UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF A DRIVER DROWSINESS ALERT SYSTEM USING OPENCV

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

by

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ABSTRAK

Projek ini adalah bertujuan untuk menghasilkan suatu alat pengesan mengantuk dan penyedaran yang dilakukan oleh pemandu kenderaan. Aktiviti mengantuk oleh pemandu kenderaan dikesan melalui pemprosesan imej yang dijalankan oleh 'OpenCV'. Pemprosesan imej akan mengesan wajah pemandu dan secara tidak langsung akan mengesan juga aktiviti mata seorang pemandu. Jika mata pemandu dikesan sebagai terpejam untuk tempoh masa tertentu, alat penyedar secara langsung akan diaktifkan. Bagi sistem penyedaran pula ia menggunakan tiga jenis pengeluaran iaitu penggera, lampu isyarat kecemasan, dan motor. Penggera bertindak sebagai penyedar kepada pemandu dengan memberikan bunyi penyedaran secara berulang. Lampu isyarat kecemasan pula bertindak sebagai maklumat penyedaran kepada pemandu kenderaan sekeliling. Motor yang dikawal oleh pemandu motor berfungsi sebagai gantian enjin yang bertindak sebagai alat memperlahankan kenderaan secara langsung apabila aktiviti mengantuk ini dikesan. Segala perlaksanaan dan reka bentuk telah dibentangkan di dalam laporan ini.

ABSTRACT

The project is intended to produce a drowsiness detection and alerting device that produce by the driver of vehicle. Drowsiness activity by the driver of vehicle is detected using image processing run by 'OpenCV'. Image processing will detect a driver's face and indirectly detect a driver's eye activity as well. If the driver's eye is detected as being closed for a specified period of time, the alerting device will be activated. For the output system, it uses three types of output which is alarms, hazard lights, and motors. The alarm acts as a warning to the driver by giving the alert in constant sound. A hazard light acts as a hazard warning to others surrounding drivers. Motor that controlled by a motor driver acts as a replacement for the vehicle engine that give response towards vehicle to slow down the vehicle when the drowsiness is detected. All the implementation and design are presented in this report.

DEDICATION

This humble effort specially dedicated to my beloved parents, family, friends and lecturers whose love can never be forgotten for their support, guidance and encouragement upon completing this project and report.

Special dedicated to my family

SARIMAH BINTI MOHAMMED NOR

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CHAPTER 1

INTRODUCTION

1.1 Background

Malaysia has been ranked as one of the top three countries in the world with the deadliest roads by record from World Health Organisation (WHO) for 2013. Based on the statistic against the estimated population of 30 million Malaysians, around 7,000 to 8,000 people in the country die on the roads every year. A total of 7,152 people died in road accidents in Malaysia in 2016, Datuk Seri Liow Tiong Lai ex minister of transport revealed in January. This was an increase from the year 2015 total of 6,706 deaths. "A total of 80.6% of the road accidents are caused by human error," he added (Tang Ruxyn, 2017). The rate of fatality on Malaysian roads is still considered very high and should be improved as it is very close to the average rate among low-income countries. The main reason for the fatalities was due to speeding and collisions, affecting 2,110 out of 5,870 people. According to the record, one of the factor that brought to the accident is cause by the drowsy driver.

Based on others side statistic, The National Highway Traffic Safety Administration estimates that 72,000 crashes, 44,000 injuries, and 800 deaths in 2013 are caused by drowsy driving. These numbers are underestimated, however, and drowsy drivers may cause up to 6,000 fatal crashes each year. As done the research in United State, it stated that drowsy driving is a major problem in accident case (NHTSA, 2018).

Drowsy driving is not just falling asleep at the wheel. Driver alertness, attention, time for reaction, judgment and decision-making are all compromised, resulting in a higher chance of crashing. Drowsy drivers involved in a crash are twice as likely as drivers not fatigued to make performance errors.

Hence, the purpose of this report is to develop one real time alert system that could prevent the car accident that cause by the drowsy driver. The development of drowsiness alert system by using OpenCV is a system where the OpenCV software takes the roles to detect the driver eye position in real time by using camera as a module to capture eye state. When the eye state being capture, the system will determine either the system will response by giving alert to the driver and surrounding or vice versa.

1.2 Problem Statement

The development of the project came from the observation that have been made when the survey shows that standard cars does not have the built in system that could monitoring and detecting the drowsy driver. Besides that, it also does not include the system that will alerting the driver when they are in drowsy situation.

This project develops to solve the problems mentioned above. These problems need to solve because it could help the drivers from being stranded in drowsiness situation.

1.3 Objective

The project is implemented in order to achieve the following objectives which are:

I. To develop the drowsiness alert system by using eye state detection with OpenCV.

II. To analyze the performance of drowsiness alert system accuracy by using eye state detection with OpenCV.

1.4 Scope of Project

The scope of the project is to study and develop drowsiness driver alert system by using eye detection with OpenCV. Besides, the scopes of the project are to study about drowsiness driver, the types of systems that had been used and understand and develop the eye detection with OpenCV. Moreover, the criteria of the project scopes are including man, material and methods.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter introduces the summary of literature review on the development of the driver drowsiness alert system by using OpenCV. The development of the different control system of the drowsiness that aims to help driver stay alert and safe while driving. The advantages and disadvantages of each drowsiness development are also presented and compared. This chapter also presents the development of the control system as main system that will be used will be utilized in this project.

2.2 History of Drowsiness

Drowsiness is a situation which tends to happen when someone felt abnormally sleepy or tired. Drowsiness may cause by additional symptoms such as forgetfulness or falling asleep at random times. This situation might be caused by mental states and lifestyle choices or by serious medical conditions. In the worst case, drivers may fall asleep while driving.

According to the U.S National Highway Traffic Safety Administration, nearly 100,000 traffic crashes can be attributed to drowsy driving each year, including more than 1,500 deaths and more than 70,000 injuries. Most of the accident that cause by

drowsy driving occur between midnight and 6 a.m. that mostly they are driving alone (HealthDay 2018).

In facts, researcher's suspect tired drivers are responsible for roughly 1 out of every 10 crashes. This crashes frequently occur on rural roads and highway.

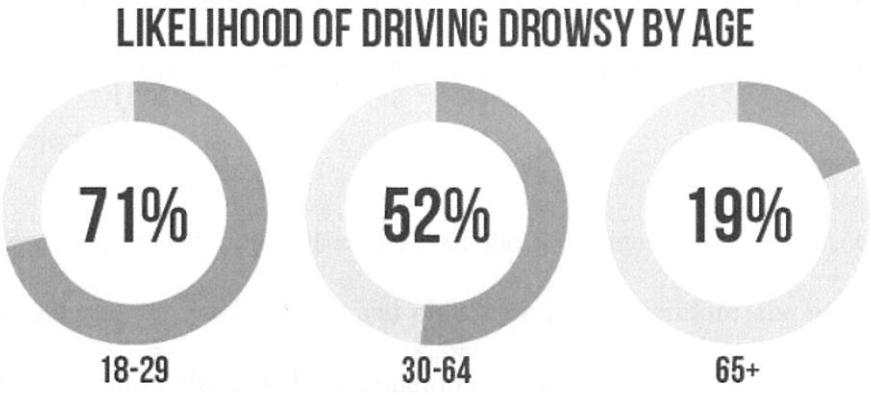

Figure 2. 1: Drowsy Driver Statistic by Age

(Beim 2017) Source of National Sleep Foundation (NFS) survey shows the statistic that teenager aging around 18 to 29 years old monopoly the record of drowsy driving. While the balance respectively 52 and 19 percent that aging around 30 to 64 and aging 65 above likelihood driving in drowsy.

On the others side, as stated by (Cummings et al. 2001) that estimated one fourth to one half of drivers report having fallen asleep at the wheel at least once. Studies in the United States have estimated that the driver can be attributed to falling asleep or drowsy between 1% and 4% of crashes. Studies in Norway, Australia, and the UK gave estimates of 4%, 6%, and 16% respectively.

2.3 Drowsiness Monitoring and Detection

2.3.1 Camera Module

As the input for drowsiness detection of alert system, camera is the main object to capture the real time eye recognition. It's contain two type of camera model which is normal camera and infrared camera. The main purpose of camera being used is to take the high-definition video or capture the still photographs. The resolution of the camera playing the big role in detecting and capturing so the system could clearly recognize the object.

However, based on the project analysis of the drowsiness alert system, the system must could operate within in day and night condition. Therefore, the normal camera could not support the low light condition because the camera only could capture the visible light.

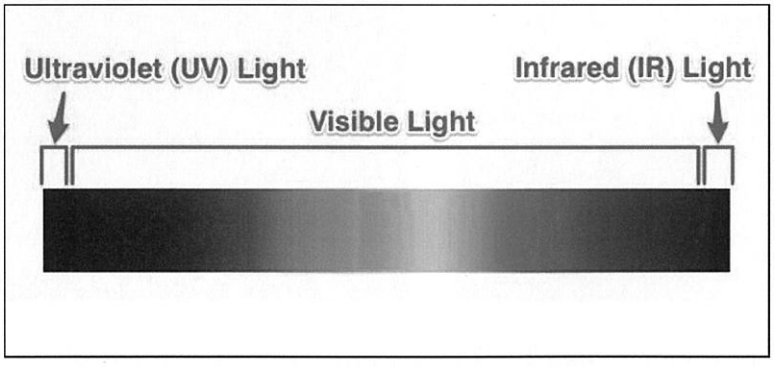

Figure 2. 2: Visible Spectrum

The visible spectrum above shows that the range of light that could captured with and without the infrared LED.

To settle down the problem occur on the camera, the infrared LED need to be place around the camera. The infrared LED will blast the light that invisible to the human eye. This light that produce by infrared LED could be capture only by digital camera means that the camera will working with both day and night mode.

Figure 2. 3: Normal Camera and Infrared LED Camera Model

Figure 2. 4: Normal Camera and Infrared LED Camera View Capture

The left side picture shows normal camera view in low light condition while on the right side picture show the camera supported by infrared LED. As can be seen on the picture, the camera with infrared LED could captured the object vision more clearly.

2.3.2 Face Recognition Approaches

Face could be act as one of the biometric feature but it less reliable due to variations in illumination conditions, posing, and expressions. To resolve the issues, cause by posing change and lighting, 3D facial recognition methods will be used. The image based recognition approach can be divided into:

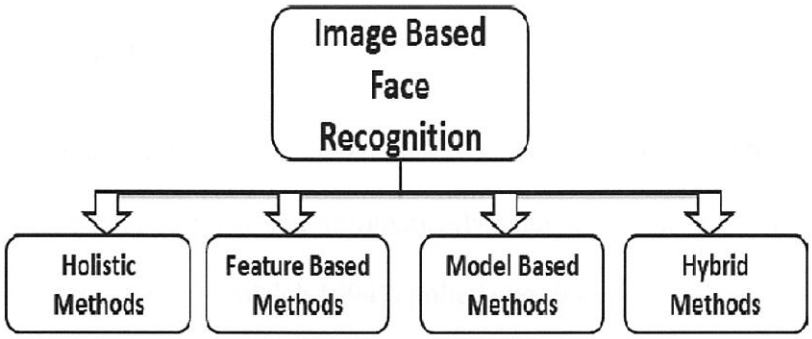

Figure 2. 5: Classification of Face Recognition Approaches

(Naeem et al. 2014)First approach is Holistic approach that consider the whole complete face as a single detection and recognition feature. The similarities of whole face would be compare, ignore the individual features such as eyes, mouth, nose etc. This approach could be classified into two parts.

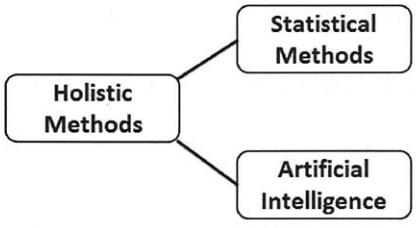

Figure 2. 6: Holistic Face Recognition Methods