Josiah:

Opioid overdose, even in Ottawa, is increasing rapidly every year, causing more deaths to people who are taking prescribed or non prescribed drugs. Most of these overdoses are accidental and during an overdose, there is no way for the user to aid themselves or call for help.

According to Public Health Ontario, between the year 2017 and 2018 (July to June), there were 1,337 confirmed deaths relating to opioid overdose in Ontario. Over 90% of these overdoses were completely accidental, and over 72% of these victims were male. What makes this even worse is that these values were recorded last year, that's not including any data from this year or last year. Since then, opioid overdose is dramatically increasing.

With this said, we were given the task to develop a low-cost, discrete and effective wearable device that allows for the detection of drug overdosage of the wearer. After detection of an overdose, the device must alert emergency services in order to request assistance for the wearer. However, how are we going to be able to develop such a device?

<https://www.publichealthontario.ca/-/media/documents/opioid-mortality-surveillance-report.pdf?la=en>

Joe : We think we have found the best solution to this problem.

Joe : So here we have a chest strap, not just any chest strap but one that may save your life. Let's take a closer look.

It consists of an adjustable and stretchable chest strap with a box on the main plastic plate containing all electrical components. The sensor is placed in a hole in the padding on the back of the plastic plate so that it is always in contact with skin. We chose the chest strap design for many reasons, it is not only discrete but also comfortable for everyday activities. We decided to put the box with all electrical components on the back rather than our original design where it is worn on the front. When we tested the device on a male it was comfortable regardless of which way you wear it, but when we had a female wear it, it was much more comfortable and there was a wider range of motion when placed on the back.

.

\*Cover shot of device

VO (Austin):

This device is powered by a 3500 mAh battery that allows it to be on all day, and can be charged overnight. The brains of the device is an arduino uno, which was chosen for its reliability and simplicity.

The primary source of information intake of this device is the special RX117 chip that is a sp02 and a heart rate sensor. The sensor is a reflectance oximeter, which measures spo2 levels via reflectance measurements using low wavelengths reflecting off oxygen molecules. Research has shown that this device can be used in other locations than earlobes and fingers, for example forearm, thigh, chest and back which is perfect with the implementation of this design. Through testing the devices was shown to perform with relative accuracy when used on the fingers compared to the forearm and back measurements varying a 3-6% deviation.

All of the components are fitted to be relatively small form factor, with the entire device fitting in a small box on a go-pro strap. This allows it to be worn without being noticeable, however still making the device comfortable to wear.

The relay for the information from the device to the app is the HC-05 bluetooth chip, an entry level bluetooth chip with incredible reliability. The software that the arduino runs takes information from the sensor, takes the information and feeds it through an algorithm that calculates SPO2 levels and heart rate, then sends it through the bluetooth module to the app where there data is monitored.

\*cover shot of app

VO(gabriel):

The app runs on android model phones. It regularly displays heart rate and Oxygen percentage, and retains, after an initial input, the contact information for a chosen “emergency contact”.

Should the %Sp02 reach under 75 percent, the app will Mark the user as "At Risk", and the app will sound an alarm to alert the User and ask them to swipe on a slider to deactivate the alarm. When the %Sp02 reaches under 65 percent, the app will Mark the user as "Critical", an alarm will sound (as well as a slider to deactivate) and the chosen contact will be alerted to the situation and will pinpoint the location of the user via longitude and latitude.

All three states are illustrated here from left to right. It is important to note that although heart rate is displayed here, it is not in any way a driver of the overdose procedure as it is incredibly unreliable as an indicator but is shown as a reassurance measure to the user of their health but obviously if it should reach zero something is very wrong. From this point, the contact may decide the best course of action.

Another advantage to keeping these numbers present regularly is the user might also be able to use them as indicators which might help them be more responsible when using the opioids.

Ethan: So now to why this design stands out. Choosing a location for this device isn't easy. If you put it on your ear it will easily fall off, On your wrist as a watch you have to trade the size of battery for form factor. But on your chest and back we don't see any of these downfalls.

Ethan: We chose this model of device because these straps are created and used for action camera mounts when doing high movement activities such as skydiving, biking and skiing meaning they are great for staying secure on your body. When testing the chest strap we were not let down. It fits on all body types well and keeps the sensor up against the skin when doing almost all motions.

If you draw attention to the pictures you can see the chest strap fits on women comfortably. This was one of the major concerns of Tali when we presented our design. The second picture shows that some of the users found the device more comfortable on the back. In the third picture it shows that the device is very discrete sitting under the shirt of a user.

Budget:

-78$ total spent on budget

-12$ on a chest strap, it is important because it is the key reason our device stands out.

-8$ on arduino uno

-35$ Oxygen sensor, this was the most important part because it allowed us to take oxygen rate from the chest opposed to the finger or ear.

-11$ on a battery big enough to keep the device running all day.

-10$ bluetooth sensor

-2.50$ on materials for the box.

\*cover shot of someone wearing it

Joseph: Joe: Some challenges we ran into were getting the bluetooth device to send proper values to the android app, figuring out how to make the chest strap work for clients varying in size. We were also unable to get all of the circuitry to work due to a lack of resources when everything shut down.

Some successes we had were getting the oxygen and heart rate sensor to work properly, we managed to make the chest strap comfortable and discreet while not sacrificing anything, and also the case worked perfectly for all our components.

There were some key components that we were unable to finish unfortunately, but overall we are very happy with our design and feel it would have done well if we had the chance to finish it.

The end

Josiah: 1:34

Joseph: 50 + 51 = 1:41

Austin: 1:21

Gabriel: 1: 35

Ethan: 1:59

Total: 8:10