University of Ottawa

GNG 1103[B]: Group 19

Deliverable D – Conceptual Design

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Deliverable B – Needs Identification

Abstract

This is a document outlining the ideate process for Group 19 and their Hot Car Emergency Project. In this deliverable each member is tasked with introducing their designs and concepts. After theses concepts are shared, they were split into subsystems and using ideas from each person/subsystem, three global ideas were created. The global ideas were then compared and the best of subsections of each Global systems were combined into a Final System.

1. Introduction

This deliverable will allow each of us to create conceptual designs, and then come together to share our ideas. With these ideas we will then form three different concepts for our project. The concepts will then be graded, and the best one will be chosen to be our concept. This a great way to get everyone's input on the design of the product, as well as insuring that we have exhausted all of our options and have chosen the best elements for our project.

2. Subsystem Design

2.1. Yale Botly

2.1.1. Environment Detectors

2.1.1.1. Temperature Sensor: Set at the child's height to determine temperature at that level. This will also determine time at which alerts are set earlier or not.

Ozone Sensor: CO2 is denser than air so the sensor will be placed just below the child to determine the level that the oxygen is still present.

2.1.1.2. Sound Sensor: If a child is panicking it will alert the Arduino to send out the alerts letting the persons know the situation

2.1.2. Environment Controls

2.1.2.1. Auxiliary Fan: When any of the Environmental Detectors will go off the Auxiliary Fan will begin to spin and help wit oxygen flow, temperature, and child comfort.

2.1.3. Alert

2.1.3.1. App: This app will send out notifications and display data accordingly.

2.1.3.2. Speaker: This speaker will loudly output an audio file urgently detailing the current situation and asking for aid and instructing passersby what to do. This speaker will also be positioned under the trunk handle in a plastic container, weatherproofing it.

2.1.4. Reliability

2.1.4.1. Auxiliary Battery: This battery will make the system completely self reliant, meaning that even when the car is off or broken, the system will function.

2.1.4.2. Weight Sensor: This sensor will be placed in the Driver's seat and will let the device know if the guardian is present or not.

2.2. Gautam Mehta

2.2.1. Alert

2.1.1.1.2.2.1.1. Buzzer: The Buzzer will be set up inside the trunk to dampen the sound affecting the child.

3. Global Concepts

2.2.3.1. Global Concept #1

From figure1, users can understand how the environmental detection subsystem works. First, the environment detects subsystem has three sensors and there are temperature, ozone, and sound sensor. The temperature sensor is responsible for measuring temperature and alerting in advance. It is well known that due to the different weights of carbon dioxide and oxygen, thus in concept1 we just use an ozone sensor to measure the oxygen content. For the sound sensor, we want to use it to detect the baby's situation such as whether the child is crying, screaming.

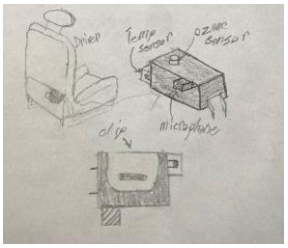

Figure 1. Yale's Enviro Detection subsystem

The following picture below tells users how the alert subsystem in concept1 works. As we can see the buzzer will be installed inside the trunk to reduce the impact of sound on children. The second part of the alert system is the phone application, it should connect to the Arduino which means it can show data and notify the guardian at any time.

Figure 2. Gautam Alert subsystem

For the reliability subsystem, our product placed a sensor in the seat of the car so that the system can sense whether there is a person in the car seat or not. By using this way, the users can avoid the situation where no one is in the car but the buzzer is ranging.

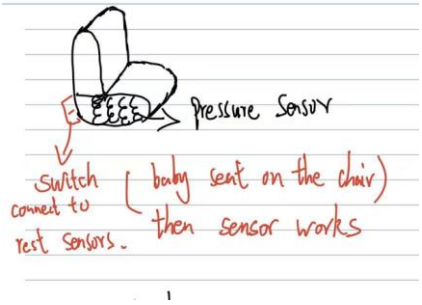

Figure 3. Haonan Reliability Sub system

At the last of this concept, our group design an auxiliary Fan and when the temperature in the car is too high, this small fan will be turned on in order to achieve the purpose of automatically adjusting the environment in the car.

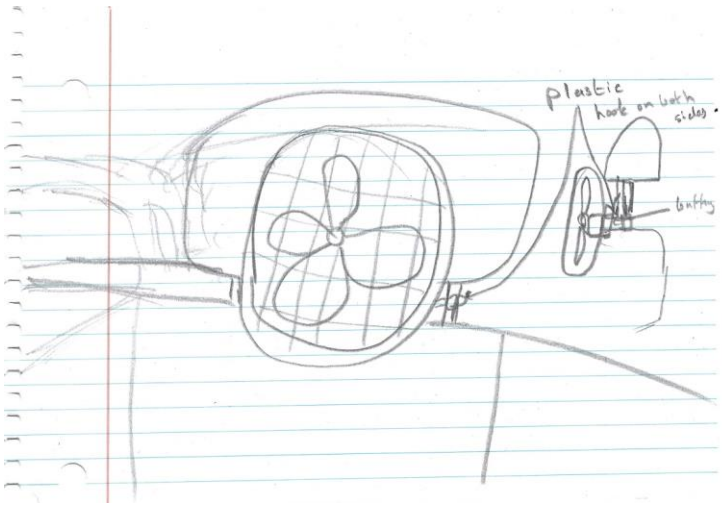

Figure 4. Ali Enviro Control subsystem

2.3.3.2. Global Concept #2

Our global concept 2 is similar to the first concept, with some more features. The environment is controlled by an auxillary fan, which turns on whenever the device senses an emergency. This will be battery powered, mounted underneath the rear seat headrest, so it would be facing towards the baby seat. A sketch is shown below in Figure 5.

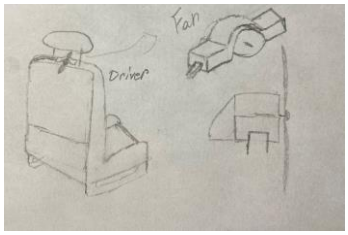

Figure 5. Yale's Enviro Control subsystem

The environment detection system will be Arduino UNO powered. It will read CO2, air temperature and humidity. With these three sensors, the device will be able to detect emergency's and when to send the alert accurately and won't rely on a single parameter. It will be in a sleek box and can be mounted underneath the driver or passenger seat to keep it hidden and out of the way.

Figure 6. Gautam Enviro Detection

The device will alert the user through an app in case of an emergency. But there will also be a loud buzzer attached on the exterior of the vehicle, to ensure that its heard by people passing by. A problem with having only a buzzer is that it would be difficult to find where the sound is coming from if the vehicle is parked in a crowded parking lot. That's why we implemented flashing of the cars lights, in order to attract attention, as well as be visible from a distance. The only problem would be that this would have to be installed professionally and might not be as viable of an option as the rest.

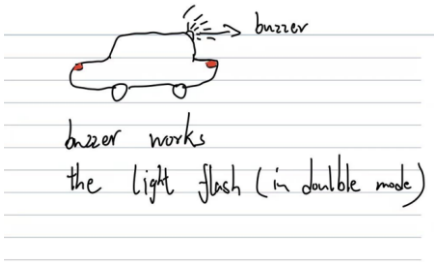

Figure 7. Haonan Alert

Lastly to ensure the device is reliable and doesn't give false alerts, a seatbelt clip device will be used on the baby seat. Whenever the belt will be buckled the device will activate. It will also have a g-force sensor. The G-Force sensor will ensure that the device does not alert if the car is in motion. With these combined the device will not send alerts as long as the car is in motion, or the baby seat is unbuckled. To ensure that all the components will have power when needed, the control unit, the seatbelt clip and the fan all will have rechargeable batteries. The control unit and the fan will also have a 12v cigarette lighter source, which can recharge the devices or can stay running if the car has a constant 12v. Leds will be implemented to show battery power.

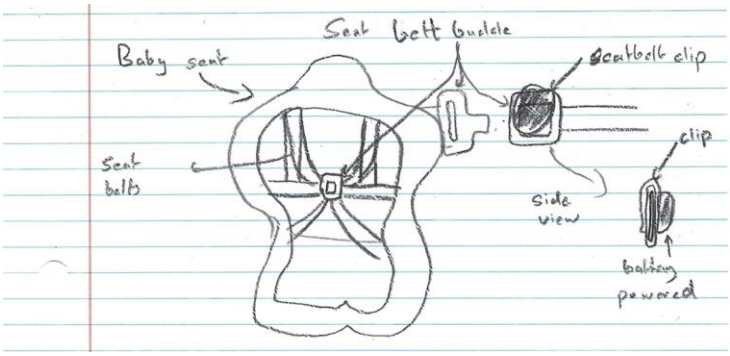

Figure 8. Ali's Reliability subsystem

Global Concept #3

Global concept three is a unique combination of subsystems which results in a very useful and functional final product. Reliability of the system is covered by Yale's subsystem which includes an enclosed battery under the driver seat as well as a pressure sensor to detect the driver. Gautam's usability subsystem contributes meaningful improvements to the product such as a small fan mounted on the C-Pillar of the car. Environmental detection is handled by Haonan's subsystem which is located in the trunk of the vehicle. Finally, Ali's alert system operates using a speaker located at the front of the vehicle.

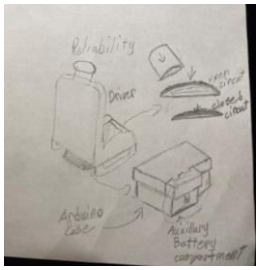

Figure 9. Yale's Reliability subsystem

This subsystem includes a backup battery located under the driver seat which keeps the system running when power from the car is unavailable. The battery is also enclosed in a 3D printed box to keep it safe. There is also a pressure sensor included in the subsystem, located on the driver seat, and will alert system if guardian is not present.

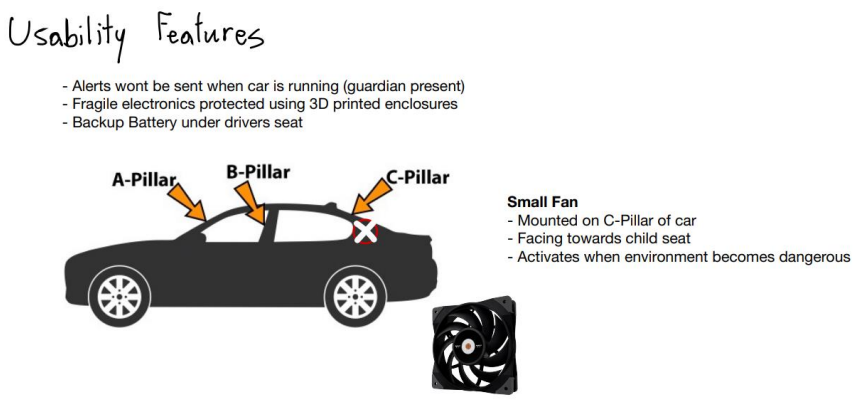

Figure 10. Gautam's Usability subsystem

This subsystem includes a small fan mounted on the C-Pillar of the car. One or Two fans can be installed on either side of the car depending on the client's needs. The fans will be facing the child seat and will activate when the environment becomes dangerous. The fans will also be incognito and blend in as to no be intrusive.

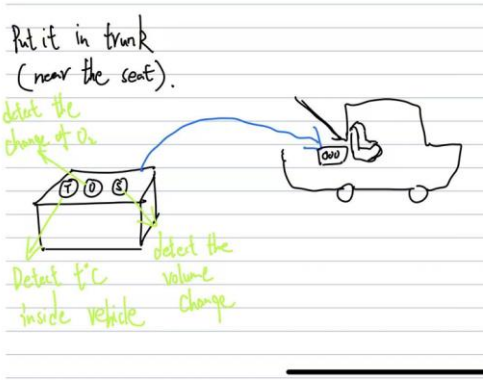

Figure 11. Haonan's enviro detection subsystem

This subsystem includes three different sensors which detect surrounding environment. These sensors will be located in the trunk of the vehicle and include an ozone sensor, temperature sensor, and a sound sensor. The sensors will be kept in a 3D printed enclosure for protection against objects in trunk.

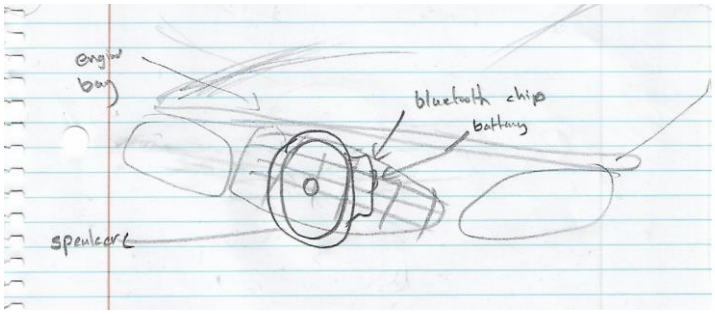

Figure 12. Ali's alert subsystem

This subsystem includes a smartphone app which sends guardian urgent notifications, as well as allowing the driver to monitor the car's environment. The second part of this alert system is a speaker located at the front of the vehicle. This speaker has its own battery and communicates with the system using Bluetooth.

4. Global Concept Comparison

Design Specifications	Global Concept #1	Global Concept #2	Global Concept #3
Obvious and unique alarm system	2	1	3
Can always alert user	2	3	1
Alerts surrounding persons	1	3	2
Auxiliary power source	1	3	2
Condition sensitive response	2	3	1
Does not alert when guardian is present	1	3	2
Situational dependant decision process	2	3	1
Cost is low	-	-	-
Multi language instructions	-	-	-
Is legal in all locations	3	3	3
Has accurate data that can always be monitored	3	1	3
Reliable contact system	3	1	3
Keeps the child calm	2	1	3
Aesthetics/Size	3	1	2
Total	25	26	26

5. Final/Ideal Concept

As far as which Global Concept is best, there is not a clear front runner. Global Concept 2 or 3 are the better out of the three. Our Final Concept will incorporate the ideal portions of Global Concept 2 & 3. This Final concept will look like A single central "Brain" housing the Arduino and the Rechargeable battery. This housing will be located under a seat and will have LED lights displaying battery life. There

are three separate systems located around the vehicle. These systems will consist of an alert system, a mounted fan and a combination of sensors to determine conditions in the vehicle. The alert system will consist of two things a speaker that is connected to the Arduino and an app on the person's phone. The speaker will alert passersby to the situation at hand and ask them to remain at the vehicle and call authorities. The app will display real time data of inside the vehicle and will notify the guardian when the conditions are unfavourable. The Mounted fan will consist of a fan mounted in the headrest of the vehicle, directed at the child. The fan will turn on when conditions are unfavourable and will increase airflow to the child and help with temperature control. The last system implemented is an array of sensors that will detect the environment around them. These will consist of O2 sensor, Temperature sensor, Humidity Sensor, and a switch integrated into the clip of the child's seatbelt. The O2 sensor will determine the air quality in the vehicle and help the decision process. The Temperature sensor will achieve a similar job to the O2 sensor and will determine the conditions inside the vehicle. The Humidity sensor will also determine the conditions inside the vehicle and help determine if there needed action. The final aspect of the switch will determine if there is a child present in the vehicle and whether the system will be live or not. With all these Aspects these systems would be the ideal combinations of the Global concepts we have explored.

6. Reflection/Conclusion

In conclusion, everyone in our group has expressed their own different ideas about these three concepts. Since the scores of concepts two and three are the same, our group still has not discussed which one is the best concept. Therefore, we think that combining concept two and concept three is the best way, because the combination of these two concepts can quickly and accurately warn passers and car owners, and some components on cars can also adjust the temperature in the car to ensure the safety of children in the car. Eventually, what our group needs to discuss is how to reduce costs, for example, what type of sensor can be used to ensure the accuracy of data transmission without spending too much.

7. Wrike URL

https://www.wrike.com/workspace.htm?acc=4975842&wr=20#path=folder&id=758826352&vid=47240218

8. Appendix

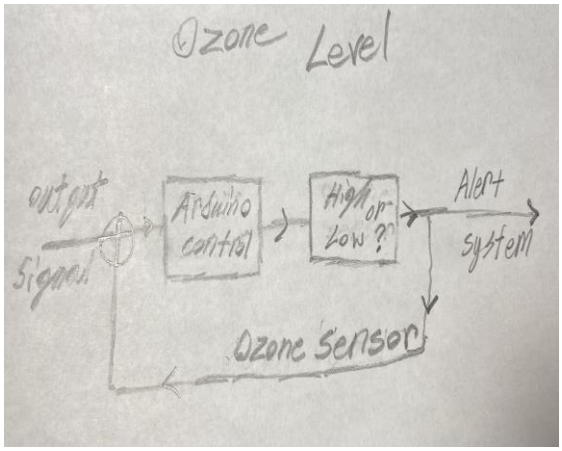

Figure 12. Ozone Control

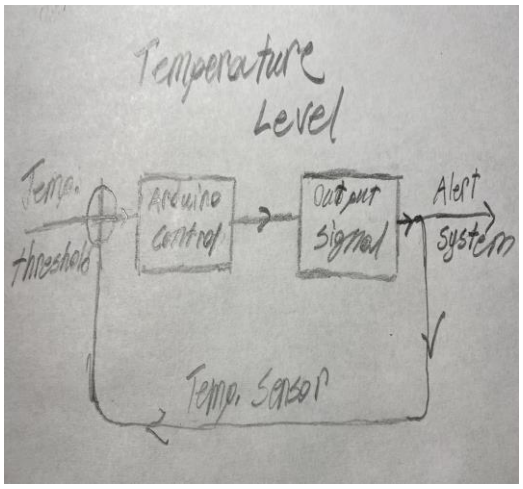

Figure 12. Temperature Control