

AN AUTONOMOUS VEHICLE USING WALL FOLLOWING DETECTION

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**This report is submitted in partial fulfillment of the requirements for the award
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For my beloved mum and dad

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ABSTRACT

The purpose of this project is to invent or develop an autonomous vehicle using wall following detection. The autonomous wall following detection robot is one of the mobile robot where is able to get out of the way from the wall or obstacles. This system would be able to maintain a safe distance from a wall, following it around both concave and convex corners [1]. The system would follow the wall to its right, turning right wherever it could, and turning left only when it had to. It would also being able to stop when it finds itself in a place where it cannot move, and reverse moving to enactive and allows the system operates continuously. However, the object of this invention is to provide a robot obstacle detection system which is simple in design, low cost, accurate, easy to implement, and easy to calibrate. Besides, this invention is to provide such a robot detection system which prevents an autonomous wall following detection robot from driving off a stair or obstacle which is too high. The objective of this project is to develop a simulation of a mobile robot that follows the wall to its right. In this project, an autonomous vehicle movement is developed that can be controlled by software using PIC 16F877A programming. In addition, there are four sensors were used for situational awareness. One is mounted on the right side of the vehicle, one on the front, and the other two pointing at 45° degrees to the front left and front right. Troubleshooting and debugging will be conducted until the source codes are successfully developed and execute properly.

ABSTRAK

Tujuan projek ini adalah untuk mencipta kenderaan berautonomi menggunakan pengesan mengikut dinding. Robot pengesan mengikut dinding ialah salah satu daripada robot bergerak dimana mampu untuk mengelak daripada terlanggar halangan atau dinding. Sistem ini akan mengekalkan jarak yang selamat daripada dinding, mengikut dinding yang mempunyai penjuru cekung ataupun cembung. Sistem akan mengikut dinding pada sebelah kanan, memusing ke kanan dan ke kiri kemana saja bila ia di arahkan. Ia juga mampu untuk berhenti bila ia berada pada tempat dimana ia tidak boleh bergerak, dan bergerak bertentangan untuk membolehkan sistem beroperasi secara berterusan. Bagaimanapun, ia adalah satu penciptaan objek untuk menghasilkan sistem robot pengesan halangan yang mana ringkas dalam reka bentuk, kos rendah, sasaran tepat, mudah untuk laksanakan, mudah untuk menentu ukur. Selain itu, penciptaan ini adalah untuk menyediakan satu sistem robot pengesan yang mana menghalang atau mengelakkan robot pengesan dinding daripada melanggar halangan. Objektif projek ialah menghasilkan robot bergerak yang mengikut dinding berdasarkan sebelah kanannya. Dalam projek ini, satu kenderaan berautonomi dihasilkan yang boleh dikawal oleh perisian menggunakan pengaturcaraan PIC 16F877A. Sebagai tambahan, terdapat empat pengesan yang digunakan untuk situasi berjaga-jaga. Satu daripadanya dipasang pada sebelah kanan kenderaan, di hadapan dan yang lain pada 45° daripada depan kiri dan depan kanan. Penyelesaian masalah akan dilakukan sehingga kod-kod berjaya dibangunkan dan dilaksanakan dengan betul.

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LIST OF ABBREVIATION

DC	-	Direct Current
EMI	-	Electromagnetic Interface
CD	-	Compact Disc
DVD	-	Digital Video Disc
4WD	-	4 Wheel Drive
RPM	-	Revolutions per Minute
RAM	-	Random-Access Memory
I/O	-	Input / Output
ROM	-	Read-Only Memory
ADC	-	Analog to Digital Converter
EEPROM-		Electrically Erasable Programmable Read-Only Memory
A/D	-	Analog to Digital
D/A	-	Digital to Analog
ICD	-	In-Circuit Debugger
CCP	-	Capture – Compare
UART	-	Universal Asynchronous Receiver/ Transmitter
PSP	-	Parallel Slave Port
LV	-	Low Voltage
LCD	-	Liquid Crystal Display
PCB	-	Printed Circuit Board
PVC	-	Polyvinyl Chloride
PIC	-	Programmable Interface Chip
PWM	-	Pulse Width Modulation

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CHAPTER I

INTRODUCTION

1.1 Introduction

This chapter will give a basic view of information about the overall system of this project; An Autonomous vehicle using wall following detection which is consist of two stages which are software and hardware development where these two main part will be combine together so that it will work and function properly and related with each other. This chapter also will cover about the overview of this project, objectives, problem statement, scope, project methodology and lastly summary structure of this thesis will be described in this chapter. Nowadays, technologies has been assimilates into our whole life without we realized it. Besides that, these technologies have good and bad impacts depend on how we use and manage it.

1.2 Project Overview

An autonomous wall following detection is a vehicle that has capability of traveling and stopping parallel to a wall includes right and left driving wheels. In the other word, this autonomous vehicle system will follow a pre-determined path marked by stationary beacons and the control system is built to control the actuation and motor system for the autonomous vehicle system.

The medium used for this autonomous vehicle are a dependent wheel for supporting the autonomous vehicle together with the driving wheels for a straightforward movement and a U-turn, a motor for driving the right and left driving wheels, a distance measurement sensor for measuring the distance to a right or left object of interest, and a controller for controlling the autonomous vehicle through the motor and the driving wheels [1].

The vehicle developed can be controlled by software using PIC 16F877 programming and perform the movement of robot. There are four sensors used for situational awareness. One is mounted on the right side of the vehicle, one on the front, and the other two pointing at 45° degrees to the front left and front right. The PIC 16F877 will be used as software to interfacing the robot.

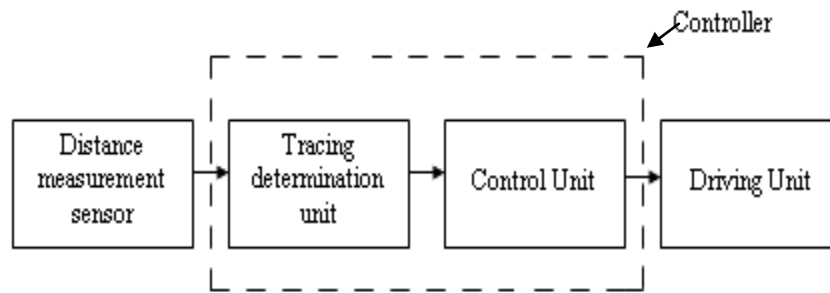


Figure 1.1 The Block Diagram of Autonomous Vehicle

As the block diagram above, it is divided into 3 sections which are the input, controller and output. The distance measurement sensor is used as an input, the tracing determination unit and control unit which have in the PIC chip is a controller. Other than that, the output component of this project is a driving unit.

Refer to figure 1.1, the input of the system are the sensors. The sensor that used is an ultrasonic sensor which is as a distance measurement sensor. When the sensor was detected an obstacle or wall, it will be transmitted a signal to the controller to determine the direction of robot. As mention above, the PIC 16F877 that has been programmed act as controller that is controlling the movement of the robot. Meanwhile, the output of a system is a motor. The motor will be moving either to left, right, forward or reverse by following to the command that has been programmed in the controller.

1.3 Project Objectives

The objectives of this project are as follows:

- i. To study how to built the robot that using the wall as a path away.
- ii. To implement the PIC 16F877 programming for this autonomous vehicle.
- iii. To study the basic of PIC programming in order to understand how to develop it in the proper sequence.

At the end of this project, all of the objectives must be achieved. However, to make sure that the objective will be achieved, the project must operates smoothly and follow the main concept of the project by using the suitable components, software and equipments.

1.4 Problem Statement

The invention results from the realization that a low cost, accurate, and easy to implement system for either preventing an autonomous porter robot from driving off a stair or over an obstacle which is too high or too low and/or for more smoothly causing the robot to follow a wall for more thorough carrying can be effected by intersecting the field of view of a detector with the field of emission of a directed beam at a predetermined region and then detecting whether the obstacles or wall occupies that region.

Besides, it is a further object of this invention to provide a sensor subsystem for a robot which consumes a minimal amount of power and unaffected by surfaces of different reflectivity.

The advantage of the invented of this robot is to do work such a human in term of sent the heavy object or thing from one place to another place especially in the room or house area. However, the purpose of this robot is as an alternative to facilitate the human work for save time and energy. It is because the autonomous robot can do the work such as sent the heavy thing from one place to another place.

1.5 Project Scope

The scopes of this project are to study about PIC 16F877, a suitable sensor or wall sensor and wall following robot system. After research, the type of a wall sensor, type of motor and the circuit design for the system will be conclude.

A sensor that is choosing for this robot is an IR sensor. It is because the low cost and good specification of this sensor can make a detection process is much better. The PIC 16F877 is a chip that stored the developed programming into it. The developed programming is created in the PIC C Compiler software by using the C language in order to give the instruction to the output of this vehicle which is the driving motor to follow the wall as the path away.

This robot is using 2 High Speed Gear Motor to drive the wheels. The input of the system is IR sensor and the output is DC motor as driving unit. The plastic transparency is used as a robot body which is integrating the entire component into its. Finally, design and create a program by using PIC 16F877 programming software to control the system.

1.6 Project Methodology

Figure 1.2 shows the process flow throughout the project.

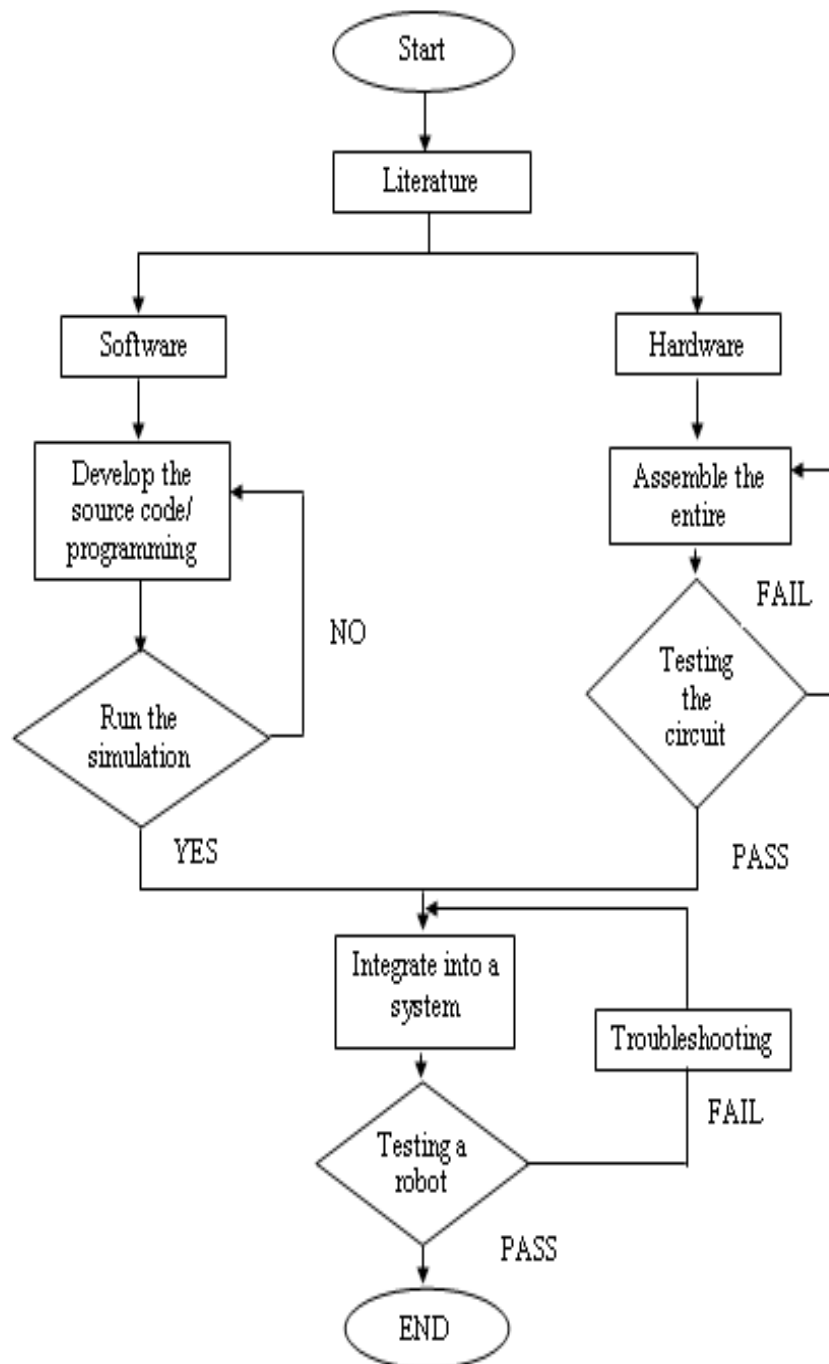


Figure 1.2 Overall Project Flows