GNG 1103 – Engineering Design

Project Deliverable F: Prototype 1 and Customer Feedback

Section B01
Team 5

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Introduction

In the previous deliverable, a project schedule and cost estimation were done to guide the team towards implementing our design concepts. This document highlights the team's approach to the development and implementation of our first design prototype. The first prototype is a basic proof of concept, which will be tested, analyzed, and optimized towards getting the best design fit to solve our client’s problem. This prototype will be presented to our client for feedback and plans to test and optimize for a second prototype are also mapped out in this document. The background of this project pins utilization of our final device to the United Arab Emirates. Our final device will be used in a vehicle, but since our design team is in Canada, we opted to use a software simulation for our first prototype. Tinker cad was used for the entire development of this first prototype, we will further discuss the next step towards building a physical prototype for prototype 2.

Prototype 1

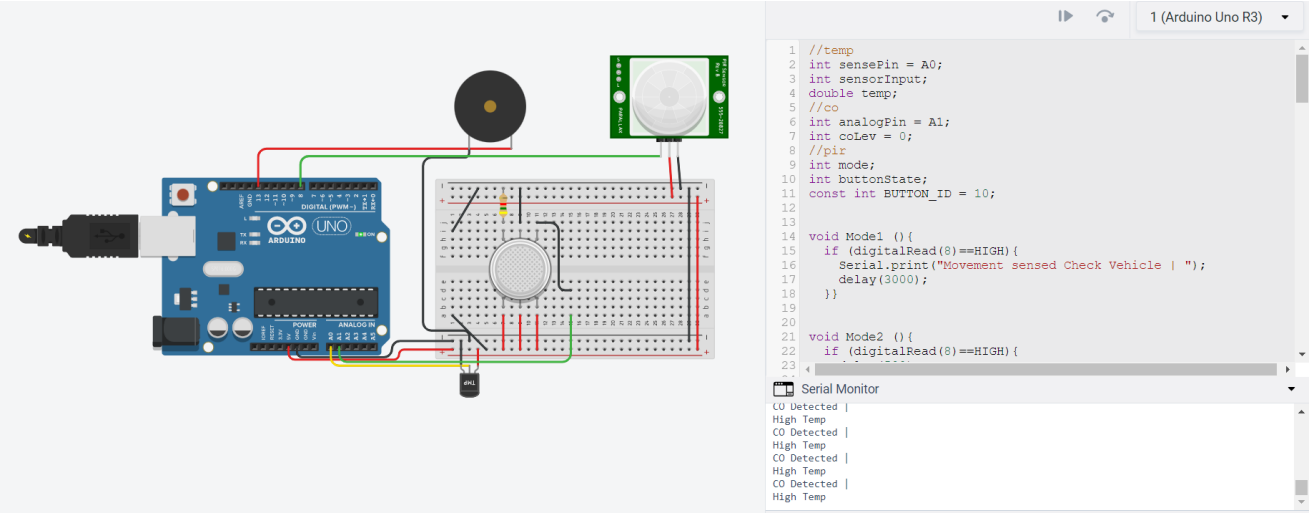


Figure 1: Full prototype Tinker cad Build and Simulation

Prototype Objectives

Objective of the prototype is to create a product that fits all the client needs and refinements from the previous meeting. This prototype aims to detect all the possible problems a parents could face if their child is stuck in a vehicle;

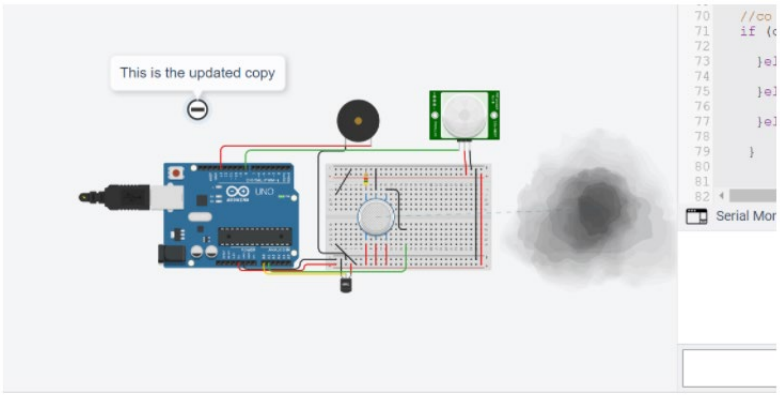
- The prototype can check for high temperatures,
- In case there is a gas leak or CO build up,
- A final precaution is a PIR sensor that can detect if there is movement in the vehicle.

This prototype is to show proof of concept and the amalgamation of the technologies and sensors presented in the previous meeting. The advice and comments of the client were addressed by making the prototype more compact and including plans for a wireless power source.

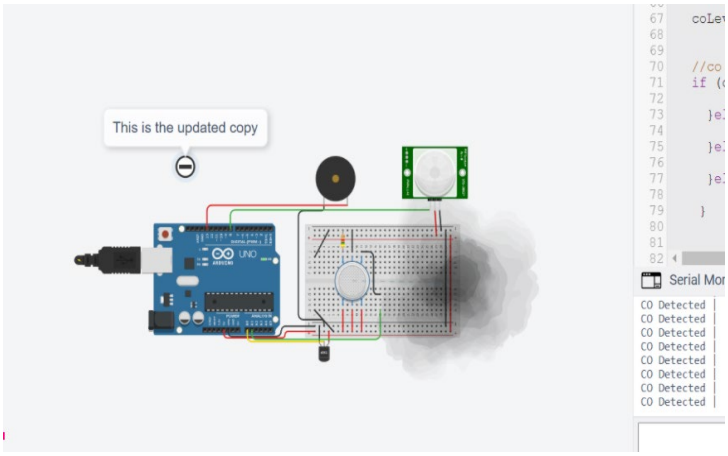
Analysis: Testing and Results

CO Sensor:

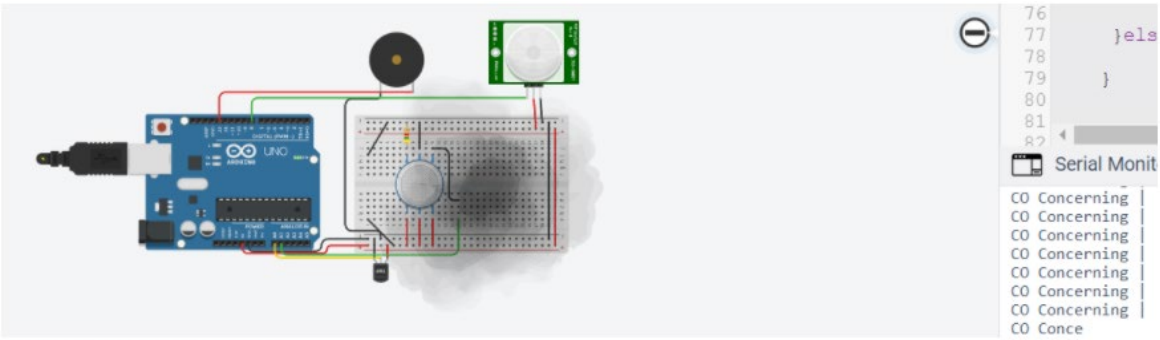
Due to the light density of carbon monoxide compared to air, CO rises, urging the positioning of the sensor on the ceiling of the car, to allow for the detection of CO levels as fast as possible. In order to save battery life, the device created, would detect CO levels when the alert for detected CO when the levels are between 307ppm to levels greater than 521ppm, but the device would begin to alert the user about the level of CO in the car in extreme recorded cases. At 300ppm, symptoms of CO poisoning start to become life threatening, hence the first warning of CO presence in the vehicle. The different alert systems between the levels of CO recorded, can prompt users about the sense of urgency as the client showed concerns of the device not being able to properly notify users.



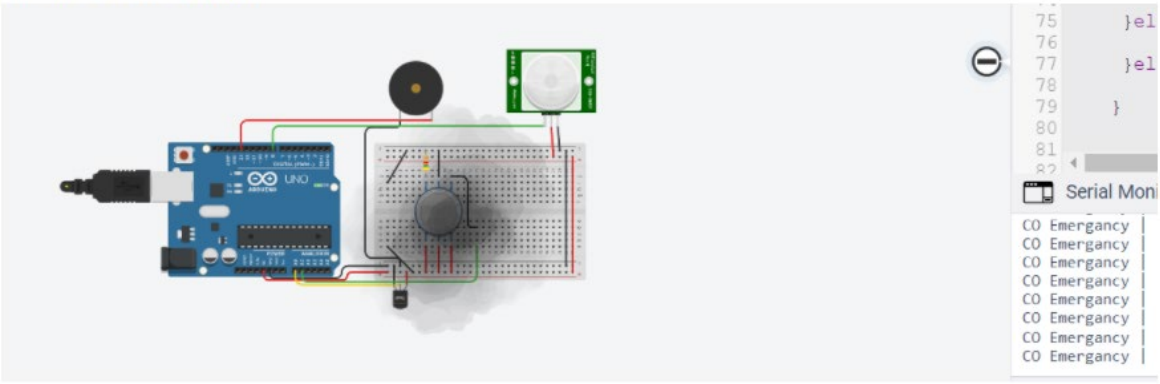
Range:0ppm-306ppm
Alert:No alert given



Range:307ppm-420ppm
Alert:CO detected



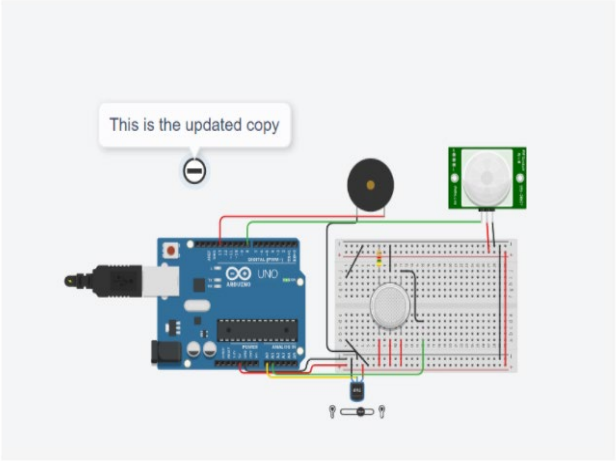
Range:421ppm-520ppm
Alert:CO Concerning



Range:>521ppm
Alert: CO Emergency.

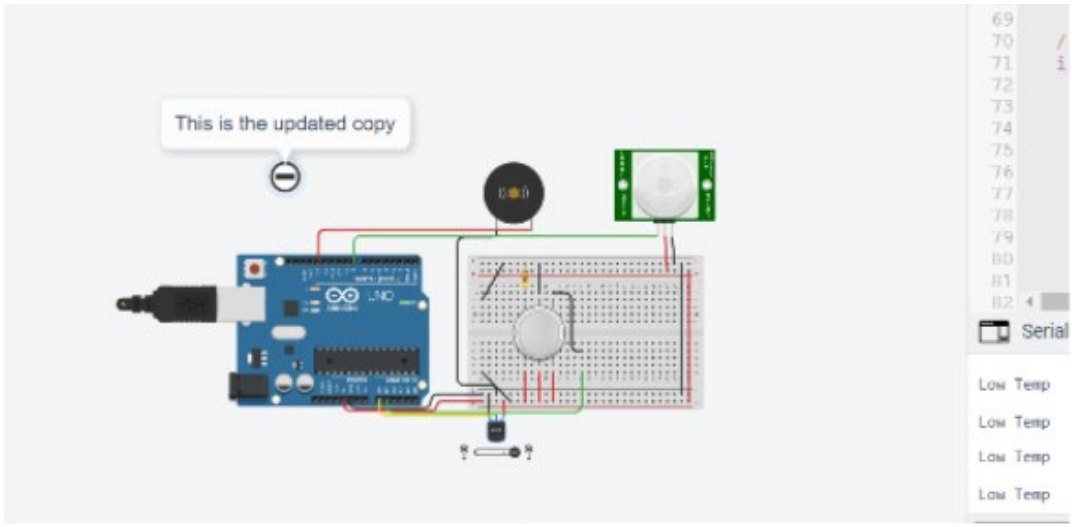
Temperature:

Initially, the device created as per the client's request was to detect the temperature and alert users of high heat in vehicles due to the nature of the client's environment. This idea led to the creation of a device that notifies the user during extreme temperatures whether it is extremely hot or cold. A settled temperature between 10℃-30℃ is used as the universal normal temperature in our device, as anything colder or hotter could be dangerous. When the temperature sensed is less than 10°C or is more than 30℃, users/drivers are notified through an alarm system indicating that the temperature recorded in their vehicles are extreme, therefore edging them to take necessary precautions to save children stuck in the vehicle during such extreme temperatures.



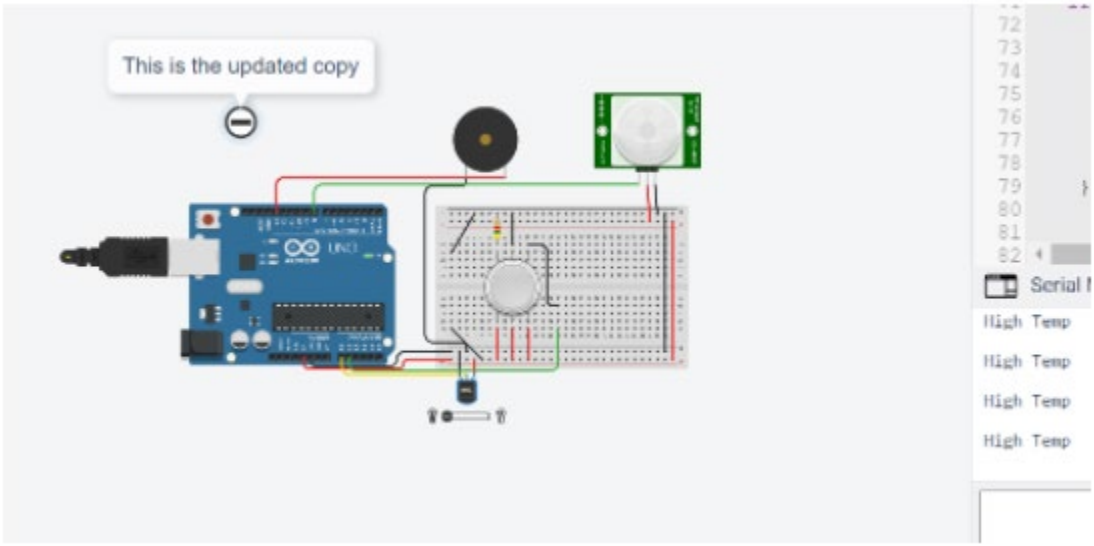
- Normal temperature:10℃-30℃
- There are no alerts given.

Low temperature:



Min temperature:<10℃
Notification: Buzzer system

High temperature.



Maximum temperature:>30℃
Alert: Buzzer

Feedback

Pending a Prototype presentation to our client, we did a demonstration of our prototype to a couple potential clients. Our goal was to get alternate user feedback which might be useful in making the best product for our client. These are a couple comments:

- “Hope this does not drain my battery?”
- “How much does it cost?”
- “Does it need the internet to work?”
- “Is this how it’s going to look when you’re done?”

We explained the scope of our project and the budget we mapped out for our final product. This explanation all pointed to the common final question, which was “when will it be ready?”. We took this as positive feedback; however, we are still open to adjustments to satisfy the needs of our client based on his feedback.

Prototype 2 Test Plan

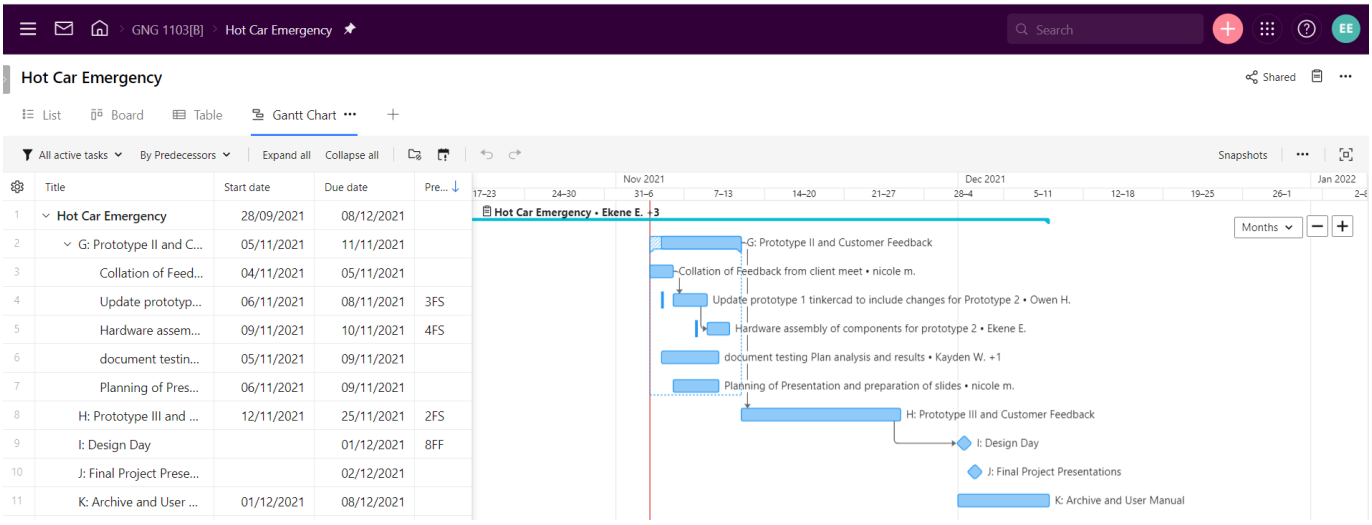
Test #	Test Objective (why)	Description of prototype used and basic test method (what)	Description of expected results and how the results will be used (how)	Estimated test duration and planned start date (When)
1	Accuracy of PIR sensor	Install the PIR sensor at the ceiling of an isolated vehicle to test its reception of human presence This will be tested by connecting the PIR sensor to the Arduino kit and see the response from it when sit in the vehicle and get out of the vehicle	Sit at the child’s seat in the vehicle, the person will be detected by the PIR sensor and there will be a warning. Leave the vehicle with nobody inside and there will be no reaction. (Since PIR sensor can detect heat energy from human body)	10 minutes. The test will start as soon as the object is received

2	Accuracy of CO/ Gas sensor	Determine the minimum and maximum amount of CO/Gas the sensor can detect. This will be tested by connecting the CO/Gas sensor to the Arduino kit and slowly releasing CO/Gas into the isolated vehicle	Testing the function of the CO/Gas sensor by slowly adding gases into the vehicle and see the results 20 - 2000 ppm	20 minutes. The test will start as soon as the object is received
3	Accuracy of Temperature sensor	Determine the lowest and the highest degrees of temperature the temperature sensor can measure. This will be tested by connecting the temperature sensor to the Arduino kit and slowly adjust the air condition of the vehicle	Testing the function of the temperature sensor while adjusting the air condition. Then take the results. 0-50 Celsius degrees	20 minutes. The test will start as soon as the object is received
4	Speaker	Make each of the sensors exceed the threshold one at a time. Test the speaker for proper operation	The speaker will remind driver by playing an audio	20 minutes. The test will start as soon as the object is received

Conclusion

We are yet to present this prototype to our client; however, we have done a demonstration for potential customers around us and so far, we received good feedback with keen interest towards implementation of a physical product. The selection of Tinker Cad as a prototyping software proved useful in our case for testing out various scenarios of our project without any form of spending although experience with Tinker cad has shown that certain simulations don't play out the same in real life. As we recently got our Bill of materials approved from the previous document, pending feedback from our client, we will adjust and start purchasing components in preparation for Prototype 2.

Appendix


GNG 1103[B]
Hot Car Emergency
Search
EE
Hot Car Emergency
Shared
List
Board
Table
Gantt Chart
All active tasks
By Predecessors
Expand all
Collapse all
Snapshots
Title
Start date
Due date
Pre...
1 Hot Car Emergency 28/09/2021 08/12/2021
2 G: Prototype II and C... 05/11/2021 11/11/2021
3 Collation of Feed... 04/11/2021 05/11/2021
4 Update prototyp... 06/11/2021 08/11/2021 3FS
5 Hardware assem... 09/11/2021 10/11/2021 4FS
6 document testin... 05/11/2021 09/11/2021
7 Planning of Pres... 06/11/2021 09/11/2021
8 H: Prototype III and ... 12/11/2021 25/11/2021 2FS
9 I: Design Day 01/12/2021 8FF
10 J: Final Project Prese... 02/12/2021
11 K: Archive and User ... 01/12/2021 08/12/2021
Nov 2021
Dec 2021
Jan 2022
17–23
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31–6
7–13
14–20
21–27
28–4
5–11
12–18
19–25
26–1
Hot Car Emergency • Ekene E. +3
Months
G: Prototype II and Customer Feedback
Collation of Feedback from client meet • nicole m.
Update prototype 1 tinkercad to include changes for Prototype 2 • Owen H.
Hardware assembly of components for prototype 2 • Ekene E.
document testing Plan analysis and results • Kayden W. +1
Planning of Presentation and preparation of slides • nicole m.
H: Prototype III and Customer Feedback
I: Design Day
J: Final Project Presentations
K: Archive and User Manual