DEVELOPMENT OF BLIND SPOT SYSTEM FOR PRIME MOVER TRUCK DRIVERS

MOHD DANIAL AFIQ BIN DAUD

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A thesis submitted
in fulfillment of the requirements for the degree of
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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

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.

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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 unvisible 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 rangka kerja 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 penderia. Penderia 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 penderia ultrasound dan memberi amaran kepada pemandu dengan buzzer dan LED berkelip. Unit penderia 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, penderia ini akan menghantar data penderia 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, penderia tidak boleh disepadukan terus ke dalam treler. Sistem Titik Buta menangani isu ini dengan menyediakan penderia mudah alih yang boleh dipasang atau dikeluarkan dalam masa beberapa minit, membolehkan pemandu memindahkan penderia dengan cepat daripada treler lama ke treler baharu.

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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.

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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 Enviroment
JKR	-	Jabatan Kerja Raya
MIROS	-	Malaysia Institute of Road Safety Research
PDS	-	Product Design Specifications
WHO	-	World Health Organization
SI	-	International System or Units
GND	-	Ground
RC	-	Remote Control
Ω	-	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	-	milliampere/hour
G	-	vibration amplitude

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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.

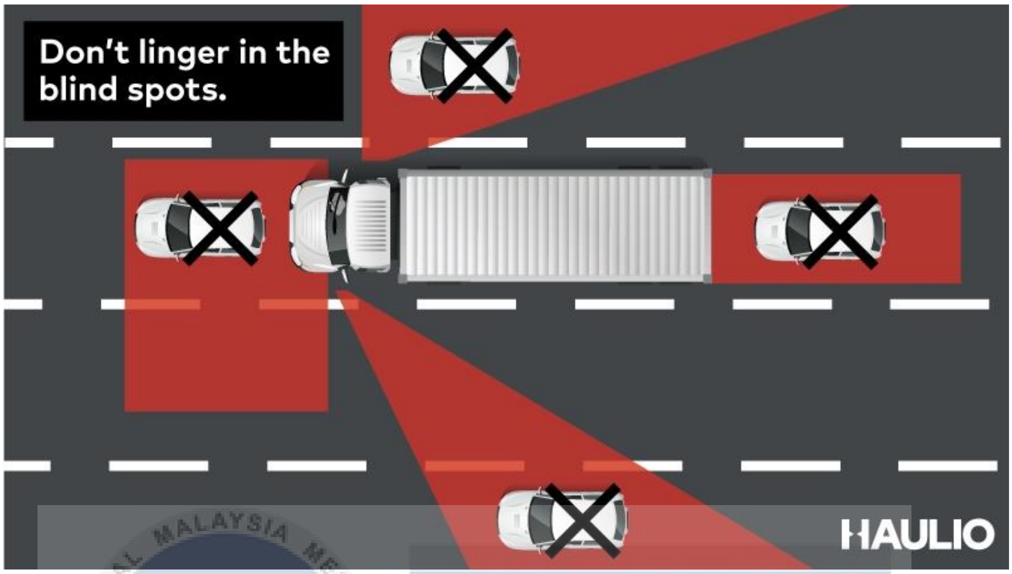

Figure 1.1: Truck Blind Spot Area

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.