### GNG1103

**Design Project User Manual**

**Deliverable K: User Manual**

Submitted by:

JerryTech 14

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**Abstract**

The Chest Strap overdose detection and alert system is a product developed to help opioid users be safer by giving them the ability to call for help even during an overdose. It can monitor their oxygen levels, monitor number and bluetooth connect to a phone to call for help when an overdose is detected, when oxygen gets too low.

This paper outlines the specific functions of the project, the work that was needed to make it able to do so, the steps to take to maintain it to the best of one’s ability and what future developments might be going forward.

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# List of Tables

**Table 1: Bill of Materials**

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# List of Acronyms

|  |  |
| --- | --- |
| **Acronym** | **Definition** |
| BOM | Bill of Materials |
| RX117 | Model Number for the sensor |
| mAh | Milliamp Hour, unit of power |
| MDF | Medium-Density Fibreboard |
| CEED | Center for Entrepreneurship and Engineering Design |
| HC-05 | The model name and number of our bluetooth model |
| SpO2 | “peripheral capillary oxygen saturation, an estimate of the amount of oxygen in the blood.”(<https://support.withings.com/hc/en-us/articles/201494667-What-does-SpO2-mean-What-is-a-normal-SpO2-level->) |
|  |  |
|  |  |

# 1 Introduction

This work began with the realization of the need for opioid users to have a system which detects overdoses and alerts the necessary people to help them once it does. The device as it exists currently assumes that each of these users has an android phone with bluetooth capabilities which they carry with them regularly and are comfortable with wearing our design in public and private settings. In a basic sense, it functions as follows:

Figure 1:



This document will detail the entirety of our research and building process throughout every step of design. We will outline how we built it; what was needed to do so; how it is intended to be used; how best to maintain it and what we would recommend doing moving forward.

**Figure 2: a b**

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**What:** Detects and alerts to overdose while being discrete and comfortable.

**Who:** Opioid users need a device that can alert people to an overdose to keep them alive.

**Why Us:** The chest strap design as well as a sensor that works anywhere and an easy power source makes this design much better in nearly every fashion than other similar designs.

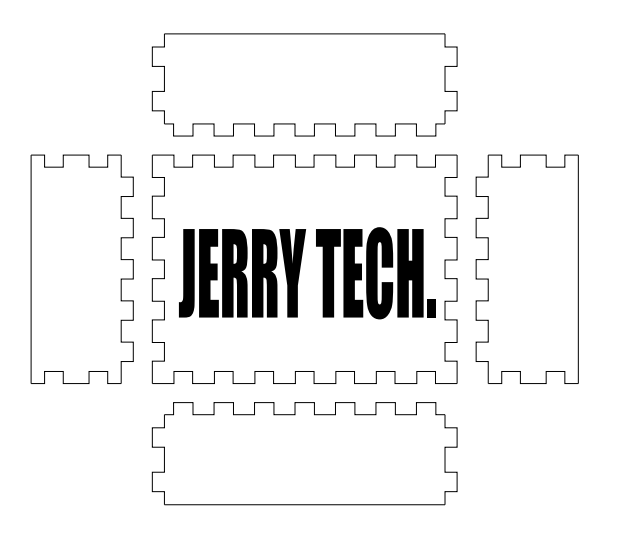
**Main Function:** Using the sensor to identify the problem and connecting it to the phone to make the alert.

# 2 How the Prototype is Made

## 2.1 Mechanical

The device consists of a GoPro chest mount and a MDF laser cut box. The strap has a buckle on the side for easy removal of the device. The box dimensions 8cm x 6cm x 3cm and it is made out of a ⅛ inch MDF board.

*Figure 3:*



The InkScape design for the box was created using a box making extension to create a 8cm x 6cm x 3cm tabbed six sided box. The bottom piece was then removed and the tabs on the bottom were removed and replaced with straight lines. The line thickness of the box must be set to 0.001 inches for the laser cutter to properly cut the MDF board.

*The InkScape design for the laser cut box.*

The bottom piece was removed since the box will be placed on the plastic plate of the strap, which will cover all electrical components.

*Figure 4:*

The sensor is located on the backside of the chest strap, inside of a piece of foam padding. The sensor has wires running through the plastic plate to the arduino board inside the box. The padding serves as added comfort when wearing the device for long periods of time, and also holds the sensor in place comfortably. It is important that the sensor is always in contact with the skin.

*The sensor and padding on the back of the device.*

*Figure 5:*



The chest strap is a GoPro chest mount. GoPro mounts are meant for filming extreme sports, therefore this strap is very durable and secure on the body. It is usually worn with the plastic plate on the front but for better functionality and comfort, the device should be worn with the plate on the back. There is a buckle on the device to make it easier to put on and remove. The straps are fully adjustable and very stretchable, making it work on various body types and genders.

*The GoPro chest mount.*

Chest mount description: <https://www.amazon.ca/gp/product/B07MFDTBMS/ref=ppx_yo_dt_b_asin_image_o03_s00?ie=UTF8&psc=1>

## 2.1.1 BOM(Bill of Materials)

**Table 1:**

|  |  |  |  |
| --- | --- | --- | --- |
| **Item** | **Quantity** | **Price we paid** | **Link** |
| Chest strap | 1 | $12.42 | <https://www.amazon.ca/Chest-Action-Camera-Harness-SJ4000/dp/B083FS82WK/ref=sr_1_14?keywords=action+camera+mount+chest&qid=1585689314&sr=8-14> |
| Arduino Uno | 1 | $7.99 | <https://www.amazon.ca/Elegoo-Board-ATmega328P-ATMEGA16U2-Arduino/dp/B01EWOE0UU/ref=sr_1_3?keywords=arduino+uno&qid=1585689028&sr=8-3> |
| RX117 Sensor | 1 | $34.59 | <https://www.digikey.ca/product-detail/en/maxim-integrated/MAXREFDES117%23/MAXREFDES117%23-ND/6165562?utm_adgroup=Development%20Boards%2C%20Kits%2C%20Programmers&utm_source=google&utm_medium=cpc&utm_campaign=Shopping_Maxim%20Integrated_0175_Co-op&utm_term=&productid=6165562&gclid=Cj0KCQiAv8PyBRDMARIsAFo4wK3MF9noO9r1FWUfucnZx3Jeaai9Sn_ElMYeu9Vyy-ZW5aDW-5dZvxYaAnapEALw_wcB> |
| 3500 mAh Battery | 1 | $10.99 | <https://www.canadianoutdoorequipment.com/fenix-3500-mah-rechargeable-18650-li-ion-battery.html> |
| HC-05 | 1 | $9.99 | We picked this up from the maker store but they can also be bought online from <https://www.canadarobotix.com/products/1258> |
| MDF Board | 1 | $2.50 | Purchased at makerstore |
|  | Total | $78.48 |  |

## 2.1.2 Equipment list

### 2.1.2.1 Physical components

* Action camera chest strap
* 1 sheet of MDF
* Glue
* Foam padding

### 2.1.2.2 Electrical components

* Arduino Uno
* RX117 sensor
* 3500 mAh Battery
* HC-05 bluetooth module.
* Wires

### 

### 2.1.2.3 Software used

* Inkscape
* Arduino IDE

### 2.1.2.4 CEED resources used

* Laser cutter
* Solder

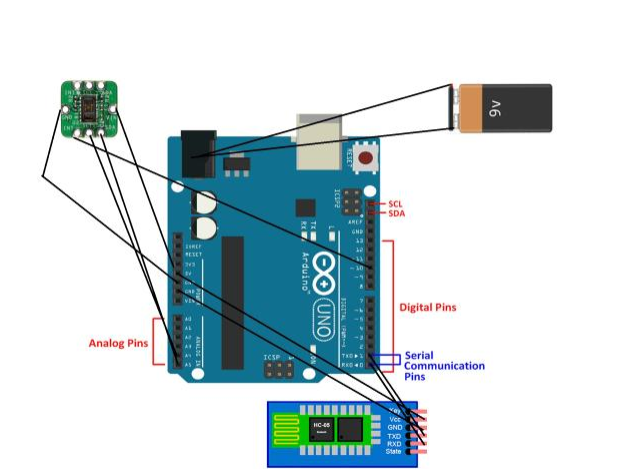
## 2.1.3 Instructions

1. Download this file and use a laser cutter and a MDF sheet to cut a box out.
2. Once the box is cut out, assemble the box and glue the sides together like this diagram.

Figure 6:

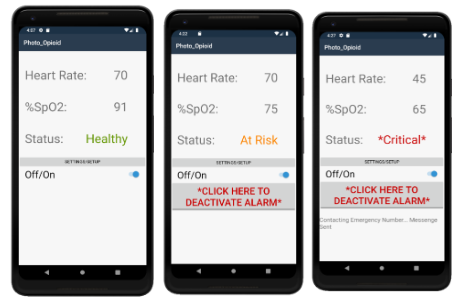


1. Now it's time to work on electrical components. Make sure you have all the items listed in section *2.1.2.2*ready in front of you.
2. Follow The schematic listed below and connect your components.

Figure 7

1. After that use the arduino IDE and copy this code which runs on the device and collects reading from the RX117 and calculates H%02 and Heart rate. This code also takes H%02 and heart rate and sends them through bluetooth to a users phone.
2. Now the app must be created. Download any app creator you are familiar with and create an interface similar to this.

Figure 8a b c



1. Heart rate and %Sp02 is displayed and calculated from bluetooth data. There also is a slider near the bottom which turns off the running program and cancels any alarms. The program must also display warnings and sound an alarm when the user goes under 75 %Sp02 and again at 65 % Sp02. Another feature the app has is location pinging and message sending. The program must have a function that when called by the %Sp02 function it records current longitude and latitude and texts then to a contact that the user has to input into the settings.
2. Once the code and components are running and have been tested it is time to place them inside the box. They should easily fit inside the box with the two ports facing out the hole like this (don't mind the chest strap in this photo we will get to that next).

Figure 2b

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1. Now we can prepare the chest strap. Take the foam padding and cut out a piece the size of the backplate on the chest strap.
2. Remove the wires from the arduino that connect to the sensor and stick them through the foam pad and backplate. Once done re-attach the sensor wires to the arduino.

Figure 4



1. Finally glue the padding with the sensor onto the backplate and the box with the components onto the front plate. The device is now complete.

Figure 2a

# 3 How to Use the Prototype

1. Ensure that the battery is charged with a potentiometer, otherwise charge the battery.
2. Acquire software for the arduino and launch it in Arduino IDE or other software of choice.
3. Connect the arduino Uno or device of choice to software of choice, then flash the software onto the controller.
4. Detach the controller and place the chest strap on the user. Make sure that the straps are comfortably in place
5. Pair the chest strap to the phone via bluetooth in bluetooth settings
6. Launch the Android app on the phone

# 4 Maintenance and Restrictions

## Software

|  |
| --- |
| **Useful Info** The application is only available for Android based devices. Application functionality may vary between unsupported devices. |

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Below you will find a list of important guidelines to well maintain the software, as well as important restrictions that may need to be attended for the application to work properly. It is necessary to follow these guidelines for easy and simple use of the software.

1 When using the Opioid Overdose application, please do not modify/edit files for this may cause malfunctions in the software. The presented data (Sp02 & heart rate) may be inaccurate. It is also important to not redistribute the app, doing so will result in personalized data possibly being leaked since they are attached to the application.

2 It is important to allow the application to use bluetooth, files, and location for usability reasons. Restricting the app from using these services will result in an inaccurate and non-functional application. All data will be secure within the app.

3 Please do not use other devices through the application, it is strictly designed for the ‘Jerry Tech’ styled overdose device. Using other devices is not supported and not recommended, data may be inaccurate leading to unforeseen circumstances.

4 Be sure that the device the application is installed on has sufficient power. Using bluetooth may drain battery for some users (devices vary) and it is recommended to keep the device changing while in use.

5 Keep a lookout for software updates, there may be flaws or inaccuracy in the software that needs fixing before it can be used properly. Not updating the application is not recommended and may result in unforeseeable events. These events may include inaccurate data being read, connectivity issues, transmission issues, etc.

6 Do not attempt to add emergency services such as 911 to the emergency contact information section found within the application. These services are illegal to be automatically contacted through a , and may result in a fine of up to $100,000. For more information about this, please visit <https://www.fcc.gov/> or contact your authorities office for more information.

## Hardware

|  |
| --- |
| **Caution** This device contains powered components which may be harmful in certain conditions. It is advised to be cautious when handling this device. Injuries may occur in not handled with care. |

## 

Below you will find a list of important guidelines to maintain the physical device. You will also find important restrictions that may need to be attended for the device to work properly. It is necessary to follow these guidelines for easy and simple use of the device.

7 Use the specified reliable batteries shown in BOM for maximum power efficiency. Not following this requirement may result in permanent damage to the device and rendering it unfixable. Various batteries may also not fit in the device.

8 Recharge the device regularly if using a rechargeable battery (default battery in the device is rechargeable). If the bluetooth signal is weak, this is most likely due to low battery

9 Avoid unnecessary pressures as possible (sitting on it, stepping on it, squishing etc). Doing so may result in permanent damage to the device. This device can only withstand a certain amount of force before the frame collapses.

10 Keep the phone in good condition as much as possible using similar techniques. Such as in reasonable temperatures like extreme hot or cold. Having the device in extreme heat may ruin the circuitry or the battery inside causing permanent damage. Exposing this device to extreme cold may cause the device to stop working and cause permanent damage to the battery.

11 Keep away from strong magnets. Exposing it to such may cause the microcontroller inside to stop working, meaning the device is now unreliable.

12 Keep this device away from water, the electrical components inside are not sealed and when exposed to water, it may cause permanent damage to the components. The shell of the device is also not suited for water and may expand.

13 Please do not use other 3rd party applications for this device (besides the required Jerry Tech opioid overdose application). Doing so will result in inaccurate readings of the device being shown, and is not recommended.

14 When storing the device, it's important to store it in a dry location with no exposure to water or moisture. It is also important to remove the battery. Long exposure to being undercharged may destroy the battery completely. Changing the device regularly is recommended.

# 5 Conclusions and Recommendations for Future Work

Our team recommends that an identical manual be made in French. This is to ensure that our device can be used by a much wider range of people, due to Ottawa being very bilingual. The programming of the device can also be further developed to be slightly faster and more efficient. Speed and efficiency is very important when dealing with overdoses since every second matters.

This product overall was a success despite the issues and problems we had to work around. If we were to do anything differently and start from the beginning, we would focus on the technical and software components of the device first, we had learnt that those two components take the most time setting up. By the time we got to the final weeks we were still working on these components slightly rushed to get it working properly, getting into it ahead of time would have really helped and saved time. Another component we would modify is the sturdiness and placement of the sensor. The supports holding the sensor could have been improved to provide consistent equal pressure onto the sense allowing for cleaner and more consistent readings. Despite these two changes, our team worked very hard to create a good, functional device which would satisfy our client and save lives. Our team did start this project a little late, we have learnt how important it is to do lots of research and understand exactly what we are making and how we are doing it. We had a good project plan which we were following and keeping up with. Having this plan gave us a sense of direction and allowed us to know what we have to work on next and how much time we have to do it.

**6 Bibliography**

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**APPENDICES**

**APPENDIX I: Design Files**

**APPENDIX II: Other Appendices**