UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Ultrasonic Based Distance Measurement System in Automotive Application

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor's Degree in Electronics Engineering Technology (Telecommunications)

by

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UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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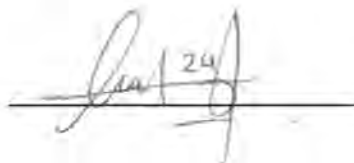
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APPROVAL

This report is submitted to the Faculty of Engineering Technology of UTeM as a partial fulfillment of the requirements for the degree of Bachelor of Engineering Technology (JTKEK) (Hons.). The member of the supervisory is as follow:

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(Madam Norain Binti Rahim)

ABSTRACT

The Ultrasonic Based Distance Measurement System in Automotive Application helps to avoid the regular accidents that will normally occurring on highways and in city traffic. The aim of the system is to prevent accidents mainly due to not knowing the following distance between one vehicle and another vehicle. In this project, it will introduce a new technique in automobile technology about how to keep 1 meter distance between one vehicle and another vehicle to prevent the vehicle from crash. The objective of this project is to develop ultrasonic based distance measurement system in automotive application by using Arduino UNO. Due to ultrasonic sensor detection, the distance between two automobiles can be calculated. On the other hand, this project can locate the other cars to protect users from accidents. Besides that, it makes an analysis of the safety distance between two cars both front and back side. At the end of this project, the system will able to detect 1 meter range car in front and can warn the driver about safety distance with car in front.

ABSTRAK

"The Ultrasonic Based Distance Measurement System in Automotive Application" boleh membantu untuk mengelakkan kemalangan yang seringkali berlaku di bandar atau ketika keadaan trafik sesak. Tujuan sistem ini adalah untuk mengelakkan kemalangan disebabkan oleh jarak antara satu kenderaan dengan kenderaan yang lain. Projek ini, akan memperkenalkan satu teknik baru dalam teknologi automobil tentang bagaimana untuk menjaga jarak selamat 1 meter antara dua kenderaan untuk mengelakkan kenderaan daripada berlanggar. Objektif projek ini adalah untuk membangunkan "The Ultrasonic Based Distance Measurement System in Automotive Application" dengan menggunakan Arduino UNO. Dengan menggunakan pengesanan sensor ultrasonik, jarak di antara dua kereta boleh dikira. Selain itu, projek ini boleh mengesan kereta lain yang berada dihadapan untuk melindungi pengguna daripada kemalangan. Selain itu, ia juga dapat membuat analisis jarak selamat di antara dua kereta. Pada akhir projek , sistem ini akan mampu mengesan jarak 1 meter kereta di hadapan dan memberi amaran kepada pemandu tentang jarak selamat antara dua kereta.

DEDICATION

I would like to specially dedicate this paper to my Father, my Mother and to all my family.

ACKNOWLEDGEMENT

I have taken efforts in this project. However, it would not have been possible without the kind support and help of many individuals and organizations. I would like to extend my sincere thanks to all of them. I am grateful to the God for the good health and wellbeing that were necessary to complete this book. I wish to express my sincere thanks to Mr. Mohd Saad Bin Hamid, head of department of JTKEK, for providing me with all the necessary facilities for the lab and research. I place on record, my sincere thank you to Assoc. Professor Mohd Rahimi Bin Yusoff, Dean of the Faculty of Engineering Technology, for the continuo's encouragement. I am also grateful to Madam Norain Binti Rahim, Project Supervisor. I am extremely thankful and indebted to her for sharing expertise, and sincere and valuable guidance and encouragement extended to me. I take this opportunity to express gratitude to all of the Department faculty members for their help and support. I also thank my parents for the unceasing encouragement, support and attention. I also place on record, my sense of gratitude to one and all, who directly or indirectly, have lent their hand in this venture.

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LIST OF ABBREVATIONS, SYMBOLS AND NOMENCLATURES

1"	-	1 degree
AC	-	Alternative Current
C	-	Celsius
Cm	-	Centimetre
DC	-	Direct Current
Ft	-	Feet
G	-	Gram
Gnd	-	Ground
GPS	-	Global Positioning System
GSM	-	Global System for Mobile Communication
Hz	-	Hertz
ICSP	-	In-system programming
Kb	-	Kilo byte
Km/h	-	Kilometres per hour
LCD	-	Light Crystal Display
LED	-	Light Emitter Diode
m	-	Meters
Mm	-	Millimetres
mA	-	Mile ampere

Max	-	Maximum
Mhz	-	Mega hertz
Min	-	Minimum
PC	-	Personal Computer
PCB	-	Printed Circuit Board
PIC	-	Peripheral Interface Controller
PWM	-	Pulse Width Modulation
RAM	-	Random Access Memory
SCL	-	Spam Confidence Level
SDA	-	Data Line
S	-	Second
UART	-	Universal Asynchronous Receiver / Transmitter
uS	-	Micro second
V	-	Volt
Vcc	-	Voltage at Common Collector
Vin	-	Voltage in
Vout	-	Voltage Out

CHAPTER 1

INTRODUCTION

This chapter focuses on the project's introduction, background, problem statement, objective and project's scope regarding the project. The Ultrasonic Based Distance Measurement System in Automotive Application will be explained more in details. The problem statement states the reason why this project is being conducted. Then, at the end of the chapter the organization of the thesis will be explained.

1.0   Background

In this project, is a new technique in automobile technology about keep 1 meter distance between one vehicle and another vehicle will introduced, so that the vehicle don't crash or cause any traffic problem. The aim of the system is to prevent accidents mainly due to not knowing the following distance between one vehicle and another vehicle.

The system comprises an idea of having safety while reversing a vehicle, detects any object within the following distance, and displays the distance between one vehicle and another vehicle to the driver using liquid crystal display (LCD). This project has used ultrasonic sensors to detect any vehicle on both front and back side of our vehicle. If the car reaches 1 meter, green colour light will glow. At 0.6 meter distance yellow colour light will glow. When it reaches 0.4 meter distance buzzer will turn on. The distance is also indicated to the vehicle driver. By this system, the safety is maintained on crowded areas and in vehicle reversing process.

1.1 Problem Statement

The Ultrasonic Based Distance Measurement System in Automotive Application helps to avoid the regular accidents that will normally occurring on highways and in city traffic. These accidents are mainly happened by distraction, unconsciousness, and distance unknown between our vehicles.

Due to this sensor, it can calculate the distance between two automobiles. This project can locate other cars and can protect users from accidents. The diagrammatic representation of the scenario is explained as figure 1.0 below:
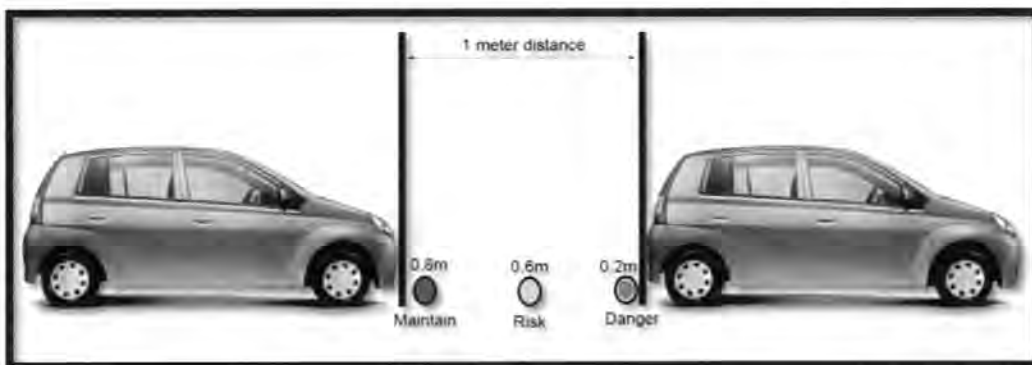
Figure 1.0 The distance between two automobiles

1.2 Project Objective

This proposal project that is the Ultrasonic Based Distance Measurement System in Automotive Application was developed by using the highest technologies to give more convenience to the user. Instead, there are several objectives as follows:

i. To develop ultrasonic based distance measurement system in automotive application by using Liquid Crystal Display (LCD) and Arduino UNO.

ii. To analyse the safety distance between two car.

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1.3   Scope of Project

The scopes of this project involve the Arduino, Ultrasonic sensor and liquid crystal display (LCD). It is a prototyping platform for controlling many devices. Through Arduino, it can build many prototypes that we imagine. A basic Arduino kit which forms the connection between the LCD and Ultrasonic sensor.

The LCD is used to display the output. Through this LCD display we can be able to see the distance of the vehicles that comes. Ultrasonic sensor is to sense the vehicles that near about to 1 meters Bread boards which allow implementing all the connections accompanied by the two LEDs and one buzzer.
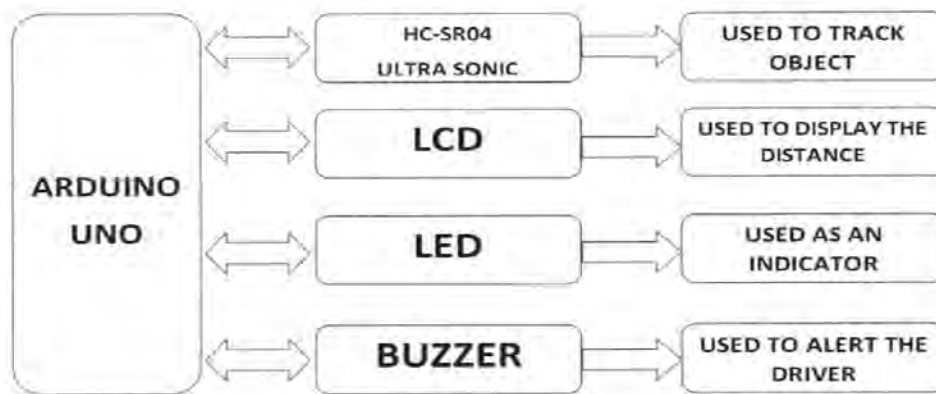
Figure 1.1 Overall project block diagram

Figure 1.1 shows the connections are made to the Arduino UNO, LCD, ultrasonic sensor, LED and buzzer. This project are using Ultrasonic sensor, so ultrasonic sensor fixed in car and it normally senses the car which is nearest. At the distance between 0.8 meter and 0.59 meter the back light LCD will turn on, LED green colour light will show the notification then, when the car reaches between 0.6 meter until 0.39 meter the yellow LED colour light will blinking and LED green colour will turn off. When the car reaches between 0.4 meter and 0.19 meter the yellow LED colour light still blinking and buzzer will turn on. When the car reach distance between 0.2 meter until 0 meter, yellow LED colour light will blinking faster and buzzer will be loud to alerts us we are in danger zone. When the distance

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in a safe zone, back light of LCD, LED green, LED yellow and buzzer will turn off. The distance between one vehicle and another vehicle was displayed in LCD.

1.4   Organization of Thesis

Generally, this thesis is divided into five chapters which are to explain all the flows and efforts in completing this project. Each chapter will discuss on different issues related to the project. The thesis covers on the introduction, literature review, research methodology, discussion, conclusion and recommendation.

The first chapter will give the overview of the project. By means that even people do not follow the development of project until the end they can still know about the project through the overview. The overview includes of Project Introduction, Problem Statement, Project Objectives, and Scope of Project. The objective that create based on the aim why this project was conducted and the project scope about the methodology. Then, the problem statement states the reason why this project is conducted.

Next, chapter 2 concentrates on the literature review that will describe all the information that was referred as a reference in order to finish up the project. Basically literature review will contain the facts or other aspect that we need that corresponds to the project that will build. For this project, the literature review covers the thing about a heart rate monitor that is used all around the world. The chosen literature review also explains the basic knowledge of pulse sensor, Arduino and PC software.

Next, chapter 3 will state and discuss about the methodology taken to complete this project with success based on the given period of time. Methodology is the important aspect as it is the beginning process of planning. If the methodology is not organized only then will encounter the problem involve the project.

Meanwhile, chapter 4 show the result were obtained from the system testing and modified in order to achieve the overall objectives of the project. Chapter 4

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considers as an important part also because the project will fully finish if the result are obtained as well as planned. Thus a lot of time has to put to carry out this chapter.

Finally, chapter 5 after trough all the process and successful to achieve the objectives as stated in the earlier chapter. The project can be concluded and explain the detail in this chapter. Other than that, a future recommendation for this project also includes improving this project for the future improvement and upgrade.

CHAPTER 2

LITERATURE REVIEW

Literature review will be continuously carried to study past and current research work. Many applications and related studies are done by the vehicle manufacturing companies and the various transport departments and agencies. Some very important issues and data have to be studied, reviewed, determined and applied for the project. Ultrasonic Based Distance Measurement System in Automotive Application will be collaborated to optimize upon reduction in accident rates in Malaysia.

2.0   Introduction

This project is present to make the one of system which applying an electromagnetic by using ultrasonic sensor. This project is used Coulomb's law. This project are using Arduino UNO which the circuit itself applying Coulomb's law when the current flows through the circuit. When the law was correctly apply, it can supply energy so that the distance meter can be measure correctly with LCD can be display the distance meter value go along with light emitting diode (LED) and buzzer sound.

2.1   Road Accident Statistics in Malaysia

Malaysia among the countries that suffered the accident and death rates are highest, said Director General of the Road Transport Department (JPJ) Malaysia, Datuk Seri Ismail Ahmad. He said that every year as many as 70,000 accidents were recorded and this is a very serious matter. "In 2011, a total of 6,286 deaths were recorded, followed by 6,917 deaths in 2012." Out of this figure, clearly show that the annual number of road accidents is increasing. (Royal Malaysian Police, 2012).

Figure 2.0 Statistic accidents in Malaysia.

2.2 4 Rules Driving Distance Vehicles

The first rules is, 2 second rules. When driving behind a vehicle, the driver recommend is 2 seconds behind the car ahead. It is considered the best distance. The second rule is 4 second rules. During rainy days, wet and slippery road conditions, no longer in practice 2 second rules again. In such condition, motorists are advised to use the method of "4 seconds rules", double the last 2 seconds. What the define is, it doubled the distance between your car and the car ahead. This will avoid a collision or cause you nuzzle behind the car ahead. Remember that violates the front car, a traffic offense.

The third rule is 3 second rules. This regulation specifically for trail bikes. Unlike cars, motorcycles considered dangerous vehicles. Motorcyclists and pillion unprotected. It's a two-wheeled. In advise, stay away from it while driving. Practice at least 3 seconds as a safety measure. Lastly is 12 second rules. This regulation of the trailing vehicles long as buses, trucks and trailers. Here, drivers learn the skills scan 12 seconds or 100 meters ahead. These rules, allows one to observe "traffic" from any direction in time for adjusting the speed and position of the vehicle (Jabatan Keselamatan Jalan Raya, 2012).

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2.3   Previous Project

Previous project was a part of research based on the previous project or research that had been found in the journal, confession paper, and thesis of project. Previous project was an important part, because this project can be reference for this project. So from this previous project, many theoretical and construction hardware has been elaborated in this part. Furthermore, it also had a lot of experiment and result can make for reference.

2.3.1   The Intelligent Embedded Control Warning System for Car Reversing

H. C. Huang, F. C. Tsai and T. F. Mao say, most of the car drivers used the reverse radar or a reverse camera to detect the road situation behind the vehicle when it is engaged in reverse gear. As a matter of fact, the pedestrians can virtually know if the vehicle is backing up or not only by seeing the permanent bright reverse lamps. And as there is not much change with the reverse lamp to be seen, therefore their warning function for pedestrians seems to be still insufficient eventually. Therefore, this research tries to design a set of embedded intelligent car backup warning system so as to promote the safety of the walkers or the other drivers on the road. This embedded system uses Microsoft Win CE operating system and matches with the Mini2440 developing board. It also uses the Visual Studio 2005 for developing the intelligent touch panel operating mode. The UART interface on the Mini 2440 developing board controls the frequency converter, RC server and LED by using PIC16F877 to transform the signal of the sensors. And then, connecting to the sensors of angle, luminosity and distance so as to read the voltage value of the sensor and transferring them into actual values and followed by using 27 fuzzy logic rules to carry on the fuzzy logic deduction. And the angle of the LED reverse lamp bracket is adjusted and driven automatically according to the results of this logic deduction eventually. This research tries to do the simulated test by using a mobile frame in the same height as a real automobile. To let the test mobile frame being located 240 cm away from the obstacle and then start the driven motor and set the frequency of it to be with 60 Hz. (in other words, its speed is

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