

***Integrated Speed Bump Detector to notify road users using Internet of Things
(IoT)***

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Bachelor of Computer Science with Honours (Software Engineering)

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Integrated Speed Bump Detector to notify road users using Internet of Things

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This project is submitted in partial fulfilment of the
Requirements for the degree of
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2019

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ABSTRACT

Internet of Things (IoT) is a new trend technology that lets us to connect objects and mechanism to the internet for remote control. Every year all over the world, many lives are lost due to accidents on the roads. Different factors has contribute to this tragic death, such as poor condition of roads and bad weather such as rain. To solve this problem, an Integrated Speed Bump Detector to notify road users using Internet of Things (IoT) has been proposed to help road users to detect speed bump earlier by get notify through sound from the buzzer and red light from LED. The objectives of this project is to detect a speed bump and notify the road users through buzzer and LED. It is also increase the safety of road users during their trips and also provide information if speed bump is approaching. Other than that, the results of this proposed system is able to send signal to the road users in a 0.01 seconds. The expected outcome of this project is to prevent an accident from occurring during the road user trips and increased be careful attitude among road users.

ABSTRAK

Objek Rangkaian Internet (IoT) adalah teknologi trend terbaru yang membolehkan kita menghubungkan objek dan mekanisme untuk internet untuk kawalan jauh. Setiap tahun di seluruh dunia, banyak nyawa yang hilang akibat kemalangan di jalan raya. Faktor yang berbeza telah menyumbang kepada kematian tragis ini, seperti keadaan jalan yang buruk dan cuaca buruk seperti hujan. Untuk menyelesaikan masalah ini, Pegasan Bonggol Kelajuan Bersepadu untuk memberitahu pengguna jalan raya menggunakan Objek Rangkaian Internet (IoT) telah dicadangkan untuk membantu pengguna jalan raya untuk mengesan bonggol kelajuan lebih awal dengan memberitahu melalui bunyi dari pembaz dan lampu merah dari LED. Objektif projek ini adalah untuk mengesan bonggol kelajuan dan memberitahu pengguna jalan melalui buzzer dan LED. Ia juga meningkatkan keselamatan pengguna jalan raya semasa perjalanan mereka dan juga memberi maklumat jika bonggol kelajuan sedang menghampiri. Selain daripada itu, hasil sistem yang dicadangkan ini dapat menghantar isyarat kepada pengguna jalan raya dalam masa 0.01 saat Hasil yang diharapkan dari projek ini adalah untuk mencegah terjadinya kecelakaan ketika perjalanan pengguna jalan raya dan peningkatan sikap berhati-hati di kalangan pengguna jalan raya.

CHAPTER 1: INTRODUCTION

1.1 Overview

Technology is now part of the human life and human nowadays sometimes cannot live without it. The society also have been surprisingly changed with the evaluation of the powerful technology. Before the advance technology have been introduced, majority people have to live with the manual things that used too much of their time such as if they want to talk they have to meet face to face but with the technology such as smartphone, they just have to call or message the person. Thanks to the technology that human life have upgraded drastically and save more time, money and energy for the others things. One of the powerful technology that had been developed are cars and other vehicles that safe enough for human use every day for them to go to their destination in a short time. But sometimes, there are unexpected event occur to the human while they was driving to their destination. Other than careless drivers and distraction while driving, unsafe or dangerous road also one of the factor that contributed to the number of accidents increase daily. Abnormalities such as manholes, potholes and speed bump also one of the unsafe and dangerous road. We have created technological options to prevent, eliminate, or lessen threats to life and the environment and to fulfill social needs (Sueb,b, 2013). The purpose of this project is to detect speed bumps and notify the road user earlier so the road user can take a precautions and avoid unexpected event from occur.

According to Patel and Gundaliya (2017) speed bump is a raised pavement surface that provides a physical remainder for motorists to slow down while traveling over it. Speed bump have been an issues by the people recently to force road users such as drivers and motorcyclist to reduce their vehicle speed to avoid accident from happen. Speed bump was implemented in Chatham, New Jersey in 1906. Designed by Arthur

Holly Compton after be noticing motorists' speed that passed Brookings Hall at Washington University in St. Louis, Missouri when he was a chancellor (ACPLM, 2019). It is implemented for the drivers to slow down their vehicle when approaching the speed bump.

Many countries had been placed this speed bumps randomly on their road that can be found at the school, playground and hospital for the safety both drivers and pedestrians. Sometimes, a traffic sign that shows there is a bump ahead may not exist and the driving pattern are distracted or disturbed and road user may hit the bump at the high speed causing accidents and damage to their vehicles. According to Patel and Gundaliya (2017) as per road accident report, 2014 in India a total of 4726 lives were lost due to crashes at speed breakers on National Highways. This problems can be solve by detecting the speed bumps ahead and notify the road users earlier so they have enough time to slow down their vehicle before hit the bump. So, a prototype to solve this problems have been develop which is an Integrated Speed Bump Detector to notify road users using Internet of Things (IoT) which is able to warn road users that speed bump is approaching.

1.2 Problem Statement

The problem occurs when the issues unsafe and dangerous road condition is one of the problems that donate to a staggering number of car accidents every year. According to World Health Organization, approximately 1.35 million people die each year as a result of road traffic crashes (WHO, 2018). Other than carelessness of a driver, abnormalities such as manholes, potholes and speed bump also one of the reasons accident occurred. This issues also has received attention from many researchers. We cannot blame drivers because of this unsafe and dangerous road. As a result, thousands of people such as

drivers, pedestrians and motorcyclists suffer injuries that are not even their fault to be blame and this problem can be avoid if the roads had been properly maintained. These abnormalities road also can cause serious incidents to the driver if they have not been notified earlier.

Besides, when the environment are dark, night or raining, the road users tend to not see the road clearly. So obstacles on the road such as speed bump may not be visible to the road users and if the road users drive vehicles at the maximum speed and did not aware of these obstacles, it can cause serious accidents and even death to the driver. Moreover, the street light at the speed bump also not bright enough to be noticed by road users. The yellow and black line at the speed bump sometimes has eroded and faded due to rain and lead to confusion to the road users. Another problem that a road user will be faced is when the road sign may be missing or broken and cause driver unfamiliar and not aware with the hazard on the road. Thus, these problems will cause confusion to the road users and accident are more likely to occur. Other than accidents that might happen due to the unsafe and dangerous road, serious damage to the vehicles also one of the problem if the road users did not aware of the bumps.

In this project, an initiative has been propose for detecting speed bumps and warning road users in advance so they can slow down their speed before hitting the bumps by a sensor called Integrated Speed Bump Detector to notify road users using Internet of Things (IoT) which is able to alert the road users if the speed bump is approaching and prevent accident from occur. With this proposed system, it can save many lives from the road traffic injuries and safety road users can be guaranteed.

1.3 Aim and Objectives

The main objective of this project is to design and develop an Integrated Speed Bump Detector to notify road users using Internet of Things (IoT) which is able to notify road users that speed bump is approaching. The proposed system is not considered as a latest invention since there are already similar devices/systems available in the market. However, the proposed system is incorporated with additional functionality to fulfill the need of these objectives.

Other objectives include:

1. To design and develop a prototype that can alert road user's speed bump is approaching ahead through a sound of buzzer and red light from LED.
2. To assemble a prototype of several sensors that can notify road user's about speed bump on the road.
3. To increase the efficiency of Integrated Speed Bump Detector system more reliable and easier to use.

1.4 Scope

This project is to develop Integrated Speed Bump Detector to notify road users using Internet of Things (IoT) in order to notify road users speed bump is approaching ahead through sound from the buzzer, so road users can take an early precaution to slow down their vehicle within enough time and the probability of accident occur can be decrease with the help of this proposed system. Therefore, an Integrated Speed Bump Detector for Driver using Internet of Things (IoT) will help the road users by sound from the buzzer, a blink of red light from LED and also received notification from Blynk Application to give a warning that speed bump is approaching. An Integrated Speed

Bump Detector to notify road users using Internet of Things (Iot) also provides a mechanism that will alert road users by providing a light in red color that will blink in a few times which will alert the driver to be extra cautions beside the sound produce by the buzzer and notification from Blynk application, so with this light the drivers do not have any excuses to not noticing the speed bump ahead.

1.5 Methodology

In this development of project Integrated Speed Bump Detector to notify road users using Internet of Things (Iot), Rapid Application Development (RAD) methodology have been chosen. RAD is chosen because it can save more time as it does not take much time or resources on planning phase and method of prototyping is used to introduce the product. Rapid application development basically follows a cyclical process that include four steps. The graphical representation of RAD phases is illustrating as in Figure 1.1.

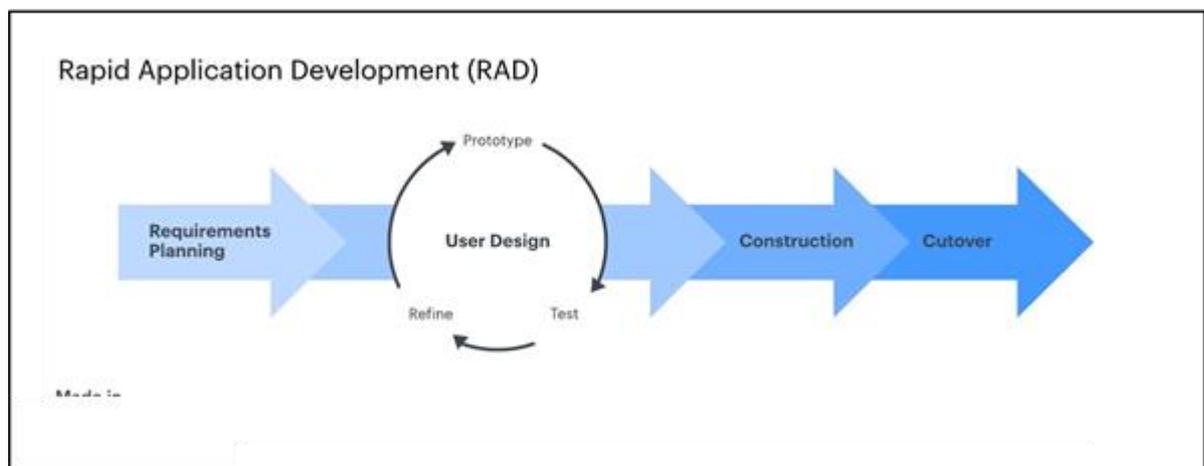


Figure 1.1: Rapid Application Development (RAD) Model (Singh, A.,2019)

The first phase in RAD is requirement planning where developer need to determine the objectives and problem statement of the proposed system where the proposed application will be obtained by using questionnaire and interview method from a

survey taken among the road users. Other than that, a proper plan and proper proposal should be prepared by the developer to explain how the proposal application will give benefits to the road users. There are a few criteria that the developer must put in the proposal which are introduction, problem statement, objectives, methodology, significance of the project, project schedule and the expected outcome in details. Analysis works also include in the RAD. During this phase, developers are required to make a comparison between the functionalities and the usage of the proposed application with the other existing application in the market. Besides that, information from road users are queried and collected to perform the requirements analysis.

The next phase is the prototyping of the user design phase. During this phase, developers are required to design and develop the project. In this phase, developers need to design the architecture structure as well as the layout of the proposed application. During designing the architecture structure, Data Flow Diagram (DFD), Entity Relationship Diagram (ERD) and data dictionary are required to be created by the developers. Furthermore, prototype cycle is an iterative phase where feedbacks from stakeholders must be taken several times and need to be collected and developed by the developers. Stakeholders will demonstrate and refine the prototype every time it is developed and every aspect that are included in the project are repeated until the results of the refinement is acceptable.

After completed the prototype phase, the construction phase will take over. During this phase, testing and compilation of the project will be included. Testing phase is an important role in the process of application development as the developers must ensure that the proposed application is successful in achieving the objectives and function. Finally, the proposed application is ready for deployment.

1.6 Significant of the Project

In this final year project, this detector will help the road users to be more careful on the road as they will face many dangerous things like obstacles such as speed bump and holes that can cause an accident if the road users did not noticed it from the earlier. The benefit of this proposed system are it have three alerting things such as sound produce from the buzzer, notification from Blynk Application and a blinking red color from the LED light to seriously give a warning to the driver to slow down their vehicle so their safety will be more secure with the help of this proposed system. Besides that, road users also does not have to worry or scared if they drive in the dark environment or in a rainy day because sometimes they tend not to see the road clearly but the help of this sensor, they can drive happily and not worrying somethings dangerous might happen to them.

1.7 Project Schedule

Duration to complete this Final Year Project 1 is about 81 days. There are 12 tasks to be completed within 81 days. Expected to be done this Final Year Project 1 is on 1st January 2020 after Amendment and Modification Period for FYP have been submitted through the FoCuSIT FYP System. Gantt chart of this proposed system can be referred at the appendix section.

1.8 Expected outcome

At the end of this project, the outcome for this project is expected to successfully develop a prototype sensor for detecting speed bump ahead within a given distance and notify the road users through sound from the buzzer and Blynk application and also red light color from the LED. This project also can help road users to notify

speed bump earlier so they can reduce vehicle speed within enough time. Thus, it also can decrease the number of accident occur as the road had been notified the location of speed bump earlier with the help of this Integrated Speed Bump Detector to notify road users using Internet of Things (IoT).

1.9 Conclusion

This chapter has discussed the introduction Integrated Speed Bump Detector to notify road drivers using Internet of Things (IoT). This chapter covers the introduction, problem statement, project description, the significant of the project and lastly expected outcomes of the proposed system. The problems statement mentions why this proposed system should be developed and how it is going to help developer thinks of a many solution to the problem. This proposed system will implemented RAD methodology which is important to guide and make sure this project fully completed.

Chapter 2: Literature Review

2.1 Introduction

This chapter will discuss the overview of three existing system and the proposed system to be developed. The review is mainly based on the functionalities, advantages and disadvantages of all these systems. After all the features have been studied and analyzed, a detailed comparison was made among all these three existing system with the proposed systems. The tools technology in the development of the proposed system also has been discussed clearly in this chapter.

There are many accidents occur due to the careless of driver, obstacles on the road and there is no warning sign on the road so that driver do not take an earlier precaution about the danger. However, there is a solution for a driver to prevent an accident from occur by using technology, an Integrated Speed Bump detector to notify driver using Internet of Things (IoT) will be proposed to helps a driver to identify speed bump earlier via send a warning sign to the driver through a sound produce by the buzzer and a red light from LED.

The devices needed for this Integrated Speed Bump detector to notify driver using Internet of Things (IoT) is a Nodemcu ESP32 board, ultrasonic Sensor, ESP32 Camera, Buzzer, LED light and power supply. The ultrasonic sensor will send an information to the Arduino if the car is approaching speed bump within a range <10 meanwhile ESP32 camera will detect speed bump and send the information to the Arduino. The sound from the buzzer and Blynk Application and also a red light from the LED will be produced if these two sensor detect a speed bump within range $< 10\text{m}$ to alert the driver immediately. According to Gupta (2014) 10m is the suitable range for road user to reduce speed without need to use emergency brake if speed bump is approaching suddenly where 80% of vehicle speed was reduction by 65%. Therefore, driver can

prevent an accident from occur if the danger sign is identify earlier so the driver can drive safely to their trips.

2.2 Review of the similar system

There are three existing systems that have been selected to be discussed in this chapter. The three existing systems are Development of Digital Vehicle Distance Monitoring System, Automatic Road Accident Detection using Ultrasonic Sensor and Vehicle Safety Distance Alarming System. All these system have their own characteristic, advantages, and disadvantages.

2.2.1 Development of Digital Vehicle Distance Monitoring System

2.2.1.1 Overall Process

The first similar system is Development of Digital Vehicle Distance Monitoring System. This system is designed to helps driver to estimate of how far distance between car and object either it is in the front or behind the car that can contribute to reduce number of incidents. The function of this system to detect an objects in front or behind the car. The devices that have been used in this system is ultrasonic sensor is placed in front of the car mainly focused to detect the object. Then PIC16F84A microcontroller which has been programmed using MPLAB software is used to analysis, send command measure the distant between the car and objects within the focused range which is between 1 m to 5m. Lastly, Analog to Digital Converter used to convert an analog signal from transducer into a digital signal.

The system is parted into two different part which is input and output. The input of this system is ultrasonic sensor based on the ADC concept whereas LCD used to display the range number will be the output of this system. The ultrasonic sensor, analog to digital converter and LCD will connect to the microcontroller which acts as

the controller to receive a signal from the sensor and display number of distant in the LCD. This assemble prototype is simulated using Proteus software to identify either each component in the circuit and the program in the PIC16F84A is correct. After that, all the hardware is develop after the simulation reveal the output and the display shown the exact distance. Figure 2.1 shows the circuit simulation using Proteus software.

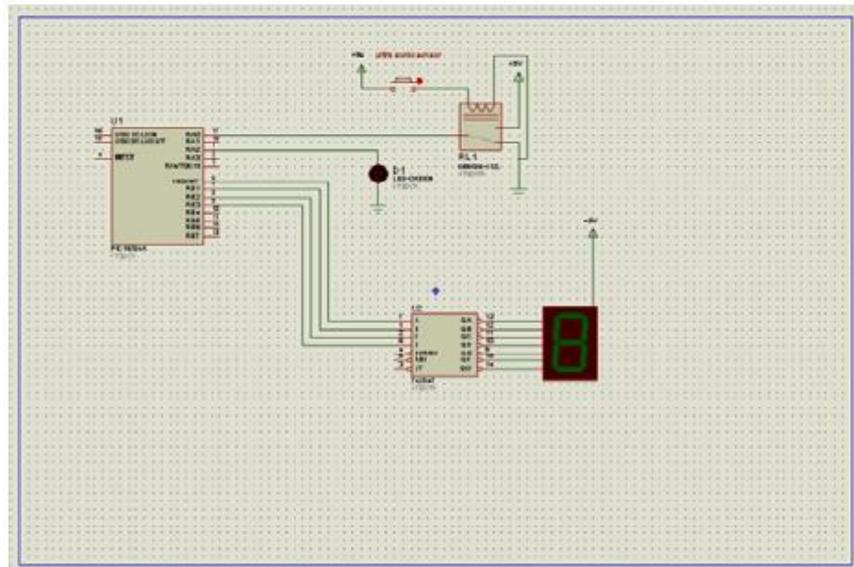


Figure 2.1: Circuit of the Development of Digital Vehicle Distance Monitoring System

The ultrasonic sensor will detect objects either it is in front or behind the car and signal will be send to the microcontroller which has been programmed using MPLAB software to analysis the signal, sends the command and also measure the distant. After that, analog to digital converter will receives the data about measure and convert it into the digital signal. Then, the number of distant between the car and object will be display in the LCD.

2.2.1.2 Function Review

The function of this system is to detect an object in front and behind the car. If the objects have been detected, the LCD will display the distance between the car and objects to the driver. In this particular system, driver can identify the distant from the car depending on the range displayed from the LCD and can take an early precaution to avoid unnecessary things from occur.

2.2.2 Automatic Road Accident Detection using Ultrasonic Sensor

2.2.2.1 Overall Process

This purpose of the system, Automatic Road Accident Detection using Ultrasonic sensor is to detect road accident and immediately inform to the emergency department. This system can save many life if it really implement in real life. The function of this system is to detect a road accident if there is accident occur and emergency department will get instant information about this accident directly. In this system, the devices that have been used is an ultrasonic sensor module HCSR04, GPS module and GSM. The ultrasonic sensor module HCSR04 and Wi-Fi will act as an input while GSM will be an output for this system.

The ultrasonic sensor module HCSR04 will be functioning to measure the distance. Two ultrasonic sensor will be placed on the front wind screen and back wind screen of the car. Distance between ultrasonic sensor and respective bumpers is measured. These distances are named as threshold distance 1 and threshold distance 2. The threshold distance is breached when any object collides with the car and the processing system is turned on immediately. Once the incidents occur, GPS will find out the location of the car immediately and send help to the emergency department immediately through GSM. The architecture of the Automatic Road Accident Detection using Ultrasonic Sensor system is shown in the figure 2.2.