



UNIVERSITI TEKNIKAL MALAYSIA MELAKA

**DEVELOPMENT OF WARNING ALERT SYSTEM FOR
MOTORCYCLIST RELATED TO FATIGUE AND
DROWSINESS USING ELECTROCARDIOGRAPHY
(ECG) SENSOR**

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

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by
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2021

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Tajuk: DEVELOPMENT OF WARNING ALERT SYSTEM FOR MOTORCYCLIST
RELATED TO FATIGUE AND DROWSINESS USING
ELECTROCARDIOGRAPHY (ECG) SENSOR

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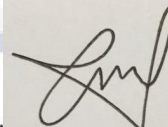
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APPROVAL

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 (Telecommunication) with Honours. The member of the supervisory is as follow:



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ABSTRAK

Projek ini adalah mengenai pembanguna sistem amaran untuk penunggang motosikal yang berkaitan dengan keletihan dan mengantuk yang dibina dengan sensor Elektrokardiografi (ECG) dan Arduino UNO. Projek ini dapat memantau aktiviti elektrik jantung penunggang motosikal. Terdapat tiga faktor sebagai penyumbang utama keletihan dan mengantuk. Faktor pertama ialah tekanan tingkah laku yang disebabkan oleh kurang tidurnya waktu. Seterusnya, faktor fizikal dan fisiologi adalah faktor sekunder yang disebabkan oleh kurang bersenam dan kebosanan. Faktor ketiga disebabkan oleh kesihatan perubatan dan neurologi yang dialami oleh penunggang motosikal. Objektif projek ini adalah untuk membangunkan sistem amaran yang berkaitan dengan keletihan dan mengantuk untuk penunggang motosikal dan juga untuk menganalisis prestasi sistem yang dirancang dari segi fungsi. Hasil dari projek ini menunjukkan bahawa jika penunggang motosikal berada dalam keadaan mengantuk, bunyi nada tinggi akan tercetus dari bel. Hasil dari projek ini akan dipantau melalui monitor bersiri dan plotter bersiri dari Arduino IDE.

ABSTRACT

This project is about a development of warning alert system for motorcyclist related to fatigue and drowsiness that is built with Electrocardiography (ECG) sensor and Arduino UNO. This project is able to monitor the heart electrical activity of a motorcyclist. There are three factors as the main contributor to fatigue and drowsiness. The first factor is the stress of behavior that results from lack of time sleep. Next, the physical and physiological factors are secondary factors caused by lack of exercise and boredom. The third factor is caused by medical and neurological health experienced by the motorcyclists. The objective of this project is to develop a warning alert system related to fatigue and drowsiness for motorcyclist and also to analyze the performance of the system designed in terms the functionality. Result from this project show that if the motorcyclist is in a drowsy state, a high pitch sound will trigger from the buzzer. The outcomes from this project will be monitored through the serial monitor and serial plotter of Arduino IDE.

DEDICATION

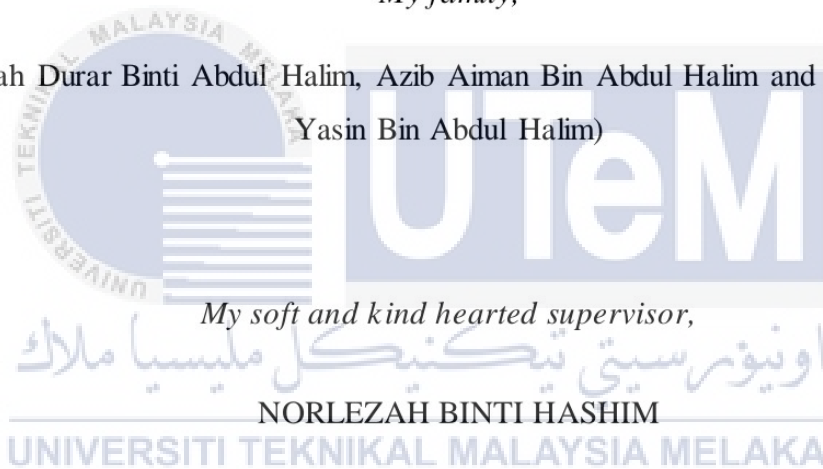
Special dedication to my beloved parents.

ABDUL HALIM BIN ASHARI

AZIMAH BINTI ABD AZIZ

My family,

(Adibah Durar Binti Abdul Halim, Azib Aiman Bin Abdul Halim and Muhammad
Yasin Bin Abdul Halim)



ACKNOWLEDGEMENTS

I am grateful to Allah SWT for giving me the strength to go through all difficulties and hardship to complete this thesis. I would like to express my gratitude to my family and my friends for the guidance and encouragement they had given me throughout the project implementation especially during this COVID-19 pandemic time. The assistance from them brings me bittersweet memories in the journey of life on which I am to embark. Besides that, I would like to express my deepest gratitude to my project supervisor, Norlezhah Binti Hashim who gives a lot of guidance, critics, advice and never gives up to support me in completing this thesis. I would also like to express my appreciation to the panel judges, lecturers, my classmates and Muhammad Harish Ilman, for guiding and helping me until this thesis is complete.

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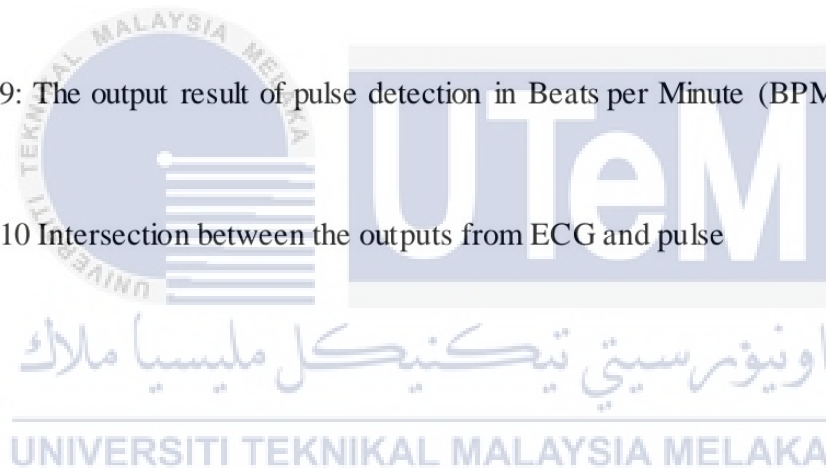
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LIST OF SYMBOLS

V	-	Voltage
GND	-	Ground
VCC	-	voltage at the common collector



LIST OF ABBREVIATIONS

Arduino IDE	Arduino Integrated Development Environment
BPM	Beats per Minute
DC	Direct Current
EAR	Eye Aspect Ratio
ECG	Electrocardiography
EEG	Electroencephalography
GND	Ground
HF	High Frequency
HRV	Heart Rate Variability
LA	Left Arm
LED	Light Emitting Diode
LH	Low Frequency
PCB	Printed Circuit Board
PPG	Photoplethysmography
PSD	Power Spectral Density
RA	Right Arm
RL	Right Leg
USB	Universal Serial Bus

CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter explains in detail the project and the implementation of the project. This first chapter will then cover the background of the project, the problem statement, the objective and the scope of the project.

1.2 Project Background

A major problem in Malaysia is motor vehicle accident, also known as road traffic accident involving cars, motorcycles and public transport. According to the Malaysian Road Safety Institute (MIROS), Malaysia's road accident rate is one of the highest as opposed to other countries in the world.

Fatigue refers to fatigue that results in a decrease in the level of sensitivity to something done. It is also a problem that many motorcycle riders often face when riders do not get enough rest before embarking on the journey. Factors that cause motorcycle fatigue include driving time, sleepiness, working hours, and driver's behavior and so on. In addition, fatigue and drowsiness are also influenced by performance, such in the workplace, road geometry, road environment and the level of complexity of the tasks that motorcyclists carry.

If the motorcyclist is present with fatigue, it can affect two interrelated situations the impact of riding and the impact of the accident. When tired, riders are more difficult to focus on riding and this is possible increase the risk of accidents.

A drowsiness monitoring system is therefore proposed to resolve this issue. It is utilized to distinguish the heartbeat pace of a motorcyclist with moment input notice of up and coming risk of falling asleep at the worst possible time. The framework should be practical and advantageous.

1.3 Problem Statement

There are three factors as the main contributor to fatigue and drowsiness. The first factor is the stress of behavior that results from lack of time sleep, work activities and so on. Physical and physiological factors are secondary factors caused by lack of exercise, boredom and so on. On the other hand, the third factor is caused by medical and neurological health experienced by the motorcyclists.

Fatigue is additionally connected with physiological changes in brain waves, eye, head, muscle and heart rate. The beginning of exhaustion lessens internal heat level, pulse, circulatory strain, respiratory rate, and adrenaline creation. A person may experience micro-sleep when exhausted. Micro-sleep refers to periods of sleep that last from a few to several seconds. It can be caused by drowsiness caused by sleep disorders like insomnia, obstructive sleep apnea or narcolepsy.

Drowsiness and fatigue is one of the components adding to the decrease sharpness to recognize and react to unexpected scene or event over a longer period, response time, memory, psychomotor coordination, data processing and decision making. Therefore, this project was undertaken to address the problems mentioned above. The

system will alert the motorcyclist from falling asleep that might lead an accident from occurring. Therefore, Figure 1.1 shown a statistic based on type of accidents and type of injuries occurred by year. Source is taken from Road Transport Department (RTD) Malaysia and also from The Ministry of Home Affairs (MOHA), and is a ministry of the Government of Malaysia.

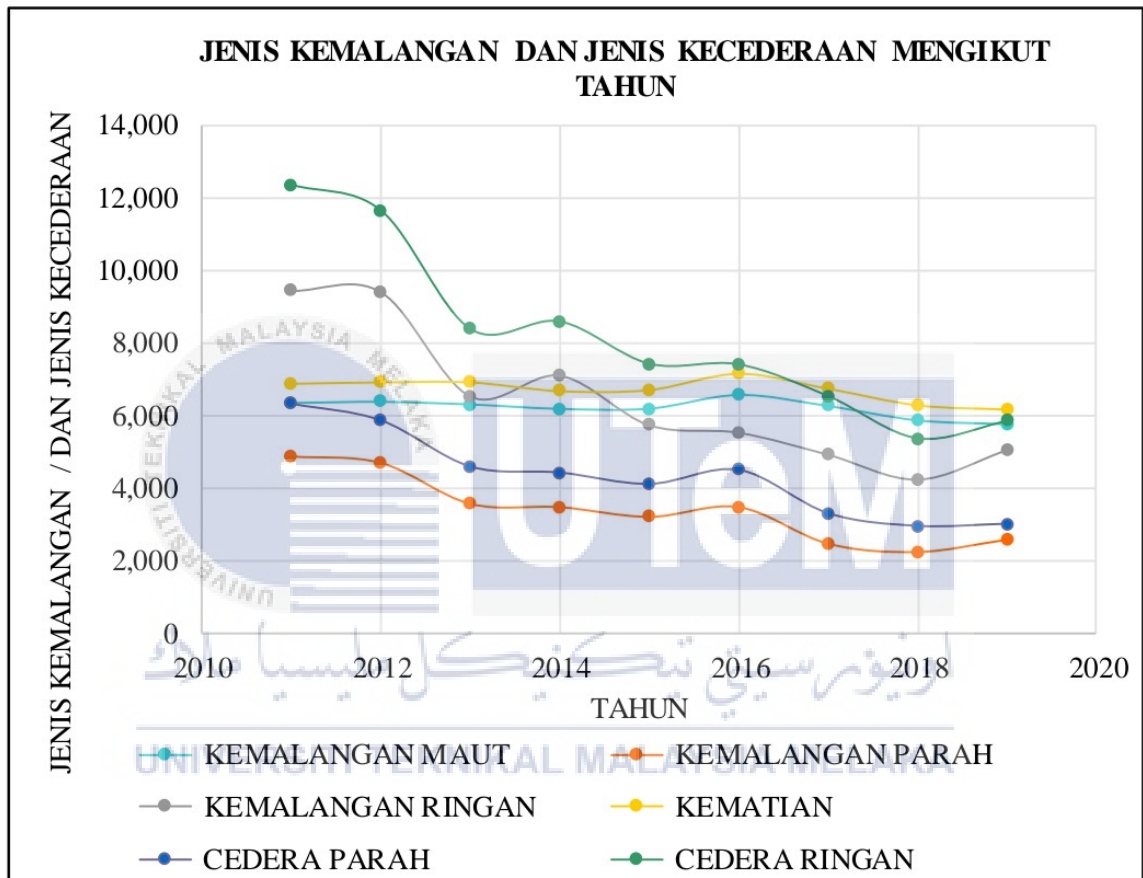


Figure 1.1: A statistic based on type of accidents and type of injuries by year

1.4 Objective

- i. To develop a drowsiness detection system for motorcyclist.
- ii. To analyze the performance of the system designed in term of its functionality.

1.5 Project Scope

Several scopes must be identified to achieve the objective of the project. The physiological and physical conditions of riders are monitored to detect drowsiness and fatigue in relation to their drowsiness level. The project scope is as follows:

- i. The heartbeat rate of the rider will be determined by the Electrocardiography (ECG) sensor.
- ii. AD8232 ECG module designed that built with the Arduino UNO Rev3 to extract, strengthen, and refine the use of very weak ECGs that have been mixed in unwanted ways.
- iii. ECG electrode lead wire connector which enables the ECG electrode press grip to be improved electrically and mechanically.

The biological data of the system will be displayed through the serial monitor and serial plotter of Arduino IDE, features are extracted and classified to detect rider drowsiness as an output of the system.

1.6 Thesis Outline

The project background, the problem statement of the project, the objectives of the project, the project scope and project outlines are introduced in Chapter 1. The aim of this chapter is to give readers a clear image and a short version of the thesis.

Next, Chapter 2 deals with the project's literature analysis. This chapter discusses and deals with previous research by other scientists. Literature review on existing techniques received and multiple technologies implemented on the previous project on the detection system of drowsiness and fatigue.

Chapter 3 describes the approach and process flow used to simulate and complete the project. In this chapter, the approaches used to simulate the detection system are explained in accordance with the necessary experimental preparation before project implementation.

Chapter 4 presents the analysis and result based on experimental setup. The outcomes acquired were to be discussed and analyzed methodically.

Finally, Chapter 5 concludes the project based on the results achieved and desired objectives. Recommendation on future works or enhancements that can be made for the project are likewise recommended in the part.