DEVELOPMENT OF A MINI AUTOMATIC VACUUM CLEANER

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DEVELOPMENT OF A MINI AUTOMATIC VACUUM CLEANER

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor Degree of Manufacturing Engineering (Robotics and Automation) (Hons.)

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APPROVAL

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

……

(DR. FAIRUL AZNI BIN JAFAR)

ABSTRAK

Tujuan projek ini adalah untuk membina satu mini pembersih vakum automatik. Mini pembersih vakum automatik direka untuk menjadikan proses pembersihan menjadi lebih mudah dan tanpa menggunakan vakum manual. Idea untuk membuat mini pembersih vakum automatik adalah kerana produk pembersih vakum automatik yang sedia ada seperti Roomba adalah besar. Jadi, untuk menyelesaikan masalah ini, reka bentuk pembersih vakum perlu dibentuk untuk menjadi lebih padat dan bersaiz kecil. Lantas itu, design yang akan dihasilkan akan dapat membantu untuk meningkatkan prestasi pembersih vakum untuk menyedut habuk pada tempat yang pembersih vakum automatik sedia ada tidak dapat dicapai.Pada asasnya mini pembersih vakum automatik mempunyai sensor untuk mengesan apa-apa objek dan menghantar output kepada PIC yang akan mengawal pergerakan mini pembersih vakum automatik. Dengan menggunakan mini pembersih vakum automatik, pengguna hanya boleh menghidupkan pembersih vakum automatik mini untuk beroperasi sendiri tanpa perlu menawalnya. Metodologi dan skop kajian dilakukan dengan melakukan ulasan kesusasteraan dan penyelidikan mengenai pembersih vakum automatik. Pada masa akan datang, projek ini dapat dihasilkan dengan lebih banyak ciri yang akan meningkatkan prestasi dalam tempoh yang cekap, teratur dan mesra pengguna, yang memenuhi keperluan manusia.

ABSTRACT

The purpose of this project is to develop a mini automatic vacuum cleaner. Robot Vacuum is designed to make cleaning process become easier rather than by using manual vacuum. The idea to come out the mini automatic vacuum cleaner is because current existing design of automatic vacuum cleaner such as Roomba is quite big. So, in order to solve this problem, the design of the vacuum cleaner need to shaped to be more compact and small in size. Thus, these design would help to increase the performance of vacuum cleaner by sucking dust at the area which could not sucked by current existing automatic vacuum cleaner. Basically mini automatic vacuum cleaner having the sensor to detect any object and send the output to a PIC that will control the mini automatic vacuum cleaner movement. By using mini automatic vacuum cleaner, user can just turn on the mini automatic vacuum cleaner to clean without having to operate the vacuum. The methodology and scope of study are performed by doing literature reviews and research about the automatic vacuum cleaner. In the future, this project should come out with more features that will increase the performance in term of efficient, organized and user-friendly, which meets human needs.

DEDICATION

To my beloved parents, Mohd Anuar and Nor Pisah

With loving, sacrifices and their unconditionally support in my life.

To my siblings and my friends,

Who always helped me to prepare and completed this report.

and

For those I love very much

also

For lecturers who have given much guidance to me without expecting any reward.

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LIST OF ABBREVIATIONS, SYMBOLS AND NOMENCLATURE

PMMA	-	Polymethyl Methacrylate
Lb	-	Pound
Ft-Feet		
^	-	Power of
MYR	-	Malaysian Ringgit rates
Kg	-	Kilogram
Gpa	-	Gigapascal
Mpa	-	Megapascal
Al	-	Aluminium
DC	-	Direct current
PIC	-	Peripheral Interface Controller
IR	-	Infra-red
USB	-	Universal Serial Bus
PWM	-	Pulse-width modulation
I/O	-	Input/output
LDR	-	light-dependent resistor
BOM	-	Bill of material

CHAPTER 1
INTRODUCTION

1.1 Introduction

Nowadays most of the vacuum cleaner machines use human energy to operate as many of the consumers use manual vacuum cleaner at their house. Usually it takes much time to move on the entire area to ensure the room or area can be cleaned sufficiently. This situation may give the user become tired especially if the cleaning process has to be made frequently.

Manual vacuum cleaner usually gives difficulties to the consumer in term of weight, maintenance and limitation in the movement of the vacuum cleaner itself. For persons who are busy, manual vacuum cleaner is not the good choice because it may consume more time and spend more energy to use the manual vacuum.

Every consumer that use manual vacuum cleaner usually does not have enough time to clean their house and it will use more energy when using the manual vacuum cleaner. Furthermore, manual vacuum cleaner also not suitable to be used for older people because the manual vacuum cleaner is heavy hence create trouble to move the vacuum.

Many consumers are using conventional or manual vacuum cleaner that consume electricity. Usually the existing manual vacuum cleaner requires for time and uses more energy to be moved on the manual cleaner. So, this situation is not practical nowadays especially to those who are working or busy person. In this

situation, automatic vacuum cleaner is more practical in order to replace manual vacuum system.

All this kind of uneasiness situations can be solved if there is a type of vacuum cleaner system that can be operated automatically. In the market actually automatic vacuum cleaner has already been introduced like iRobot's Roomba as Figure 1.1. This automatic vacuum cleaner is the most popular in United State which comes in various ranging.

Figure 1.1: iRobot Roomba 565
(Source :< http://www.conrad.com/ce/en/product/192581/>).

Automatic vacuum cleaner or autonomous robotic vacuum cleaner has intelligent programming and a limited vacuum cleaning capability. Automatic vacuum cleaner is better than manual vacuum cleaner because it helps consumer to save time and energy. By using automatic vacuum cleaner, others job can be done at the same time, for example watching television, reading, cooking or etc. It can save some of the valuable time and energy of human by doing so.

1.2 Problem statement

Automatic vacuum cleaner has been introduced in the market, the product is more expensive and current existing design of automatic vacuum cleaner such as Roomba is quite big. Due to current design of the automatic vacuum cleaner, reaching a small or narrow space or wall corner may be a difficult task to be achieved.

Based on that problem, a recommended solution is to come out with a mini automatic vacuum cleaner. Perhaps, through the new innovation, it will be able to help consumer to save their time, money and energy to operate the vacuum cleaner, as the proposed mini automatic vacuum cleaner will operate wirelessly and equipped with rechargeable battery. Through this development, the mini automatic vacuum cleaner is just need to be put in room, switch it ON and the sensor will help to ensure the automatic vacuum cleaner runs with a capability to avoid obstacle in the operation.

The design of the vacuum cleaner needs to be compact and smaller. Mini automatic vacuum cleaner will be designing in smaller scale compared to existing automatic vacuum cleaner. This is because existing automatic vacuum cleaner such as Roomba is in large design and gives some limitations during operation.

This design of mini automatic vacuum cleaner will produce improvement in term of the working operation because it can reach till the small spaces. This design would also help to increase the performance of vacuum cleaner by sucking dust at the area which could not sucked by current existing automatic vacuum cleaner.

Furthermore, the proposed mini automatic vacuum cleaner will be powered by batteries and able to work autonomously to clean up dust. It is equipped with the sensor to make it intelligent or smart and able to detect obstacles.

1.3 Objective

The main objective is to develop a mini automatic vacuum cleaner that is uses to clean up dust automatically. Besides that, other goals that need to be achieved are:

i. To design and develop a small size of automatic vacuum cleaner
ii. To analyse the performance of the small size automatic vacuum cleaner.

1.4 Scope and limitation

To successfully complete this project, there are some limitations of the project:

i. This project will come out as prototype and not as actual product.
ii. The operation movement area must be flat and no curve.
iii. Test and experiment will be done where the robot is to run in a certain limited area that had been decided at first.
iv. Navigation and localization of the mini vacuum cleaner is not involved as only locomotion is considered.
v. The performance of the vacuum is not analyse in detail.

1.5 Report structure

Chapter one describes briefly about the project introduction and motivation that lead to the implementation of the project. It is also discuss about the problem statement, objectives, scopes and limitation of project.

Chapter two describe about the literature review that consists of the background of the project. It also describes about the similar works that have been done by other person and is a comparison to the similar works, thus discuss the advantages and disadvantages of previous project. Other than that, it also describes about types of the vacuum cleaner that had been existed in the market and the locomotion of the automatic vacuum cleaner.

Chapter three describes about the project planning. The project planning consists of hardware design, software and electrical circuit system. This chapter also discusses about the development method that will be used in the project such as material selection, fabrication process, control system development and programming. Then, the testing method and method to analysis will be discussed.

Chapter four describes about the result and analysis data. The analysis in this chapter is consists of the suction analysis and performance analysis.

Chapter five describes about conclusion and recommendation. This chapter will include about the overall knowledge that comes out from the project and some recommendation for the further study.

CHAPTER 2

LITERATURE REVIEW

This chapter is focusing on the related works of automatic vacuum cleaner. The section 2.1 of this report will explain about vacuum cleaner, section 2.2 will explain about the operation inside of the vacuum cleaner, section 2.3 will explain about the cleaning robot, section 2.4 will discuss about the automatic vacuum cleaner, section 2.5 will talk about the future of the automatic vacuum cleaner and followed by section 2.6 which is summary of this chapter.

2.1 Vacuum cleaner

There are several types of vacuum cleaner, as well as upright vacuum cleaner and canister vacuum cleaners. An upright vacuum cleaner consist of two main sections namely a ground engaging portion which includes a cleaning head and a motor is pivotally mounted above the ground engaging portion. Including the accumulation of dirt filtering means for separating the trapped dirt from the air intake and means to keep dirt separated (Soler et al., 1993).