Project Deliverable C: Design Criteria and Target Specifications

GNG 1103 – Engineering Design

Faculty of Engineering – University of Ottawa

Team 2

Introduction:

After the first client meeting, the general needs and concerns of the consumer were identified. One client concern addressed the quickness in which a drug overdose can lead to death. An overdose can cause oxygen levels within the body to fall under 90% and the body's breathing rate to fall under 10 breaths per minute. Death occurs due to poor oxygen saturation in the body. Therefore, a drug overdose can be identified by measuring the oxygen saturation levels within one's body and comparing the result to the natural value. This method also proves to be far more accurate in determining an overdose than breathing rate, or pulse.

Most overdoses are characterized as accidental poisoning, which means they are unintentional. In addition to this, our target audience will be focused on men in the working class, between the ages of 20-30 who have mainly become addicted to opioids through prescription. These individuals will have a high level of stigma and they cannot use it with their colleagues and need a discrete device to help them when they are using in case of overdose.

To solve this problem a device is required which can detect these symptoms and help the individual. The primary strategy is to detect an overdose, track the GPS location, administer naloxone (temporary treatment) and alert the paramedics.

Functional Requirements:

a) The device should be able to detect the location
b) The device should be able to contact authorities
c) The device should be able to detect and send GPS location
d) The device should be able to administer naloxone
e) The device should be able to contact emergency contacts
f) The device should be able to beep loudly through a speaker when an overdose occurs
g) The device should be able to detect when the oximeter detects oxygen levels to be under 90%

Non Functional Requirements

a) The device should be comfortable (light, padding,)

b) The device should be attractive

c) The device should be simple enough to produce and have longevity (sturdy, waterproof)

d) Data interface of the device should be simple to use

e) The device should be cost-efficient

f) The device should be discrete

g) The device should battle stigma

Constraints:

a) It can't be more than $100
b) Must be built within 2 months
c) Choosing the right components (benchmarking)
d) Choosing right material: plastics
e) Having enough time to troubleshoot problems at the end
f) Not enough experienced coders
g) Finding a placement for the device that is efficient for an oximeter

Metrics:

a) Weight: 20g-200g
b) Cost: $50-$100

For Ring

c) Diameter(inner): 2cm-6cm
d) Diameter(outer): 3cm-7cm

For Patch

e) Dimensions: 4cmx4cm-7cmx7cm

For Respiratory Clamp

f) Size: 2cm-4cm length/ under 50g weight

Determine a target range of design specifications:

a. minimum or maximum weight: between 20g-200g
b. Speed: must administer naloxone and contact authorities within 3 minutes of detecting overdose
c. Dimensions: must be discrete and small; can split into 2 devices to maintain discreteness

Benchmarking:

Benchmarking is important in helping us determine the average cost and specifications for the device.

Product Name	**Cost ($)**	**Weight (g)**	**Dimensions**	**UI**	**Alarm/GPS**	**Features**

Choicemmed OxyWatch Fingertip Pulse Oximeter	$40	Approximately 50g without the batteries.	Dimensions: 62.5mm (L) 47mm (W) 39.5mm (H)	UI with adjustable brightness. OLED displays SpO2, PR, Plethysmogram and pulse bar	N/A	-Unique soft silicone housing for superior comfort and fit. **SpO2**: -Measurement accuracy 70% - 99%: ±3 digits. **Pulse Rate:** -Measurement range 30 - 235bpm. -Accuracy 100 - 235bpm: ±2%. **Approved by HealthCanada**
ToronTek-B400 Pulse Oximeter	$175	Approximately 50g with the batteries.	Dimensions: 61*56*24 mm	UI with adjustable brightness. OLED displays with multi-directional views	Built-in alarms for SPO2 and pulse rate (Activated when measurements are outside set limits)	-Operating Temperature: 10°C-40°C -Storage Temperature: -40°C- +60°C -USB Interface for computers -Built-in rechargeable Lithium-ion battery cell -Adjustable band. -24Hr battery life. **Pulse Rate:** -Range: 30bpm-250bpm -Accuracy: ±2bpm or ±2% **SPO2**: -Range: 0%-100% -Accuracy: ±2% (70-100%) **Approved by HealthCanada**
Finger Bluetooth APP Pulse Oximeter Medical Household Digital Oxygen Saturation Meter Portable Mini Finger SPO2 PR Oximetro	$25	Approximately 50g.	N/A	Compatible with IOS and android. Has SpO2 and PR readings.		**-Brand Name: OLIEC** -Size: Finger Bluetooth APP Oximeter -Material: Medical ABS -Application: Finger -Model Number: BM1000 -Commodity Quality -**Certification: FDA,CE** -Material: ABS

CE						**-SpO2 ranger: 35-100%** **-PR ranger: 25-250bpm** -Color: Blue **-Support: IOS & Android** -Battery: 2*AAA 1.5v (not included) -Auto shut-off: 8S -Display direction: 2

Design Specifications:

#	Identified Need	Importance (1-3)	Design Criteria	Criteria
1	Weight	2	Weight (Grams/N)	-Maximum weight: 200g. -Recommended: <150g.
2	Affordable	2	Cost ($CAD)	< $100 budget.
3	Identify the Location of Overdosing Individual	1	GPS Coordinates	-Able to send coordinate locations to EMS. -Sends correct coordinate locations only when an overdose is detected.
4	Sturdy	3	Physical Property	-Will not fall off easily.
5	Contact EMS	1	GPS Coordinates	-Able to contact EMS.
6	Alarm system	1	Sound	-Alarm sound to alert nearby citizens when an overdose is detected.
7	Interface	3	User Interface	-Organized UI that properly displays the correct SpO2 readings. -Battery display. -Bilingual Options.

8	Warning	2	Sound and/or light User Interface	-Warns the user as he approaches overdose levels. -Warning symbol on the UI. -A pseudo or LED will be turned on if overdose occurs to alert people around the user
9	Safety	1	Safety	-Safe material for skin contact / non-irritable -The device does not overheat.
10	Easy to use	2	User Interface	-A user-friendly device that is easy to use -Easy and quick set up -Easy charging or battery replacement
11	Discreteness	1	Physical Property	-Must be discreet in order to prevent stigma. In a case where an overdose does occur, discreteness is no longer necessary. -Includes: no bright colors, not bulky
12	Water Resistant	3	Physical Property	-Able to sustain many drops of water without breaking/malfunctioning.
13	Dust Resistant	3	Physical Property	-Able to protect the device from dust and avoid damage. -Able to wipe off mud/dirt -Any wires must be protected from the environment
14	Aesthetics	3	Physical Property	-The design must be pleasing to the user. (this includes the organized UI) -Must be a simple design that can blend into work/day clothes

Conclusion:

After listing all of the necessary design criteria and discussing possible ideas for what the product will look like, we now have a much better idea of how we will reach our goal. There are still many skills that we will need to learn in order to construct the product and know how to make it compatible with the processing system (most likely Arduino Nano). None of us have in-depth experience using machines such as 3D printers, laser cutters, and other tools in the maker labs, so it will need to be a quick learning process for us in order to produce prototypes with enough time to test and modify them.