

Design Criteria and Target Specifications

Introduction:

The goal of this project is to create a device that detects the early stages of opioid overdoses, alerts help, and injects an antidote. This will be achieved by making the device check if for any irregularities in a user's respiration and heart rate. As per our client's request, the device should be durable, discreet, non- invasive, and have a long battery life. In order to develop the best product, we have identified the product's limitations and approximate metric values associated with each requirement. We also benchmarked four different opioid detection devices and determined each of their strengths and weaknesses. This will help us to understand what is effective and what compromises are reasonable to make with the client such that they are happy enough with all product functions and features.

Design Criteria:

<u>Design Specifications</u>	<u>Relation</u>	<u>Value</u>	<u>Units</u>	<u>Verification Method</u>
Functional Requirements				
Long-Lasting battery	>	24	hours	Test
Fast detection	<	3	minutes	Test
Fail-safe detection	=	yes	N/A	Test
Constraints				
Cost	≅	100	\$	Test
Weight	<	170	g	Test
Non-invasive	=	yes	N/A	Test
Non-functional requirements				

Aesthetics (discrete, simple)	=	yes	N/A	Test
Durability	=	yes	N/A	Test
Product Life	>	1	year	Test

Benchmarking:**Legend:****Green:** 3 points**Yellow:** 2 points**Red:** 1 point*****Multiply the value of each weight by this for the total*****

Devices:	Importance (weight) ***	Device #1	Device #2	Device #3	Device #4
Name	-----	Wearable Opioid Antidote Device	Second Chance	N/A	HopeBand
Link	-----	https://www.purdue.edu/newsroom/releases/2019/Q3/device-could-automatically-deliver-drug-to-reverse-opioid-overdose.html	https://www.sciencedaily.com/releases/2019/01/190109142715.htm	https://dailynorthwestern.com/2019/10/29/campus/interdisciplinary-research-team-awarded-10-million-nih-grant-to-develop-device-to-treat-opioid-overdose/	https://spectrum.ieee.org/the-human-os/biomedical/devices/wristband-and-for-detecting-opioid-overdose-joins-national-race-for-tech-solutions
Send & receive signals (in under 3 min)	4	The antidote can be released in 10 seconds. It gives the person an extra hour to get medical help before relapsing. The goal is to make the product be able to alert	Once overdose is detected, it contacts a friend or emergency service that can provide naloxone.	Dispenses Narcan and sends a signal within seconds of overdose detection.	Sends signal in under 10 seconds.

		medical services.			
Accuracy	5	<p>Detects overdose by measuring respiratory rate and heart rate. Tests have shown success with detecting low respiration and triggering the release of the naloxone. However, no automatic injection yet. A solution to resolve the antidote leakage is yet to be determined.</p>	<p>90% accurate Only detects breathing rates, not blood oxygen levels Works best for illegal injecting drugs (so not our target audience)</p>	<p>Detects overdose by measuring blood oxygen content.</p>	<p>Measures blood-oxygen-level via pulse oximetry-the most reliable form of detection.</p>
Long-lasting (long battery life)	3	<p>The battery is connected to the central device and is put by the hip.</p>	<p>It is a cell phone application, it itself has no battery life</p>	<p>TBD. It should last since it's an implantable device that's hard to replace frequently.</p>	<p>Depends on your phone battery life as it connects via Bluetooth to the GPS on your phone to send location.</p>

Discreet	2	Armband wrapped around bicep which connects to a portable battery on the hip. There's also an EKG "sticker" attached to the chest to measure respiratory rate.	Since it is a cell phone application, no one would know that they have it on them	Under the skin implantable device.	Discreet Wristband
Wearable / Non-invasive	5	The surgical procedure necessary in order to attach the device to a person. Implantation can be between 0.5-2cm.	It's an application on the phone Doesn't have to be on you-can detect breathing rate up to 6 feet away	A subdermal implant that's the size of a quarter or a small USB drive.	Wristband
Durable (can resist daily function)	4	The device is fairly dirt and water-resistant. Intensive motion or change in orientation doesn't impact quality.	It will last as well as a phone lasts	Skin will protect it from water, dust and other damage.	As durable as most apple watches. It can withstand small damages.
Cost	4	TBD	Cheap App	TBD	\$21-\$26
Failsafe	5	No failsafe	They will add	TBD. The	When it

detection		detection, however, they are working towards creating a device with little to no faults.	an interactive feature where if the user cannot interact with the app after an overdose is detected, then it alerts someone who can provide naloxone. If they interact with the app then no one is alerted.	device should have a reservoir full of naloxone that it pumps out into the blood in case of overdose.	detects a possible overdose, the device waits 10 seconds to monitor the wearer. If their condition doesn't improve in that time, it will sound an alarm, flash red lights, and send out a text message alert with the wearer's current location.
TOTAL Highest Possible Score: 96	96	58	82	71	83

Conclusion:

Based on our established constraints and weighing conditions, the benchmarking comparison results have proved to favour the HopeBand designed wristband over the WashingtonU designed implant and the wearable opioid detection device. The Second Chance phone app also did not lag too far behind coming in second behind HopeBand. Our criteria and constraints both come together in support of a design that's low maintenance and must not impede the daily lives of its users. We realize that our client-base may not be interested in invasive solutions such as the implant or bulky restricting prospects like the wearable antidote device because they have lives that run parallel to and in spite of their substance use. Furthermore, the design must be discreet as the stigma attached to the notion of substance use may just by itself steer people away from our life-saving device. HopeBand and Second Chance can function within those constraints. Thus, they come on top according to our benchmarking

results. They also utilize the capability of modern smartphone devices. As smartphone devices become globally more available to all the different factions of people. It's a resource that we aspire to include in our design as it will unlock an array of functions.