GNG 1103

Deliverable E: Project Plan & Cost Estimate

OPIOID OVERDOSE DETECTOR

By

GNG1103, SECTION C00, GROUP 5

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Introduction

The goal of this deliverable is to come about a project plan, cost estimation of the materials and components as well as a schedule to ensure that the team progresses on schedule. This schedule is composed of all three phases of prototyping that was originally planned using a Gantt Chart. Completing the three phases of prototyping will be done by dividing tasks evenly and integrating everyone's ideas in order to create a coherent product. Trello is used to create a Gantt chart that clearly lists each member's responsibilities as well as the expected timeline.

Project Plan

1). Tasks to Be Completed

Prototype 1

For the first prototype, a complete physical model of the opioid overdose detection device will be created mainly using 3D printing and other relatively cheap materials. The model will be used to demonstrate how the device will look, as well as help the team visualize the end result. This will be useful in getting proper feedback and generating further ideas. In addition, the model can be shown to our client in order to receive any additional critique. In order to do this, parts of the model will be given to different team members and designed in SolidWorks. Then each designed piece will be evaluated based on our previously determined criteria and compared in order to find the best version. Each member will be responsible for creating their part of the model during the reading week.

Task List	*Task Owner*	*Estimated Duration*
Dimensioning models	Ru	1 hour
Creating each part in SolidWorks	Mohamad	5 days
3D printing parts	Ru	1 day
Assembling the parts	All team members	1 day
Presenting prototype to customer and receive feedback	All team members	1 hour
Analyse Prototype I and complete Deliverable F	All team members	3 days

Task list of Prototype 1

Buying List (Deadline: February 20th 2020)

1. Hot glue gun

Preparation for Presenting Prototype (Client Meeting):

In order to prepare for our presentation of ideas, we will first determine the most important aspects of our design and create an effective and clear way to project our ideas. Next, using our 3D printed parts, we will create a coherent prototype in order to help the client visualize our concept.

Prototype 2

For the second prototype, a minimal version of our final design will be produced in order to test the design without wasting materials. The prototype will focus on creating a proper sensor capable of recording oxygen saturation levels. To accompany it, a display will be connected and allow us to verify whether we are able to receive and send data between the two devices. In addition, an actual bluetooth device will be added to each part to test how consistent the connection is. These parts will then be tested and analyzed in order to refine our design for the final product.

Task List	Task Owner	Estimated Duration
Create a working sensor	All group members	6 days
Program the display to the sensor	Sheetal	1 day
Integrate Bluetooth to the sensor and display	Sheetal	1 day
Test the connection and determine the maximum distance/range	Dhvani	1 day
Analyse test results, refine design	All group members	2 days
Complete Deliverable G	All group members	3 days

Task list of Prototype II

Buying List (Deadline: March 1st, 2020)

1. Oxygen saturation sensor
2. Display Screen
3. Connecting wire (Just in case)

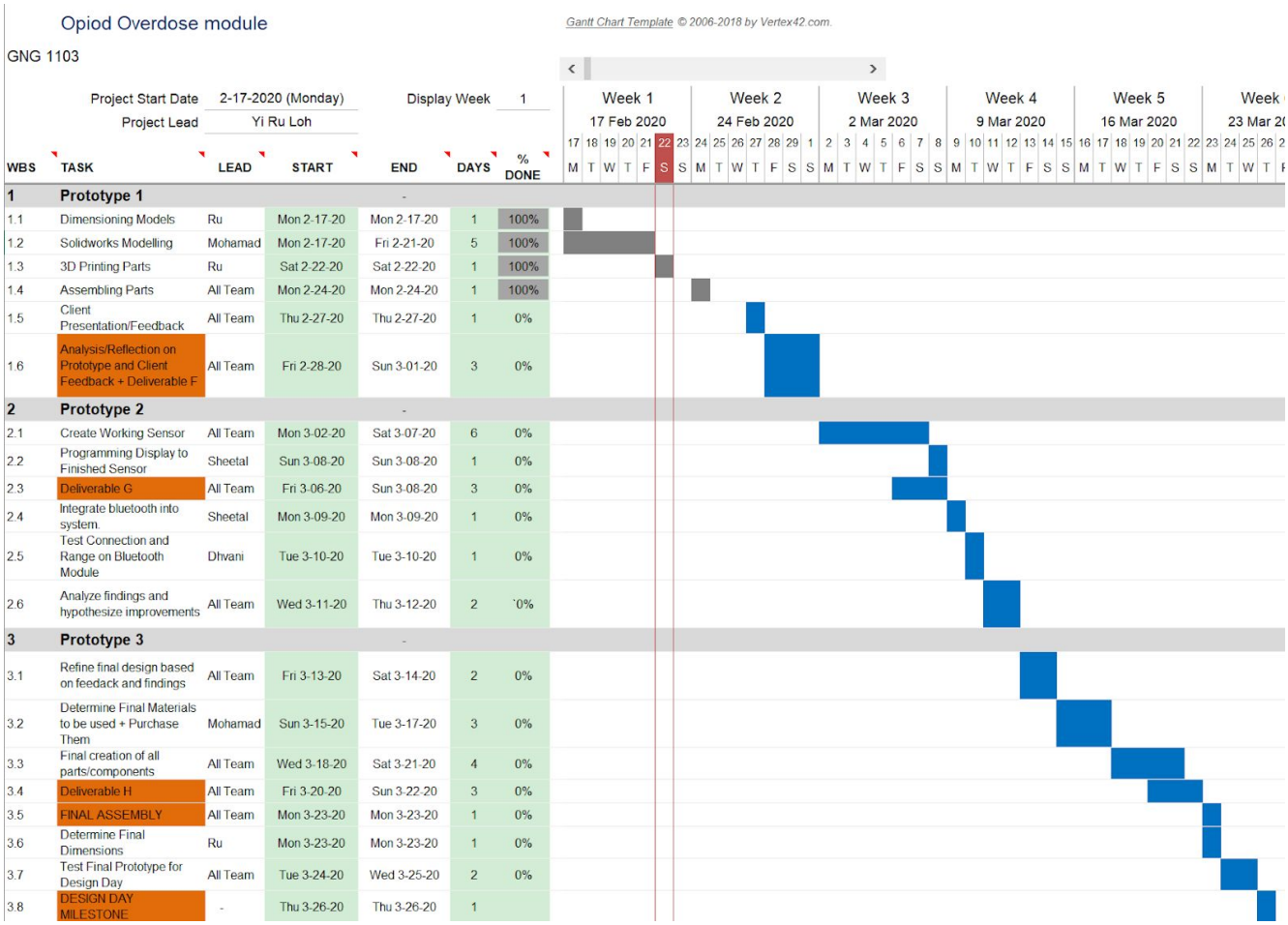
Prototype 3

For the third prototype, a fully functioning, comprehensive prototype would be created in order to represent our product. Before creating the final product, the design will be reviewed and further revised using the feedback received from the first two prototypes. In addition, the actual materials and proper dimensions would be used and applied; resulting in additional tweaking if needed. In this prototype, aesthetics will be applied as well in order to allow our product to be visually appealing for the user. One member will be in charge of purchasing the materials, and together we will assemble the product. After it is built, more testing will be done in order to ensure the device is performing properly and has no issues.

Task List	Task Owner(s)	Estimated Duration
Refine final design using feedback and results from Prototypes I and II	All group members	2 days
Determine material being used for Prototype III + Purchase all the needed materials	Mohamad	3 days
Determining final dimensions and weight	Ru	1 day
Final creation of all parts	All group members	4 days
Assemble final product	All group members	1 hour
Test Prototype III	All group members	2 days
Complete Deliverable H	All group members	3 days

Task list of Prototype III

2) Gantt Diagram



Opiod Overdose module

GNG 1103

Gantt Chart Template © 2006-2018 by Vertex42.com.

Project Start Date: 2-17-2020 (Monday) | Display Week: 1

Project Lead: Yi Ru Loh

WBS	TASK	LEAD	START	END	DAYS	% DONE
1	**Prototype 1**			-		
1.1	Dimensioning Models	Ru	Mon 2-17-20	Mon 2-17-20	1	100%
1.2	Solidworks Modelling	Mohamad	Mon 2-17-20	Fri 2-21-20	5	100%
1.3	3D Printing Parts	Ru	Sat 2-22-20	Sat 2-22-20	1	100%
1.4	Assembling Parts	All Team	Mon 2-24-20	Mon 2-24-20	1	100%
1.5	Client Presentation/Feedback	All Team	Thu 2-27-20	Thu 2-27-20	1	0%
1.6	Analysis/Reflection on Prototype and Client Feedback + Deliverable F	All Team	Fri 2-28-20	Sun 3-01-20	3	0%
2	**Prototype 2**			-		
2.1	Create Working Sensor	All Team	Mon 3-02-20	Sat 3-07-20	6	0%
2.2	Programming Display to Finished Sensor	Sheetal	Sun 3-08-20	Sun 3-08-20	1	0%
2.3	Deliverable G	All Team	Fri 3-06-20	Sun 3-08-20	3	0%
2.4	Integrate bluetooth into system	Sheetal	Mon 3-09-20	Mon 3-09-20	1	0%
2.5	Test Connection and Range on Bluetooth Module	Dhvani	Tue 3-10-20	Tue 3-10-20	1	0%
2.6	Analyze findings and hypothesize improvements	All Team	Wed 3-11-20	Thu 3-12-20	2	`0%
3	**Prototype 3**			-		
3.1	Refine final design based on feedack and findings	All Team	Fri 3-13-20	Sat 3-14-20	2	0%
3.2	Determine Final Materials to be used + Purchase Them	Mohamad	Sun 3-15-20	Tue 3-17-20	3	0%
3.3	Final creation of all parts/components	All Team	Wed 3-18-20	Sat 3-21-20	4	0%
3.4	Deliverable H	All Team	Fri 3-20-20	Sun 3-22-20	3	0%
3.5	FINAL ASSEMBLY	All Team	Mon 3-23-20	Mon 3-23-20	1	0%
3.6	Determine Final Dimensions	Ru	Mon 3-23-20	Mon 3-23-20	1	0%
3.7	Test Final Prototype for Design Day	All Team	Tue 3-24-20	Wed 3-25-20	2	0%
3.8	DESIGN DAY MILESTONE	-	Thu 3-26-20	Thu 3-26-20	1	

Week 1 — 17 Feb 2020 | Week 2 — 24 Feb 2020 | Week 3 — 2 Mar 2020 | Week 4 — 9 Mar 2020 | Week 5 — 16 Mar 2020 | Week — 23 Mar 20

3) Project Risks and Contingency Plans

Risk Severity	What is the risk?	Subjective likelihood of it happening	Threat imposed
Mid	Arduino sensors and components may not fit inside the oximeter-containing device.	2.5	Oximeter data may not be able to be sent wirelessly (wires required to protrude from the oximeter to a receiver).
High	Bluetooth sensor within oxygen saturation sensor and display has a short connection distance	3	Sensors may lose connection resulting in the device not working or sensing an overdose
High	Prototype III does not perform as expected	3	The comprehensive prototype may not function as expected/planned and disrupts the final presentation of the project.
Mid	Purchased materials does not arrive on time as planned	2	The team will not be on track with the schedule that was planned as certain parts have dependencies on one and another.

**Evaluations on the subjective likelihood of the risk happening are given on a 5 point scale:*

1 - Very unlikely to happen
2 - Unlikely to happen
3 - Equally likely as unlikely to happen
4 - Likely to happen
5 - Very likely to happen

Risk 1 - Contingency plan

If we're unable to fit bluetooth or other sensor components into the actual frame of the oximeter, our plan is to remove the bluetooth sensors and fit in the oximeter sensors at the very least (gathering reliable data is far more prioritized than having wireless data). Then, we would pursue one of the 3 following options;

a) Resize the oximeter apparatus to an absolute maximum (see if there are any ways to make it even larger without it starting to get uncomfortable). Then we would try again to fit in all the components.
b) Try exploring possibilities that keep the oximeter sensor in the device, but allow bluetooth/accessory components outside of the device.
c) As a last resort, run a wire from the oximeter straight to the data receiving apparatus. This removes the wireless aspect of the device but preserves the oximeter data nonetheless.

Risk 2 - Contingency plan

If we were to face this problem and the distance from the oxygen saturation sensor to the display is very minimal, the plan again is to remove the bluetooth sensor and go with a wire connected device instead of bluetooth. Incase of this risk occurring, we would have to go with the following 2 options:

a) Determine the absolute maximum distance that the bluetooth connection is functional for and try to adjust the wrist watch accordingly (moving it closer).
b) Make the device connected by wire instead of bluetooth and to ensure that the wire isn't too intrusive we would move the watch like display to minimize the length.

Risk 3 - Contingency plan

If we were to face this problem, the first step that we will take is to locate the source of the problem. We will identify the problem and come up with plans to solve the problem in the shortest time possible. We would then revise the design immediately as a team and only focus on fixing the specific component that causes the prototype to fail to function. The last step will be to carry out a test of the revised prototype and make sure it works accordingly before presenting the final product.

Risk 4 - Contingency Plan

If we were to face this problem that the materials or components that were ordered online will not be able to arrive on time, we will pursue one of the following 2 options:

a) Buy the components and materials that are needed at a physical store.
b) Ask around for other teams that are working on the same project if they have extra of the parts that we need, and we will purchase from them.

Estimated Cost

Bill of Materials

ID	Description	Vendor	Part Number	Qty	Cost before tax ($CAD)
1	Oxygen saturation sensor	Amazon	856964007513	1	11.95
2	Display Screen	Amazon	I2C LCD1602	1	6.49-12.99
3	Arduino Nano	Amazon	7630049200173	1	22.00
4	Jumper Cables	MakerStore	n/a	1	1.00
5	PCB Mount Mini Speaker	MakerStore	n/a	1	4.00
6	Wearable Electronic Platform	MakerStore	n/a	1	25.00
7	Bluetooth Module For Arduino	Amazon	HC-05	1	8.49

Total sum at the uOttawa Maker Store with tax and shipping: CAD $ 33.90

Total sum for components from Amazon: CAD $ 50.57

Total Sum of Material Costs: **CAD $ 84.4**

Conclusion and Next Steps

With this project plan, we have determined how we are going to advance with our project. First, we had determined what each prototype will entail, who is responsible for what tasks, and created a deadline for when the tasks should be completed by. Next, a list of materials was created for each step to ensure that it was all purchased and would arrive before any deadlines. Additionally, a Gantt diagram was made in order to visually demonstrate our task lists and show dependencies. Next, projected risks and contingency plans were made in order to plan ahead for any potential issues that may arise. Moreover, our estimated cost was determined by calculating the total sum of our materials and ensuring we stayed within our budget of $100. This step had helped us advance in the general “big picture” of the project and emphasized the urgency of when we should begin prototyping in order to follow our schedule.

For our next steps, we are starting to order parts as well as 3D print basic things at the makerspace in order to help us get more comfortable with the machines, as well as help us decide which ideas to pursue (i.e. ring or earpiece sensor). With this in mind, it is important to make sure that the team checks in with each other to make sure that everything is on track and following the project plan.

References

[1] - Oxygen Saturation Sensor

[2] - Arduino Display

[3] - Arduino Nano

[4] - Jumper Cables

[5] - Mini Speaker

[6] - Wearable Platform

[7] - Bluetooth Module

https://www.dfrobot.com/product-1122.html

https://store.digilentinc.com/pmod-gps-gps-receiver/

https://www.amazon.ca/Color-Screen-Bracelet-Pressure-Oximeter/dp/B07QXMKYP9/ref=sr_1_31?crid=16WZMGSUGIHIM&keywords=pulse+oximeter+finger+monitor&qid=1582859980&sprefix=pulse+o%2Caps%2C158&sr=8-31