Hot Car Emergency

Deliverable E: Project Schedule and Cost

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1. Introduction

In this deliverable we will discuss our schedule to get the prototypes done on time and in the most efficient way possible now that we have discussed our three main ideas and decided on one (see Figure 1). We will be organizing our tasks and prototype due dates into a gantt chart on wrike to make sure everything will move in an orderly manner with little to no setbacks. We will also discuss the possible risks and contingency plans in addition to the list of equipment we will need and the bill of materials. Finally we will review the ways in which we plan to test our prototypes.

1.1. Sketch

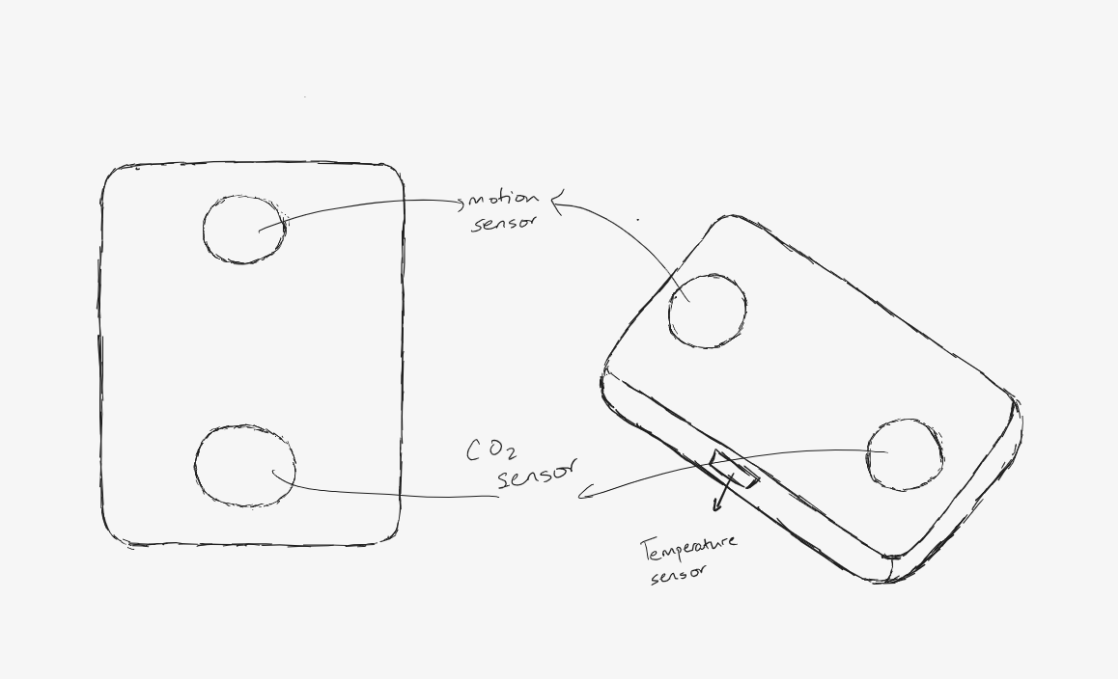


Figure 1

2. Detailed Design

Our design will use an Arduino uno that will be powered by a battery that charges through the cigar lighter receptacle in cars while the engine is running and discharges to power our device while the car is off. To the Arduino we will connect three sensors, a temperature sensor, a motion sensor, and a CO_2 sensor. The temperature sensor will detect whether the temperature inside the car is safe. Temperatures dangerous to humans is > 32˚C, meaning our temperature sensor must be able to cover a greater range than that which, as shown in the table below, it does. If the temperature rises above 32˚C we will have a small speaker connected to this system and it will make an alerting sound. For the sake of illustrating our idea

for this project the sound will not be loud and alert a great range but if in the future this project were to be pursued, a louder sound would be emitted using more advanced speakers. The motion sensor will be used to detect the child, if motion is detected once the car is turned off (once the system is powered through the discharge of the battery), the speaker will emit a sound to alert others, as illustrated by the table below, the time delay of our sensor is approximately 5s - 100s to give the most immediate response possible to try and avoid harm to the child. Nevertheless, we have to account for as many scenarios as we can to ensure the effectiveness of our product, one of which is if the kid is asleep. This is likely as it is doubtful for the child to be missed if they were moving around, to account for this we will be including a third and final sensor, the CO_2 sensor. This sensor will serve two purposes, it will measure the increase in CO_2 over time each minute as a backup method for detecting the kid while also detecting the CO_2 levels and checking if they are not suffocating. Once again if the CO_2 levels rise above the safe ppm for humans (>5,000 ppm) or the CO_2 level is increasing drastically over time, the speaker will emit a sound. To sum up, the speaker will be activated during these four different scenarios, 1) temperature level rises above 32˚C. 2) CO_2 levels rise above 5,000 ppm 3) motion is detected by the motion detector after the car is turned off, and finally 4) CO_2 levels are increasing over time. All of these different sensors will be connected to the arduino using the suitable wires and a printed circuit board; however, for the prototype I & II process we will be using a breadboard as errors might occur and the printed circuit board will be included only in the final build. Additionally, each sensor will be connected to the suitably rated resistor to prevent overcurrent in the circuit.. This whole system will be attached to the top of the car using double sided velcro tape on the device and roof of the car therefore allowing for the easy removal or exchange of the device. Since we will be relying on the motion and CO_2 sensors to detect the child having the device on the roof is the smartest placing as our motion sensor has a range of 7m with an angle of <110˚ additionally, CO_2 exhaled would rise to the top therefore having it at the top of the car in the middle would best fit these specifications and make our device compatible with larger vehicles.

2.1. Sensor specifications

Table 1: this table shows our sensors' specifications

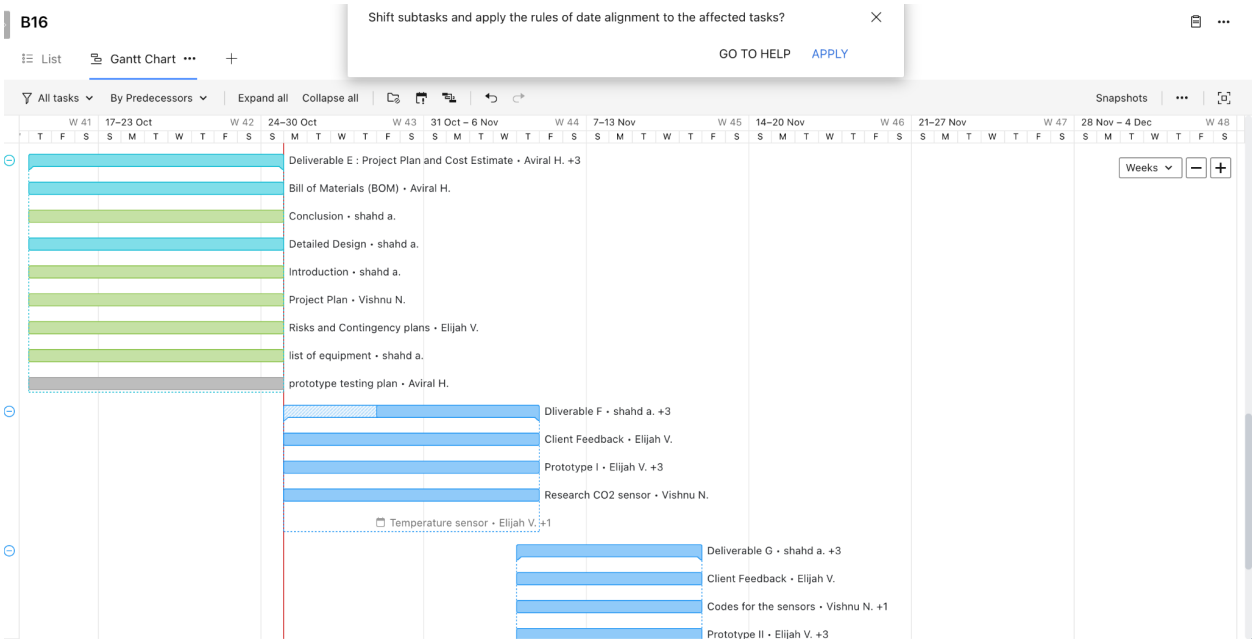
Temperature Sensor [1]	Detecting range: -25 - +100 ° C
CO_2 Sensor [2]	CO2 sensing range: 400 - 60,000 ppm
Motion Sensor [3]	Delay Time: 5s ~ 300s MAX sensing distance = 7m Sensor Angle: < 110˚

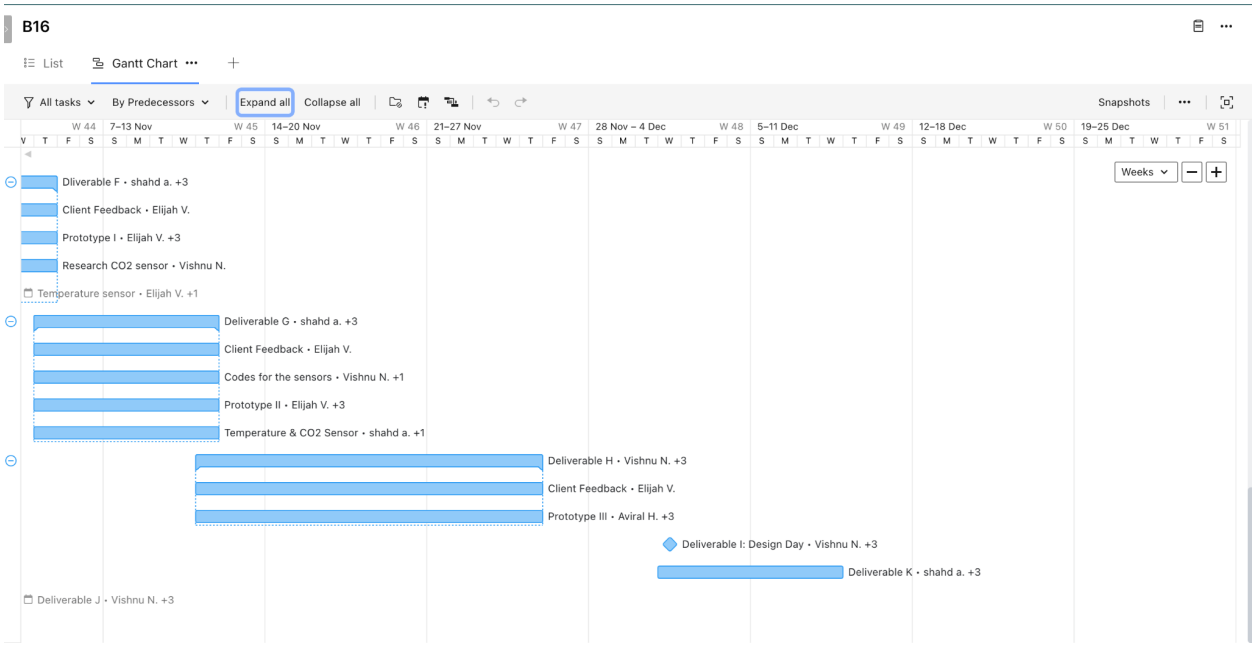
3. Project plan

Table 2: This table lists the different tasks, their owners and duration to keep everyone on track

Deliverable	Task	Owner	Duration	Due Date
Deliverable E	BOM	Aviral	11 days	25th October 2021
Deliverable E	Sketch	Vishnu	11 days	25th October 2021
Deliverable E	Powerpoint	Elijah	11 days	25th October 2021
Deliverable E	Detailed design	Shahd	11 days	25th October 2021
Deliverable F	Prototype I	Everyone	7 days	4th November 2021
Deliverable F	Research CO_2 Sensor	Vishnu	7 days	4th November 2021
-	Purchasing materials	Vishnu	When BOM is approved	Before Prototype II
Deliverable F	Temperature sensor	Shahd & Elijah	7 days	4th November 2021
Deliverable F	Client FeedBack	Elijah	7 days	4th November 2021
Deliverable G	Prototype II	Everyone	7 days	11th November 2021
Deliverable G	Temperature & CO_2 Sensor	Shahd & Elijah	7 days	11th November 2021
Deliverable G	Codes for the sensors	Aviral & Vishnu	7 days	11th November 2021
Deliverable G	Client FeedBack	Elijah	7 days	11th November 2021
Deliverable H	Prototype III	Everyone	14 days	25th November 2021
Deliverable H	Client FeedBack	Elijah	14 days	25th November 2021

Deliverable I	Design day Presentation	Everyone	7 days	1st December 2021
Deliverable J	Project Presentation	Everyone	-	-
Deliverable K	User and Product Manual	Everyone	7 days	8th December 221





4. Risks and Contingency plans

The different risks of this project are our material availability, time constraints, team management and potentially no WiFi. In order to solve these problems, we have developed a list of contingency plans.Regarding the time constraints, we will have to meet frequently to ensure that everyone completes their tasks on time and ensure that we have all our materials ordered and ready to go for prototype building and testing. In order to make sure that we have all of our materials, we will have to meet as a group and decide what materials we need and order them as soon as possible to allow us enough time to build our product. If we have any team problems we can easily solve that by meeting with our group and discussing the issue at hand to ensure we are all on schedule and help each other out if needed. If any group member refuses to work then we can bring up this issue to our TAs, project manager or professor. A risk concerning the actual functionality of our future product is that the child could be asleep and so the motion detector will not be enough alone, therefore we have coupled it with a backup CO_2 sensor. Finally, if we have the time to make an app alongside our product, a potential risk would be the car being parked in an area with no service or WiFi, for example some underground parking lots. To tackle that we would include a WiFi shield.

5. Bill of Materials (BOM)

Table 3: This table is the bill of materials, it shows the products we will purchase and their respective price.

#	Product	Price
1	Arduino Uno[8]	$16.98
2	Battery[6]	$5.5
3	Wires[9]	$2.98
4	Speaker[7]	$1.16
5	Motion sensor [3]	$8.99
6	OCB[5]	$10
7	Velcro tape	$0
8	Temperature sensor [1]	$10.13
9	CO2 [2]	$14.04
Total		$69.78

6. List of equipment

1. Arduino Uno
2. Breadboard
3. Temperature sensor
4. CO2 sensor
5. Wires
6. Resistors
7. Speaker
8. Printed Circuit Board (final build)
9. Velcro Tape

7. Conclusion

To sum up, we decided on our detailed design after discussing the possible risks and how to avoid them in addition to the bill of materials. As a result, we can now begin working on our prototypes. As we move on to this next step, a list of task schedules, owners, and due dates was required to make sure the process flows as smoothly as possible. We will now begin

working on our prototype virtually through tinker CAD simulation until the parts are in our possession.

8. Bibliography

[1] https://www.robotshop.com/ca/en/grove-zero-temperature-sensor.html

[2] https://www.robotshop.com/ca/en/m5stack-tvoc-eco2-gas-sensor-unit-sgp30.html

[3] https://electropeak.com/pir-motion-sensor

[4]https://www.robotshop.com/ca/en/dht11-temperature-humidity-sensor-module.html?gclid=Cj0KCQjwiNSLBhCPARIsAKNS4_d6ghH1lltx7oP3jnNs9_JAyYF6ppMlHy3lu8JO8fHnbSYtlhZCVDcaArztEALw_wcB

[5]https://www.amazon.ca/Eiechip%C2%AE-Prototype-Universal-Electronics-Protoboard/dp/B07MTBNX8F/ref=asc_df_B07MTBNX8F/?tag=googleshopc0c-20&linkCode=df0&hvadid=335884503277&hvpos=&hvnetw=g&hvrand=2388419833878994 92&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000844&hvtargid=pla-905216909696&psc=1

[6]https://www.robotshop.com/ca/en/sfe-2-aa-battery-holder-w-switch.html?gclid=CjwKCAjwq9mLBhB2EiwAuYdMtRRtYnGw3bHbBGSXiWc5-H8ZwCol2zq90014OYhNtjdobxOHyNtQsxoC1XwQAvD_BwE
https://www.amazon.ca/AmazonBasics-A23-Alkaline-Batteries-4-Pack/dp/B07GNMFLKH/ref=asc_df_B07GNMFLKH/?tag=googleshopc0c-20&linkCode=df0&hvadid=335145214684&hvpos=&hvnetw=g&hvrand=14873835440792459338&hvpone=&hvptwo=&hvqmt=&hvdev=c&hvdvcmdl=&hvlocint=&hvlocphy=9000844&hvtargid=pla-668996821579&psc=1

[7]https://www.aliexpress.com/item/32950621219.html?src=google&src=google&albch=shopping&acnt=708-803-3821&slnk=&plac=&mtctp=&albbt=Google_7_shopping&albagn=888888&isSmbAutoCall=false&needSmbHouyi=false&albcp=7386552844&albag=80241711349&trgt=743612850714&crea=en32950621219&netw=u&device=c&albpg=743612850714&albpd=en32950621219&gclid=CjwKCAjwq9mLBhB2EiwAuYdMtaqZRFV74xiVxlDbyEDMzzJtLXgOXXOTNbAt-WJTnHtMjIsax00oZhoCf5gQAvD_BwE&gclsrc=aw.ds&aff_fcid=9874fa0b4937477f8daa51607ab0701f-1635212768738-09296-UneMJZVf&aff_fsk=UneMJZVf&aff_platform=aaf&sk=UneMJZVf&aff_trace_key=9874fa0b4937477f8daa51607ab0701f-1635212768738-09296-UneMJZVf&terminal_id=83acb9dcf238415096786486554454f2

[8]Elegoo UNO R3 Board ATmega328P ATMEGA16U2 with USB Cable for Arduino : Amazon.ca: Electronics

[9]https://www.digikey.ca/en/products/detail/sparkfun-electronics/PRT-12794/5993859?utm_adgroup=Jumper%20Wire&utm_source=google&utm_medium=cpc&utm_campaign=Shopping_Product_Prototyping%2C%20Fabrication%20Products_NEW&utm_term=&productid=5993859&gclid

=CjwKCAjwq9mLBhB2EiwAuYdMtZYkW0oVUa8b6qsvRoSlMJKTy132vS29aJbgJaLv-dueKDg-FJcTOBoC3ZUQAvD_BwE

9. Wrike link:

https://www.wrike.com/open.htm?id=758826332