DESIGN OPTIMIZATION OF THIRD BRAKE LIGHT AND SIGNAL SYSTEM ON MOTORCYCLE HELMET

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"It is hereby certified that I have read this thesis by Logeswaran A/L Kanasin and in our opinion it is satisfactory in terms of scope, quality and presentation as a fulfillment of the requirements for the course Bachelors Degree in Mechanical Engineering (Automotive)"

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This report was submitted in accordance with the partial requirements for honor of Bachelor of Mechanical Engineering (Automotive)

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DECRALATION

I hereby, declare this thesis entitled
"DESIGN OPTIMIZATION OF THIRD BRAKE LIGHT AND SIGNAL SYSTEMON MOTORCYCLE HELMET"
is the result of my own research except as cited in the reference.

Signature : .....

Author's Name : LOGESWARAN A/L KANASIN

Date : .....

DEDICATION

To my beloved family.

ACKNOWLEDGEMENTS

In name of GOD I would like to express my first and foremost thankfulness for giving me the optimum health, courage and strength along the period of completing this project.

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ABSTRACT

A new helmet design where it is integrated with wireless based third brake light and turn signal lights is being developed in this thesis. This invention will function to be more flexible, and increase the safety of motorcyclists. The presence of third brake light and turn signal light at the back of helmet will increase the visibility of the rider and his motorcycle especially at night and raining. The design is based on existing third brake light system using wireless system. Extra feature that is added to this invention is the addition of turn signal lights at the back of helmet. The new design will be integrated into an air spoiler unit to make it as an accessory. The systems will be functioning by signal transmission between transmitter and receiver using radio frequency (RF). The transmitter unit will be attached to motorcycle and receiver will be placed at the helmet.

ABSTRAK

Satu reka bentuk topi keledar yang terkini disepadukan dengan sistem tanpa wayar yang menghubungkan lampu brek ketiga dan satu suis membelok adalah dibangunkan dalam tesis ini. Ciptaan ini akan berfungsi supaya lebih fleksibel, dan meningkatkan keselamatan penunggang motosikal. Kehadiran lampu brek ketiga dan lampu isyarat membelok di belakang topi keledar akan meningkatkan jarak penglihatan penunggang dan pengguna jalanraya yang lain di belakang motosikal terutama pada waktu malam dan semasa hujan. Reka bentuk adalah berdasarkan terdapat brek ketiga sistem lampu menggunakan sistem tanpa wayar. Ciri-ciri tambahan yang ditambah untuk ciptaan ini adalah lampu isyarat membelok kiri dan kanan di belakang topi keledar. Reka bentuk ini adalah berdasarkan kepada lampu brek ketiga menggunakan sistem tanpa wayar yang sedia ada. Reka bentuk baru ini akan diintegerasikan ke dalam bekas aerodinamik udara bagi menjadikan ia seperti satu aksesori topi keledar. Sistem-sistem itu akan berfungsi oleh transmisi isyarat antara pemancar dan penerima menggunakan frekuensi radio. Unit pemancar akan menjadi diletakkan pada motosikal dan penerima akan dipasang pada topi keledar.

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JPJ	=	Jabatan Pengangkutan Jalan
JKJR	=	Jabatan Keselamatan Jalan Raya
IR	=	Infrared
RF	=	Rado Frequency
Hz	=	Hertz
ISM	=	Industrial, Scientific and Medical
CPU	=	Central Processing Unit
FM	=	Frequency Modulator
AM	=	Amplitude Modulator
VHF	=	Very High Frequency
UHF	=	Ultra High Frequency
PPE	=	Personal Protective Equipment
ISO	=	International Standards Organization
EPS	=	Expanded Polystyrene
IC	=	Integrated Circuit
LED	=	Light Emitting Diode
SPSW	=	Single Pole Single Way
SPTW	=	Single Pole Two Way
MTBI	=	Mild Traumatic Brain Injury
CPSC	=	Consumer Product Safety Commission
SAR	=	Specific Absorption Rate
ERP	=	Effective Radiated Power

CHAPTER 1

INTRODUCTION

In Malaysia, the major mode of transportation is motorcycle since 1980's. Currently, the motorcycles on the road constitutes more than halves of all registered vehicles population in Malaysia. According to Jabatan Pengangkutan Jalan (JPJ), about 485,236 new motorcycles have been registered in the year 2007 alone. The percentage of motorcycles registered annually in Malaysia is about 60% with an annual growth rate of 7% (Highway Planning Unit, Ministry of Works, 2003).So, the presence of higher number of motorcycles on the road constitutes to higher number of cases involving road accidents compared to other vehicles. The use of motorcycles and motor vehicles imposes risks of death or permanent impairment due to head injury. So, for motorcycles, the proper use of protective helmets can minimize the risk of death or permanent impairment.

Table 1.1: Breakdown of registered vehicles from 1999 to 2007

(Source: JKJR, January 2009)

Year	**No. Of Registered Vehicles**				
	Car	***Motorcycle***	**Lorry/Van**	**Bus**	**Taxi**
1999	3,787,047	***5,082,473***	642,976	47,674	55,929
2000	4,145,982	***5,356,604***	665,284	48,662	56,152
2001	4,557,992	***5,609,351***	689,668	49,771	56,579
2002	5,027,173	***5,859,195***	714,796	51,251	58,385
2003	5,428,774	***6,164,953***	740,462	52,846	60,723
2004	5,911,752	***6,572,366***	772,218	54,997	65,008
2005	6,473,261	***7,008,051***	805,157	57,370	67,451
2006	6,941,996	***7,458,128***	836,579	59,991	70,409
2007	7,419,643	***7,943,364***	871,234	62,308	72,374

Table 1.2: Road Accident Fatalities according to type of road users

(Source: JKJR, August 2009)

Road User Categories	**2007**	**2008**
Car driver/passengers	1228	1335
Motorcyclists/pillion riders	***3646***	***3898***
Pedestrians	636	598
Cyclists/pillion	190	203
Bus driver/passenger	75	48
Lorry drivers	204	195
Van drivers	133	96
Four-wheel Vehicle drivers	99	106
Others	71	48
Total	6282	6527

The seriousness of injuries sustained in road accidents among the users are more prevalent in motorcyclists and pillion passengers category. Although many precaution steps have been implemented in recent years, the fatalities keep on increasing every year. Normally, in motorcycle accidents, our upper parts of human body especially head and neck are more prone to serious injuries. According to a research done by Road Safety Research Centre, Universiti Putra Malaysia (UPM) in 1999, the distribution of injuries in fatally injured motorcyclists shows that their head is the most frequent part of human getting injured at 44.1%.

This alarming rate of road fatality among motorcyclists is contributed largely by its safety aspects such as safety helmet and hazard lights. Some of these elements does not comply the standards set by Jabatan Keselamatan Jalan Raya (JKJR) and Standard and Industrial Research Institute of Malaysia (SIRIM) and also international standard like Federal Motor Carrier Safety Administration (FMCSA).

Other than that, innovative ideas like new design on helmet which consists of brake light and signal lights at the back of helmet will help in improving road fatalities involving motorcycles. The presence of these lights at the back of helmet will alert other road users behind them. This will be helpful during heavy rain and at night.

1.1 Problem Statement

The appearance of motorcycles and its riders during night and under rain is greatly reduced due to poor visibility. The motorists behind a motorcycle can’t see them under these weather conditions. Furthermore, although the usage of safety vests can be helpful, not many motorcyclists are using it.

In the meantime, the position of motorcycle’s rear brake light which is low for other motorists including motorcyclists. In terms of peripheral vision of a helmet, the downward visual clearance is 30° where the second plane is tilted 30° down

from the basic plane. This criteria is suitable for helmets without integrated brake and signal light on helmet.

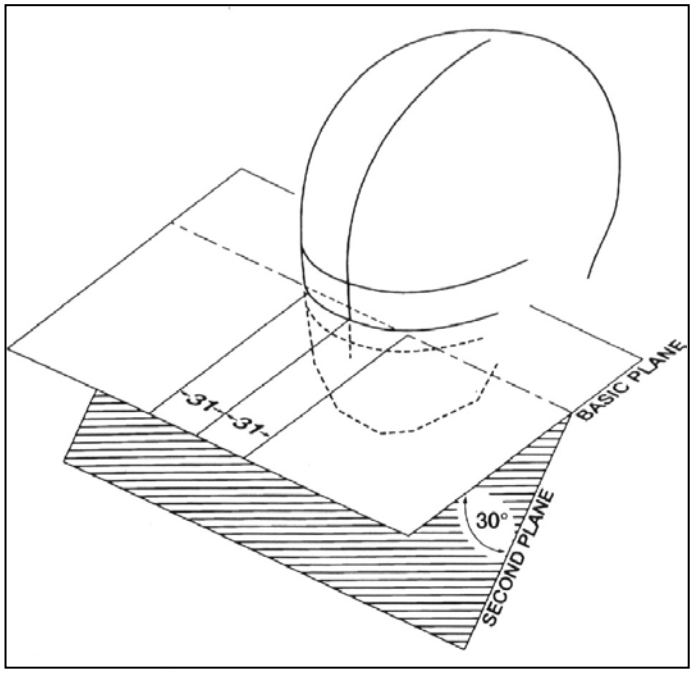

Figure 1.1: Downward visual clearance

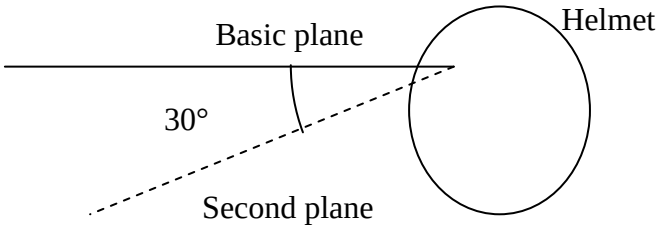

Figure 1.2: Downward visual clearance (side view)

But for visual clearance above the basic plane (upward visual clearance), the second plane is tilted 7° up from the reference plane. This implies that the motorcyclists can view upward up to 7° from their eye (reference plane). For better safety precaution, the riders need more and better visible brake and signal light. Attaching brake and signal light on motorcycle helmet based on upward visual clearance could be the solution for this.

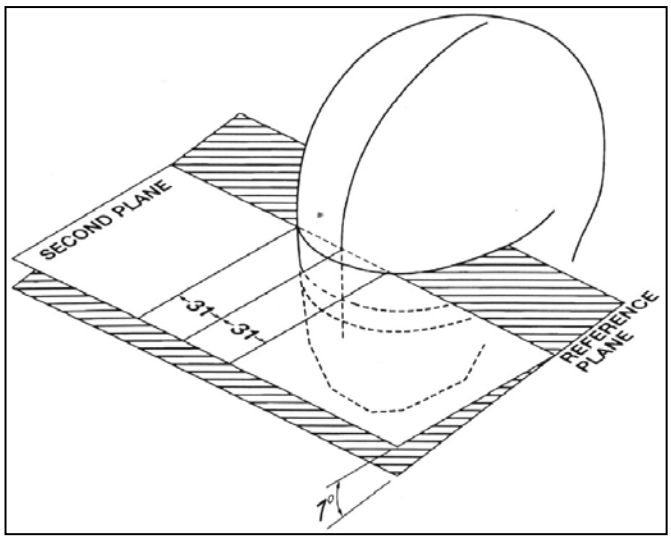

Figure 1.3: Upward visual clearance

(Source: 2005 Standard for Protective Headgear, Snell Memorial Foundation)

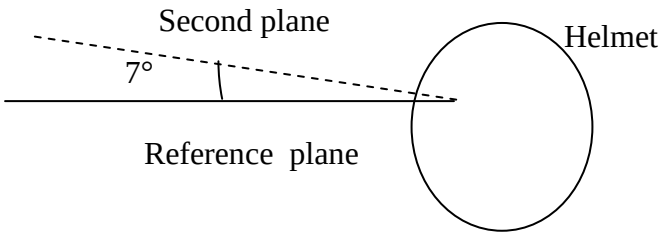

Figure 1.4: Upward visual clearance (side view)

1.2 Objective

i) Develop new third brake light and turn signal on motorcycle helmet using wireless system.

1.3 Scope

i) Literature study on wireless systems and its effects to environment
ii) Literature study on motorcycle's existing helmet design
iii) Perform analytical study on critical components
iv) Design and develop a new electrical circuit for wireless brake and signal system.
v) Design and modelling new concept and design in MSC CATIA V5 of new helmet design
vi) Fabricate prototype model and testing

CHAPTER 2

LITERATURE REVIEW

2.1 Wireless System

In this thesis, wireless system will be used for the new third brake light and signal system on the helmet. Basically, examples of wireless systems are Bluetooth, Infrared (IR), and Radio Frequency (RF). Mobility is one of the key terms in wireless system where users of wireless system tend to be mobile. To choose the best wireless system for this project, comparisons will be made in terms of advantages and disadvantages among the three available wireless systems.

2.1.1 Bluetooth

Bluetooth is one method of connecting devices like computers with hand phones and to other electronic gadgets. Bluetooth is an open wireless protocol that enables short-range wireless voice and data communications anywhere in the world.