Project Deliverable D:
Conceptual Design

GNG 1103
Group C6

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Introduction

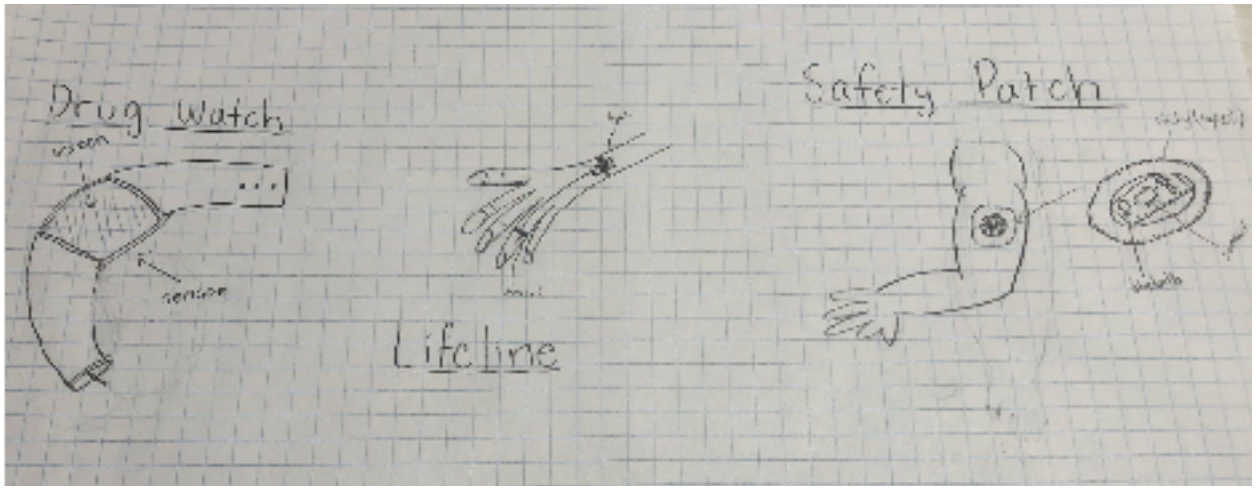
The objective of this deliverable is to develop a set of conceptual designs for the problem statement based on benchmarking and the list of prioritized design criteria that was developed in the previous deliverables. Additionally, these concepts will be analyzed and evaluated. Based on the analysis, concepts will be chosen for the group to continue to develop.

This deliverable is split into three parts. In the first part, the personal conceptual designs from each team member will be presented which are divided into the external design subsystem and transmission of data subsystem. In the second part, the designs from the first part will merge together to create three global concepts. In the third part, the three global designs will be compared. Through analysis, the team will choose one global concept that is the most suitable to the design criteria.

Part 1: Designing Concepts

Parsa's concepts

Subsystem: Exterior design



Drug Watch

The Drug Watch is made up of two main components, the hardware and the strap. The hardware part of this design includes a pulse oximeter on the bottom along with a bluetooth device built-in. When the sensor detects a person overdosing, it will send a warning to a third party.

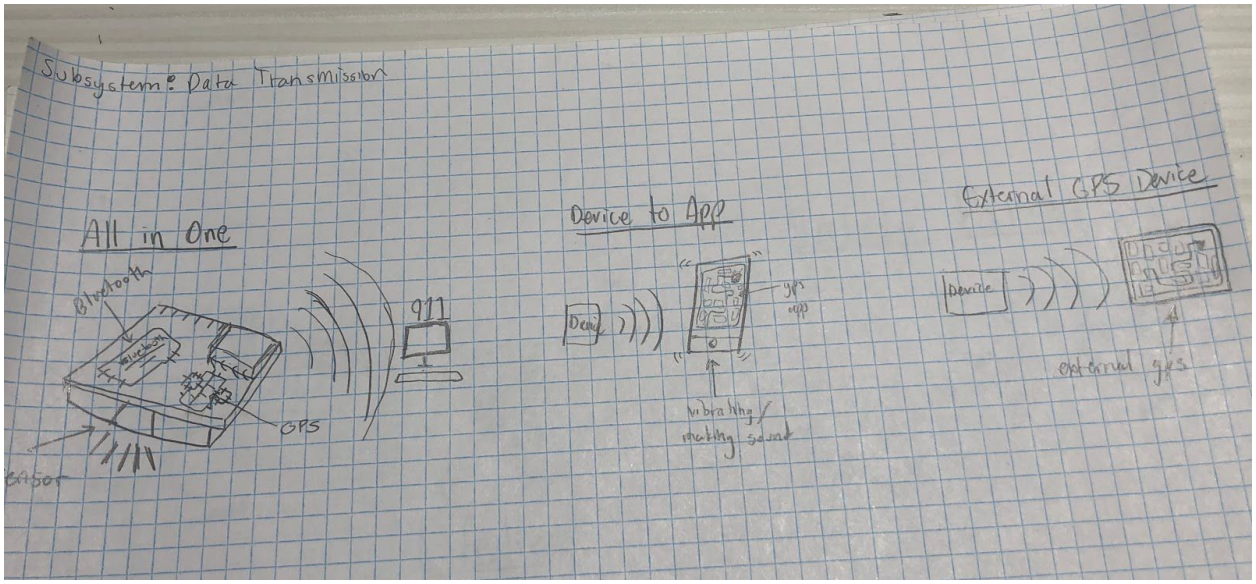
Lifeline

The lifeline is made up of two main components, the device on the wrist and the device on the finger. These two devices are connected by a discreet and sturdy wire. The component that goes onto the finger of the user contains a pulse oximeter and the wrist component contains a bluetooth device and gps.

Safety Patch

The safety patch is made up of two main components, the adhesive path, and the hardware inside. The hardware built into the patch contains a bluetooth device and gps. The hardware will also contain a pulse oximeter within.

Subsystem: Transmission of data



All in One

For the All in One, the bluetooth sends a bluetooth signal to the CPUs that belong to 911. The computers will have coordinates that can be seen on a computer.

Device to App

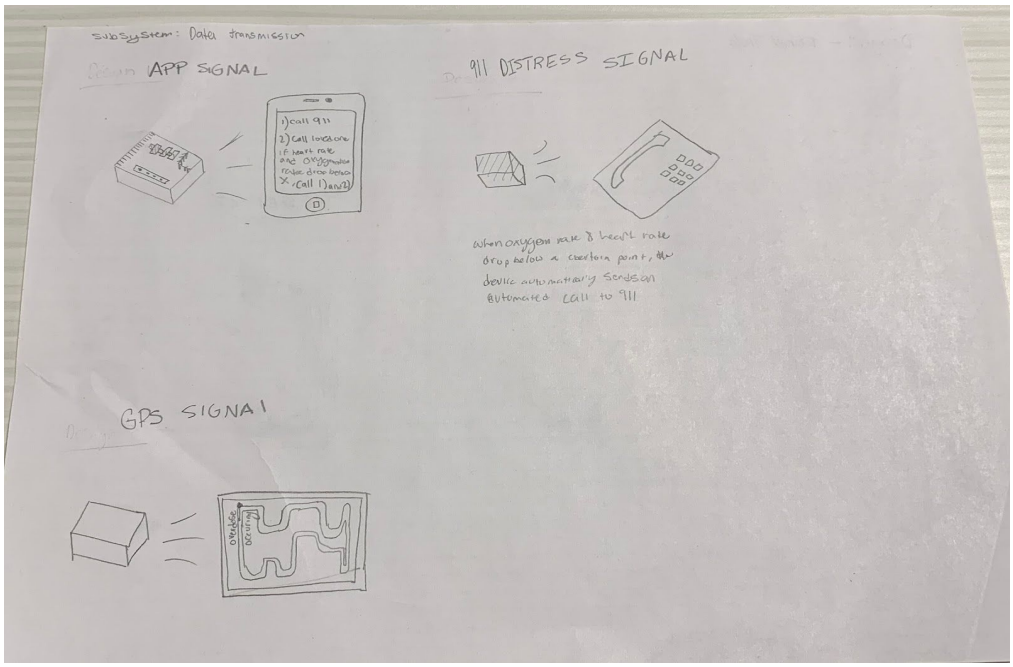
For the device to app, the device sends a bluetooth signal to a third party's phone which instantly opens the up the app with a map and directions to the overdosing person.

External GPS device

The external gps device connects the device to a gps device that can determine directions to the overdosing person's location.

Daniel's concepts

Subsystem: Transmission of data



App Signal

The data from the sensor will be sent to an app. The app will then show the data from the sensor such as oxygenation rate and heart rate. Once the data falls to a certain point, a loved one and authorities will be notified.

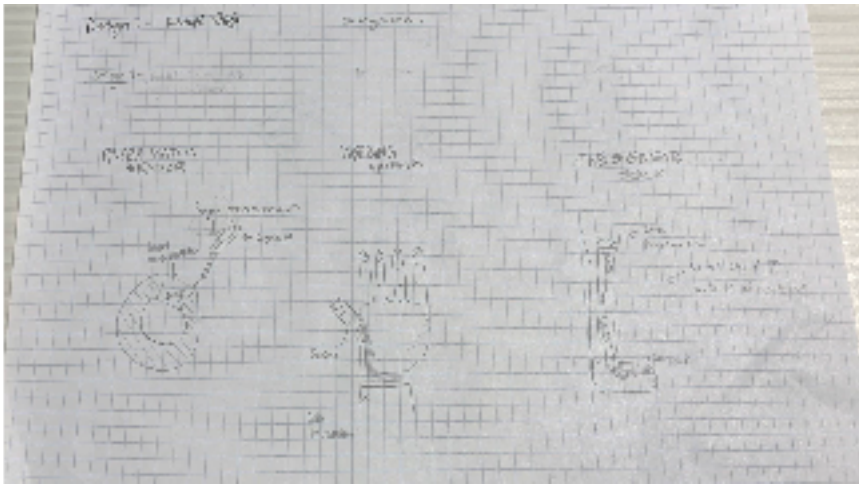
911 Distress Signal

The data from the sensor will go directly to emergency services. Emergency services will receive a call once the data that the sensor collects gets below a certain point with an automated message notifying them about a potential overdose and a location.

GPS Signal

The data that the sensor collects will be collected from the patient. Once the data is very low, a GPS signal will be provided to authorities with an exact location to where the potential overdose is occuring.

Subsystem: Exterior design



Finger Watch Sensor

A watch design will be placed on the wrist and used as to monitor oxygenation rate and heart rate. A finger sleeve will be used on the index finger to act as a pulse oximeter and the data will show on the watch device. Once the heart rate and oxygen rate gets below a certain point, emergency services will be notified.

Webbing Sensor

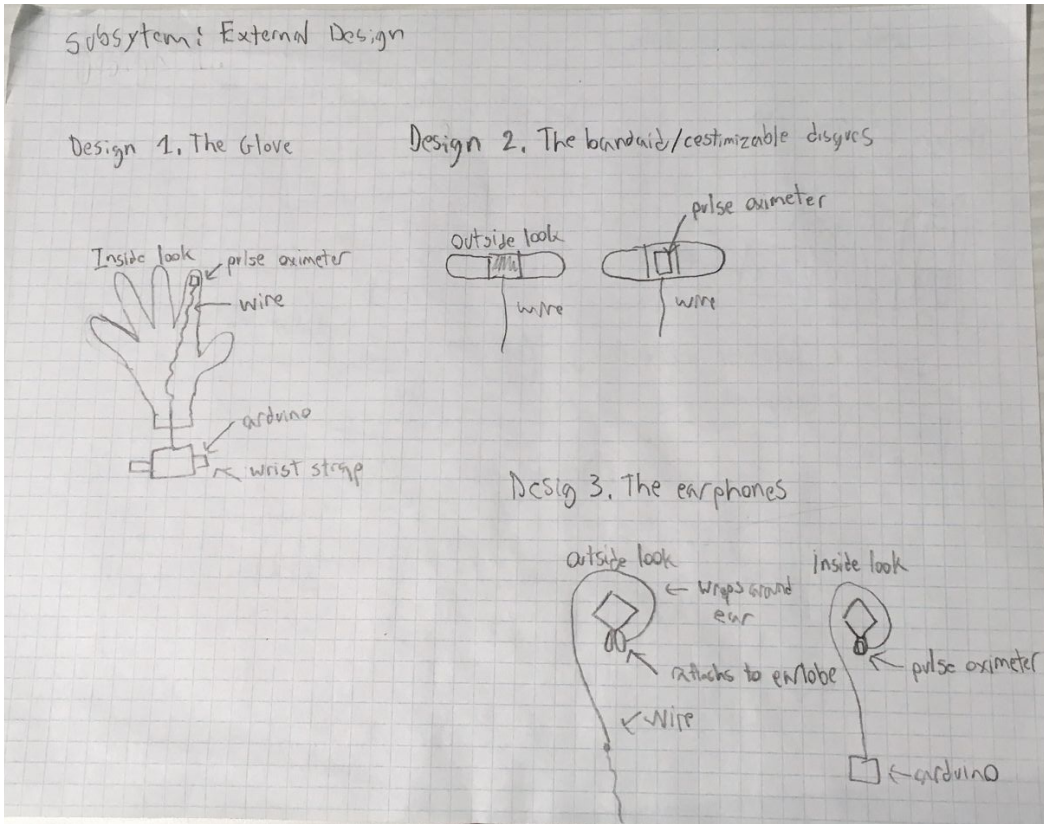
A band will be around the wrist and used to transmit data to authorities and will notify them if a potential overdose is occuring. A webbing of wires will be wrapped around the purlicue (space between index finger and thumb) in order to gather the data and act as a pulse oximeter.

The Sensor Sock

This design will have a pulse oximeter placed on the patient's toe and the wiring system will be attached to it and connect patch placed on the thigh. This thigh will collect the data from the pulse oximeter and then notify authorities if a potential overdose is occurring and provide an exact location.

Viktor's concepts

Subsystem: Exterior design



The glove

A pulse oximeter attached to a glove is placed on one of the fingers of the glove. A wire goes from the sensor to the wrist where an arduino is. The arduino is attached at the wrist.

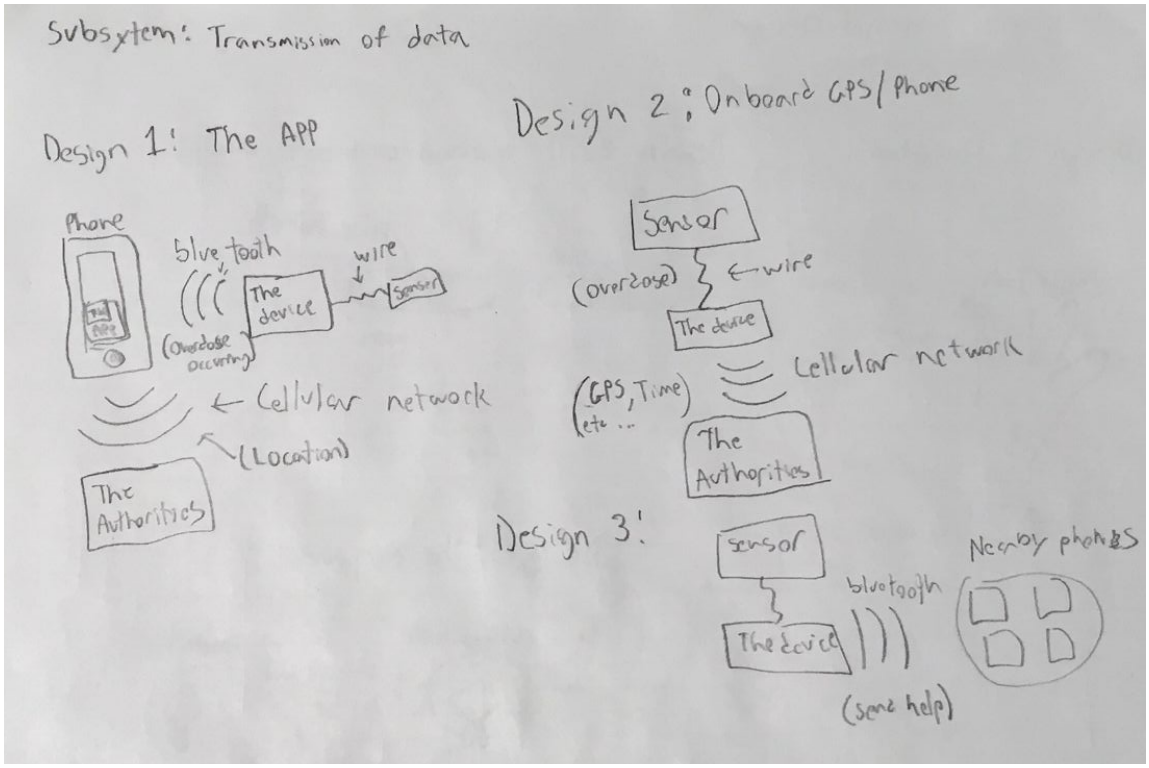
The band aid

A pulse oximeter is placed under a band aid which can be placed in numerous places. A wire protruding from the sensor will be connected to the processor of the device.

The ear device

A pulse oximeter will be placed on the ear lobe of the user which is disguised as a device for listening. The wire from the sensor will attach the device's processor.

Subsystem: Transmission of data



The App

The sensor will send a signal to the device through a wire. The device will send a signal via bluetooth to a phone. The app will obtain information such as location from the phone a send it to the proper authorities using the cellular network.

Onboard GPS

The sensor will send a signal to the device through a wire. The device will obtain information such as location from an on board GPS and send a signal to proper authorities.

The dropbox

The sensor will send a signal to the device through a wire. The device will send a signal via Bluetooth to nearby phones.

Abdelrahman's concepts

Subsystem: Exterior design and Transmission of data

Life Ring

Design number one is a device that can be worn on the pinkie. The device is small. The device consists of an adjustable ring, a display, and a pulse oximeter. The display showcases the heart rate and oxygen level.

If the person overdoses the device is designed to call emergency personnel and loved ones. The device also sends out a text that explains the situation and gives out the GPS location.

Life Watch

Design number two is a device that can be worn on the wrist. The device would have similar dimensions to a watch. The device consists of an adjustable wrist band, a display, and a pulse oximeter. The display showcases the heart rate and oxygen level.

If a person overdoses the device is designed to play alarm sounds and then a repeated message explaining the situation so that a bystander can contact proper emergency personnel.

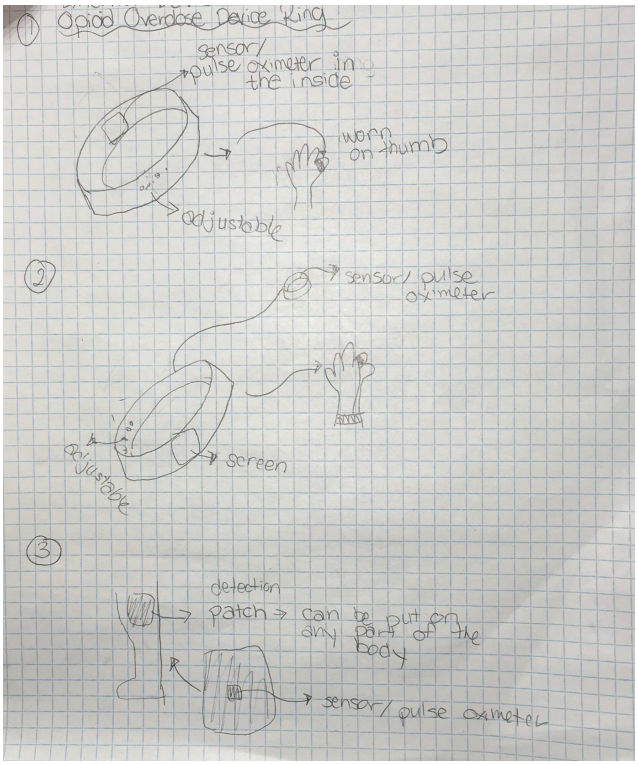
Ear Clamp

Design number three is a device that can be worn on the ear. The device would be small. The device consists of a clamp, a display, and a pulse oximeter. The display showcases the heart rate and oxygen level.

If a person overdoses the device is designed to send out an email to proper emergency personal.

Rikki's Concepts

Subsystem: Exterior design



Opioid Overdose Detection (O.D.) Ring

This device is an adjustable detection ring that can be worn on the fingers. It is small and discreet and unobtrusive; the patients can use his or hands when wearing this device.

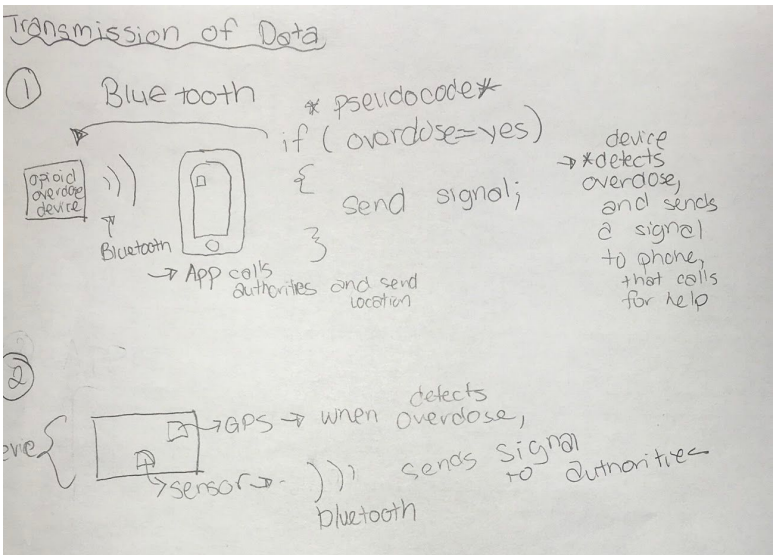
O.D. Band

This device has a screen on an adjustable band that can show the user his or her health update. The band is attached to a ring that can be put on the finger with sensors that can detect the overdose.

O.D. Patch

This device is a detection patch with sensors that can be patched on to any part of the body to detect an overdose.

Subsystem: Transmission of data



Bluetooth App Transmission

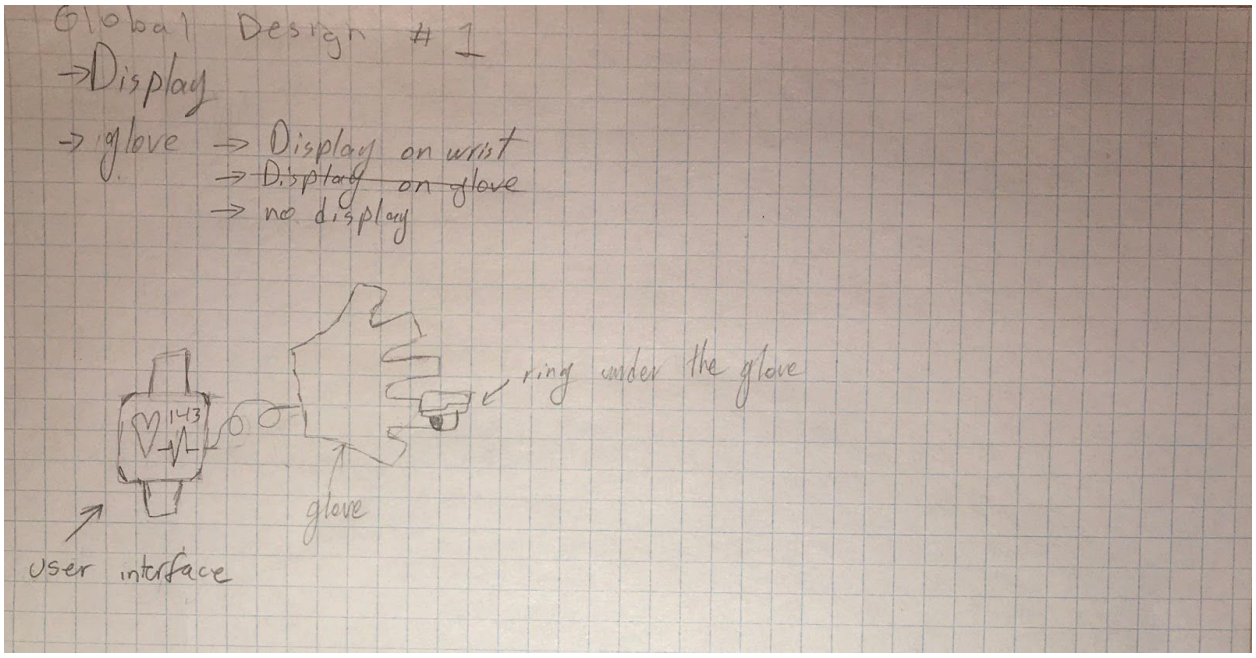
This transmission of data uses bluetooth and an app. When an overdose is detected, the device uses bluetooth to send data to the phone. The phone then uses its cellular network to call and send the GPS location to the authorities.

All-In-One Bluetooth and GPS transmission

This transmission of data also uses bluetooth to send a signal to authorities. When an overdose is detected, the device itself that has the GPS and bluetooth chip will send a signal to authorities using bluetooth.

Part 2: Functional Concepts

Global concept 1: The Glove

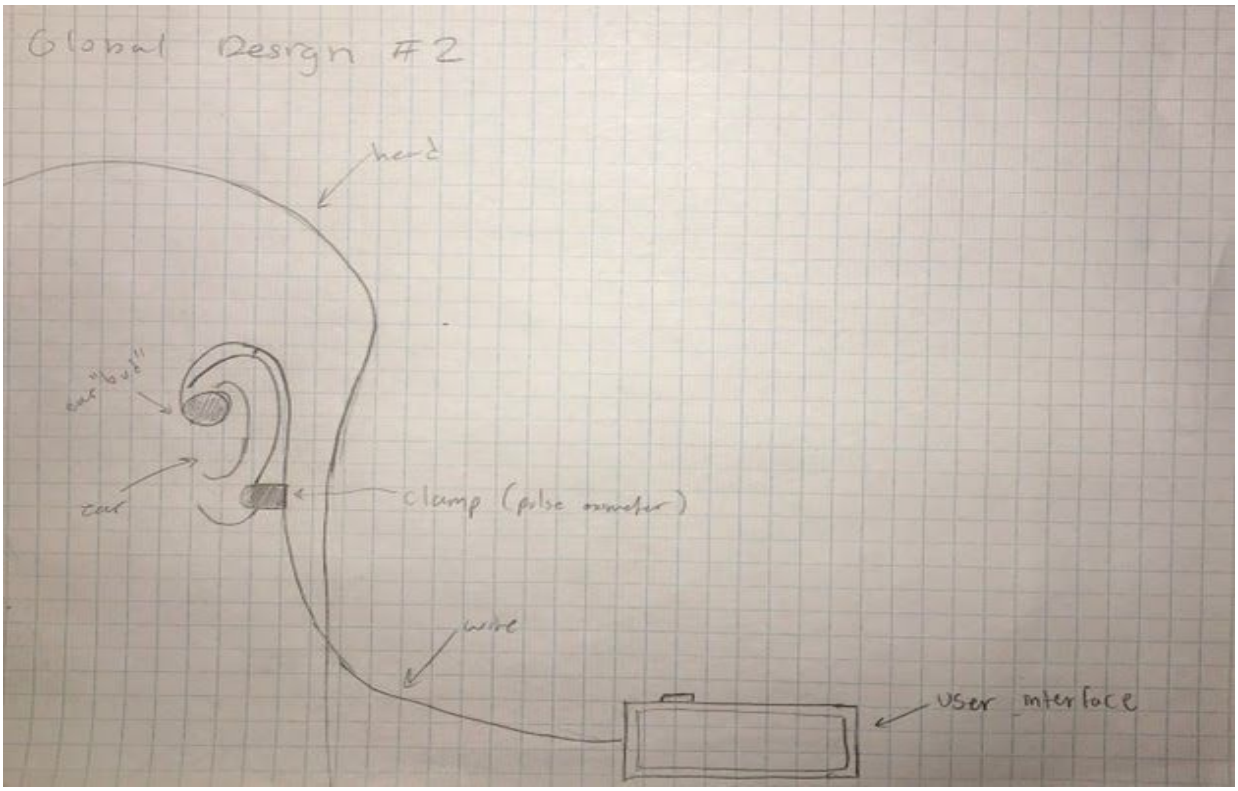


General Description:

The idea came from a similarity in the designs of most concepts, where the pulse oximeter was separate from the processor and connected to it by a wire. The main processor is attached at the wrist by a band. This design added a glove from Viktor's concept to be used to hide the wiring and pulse oximeter so the device may be discrete.

The device reads the oxygen saturation in the user's blood through the pulse oximeter on the fingertip of the glove. This information is conveyed through the wire to the main processor. If the processor detects the oxygen saturation is below 90, the device will send a message that the user is overdosing to authorities.

Global concept 2: The earpiece

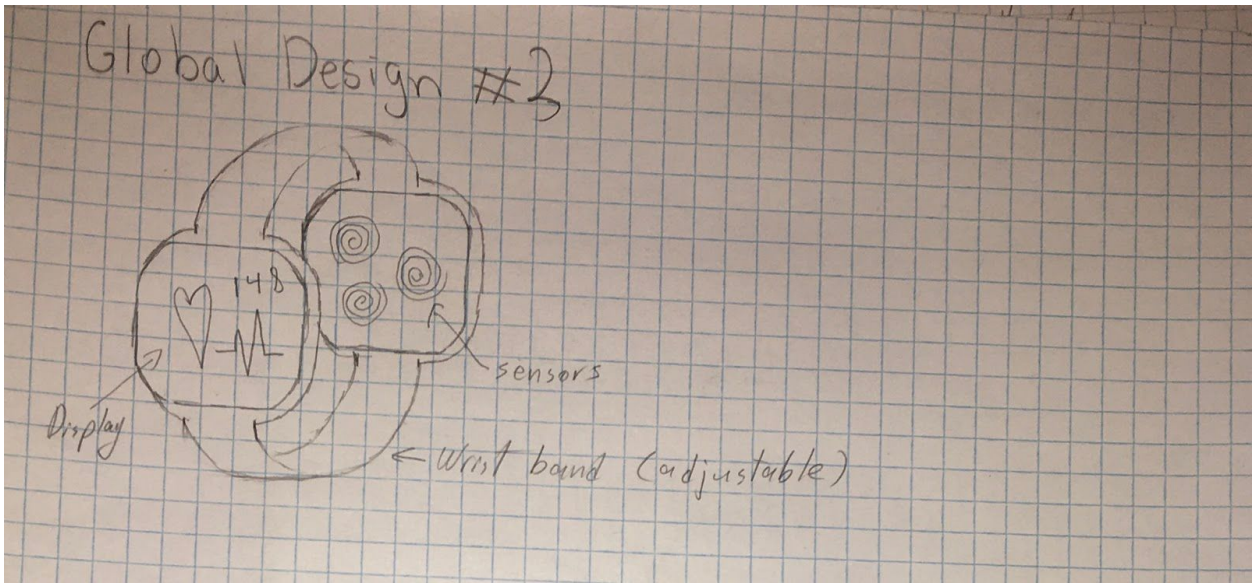


General description:

This design was thought of after the group members had their other ideas, which were all proposed for the patient's hands or arms. This design was thought of because they wanted a small device that would be diverse from the other ideas. This design has the appearance of regular earbuds that wrap around the ears. A sensor clamp is connected to the earlobe and the data is collected from the ear instead of the finger. This clamp is then connected to a wire which further connects to a device which reads the data collected, such as oxygen saturation and heart rate.

The main difference from this global design from the others is the main design features. The device is very discrete and is inobtrusive. The data is collected the same, just from a different method.

Global concept 3: The watch



General description:

Everyone in the group had come up with a design that can be worn on the wrist. For the “global concept 3: The Watch " the group took Abdelrahman’s 2nd design. The design is a device that can be worn on the wrist. The device would have similar dimensions to a watch. The device consists of an adjustable wrist band, a display, and a pulse oximeter. The display showcases the heart rate and oxygen level.

If a person overdoses the device is designed to do a few things different from Abdelrahman’s original design. The device will call emergency personnel and loved ones to notify them of an overdose. The device also sends out a text that explains the situation and gives out the GPS location.

Part 3: Comparing Concepts

Table 1: Comparison Between Different the Global Concepts

#	Design	Global Concept 1 (Glove)	Global Concept 2 (The Earpiece)	Global Concept 3 (The Watch)	Importance
1	Cost ($)	50	60	100	5
2	Weight (g)	50	35	60	3
3	Battery Efficiency	High	Medium	Low	4
4	Size	Large	Small	Medium	4
5	Obtrusiveness	Medium	Medium	Low	5
6	Concealment	High	Low	Medium	3
7	Durability	Medium	Low	High	3
8	UI	N/A	Yes	Yes	2

Table 2: Legend for Three Point System

	3 points
	2 points
	1 point

The point system for choosing the most suitable global concept was based on the importance of the design criteria and the three point system (Refer to *Table 1* above). For example, the Cost part for the Global 1 Concept in *Table 2* was determined as 5 (the importance of the design criteria) times 3 (from the three point system).

Glove: 64
Earpiece: 61
Watch: 56

After doing the calculations, the glove (Global Concept 1) has the most points which means it is the most suitable concept based on our design criteria.

Analysis

Based on *Table 1*, we can analyze what each concept has for the design criteria.

1. Cost ($) - The most inexpensive design is Global Concept 1 (GC1). Global Concept 2 (GC3) is next to the most inexpensive design with it being $10 more than the Global Concept 2. Global Concept 3 (GC3) is the most expensive design. The importance for cost is ranked as 5, so choosing the most inexpensive design is important.
2. Weight (g) - The lightest concept is GC2, then GC1, and GC3 being the heaviest. The importance of this design criteria is ranked as 3 meaning it's not prioritized as the most important, but having a light device would still be good for the user.
3. Battery Efficiency - The device with the most efficient battery is GC1, then GC2, and GC3 being the least efficient. The importance for the battery efficiency is ranked as 4, so choosing the device with the most efficient battery is important for the user.
4. Size - The smallest device was GC2, then GC3, and GC1 being the largest. The importance for this design criteria is ranked as 4, so choosing a device that's small is ideal for the user.
5. Obtrusiveness - The least obtrusive concept is GC3, and GC1 and GC2 are both tied as the second least obtrusive. The importance for this design criteria is ranked as 5, so it's very important to choose a concept that's not obtrusive.
6. Concealment - For this design criteria, the concept that is the best is GC1, then GC3, then GC2. The importance rank for this is 3, so it's not prioritized at the top but would still be good for the user.
7. Durability - For this design criteria, the most durable concept is GC3, then GC1, and GC2 being the least durable. The durability is ranked as 3 meaning that it's not very important, but would still be good for the user.
8. UI - The Global Concept 1 does not have a UI, unlike the other two designs, but the importance for this specific design is very low which means it is not really needed.

The Global Concept 1 is the design that fits the most criteria based on the analysis.

Conclusion

After creating many potential designs, merging the team's concepts, and analyzing the potential global concepts, a final design concept was chosen for the team to further develop in upcoming deliverables and prototypes. The chosen concept for this deliverable was based on comparing the Global Concepts with the Design Criteria and carefully analyzing which concept suited the criteria the most. In conclusion, the team has decided to choose Global Concept 1 (The Glove design) as it is the solution that fits best to the client's needs.