GNG 1103

**Deliverable H**

Prototype 3 and Customer Feedback

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# Introduction

Prototypes are a way to test and experiment different components or designs of an idea. As more and more prototypes are created for a specific design, they will become more like the final ideal product. The third/final prototype is essentially a functional representation of the overdose detection device, minus some minor tweaks. Components from the first prototype such as the chest strand, and the electrical components from the second prototype were merged together with some adjustment, and small changes to form the third prototype. After performing various experiments and testing the components of the first and second prototype, we were able to make changes to our design so that it will perform more adequately and as expected. The third prototype contains in addition to all the previous components, a new modeled case for the components.

Due to an outbreak of COVID-19 (Coronavirus disease), all workspaces were closed, and most social gatherings such as Design Day were cancelled. Forcing the third and final prototype production to be halted. COVID-19 is an infectious disease, very similar to the flu. This virus infects the lungs which causes respiratory problems, many symptoms similar to the flu, and in some cases death (mostly affectings people of older age, or very young age). Because of all of this, it is necessary to keep a far distance with everyone (approximately 1 meter or 3 feet) which led to the halt of this prototype. It is important to follow any new regulations or changes that are implemented due to the virus. If any regulation isn’t addressed correctly, the virus could spread more easily infecting even other students or partners in this team.

# Prototyping

## 2.1 Testing Purpose

* Test the device as a whole in terms of comfort to wear on multiple body types and discreteness of the device.
* Set up and test circuitry
* Ensure sensor and overall system work as intended
* Ensure the app functions connects correctly
* Verify bluetooth connection

Overall: Finish and connect the functional and non-functional components of the design and test that they work in conjunction with each other to produce an optimal final product within the bounds of the previously stated Problem Statement, target specifications, and chosen design.

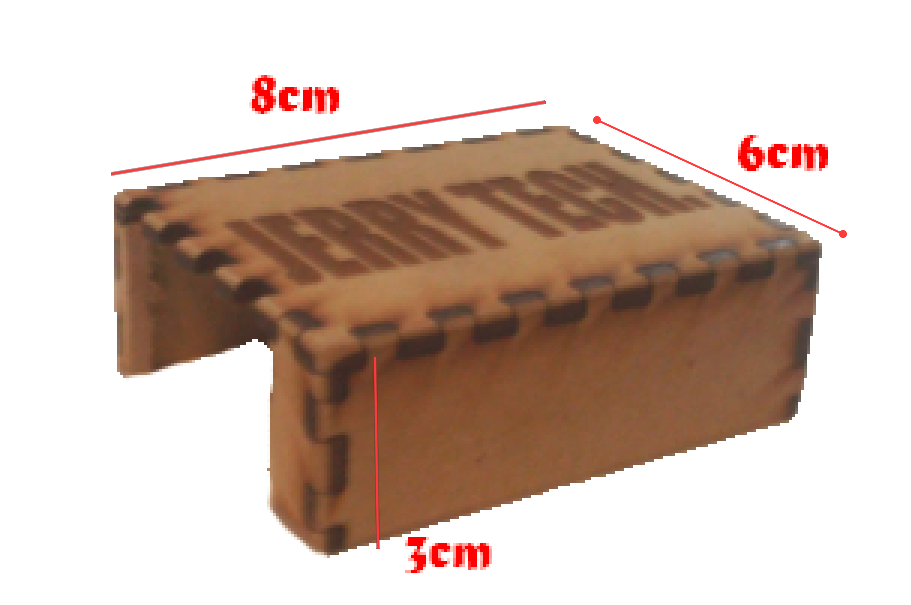
## 2.2 Design Concept

Combining and adding to both previous prototypes, we have elected to place the electrical components in the box from prototype 2 and attach that to prototype 1. The intention is that it will be placed on the back to help mitigate discomfort which was one of the main concerns the client had with our previous progression plan to put it on the front.

Furthermore, we intend to put the sensor on the inside of the chest strap where it can make direct contact with the skin and will be surrounded by a foam padding to further prevent discomfort.

Our product operates in the following way:

The client wears the device as a chest strap with the box that contains the circuitry, battery, and on the reverse side the sensor, on the back. The box that could fit the components ended up being 8x6x3 cm.



The battery provides power to the sensor, which uses the light and reflections to monitor and relay to the app regularly the SpO2 percentage and heart rate of the user. The app then declares as being in 1 of 3 generalized status conditions -- Healthy, At Risk, and Critical -- depending on the %SpO2 read to it by the sensor -- any, 75, and 65 respectively(Figures 3-5).

The fall in %SpO2 is used as an accurate detector of progression of overdose as the user uses opioids. We use this as an indicator for opioid overdose because opioids cause the user to reduce breathing which means it lowers oxygen levels in the body.

So far, we managed to take both prototypes

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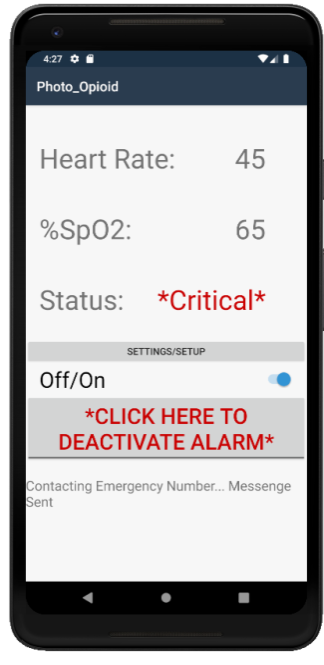
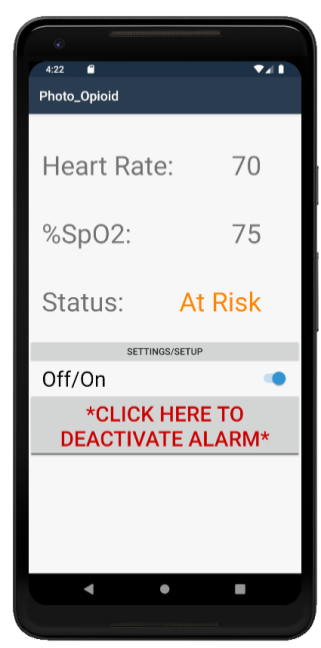
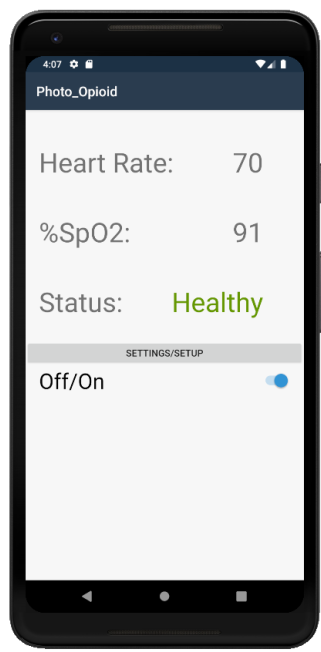
and to put the prototypes together. This was done to test that the design concept is functional. It goes on the back with the foam as seen against the body for comfort while the sensor takes its readings.



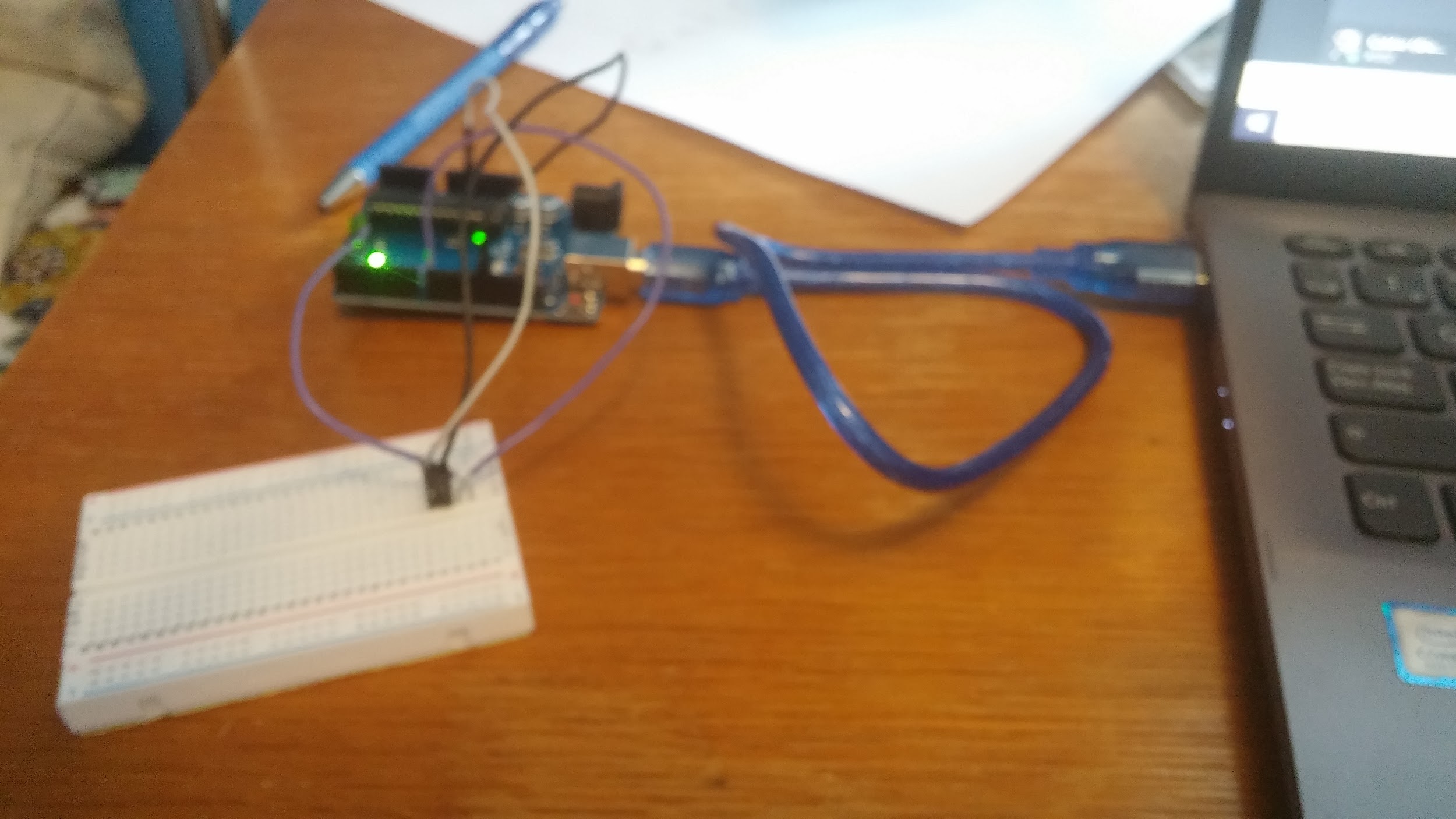
We also tested comfort with actual people and the discreteness.



Additionally, we created the app and showed it could show data, classify the 3 states, and sound the alarm and contact people as necessary.



Furthermore, we tested the circuitry to make sure the sensor and attached functioned properly:



And that it fit in the box on the strap for the sake of the design.



## 2.3 Testing

Prototype 3 was mostly about finalizing and combining all the aspects of our design to be able to test our device as a whole. With all our physical components we set up each system and then integrated the software with the device.

Design testing was done by trying many ways to put the components together as well as getting the bluetooth sensor and RX117 chip working. Once the components were working, the sensor was tested by collecting SpO2 readings from the finger forearm, chest and back. The data was also recorded to ensure consistency, making sure it was valid to record from the target location.

In addition we also managed to put the components in the box and when testing it was found that the device was much more comfortable when there was foam padding on the back.

# Current Status

The project currently has the third prototype structurally complete, however is still missing some major key functionalities. The hardware components of the devices were completed, with the sensor mounted to the strap and all the other electrical components being fitted and enclosed in the enclosure on the strap.

The software for the device is however still in development. The code that the arduino runs allows for the reading of SpO2 levels and forwarding the data to the app. However, the app is still in progress, and due to the current COVID-19 situation the app and other further refinements and optimization is not possible.

# Future Plans

We made it almost as far as we could designing our product but due to the virus we were not able to follow through with all our future plans. We were very close to finishing the final prototype, we just needed to finalize a few parts and put everything together.

If we had the chance to finish the project, we would have continued to finalize the app. The app was almost complete, it was able to display data and give an alert when SpO2 levels were too low. If we were able to finish the app we would have finalized the gps system in it, as well as further developed the emergency contact system.

The software was complete for the most part, it was able to read proper SpO2 values, as well as connect to our app via bluetooth and send the proper values. The code needed a bit of touching up and finalizing but overall was almost finished. If we were able to complete our device we would not have needed to change the code very much.

As far as aesthetics and structure of the device, that was all complete. We had a final chest strap design with a laser cut box containing all electrical components. The device was very discrete and comfortable for everyday activities.

Overall, our future plans were to finalize every aspect and put together a final prototype that fit the clients needs. We came very close and feel we would have created a great product had we had the chance to finish.

# Conclusion

We have worked very hard to get to where we are with the project and support our client. Although we were not able to finish the final prototype/product due to the constraints caused by Covid19. We will continue to work as hard as we can to deliver something functional to our client, although nothing can be guaranteed. We have our final goals to set for this project, and we hope to accomplish them in time.

# List of cited work

Public Health Agency of Canada. (2020, March 26). Government of Canada. Retrieved from https://www.canada.ca/en/public-health/services/diseases/coronavirus-disease-covid-19.html

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