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EFFECTS OF ONCOMING VEHICLE SIZE ON OVERTAKING JUDGMENTS FROM DRIVER AUTOMOBILE

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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BACHELOR OF MECHANICAL ENGINEERING TECHNOLOGY (AUTOMOTIVE TECHNOLOGY) WITH HONOURS

2022

Faculty of Mechanical and Manufacturing Engineering Technology

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MOHAMMAD ISKANDAR BIN NORDIN

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

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Faculty of Mechanical and Manufacturing Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

DECLARATION

I declare that this Choose an item. entitled “Effects of Oncoming Vehicle Size On Overtaking Judgments From Diver Automobile” is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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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 Technology) with Honours.

Signature :

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Date : 27/01/2022

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DEDICATION

I am dedicating this thesis to my beloved parent, Mr. Nodin Bin Mohd Sapi and Mrs. Habsah Binti Abdual Kadir who has always played a supportive role and consistently offers moral, spritual and financial support throughout my life. Thank you for inspiring me, and provide me with energy when i am in my distress.

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ABSTRACT

Nowadays, accident always occurs although technology gets advanced years by years. One of the reasons accidents happen is that vehicles had no time to avoid front vehicles or obstacles. To reduce the accident, we will have to understand how the car had to avoid obstacles in real-time. Consequently, we hypothesized that drivers would rely on perceived distance and velocity and that their overtaking judgments would be influenced by oncoming vehicle size. This experiment will use an Arduino Uno, GPS sensor and MPU6050 (three-axis accelerometer and a three-axis gyroscope) to record vehicle dynamics when is avoiding two obstacles with different distance

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ABSTRAK

Kini kemalangan selalu berlaku walaupun teknologi semakin maju dari tahun ke tahun. Salah satu sebab selalu berlaku kemalangan adalah kenderaan tidak mempunyai masa untuk mengelakkan kenderaan depan atau halangan. Untuk mengurangkan kemalangan kita perlu memahami bagaimana kenderaan harus mengelakkan halangan dalam masa nyata. Oleh itu, kami membuat hipotesis bahawa pemandu akan bergantung pada jarak dan kecepatan yang dirasakan, dan bahawa penilaian penyeberangan mereka akan dipengaruhi oleh saiz kenderaan yang akan datang. ini akan menggunakan Arduino Uno, sensor GPS dan MPU6050 (pecutan tiga paksi dan giroskop tiga paksi) untuk merekodkan dinamik kenderaan apabila mengelak dua halangan dengan jarak yang berbeza.

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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. I would like to extend my appreciation to the Universiti Teknikal Malaysia Melaka (UTeM) for providing the research platform.

My utmost appreciation goes to my main supervisor, Dr. Nur Hazwani Binti Mokhtar, Universiti Teknikal Malaysia Melaka (UTeM) for all his support, advice and inspiration. His constant patience for guiding and providing priceless insights will forever be remembered.

Last but not least, from the bottom of my heart a gratitude to my beloved parents who has been here to inspire, motivate and offer their endless support during this ongoing project report. I would also like to thank my beloved brothers and sister for their guidance, love and prayers. Finally, thank you to my colleagues who shared a lot of technological information and inspire me to try gather more information on this project report

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LIST OF SYMBOLS AND ABBREVIATIONS

MIROS	-	The Malaysia Institute of RoadSafety Reseacrh
App	-	APPLICATION
MATLAB	-	MATRIC LABORATORY
WHO	-	World Health Organization
OBD-II	-	On-Board Diagnostic 2
DRF	-	Driver's Risk Field
SDLP	-	Standrad leteral Position
THW	-	Time headway

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CHAPTER 1

INTRODUCTION

1.1 Background

Year after year, technology has become more advanced. Since the invention of the automobile, research has been ongoing in vehicle safety systems. The automobile was a common transport choice for a family because it is comfortable and protects against rain and sunlight. The rate of Automobile accidents was increasing every year because of so many people using cars, 13.288.797 registered as primary cars in 2017 (Lee, 2017). Collision Mitigation Braking System, Lane Keeping Assist System, and Adaptive Cruise Control System are examples of technology that can be used to keep a vehicle in its lane or control its speed in a variety of situations. However, the number of traffic accidents in 2010 rose from 414,421 to 567,516 in 2019 (MIROS). In the meantime, road deaths were somewhat reduced from 7152 in 2016 to 6167 in 2019 (MIROS). To increase vehicle safety systems, we need to understand the causes and take appropriate measures to help reduce the accident.

Few studies can indicate that human error is the main cause of a car accident. Human error, such as speeding, aggressive/reckless driving, distracted driving, and drunk driving, are key causes of accidents, putting the driver and others in danger resulting in fatalities. Speeding reduces time to response. However, according to the General Director of the Department of Road Transport, 40% of the traffic accidents in Malaysia are caused by too close follow-up, 26% risky cornering, 13% unsafe overtaking, and 12% speed. Distracted driving, such as diving by the telephone, eating, talking to other passengers, and listening to

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music that is likely to fall asleep. The Malaysian Institute of Road Safety Research (MIROS) statistic shows that more than 43% of Malaysian drivers use phones while driving.

Road restrictions, including no smooth road or direct road, might create accidents when driving on the road as sharp turns or edges. Studies focused on an investigation of road traffic accidents from 2000 to 2010 suggest that mortality resulting from road faults is 48.6 percent after lack of street lighting. Where dropping and potholes on the route shoulder contribute 15.4% and 11.2% of road deaths (YUSRIA, REHAN, SULAIMAN,2017). This is the key reason for developing a vehicle system that aids drivers in various fields to make their driving experience more pleasant and safe.

1.2 Problem Statement

Automobile faced a high risk of injury, in the worst-case scenario, resulting in death if involved in a road accident. Accidents always happen through technology that advances year by years. According to Road Transport Department, Malaysia, from 2007 to 2016, the number of fatality cases involving automobiles was the highest (68.2%) as compared to other categories. One of a cause of the accident is avoidance from the front collision. This way we had to create scenarios of automobile avoid from the front collision when straight line in real-time to understand the dynamic vehicle.

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Nowadays many automobiles are on the road, causing damage to the roads and insufficient road maintenance. If you don't see potholes and broken roads, you're more likely to lose control of your vehicle when driving. Aside from it, human error, such as bias or fear when overtaking a vehicle, is one of the causes of an accident that results in death.

1.3 Research Objective

The main objective of this research is to propose reasonably accurate, methodical, and effective methods of automobile accident avoidance. Specifically, the objectives are as follows:

a) To develop a set of automobile crash avoidance test procedure and establishing the relevant objective response criteria to measure crash avoidance capacity.

b) To simulate an accident scenario for the evaluation of automobile accident avoidance capabilities using an Arduino devise.

1.4 Scope of Research

The scope of this research are as follows:

a) Start with the benchmarking test of automobile accident avoidance.

b) Benchmarking test undergoes analysis using Sensor Lab application in Android device.

c) Finally, interpret the results from Arduino with GPS sensor, Gyroscope sensor and Accelerometer sensor.

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CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

A literature review is a body of text aimed at reviewing the critical points of current knowledge or approaches to a particular topic. A literature review, which is most often associated with academic literature like these, usually comes before a research proposal and results from section. Its primary goal is to provide the reader with up-to-date information on a topic, laying the groundwork for a secondary goal, such as future research in the field. A well-structured literature review of current and relevant references with a consistent, appropriate referencing style, proper terminology, and an unbiased and comprehensive view of previous research on the topic is characterized by a logical flow of ideas.

The report that we want to produce needs to take into account a few factors until this project is implemented. To obtain quality project results, we must study car dynamic behavior when there are obstacles at the front and how the dynamic data vehicle collects, and so on. This reason is what we need to achieve and take into account the result we get. All this ensures that there will be no problems when the project is finished or even presented.

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2.1 Accident Statistic

In Malaysia, road accidents are one of the most common causes of death. According to the Department of Statistics Malaysia, a 3.7% of death in Malaysia in 2018 was caused by transport accidents and increased by 0.1% by 2019. According to the study carried by (Lazim Abdullah & Nurnadiah Zamri, 2010), by using Correlation Analysis and Fuzzy

TOPSIS method, he found out that road accidents caused the most deaths and injuries. The rise in road accidents is attributed to the country's rapid population expansion, economic expansion, industrialization, and motorization.

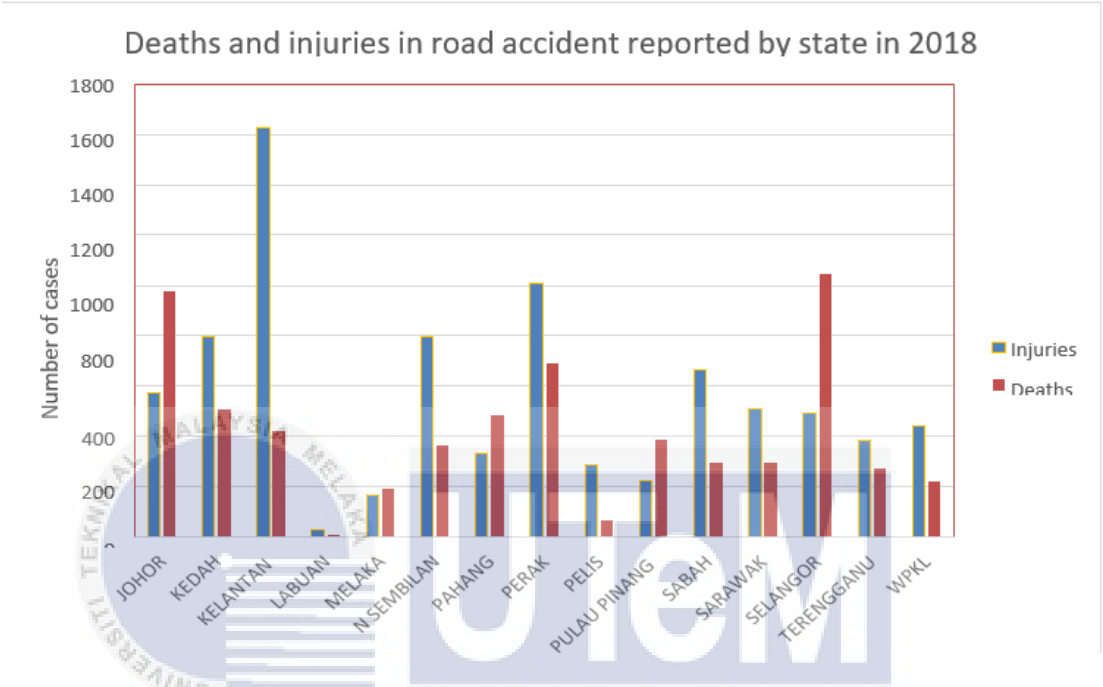

Figure 2.1 Deaths And Injuries In Road Accident Reported By State In 2018

According to figure 2.1, Selangor is the leading of death cases compared to other states. They were followed by Johor at 977 deaths cases, Perak with 693 cases, and Kedah with 509 cases. Meanwhile, Kelantan is leading of injuries cases compare to other states. They were followed by Perak at 1006 cases, Kedah with 797 cases, and N Sembilan with 796 cases. Labuan and Perlis are the smallest deaths cases that are 12 and 64, and the smallest injuries cases 31 and 289 cases. The total recorded Deaths and injuries in road accidents in 2018 are 8341 cases and 6284 cases. According to (World Health Organization (WHO), 2015)(2018)) says the state of Selangor are the highest accident rate while Perlis state recorded the lowest accident rate. This statement can conclude the most serious accident that happened at the country's rapid population expansion, economic expansion, industrialization, and motorization.

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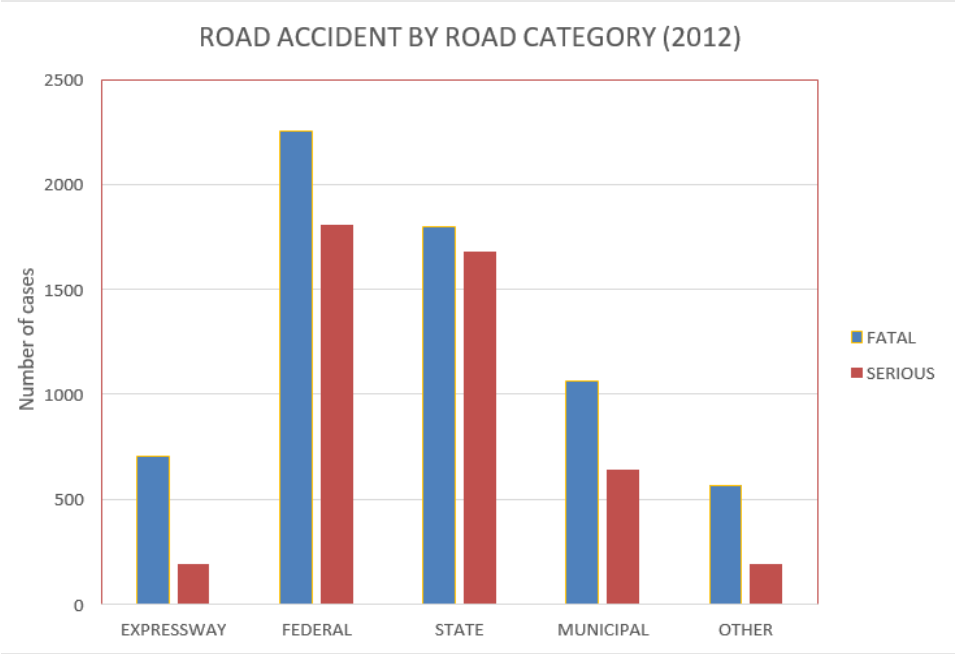

Figure 2.2 Road Accident By Road Category In 2012

From figure 2.2, the federal road is lending for both fatal and serious road accidents compared to other roads. Followed by state road with 1797 fatal cases and 1679 serious cases, municipal road with 1063 fatal and 640 serious cases, expressway road with 704 fatal cases and 109 serious cases, and other roads with 565 fatal cases and 191 cases.

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2.2 Moving Obstacle Avoidance For Large, High-Speed Autonomous Ground Vehicles

The researchers' goal in this study is hard constraints to avoid moving obstacles using nonlinear model predictive control in a single-level architecture, where path planning and tracking are combined into a single optimization problem for navigating a large, high-speed autonomous ground vehicle in an unstructured environment. Researchers controlled a sports vehicle to drive autonomously at high speeds along with a mountain road addition the controller develops active steering algorithms to assist drivers in avoiding obstacles.