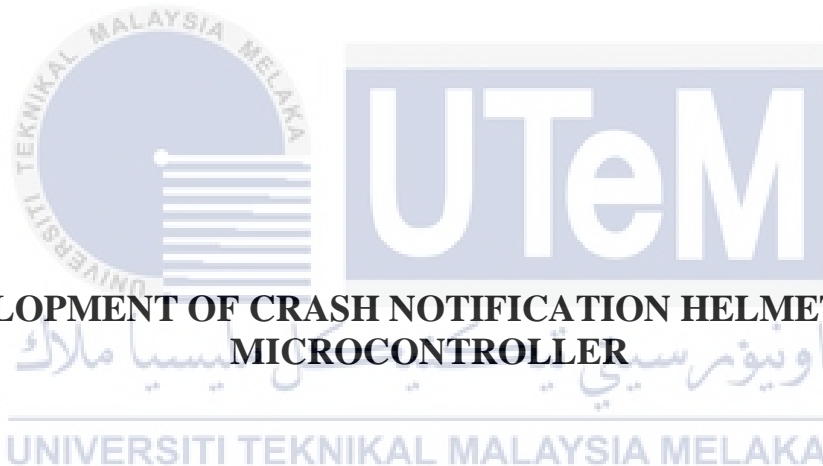




Faculty of Electrical and Electronic Engineering Technology



**DEVELOPMENT OF CRASH NOTIFICATION HELMET USING
MICROCONTROLLER**

MUHAMMAD SHAZRIE BIN AZMAN

**Bachelor of Electronics Engineering Technology (Industrial Electronics) with
Honours**

2021

**DEVELOPMENT OF CRASH NOTIFICATION HELMET USING
MICROCONTROLLER**

MUHAMMAD SHAZRIE BIN AZMAN

**A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology (Industrial Electronics) with
Honours**



اونيورسيتي تیکنیکل ملیسيا ملاک
Faculty of Electrical and Electronic Engineering Technology
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021



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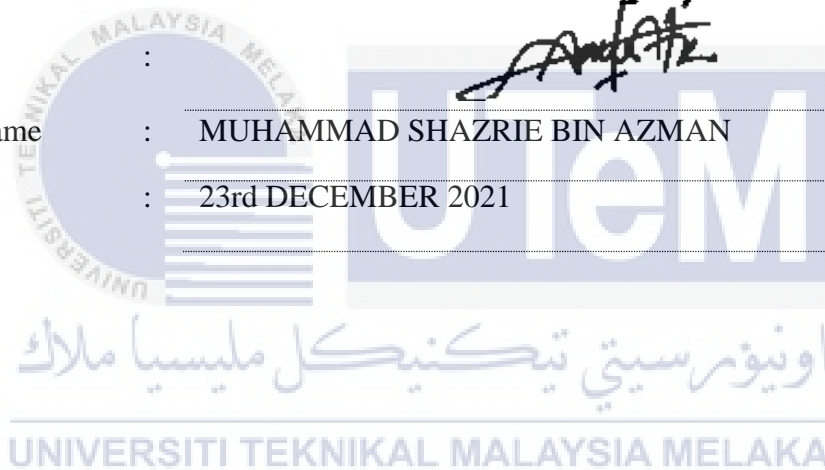
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11 JANUARI 2022

DEDICATION

*To my beloved mother, FARIDAH BINTI ABDUL RAHMAN, and father, AZMAN BIN
ABDUL GAFFOR.*



ABSTRACT

Motorcycle is highly utilised in logistic with the expansion of delivery services, such as food and goods. In this pandemic era, the consumption of motorcycle increases as some of the delivery agent also use own transportation to deliver customer parcels. However, motorcycle is the most dangerous vehicle compared to others because of the only safety that is equipped to rider is a helmet. According to the statistics, accident that occur to the motorcycle is the highest compared to other vehicle, and the number of deaths caused by motorcycle also the highest. The goal of this project is to create a prototype of a safety helmet which not only able to protect the rider physically but also able to notify the rider close contact in the case of accident happened. By taking into consideration that delivery may occur at rural area with limited or no internet coverage, this project focuses on the notification via short messaging service (SMS). The prototype is constructed by using Arduino and programmed to control elements involved such as crash sensor, GSM module, GPRS module and antenna. In final phase the crash notification system will be mounted into the basic helmet which is commonly used by normal riders and verified its functionality. Lastly, a crash notification helmet is developed using the Arduino Uno as a microcontroller, to notify close contact in the case of accident occurs.

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ABSTRAK

Motosikal banyak digunakan dalam logistik selari dengan pengembangan perkhidmatan penghantaran, seperti makanan dan barangan. Dalam era pandemik ini, penggunaan motosikal semakin meningkat kerana beberapa ejen penghantaran juga menggunakan pengangkutan sendiri untuk menghantar bungkusan pelanggan. Bagaimanapun, motosikal adalah kenderaan yang paling berbahaya berbanding yang lain kerana satu-satunya keselamatan yang dilengkapi penunggang ialah topi keledar. Mengikut statistik, kemalangan yang menimpa motosikal adalah yang paling tinggi berbanding kenderaan lain, dan jumlah kematian akibat motosikal juga paling tinggi. Objektif projek ini adalah untuk membangunkan prototaip topi keledar keselamatan yang bukan sahaja dapat melindungi penunggang secara fizikal tetapi juga dapat memaklumkan kontak rapat penunggang sekiranya berlaku kemalangan. Dengan mengambil kira bahawa penghantaran mungkin berlaku di kawasan luar bandar dengan liputan internet yang terhad atau tiada, projek ini memberi tumpuan kepada makluman melalui khidmat pesanan ringkas (SMS). Prototaip ini dibina dengan menggunakan Arduino dan diprogramkan untuk mengawal elemen yang terlibat seperti penerima ranap, modul GSM, modul GPRS dan antena. Pada fasa akhir, sistem pemberitahuan kemalangan akan dipasang pada topi keledar asas yang biasa digunakan oleh penunggang biasa dan kebolehfungsianya disahkan. Akhir sekali, topi keledar yang dilengkapi dengan notifikasi kemalangan dibangunkan menggunakan Arduino Uno sebagai mikropengawal, untuk memberitahu kontak rapat sekiranya berlaku kemalangan.

ACKNOWLEDGEMENTS

First and foremost, I want to thank my supervisor, Dr Suraya Binti Zainuddin, for her invaluable assistance, wise counsel, and patience during this research.

I'm also grateful to Universiti Teknikal Malaysia Melaka (UTeM) for providing financial assistance that allowed me to complete the project. Not to mention my boss, Dr. Suraya binti Zainuddin, who was eager to offer his thoughts and ideas on the project.

My gratitude is extended to my parents and family members for their love and prayers during my studies. Faridah binti Abdul Rahman deserves special recognition for her dedication and understanding.

Finally, I'd want to express my gratitude to all of my friends, coworkers, and classmates, as well as Faculty members and those who aren't named here, for their cooperation and assistance.

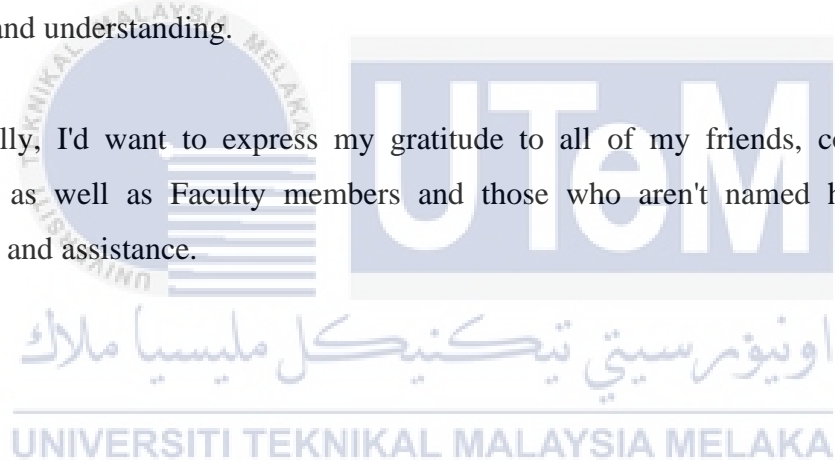


TABLE OF CONTENTS

	PAGE
DECLARATION	
APPROVAL	
DEDICATIONS	
ABSTRACT	i
ABSTRAK	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	i
LIST OF TABLES	iii
LIST OF FIGURES	iv
LIST OF SYMBOLS	v
LIST OF ABBREVIATIONS	vi
LIST OF APPENDICES	vii
CHAPTER 1 INTRODUCTION	8
1.1 Background	8
1.2 Problem Statement	9
1.3 Project Objective	10
1.4 Scope of Project	10
CHAPTER 2 LITERATURE REVIEW	11
2.1 Introduction	11
2.2 The Basic Helmet Design.	12
2.3 Bicycle Crash Sensor Helmet.	13
2.4 Past Related Works on Additional Helmet Features.	14
2.5 Summary	17
CHAPTER 3 METHODOLOGY	18
3.1 Introduction	18
3.2 Design concept of the prototype.	18
3.3 Feasibility study.	20
3.4 Project workflow	22
3.4.1 Project Planning and Flow Chart	23
3.5 Modules and Components for Prototype Development	26
3.5.1 GSM Module or GPRS Module	28
3.5.2 S230 Crash Collision Sensor	30

3.5.3	GPS module	32
3.5.4	Arduino Uno	34
3.6	Summary	38
CHAPTER 4	RESULTS AND DISCUSSION	39
4.1	Introduction	39
4.2	Overall Circuit	39
4.2.1	Prototype of crash notification helmet.	40
4.3	Programming Codes	40
4.4	Verification on SMS notification.	45
4.5	Prototype Mounted on a Helmet	46
CHAPTER 5	CONCLUSION AND RECCOMENDATION	47
5.1	Conclusion	47
5.2	Future Works	47
	REFERENCES	49
	APPENDICES	50



LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1	Previous Related Work	15
Table 3.1	The proposed helmet working principle	20
Table 3.2	Components and modules for crash notification Helmet development	21
Table 3.3	BDP1 Gantt Chartt	24
Table 3.4	BDP2 Gantt Chartt	25
Table 4.1	Programming code of the project	41-44



LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 2.1	The Basic Helmet Design	12
Figure 2.2	ANGi Helmet Crash Sensor.	14
Figure 3.1	Conceptual design of the prototype.	19
Figure 3.2	Emergency notification workflow.	21
Figure 3.3	Overall project process flow.	22
Figure 3.4	Project Workflow.	23
Figure 3.5	Integration of GSM module, GPS module and S230 sensor for all collision detection and notification.	26
Figure 3.6	Technical Workflow	27
Figure 3.7	Block diagram of GPS and GSM Tracking System[6].	29
Figure 3.8	GSM or GPRS module.	30
Figure 3.9	Keycode for S230 sensor.	31
Figure 3.10	S230 Crash Collision Sensor.	31
Figure 3.11	GPS module.	34
Figure 3.12	Arduino Uno Board Pin Configuration [9].	35
Figure 4.1	Components of this project.	39
Figure 3.11	Arduino UNO.	38
Figure 4.1	Component of the project.	39
Figure 4.2	Connection of the components.	40
Figure 4.3	Location been sent via SMS.	45
Figure 4.4	Prototype mounted on a helmet.	46

LIST OF SYMBOLS

V - Voltage angle



LIST OF ABBREVIATIONS

V	-	Voltage
MCO	-	Movement Control Order
GSM	-	Global System for Mobile Communications
GPRS	-	General Packet Radio Service



LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	Coding of the project	51



CHAPTER 1

INTRODUCTION

1.1 Background

A helmet is the only safety equipment that a regular rider can use. It will be better if all riders are required to wear all guards used by the professional rider for their safety while riding. According to the global status report on road safety 2015, which includes data from 180 countries, road injuries claim the lives of nearly 1.25 million people per year. Motorcyclists were about a quarter of all accident victims[1]. Over-speeding and reckless driving are the leading causes of death among two-wheeler drivers. Besides that, microsleeep also can cause accidents and death to motorcycle riders. There was news on the effect of the motorcycle rider falling asleep[2] .

The Malaysian Institute of Road Safety Research presented that fatal cases of the year 2020 was mostly caused by motorcycle, which is 67.29% out of total cases[3]. From the report, we can observe that motorcyclists have a major risk compared to other vehicles. Over-speeding and reckless driving are the leading causes of death among two-wheeler drivers. Besides, microsleeep also can cause accidents and death to motorcycle riders [2]. Unfortunately, a helmet is the only safety equipment that equips a regular rider for protection.

With the Movement Control Order (MCO), many people have lost their jobs and become delivery riders, such as grab riders. This resulted in the incremental numbers of motorcyclists on-road. However, with the incremental number of delivery riders, riders' status is not tracked by the service provider in the case of any accident. Therefore, the motivation of this project is to provide an emergency notification sent out in case a rider encounters an accident, even in rural areas with internet limitations.

1.2 Problem Statement

A motorcycle is the most dangerous vehicle that we use to transport from one location to another location daily. A microsleep is one of the issues encountered by motorcyclists during their ride. It is known and very dangerous. Microsleep is an event when people happen to doze off for a few seconds without realizing it. On the 28 June 2020, a case reported an accident that caused a student's death due to microsleep[].

Although motorcycles are widely used, the only safety measure that a rider is equipped with is only a helmet. In addition, we are aware that for all accidents that involve motorcycles, most riders will have a hard impact over the head resulting from the accident.

Furthermore, helps are always late to reach the accident scene because the exact location of the rider is unknown. In Malaysia, if an accident occurs, it will take some time for the ambulance to reach the location. On 20 April 2021, an accident occurred in a rubber plantation, and the people were dead after 2 hours at the accident scene. Riders also hardly notify their close contact when they involve in an accident. If the notification is easy to be sent out at any place, a better turnaround time for help can be provided.

We understand that an existing helmet is designed to fit the customer's head for protection. This project thus explores the crash notification helmet design to enable the emergency notification to be sent out and expedite the help in case of an accident.

1.3 Project Objective

This project aims to develop a crash notification helmet using a microcontroller.

Specifically, the objectives are as follows:

1. To produce a crash notification helmet concept design using a microcontroller.
2. To enable the helmet to send notification of the current location to the contact set by the rider.
3. To develop a prototype of a crash notification helmet using a microcontroller.

1.4 Scope of Project

Create prototype of a crash notification helmet using microcontroller is the goal. This prototype able to send exact location of the rider to any contact that been set by the rider immediately. By this way, the help could come to the place if anything happens to the rider faster than before. The scope of work are as follows:

- U To identify feature to be embedded into the crash notification helmet using microcontroller.
- V To identify the components to be utilized in the design.
- W To develop a crash notification helmet using microcontroller.
- X To analyze the developed system performance.

Delimitation of the project includes:

1. Ability to directly contact the ambulance or any emergencies contact.
2. It takes time to get the location because of the GSM module.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Motorcycle riding is much fun if it is not without danger. People prefer motorcycles to cars because they are less expensive to operate, easier to park, and more flexible in traffic. For example, there are more than 37 million people in India ride two-wheelers[1] . Due to widespread usage, two-wheelers have a higher accident rate compare to four-wheelers. Motorcycles are more likely than four-wheelers to be involved in fatal accidents. If a driver is involved in a high-speed collision and not wearing a helmet, the consequences are more dangerous, which can result in fatalities. As a result, wearing a helmet will help to minimise the number of injuries and even safe lives. However, it is always difficult and not safe to be riding your motorcycle and answering phone call simultaneously. With grab & foodpanda riders which are now highly demand; it requires rider to contact customer for delivery purposes. Making communications, listening to songs, getting instructions during ride has always been wanted by motorcyclists. Besides, a long boring ride can induce hypnotic state, and may cause a rider to feel drowsy. Rider will feel boring and sleepy while ride all the way long. These are some issues encountered by most motorcycle riders. This chapter describes the existing basic helmet features, modules or component requires to build the crash notification helmet.

2.2 The Basic Helmet Design.

The helmet utilised by regular bikers consists of a protective plastic outer layer and a polystyrene at the inner shell that increase the time impact force. There are several types of helmets, which are full face helmet and not full face helmet. Some helmets have features including ventilation, face shields, sun visors, and ear protection. Figure 2.1 depicts the structure of basic full face helmet design [4].

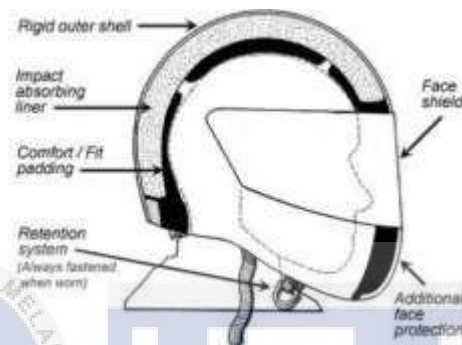


Figure 2.1 The Basic Helmet Design.[4]

The quality of a helmet is based on its impact capacity, penetration from an external object, retention from breaking or stretching, and peripheral vision. Different helmets accomplish different goals. Motorcycle helmets are very complex and purpose-built for the sport. They've been meticulously and scientifically developed over time.

An outer shell, an impact-absorbing liner, comfortable internal cushioning, and a solid strap or retention system are the four essential components of a helmet that work together to give protection. The helmet's outer shell is usually made of reinforced composites or thermoplastics such as polycarbonate. These are tough materials, yet they're made to crunch when they come into contact with a hard surface. That crunch-action disperses energy from the impact to reduce the blow's force before it reaches the user's head. An impact-absorbing liner, usually constructed of expanded polystyrene, is found inside the helmet shell (commonly thought of as Styrofoam). This dense layer is intended to cushion and absorb the

impact's shock. In other words, as the helmet absorbs the shock, the user's head continues to move inside the helmet, and the cushion absorbs the impact. The exterior shell and the inside liner work together to basically self-destruct in the case of a crash or a violent blow, dissipating the destructive forces of impact throughout the helmet. The more negative impact energy deflected or absorbed by the helmet, the less harm user will sustain.

On impact, some helmet shells delaminate. Others are designed to crack or break apart if severely impacted. A cracked helmet may not be a sign of a defective helmet but rather an indication that it did its job. The comfort cushioning is the soft-foam-and-cloth layer next to the user's head. It aids in keeping the user comfy and the helmet in place. This cushioning can even be removed from some helmets for cleaning. The retention mechanism, often known as the chin strap, is crucial. It is the only part that holds the helmet on the user's head in a crash. Each side of the shell has a strap attached to it. It would be as dangerous to bike without a helmet firmly strapped on as it would be to drive without a seat belt on [4].

2.3 Bicycle Crash Sensor Helmet.

The concept of a crash sensor helmet was also adopted in a bicycle helmet, for example, the ANGi by Specialized. This device helps to protect cyclists before, during and after a crash. It works by pairing the device to a Ride mobile application developed by Specialized.

The ANGi is a sensor-packed pod that attaches to the back of the helmet, and if it detects an impact with enough force to cause unconsciousness to the rider, it triggers your handphone and starts a countdown[5]. If the timer hits zero, the rider's last GPS coordinates message is sent to an emergency contact. It provides customers with the most cutting-edge cycling gear available, transforming the bicycle helmet into a live tracking device, crash detector, and safety beacon. However, the utilisation requires an annual subscription charge,

on the other hand, was the biggest drawback. After receiving feedback from consumers, the Specialized finally removed the annual subscription charge and offered the crash detection and warning service for free, allowing it to compete more effectively with other crash detection services such as Garmin's. The ANGi sensor is now included with many Specialised road and mountain bike helmets to any helmet with a flat space for the sensor to be installed, independent of brand. Figure 2.2 shows the ANGi helmet crash sensor by Specialized.

Thus, it was proven that it is crucial to have an emergency detection for two-wheel riders to provide alternative assistance in case of an accident happens. This is one of the motivations for the project to employ the similar mechanism into the motorcyclist helmet; however, utilising an existing GSM network to serve rural areas with limitation of network coverage.



Figure 2.2 ANGi Helmet Crash Sensor[5].

2.4 Past Related Works on Additional Helmet Features

Various studies had been done on a smart helmet features and functionality. This shows the importance of additional features to be embedded into a regular helmet, in a way to make helmet more useful for the motorcycle's riders. Table 2.1 tabulates some of work on helmet additional features.

Table 2.1 Previous Related Works

Reference, Year	Author	Title	Type of Micro controller	Description of Feature	Type of Communication System	Functionality
[1], 2018	Nataraja N Mamatha K S Dr. Keshavamurthy Dr. Shivashankar	Smart Helmet	Arduino	<ul style="list-style-type: none"> • Accident detection • Signboard detection 	GSM	<ul style="list-style-type: none"> • Speed the emergency notification to a contact. • Reduce the turnaround time for help during the emergency.
[12], 2017	P. Ahuja	Microcontroller based smart helmet using GSM and GPRS	Arduino	<ul style="list-style-type: none"> • Accident detection • Send notification to contact on accident's time and location. 	GSM and GPRS	<ul style="list-style-type: none"> • Speed the emergency notification to a contact. • Reduce the turnaround time for help during the emergency.
[13], 2017	Sri Sivasubramaniya	Iot based smart helmet for accident	Internet-based	<ul style="list-style-type: none"> • Accident detection • Send notification to contact to notify the accident. 	GPS	<ul style="list-style-type: none"> • Speed the emergency notification to a contact.