Project Deliverable C: Design Criteria and Product Specifications

By: Abdel Baig, Bilal Ahmed, Yazan Elmasry, Ali Al-Zaidi, David Onoruvwe
Due Date: Sunday February 2nd, 2020
GNG1103 Section #C
Team #7

When the process of design thinking is generated, one must consider the possible design criteria of the product being created. In the defining stage process, certain criteria and specifications must be presented in order to effectively determine which of the users' needs are functional, non-functional, or constraints (those that inhibit the defining stage process). The opioid overdose device that our group will create must clearly meet the functional and non-functional requirements of our users' needs. In order to understand the user's needs, we must derive and compare them to specific design criteria which will make the device optimal for them. However such criteria will encompass constraints which ultimately increase the risk of contingencies for the device produced. These aspects must be taken into consideration as they can increase the amount of time generated to complete the project. To gain an understanding of the users' requirements, it would be beneficial to compare our device and its respective specifications with ready made devices on the market. The reason why benchmarking is beneficial is because it will better our team's judgement when deciding on what the final design concept must include. The divergence and convergence of ideas will come in the next assignment, entitled, "Project Deliverable D."

Table 1: User Interpreted Needs vs Design Criteria

#	Need	Design Criteria
1	The device is discreet	Watch size (mm^3) GPS tracking system Weight (lbs) Watch shape Optical sensor
2	The device is user-friendly	Weight (lbs) Watch shape Optical sensor
3	The device is non-intrusive	GPS tracking system
4	The device is low cost	Cost ($)
5	The device is waterproof	Watch material

Design Criteria and Constraints

Functional requirements

- Sends a notification to nearby paramedic to inform that an opioid overdose has occurred using GPS tracking system
- Weight supported (lbs)
- Quick response time (min)
- Measuring range (bpm)
- Optical sensor to display accurate readings for pulse and SpO2 rates
- Safety readings for when oxygen saturation levels are excessive or insufficient
- Charging capability (i.e. wireless or battery-powered)

Constraints

- Weight (lbs)
- Cost ($)
- Size of watch (volume in mm^3)
- Operating conditions: temperature in °C
- Material type of watch (dependent on heat resistance)

Non-functional requirements

- Aesthetics
- Product life (years)
- Corrosion from rust
- Reliability
- Compatibility (i.e. Bluetooth technology)
- Screen Display (i.e. LCD or LED)
- Day-to-day water resistance

Table 2: Benchmarking

Pulse Oximeter Device (Specifications)	POX Wristband (Our group)	Pulse Oximeter Fingertip (Oximetro)	Zacurate Fingertip Pulse Oximeter
Company	DAAB Designers	ANKOVO	Zacurate
Cost	$100 (CAD)	$19.63 (CAD)	$19.70 (CAD)
Weight	0.11 lbs	Not specified	Not specified

Material	Stainless steel	Plastic	Plastic
Shape	Round	Squircle	Squircle
Pulse and SpO2 Measuring Range	25 bpm-250 bpm 35%-100%	25 bpm-250 bpm 35%-100%	Not specified
Pulse and SpO2 Accuracy	+/- 2 bpm 70%-100%	+/- 2 bpm 70%-100%	Not specified
Safety	Yes	Yes	Yes
Optical Sensor	Yes	Yes	Yes
Charging	Wireless	Battery	Battery
Tracking System	GPS	None	None

The table below is color-coded with (green = 3, yellow = 2, red = 1). The purpose of this is to determine which of the three products best fits the user's needs based on the provided design criteria.

Table 3: Benchmarking Analysis

Pulse Oximeter Device (Specifications)	POX Wristband (Our group)	Pulse Oximeter Fingertip (Oximetro)	Zacurate Fingertip Pulse Oximeter
Company	DAAB Designers	ANKOVO	Zacurate
Cost	$100 (CAD)	$19.63 (CAD)	$19.70 (CAD)
Weight	40 g	Not specified	Not specified
Material	Stainless steel	Plastic	Plastic
Shape	Round	Squircle	Squircle
Pulse and SpO2 Measuring Range	25 bpm-250 bpm 35%-100%	25 bpm-250 bpm 35%-100%	Not specified
Pulse and SpO2 Accuracy	+/- 2 bpm 70%-100%	+/- 2 bpm 70%-100%	Not specified
Safety	Yes	Yes	Yes
Optical Sensor	Yes	Yes	Yes
Charging	Wireless	Battery	Battery

Tracking System	GPS	None	None

POX Wristband
- Sum of Values = 28

Pulse Oximeter Fingertip (Oximetro)
- Sum of Values = 24

Zacurate Fingertip Pulse Oximeter
- Sum of Values = 21

The POX Wristband wins as the user's most beneficial product when compared to the other devices.

Note: EDS = Engineering Design Specifications

Table 4: EDS - Functional Requirements

#	Design Specifications	Relation (=, < or >)	Value	Units	Verification Method
1	Send notification to nearby paramedics using GPS tracking system	=	yes	N/A	Analysis, final test
2	Pulse measuring range	=	25-250	bpm	Test
3	SpO2 measuring range	=	35-100	%	Test
4	Quick response time	<	1	min	Analysis, final test
5	Safety	=	yes	N/A	Test
6	Charging capability	=	wireless	N/A	Test
7	Optical Sensor	=	yes	N/A	Test

Table 5: EDS - Constraints

#	Design Specifications	Relation (=, < or >)	Value	Units	Verification Method
1	Weight	<	0.11	lbs	Analysis
2	Cost	<	100	$	Estimate,

					final check
3	Size of watch	=	80x50x2	mm^3	Analysis
4	Operating conditions: temperature	=	-40 to 60	°C	Test
5	Material type of watch	=	Stainless steel	N/A	Test

Table 6: EDS - Non-Functional Requirements

#	Design Specifications	Relation (=, < or >)	Value	Units	Verification Method
1	Aesthetics	=	yes	N/A	Test
2	Product life	>	5	years	Test
3	Corrosion from rust	=	yes	N/A	Test
4	Screen display	=	LED	N/A	Test
5	Reliability	=	yes	N/A	Test
6	Compatibility	=	yes	N/A	Test

The first client meeting greatly impacted the development of our group's design criteria and specifications. The client gave us tidbits regarding the users' needs. These needs included the ones which were stated in Table 1. The needs that were provided in this table were based off of what our team learned from the meeting. These needs are categorized using a numerical ranking system. In this method, they are numbered from 1-5 in descending order, with 1 being the most important need and 5 being the least. The list of needs aided us when we got into benchmarking because our team was able to interpret design criteria and user specifications. The most important feature that the client pointed out in the meeting was that the device has to be discreet because many users are afraid of others exhibiting discriminatory behavior towards them. This need was the gateway to many other needs which helped us with the benchmarking. Moving onto the constraints, the most important factor is the weight of the device. This directly relates to the second most important need for the device which is that it must be user-friendly. A lightweight watch will allow users to wear the device for extended periods of time and not wear out their wrists. For the non-functional requirements, the most important one is aesthetics, the overall appearance of the device. This is considered to be non-functional because the client had stated that aesthetics is secondary to functionality.

After analyzing the tables and benchmarking our design criteria with the ready made devices, we can see that our device is better suited for the needs of the user. The reason being is that our device meets most of the functional and non-functional requirements of the opioid overdose device. However, this device will come with its fair share of implications. In order to have a successful device, team members need to account for the constraints which have been implemented. Overspending the allocated budget and increasing the size and weight can create problems which will delay the design process.

In conclusion, our process of prioritizing design criteria, benchmarking, and determining target specifications provided our team with valuable information regarding the users' needs. This will be vital information moving forward into the ideation stage, which focuses on the divergence and convergence of all possible ideas to develop a final solution.