raf
TJ211.35 .N56 2009.
0000065914
Vacuum robot / Nik Mohd Hafiz Mohd Nawi.

VACUUM ROBOT

NIK MOHD HAFIZ BIN MOHD NAWI

APRIL 2009

© Universiti Teknikal Malaysia Melaka

"I hereby acknowledge that I have read this report and I find that this content meet the requirements in term of scope and quality for the award of the Bachelor's Degree of Electrical Engineering with Honours."

Signature : .....

Supervisor : **MR. MUHAMMAD NIZAM BIN KAMARUDDIN**

Date : 13/05/09

© Universiti Teknikal Malaysia Melaka

VACUUM ROBOT

NIK MOHD HAFIZ BIN MOHD NAWI
B010610237

A project report submitted as a partial fulfillment of the requirements for the award of Degree of Bachelor's Degree of Electrical Engineering with Honours

Faculty of Electrical Engineering
University Teknikal Malaysia Melaka

ARPIL, 2009

© Universiti Teknikal Malaysia Melaka

"All trademarks and copyrights use here in are property of their respective owner. References of information from other sources quoted accordingly; otherwise the information presented in this report is solely the work of author."

Signature :

Name : NIK MOHD HAFIZ BIN MOHD NAWI

Ic/No : 850812-03-5841

Date : 13/5/09

© Universiti Teknikal Malaysia Melaka

To my beloved dad and mum

Mohd Nawi Bin Mat and Tuan Azizah Binti Tuan Muda

My supervisor, lecturers,family members and friend
Thanks for all the supports.

© Universiti Teknikal Malaysia Melaka

ACKNOWLEDGMENT

Alhamdullilah, I'm very grateful to the god that I can manage to complete this report. Firstly, I would like to express my highest gratitude to **MR.MUHAMMAD NIZAM BIN KAMARUDDIN** as my project supervisor for guidance, advices, supports and necessary information to complete this report.

Thanks also to the lecturers of Faculty Electrical Enggineering of UTeM that give me the cooperation during finishing this report.

Besides that, I would like to thank my parents, sister and brother for giving their psychology and physical support in this project. They are never give-up to support mine finance during finishing this report.

Lastly for all my friend, I sincerely to appreciate their supportive, bright ideas valuable suggestions to helping me in completing this report.
Thanks you.

© Universiti Teknikal Malaysia Melaka

ABSTRAK

Projek ini membincangkan rekabentuk satu robot pembersih hampagas yang menggunakan pengawal mikro. Robot ini berfungsi untuk membersihkan kotoran dan habuk dalam kawasan yang terhad selain berupaya mengelak halangan. Robot pembersih hampagas direka bagi menggantikan sistem vakum manual yang menggunakan elektrik. Oleh itu, robot vakum ini menggunakan sistem kuasa bateri yang menggurangkan bekalan elektrik tetapi pameran prestasinya serasi dengan sistem-sistem vakum manual. Bahagian-bahagian utama dalam pembinaan robot ini terdiri daripada kerangka robot, penderia inframerah, pembersih hampagas, motor arus terus dan pengawal mikro. Satu jenis pengawal mikro PIC16F84 akan digunakan. Tujuan pengawal adalah untuk menguasai pergerakan robot. Motor arus terus akan digunakan untuk menggerakkan robot dan vakum. Bagaimanapun,motor arus terus akan berpusing terlalu cepat dan mempunyai juga sedikit daya kilas untuk mengawal beban. Oleh itu,penurunan gear diperlukan untuk memperlahankan kelajuan berputar dan peningkatan pada daya kilas motor. Robot pengesan halangan di sambung melalui penderia inframerah. Pengesan ini dipasang di depan robot.

© Universiti Teknikal Malaysia Melaka

ABSTRACT

This project is concerned with the design of a vacuum robot by using microcontroller. Vacuum robot is designed to clear a limit area of the dirt-track. Vacuum robot is also designed to replace manual vacuum systems which consume electricity. Therefore, this vacuum robot is a battery powered system which consumes less electricity yet exhibit compatible performance with manual vacuum systems. The main part of the robot consists of chassis, infrared sensor, vacuum, DC motor and microcontroller. The type of a PIC16F84 microcontroller will be used. The purpose of the controller is to control the movement of the robot. DC motor will be used to propel the robot and the vacuum. However, DC motor spins too fast and has too little torque to drive the loads. Thus, gear reduction is required to slow down the rotational speed and increase the torque of the motors. The robot senses the obstacles through the infrared sensor. These sensors are installed at the front of the robot.

© Universiti Teknikal Malaysia Melaka

TABLE OF CONTENTS

CHAPTER	ITEM		PAGE
	TITLE		**ii**
	DECLARATION		**iii**
	DEDICATION		**iv**
	ACKNOWLEDGEMENTS		**v**
	ABSTRAK		**vi**
	ABSTRACT		**vii**
	TABLE OF CONTENT		**viii**
	LIST OF FIGURE		**xii**
	LIST OF TABLE		**xv**
I	**INTRODUCTION**		
	1.1	Introduction	1
	1.2	Aim of Project	1
	1.3	Objectives of Project	2
	1.4	Scope of Project	2
	1.5	Problem Statement	2
	1.6	Project Overview	3
	1.7	Application	4
	1.8	Thesis Outline	4

© Universiti Teknikal Malaysia Melaka

II LITERATURE REVIEW

2.1	Introduction	6
2.2	Overview of related	6
2.3	The journal that related with vacuum cleaner robot	7
	2.3.1 Vacuum Robot (GatorVac)	7
	2.3.2 Vacuum Robot (Mop'n Bot)	8

III METHODOLOGY

3.1	Introduction	10
3.2	Flow Chart for PSM 1	12
	3.2.1 Identification of Title, Objective, Scope of Project and Application	14
	3.2.2 Collecting data and information for Literature Review	14
	3.2.3 Project Planning	14
3.3	Sensing System	15
	3.3.1 Infrared Sensor	15
	3.3.1.1 Infrared Transmitter	16
	3.3.1.2 Infrared Receiver	16
	3.3.2 Limit Switch	17
3.4	PIC 16F84A Microcontroller	18
	3.4.1 Pin Description	18
	3.4.2 PIC 16F84A Features	19
	3.4.3 Flash Program Memory	20
	3.4.3.1 Reset Vector (0000h)	20
	3.4.3.2 Peripheral Interrupt Vector (0004h)	21
	3.4.3.3 Configuration Word (2007h)	21
	3.4.4 RAM (Random Access Memory) File Register	21
	3.4.5 EEPROM (Electricity Erasable	22

© Universiti Teknikal Malaysia Melaka

Programmable Read Only Memory)

3.4.6 Program Counter 22

3.4.7 Timer 22

3.4.8 Input and Output Ports 22

3.5 The Actuators 23

3.5.1 Direct Current (DC) Motor 23

3.5.2 Gear System 24

3.5.3 Motor Driver (L293D) 25

3.5.4 Wheels 26

3.5.5 Drive Method 26

3.6 Circuit of PIC 16F84A and L293D 27

3.7 MPLAB Integrated Development Environment (IDE) 27

3.7.1 Program of using the MPLAB IDE 28

3.7.2 Step of using the MPLAB IDE 29

3.8 Proteus Professional 7 Software 33

3.7.1 Step of using the Proteus Professional 7 34

3.9 Work Schedule 34

IV RESULT AND ANALYSIS

4.1 Introduction 36

4.2 Result 36

4.3 Analysis 39

4.3.1 PIC16F84A Microcontroller 39

4.3.1.1 Output from RB5 and RB6 39

4.3.1.2 Output from RB4 and RB7 43

4.3.2 Motor Driver 46

4.3.2.1 Output 2 and Output 3 according the data sheet of motor driver 46

4.3.2.2 Output 1 and Output 4 according the data sheet of motor driver 50

© Universiti Teknikal Malaysia Melaka

V	**CONCLUSION AND RECOMMENDATIONS**	
	5.1 Conclusion	54
	5.2 Recommendations	55
REFERENCES		56
APPENDIX A – B		57-70

© Universiti Teknikal Malaysia Melaka

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
1.1	An Overview of the system	3
2.1	Vacuum Robot (GatorVac)	7
2.2	Vacuum Robot (Mop'n Bot)	8
3.1	Methodology	10
3.2	Flow Chart for PSM 1	12
3.3	Flow Chart for PSM 2	13
3.4	Infrared sensor	15
3.5	Circuit of Infrared sensor	16
3.6	Reflected IR Sensor	17
3.7	Limit switch 24	17
3.8	PIC16F84A pin diagram	18
3.9	Flash Memory	20
3.10	Gear system	24
3.11	IC L293D	25
3.12	Drive method	26
3.13	Circuit of PIC 16F84A and L293D	27
3.14	MPLAB Integrated Development Environment (IDE)	28
3.15	Project Window	30
3.16	Proteus Professional 7 software	34
4.1	Flow chart for operation of robot	38
4.2	The output signal of PIC16F84A when the motor is constant	40
4.3	The output signal of PIC16F84A when the motor is move	40

© Universiti Teknikal Malaysia Melaka

	Forward	
4.4(a)	The comparison voltages of PIC16F84A between motor is move forward and motor stop	41
4.4(b)	The output signal of PIC16F84A when the motor is stop	41
4.5	The output signal of PIC16F84A when the motor is move reverse	42
4.6	The output signal of PIC16F84A when the motor is turn right	42
4.7	The output signal of PIC16F84A when the motor is turn left	43
4.8	The output signal of PIC16F84A when the motor is move forward	43
4.9	The output signal of PIC16F84A when the motor is stop	44
4.10	The output signal of PIC16F84A when the motor is move reverse	44
4.11	The output signal of PIC16F84A when the motor is turn right	45
4.12	The output signal of PIC16F84A when the motor is turn left	45
4.13	The output signal from motor driver when the motor is constant	46
4.14	The output signal from motor driver when the motor is move forward	47
4.15(a)	The comparison voltages of motor driver between motor are move forward and motor stop	48
4.15(b)	The output signal of motor driver when the motor is stop	48
4.16	The output signal of motor driver when the motor is move reverse	49
4.17	The output signal of motor driver when the motor is turn right	49
4.18	The output signal of motor driver when the motor is turn	50

© Universiti Teknikal Malaysia Melaka

	left	
4.19	The output signal from motor driver when the motor is move forward	51
4.20(a)	The comparison voltages of motor driver between motor are move forward and motor stop	51
4.20(b)	The output signal of motor driver when the motor is stop	52
4.21	The output signal of motor driver when the motor is move reverse	52
4.22	The output signal of motor driver when the motor is turns right	53
4.23	The output signal of motor driver when the motor is turns left	53

© Universiti Teknikal Malaysia Melaka

LIST OF TABLE

TABLE NO.	TITLE	PAGE
2.1	Comparison between Related Robots	9
3.1	PIC16F84A Pin Description	19
3.2	Gantt chart Project Planning	35

© Universiti Teknikal Malaysia Melaka

	left	
4.19	The output signal from motor driver when the motor is move forward	51
4.20(a)	The comparison voltages of motor driver between motor are move forward and motor stop	51
4.20(b)	The output signal of motor driver when the motor is stop	52
4.21	The output signal of motor driver when the motor is move reverse	52
4.22	The output signal of motor driver when the motor is turns right	53
4.23	The output signal of motor driver when the motor is turns left	53

© Universiti Teknikal Malaysia Melaka

LIST OF TABLE

TABLE NO.	TITLE	PAGE
2.1	Comparison between Related Robots	9
3.1	PIC16F84A Pin Description	19
3.2	Gantt chart Project Planning	35

© Universiti Teknikal Malaysia Melaka

CHAPTER 1

INTRODUCTION

This chapter will discuss about introduction, aim, objectives, scope, problem statement, overview, application, and thesis outline for this project.

1.1 Introduction

This "Robot Vacuum" guided by PIC Microcontroller Technologies. Major others part robot containing chassis, sensor and engine DC. Basic information about microcontroller, sensor and engine will be decommissioned perform in this project. PIC's microcontroller would control all mobilization robots. PIC's microcontroller would make as a brain for this system.

This robot is programmed to clean up the dust on the floor by turn left and right. It used infrared sensor to avoid the obstacles at the in front of the robot.

1.2 Aim of Project

The aim of this project is to create and build one of the prototypes of robots to clean up the dust automatically.

© Universiti Teknikal Malaysia Melaka

1.3 Objectives of Project

The main objective of project is to design and develop the smart of robot that is used to clean up the dust automatically. Besides that, the goals that want to achieve are:

i. To design electronic system for the movement robot and application
ii. To program an algorithm in C programming language, which embedded in microcontroller based system.
iii. To implement the integration of software and hardware part.
iv. To perform testing and analysis of the robot in obtaining robot's stability

1.4 Scopes of Project

To accomplish this project in order to work successfully, there are a few things defined in the scopes of the project. There are:

- The project using microcontroller to achieve the automation. The microcontroller will control a motor and receive the signal from a sensor
- Vacuum robot suitable using at roomy area.
- The test area must be flat and no curve. Otherwise, the movement is like the "pulse signal".

1.5 Problem Statement

Nowadays a lot of users are using manual vacuum systems that consume Electricity. As we know, the system needs a lot of time and human energy to moving.

So, that is not practical nowadays especially for working person. In this situation, an automatic vacuum is more practical in order to replace manual vacuum system.

© Universiti Teknikal Malaysia Melaka

In order to solve this problem, smart vacuum robot is develop. Vacuum robot is powered by batteries and can work autonomously to clean up the dust. It is equipped with sensor to make vacuum robot intelligent or smart and can detects the obstacles.

1.6 Project Overview

Vacuum Robot construction can be divided into three main parts. There are brain, actuators and the sensors. Figure 1 shows an overview of the system in the Vacuum Robot.

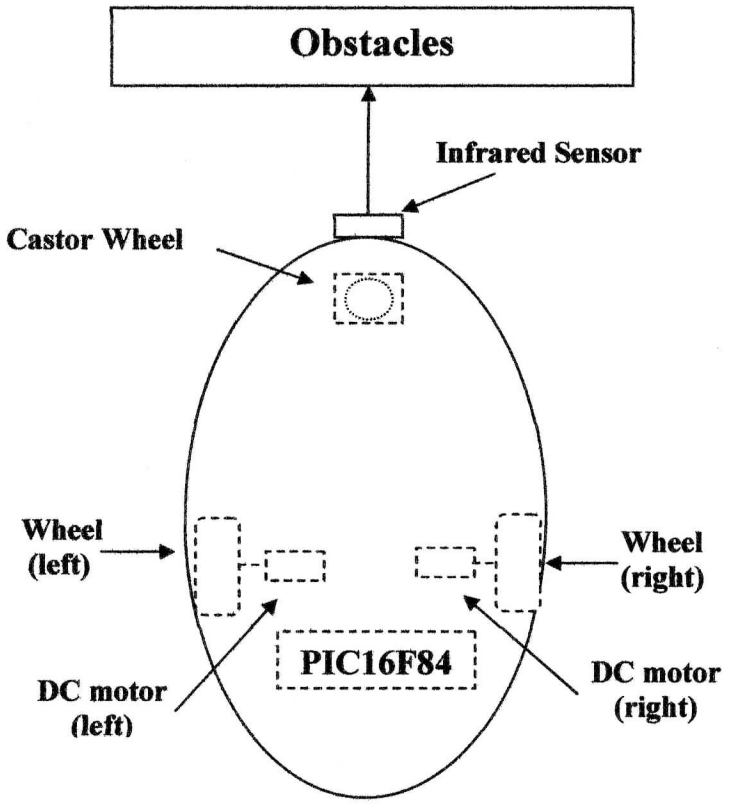

Figure 1.1: An Overview of the System

The three main parts of system are:

- The brain : Microcontroller PIC16F84A
- The actuator : DC motor, gearbox, wheels and castor wheels
- The sensors : Infrared sensors, limit switch

© Universiti Teknikal Malaysia Melaka

1.7 Application

Vacuum Robot is a robot that has all the advantage of cleaning robot with speed and capability to clean up the dust automatically. The characteristic of this robot is it could mobile and should move without human intervention when it is started. This robot uses the infrared sensor to avoid obstacles.

The project is focus on flatten and no curve floor. If the robot detects the obstacles such as furniture, human, wall and so on, the robot will turn different way to avoid it. There are two active wheels. Both of two wheels behind the robot can move to left or right following the programming instruction on microcontroller. A Castor wheel is put at the in front of the robot to stable the body of robot. The whole system of the robot is controlled by PIC16F84A microcontroller that performs as a brain of the system.

1.8 Thesis Outline

The project thesis is done basically to document the concept, activities and outcome of the project that is relevant to the project progress. The thesis consists of six main chapters. There are:

- Chapter one describes briefly about the project's introduction. It is also discuss about the objectives, scopes of project and project application.
- Chapter two describes about the literature review that consists of the background of the project. It also describes about the same projects that have been done of previous person and it's more to make research on different, advantages and disadvantages of previous project.
- Chapter three describes about the project planning where the project implementation will be divided into three phase. There are hardware design, software and electrical circuit system. This chapter also discusses more detail about the principle of the component that will be used in the project such as infrared sensor and actuator.

© Universiti Teknikal Malaysia Melaka

- Chapter four describes about the analysis data. This chapter will discuss about the PIC16F84A microcontroller analysis and output of motor driver analysis.
- Chapter five describes about conclusion and recommendation. This section will conclude about knowledge that comes out from the project and some recommendation to the further study.

© Universiti Teknikal Malaysia Melaka

CHAPTER II

LITERATURE REVIEW

This chapter will explain about the review for this project.

2.1 Introduction

This chapter informs us all about the research before the robot has been set up. To build this project, it requires the knowledge that are not readily offhand. There are three main parts need to be investigated in this project, namely mobile robot design, sensing technology and microcontroller specification. Motor is a one of the method an electronic device achieving movement. Motors are the most important parts of mobile robotics platform. Moreover, a sensor is a device which detects a signal to involve the obstacles. The main objective of incorporating sensors technology in robotic system is to enable the robots to work in non-structured and random environment. The robot needs the microcontroller specification in order build the robot that will follow the project planning. The microcontroller performs as a brain of the system. After that, the mechanical part, electrical part and programming will be combined together to produce an autonomous system.

2.2 Overview of Related Project

Building an autonomous vacuum robot requires knowledge that not readily offhand. In this chapter, u will discover about previous review that comes from journals, observations and internet.

© Universiti Teknikal Malaysia Melaka