



# **UNIVERSITI TEKNIKAL MALAYSIA MELAKA**

## **INVESTIGATION AND ANALYSE OF COOLING SYSTEM FOR MOTORCYCLE HELMET**

This report is submitted in accordance with the requirement of the UniversitiTeknikal  
Malaysia Melaka (UTeM) for the Bachelor of Mechanical Engineering Technology  
(Automotive) with Honours.

by

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**2018**

**BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA**

Tajuk: **Investigation and Analyse of Cooling System for Motorcycle Helmet**

Sesi Pengajian: 2019

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## APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours. The member of the supervisory is as follow:

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## ABSTRAK

Di zaman yang serba moden ini, kepanasan global merupakan salah satu masalah dimana boleh menyebabkan kesan yang serius terhadap manusia. Ianya berlaku akibat daripada perbuatan manusia sendiri dimana keadaan alam flora dan fauna terjejas akibat pembangunan di zaman moden ini. Kepanasan global boleh memberikan kesan kesihatan kepada manusia, diantaranya ialah stroke haba, badan akan menjadi cepat penat, dan juga boleh menjejaskan prestasi kerja atau aktiviti yang dilakukan oleh manusia. Projek ini adalah untuk menjalankan pengujian terhadap topi keledar yang telah diubah suai dengan menggunakan paraffin wax sebagai ejen penyejuk. Eksperimen ini dijalankan menggunakan beberapa kaedah, dimana analisis telah dibuat semasa pemanduan dijalankan dan pastinya topi keledar ini selamat digunakan. Selain melakukan analisis semasa pemanduan, topi keledar ini juga telah di bandingkan dengan topi keledar yang berada di pasaran. Hasil daripada analisis adalah, topi keledar paraffin wax mempunyai suhu yang rendah berbanding dengan topi keledar yang biasa. Selain itu, analisis juga dilakukan dengan menangkap gambar suhu diantara kedua-dua topi keledar. Hasil menunjukkan topi keledar yang mempunyai paraffin wax menghasilkan suhu yang lebih rendah berbanding topi keledar biasa di bahagian dalam. Ini menunjukkan paraffin wax boleh merendahkan suhu kepala manusia berbanding dengan topi keledar yang biasa.

## ABSTRACT

In the modern years, global warming is the problem that can effects a serious human healthy. This global warming happens because of human being itself destruct flora and fauna for a better future, but they didn't know that temperature of global warming increase by each day. Global warming can affect our body which is heat stroke; human will get fatigue, and effect daily jobs and others activities. This project is to investigate and analysis about the helmet that upgraded with cooling agent which is paraffin wax. This experiments using two methods which is this experiment is doing while riding on road compared to previous experiment that only using a temperature box. After make an experiment, this helmet was compared with the regular helmet. The results from this experiment are helmet with paraffin wax is cooler than regular helmet. Besides this experiments, the other methods that used is captured the thermal image of these helmets to analyze the temperature comparison. These experiments also show that, paraffin wax helmets cooler than regular helmet in the inside of the helmets. This shows that, paraffin wax can reduces the temperature inside of the helmet compared with regular helmets.

## **DEDICATION**

To my beloved parents,

Noriah Binti Abdul Rani and Ismail Bin Daud

Thank you for all supports, sacrifices, patient and the most important your prayers.

To my honoured supervisor,

Mr Muhammed Noor Bin Hashim

Thank you for always give me a guidance and persistent help me to complete this project thesis.

To my beloved friends,

AinHidayah Zulkefli, Sallehuddin Kaus Bin Abd Aziz, Kamarul Nazreen and Vikesh

Thank you for all always helps, support and always make me laugh along this year.

## ACKNOWLEDGEMENTS

All praise belongs to Allah SWT. Without the health, strength and perseverance that He gave, I would not be able to complete this project thesis. I have taken efforts in this project and spend time wisely to complete this thesis. However, this project also not possible without the kind support and help by many individuals. In particular, I want to thank to anyone that contributed in my project thesis. They have encouraged me and gave full idea, thought, and help during this project running. First, I would like to express the deepest appreciations to my supervisor Mr Muhammed Noor Bin Hashim for his patient and endless support that teaching me all the times for my project. He gave me necessary suggestions and constant supervision as well for providing information regarding this thesis. Without his guidance and persistent help this project thesis would not complete successfully. Besides that, he introduced me to this project and he gave me an inspiration idea about the project. By spending his valuable time, he shared his knowledge with his full attentions in carrying out this project thesis. I also want to express my million thanks to my parents and friends for their support and the motivation to give me strength and supports while carrying out this project. My appreciations also to people who are directly or indirectly help me in this investigation and analyze project.



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## LIST OF SYMBOLS

<b>D, d</b>	-	Diameter
<b>F</b>	-	Force
<b>Pa</b>	-	Pascal
<b>kg/m<sup>3</sup></b>	-	Kilogram per meter cube
<b>l</b>	-	Length
<b>m</b>	-	Mass
<b>P</b>	-	Pressure
<b>Q</b>	-	Volumetric flow-rate
<b>r</b>	-	Radius
<b>V</b>	-	Velocity
<b>cm</b>	-	Centimetre
<b>J / g</b>	-	Joule per gram
<b>V</b>	-	Velocity
<b>mJ / m<sup>2</sup></b>	-	Mili Joule per meter square
<b>°C</b>	-	Degree of Celsius
<b>%</b>	-	Percentage
<b>m/s</b>	-	Meter per second
<b>K</b>	-	Kelvin

## LIST OF ABBREVIATIONS

<b>PCA</b>	Principal Component Analysis
<b>GP</b>	Grand Prix
<b>EPS</b>	Expanded Polystyrene Sheet
<b>DOT</b>	Department of Transportation
<b>UV</b>	Ultra Violet
<b>ABS</b>	Acrylonitrile–Butadiene–Styrene
<b>ASHRAE</b>	American Society of Heating, Refrigeration, and Air Conditioning Engineers
<b>EPF</b>	Expanded Polypropylene Foam
<b>HIC</b>	Head Injury Criterion
<b>SET</b>	Standard Effective Temperature
<b>PVC</b>	Polyvinyl Chloride

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

Chapter one consists of the background of the project for this dissertation. The information of the type of the helmet that being used nowadays, cooling system and the paraffin wax was presented in the background. Secondly, this section also consists of another four item which consist of the investigation and the analysis, the objective of this dissertation, scope of the work for this project and the dissertation outline.

### 1.2 Background

This project is to analyst the full face helmet that made by last year student which is using paraffin wax to cool inside the helmet and the top of the human head. Now days, global warming is the most important issues that can affect the environment, flora and fauna. The temperature has been risen day by day because of our industry to moving forward. In this situation, this project to investigate the cooling system in the full face helmet in real situation while riding on sunny day.

In this global warming, it will give uncomfortable to long or short riders in their journey until reach to their destination. This will increase the heat in the helmet and effect on human head over the long term riding under the sun. Riders will feel uncomfortably and producing extreme sweat which is disturbs the way to reach the destination.

There have many factors that will affect the temperature while driving during sunny day. There is the color of the helmet, the thickness of the sponge or material that cover the interior used to made a helmet, air ventilation of the helmet and the material that used to made a helmets body.

### **1.3 Problem Statement**

Global warming is the most problem that we had to face today. This phenomenon, will affect the heat thermal on human body, flora and fauna, and comfort ability. Thermal infertility has been proven to be a problem with bicycle helmet (Gisolfi et al., 1988) and industrial helmets (Liu et al., 1999), and he expect that it will be on motorcycle helmet too (Buyan et al., 2006; Patel and Mohan, 1993). Human head will expose on the warm air during sunny day while riding a motorcycle. The thickness of the material inside of the helmet interior will make rider head become sweating and uncomfortable while riding during sunny day with poor air ventilation in the helmet.

Warm airs that enter in the ventilation also distract the rider's focus on riding. In the helmet's interior, the temperatures can quickly rise between 37 °C and 38°C (Tan &Fok 2006). Focus and concentration is the most important while riding to make sure he or she have the safe journey and avoid any incident happen before reach to the destination. Besides that, human head is the place for the human brain. If the human head exposed to the heat, it will affect to human body like fatigue, sleepy, sweating and uncomfortable because human body controlled by the brain. Because of all the effect to human brain and body, it will expose the rider to dangerous situation which lead the driver become distract of concentration while riding.

Because of the global warming, here we test and analyst the full face helmet that made by last year student which is using paraffin wax to cool inside the helmet and the top of the human head which is to compare with the full face helmet that design by manufactured whether it can or cannot reduce the thermal on human head and inside the helmet.

#### **1.4 Objective**

After this helmet was developed by last year student, more specifically, this study has the following objectives to achieve:

1. To investigate and test on real riding a prototype of motorcycle helmet that has cooling system using paraffin wax.
2. To analysis and compare a prototype of this motorcycle helmet.

#### **1.5 Scope**

This investigation and analysis is using a helmet that had been developed by a past year student that have cooling system using paraffin wax as the cooling agent in the interior of the full face helmet.

This investigation do in real long distance riding motorcycle on sunny day, whether the paraffin wax that had been used in the full face helmet can or cannot reduces temperature inside the helmet and at the top of human head by using the thermometer.

The effectiveness of the paraffin wax will be analyzed as the cooling agent with the helmet air ventilation system. This analysis of the paraffin wax will be the best minimum temperature of the paraffin wax that reduces the temperature inside the full face helmet.

## **1.6 Dissertation Outline**

This dissertation consists of five main chapters. Chapter one is about the general introduction of global warming, comfort ability, problem statements, objective and the scope of investigation and analysis. Chapter two is about the previous study about type of motorcycle helmet, paraffin wax, and the other theory about safety when have an impact. Chapter three explaining about methodology which is how the study us going to carry out. Chapter four will explain about the result and data that have been collected to verify the objectives. And chapter five is the conclusion about this project and recommendation for improvements about this full face helmet.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Introduction

Chapter two will provide the review and the analysis from the previous research that related to the investigation and analysis. The previous journal or research is for understanding about paraffin wax, type of helmet, safety, helmet test and effect to the human brain to make the reader understand further about this project. Figure 2.1 show the k-chart flows that start from literature review analysis through methodology and result.

This review consists of the type of helmets which is there is many types of helmets that has been wear by users in this world. Besides that, this chapter is about how the helmets made. For example, personal racing helmet for Moto GP racer which is Valentino Rossi. The different between regular helmets and personal racer helmet is about ergonomic, comfort ability and more.

Lastly, this chapter is about helmet testing. There is many type of testing, which is heat test, ergonomic, thermal and impact test that had done before.

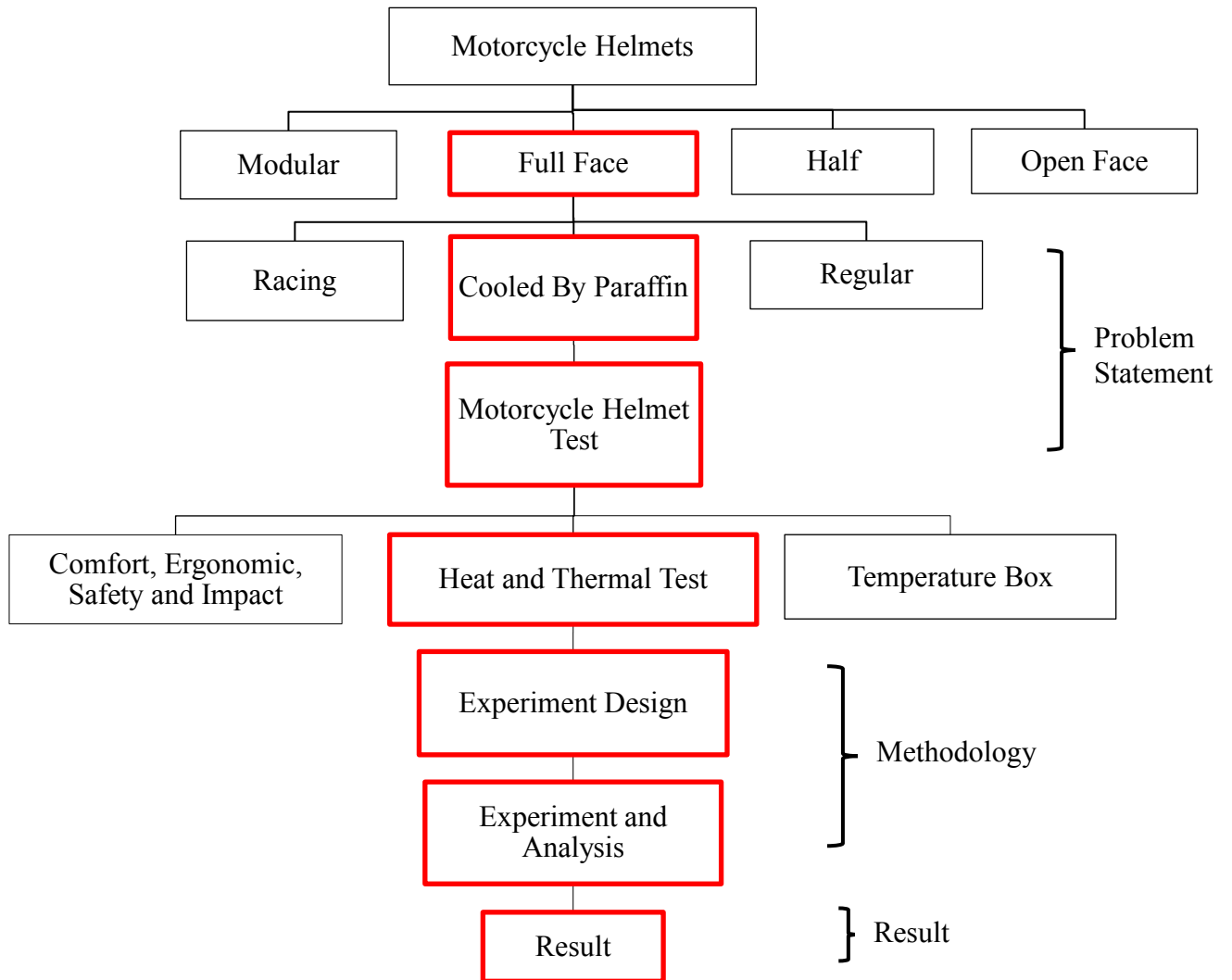


Figure 2.1: K- Chart Literature Review