

ACCIDENT NOTIFIER WITH SMART EMBEDDED SYSTEM

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ACCIDENT NOTIFIER USING SMART EMBEDDED SYSTEM

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**This Report Is Submitted In Partial Fulfillment of the Requirements for the
Bachelor of Electronic Engineering (Telecommunication Engineering)**

**Faculty of Electronic and Computer Engineering
Universiti Teknikal Malaysia Melaka**

JUNE 2014



UTeM

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI KEJURUTERAAN ELEKTRONIK DAN KEJURUTERAAN
KOMPUTER

**BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II**

Tajuk Projek : ACCIDENT NOTIFIER WITH SMART EMBEDDED SYSTEM

Sesi Pengajian :

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

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ACKNOWLEDGEMENT

First and foremost, I would like to express my greatest gratitude to my most dedicated and supportive supervisors, Engr. Vigneswara Rao A/L Gannapathy and Mr. Ahamed Fayeez Bin Tuani Ibrahim for providing their insightful knowledge and valuable assistance throughout the completion and successfully of this project. It has been a precious learning experience to be to work on this project under his guidance.

A special note of appreciation is extended to my parents, for their unfailing encouragement and financial support that they have given to me for over the years. Their supports and encouragement is one of the main causes of the success I gain. My deepest appreciation also goes to my friends, especially Selvakumar A/L Mariappan and fellow friends for their moral supports and guidance.

Thanks also to FKEKK lectures and the technicians for their guidance and knowledge they provide to me. My thanks also go to all who support me directly and indirectly in completing this project.

Thank you.

ABSTRACT

Currently, lots of accident has been occurring either in metropolitan or in rural areas. These accidents would threaten or more drastically could take the lives of our loved ones. This would significantly increase the death rate in our country and in other countries. But, there is still a remedy to solve this scenario whereby the accidents would be notified to both emergency departments as well as our family in nick of time. At that moment, the Accident Notifier with Smart Embedded System will be introduced and becomes handy. This system is mainly designed and focused to prevent the increase in death rate in our country. The user is able to key in their favourite mobile numbers into the LCD display by using the 4×4 keypad provided. Then, the LCD would display “System Activated” to inform that the system is ready to be used. The system is also been attached with real life crash sensors, GPS and GSM. Once the impact has been sensed by one of the crash sensor, the system would automatically deliver series of SMS’s to the predefined numbers key in earlier by the user. The SMS received by a recipient consist of name of the driver, car number plat, number of passengers, and most importantly GPS location. These SMS’s would be very helpful for the emergency rescue team to locate the place of incident in short period of time. Hence, with the introduction of this product, many innocent lives could be saved as well as drivers will no longer feel insecure and hapless when using in the road.

ABSTRAK

Sejak kebelakangan ini, banyak kemalangan telah berlaku sama ada di dalam metropolitan mahupun di luar bandar. Kemalangan mungkin akan mengancam atau secara lebih drastik boleh meragut nyawa orang tersayang. Ini secara ketara akan meningkatkan kadar kematian di negara kita dan di negara-negara lain. Tetapi, masih ada jalan penyelesaian untuk mengurangkan senario ini di mana kemalangan akan dimaklumkan kepada kedua-dua jabatan kecemasan dan juga keluarga kita dalam masa yang singkat. Oleh itu, 'Accident Notifier with Smart Embedded System' akan diperkenalkan dan mampu membawa perubahan. Secara umumnya, sistem ini direka dan diberi tumpuan untuk mengelakkan peningkatan kadar kematian di negara kita. Pengguna dapat menekan nombor telefon bimbit yang penting bagi mereka ke dalam paparan LCD dengan menggunakan 4×4 papan kekunci yang sedia ada. Kemudian, LCD akan memaparkan 'System Activated' untuk memaklumkan bahawa sistem tersebut sedia untuk digunakan. Sistem ini juga telah dipasang dengan 'crash sensor' yang digunakan dalam kehidupan seharian, GPS dan GSM. Apabila tekanan itu telah dikesan oleh salah satu 'crash sensor', sistem secara automatik akan menyampaikan siri SMS kepada nombor utama yang telah ditetapkan oleh pengguna pada awal masa. SMS yang diterima oleh penerima terdiri daripada nama pemandu, nombor plat kereta, bilangan penumpang, dan lokasi GPS. SMS ini amat berguna bagi pasukan penyelamat untuk mencari tempat kejadian dalam tempoh yang singkat. Oleh itu, dengan pengenalan produk ini, banyak nyawa yang tidak berdosa dapat diselamatkan dan pemandu akan berasa lebih selamat serta bertuah apabila menggunakan system ini di jalan raya.

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LIST OF ABBREVIATIONS

ACN	- Automatic Crash Notification
Apps	- Applications
CDMA	- Code Division Multiple Access
COM	- Computer port
GPS	- Global Positioning System
GSM	- Global System for Communication
GUI	- Graphical User Interface
PIC	- Peripheral Interface Controller
UART	- Universal Asynchronous Receiver Transmitter
LCD	- Liquid Crystal Display

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CHAPTER 1

INTRODUCTION

This chapter briefly describes the introduction, objectives, problem statements, scope of work, methodology and the structure of the project.

1.1 Project Introduction

Currently, our country is vastly progressing in many technological and economical industries. The transportation system is one of the sectors that have been enhanced with

current progress. Transportation system plays pivotal role in our daily routine. There has been a drastic increase in vehicles, especially public transportation such as taxi, bus, and train in order to travel from one place to another. However, there has been a threat to human lives as the amount of transport currently rising causing a sudden increase in the number of accidents in our country.

According to the statistics made by the Road Transformation Department of Malaysia of the year 2013, there have been 462,423 accidents occurred in 2012, a drastic increase of 2.98 % as compared with year 2011, that records 449,040 accidents in overall. [1] The statistics also depicts that the number of deaths involved in the accident rises year by year. This causes the public to feel insecure of their safety when using transportation. Besides that, the authorized emergency team failed to reach the particular location of accident in the nick of time causing death of our loved ones as the response from witnesses is slow. Eventhough with current advancement in wireless communications section, the time taken to inform the authorities on an accident is quite lengthy.

The Accident notifier with smart embedded system will be created with the aim reducing the time taken by the authorized respond team to act in a short period of time once an accident has taken place. If an accident had occurred, an electrical signal will be sent to PIC microcontroller through a crash sensor used in an airbag system which will fetch the data from the GPS module that displays the accurate GPS location and driver's details in a form of an SMS. [2] [3] The SMS will be delivered quickly to the predefined numbers running in an LCD screen. The predefined numbers will be set by the users using 4×4 keypad. The SMS is comprised of the driver's detail, number of passengers aboard, GPS location (longitude and latitude), and vehicle model as well as car plate number to make the emergency medical workers easily spot the accurate position.

The usage and functionality of the accident notifier with smart embedded system is vital in current scenario. Therefore, the requirement to create this application, function of each components and operation principle of the system should be known well in order

to apply it in real life. In this thesis, an accident notifier with smart embedded system shall be revealed and designed.

After that, a prototype will be created based upon the working principle of the system, after a brief studying and surveying been conducted on the functionality of each component used throughout this project. In overall, the accident notifier with smart embedded system is comprised of certain hardware, such as an airbag crash sensors, PIC microcontroller, 4×4 keypad, LCD screen display, GSM module, GPS module.

1.2 Objectives

The objectives that tend to be achieved through this project are:

- a) To enhance the automatic accident notifier using an embedded system.
- b) To develop the SMS deliverance to the specific people in nick of time.
- c) To study the functionality of crash sensor, LCD display, Light Emitting Diode (LED), PIC microcontroller, GPS and GSM modules.
- d) To develop an accident notifier without the usage of an Android Smartphone.
- e) To change the predefined number time to time prior to user's favourite.

1.3 Problem Statement

In overall, this project is designed to notify an accident by using PIC technique. Besides that, this project also does not require the use of a Smartphone. Once an accident has taken place, with severity to victims, a message on the incident and the exact place of the collision are vital in order for the rescue team rushed to the scene

immediately. [4] According to Schurmer & Drane, a professional corporation law office, there are almost 17,589 accidents occurring in the United States of America in each day. Moreover, a number of 3000 Samaritans die every single day due to accidents around the globe. In the United States, car accidents are the number one reason for civil litigation, whereby India that recorded the highest number of road accident deaths in the world with 80% do not receive any help within the Golden Hour, that is a crucial time after an accident, and 60% of them consequently die. Mostly, the cause of vehicle accidents is determined by certain factors such as location of impact, driver's condition during an accident, climate, speeds, inattentiveness and other factors. If we are injured in a car accident, it is compulsory to first seek medical attention. [5] [6] However, if an accident has occurred in an isolated place, there would be no passerby to supply necessary aid required by the victims.

On the other hand, if an accident has occurred in a crowded place, it would not assure that the involved victims could get instant help from the witnesses. This is because, the general public is not properly trained but besides afraid to help victims for fear of getting involved in a legal hassle. Even, if a responsible witness alerted the authorities on an accident would provide unclear details on the location of the incident. For example, if an accident has occurred at Putrajaya, he/she informs the authorities regarding the location, without informing which part of Putrajaya. Putrajaya has a very vast area of coverage, for instance Putrajaya International Convention Centre (PICC) has an area of coverage of 1.3 million square-foot or approximately equivalent to 135,000 m². [7]

Previously, an alert notification via Smartphone was built, but there are several doubts on its function in real life situation. The user of a Smartphone has to turn on his/her Smartphone Bluetooth and GPS capabilities once travelling to a destination. This is indeed not advisable as it will increase the battery consumption of the Smartphone, causing it failed to function during critical situations. In addition, the condition of the Smartphone is questionable has it might have crashed during a collision. A victim couldn't send a message to his/her family member in a severe condition once an accident

has taken place. If an immediate help is not given to the victims, it might take their lives. However, this project will automatically send few SMS's to predefine numbers if an accident had taken place in a matter of seconds. This accident notifier will be helpful in deserted or in a crowded place.

1.4 Scope of project

In overall, the analysis, design and advancement on the accident notifier with a smart embeded system covers up the whole project. This system is able to inform specific recipients in an SMS form together with the GPS location. A brief study on the functionality of the crash sensor use in the airbags of vehicles, PIC microcontroller, GPS module, GSM module, LCD screen, keypad, Light Emitting Diode (LED), Light Emitting Diode (LED) and also SMS deliverance. This project focuses on the technique to prevent the usage of the Android Smartphone in the overall process of the system. In addition, it also includes the study on avoiding false signal detected as the positive impact with usage of crash sensor used in a an airbag system.

1.5 Methodology

This project is started with some researchers conducted on the hardware that will be used throughout the design such as the crash sensor (air bag), PIC controller 18F46K22, LCD display, Light Emitting Diode (LED) GPS and GSM module, LCD screen. Next, the project will be continued with the development of both hardware and software

development, for instance crash sensor, PIC coding, GPS and GSM functionality, SMS deliverance. Then, both software and hardware are integrated as one system. On the other hand, if there are any defective or faulty on the system, proper testing and troubleshooting are compulsory in order to get the verification.

1.6 Structure of the project

Basically, chapter 1 explains the overview of the project, current problem statements, objectives and scope of the design so that system will be completed.

Chapter 2 explains on the literature review of the project, statistics of the accident occurring in Malaysia, crash sensor in an airbag, PIC controller 18F46K22, Global Positioning System (GPS), Global System for Mobile Communication (GSM), Light Emitting Diode (LED), keypad, and Short Message Service.

Chapter 3 stressed on the logical and organized techniques used in developing an accident notifier with smart embedded system. Next, an overview of the project is proposed in this paper which clarifies the detailed and concise steps taken in designing this system. Besides that, any logical suggestions and justified approach done to obtain the objectives of this project in order to get a significant output is also highlighted.

In addition, chapter 4 elaborates on the overall operation of accident notifier using smart embedded system. The final result obtained through this research is analyzed and discussed.

Finally, chapter 5 concludes overall design process and enhancement required on accident notifier with smart embedded system. A detailed statement is given to the created design as well as a future advancement that might be conducted under this field is listed down.

CHAPTER 2

LITERATURE REVIEW

This chapter briefly narrates on the existing technologies, crash sensor in an airbag system, Global Positioning System, Global System for Mobile Communication, PIC 18F46K22, LCD display, 4×4 keypad, Light Emitting Diode (LED), Global Positioning System (GPS), and Global System for Communication (GSM).

2.1 Existing Technologies

There have been several systems being developed in order to notify authorities of a collision. BMW Assist, Toyota's Safety Connect, Ford's 911 Assist and OnStar technologies have been designed to ensure the rescue team could urge to the accident location in time. All the existing technologies mentioned previously uses Automatic collision notification (ACN) system that uses an OEM design which is capable of informing particular authority once an accident has taken place. [8] It's also multi-functional; for example hands-free calling, voluntary collision respond , roadside assistance, vehicle safety aid system, direction navigator, details of road traffic and links up with the audio/video design in the vehicle. Besides that, monthly fees will be also charged to the user of the system depending on the chosen plan by the customer. However, this technology is only applicable to specific models of cars only. [9] Some information was gathered regarding this project on existing technologies is shown below:

a) BMW Assist

The BMW Assist operates by contacting emergency number and outlines any possible injuries to either driver or passengers based on the seriousness of the collision in the nearest hospital trauma center once an accident has occurred. The special feature of this technology is that, this system will inform specific departments on way to act either by sending an ambulance or helicopter to the accident site in nick of time. [10]



Figure 1: Basic operation of BMW Assist [32]