Alchemist

Designing Emerging Technologies / Fall 2019 / Project 04

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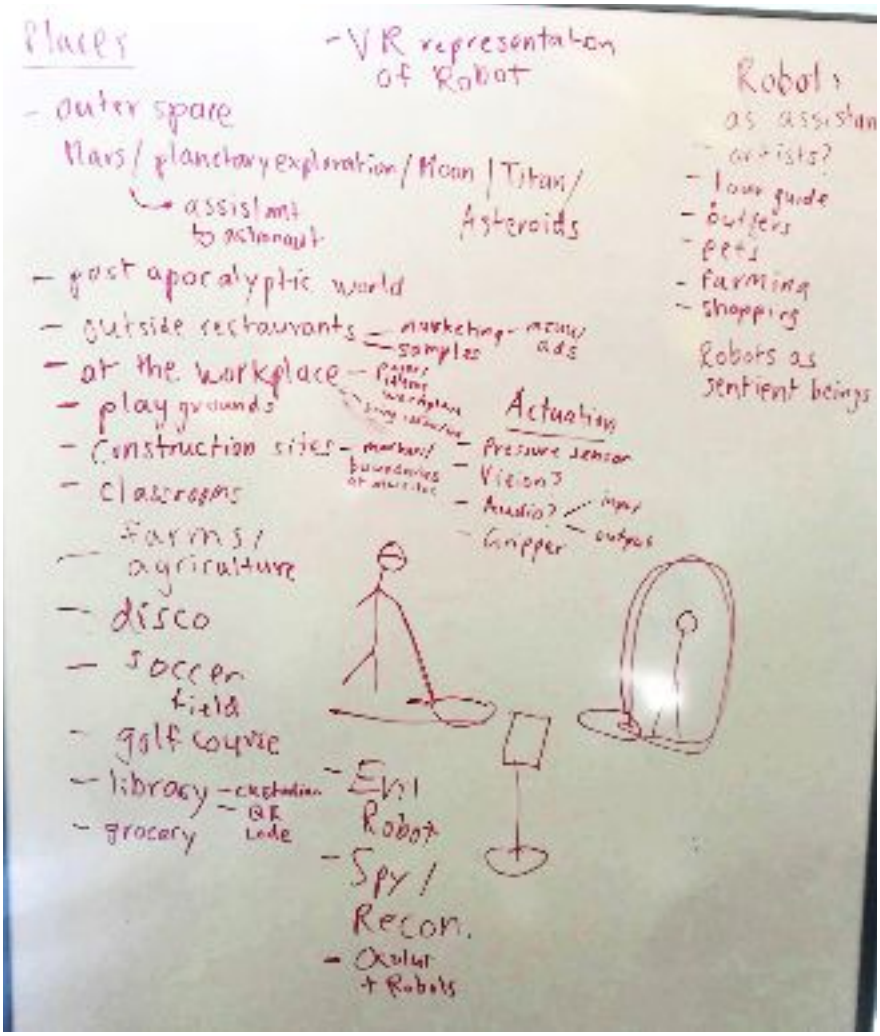
PROVOCATION

Robots are usually considered inferior to humans in today's social order, since we see them as machines we build to perform dirty jobs or repetitive and labor-intensive tasks. However, how would this change in the future, especially in a post-apocalyptic scenario? In 2050, when nuclear weapons are likely to destroy most known civilizations, the robots we've built, especially with materials and sufficient intelligence to withstand such an apocalypse, will be our hope. In such a world, Alchemists will roll over the seemingly hopeless lands full of radiation, detecting clean air and soil, marking the boundary of radioactive zones and dispensing seeds to grow hope for human beings. We want to challenge the notion of how humans will perceive robots as more than just agents of dirty works that goes invisible, by making it more valuable and visible than before. All in all, we are looking to promote the idea of robots and humans coexisting on the planet.

IDEATION

Our group was very interested from the very beginning at using robots as a creative material for **storytelling**. We were all inspired by the idea to tell a compelling story and using the robot as a primary medium to communicate an invisible or less visible truth around a topic of our interest. We started by ideating on different locations that a robot would conventionally (or unconventionally!) be deployed on and came up with the following ideas:

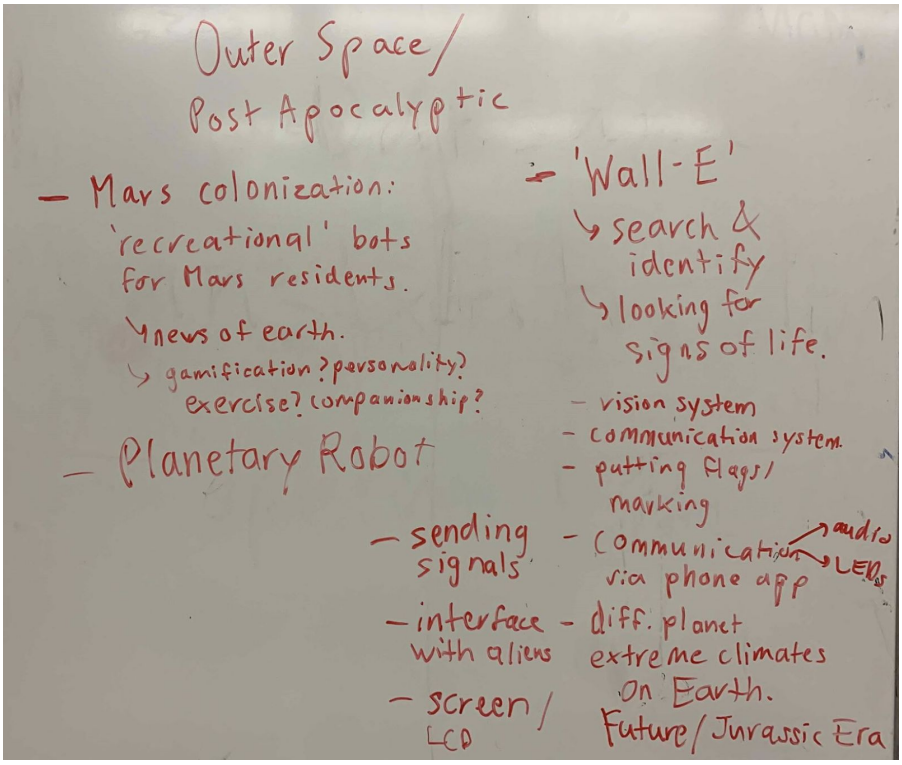
Iteration 1: Exploration



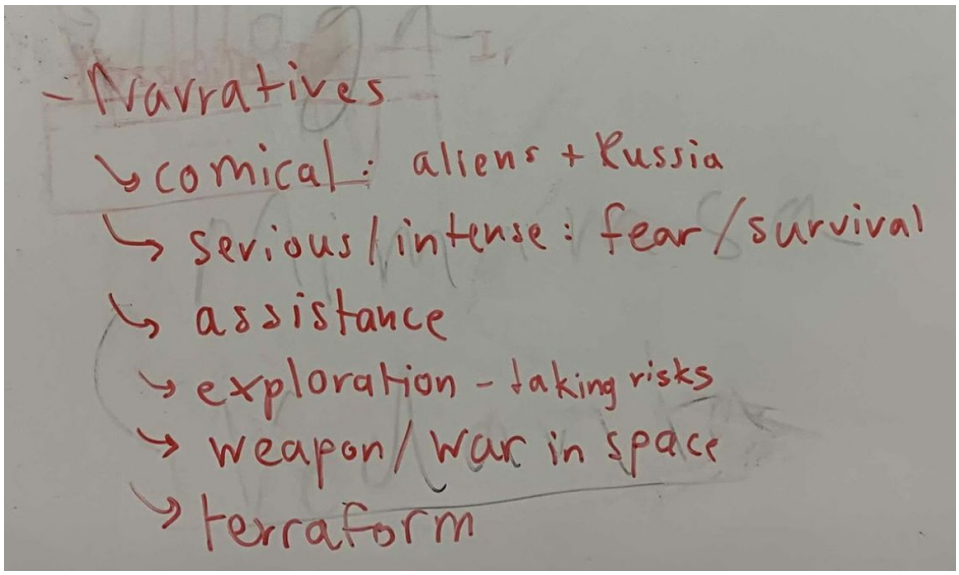
Outcome of the First Iteration of Ideation

Iteration 2: Focusing on Narratives

We decided to take a different approach, by focusing in on broader narratives that we were interested in. What type of story should we tell seemed like a better starting point than what story we should tell. We listed down an assortment of narratives and discussed various ideas around each of them.



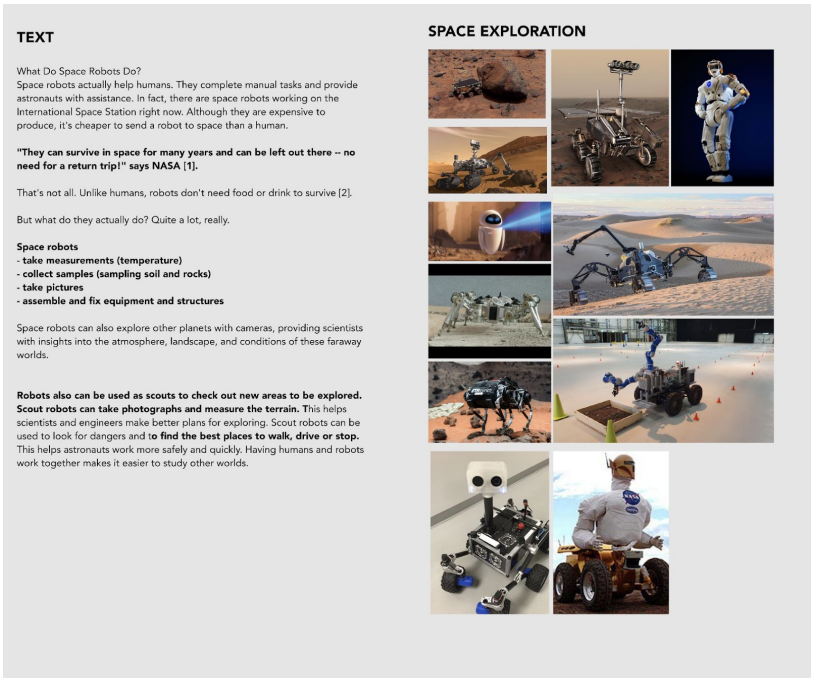
Scope of the Outer Space/Post Apocalyptic Idea

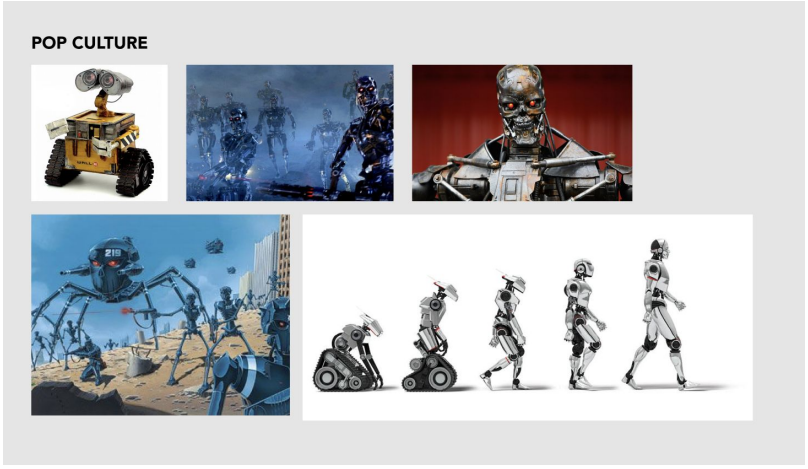


Potential narratives

Iteration 3: Case Studies

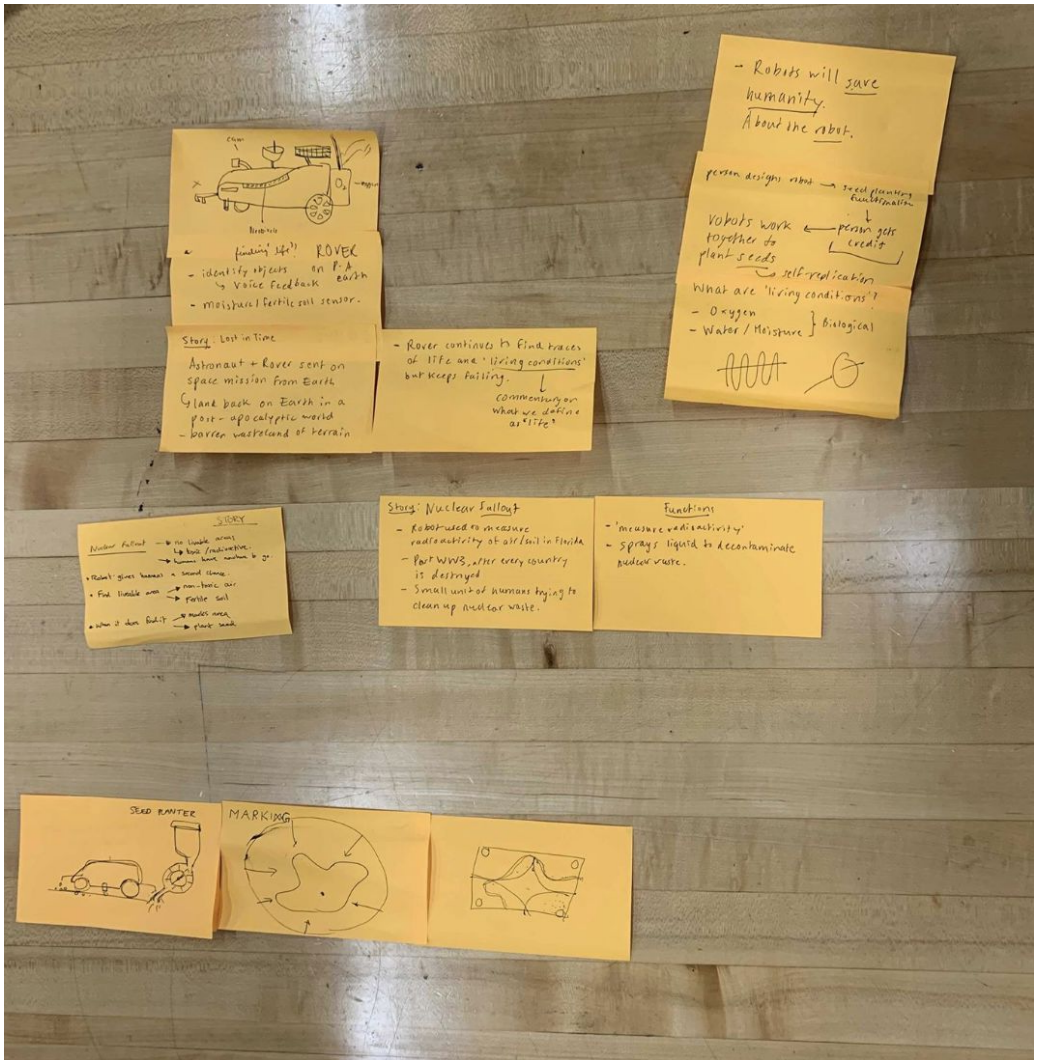
In this iteration, we looked closely for aesthetic inspiration through various case studies. If we were to critique a dominant cultural theme around robots, we had to first understand it. We had some discussions about why robots are designed the way they are, and how might we critique that?





Iteration 4: Converging and Concept Development

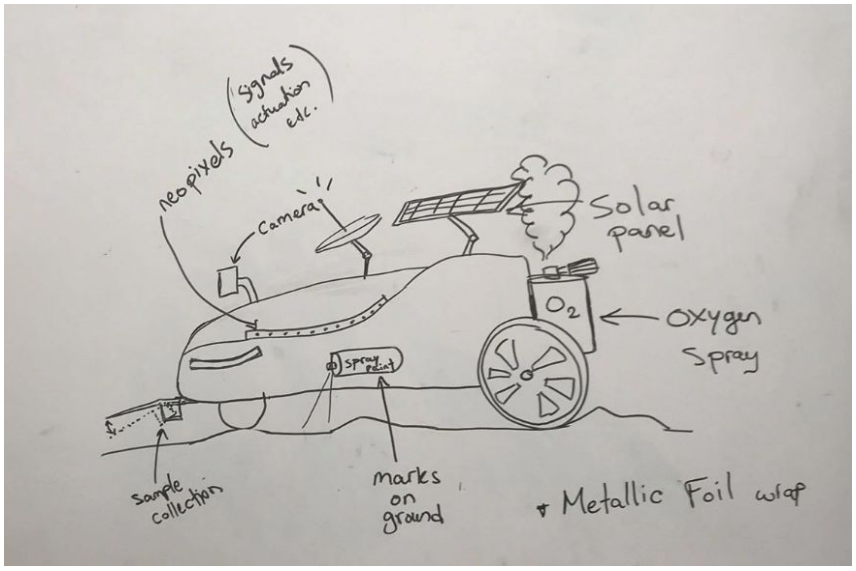
After talking extensively and showing broad interest in the themes of exploration and taking into account instructor feedback, we converged on the setting of a post-apocalyptic (post nuclear-war) world and started to discuss critical narratives that we could address - specifically centered around issues of robots and humans coexisting as well as promoting denuclearization by depicting an alternate reality.



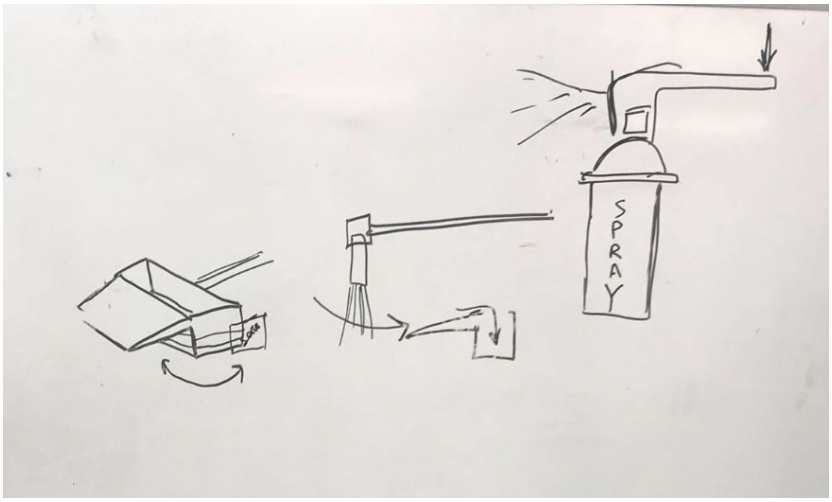
Concept Development

Iteration 5: Finalizing Design Concept

We decided to narrow down on the features we would build out in the robot while working in parallel on the story. The robot would be a doomsday machine and symbolically bring back hope for life through its seed planting mechanism. We drew out what this would actually look like (as seen below) on the Husqvarna, and added an even mix of aesthetic decorations and functionality.



Consolidated Robot Concept



Mechanisms overview

HARDWARE DESIGN AND SPECIFICATIONS

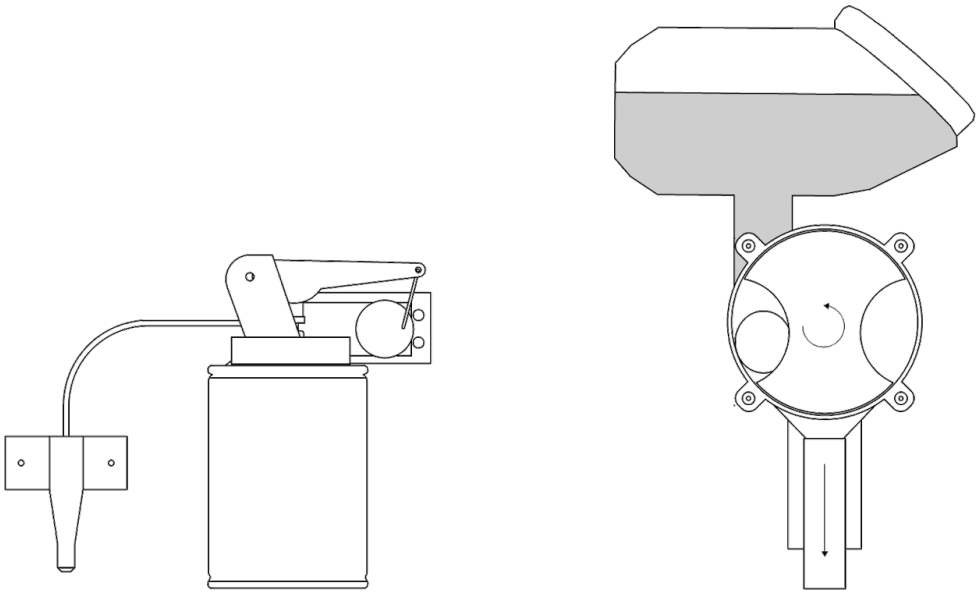
MECHANISMS

Spray Painter

The mechanism design aimed to use a single servo motor as a trigger for both, the spraying and seed dispensing mechanism. A 3D printed spray can trigger was developed to transfer the rotating servo motor movement to a lever that presses down the spray can cap. The 3D printed part is clipped onto the spray can, and holds the servo motor using four screws. The can and 3D printed mechanism are then placed behind the front bumper of the robot and secured using zip ties. A thin 5’ spray can tube is connected to the tip of the nozzle and is channeled to the side of the robot. Another 3D printed nozzle is mounted to the robot’s side which holds the spray tube in place.

Seed Dispenser

To create a seed dispenser, a paintball hopper was used as a seed storage container. Attached to the bottom opening of the paintball hopper is a 3d printed housing that acts like a rotating valve. The valve housing has two openings, and holds a servo motor in place. The second opening is at the bottom of the housing where seeds can be dispensed. The servo motor rotates a round 3d printed wheel that carries the seeds from the first to the second opening. An acrylic cap is used to close the face of the housing which enables us to see and deal with any jamming seeds inside the valve. The second housing hole is attached to a hose which guides the seeds to drop in front of the robot’s back wheel. The placement of this mechanism is to for using the wheel to burry the seeds into the ground as they are dropped and driven over. Different wheel prototypes have been tested to avoid any jamming. For the demo, coffee bean powder was used for optimal size and texture.



Spray Paint Mechanism (L) and the Seed Dispenser (R)

Electronics

The wiring for the robot was relatively simple; we chose to attach the Raspberry Pi directly to the bottom of the robot, as that was the central location for all the electronic components that we were planning to add. We added two 180° servos and a Neopixel LED strip. We were planning to implement an additional 180° servo to use for a soil moisture probe, but due to time constraints, we were not able to include this servo.

The two servos included were used to run the mechanisms explained above. The seed dispenser required a 90° rotation to be able to refill and discharge seeds, and the spray paint mechanism needed a 30° rotation in order to press and hold the trigger on the top of the spray can.

We used 42 Neopixel LEDs under the front bumper of the robot's outer casing to provide accent lighting when the robot encountered "safe" or "dangerous" areas to plant seeds. This would be determined by checking 1) radiation levels using a Geiger counter and 2) soil moisture levels using a soil moisture sensor. As mentioned before, we were unable to implement the soil moisture sensor. We also did not implement the Geiger counter, as we are not in an area with sufficient radiation to trigger the sensor. However, with this two part check, we could effectively determine whether a specific location was able to have seeds planted. In the case that the radiation levels were low and soil moisture level was high, the area would be deemed safe and we would pulse

green lights. In the case that either the radiation levels were high or soil moisture level was low, the area would be deemed dangerous and we would pulse red lights.

In addition to the lights, we would plant seeds if the area was safe by using our seed dispensing mechanism. If the area was dangerous due to high radiation levels, we would mark the area using the spray paint mechanism so that humans would know not to venture too close to the area.

Overall Appearance

We envisioned our robot having a bit of a rugged and industrial look. As such, we used reflective vinyl on the outer casing to represent a radiation-proof material that would protect the robot from its dangerous environment. We also found a few other miscellaneous hardware components from a junk shop that we attached to the robot. An external tube was attached to represent the spray paint tubing, and to make the purpose clear to others that encounter the robot. The hardware components and the tube were spray painted black to align with our branding and to further the apocalyptic feeling that we wanted our robot to portray. We also had a speaker in the shape of a dog head on the crest of the casing of the robot, symbolizing the role of the robot as a helper and loyal companion to humans in this time of need.

The spray paint mechanism, seed dispensing mechanism, soil sensor, and satellite were all 3D printed in a black color, again aligning with the brand of the robot. Although the soil sensor and satellite were purely cosmetic, they represent important roles that the robot will play if deployed. The sensor would be part of the two-part safety check before planting seeds, and the satellite would be used to either communicate with humans, or to communicate with other robots fulfilling the same role.

We also laser cut a few components to attach to the robot and further our brand, attaching them to the wheel hubs and the front bumper. These components were spray painted black and featured the Alchemist brand logo.

DEMO DESIGN

Building a compelling demo was an important component of our project, since our focus was storytelling. The story we were planning to tell during the demo had to be consistent, adequately depict all the features we built and lastly but most importantly, be memorable in a lasting way.

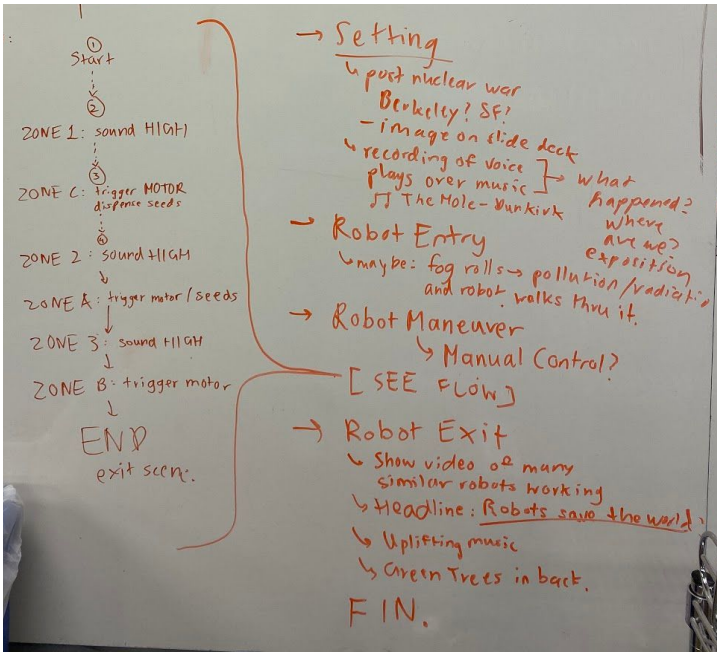


Diagram depicting the demo flow

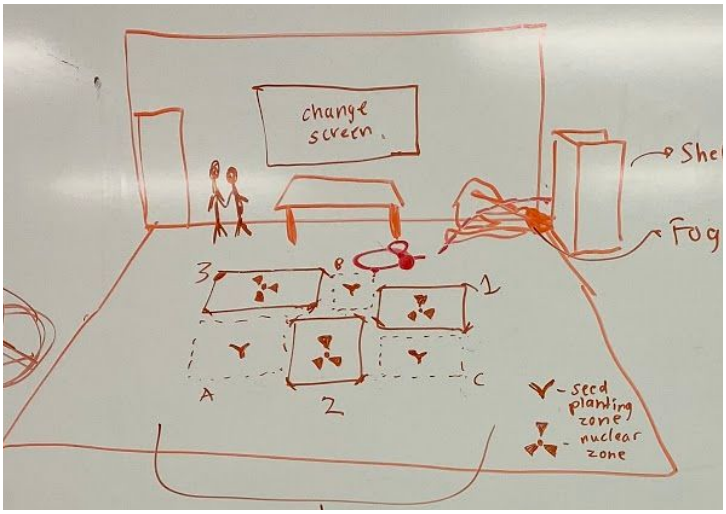


Diagram depicting the layout of the space during the demo

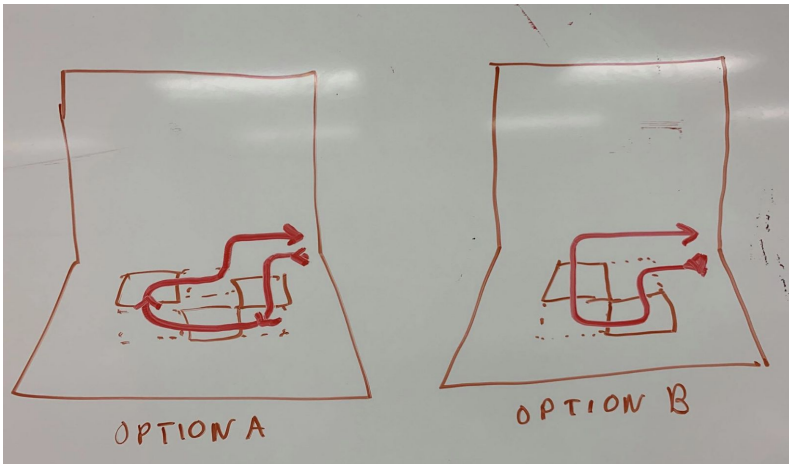


Diagram depicting different possible navigation routes

CONSOLIDATED DEMO

Part 1. Setting

- Play the music from laptop: **The Mole - Dunkirk**
- Play recorded Narrator Voice also from laptop? (Story & Record Voice Over)
- Background Slide: UC Berkeley after a nuclear explosion

Part 2. Robot Entry

- Start the fog machine
- Drive robot & let it come out through the fog (pollution after a nuclear explosion)

Part 3. Robot Maneuver (Manual Control)

- Play the ticking sound from phone
- Robot walks in Zone 1 (radioactive, high geiger sound, activate soil sensor, red light)
- Robot walks in Zone 2 (clean, 0 geiger sound) [stop, activate soil sensor, green light, dispense seeds, make a mark, leave]
- Robot walks in Zone 3 (radioactive, high geiger sound, activate soil sensor, red light)
- Robot walks in Zone 4 (clean, low/0 geiger sound) [stop, activate soil sensor, green light, dispense seeds, make a mark, leave]

See Route Maps below

Part 4. Robot Exit (~15-20 secs)

While the robot is exiting, we will play:

- Background Music
- a short slide + video
- Fin.

Script for Demo

In the early 21st century, the promise of a future powered by technology couldn't have been brighter. But we never got the future we wanted. Politicians couldn't put their differences and vendettas aside and the worst case scenario came to life: all out nuclear war.

It is now 2050. With most of the human population wiped out and arid, desolate landscape everywhere, life on Earth is doomed. Radiation levels are off the charts, making the air unbreathable and contaminating our food.

In times like these, hope is the most powerful tool for humanity. But there is no hope.

In these final moments, a small troop of robots called the Alchemists are being deployed to find arable soil and plant seeds to make the Earth livable again. Now, our fate lies in the success of these machines.

The question lingers... will we make it?

NAMING THE ROBOT

Like every other project, there came a critical moment when we had worked on this long enough for us to stop calling it the generic 'robot' or 'Husqvarna' and give it an actual name of its own. Interestingly, deciding a name for a robot felt so much more personal than deciding a name for any other design project in this class so far. Is this, in some ways, our implicit acceptance of the sentience of robots?

We brainstormed and came up with a list of names that were related in some ways to the story we were telling and picked one based on the fit into the overall narrative.

NX007
Alchemist
Nucleo
Atom
NZ5
Seedist
Accelo
Fermi
Nyx
Yejun:
RD50
Rado
Nuclear
Hopsy

We really liked Alchemist because of the concept of alchemy - the (almost) magical process of converting something into gold or elixir, which some consider, is the essence of life. We believed that planting seeds is like sowing hope for humanity, especially in a scenario where there exists none. Our robot is performing alchemy of sorts, converting dry and arid landscape back into something with more life.

And with that, **Alchemist** was born.

BRAND DESIGN

We proceeded to design a logo to tell a story about the brand of **Alchemist**. This logo inherits a part of the common nuclear sign, to easily remind people of the element of nuclear war that is deeply embedded in our story. On the other hand, there's a circle dropping from the top, as a simplistic representation of one of our core functions, the seed dispensing mechanism. The overall shape of the logo looks like the alphabet A, the first letter of Alchemist.


After we completed the design of the logo, we wanted to decorate our robot with the logo to highlight our brand. We first laser cut the logo with acrylic and put reflective vinyl on it. We then glued the logo on a black wood and glued the whole thing on the shield shape front, the seed dispenser and the wheels. Although these pieces are relatively small and hidden, people were quickly attracted to this shiny and 3D logo with a close look.

FUTURE EXPLORATION

Given the short time frame of a week to actually fabricate Alchemist, there were a lot of interesting paths, features and ideas that we couldn't implement but would make for strong points for future exploration both from the storytelling and functionality perspective. These include:

Using an actual Geiger Counter to measure radioactivity
As a storytelling tool, we used an audio file with a ticking sound to depict how a geiger counter would work, but it would be interesting to explore planting an actual geiger counter inside an Alchemist. The data collected as inputs could be highly valuable in itself, outside of the role of actuation mechanisms (seed dispensing, spray painting.)

Complete System of A Fleet of Alchemists
Exploring the option of a swarm of robots interacting within different environments would be an interesting direction to take. Consistent with the story we're telling, there's

no way that a single one of these robots could mark all radiation zones and plant enough seeds to save the world. Ideally, demoing how a fleet of these could work in collaboration would be very interesting, given that they will probably relay data.

Decontamination
An important feature for almost anything that ventures into a radiation zone is having decontamination as part of the process. Perhaps having a self decontamination feature would be interesting, or building an exterior shell out of lead could be an option too. Another thing we discussed but didn't implement was building out a whole 'docking station' for the robot that would also serve as a decontamination tool.

Enhance Human Robot Relationships
A less explored pathway for this iteration of the design was the specifics of how this robot would interact with humans. How might humans control or coexist with Alchemists? What would the interactions look like? Would Alchemists have a personality? Or would the lack of a 'human' personality as we know it be their personality?

VIDEO LINK

https://www.youtube.com/watch?v=3gPzwiucMzI