



**DEVELOPMENT OF BLIND SPOT SYSTEM FOR PRIME  
MOVER TRUCK DRIVERS**



**BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY  
(AUTOMOTIVE) WITH HONOURS**

**2022**



**Faculty of Mechanical and Manufacturing Engineering Technology**



**DEVELOPMENT OF BLIND SPOT SYSTEM FOR PRIME MOVER  
TRUCK DRIVERS**

**MOHD DANIAL AFIQ BIN DAUD**

**Bachelor of Mechanical Engineering Technology (Automotive) with  
Honours**

**(2022)**

# **DEVELOPMENT OF BLIND SPOT SYSTEM FOR PRIME MOVER TRUCK DRIVERS**

**MOHD DANIAL AFIQ BIN DAUD**

**A thesis submitted  
in fulfillment of the requirements for the degree of  
Bachelor of Mechanical and Manufacturing Engineering Technology (Automotive)  
with Honours**



اونيورسيتي تيكنيكل مليسيا ملاك

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**Faculty of Mechanical and Manufacturing Engineering Technology**

**UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

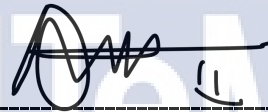
**2022**

## DECLARATION

I declare that this thesis entitled “ *Development of Blind Spot System for Prime Mover Truck Drivers*” is the result of my own research except as cited in the references. The report has not been accepted for any degree and is not concurrently submitted in the candidature of any other degree.

Signature

:



Name

:

**MOHD DANIAL AFIQ BIN DAUD**

Date

:

27/1/2022

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

## APPROVAL

I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology (Automotive) with Honours.

Signature : *Mohd Zakaria*

Supervisor Name : **Ts MOHD ZAKARIA BIN MOHAMMAD NASIR**

Date : 27/1/2022



## DEDICATION

This thesis is devoted to the glory of Allah S.W.T, my Creator, my great teacher, and messenger, Mohammed (May Allah bless and grant him peace), who taught us the meaning of life and who is the source of all knowledge. I want to convey my gratitude to everyone who participated in many ways to the success of this study and helped make it an unforgettable experience for me.

My beloved parents, Daud bin Man and Syazana Abdullah supported me throughout my career. Their unconditional love, encouragement, support, and sacrifices have sustained us through the years for giving their moral, spiritual and financial support and prayers with served as my inspiration to finish this piece of work.

In addition, I would like to dedicate this thesis to my honorable teachers, who are highly well-informed, extremely diligent, and supportive. Their encouragement and guidance help me to complete my education and thesis.

I owe a special pledge to our project leader and supervisor, Ts Mohd Zakaria Bin Mohammad Nasir, who gave me the strength to do this research work and provided me with the necessary supervision and encouragement. Thank you for always giving me guidance and persistence help to complete this project thesis.

## ABSTRACT

The number of heavy vehicle accidents in Malaysia due to this situation is troubling. This problem is due to Malaysia's growing population of road users. Furthermore, several sectors of the economy are expanding, resulting in increased demand for all industries in Malaysia. The only way to meet this high demand is to use a heavy vehicle. As a result, highways and narrow roads are often used by heavy vehicles. Due to the large size of heavy vehicles, it is also located in a large blind spot area where significant motor vehicle drivers cannot see other vehicles. However, as for larger vehicles such as lorries, trailers, and buses, the blind spot areas or zones are much larger. Accidents related to blind spot areas are based on the collision type angular/side, side swipe, and squeezed. This study was conducted to determine the prevalence of blind spot issues among Malaysia's rigid and small lorry drivers. Several types of data collection were conducted, which consisted of surveys, on-site measurements, and field experiments. This research aims to assist more experienced drivers in locating additional vehicles in their blind spots. This project also aims to create a framework that will attract users. The findings of this study can be a benchmark for future studies involving other classes of heavy vehicles. However, in terms of the location of blind spots, most drivers perceived that the rear is the blind spot area without knowing that the front and both sides of a truck are also blind spots. The Blind Spot System was developed to ensure driver safety and convenience. The Blind Spot System is comprised of a central hub and four sensor units. The ultrasonic sensor placed on the front and side body senses the obstacles and sends the Arduino MEGA to trigger the system and LED as an output blinks up. The device can identify other vehicles using ultrasound sensors and warn the driver with a buzzer and LED flickering. The sensor units will be placed strategically around the truck in areas known as blind spots or invisible areas to the driver. While the system is operational, these sensors will continuously transmit sensor data to the hub unit, located in the driver's cabin in the most convenient location. Blind spots created by vehicles or other obstructions will illuminate red, alerting the driver to the presence of something in their path. The LED indicates clear areas will remain turned off. Then the hub unit displays the sensor data's result by LCD. This document will then detail the system's hardware and software design. This paper includes a variety of schematic diagrams, block diagrams, and data flow diagrams. More precisely, the hardware design section will cover power management and printed circuit board design. Following that, the software design section will discuss the logic of the code for the system's two distinct units and how they operate. Next, this document will illustrate and explain the system's housing design and analysis of aerodynamics. Following that, the paper will be detailing the system's testing procedures. This blind-spot warning system makes it easier for the driver to be more cautious in the lane. What distinguishes Blind Spot System is its portability. The trailers that the truck driver hauls are not uniform. Rather than that, they are constantly dropping off and picking up new ones. As a result, sensors cannot be integrated directly into trailers. Blind Spot System addresses this issue by providing portable sensors that can be installed or removed in a matter of minutes, allowing the driver to quickly transfer the sensors from the old trailer to the new trailer.

## ***ABSTRAK***

Jumlah kemalangan kenderaan berat yang telah berlaku di Malaysia akibat keadaan ini membimbangkan. Masalah ini berpunca daripada bilangan pengguna jalan raya Malaysia yang semakin meningkat. Tambahan pula, beberapa sektor ekonomi sedang berkembang, menyebabkan permintaan meningkat untuk semua industri di Malaysia. Satu-satunya cara untuk memenuhi permintaan yang tinggi ini adalah dengan menggunakan kenderaan berat. Akibatnya, lebuh raya dan jalan sempit sering digunakan oleh kenderaan berat. Bagaimanapun, bagi kenderaan yang lebih besar seperti lori, treler dan bas, kawasan atau zon titik buta adalah lebih besar. Kemalangan yang berkaitan dengan kawasan titik buta adalah berdasarkan jenis perlanggaran sudut/sisi, leret sisi dan terhimpit. Kajian ini dijalankan untuk menentukan kelaziman isu titik buta dalam kalangan pemandu lori tegar dan kecil di Malaysia. Beberapa jenis pengumpulan data telah dijalankan, yang terdiri daripada tinjauan, pengukuran di tapak, dan eksperimen lapangan. Penyelidikan ini bertujuan untuk membantu pemandu yang lebih berpengalaman dalam mencari kenderaan tambahan di tempat buta mereka. Projek ini juga bertujuan untuk mencipta rangkakerja yang akan menarik pengguna. Dapatan kajian ini boleh menjadi penanda aras untuk kajian masa hadapan yang melibatkan kelas kenderaan berat yang lain. Bagaimanapun, dari segi lokasi titik buta, kebanyakan pemandu menganggap bahagian belakang adalah kawasan titik buta tanpa mengetahui bahagian hadapan dan kedua-dua belah lori juga merupakan titik buta. Sistem Titik Buta dibangunkan untuk memastikan keselamatan dan keselesaan pemandu. Sistem Titik Buta terdiri daripada hab pusat dan empat unit penerima. Penerima ultrasonik yang diletakkan di bahagian hadapan dan sisi badan mengesan halangan dan menghantar mesej kepada Arduino MEGA untuk mencetuskan sistem dan LED sebagai output berkelip ke atas. Peranti boleh mengenal pasti kenderaan lain menggunakan penerima ultrasound dan memberi amaran kepada pemandu dengan buzzer dan LED berkelip. Unit penerima akan diletakkan secara strategik di sekeliling trak di kawasan yang dikenali sebagai titik buta atau kawasan yang tidak dapat dilihat oleh pemandu. Semasa sistem beroperasi, penerima ini akan menghantar data penerima secara berterusan ke unit hab, yang terletak di dalam kabin pemandu di lokasi yang paling mudah. Bintik buta yang dicipta oleh kenderaan atau halangan lain akan menyala merah, menyedarkan pemandu tentang kehadiran sesuatu di laluan mereka. LED menunjukkan kawasan yang jelas akan kekal dimatikan. Kemudian unit hab memaparkan hasil data sensor dengan LCD. Dokumen ini kemudiannya akan memperincikan reka bentuk perkakasan dan perisian sistem. Kertas ini merangkumi pelbagai rajah skematik, rajah blok dan rajah aliran data. Lebih tepat lagi, bahagian reka bentuk perkakasan akan merangkumi pengurusan kuasa dan reka bentuk papan litar bercetak. Selepas itu, bahagian reka bentuk perisian akan membincangkan logik kod untuk dua unit sistem yang berbeza dan cara ia beroperasi. Selepas itu, kertas ini akan memperincikan prosedur ujian sistem. Sistem amaran titik buta ini memudahkan pemandu untuk lebih berhati-hati di lorong. Apa yang membezakan Sistem Blind Spot ialah mudah alihnya. Treler yang dibawa oleh pemandu lori tidak akan kekal. Sebaliknya, mereka sentiasa menghantar dan mengambil yang baru. Akibatnya, penerima tidak boleh disepadukan terus ke dalam treler. Sistem Titik Buta menangani isu ini dengan menyediakan penerima mudah alih yang boleh dipasang atau dikeluarkan dalam masa beberapa minit, membolehkan pemandu memindahkan penerima dengan cepat daripada treler lama ke treler baharu.



## ACKNOWLEDGEMENTS

In the Name of Allah, the Most Gracious, the Most Merciful

First and foremost, I would like to thank and praise Allah the Almighty, my Creator, my Sustainer, for everything I received since the beginning of my life. Without the health, strength, and perseverance He gave, I would not complete this project thesis. I have made efforts in this project and spent the time wisely to complete this thesis. I want to extend my appreciation to Universiti Teknikal Malaysia Melaka (UTeM) for providing the research platform. Thank you also to the Malaysian Ministry of Higher Education (MOHE) for the financial assistance.

First, I want to express my heartfelt gratitude to my supervisor, Ts Mohd Zakaria Bin Mohammad Nasir, for his patience and unwavering support throughout my project. He gave me sound advice, constant supervision, and project thesis information. Without his guidance and persistence help, this project would not succeed. He introduced me to this project, providing a brilliant idea and perspective on the project. He also offers me the opportunity to work with him on a project requiring study and research. He shared his knowledge with all his attention by devoting his valuable time to this project thesis.

Furthermore, I want to express my gratitude to my adoring parents and families for motivating me to persevere through all the complex tasks and provide support and positivity throughout this project. I am also indebted to those who gave me the necessary background information and thesis ideas. To conclude, I want to express my gratitude to the individuals who helped me, directly and indirectly, develop this project thesis. Once again, I would like to thank everyone who helped me.

## TABLE OF CONTENTS

	<b>PAGE</b>
<b>DECLARATION</b>	
<b>APPROVAL</b>	
<b>DEDICATION</b>	
<b>ABSTRACT</b>	<b>i</b>
<b>ABSTRAK</b>	<b>ii</b>
<b>ACKNOWLEDGEMENTS</b>	<b>iii</b>
<b>TABLE OF CONTENTS</b>	<b>iv</b>
<b>LIST OF TABLES</b>	<b>vii</b>
<b>LIST OF FIGURES</b>	<b>viii</b>
<b>LIST OF SYMBOLS AND ABBREVIATIONS</b>	<b>xiii</b>
<b>LIST OF APPENDICES</b>	<b>xiv</b>
<b>CHAPTER 1 INTRODUCTION</b>	<b>1</b>
1.1 Background	1
1.2 Problem Statement	3
1.3 Research Objective	4
1.4 Scope of Research	4
<b>CHAPTER 2 LITERATURE REVIEW</b>	<b>5</b>
2.1 Introduction	5
2.2 Road Conditions	5
2.3 Road Accidents	8
2.3.1 Road Accidents happened in Malaysia	8
2.3.2 Accidents because of blind-spot on the trucks or heavy vehicles.	11
2.4 House of Quality	14
2.5 Fundamental Principles of Electrical Engineering	16
2.5.1 Basic Unit in Electrical Quantities	16
2.5.2 An Introduction to Electrical Circuit	17

2.5.3	Basic Circuit Laws	20
2.5.4	Series and Parallel Networks	24
2.5.5	Light-Emitting Diodes	27
2.5.6	Battery Terminology	29
2.6	Study on Sensor Device	30
2.7	Blind Spot System for Truck	31
2.7.1	Ultrasonic Sensor Principle	33
2.8	Arduino	36
2.9	Product Design Specification (PDS)	38
2.9.1	Introduction of Product Design Specification (PDS)	38
2.9.2	A Project Design Specification (PDS) Checklist	40
2.9.3	The System Boundary of PDS	42
2.9.4	Concept Selection Method	46
2.9.5	Solidworks Software	49
<b>CHAPTER 3                    METHODOLOGY</b>		<b>50</b>
3.1	Introduction	50
3.2	Microcontroller Selection	50
3.2.1	Arduino Mega 2560 Rev3	50
3.2.2	Atmega 2560	52
3.3	Solidworks Arduino Software Application	53
3.4	The component in Arduino System	53
3.4.1	Ultrasonic Sensor	53
3.4.2	Ultrasonic sensor (HC-SR04)	54
3.4.3	Buzzer	55
3.4.4	Light Emitting Diode (LED)	56
3.4.5	Dupont Connector Wires	56
3.4.6	Switch	57
3.4.7	Breadboard	58
3.4.8	Resistors	58
3.4.9	Transistors	59
3.4.10	USB Cable	60
3.4.11	LCD Display	60
3.4.12	Battery Pack	61
3.5	Project Flow Chart	62
3.6	Product Design Specification (PDS)	63
3.6.1	Customer Requirements	63
3.6.2	PDS Criteria Table	64
3.7	List of Raw Sketching and 3D Modelling	64
3.7.1	Sketching and Design 1	65
3.7.2	Sketching and Design 2	65
3.7.3	Sketching and Design 3	66
<b>CHAPTER 4</b>		<b>67</b>
4.1	Fabrication Process	67
4.2	Block Of Diagram	74
4.3	Sensor Implementation and Schematic Profile	76
4.4	Collecting the sensor's data	80
4.4.1	Peripheral Sensor Unit	81

4.4.2	Blind Spot System Cabin Hub Unit	83
4.5	Housing Fabrication	86
4.5.1	Material Types and Properties	86
4.5.2	Ultrasonic sensor housing	86
4.5.3	Aerodynamics of the Housing	87
4.5.4	Weatherproofing housing	90
4.6	Arduino Programming	90
4.6.1	Programming Setup	91
4.7	Measuring Voltage and Current Of The System	96
4.7.1	System Components Overview and Output Selection	98
4.7.2	Power Management and Distribution	100
4.8	System Testing and Demonstration	101
4.8.1	Functionality test	103
4.9	Result of Voltage and Current Flow in the system	105
4.9.1	Voltage	105
4.9.2	Current	106

**CHAPTER 5** **107**

5.1	Conclusion	107
5.2	Recommendation	108

**REFERENCES** **109**

**APPENDICES** **112**



## LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1:	Basic SI Units	16
Table 2.2	Six Most Common Multiples	17
Table 2.3:	Difference between Circuit Diagram, Battery Voltage, Total Resistance, and Current	20
Table 2.4:	List of Electromechanical	29
Table 2.5 :	The plan detail checksheet	40
Table 2.6:	Example of a Concept Screening Matrix	48
Table 2.7:	Example of a Concept Scoring Matrix	48
Table 3.1 :	Customer Requirements Checksheet	63
Table 3.2 :	PDS Criteria Table	64
Table 4.1	Peripheral Sensor Atmega2560 Pinout	76
Table 4.2	Blind Spot System Cabin Hub Pinout	78
Table 4.3	Blind Spot System for Truck Drivers Power Consumption	99

## LIST OF FIGURES

<b>FIGURE</b>	<b>TITLE</b>	<b>PAGE</b>
Figure 1.1:	Truck Blind Spot Area	2
Figure 2.1	Total Number of Truck Registered in Malaysia in 2014 and 2015	6
Figure 2.2	Number of Goods Vehicles Registered by Year	7
Figure 2.3	Road Traffic Death By Type of Road User	9
Figure 2.4:	Road Traffic Death By Type of Road User in Malaysia for the Year 2014	10
Figure 2.5:	Malaysia Road Deaths 1985-2017 & Reduction Target by MIROS	10
Figure 2.6:	Total Fatal Accidents Involving Trucks in Malaysia For the Year 2014 and 2015	11
Figure 2.7:	Fatal Accidents Involving Trucks by Time in Malaysia For the Year 2014 and 2015	12
Figure 2.8:	Fatal Accidents Involving Trucks by Collision Type in Malaysia For the Year 2014 and 2015	13
Figure 2.9:	House of Quality Specification	15
Figure 2.10:	Standard Symbols for Electrical Component	18
Figure 2.11:	Open and Closed Circuit	20
Figure 2.12:	Series Circuit	24
Figure 2.13 :	Parallel Circuit	25
Figure 2.14 :	Symbol of LED	28
Figure 2.15:	Installation Of Ultrasonic Sensors Along One Side Of The Truck	32
Figure 2.16:	Figure 2.9: Lateral Detection Condition	32
Figure 2.17:	Basic Sensor Operation Principle	34

Figure 2.18: Board of Arduino	36
Figure 2.19: Programming of Arduino on Arduino IDE	37
Figure 2.20: A spiral design model of PDS development	39
Figure 2.21: Information content of a typical product design specification. List originally developed by Pugh (1990).	43
Figure 2.22: Information Needed To Create The Product Design Specification	44
Figure 2.23 Conventional Representation of Machine Component	45
Figure 2.24 : Conventional Representation of Material	45
Figure 2.25: Drawing Utilizing Solidworks 2020 Software	46
Figure 2.26: Example of 3d Design in Solidworks	49
Figure 3.1: Arduino Mega 2560 Rev3 Development Board Microcontroller	50
Figure 3.2: Arduino Mega with 2560 Microcontroller	52
Figure 3.3: Atmega 2560	52
Figure 3.4: Sound Spectrum of Ultrasonic Sensor	53
Figure 3.5: HC-SR04 Ultrasonic Sensor	54
Figure 3.6: Working of HC-SR04 Ultrasonic Sensor	55
Figure 3.7: Piezoelectric Buzzer	55
Figure 3.8: LED used in the system	56
Figure 3.9: Jumper Wire Used in System	56
Figure 3.10: Push Button Switch	57
Figure 3.11: Breadboard	58
Figure 3.12 : Resistors	58
Figure 3.13: NPN Transistors	59
Figure 3.14: USB Cable	60

Figure 3.15: 1602 LCD	60
Figure 3.16: 2x18650 Battery Holder with DC Jack	61
Figure 3.17: Project Flow Chart	62
Figure 3.18 : Sketching And Design Sensor Case Using Solidworks	65
Figure 3.19 : Sketching And Design Sensor Case Using Solidworks	65
Figure 3.20 : Sketching And Design Arduino Case Using Solidworks	66
Figure 4.1 The Components Used to Setup a Test Bed	68
Figure 4.2 All components connection soldered in the PCB board	69
Figure 4.3 The main components install at board	69
Figure 4.4 Connection between the ultrasonic sensor and the main board	70
Figure 4.5 Connection between LED to the mainboard	70
Figure 4.6 LED soldered on jumper wire	71
Figure 4.7 Lcd shows display the indication of each sensor	71
Figure 4.8 LED light jumper wire on LCD mainboard	72
Figure 4.9 Buzzer connection on the Printed Circuit Board (PCB)	72
Figure 4.10 Fabrication process flow chart	73
Figure 4.11 Hardware Block Diagram	74
Figure 4.12 Software Block Diagram	75
Figure 4.13 Peripheral Sensor Schematic Diagram	77
Figure 4.14 Blind Spot System Cabin Hub Schematic Diagram	79
Figure 4.15 Sensor's Layout and Integration with the System	81
Figure 4.16 Software Flowchart: Peripheral Sensor Unit	82
Figure 4.17 Software Flowchart: Blind Spot System Cabin Hub Unit	83
Figure 4.18 Software Flowchart: Data Analysis System	84



Figure 4.19 Software Flowchart: Troubleshooting the System	85
Figure 4.20 Truck Blind Spot System's Peripheral Sensor Housing Concept	87
Figure 4.21 CFD Analysis on the Surface Plot with Pressure of the Peripheral Sensor	88
Figure 4.22 CFD Analysis on the Cut Plot in a Front Plane of the Peripheral Sensor	89
Figure 4.23 The CFD Analysis on the Flow Trajectories	89
Figure 4.24 The define of coding pins of components in Arduino IDE	91
Figure 4.25 The coding void setup of the ultrasonic sensor, buzzer, LCD, and LED	91
Figure 4.26 The void loop of ultrasonic sensor	92
Figure 4.27 The alert distance interval of ultrasonic sensor	93
Figure 4.28 String function on the LCD system	94
Figure 4.29 The void loop coding for the buzzer	95
Figure 4.30 The coding of the void loop of four LEDs	96
Figure 4.31 Measuring The Voltage Flow in the circuit using a Multimeter	97
Figure 4.32 Measuring the Current Flow in the circuit using a Multimeter	97
Figure 4.33 Battery holder with DC Plug	99
Figure 4.34 Peripheral Sensor Power Schematic	100
Figure 4.35 Cabin Hub Power Schematic	101
Figure 4.36 Blindspot area on the left side of the truck	101
Figure 4.37 Blindspot area on the front of the truck	102
Figure 4.38 Placement of the sensor on the front and left door side	102
Figure 4.39 Placement of the sensor on the front and right door side	103
Figure 4.40 Blind Spot System Cabin Hub component testing	103
Figure 4.41 The placement of Blind Spot System Cabin Hub on the actual truck	104

Figure 4.42 A motorcyclist in a blind spot area will trigger the buzzer to alert the driver	104
Figure 4.43 The Graph for Voltage Flow in the System	105
Figure 4.44 The Graph of Current Flow in the System	106



## LIST OF SYMBOLS AND ABBREVIATIONS

V	-	Voltage
I	-	Current
R	-	Resistance
P	-	Power
Q	-	Charge
A	-	Ammeter
G	-	Gram
LED	-	Light-Emitting Diode
USB	-	Universal Serial Bus
IDE	-	Integrated Development Environment
JKR	-	Jabatan Kerja Raya
MIROS	-	Malaysia Institute of Road Safety Research
PDS	-	Product Design Specifications
WHO	-	World Health Organization
SI	-	International System of Units
GND	-	Ground
RC	-	Remote Control
$\Omega$	-	Ohms
TX	-	Transmit
RX	-	Receive
VSS	-	Voltage Source Supply
VDD	-	Voltage Drain Drain
NPN	-	Negative Positive Negative
LCD	-	Liquid Crystal Display
DC	-	Direct Current
US	-	Ultrasonic Sensor
mAh	-	milliamperes/hour
G	-	vibration amplitude

## LIST OF APPENDICES

APPENDIX	TITLE	PAGE
APPENDIX A	Technical Data Of Pic16f877a	112
APPENDIX B	Arduino Coding	113
APPENDIX C	Arduino Uno Pin Descriptions	120
APPENDIX D	Gantt Chart	121



# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Driving has become an increasingly common activity in Malaysia. The high possibility could manifest if the motive force views the forthcoming road risks and appearance in reverse while riding on expressways. Therefore, it is essential to look both sideways and in the opposite direction before securely changing the demands. In addition, a common issue that drivers face is that the ranges are not apparent through the side and rearview mirrors, which is referred to as the truck's blind spot. Even if someone does not drive, the chances are that they are at the very least a frequent passenger in a vehicle. Therefore, despite how important travel is in Malaysian lives, it is still potentially risky. Then, I have firsthand knowledge of car accidents caused by a truck's blind spot. One of these mishaps directly involved one of the team members. As a result, I decided to use senior design to improve the roads for all users. With comfort and safety in mind, I designed the Blind Spot System for Prime Movers Truck Drivers. It consists of two parts: a hub and four sensor modules.

The sensor units will be positioned strategically around the truck in key blind spots or places not accessible to the truck driver. These sensors will continuously send sensor data to the hub unit seated in the cabin at the most suitable position for the driver while the device is turned on. The sensor data is shown on the hub unit. Blind spots with cars or other obstructions will turn red, alerting the driver to the presence of an obstacle. Clear areas will have their LEDs turned off. The system's portability is what sets Blind Spot System apart.

The trailers that a truck driver transports are not all the same. They keep dropping off and picking up new ones. Figure 1.1 shows the blind spot area in a truck.



**Figure 1.1: Truck Blind Spot Area**

As a result, sensors cannot be directly integrated into trailers. Blind Spot System solves this problem by having portable sensors that can be mounted or removed in a matter of minutes, allowing the driver to quickly switch the sensors from the old trailer to the new trailer. All of the sensors are now totally wireless, making cable management a thing of the past. The Truck Smart design process is recorded in this article. It will begin by describing the project's inspiration and objectives. It will then go over specifications and criteria such as measurements and battery life in greater depth. The analysis chapter would detail the decisions taken for each device component and why they were made. Topics such as whether the ATmega258P, Arduino Uno, and ultrasonic technologies were selected are important decisions. The paper would then go through the different constraints (economic, sustainability, etc.) and principles (IEEE, DoT) that influenced the project's design decisions. This paper will then discuss, in detail, the hardware and software architecture of the device. Various schematics, block diagrams, and data flowcharts are used. The hardware design

section will cover power control and PCB design in particular. The software architecture section would illustrate how the wireless network was implemented and the rationale of the code for the two distinct units of the device. Next, this paper would demonstrate and describe the system's housing architecture and how it protects the environment. After that, the paper would go over the research techniques used on the device in detail. Finally, the managerial section reveals how the budget was broken up and a basic production process schedule in the milestone section.

## **1.2 Problem Statement**

Automobile innovation has grown exponentially in recent years to reduce the chance of mishaps while driving a vehicle. As a result, numerous studies have been suggested regarding the user assistance system focusing on the blind spot district.

Blind spots are areas around a truck lorry that can't be seen, mostly by the driver. As a result, many street accidents occur due to the driver's inability to see other vehicles approaching the blind spot, significantly when changing lanes. To fix this problem, a device capable of detecting motors and cars inside blind spot stages must be developed to warn the driver about the situation in the blind spot ranges, ensuring the safety of road users.

In addition, motors in adjacent road lanes can also enter such blind spots, and a driver can no longer see abutting vehicles with only the vehicle's mirrors. Blind spots are specific zones that are too low to see behind regularly and ahead of cars. Besides, blind facets may appear on one side or the other in cases where side vision is impaired.

### 1.3 Research Objective

This research aims to minimize road accidents caused by trucks and lorry with the Blind Spot System for the truck drivers. Specifically, the objectives are as follows:

- a) To Design a new Blindspot System for Truck Drivers using 3D CAD Software and Arduino MEGA 2560.
- b) Develop an electronic and control system for the entire system.
- c) Perform design analysis and optimization as well as an actual test prototype.

### 1.4 Scope of Research

The scope of this research are as follows:

- a. Create an electronic circuit that can be controlled by Arduino software.
- b. Create a model of the system's circuit and prototype.
- c. To test the efficiency of the blind spot system by using ultrasound sensors and programming applied in Arduino MEGA2560 Controller.
- d. When a vehicle enters the blind spot area, display a warning by calculating the distance to the detected object and displaying data value and warning audio on the screen and speaker.
- e. To compare the result with actual test and simulation.
- f. The identified objectives are expected to appear and be presented by the project's completion result.