ANTI-MICROSLEEP: DROWSINESS DETECTION

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JUDUL: ANTI-MICROSLEEP: DROWSINESS DETECTION

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ANTI-MICROSLEEP: DROWSINESS DETECTION

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This report is submitted in partial fulfillment of the requirements for the Bachelor of Computer Science (Artificial Intelligence) with Honours.

FACULTY OF INFORMATION AND COMMUNICATION TECHNOLOGY UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2023

DECLARATION

I hereby declare that this project report entitled

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is written by me and is my own effort and that no part has been plagiarized

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STUDENT : Date : 15 September 2023

(MUHAMMAD MUHAZILL DANIEL BIN HASSAN)

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SUPERVISOR : _____ Date : 20/9/2023

(DR. NUR ZAREEN BINTI ZULKARNAIN)

DEDICATION

I would like to dedicate this Final Year Project to all those who had supported me in completing this project, especially my supervisor, Dr. Nur Zareen Binti Zulkarnain, who had guided me along this project.

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Firstly, I would like to express my deepest appreciation to my supervisor, Dr. Nur Zareen Binti Zulkarnain for guiding me along the process to complete this project. She provided lots of advice and suggestions to help improve my project, without her guidance this project would not have been able to be completed.

Besides that, I would also like to thank my family for supporting me spiritually throughout this project. Last but not least, I would like to thank my friends also who had given me some inspiration and spiritual support for this project.

ABSTRACT

By examining facial expressions and responses, the "Anti-Microsleep" project seeks to create an artificial intelligence (AI) system that can identify driver sleepiness. Anti-Microsleep evaluates the complete face to offer a more thorough assessment, whereas existing drowsiness detection systems generally rely on eye-related data. The device features a cloud computing module for data storage and uses image processing algorithms to distinguish faces and eyes. The project's goals include creating an AI system that can detect sleepiness effectively, assessing how well Haar Cascade operate for facial classifier, and improving road safety by lowering the number of accidents brought on by driver weariness. The crucial issue of sleepy driving and its role in accidents is addressed by the Anti-Microsleep initiative. The project seeks to produce a dependable system that can precisely identify and prevent driver sleepiness by utilising AI and facial recognition technology. The initiative has the potential to greatly increase traffic safety, save lives, and progress AI and computer vision technology.

ABSTRAK

Dengan meneliti ekspresi muka dan tindak balas, projek "Anti-Microsleep" berusaha untuk mencipta sistem kecerdasan buatan (AI) yang boleh mengenal pasti rasa mengantuk pemandu. Anti-Microsleep menilai wajah lengkap untuk menawarkan penilaian yang lebih teliti, manakala sistem pengesanan mengantuk sedia ada biasanya bergantung pada data berkaitan mata. Peranti ini mempunyai modul pengkomputeran awan untuk penyimpanan data dan menggunakan algoritma pemprosesan imej untuk membezakan wajah dan mata. Matlamat projek termasuk mencipta sistem AI yang boleh mengesan rasa mengantuk dengan berkesan, menilai sejauh mana Haar Cascade beroperasi untuk pengelas muka, dan meningkatkan keselamatan jalan raya dengan mengurangkan bilangan kemalangan yang disebabkan oleh keletihan pemandu. Isu penting pemanduan mengantuk dan peranannya dalam kemalangan ditangani oleh inisiatif Anti-Microsleep. Projek ini bertujuan untuk menghasilkan sistem yang boleh dipercayai yang boleh mengenal pasti dan mencegah rasa mengantuk pemandu dengan tepat dengan menggunakan teknologi AI dan pengecaman muka. Inisiatif ini berpotensi untuk meningkatkan keselamatan lalu lintas, menyelamatkan nyawa dan memajukan teknologi AI dan penglihatan komputer.

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LIST OF ABBREVIATIONS

FYP	**-**	**Final Year Project**
EAR	**-**	**Eyes Aspect Ratio**
MAR	**-**	**Mouth Aspect Ratio**
CNN	**-**	**Convolutional Neural Network**
SCM	**-**	**Software Configuration Management**
ML	**-**	**Machine Learning**

CHAPTER 1: INTRODUCTION

1.1 INTRODUCTION

Our lives are not complete without sleep because it gives our bodies and minds the chance to recover and replenish. However, even in circumstances where remaining awake is crucial, tiredness can suddenly set in. Microsleep, a small period of sleep that can happen when awake and typically lasts only a few seconds, is the term used to describe this phenomenon. Even while it may appear innocent, microsleeping can have detrimental effects, especially when it occurs when we are engaged in activities that require our whole concentration, including operating machinery or conducting important duties.

We can empower people, businesses, and communities to fight this quiet threat if we comprehend the processes of microsleep and arm ourselves with practical solutions. Together, we can pave the way for improved alertness and reduce the threats posed by microsleep, ensuring that everyone lives in a world that is safer and more awake.

1.2 PROBLEM STATEMENT

1. The rate of traffic accidents caused by microsleep is high. According to the National Highway Traffic Safety Administration (NHTSA), approximately there are 7% of all motor vehicle crashes in the United States and up to 21% of fatal crashes are attributed to drowsy driving.
2. There is an issue when the driver's eyes were not detected because of lack of images which is datasets. Like current systems, it needs large datasets to identify and recognise eyes.

1.3 OBJECTIVES

1. To identify features of human face that related to drowsiness.
2. To develop an AI system that can recognize the face and eyes and alarming driver if driver having drowsiness.
3. To evaluate the model which is Anti-Microsleep.

1.4 SCOPE

Making an AI system which is real-time detection called Anti-Microsleep to detect human face and eyes at once, prevent drivers from accident and decrease road accident rate.

Project Module:

1. Machine Learning for training data using Haar Cascade (Eyes and face detection)
2. Statistical Module
3. Data Collection (Database)

Target User:

1. Driver
2. Machine Operator

1.5 PROJECT SIGNIFICANT

The project aimed at combating microsleep holds significant importance due to the following reasons:

1. Enhancing Road Safety: Around the world, drowsy driving is a major cause of traffic accidents. The research intends to drastically lower the incidence of accidents brought on by driver weariness by building an AI system that can identify driver sleepiness through facial expression and eye surveillance. This technology has the power to reduce traffic accidents and save countless lives.
2. Comprehensive Drowsiness Detection: The Anti-Microsleep function considers the full face, in contrast to conventional sleepiness detection systems that largely concentrate on eye-related data. This project looks to offers a more comprehensive and precise assessment of driver

tiredness by examining facial expressions and behaviours. The efficacy and dependability of sleepiness detection are increased by this holistic method, thus boosting traffic safety.

Consequently, the Anti-Microsleep project is very important since it intends to increase traffic safety, improve sleepiness detection techniques, avoid accidents brought on by driver weariness, and progress AI and computer vision. This initiative has the potential to save lives, lessen injuries, improve public health, and have a beneficial effect on transport systems by tackling the serious problem of sleepy driving.

1.6 EXPECTED OUTPUT

The expected outcome of Anti-Microsleep is to accurately identify when a person is becoming drowsy or fatigued while operating a vehicle or other machinery. This can be done by monitoring human face and eyes. The goal of Anti-Microsleep is to prevent accidents caused by fatigue. By detecting drowsiness early on, drivers and machine operators can be alerted to take a break, switch drivers, or take other necessary precautions to avoid accidents. This can help reduce the number of injuries and fatalities caused by drowsy driving and other fatigue-related accidents. Overall, the expected outcome of Anti-Microsleep is to improve safety on the roads and in other settings where fatigue can pose a risk.

1.7 CONCLUSION

The Anti-Microsleep programme is motivated by the need to help drivers and machine operators prevent the potentially dangerous occurrences of microsleep, to sum up. This project's main goal is to make it possible for people to carry out their activities without falling asleep, so insuring both their safety and the safety of others. The following chapter will go into detail on related studies and explain the technique used in this project.

CHAPTER 2: LITERATURE REVIEW AND PROJECT METHODOLOGY

2.1 INTRODUCTION

This chapter offers crucial details on the project's domain. It also examines practical methods for creating our own model after reviewing current sleepiness detection technique. The project process, requirements, and milestones are also covered in this chapter. Overall, it lays the groundwork for our study and directs how we will tackle the problem of microsleep.

2.2 FACTS AND FINDINGS

Figure 2.1 Findings related to drowsiness (Gross, 2020)

According to Figure 2.1, a recent study from the AAA Foundation for Traffic Safety , driver weariness accounts for roughly one-fifth (21%) of fatal automobile accidents (Gross, 2020). This research confirms the assumptions of safety professionals that sleepy driving is more common than what the National Highway Traffic Safety Administration's (NHTSA) official figures indicates. To prevent catastrophic accidents throughout the holiday season, AAA emphasises the need of drivers being aware of the indicators of driver tiredness and implementing preventive steps. This is

especially important as the end of daylight-saving time approaches and night-time journeys get darker.

2.2.1 DROWSINESS

Driving when inebriated from a lack of sleep is referred to as drowsy driving (Chowdhary, 2018). Driving when exhausted, sleep deprived, or tired are some names for it. Slow reaction times, poor judgement, and a diminished ability to react to stimuli are the effects of this syndrome. In extreme circumstances, the motorist may even nod off behind the wheel. Lack of sleep is a major cause of auto accidents and can have comparable negative effects on the brain as drinking alcohol.

A lot of avoidable accidents are caused by drowsy driving, which is a serious concern on the roadways. The National Highway Traffic Safety Administration (NHTSA) estimates that sleepy driving causes up to 6,000 fatal collisions annually in the United States alone (Martin, 2023). The urgent need to address driver tiredness and its adverse effects on road safety is highlighted by this worrying number.

Initiatives like the Anti-Microsleep project have developed to address the issue head-on considering how serious it is. The research tries to recognise indicators of driver sleepiness using face recognition technology and artificial intelligence. The technology can correctly detect the start of weariness by analysing facial expressions and behaviours, and it may prompt drivers to take breaks, swap drivers, or take other safety precautions by sending them timely signals.

2.2.2 EXISTING SYSTEM

One of the existing works related to this project is Car Built In Drowsiness Alert (Martin, 2017). A major development in vehicle safety technology is a car with a Drowsiness Alert system. The goal of this function is to identify indicators of driver weariness and warn the driver to take the appropriate safety measures, eventually reducing accidents.

The Drowsiness Alert system makes use of a variety of sensors and technologies to track the actions and physiological signs of the driver. Infrared cameras, steering angle sensors, lane departure warning systems, and even wearable technology can be used as these sensors. The technology can spot patterns linked to inattention or tiredness by continually analysing the driver's activities, including steering patterns, lane deviations.

In another existing work, known as the Eye Detection Camera (Team, 2023), this model is a specialized camera system designed to accurately identify and track the movements and condition of a person's eyes. This technology has various applications, including driver monitoring systems.

While having microsleep, many things can happen such as collision, accident, and others. There is system called Collision Avoidance System known as CAS which is a technology that designed to prevent and reduce the severity of collisions between vehicle and pedestrians, cyclists, or obstacles. These systems utilize various sensors, data processing algorithms, and communication technologies to monitor the vehicle's surroundings and take proactive measures to avoid potential collisions. Key components in this system include sensors, data processing, warning systems, automatic braking and steering, and communication (The Next Wave in Safety Tech: Collision Avoidance Systems 2023).

2.2.3 TECHNIQUES

2.2.3.1 LANE DEPARTURE WARNING SYSTEM

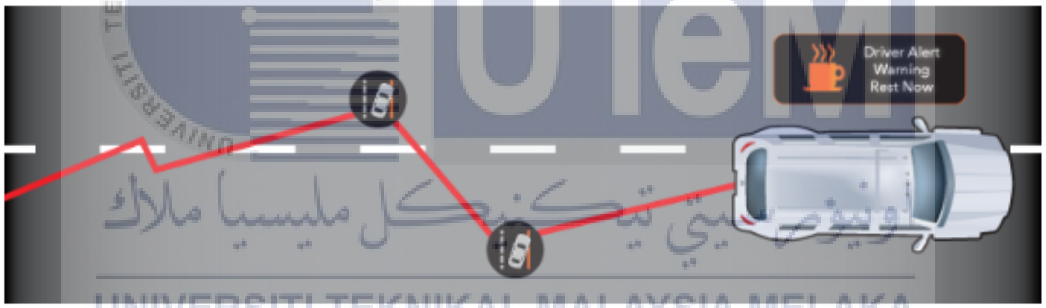

Figure 2.2 Car built in drowsiness alert system (Martin, 2017)

Figure 2.2 shows the safety element that utilises a variety of sensors and technologies is the installation of a Drowsiness Alert system in automobiles. Infrared cameras, steering angle sensors, lane departure warning systems, and wearable technologies are a few examples of these sensors. Each of these elements is essential for recognising and stopping driver sleepiness, improving all-around traffic safety.

The driver's emotions and eye movements are observed via infrared cameras. These cameras use thermal imaging to detect minute variations in the driver's body temperature, perhaps signalling indicators of exhaustion or sleepiness. This enables the system to alert the driver when required, urging them to take the appropriate safeguards.

By observing the driver's steering behaviour, steering angle sensors are an essential component of the Drowsiness Alert system. Any changes or inconsistencies in the driver's steering habits may be a sign of inattention or sleepiness. The system can analyse these signals to identify whether the driver is showing indications of drowsiness and can then issue the proper alerts to protect their safety.

The Drowsiness Alert system also includes lane departure warning devices. These technologies can identify any unintended drifting or deviating from the lane by continually monitoring the vehicle's position inside it. Such actions may be signs of driver intoxication, which would cause the system to provide alerts to the driver to warn them and maybe avoid an accident. These signals might be auditory or visual.

Smartwatches and other specialised drowsiness detecting devices are examples of wearable technology that can contribute more information to the Drowsiness Alert system. To identify indicators of exhaustion, these devices may monitor several physiological data, such as heart rate, skin conductance, and body movements. To generate a more thorough evaluation of the driver's health, wearable data can be combined with sensor input from other devices.

The sleepiness Alert system offers a multi-faceted method to identify and prevent driver sleepiness by integrating infrared cameras, steering angle sensors, lane departure warning systems, and wearable technologies. Due to the system's thorough integration of sensors, it can correctly determine the driver's level of attentiveness and send out suggestions or alarms as necessary, reducing the hazards associated with driving when fatigued.

In conclusion, the sleepiness Alert system's efficiency in identifying and preventing driver sleepiness is increased by the employment of multiple sensors, including infrared cameras, steering angle sensors, lane departure warning systems, and wearable technologies. These technologies enable the system to give the driver real-time feedback, encouraging better driving habits and lowering the risk of accidents brought on by drowsiness.

As we know, every country has different road type, different sign on road. Different road type can lead to system fault. As example, lack of redundancy which is It is essential to have backup methods or redundancy measures in place in case of system breakdown. If the sleepiness alarm system is lacking these features, a malfunction might leave the driver without any help or warning, which would increase the danger of accidents. Besides, false positive which are the driver may be awake and attentive, yet the system may mistakenly identify tiredness and sound alarms. The motorist may become annoyed and distracted unnecessarily as a result, which might lower their faith in the system and cause them to overlook real alarms in the future.

2.2.3.2 FACE RECOGNITION

Figure 2.3 Eye detection camera model (Patil, 2022)

Figure 2.3 shows a model was built You Only Look Once version 5 (YOLOv5) (Maindola, 2021). YOLOv5 is a state-of-the-art object detection algorithm that belongs to the YOLO family of models. It is designed to detect and classify objects within an image or video in real-time. YOLOv5 builds upon its predecessors, incorporating advancements in architecture, network design, and training techniques to achieve improved accuracy and performance.

It uses YOLOv5 because of powerful object detection algorithm that provides accurate and efficient real-time object detection capabilities. It has gained popularity due to its speed, performance, and continuous development by the computer vision community. Besides, we analyse and make image classification using YOLOv5 classification that can classify based on what item has been select in editing image.

Based on model Eye Detection Camera, it just makes detection for EYES ONLY that make a problem for every user that has different eye characteristics. In our model, we make it 2 attributes which is Pair Eyes.

Pair of Eye: Detection of eye.

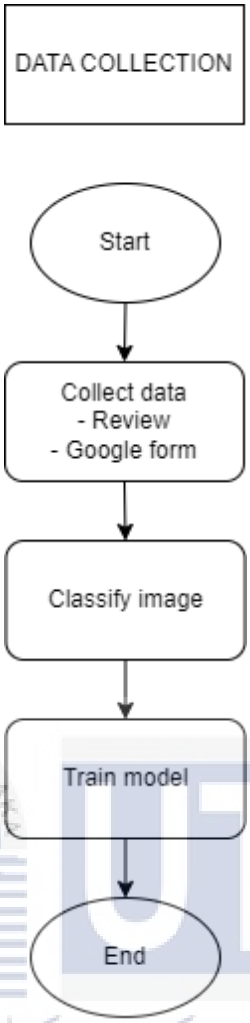

Figure 2.4 Process of data collection (Jocher, 2023)

Figure 2.4 shows the flow of real-time detection will be using the image processing technique to detect and identify the attributes on the human face that already declared by model which is Pair of Eyes (Jocher, 2023). The attributes classifier will be implemented into this module so that the classification process can be carried out in this module. The attributes on every image will be trained by YOLOv5 custom object detection model.