**Deliverable H: Prototype III and Customer Feedback**

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*Abstract*

*The purpose of this report is to document the final stage of prototyping, to prepare for the presentation of the final prototype. This will include images of the third prototype, an updated bill of materials, and an analysis of all the critical systems. Customer feedback will be also gathered and considered to ensure the final prototype meets all the criteria outlined in previous deliverables as per the client’s needs.*

[**Prototype Testing**](#_6wp04mm7b2zz) **4**

[Combined Sensor Testing](#_2mfxbjz08is4) 4

[Installation Testing](#_w3gwno8yj5cy) 5

[Notification System Testing](#_3jxkrvo0drmi) 5

[**Updated Bill of Materials**](#_z052nqjd0p5n) **5**

[**Prototype Test Plan:**](#_d42wr1r6muvz) **6**

[Objective:](#_ie7bvd2i9nu6) 6

[Procedure:](#_lv5e3rkd9mqo) 6

[Stopping Criteria:](#_vvx0pss7ej8z) 6

[**Customer Feedback**](#_g11r93trxq8p) **6**

[Case testing](#_l6bfw6lievnt) 6

[Battery Testing](#_9pni3qpys4j2) 7

[System Testing](#_e2jhg84mq8j0) 7

[**Conclusion**](#_bnm9upddvhr3) **7**

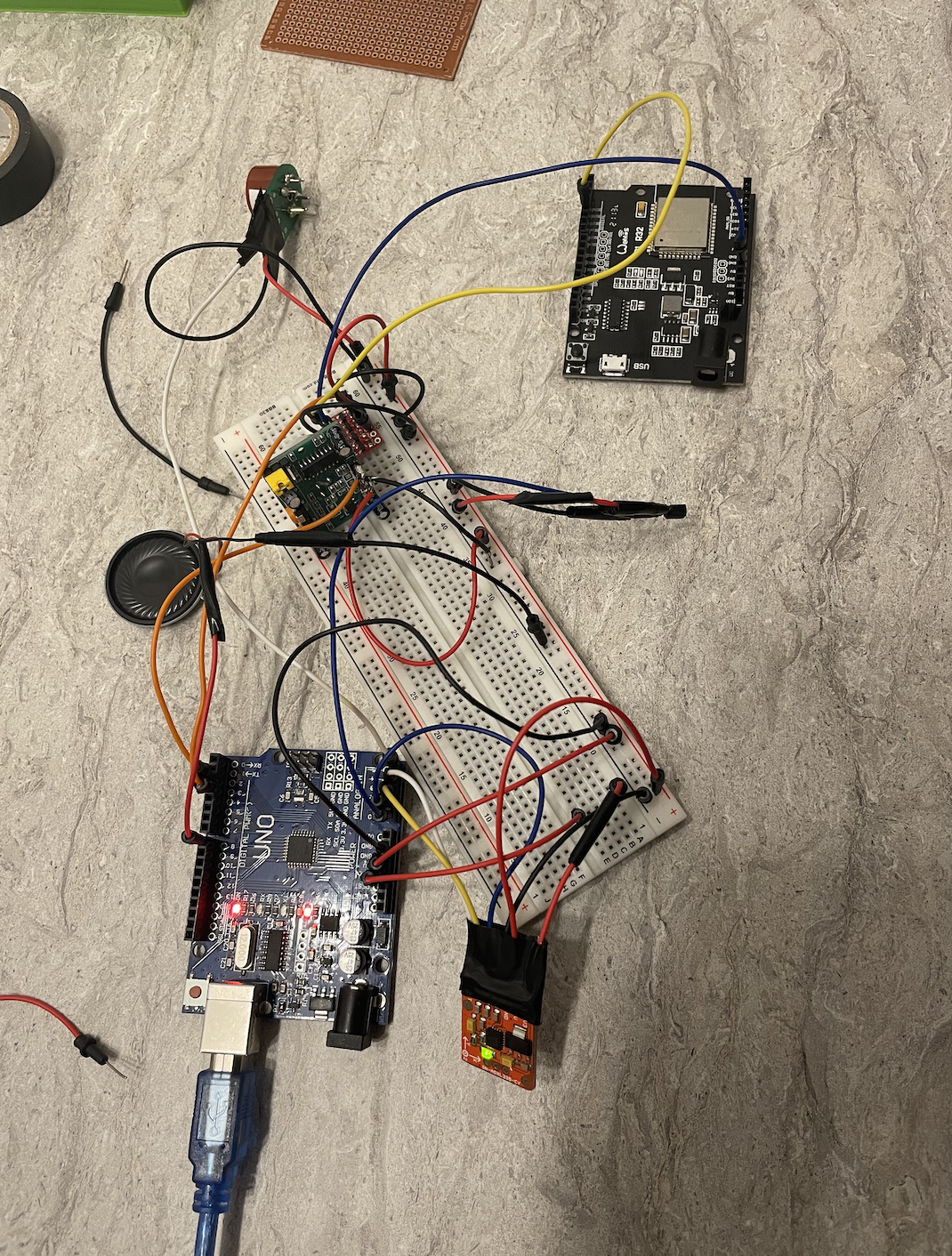
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# Prototype Testing

## Combined Sensor Testing

The final circuits have been soldered together which required final testing to ensure they are functional. This testing was successful and all the sensors were still functional after soldering the connections.



## Installation Testing

Due to a misinterpretation of the dimensions testing the installation process has not yet been conducted. Upon 3D-printing the case, we noticed that it was designed much too small to encompass everything necessary. Testing of the installation process will be conducted as soon as possible to ensure the product is complete by the deadline.

## Notification System Testing

The first sub-system in the notification system is the alarm system powered by the Arduino. The testing for this system has been conducted successfully, meaning that the Arduino was able to play an audible alarm sound when the temperature or carbon monoxide levels were in unsafe ranges and/or motion was detected in the surroundings. The second sub-system of notifications is the phone application that will send notification to the drivers device via bluetooth low energy connections. The application has been developed, however it still requires some refinement

# Updated Bill of Materials

| Item | Quantity | Cost | Taxes | Shipping | Total | Link |
| --- | --- | --- | --- | --- | --- | --- |
| Arduino Uno | 1 | 17.00 | N/A | N/A | 17.00 | [[1]](https://makerstore.ca/shop/ols/products/arduino-uno-r3) |
| Motion Sensor (HC-SR501) | 1 | 11.99 | N/A | N/A | N/A | [[2]](https://www.amazon.ca/gp/product/B086XCTTP6/ref=ppx_yo_dt_b_asin_title_o02_s00?ie=UTF8&psc=1) |
| ESP32-BLE | 1 | 16.90 | N/A | N/A | N/A | [[3]](https://www.amazon.ca/gp/product/B07P1L7839/ref=ppx_yo_dt_b_asin_title_o02_s00?ie=UTF8&psc=1) |
| Various Capacitors | 1 | 11.68 | N/A | N/A | 54.36 | [[4]](https://www.amazon.ca/gp/product/B00W1COWV8/ref=ppx_yo_dt_b_asin_title_o02_s00?ie=UTF8&psc=1) |
| Carbon monoxide gas sensor (MQ-7) | 1 | 8.76 | 2.69 | 9.21 | 20.66 | [[5]](https://www.robotshop.com/ca/en/carbon-monoxide-sensor-mq7.html) |
| Accelerometer (Cytron ADXL335) | 1 | 11.86 | N/A | N/A | N/A | [[6]](https://www.robotshop.com/ca/en/cytron-adxl335-3-axis-accelerometer.html) |
| Temperature Sensor (TMP-36 | 1 | 1.92 | 3.44 | N/A | 26.43 | [[7]](https://www.robotshop.com/ca/en/temperature-sensor-tmp36.html) |
| 8Ohm speakers | 1 | 9.26 | N/A | N/A | 20.90 | [[8]](https://www.amazon.ca/gp/product/B07BFTYY6L/ref=ppx_yo_dt_b_asin_title_o01_s01?ie=UTF8&psc=1) |
| Resistors (10k,15k,27k,470k)Ohm | 4 | 0.65 | 3.29 | 13.85 | 25.27 | [[9]](https://www.pcboard.ca/index.php?route=account/order/info&order_id=2798) |
| Pololu Carrier for MQ Gas sensors | 1 | 1.95 | 0.30 | 7.69 | 9.93 | [[10]](https://www.pishop.ca/product/pololu-carrier-for-mq-gas-sensors-bare-pcb-only/) |
| Logic Level Converter Bidirectional | 1 | 3.78 | 1.97 | 9.33 | 15.08 | [[11]](https://www.robotshop.com/ca/en/logic-level-converter-bidirectional.html) |

(Taxes and shipping costs grouped by order)

**Total cost including taxes and shipping = $189.63**

# Prototype Test Plan:

## Objective:

Outline the stages of final testing to ensure the third prototype is fully functional by the presentation deadline.

## Procedure:

1. Alter the case design to fit the required dimensions.
2. 3D-print the case.
3. Test the installation process
4. Connect the application to the Arduino via bluetooth module.
5. Test the notification system

## Stopping Criteria:

Testing will be finalized once the system successfully sends notification to the driver device, and the system is properly secured in a vehicle.

# Customer Feedback

Since no feedback was provided in the previous client meeting and there are no further meetings, we have asked potential users for feedback instead.

## Case testing

Concern was presented that the case has still yet to have been tested. Whilst we agree that testing would ideally have been done by now, it was not possible as there was an error in the dimensions of the case size. This is planned to be solved as soon as possible. Although less time than initially planned will be available for testing, there is still lots of time to complete, and analyze it.

## Battery Testing

Many potential customers would like to see testing of the battery soon as well. This is very simple to test and has not yet been tested because we want to ensure that the main functionality of the device is complete so that power drain in testing will be more accurate. If the final prototype draws more power than initially estimated then it is possible that the device will not last as long as the initial tests would make us believe. Testing can also be done using simulations.

## System Testing

Potential clients were pleased to see that the function is continuing to function as expected.

They were happy to see the systems working individually and that the code is unifying all parts. Additionally the soldering of the connections has made the connections much more durable and reliable than friction and using the breadboard. This also allows the system to be made much more compact.

# Conclusion

We have documented the third stage of prototyping to prepare for the presentation of the third and final prototype. Customer feedback has been gathered and considered to ensure our final prototype meets the criteria as outlined by the client in previous deliverables. We have also outlined the remaining tasks necessary for the completion of the final product.