Hong Kong Institute of Vocational Education (Tsing Yi)

Department of Information Technology

HD in Data Science and Analytics (IT114116)

(ITP4870M) Final Year Project

Initial Report (2020/2021)

Driver assistance system

|  |  |
| --- | --- |
| Supervisor: | Johnny Cheng |
| Co-supervisor: | Arion Ko |
| Student: | Au Cheuk Sam  Ho Tsz Hin  Lo Lok Sang  So Chak Shing |

We declare that this is a group project and that no part of this submission has been copied from any other student’s work or from any other source except where due acknowledgement is made explicitly in the text, nor has any part been written for us by another person.

|  |  |  |
| --- | --- | --- |
| Student | Contribution to the project (%)  (Total 100%) | Signature |
| Au Cheuk Sam | 25% |  |
| Ho Tsz Hin | 25% | Shape  Description automatically generated with medium confidence |
| Lo Lok Sang | 25% |  |
| So Chak Shing | 25% |  |

# Abstract

Hong Kong is a fast paced city with a high pressure rate. In order to ensure economic growth, work hours take a big place in modern city citizens’ life, it’s hard for people to have enough rest because of the heavy workload lifestyle, the health condition among Hong Kong people is bad because of the high pressure rate and their lifestyle, rest deprivation and taking medicine makes a driver not suitable to drive. That’s why traffic accident is common in Hong Kong.

Therefore, we would like to build a system that can help the stakeholders in traffic accident to proof themselves.

Table of Contents

[Abstract 2](#_Toc88852508)

[1.Introduction 5](#_Toc88852509)

[1.1 Background and Motivation 5](#_Toc88852510)

[1.2 Objective and Scope 5](#_Toc88852511)

[1.3 Outline of Report 6](#_Toc88852512)

[2.Related Works 7](#_Toc88852513)

[2.1 Existing Works 7](#_Toc88852514)

[2.2 Compare your proposed solution with other existing solutions 7](#_Toc88852515)

[2.3 Pros and Cons of your design 7](#_Toc88852516)

[3. Methodology / Analytical Framework 8](#_Toc88852517)

[3.1 Data Acquisition and Understanding 8](#_Toc88852518)

[3.2 Data Models / Algorithms 8](#_Toc88852519)

[3.3 Performance Metrics 10](#_Toc88852520)

[3.4 Data Presentation and Application 10](#_Toc88852521)

[3.5 Constraints and Limitations 10](#_Toc88852522)

[4.Solution Design 11](#_Toc88852523)

[4.1 Project Background 11](#_Toc88852524)

[4.2 Overview of the Solution 11](#_Toc88852525)

[4.3 Target Users / Expected Stakeholders of the solution 11](#_Toc88852526)

[4.4 System Architecture (Clients, Server and Database connections in your system) 11](#_Toc88852527)

[4.5 Interface Design 11](#_Toc88852528)

[4.6 Hardware and Software Requirements 11](#_Toc88852529)

[4.7 Technical Considerations 12](#_Toc88852530)

[5. System Architecture 13](#_Toc88852531)

[6. Current Status 14](#_Toc88852532)

[6.1 Progress so far 14](#_Toc88852533)

[6.2 Difficulties encountered 14](#_Toc88852534)

[7. Project Plan 15](#_Toc88852535)

[7.1 Schedule 15](#_Toc88852536)

[7.2 Milestone description 15](#_Toc88852537)

[7.3 Work Distribution 15](#_Toc88852538)

[8. References 16](#_Toc88852539)

# 1.Introduction

## 1.1 Background and Motivation

Hong Kong is a city with severe traffic problem caused by poor road management and land shortage.

According to road traffic accident statistics released by the Hong Kong transport department, we can see that there is no drastic change in the number of accidents from 1990 to 2020, but from 2009 to 2020, we can see that there is an upward trend in the number of accidents. But we think that as technology evolve, the trend of road traffic accidents should decrease since there has to be multiple ways to prevent road traffic accident from happening.

Chart

Description automatically generated

Photo of Trend of road traffic accidents from 1950 to 2020

Chart, line chart

Description automatically generated

Photo of Trend of road traffic accidents from 1950 to 2020 with red line to indicate the trend between 1990 to 2020

## 1.2 Objective and Scope

The goal of this project is to provide a product that can help stakeholders in traffic accident to provide an evidence of their consciousness when the accident happened.

Our product would examine the consciousness of the driver, then the product will use GPS to check the location of the driver, and see if the driver’s location is a high-risk area, if it’s a high-risk area, then our product would see if the consciousness of the driver is high or low, if the consciousness of the driver is low or is not high enough for the area then our product would tell the driver that you are not in a state that is suitable to drive with sound.

To identify if the driver’s location is a high-risk area, we’ll collect data of traffic accident in different areas, if the area has a high traffic accident rate, then we’ll identify the area as a high-risk area.

# 2.Related Works

## 2.1 Existing Works

There are products that has some similarity to our work. To maintain the security of a specific area, some company like to use CCTV to monitor and protect their own property from being stolen.

A picture containing sky, outdoor, blue

Description automatically generated

**Photo of CCTV**

The New World First Bus Services Limited (NWFB) installed advanced driver assistance systems (ADAS) in their bus to monitor if the bus is in a safe separation distance, if the vehicle is moving out of it’s lane and the driver’s status, so that the driver can adjust the car speed, move back to the proper lane and alert the driver if they are not in a good state to drive.

A picture containing car, control panel

Description automatically generated

Photo of the advanced driver assistance systems (ADAS)

## 2.2 Compare your proposed solution with other existing solutions

Some bus driver complained that the ADAS system that NWFB used is too sensitive, for example, when the driver is looking sideway because they need to switch lane or check if the passenger is properly seated, the ADAS system would alert the driver regardless of the drivers’ state, which makes the system become very annoying. Also, because the ADAS system is combined with various system like the Three-in-one Safety Monitoring System and Vehicle Reversing Camera System, since the road is a place where even one second can make a huge difference, so it’s hard to process all the data that the system has collected in such a short time.

Our product has integrated traffic accident hotspot data, so our system won’t face difficulty when it’s processing the data of the driver. Also, since our product is not mainly for business use, so our system won’t affect multiple passengers in the vehicle like the ADAS system, we’ll also provide data of driver looking sideway to improve the accuracy of the product.

# 3. Methodology / Analytical Framework

## 3.1 Data Acquisition and Understanding

For data acquisition, currently we’ve collected photos of closed human eyes and opened human eyes from Kaggle, but we figure that is not enough to build our model, so we added some primary data which is the photos of our eyes. We are trying to collect data of people looking sideway.



Example of a closed human eye data



Example of an opened human eye data

## 3.2 Data Models / Algorithms

For data cleaning, we’ve decided to use R to do data cleaning, not only because we are familiar with R, also it is there are multiple packages for data cleaning in R. Therefore, R is very convenient for data cleaning.

For training data, since not all the data we collected is already cleaned like the data from Kaggle, so sometimes we need to crop out the background of the photo.

A picture containing text, clipart

Description automatically generated

**Photo of R**

A close-up of a person's eye

Description automatically generated with medium confidence

Photo of labelIMG detecting a closed human eye

Text

Description automatically generated

Photo of label image and splitting training data set and testing data set

## 3.3 Data Presentation and Application

For data visualization, we’ll use tableau to do data visualization. Because tableau is easy to operate, tableau also provide a powerful dynamic plotting function and tableau can drill down into the details of the data using dashboard, so we can understand the deeper meaning of our data.

Chart, line chart

Description automatically generated

**Photo of plotting line chart using tableau**

Graphical user interface, chart, line chart

Description automatically generated

**Photo of dashboard using tableau**

## 3.4 Constraints and Limitations

Time limitation

One of the major difficulties that we are facing is that we don’t have enough time to complete the whole project. After finishing the industrial attachment in august, we have to start preparing the project immediately, we have to figure out the suitable topic for our project, schedule and design everything in such limited time. We need to self-study different aspects that are outside the syllabus.

Privacy limitation

Privacy is one of the biggest concern when we are designing the project. because our project is going to record the face, the surroundings of the driver, so we must find a way to protect the user’s privacy while maintain the practicality of the product. In the end, we decided to store the data in the local device, instead of server.

# 4.Solution Design

## 4.1 Project Background

Traffic accident related topic is being decide because the authors think that there are many traffic accident related news in the recent years, the authors want to contribute in these kind of issue, so the authors started to do research in traffic related fields.

## 4.2 Overview of the Solution

According to the road traffic statistics that is released by the Hong Kong police force, careless driving is the number 1 cause of traffic accident, so the authors want to find a solution to tackle this issue. The authors have come up with some solutions before, since alert the driver with alert sound may cause negative effect, so the authors decided to warn the driver with AI voice. The product can decide the level of danger based on the level of risk of the driver location and the consciousness of the driver.

## 4.3 Target Users / Expected Stakeholders of the solution

The target user of this product is public, or transport worker. We don’t aim to serve bus driver because bus company usually have their own system to monitor driver, and thus don’t need this product.

## 

## 4.4 System Architecture (Clients, Server and Database connections in your system)

Our product won’t collect server since the data is stored on the user’s device, just like how dashboard camera works.

For database, mongodb is decided to do data storing. The plan is to do classification on the dataset that is collected with the level of risk, then the data will be stored to mongodb so the product can warn the user based on the level of risk.



**Photo of mongodb**

For client, we’ll provide an interactive website. We’ll let the user to allow our product to access the camera first, once the user selected allow, then our product will start recording and analyzing.

## 4.5 Interface Design

The layout of the website is still being discussed and not confirmed, but for now, the website will have a home page and a camera access button.

Diagram

Description automatically generated

**Photo of the webpage architecture**

## 4.6 Hardware and Software Requirements

The hardware requirement for the model:

|  |  |
| --- | --- |
| Component | Model |
| CPU: | Intel Core i5-12600K |
| RAM: | 8GB DDR3 |
| GPU: | GTX 1070 |
| STORAGE: | 237GB SSD |
| OS: | WINDOWS |

Hardware requirement for using the product:

|  |  |
| --- | --- |
| Component | Model |
| STORAGE | 4GB of free disk space |
| OS | WINDOWS/IOS/ANDROID |

## 4.7 Technical Considerations

The original plan was to design a standalone application, but due to the time limitation and knowledge limitation, so the authors decided to build a webpage.

Node.js and PHP were putted into consideration for building the webpage, but since the authors doesn’t have PHP related experience, so the plan to build the webpage with PHP is scraped.

Moreover, basic html and JavaScript knowledge were acquired in semester 3, which suits the nature of Node.js, and Node.js is less likely to encounter compatibility issue when compared to PHP, so the authors figured that Node.js is a more suitable option.

# 5. Current Status

## 5.1 Progress so far

For the model, currently we’ve built a prototype of an Object detection model with the concept of R-CNN, the model can classify if the eye of the user is closed or opened at the moment.

Diagram

Description automatically generated

**Photo that explain R-CNN**

For the data, 2020 traffic accident statistics released by the transport department and Hong Kong police force, human eye data from Kaggle is collected.

For the webpage, the layout and the features of the webpage is still in the design phase.

## 5.2 Difficulties encountered

The prototype of the model won’t work if the user is looking sideway or the eye of the user is too small, more data is required to tackle these issues.

The authors tried to find data that can do normal distribution to find outliers, but the authors failed to find one.

# 6. Project Plan

## 6.1 Schedule

Chart

Description automatically generated with medium confidence

Table

Description automatically generated

## 6.2 Milestone description

Milestone 1: Finish Collecting all the data we need for the model

Milestone 2: Finish designing the website

Milestone 3: Build a webpage that can access the user’s camera

Milestone 4: Finish the model

## 6.3 Work Distribution

|  |  |
| --- | --- |
| Au Chuek Sam | 1. Project management 2. Model Building |
| Ho Tsz Hin | 1. Documentation 2. Webpage Development |
| Lo Lok Sang | 1. Data prepossessing 2. Data visualization |
| So Chak Shing | 1. Data prepossessing 2. Data visualization |

# 7. References

1. Chengyu Z. (2018, July 5). *疲勞原因到底是什麼？WHO公開11項癌因性疲勞警訊*. https://www.edh.tw/. https://www.edh.tw/article/19357
2. *Eyes- Open or Closed*. (2021, March 25). Kaggle. https://www.kaggle.com/akshitmadan/eyes-open-or-closed
3. Wikipedia contributors. (2021, November 17). *Closed-circuit television*. Wikipedia. https://en.wikipedia.org/wiki/Closed-circuit\_television
4. *巴士司機抱怨新巴安全系統過份敏感！警報器咇足全程 - ezone.hk - 網絡生活 - 網絡熱話*. (2019, January 4). Ezone.Hk 即時科技生活. https://ezone.ulifestyle.com.hk/article/2243612/504
5. 香.港.經.濟.日.報.H.K.E.T. (2021, February 21). *巴士安全｜新巴城巴加裝駕駛輔助系統 逾240車作先導測試*. 香港經濟日報HKET. https://topick.hket.com/article/2882663?r=cpsdlc
6. N. (2021, April 3). *GitHub - nicknochnack/TFODCourse*. GitHub. https://github.com/nicknochnack/TFODCourse
7. *Tensorflow Object Detection in 5 Hours with Python | Full Course with 3 Projects*. (2021, April 9). YouTube. https://www.youtube.com/watch?v=yqkISICHH-U
8. *Transport Department - Accident Trend Since 1953*. (2021, July 20). Transport Department. https://www.td.gov.hk/en/road\_safety/road\_traffic\_accident\_statistics/accident\_trend\_since\_1953/index.html
9. Yeung, S. (2019, April 1). *巴士司機抱怨新巴安全系統過份敏感！警報器咇足全程 - ezone.hk - 網絡生活 - 網絡熱話*. Ezone.Hk 即時科技生活. https://ezone.ulifestyle.com.hk/article/2243612/504
10. *運輸署 - 二零二零年*. (2021, October 7). Transport Department. https://www.td.gov.hk/tc/road\_safety/road\_traffic\_accident\_statistics/2020/index.html
11. *Transport Department - Accident Trend Since 1953*. (2021, July 20). Transport Department. <https://www.td.gov.hk/en/road_safety/road_traffic_accident_statistics/accident_trend_since_1953/index.html>
12. 二零二零年 交通報告. (2020). Hong Kong Police Force. https://www.police.gov.hk/info/doc/statistics/traffic\_report\_2020\_tc.pdf
13. *道路安全議會年報2018*. (2018). Road Safety Council. <http://www.samfreelance.com/RSC2018/report_tc2018.html#TAS>
14. Shen, J. (2019, June 24). *Object Detection : R-CNN, Fast-RCNN, Faster RCNN - John Shen*. Medium. https://ccshenyltw.medium.com/object-detection-r-cnn-fast-rcnn-faster-rcnn-mask-rcnn-retinanet-to-be-continued-71b67640445
15. Wikipedia contributors. (2021a, June 13). *MongoDB*. 維基百科，自由的百科全書. https://zh.wikipedia.org/zh-tw/MongoDB
16. Wikipedia contributors. (2021b, November 20). *R语言*. 維基百科，自由的百科全書. https://zh.wikipedia.org/wiki/R%E8%AF%AD%E8%A8%80