Faculty of Electrical and Electronic Engineering Technology

DROWSINESS DETECTION AND ALERTING SYSTEM FOR DRIVERS USING SINGLE BOARD COMPUTER

NORISA SHAFIKA BINTI MOHD GHANI

Bachelor of Computer Engineering Technology (Computer Systems) with Honours

2022

DROWSINESS DETECTION AND ALERTING SYSTEM FOR DRIVERS USING SINGLE BOARD COMPUTER

NORISA SHAFIKA BINTI MOHD GHANI

A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Computer Engineering Technology (Computer Systems) with Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Drowsiness Detection And Alerting System For Drivers Using Single Board Computer

Sesi Pengajian : 2022/23 Semester 1

Saya NORISA SHAFIKA BINTI MOHD GHANI mengaku membenarkan laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (✓):

☐ **SULIT*** (Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

☐ (Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

☐ **TIDAK TERHAD**

Disahkan oleh:

(TANDATANGAN PENULIS)
Alamat Tetap: LOT 3410 JALAN OH, KG OH JABI, 22020 JERTEH, TERENGGANU.

(COP DAN TANDATANGAN PENYELIA)

Tarikh: 17/02/2023

Tarikh: 20/02/2023

*CATATAN: Jika laporan ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali tempoh laporan ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I declare that this project report entitled “Drowsiness Detection And Alerting System For Drivers Using Single Board Computer” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

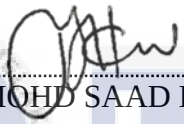
Signature : 

Student Name : NORISA SHAFIKA BINTI MOHD GHANI

Date : 17/02/2023

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Engineering Technology (Computer Systems) with Honours.

Signature : 

Supervisor Name : TS. MOHD SAAD BIN HAMID

Date : 20/02/2023

Signature :

Co-Supervisor :

Name (if any)

Date :

DEDICATION

To my beloved mother, Wan Nor Azizah Binti Wan Abdullah, and father, Mohd Ghani Bin Mohd Noor and myself.

ABSTRACT

Due to the massive growth in traffic, road accidents have become a major concern. Drowsiness of drivers during the night is the leading cause of accidents. Fatigue and drowsiness are two of the most common causes of serious accidents. The only way to solve this problem is to detect tiredness and notify the driver. The objectives of this project is to study the implementation of IOT for this project which is to Drowsiness Detection And Alerting System For Drivers Using Single Board Computer, make the system to alert the drivers by measure the drivers' drowsiness level based on the state of eyes and to analyze how much this system's accuracy and reliabilty of this proposed project. This project will be built using the Raspberry Pi 3 Model B, buzzer, web-camera and an LED. This is because drowsiness will be detected by the image acquired by the web-camera, which will send the data to the microcontroller. The microcontroller then will process the data to indicate the driver's status. This will form part of a driver drowsiness detection and alerting system for drivers. The fundamental of this system is to use web-camera to capture picture and the Haar Cascade algorithm to detect the driver's face and both eyes movements, and if the driver is feeling tired, the system will send out a warning message via a loud buzzer alert and the LED will be lighted up. The drowsiness detection warning message also will be sent to the Telegram along with the captured picture of being drowsy by the web-camera. As a result, this system have 90% accuracy to detect drowsiness of drivers since the system can detect the drowsiness in real time when the driver is wearing the glasses or not wearing them accurately as long the brightness of the image in the video is not too bright or too dark. As a conclusion, the system is successfully detect drowsiness for drivers and alerting them to wake them up so that they can avoid the accidents when driving on the road.

ABSTRAK

Oleh kerana pertumbuhan yang besar dalam trafik, kemalangan jalan raya telah menjadi kebimbangan utama. Pemandu yang mengantuk pada waktu malam adalah punca utama kemalangan berlaku. Keletihan dan mengantuk adalah dua daripada punca kemalangan serius yang paling kerap berlaku. Satu-satunya cara untuk menyelesaikannya masalah ini adalah untuk mengesan keletihan dan memberitahu pemandu. Objektif projek ini adalah untuk mengkaji pelaksanaan IOT untuk projek ini iaitu Sistem Pengesanan Dan Pemakluman Mengantuk Bagi Pemandu Yang Menggunakan Komputer Papan Tunggal, membuat sistem untuk memberi amaran kepada pemandu dengan mengukur tahap mengantuk pemandu berdasarkan keadaan mata dan menganalisis sejauh mana ketepatan dan kebolehpercayaan sistem ini terhadap projek yang dicadangkan ini. Projek ini akan dibina menggunakan Raspberry Pi 3 Model B, buzzer, kamera web dan LED. Ini kerana mengantuk akan dikesan oleh imej yang diperoleh oleh kamera web, yang akan menghantar data ke mikropengawal. Mikropengawal kemudian akan memproses data untuk menunjukkan status pemandu. Ini akan membentuk sebahagian daripada sistem pengesanan dan amaran mengantuk pemandu untuk pemandu. Asas sistem ini adalah menggunakan kamera web untuk menangkap gambar dan algoritma Haar Cascade untuk mengesan wajah pemandu dan kedua-dua pergerakan mata, dan jika pemandu berasa letih, sistem akan menghantar mesej amaran melalui amaran buzzer yang kuat dan LED akan menyala. Mesej amaran pengesanan mengantuk juga akan dihantar ke Telegram bersama-sama dengan gambar yang ditangkap mengantuk oleh kamera web. Oleh itu, sistem ini mempunyai ketepatan 90% untuk mengesan rasa mengantuk pemandu kerana sistem dapat mengesan rasa mengantuk dalam masa nyata apabila pemandu memakai cermin mata atau tidak memakainya dengan tepat selagi kecerahan imej dalam video tidak terlalu terang atau terlalu gelap. Sebagai kesimpulan, sistem ini berjaya mengesan rasa mengantuk bagi pemandu dan memberi amaran kepada mereka untuk membangunkan mereka supaya mereka dapat mengelakkan kemalangan ketika memandu di jalan raya.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Ts. Mohd Saad Bin Hamid for his precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) and Yayasan Tenaga Nasional for the financial support which enables me to accomplish the project. Not forgetting my fellow colleague, Hanis for the willingness of sharing her thoughts and ideas regarding the project since we both do involvement of detection system.

My highest appreciation goes to my parents and family members for their love and prayer during the period of my study. An honourable mention also goes to Ayu, thanks for landing hands and support to me during my hard times. And to Aziah, for all the motivation and understanding in journey to complete this project.

Finally, I would like to thank all the staffs at the FTKEE, fellow colleagues and classmates, the faculty members, as well as other individuals who are not listed here for being co-operative and helpful.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

Iot	-	Internet of Things
ICT	-	Information and Communication Technology
RMP	-	Royal Malaysian Police
$MIROS$	-	Malaysian Institure of Road Safety Research
EAR	-	Eye Aspect Ratio
MAR	-	Mouth Aspect Ratio
IPP	-	Integrated Performance Primitives
MLL	-	Machine Learning Library
GSM	-	Global System for Mobiles
GPS	-	Global Positioning System
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
EEG	-	Electroencephalogram
LAN	-	Local Area Network
$NIRM$	-	Near-Infrared Reflectance Module
BLE	-	Bluetooth Low-Energy
PPG	-	Photoplethysmography
RRV	-	Respiratory Rate Variability
$TEDD$	-	Thoracic Effort Drowsiness Detection
HOG	-	Histogram of Oriented Gradients
BCI	-	Brain-Computer Interface
T	-	Temporal lobe
F	-	Frontal lobe
P	-	Pariental lobe
$PERCLOS$	-	Percentage of Eye Closure
IR	-	Infrared
IDE	-	Integrated Development Environment
SBC	-	Single-Board Computer

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

Our civilization is greatly influenced by technology. It has become a vital part of our life because it provides us with so many advantages. Technology boosts productivity in a variety of industries, including healthcare, transportation, and entertainment. The Internet of Things is one example of technology. The demand for internet application development is extremely high these days. By combining wireless communications, sensors, and data gathering and processing techniques, the Internet of Things (IoT) is bringing about enormous evolutionary processes in information and communication technology (ICT). IoT will create new ICT aspects in practically every sector of society and business.

Based on the statistic from the official portal of Ministry Of Transport Malaysia, the methods to track the road crash and fatalities are authorized-based by Royal Malaysian Police (RMP) and a research-based by Malaysian Institure of Road Safety Research (MIROS). The Road Transport Act of 1987 forms the basis of RMP's investigation, which includes all levels of road accident data on the scene. MIROS is a research-based approach that uses two criteria which are retrospective and on-the-spot analysis to identify accident and injury factors that include human, engineering, and environmental aspects. Figure 1 depicts statistics on the number of road accidents, while Figure 2 depicts data on the number of fatalities in Malaysia. In ten years, the number of road accidents has climbed from 414,421 in 2010 to 567,516 in 2019. In terms of fatalities, the figure has reduced from 7,152 in 2016 to 6,167 in 2019.

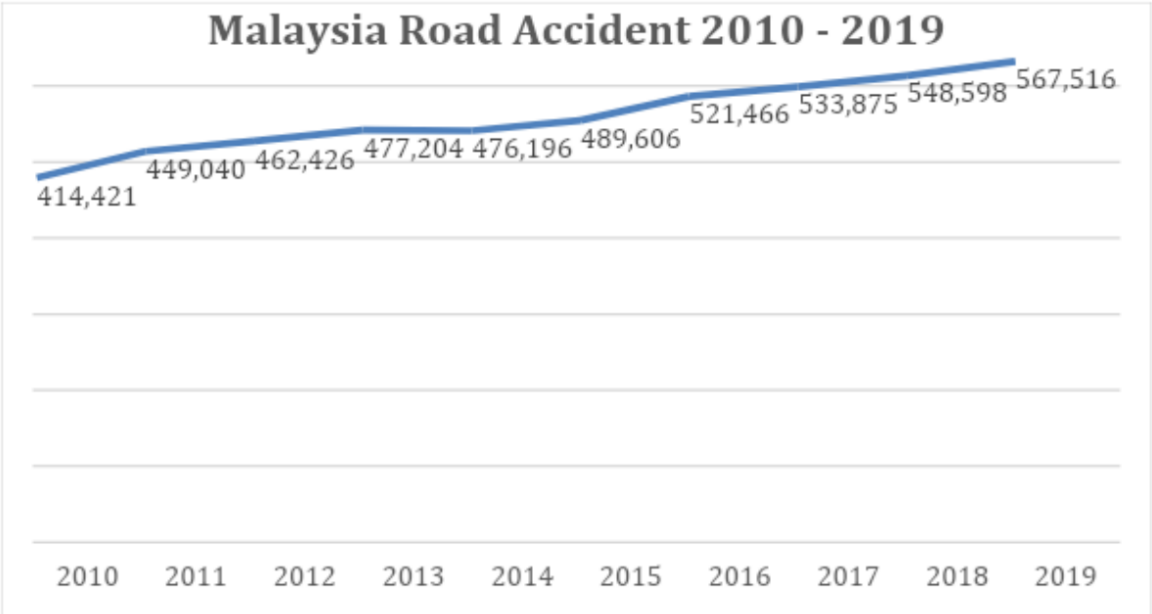


Figure 1.1 Malaysian Road Accidents Statistic (*Ministry of Transport Malaysia Official Portal Road Accidents and Fatalities in Malaysia*, 2022)

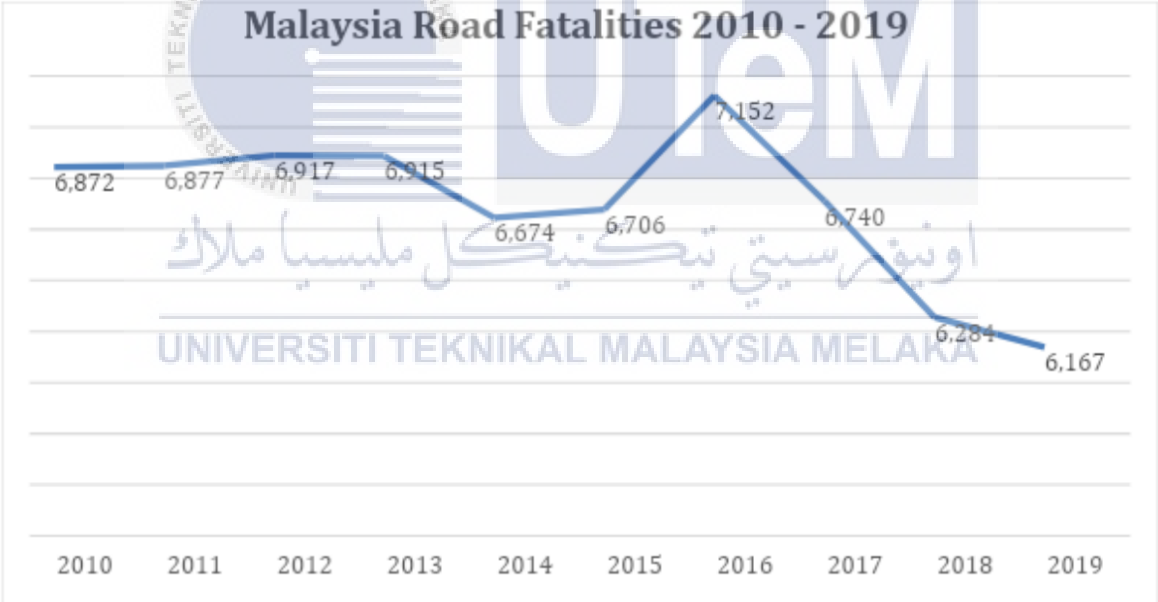


Figure 1.2 Malaysian Road Fatalities Statistic (*Ministry of Transport Malaysia Official Portal Road Accidents and Fatalities in Malaysia*, 2022)

1.1 Background

In Malaysia, there is an increase in the number of cases of traffic accidents involving cars and heavy vehicles such as buses, lorries, and trucks each year. One of the primary causes contributing to traffic accidents is drowsiness and fatigue. Driving in this

situation can have disastrous consequences because it disturbs the driver's vision and concentration. If drivers take actions such as getting adequate sleep before driving, having a coffee, or stopping for a break when weariness or drowsiness appear, they can avoid getting asleep while driving. However, even when drivers are aware that they are fatigued, they frequently refuse to take one of these actions and continue driving. As a result, identifying drowsiness is a crucial step in preventing road accidents. This study claimed that yawning and the detection of eyes are the most obvious symptoms of exhaustion and drowsiness.

1.2 Problem Statement

According to several studies, roughly 20% of all road accidents are caused by fatigue, with up to 50% on particular highways (Ramakrishna, Mohan and Kumar, 2020). The driver's eyelids will typically grow heavy because to exhaustion after lengthy hours of driving or in the absence of mental alertness. The driver's concentration begins to weaken, potentially resulting in an accident. These are the most common fatigue reactions, and they can be fatal. People who have had a long day and need to stay awake in order to finish their job. This will make it tough for them to stay focused when their brain is tired or sleepy (SCAD Institute of Technology and Institute of Electrical and Electronics Engineers, 2018). Drowsiness can be identified by monitoring the driver through a camera's continuous video stream. The overall aim is to develop a model that can detect whether or not a person is drowsy. Every second, the model captures a picture and checks for eye blinking and mouth gestures before calculating the EAR and MAR. If the blinking and yawning rate is excessive, and the eye is closed for a long period of time, the driver will be alerted by a sound.

1.3 Project Objective

At the end of this project, these three objectives are need to be achieved which are:

a) To study the implementation of IOT for Drowsiness Detection And Alerting System For Drivers Using Single Board Computer

b) To develop a system which can be used to measure the drowsiness level of a driver while driving

c) To analyze the accuracy and reliability of the proposed project

1.4 Scope of Project

The scope of the project is defined as follows to prevent any uncertainty about the project due to the following limits and constraints:

a) Identify the factor that contribute to the drowsiness and fatigue

b) Determine the level of drowsiness based on criterias (A blink of the eye, Pupil area observed at the eyes)

c) Do the drowsiness detection by using two different platforms which are laptop for windows (PyCharm IDE) and Single-Board Computer, SBC (Raspberry Pi)

d) Do the data collection and analysis for based on the research project to create a drowsiness detection system (Do experiment for 6 static images, real time for wear and not wear glasess to test the drowsiness detection system)

e) Choosing the best methods which is will be focused to Haar cascades method to be implimented in the project that suitable with the given time to finish the project in 1 year (2 semester)