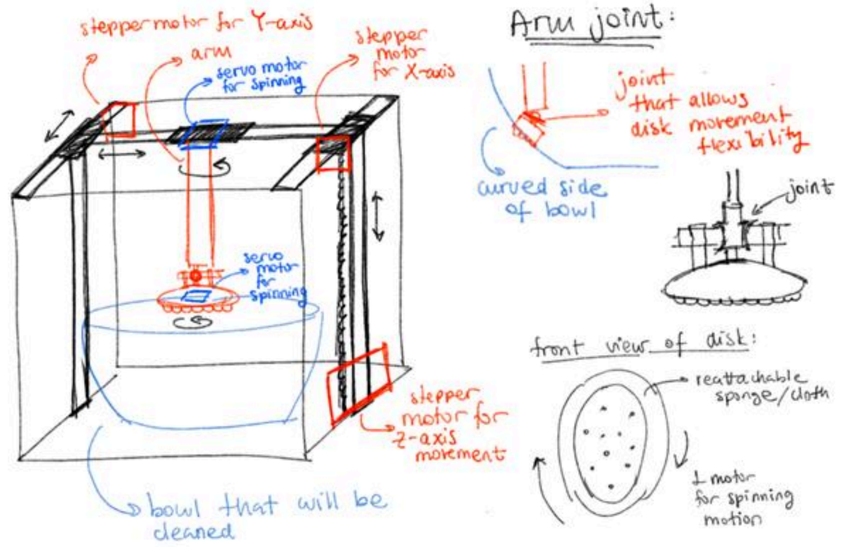
Design Iteration 1:



Design Iteration 2:

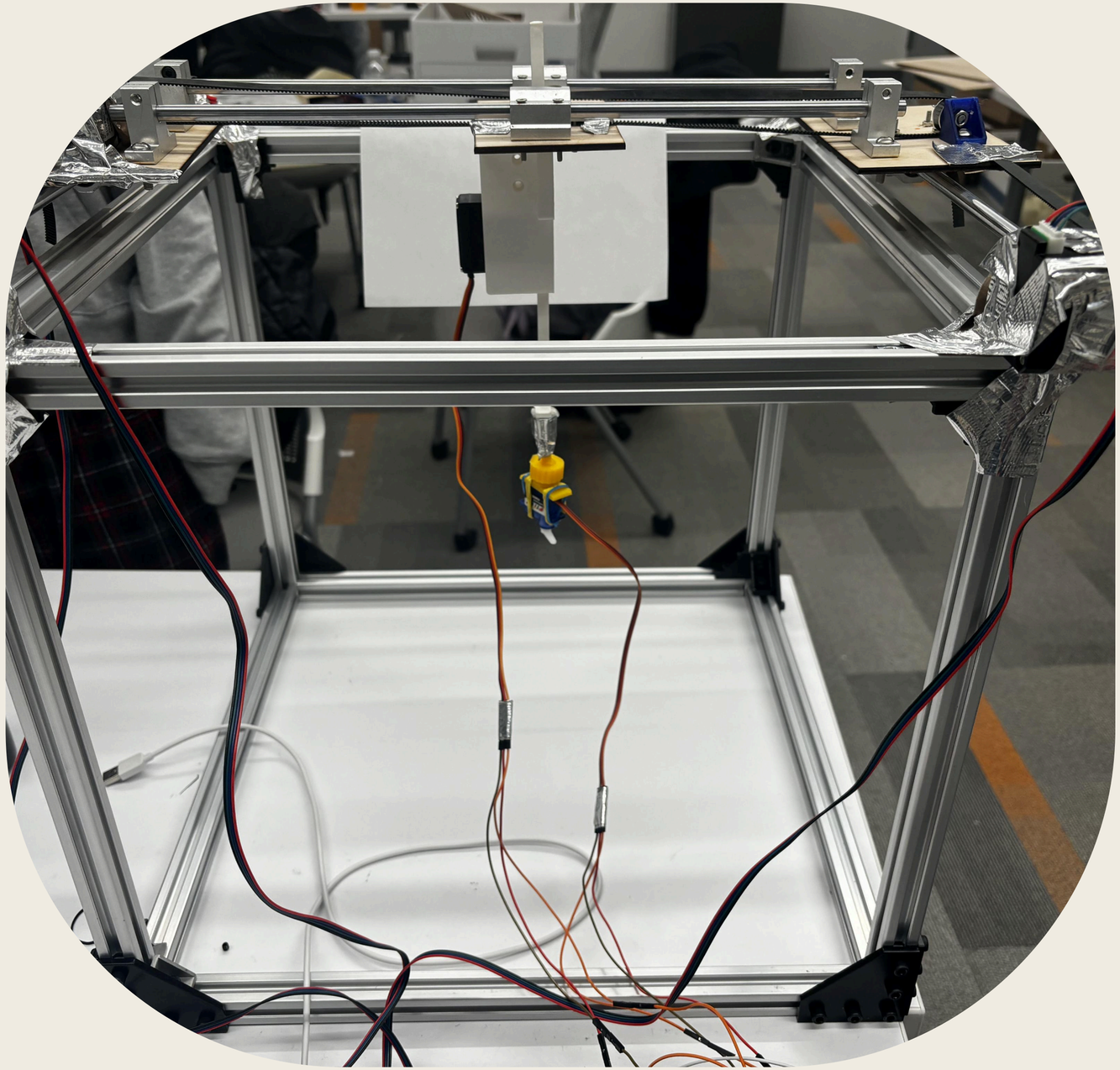


Design Iteration 3:

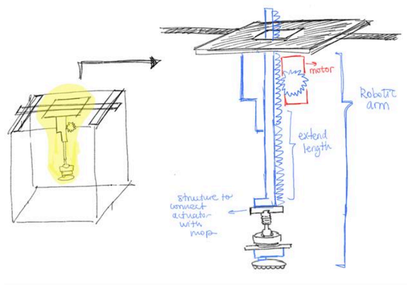
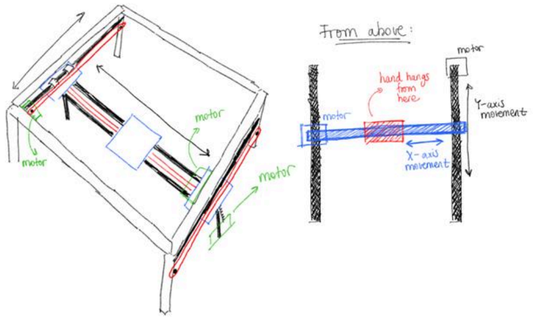
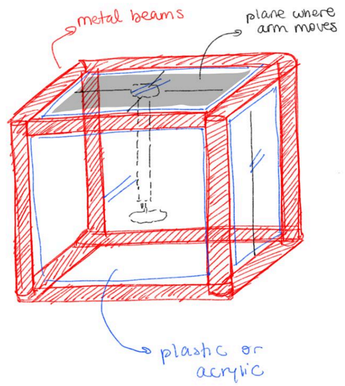
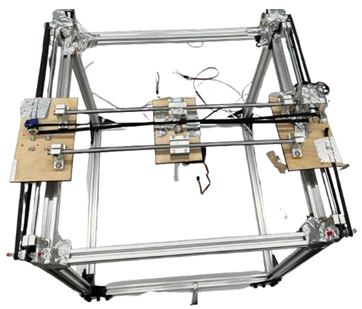


First Prototype

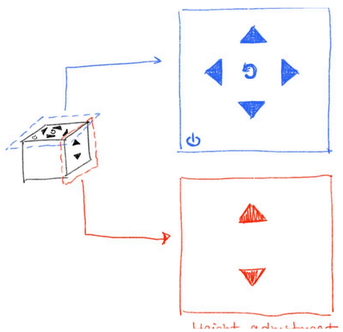
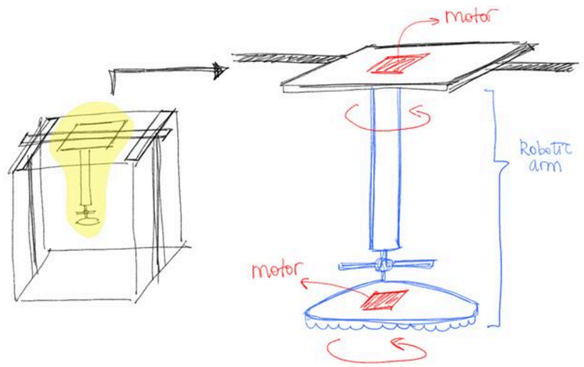
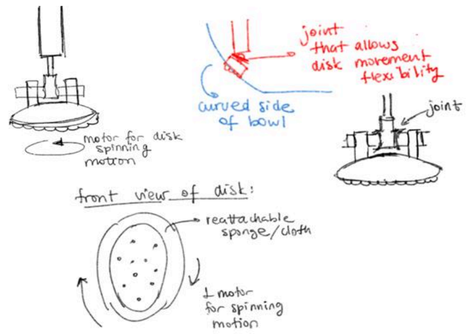
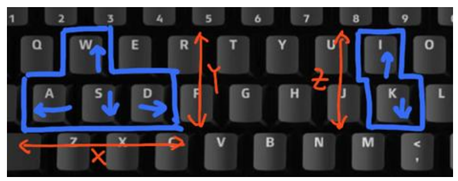
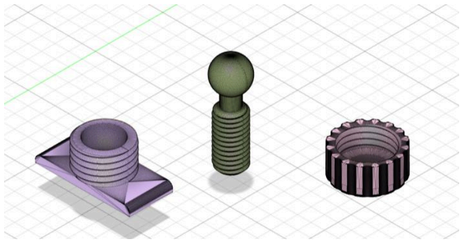
The first prototype ensured the working of all the basic functionalities and testing to assess if any fundamental refinements were necessary.



Functional Units

	Z-axis	X and Y axes	The box
GOAL			
FIRST PROTOTYPE			
MECHANISM & HARDWARE	3D printed gear and pinion + continuous rotation servo motor	3 belt and pulley mechanisms + stepper motors	Aluminum extruders screwed together.

Functional Units

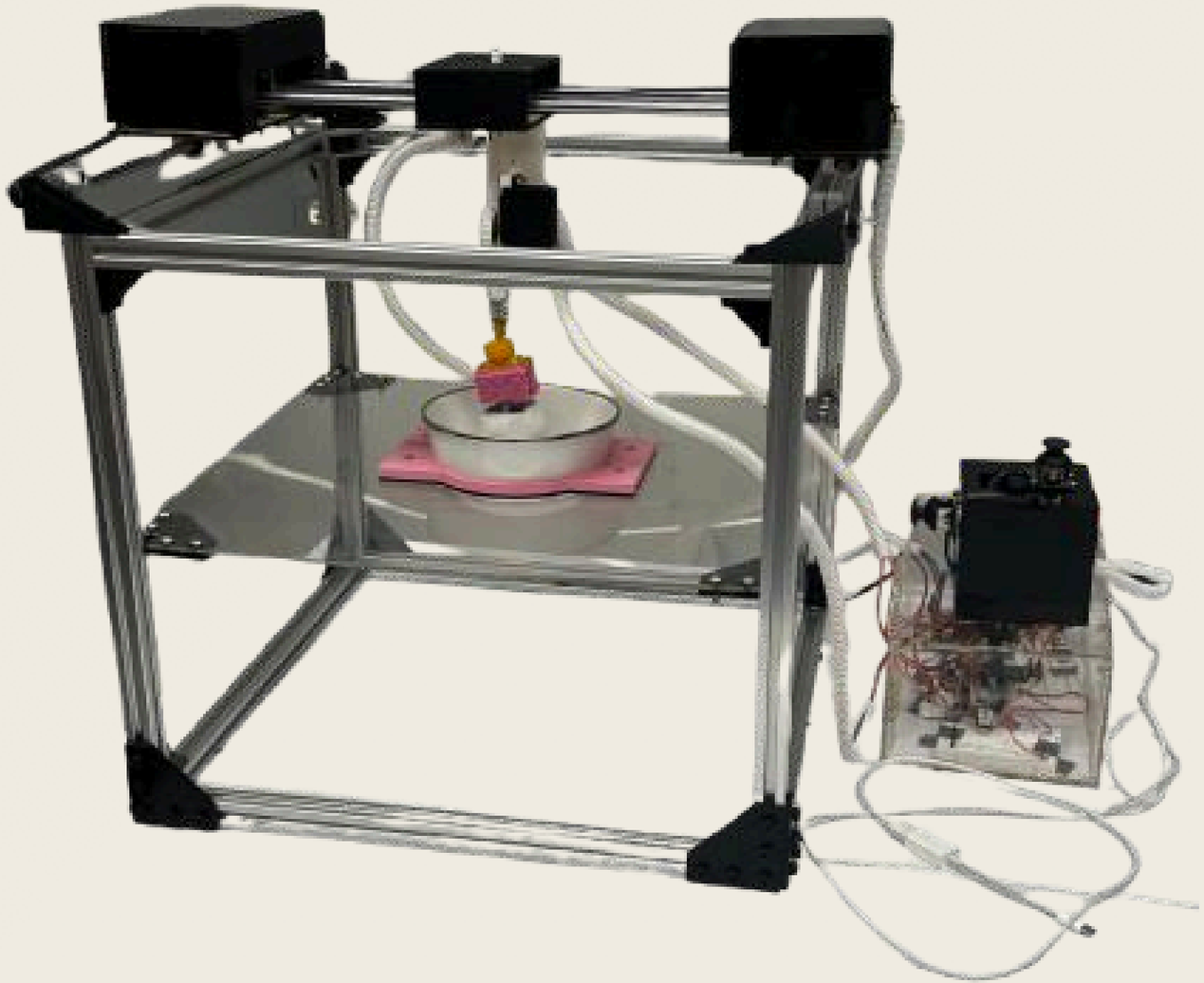
	Controller	Spinning Arm	Flexible Joint
GOAL			
FIRST PROTOTYPE			
MECHANISM & HARDWARE	Serial monitor input through keyboard keys.	Flexible 3D printed bowl joint attached to a continuous servo motor.	3D printed flexible bowl joint.

Final Prototype

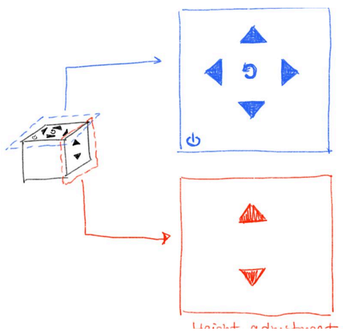
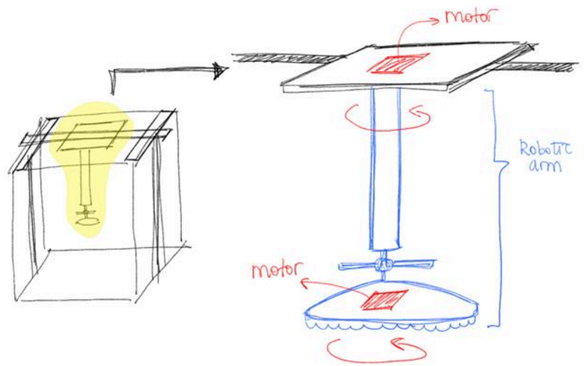
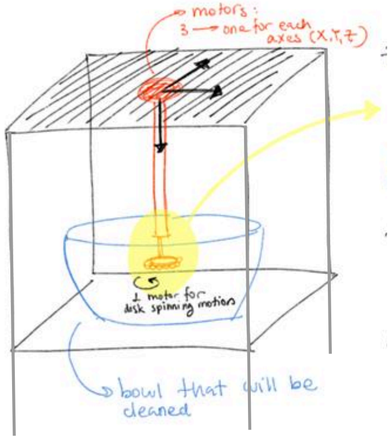
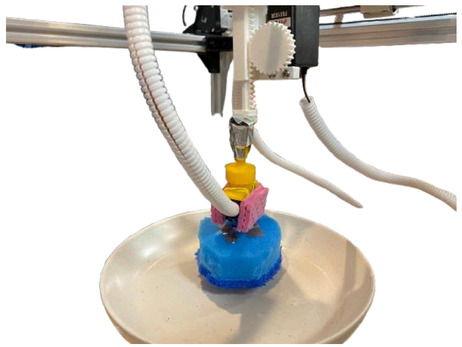
For the final prototype we refined the functional units and conducted the necessary changes to the first prototype.

The main changes included creating a platform to hold the plates in place during the wash, wire management through covering the mechanisms and hiding the wires, refining the detachable sponges to the cleaning arm, and creating the controller.

The final prototype was showcased at the Ithaca Science Center.



Refined Functional Units

	Controller	Spinning Arm	Platform
GOAL			
FINAL PROTOTYPE			
MECHANISM & HARDWARE	Laser cut acrylic box with two joysticks on the corresponding sides of the box.	Flexible 3D printed bowl joint attached to a continuous servo motor and detachable sponges.	Laser cut acrylic screwed to the aluminum extruders. 3D printed plates to hold the bowls in place.

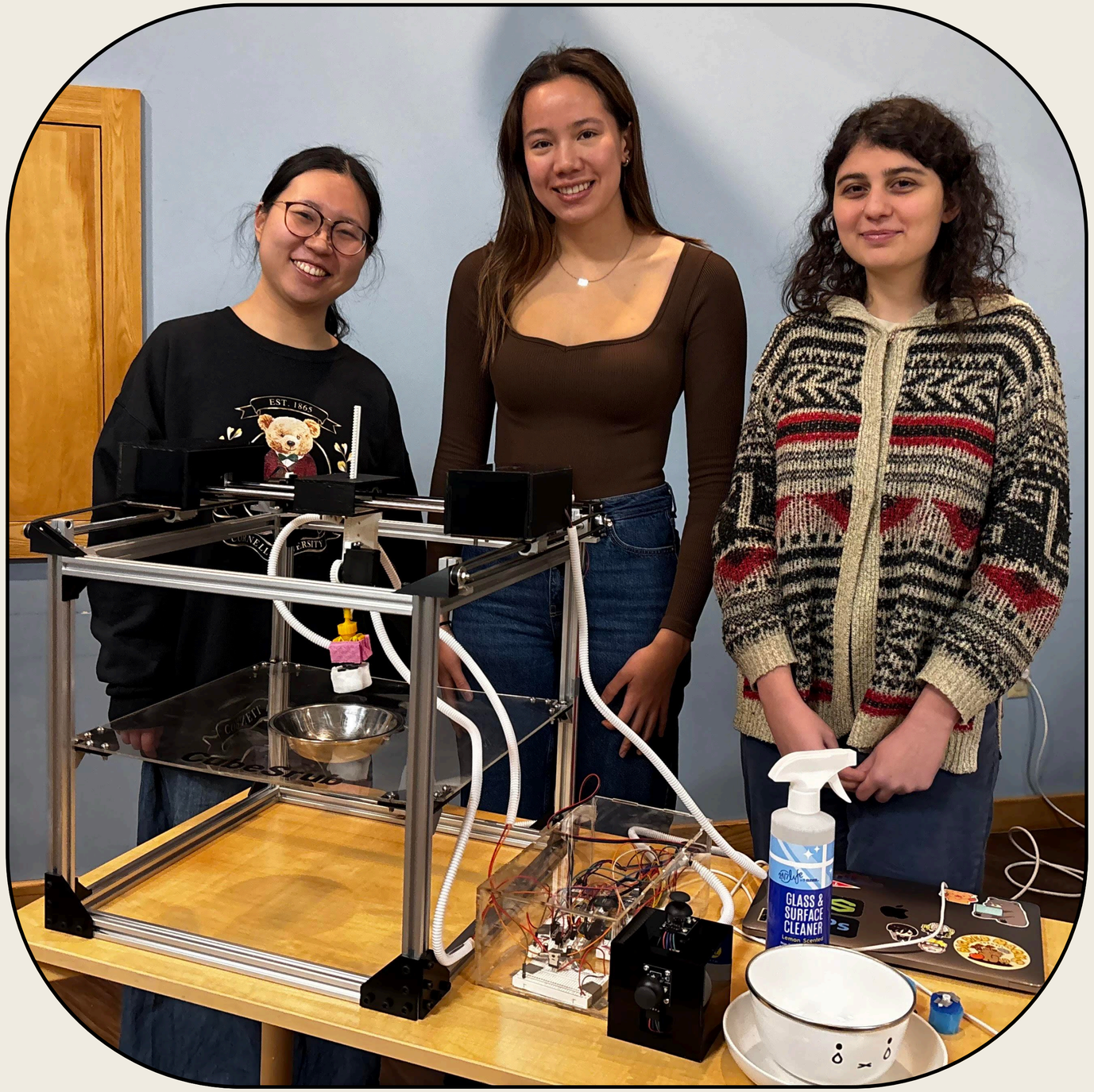
CubeScrub Reflection

MY CONTRIBUTIONS

- Contributed to wiring the hardware pieces, such as the buttons and motors
- Contributed to assembling the aluminum extruders for the structure.
- 3D printed the flexible joint bowl for the arm.
- Designed and laser cut the acrylic for the platform, controller, and wire covers.
- Designed and 3D printed the plates for the bowls.
- Contributed to wire management.
- Contributed to assembling the belt and pulley mechanisms.

SKILLS ACQUIRED

- Wiring hardware
- 3D designing in Fusion 360 and 3D printing using PrusaSlicer
- Designing in Inkscape and Fusion 360 and laser cutting
- Drilling and assembling mechanisms



SciFi Lab Research

Efficient eyelid movement and blink detection using wearable technology.

TEAM	Lili, Ke, Cheng
DURATION	Ongoing
TERM	Fall 2024
CONTEXT	SciFi Lab

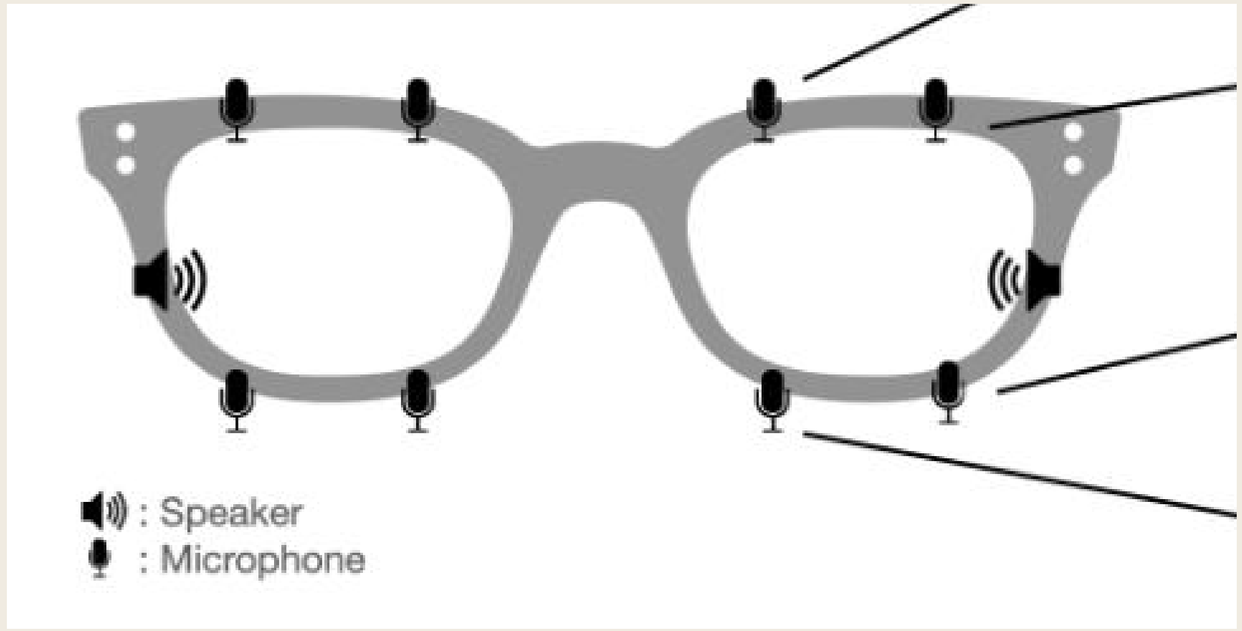


Image 1: Ke Li et al, 2024. GazeTrak: Exploring Acoustic-based Eye Tracking on a Glass Frame. In Proceedings of the 30th Annual International Conference on Mobile Computing and Networking (ACM MobiCom '24)

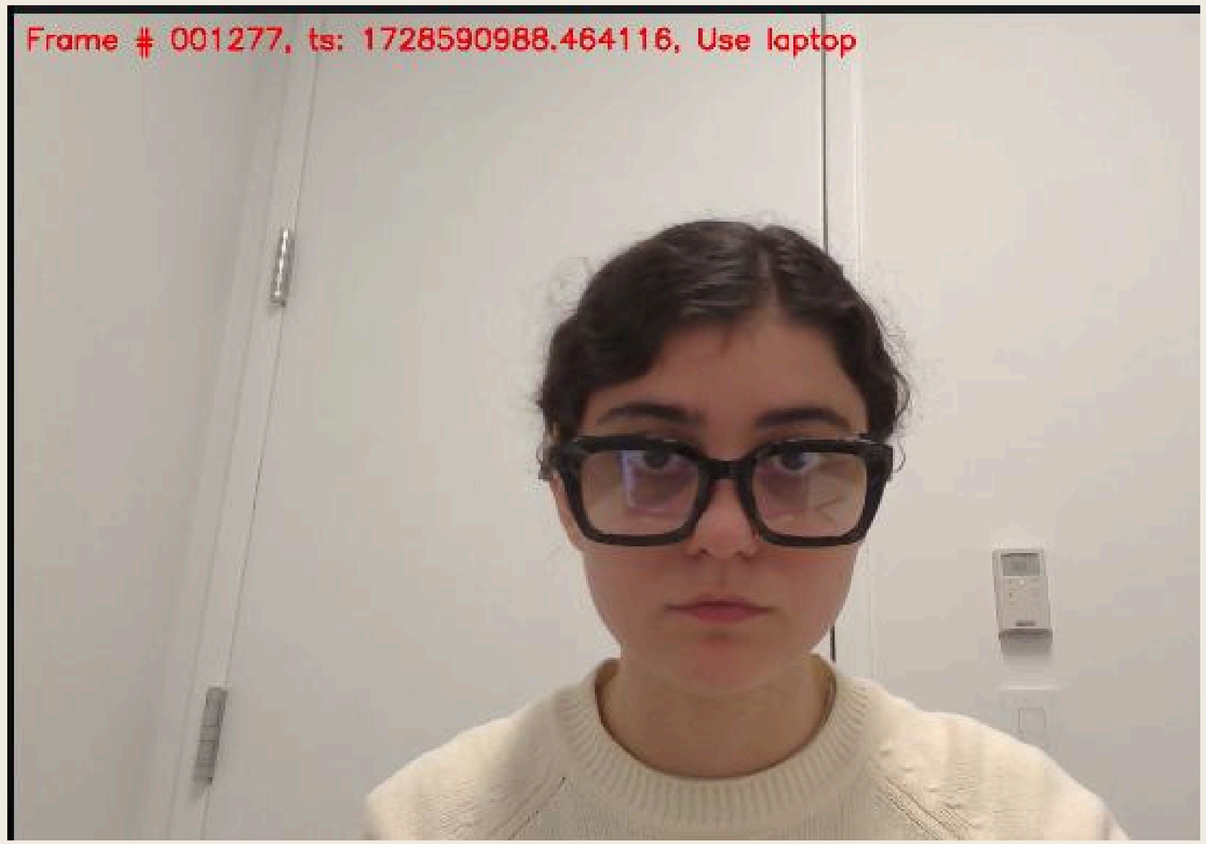
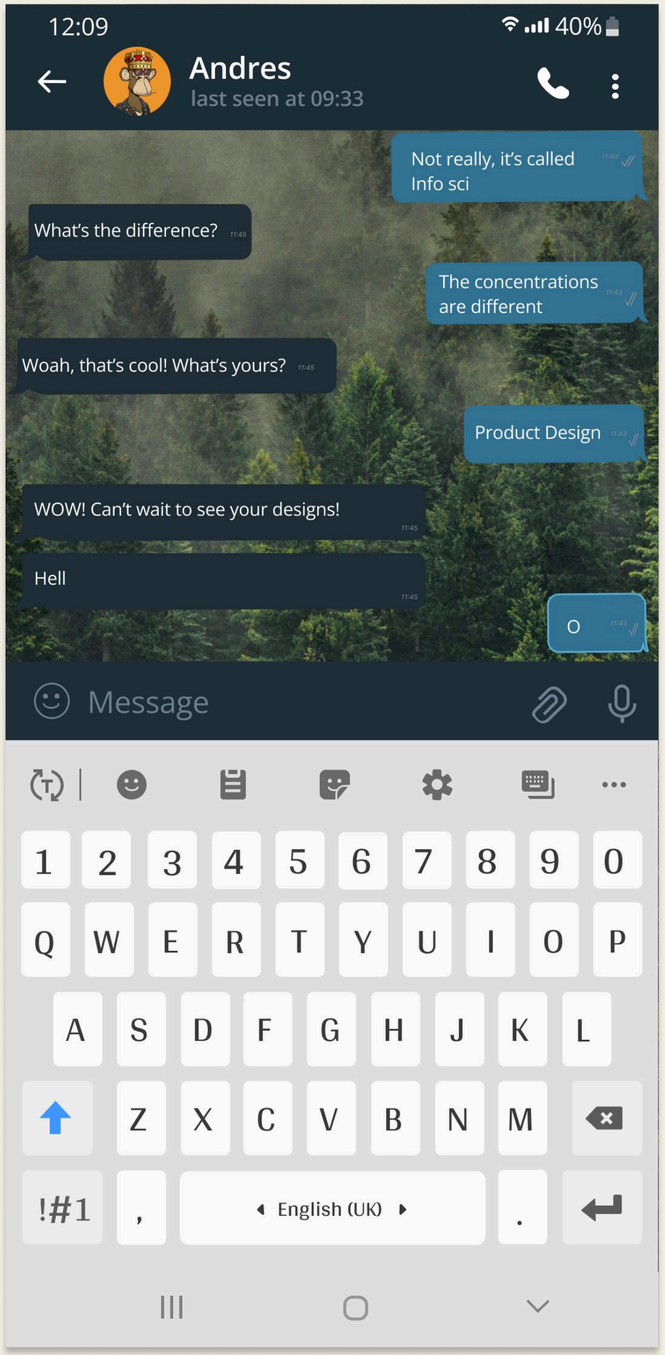


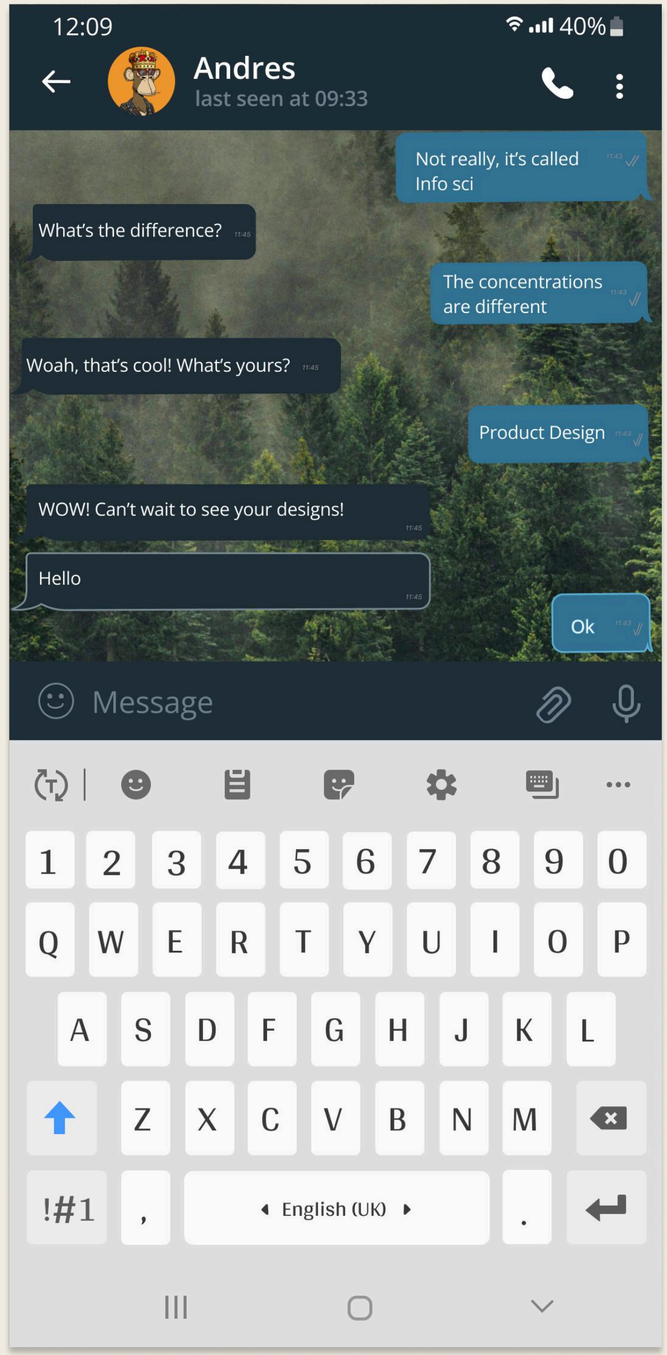
Image 2: Lili during the pilot study

Telegram LiveChat

Experience the conversation as it happens with Telegram Live Chat—see every thought take shape in real time!

TEAM	Lili
DURATION	1 Week
TERM	Fall 2023
CONTEXT	Personal Project

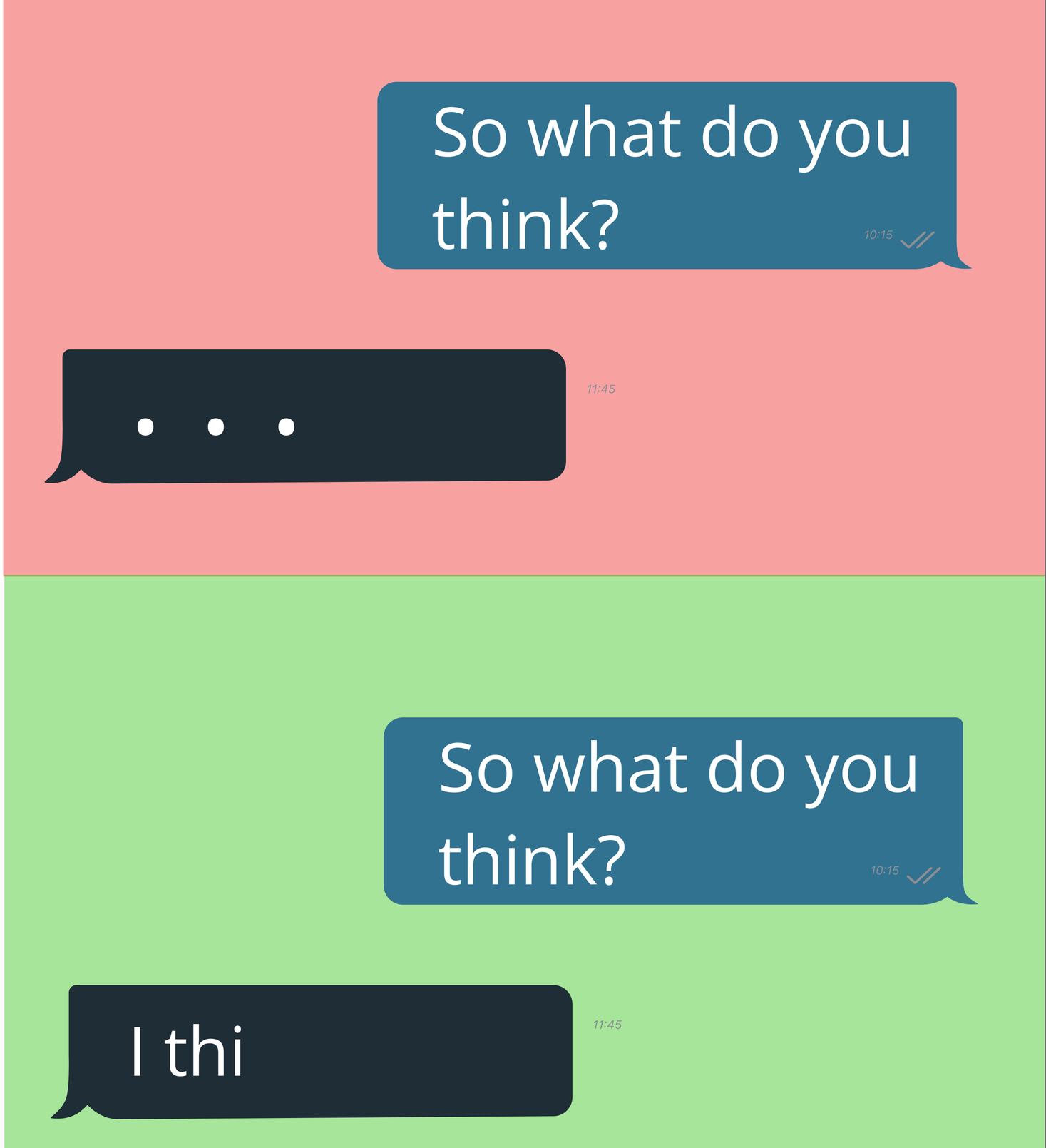




Telegram LiveChat

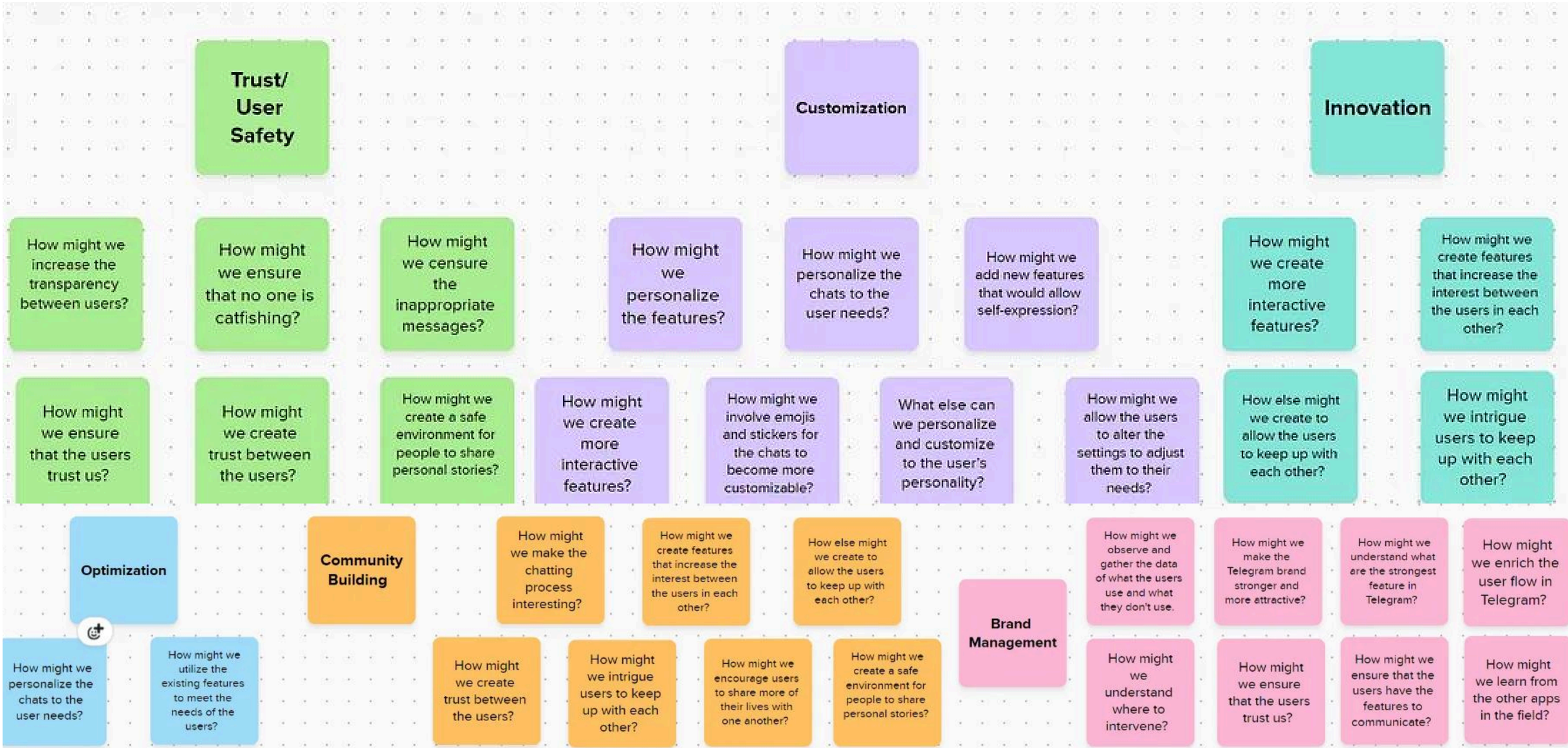
Concept

Typing awareness indicators, or "bubbles," seem harmless but actually fuel anxiety by amplifying emotional stakes in text exchanges. These looping animations create a tense wait for responses that are often trivial, leaving users obsessing over potential interpretations. The bubble's ambiguity — showing activity without content — heightens impatience and frustration. Sociologists suggest that these constant digital signals prime us for an exhausting cycle of anticipation, turning a simple feature into a potent source of anxiety and miscommunication.



Group Brainstorming

Problem Statement: I want to communicate with other people through Telegram, but I cannot do it well because the typing indicators create anxiety and miscommunication by making me overanalyze pauses, delays, and the intent behind messages.



Evaluation & Iterations

S	W	O	T
Provides insights into other users' emotions and mental state, and sets the expectations of the conversation.	Oversimplifies human emotions by allowing a very limited selection of emojis for the users to express themselves.	Makes the conversations more intentional and conscientious.	Emojis might replace human interaction and conversation.
Increases transparency between users and minimizes uncertainty.	Discourages direct communication and opens a room for misunderstanding and prejudice.	Makes talking about hard topics easier through displaying emojis.	Can take away the main purpose of the app.

Mid fidelity prototype 1: Emoji moodboard

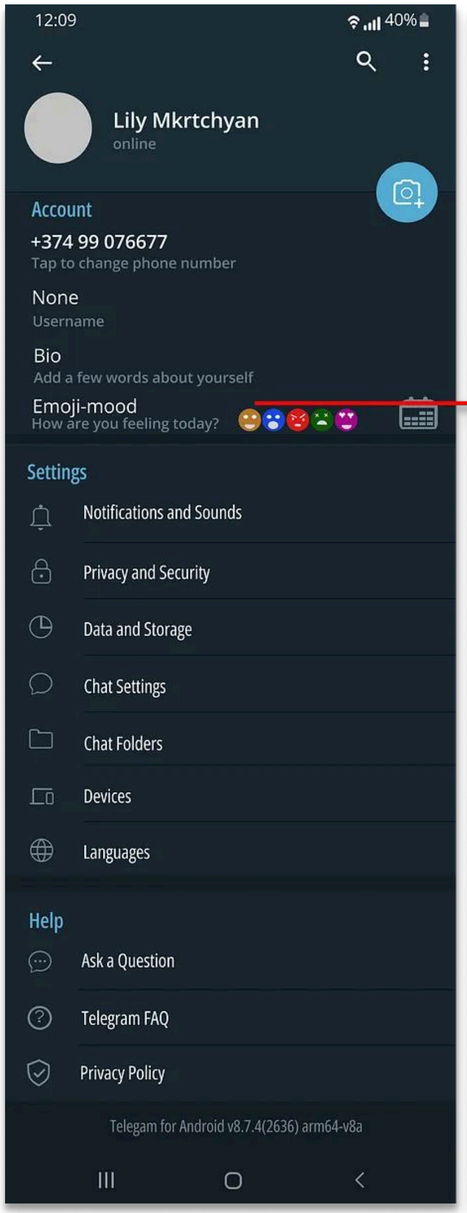


Image 1: Selecting the Emoji-mood function

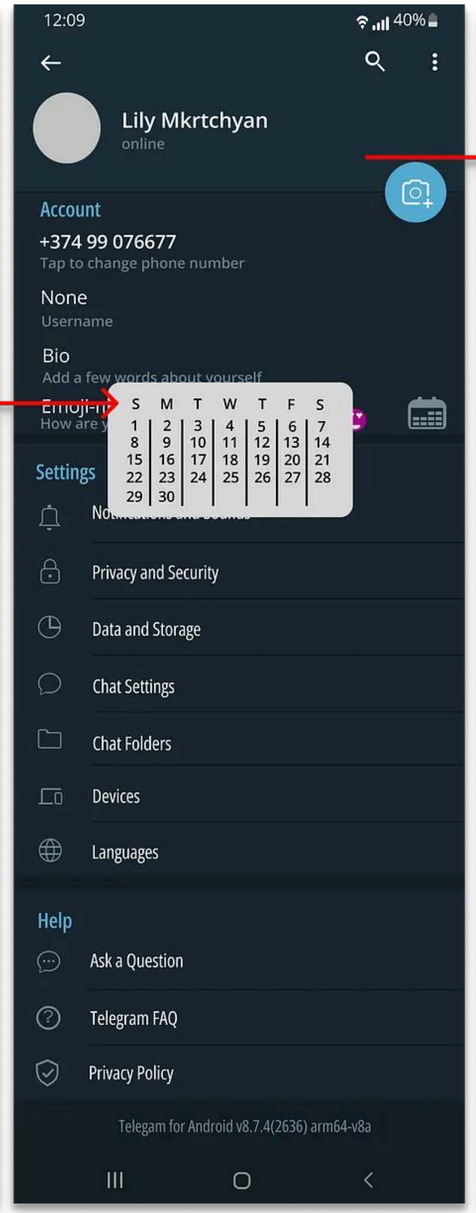


Image 2: Selecting the date to display the emoji.

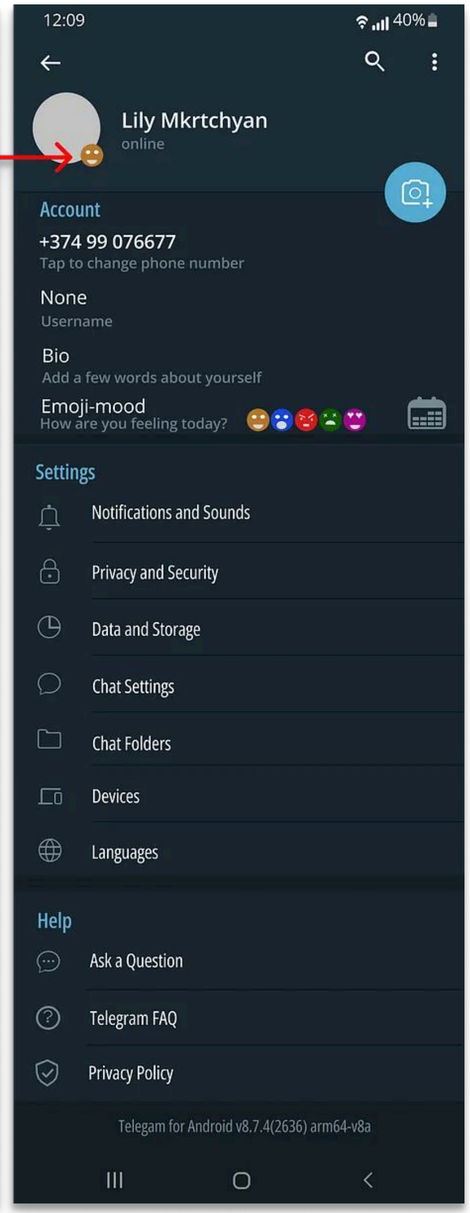


Image 3: Observing the result.

Evaluation & Iterations

S	W	O	T
Reduces pressure for instant replies.	Might result in increased social comparison.	Encourages more authentic connections by allowing users to share spontaneous moments, which can foster deeper relationships.	Users' privacy concerns.
Provides improved emotional context allowing users to understand each other's current mood or situation more intuitively.	Since Stories are temporary, important information shared there can be easily missed or forgotten, which may lead to miscommunicati on, especially in professional or urgent situations.	Creates topics for a dialogue for people who want to talk to each other but who don't know what to talk about or how to start a conversation.	This can create a different kind of anxiety around "keeping up" with peers or managing others' perceptions based on shared content.

Mid fidelity prototype 2: Telegram Stories

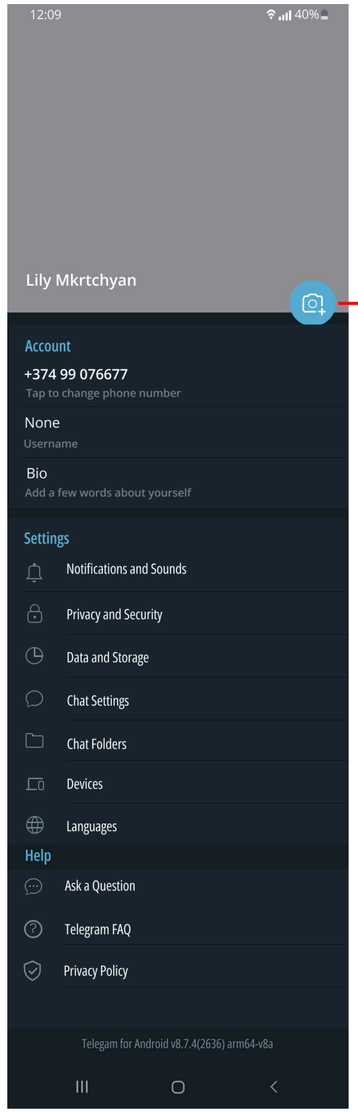


Image 1: Selecting the Telegram Story Icon

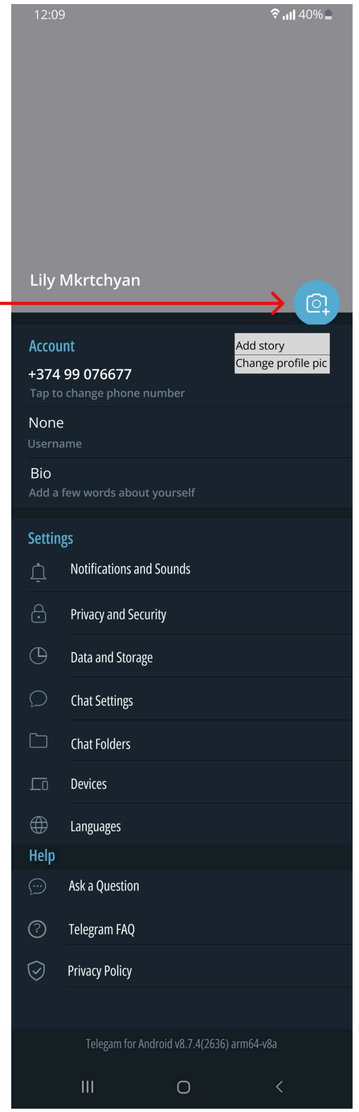


Image 2: Selecting the Add story option that enables for Telegram Story feature.

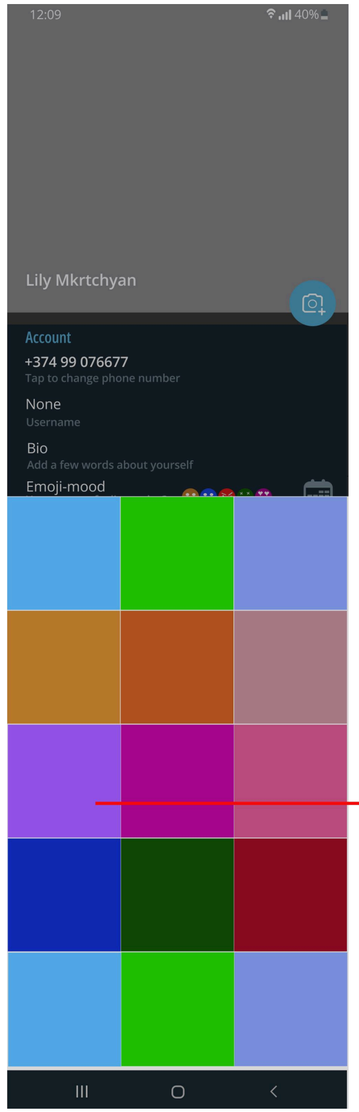


Image 3: Choosing an image from the gallery.

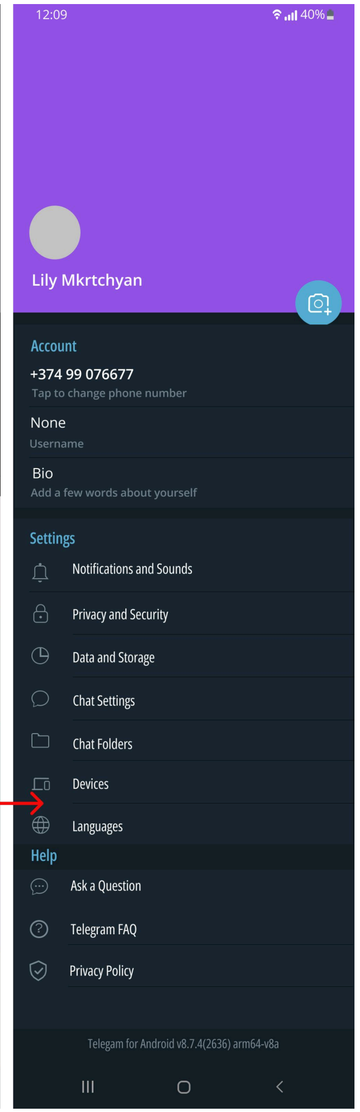


Image 4: Observing the result of the feature.

Evaluation & Iterations

S	W	O	T
Allows users to see each others' flow of thoughts and to better understand each other	Increases transparency. By watching each other type in real time, users will know exactly what the other user is thinking.	The other user can guide and lead the conversation as opposed to sitting and waiting for a message in a regular mode.	Users have to "complete" their real time messages in order to move on and have a conversation, instead of too long messages
Increases transparency. By watching each other type in real time, users will know exactly what the other user is thinking.	Users' spelling and grammatical mistakes will be immediately seen. Users' won't have the chance to double check themselves or run their messages by checking websites.	Users will have the chance to get to know the real users. Furthermore, authentic relationships that will form as a result of this feature will weigh more in the eyes of the users than grammar and spelling mistakes.	Users can prepare their "perfect" messages beforehand and input them from somewhere else as they type. This way they would not edit or change anything and they would not be honest and transparent

Mid fidelity prototype 3: Telegram LiveChat

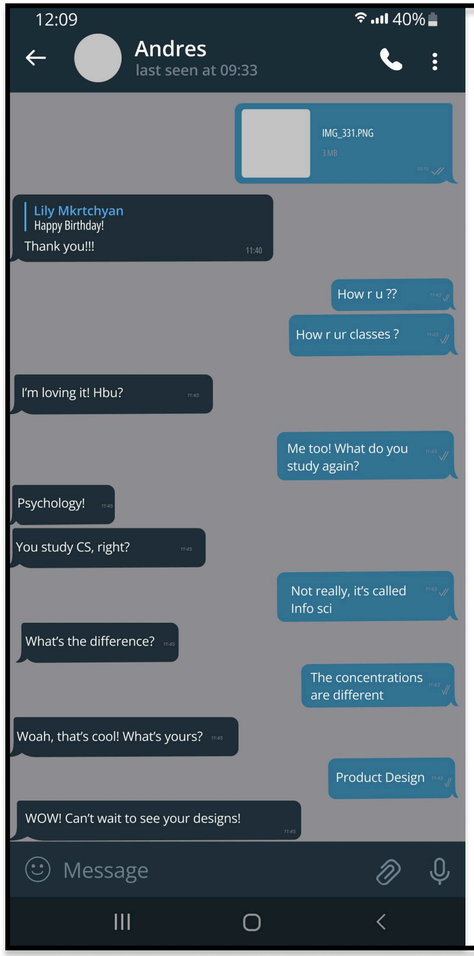


Image 1: Observing the previously sent message in the chat.

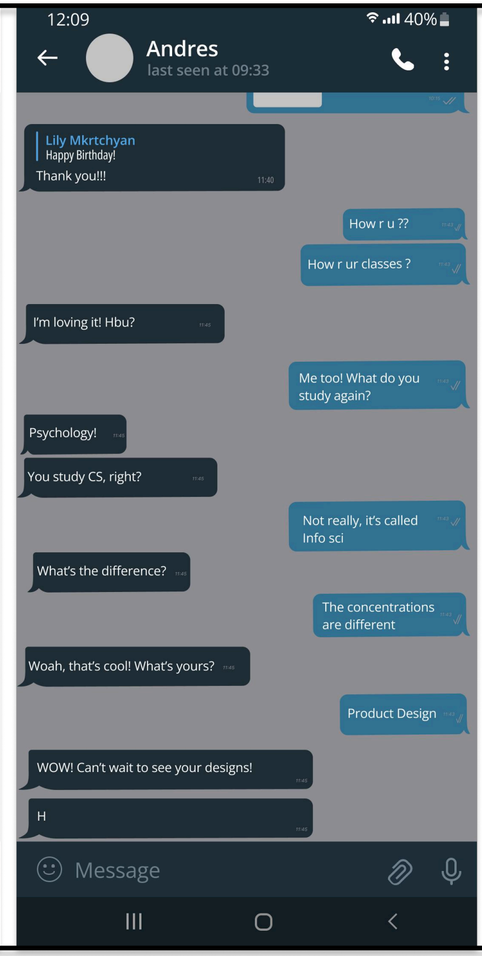


Image 2: Observing a new message being typed in real time.

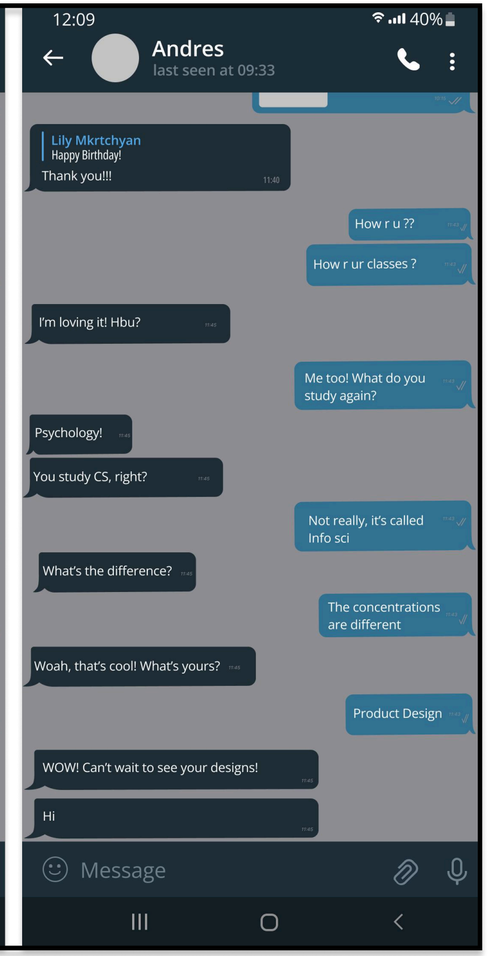


Image 3: Observing a new message being typed in real time.

Information Hierarchy

To design and integrate the new feature seamlessly into the existing system, I utilized an information hierarchy diagram to map out the structure of the application. This diagram allowed me to analyze the existing navigation flow and identify the most intuitive location for the new feature. By nesting the feature appropriately within the hierarchy, I ensured that users can easily discover and access it without disrupting the overall usability of the app.

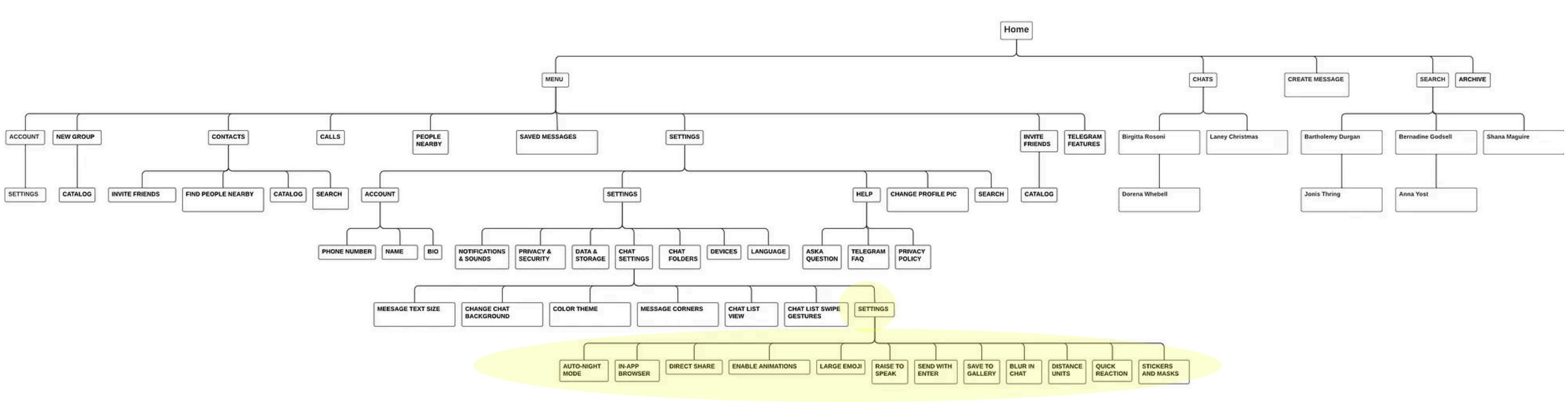


Image 1: Information hierarchy diagram used to identify where to nest the new feature for a seamless integration into the app.

High Fidelity

Menu → Settings → Chat Settings → Live Chat (On)

The Live Chat activation switch would be within the settings as it is related to other settings of the chat within the information hierarchy. The user would switch the Live Chat switch from “off” condition to “On” condition. The switch looks and functions identical to all the other buttons related to similar settings within the information hierarchy, hence there should be no confusion as to how to use it.

LiveChat Activation

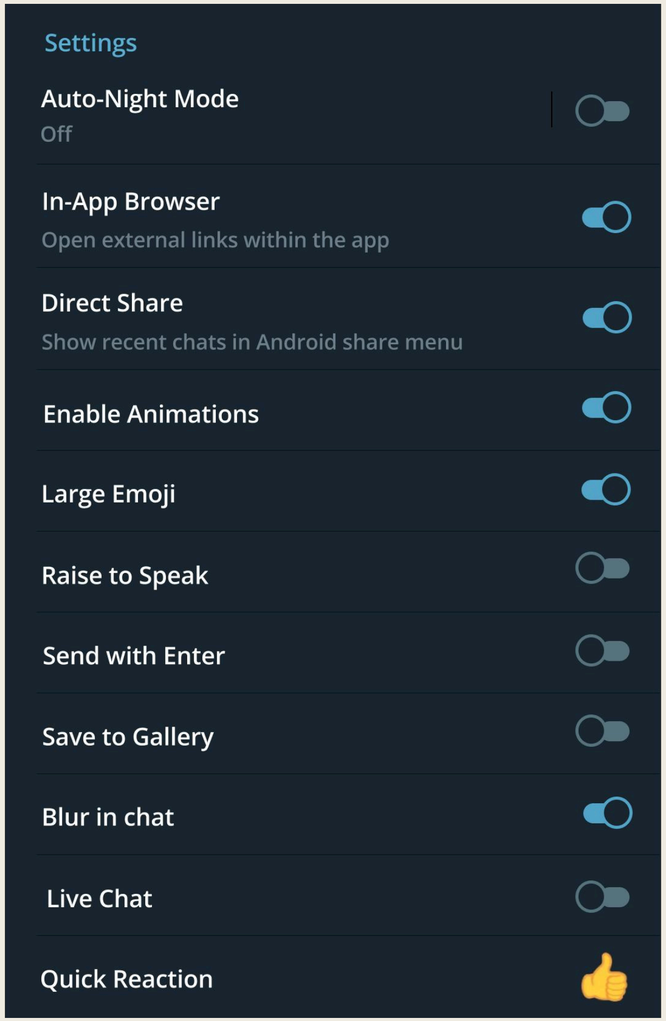


Image 1: LiveChat feature is off.

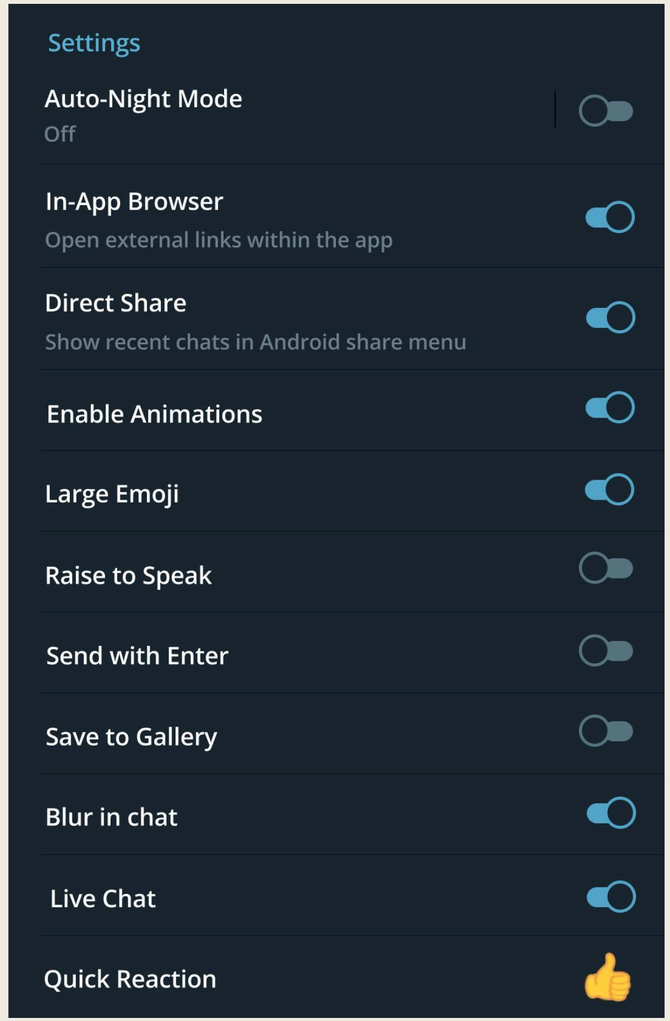


Image 1: LiveChat feature is on.

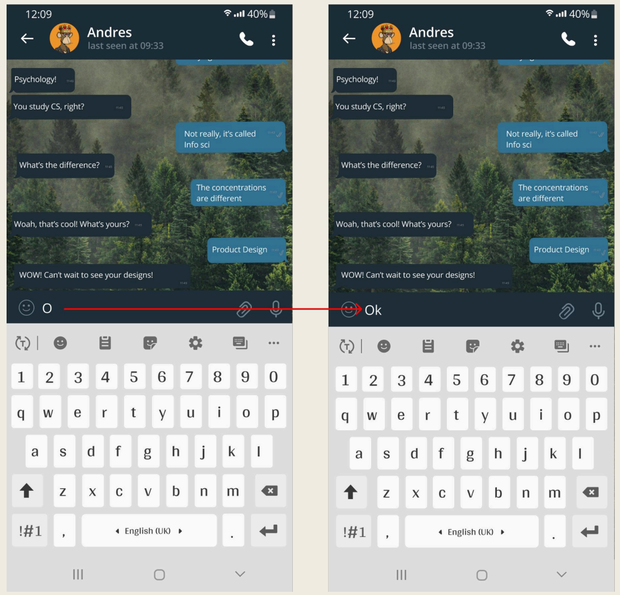
How Does The Typing Box Look Like For Us?

I think that the second version of the typing box is more suitable for the feature as it displays exactly how the user on the other side of the conversation would see the typing. It avoids the confusion that may occur with the traditional typing box and it shows the typing user exactly what the other person is seeing.

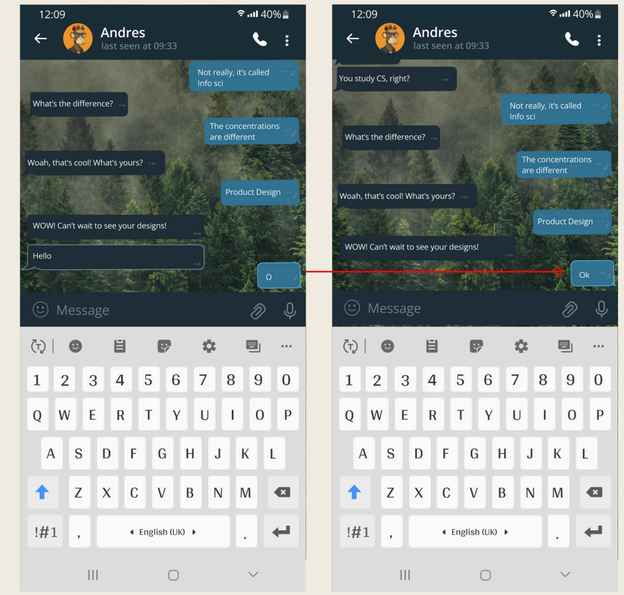
What Would Indicate That The Message Is Complete?

I have designed a message layout that lights up when the message is complete (when the user presses enter). The Enter key in the traditional Telegram messaging sends the message to the chat, however, in the Live Chat it completes the message.

TYPING BOX VERSION 1



TYPING BOX VERSION 2



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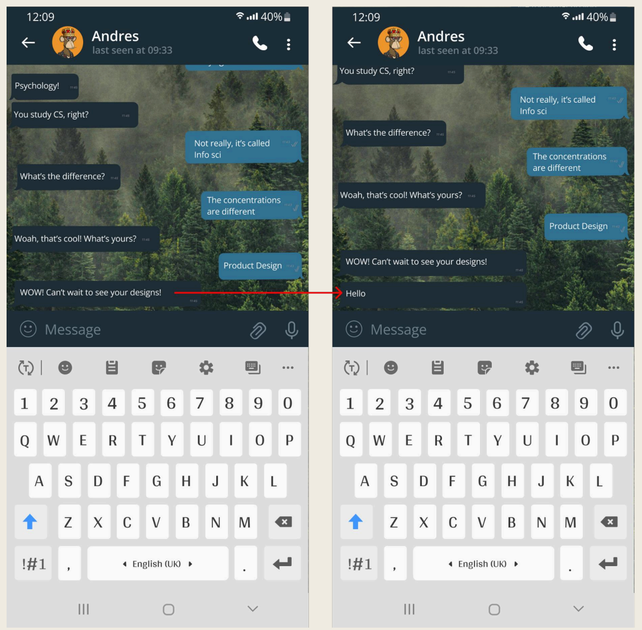

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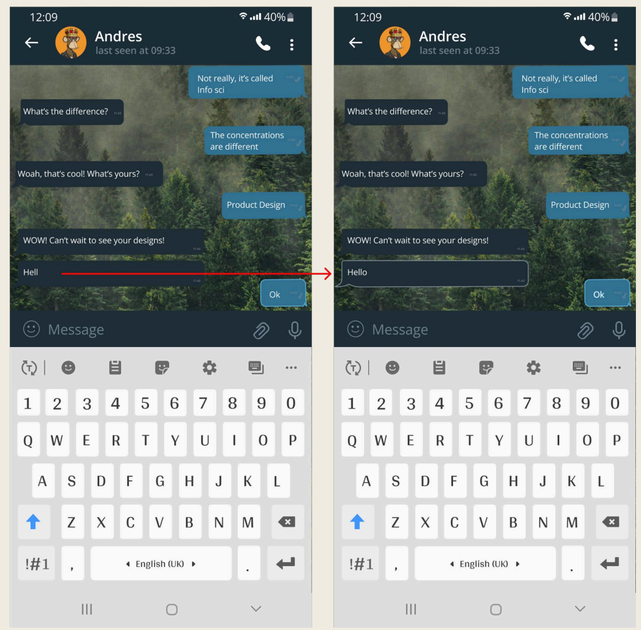


FringeEasy

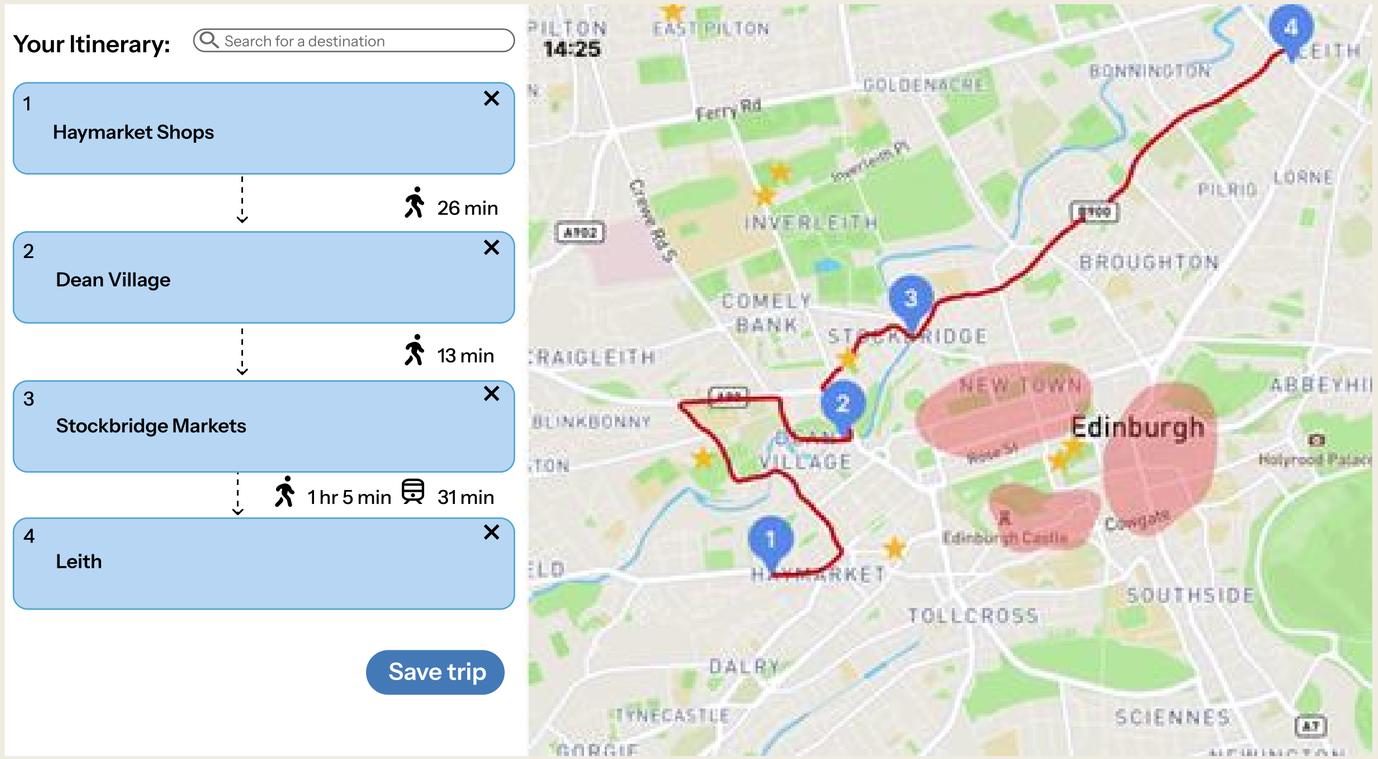
Navigate, Play, and Discover Edinburgh Like a Local.

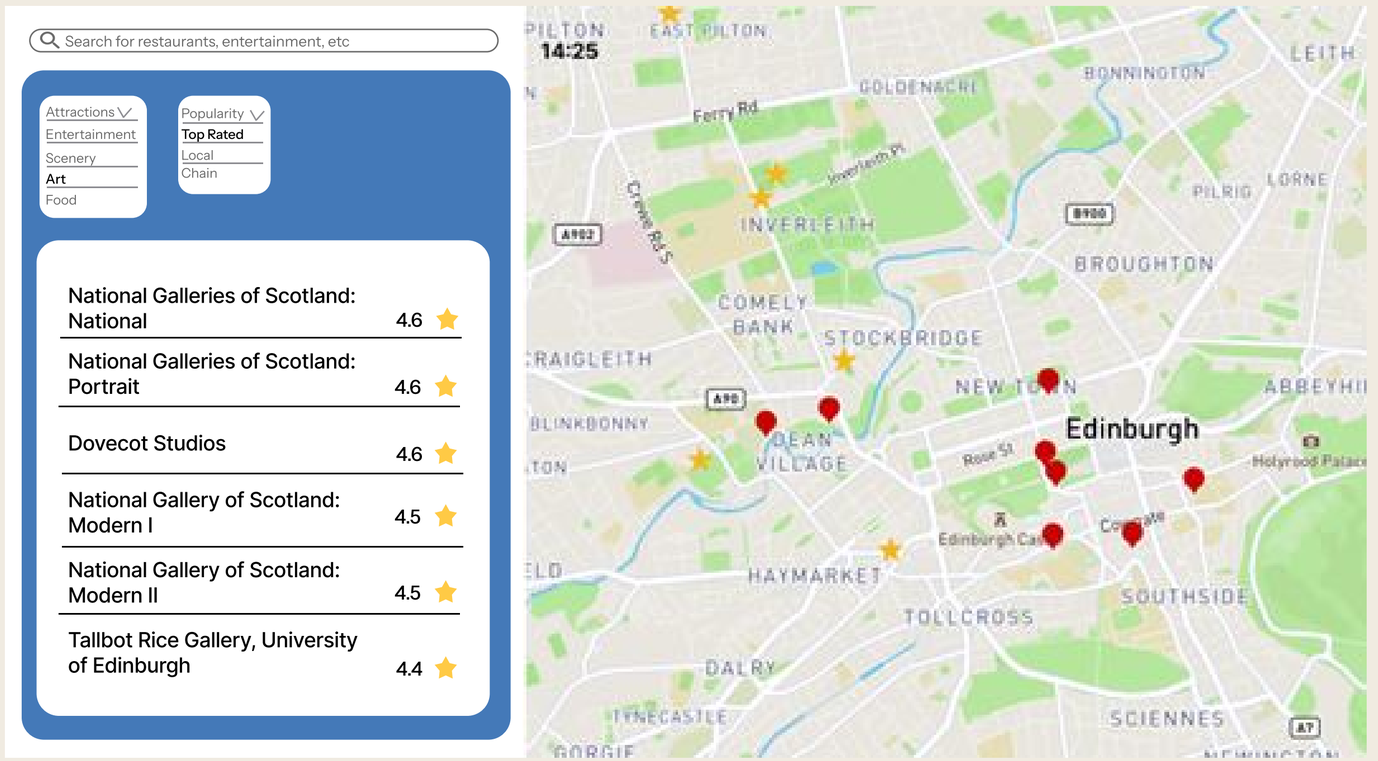
TEAM Lili, Ayslin, Amelia, Alex

DURATION 4 Months

TERM Spring 2024

CONTEXT Data, Design, and The City





FringeEasy Participatory Design Timeline

Interviews & Focus Groups

We gathered insights by conducting interviews with tourist agencies and facilitating a focus group.

Prototype Development

We leveraged insights from participatory activities to create the FringeEasy prototype.

1

3

Research

In the initial design stage, we analyzed available data, social media reviews, academic insights, and policy responses.

2

Elicitation Activity

We used an elicitation technique by observing potential Fringe Festival participants plan their day using all available resources.

4

1. Research

DATA

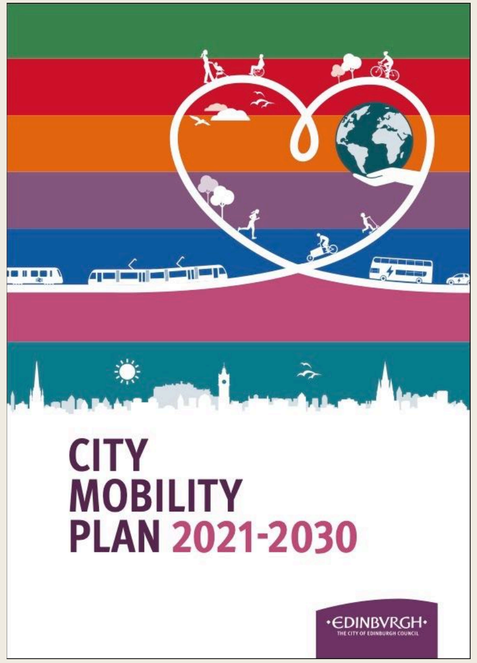
- Between 2022 and 2023, visits to top sights, such as The Edinburgh Castle and The Scottish National Museum, surged, with numbers rising by 50%, indicating a lack of distribution in tourist flows. This clustering places immense pressure on central urban areas, creating bottlenecks and diminishing the overall visitor experience, particularly during peak seasons.

POLICY

- Through the City Mobility Plan 2021-2030 and the Edinburgh Tourism Strategy 2030, is it apparent that there is an issue of overtourism, however there was a critical gap in strategies to disperse tourists beyond these crowded landmarks. While these policies emphasize sustainable travel and urban livability, they underutilize digital solutions such as queue monitoring, pre-booking systems, and promoting alternative attractions.

THEORY

- From an academic standpoint, theories like Henri Lefebvre's Right to the City highlight the alienation that arises when urban spaces are dominated by a small number of attractions.



Technological solutions: Use technology to monitor visitor flows and queues, as well as pre-booking and differentiated pricing for attractions.

SUSTAINABLE AND INTEGRATED TRAVEL

Edinburgh is a successful and prosperous city, regularly voted as one of the best places in the world to live, work and visit. With a strong and varied economy, growing inward investment, a flourishing cultural offering and being the UK's second most visited city by tourists, the Capital has solid foundations on which to build.

TOP ATTRACTIONS

Between 2022 and 2023 the number of visits to the top five attractions (paid and free) in Edinburgh increased by 50% from 4.1 million to 6.2 million visits. The National Museum of Scotland and Edinburgh Castle are the most popular attractions.

Edinburgh's top visitor attractions (2014)

Attraction	Number of visitors
National Museum of Scotland	2,186,841
Edinburgh Castle	1,900,000
Scottish National Gallery	1,836,057
St Giles Cathedral	1,029,359
Royal Botanic Garden	1,088,239

Source: VisitScotland

IN 2023 THE FESTIVAL FRINGE ISSUED
2,450,000
TICKETS

2. Interviews & Focus Groups

FOCUS GROUP INSIGHTS

- Preferences are highly subjective.
- There is willingness among students to explore.
- Preference for social media as research tool.
- Willingness to engage in active travel.

INTERVIEW WITH JOSHUA RYAN-SAHA

- Decide which stage would the solution target out of 5 stages of journey.
- Open-source applications are efficient but require effort in creating the initial user base.
- People gravitate towards applications that advocate for values that align with their own.
- Need to differentiate between “crowd” and “vibey”.

INTERVIEW WITH ICENTRE TOURIST AGENCY

- There are no tourist agencies targeting students: The only one, STA, closed right after the Covid-19 pandemic.
- The tourist agencies don’t change their itineraries to accommodate for the Fringe Festival and other popular ceremonies.

Visiting student at UoE
@focus_group

“I’m an architectural history major, so definitely for me I would say that it appeals to me and I definitely would say that it depends on your interests”

Joshua Ryan-Saha
@interview

“You need to think about how it contributes to the community.”

Visiting student at UoE
@focus_group

“The health culture here is really nice”

Joshua Ryan-Saha
@interview

“You have to understand if the place will be busy before it’s busy.”

Student at UoE
@focus_group

“I look at social media to see what’s popular also”

Joshua Ryan-Saha
@interview

“Maybe there’s no clear definition of what's busy because crowd vs what’s busy but it’s vibey.”

Student at UoE
@focus_group

“There is like so much to do that is hidden away so I guess it would be good to push myself to look for those things a bit more”

Image 1: Brochure/Map of iCentre tourist agency tours.

3. Elicitation Activity

In this participatory design activity, University of Edinburgh students used a prototype app and Fringe Festival maps to plan their day, focusing on where to visit and which factors influenced their choices. The activity highlighted students' reliance on social media to find popular spots, their preference for walking, and the tendency to remain in central, crowded areas. This insight supports the potential effectiveness of an app designed to balance foot traffic and encourage exploration beyond the city center.

PARTICIPANTS' NOTES

- "Start at Haymarket"
- "Dean village is scenic"
- "Find interesting stuff on route to Stockbridge"
- "Bus or tram to Leith depending on weather"

Thoughts and Feelings:

- "Happy for good weather"
- "Tramming from Haymarket is inconvinient"
- "Glad to have found hidden gems outside from centre of city"

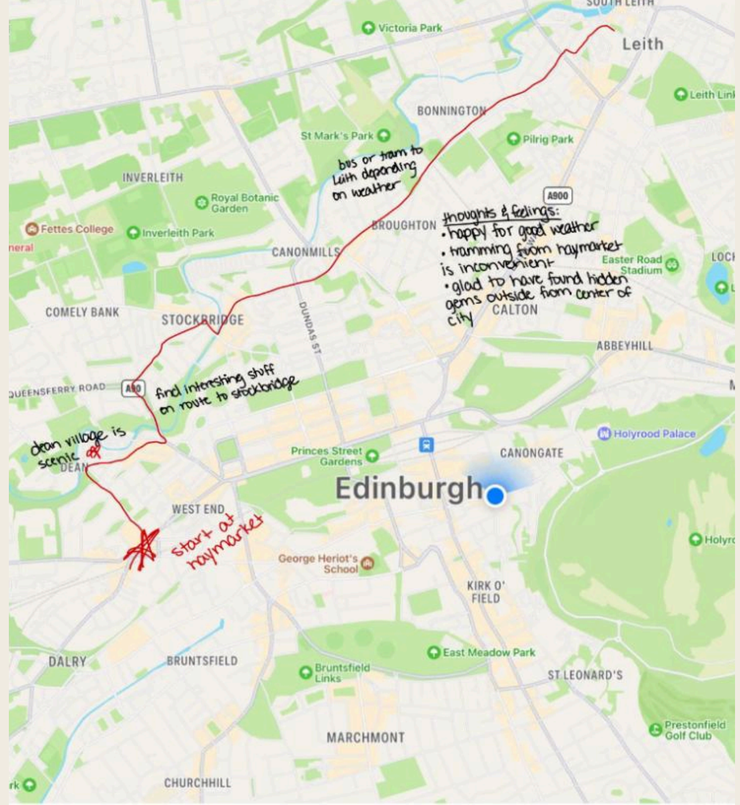
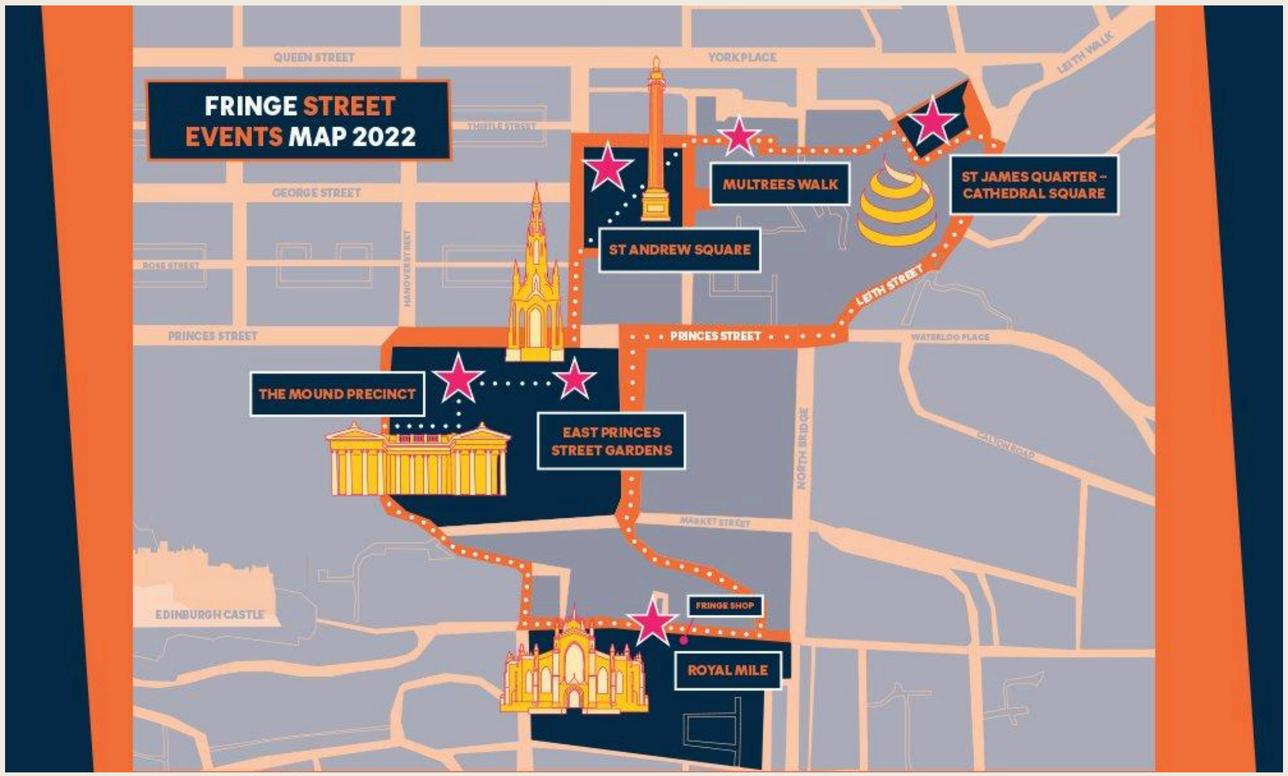
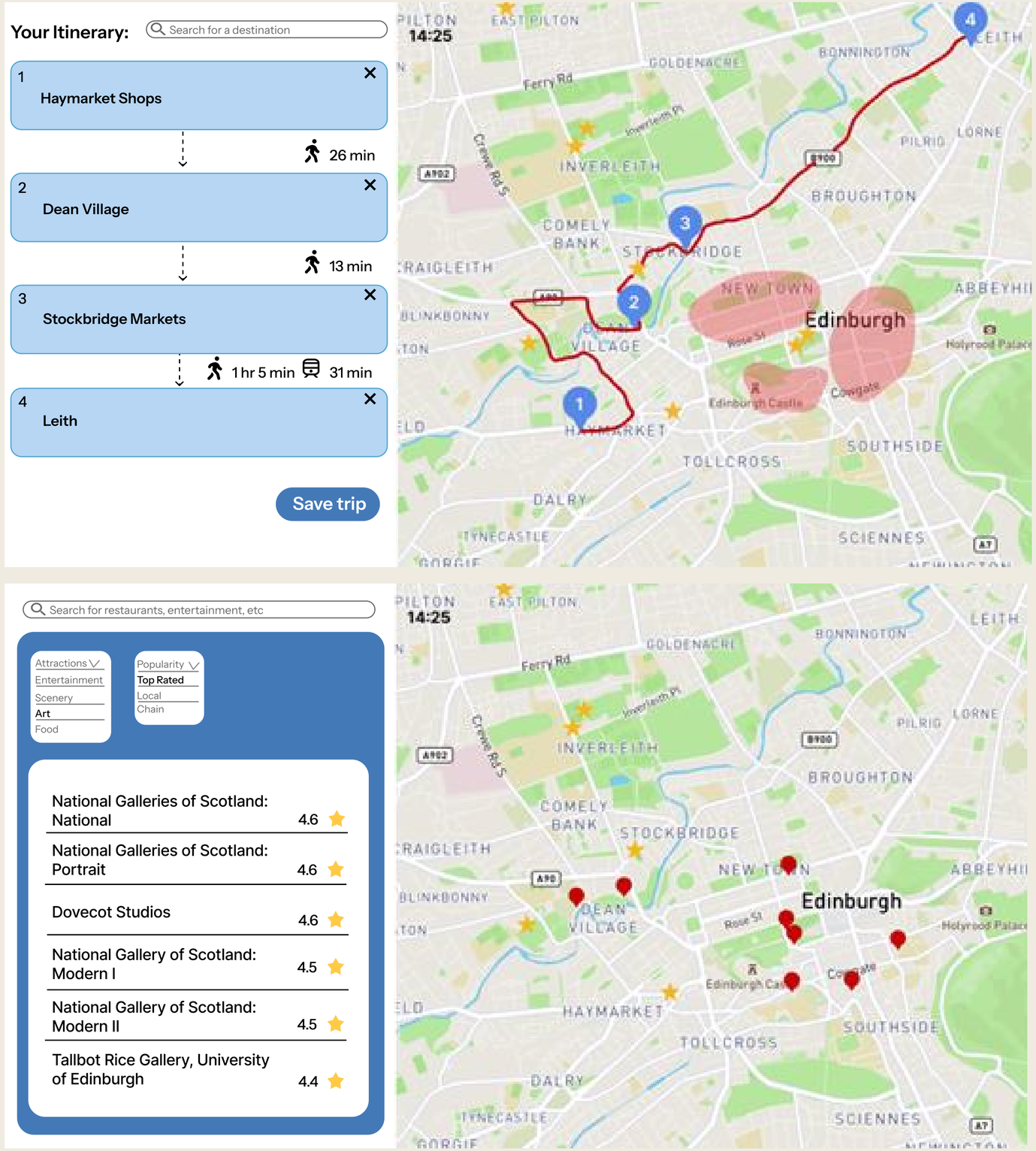


Image 1: The map annotated by the participants during the activity



4. Prototype Development

- A travel planning mapping tool with search features
- Providing all necessary information that would traditionally be sought out through various avenues
- Community favorites: Other students can pin spots that they have discovered in the city that they think are interesting and others may enjoy
- Students can filter for attractions that suit their interests
- Brings visibility to smaller businesses with “local” vs “chain” filters
- Brings together recommendations from various avenues to reduce need to research elsewhere
- Streamlines planning process
- Provides real time updates on tourist congestion so students can plan accordingly
- Recommends easiest modes of transportation between given destinations



Design Projects

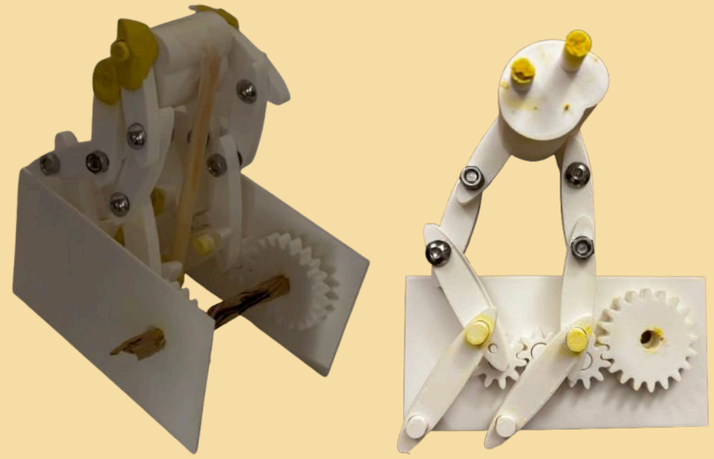
Rapid prototyped locker, Jack-in-the-box, and 3D printed spider automaton.

TEAM Lili

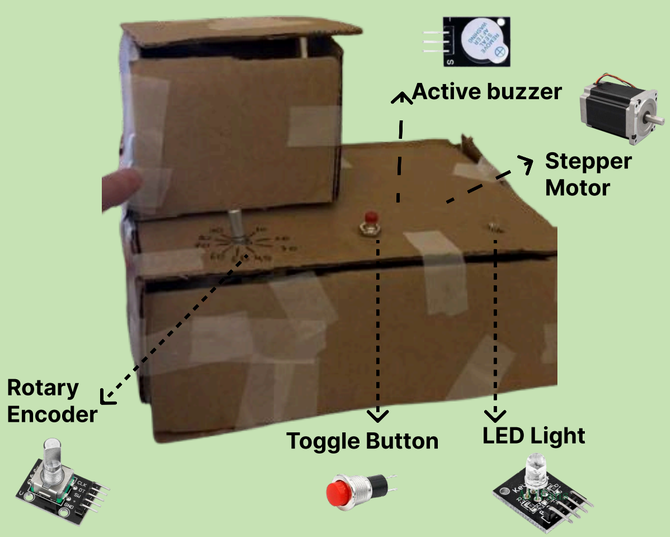
DURATION 1-2 weeks each

TERM Fall 2024

CONTEXT Intro to Rapid Prototyping and Physical Computing



A designed spider model, created using Fusion 360 and 3D printing.



Rapidly prototyped locker.

Designed and laser cut Jack-in-the-box.