Project Schedule and Cost

Project Deliverable E

GNG1103
Team 13
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Contents

1.0 Introduction

In the previous deliverables, a problem statement was created which states the need for a non-intrusive, wearable device that monitors oxygen levels of an opioid user and detects overdoses. The device must be affordable, lightweight and compact; it must alert emergency responders of the location of the person affected. Based on the problem statement and general benchmarking; the team concluded that the ideal product will cost less than $100 CAD, weighing around 15g to 25g, have a battery life greater than 24 hours, be water resistant, and have an oxygen saturation, heart rate, and respiratory rate monitors.

Each member then created three conceptual designs using the list of prioritized design criteria, and benchmarking. From the various designs, three fully-functional subsystems were put together. The three designs include a watch, a patch that can be placed on multiple locations of the body, and an earpiece. Through careful consideration of the pros and cons, the watch design was determined to be the most feasible.

This deliverable contains an analysis, list of tasks, and a list of costs. The analysis includes a brief summary of the client meeting, which was held on the 10th of February. Then a general plan is provided for each of the three prototypes which includes the task, estimated duration, and the due date. A quick preparation is also made for the next client meeting regarding the first prototype. The list of tasks includes the description of task, estimated duration, owner, and dependencies. The list of costs includes the item description, quantity, unit price, and amount. Lastly, a risk/contingency plan is made in case something does not go as planned during the project.

2.0 Analysis

2.1 Feedback

During the client meeting, the client was informed on the three fully-functional designs along with the selected device for the project. Based on the facial expressions and comments received, the client seemed to be interested in the ideas that were presented. When presenting her with the patch idea, she voiced a concern regarding the size and being able to fit all the necessary components in a flat format. She also mentioned that getting the patch to be sticky enough to last a long time would be difficult to achieve. The next product that was presented was the earpiece, her only issue with that was its design and aesthetic. If the earpiece looked too much like a hearing aid, younger customers may not want to wear that for long periods of time or in public settings. Lastly, the watch idea was presented which was favoured most. She offered

some advice along with new ideas that can be added on to the watch design. These ideas include creating an app to display all the information the watch collects, adding a SIM slot in the watch so that calls can be made directly from the device, and programming the watch to make a sound to wake the person up or to alert others around them when an overdose is detected. After some consideration, the alarm/sound and possibly the app idea will be incorporated into the final design.

2.2 Prototype I plan

Prototype I is simply creating a basic proof of concept which will be made using materials and components that cost very little. A simple analysis of critical components or systems will also be included. The first prototype is due on March 1st which gives us approximately one week to fill out the test plan, put it together, get feedback, and complete Deliverable F given that the needed materials or components arrive before February 23. This prototype requires the least amount of work so it should not take too long to put together, the only contingency is whether or not the items will arrive on time. The plan is to complete the list of materials and tasks for all prototypes prior to February 17 so that all of the items can be purchased on that day. Only about 10% of the budget will go towards prototype I since it requires less materials/components.

Getting feedback and finishing the deliverable should not take too long because based on past experience, we are usually able to finish it within 2 days. The analysis part of the deliverable should include feedback received, verifying feasibility, analysis of critical subsystems or system integration or reducing risk and uncertainty, and defining a stopping criteria.

2.3 Prototype II plan

The second prototype will mostly be a critical subsystem, in order to ensure that the design will work. An analytical, numerical or experimental model will also be included. The second prototype is due March 8 which gives us approximately one week to work on it given that prototype one is finished by March 1st. It would be best if prototype one is finished earlier giving us more time to work on this prototype since it needs to be functioning properly. As time goes on, the group will be meeting more often to ensure that everyone is doing their work and are on the same page. By this point, we will most likely be working more in parallel to get more work done in the short period of time.

Prototype II will have a similar plan as prototype I. A test plan will be filled out prior to building the prototype. After the prototype is made, feedback will be received and analysed. For Deliverable G, a short explanation of the results from prototype I will be given along with how the second prototype continues the development of the

solution. In addition, an analytical, numerical, or experimental model will also be included. Analysing the feedback and writing the report should not take more than 2 days. The main focus here is to put together the prototype with all the necessary components with functional sensors and working codes. The rest of the budget, 90%, will go towards this prototype and the third prototype. Since the third prototype will just be an improved version of the second prototype, the components will remain the same and so both can share the remainder of the budget.

2.4 Prototype III plan

The third prototype will be a fully functional version of the solution (a comprehensive prototype). Prototype III is due March 22nd, which gives us approximately 2 weeks to finalize the product and ensure that it is working and ready to be presented. In terms of costs, as mentioned above, the rest of the budget will be split. If there is some money left over from the second prototype, it would be used for any final adjustments or changes for the third prototype.

Same steps as previous prototypes: creating a test plan, completing Deliverable H, including a short explanation of the results from previous prototypes, how the third prototype continues the development of the solution, gather feedback/comments, and document results.

The bulk of the time will be spent working on the prototype itself, approximately 12 days, some of which will be spent working on individually and other times will be spent as a group to ensure everything is moving smoothly. The last 2 days will be spent completing the written components since we are capable of finishing them within that time frame.

2.5 Client meeting preparation

The next client meeting will be held on March 2nd. The goal of this meeting is to update the client on our progress and show the first prototype of the design. Prior to the meeting, the test plan for prototype I, Deliverable F, and the physical prototype will be completed and ready to be presented to the client. A list of questions, risk/contingency plans, plans for future prototypes, and any changes made will also be brought up during the meeting.

3.0 Tasks

3.1 Prototype I

Task ID	Task Description	Estimated Duration	Owner	Depends on Task ID:
1	Finalize target specifications	1 day	Sam	N/A
2	Fill out Prototyping Test Plan	1 day	Naomi	N/A
3	Create detailed sketch of the device	1 day	Mariyam	1
4	Create model in Solidworks	1 day	Liam	1
5	Get materials needed	1 day	Naomi	N/A
6	Create the watch strap (if silicone arrives on time, then no need for this step)	1 day	Sam	1, 3, 4
7	Create the screen part of the device with appropriate dimensions and locations of components	1 day	Yi	1, 3, 4
8	Assemble prototype I	1 day	Liam	6, 7
9	Test/Present finished prototype/ Feedback	1 day	Liam	6, 7
10	Deliverable F -	1 day	Mariyam	9

	Introduction			
11	Deliverable F - Analysis (risks, assumptions, feedback)	1 day	Mariyam	9
12	Deliverable F - Investigation (how, who, what, how much)	1 day	Naomi	9
13	Deliverable F - Conclusion	1 day	Yi	11, 12

Task List

3.2 Prototype II

Task ID	Task Description	Estimated Duration	Owner	Depends on Task ID:
1	Complete Prototype I (make adjustments, leave what is needed for prototype II)	1 day	Liam	N/A
2	Complete test plan	1 day	Sam	1
3	Adjust solidworks model	1 day	Liam	1
4	3D print any required parts (for the inside or outside)	1-2 days	Sam	3
5	Assemble casing for the screen part	1 day	Yi	4
6	Add battery	1 day	Yi	5

7	Add oxygen saturation and heart rate sensors	1 day	Mariyam	5
8	Add respiratory rate sensor (if needed)	1 day	Mariyam	5
9	Connect arduino to connect sensors to display	1-2days	Mariyam	5-8
10	Write the necessary codes to link the sensors to the display	3-4 days	Mariyam	9
11	Connect arduino for bluetooth connection	1-2 days	Naomi	5-8
12	Create the app on android	3-4 days	Naomi	11
13	Write the necessary code to connect watch to app through bluetooth	3-4 days	Liam	11, 12
14	Check all codes, connections, arduino, wires	1-2 days	Yi	9, 10, 11,13
15	Test/Gather Feedback	1 day	Sam	14
16	Deliverable G - Introduction	1 day	Mariyam	1
17	Deliverable G - Prototyping	1 day	Yi	15
18	Deliverable G - Investigation	1 day	Naomi	15, 17

	(test plan, modeling, feedback)			
19	Deliverable G - Conclusion	1 day	Sam	17, 18

Task List (Most tasks will be done in parallel to ensure its completion by the due date)

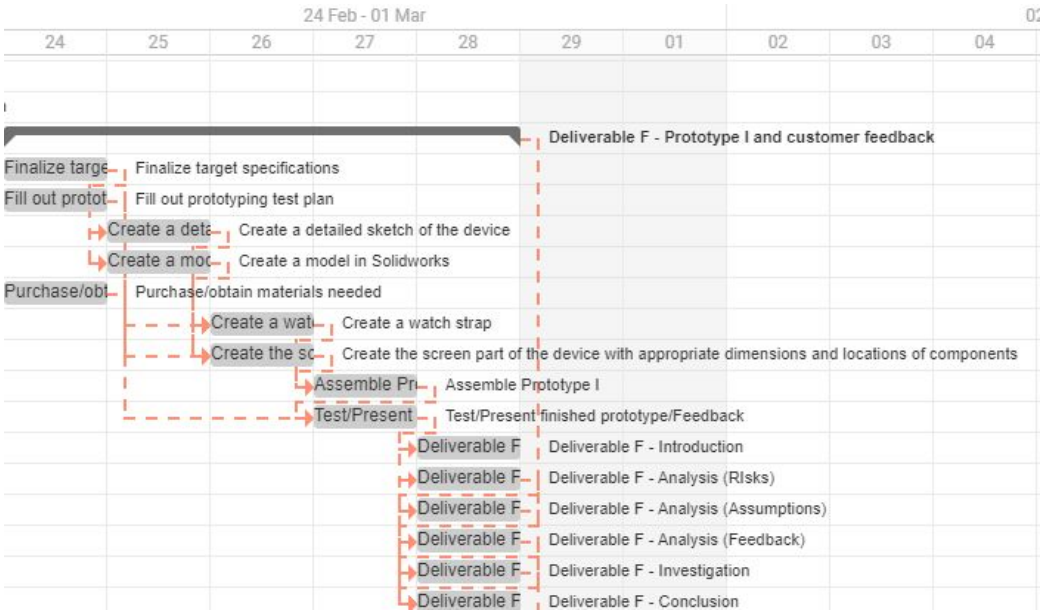
3.3 Prototype III

Task ID	Task Description	Estimated Duration	Owner	Depends on Task ID:
1	Complete Prototype II (make adjustments, leave what is needed for prototype III)	1 day	Yi	N/A
2	Complete test plan	1 day	Sam	1
3	Final solidworks model	1 day	Liam	1
4	Adjust/finalize prototype	1-6 days	Liam	3
5	Adjust/finalize code	1-6 days	Naomi	1
6	Adjust/finalize app	1-6 days	Mariyam	1
7	Test/gather feedback	1-3 days	Sam	4-6
8	Deliverable H - Introduction	1 day	Mariyam	1
9	Deliverable H - Prototyping	1 day	Mariyam	7
10	Deliverable H - Investigation	1 day	Yi	7, 9

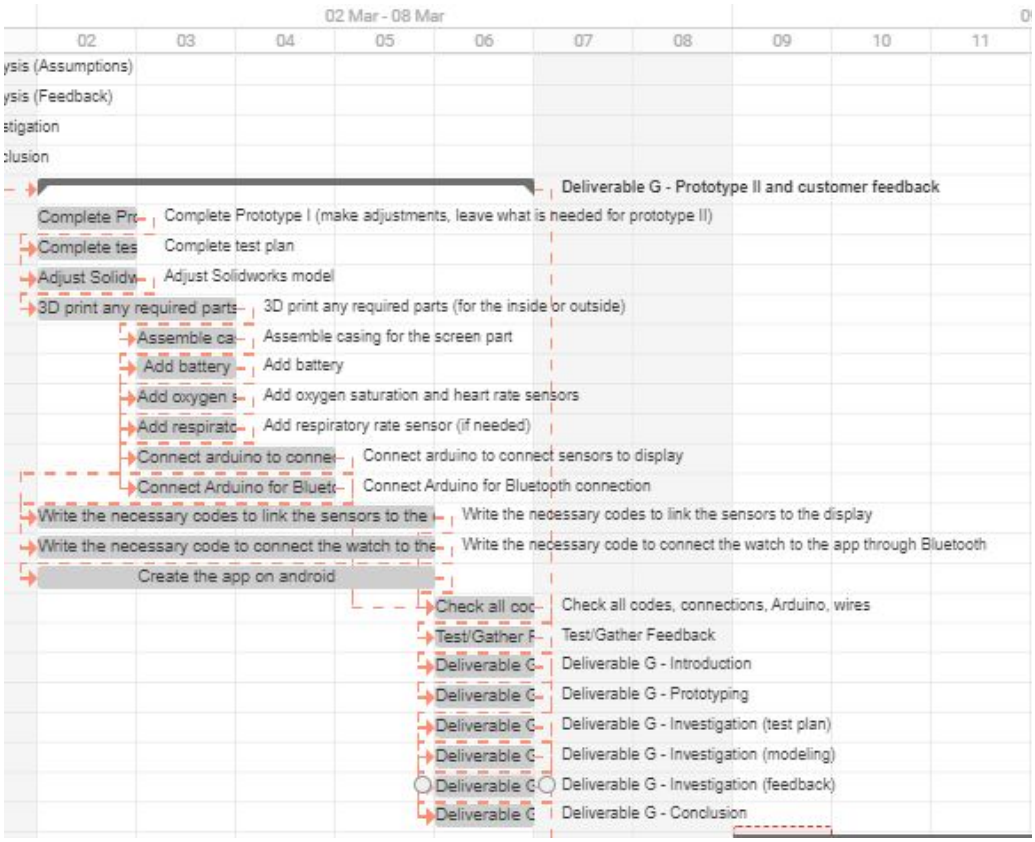
	(test plan, functional prototype, feedback)			
11	Deliverable H - Conclusion	1 day	Yi	9, 10

Task List

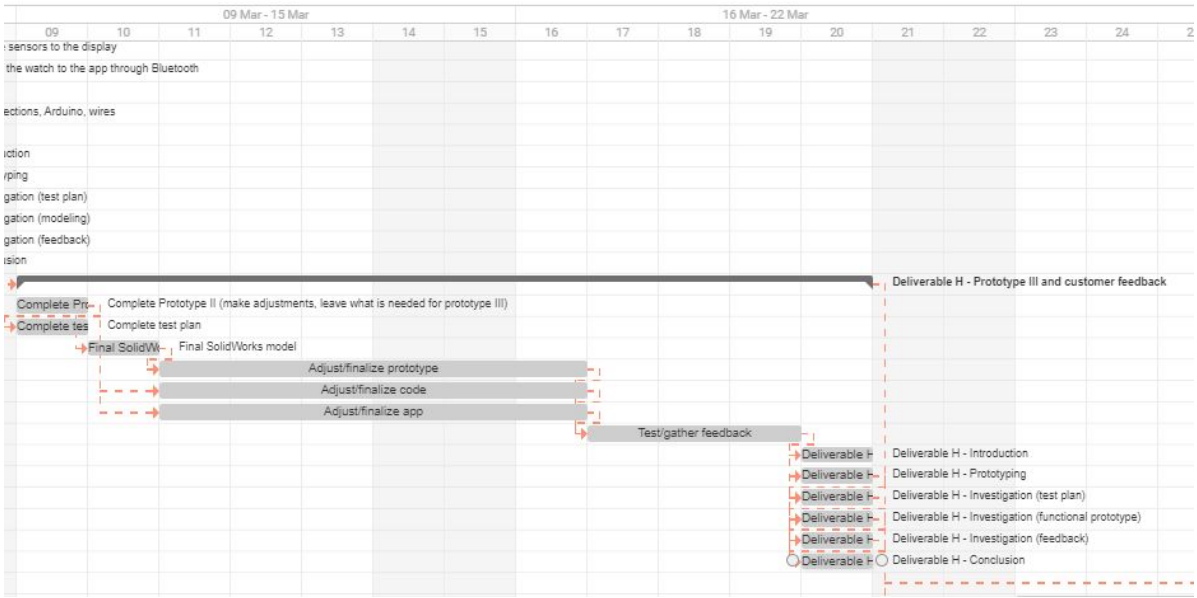
3.4 Gantt Chart



Prototype I



Prototype II



Prototype III

4.0 Cost

4.1 Prototype I

Item Number	Website	Product Name	Price	Shipping	Amount + Tax
1	N/A	Plain Cardboard	$2.00	N/A	$2.26

Bill of Materials

4.2 Prototype II/III

Item Number	Website	Product Name	Price	Shipping	Amount + Tax
1	https://www.digikey.ca	(ABX00030) ARDUINO NANO 33 BLE	$34.63	$8.00	$74.22
2		MAXREFDES117	$23.97		
3	https://www.amazon.ca	Lipo Battery and Charger (might be able to burrow one and reduce costs).	$15.90	N/A	$17.97
4	N/A	Recycled Watch Straps.	N/A	N/A	N/A

Bill of Materials

5.0 Risk/Contingency Plan

Our contingency plan accounts for various obstacles that might come up during this design process. This plan covers what happens if a member drops the course, if a member does not do their assigned work, if items we need to build our prototype do not arrive on time, or if our preferred items exceed the set budget. This plan also accounts for if group members' schedules get too busy to work on the project and if the prototype is unsatisfactory or does not work. If a group member chooses to drop the course and leave our group, we will evenly distribute the extra work among the remaining group members. Group members who do not do their assigned part will get several reminders and allowances as we understand that schedules

do get busy. If a group member feels that they cannot do their assigned work, they will let the group know and arrangements will be made to accomodate. We will, as a group, ensure that everyone contributes to the project. If our items do not arrive on time, we will find a temporary replacement that will allow us to continue with the project so as to not prevent us from continuing with the project. Our current prototype plan is under budget, giving us the freedom to make changes with future prototypes if necessary and ensuring we do not go over the assigned budget. If our prototypes do not work, we will revisit the design stage where we can review our previous designs and find a design that will work now that we understand why our original design did not work.

6.0 Conclusion

From the client meeting, we were able to take the feedback and use it to make changes to our existing plan inorder to improve it. We decided to add an app that connects through bluetooth to the watch so that all of the information that the sensors collect can be displayed in one place. In addition, a brief plan of action including the instructions, an estimated timeline, due date, and cost break down is also outlined for each of the prototypes. Following that, each prototype is broken down into a list of tasks with an estimated timeline, ownership, and dependencies. The task ownership is split evenly between members with consideration of each individual's workload. Lastly, a bill of materials for each prototype is listed with the total adding up to $100.01. The materials that will be purchased are the following: cardboard, MAXREFDES117, Arduino Nano 33 Ble, and Lipo Battery and Charger.

7.0 References

https://www.digikey.ca/product-detail/en/MAXREFDES117%23/MAXREFDES117%23-ND/6165562/?itemSeq=318112969

https://www.digikey.ca/product-detail/en/ABX00030/1050-ABX00030-ND/10239969/?itemSeq=318540217

https://www.amazon.ca/Fytoo-Battery-aircraft-helicopter-accessories/dp/B0795F139D/ref=pd_rhf_se_p_img_5?_encoding=UTF8&psc=1&refRID=6X2PNCDYC0CSX5ZVJGJ3