UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF BLIND SPOT DETECTION SYSTEM FOR VEHICLE

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronics Engineering Technology (Industrial Electronics) with Honours.

by

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2016

DECLARATION

I hereby, declared this report entitled development of the blind spot detection for vehicle is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor in Electronic Engineering Technology (Industrial Electronic) with Honours. The member of the supervisory is as follow:

……

(Siti Halma Binti Johari)

ABSTRAK

Memandu kenderaan pada masa kini adalah sangat berisiko. Malah, jika pemandu tidak menyedari kehadiran kenderaan atau halangan di kawasan titik buta, kemalangan boleh berlaku. Objektif projek ini adalah untuk mencadangkan penyelesaian bagi meningkatkan keselamatan pemandu apabila menukar lorong di jalan raya, yang memberi tumpuan kepada kenderaan biasa. Sistem pengesan titk buta atau BSD system berdasarkan teknik mengesan wayarles adalah dicadangkan untuk memantau kawasan titik buta yang kehadiran halangan, kereta atau objek lain. Sistem BSD dipasang pada cermin sisi sebelah kiri dan cermin sisi sebelah kanan kenderaan. Pengesanan kereta di kawasan titik buta dipaparkan dengan memberi amaran kepada pemandu melalui cahaya petunjuk. Algoritma sistem BSD dicadangkan adalah berdasarkan pengiraan jarak antara objek. Sensor ultrasonik diprogramkan bagi mengesan jarak kenderaan yang akan datang, objek atau halangan untuk mengaktifkan litar amaran penunjuk cahaya tertentu. Sekiranya kawasan titik buta kenderaan dapat dikurangkan, dijangka kes-kes kemalangan juga dapat dikurangkan.

ABSTRACT

Driving a vehicle in current conditions is highly risky. In fact, if the driver is not aware of the presence of a vehicle or obstacle in his blind spot, a crash can easily occur. The objective of this project is to propose a solution to improve a driver's safety when changing lanes on the road, which focuses on the low-end vehicle. The Blind Spot Detection (BSD) system based on wireless detecting technique is proposed to monitor the blind spot area for the presence of obstacles, automobiles or other objects. The BSD systems are mounted on the left side mirror and the right side mirror of the vehicle. The detection of cars in the blind spot region is displayed by warning light indicators. The BSD system algorithm proposed here is based on a distance calculation between the object. The ultrasonic sensor is programmed at certain parameter or distance to detect upcoming vehicle, object or obstacle to activate the warning light indicator circuitry. If the blind spot region of the vehicle can be minimized, it is expected the accident cases could be reduced.

DEDICATION

Special dedication to:

To my mother, father, siblings, housemate, friends and her to always support and encourage me through my education journey.

My supervisor Miss. Siti Halma Binti Johari

Thank you for everything.

ACKNOWLEDGEMENT

In the name of Allah, the Most Beneficent and Most Merciful.

Firstly of all, all praised to Allah with the Most Kindness for giving me a chance to finish and completed this project.

Besides, I would like to express my greatest gratitude to my respected supervisor Miss. Siti Halma Binti Johari for his guidance, encouragement, invaluable support and motivation through the whole completion of this project. This project would not be succeeded without her continuous support.

Secondly, I would like to drop my sincere appreciation to thank to my family who have motivated me and support me in completing this project. Thanks for their encouragement, love and emotional supports that they had given to me.

Last but not least, I would like to express my heartiest appreciation to my friends and those whom involve directly or indirectly with this project. Thank You So Much.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

UTeM	-	Universiti Teknikal Malaysia Melaka
PSM I	-	Project Sarjana Muda I
PSM II	-	Project Sarjana Muda II
BSD	-	Blind Spot Detection
BLIS	-	The Blind Spot Information System
LED	-	Light Emitter Diode
RIO	-	Region of Interest
LBP	-	Local Binary Pattern
HoG	-	Histogram of Oriented Gradient
Haar	-	Haar-Like-Based LP Detectors
LP	-	License Plate

CHAPTER 1
INTRODUCTION

1.0 Introduction

Driving a vehicle in current situations is exceptionally unsafe on the grounds that most mishaps are identified with driver's carelessness. The high hazard can happen if the driver looks the street of approaching threat and in the meantime think back on expressways driving. It is imperative to look both sideway and backward before securely changing the lanes. An issue that frequently worried by the driver is the regions can't be seen by side view and rear mirrors, which is known as blind spot region of a vehicle [5]. Thusly, in a few accident cases, it happens because of an inability driver's to monitor the blind spot region well.

In Figure 1.1 show on the following page, the region called a blind spot is the back quarter blind spot, the region towards the back of the vehicle. Vehicles in the nearby paths of the street may classifications as blind spots and a driver once in a while can't see contiguous vehicle utilizing just the car mirrors. Then, the other area that is once in a while called blind spot is those that shorted to see behind and before a vehicle. Additionally, in situations where side view is blocked, regions to the left or right can get to be blind spot [4].

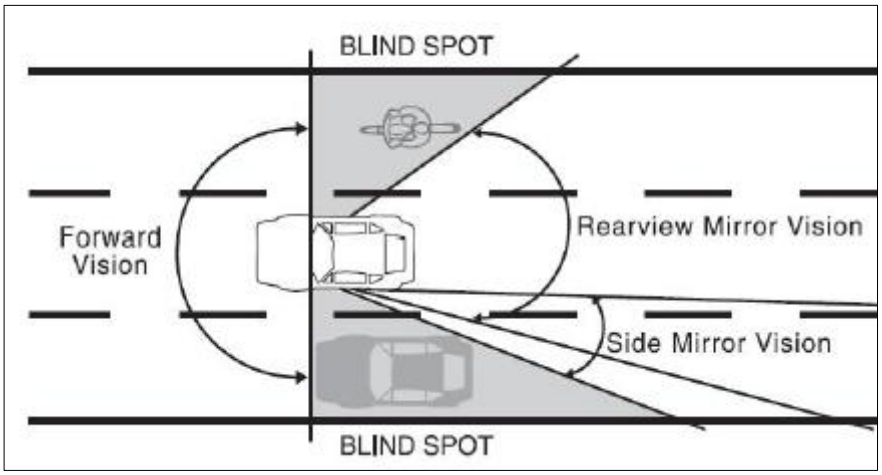

Figure 1.1: The Blind Spot Definition

1.1 Problem Statement

These days, innovation in vehicles has been quickly expanding to lessen the danger of mishap while driving vehicle. A few accident cases happens as a result of a powerlessness driver's to monitor the blind spot region and an issue that frequently worried by the driver is the area can't be seen by side view and back perspective mirrors, which is known as blind spot area as well [5]. There are numerous sorts of exploration proposed in view of the driving help framework concentrating on the blind side locale. The modern technology based on sensors like camera, laser, ultrasonic and radar are most likely applies in high-end and high-tech vehicle to monitor blind spot region.

All of the high-end and high-tech cars are most likely to have embedded system of blind-spot detection and these active blind spot detection systems are not available for low-end vehicle. This blind spot detection system in high-end vehicle is also remade act as driving assistance system for driver and implement into low-end vehicles. However, the high product price and installation cost are the some of the factor which do not attract the low end users to use BLIS system. The driving assistance of blind spot detection or monitoring system for vehicles is highly desirable to low-end vehicles to monitor blind spot region. So the research of blind spot detection system with high ratio of capability and more

affordable price for low-end vehicle is an important task to reduce collision among vehicle.

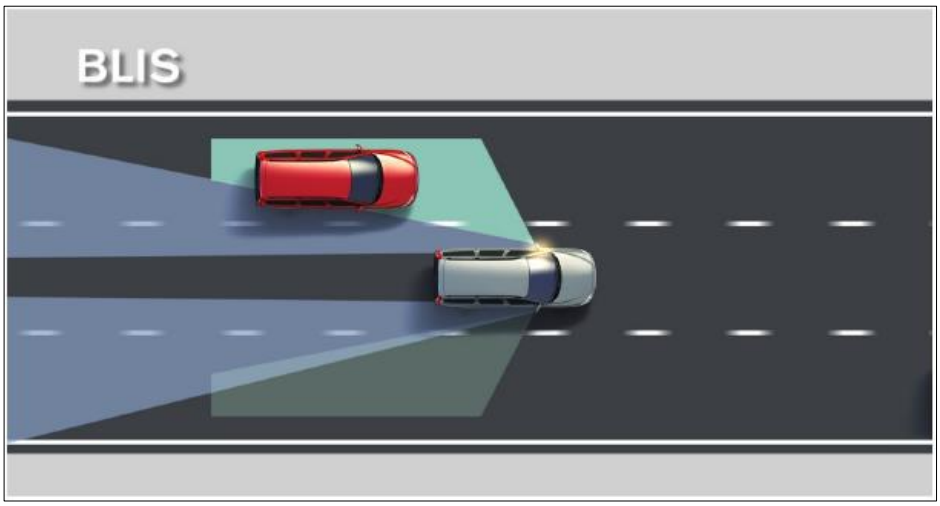

Figure 1.2: The Blind Spot Information System [7]

1.2 Project Objectives

The objectives of this project are:

1. To develop a portable and wirelessly controlled BSD system for low-end vehicle.
2. To calculate the distance for detecting object when vehicle enter the blind spot region.
3. To analyse the producing visible alert when a vehicle enter the blind spot region.

1.3 Project Scope

They a several scopes of work have been determined are as follows:

- The system will utilize ultrasonic technology.
- BSD system is appropriate to apply for car, van and a little lorry.
- A solution to improve a driver's safety when changing lanes on the road.

1.4 Thesis Outline

This project involves five chapters. Chapter 1 consists of the overview of the project that describes the project in general like little bit project background, problem statement, project objectives and scope of project. Chapter 2 contains literature review that related with this project where all the information regarding the project shown in this section. The explanation is based on gathered information from the journal, thesis, internet, reference books and relevant article. Chapter 3 contains the methodology that explains the in detail the overall project flow of blind spot detection (BSD) system including hardware and software implementation. Then, in chapter 4 the results and analysis are discussed. Finally, Chapter 5 contains the conclusion and recommendation of the project.

CHAPTER 2
LITERATURE REVIEW

2.0 Introduction

The literature review was clarifies all through the theory project to increase the knowledge and enhance skills to finish this project. The main sources for this project are the research previous thesis that related with my project, books, journals and articles that mostly provided by UTeM and UTeM library. This chapter focuses on the basic concept and fundamental theories which related to this project.

2.1 Blind Spot Detection System

As indicated by the statistics, the majority of car crashes are identified with drivers' disruption. In the event that a driver is alarmed at 0.5 seconds before being an accident, it can stay away from no less than 60% of backside crashes, 30% of head-on accidents and 50% of street slope related traffic accidents. In the event that cautioned before one second, it can avoid 90% of accidents. The statistics indicated traffic accidents can be lessened if the drivers have enough response time. In this way, blind spot detection (BSD) system, which is smart vehicle equipment, is created for such needs [1] [2].

Blind spot detection has been produced with a goal to distinguish the nearness of a vehicle or other object in the driver's blind spot. The driver's blind spot

is that divide of the vehicle in which an object won't ordinarily be seen by the utilization of the inside and outside mirrors of the vehicle [3]. The BSD system is a safety method for vehicles [2]. All the more particularly, the BSD system utilizes ultrasonic sensor, to distinguish deterrents in blind spot area on a left, right and back sides of a vehicle. If BSD system notices that a particular snag exists in a blind spot area, the BSD system effectively conveys a message of light or sound, for instance, to a driver, so that the driver can decide a driving course appropriately, to stay away from a crash because of the driver's careless or blind spot of vision [2].

Henceforth, around 75% of the mishap during lane changes is because of driver Situation Awareness disappointment [4]. Blind spot monitoring system is importance to enhance visibility and diminish the blind zone in order to execute safety driving [2].

These days, the blind spot monitoring system is applied in some type of vehicles. The present day innovation based on sensors like camera, laser, ultrasonic and radar are applied in high-end and high-tech vehicle, for example, Volvo, Ford, BMW and Audi [7]. In the interim, low-end vehicle needs driving help of blind spot monitoring system.

2.1.1 Volvo

Volvo vehicle was initially presented BLIS system that created alert system if there any vehicle enters blind spot area. After 10 years, Volvo vehicle enhances their BLIS system by utilizing radar-based indicator to monitor in blind spot region [7]. Which the LED light turns on to distinguish the nearness element vehicle. From Figure 2.1, the example of execution of blind spot monitoring system. The Volvo vehicle uses in light of radar detecting that notifies the driver about vehicles in the blind spots on both sides of the car. It is likewise distinguished and alarms the driver to quickly drawing nearer vehicles up to 70 meters behind the car [4] [6].

Figure 2.1: The Blind Spot Information System (BLIS) of Volvo [6]

2.1.2 Ford

Ford vehicle additionally actualizes the same BLIS sensor that Volvo developed. As appeared in Figure 2.2, Ford vehicle places radar-based detectors close to the back of the car, however, the light that flashes to caution driver of shrouded vehicle is on the outside back perspective mirror. Audi vehicle additionally presented Audi Side Assist that will recognize cars coming up from to the extent 150 feet (45.7 meters) behind in abutting paths and blaze a light in an outer back perspective mirror [4].

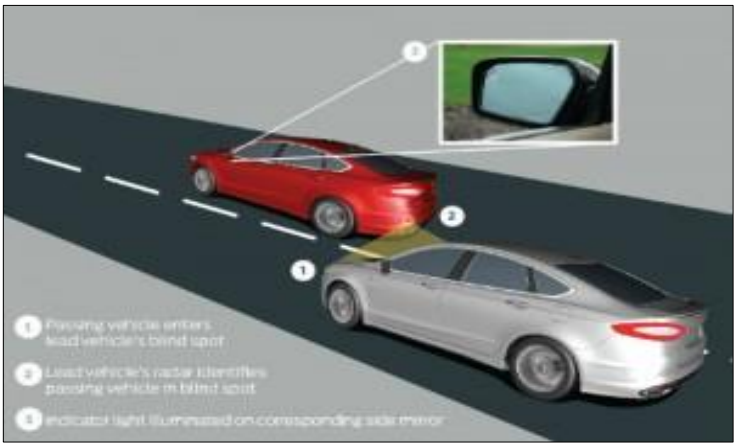

Figure 2.2: The Blind Spot Information System (BLIS) of Ford [15]

2.1.3 BMW

BMW (5series) model have the dynamic blind spot discovery to ready driver if there any up and coming potential peril in blind spot zone. From Figure 2.3, dynamic blind spot discovery arrangement of BMW (5series) model disposes of blind spots and really permits drivers to stay away from crashes while switching to another lane, actually keeping your look straight ahead. Utilizing radar detecting to distinguish substance vehicle and put at the back of the vehicle. This system cautions drivers if a vehicle is in their blind spot locale vehicle. The light show on their side-view mirror lodgings starts to streak furthermore guiding wheel vibrates [4].

Figure 2.3: The Blind Spot Information System (BLIS) of BMW (5series) [16]

2.2 The ideas of Blind Spot Detection System from Previous Project

The main reason for development thoughts of BSD system is to understand strategy utilized in previous project of blind spot monitoring system before use to this project. There are a few thoughts of creation that identified with blind spot information system:

2.2.1 Mono-Camera Based Side Vehicle Detection for Blind Spot Detection Systems [8]

In this research paper, the task concentrate as an afterthought vehicle discovery in the blind side region utilizing picture outlines from the cameras which are introduced as an afterthought mirrors. The classifier-based identification system is utilized as a driving help for vehicle. The classifier-based vehicle identification utilizes highlight vectors, for example, Haar, LBP or HoG. In that plan, the classifier figures out if a picture area is a vehicle or a non-vehicle taking into account the component vector. The venture utilizes the classifier-based discovery to recognize a vehicle in the blind side locale. The figure 2.4 beneath, demonstrate the blind side cautioning zone.

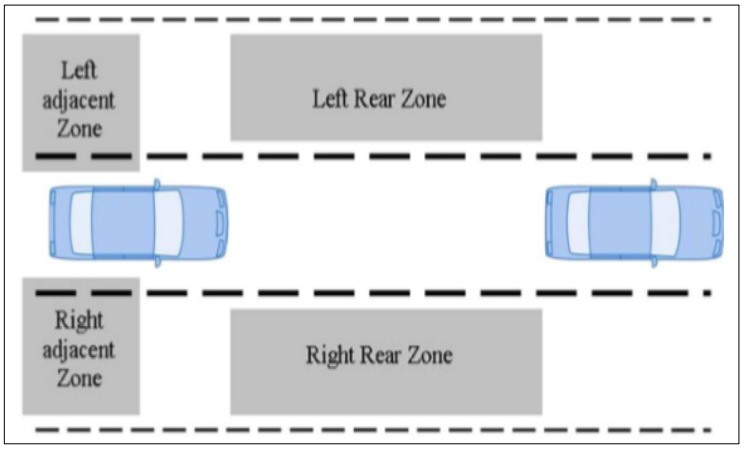

Figure 2.4: The blind spot warning zone

This paper proposes a vision-based vehicle detection algorithm for the blind spot detection system. The Figure 2.5 on the next page shows the processing flow diagram of the proposed algorithm. First, the video query process retrieves an image frame from the camera installed on side mirrors. The image frame is scaled down to one quarter of its size in order to reduce the processing time. The next step is to detect vehicles in the scaled down image. The vehicle detection is performed periodically because it consumes much processing time. For the intermediate frames, vehicle tracking is used. If configure the detection period is five, the vehicle detection process is

performed per a fifth frame, and the detected vehicles are tracked in the four intermediate frames.

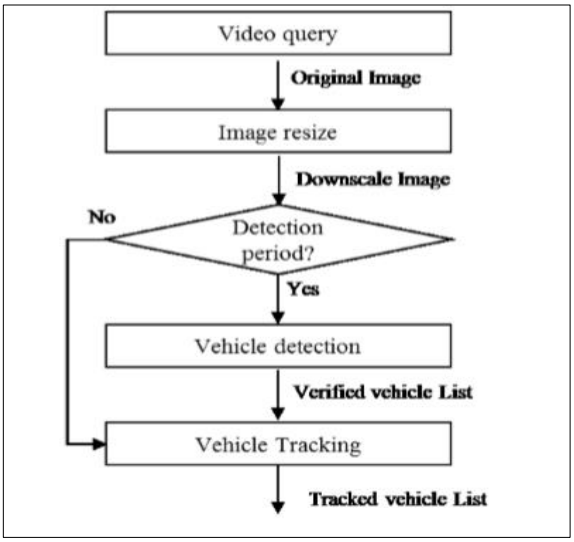

Figure 2.5: The Blind Spot Warning Zone Flowchart

The region of interest (ROI) has been set where the vehicles can exist with investigations the genuine position of vehicles in the picture outline. The Figure 2.6 beneath demonstrates the area of interest is the red rectangle in the picture. The sky territory has been removed, the neighboring base street surface, and the back zone of the subject vehicle in the picture. The proposed calculation recognizes the vehicle with multi-scale in the locale of interest picture. The course classifier is utilized to distinguish vehicles in the picture.

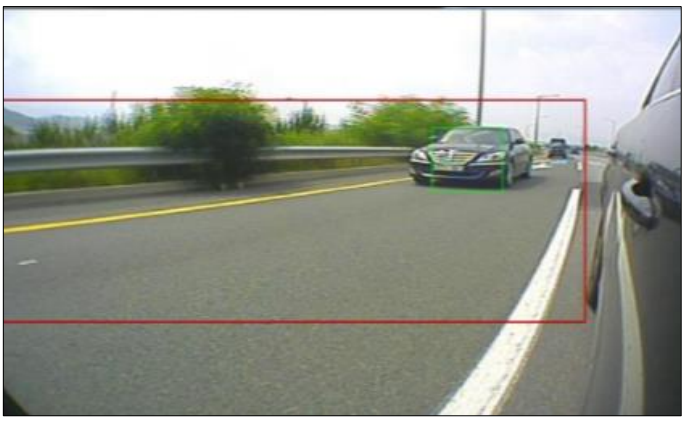

Figure 2.6: The Blind Spot Warning Zone Result [8]

2.2.2 Robust Vehicle Detection and Tracking Method for Blind Spot Detection System by using Vision Sensors [9]

In this research paper, the project used the vision sensor method for blind spot detection system. This is because to detect the present of vehicles from side and rear for this system. The vision sensor method using the symmetry and shadows gave a judgment for the target vehicles such as the extracted edge of the object and horizontal line segments, and then the candidates of vehicle were judged. The position of the vehicle was defined with its outer size by using the symmetry of the image histogram.

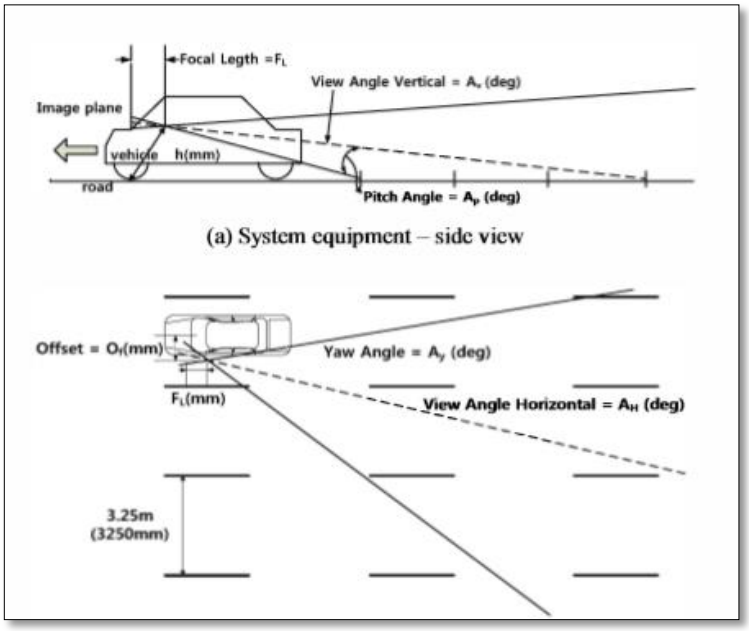

Figure 2.7: System Equipment by Top View [9]