Project Deliverable [E]: Project Schedule and Cost

GNG1103[F]: Engineering Design

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Introduction:

When initially starting our brainstorming process of what materials would be necessary when creating a functional final prototype. Cost was a big factor. We have a strict budget of $100 CAD and thus, the materials which we wish to purchase should have a large and significant impact on the functionality of our device. In order to do this, evaluation and thorough analysis of all components, systems and analytics must be done. In this report, we go through the analysis process, in great depth, for why our bill of materials consisted of the elements it did.

This report has the main goal to demonstrate a better understanding of the subsystems and individual components that make up our final device. Though there is much more experimentation needed in order to finalize our proposal, the main components of the device are clearly outlined with individualized advantages that lead to the implication of specific elements. All emistated tasks and their spertae durations are mentioned in the report as well with Wrike. Uncertainties are clearly outlined and contingency plans have been put in place. Most importantly, the bill of materials is listed awaiting approval.

Final Solution Sketches:

All sketches displayed below are the initial visuals associated with our final device. These are still tentative as the prototyping task is yet to be completed and thus changes may arise. Throughout the images, red and blue arrows are depicted. The red arrows demonstrate the flow of energy, may be thermal or electrical. The blue arrows demonstrate the natural flow of liquid from environmental precipitation throughout the device.

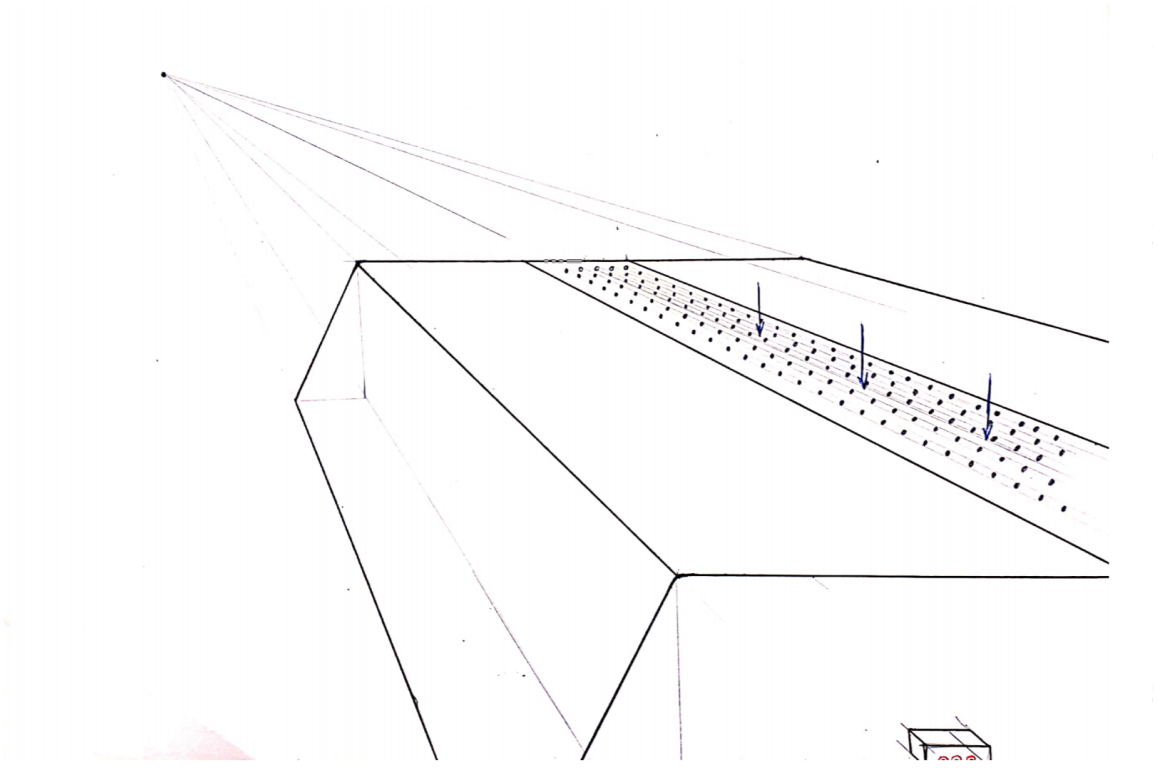


Figure 1: Demonstration of a close up user point of view of the grated drainage system component.

The blue arrows in Figure 1 indicate the liquefied precipitation input into the device. Disposal of this imputed liquid will be done as quickly as possible to avoid heat loss. Not shown in the image are the anti-slip tracts on either side of the grated center. This material will be heat resistive and will have a high coefficient of friction.

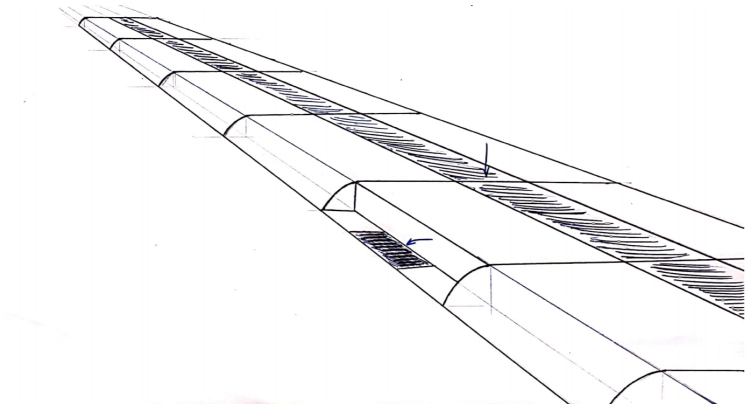


Figure 2: Outward perspective of the interaction between typical sewer systems and the device.

Figure 2 depicts the outward perspective of the interaction between typical sewer systems and the device. This is quick, energy efficient and decreases safety risks over a larger range. Ramped/curved edges allow a larger range of use with ease. For example wheelchairs will have the ability to use the device without any risk. Central shaded area demonstrates the grated precipitation input area into sewers via devices integrated drainage system

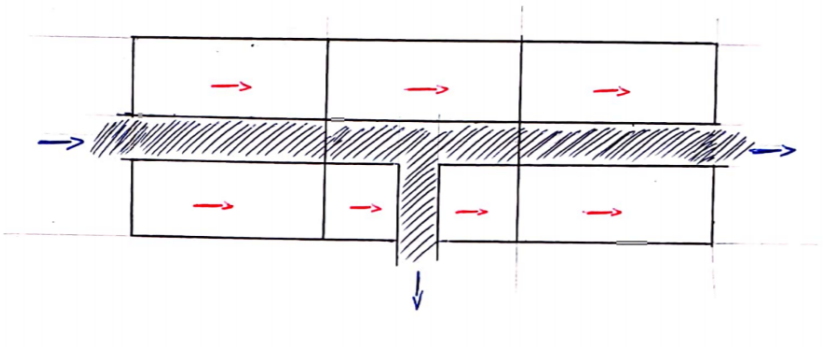


Figure 3: Demonstration of the flow of liquid out the upper, drainage level of the device through overhead view.

The blue arrows show precipitation flow whereas the red arrows show the electrical flow. Three components are shown above, connected via physical prong connectors. T-shaped component (central) depicts output of liquid from the device. Output would be disposed of into city sewer systems around the University of Ottawa as well as sewers around the campus.

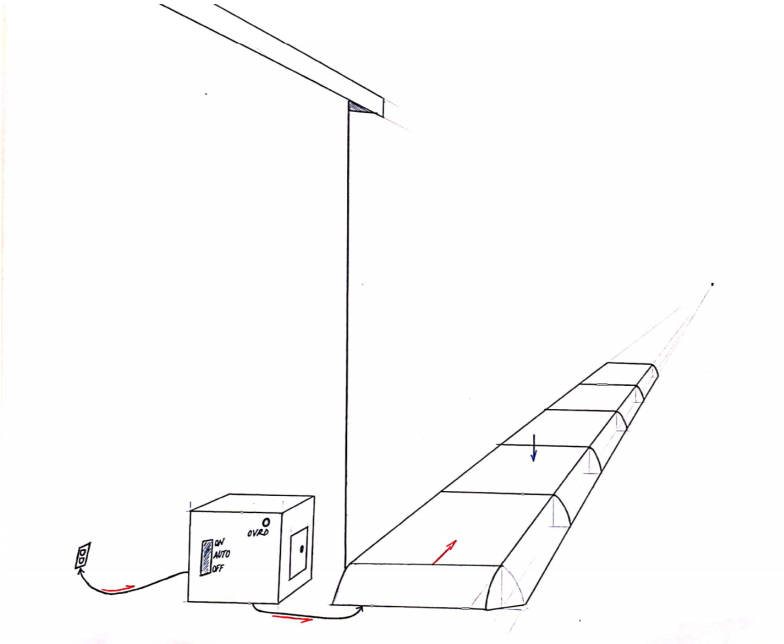


Figure 4: Demonstration of how the control system/box will be connected to the component systems of the device.

As per Figure 4, the control system/box will be connected to the component systems of the device. Integration will be effective and will diminish the risk of electrically problematic situations. Red arrows demonstrated the electrical current flow from grounded 120 V input to the control system.

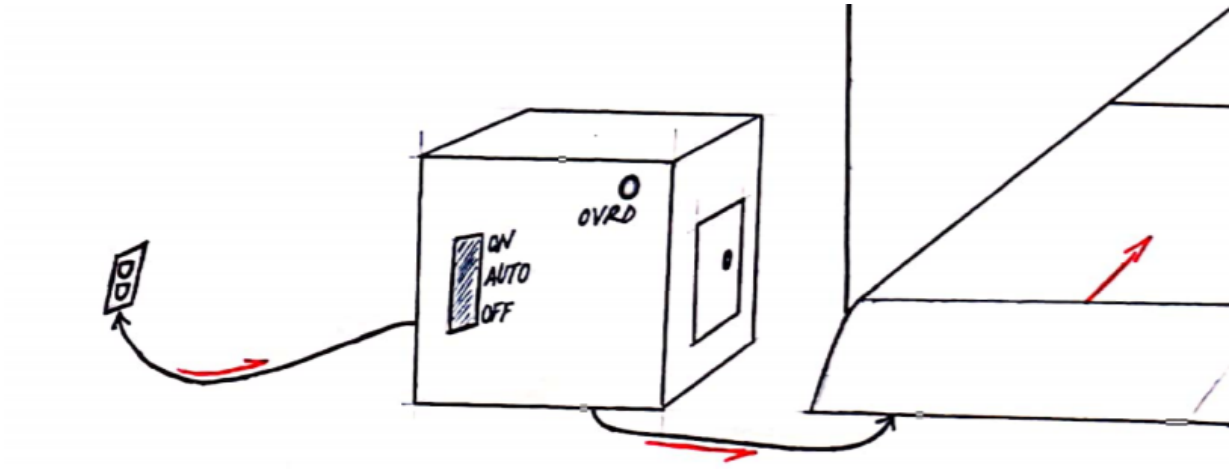


Figure 5: Close-up view of the control system/box.

In Figure 5, shown are the outward controls, always on, always off and automatic regulation via use of moisture and temperature controls. Not shown are the temperature and moisture detectors within the control system and throughout the component system. An override option if also displayed, increasing safety throughout the device. Red arrows demonstrated the electrical current flow from grounded 120 V input to the control system.

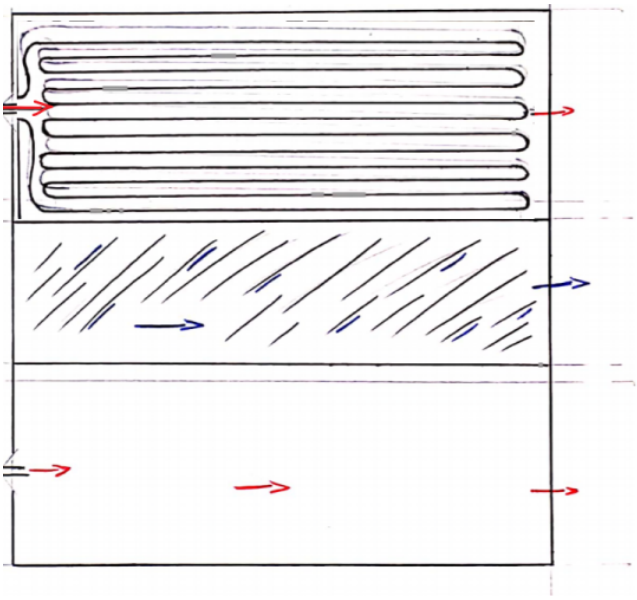


Figure 6: Overhead view of individual, typical component of assembly system.

In Figure 6, coiling of the heated wire is shown above. This pattern continuously repeats along the bottom compartment of the device, below the drainage system. This ensures no interaction between liquid and electricity for optimal safety. The red arrows show the electrical current transported via thermal wiring and the blue arrows demonstrate liquid flow within the device.

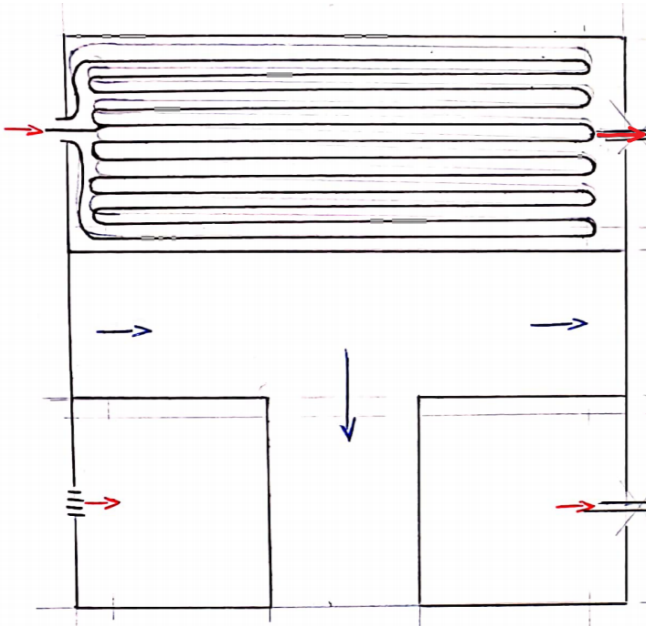


Figure 7: Flow of liquid input into system via surface grates

In Figure 7, following the blue arrows, the flow of liquid inputted into the system via surface grates flows as output from the system within T-shaped drainage compartments into sewers surrounding the pathways. Extensions of the drainage piece are also available as required.

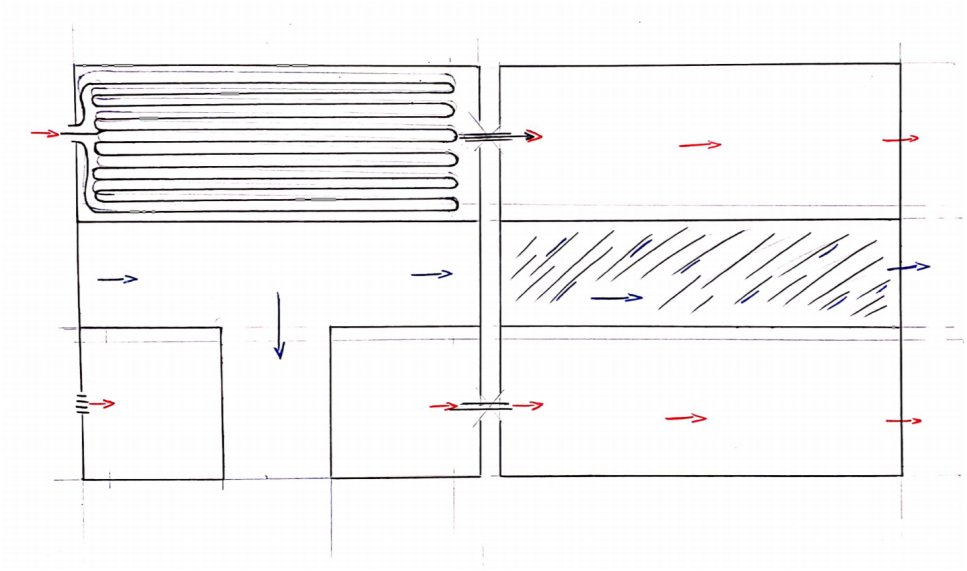


Figure 8: Demonstration of the close integration of specified components of the system as detailed in Figure 6 and 7.

In Figure 8, there is no specific ratio to how many T-shaped components there are versus regular components. This is dependent on the proximity and location of liquid disposing areas such as sewers of the city or the university. Pattern, as seen on the top left-hand compartment, is followed throughout the components (unshown in image) and run along the bottom of the device within a protective membrane.

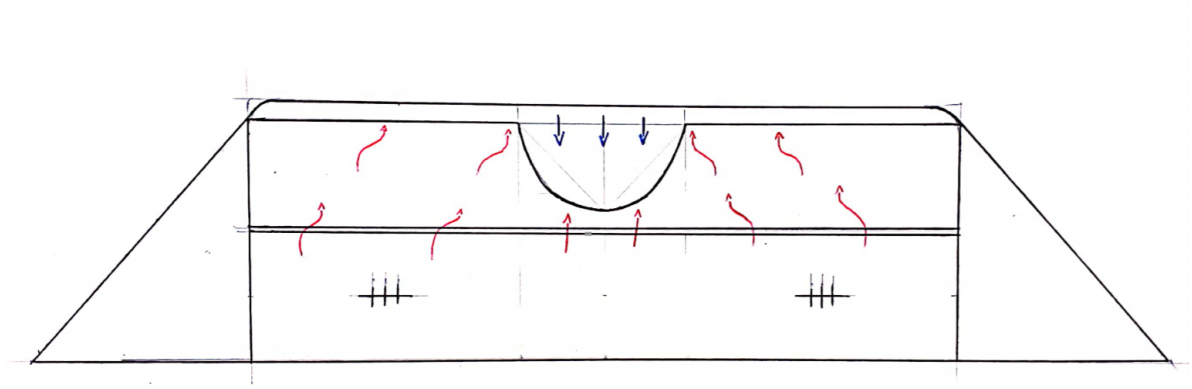


Figure 9: Demonstration of the layering of electrical current components and liquid flow.

In Figure 9. The red arrows show the thermal energy used to melt precipitation on the surface of the device. The semi-cylindrical pipe-like character is the device by which the precipitation will be inputted into the system (as shown by the blue arrows). The three lines crossed demonstrated the prongs by which the individual components will be electrical connected and integrated with the control system as shown in detail in Figure 5.

Subsystem Analysis:

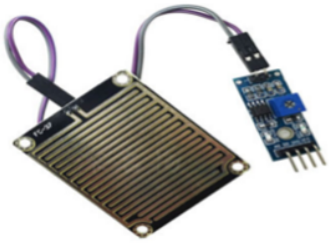
Table 1: Subsystem Analysis

Systems	Analysis
Assembly	This system has a purpose to be modular and easy to maintain. This includes flexibility in terms of assembly and disassembly as well as cost of replacement. Integration of this system to the main power system will be done via electrical connection devices such as the Saf-D-Grid® Connector Series or Powerpole® Connector Series. This ensures that the power supply is safe and remains functional after a situation of flooding inside the device. The assembly serves as the first connection between the device and the general public therefore safety is held paramount and this set up allows for optimal safety via ability to control the situation. Not only electrical safety but also physical safety such as tripping hazards. Edges of the assembly system will be shaped in a ramp-like orientation to ensure safety of all as well as allow wheelchair persons to have no difficulty with the implantation of our system. The internal environment of each individual component will be protected with heat resistive materials that will act as insulators creating an energy efficient solution. The external surface will include anti-slip grooves and treads as well as a thin layer of material which will be able to remain functioning as an anti-slip surface in the presence of water and precipitation. This will ensure maximum coefficient of friction between the surface and the user. Overall, the assembly component of the device will ensure modularity and flexibility for efficient use, maintenance and storage as well as an anti-slip surface and external power surface to ensure maximum safety during operation.
Drainage	The functionality of the drainage system is to provide a method by which liquid (from precipitation) is collected and removed to prevent the liquid from freezing in other high frequency areas that border sidewalks and emergency exits. Liquid collection will be executed via a grated surface layer that runs down the centre of each individual assembly component. This segment will be pierced with small, circular holes, enough to ensure continual flow of liquid into the collection trough. This trough is also thermally conductive to ensure prevention of any blockage due to freezing of liquids within the system. This compound will be removable and replaceable as pleased. For the method to remove liquid from the system a safe method of disposing the liquid is required without the addition of chemicals or another form of ice removal. To reduce the amount of ice, snow or slush that may get stuck between the panel and the sidewalk, the draigange system would be integrated into the component system of the device. The heat released from the collected liquid will be removed at a high speed to reduce the heat loss from the drainage panel as it is exposed to the outside atmosphere and the liquid itself. To prevent the liquid from freezing during transportation, the wire coil lining the sections of the drain will be implemented. A temperature sensor that is automated to turn on when the temperature drops below the freezing point which will be controlled automatically or manually as required. The heat to ensure that the liquid does not cause blockages in the functionality of the system will come from the thermal conductivity of the device itself as well as the natural heat produced by the

	sewers around the University of Ottawa. The sewers are also the location at which the lucid waste from melting and collecting precipitate will be disposed of. This ensures that the environment neighboring the device will remain safe and anti-slip zones. To allow the electrical systems and collection components of the drainage system to function in harmony without negative and risky interactions, the drainage system will run along the middle of the individual assembly whereas the electrical system will run along the whole area of the components but slightly below the drainage system. It would be found covering the full area, only slightly less concentrated around the central trough.
Power and Heating	The control system acts as the controller of all electrical input to the component-based assembly. To ensure modularly, a lightweight and flexible option would serve as the best option. Individual control systems integrated into each sub component would increase production cost as well as decrease modularity and safety during installation and disassembly.Therefore a separate, censored control system would be optimal. The system would be the first section of the device to receive the electrical input from a regular 120 V power supply connected to a GFCI outlet to ground the control box.Inside the box there will be an arduino with a TMP36 temperature sensor and a rain and snow sensor on the top of the box to ensure adequate and energy efficient application. Having this separate control box will allow the power input to be controlled via three main settings. A completely off option for days without precipitation or wet surfaces. A completely on option where the sensors would be determining the electrical input and translating it into thermal energy as required, based on temperature and mixture levels. A selectively manual setting where the customer will be able to turn the system on and off at their will. An autotimer is also incorporated into this setting. The arduino will be programmed so that if the temperature is below 0℃ and the rain and snow sensor is sensing snow the device will be on for a set amount of time. This time will still need to be determined through product testing. A manual override option is also applied and will turn off all electrical input. The arduino will act only as a control signal to turn on a relay inside the box to pass the entire 120V required to the mats since 5 volts will not be enough and will burn out the arduino. The 120V coming from the control box will have the same connectors as the mats therefore allowing any mat to be placed first.

Table 2: Bill of Materials

Part	Material	Quantity / size	Cost ($CAD)	Picture	Name and URL Link for material
Heating system	**Heating Wire**	**9 ft**	**$ 21.77** **$24.60 WITH TAX**		9 ft. Automatic Electric Heat Cable Kit https://www.homedepot.com/p/Frost-King-9-ft-Automatic-Electric-Heat-Cable-Kit-HC9A/205933690
	Connectors	**1**	**$ 4.34** **$4.90 WITH TAX**		Safe-D-Grid 400 Receptacle Housing https://www.andersonpower.com/shop/app_us_en/2002g2-saf-d-gridr-400-receptacle-housing.html
	AC Solid State Relay	**1**	**$ 24.95** **$ 28.19 WITH TAX**		RELAY SSDC 3-32V 25A/280VAC SCREW MOUNT WITH INDICATOR https://secure.saval.com/STORE2/View_SHOP.php?SKU=237915

Sensors	**Arduino Temperature Sensor (TMP36)**	**1**	**$ 2.00** **$2.26 WITH TAX**		Temperature Sensor – TMP36 https://www.robotshop.com/ca/en/temperature-sensor-tmp36.html
	Arduino Rain Sensor	**1**	**$ 1.41** **$1.60 WITH TAX**		Rain Weather Sensor Water Raindrops Detection Module for Ardunio https://www.ebay.com/c/2101008493
Drainage System	**Gutter**	**1**	**$ 6.67** **$7.53 WITH TAX**		3 in. x 24 in. PVC Sch. 40 Pipe https://www.homedepot.com/p/VPC-3-in-x-24-in-PVC-Sch-40-Pipe-2203/205706641
	PEX Drainage Tubing	**5 ft**	**$ 4.48** **$ 5.06 WITH TAX**		SharkBite 3/4 Inch x 5 Feet WHITE PEX PIPE https://www.homedepot.ca/product/sharkbite-3-4-inch-x-5-feet-white-pex-pipe/1001013602

	PEX Drainage Elbow	**1**	**$ 1.17** **$ 1.32 WITH TAX**		3/4 in. PEX Barb Plastic 90-Degree Elbow Fitting 1 unit https://www.homedepot.com/p/SharkBite-3-4-in-PEX-Barb-Plastic-90-Degree-Elbow-Fitting-5-Pack-UP256A5/206133135
	PVC glue	**1**	**$ 5.40** **$6.10 WITH TAX**		8 oz. Regular Clear PVC Cement https://www.homedepot.com/p/Oatey-8-oz-Regular-Clear-PVC-Cement-310133/100345577
Shell	**Bus Bin**	**1**	**$ 12.17** **$ 13.75 WITH TAX**		16 Qt. Bus/Utility Box in Grey https://www.homedepot.com/p/Rubbermaid-Commercial-Products-16-Qt-Bus-Utility-Box-in-Grey-RCP3349GRA/100642673
Total Cost: $84.36 CAD + Tax Total Cost with tax: $95.32 CAD					

The design for electrically heated panels to melt snow or ice includes the list of materials shown in table 2.0 directly above. Each material that has been chosen has been done for two reasons. The first

being that the material will be needed in the prototyping in order to have a working design and the second being that it is the best material to maximize the $100 of allocated funding. Note that this table is only showing what materials will need to be purchased. Many of the materials shown will be reconstructed to create our heating system in the prototyping process.

Cost is a major constraint for this design so when choosing the appropriate materials and tools, that was the main deciding factor. For technology, arduino was chosen because it is cheap, easy to use and quite powerful. The arduino IDE is the chosen choice of programming because it is a free program. Another tool used was Onshape. Onshape was chosen because it is free for students and cloud based so the entire team can view and modify documents real time. Another advantage is that this software was taught in a lab so the team is familiar with it. Regular hand tools will be used for the construction as they are available and easy to use. When choosing materials team 5 looked for existing products that would not need to be manufactured due to the small scale of the final design. This keeps the costs low since there is no need to get a product custom manufactured. Pex tubing was chosen because it is low cost and can withstand the temperatures required. Pex tubing is also available everywhere. The tote was chosen because it is the right size and easy to incorporate into the design while still being sufficiently strong. The heating wire was chosen because it is small enough for the scale of the project and is easy to implement since it is 120V to begin with. The electrical connectors are chosen because they are low cost and not standard plugs so this will help deter theft as they will be useless without the rest of the system. The gutter was chosen because of its low cost and proper size for the tote it will be kept in.

Plan/Schedule:

The team meets every Saturday and Sunday morning to consult and finish the Deliverable due that week. During the weekly meetings, the tasks for the upcoming week are assigned and the deadline is set for Sunday night of that week (usually around 5 p.m.). The use of the Wrike Platform has been helpful in reminding all team members about the upcoming deadlines, however, the system is the most effective when all of the events and tasks are updated in advance. The system the Team has been following has worked for the workload and content up until [PD-E]. However, for the [PD-E] and the upcoming deliverables, this system needs to be modified. The type of work is transitioning out of the research and brainstorming phase, and shifting towards a heavier workload and a more interactive stage, the prototyping stage. Therefore, our team's solution to this shift was to outline a Task List and schedule all of the upcoming tasks, from [PD-E] until the end of the semester. In *Table 3* below, the Task List consists of the following Tasks that are due before the end of the Semester.

Table 3: Team 5 Task List

Task List:		Deadline:
1.	Completion of [PD-E]	02/28/21
2.	Completion of [PD-F]	03/07/21
3.	Completion of [PD-G]	03/14/21
4.	Completion of [PD-H]	03/28/21
5.	Completion of [PD-I]	04/08/21
6.	Completion of [PD-J]	TBD
7.	Completion of [PD-K]	04/11/21

From the Task List, the following Tasks; 1, 2, 3, 4, & 5, were scheduled based on the content requirement in each section. In *Table 4* below, the Schedule for Task 1 is listed. The roles that are assigned for this [PD-E], was based on the prior experience to allow for each individual to contribute their best strengths towards the project, while sharing their gained knowledge with the team.

Table 4: Team 5 Schedule for Task 1

Team 5 Schedule for Task 1:							
Task 1: [PD-E]	Subtasks:	Predecessors :	Successors:	Estimated Task duration (max.):	Individual Responsible:	Reasoning for assigning:	Deadline:
1) Draft design drawing of final solution (min. 3)	1.A) Hand Drawn Sketches of final solution design of singular panel	[PD-D]	[PD-F] Subtask 1. B.	20 minutes	Krishna	Enjoys drawing and has taken art lessons before. Familiar with the sketches to complete a proper analysis.	02/28/21
	1.B) Hand Drawn Sketches of subsystems design: Drainage System Assembly System Power/Heating System	[PD-D] Subtask 1. A.	[PD-F] Subtask 1. C.	30 minutes (10 minutes per subsystem)			
	1.C) Label/colour code each design	[PD-D] Subtask 1.A Subtask 1. B.	[PD-F] Task 1.2. Task 1.5	5 minutes			
2) Analysis of Critical components of subsystem in final design	2.A) Research and analysis of each component of each subsystem (in paragraph format)	[PD-D] Task 1.1	[PD-F] Task 1.5.	15 minutes			
3) Outline tasks and a schedule for completion	3.A) Create a task list for [PD-E] & future deliverables & prototyping	[PD-D]	[PD-F] Subtask 3. B.	30 minutes	Lucy Amenah	Dividing workload evenly.	
	3.B) Schedule/plan for [PD-D] & future deliverables & prototyping	[PD-D] Subtask 3. A.	[PD-F] Task 1.4.	30 minutes			
4) Update Wrike Platform with schedule and task list	4.A) Set estimated task durations for new schedule and task list	[PD-D] Task 1.3.	[PD-F] Subtask 4. B.	10 minutes	Lucy	Team's Wrike Manager – familiar with the platform.	

	4.B) Identify responsibility for tasks (based on criteria)	[PD-D] Subtask 4. A.	[PD-F] Subtask 4. C.	20 minutes	Amenah	Experience with project analysis.	
	4.C) Set new milestones on Gantt Chart (for new schedule)	[PD-D] Subtask 4. B.	[PD-F] Subtask 4. D.	5 minutes	Lucy	Team's Wrike Manager – familiar with the platform.	
	4.D) Establish task dependencies on Wrike	[PD-D] Subtask 4.C	[PD-F] Subtask 4. E.	5 minutes			
	4.E) Upload task identification tables for PD's and updated schedule on [PD-E]	[PD-D] Subtask 4. D.	[PD-F] Task 1.5.	5 minutes	Lucy Amenah	Dividing workload evenly.	
5) Determine the risks and uncertainties of each task	5.A) Create a table highlighting risks of each task	[PD-D] Task 1.4.	[PD-F] Subtask 5. A.	10 minutes	Amenah	Experience with project analysis.	
	5.B) Discussing the highest and lowest risks, and missed tasks (in paragraph format)	[PD-D] Subtask 5. A.	[PD-F]	15 minutes			
6) Determine material and equipment costs	6.A) Determine the materials used in the prototype	[PD-D] Task 1.1.	[PD-F] Subtask 6. B.	30 minutes	Thomas (consulting with team)	Experience with equipment, such as power tools and electrical components.	
	6.B) Determine the tools needed to construct the prototype	[PD-D] Subtask 6. A.	[PD-F] Subtask 6. C.	15 minutes	Thomas		
	6.C) Concluding paragraph on findings (research based)	[PD-D] Subtask 6. B.	[PD-F] Subtask 6. D.	15 minutes			
	6.D) Research & Benchmark costs for materials and equipment	[PD-D] Subtask 6.C	[PD-F] Subtask 6. E.	30 minutes	Johnathan	Experience with budgeting and cost analysis.	

	6.E) Concluding paragraph discussing the budget, materials and equipment	[PD-D] Subtask 6. D.	[PD-F] Subtask 6. F.	15 minutes	Thomas Johnathan	Dividing workload evenly.	
	6.F) Concluding paragraph discussing how the funds were allocated to maximize budget	[PD-D] Subtask 6. E.	[PD-F]	15 minutes	Johnathan	Experience with budgeting and cost analysis.	

The schedule for Task 2 is presented in *Table 5* below. It is important to note that the Schedules for Tasks; 2, 3, 4 & 5, may vary in the roles that are assigned. This may change depending on each Team member's availability for the upcoming week. This is a rough estimation of workload divided amongst the team members and the work that needs to be completed. If the workload is to be changed or shifted, the Wrike Platform and the Schedule will be updated in a separate document. This will also be discussed further in the upcoming Team Meetings.

Table 5: Team 5 Schedule for Task 2, PD-F

Team 5 Schedule for Task 2, PD-F:							
Task 2: [PD-F]	Subtasks:	Predecessors:	Successors:	Estimated Task duration (max.):	Individual Responsible:	Reasoning for assigning:	Deadline:
1) Introduction & Conclusion	1.A) Introduction paragraph	[PD-E] Task 2.2.	[PD-G] Subtask 1. B.	15 minutes	Amenah	Written past introductions and conclusions, experience with formatting google documents.	03/07/21
	1.B) Conclusion paragraph	[PD-E] Subtask 1. A.	[PD-G]	10 minutes			
2) Prototyping Steps	2.A) (the why) Prototyping objectives and efforts in paragraph format	[PD-E]	[PD-G] Subtasks 2. B.	15 minutes	Krishna	Developed final sketches for [PD-E].	
	2.B) (the what) A test plan description is developed (clear and concise)	[PD-E] Subtasks 2. A.	[PD-G] Subtasks 2. C.	30-45 minutes	Krishan (consulting group)		

	2. C) (the how) Analysis and feedback on how the test plan will work and provide effective results	[PD-E] Subtasks 2. B.	[PD-G] Subtasks 2. D.	20 minutes	Lucy	Experience with product analysis from previous projects.	
	2.D) (the when) Adjust the team schedule and update Wrike platform based on results from analysis	[PD-E] Subtasks 2. C.	[PD-G] Subtasks 2. E.	15 minutes		Team's Wrike Manager – familiar with the platform.	
	2.E) A concluding paragraph discussing the analysis of results	[PD-E] Subtasks 2. D.	[PD-G] Tasks 3.	15 minutes		Experience with product analysis from previous projects.	
3) Referencing past projects testing application and provide an analysis and future recommendations	3.A) Benchmark or research different testing methods results	[PD-E] Task 2.2.	[PD-G] Subtask 3. A.	40 minutes	Johnathan	Experience from previous [PD-E] with benchmarking and budget development.	
	3.B) Comparison analysis between research and test plan, and research and results developed (table format)	[PD-E] Subtask 3. A.	[PD-G] Subtask 3. C.	40 minutes	Thomas	Experience from previous [PD-E] with equipment, such as power tools and electrical components.	
	3.C) A concluding paragraph to discuss the findings and future recommendations for the next round of prototyping	[PD-E] Subtask 3. B.	[PD-G] Subtask 3. D.	15 minutes			

	3.D) Reflection paragraph on how the team is implementing prior knowledge, as well as learning throughout the project	[PD-E] Subtask 3. C.	[PD-G] Task 2.4.	15 minutes	Johnathan	Experience from previous [PD-E] with benchmarking and budget development.	
4) Project Task plan Maintenance and Task Assignment	4.A) Updating Wrike Platform	[PD-E]	[PD-G] Subtask 4. B.	10 minutes	Lucy	Team's Wrike Manager – familiar with the platform.	
	4.B) Assign Tasks from Task list [PD-E]	[PD-E] Subtask 4. A.	[PD-G] Subtask 4. C.	10 minutes	Team effort	Dividing workload evenly.	
	4.C) Analysis of task completion effectiveness and develop strategies to identify missing subtask (in table format)	[PD-E] Subtask 4. B.	[PD-G] Subtask 4. D.	20 minutes	Amenah	Completed an analysis of uncertainties and risks from past deliverable.	
	4.D) Reflection paragraph describing findings from subtask 4. C.	[PD-E] Subtask 4. C.	[PD-G] Task 2.1.	15 minutes	Amenah		

The schedule for Task 3 is presented in *Table 6* below.

Table 6: Team 5 Schedule for Task 3, PD-G

Team 5 Schedule for Task 3, PD-G:							
Task 3: [PD-G]	Subtasks:	Predecessors:	Successors:	Estimated Task duration (max.):	Individual Responsible:	Reasoning for assigning:	Deadline:
1) Introduction & Conclusion	1.A) Introduction paragraph	[PD-F] Task 3.2.	[PD-H] Subtask 1. B.	15 minutes	Amenah	Written past introductions and conclusions, experience with formatting google documents.	03/14/21
	1.B) Conclusion paragraph	[PD-F] Subtask 1. A.	[PD-H]	10 minutes			
2) Prototyping Steps	2.A) (the why Part 2.) Prototyping objectives and efforts in paragraph format. Reflect and build on [PD-F]'s limitations and design	[PD-F]	[PD-H] Subtasks 2. B.	15 minutes	Krishna	Developed the test plan in [PD-F].	
	2.B) (the what part 2.) A test plan description that reflects and build on the plan developed in [PD-F] (clear and concise)	[PD-F] Subtasks 2. A.	[PD-H] Subtasks 2. C.	30-45 minutes	Krishan (consulting group)		
	2. C) (the how part 2.) Analysis and feedback on how the test plan will work and provide effective results. Reflect on how the newly developed test plan recovers the limitations identified in [PD-F] and the	[PD-F] Subtasks 2. B.	[PD-H] Subtasks 2. D.	20 minutes	Lucy	Experience with product analysis from previous projects.	

	limitations of the new plan.						
	2.D) (the when part 2.) Adjust the team schedule and update Wrike platform based on results from the analysis	[PD-F] Subtasks 2. C.	[PD-H] Subtasks 2. E.	15 minutes		Team's Wrike Manager – familiar with the platform.	
	2.E) A concluding paragraph discussing the analysis of results, limitations improved from the [PD-F], and new limitations.	[PD-F] Subtasks 2. D.	[PD-H] Tasks 3.3.	15 minutes		Experience with product analysis from previous projects.	
3) Referencing past projects, the analysis performed on [PD-F], and future recommendations and limitations of the current design	3.A) Benchmark or research different testing methods results based off the design of [PD-F]	[PD-F] Task 3.2.	[PD-H] Subtask 3. A.	40 minutes	Johnathan	Experience from previous [PD-F] with this section.	
	3.B) Comparison analysis between research, the results from [PD-F], and the analysis performed on the newly developed test plan (table format)	[PD-F] Subtask 3. A.	[PD-H] Subtask 3. C.	40 minutes	Thomas	Experience from previous [PD-F] with this section	
	3.C) A concluding paragraph to discuss the findings and future recommendations for the third round of prototyping	[PD-F] Subtask 3. B.	[PD-H] Subtask 3. D.	15 minutes			

	3.D) Reflection paragraph on how the team is implementing prior knowledge, as well as learning throughout the project	[PD-F] Subtask 3. C.	[PD-H] Task 3.4.	15 minutes	Johnathan	Experience from previous [PD-F] with this section	
4) Project Task plan Maintenance and Task Assignment	4.A) Updating Wrike Platform	[PD-F]	[PD-H] Subtask 4. B.	10 minutes	Lucy	Team's Wrike Manager – familiar with the platform.	
	4.B) Assign Tasks from Task list [PD-E]	[PD-F] Subtask 4. A.	[PD-H] Subtask 4. C.	10 minutes	Team effort	Dividing workload evenly.	
	4.C) Analysis of task completion effectiveness and develop strategies to identify missing subtask (in table format)	[PD-F] Subtask 4. B.	[PD-H] Subtask 4. D.	20 minutes	Amenah	Completed an analysis of uncertainties and risks from past deliverable.	
	4.D) Reflection paragraph describing findings from subtask 4. C.	[PD-F] Subtask 4. C.	[PD-H] Task 3.1.	15 minutes	Amenah		

The schedule for Task 4 is presented in *Table 7* below.

Table 7: Team 5 Schedule for Task 4, PD-H

Team 5 Schedule for Task 4, PD-H:							
Task 4: [PD-H]	Subtasks:	Predecessors:	Successors:	Estimated Task duration (max.):	Individual Responsible:	Reasoning for assigning:	Deadline:
1) Introduction & Conclusion	1.A) Introduction paragraph	[PD-G] Task 4.3.	[PD-I] Subtask 1. B.	15 minutes	Amenah	Written past introductions and conclusions, experience with formatting google documents.	03/28/21
	1.B) Conclusion paragraph	[PD-G] Subtask 1. A.	[PD-I]	10 minutes			

2) Prototyping Steps	2.A) (the why Part 3.) Prototyping objectives and efforts in paragraph format. Reflect and build on [PD-H]'s limitations and design	[PD-G]	[PD-I] Subtasks 2. B.	15 minutes	Krishna	Developed the test plan in [PD-G].	
	2.B) (the what part 3.) A test plan description that reflects and build on the plan developed in [PD-H] (clear and concise)	[PD-G] Subtasks 2. A.	[PD-I] Subtasks 2. C.	30-45 minutes	Krishan (consulting group)		
	2. C) (the how part 3.) Analysis and feedback on how the test plan will work and provide effective results. Reflect on how the newly developed test plan recovers the limitations identified in [PD-H] and the limitations of the new plan.	[PD-G] Subtasks 2. B.	[PD-I] Subtasks 2. D.	20 minutes	Lucy	Experience with product analysis from previous projects.	
	2.D) (the when part 3.) Adjust the team schedule and update Wrike platform based on results from the analysis	[PD-G] Subtasks 2. C.	[PD-I] Subtasks 2. E.	15 minutes		Team's Wrike Manager – familiar with the platform.	
	2.E) A concluding paragraph discussing the analysis of results, limitations improved from the [PD-H], and new limitations.	[PD-G] Subtasks 2. D.	[PD-I] Tasks 4.3.	15 minutes		Experience with product analysis from previous projects.	

3) Referencing past projects, the analysis performed on [PD-F], and future recommendations and limitations of the current design	3.A) Benchmark or research different testing methods results based off the design of [PD-H]	[PD-G] Task 4.2.	[PD-I] Subtask 3. A.	40 minutes	Johnathan	Experience from previous [PD-G] with this section	
	3.B) Comparison analysis between research, the results from [PD-H], and the analysis performed on the newly developed test plan (table format)	[PD-G] Subtask 3. A.	[PD-I] Subtask 3. C.	40 minutes	Thomas	Experience from previous [PD-G] with this section	
	3.C) A concluding paragraph to discuss the findings and future recommendations for the third round of prototyping	[PD-G] Subtask 3. B.	[PD-I] Subtask 3. D.	15 minutes			
	3.D) Reflection paragraph on how the team is implementing prior knowledge, as well as learning throughout the project	[PD-G] Subtask 3. C.	[PD-I] Task 4.4.	15 minutes	Johnathan	Experience from previous [PD-G] with this section	
4) Project Task plan Maintenance and Task Assignment	4.A) Updating Wrike Platform	[PD-G]	[PD-I] Subtask 4. B.	10 minutes	Lucy	Team's Wrike Manager – familiar with the platform.	
	4.B) Assign Tasks from Task list [PD-E]	[PD-G] Subtask 4. A.	[PD-I] Subtask 4. C.	10 minutes	Team effort	Dividing workload evenly.	
	4.C) Analysis of task completion effectiveness and develop strategies to identify missing subtask	[PD-G] Subtask 4. B.	[PD-I] Subtask 4. D.	20 minutes	Amenah	Completed an analysis of uncertainties and risks from past deliverable.	

	(in table format)						
	4.D) Reflection paragraph describing findings from subtask 4. C.	[PD-G] Subtask 4. C.	[PD-I] Task 4.1.	15 minutes	Amenah		

The schedule for Task 5 is presented in *Table 8* below.

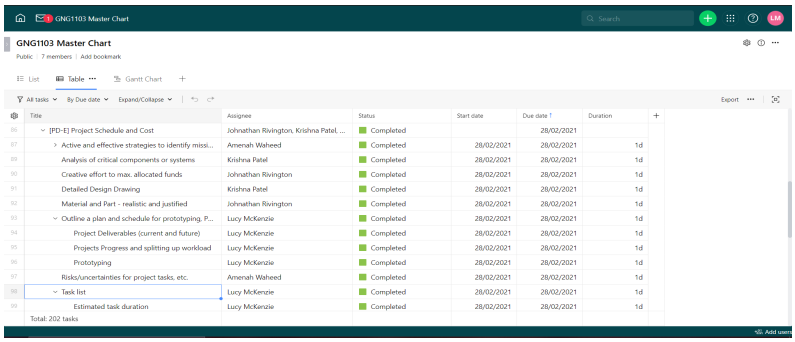
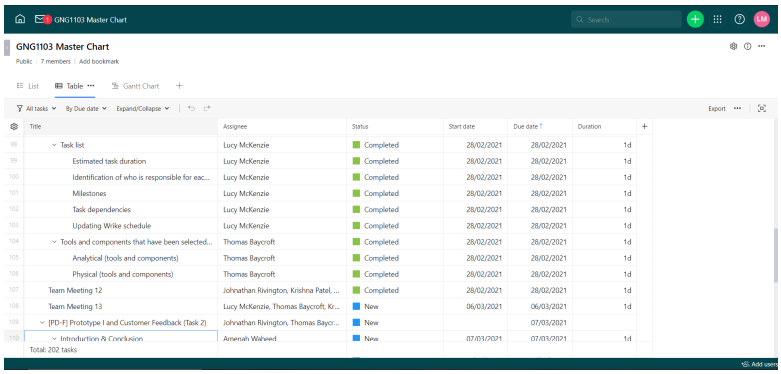
Table 8: Team 5 Schedule for Task 5, PD-I

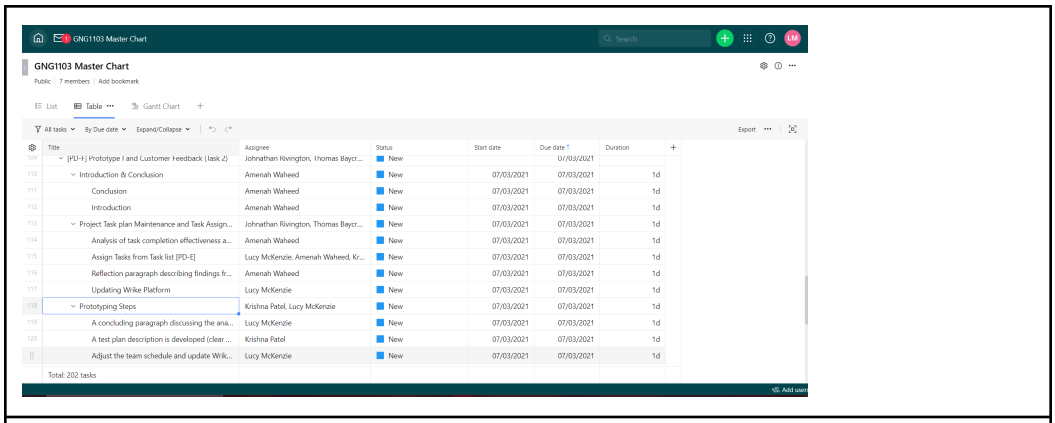
Team 5 Schedule for Task 5, PD-I:							
Task 5: [PD-I]	Subtasks:	Predecessors:	Successors:	Estimated Task duration (max.):	Individual Responsible:	Reasoning for assigning:	Deadline:
1) Problem Analysis	1.A) Background and context of client slide	[PD-H]	[PD-J] Subtask 1. B.	15 minutes	Amenah	Dividing workload evenly.	04/08/21
	1.B) Identification of problems and formulations slide	[PD-H] Subtask 1. A.	[PD-J] Subtask 1. C.	15 minutes	Krishna		
	1.C) Incorporation of client feedback and limitations (throughout all prototype phases) slide	[PD-H] Subtask 1. B.	[PD-J] Task 5.2.	15 minutes	Thomas		
2) Design	2.A) Design Specifications slide	[PD-H]	[PD-J] Subtask 2. B.	20 minutes	Johnathan		
	2.B) Benchmarking slide	[PD-H] Subtask 2. A.	[PD-J] Subtask 2. C.	20 minutes	Lucy		
	2.C) Technical Analysis slide	[PD-H] Subtask 2. B.	[PD-J] Subtask 2. D.	20 minutes	Amenah		
	2.D) Quality of design solution slide	[PD-H] Subtask 2. C.	[PD-J] Subtask 2. E.	20 minutes	Krishna		
	2.E) Health and Safety Considerations slide	[PD-H] Subtask 2. D	[PD-J] Subtask 2. F	20 minutes	Thomas		
	2.F) Economic Planning slide	[PD-H] Subtask 2. E	[PD-J] Subtask 2. G.	20 minutes	Johnathan		
	2.G) Environmental, cultural, and societal considerations slide	[PD-H] Subtask 2. F	[PD-J]	20 minutes	Lucy		
3) Prototype	3.A) Functionality and quality slide	[PD-H]	[PD-J] Subtask 3. B.	20 minutes	Amenah		
	3.B) Design Breakdown slide	[PD-H] Subtask 3. A.	[PD-J] Subtask 3. C.	20 minutes	Krishna		

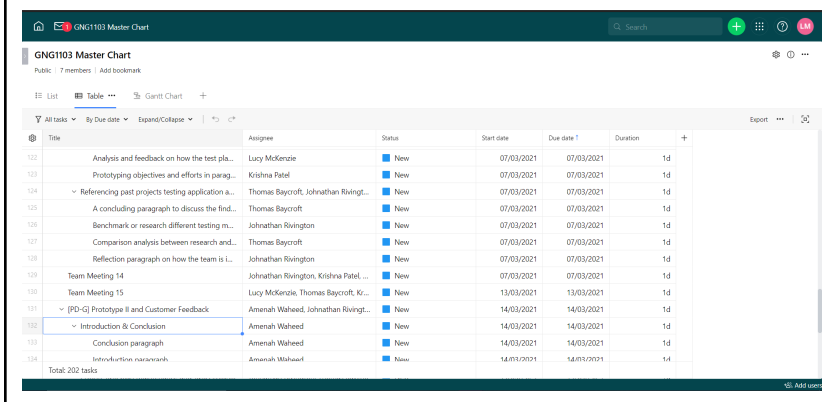
	3.C) Testing & Analysis of prototype slide	[PD-H] Subtask 3. B.	[PD-J] Subtask 3. D.	20 minutes	Thomas		
	3.D) Results and limitations slide	[PD-H] Subtask 3. C	[PD-J] Subtask 3. E.	20 minutes	Johnathan		
	3.E) Recommendations for future design	[PD-H] Subtask 3. D.	[PD-J]	20 minutes	Lucy		
4) Formatting	4.A) Formatting overall presentation	[PD-H] Task 5.1 Task 5.2 Task 5.3	[PD-J]	15 minutes	Team effort		
	4.B) Script for each section	[PD-H] Task 5.1 Task 5.2 Task 5.3	[PD-J]	15 minutes	Team effort		

Once the schedules for each task were generated, the Wrike Platform could then be updated. In Table 9 below, are the Wrike Screenshots.

Table 9: Wrike Screenshots

Wrike Screenshots:




GNG1103 Master Chart
Public | 7 members | Add bookmark
List
Table
Gantt Chart
All tasks
By Due date
Expand/Collapse
Export
Title
Assignee
Status
Start date
Due date
Duration
[PJ-I] Prototype I and Customer Feedback (task 2)
Johnathan Rivington, Thomas Baycr...
07/03/2021
Introduction & Conclusion
Amenah Waheed
Conclusion
Introduction
Project Task plan Maintenance and Task Assign...
Johnathan Rivington, Thomas Baycr...
Analysis of task completion effectiveness a...
Assign Tasks from Task list [PD-E]
Lucy McKenzie, Amenah Waheed, Kr...
Reflection paragraph describing findings fr...
Updating Wrike Platform
Lucy McKenzie
Prototyping Steps
Krishna Patel, Lucy McKenzie
A concluding paragraph discussing the ana...
A test plan description is developed (clear ...
Krishna Patel
Adjust the team schedule and update Wrik...
New
07/03/2021
1d
Total: 202 tasks
Add users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Gantt Chart
All tasks
By Due date
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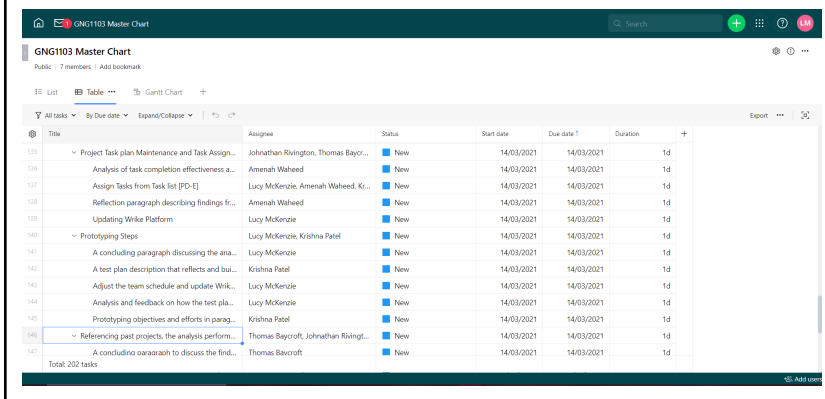
Export
Title
Assignee
Status
Start date
Due date
Duration
Analysis and feedback on how the test pla...
Lucy McKenzie
Prototyping objectives and efforts in parag...
Krishna Patel
Referencing past projects testing application a...
Thomas Baycroft, Johnathan Rivingt...
A concluding paragraph to discuss the find...
Thomas Baycroft
Benchmark or research different testing m...
Johnathan Rivington
Comparison analysis between research and...
Reflection paragraph on how the team is i...
Team Meeting 14
Johnathan Rivington, Krishna Patel, ...
Team Meeting 15
Lucy McKenzie, Thomas Baycroft, Kr...
[PD-G] Prototype II and Customer Feedback
Amenah Waheed, Johnathan Rivingt...
Introduction & Conclusion
Conclusion paragraph
Introduction paragraph
New
07/03/2021
13/03/2021
14/03/2021
1d
Total: 202 tasks
Add users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All tasks
By Due date
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Title
Assignee
Status
Start date
Due date
Duration
Project Task plan Maintenance and Task Assign...
Johnathan Rivington, Thomas Baycr...
Analysis of task completion effectiveness a...
Amenah Waheed
Assign Tasks from Task list [PD-E]
Lucy McKenzie, Amenah Waheed, Kr...
Reflection paragraph describing findings fr...
Updating Wrike Platform
Lucy McKenzie
Prototyping Steps
Lucy McKenzie, Krishna Patel
A concluding paragraph discussing the ana...
A test plan description that reflects and bui...
Krishna Patel
Adjust the team schedule and update Wrik...
Analysis and feedback on how the test pla...
Prototyping objectives and efforts in parag...
Referencing past projects, the analysis perform...
Thomas Baycroft, Johnathan Rivingt...
A concluding paragraph to discuss the find...
Thomas Baycroft
New
14/03/2021
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Total: 202 tasks
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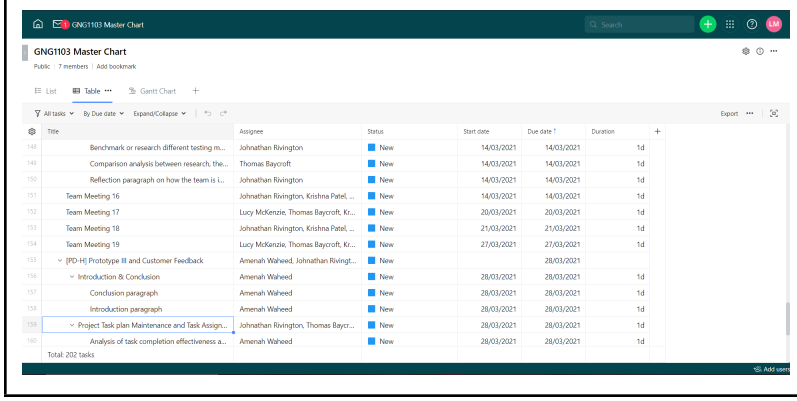
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Gantt Chart
All tasks
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Assignee
Status
Start date
Due date
Duration
Benchmark or research different testing m...
Johnathan Rivington
Comparison analysis between research, the...
Thomas Baycroft
Reflection paragraph on how the team is i...
Johnathan Rivington
Team Meeting 16
Johnathan Rivington, Krishna Patel, ...
Team Meeting 17
Lucy McKenzie, Thomas Baycroft, Kr...
Team Meeting 18
Johnathan Rivington, Krishna Patel, ...
Team Meeting 19
Lucy McKenzie, Thomas Baycroft, Kr...
[PD-H] Prototype III and Customer Feedback
Amenah Waheed, Johnathan Rivingt...
Introduction & Conclusion
Amenah Waheed
Conclusion paragraph
Introduction paragraph
Project Task plan Maintenance and Task Assign...
Johnathan Rivington, Thomas Baycr...
Analysis of task completion effectiveness a...
New
14/03/2021
20/03/2021
21/03/2021
27/03/2021
28/03/2021
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Total: 202 tasks
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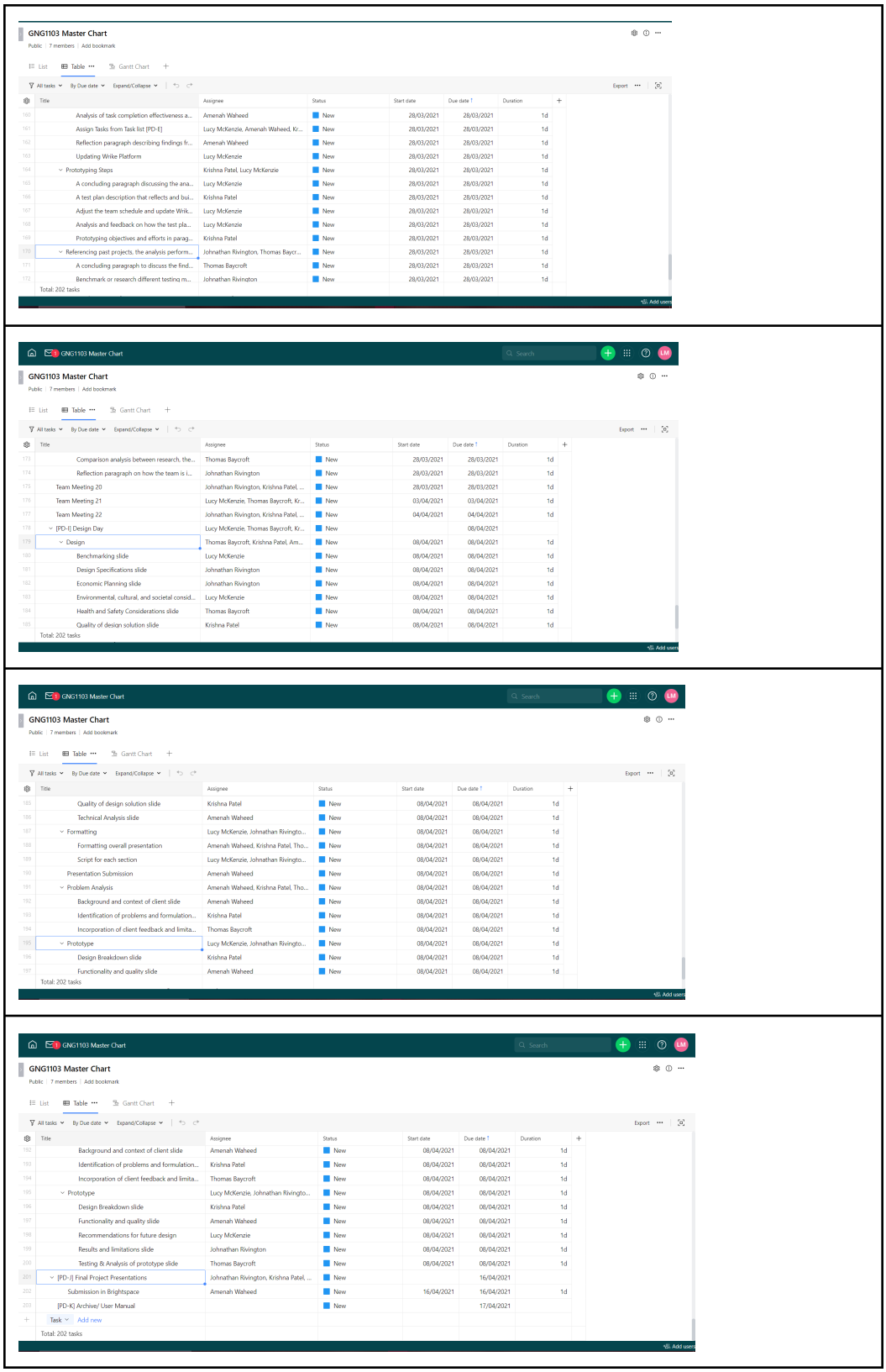
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List | Table | Gantt Chart
All tasks | By Due date | Expand/Collapse
Export
Title | Assignee | Status | Start date | Due date | Duration
Analysis of task completion effectiveness a... | Amenah Waheed | New | 28/03/2021 | 28/03/2021 | 1d
Assign Tasks from Task list [PD-E] | Lucy McKenzie, Amenah Waheed, Kr... | New | 28/03/2021 | 28/03/2021 | 1d
Reflection paragraph describing findings fr... | Amenah Waheed | New | 28/03/2021 | 28/03/2021 | 1d
Updating Wrike Platform | Lucy McKenzie | New | 28/03/2021 | 28/03/2021 | 1d
Prototyping Steps | Krishna Patel, Lucy McKenzie | New | 28/03/2021 | 28/03/2021 | 1d
A concluding paragraph discussing the ana... | Lucy McKenzie | New | 28/03/2021 | 28/03/2021 | 1d
A test plan description that reflects and bui... | Krishna Patel | New | 28/03/2021 | 28/03/2021 | 1d
Adjust the team schedule and update Wrik... | Lucy McKenzie | New | 28/03/2021 | 28/03/2021 | 1d
Analysis and feedback on how the test pla... | Lucy McKenzie | New | 28/03/2021 | 28/03/2021 | 1d
Prototyping objectives and efforts in parag... | Krishna Patel | New | 28/03/2021 | 28/03/2021 | 1d
Referencing past projects, the analysis perform... | Johnathan Rivington, Thomas Baycr... | New | 28/03/2021 | 28/03/2021 | 1d
A concluding paragraph to discuss the find... | Thomas Baycroft | New | 28/03/2021 | 28/03/2021 | 1d
Benchmark or research different testing m... | Johnathan Rivington | New | 28/03/2021 | 28/03/2021 | 1d
Total: 202 tasks
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List | Table | Gantt Chart
All tasks | By Due date | Expand/Collapse
Export
Title | Assignee | Status | Start date | Due date | Duration
Comparison analysis between research, the... | Thomas Baycroft | New | 28/03/2021 | 28/03/2021 | 1d
Reflection paragraph on how the team is i... | Johnathan Rivington | New | 28/03/2021 | 28/03/2021 | 1d
Team Meeting 20 | Johnathan Rivington, Krishna Patel, ... | New | 28/03/2021 | 28/03/2021 | 1d
Team Meeting 21 | Lucy McKenzie, Thomas Baycroft, Kr... | New | 03/04/2021 | 03/04/2021 | 1d
Team Meeting 22 | Johnathan Rivington, Krishna Patel, ... | New | 04/04/2021 | 04/04/2021 | 1d
[PD-I] Design Day | Lucy McKenzie, Thomas Baycroft, Kr... | New | | 08/04/2021 |
Design | Thomas Baycroft, Krishna Patel, Am... | New | 08/04/2021 | 08/04/2021 | 1d
Benchmarking slide | Lucy McKenzie | New | 08/04/2021 | 08/04/2021 | 1d
Design Specifications slide | Johnathan Rivington | New | 08/04/2021 | 08/04/2021 | 1d
Economic Planning slide | Johnathan Rivington | New | 08/04/2021 | 08/04/2021 | 1d
Environmental, cultural, and societal consid... | Lucy McKenzie | New | 08/04/2021 | 08/04/2021 | 1d
Health and Safety Considerations slide | Thomas Baycroft | New | 08/04/2021 | 08/04/2021 | 1d
Quality of design solution slide | Krishna Patel | New | 08/04/2021 | 08/04/2021 | 1d
Total: 202 tasks
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All tasks | By Due date | Expand/Collapse
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Title | Assignee | Status | Start date | Due date | Duration
Quality of design solution slide | Krishna Patel | New | 08/04/2021 | 08/04/2021 | 1d
Technical Analysis slide | Amenah Waheed | New | 08/04/2021 | 08/04/2021 | 1d
Formatting | Lucy McKenzie, Johnathan Rivingto... | New | 08/04/2021 | 08/04/2021 | 1d
Formatting overall presentation | Amenah Waheed, Krishna Patel, Tho... | New | 08/04/2021 | 08/04/2021 | 1d
Script for each section | Lucy McKenzie, Johnathan Rivingto... | New | 08/04/2021 | 08/04/2021 | 1d
Presentation Submission | Amenah Waheed | New | 08/04/2021 | 08/04/2021 | 1d
Problem Analysis | Amenah Waheed, Krishna Patel, Tho... | New | 08/04/2021 | 08/04/2021 | 1d
Background and context of client slide | Amenah Waheed | New | 08/04/2021 | 08/04/2021 | 1d
Identification of problems and formulation... | Krishna Patel | New | 08/04/2021 | 08/04/2021 | 1d
Incorporation of client feedback and limita... | Thomas Baycroft | New | 08/04/2021 | 08/04/2021 | 1d
Prototype | Lucy McKenzie, Johnathan Rivingto... | New | 08/04/2021 | 08/04/2021 | 1d
Design Breakdown slide | Krishna Patel | New | 08/04/2021 | 08/04/2021 | 1d
Functionality and quality slide | Amenah Waheed | New | 08/04/2021 | 08/04/2021 | 1d
Total: 202 tasks
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All tasks | By Due date | Expand/Collapse
Export
Title | Assignee | Status | Start date | Due date | Duration
Background and context of client slide | Amenah Waheed | New | 08/04/2021 | 08/04/2021 | 1d
Identification of problems and formulation... | Krishna Patel | New | 08/04/2021 | 08/04/2021 | 1d
Incorporation of client feedback and limita... | Thomas Baycroft | New | 08/04/2021 | 08/04/2021 | 1d
Prototype | Lucy McKenzie, Johnathan Rivingto... | New | 08/04/2021 | 08/04/2021 | 1d
Design Breakdown slide | Krishna Patel | New | 08/04/2021 | 08/04/2021 | 1d
Functionality and quality slide | Amenah Waheed | New | 08/04/2021 | 08/04/2021 | 1d
Recommendations for future design | Lucy McKenzie | New | 08/04/2021 | 08/04/2021 | 1d
Results and limitations slide | Johnathan Rivington | New | 08/04/2021 | 08/04/2021 | 1d
Testing & Analysis of prototype slide | Thomas Baycroft | New | 08/04/2021 | 08/04/2021 | 1d
[PD-J] Final Project Presentations | Johnathan Rivington, Krishna Patel, ... | New | | 16/04/2021 |
Submission in Brightspace | Amenah Waheed | New | 16/04/2021 | 16/04/2021 | 1d
[PD-K] Archive/ User Manual | | New | | 17/04/2021 |
Task | Add new
Total: 202 tasks
Add users

Risks and Uncertainties regarding Project Tasks

When creating a project schedule well in advance of deliverable due dates, it is difficult to fully understand and determine all tasks and subtasks that will need to be completed to finish each deliverable. Naturally, as due dates of each deliverable approach, the team focuses on each deliverable and determines more tasks to be completed, while more information is provided from the professor and TAs to help complete each upcoming deliverable. For this reason, there may be many risks/uncertainties associated with current and future planned tasks; some tasks may also be missing altogether in the project schedule as they may have been unforeseen. For example, tasks created for deliverables PD-F through PD-I are tentatively scheduled, and may be subject to change when the due dates approach. This is because, similar to the design process, the more work the team puts into the deliverables, the more tasks and subtasks can be identified, that may have been missed when creating the project schedule week(s) prior to the actual deliverables. Additionally, each team member's availability changes with each week, and some team members are not yet aware of their weekly schedule due to prior commitments, such as work. For this reason, a risk is associated with assigning tasks (along with fixed durations of tasks) to each member as they are not yet sure that they can complete the task on time, and/or if they will have the availability to complete it to the team's high standards. The project schedule may thus need to be updated as each team member communicates their weekly availability, along with the amount of time they can allocate to completing each assigned section. Tasks may also be shared between team members, as through weekly meetings, team members may decide to collaborate on tasks depending on their expertise. These decisions are made during the meeting, after extensive discussion, and cannot be determined beforehand. These risks and uncertainties are unavoidable. However, they can be mitigated through constant communication between team members, to ensure all tasks have been assigned to a member who can complete them well and on time. This method to reduce risk was used to create the deliverables' workloads. However, despite beforehand communication, team members' schedules are subject to change and will need to be communicated closer to the date of the tasks in the deliverables. Another method used to mitigate the risks is to create contingency plans. Contingencies can be created during the team meeting, where all members consensually decide how to reshuffle workload if another team member is feeling sick, overwhelmed, or is unavailable. An example of one contingency plan in place, is that if one member has an emergency and cannot complete his/her tasks, they will communicate in the group chat as soon as possible, and the members with most availability will take on the task. The responsibilities will be accordingly adjusted in Wrike. If no team member is available or has volunteered to do the task, it will be evenly distributed amongst all members, so that all members may divide and conquer the task. Another option is to reschedule the task such that the original team member and/or others may complete the task with ease. This is possible when all team members start working on their tasks earlier in the week and keep open communication with other members. Lastly, risk of incomplete tasks, while always lingering until the task is complete, may be reduced by starting early. Therefore, timelines of the project may be better dispersed over the week, thereby allowing all group members to finish their tasks early to prevent uncertainty; scheduling tasks earlier in the week also allows for flex time, in case emergencies occur. This strategy may be incorporated during the creation of contingency plans.

Missing Tasks in Project Schedule, with associated risks

While risks and uncertainties of the project schedule have been discussed, there are some tasks that are currently missing from the project schedule altogether. For example, PD-J and PD-K, along with their tasks and subtasks are not included/missing in the project schedule as the date of PD-J has not been scheduled by the professor yet, and PD-K is a task that will need to be completed when the team determines the final prototype for the heated sidewalk. The previous deliverables, PD-F, PD-G, and PD-H span three weeks of time, and will most likely require multiple iterations of the prototyping process; multiple prototypes will be constructed in the duration of these deliverables. Therefore, PD-K (along with

its tasks, subtasks, timelines and assignations of these tasks) cannot be developed until the final design is built, as PD-K requires the creation of an instruction manual of the final prototype. Another missing task is the purchasing of materials, listed in this deliverable's bill of materials (BOM). This task is missing as it relies on approval from the TA/PM, and the BOM may be subject to change depending on their suggestions (regarding materials and/or costs), and the group's decision to implement them. Additionally, after the BOM is approved, the team needs to decide on which member(s) will purchase the materials, depending on each team member's availability, ability to drive, comfort level for shopping during COVID-19, etc. These tasks are missing because they contain a high level of uncertainty and dependency on other tasks. Another missing task includes the construction of the prototypes, as this task is also associated with a very high level of risk. For example, it is entirely possible that the material to be purchased is out of stock; and/or has experienced price increase which may exceed the current budget of the team; and/or the material is not as expected and may need to be exchanged/refunded for a better material; and/or the material (if bought online) is shipped too late into the semester. These aforementioned risks are very high level, and thus force the group to leave out missing tasks such as material purchasing schedule, as the timeline and task assignment needs to be thoroughly discussed with contingency plans during the group's weekly meeting after the BOM has been approved by the TA/PM. Therefore, it is important to note that while some tasks are missing due to missing information for certain project deliverables, other tasks may be missing as they contain a high level of risk/uncertainty and need more time to be mulled over and discussed by the group. To help mitigate the risks of these tasks, contingencies will be put in place (such as those mentioned in the previous section), the TA/PM will be consulted for advice if needed, and team members will begin purchasing materials early to lower the level of the aforementioned risks. If budget is exceeded on the chance that the material price has gone up, or if the material is out of stock, team members will look into alternative options, such as second-hand, upscaled, or recycled materials, such as on Kijiji or Facebook Marketplace, to get a bargain on the required material without exceeding the $100 CAD budget. Research and resourcefulness will be required for this task.

Conclusion:

In conclusion, the team's bill of materials was decided upon by consensus of all members of the team and consistent only with elements that have a significant impact on the functionality of the device. The main criteria we strive to meet were safety, cost and snow melting function. A full schedule was derived off each required per deliverable. Adequate time was allowed for the completion of each task as well as extra time that would act as contingency or finalization. However, risks and uncertainties along with missing tasks were included as a discussion (external to the project schedule). Overall we ensured our individual subsystems will work together in harmony and deliver the results expected.

References

Please refer to Bill of Materials table for the links corresponding to each material. The link was provided instead of proper citations as the websites do not contain information in articles (such as Home Depot's catalogue), and the link is more convenient for the TA/PM, in case they want to gather more information on the material quickly.