

**DESIGN AND IMPLEMENTATION OF VACUUM ROBOT**

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**MAY 2008**

“I hereby declared that I have read trough this report and found that it has comply  
the partial fulfillment for awarding he degree of Bachelor of Electrical Engineering  
(Control, Instrumentation and Automation)”

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This report is submitted in partial fulfillment of requirements for the bachelor  
Degree of Electrical Engineering (Control, Instrumentation and Automation)

Faculty of Electrical Engineering  
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May 2008

“I hereby declared that this report is a result of my own work except for the works that  
have been cited clearly in the references”

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**DEDICATION**

*For my beloved mother, Mariah binti Musa and father,  
Daud bin Salleh*

## ACKNOWLEDGEMENT

In the name of Allah, the Most Gracious and the Most Merciful, the utmost thanks to Allah with His Greatest power, I have successfully completed this PSM report *Alhamdulillah*. A special acknowledgement and appreciation goes to my supervisor, Mr. Maslan Bin Zainon for his supervision, commitment, professionalism, advice and guidance in assuring my project succeed. Secondly, I would like to express warm gratitude to the Faculty of Electrical Engineering Staffs for full co-operation and commitment given to assist me a lot while performing this project. And finally, special thanks to my family and to those who had helped directly or indirectly in undertaking my project a success. The contributions and insights are highly appreciated and may Allah repay your kindness.

## **ABSTRACT**

The purpose of this project is to design and implement a Vacuum Robot. Vacuum Robot is designed to make cleaning process become easier rather than by using manual vacuum. The idea is basically by having the sensor to detect any object and send the output to a PIC that will control the Vacuum Robot movement. By using Vacuum Robot, user can just turn on the Vacuum Robot to clean without having to operate the Vacuum. The methodology and scope of study are performed by doing literature reviews and research on various sensors, motor, PIC, and the programming of the PIC. Vacuum Robot will have several criteria that are efficient, organized and user-friendly, which meets human needs.

## ABSTRAK

Tujuan projek ini ialah untuk merekabentuk dan melaksanakan Robot Vakum. Robot Vakum ini direkabentuk untuk memudahkan proses pembersihan berbanding penggunaan vakum manual. Idea membina robot vakum ini pada asasnya ialah dengan mempunyai pengesan untuk mengesan sebarang objek dan menghantar keluarannya kepada PIC yang akan mengawal pergerakan Robot Vakum. Dengan menggunakan Robot Vakum, pengguna hanya perlu mengaktifkan Robot Vakum tanpa perlu menjalankan Vakum tersebut. Metodologi dan skop pengkajian dilakukan dengan melaksanakan kajian literatur dan penyelidikan terhadap pelbagai pengesan, motor, PIC, dan program bagi PIC. Robot Vakum mempunyai beberapa kriteria iaitu efisien, teratur dan mesra pengguna dimana ia memenuhi keperluan manusia.



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## LIST OF ABBREVIATIONS

PIC - Peripheral Interface Controller Peripheral Interface Controller

ppr = Pulses per revolution

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# CHAPTER 1

## INTRODUCTION

This chapter will explain about the objective, problem statement and scope of the project.

### 1.1 Project Overview

Vacuum Robot is design to make cleaning process become easier for human task. This project is a combination between software and hardware. The hardware of Vacuum Robot consists of the microcontroller, the motor, the vacuum, the sensors, the power distribution and also the chassis for the robot. Software MikroC and Proteus is used to write the programming and simulate the circuit design.

## 1.2 Project Objective

The main objective of this project is to design and implement a vacuum robot prototype by using Microcontroller PIC 16F877A. To achieve the goal of this project, knowledge about sensor, control motor circuit, PIC circuit and compatible software need to be determined. The project is aimed to meet the following objectives:

- To design and implement a working Vacuum Robot prototype;
- To make consistent floor cleaning process by using Vacuum Robot and;
- To produce user friendly Vacuum Robot.

## 1.3 Problem Statement

In fact, most of us usually using sweep for cleaning. From time to time technology come up and need to upgrade for easier human task. In addition, most of the people are working and they did not have enough time to clean.

Furthermore, most of the designations of vacuum robot in the market are expensive and large in size. So it is difficult to clean anywhere, under beds, as well as kitchen baseboards. Therefore, this project is built to be one of the advantages for human to clean the floor within small period and more effective.

## 1.4 Scope of project

In order to complete this project, knowledge about hardware for example microcontroller, sensor, motor, battery, relays, and compatible software such as MP LAB and Proteus must be gained. Vacuum Robot is developed to make cleaning process easier especially for working people. This vacuum robot is designed for specific area such as under beds, as well as kitchen baseboards.

The scope of this project is divided in several phase which are mainly the planning, research, material selection, constructing prototype and lastly testing the all the integrated hardware that have been developed. The hardware involves designing the mechanical parts and electrical parts of Vacuum Robot prototypes. The mechanical part involves the chassis, the drive system, the sensor layout and the electrical part involves in microcontroller, drive circuit and sensor interface.

## CHAPTER 2

### LITERATURE REVIEW

Chapter 2 presents the supporting information related to the project. Analysis and research has been done to make sure there is no mistake during in selecting materials, understanding the PIC configurations and to make sure the best possible decision are made to implement this project.

#### **2.1 First review from internet: Autonomous Vacuum Robot**

This Autonomous Vacuum Robot developed during the 2000 Capstone Senior Mechanical Design course at The Cooper Union for the Advancement of Science and Art. This robot with its accompanying software can vacuum a room by importing an AutoCAD map of the room and its furniture. It has a ring of bump sensors for collision detection and several infrared rangers for position determination.

Shaft encoders help the robot detect the distances it has traveled throughout the room. A vacuum cleaner fitted with a custom nozzle allows it to pick up debris in its path.

This robot was at first controlled by the Parralax BASIC Stamp, but evolved to use the Handy Board robot controller. [8]



(a)



(b)

Figure 2.1 (a) & (b): The vacuum robot circling the garbage can to clean around it.

## 2.2 Second review from newspaper: Vroom... it's the Cruise-missile vacuum cleaner

PARIS Jan 22 - South Korean scientists have adapted a navigation system from Cruise missiles to build a robot vacuum cleaner that can find its way around a room day or night, New Scientist reports in next Saturday's issue. Robot cleaners usually keep track of their position by measuring how far their wheels have turned. But if the wheels slip on a parquet floor or on carpet pile, the cleaner gets confused.

The patented device built by researchers at Samsung gets around this by placing a video camera and infrared detector on top of the cleaner, giving it normal and infrared vision of the room. The robot's computer continually compares this picture with a wide-angle photograph of the room in its memory. The system is ``just like (that of) a Cruise missile, which compares pictures of the terrain it is supposed to fly over with images from onboard cameras," the British weekly says. – AFP [7]

### **2.3 Third review from journal: Architecture for a Synthetic Vacuum Cleaner (The Synthetic Vacuum)**

A more sophisticated autonomous vacuum would be able to apply different vacuuming strategies at different times in different situations. Differentiating situations that require alternative strategies will often depend on sensor information, experience, instructions, and vacuuming knowledge. For example, consider the need to vacuum around and under complex furniture.

One approach is to examine the piece of furniture (or perhaps just the spaces needing cleaning) and retrieve or create a plan to vacuum that area effectively. A similar situation arises when the floor can be littered with objects that need to be picked up and put away, or at moved and vacuumed underneath. A natural solution is to classify each object and choose a plan to move it appropriately. One might also want the vacuum to adopt different vacuuming strategies when different types of object are moving around the room. Perhaps adults can be safely ignored but when a child enters the room the vacuum should stop and wait for the child to leave.

The vacuum cleaner may also need to carry out special instructions from its user. For example, the user may want the vacuum to follow different plans in different situations vacuuming the living room only when no one is home, or vacuuming the west side of the room first and then the east.