Delphi Automotive Systems: Safe - Green - Connected

EDSGN 100
Section 002
Design Team #6
Dream Team
Fall 2014
Submitted to:
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5 Dec 2014

ACKNOWLEDGMENTS

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Section 1  Executive Summary
Falling asleep at the wheel has caused 1,550 deaths, 71,000 injuries, and $12.5 billion in damages every year (drowsydriving.org). With such devastating numbers, something must be done to lower these incidents. Design Team 6 has devised a sensor that can detect drowsiness, fatigue, and even tunnel vision. The sensor, which will be built into vehicles, can sense eye movements to determine the symptoms of the conditions listed above. In addition, there will be sensors in the steering wheel, monitoring the driver's heart rate incase he/she is wearing sunglasses, which would inhibit the eye movement sensor. Lastly, a head-up display (HUD) screen will be placed in the windshield which will display the speedometer, a small gps, and will warn drivers when fatigue is sensed.

Section 2  INTRODUCTION
2.1  PROJECT OBJECTIVES. With today’s technology, it seems as if anything is possible. Cars are becoming better by looking more stylish, getting smaller, and faster. One of the negative issues of these new technologies is that it might not always be safe or environmentally friendly. Cars are able to get to higher speeds which could cause an increase in car accidents and there are still many vehicles that emit carbon dioxide. Even though the new technology can bring a lot of negative aspects, it also is beneficial to fixing these problems. Delphi has many products such as sensors, hybrid/electric vehicle products, safety electronics, etc., that uses advanced technology to make cars safer on the road, greener, and more connected.
2.2  PROJECT BACKGROUND. Not visible to the human eye, there are up to 50 computers within the cars and trucks you see everyday. But each of them is making that vehicle safer, greener, and more connected. Many of those computers were designed and built by Delphi. Cars seem to be getting more technologically advanced everyday, such as cars that can park themselves or cars that can sense potential dangerous situations before the driver does. What does this mean in terms of the technologies
needed, societal acceptance, and the policies and supporting systems needed to enable these safer, greener, more connected cars and trucks?

2.3 SPONSOR BACKGROUND. Delphi Automotive is a global automotive components design and manufacturing company— it is one of the world’s largest automotive parts manufacturers and provides electrical and electronic, powertrain, safety, and thermal technology solutions to the global automotive and commercial vehicle markets. Delphi operates 126 manufacturing facilities and 15 technical centers across 32 countries, utilizing a regional service model that enables it to serve its global customers. It has approximately 161,000 employees worldwide, with around 5,000+ located in the United States. Delphi operates through four segments: Delphi delivers innovation for the real world with technologies that make cars and trucks safer, more environmentally friendly, smarter, better connected, and more affordable than ever before.

*Electrical / Electronic Architecture*
Today’s vehicles have to be about more than transportation. They have to entertain, inform, connect, and protect their passengers. The competitive landscape is all about features and functionality. Delphi’s goal is to help auto manufacturers incorporate in demand features without substantially adding to a vehicle’s mass or cost. And it’s not easy. But they have the electrical integration experience, the systems capabilities, and the technologies to deliver unique electrical/electronic architectures for unique needs.

Major products: Wiring harnesses, electrical centers, vehicle and cell phone wireless charging, data communication cabling, hybrid vehicle charging systems

*Powertrain Systems*
Delphi’s advanced engine management systems are making an important contribution to a cleaner tomorrow by minimizing the environmental footprint of vehicles. The manufacturers of motorcycles, lawn and garden equipment, recreational products, power generators, marine engines, and other small engine products also rely on their systems-level knowledge and analysis resources. They have extensive knowledge and experience in fuel injection, electronic controls, sensors, air and fuel management, ignition systems, valve train, fuel handling, and evaporative emissions canisters. And they have a global network of 3 engineering and manufacturing resources to respond quickly and efficiently with localized program support.


*Electronics and Safety*
Delphi is working to build safer driving experiences that have more information, entertainment and connectivity. Their safety expertise encompasses everything from crash sensing electronics to collision mitigation. And with their radar, vision, and vehicle integration expertise, they’re enabling innovative active safety systems that help make
high-performance safety features affordable in the mainstream vehicle market. These systems are designed to support their vision of a society with zero fatalities, zero injuries, and zero accidents. Major products: Engine Control Module, Advanced reception systems, Navigation, displays, adaptive cruise control, radar and camera systems, parking guidance systems

**Thermal Systems**

Delphi meets its customers’ heating and cooling needs across a wide range of industries, with products that provide world-class comfort. In fact, they’ve been managing air, liquids, and temperature longer than any other automotive supplier in the world. They’ve virtually perfected the science, and were first to integrate electronics, sensors, and special algorithms into climate control systems to make them smarter, faster and better than ever before. This special Delphi technology creates a precise orchestration of vehicle air temperature that can be as sensitive as one-tenth of one degree. At Delphi, they call it thermal management intelligence.

Major products: Compressors, HVAC systems, powertrain cooling modules

2.4 **PROJECT CATEGORIES.**

1. Safety: Ultimate goal is to help make zero fatalities, zero injuries, and zero accidents a reality
2. Green: Passionate about creating a world with zero emissions
3. Connectivity: Technology to allow seamless connectivity in the vehicle – it’s what consumers want, and we can make it a reality

2.5 **PROBLEM STATEMENT.** Driving while tired is a very dangerous action to take. It can be just as fatal as driving under the influence. When people are tired, their reaction time is slowed, they have decreased alertness, their judgment is impaired, and their risk for crashing is increased. With our design, we hope to eliminate the dangers of driving while tired so that people can safely arrive to their destinations. Our design falls under Delphi’s Safety category, which we feel is the most important aspect of any design.

**SECTION 3  METHODOLOGY**

3.1 **PROPOSED DEVICE.** Sensors that detects drowsiness, and fatigue through eye movement and heart rate. One sensor will be placed on the visor to enable it to scan up and down and another sensor will be placed on the steering wheel in order to detect heart rate incase the driver is wearing sunglasses, which would inhibit the eye movement sensor from working properly. In addition, a HUD screen will be placed on the windshield to warn drivers when drowsiness is detected, show speedometer when needed, as well as a small gps that has lane detection.

After the sensor detects drowsiness or fatigue, there will be three beeps and the HUD screen will display “Drowsy/Fatigue driving. Please pull over”. The same warning and
beeping will occur every five minutes, for a span of fifteen minutes to allow the driver ample amount of time to find a safe area to pull over. After those fifteen minutes, there will be a constant beeping until the driver pulls over.

3.2 RATIONALE FOR SELECTION. This selection provides a safe driving environment through the use of gentle, yet effective methods. The HUD screen allows for a safer environment since the driver will never have to take his/her eyes off of the road in order to look at the gps or the speed. The driver will push a button on the steering wheel, which will light up the HUD screen for about 30-45 seconds and then disappear. During this process, the driver never has to look down or to the right since the screen is right on the windshield in front of the driver. In addition, when the sensors sense fatigue, the warning that shows up on the HUD screen is not too pushy in a way that will scare the driver or make him/her feel rushed, which could ultimately lead to an increased risk for an accident.

3.3 CUSTOMER NEEDS. The sensor gives the driver an ample amount of time to pull over. It understands that the driver may not be able to pull over right away which is why it will send a warning every five minutes for fifteen minutes to remind the driver. In addition, the driver will no longer have to take his/her eyes off of the road to check their speed or gps. Instead, all of the essential information can be posted on the windshield with a click of a button. The customers who would find these devices to use can be anyone. Teenagers and grownups alike, do not get enough sleep at night and if driving long distances, fatigue might strike which could be deadly. Therefore, some of the customers needs that these devices would satisfy would be: safety, convenient, gentle approaches, reliable, and economical.

3.4 OBJECTIVES AND GOALS. To provide customers with a cost effective way to improve vehicular safety by using an eye sensor/heart rate monitor to detect whenever a driver is starting to fall asleep at the wheel.

3.5 CONCEPT OF OPERATION. The sensor will automatically turn on when the car is turned on. While the driver is driving, the HUD will automatically light up to show the driver’s speed limit whenever the speed limit changes, which can be detected through the GPS. Otherwise, the user will push a button on the steering wheel to see his/her speed. If the sensor begins to sense drowsiness or fatigue in the driver, a warning screen will pop up on the HUD screen and there will be three beeps to further catch the attention of the driver. The warning will pop up, along with the beeps, 5 more times during a span of 15 minutes. After that time, the beeping will be continuous until the driver pulls over.

3.6 SYSTEM CONTROLS. A button on the steering wheel to turn on the HUD screen or a switch to keep the HUD screen on continuously.

The sensors will be placed on the visor of the drivers seat to scan eye movement. There will also be sensors in the steering wheel to sense heart rate, which the user will have to set up when he/she first gets the device. If fatigue or drowsiness is sensed, the driver will be warned and then eventually, forced to pull over.

3.7 SYSTEM MODEL.
Clip on back of sensor is clipped onto the visor of driver seat.

3.8  **DAY-IN-THE-LIFE.** Sally only gets five hours of sleep the night before because she is up all night planning a surprise party for her best friend who lives 5 hours away
from her. She wakes up early to get started on her road trip. An hour into the drive, Sally starts to feel herself falling asleep, and right as her eyes begin to close, the sensor beeps three times and the HUD screen pops up warning her. She feels relieved that she did not fall asleep, as she could have gotten into an unpleasant accident. She is two miles away from a rest stop, so she pulls over in the parking lot and takes a break from driving and buys a coffee. Thirty minutes later, she is back on the road and makes it to her friends surprise birthday party safe and sound.

3.9 LIFE CYCLE ASSESSMENT (LCA). Recycled materials are used in the manufacturing of our sensors, which includes plastics and metals. There are no known environmental impacts of the use of our sensors.

3.10 ECONOMIC ASSESSMENT. The Class 5 estimate includes a zero to two percent range as the level of project definition. The end usage is to get drowsy drivers off the roads. There is a concept screening as part of the class 5 assessment. The steering wheel and visor in front of the driver will be vital to the use of the product. The model is one inch by four inches and will clip nicely onto any car visor. The expected accuracy range is anywhere between negative twenty percent to negative fifty percent for L and for H it is positive thirty percent to one hundred percent. The preparation effort for the sensor can be classified as level one which is very minimal effort.

3.11 PRODUCT DEVELOPMENT AND MARKETING. We will market our product as a safety necessity. The sensor device and HUD screen will be integrated nicely into any vehicle and will have a sleek and clean look. To market the product to prospective buyers, we will employ various statistics in order to show the dangers of falling asleep at the wheel. Our product development relies heavily on the use of “eye tracking” software used in other fields. We will take this software and use it in order to track the eyes of a driver. The main challenge that comes into play in terms of product development is developing our product to work when someone is wearing sunglasses. We have implemented sensors in the steering wheel as well to overcome this challenge. The sensors can sense heart rate, which the user will have to set up.

Each of our devices (sensor, steering wheel sensor, and HUD screen) will be sold as a package with a target selling price of $250. Our estimated sales volume is $125,000 (500 packages sold). Our product will be launched at several malls with virtual driving experiences with our package. Interested customers will be able to get into a car and drive in a computer simulated driving game. The simulated driving game will be programmed to show on the screen that the driver starting to close his eyes due to fatigue, and the warnings will show. Essentially, the computer game will go through the examples of what it would be like to drive with the package.

To promote our product, we will create commercials to be shown all over the United States. The commercial will show how our products can save lives and it will be mostly targeted to grown-ups and parents to advertise to them to buy it for themselves, or for their teenagers.

SECTION 4 SUMMARY
Implementing our sensors can reduce the risk of people driving in a drowsy or fatigued state, which can lead to accidents. It will allow drivers to know when they are not alert enough to drive so that they can safely be taken out of dangerous driving situations.

SECTION 5 REFERENCES

