Semi-Truck Blind Spot Detection System

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Group 32

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Project Description

Motivation

Across the United States and the world, there are thousands of accidents every year due to drivers not checking their blind spots before switching lanes or making a turn. With the technology nowadays, a lot of car manufactures have integrated blind spot detection technology in the newer vehicles. However, there isn't a fully developed blind spot detection system to help truck drivers reduce or eliminate their blind spots when they have a trailer attached to the cabin. According to a study published by the Federal Motor Carrier Safety and Administration, of all the truck accidents that occur each year, 20 000 of them happen due to blind spots or because a truck driver failed to adequately survey his or her surroundings. The goal for our Senior Design project is to create a sensor based system that will alert truck drivers on real time whether or not there is a car, pedestrian, bicycle, or any vehicle within a close proximity of their truck. With this project, our main objective will be to reduce the amount of accidents that happen every year and help save thousands of lives with our system.

Goals & Objectives

- The system will be portable allowing drivers to easily move it from one trailer to another when they load and unload their trailer at their destinations.

- The system will have low power consumption. The only components consuming power will be the microcontrollers attached to sensors and an LCD or LED display for the output of the sensors. With the technology nowadays, these devices are usually very low powered making this an easy feature to accomplish.

- Our system will have a low cost. Making it a lifesaving system is our main goal along with not making a huge profit from it should it be commercialized at some point in the future. We want all truck drivers or corporations to be able to afford it while keeping them safe as well as the surrounding drivers.

- The system must be accurate. Accuracy is extremely critical for this project considering there will be lives on the line should it fail to properly display the information. We want our system to display at all times whether or not there will be a car next to the truck's trailer with almost no margin of error.

- The system must be very easy to use. Truck drivers have very busy lives and they drive nonstop for days across the country on a daily basis. We want truck drivers to be able to use this system regardless of their technological background and with minimal effort. The system will be fully automated and just simply display the output of the sensors on the screen after being powered.

- The system must be safe and efficient. We do not want drivers to be distracted by the system by looking away from the road into the display. As a result, we would like the system to either be located within the driver's line of sight with the road so he or she does not look away from the road when trying to see the outputs of the sensors, or to simply play a sound if there is a car in any of the blind spots.

- A possible objective would be to have the system being powered using solar or wind technology. This would benefit our application by taking advantage of green technology and burning less fossil fuel.

Function

The main function of our project is to save lives. After interviewing a current truck driver, Mr. Reynold Marrero, and asking for his feedback on whether or not this would be a useful product for him, we came up to the conclusion that this would be a very practical application. During the interview, the driver stated that the line of sight when he makes a turn or switches lanes is very limited due to the huge blind spots he has if a trailer is attached to the truck. Mr. Marrero also stated that the trailers can be anywhere from 20 to 50 feet long which has a significant impact on the blind spots. His concern was that a lot of times, cars pass him at a high rate of speed and he has a hard time seeing them. In the functionality of our project a very important consideration is adaptability. Since trailers can have different sizes we want to be able to simply plug and play the sensors into the trailers regardless of the size. As a result, our best approach would be to use a wireless communication system between the sensors and the base that way we will not have to worry about the cables being too long or too short depending on the size of the trailer.

Another function of our system would be to make the driver's experience an easy one and not incorporating more stress into the lives of the drivers who work very long hours with very little sleep. If a truck driver has to be worrying about modifying his truck or spending extra resources into making the system adaptable to his truck, then this would create a negative impact on our application. We want the system to be easily adaptable, portable from one trailer to the other, easy to use, safe, and efficient. There is a similar product now in the market made by a company named "Gosher" that does a similar function. However, the system is only for the truck's cabin, and not for the trailer itself. In addition, the price is almost $400 dollars and it requires a professional installation making it even more expensive by adding about $300 - $400 more to the price of the product itself. Our goal would be to implement this system for trailers with a friendly user interface and easy adaptability.

Requirement Specifications and Constrains

Specifications:

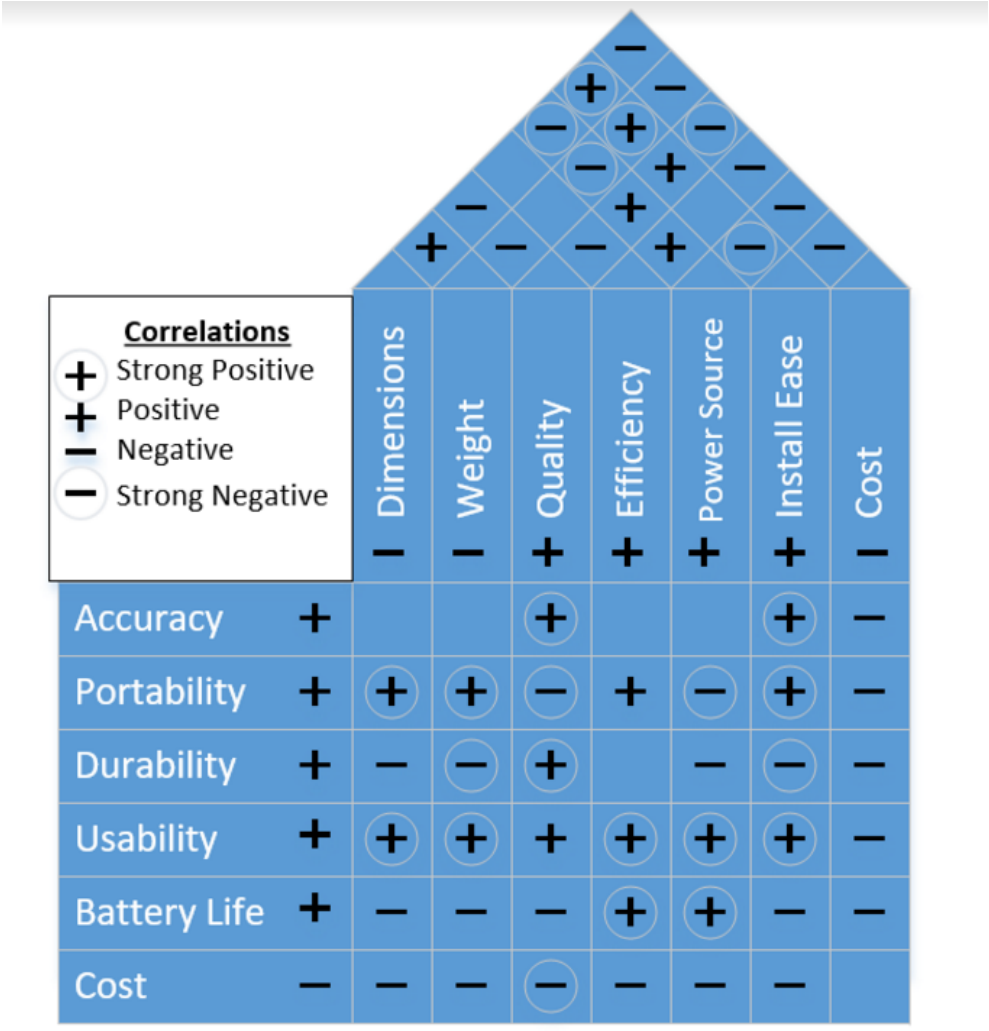
- The system shall assist lane changes by warning the driver of nearby vehicles.
- The system shall include distance detection sensors (IR/Sonar/Other) strategically placed around the vehicle and a display placed in the cabin.
- The system shall include multiple transmitters to transmit the data collected by sensors and one centralized receiver to collect this data and control the display.
- The sensors shall be battery powered, the display shall be powered from the cigarette lighter receptacle.
- All the sensors shall be connected wirelessly to the display in cabin, making the system easily switchable between vehicles.
- The sensors shall be easily installable on the vehicle.
- The sensors shall be housed in a rigid body to increase the lifespan.
- The in cabin unit shall house receiver, microcontroller, and display.
- The system shall be “plug and play” requiring no configuration or programming on the user end.

Constrains:

- The team contacted a trucker who has agreed to let them use a truck for testing. However, the team will have a limited access to this truck, making it harder to schedule the testing periods.

- The team will have to do a lot of research and trial and error to determine which sensors (Sonar/IR/Electromagnetic/other) would work the best for distance detection. Buying different kinds of sensors will increase cost of the prototype.
- A very important feature of this system is that it shall be easily mountable on the truck body. Figuring out a technique to do so using readily available materials would be a challenge.

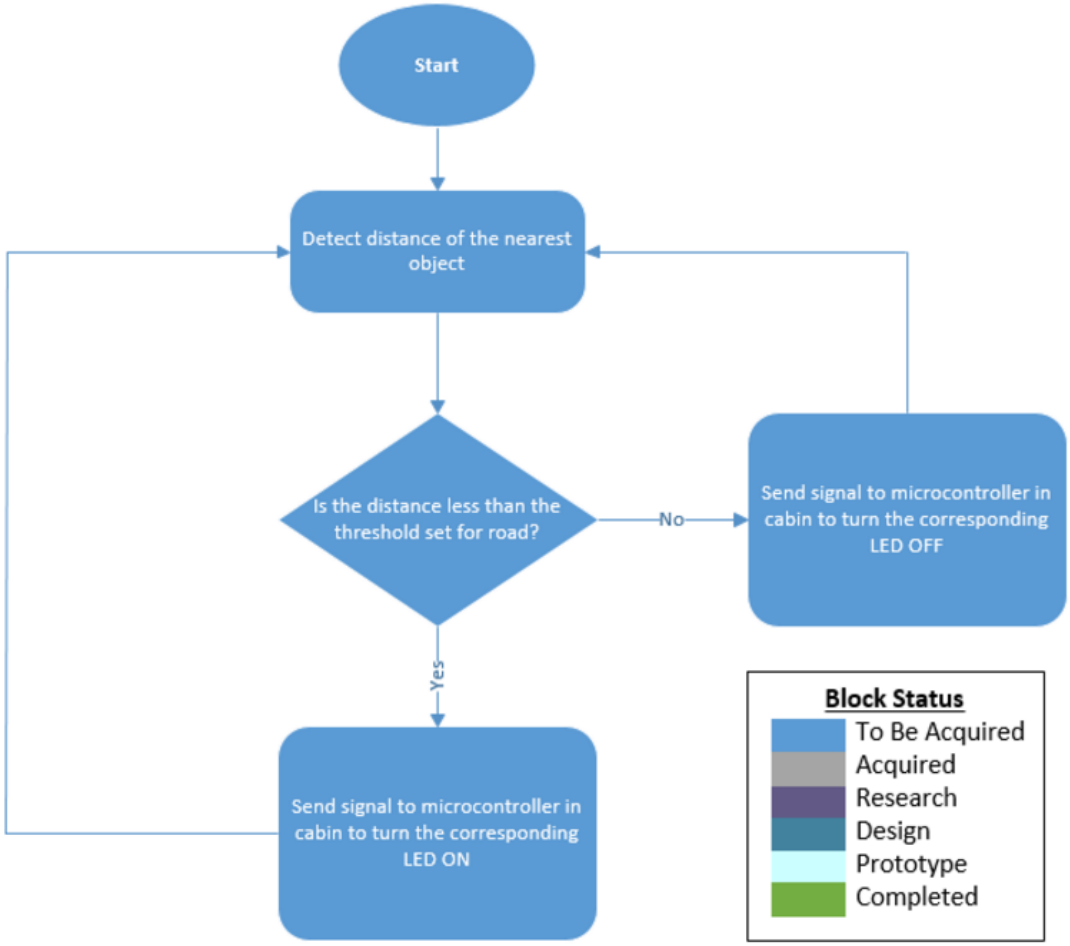
House of Quality



Block Diagrams

Hardware Block Diagram:

Software Block Diagram:



Budget & Financing

Item Description	Price / Unit	Amount	Estimated Price
Transmitter microcontrollers	$15.99	6	$95
Receiver / Base Microcontroller	$100	1	$100
LCD/LED display for the Base	$30	1	$30
Sensors	$9	6	$54
Power Supply	$15	3	$45
System Packaging	$100	1	$100
Printed Circuit Board	$30	6	$180
Wireless Transmitter	$10	6	$60
Wireless Receiver / Base	$12	1	$12

Total Cost (subject to change) = $676

**The project will be self – financed by the group members. **

Milestones

Milestone	Task	Start Date	End Date	Status	Responsibility
Senior Design 1					
	Administrative Outlook				
A	Concept Ideas & Project Selection	8/25/2016	9/6/2016	Complete	Group 32
B	Responsibility Assignments	9/6/2016	9/9/2016	Complete	Group 32
C	Initial Project Document	9/6/2016	9/9/2016	Complete	Group 32
D	Develop Table of Contents	9/6/2016	11/4/2016	In Progress	Group 32
E	Draft Document	9/6/2016	11/11/2016	In Progress	Group 32
F	Final Document	9/6/2016	12/6/2016	In Progress	Group 32
	Technical Outlook				
1	Component Research & Gathering	9/6/2016	12/6/2016	In Progress	Group 32
2	Circuit Design & Integration	10/1/2016	SD2	Researching	EE
3	User Interface Design	11/1/2016	SD2	Researching	CE
Senior Design 2					
	Administrative Outlook				
G	CDR Presentation	-	-	TBD	Group 32
H	Peer Review	-	-	TBD	Group 32
I	Conference Paper	-	-	TBD	Group 32
J	Mid-term Demo	-	-	TBD	Group 32
K	Final Presentation	-	-	TBD	Group 32
L	Web Exit Interview	-	-	TBD	Individual
	Technical Outlook				
4	User Interface Design (continued)	-	-	Researching	CE
5	PCB Layout Design	-	-	Researching	EE
6	Housing Design	-	-	Researching	CE/EE
7	Network Interfacing	-	-	Researching	CE
8	Display & Presentation Preparation	-	-	Researching	Group 32