UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF IOT BASED EMERGENCY VEHICLE ALERT SYSTEM USING NODEMCU

ABDUL MUIZ BIN HAMIRUDIN

BACHELOR OF COMPUTER ENGINEERING TECHNOLOGY (COMPUTER SYSTEM) WITH HONOURS

2020

ABDUL MUIZ BIN HAMIRUDIN

BACHELOR OF COMPUTER ENG. TECH. (COMPUTER SYSTEMS)

2020

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF IOT BASED EMERGENCY VEHICLE ALERT SYSTEM USING NODEMCU

ABDUL MUIZ BIN HAMIRUDIN

BACHELOR OF COMPUTER ENGINEERING TECHNOLOGY (COMPUTER SYSTEM) WITH HONOURS

2020

Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IOT BASED EMERGENCY VEHICLE ALERT SYSTEM USING NODEMCU

Abdul Muiz Bin Hamirudin

Bachelor of Computer Engineering Technology (Computer Systems) with Honours

2020

DEVELOPMENT OF IOT BASED EMERGENCY VEHICLE ALERT SYSTEM USING NODEMCU

ABDUL MUIZ BIN HAMIRUDIN

A project report submitted
in fulfillment of the requirements for the Bachelor Of
Computer Engineering Technology (Computer System) With Honours

Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2020

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: DEVELOPMENT OF IOT BASED EMERGENCY VEHICLE ALERT SYSTEM USING NODEMCU

Sesi Pengajian: 2020

Saya **ABDUL MUIZ BIN HAMIRUDIN** mengaku membenarkan Laporan PSM ini disimpan di Perpustakaan Universiti Teknikal Malaysia Melaka (UTeM) dengan syarat-syarat kegunaan seperti berikut:

1. Laporan PSM adalah hak milik Universiti Teknikal Malaysia Melaka dan penulis.
2. Perpustakaan Universiti Teknikal Malaysia Melaka dibenarkan membuat salinan untuk tujuan pengajian sahaja dengan izin penulis.
3. Perpustakaan dibenarkan membuat salinan laporan PSM ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. **Sila tandakan (X)

☐ SULIT* Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia sebagaimana yang termaktub dalam AKTA RAHSIA RASMI 1972.

☐ TERHAD* Mengandungi maklumat TERHAD yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan.

☒ TIDAK TERHAD

Yang benar,

.....

ABDUL MUIZ BIN HAMIRUDIN

Alamat Tetap:

NO 29, JALAN SD 2/19,

TAMAN SERI DUYONG 2,

75460 MELAKA.

Tarikh: 08/02/2021

Disahkan oleh penyelia:

.....

DR. FARA ASHIKIN BINTI ALI

Cop Rasmi Penyelia

DR. FARA ASHIKIN BINTI ALI
Pensyarah
Jabatan Teknologi Kejuruteraan Elektronik dan Komputer
Fakulti Teknologi Kejuruteraan Elektrik dan Elektronik
Universiti Teknikal Malaysia Melaka

Tarikh: 11/02/2021

*Jika Laporan PSM ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan PSM ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I declare that this project entitled “Development of IoT Based Emergency Vehicle Alert System using NodeMCU” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature : 

Name : Abdul Muiz Bin Hamirudin

Date : 08/02/2021

APPROVAL

I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Computer Engineering Technology (Computer System) with Honours.

Signature : 

Supervisor Name : Dr. Fara Ashikin Binti Ali

Date : 11/02/2021

DEDICATION

To my beloved parents and family

Thank you for providing all the encouragement you have never given up.

To my supervisor and lecturer

Thank you for all your untiring guidance and assist. Your patience, support and words of encouragement gave me great strength to accomplish this project.

To all my friends

Thank you for your opinion and motivations.

ABSTRACT

Emergency vehicles such as police car, fire truck and ambulance need to arrive to their destination quickly and safely. Sirens and warning lights mounted in emergency vehicles are as tools to facilitate their movement through traffic to get them to their destination without any obstruction. However, there are some drivers who are unaware of the presence of the emergency vehicle. This is because some drivers like to listen to loud audio and some vehicles are equipped with a noise-canceling device resulting less outside noise can be heard from inside chassis. Therefore, there are several alert systems have been proposed to alert nearby vehicles with the presence of the emergency vehicles. In this paper, IoT based emergency vehicle alert system is proposed. In this system, NodeMCU, GPS module with antenna and LCD display are utilized as the hardware. For the software, Fritzing, Firebase Realtime Database and Arduino IDE are used to configure the activity of the system and MIT App Inventor is used to develop an application that provides a notification and inform the nearby vehicles the location of the emergency vehicle via map through smart phone. As the result, GPS module able to transmit the coordinates information of the emergency vehicle to the Firebase Realtime Database. Then the nearby driver within a radius range of 3.0 km from emergency vehicle receives a notification of "Emergency Vehicle Detected". Thus, the driver can open the maps to view the location of the emergency vehicle. It is shows that the data from NodeMCU successfully transmitted and received between NodeMCU, Firebase and the application.

ABSTRAK

Kenderaan kecemasan seperti kereta polis, trak bomba dan ambulans perlu tiba ke destinasi mereka dengan cepat dan selamat. Siren dan lampu amaran yang dipasang di kenderaan kecemasan adalah sebagai alat untuk memudahkan pergerakan mereka melalui lalu lintas untuk mereka tiba ke destinasi tanpa sebarang halangan. Namun, ada sebilangan pemandu yang tidak menyedari terhadap kehadiran kenderaan kecemasan ini. Ini kerana ada sebilangan pemandu gemar mendengar audio yang kuat dan ada sebilangan kenderaan dilengkapi dengan alat peredam bunyi untuk mengurangkan bunyi dari luar supaya tidak dapat didengari dari dalam casis. Oleh itu, terdapat beberapa sistem amaran yang telah dicadangkan untuk memberi amaran kepada kenderaan berdekatan dengan kehadiran kenderaan kecemasan. Dalam laporan ini, sistem amaran kenderaan kecemasan berasaskan IoT telah dicadangkan. Dalam sistem ini, modul NodeMCU, modul GPS dan paparan LCD digunakan sebagai perkakasan. Untuk perisian, Fritzing, Firebase Realtime Database dan Arduino IDE digunakan untuk menkonfigurasi aktiviti sistem dan MIT App Inventor akan digunakan untuk membangunkan aplikasi yang berupaya untuk memberi amaran dan memberitahu kenderaan berdekatan mengenai lokasi kenderaan kecemasan dengan menggunakan peta pada telefon bimbit. Untuk hasilnya, modul GPS dapat menghantar maklumat berkenaan koordinat kenderaan kecemasan ke Firebase Realtime Database. Seterusnya, kenderaan berdekatan yang berada sekitar 3.0 km daripada kenderaan kecemasan mendapat pemberitahuan "Kenderaan Kecemasan Dikesan". Oleh itu, pemandu boleh membuka peta untuk melihat lokasi sebenar kenderaan kecemasan. Ini menunjukkan bahawa data dari NodeMCU berjaya dihantar dan diterima antara NodeMCU, Firebase dan aplikasi.

ACKNOWLEDGEMENTS

In the Name of Allah, the Most Gracious, the Most Merciful

First of all, thanks to God as the Final Year Project (FYP) is completed without any difficulty and distraction. I hereby would like to take this precious opportunity to thank all people who has involved generously in helping and assisting me while I was completing the FYP report which is a compulsory to all Universiti Teknikal Malaysia Melaka (UTeM) students in order to complete our degree.

First and foremost, I would like to express my sincere acknowledgement to my supervisor Dr. Fara Asyikin Binti Ali from the Electrical Engineering Department from Faculty of Electrical and Electronic Engineering Technology, Universiti Teknikal Malaysia Melaka (UTeM) for her undivided support morally and physically, assistance, guidance, tolerance, constructive critics and suggestion during the planning and development of this project.

Secondly, I would like to express my sincere thanks and appreciation to my entire lecturer from Faculty of Electrical and Electronic Engineering Technology (FTKEE) who had pass down their knowledge and guide me as well during my studies in UTeM. Besides that, I would like to express my sincere thanks and appreciation to my beloved family especially my parents for giving me support, encouragement and motivation from starting of the project until completion of the project.

I would like to thank everyone who is involved in this project either directly or indirectly for their helps and cooperation. Last but not least, special thanks to all of my friends and course mates as well as to all those who help for making my time at UTeM a memorable one.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS AND ABBREVIATIONS

IoT	-	Internet of Things
Wi-Fi	-	Wireless Fidelity
MCU	-	Microcontroller Unit
IDE	-	Integrated Development Environment
Apps	-	Applications
PCB	-	Printed Circuit Board
GUI	-	Graphical Users Interface
RFID	-	Radio Frequency Identification

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background Study

An emergency vehicle is vehicle authorized and allowed to respond to a life-threatening emergency. Generally, police vehicle, ambulance and fire trucks are categorized as the emergency vehicle. These vehicles are normally operated by specified organization of government and also managed by charities, non-governmental organizations as well as certain commercial companies. In most states, emergency vehicles are allowed by law to break standard road rules such as break a traffic signal or cross the speed limit in order to reach their destination in the quickest possible period (Goldasz, 2017). However, there are also some states will take action against the driver of an emergency vehicle if the driver displays reckless disregard for other people's safety.

Besides, in a position of nearby vehicle, when drivers know the situation where they hear an emergency vehicle siren, sometimes they might get confused with what to do next. Locating the emergency vehicle, determining where it will go and what would be the safest option to give way, are always challenging. Thus, sometimes the driver responds too late or in a wrong situation, which can lead to a serious accident with the emergency vehicle which supposedly provide support and help. Moreover, many lives are lost in accidents involving emergency vehicles. As shown in Figure 1.1 statistic in (Council, 2018) state that 168 people died in emergency vehicle accidents. The most deaths were involving police vehicles (107), followed

by ambulances (47), and fire trucks (14). Thus, a method in order to alert nearby vehicles drivers with the presence of the emergency vehicle is needed.

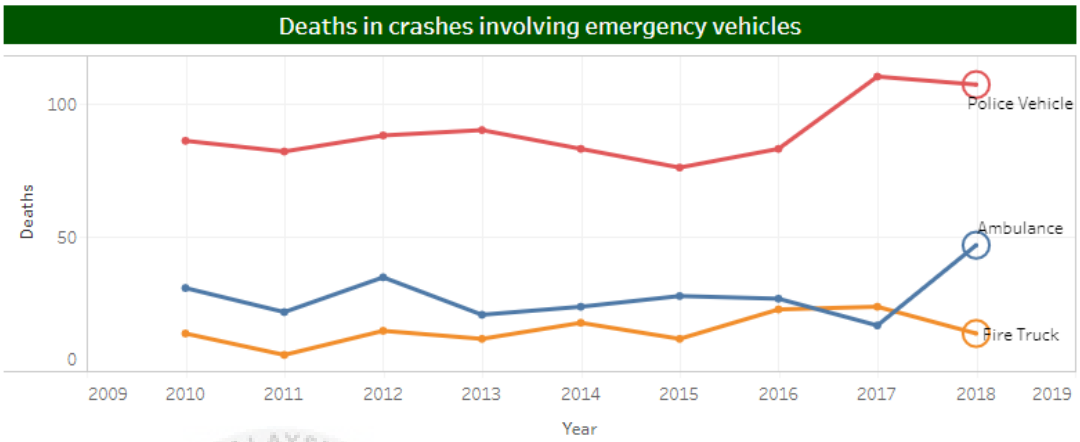

Figure 1.1: Deaths in crashes involving emergency vehicles

Since a decade ago, there are several emergency vehicle alert systems have been introduced such as Alert System for Emergency Vehicle Using Software-Defined Radio (Bosquez, Moreira and De La Cruz, 2017), Ambulance Detection and Traffic Control System (Karthik *et al.*, 2019) and IoT based Stolen Vehicle Detection and Ambulance Clearance System (Prof, 2017). In this study, Development of IoT Based Emergency Vehicle Alert System using NodeMCU is proposed. This system allows the driver of an emergency vehicle to show their current location to the nearby driver while they in an emergency. This proposed system also provides a notification to the nearby driver's smart phone when the system transmitted from the emergency vehicle within a radius range of 3.0 km.

1.2 Problem Statement

Generally, siren is used in emergency vehicles as a tool to alert nearby vehicles or others on their way. Siren is defined as a loud noise making device that transmit a signal or warning from an emergency vehicle to nearby vehicles and people. So that, the nearby vehicles and people will be alert and need to move their vehicle to give way to emergency vehicle such as ambulance, fire truck or police vehicles to allow them to arrive to the destination as soon as possible. However, the volume of the siren limits the distance at which the siren can be heard. Because of this limitation, it is difficult to locate the emergency vehicle, to decide where it is driving to, and what would be the best maneuver to give a way. Therefore, nearby drivers often react too late or in a wrong way, which may lead to severe accident with the emergency vehicle.

There are several approaches have been taken by previous researchers for example Alert System for Emergency Vehicle Using Software-Defined Radio (Bosquez, Moreira and De La Cruz, 2017). The objective is to transmit audio alert messages to FM receiver in nearby vehicle for alerting the driver to the presence of emergency vehicle. However, this research focused on the most listened radio station only to receive the audio signal. Next is Ambulance Detection and Traffic Control System (Karthik *et al.*, 2019). GPS module and Wi-Fi module are used to transmit the coordinate of the emergency vehicle and the microcontroller will make the traffic light turn green when the emergency vehicle needs to pass by. So that, it will make the road clear and avoid road congestion. However, the system is high-cost due large cloud size needed to monitor the road traffic. Then, IoT based Stolen Vehicle Detection and Ambulance Clearance System (Prof, 2017) is proposed to make the traffic light turn green when the RFID tag from the emergency vehicle and the receiver is match. This will avoid crash from the vehicle from another

intersection by make sure only route that emergency vehicle will be passed by will turn green. Nevertheless, it also has a disadvantage where it requires the data from the starting point and end point of the journey. It may not be successful if the ambulance requires to take an alternative way for some reasons. Therefore, the Development of IoT Based Emergency Vehicle Alert System using NodeMCU is proposed.

In this study, the Development of IoT Based Emergency Vehicle Alert System using NodeMCU is proposed to be capable to help out equally between emergency vehicle drivers and road drivers in term of to avoid the collision. Furthermore, it is developed so that the dilemma that all emergency vehicle drivers are confronting may be reduced and it may deliver awareness to all drivers of it benefits and practicality in the upcoming.

1.3 Project Objective

In this study, there are three main objectives. There are as follows:

a) To design an IoT based emergency vehicle alert system using NodeMCU.

b) To transmit and receive a signal from an emergency vehicle and nearby vehicle, respectively in a predefined distance.

c) To analyze the performance of the system.

1.4 Scope of Study

This project consists of hardware and software. For the hardware, NodeMCU ESP8266 is used as a microcontroller to control the systems activity. NodeMCU with built-in Wi-Fi module is utilized in order to transmit the coordinate of emergency vehicle to Firebase Realtime Database. GPS module is used to provide the GPS coordinate of an emergency vehicle and GPS

module inside smart phone is used to provide GPS coordinate of the nearby vehicles. Lastly, the LCD display is used to make easier for the emergency vehicle to know the current activity of the system.

For the software, MIT App Inventor and Arduino IDE are applied to configure the activity of the system. For the application to the users, MIT App Inventor will develop an application in order to give an alert and show the location of the emergency vehicle via maps. This system is limited to 3.0 km in radius from the emergency vehicle and limited to nearby users only.

1.5 Organization

This project centers around the alert system for an emergency vehicle using an IoT based system. This report comprises of five chapters. An introduction to the issue, objectives and scopes are given in **Chapter 1**. In **Chapter 2**, literature review on current methods embraced and dissimilar advances that actualized in past project as well as the comparison regarding pros and cons are discussed. Next, the project development including hardware and software, as well as the method applied are specifically explained in **Chapter 3**. In **Chapter 4**, results including data tabulation and project analysis are shown and discussed. Finally, conclusion and future suggestion will be highlighted in **Chapter 5**.