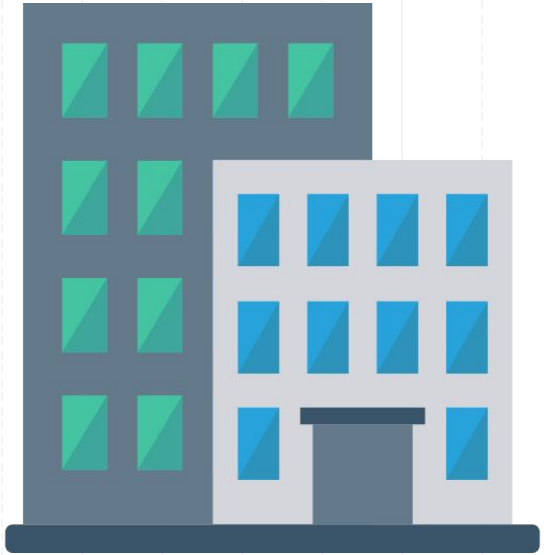
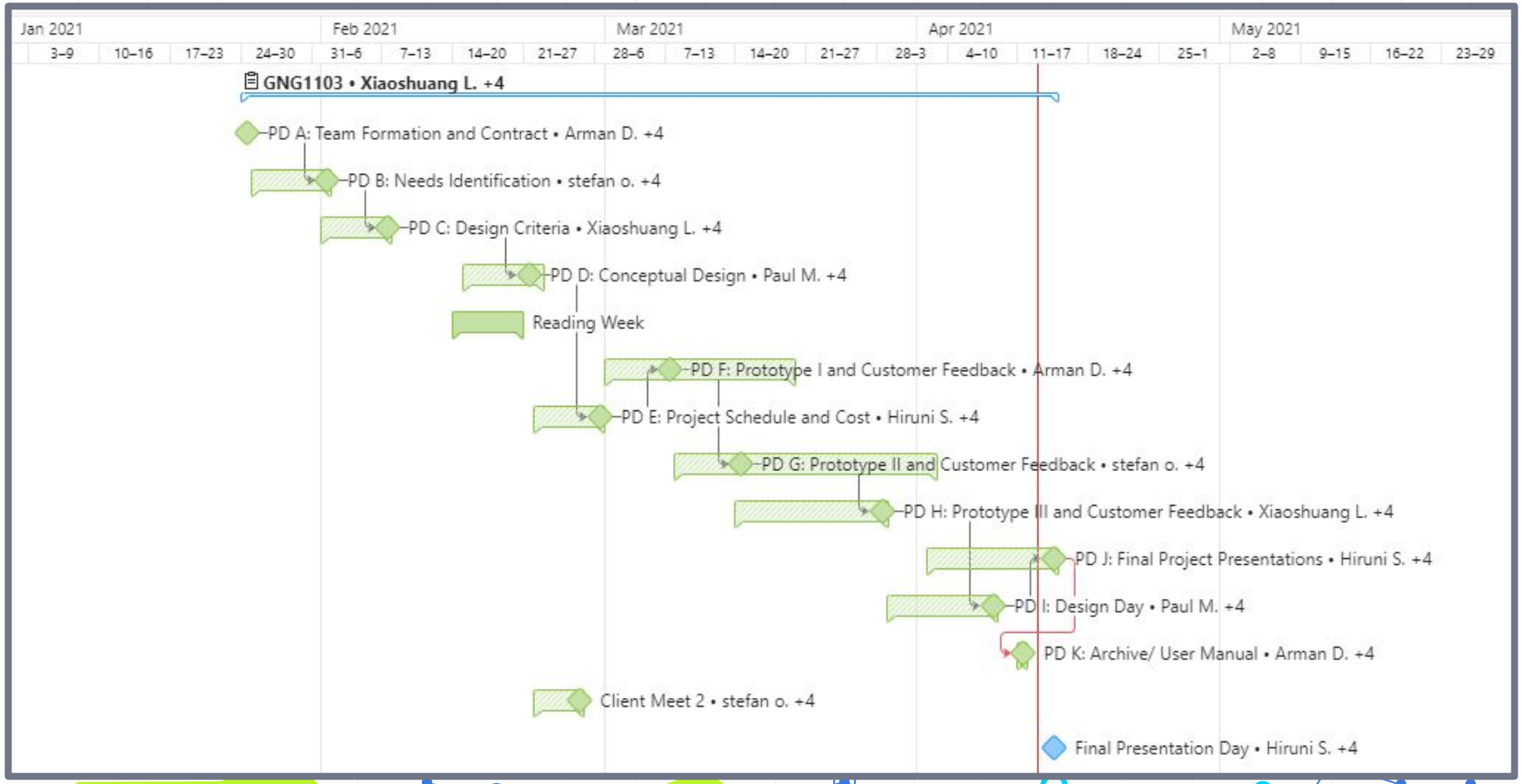
Not Salt

Group 4



Reduces service life by
25% to 50% at Uottawa

Damage nearby greenery
and toxic towards wildlife!


Jan 2021
Feb 2021
Mar 2021
Apr 2021
May 2021
3–9
10–16
17–23
24–30
31–6
7–13
14–20
21–27
28–6
7–13
14–20
21–27
28–3
4–10
11–17
18–24
25–1
2–8
9–15
16–22
23–29
GNG1103 • Xiaoshuang L. +4
PD A: Team Formation and Contract • Arman D. +4
PD B: Needs Identification • stefan o. +4
PD C: Design Criteria • Xiaoshuang L. +4
PD D: Conceptual Design • Paul M. +4
Reading Week
PD F: Prototype I and Customer Feedback • Arman D. +4
PD E: Project Schedule and Cost • Hiruni S. +4
PD G: Prototype II and Customer Feedback • stefan o. +4
PD H: Prototype III and Customer Feedback • Xiaoshuang L. +4
PD J: Final Project Presentations • Hiruni S. +4
PD I: Design Day • Paul M. +4
PD K: Archive/ User Manual • Arman D. +4
Client Meet 2 • stefan o. +4
Final Presentation Day • Hiruni S. +4

Empathize + Define

Needs

Main grouping of needs	Number	Needs	Importance
Performance	1	Heat up to about 2°C	5
	4	Efficient or more efficient than using salt	5
	5	Quickly heats sidewalks to melt snow and ice as soon as possible	5
Safety and Design	6	Have a grip to walk on while also being accessible to those with wheelchairs or other transportation tools	5
	8	Any alterations to the sidewalk abides by the Ontario Building Code	5
	9	The heated sidewalk is low cost	5
Longevity and Maintenance	11	Easy access to internal components for repairing and maintaining quality performance	5
	13	Cost-effective maintenance	5

Problem Statement

The University of Ottawa needs an environmentally friendly device to remove snow and ice that is cost effective, modular and scalable in order to reduce the use of salt on campus.

Benchmarking

- Specified design criteria
- Sought out comparable products
    - Replace salt
- Assigned weighting to criteria → metrics
- Applied comparison test
- Conclude on best benchmarks

Metrics

- Heating range (°C)
- Operating range (°C)
- Weight (kg)
- Energy consumption (W)
- Cost ($)

Translation of Needs

- Needs → criteria
- Ranking

#	Needs	Importance	Design Criteria
1	Heat up to about 2°C	5	Heating range (°C)
2	Can operate in temperatures around -25°C	3	Operating range (°C)
3	Controls the direction of where the water runoff travels	3	Volume of water left on the surface (mL)
4	Quickly heats sidewalks to melt snow and ice as soon as possible	5	Snow Melting Rate (cm per hour)
5	Have a grip to walk on while also being accessible to those with wheelchairs or other transportation tools	5	Surface Material
6	Minimal usage of power	2	Voltage (V) Energy Consumption (W)
7	Any alterations to the sidewalk abide by the Ontario Building Code	5	Follows all regulations (Yes or No)
8	The heated sidewalk has a low cost	5	Cost ($CAD)
9	Prevents waterlogging	4	Operating conditions: snow, water, and ice

Comparison of Products

- Selection of products
- Colour coded by rank

Specification / Product	Heated Snow Melting Walkway Mat - Long	Scotts Elite Spreader	Outdoor Heating Mat
Company	HeatTrak	Scotts	Radiant Heating Systems
Heating Range	7 to 10 °C	None	12.8-18.3 °C
Operating Range	Up to -20.5°C	Results vary on the type of salt used, calcium chloride melts ice as cold as -31.7°C	None
Snow Melting Rate	5 cm per hour	~9.5 cm per hour	5.08 cm per hour
Surface Material	Customized Thermoplastic, Flame Retardant	Spreader is made of plastic	Unspecified anti-slip, double-sided
Voltage	120 V	None	120 V
Energy Consumption	300 W	None	320 W
Cost	$179.61 (CAD)	$131.20 (CAD)	$159.95 (CAD)
Operating Conditions	Snow, ice, water	Any season	Snow, ice, water
Connection Type	Watertight connector cable	None	Cable (unspecified construction)
Deployed Size (LxWxH)	152.4 x 50.8 x 1.27 cm	49.53 x 58.166 x 56.5404 cm	121.92 x 60.96 x 0.3 cm
Weight	5.17 kg	8.9584493 kg	3.63 kg

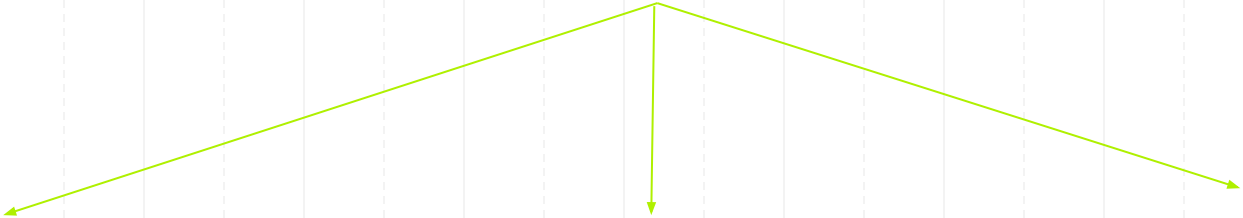
Evaluation of Products

- Assigned score of 1-3
- Multiply by importance
- Determination of comparables

Specification/Product	Importance (weight)	Heated Snow Melting Walkway Mat - Long	Scotts Elite Spreader	Outdoor Heating Mat
Company		HeatTrak	Scotts	Radiant Heating Systems
Heating Range (°C)	5	2	1	3
Operating Range (°C)	3	2	3	1
Snow Melting Rate	5	1	3	2
Surface Material	5	3	1	2
Voltage (V)	2	3	1	3
Energy Consumption (W)	2	3	1	2
Cost ($CAD)	5	1	3	2
Operating Conditions	4	2	3	2
Connection Type	5	3	1	2
Deployed Size (LxWxH)	4	3	1	2
Weight (kg)	4	2	1	3
Total		96	78	96

Ideate

Subsystems



External

- Modularity
- Connectivity

Internal

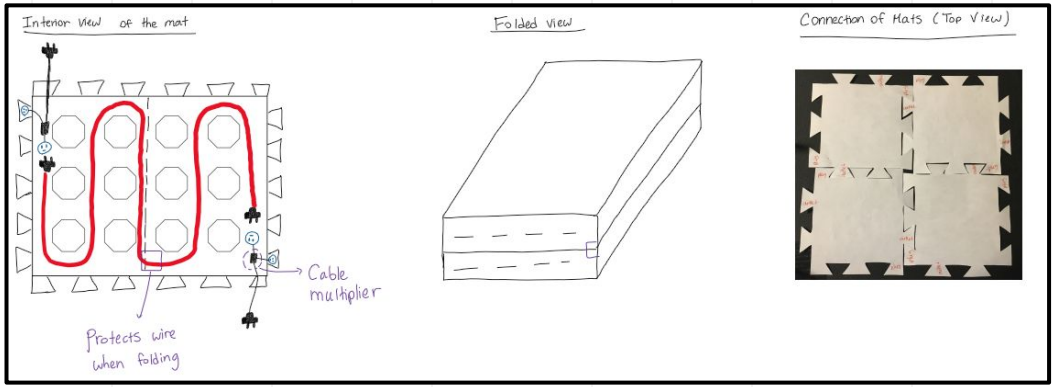
- Heating method
- Sensors
- Electronics

Maintenance

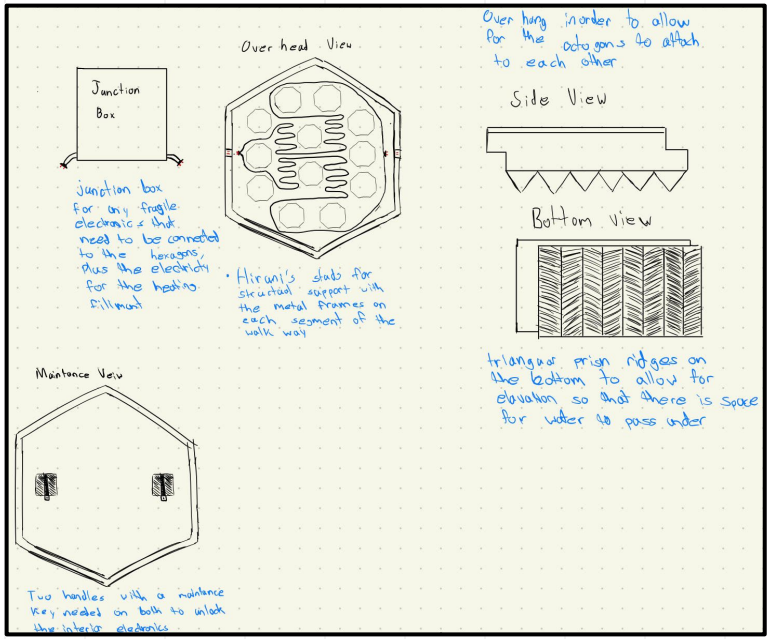
- Access for repair
- Security features

Concepts

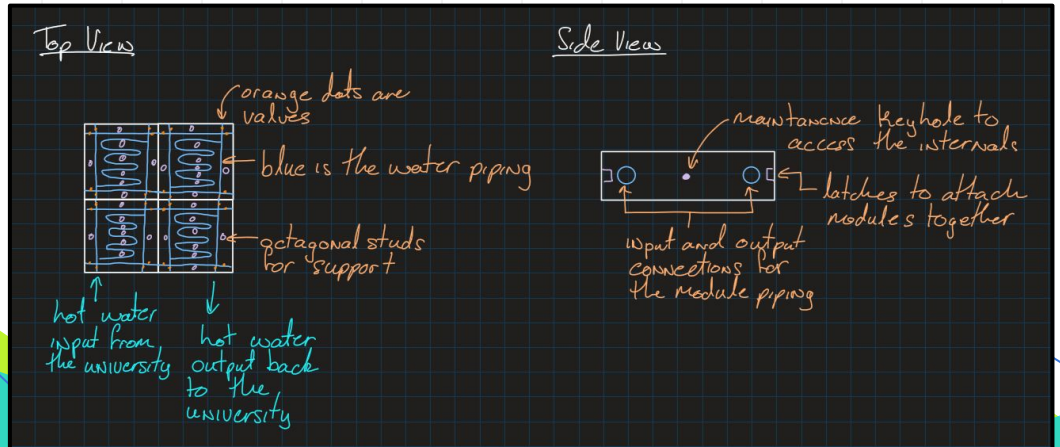
Design 1



Design 2



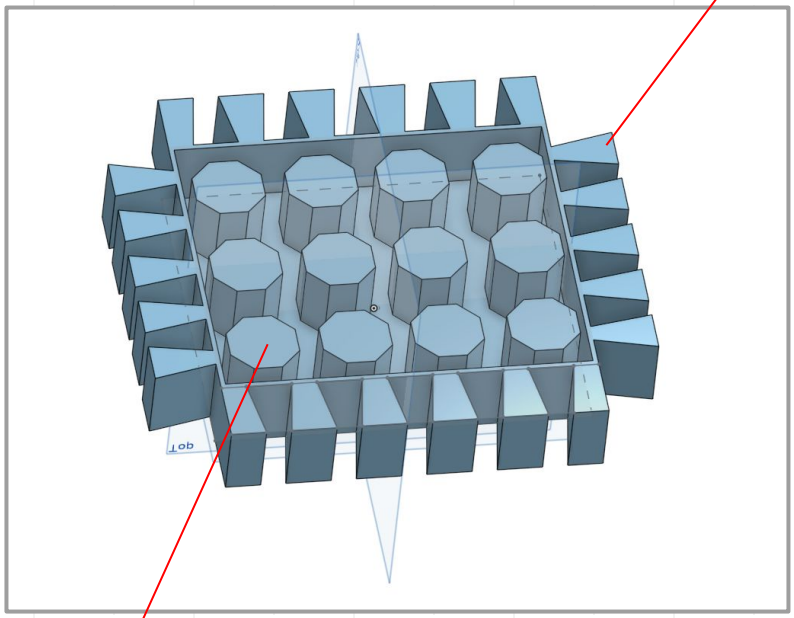
Design 3

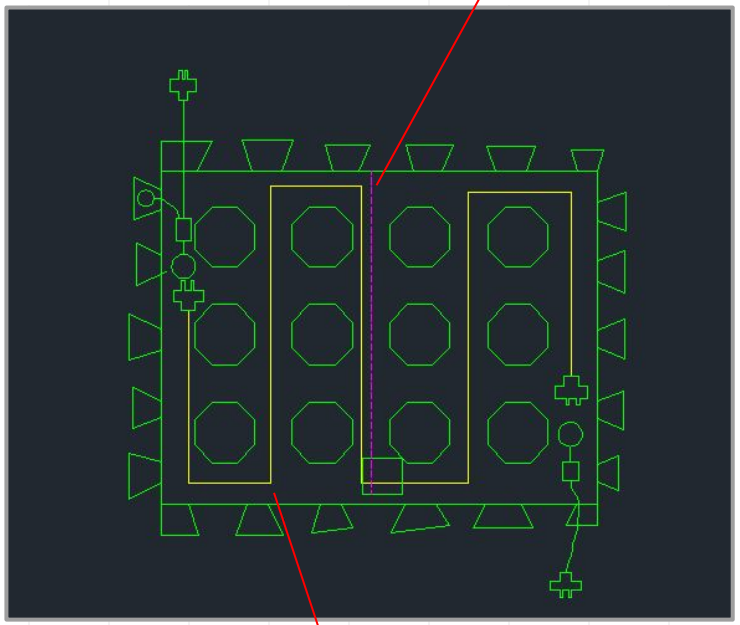


Chosen Concept

Dovetail connections

Folding point





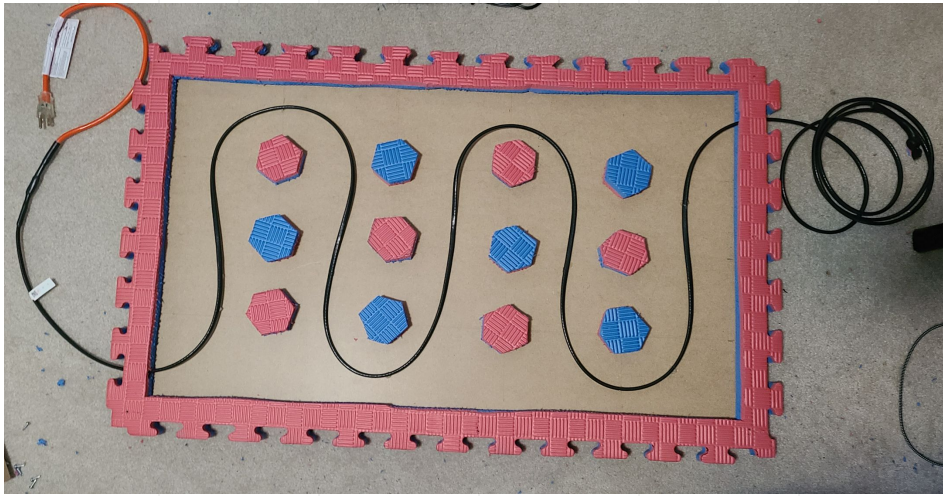
Support columns

De-icing cable

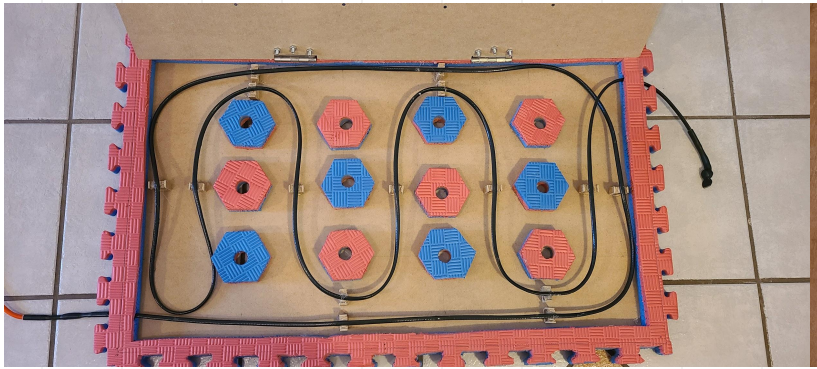
Prototype + Testing

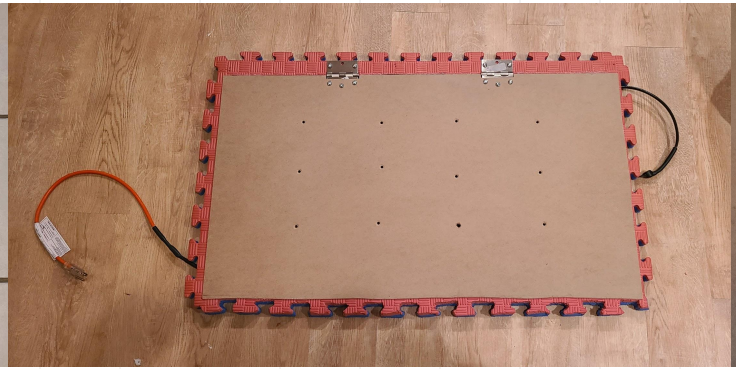
Prototype 1

Prototype 2

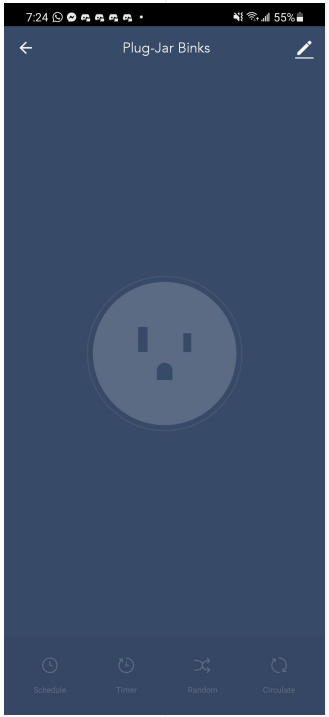


Prototype 3

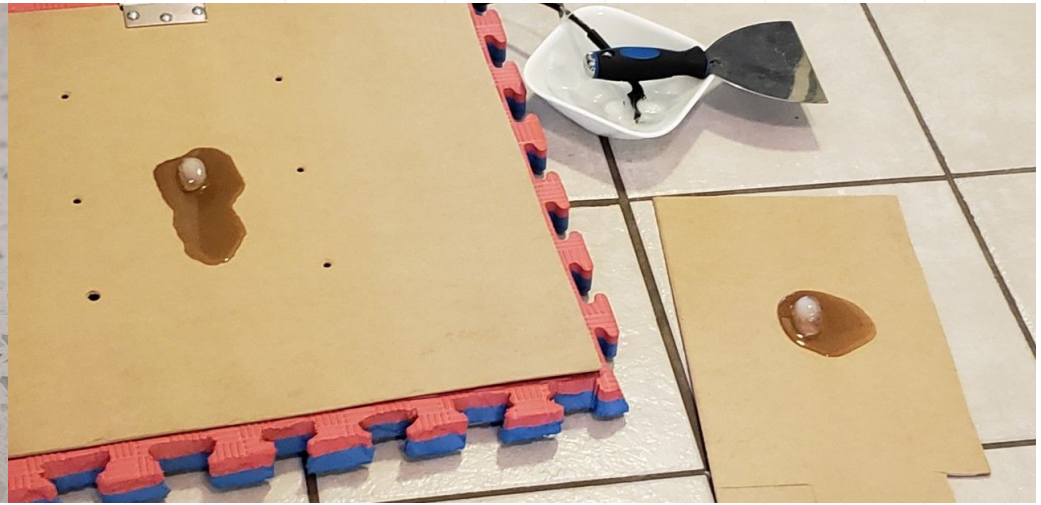




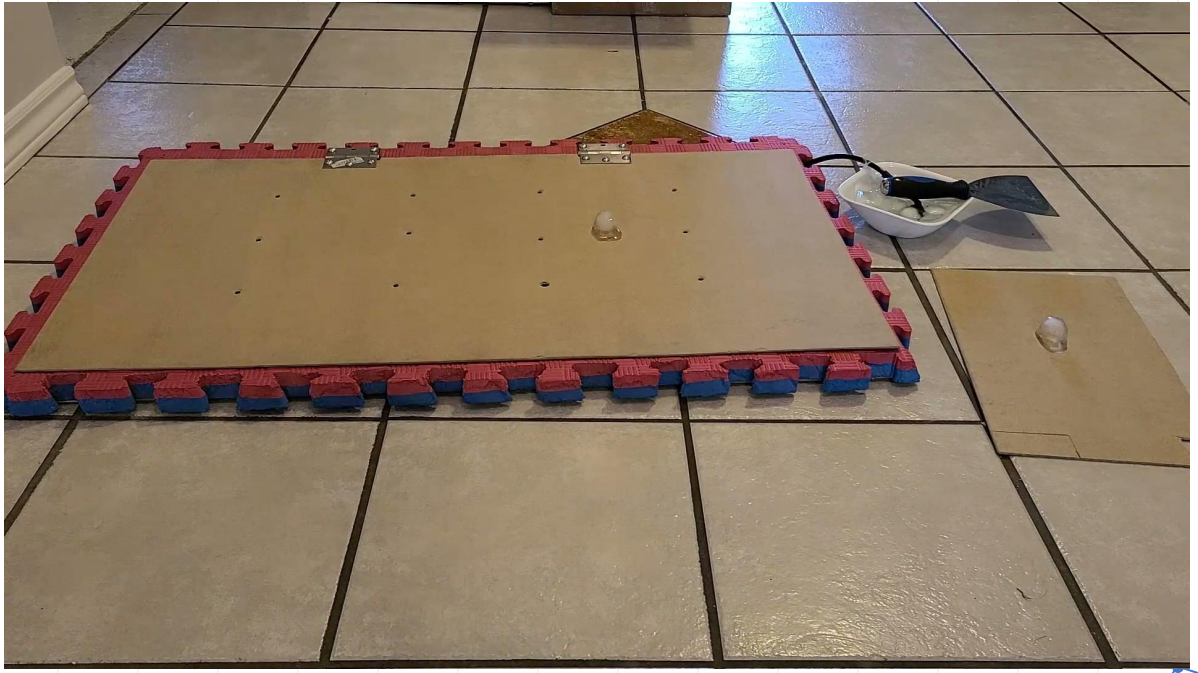
Prototype 3 (Continued)



Testing



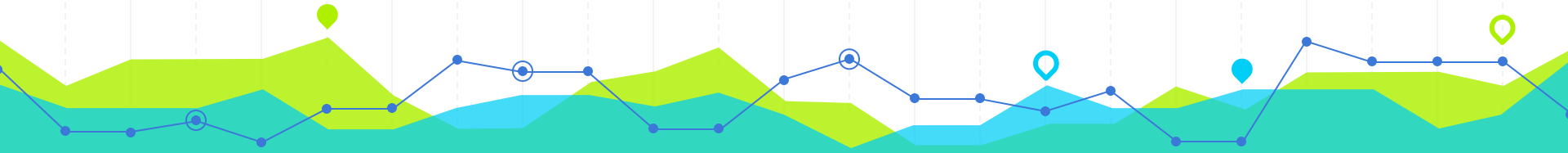
Testing (Continued)



Testing (Continued)

Ice on the mat after test

Control ice after test



Conclusion

Lessons Learned

- Make a clear plan
- Comprehensive consideration
  - Combine various factors to think about the problem and solve it
- Active discussion
- Have group meetings every week

Future Recommendation

Some places need to be more reasonable

- *A suitable junction box*
- *More reasonable cost*
- *Make it more waterproof*

Questions