DEVELOPMENT OF 3RD BRAKE LIGHT AND SIGNAL FOR FOOD DELIVERY MOTORCYCLIST

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Faculty of Mechanical Technology and Engineering

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A thesis submitted
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I hereby declare that I have checked this thesis and in my opinion, this thesis is adequate in terms of scope and quality for the award of the Bachelor of Mechanical Engineering Technology (Automotive Technology) with Honours.

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Date : 8 FEBRUARY 2024

DEDICATION

I would like to thank my loving and supportive parents, Syed Sazally Wafa and Rabaah Ngah, for their unending love, sacrifices, prayers, and support, as well as my relatives for their financial assistance. I'd also like to thank my supervisor, TS. Mohd Zakaria bin Mohammad Nasir, for his support and advice

ABSTRACT

Food delivery is a service that brings excellent food from a nearby restaurant to hungry clients' doorsteps.Customers, on the other hand, prefer to order food delivery services through third-party websites and web applications. Motorization is rapidly growing in Asian countries, and motorcycles have surpassed cars as the most popular mode of transportation. In several large Asian cities, the number of motorcycles per thousand people is substantially higher than in other countries. With the expanding use of motorbikes, traffic injuries and fatalities in Malaysia are becoming a significant problem, with speeding being one of the leading causes. The majority of incidents occur at night or during heavy rain, when the rider is unable to see the car stop. This could endanger other people's autos. Motorcycle fatalities are more likely between 4 p.m. and 10 p.m. The goals of this project are to design and create a brake light and signal hazard system that can be attached to the bags of food delivery riders to improve visibility and prevent unforeseen events, particularly in bad weather. This project will create an LED flashing system that will be attached to the bags of food delivery riders to help other road users identify other motorcyclists in front of them. The receiver and transmitter are used to build the electrical circuit of the Arduino controller. An LED blinking light will be used to illuminate the food delivery rider's bags. The advantages are lower costs, technicality, simplicity, affordability, and compatibility. In this system, Arduino is properly developed to combine with current brake and signal to be utilised in motorcycles. The wireless system in this project consists of a transmitter and a receiver. It uses an Arduino system to produce the signal or brake light received from the motorbike transmitter and give it to the receiver linked to the food delivery rider's bag to switch on the light instruction. A true prototype is a success to develop since it is straightforward and works well in all weather. There is also no buffering data flow between the transmitter and receiver. Although the contemporary motorcycle has a tail light, it is insufficient to attract the attention of the car behind them. As a consequence, this third prototype brake light and signal definitely assists other vehicles from behind to see the motorbike rider clearly even during the night within 10 metres, 20 metres and 30 metres. Finally, installing a third brake light and signal, as well as an LED blinking system, can aid improve visibility and notify other drivers to the presence of a motorbike ahead of them. The maximum sight and distance range for the third brake light and signal is between 10,20,30 metres and above.

ABSTRAK

Penghantaran makanan ialah perkhidmatan yang membawa makanan yang sangat baik dari restoran berdekatan ke depan pintu pelanggan yang lapar. Pelanggan, sebaliknya, lebih suka memesan perkhidmatan penghantaran makanan melalui tapak web dan aplikasi web pihak ketiga. Permotoran berkembang pesat di negara-negara Asia, dan motosikal telah mengatasi kereta sebagai mod pengangkutan yang paling popular. Di beberapa bandar besar Asia, bilangan motosikal bagi setiap seribu orang adalah jauh lebih tinggi daripada di negara lain. Dengan penggunaan motosikal yang semakin meluas, kecederaan lalu lintas dan kematian di Malaysia menjadi masalah yang ketara, dengan memandu laju menjadi salah satu punca utama. Kebanyakan kejadian berlaku pada waktu malam atau semasa hujan lebat, apabila penunggang tidak dapat melihat kereta berhenti. Ini boleh membahayakan kenderaan orang lain. Kematian motosikal lebih berkemungkinan antara jam 4 petang. dan 10 malam. Matlamat projek ini adalah untuk mereka bentuk dan mencipta lampu brek dan sistem bahaya isyarat yang boleh dipasang pada beg penunggang penghantaran makanan untuk meningkatkan keterlihatan dan mengelakkan kejadian yang tidak diduga, terutamanya dalam cuaca buruk. Projek ini akan mewujudkan sistem berkelip LED yang akan dipasang pada beg penunggang penghantaran makanan untuk membantu pengguna jalan raya lain mengenal pasti penunggang motosikal lain di hadapan mereka. Penerima dan pemancar digunakan untuk membina litar elektrik pengawal Arduino. Lampu berkelip LED akan digunakan untuk menerangi beg rider penghantaran makanan. Kelebihannya ialah kos yang lebih rendah, teknikal, kesederhanaan, keterjangkauan dan keserasian. Dalam sistem ini, Arduino dibangunkan dengan betul untuk digabungkan dengan brek semasa dan isyarat untuk digunakan dalam motosikal. Sistem wayarles dalam projek ini terdiri daripada pemancar dan penerima. Ia menggunakan sistem Arduino untuk menghasilkan isyarat atau lampu brek yang diterima daripada pemancar motosikal dan memberikannya kepada penerima yang dipautkan ke beg penunggang penghantaran makanan untuk menghidupkan arahan lampu. Prototaip sebenar adalah kejayaan untuk dibangunkan kerana ia mudah dan berfungsi dengan baik dalam semua cuaca. Juga tiada aliran data penimbal antara pemancar dan penerima. Walaupun motosikal kontemporari itu mempunyai lampu belakang, ia tidak mencukupi untuk menarik perhatian kereta di belakang mereka. Akibatnya, lampu brek dan isyarat prototaip ketiga ini pasti membantu kenderaan lain dari belakang untuk melihat penunggang motosikal dengan jelas walaupun pada waktu malam dalam jarak 10 meter, 20 meter dan 30 meter. Akhir sekali, memasang lampu brek dan isyarat ketiga, serta sistem berkelip LED, boleh membantu meningkatkan keterlihatan dan memberitahu pemandu lain tentang kehadiran motosikal di hadapan mereka. Jarak penglihatan dan jarak maksimum untuk lampu brek dan isyarat ketiga ialah antara 10,20,30 meter dan ke atas.

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D,d	-	Diameter
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CHAPTER 1

INTRODUCTION

1.1 Background

Malaysia has become the highest road fatality risk per 100 thousand populations among the ASEAN country such as Indonesia, Thailand and Singapore. Moreover, more than 50% of road accidents come from motorcyclists. Motorcycles are one of transportation sector in Asia which is fast growing but the number of motorcycles per person in certain Asian cities far exceeds the world average. As the number of Malaysians riding motorbikes increasing so does the incidence of traffic- related injuries and deaths because of the vehicle's natural blind spots being one of the most common contributing reasons. Motorcycle is very popular and often use in these countries because of their low cost and low use of petrol which making them accessible to everyone. In cities where the roads are continuously congested, owning a motorbike may reduce the time it takes to get to your destination (Abdul Manan & Várhelyi, 2012). Compared to automobile passengers, motorcycle riders are 37 percent greater likely to experience and eight times more likely to be injured (Granieriet al., 2020). Malaysia has 332 motorcycles per 1000 people, which is fewer than Vietnam, which has 358 motorcycles per 1000 people when there is more motorcycle on the road, accidents are more likely to caused.

Nowadays, many people died on the road with a variety of cases. When it comes to fatal motorcycle accidents in Malaysia, distractions are a contributing factor. Riding becomes unnecessary or insecure when a rider's attention is diverted by a specific event, person, or item (Lee, 2017). As a result, drivers begin to drift away from the vehicle and lose concentration. The crash was caused by the driver's actions, the weather, and the state of the road. Traffic accidents are mostly caused by young drivers, inexperienced drivers, and drivers under the influence of alcohol or drugs.

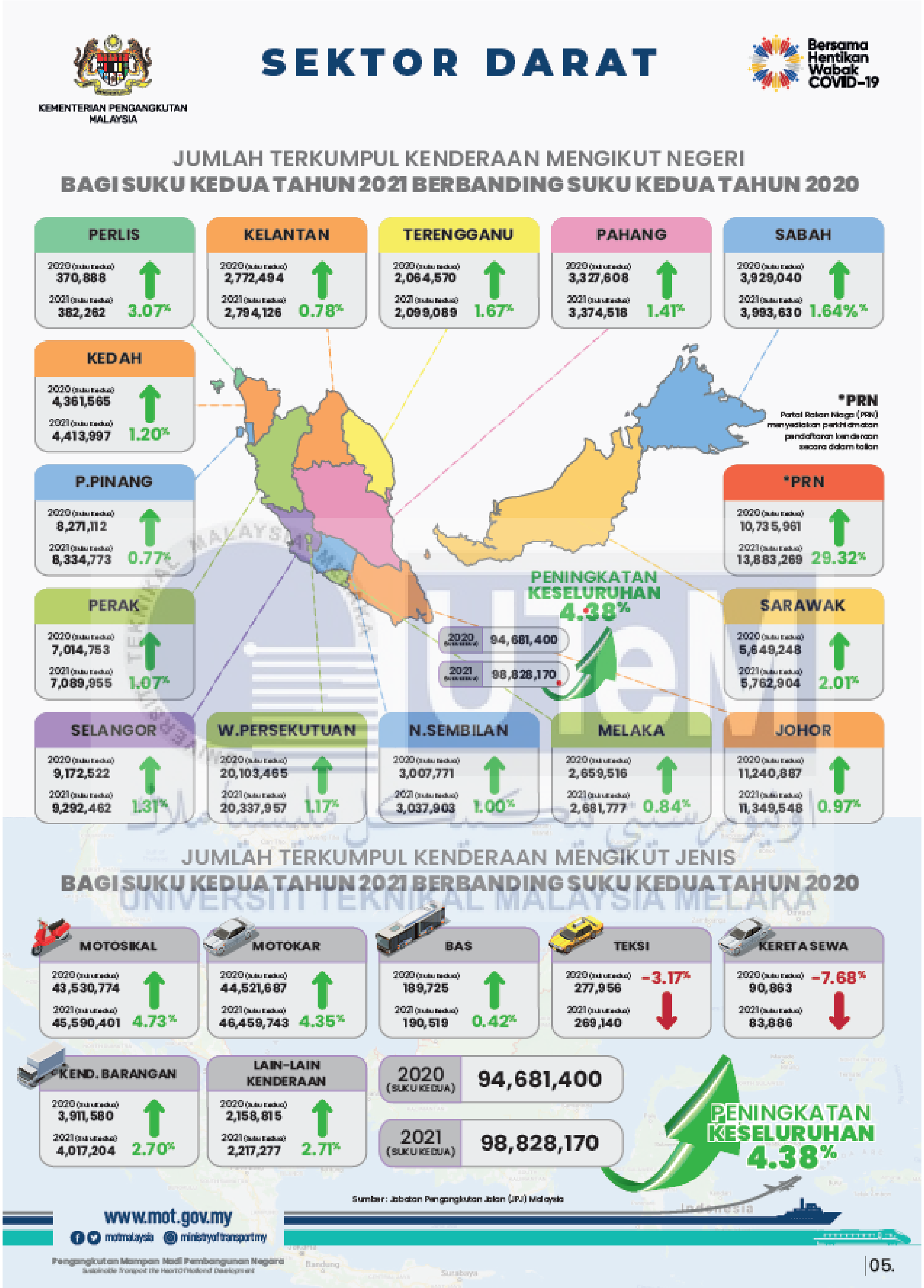

Figure 1.1: Total data collected on population of registered vehicles in Malaysia in 2nd quarter 2021 by Kementerian Pengangkutan Malaysia (Portal Rasmi Kementerian Pengangkutan Malaysia Statistik Tahunan Pengangkutan, 2022)

Based on figure 1.1, until second quarter 2021, motorcycles are second tier of the most popular vehicles that used by Malaysian. More than 45 milion motorcycle has been registered on the road compare to year before which 43 milion. From that, road accidents are higly risk and the rate of accidents is growing year after year. Factors such as reckless driving, speeding, lack of adherence to traffic regulations, and inadequate safety measures contribute to the high number of motorcycle crashes. These incidents not only result in the loss of precious lives but also leave behind devastating physical and emotional consequences for the victims and their families. Recognizing the gravity of the situation, authorities, road safety organizations, and the public are actively striving to promote awareness, enforce stricter regulations, and implement effective measures to curb motorcycle crashes and create a safer road environment for all.

1.2 Problem Statement

In Malaysia, there are many meal delivery businesses, many of which provide online food delivery services. At the time of writing, there are about 20 food delivery markets operating in Malaysia, with both local and international firms participating. Online food ordering is becoming more and more popular since it is quick, easy, and convenient. People ordered meals online because they didn't want to prepare them themselves and preferred to have them delivered to their home or place of business without having to make a big effort. Most collisions occur at night or during periods of heavy weather when the driver cannot see the automobile stop. This might put both the food delivery rider and other people's cars in danger. The most motorcycle fatalities occur between 4 p.m. and 10 p.m. As a result, the 3rd Brake Light and Signal for Food Delivery Motorcyclist is required to improve current technology and safety.

1.3 Research Objective

The main aim of this research is to:

A. To develop brake light design and signal hazard system for food delivery motorcyclist box.

B. To gain more information about food rider safety based on online research survey.

C. To improve visibility and prevent unforesenn events, especialy during bad weather.

1.4 Scope of Research

The scope of this research are as follows:

A. Literature study on electrical, wireless, Radio Frequency and other system.

B. Program design controller system Arduino UNO/Nano

C. Developing the prototype model

D. Testing the prototype model

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In order to develop an intelligent hazards system, the goal of this literature review is to investigate the 3rd Brake Light and Signal for Food Delivery Motorcyclist. Modern cars now include a system called the Intelligent Hazard System that improves vehicle safety. Either driving or riding at night, including drivers and passengers. Driving at night places restrictions on drivers and passengers, particularly when turning, changing lanes, halting, and driving through torrential rain. Rear-ending collisions account for the majority of traffic accidents. There are numerous repercussions if a vehicle is ignored when it is delayed or halted.

2.1 Malaysia Road Fatalities Index

Each year where 1.35 million individuals lose their lives in traffic accidents; on average, 3,700 people pass away every day. Road traffic accidents result in significant economic damage for victims, their families, and entire countries. According to MIROS' 2018 Value of Statistical Life (VSOL) Year, Malaysia's government has suffered losses of at least 3.12 million for each life. With an average of 18 people dying in traffic accidents every day in Malaysia, the country faces a significant public health concern. Additionally, it emphasizes the urgent requirement for a successful policy response.

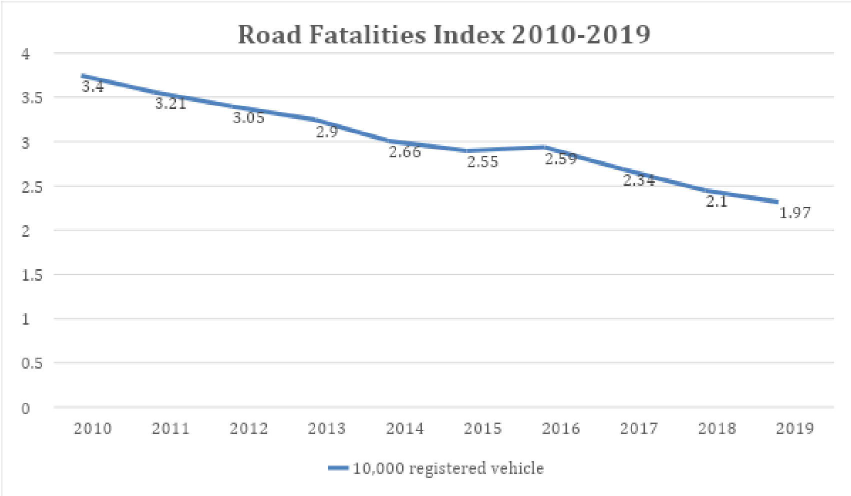

Figure 2.1: Malaysia Road Fatalities Index 2010 - 2019

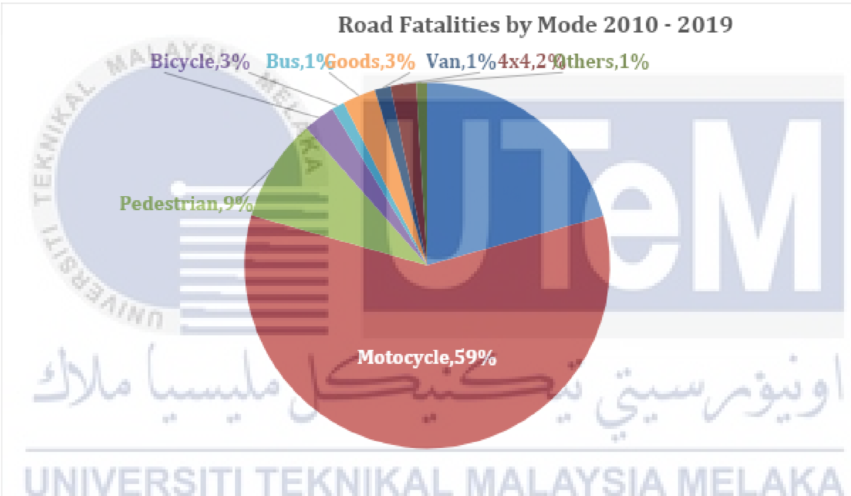

Figure 2.2: Malaysia Road Fatalities by Mode 2010 -2019

Based on figure 2.1, Malaysia has demonstrated a consistent decline in road user and type-related fatalities since 2010. Most traffic fatalities (59%) are caused by motorcyclists, while passenger cars are responsible for 21% of all traffic fatalities as shown in figure 2.2. This happens because motorcycle is easier to use and more practical to ride in the city which have so much busy road and traffic jams. Mostly people go to work every morning by using 2-wheel vehicle because it will take less time than using a car because of traffic jams. Moreover, when they are at traffic light, they don't need to queue along with the car so they no need to wait. This is a good advantage especially for food riders because they can deliver the food earlier so they will not get mad by the customers. Nowadays, many people prefer meal delivery services like FoodPanda, GrabFood, Domino Delivery and Shopee Food. Customers can order food from local restaurants using a smartphone app and a website.

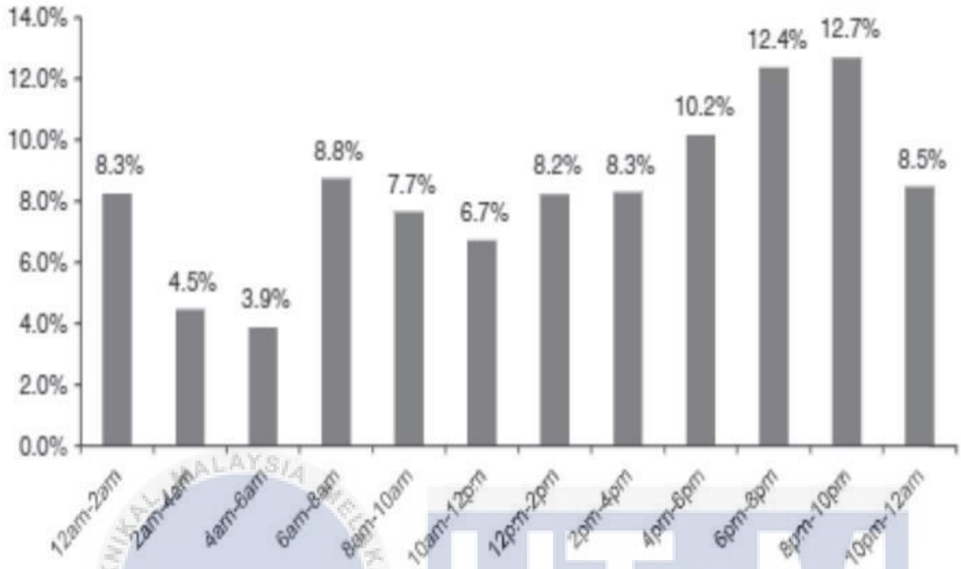

Figure 2.3: Cumulative percentage of motorcycle fatality by time of the day

According to figure 2.3 above, the most accidents occurred between the hours of 8 and 10 p.m., while the least accidents occurred between 4 and 6 a.m. According to severity, most fatalities happened between 8 and 10 p.m., whereas most fatalities happened between 4 and 6 a.m. Malaysians lost their lives riding motorcycles at a rate of 243 per month, 60 per week, and 8 per day over the past ten years. It's likely that the pace at which the drivers were operating during both periods of sleep loss contributed to the negative outcomes because there was less traffic on the roads between 4 and 6 a.m. and 8 and 10 p.m.

Figure above reveals that the most occurred between 8 and 10 p.m. and the least occurred between 4 and 6 a.m. In terms of severity, most fatalities occurred between 8 and 10 p.m., whereas the majority of deaths occurred between 4 and 6 a.m. During the last decade, Malaysians died on motorcycles at a rate of 243 per month, 60 per week, and eight perday. Because of the reduced vehicle traffic between 4 and 6 a.m. and 8 and 10 p.m., it's possible that the speed of the drivers who drove during both periods of sleep loss played a role in the poorresults.

Weather	Light conditions				Total	%
	Day	Dawn/ dusk	Night with street light	Night without street light		
Clear	1760	289	593	477	3119	93.0
Windy	1	1	1	1	4	0.1
Foggy	4	15	0	10	29	0.9
Rain	90	14	37	41	182	5.4
Other	8	6	2	2	18	0.5
Total	1863	325	633	531	3352[a]	100.0
%	55.6	9.7	18.9	15.8	100	

[a] Excluding 718 unknown cases.

Table 2.1: Percentage of Fatalities Occur by Weather and Light Condition (PDRM 2009)

According to a Malaysian study on motorcycle fatalities, more than 93 percent of motorcycle fatalities take place in clear weather, with 55.6 percent taking place during the day, as indicated in table 2.1 below. On days when the weather is favourable, the daily fatality rate is 52.5%. According to (Abdul Manan and Várhelyi,2012), a third of all fatal nighttime accidents take place while the sky is clear. The likelihood of motorcycle-related fatality increases during night and inclement weather. Wearing a brightly coloured shirt or a reflective coat at night is one way to ensure that other motorcyclists can see you when riding in the rain. The brake light and limitless light are additional options, but they are not as bright as front light.

The majority of motorbike accidents, as shown in table 2.2 below, take place on arterial or main routes (Abdul Manan & Várhelyi, 2012), (PDRM, 2009). On main or arterial roadways, there are more fatalities per 100 kilometres, however the number of fatalities per 100,000 motorcycle riders varies depending on the distance covered. Furthermore, there are more motorbike fatalities per 100 kilometres on Malaysia's major highways than on secondary highways, city streets, and local roads. Unfortunately, there is no way to link the existence of heavy motorcycle traffic on certain routes with motorcycle accidents.

Road hierarchy	Road length		ADT (million)		MC fatalities		MC fatal/ 100 km	MC fatal/ 100,000 MC
	km	%	Veh	MC	N	%		
Expressway	1635	1.3	20.6	*	121	3.0	7.4	*
Primary/arterial	16,939	13.6	12.8	2.6	2021	49.7	11.9	76.7
Secondary/collector	54,681	43.9	6.3	1.6	672	16.5	1.2	42.0
Local street	43,363	34.8	*	*	755	18.6	1.7	*
Minor roads	8038	6.4	*	*	501	12.3	6.2	*
Total	124,656	100	–	–	4070	100	3.3	–

Table 2.2: Motorcycle Fatalities by Road Type in Malaysia 2009 (PDRM,2009)

As can be seen in figure 2.4 below, the vast majority of motorbike accidents take place over long stretches of straight highway. There are three times as many deadly motorbike accidents on straight portions of road than on curves. The fewest deadly accidents occur at angled intersections, crossings, and cycling lanes, with each recording 1.0 percent or less fatal incidents in 2009 (PDRM, 2009).

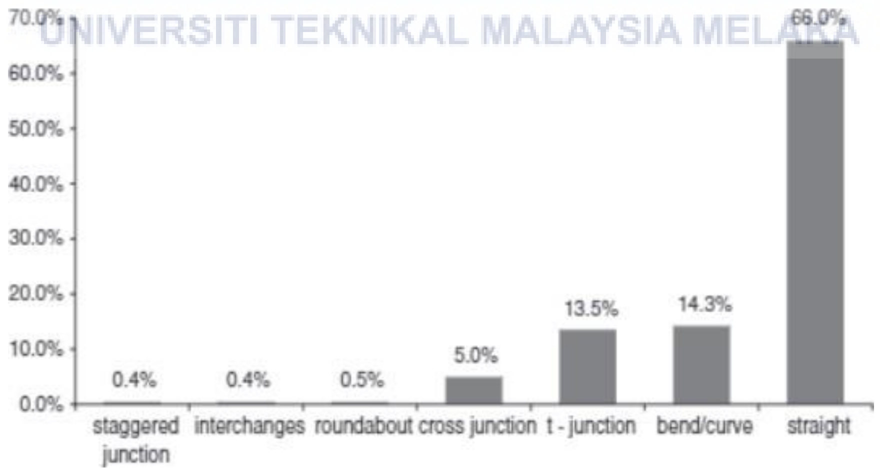

Figure 2.4: Percentage Motorcyle Fatalities on Various Parts of The Road Network in 2009 (PDRM,2009)

Figure 2.5 (PDRM, 2009) Police statistics show that 61% of these incidents result in harm in rural areas whereas only 8% do so in urban areas. Highways and major roads are the most frequently reported locations for motorbike fatalities (62 percent). Except in this instance, residential areas had a 20% greater rate of motorbike fatalities than other sorts of places.

The atmosphere played a role in the accident in Malaysia. In an automobile collision, the environment is more than just the route you were taking. As a result, driving during this period is not adversely affected by good weather. Routes from the country to the urban might be impacted by the weather. When the weather is severe, rural authorities experience the highest accident rate. Compared to urban areas, which are typically more congested, rural areas have less traffic and infrastructure. In contrast, there are much fewer cars and much less traffic in rural areas.

Due to less traffic and typically inferior roadways that were not designed for speed, rural vehicles may be able to travel more quickly. In fact, the risk of an accident is lower when it is raining than when it is sunny and clear. Slow down, be more cautious, and drive more conservatively when driving in the rain. Due to drivers' failure to take into account the dangers of the slick surface, numerous small accidents on wet roads happen during the rainy season. Indirectly, strong winds can cause dangerous road obstructions like toppled trees, blown-over walls, and panelling to deviate from a vehicle's intended path (Edwards, 1998).

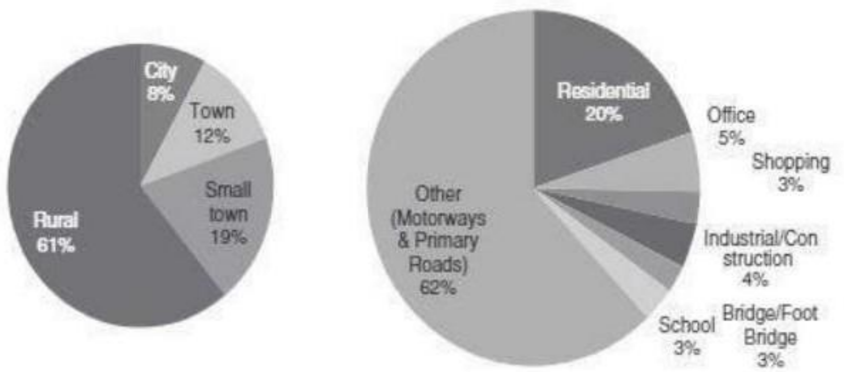

Figure 2.5: Motorcyle Fatalities Base on Area Type (PDRM,2009)

Table 2.3 demonstrates that the largest number of motorbike fatalities and fatality rate per 100,000 persons occur in Malaysia's coastal states. The highest mortality rate per 10,000 motorcycles is found in the east coast region, which has a lower motorcycle population and less dense habitation (PDRM, 2009). Despite having the highest population density, the Federal Territories had the lowest rate of motorcycle fatalities per 10,000 registered motorcycles.

Region of Malaysia[a]	Population	Population density (per km^2)	Registered motorcycles	Motorcycle fatality	Motorcycle fatality/100,000 population	Motorcycle Fatality/10,000 motorcycles
West Coast	4,044,205	730	2,452,630	1031	25.5	4.2
East Coast	3,919,135	215	1,047,225	707	18.0	6.8
Southern	3,233,434	168	1,701,272	673	20.8	4.0
Northern	3,637,266	1926	1,777,419	672	18.5	3.8
East Peninsular	5,540,049	62	689,916	174	3.1	2.5
Federal Territories	1,780,408	9020	1,271,768	95	5.3	0.7
Total	27,565,821[b]	83	8,940,230	3352[c]	–	–

[a] Malaysia consists of 14 states – 3 in the North, 3 in the West and East coast, 3 Federal territories and 2 in the East Peninsular.
[b] Including 5,411,324 population count based on DOSM 2010.
[c] Excluding 718 unknown cases.

Table 2.3: Motorcyle Fatalities Rates by Region in Malaysia in Year 2009 (PDRM,2009)

2.2 Review of Climate Influence Road Safety

The assessment of risk for each category is based on the potential and timing of future impacts. Recent climate patterns in Malaysia indicate a daily increase in temperatures, along with a significant rise in extreme rainfall events, including heavy rain days and high rainfall. Climate models suggest a substantial increase in rainfall for Malaysia in the future (Communication, n.d., Andersson & Chapman, 2011). Consequently, the occurrence of flooding and water logging may become more frequent due to these extreme rainfall events. On the basis of the likelihood and timing of likely future effects, each category's risk is assessed. Recent meteorological patterns in Malaysia, including an increase in daily temperatures, also point to a significant rise in extreme rainfall events, such as heavy rain days and high rainfall. Climate models indicate that rainfall in Malaysia will greatly increase in the future (Communication, n.d.; Andersson & Chapman, 2011). These heavy rainfall episodes could lead to more frequent floods and water logging. Therefore, the main purpose of this study is to investigate how weather conditions, specifically rainfall and temperature, affect traffic accidents. This succinct study offers a summary of studies examining the global impact of temperature and precipitation on traffic fatalities and injuries.

2.2.1 Influence of Rainfall on Road Accident

Road accidents occur at different times of the year and in different locations due in major part to wet roads. However, the impact of rainfall on traffic accidents varies significantly over the world. The majority of studies found that there is an increase in traffic accidents when it rains. On the other hand, a small number of research suggested that there is either no effect of rainfall on accidents on the road or that they decrease during rainfall. As a result, the review of the effects of climate change on traffic accidents has been explained by some reports.

2.2.2 Reports on increased accident during rainfall

Rainfall is said to limit visibility, which can drop to only a few metres during strong downpours (Jaroszweski & McNamara, 2014). Water splashing from large trucks may result in further reductions (Mart et al., 2010). In the event of heavy rain, the headlights of approaching vehicles may create nighttime blindness due to the reflected light from logged water on the road. During a downpour, high humidity can make windows and windscreens foggy, decreasing vision. When it rains, a reduction in road surface friction could lead to dynamic aquaplaning (Mart et al., 2010). These factors working together can result in more traffic accidents. According to Smith (2008), on the other hand, found a 52 percent rise in accidents when it rains, indicating that there is a 22% increase in road accidents when it rains. Satterthwaite found that accidents increased twofold on rainy days (Satterthwaite, 1976). In contrast to dry days, accident rates increased by 2.2 and 3 times, respectively, according to (Brodsky & Hakkert, 1988). Although the driver behavior changes during the rainfall, the risk accident can be happening is greater than during the dry weather.

2.2.3 Reports on Decreased Accident during Rainfall

Rainfall is said to limit visibility, which can drop to just a few metres in strong downpours. Water splashing, especially from large trucks, can further lower this. In the event of a heavy downpour, headlamp reflection on clogged water on the road may result in nighttime blindness. Rainfall-induced increases in humidity can cause windscreens and windows to become foggy and limit vision. Rain also decreases surface friction, which can result in dynamic aquaplaning. Together, these factors may result in an increase in traffic collisions. Moreover, rainwater creates a layer of water on the road making the surface slippery. This reduce the traction and increase the distance required for vehicles to come to a stop. The lack of grip can cause vehicles to skid or lose control, resuming in accidents. However, some drivers may fail to adjust their driving behavior appropriately during rainfall. Speeding, tailgating, sudden braking, or aggressive maneuvers in wet conditions significantly increase the chances of accidents. Plus, drivers who are not adequately prepared for driving in rainy conditions may not take necessary precautions or maintain their vehicles properly. This lack of preparedness can lead to increased risks on the road.

2.2.4 Influence of Temperature on Road Accident

Temperature has less of an effect on traffic accidents than precipitation. There hasn't been many research on how hot it gets and how that affects car accidents. Road accidents and temperature have been linked in many ways, from having no discernible relationship (Gardner, 2016) to having more accidents (Al-Harbi et al., 2013) and more disruption (Yaacob et al., 2014) when temperatures are low. The emotional and physical health of a driver may be impacted by driving in hot weather (De Freitas, 1975). Drivers may be unable to adapt their driving to the excessive heat as a result of weariness and possibly angry attitudes, which could result in more accidents (af Whlberg, 2008). (De Freitas, 1975) asserts that accidents do not generally result from higher temperatures. On hot, bright days, there is more traffic, which may have an effect on how often accidents happen on the roads (Andreescu & Frost, 1998).

According to (Rooney De Freitas, 1975), air temperature has no bearing on car accidents. (Scott, 1986) asserts that higher temperatures in the UK are associated with a rise in the number of accidents. According to Frost and Andreescu, people who drive without air conditioning are more likely to be irritable and make poor decisions. People's reaction times increase with temperature, which raises the possibility of an accident (Andreescu & Frost, 1998). German researchers found that as the temperature rises, people become less focused, more irritable with others, and respond more quickly. Drivers were found to react more slowly and commit more mistakes in hot weather (Wyon et al, 2000). Accidents may rise as a result of tiredness brought on by the temperature (Salminen et al., 2005). According to (Hermans et al., 2006), an increase in the number of hours that sunlight has an impact on daytime temperature may be a contributing factor to an increase in traffic accidents. (Malyshkina et al., 2009) asserts that a rise in road accidents is correlated with high summer temperatures. Drivers' performance would deteriorate if they were exposed to high temperatures for a lengthy period of time, according to (af Whlberg, 2008). In the tropics, temperature has negligible impact on auto accidents. In this connection, one of the most significant investigations was finished by (Al-Harbi et al., 2012) in Kuwait City. Their research indicates that the most hazardous weather conditions occur during temperature fluctuations in the autumn, spring, and winter. Throughout the summer, wind speed is the primary cause of an increase in traffic accidents, with temperature coming in second. A study found that in tropical regions, temperature had a big effect on road accidents.

2.3 Possible impacts of Climate Change on Road Safety in Malaysia

Nowadays, Malaysia have increasing rainfall and also increasing temperature. However, it would have a negative influence especially on road safety and the frequency of accidents. Rainfall is consistently cited as the weather type responsible for the greatest number of weather-related accidents (Edwards, 1999, Qiu and Nixon, 2008). A conclusion about how climate change affects traffic accidents cannot be made since behavioural changes offset the increased risk brought on by changes in the road environment.

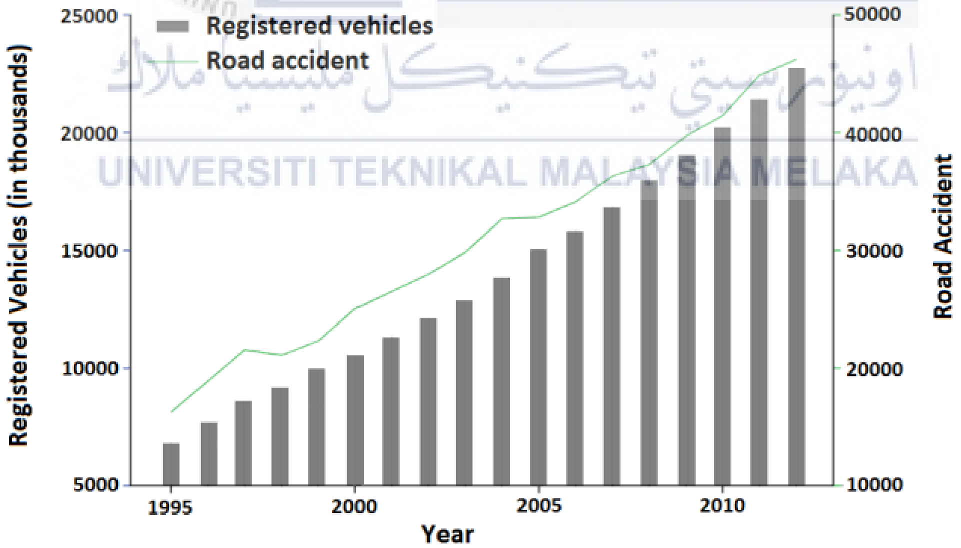

Figure 2.6: Increasing trends in total registered vehicles and road accident in Malaysia

Based on figure 2.6, the traffic is increasing due to increasing of number registered automobiles. One of the main forces behind Malaysia's quick socioeconomic development is road transport. It has made a significant contribution to the nation's overall socioeconomic development and population well-being. With the expansion of the road transport system and the number of vehicles on the road, road accidents have also greatly increased in Malaysia. In terms of traffic accidents, Malaysia is thought to have the 17th most hazardous roads in the world. The fifth most common cause of mortality in Malaysia is traffic accidents. Every year, road accidents cost the nation more than ten billion ringgits in losses. According to statistics from the Malaysian Road Safety Department, the cost of road accidents to the nation's economy in 2012 was RM9.3 billion, or 1.5% of the GDP. The frequency of traffic accidents has increased over the years despite the introduction of numerous intervention strategies.

Following an examination of the impact of rainfall and temperature on traffic accidents around the world, it can be noted that Malaysia's expected increased rainfall and temperature will likewise have an impact on road safety and the number of accidents there. However, since behavioural changes might counteract the increased danger caused by climate change-induced changes in the road environment, it is impossible to draw a conclusion about how climate change will affect traffic accidents. As previously shown on figure 2.6, as the total number of registered vehicles rises, so do the number of traffic incidents in Malaysia. However, the rise in the number of registered automobiles is to blame for this increase. Figure 2 displays the proportion of registered vehicles involved in traffic accidents in Malaysia. The graph illustrates the sharp decline in recent years in the percentage of registered automobiles involved in traffic accidents. In Malaysia, fewer accidents have been reported per 10,000 automobiles, according to reports. This may be the result of drivers' increasing awareness in recent years. Additionally, recent government initiatives have helped to lower the number of traffic fatalities and accidents.

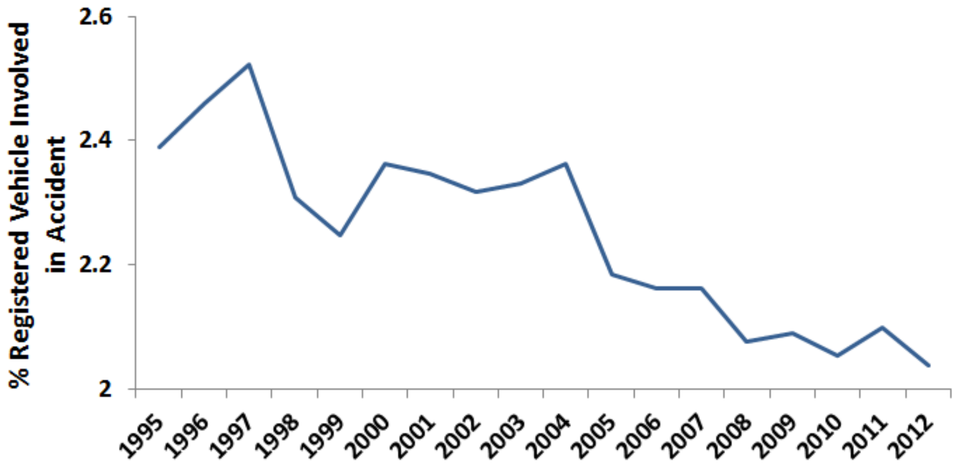

Figure 2.7: Percentage of registered vehicle involved in road accident over year 1995-2012

Road accidents are directly impacted by increased rainfall. However, because it requires high resolution continuous rainfall data, it is frequently exceedingly challenging to establish. To understand the effects of recent changes in road accident owing to wet road condition, accessible data on road accidents due to wet road conditions are presented in the current study. The number of traffic accidents per 100,000 registered vehicles on wet roads is shown in Figure 2.8. The graph shows that the number of accidents on the road per 100,000 registered vehicles is on the decline as a result of the wet road conditions.

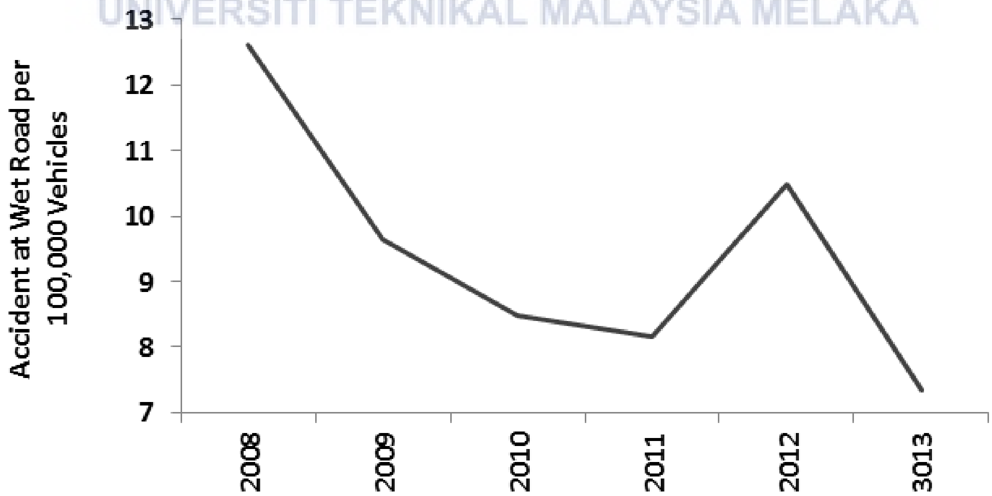

Figure 2.8: Number of road accident at wet road condition

When the ratio of road accidents caused by wet road conditions to all other road accidents is taken into account, a different pattern can be seen. Figure 2.9 depicts changes in the ratio of road accidents caused by wet road conditions to all other accidents in Malaysia from 2008 to 2013. We can confirm that the ratio of road accidents due to wet road condition to total number of road accident has increased in Malaysia.

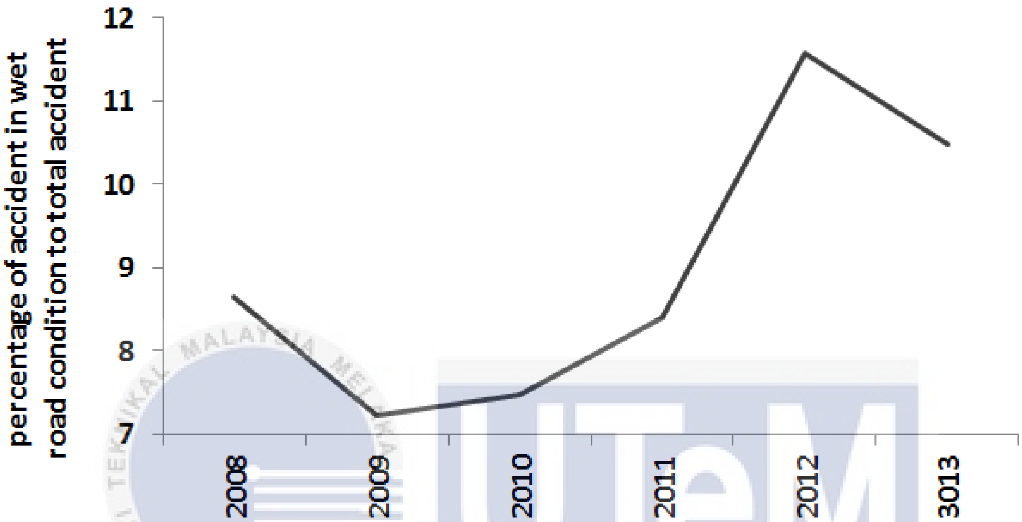

Figure 2.9: Percentage of road accident at wet road condition to total number of road accident

According to the study above, Malaysia has seen a drop in the number of accidents caused by wet roads per 100,000 registered vehicles in recent years. This is to be expected given the drop in Malaysia's overall rate of traffic accidents per 100,000 registered vehicles. On the other hand, a rise in the proportion of accidents caused by wet roads compared to all accidents shows that Malaysia's road accidents are becoming more and more influenced by rainfall. With this scant quantity of information, though, it is impossible to make a firm choice.

Increasing temperatures have largely indirect effects on traffic accidents. Temporal psychological and/or physiological changes in response to high temperatures may alter a driver's focus, which may then modify the course of an accident. Climate change, on the other hand, is a slow-moving phenomenon that over a long period of time will gradually raise temperatures and bring about related extremes. The estimated increase in temperature for

Malaysia over the course of this century is between 1 and 2 degrees Celsius, which is less than the anticipated rise in average global temperature. The effects of higher temperatures on human sensitivity and the potential danger of a car accident can thus be easily adjusted by raising knowledge of these effects.

Finally, it should be noted that the changing road environment brought on by climate change would undoubtedly put Malaysian road safety at danger. However, as climate change might also alter driver behaviour, it is impossible to make a firm judgement regarding how it will affect Malaysian road accidents. One of the main factors contributing to Malaysia's gradual decline in road accidents is government efforts to raise public awareness of the importance of driving safely. The apparent increase in public knowledge of traffic safety in recent years may help Malaysia adjust to the changing road environment brought on by climate change.

2.4 Factors analysis of motorcycle crashes in Malaysia

Motorcycle is one of the transportations that commonly use Asia such Malaysia, Thailand and Indonesia. It is very popular to use the 2-wheel vehicle due to a variety of features, including their low cost and low fuel consumption. Accidents typically come from several different things happening at once. The World Health Organisation (WHO) categorises road traffic injuries as "fatal or nonfatal" and defines a road traffic accident as "a collision or occurrence that may or may not result in harm, occurs on a public road, and involves at least one moving vehicle" (Masuri et al., 2012).

2.4.1 Human Factor

Human factors play a significant role in motorcycle crashes in Malaysia, as they do in many other countries. Reckless driving is one of these factors, many motorcycle accidents occur due to reckless driving behaviors such as speeding, overtaking without proper visibility, and disregarding traffic rules. Some riders engage in dangerous maneuvers, including weaving in and out of traffic, which increases the risk of collisions. Inexperienced riders or those who have not undergone proper training may lack the necessary skills to handle various road situations effectively. Insufficient knowledge of defensive driving techniques and inadequate understanding of traffic laws can lead to errors and poor decision-making on the road. Besides, alcohol consumption impairs judgment, coordination, and reaction times, increasing the likelihood of accidents. Riding under the influence of alcohol or drugs is a significant risk factor for motorcycle crashes in Malaysia, as it is in many other countries.

Moreover, fatigue can severely affect a rider's ability to focus, react quickly, and make sound judgments. Long hours of riding without breaks, sleep deprivation, and irregular working patterns can contribute to fatigue-related crashes. Not just that, the use of mobile phones, headphones, or other electronic devices while riding can distract motorcyclists, divert their attention from the road, and impair their reaction times. Distractions also include eating, drinking, and engaging in conversations with pillion passengers. Lastly, failure to wear appropriate safety gear, such as helmets, protective clothing, and reflective materials, increases the risk of severe injuries or fatalities in the event of a crash. Some riders may neglect safety gear due to comfort issues or lack of awareness about its importance.

2.4.2 Road/Traffic Factors

Malaysia, a member of the Association of Southeast Asian Nations (ASEAN), has a low rate of motorbike deaths, as seen in table 2.4. In ASEAN nations, motorcycles make up over 58 percent of all vehicles, and over the previous ten years, they have been the main contributor to traffic fatalities. Malaysia is ranked eighth among nations in terms of the number of motorbike fatalities per 10,000 registered cars, according to study. The three highest-ranking nations in terms of the number of fatal motorcycle accidents per 10,000 registered motorcycles are Cambodia (75.1), Lao PDR (9.6), and Singapore (7.1). On the other side, Malaysia has the highest global rate of road fatalities per 100,000 inhabitants (Abdul Manan & Várhelyi, 2012).

	Fatalities per 100,000 pop (est.)	Reported casualties			Registered vehicles		GNI per capita (US$2007)
		Deaths	Male deaths	Injuries ('000)	Total ('000)	Motorcycles and tricycles	
Brunei	13.8	54	80%	0.6	304.4	4%	30,580
Cambodia	12.1	1545	79%	25.9	154.4[a]	84%	540
Indonesia	16.2	16,548	73%	66	63,318	73%	1650
Laos	18.3	608	–	8.7	641.1	79%	580
Malaysia	23.6	6282	84%	21.4	16,825	47%	6540
Myanmar	23.4	1638	75%	12.4	1045.1	65%	281
Philippines	20	1185	–	5.9	5515.6	48%	1620
Singapore	4.8	214	80%	10.4	851.3	17%	32,470
Thailand	19.6	12,492	78%	973.1	25,618	63%	3400
Vietnam	16.1	12,800	79%	10.3	22,926	95%	790

a: Cambodia had 869,000 registered vehicles in 2007 according to ASEAN (2009).
Source: WHO (2009a)

Table 2.4: Road traffic safety data from ASEAN countries

The West Coast States of Malaysia have both the greatest mortality rate per 100,000 inhabitants and the highest number of motorbike fatalities. The East Coast Region has the greatest deaths per 10,000 motorbike riders due to its lower motorcycle population and lower built-up density. Despite having the highest population density, the Federal Territories had the lowest motorcycle mortality rate of 21 per 10,000 registered bikes. Statistics from the police show that there were 61% more fatalities in rural areas than in urban ones. More specifically, highways and main routes account for 62% of all motorbike fatalities reported. Additionally, the fact that residential areas account for 20% more motorcycle fatalities than any other sort of region demonstrates that arterial and main roadways account for the vast majority of motorcycle fatalities. Due to their length, principal and arterial routes have the greatest mortality rates per

100 km and per 100,000 motorcyclists. Malaysia's major highways have more motorcycle fatalities than secondary roads, local streets and tiny roads combined.

2.4.3 Environment factors

The atmosphere was one of the variables that contributed to the Malaysian catastrophe. Some experts think that the term "environment" should be used to describe meteorological conditions that cause accidents on the roadways. Because the bulk of accidents occur during this time, nice weather has no effect on driving. The weather may impact the route a road takes from one urban region to the next. During bad weather, rural authorities tend to have the greatest accident rates. Urban areas usually have more traffic and infrastructure than rural areas. Although there is less traffic and fewer cars on the road in rural areas, this is not always the case. Rural drivers may drive faster since there is less likelihood of an accident due to less traffic and typically poor roads that were not built for speed. Accidents are more likely to occur when it is raining, which is the most prevalent weather condition. Even if rainy weather increases the likelihood of an accident, drivers should take extra measures by slowing down and modifying their driving habits. A large number of small accidents occur during rainstorms as a result of drivers failing to account for the wet road surface. High winds can cause a vehicle to stray from its intended path, roll over, or be blown over by potentially hazardous road obstructions like fallen trees or blown-over walls and panels (Edwards, 1998).

The term environment is used in several research to define a road situation. The Malaysian Ministry of Works' Road Safety Programme is organised on four main strategies. Accident prevention, accident reduction, road maintenance, and the development of new roads are all examples of preventative approaches. According to the idea, reducing the amount of time drivers spend on the road will make them less likely to be involved in an accident. Roads in developed countries such as Denmark and the United States should be constructed to meet the needs of the people who use them. Accidents have dropped in the Netherlands. In Malaysia, the number of roadways has increased. Rapid population growth, economic development, and industrialization are all associated with an increase in the number of accidents. Industries associated with automobiles.

2.5 Driver Reaction Time in Road Traffic

Driving reaction time is an important factor in road safety because it includes the time it takes for a driver to recognise a possible threat or circumstance that requires a response and then execute that response. The perception time, during which a motorist recognises a threat or stimulus, such as the appearance of brake lights ahead, is one of the most important components of this process. Following that, processing time occurs, which includes mental processing of information and decision-making about the best course of action. Distractions, exhaustion, impairment from substances such as alcohol or drugs, age-related changes, driving experience, and environmental circumstances can all have an impact on a driver's reaction time. Distractions must be minimised, driver alertness must be maintained, and impaired driving must be avoided. Defensive driving methods, such as maintaining a safe following distance and remaining alert to the road, are critical in compensating for differences in reaction time, lowering the likelihood of accidents, and guaranteeing safe travel. As reaction times depend on the urge for the response (Burckhardt, 1981)

Several factors can affect an individual's reaction time whether in everyday situations or when driving. These factors can either slow down or in some cases enhance the reaction time.

2.5.1 Characteristics

In the intricate web of factors influencing road safety, one critical aspect is the reaction time of drivers. Reaction time is the interval between the perception of a stimulus and the initiation of a response. Various individual characteristics significantly affect a driver's reaction time, subsequently influencing their ability to navigate safely through road traffic. Understanding these characteristics is crucial for devising effective strategies to enhance road safety.

2.5.1.1 Age

The age factor has a considerable influence on reaction time. Reaction time normally increases with age, implying that elderly people have longer reaction times than their younger counterparts. This phenomenon is caused by a variety of age-related changes in cognitive and physical ability. Natural cognitive changes that occur as people age might affect reaction time. Processing speed, working memory, and attention span have all slowed slightly as a result of these alterations. Because it entails recognising a hazard or stimulus and deciding how to respond, cognitive processing is an essential component of response time. Physical changes such as diminished muscle strength and coordination are common in the elderly. This can lead to a lengthier movement time, which is the portion of reaction time spent physically performing a response, such as shifting one's foot from the accelerator to the brake pedal.

It's important to note that while older drivers may have slower reaction times on average, they can compensate for this to some extent with experience and expertise. Older drivers often have a wealth of driving experience and have developed strategies for anticipating and responding to potential hazards, which can partially mitigate the effects of age-related changes. It's essential to remember that age-related changes in reaction time vary from person to person. While reaction time tends to increase with age, it is not an absolute rule, and there is a wide range of individual differences. Some older individuals may maintain relatively fast reaction times, while some younger individuals may have slower reaction times due to other factors like distractions, fatigue, or impaired judgment. Age-related changes in cognitive and physical abilities can result in older people having longer reaction times. These changes, however, are not universal, and individual circumstances, as well as experience and competence, can impact how much ageing affects reaction time. Recognising the possible influence of age on response time can be critical for road safety, especially when creating and implementing programmes that encourage safe driving practises among older drivers, such as frequent vision and hearing examinations and refresher courses.

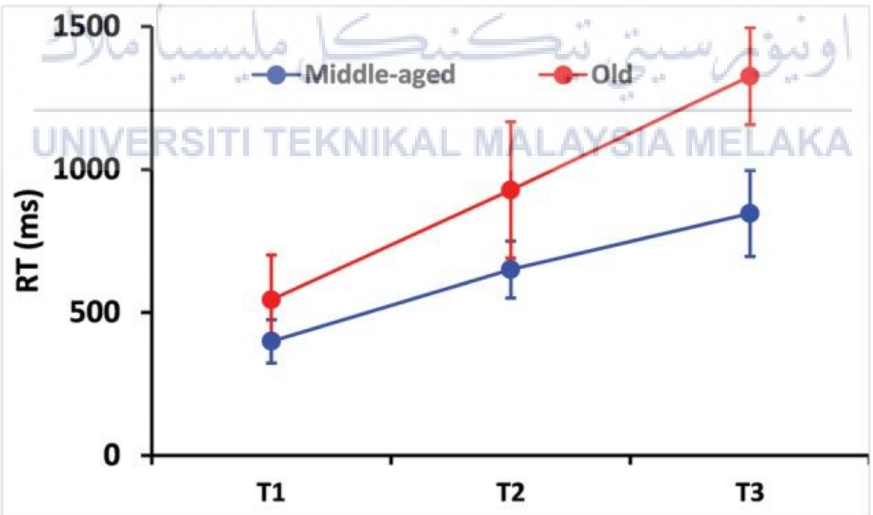

Figure 2.10: Reaction vs Time

From the figure above, that can be concluded the reaction time increased along with the action. Similarly, as task difficulty increased, the rate of correct responses declined while the rate of no-response increased. Inter-group comparisons found that the middle-aged group outperformed the elderly group, indicating that ageing has a distinct effect on both reaction time and response accuracy. According to a study by (Hale et al, 1987), the reaction time of people aged between 50 and 60 years increased about 10% faster than those young people, while the reaction time of elderly people (65 to 75 years) increased about 30% faster. Another study by the National Highway Traffic Safety Administration (NHTSA,), states that the typical reaction time to perceive a threat such as a deer or a child running into the road is about 3/4 second. It is important to note that the reaction time of drivers is influenced by age. The NHTSA also reports that speeding is a major factor in road accidents, and the youngest males are most likely to die in speeding-related crashes: 15 – 20 years old males (35%), 21- to 24-year-old males (35%), and 25- to 34-year-old males (30%). There is a steady drop with age for males. Up to age 34, almost twice as many males die in speeding crashes than females.

2.5.1.2 Experience

The level of experience a driver accumulates over time significantly influences their reactions and behavior on the road. Experienced drivers tend to make more informed and efficient decisions on the road. The wealth of encounters with diverse traffic scenarios allows them to anticipate potential hazards and select appropriate actions. For instance, a driver with extensive experience might seamlessly navigate through complex intersections, choosing optimal routes and paths based on past experiences.

Novice drivers typically undergo a learning curve where they acquire and refine basic driving skills. These skills include steering control, braking, accelerating, and navigating traffic rules. As drivers gain experience, they become more adept at handling their vehicles in diverse situations. Experienced drivers have encountered a wide array of traffic conditions, such as heavy traffic, adverse weather, and complex intersections. Exposure to these diverse scenarios enhances their ability to anticipate and respond effectively to potential hazards. Novice drivers, on the other hand, may find it challenging to adapt quickly to unexpected situations. Over time, drivers become familiar with the road networks they frequent. Knowing the layout of roads, recognizing landmarks, and being aware of common traffic patterns contribute to a driver's ability to navigate efficiently. Drivers with longer experience already know their capabilities and feel more confident behind the wheel, and their driving technique improves as well, (Pawel Droździel, 2020). This familiarity can play a role in reducing reaction times as drivers anticipate changes in the road environment.

Besides, experience sharpens a driver's decision-making abilities. Seasoned drivers are often more confident in assessing situations and making split-second decisions. They develop a better understanding of the consequences of their actions on the road, contributing to safer and more efficient driving. Experienced drivers tend to develop strong anticipatory skills. They can predict the actions of other road users, foresee potential hazards, and proactively adjust their driving to minimize risks. Anticipatory skills are crucial for reducing reaction time, as experienced drivers may start responding to a situation before it fully unfolds. Together with the experience gained, the driver improves his or her judgmental skills, improves his or her driving technique and learns to respond to emergencies, (Paweł Droździel, 2020)

2.5.1.3 Fatigue

Fatigue is a significant factor that can adversely impact a driver's reaction time on the road. Fatigue refers to a state of physical or mental exhaustion resulting from prolonged periods of wakefulness, insufficient sleep, or strenuous activities. When drivers are fatigued, their ability to remain alert, make quick decisions, and respond promptly to stimuli is compromised. The major effect of driver fatigue is that they becomes gradually diverted from the road and road traffic, with the resultant poorer driving performance. Thus, the effects of fatigue in a driver are comparable to those after alcohol intake, (Teresa Makowiez, 2011). From this article, fatigue impairs cognitive functions, including attention, memory, and processing speed. Drivers experiencing fatigue may have slowed mental processing, leading to delays in recognizing and responding to changes in the road environment. Fatigue diminishes overall alertness and vigilance. A fatigued driver is more likely to miss critical cues on the road, such as traffic signals, road signs, or the movements of other vehicles. This reduced alertness can significantly extend reaction times.

Fatigue negatively affects a driver's ability to make sound and timely decisions. The tired brain may struggle to assess situations accurately and choose appropriate responses. This impairment in decision-making can lead to delayed reactions in critical driving scenarios. Fatigue can influence a driver's risk perception and tolerance. Fatigued individuals may exhibit more risk-taking behavior, as their judgment becomes compromised. This can lead to situations where the driver fails to react appropriately to potential hazards or takes unnecessary risks on the road. Extreme fatigue can result in microsleep episodes, where the driver briefly loses consciousness for a few seconds. During these episodes, the driver is essentially asleep, leading to a complete lapse in attention. If a microsleep occurs at a crucial moment, such as when approaching a red light or a stop sign, it can significantly increase reaction time. Statistics from the Royal Malaysia Police reported that between 2011 and 2021, there were 1,305 fatalities attributed to drivers falling asleep at the wheel, (NSTP, 2022). It is essential for drivers to prioritize adequate rest and sleep, take regular breaks during long journeys, and be aware of the signs of fatigue. Additionally, awareness campaigns and education on the dangers of driving while fatigued can contribute to promoting safer driving habits and reducing the risks associated with delayed reactions on the road.

2.5.1.4 Alcohol and Drug Use

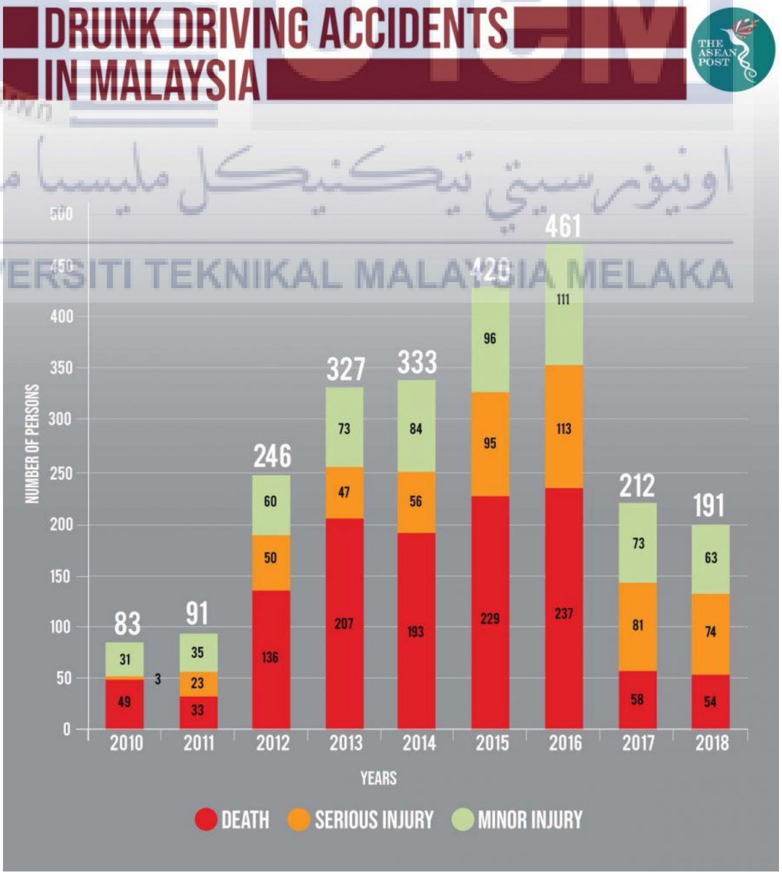

Figure 2.11: Druk Driving Accidents in Malaysia

Based on figure 2.11, alcohol and drug use significantly impairs a driver's ability to react quickly and appropriately on the road, posing serious risks to themselves and other road users that cause death. In 2016, the statistic recorded with the highest value of cases with 461 while the lowest is on 2010 with 83 cases. This increasing trend is very serious matter because of driver behavious become more worse and worse over years. The impact of alcohol and drug use on reaction time can be profound, affecting various cognitive and motor functions. Alcohol and drugs can compromise fine motor skills and coordination. Drivers under the influence may struggle with tasks requiring precise movements, such as steering, braking, and shifting gears. Impaired coordination contributes to delayed physical responses, increasing the overall reaction time.

Alcohol and drugs can induce drowsiness and decrease overall alertness. A drowsy driver is more likely to miss critical cues on the road, such as traffic signals, pedestrians, or other vehicles. Diminished alertness hampers the ability to react quickly to changing road conditions. Driving requires effective multitasking, involving attention to the road, monitoring traffic signals, and responding to various stimuli. Alcohol and drug use diminish the ability to multitask efficiently, making it challenging for drivers to process information from different sources simultaneously. Moreover, alcohol and certain drugs slow down the central nervous system, resulting in delayed reactions to external stimuli. This delay can be critical in situations requiring quick responses, such as avoiding a collision, braking suddenly, or swerving to avoid an obstacle. To address the impact of alcohol and drug use on reaction time in road traffic, strict enforcement of laws prohibiting impaired driving is crucial. Public awareness campaigns, educational programs, and rehabilitation efforts are also essential to prevent and address substance abuse among drivers. The combination of legal measures, education, and societal awareness can contribute to reducing the risks associated with impaired driving and improving overall road safety.

2.5.1.5 Distraction

Distraction is a pervasive issue that can significantly impact a driver's reaction time on the road. Distractions divert a driver's attention away from the critical task of driving, increasing the risk of delayed reactions to potential hazards. Distractions can be categorized into various types, and each type can have a distinct effect on a driver's ability to react promptly According to (McGrady & McGrady, 2022), A lack of concentration on the task at hand can leave drivers struggling to react in time to obstacles. If people are thinking about a text message or a conversation with a family member, then they may not notice other drivers around them. Cognitive distractions affect a driver's mental focus on driving. Daydreaming, talking on the phone, or engaging in deep conversations can divert attention from the road. Cognitive distractions can lead to delayed processing of information and slower reaction times when quick decisions are needed. Modern technology, including smartphones and in-car infotainment systems, has introduced new challenges to driver attention. Notifications, calls, and messages can be sources of distraction, pulling a driver's focus away from the primary task of driving. To address the impact of distraction on reaction time, it is essential for drivers to practice focused and attentive driving. This involves avoiding the use of mobile phones, minimizing in-car distractions, and staying mentally engaged with the task of driving. Public awareness campaigns, legislation, and enforcement of distracted driving laws also play crucial roles in promoting safer driving habits and reducing the risks associated with delayed reactions on the road.

2.5.2 Road and Environmental Conditions

The road and environmental conditions play a crucial role in influencing a driver's reaction time. Various factors related to the road and the surrounding environment can impact how quickly and effectively a driver can respond to changing circumstances. Rain, snow, or ice can create slippery road surfaces, affecting the friction between tires and the road. In such conditions, a driver may experience longer braking distances and reduced traction, leading to delayed reactions. Poor road conditions, such as uneven surfaces or potholes, can contribute to a bumpy ride. Drivers may need extra time to navigate these obstacles, impacting their reaction time.High traffic volumes and congestion can limit a driver's ability to maneuver freely. In congested areas, drivers may experience delays in responding to changes in traffic flow or sudden events due to limited space and restricted movement. Busy intersections require heightened attention. The complexity of interactions with other vehicles, pedestrians, and traffic signals can influence a driver's reaction time.

Besides, fog, rain, snow, or low visibility due to darkness can impair a driver's ability to perceive the road environment accurately. Reduced visibility increases the time it takes to identify potential hazards and respond appropriately. Objects such as large vehicles, signage, or landscaping features may obstruct a driver's line of sight. Limited visibility can lead to delayed reactions to unexpected events. Visually stimulating roadside advertisements and distractions can divert a driver's attention from the road. Excessive distractions can contribute to delayed reactions to unfolding events. To enhance road safety and minimize the impact of road and environmental factors on driver reaction time, it is essential for road infrastructure to be well-designed, adequately maintained, and equipped with proper signage. Additionally, driver education and awareness campaigns can help individuals understand the importance of adapting their driving behavior to varying road and environmental conditions. Improved road design, proper maintenance, and comprehensive driver training contribute to creating a safer driving environment for everyone on the road.

2.6 Summary

As the conclusion, motorcycles are very popular in Asia country due to a variety of features such as low fuel consumption, compact and low maintenance. However, motorcycle accidents are on increasing in these countries. The first cause of increased mortality is human error, since the majority of motorbike accidents were caused by speeding and a high level of alcohol in the blood. The second component is the road and traffic aspect, because motorcycle fatalities are more common in residential areas, and main highways account for the vast majority of motorcycle deaths. The final aspect is the state of the environment, because some experts say that the term "environment" should be used to designate meteorological conditions that affect roads and cause accidents. Because the bulk of accidents occur during this time, nice weather has no effect on driving. So, with the enhancement of the 3rd Brake Light and Food Delivery Signal, Motorcyclist is developing an intelligent hazards system. The Intelligent Hazard System is a technology that has been added to modern automobiles to improve the safety of vehicle drivers and passengers when driving or riding in a variety of environmental conditions. Drivers and passengers will be more vigilant in all situations. There are numerous implications to failing to respond to a delayed or stopped vehicle.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter explains the research procedure for the project, which involves experimental activities, data collection, and statistical analysis. It will show how technology was used to design and improve the third light brake and signal for motorcycle riders. It also displays the project's flow chart from start to finish. In this chapter, all hardware equipment that need to use. A survey will be conducted to get opinion from food rider that can develop the 3rd Brake Light and Signal Hazard.

3.2 Project Flowchart

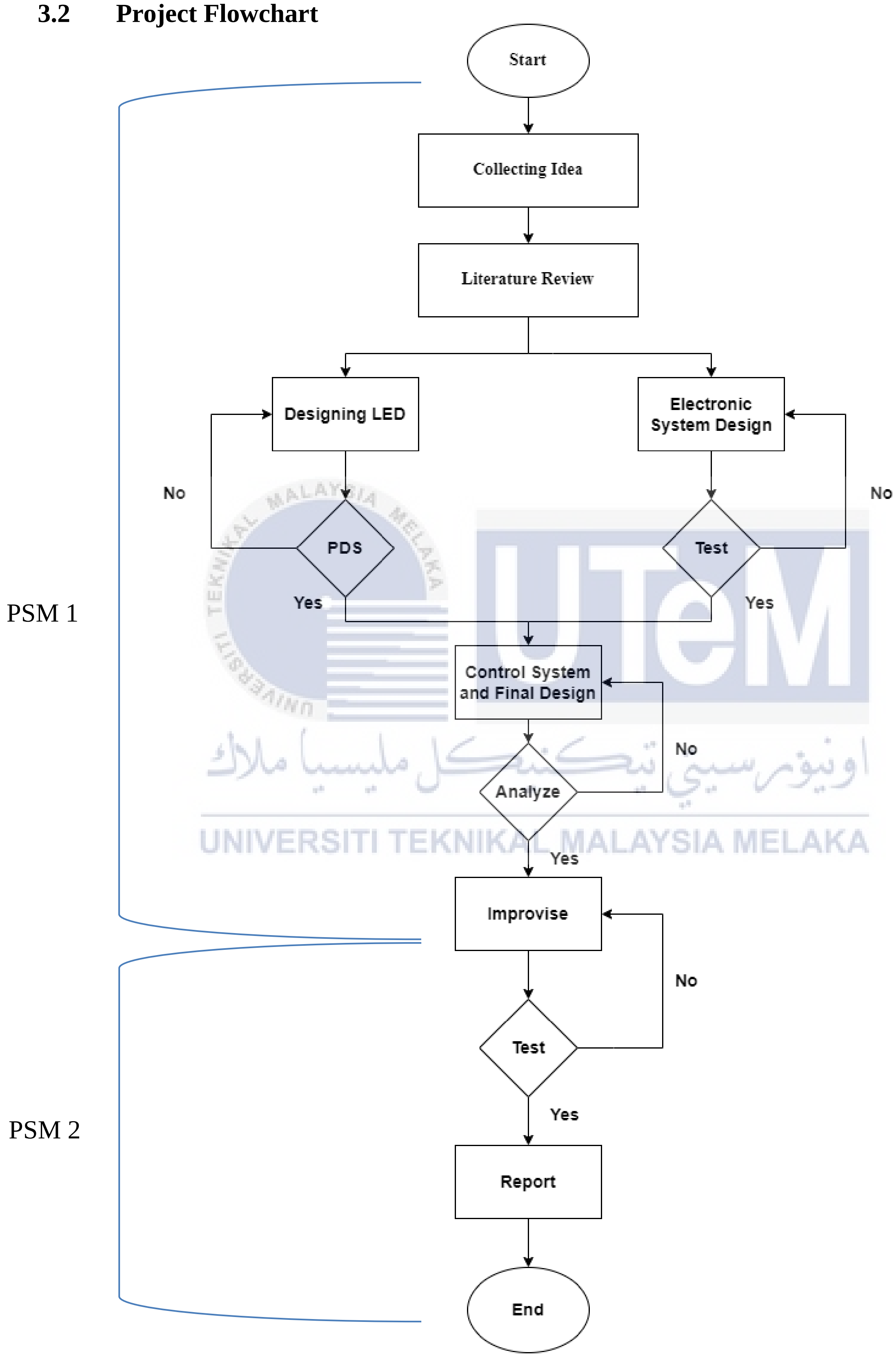

Figure 3.1: Flow Chart PSM 1 and 2

3.3 Implementation Hardware

This part will go deep into the material and components that use in improved 3rd brake light and signal hazard.

3.3.1 Arduino (Nano V3)

The Arduino Uno, a microcontroller board manufactured by Arduino.cc, is interchangeable, modular, and built around the Arduino Microcontroller. Smaller versions of the Arduino UNO are commonly available and perform similar functionality. It runs on 5 volts.

However, the voltage level can be varied between 7 and 12. The Arduino Nano has 14 digital pins, 8 analogue pins, 2 reset pins, and 6 power pins. This board connects to a laptop through a tiny USB connector rather than a standard USB port. Because of its small size and breadboard compatibility, this microcontroller is an excellent choice for most projects where the size of electrical components is critical.

Figure 3.2: Arduino Nano

3.3.2 Breadboard

Breadboards are small plastic boards that house integrated electrical components like as transistors, resistors, and semiconductors.These tools are useful for developing one-off systems, although they are rarely marketed.An electrical circuit is built on a breadboard. A prototype that can be used in future applications is created.

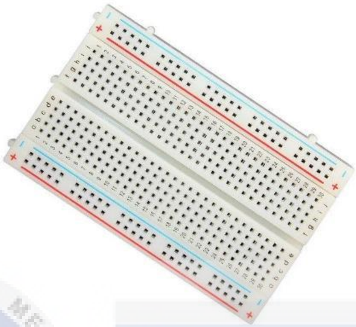

Figure 3.3: Breadboard

3.3.3 Tranceiver (NRF 24L01)

An Arduino-controlled NRF24L01 wireless transceiver module provides a more versatile, inexpensive, and user-friendly wireless control option. The Arduino unit can be used to control any electrical or electronic equipment by simply connecting it and entering the relevant control code. The wireless transceiver module nRF24L01, Arduino Nano V3, and other control components are all readily integrated. As a result, it can be utilised to power a variety of systems without the need for circuitry replacement. Changing only a few control codes in the transmitter and receiver is required.

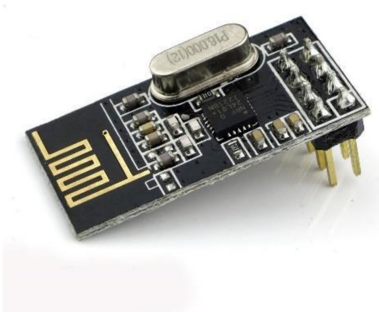

Figure 3.4: Tranceiver

3.3.4 Relay

A relay enables electrical devices to switch circuits; for example, a timer circuit with an arelay can switch electricity on and off at a certain time.

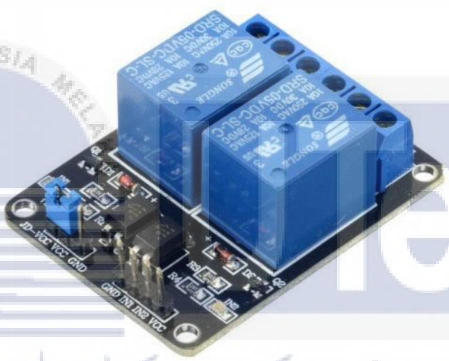

Figure 3.5: Relay

3.3.5 Connecting Wire

There are several ways to explain joining wires. A wire is a metal strand that is long, thin, and flexible that is used in metalworking. Wires carry electrical current between two or more components in an electrical circuit. They are a low-resistance conductor. There are several type such male-female, male-male and female-female that can adapt with the circuit

Figure 3.6: Connecting Wire

3.3.6 Ethernal Cable

The Arduino Ethernet Shield V1 allows you to instantly connect the Arduino to the internet (through PC or Laptop).This module connects to the Arduino board and can be used to remotely control your environment.Using this cable, you may programme the Arduino Uno from a laptop or desktop computer.

Figure 3.7: Ethernal Cable

3.3.7 Battery

Battery provide an electricity to the circuit so the output can be obtain. .This battery is commonly used in smoke alarms, smoke detectors, walkie-talkie radios, transistor radios, test and instrumentation equipment, medical batteries, LCD screens, and other small portable electronics.

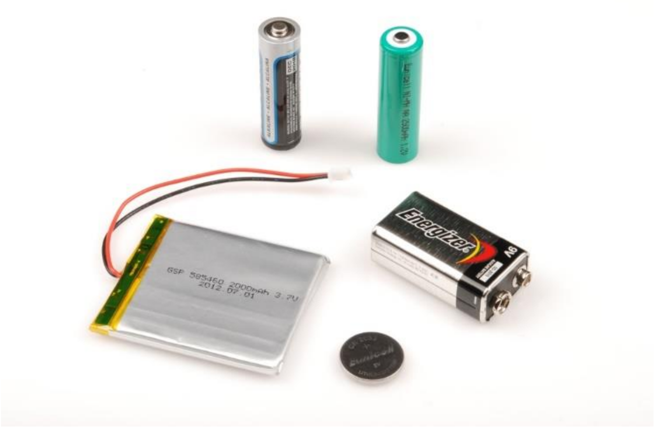

Figure 3.8: Battery

3.3.8 Battery Cap

It is used to shield and insulate a battery. Furthermore, it protects the batteries from contamination and damage, as well as circuits from unintentional electrical discharge caused by inadvertent grounding.

Figure 3.9: Battery Cap

3.3.9 LED

LED lights are brighter than standard bulbs.LED lighting can also help to save batteries.As a result, this LED light was chosen to be used in this product for increased visibility.

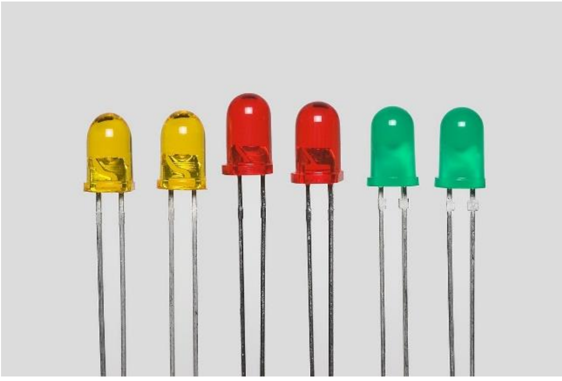

Figure 3.10: LED

3.3.10 Resistor

A resistor is a two-terminal passive electrical component that implements electrical resistance to operate as a circuit element.

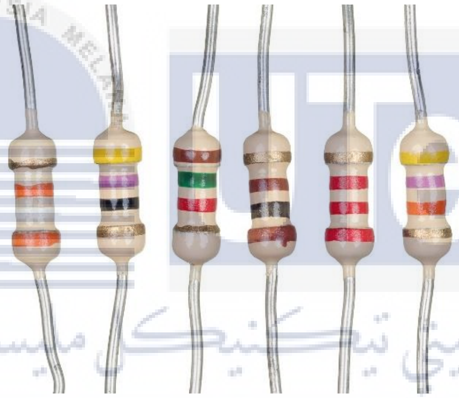

Figure 3.11: Resistor

3.3.11 Push Button Switch

This push button switch serves as a motorbike brake light.This switch was installed since it is portable and easy to transport.

Figure 3.12: Push Button Switch

3.3.12 Turn Signal Switch

The turn signal switch is used to test it on a real motorcycle.The switch has the same function as a standard switch, which has three positions: left, right, and off.

Figure 3.13: Turn Signal Switch

3.3.13 Velcro Strap

A Velcro strap is a type of fastening mechanism commonly used in various applications. It consists of two components: a strip of fabric with tiny hooks and another strip with small loops. When pressed together, the hooks catch onto the loops, creating a secure and temporary fastening.

Figure 3.14: Velcro Strap

3.4 Illustrated Diagram

Figure 3.15: Simple Illustrated of wiring

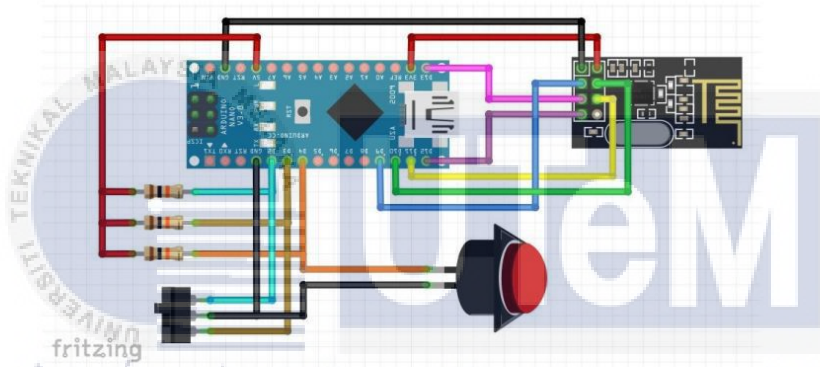

Figure 3.16: Transmitter Schematic Diagram

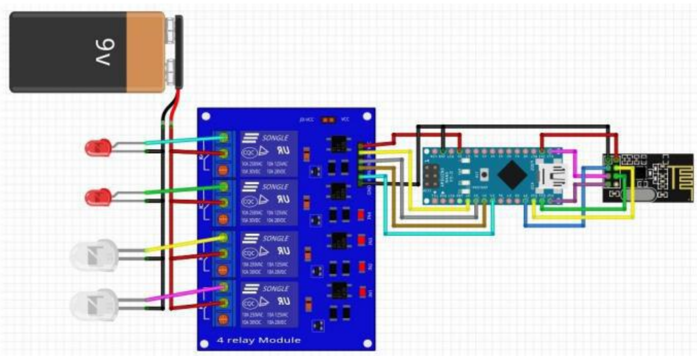

Figure 3.17: Transreceiver Schematic Diagram

3.5 LED Blinking System

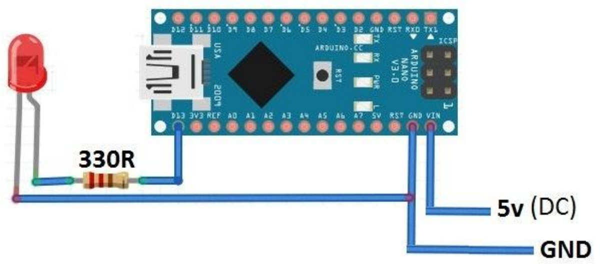

Figure 3.18: Basic Schematic Diagram for LED Blinking System

3.6 Hardware Requirement

No	Hardware	Quantit
1	Arduino	1
2	Breadboard	1
3	LED	3
4	Resistor	3

Table 3.1: Requirement Hardware

3.6.1 Required Hardware for Lighting Up LED using Arduino

No	Arduino	LED
1	Pin	Anode(+)
2	GND	Cathode(-)

Table 3.2: Connection of Arduino and LED

3.6.2 Arduino Coding

```
void setup() {
  pinMode(13, OUTPUT);
}
void loop() {
  digitalWrite(13, HIGH);
  delay(1000);
  digitalWrite(13, LOW);
  delay(1000);
}
```

Figure 3.19: Basic LED Coding using Arduino

3.6.3 Code Explanation

1. We define whether digital pins should be utilised as INPUT or OUTPUT in the setup() procedure. The "pinMode()" function is used to specify the working mode of a pin as an input/output device.
2. In the loop function, we employ two intrinsic functions: digitalWrite() and delay (). The function digitalWrite() tells the controller/Arduino whether a specific digital pin should be set to LOW or HIGH. The delay() function is used to postpone the preceding instruction, causing the succeeding instruction to wait until the delay time is up. We give delay one parameter, which is the amount of time to be delayed in milliseconds.

3.6.4 Summary

Even for beginners, the Arduino platform is remarkably simple to use and programme.The Arduino IDE programme includes a plethora of straightforward code samples.The boards can also be USB flash-programmed right there.As a result, bringing your computer to the project simplifies using Arduino.The nRF 24L01 transceiver module, which acts like a radio frequency signal, is used in the project to transfer signals wirelessly.This device is simple to use, easy to programme, has a quick response time, and has a range of up to 100 metres.Because of its tiny size, this gadget is appropriate for use in a food rider pack and implementation on a motorbike. This Arduino Nano V3 and nRF24L01 transceiver module combination is ideal for wireless IMPROVEMENT OF 3RD BRAKE LIGHT AND SIGNAL FOR FOOD DELIVERY MOTORCYCLIST. The finest feature is the ability to customise the output signal and brake light, which can utilise many sorts of design and form based on our own imagination to increase the visibility of this project's output.

3.7 Idea Design

There are several desgin for the brake light and signal hazard with different placement such below:

1. Design 1

Figure 3.20: Design 1

2. Design 2

Figure 3.21: Design 2

From the design above, desgin 2 is more suitable for the food box because of simple look. But, this design not yet to be decided so a survey will create to get others opinion.

3.8 Design Improvement

From the previous project, the setup of the circuit was good but as we can see from figure 3.23, the arrangement of wire was unorganise and the signal light was seperated with the brake light. This consume more space and wire connector for the circuit so the circuit look complicated.

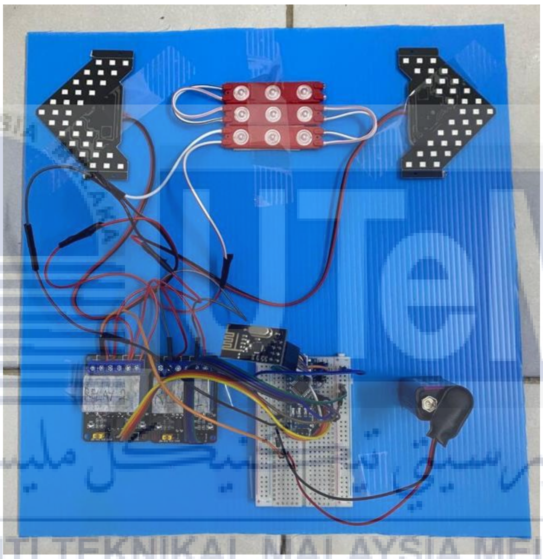

Figure 3.22: Brake light & Signal Circuit

With that, the design of the brake and signal light change with the simple and efficien one. Figure 3.24 shows the newer design where it is combination of signal light and brake light in one setup. This is very efficien especially for the food rider where they need the tail light with the simplest one but effective. The previous version of LED light were not durable enough for the any condition so the latest design come with the guarantee water resist so that the light can be placed onto the food box. With that, this design are choose for this project.

Figure 3.23: New design of LED Light

3.9 Catia

The casing for the transmitter and receiver from the previous project were not good enough so some improvement of the casing design shown as the figure below by using the Catia software. The material for this box are PLE which more durable and suitable for this project.

3.10 Survey Form

A survey has been made and there were 20 peoples were choosen to answer this survey. The survey was given through social media such as WhatsApp, Instagram and Facebook. This survey is very important to investigate and study about food delivery motorcyclist safety. So the questions are listed below:


Food Delivery Motorcyclist Safety

Assalamualaikum,
I am Syed Muhammad Munel Wafa final year student from BMMA University Technical Malaysia Melaka. This survey is to study food delivery motorcyclist safety in Malaysia and prevent them from accident. We hope all food riders can help us to answer this survey and we appreciate your answer.

Figure 3.24: Survey Discription

3.10.1 Summary From Survey

A total 20 food rider responded to the survey within 17 from them were single male while single female were the rest and mostly the were in between 20 to 25 years old. The majority of food delivery rider is from GrabFood (75%), FoodPanda (60%) while Shopee Food (25%) and McDelivery (25%) share same value. However, the Pizza Hut Delivery (15%) and KFC Delivery (15%) are the least in this survey. Most of the repondent posses experience as a food delivery rider below than 6 month (70%) and there were (20%) from them have experience for below 2 years. They made food delivery rider job as a partime job (80%) while (20%) as fulltime. Most of them working at day shift while there were only (5%) who were working at night shift but (45%) choosed to have flexible shift. Furthermore, most food delivery rider have total range of 5 – 10 km for range of delivery (50%) while they have a total trip were about 10 – 20 trip per day (55%). Involving in accident, (40%) of them have involve 1 – 5 times in accident while the rest of them never experience. However, they are totally agree to install the 3rd Brake Light on their motorcycle (85%) and all agree that this idea can prevent from accident happening.

3.11 Summary

In this survey form outcome and analysis, the process of obtaining, assessing, and interpreting data from a large number of individuals is convenient.It aims to gain insights into a population.A survey collects much more detailed data than a questionnaire and usually employs various data collection methods.So, with this survey, a lot of data from food delivery riders will be collected and used to help this project's consumers.Many recommendations and ideas can be derived from the data in order to successfully complete this project in accordance with the needs of the consumers.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Schematic Diagram

Schematic diagram are combined of equipment that include in Chapter 3. A transmitter will be used to communicate the input from the brake and signal switches. Once the input has been received, the receiver will turn on the blinking LED light.

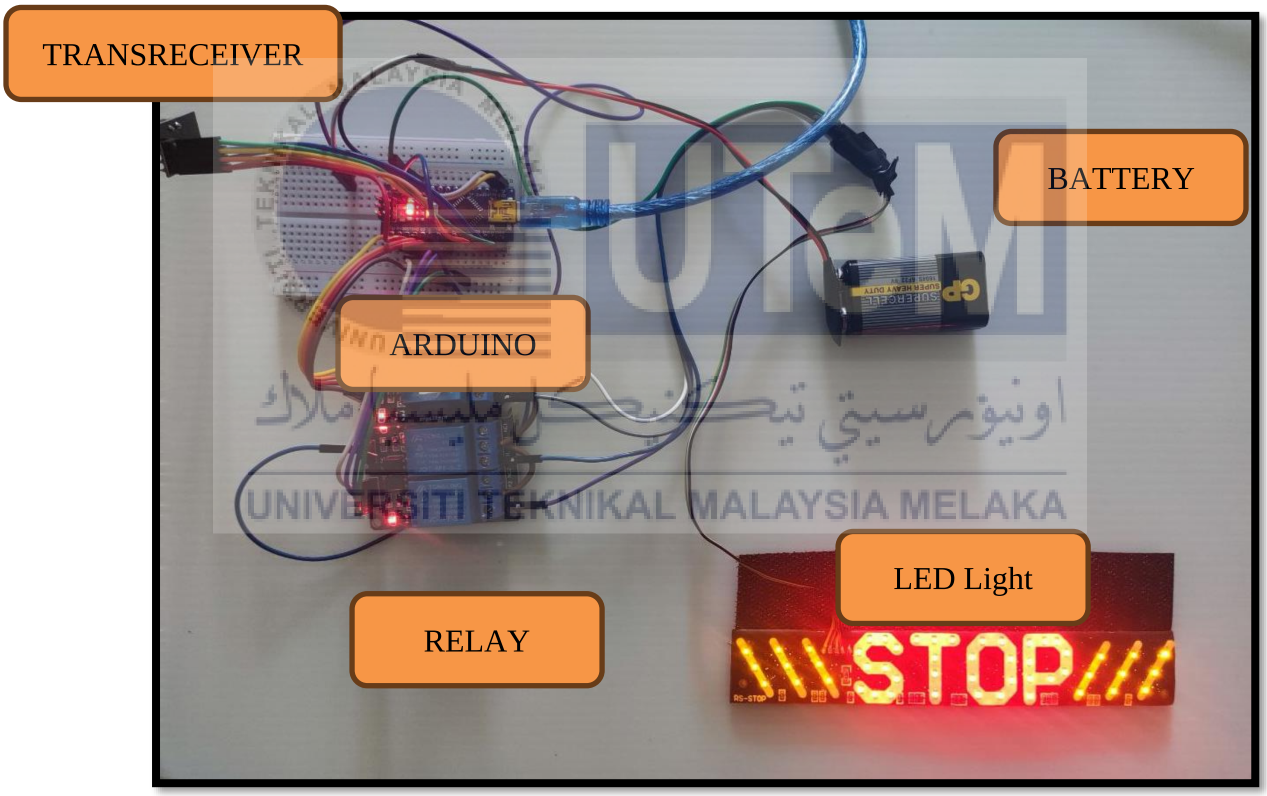

Figure 4.1: Receiver circuit

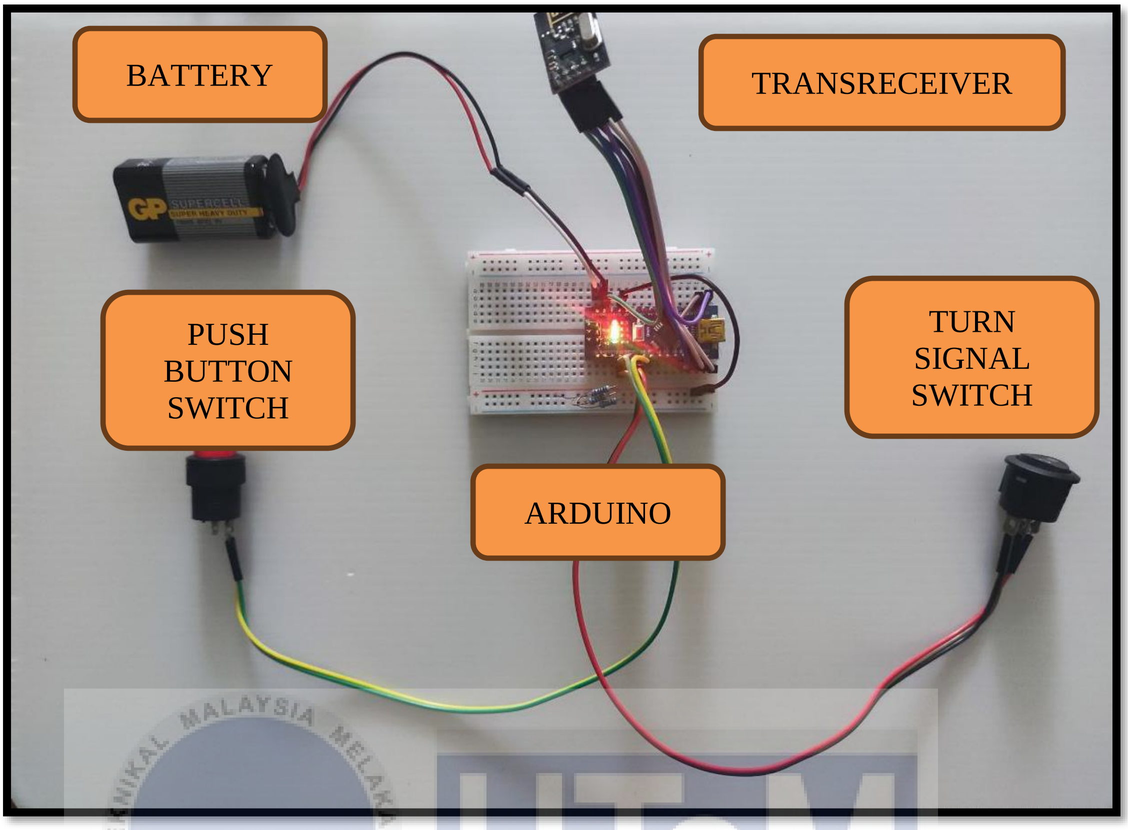

Figure 4.2: Transmitter Circuit

4.2 Circuit Box

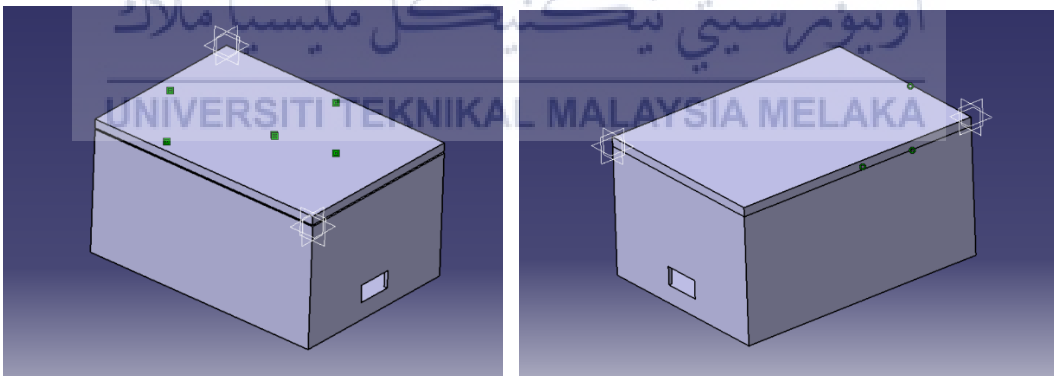

Figure 4.3: Transmitter and Receiver Box Circuit

Figure 4.3 show the design proposal for the circuit transmitter and receiver so that the circuit and wiring are in good condition in any condition because of material that using PLE which water resist.

4.3 Testing

Figure 4.4: Brake Light Blinking

Figure 4.5: Right Signal Blinking

Figure 4.6: Left Signal Blinking

4.4 Result

The result visibility has been taken during night when applying brake and turn signal. The test perform by using distance 10, 20 and 30 meter on the actual road. This result has been taken to see the improvement of the brake light and turn signal instead using the motorcyle light.

4.4.1 Visibility Test Result

- 10 meters

Figure 4.7: Brake Light

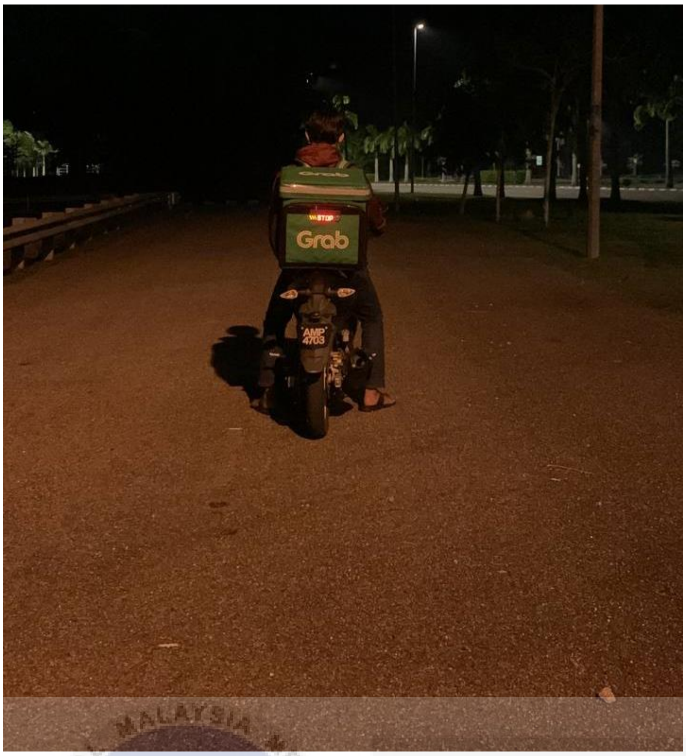

Figure 4.8: Left signal

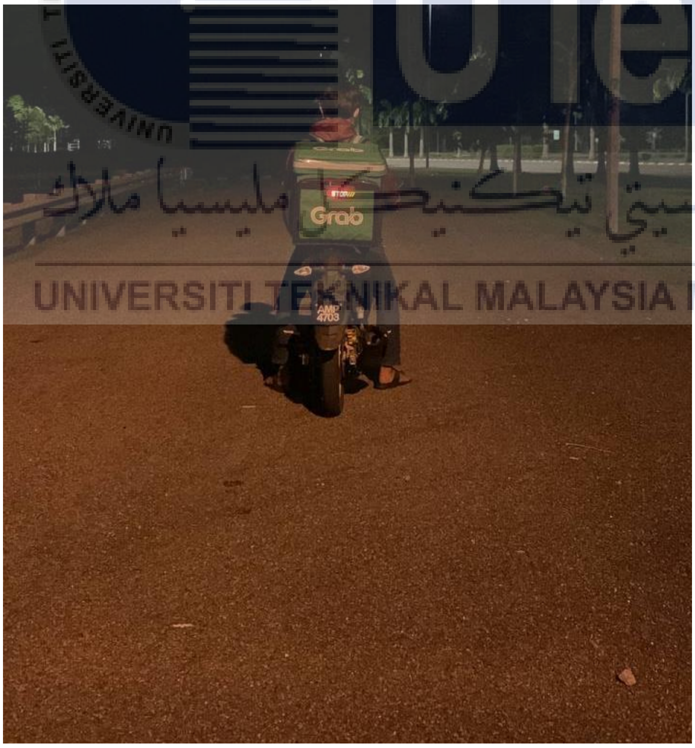

Figure 4.9: Right signal

- 20 meters

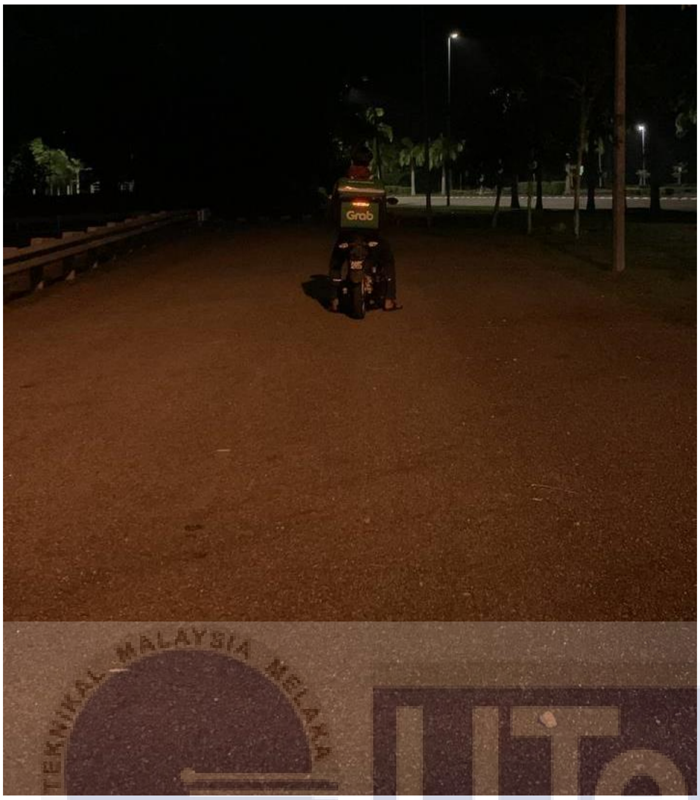

Figure 4.10: Brake light

Figure 4.11: Left signal

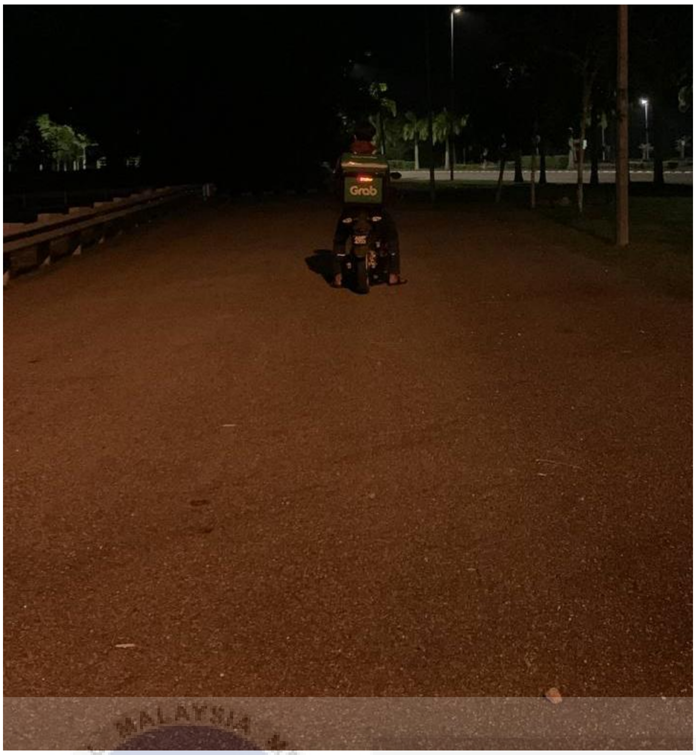

Figure 4.12: RIght signal

- 30 meters

Figure 4.13: Brake light

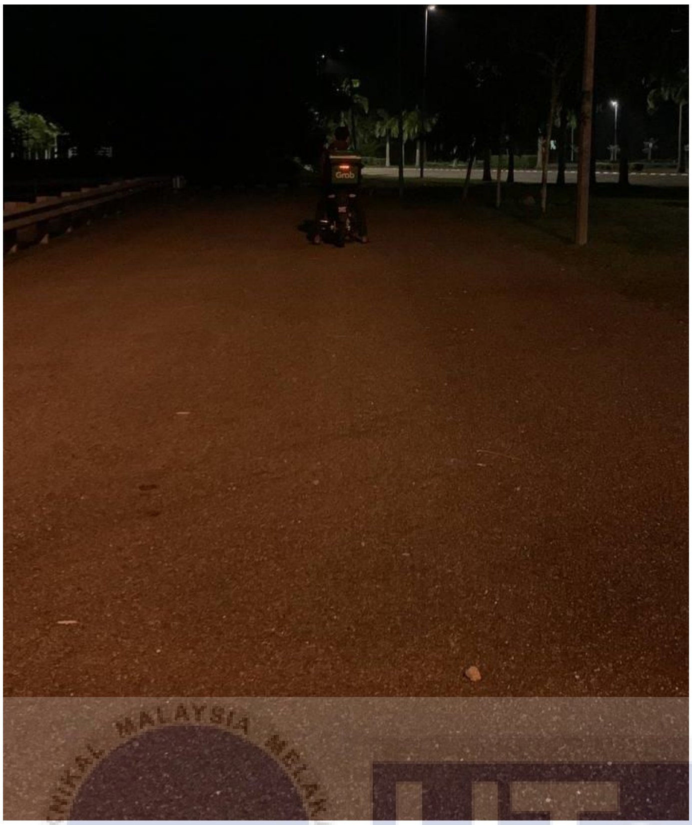

Figure 4.14: Left signal

Figure 4.15: Right signal

The figures in 4.3 RESULT werw taken to see the visibility of the LED light for old unit with thest distance from 10m, 20m and 30m. The brightness of the LED was poorly for at range 30 meter because it too far away from human eye.

4.5 Improvement Result

To increase the visibility of the LED light, the secondary light which is duplicate the light attach to the circuit on the food box to increase the brightness.

Figure 4.16: Improved Brake Light

Figure 4.17: Improved Right Signal

Figure 4.18: Improved Left Signal

4.5.1 Visibility During Night

- 10 Meter

Figure 4.19: Brake Signal

Figure 4.20: Right Signal

Figure 4.21: Left Signal

- 20 Meter

Figure 4.22: Brake Signal

Figure 4.23: Left Signal

Figure 4.24: Right Signal

- 30 Meter

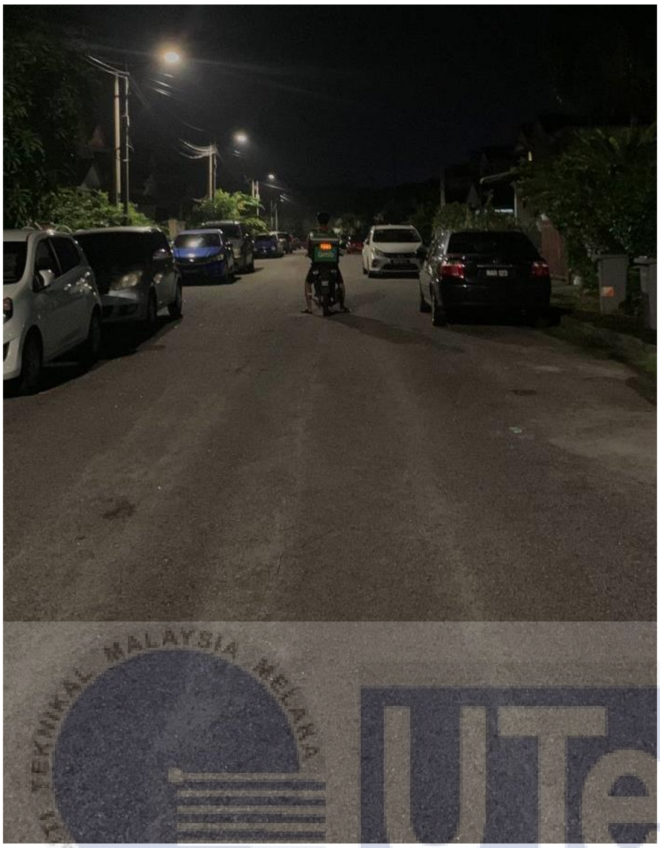

Figure 4.25: Brake Signal

Figure 4.26: Right Signal

Figure 4.27: Left Signal

The figures in 4.4.1 and 4.4.2 were taken night to see the visibility of the LED light that have been improved with the test distance from 10 meter to 30 meter. Therefore, this idea to increase the number of brake and signal light make it easier for the other road user to see it clearly because of increasing the brightness. With this, it can alert other road user to the presence of motorcycle in front of them.

4.6 Visibiity Output

After perform the test, some analysis has been made by comparing the visibility output for each side from brake signal, left signal to right signal. From this, we can see the different between the old version with the latest one whether the can see from far or not. The result as table below:

4.6.1 Brake Signal

Range / Visibility	Old	New
5 Meter	✓	✓
10 Meter	✓	✓
15 Meter	×	✓

Table 4.1: Visibility Output (Brake Signal)

4.6.2 Left Signal

Range / Visibility	Old	New
5 Meter	✓	✓
10 Meter	×	✓
15 Meter	×	✓

Table 4.2: Visibility Output (Left Signal)

4.6.3 Right Signal

Range / Visibility	Old	New
5 Meter	✓	✓
10 Meter	×	✓
15 Meter	×	✓

Table 4.3: Visibility Output (Right Signal)

4.7 Analysis

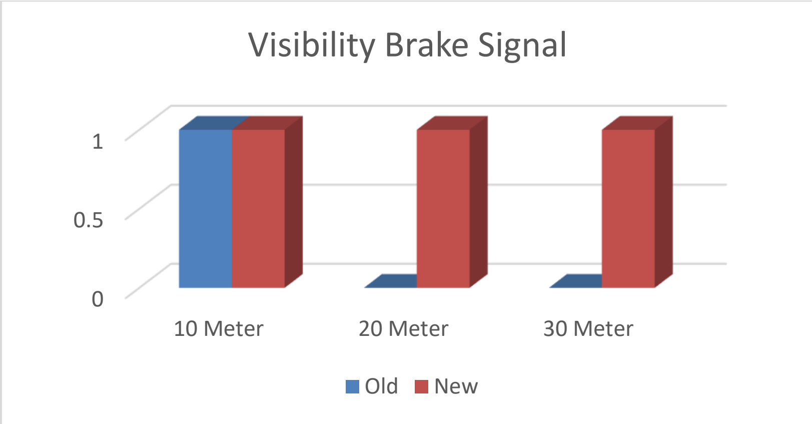

Table 4.4: Visibility Graph (Brake Signal)

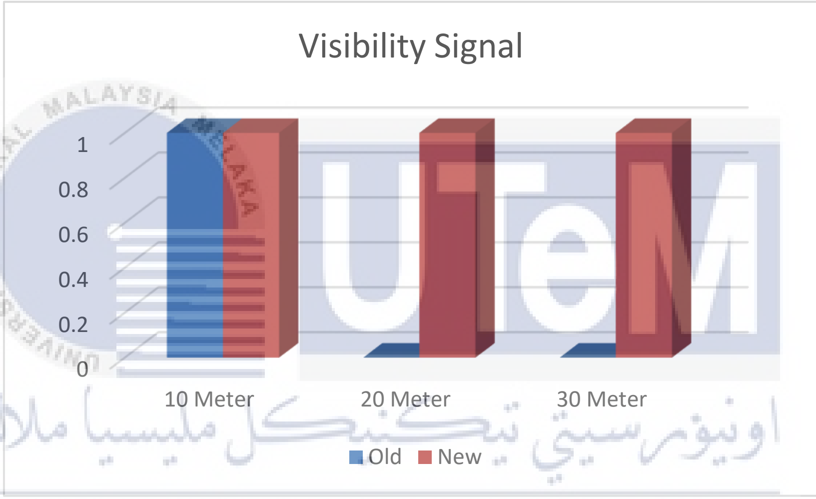

Table 4.5: Visibility Graph (Left Signal)

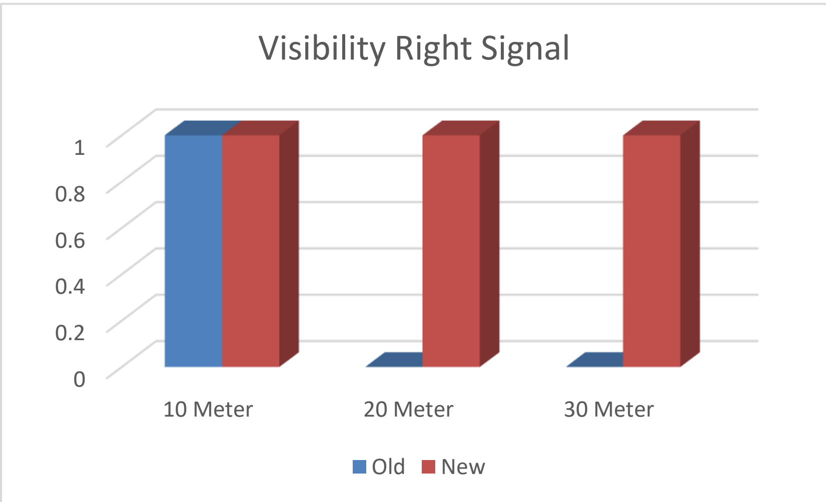

Table 4.6: Visibility Graph (Right Signal)

The table 4.4, 4.5 and 4.6 shows the graph of visibility for 10 meter, 20 meter and 30 meter during night. The horizontal axis of 10 meter, 20 meter and 30 meter show the distance and range that measured during the test for result ouput. The vertical axis of number 1 define as visibility while number 0 for non-visibility.

The first 10 meter for all graph are equal to 1 for both prototype either old or new design. For new desgin, the visibility for range 20 meter and 30 meter are equal to 1 because of the brighness and sharpness are much better than the old one where the old desgin got value equal to 0.

All of the graph output is the same for all signal so that can conclude the new LED design is visible to all condition

4.8 Summary

In this result and analysis, the brake and signal switches input will be transmitted using a transmitter. The receiver will activate the blinking LED brake light after receiving the input. So with this method, a 3rd brake light and turn signal will be visible. The visibility are tested using visual and distance. The output of the result of dais night are successful to be perceive in all hours. So with the reliability of 3rd brake light and turn signal, the safety of food delivery rider will much secure than before.

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

In conclusion, the 3rd brake light and signal project represents a significant enhancement in automotive safety and communication systems. This project not only improves visibility but also provides an additional visual cue to following drivers, reducing the risk of rear-end collisions. Furthermore, integrating turn signals into this third brake light enhances communication between drivers, fostering a safer driving environment. The synchronized display of brake and turn signals provides clearer information to surrounding motorists, helping to mitigate potential confusion and contributing to smoother traffic flow.

The implementation of this project aligns with the ongoing efforts in the automotive industry to leverage technology for improving road safety. The integration of innovative lighting solutions not only meets regulatory standards but also exceeds them by addressing visibility challenges and enhancing the overall effectiveness of brake and signal systems.

As vehicles continue to evolve with advanced technologies, the 3rd brake light and signal project represents a noteworthy stride towards creating more intelligent and communicative vehicles. With its potential to enhance safety, reduce accidents, and improve overall driving experience, this project underscores the importance of continuous innovation in automotive design and safety standards. As these enhancements become more widespread, they have the potential to contribute significantly to the broader goal of creating a safer and more efficient road transportation system.

5.2 Recommendations

For future improvements, estimation result could be enhance as follows:

a. Use proper equipment by borrowing the visibility sensor from faculty for visibility testing to get accurate data for analysis

b. Increase the brighness of the LED light to avoid glare when in daylight because ot the visibility in daylight is poor compared to night due to glare of sunlight.

c. Fabricate more smaller and detachable box for both transmitter and receiver circuit to make the device portable for the rider easy to implement.

d. Tidy up the wiring management of both circuit as making it invisible and more durable for any condition to avoid any disconnection of any wire.

5.3 Project Potential

This project has very big potential and need to improve as the technology become more forward and modern. This project cost is budget-friendly to be produce to the market. This project can decrease a lot amount of accidents that can happen every day as a food rider. This product need to improve as stated at 5.2 RECOMMENDATIONS then the product can be ready for the market. This project is not just potential for the food delivery riders but also for other public motorcyclist that need to improve their safety by increase the visibility of precautions using this project.

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APPENDICES

APPENDIX 1 Coding for Transmitter

```
#include <SPI.h>
#include <nRF24L01.h>
#include <RF24.h>
const uint64_t pipeOut = 0xE8E8F0F0E1LL;
RF24 radio(9, 10);
#define SWstop 4
#define SWleft 2
#define SWright 3
struct Signal {
 byte a;
 byte b;
 byte c;
};
Signal data;
void setup() {
 Serial.begin(9600);
 pinMode(SWstop, INPUT);
 pinMode(SWleft, INPUT);
 pinMode(SWright, INPUT);
 radio.begin();
 radio.setAutoAck(false);
 radio.setDataRate(RF24_250KBPS);
 radio.openWritingPipe(pipeOut);
}
void loop() {
 Serial.print("SW-L: ");
 Serial.print(digitalRead(SWleft));
 Serial.print(" | ");
 Serial.print("SW-R: ");
 Serial.print(digitalRead(SWright));
 Serial.print(" || ");
 Serial.print("SW-Stop: ");
 Serial.println(digitalRead(SWstop));
 int i = digitalRead(SWstop);
 int j = digitalRead(SWleft);
 int k = digitalRead(SWright);
 data.a = i;
 data.b = j;
 data.c = k;
 radio.write(&data, sizeof(Signal));
}
```

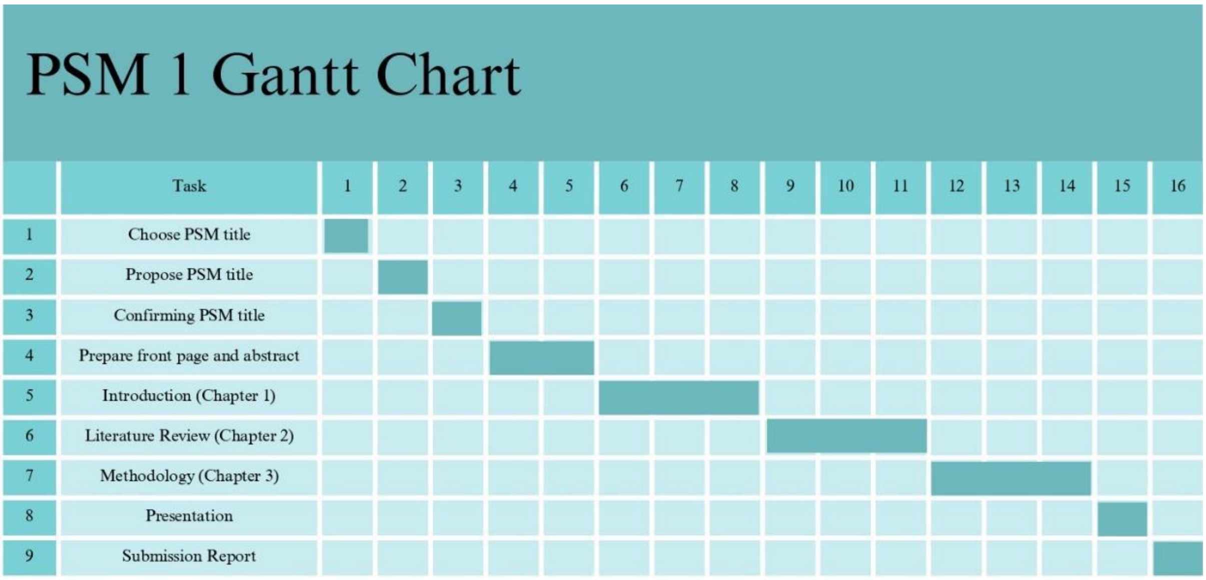
APPENDIX 2 Coding for Receiver

```
#include <SPI.h>
#include <nRF24L01.h>
#include <RF24.h>
const uint64_t pipeIn = 0xE8E8F0F0E1LL;
RF24 radio(9, 10);
#define LstopH 5
#define LstopL 4//transreceiver
#define Sleft 2
#define Sright 3
int st = 200;
struct Signal {
 byte a;
 byte b;
 byte c;
 //byte d;
};
Signal data;
void setup() {
 Serial.begin(9600);
 pinMode(LstopH, OUTPUT);
 pinMode(LstopL, OUTPUT);
 pinMode(Sleft, OUTPUT);
 pinMode(Sright, OUTPUT);
 digitalWrite(LstopH, HIGH);
 digitalWrite(LstopL, HIGH);
 digitalWrite(Sleft, HIGH);
 digitalWrite(Sright, HIGH);//low=menyala
 radio.begin();
 radio.setAutoAck(false);
 radio.setDataRate(RF24_250KBPS);
 radio.openReadingPipe(1, pipeIn);
 radio.startListening();
}
unsigned long lastRecvTime = 0;
void recvData()
{
 while ( radio.available() ) {
 radio.read(&data, sizeof(Signal));
 lastRecvTime = millis(); // receive the data | data alınıyor
 }
}
void loop() {
 recvData();
 unsigned long now = millis();
 int i = data.a; //Stop sw
 int j = data.b; //Left Signal
 int k = data.c; //Right Signal
```

```
Serial.print("SSw= ");
Serial.print(i);
Serial.print(" | ");
Serial.print("LSw= ");
Serial.print(j);
Serial.print(" | ");
Serial.print("RSw= ");
Serial.println(k);
if (i == 0 && j == 1 && k == 1) //stop
{
digitalWrite(LstopL, HIGH);
digitalWrite(LstopH, LOW);
digitalWrite(Sleft, LOW);
digitalWrite(Sright, LOW);
delay(st);
digitalWrite(LstopL, LOW);
digitalWrite(LstopH, HIGH);
digitalWrite(Sleft, LOW);
digitalWrite(Sright, LOW);
delay(st);
}
else if (i == 1 && j == 0 && k == 1) //signal Left
{
digitalWrite(LstopL, LOW);
digitalWrite(LstopH, LOW);
digitalWrite(Sleft, HIGH);
digitalWrite(Sright, LOW);
delay(st);
digitalWrite(LstopL, LOW);
digitalWrite(LstopH, LOW);
digitalWrite(Sleft, LOW);
digitalWrite(Sright, LOW);
delay(st);
}
else if (i == 1 && j == 1 && k == 0) //signal Right
{
digitalWrite(LstopL, LOW);
digitalWrite(LstopH, LOW);
digitalWrite(Sleft, LOW);
digitalWrite(Sright, HIGH);
delay(st);
digitalWrite(LstopL, LOW);
digitalWrite(LstopH, LOW);
digitalWrite(Sleft, LOW);
digitalWrite(Sright, LOW);
delay(st);
}
else if (i == 0 && j == 0 && k == 1) // STOP signal Left
```

```
{
digitalWrite(LstopL, HIGH);
digitalWrite(LstopH, LOW);
digitalWrite(Sleft, HIGH);
digitalWrite(Sright, LOW);
delay(st);
digitalWrite(LstopL, LOW);
digitalWrite(LstopH, HIGH);
digitalWrite(Sleft, LOW);
digitalWrite(Sright, LOW);
delay(st);
}
else if (i == 0 && j == 1 && k == 0) //STOP signal Right
{
digitalWrite(LstopL, HIGH);
digitalWrite(LstopH, LOW);
digitalWrite(Sleft, LOW);
digitalWrite(Sright, HIGH);
delay(st);
digitalWrite(LstopL, LOW);
digitalWrite(LstopH, HIGH);
digitalWrite(Sleft, LOW);
digitalWrite(Sright, LOW);
delay(st);
}
else
{
digitalWrite(LstopL, LOW);
digitalWrite(LstopH, LOW);
digitalWrite(Sleft, LOW);
digitalWrite(Sright, LOW);
}
}
```

APPENDIX 3: Gantt Chat PSM 1



APPENDIX 4: Gantt Chart PSM 2