EDSGN 100: Introduction to Engineering Design

Project 2

Reflex

Section 10, Team 5

Submitted by Yahya Almumin, Marcus Ford, Jacob Johnson,

Brian Kim, Anqi Ren

Submitted to Xinli Wu

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Abstract

Anqi Ren

This report documents the dumpling maker project designed by Yahya Almumin, Marcus Ford, Jacob Johnson, Brian Kim, and Anqi Ren. In this report, four topics will be further discussed including a description of the design task, the design approach, the final design and its prototype as well as the engineering analysis.

Table of Contents

1. Introduction ····· 1 Anqi Ren

2. Description of the Design Task

2.1 Problem statement ····· 1 Brian Kim

2.2 Mission statement ····· 2 Brian Kim

2.3 Design specifications ····· 2 Brian Kim

3. Design Approach

3.1 Project management - Gantt chart ····· 2 Yahya Almumin

3.2 Concept generation - Brainstorming ····· 3 Yahya Almumin

3.3 Design selection matrices ····· 3 Brian Kim

3.4 Trade studies ····· 4 Jacob Johnson

3.5 Description of the best design selected ····· 5 Brian Kim

4. Prototype and model

4.1 Design drawings ····· 6 Marcus

4.2 Prototype scale and digital images of the prototype

4.3 Design features ····· Jacob Johnson

5. Engineering Analysis including cost analysis

5.1 Concept of operations ····· Anqi Ren

5.2 Life cycle analysis ····· Brian Kim

5.3 Cost analysis ····· Jacob Johnson, Brian Kim

6. Summary and Conclusions ····· Anqi Ren

7. Attachment of the PowerPoint Presentation Slides

8. Attachment of the tri-fold brochure

9. Acknowledgement

1. Introduction

Anqi Ren

This project was sponsored by Delphi which identifies opportunities to make cars safer, greener, and more connected. The design project was assigned by Xinli Wu on October 20th, 2014. First, the team discussed about the three goals that Delphi provided and chose two that fitted the members' interests, which were safety and connectivity. Then all five members did research online and found out which technologies already existed. After that, the team started to brainstorm and compared different ideas using the design matrices. All team members agreed that it would be a better idea to combine some of the existing technologies and improve them. The final design was the result of several heated discussions in class. Then a prototype was built to enable others to envision the design and all members were involved in parts of it. Finally the team presented the final ideas in front of the whole class and wrote this report to review the design process.

2. Description of the Design Task

2.1 Problem statement

Brian Kim

One of the biggest problems relating to safety is that the drivers are not fully be aware of the surroundings in certain conditions such as that of inclement weather and complete darkness. Bad weather conditions include rain, snow, fog and terrible storm. When those bad weather conditions are encountered, the vision through the front window and side mirrors of a car could be compromised. As a result, the driver cannot clearly see what happens around the car, and that

causes serious safety concerns. More importantly, when driving at nights, some of the blind spots might also cause potential accidents.

2.2 Mission statement

Brian Kim

The mission for this project was to limit human error by integrating innovative technologies to increase the vision and range by alerting the driver of any incoming or potential threats. To fulfill this mission, a system combining HUD (Heads-up display) technology, cameras and sensors that have night vision technology, and user-friendly multi control system is designed.

2.3 Design specifications

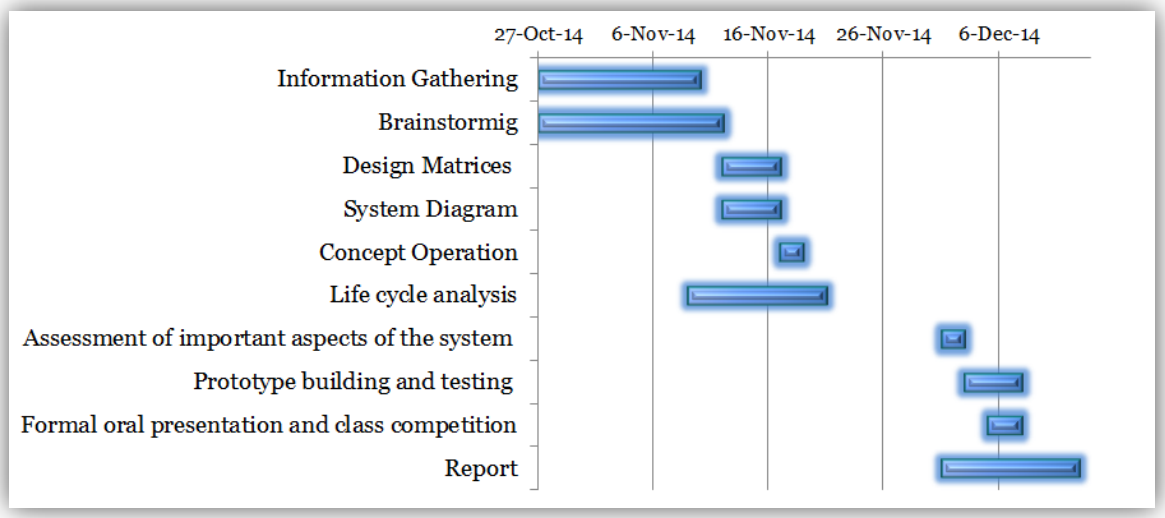
Brian Kim

This system implements the usage of Heads-Up display system and a touch screen control system to allow drivers to view different camera angles and sensors so that the driver may be able to have complete awareness of his/her surroundings and limit driver negligence. Cellular and multimedia connectivity are also integrated into the system.

3. Design Approach

3.1 Project management - Gantt chart

Yahya Almumin



3.2 Concept generation – Brainstorming

Yahya Almumin

The ultimate goal of this project is to identify and improve car technologies in order to highlight one or more of the main issues that car industries are facing nowadays which are connectivity, staying green and safety. By systemized brainstorming it has been concluded that safety and connectivity were the topics that looked appealing. Using direct comparison through matrices and comparing some other aspects, a clear outline helped to choose the design that satisfies two of the problems that were targeted in the in the problem statement.

3.3 Design selection matrices

Brian Kim

CONCEPTS					
Criteria	LED Lights	Projection Display	Windshield Integrated Projector	Touch Screen Monitor	Display Monitor
Cost	+	0	-	0	+
Ease Of Installation	+	+	-	+	+
Lifetime	-	+	+	-	0
Reliability	-	+	0	+	0
Maintenance Required	0	+	0	0	0
Ease of Use	0	+	+	+	0
Accuracy	0	+	+	+	0
Sum +'s	2	6	3	4	2
Sum 0's	3	1	2	2	5
Sum -'s	2	0	2	1	0
Net Score	0	6	1	3	2
Rank	5	1	4	2	3
Continue?	No	Yes Develop	No	Yes Develop	No

As shown in the design matrices above, after comparing different ideas, projection display and touch screen monitor were selected as the best ideas that can be developed and improved in the final design.

3.4 Trade studies

Jacob Johnson

For coming up with the best design concept, a design matrix was created. Within the design matrix the best ways to alert and guarantee the driver's safety was analyzed. The idea of incorporating LED lights vs a display monitor was first analyzed. With LED lights the driver will see a blinking LED light appear on either his rear or side mirrors warning the driver that a car is approaching in his blind spot. With the display monitor the driver will be able to see a visual of his blind spot and well as many other features ensuring the driver's absolute safety. Since the display monitor seemed to be a lot more practical and convenient it was stacked up against a

projection display (heads up display system) incorporated with a touch screen monitor. In this case the projection display is a more ideal design than the display monitor this is because, the projection display offers a wider view than the display monitor allowing the driver to display a 360 ºvisual of his surroundings. In addition, the touch screen monitor offers a user friendly aspect to the system, which enables the driver to easily navigate through of the system features. The projection display and touch screen monitor was then compared to an integrated windshield which included all of the capabilities and features as the projection display/ touch screen monitor. The issue with the integrated windshield is that it is a technology that currently does not exists, and therefore could not be implemented into the design. So after analyzing the design matrices, it was concluded that the best design should contain both a projection display and a touch screen monitor.

3.5 Description of the best design selected

Brian Kim

This system implements the usage of Heads-Up display system and a touch screen control system to allow drivers to view different camera angles and sensors so that the driver may be able to have complete awareness of his/her surroundings and limit driver negligence. Cellular and multimedia connectivity are also integrated into the system. The driver has full control of his Heads-Up display system through the use of his touch screen control system or the hotkeys installed into the steering wheel. The system is completely customizable to the drivers' specifications, from the size of the camera screens depicted through the heads up display to the programming of different tasks assigned to each integrated steering wheel button. Cameras and

sensors will be specifically placed at the front, rear, and at both sides of the car (angled at the blind spot). The camera will be fully controlled by the main system. At the front of the car, the driver has the ability to use infrared, thermal, and night vision technology to see obstructions in front of the car during inclement weather or in the dark. Finally, as previously mentioned the system has full cellular and multimedia connectivity which ultimately provides drivers with a whole new driving experience where they can sync their phones and control their phones as they drive to limit distraction from veering their direction from the road. The driver will also be able to connect to applications such as Pandora and other internet services to further enhance their driving experience. In all, we want our design to provide completely safety and comfort to drivers.

4. Prototype and model

4.1 Design drawings

4.2 Prototype scale and digital images of the prototype

4.3 Design features

Jacob Johnson

The design features incorporated into this system include:

- HUD system which is integrated with
- Blind spot, rearview and side view monitoring technologies,
- Infrared, thermal and night vision imaging technologies,

- GPS navigational system,
- Multimedia support,
- Cellular connectivity
- Voice over technology.

The system is operated by a computer built into the car's dashboard. The computer is essentially a touch pad based control system. This control system controls the built-in projector that allows for the system's HUD feature. The systems computer allows for a voice control option as well as the ability to control the system with the toggle buttons on a steering wheel. Through this "multi-control" system all of the systems display features such as blind spot monitoring can easily be displayed on to the windshield, all while being distraction free.

5. Engineering Analysis including cost analysis

5.1 Concept of operations

Anqi Ren

The goals and objectives of the design include safety and convenience. The design is based on high-quality technologies which connected to the Internet to provide the customers with updated information.

The product was designed based on customers' needs. Some drivers keep complaining about the danger of turning around their heads while they are backing their cars or trying to move into another lane. The design solved the problem by using existing technologies and improved them to be more user-friendly. The marketing of the product is bright because it uses new technologies to help improve the safety of the car. Although more technologies used means more difficult to

maintain the devices, the advantages of the design weigh a lot more than its disadvantages. After all, it is a design heading to the future.

5.1 Life cycle analysis

Brian Kim

Stage 1: Manufacturing

The manufacturing of this product will not hurt the environment too much because the technology implements the use of micro technology, so not much natural capital will be utilized.

Stage 2: Packaging

Due to the small nature of this technology (simply cameras, sensors, a projector, and a screen), the packaging and distribution phase will not use much product in enclosing and shipping it.

Stage 3: Marketing

Since marketing itself is mostly done virtually today, we will not have to use too much natural capital in advertising or dispersing the nature of our product.

Stage 4: Use, Reuse, and Maintenance of the Product

Since our product is of the new age, it will be utilized for a long time until some other forms of technology takes its place. However, that will take a while due to the futuristic nature of our technology.

Stage 5: Recycling, Disposal, as Waste at the End of its Useful life

Our product does not contain much natural capital, so it is not huge in disposing of it. However, since it is mostly of the metallic nature, it could be recycled further for future use.

Stage 6: Extraction and Processing of Raw Materials

Our product is mostly metal so it could be processed and extracted easily and efficiently for future reuse.

5.2 Cost analysis

Jacob Johnson, Brian Kim

Parts	Estimated Cost	Description
Touch Screen Monitor	$200	Main control system and ability to adjust Heads-up display technology
Date Storage	$50	1 TB memory storage system
Projector	$175	Project Heads-up display technology
Sensors	$25*4=$100	Infrared sensors
Camera	$25*4=$100	Basic camera placed strategically at blind spots and the rear of the car
Front-car Camera	$500	Infrared and thermal camera placed in front of car to allow projective visibility against all weather and conditions

ESTIMATED COST = $1125

6. Summary and Conclusions

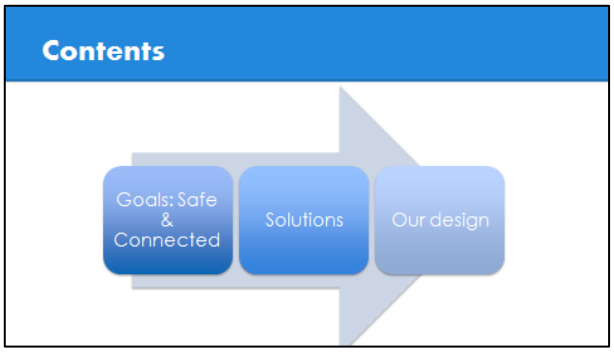
Anqi Ren

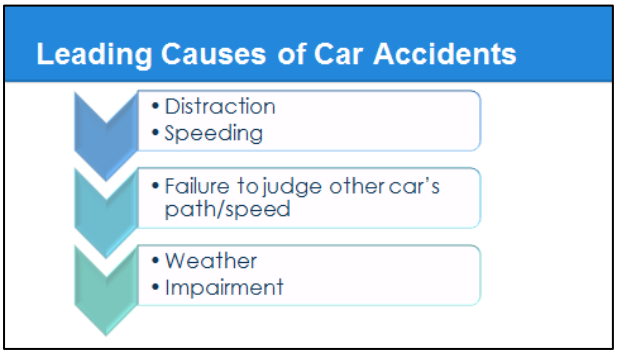
The team was satisfied with the final design and was confident on the presentation day because the final design idea met all the goals and concepts that were originally set for this project, safe and connected. All team members enjoyed the teamwork throughout the project. All members not only learned engineering design skills start with analyzing customer needs, followed by using design

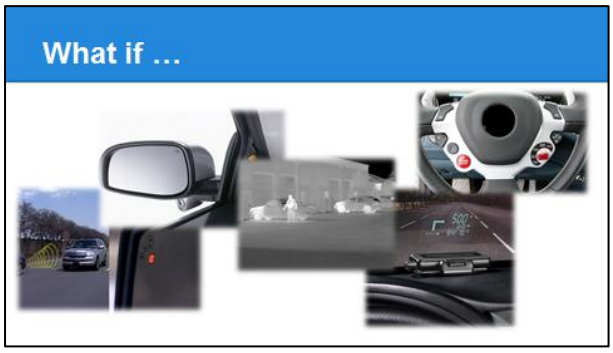
selection matrices to choose the best design and use CAD to work on detailed drawings and cost analysis, but also built up cooperation and problem-solving skills. More importantly, the team was confident to present ideas in front of the whole class and experienced the success of teamwork. All team members showed up to labs and team meetings, and contributed their own ideas when discussing about the design ideas and making prototype.

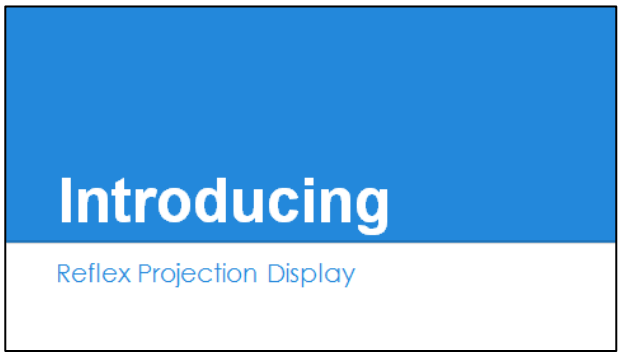
Dedication and genius ideas of every single member in the group lead to the final design done. It all paid off when the team was voted to present in the design showcase.

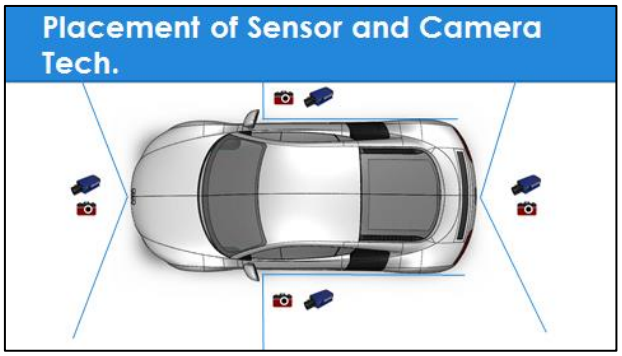
7. Attachment of the PowerPoint Presentation Slides

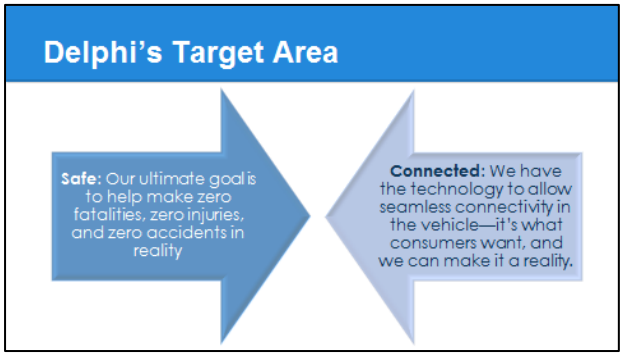






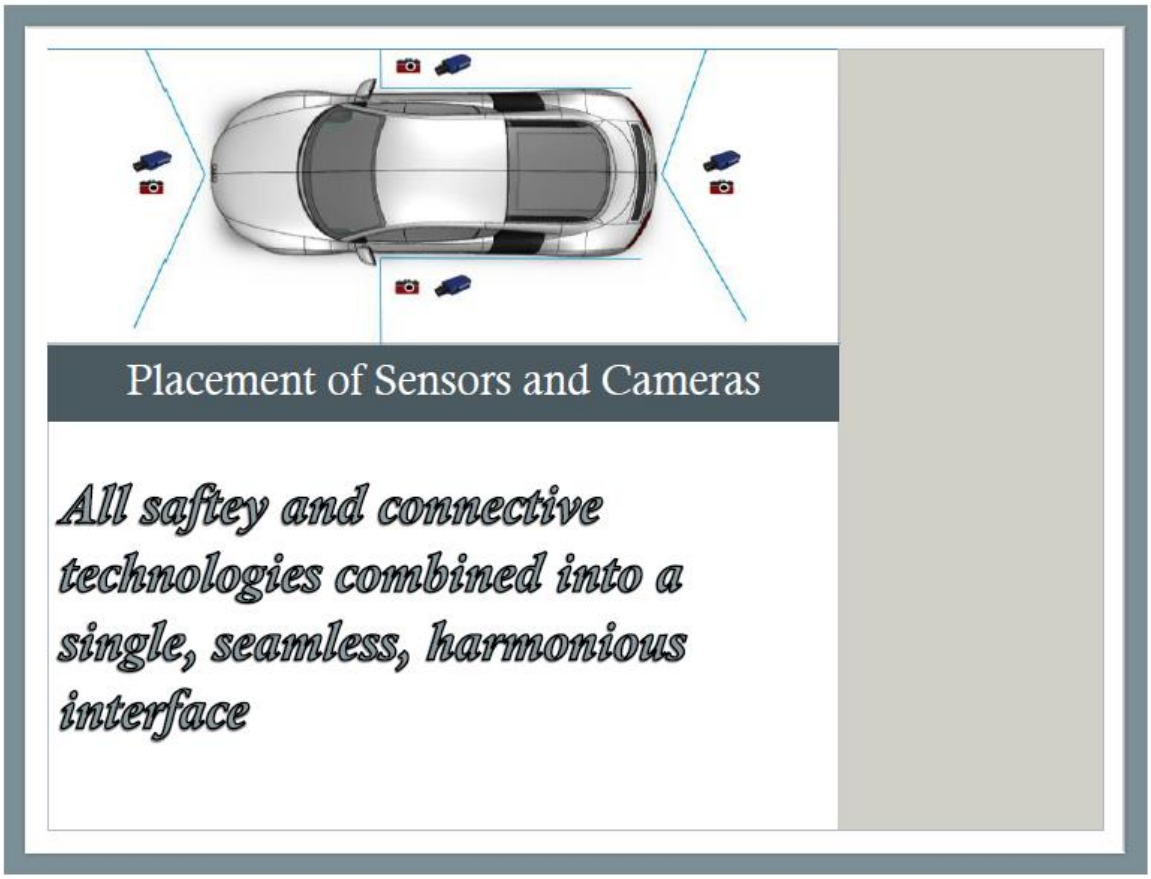






8. Attachment of the tri-fold brochure

Technologies
Thermal & Night Vision Camera Technology
Integrative Technology
GPS System
Internet & Multimedia Support
Cellular Device Connectivity
Natural Language User Interface
What can I help you with?
Technologies
Heads-Up Display
Touch User-Interface Control System
Blind Spot Technology
Rear & Side View Cameras
Steering Wheel Remote Control System
Reflex Projection Technology
DELPHI
PENNSTATE
1855
Safe & Connected
Group 5
EDSGN 100


Placement of Sensors and Cameras
All saftey and connective technologies combined into a single, seamless, harmonious interface

9. Acknowledgement

Anqi Ren

Special thanks to Dr. Xinli Wu, who guided the team and taught everything they needed to know to get the project done and helped us prepare for the presentation at the showcase. The team would also like to thank the teaching assistant Jeremy Barnhart who helped the team comp up with ideas and make improvements to the final designs.