Delphi Automotive Systems: Safe - Green - Connected

EDSGN 100
Section 002

Design Team 2
Team Cosmos
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Submitted to:
Professor Berezniak

College of Engineering
School of Engineering Design, Technology and Professional Programs
Penn State University

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Innovation for the Real World

Ultimate goal is to help make zero fatalities, zero injuries, and zero accidents a reality

Passionate about creating a world with zero emissions

Technology to allow seamless connectivity in the vehicle – it’s what consumers want, and we can make it a reality
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Penn State University

- **Dean, College of Engineering**
  Dr. Amr Salah Elnashai
- **Department Head, SEDTAPP**
  Dr. Sven Bilen, PE
- **Course Instructor**
  John Berezniak, PE, Instructor EDSGN 100
- **Laboratory Assistants**
  Ethan Bauer
  EDSGN100.002 Lab Assistant
  Aerospace Engineering Student
  Penn State University

Delphi

- **World Headquarters and Customer Center**
  5725 Delphi Drive
  Troy, Michigan
  USA
  Tel: (1) 248.813.2000
  Fax: (1) 248.813.2670
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SECTION 1  EXECUTIVE SUMMARY

According to the United States Department of Transportation, more than 73% of all deaths due to car accidents are a result of large/professional vehicle operators (truck drivers, taxi drivers, etc.). A common variable among these drivers is their long, extended periods of operation. As a result, it is expected that these people can become easily drowsy while operating the motor vehicle. In addition, The National Highway Traffic Safety Administration estimates that at least 100,000 police-reported crashes are due to driver fatigue each year. Team Cosmos, in partnership with Delphi, seeks to drastically reduce the number of car crashes due to drowsiness. We plan to do this by implementing sensors in a steering wheel, which will allow the car to alert the driver to regain full consciousness and drive safely.
SECTION 2 INTRODUCTION

2.1 PROJECT OBJECTIVES. Identify technologies and opportunities to make cars and trucks safer, greener, and more connected.

2.2 PROJECT BACKGROUND. There are up to 50 computers buried beneath the skin of the cars and trucks that you see every day on the road. You wouldn’t know they were there. But each of them is making that vehicle safer, greener, and more connected. Many of those computers were designed and built by Delphi. It seems every day we’re hearing in the news about “cars of the future”, ones that will park themselves, drive themselves, talk to us, use fuel more efficiently, report data to insurance companies, avoid accidents, etc. 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 engineering and manufacturing resources to respond quickly and efficiently with localized program support.

Major products: Engine Management Systems, Fuel Injection Systems, Ignition Systems,

Alternative fuel management systems

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. There are three Delphi megatrends that drive the technology portfolio: Safety, Green and Connected.

The goal of the Safety megatrend is to increase safety and security while reducing driver workload and distractions. The vision is to ultimately reach a society that sees zero fatalities, zero injuries and zero accidents.

The next megatrend is Green and it is to make sure the vehicle’s impact on the environment is as minimal as possible. With new powertrain systems, weight reduction and other innovative ideas, the environment is becoming less affected by motorists worldwide.

The last megatrend is Connected. This provides a way for the user to connect to any content, anywhere at any time while also mitigating distraction all at the same time.

2.5 PROBLEM STATEMENT. Driver fatigue/drowsiness is a problem among all types of drivers. If they become too tired, they may be a major hazard for themselves, and more importantly, to other drivers. With this new type of steering wheel, driver fatigue/drowsiness can be avoided or prevented by simple vibrations and noises notifying the driver of his/her lack of attention to the road. This type of device would fall under the Safety megatrend that Delphi has identified, as it will significantly increase safety for all those on the road.
3.1 PROPOSED DEVICE. An intelligent steering wheel that can detect heart rate and give feedback based on the driver’s state of mind (level of drowsiness).

3.2 RATIONALE FOR SELECTION. According to the National Highway Traffic Safety Administration, more than 100,000 reported car crashes per year are due to driver fatigue. By using this device, we can advise the driver on whether or not they should be driving, or help them to regain their attention to the road.

3.3 CUSTOMER NEEDS. Driving is a task that requires constant attention and concentration. While moving at high speeds, accidents can happen very quickly. When a customer is operating their vehicle they want to get there destination responsibly and safely. Truck drivers will most benefit from this product because they operate vehicles for long periods of time, and are therefore more likely to get tired while driving. Transportation companies want to reduce the risk and liability of their drivers. This wheel can help them stay alert and keep their attention on the road.

3.4 OBJECTIVES AND GOALS. To reduce the number of accidents due to driver drowsiness, most specifically in professional motor vehicle operators (truck drivers, taxi drivers, etc.).

3.5 CONCEPT OF OPERATION. The appearance of our steering wheel will be similar to any normal wheel, except for the addition of small metal sensors along the outside. The first ten minutes of operation, the wheel will calibrate to the user’s heart rate. If it is found that the heart rate is decreasing into “drowsy” levels, the car will beep and the wheel will vibrate.

3.6 SYSTEM CONTROLS. The steering wheel is powered by the vehicle’s battery/electrical system. The wheel is standalone, so no other signals will be sent to or from the vehicle. The sensors will be sticking out on the surface of the wheel, where the hands will be in contact. When the heart rate of the person drops to an unsafe level (determined by internal software), the wheel will alert the driver, causing them to become more awake and attentive.

3.7 SYSTEM MODEL. < Provide both a visual (virtual) conceptual system model that describes and represents the proposed device and a systems model showing how the proposed device will be integrated in the car.>
Figure 1 shows the proposed independent steering wheel design. Its appearance is similar to any other wheel and can be adapted to fit the style of the motor vehicle in which it is installed. The essential addition is the heart rate sensors lined along the outside. These are designated by the silver/chrome circles along the outer edge. All electrical components of the wheel are located inside.

Figure 2 shows the process that will take place to alert the driver. The wheel is installed after the vehicle is bought and it is ready for operation. The person’s hands rest on the steering wheel, it begins calibration and starts to monitor the heart rate. When the heart rate becomes dangerously low (indicating drowsiness), the wheel vibrates and emits a loud beeping sound.
3.8 DAY-IN-THE-LIFE. A driver of a large shipment truck is flying down the highway at 60+ miles per hour. It is currently 2:00 in the morning, and he has been on the road for 6 hours. He begins to doze off behind the wheel, and the truck begins to slowly swerve off the road. His heart rate drops, and suddenly the steering wheel is beeping loudly and vibrating. The driver is alerted, regains attention and control of the vehicle, and stops at the nearest rest stop. Disaster and tragedy avoided.

3.9 LIFE CYCLE ASSESSMENT (LCA). The proposed modified steering wheel will be similar in production and disposal to the average wheel. The infrastructure is already in place to handle such operations. The materials used are plastic (leather), and various metals. Most of these materials can be responsibly recycled and used over.

3.10 ECONOMIC ASSESSMENT. At a project definition percentage of 2%, with the purpose to create a price estimate at a concept level, we produced a cost value by judgment and comparable prices. A high quality steering wheel can cost about $400, a heart rate sensor is about $100, and other various software and hardware costs can equate to about $150. So, the total cost of this wheel will be about $650.

Most of the components of this device will not be susceptible to a considerable amount of wear and tear. In the event of an electrical malfunction, a fuse may need to be replaced. In the event of an accident, the entire system will likely need to be replaced.

3.11 PRODUCT DEVELOPMENT AND MARKETING. Current vehicle manufacturing facilities can be outfitted to add the heart-rate sensing features to a steering wheel. Once a prototype is produced, it will be necessary to undergo testing to ensure that the readings and warnings are accurate. To guarantee accurate heart rate readings, medical equipment should be used to determine the level accuracy of the wheel’s sensors. After a successful performance, it can be tested in the market by volunteer trucking/car companies.

Since the estimated manufacturing cost is $650, the target selling price is $1000. Due to the large amount of trucks in the United States, and the high cost of liabilities, we can expect a large interest in our product. To guarantee a large sales volume, it should be marketed to truck companies to install in preexisting trucks to begin. Once it becomes accepted as a strong safety feature, it can be given to vehicle manufacturing companies to provide the wheel already built-in to trucks, cars, et cetera.
The benefits of implementing this design into motor vehicles is an increase in the safety of drivers and people on the roads. Many accidents are caused every year by driver fatigue/drowsiness, which results in a lot of preventable deaths. This purpose of this design is to make sure these deaths do not occur.

There are some downsides to implementing this technology. The primary weakness is economic cost. The system is more expensive than a standard steering wheel and will therefore cost companies extra money upfront. Some users may not like the feel of the sensors on the wheel.

This product needs to be marketed as a feature that will improve the safety of drivers. Transportation companies spend large sums of money every year on insurance and liabilities. If we can decrease the number of accidents, it will ultimately save money and make their employees safer. After it is launched for professional drivers, it can be marketed to family drivers to improve the safety of everyday people.

Since the extra cost is not exceedingly high, automakers are likely to adopt this technology because it will pay back in safety and peace of mind.
Works Cited

