Hot Car Emergency

Deliverable D: Conceptual Design

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1. Introduction:

This deliverable will focus on the different solutions proposed by team members, and also filter down to the most efficient and cost effective solution implementable. The final solution will be checked with the client to get feedback before proceeding with the plan.

2. Concepts:

2.1. Shahd's Concept:

2.1.1. Ideas

- A motion sensor outside the car that will make a sound every time someone passes by to let them know about the kid in the car.
- Detect the child through their body temperature.
- Send a message to the app which is paired to the sensors to alert parents.

2.1.2. Cons

- A body temperature sensor is too expensive and above budget.
- If no one is around the car it will not alert anyone other than parents

2.1.3. Pros

- It will alert anyone who passes by so if one person ignores the alert the next one will also become aware of the kid.
- Body temperature sensor is a good way to sense the child even when they are motionless/ asleep.

2.2. Vishnu's Concept:

2.2.1. Ideas

- Have a pressure plate sensor laid out on the seats to sense the pressure distribution and any change in its distribution
- Detect the child using their presence on the pressure sensor
- Send a message on the app via Wifi on the arduino

2.2.2. Pros

- The seat has a direct reading with regards to the subject and will not miss the target.

- Will not probably need additional sensors since we can check for a change in pressure distribution in a certain range of time, indicating a living being on the car seat

2.2.3. Cons

- Pressure plate sensors are very expensive
- Too advanced to install and program

2.3. Elijah's Concept:

2.3.1. Ideas

- Carbon dioxide sensors
  - These will detect any carbon dioxide the child is breathing out and will alert the parents through the app
- Motion sensors
  - These will be installed into the car, detect any motion the child makes and alert the parent

2.3.2. Pros

- The motion detectors are inexpensive and affordable
- CO2 sensor will always detect the child even if it is unconscious as it still exhales CO2 when motionless
- They are easy to install as they do not require wires to install and are wireless and portable
- They are able to detect a motionless child through CO2 as it is a lot cheaper than other alternatives

2.3.3. Cons

- Since the components are cheaper, the accuracy will not be the same compared to industry standard components
- If it is a wireless motion detector then it could run out of battery

2.4. Aviral's Concept:

2.4.1. Ideas

- Carbon dioxide sensors

It will detect a rise in the carbon dioxide levels and alert the user through the app.

- Motion sensors

  We need to install motion sensors on the cars seat so it can detect if someone is sitting on the seat or if there's a passerby it starts buzzing alerting the passers by.

- Temperature sensors
  Detects a rise in temperatures and alerts the user.
  Co sensor
  Checks for adequate levels of co2 in the surrounding atmosphere and alerts the parents

2.4.2. Pros

- Have all kinds of sensors including a temperature, motion and carbon dioxide sensor.

2.4.3. Cons

- Sometimes the motion sensor might not be as accurate and might sense objects that it is not supposed too
- It is going to be expensive as there's a lot of sensors

3. Global Concepts

3.1. Global Concept 1:

Our main goal from this project is to come up with a device that will alert others of a forgotten child in the car. To alert others of a forgotten child we first have to detect it, there are many different sensors to choose from all with their different limitations. The most accurate way to detect a child even when they are not moving is by their body temperature which can be done using a grid eye sensor which detects people by their body temperature [1] (Figure 2). Once we have detected a kid we can now alert others by using a motion sensor (e.g. sonar sensor (Figure 1)) that will play a specific sound every time someone passes by or is within a certain range of the car, additionally, it will be paired to the parents' phone through an app and send alerts to their phone once the child it detected. Now the drawbacks of this idea are that sensors that sense body temperature are expensive and will increase the price making it unaffordable to some which goes against one of our client's needs. Additionally, this will alert others that are already there therefore, if the car is in an abandoned area with no one around this will not work. On the other hand, this will be able to detect the child even if they are asleep which will most likely be the case and will constantly alert any passerby which is beneficial in the case that a passerby chooses to ignore the forgotten child.

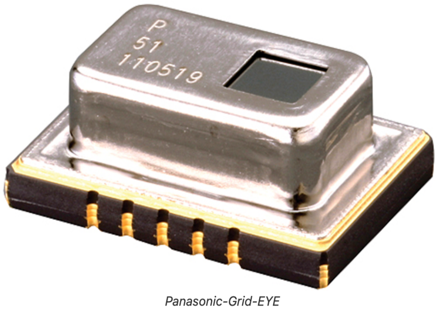

Figure 2 [3]

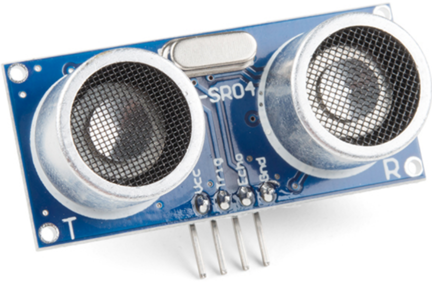

Figure 1 [2]

3.2. Global Concept 2:

My concept consists of detecting the child/pet through a motion detector (Figure 4) and alerting others and their parents. However, in most cases this won't be possible as the child will most likely be asleep. To tackle this issue, we will have a backup CO2 sensor (Figure 3) that will detect the child through an increase in the level of CO2 in the car. After successfully detecting the child, it will alert their parents and through a series of alerts to their phone and alert passerbys through alarms. The CO2 sensor will always detect the child even if it is unconscious as it still exhales CO2 when motionless. The motion detectors are inexpensive, affordable and are easy to install as they do not require wires to install and are wireless and portable and are able to detect a motionless child through CO2 as it is a lot cheaper than other alternatives. However, since the components are cheaper, the accuracy will not be the same compared to industry standard components. If it is a wireless motion detector then it could run out of battery.

Figure 4 [4]

Figure 3 [5]

3.3. Global Concept 3:

Have a pressure plate sensor (Figure 5) set up on the seats of the cars to track the rate of pressure distribution each second. This way, the sensor can get a reading, and the arduino can determine whether the object on the seat is an inanimate object or a living being and take appropriate action. One way the alert can be to send a message via the app using Wi-Fi. The Arduino can use a wifi shield to transmit the alert to the accompanied app. The solution is suitable since it does not require additional sensors for backup, and can take a direct reading with regards to the subject and will not miss the target. The only downsides are it not being very cost-effective and will require more complex coding for child/pet detection and be installed by professionals.

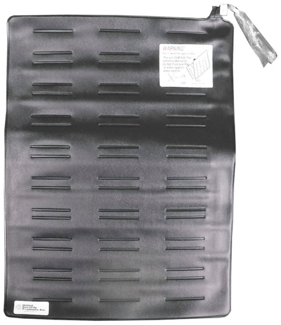

Figure 5 [6]

4. Comparing Global Concepts:

Table 1: this table compares the different concepts by ranking certain aspects from 1-3 (3 being the best and 1 being the worst.)

	Global Concept 1	Global concept 2	Global Concept 3
Cheap & Affordable	2	3	1
Installable and compatible with all car	3	3	2
Alerts Others of the forgotten child	2	3	3
CO2 sensor to sense if the kid will suffocate	1	3	1
Temperature sensor to sense if the kid will die of a heat stroke	1	1	1

Alert Parents through an app	3	1	3
Total	12	14	11

5. Final Concept:

As illustrated by the table above, global concept 2 is the most efficient. We will replace the motion sensor with a temperature sensor to reduce the cost and increase the efficiency. Our product will have a co2 sensor that determines adequate co2 levels to make sure the kid is not suffocating and also detect the kid through an increase in the CO2 levels inside the vehicle .In addition, we will have a temperature sensor that determines the suitable temperatures and alerts the parents accordingly. To alert the parents and passerbys we will have a speaker connected to the sensors to play a sound once the kid has been detected to alert anyone within the vicinity of the forgotten child and the parents will be alerted through a series of alerts sent to their phone which will be paired to the sensors through an app, hence, the need of the wifi shield for the arduino.

6. Conclusion:

In conclusion, we have gone over each other's concepts for the Hot Car Emergency and found the most efficient and cost effective solution. We have compared our concepts and they are ready to be presented to the client. Moving forward we will update our prototype accordingly to our client’s feedback and start building it.

7. Bibliography:

[1]“panasonic,” *panasonic*. https://na.industrial.panasonic.com/products/sensors/sensors-automotive-industrial-applications/lineup/grid-eye-infrared-array-sensor

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[4] “motion sensor.” https://www.google.com/url?sa=i&url=https%3A%2F%2Fwww.lorextechnology.com%2Fsensors%2Fam41tk-pir-motion-sensor%2FAM41TK-1-p&psig=AOvVaw005Cap8NtL-dsqulrYBfTb&ust=1634250909171000&source=images&cd=vfe&ved=0CAsQjRxqFwoTCMDH6LLhyPMCFQAAAAAdAAAAABAGhttps://images.app.goo.gl/MnJaBL7NNz3MmuPf9

[5] “CO2 sensor.” https://www.co2meter.com/products/cozir-wr-20-percent-co2-sensor

[6] USP-904 24" x 30" Indoor Outdoor Pressure Mat (alarmsystemstore.com)

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