Sprout Saver
DELPHI

Figure 1: Sprout Saver final design

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Dr. Ritter
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Executive Summary

Our group’s task was to create a design for Delphi that would make the car safer, greener, or more connective. Our design is one that controls the temperature of the interior of the car, in order to protect children and pets in cars even if the driver is not present. There are an unfortunate number of deaths in young children and pets due to elevated temperatures inside vehicles, thus we wanted to be able to combat this issue. Using multiple matrices and charts, we settled on a design that utilizes thermal sensors, a thermometer, GPS tracking, and electricity. Our design is very accurate and it will reduce child and pet deaths, it does not emit gases, and it is connective in a way that the driver will not be hindered while driving.

Introduction and Problem Statement

Delphi wants to make zero fatalities, zero injuries, and zero accidents a reality. Our goal for this project is to aid in this process by reducing the number of deaths and injuries of children and animals being left in cars.

Our goal for this project is to reduce the number of deaths and injuries caused by children and animals being left in cars to zero by 2025.

We will reach our goal by developing a system to detect when children or animals are left in the car and automatically adjusting the temperature to a safe level. We plan to get the system regulated to be required in all new cars by 2020. Our system uses a thermal sensor to recognize the presence of a child or an animal. The system will communicate with the car’s on board computers to monitor temperature and notify the driver and the authorities via phone call. When the police are notified, the car will send the location using the onboard GPS. Our system will be cost effective, totaling under $1,000 per unit once regulated.

Background

From 1998 to today, 636 children being left in cars have died due to heat stroke\(^1\). Of these deaths, over half have been due to the guardians forgetting the children in the car, and almost a third of them have been due to children playing in the car without anyone knowing\(^1\). On average, about 40 children die per year due to heat stroke from being in cars. In one month alone, there were 10 near deaths for children, showing that most instances end in death, and when they do not, extreme injury is the result.

Researching current solutions for this issue, we found that there are no current technologies to remedy this problem. We believe that this is an easy problem to fix, yet manufacturers may have not pursued solutions due to the increase in liability. Despite the increase in liability, we believe that this feature is imperative to increase passenger safety and should an accident occur, the blame would still be placed on the guardian.

Customer Needs

Taking the importance of child safety in mind, we thought of all the requirements the design would need. It needed to be lightweight to maintain the car’s efficiency; it had to be energy efficient—if it is running while the car is off, then it will kill the battery (the battery is meant to last for 30 minutes by itself); it needed to be reliable—so nobody or nothing dies; it had to be inexpensive so people would be willing to pay for it needed a working failsafe plan for an added safety measure; it needed to be able to connect to the driver and authorities in case of
emergency; and it had to have a fast response time to keep the child or pet cold. We found that
the most important features were the failsafe plan, reliability, and response time.

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<th>Interconnectivity</th>
<th>Response Time</th>
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<td>Response Time</td>
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<td>3</td>
<td>.25</td>
<td>8</td>
<td>.25</td>
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Grand Total: 129.046

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<td>Lightweight</td>
<td>Keep the weight under 20lbs. to conserve weight of the car. This increases efficiency.</td>
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<td>Efficient Power Usage</td>
<td>This is important because if it is running while the car is off, then it will kill the battery. The battery is meant to last for 30 minutes by itself.</td>
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<tr>
<td>Reliability</td>
<td>The system must activate 99% of the time. False positives and false negatives should not be very common as the thermal sensor is very sensitive and accurate.</td>
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<tr>
<td>Low Price</td>
<td>The price must be kept under $1,000 for the car buyer, as most car buyers do not like added features for more than $1,000. We plan to implement the Sprout Saver in luxury family vehicles first.</td>
<td></td>
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<tr>
<td>Has a Working Failsafe</td>
<td>The fail safe must always activate in the event of shutting off/on, and should activate after 10 minutes.</td>
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<tr>
<td>Connectivity with the User and Proper Authorities</td>
<td>After 20 minutes, the system should send out a message to emergency authorities.</td>
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<tr>
<td>Response Time</td>
<td>Sensor determines presence of child or animal within one minute of the car being shut off.</td>
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**Concept Generation**

We wanted to make sure that our design would cover the most important features. For an automatically adjusting temperature mechanism, we realized we would need to figure out how it would be powered, what kind of sensors would detect the heat, and how it would connect to the user. Out of the three kinds of power we could think of—battery operated, solar power, or using the cigarette adapter—being attached to the car battery would be the most cost effective and easiest to work with.

We decided on only using a thermal sensor as sometimes kids are sleeping in the car, so motion sensors might not realize there’s a child in the car, and CO₂ and noise sensors might not
be the best idea if the car windows are cracked open as the gas could escape or outside noise could get in to the car, so the sensors wouldn’t be that accurate.

The failsafe part is covered with the connectivity of the Sprout Saver. It sends a text to the driver after 10 minutes, if the car isn’t turned on and the air conditioning manually activated. After 20 minutes with no action, the driver and emergency responders are contacted via call and text notifying them of the child/pets presence in the vehicle.

Figure 2: Classification Tree to compare possible design features

**Concept Selection**

In our concept selection matrix, we compared the different kind of sensors we could use—a motion sensor and microphone vs. a CO₂ sensor vs. a thermal sensor. While the motion and microphone sensor scored highest, mostly due to the high efficiency, we decided to go with the thermal sensor, the second highest, because we felt it would be more accurate and have less room for error. We believed that a microphone and motion sensor could produce multiple false positives due to the surroundings of the car vehicle being loud or objects moving—especially if a vehicle has its windows slightly opened, which would let in outside noises and bugs. A CO₂ sensor might not be effective enough, because the gas might not reach the sensor fast enough, or at all, and if the windows of the vehicle were opened slightly, the gas could escape before reaching the sensor. Thus, we decided that the thermal sensor would be the best option because it would be able to detect the internal body temperatures of children or pets regardless of if the children or pets are asleep or awake.
Table 3: Concept Selection Matrix to determine design features

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</thead>
<tbody>
<tr>
<td>Microphone and Motion</td>
<td>5 (.105)</td>
<td>5 (.58)</td>
<td>3 (.801)</td>
<td>5 (.11)</td>
<td>3.5 (.693)</td>
<td>3 (.219)</td>
<td>24.5</td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td>(2.508)</td>
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<tr>
<td>CO₂</td>
<td>5 (.105)</td>
<td>4 (.464)</td>
<td>2.5 (.668)</td>
<td>4 (.088)</td>
<td>2 (.396)</td>
<td>4 (.292)</td>
<td>21.5</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(2.013)</td>
</tr>
<tr>
<td>Thermal</td>
<td>4 (.084)</td>
<td>2 (.232)</td>
<td>5 (1.335)</td>
<td>2 (.044)</td>
<td>4 (.792)</td>
<td>5 (.365)</td>
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<td>(2.852)</td>
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</table>

**Systems Diagram**

The Sprout Saver utilizes a thermometer, thermal sensor, GPS tracking, and electricity. It activates the air-conditioning and sends out phone calls and text messages with the location and temperature of the car to the driver and emergency responders.

**INPUTS**

- Thermometer
- Thermal Sensor
- GPS
- Electricity
- Time
- Information

**OUTPUTS**

- Electrical Signals
- Air Conditioning
- Phone Calls
- GPS Coordinates

![Figure 3: Project system diagram](image)

**3D Model/Prototype App/Images of interface, process, etc.**

The Sprout Saver is a small box-like compartment that contains a thermal sensor as well as wiring that is connected to the battery of the car. The sensor would be attached to the ceiling of the car and would detect if there were any people or pets in the car. It would automatically activate the air-conditioning if the temperature of the car interior exceeds 85°.

![Figure 4: Sprout Saver device would be placed on the ceiling of the car facing the back seats.](image)
Concept of Operations

A child is left alone in the car by the parent. The child, locked in a car seat cannot exit the vehicle. The thermal sensors detect the child in the seat, as its internal temperature is much higher than that of the rest of the car. Running off of the car’s battery, the system turns the air conditioner on to regulate the temperature of the car keeping the child safe. If ten minutes pass without the car being turned on and the air conditioning being activated via the car, the driver is notified of the child via text. If the system still detects the child after twenty minutes, the police will be notified and given the car’s location through the car’s GPS system. If the air conditioner fails to turn on, both the police and driver are notified after ten minutes.

Cost and Feasibility Analysis

Retail price, the Sprout Saver costs a little over $1,000, at $1082.04\(^2\). This cost is nothing compared to the price of a pet or human life, which is priceless. If you had to put a price on your pet, it would be a little under $10,000 for taking care of your pet\(^3\), and a person’s value is at $6.1 million according to the US Transportation Department\(^4\). In ten minutes, the interior temperature of a car can increase by about twenty degrees Fahrenheit. Thus, on a sunny day, a car in 75\(^\circ\)F weather could jump to 110\(^\circ\)F, so essentially one could lose from thousands of dollars to millions, as their loved ones could die\(^5\). For Delphi, the cost of producing this product is only $180.34, which is the price of a thermal sensor and power wire. It should not be too difficult to create this product and install it within the car. We believe that if the product were to be regulated, the price for the consumer would decrease, and as technology improves, the price for Delphi to replicate this design for cars should also decrease.

If the product were to fail, it could cause accidental death of a child or a pet. However, the sensor is very accurate so there is a low chance of failure. In the event of failure, the system will be programmed to inform the authorities and driver of the situation. Some may be skeptical about this design idea regarding where blame would be placed if the sensors were to fail, but blame would still be placed on the guardians, as despite this design being implemented, people should not leave their children in cars. There is also an issue of privacy, as some may dislike the fact that the government would be involved through the GPS locations sending out the location of the car. However, the locations are only divulged in emergency situations, and they are used to protect and save lives, thus we believe that the benefits of the product would be able to conquer social stigma.

Life Cycle Analysis

The average life of a car battery is four years and has 12.6 Volts\(^6\). The thermal sensor uses 3 Volts, meaning that the thermal sensor system would use only 23.8% of the car battery life. Car batteries these days are often rechargeable, so battery lifespan of cars continues to lengthen. Thus, the 3Volts that the Sprout Saver uses is almost negligible, and it will not detract from the car life cycle.

Conclusions

The Sprout Saver is an imperative invention that would help Delphi reach their goal of zero fatalities, zero injuries, and zero accidents, it doesn’t emit any gasses, and it connects the vehicle to the outside world in a way that would not distract the driver at all. We believe that the Spout Saver should be implemented in cars to protect our loved ones. As technology continues to progress, we hope that the compartment for the Sprout Saver would continue to shrink until it is
almost impossible to notice inside a car, so that there will not be as much bulkiness on the ceiling
of a car. Making the design double sided was also a possible future design change, to
accommodate for pets that stay in the passenger seat of the vehicle or toddlers who want to play
in the front of the vehicle unattended. From this project, our team learned to research and explore
all possible design ideas, as well as make sure that our product is cost friendly so both the
company with the design as well as the consumer would be willing to use the product.

References