

A close-up photograph of a hand holding several colorful pills (red, blue, yellow, green) over a spill of many more pills on a white surface. The background is blurred, showing a white container and a red vertical bar in the top right corner.

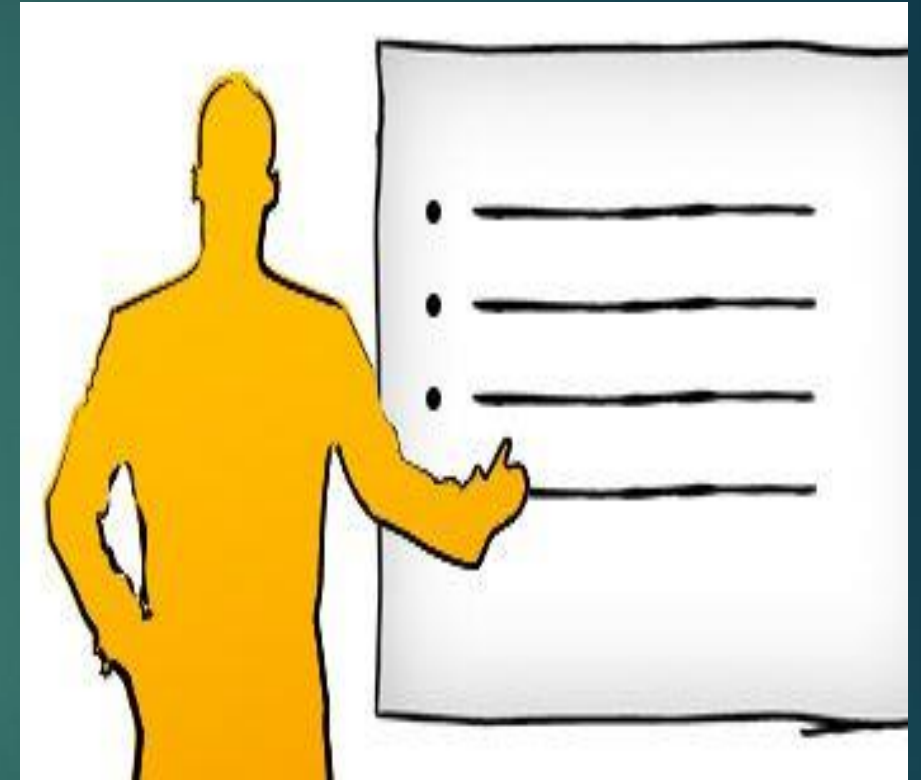
# OP-WATCH

SUPREME DESIGNERS

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# Presentation Outline

- ▶ Design Process Summary
- ▶ Current Prototype Showcase
- ▶ Next Steps
- ▶ Challenges Faced and Lessons Learned



# Who?

- ▶ Mostly trade industry-based
- ▶ ¾ were male (between ages 20-30)
- ▶ Stigma and discrimination amongst all users
- ▶ Another highly affected demographic – homeless



# What?

## Needs

The device triggers an emergency response to prevent death or harm to the overdosed user

The device is easy-to-use

It's non-intrusive, the wearer isn't conscious of its presence at every second

It's inexpensive, less than \$100

It's discreet, does not attract the attention of others

It's durable, won't fail due to normal abuse

The device is water-resistant

# What?

#	Need	Design Criteria
1	The device is discreet	Watch size (mm <sup>3</sup> ) GPS tracking system Weight (lbs) Watch shape
2	The device is user-friendly	Weight (lbs) Watch shape
3	The device is non-intrusive	GPS tracking system
4	The device is low cost	Cost (\$)
5	The device is waterproof and durable	Watch material

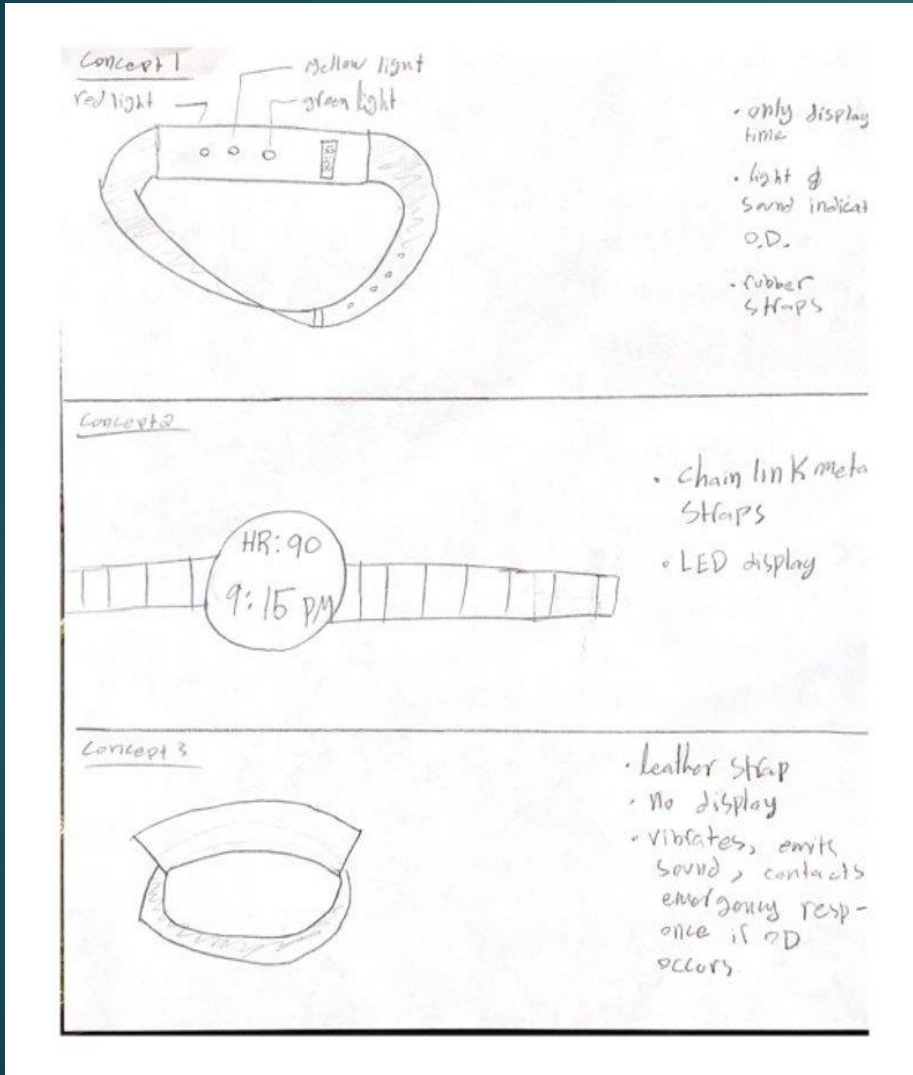


# Problem Statement



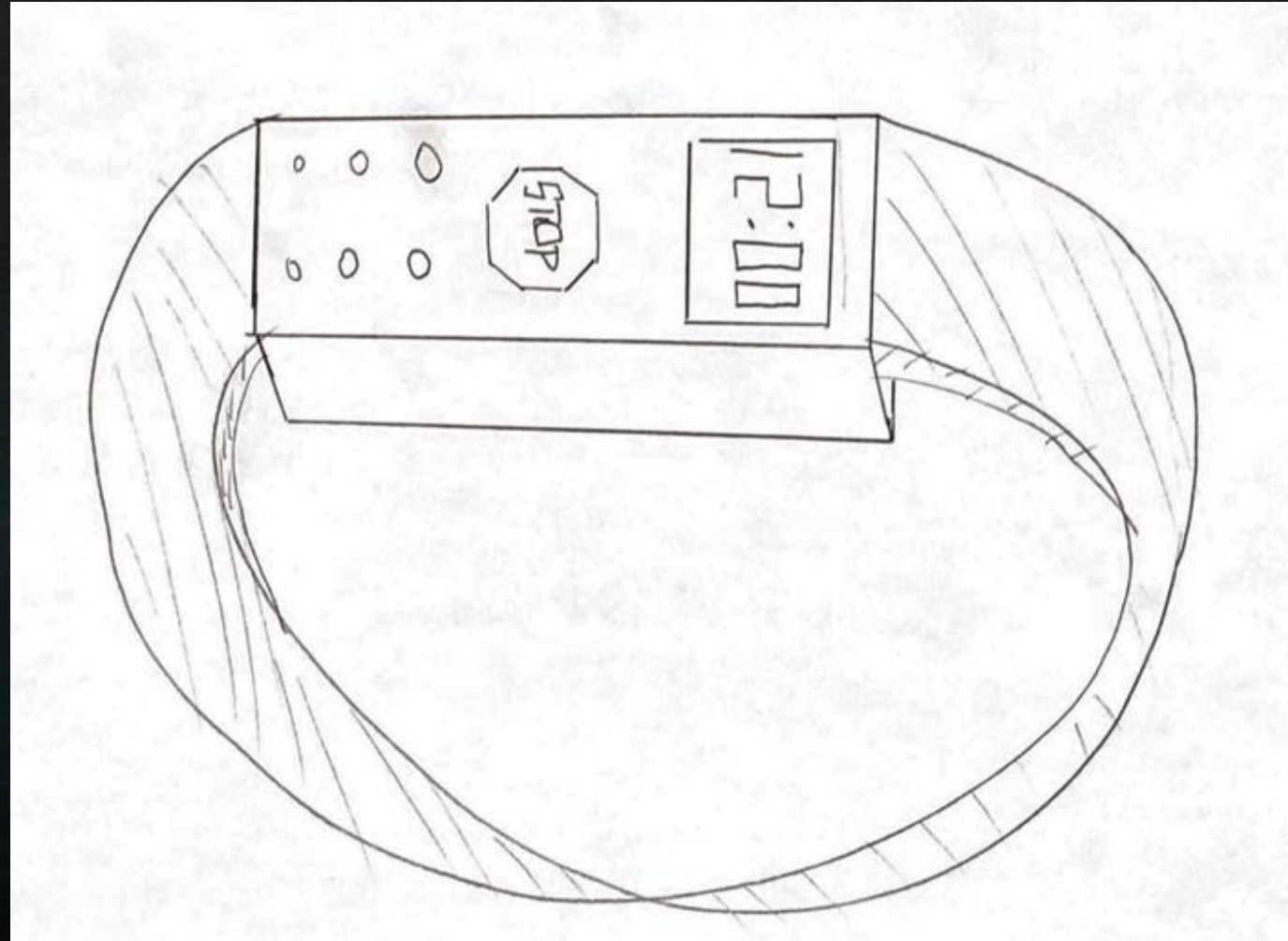
"Opioid users are in need for a device that will monitor the possible risk of an overdose. It is discreet, durable, and sends out an emergency response to local paramedics indicating the current location of the user in the event of an overdose."

# Three Concepts and Benchmarking



Concept	1	2	3
Cost	\$100 (CAD)	\$100 (CAD)	\$100 (CAD)
Weight (g)	145	125	175
Material of Case	Metal	Metal	Metal
Material of Straps	Rubber	Metal	Leather
Shape of Case	Cuboid	Cylinder	Curved
Pulse Range	25 bpm-250 bpm	25 bpm-250 bpm	25 bpm-250 bpm
Pulse Accuracy	+/- 2 bpm	+/- 2 bpm	+/- 2 bpm
Safety	Yes	Yes	Yes
Optical Sensor	Yes	Yes	No
Power	Replaceable Battery	Replaceable Battery	Replaceable Battery
Tracking System	GPS	GPS	GPS
Heart Rate Digital Display	No	Yes	No
Display Time	Yes	Yes	No
Sum of Values	35	33	27

# Final Global Concept





# Prototype 1



Top  
View



Front  
View



Right-Side  
View

# Prototype I Test and Outcomes

- ▶ Test plan included volunteers wearing the watch for a full day and sharing feedback with the team
- ▶ Feedback included:
  - ▶ Restricts wrist movement
  - ▶ Metal edges at bottom are irritating to skin
  - ▶ Hard to wear/remove clothes
  - ▶ Metal corners can get caught on clothing or fabric
  - ▶ People always ask, "what are you wearing on your wrist?"
    - ▶ Attracts attention
- ▶ Based on the feedback, a decision was made to change the manufacturing process

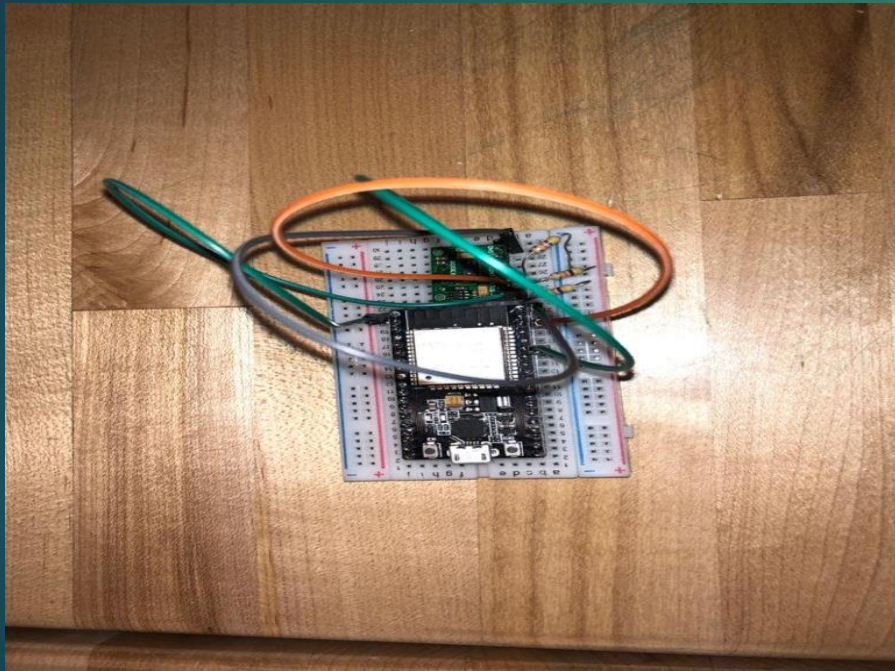
# Prototype I Assumptions and Fidelity

- ❖ There are no cutouts for LEDs and OLED screen
- ❖ Case is empty, weight is assumed but inaccurate
- ❖ Dimensions were assumed
- ❖ Materials are the exact same as we would like to use in real life
- ❖ Fidelity rating: medium

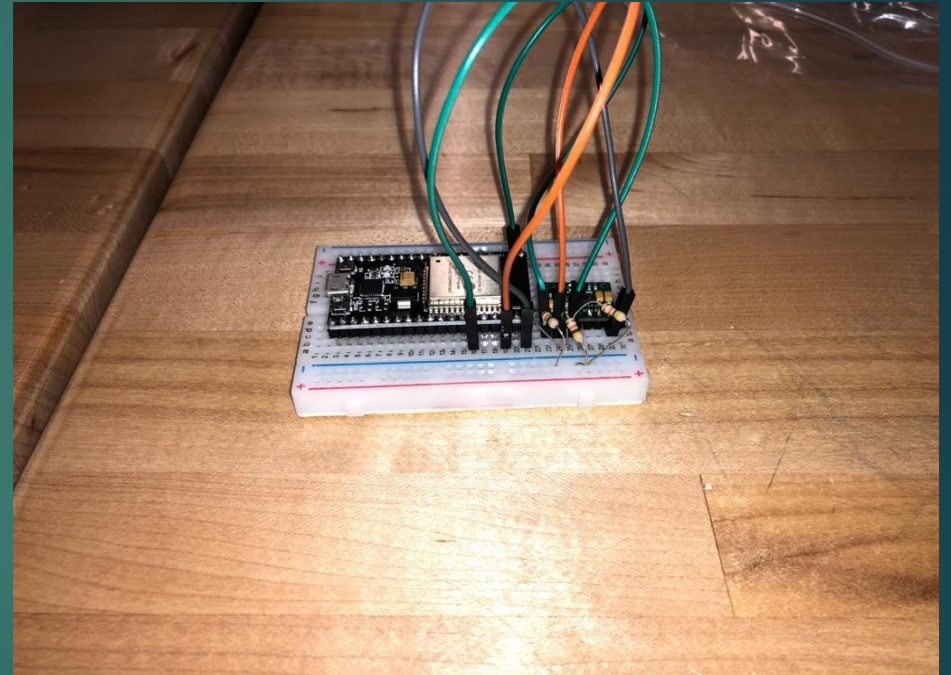




# Prototype II (Breadboard Circuit)



Top  
View



Front View



# Prototype II Assumptions and Fidelity

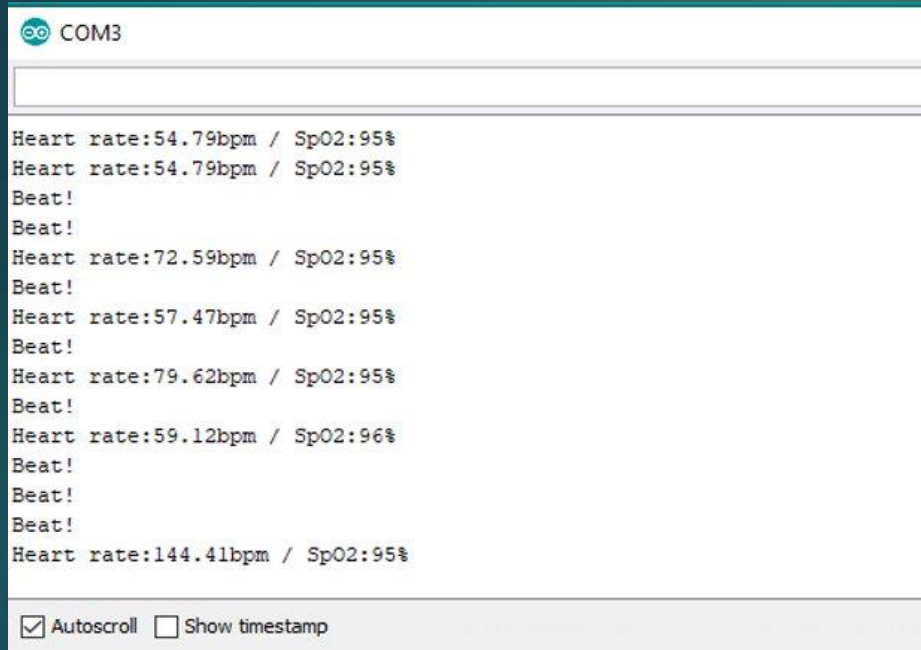
- ▶ Place where values are being measured is assumed
- ▶ Activity that the user is performing
- ▶ Movement of the device
- ▶ Prototype was very focused
- ▶ Fidelity rating: **low**
- ▶ A more comprehensive prototype can be made to address the assumptions



# Prototype II Test and Outcomes

- ▶ Objective was to test the precision of the MAX30100
- ▶ The test plan involved a volunteer placing his finger on the sensor for 30s
- ▶ Uniformity of measured values was then determined
- ▶ A limitation of this is that it tests precision, not accuracy
  - ▶ Could have compared it to another device's results
- ▶ It was discovered that the sensor defected
  - ▶ Finger must be placed very specifically on MAX30100
- ▶ The values obtained did not satisfy our precision requirements

# Prototype II (Arduino Monitor)

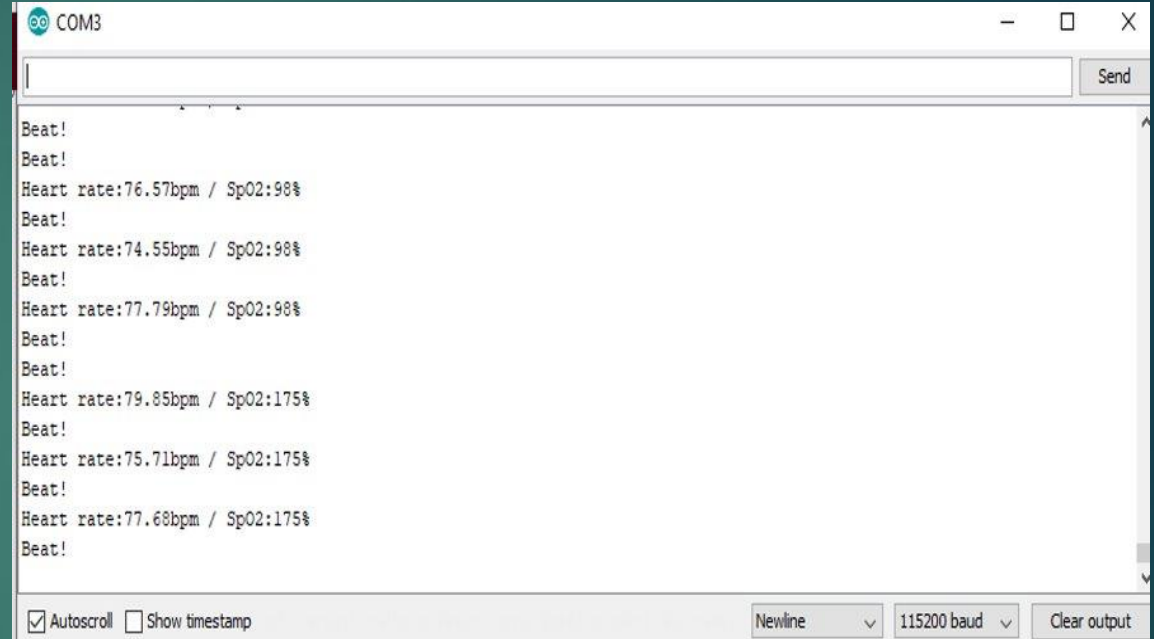


A screenshot of the Arduino Serial Monitor window for COM3. The window displays a series of data points for heart rate and SpO2. The heart rate values fluctuate between 54.79 bpm and 144.41 bpm, while the SpO2 values remain consistently high, between 95% and 96%. The text is as follows:

```
Heart rate:54.79bpm / SpO2:95%  
Heart rate:54.79bpm / SpO2:95%  
Beat!  
Beat!  
Heart rate:72.59bpm / SpO2:95%  
Beat!  
Heart rate:57.47bpm / SpO2:95%  
Beat!  
Heart rate:79.62bpm / SpO2:95%  
Beat!  
Heart rate:59.12bpm / SpO2:96%  
Beat!  
Beat!  
Heart rate:144.41bpm / SpO2:95%
```

At the bottom of the window, there are checkboxes for 'Autoscroll' (checked) and 'Show timestamp' (unchecked).

Serial monitor displaying fluctuation in heart rate



A screenshot of the Arduino Serial Monitor window for COM3. The window displays a series of data points for heart rate and SpO2. The heart rate values fluctuate between 74.55 bpm and 79.85 bpm, while the SpO2 values fluctuate between 175% and 98%. The text is as follows:

```
Beat!  
Beat!  
Heart rate:76.57bpm / SpO2:98%  
Beat!  
Heart rate:74.55bpm / SpO2:98%  
Beat!  
Heart rate:77.79bpm / SpO2:98%  
Beat!  
Beat!  
Heart rate:79.85bpm / SpO2:175%  
Beat!  
Heart rate:75.71bpm / SpO2:175%  
Beat!  
Heart rate:77.68bpm / SpO2:175%  
Beat!
```

At the bottom of the window, there are checkboxes for 'Autoscroll' (checked) and 'Show timestamp' (unchecked). To the right of these are dropdown menus for 'Newline' and '115200 baud', and a 'Clear output' button.

Serial monitor displaying fluctuation in oxygen saturation levels



# Current Prototype Demonstration



# Next Steps

- ▶ Create the final metal casing and attach it to the rubber straps
- ▶ Test and attach OLED screen to the device
- ▶ Implement LED lights to reflect heart rate and SpO2 levels
- ▶ Add vibrational motor and rechargeable batteries
- ▶ Create a STOP button
- ▶ Solder all components together



Analytical  
model of  
Prototype III

# Challenges Faced and Lessons Learned

- ▶ COVID-19
- ▶ Time Management
- ▶ Organization

