AUTOMATIC CRASH NOTIFIER SYSTEM FOR MOTORCYCLISTS

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Tajuk Projek : **AUTOMATIC CRASH NOTIFIER SYSTEM FOR MOTORCYCLISTS**

Sesi Pengajian : | **1** | **5** | **/** | **1** | **6** |

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"I acknowledge that I have read this report and in my opinion this report is sufficient in term of scope and quality for the award of Bachelor of Electronic Engineering (Industrial Electronics/ Computer Engineering/ Electronic Telecommunication/ Wireless Communication)* with Honours."

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Dedicated to my beloved parents for their support and understanding, to my supervisors who were always kind to help in many ways and to a special friend, friends and lecturers who always support and give encouragement.

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ABSTRACT

Motorcycle crashes happen very often here in Malaysia. Most of these accidents case are severe as the motorcyclist involve needs immediate medical treatment. Since they are seriously injured, notifying people about the crash is difficult if alone. In addition to this, a system that detects an accident and promptly notifies the proper authorities is absent in the current market. The aim of this project is to construct a crash notifier system that can automatically alert people of a motorcyclist who is involved in an accident. This system utilises an Arduino microcontroller, gyroscopic sensor, Global Positioning Satellite (GPS) system and Global System for Mobile (GSM) module. The system detects the upright position of a motorcycle, pin-point the location of a crash and send the details of a crash to the proper authorities successfully. For the conclusion, the development of this system can indefinitely help motorcyclists that have crashed and in need of assistance.

ABSTRAK

Kemalangan motosikal selalu berlauk di Malaysia. Kebanyakan kemalangan ini adalah kemalangan yang teruk di mana penunggang motosikal memerlukan rawatan kecemasan. Di sebabkan kecederaan yang teruk, memberitahu orang lain adalah sukar untuk dilakukan sendirian. Projek ini adalah sistem yang membantu memberitahu pihak berkuasa dengan serta merta akan kemalangan yang berlaku kerana sistem ini masih lagi tiada di pasaran. Tujuan projek ini dilaksanakan adalah untuk menghasilkan sistem yang memberitahu pihak berkuasa akan kemalangan yang melibatkan penunggang motosikal. Sistem ini menggunakan mikro-pengawal Arduino, pengesan gyroscopic dan juga modul Global System Mobile (GSM). Sistem ini mengesan posisi motosikal, mengenal pasti tempat berlakunya kemalangan dan menghantar Segala maklumat kemalangan kepada pihak berkuasa dengan jayanya. Konklusinya, sistem ini mampu membantu penunggang motosikal yang terlibat dalam kemalangan yang di mana mereka memerlukan pertolongan.

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LIST OF ABBREVIATIONS

PDRM	Royal Malaysian Police
GPS	Global Positioning Satellite
GSM	Global Service for Mobile
IDE	Interactive Development Environment
UART	Hardware Serial Port
USB	Universal Serial Bus
AC	Alternating Current
DC	Direct Current
PWM	Pulse Width Modulation
NMEA	National Marine Electronics Association
SIM	Subscriber Identity Module
BSS	Base Station Subsystem
NNS	Network and Switching Subsystem
OSS	Operation Support Subsystem
MS	Mobile Station
MSC	Mobile Switching Centre
BSC	Base Station Controllers
SMS	Short Messaging System

CHAPTER I

INTRODUCTION

1.1 PROJECT BACKGROUND

Crashes could happen at any moment without prior warning to the people who are not prepared for on-road accidents. This is a haunting threat while on the road, especially to motorcyclists. Based on the statistics from the year 2012, the most dangerous mode of transportation according to the number of fatal accidents is the motorcycle [1]. In reflection to this issue, the government has tried various ways to decrease this statistic. This project is aimed to provide a method to automatically notify the proper authorities such as the Royal Malaysian Police and hospital staff that a motorcyclist had an accident. The expected results of this project is for the components to work synchronously.

That means that the project will make use of the Arduino MEGA prototyping board for the programming, 6DOF MPU6050 Module which has an integrated gyroscope to detect the upright position of the motorcycle whether it is upright or not, a Global Positioning Satellite (GPS) module to detect the location of an accident and a Global Service for Mobile (GSM) module used to send out text messages to the authorities.

1.2 Problem Statement

The number of accidents that involve motorcyclists in Malaysia is significant and could be seen increasing within the recent years. In 2012, there was a stagnation in the number of road fatalities, with 6 917 road deaths compared to 6 877 in 2011 (+0.58%). The number of severe and slight crashes decreased by 3.7% and 0.4% respectively [1].

Besides that, a system capable of automatically notifying the appropriate authorities about the overall fatality of an accident by analysing the impact measurement and location of the accident is absent from the current market.

1.3 Objectives

The objectives of this project are to:-

1. Design a microcontroller system that has the ability to detect the upright position of a motorcycle, pin-point the location of a crash and send the details of a crash to the proper authorities.

2. Integrate a gyroscopic sensor, an accelerometer, a GPS unit and a GSM module on to a single microcontroller system and make the system work correctly

1.4 Scope of Work

1. This project will only be implemented onto a motorcycle.

2. An embedded gyro sensor and accelerometer will detect the upright position and the force of impact should one occur respectively.

3. Authorities such as the Malaysian Royal Police force and the hospital staff will also contribute to this project as they represent the receiving end of this notifier system.

4. If an accident should occur, a detailed text message will be sent to the authorities as well as the closest relative to the motorcyclist.

5. This project will be focused on a system design which uses an Arduino microcontroller board, a gyroscopic sensor, GPS module and a GSM module.

1.5 Thesis Outline

This thesis consist of five chapters which include introduction, literature review, methodology, results and discussion and conclusion and recommendation for this project.

Introduction to the project is the Chapter 1. In this chapter, project background, problem statement, objectives, scope of projects and report structure are explain. The concept and overall overview of this project will be discussed in Chapter 1.

Chapter 2 is about the Literature Review. This literature review will give more insight on the concepts regarding to this notification system and also a comparison of several journals by researchers of the past.

Chapter 3 is about the project Methodology. The hardware and the software used in this project will be discuss in this project. The synchronization of all the components, the Arduino coding, the compilation of the all hardware will be shown in this chapter.

Results and discussion will be discussed in Chapter 4. The expected results from this project and justification of its performance to make sure the objectives are achieved. The last chapter, conclusion and recommendation of the project. This chapter will conclude everything about the project and proposes a recommendation to upgrade the project.

CHAPTER 2

LITERATURE REVIEW

In this chapter, the key concepts that play specific roles for this project is explained in detail. In addition to that, journals explaining the concepts will also be included to aid comprehension.

2.1 Statistics

A journal on road accident statics was published in 2012. It mostly covers the accident statistics of Malaysia and the national road safety targets for the year 2012. It can be said within this journal that a total number of deaths increased from 2003 (6286) to 2012 (6917). A 9% increase. About 50% of total deaths were motorcyclists. This

amount of deaths must not be ignored as it is a significant amount. This fact also is proof that a system such as this is required as an added safety measure for the motorcyclists [1].

Table 2.1 reports the number of people involved in fatalities, injury crashes, deaths per 100,000 population, deaths per 10,000 registered vehicles and the number of deaths per billion vehicle kilometres from the year 1990 to 2012.

						2012% change from		
	1990	2000	2010	2011	2012	2011	2000	1990
Reported safety data								
Fatalities	4 048	6 035	6 872	6 877	6 917	0.6%	14.6%	70.9%
Injury crashes	25 766	44 165	21 397	18 693	17 522	-6.3%	-60.3%	-32.0%
Deaths per 100,000 population	22.7	25.9	23.8	23.7	23.6	-0.4%	-9.0%	3.8%
Deaths per 10,000 registered vehicles	9.0	5.7	3.4	3.2	3.1	-3.1%	-45.5%	-65.4%
Deaths per billion vehicle kilometres		26.3	16.2	14.7	13.4	-8.7%	-49.0%	
Traffic data								
Registered vehicles[2] (thousands)		10 99	20 189	21 311	22 702	6.5%	114.2%	
Vehicle kilometres (millions)			424 021	467 611	517 193	10.6 %		
Registered vehicles per 1,000 population)		455.6	698.3	738.0	774.8	5%	70.1%	

Table 2.1: Road safety and traffic data [1]

Figure 2.1 shows the percentage of road fatalities according to each road user group which are the pedestrians, motorcyclists, cyclists, car occupants, van, bus, lorry, 4 wheelers and other type of vehicles from the year 2010 to 2012.

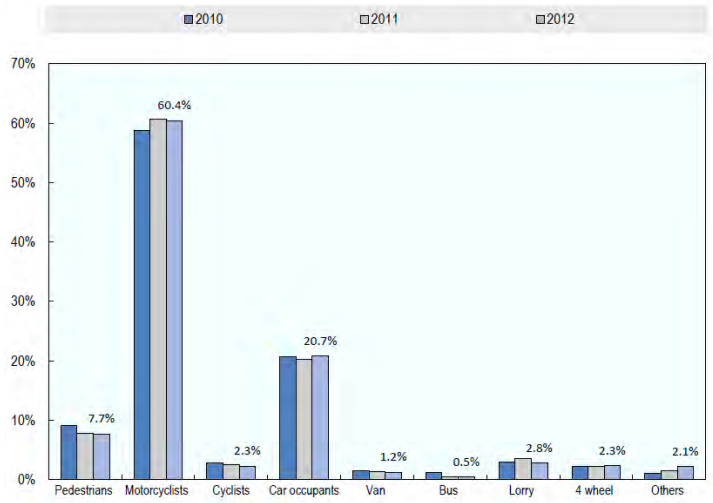

Figure 2.1: Road fatalities by road user group. [1]

2.2 Arduino

Arduino is an open-source platform used for constructing and programing of electronics [2]. It can receive and send information to most devices, and even through the internet to command the specific electronic device. It uses a hardware called Arduino Uno circuit board and software programme (Simplified C++) to programme the board.

In these modern day, Arduino boards are used a lot in microcontroller programing among other things due to its user friendly or easy to use setting. Like any microcontroller, an Arduino is a circuit board with chip that can be programmed to do numerous types of tasks, it sends information from the computer programme to the Arduino microcontroller and finally to the specific circuit or machine with multiple circuits in order to execute the specific command.

The Arduino platform has become well acquainted with people into electronics [2]. Unlike most previous programmable circuit boards, the Arduino does not have a separate piece of hardware in order to load new code onto the board, users can simply use a USB cable to upload the program. The software of the Arduino uses a simplified version of C++, making it easier to program, and it provides users with an easier environment that bypass the functions of the micro-controller into a more accessible package.

Figure 2.2 describes the Arduino Uno board according to each of its pins and states the components that make up the microcontroller board.

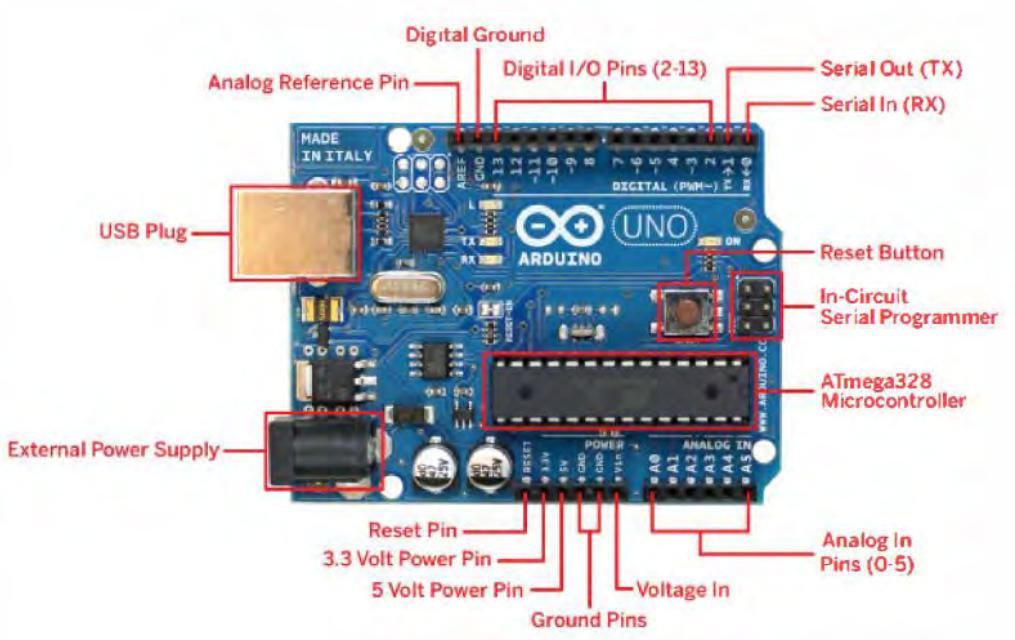

Figure 2.2: Arduino Uno prototype board [2]

The board itself consists of numerous components that make it work but these components below represent the main components on the Arduino board:

- USB Plug: This is the first part of the Arduino because it is used to upload a programme to the microcontroller and has a regulated power of 5 V which also powers the Arduino board.
- External Power Supply: This is only used to power the board and has a regulated voltage of 9 V to 12 V.
- Reset button: This button resets the Arduino when it when it's pressed in another command was uploaded.
- Microcontroller: This is the device that receive and send information or command to the respective circuit.
- Analog Pins (O-5): These are analogue input pins from A0 to A5.
- Digital I/O Pins: These are the digital input and output from Pins 2 to l3.
- In-Circuit Programmer: This is another source to upload or programme.
- Digital and analogue Ground pins
- Power Pins: 3.3 V and 5 V power pins.

Figure 2.3 is displayed when the Arduino IDE software was initialised. This is to show that the program is loading.

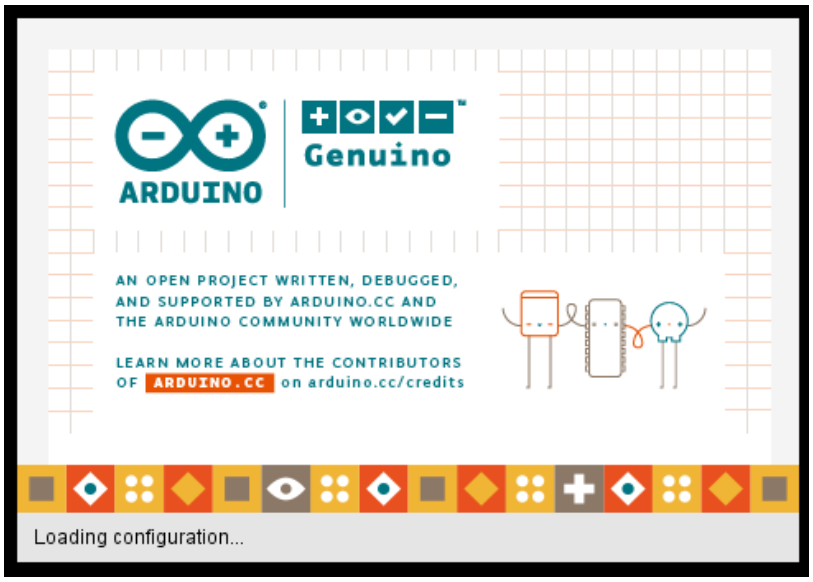

Figure 2.3: Arduino IDE splash screen

Figure 2.4 shows the main interface of the Arduino IDE. This is where coding could be done to program the Arduino board.

Figure 2.4: Screenshot of Arduino IDE. [2]

The Arduino IDE software is a set of instructions that informs the hardware on what to do and how to do it. The software interface is divided into three main parts:

- Command Area: This is the area where menu items such as File, Edit, Sketch, Tools, Help and Icons like Verify Icon for verification, Upload Icon for uploading the programme, New, Open, Save and Serial Monitor used for sending and receiving of data between the Arduino and the IDE.
- Text Area: This is where code writing is done. It uses a simplified version of C++ programming language that makes it easier to write programmes, which is also called a sketch. When writing the code there are mainly two important parts :
    - The setup function: Before the setup variables need to be initialised so that they can be used and values assigned to them. Then the setup routine begins, this is where users can set the initial condition of their variables and run preliminary code only once. Here is an example of how it should be written.