UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF VACUUM CLEANER ROBOT USING PIC MICROCONTROLLER

This report submitted in accordance with requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electrical Engineering Technology (Industrial Automation and Robotics) with Honours

by

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FACULTY OF ENGINEERING TECHNOLOGY

2015

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

TAJUK: **Development of Vacuum Cleaner Robot using PIC Microcontroller**

SESI PENGAJIAN: **2015/16 Semester 1**

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APPROVAL

This report is submitted to the Faculty of Technology Engineering of UTeM as a partial fulfillment of the requirements for the Bachelor of Electrical Engineering Technology (Industrial Automation and Robotics) with Honours. The member of the supervisory is as follow:

………………………………………

(Khalil Azha Bin Mohd Annuar)

ABSTRACT

In today's reality, time is cash. Most families comprise of youthful kids and working folks. In such a situation, cleaning turns into a period devouring and debilitating undertaking, particularly in bigger homes. A robotic vacuum cleaner may all do the job alone without individual guidance. By buying one of these models, you possibly can escape considerable time as well as effort. The principle purpose of this kind of undertaking would be to develop a preliminary understanding to create as well as apply a vacuum cleaner robot designed to help to make cleanup method come to be simpler in contrast by using manual vacuum. This vacuum robot battery powered system compared to manual vacuum which consume electricity. An addition, we can save our money to pay the electricity. The operation of this project 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 utilizing vacuum cleaner robot, person could merely first turn on the actual vacuum cleaner robot to clean without having to work the actual cleaner. This methodology as well as opportunity regarding study are usually conducted simply by accomplishing books opinions as well as research about various sensor, motor, PIC, programming for PIC. A crucial illustration regarding vacuum cleaner robot will have numerous standards which might be useful, structured as well as user-friendly, which usually fulfills individual needs.

ABSTRAK

Dalam realiti hari ini, masa adalah sangat berharga. Kebanyakan keluarga terdiri daripada orang dewasa dan orang bekerja. Dalam keadaan seperti ini, kebersihan bertukar menjadi tempoh memakan dan memenatkan, terutamanya di rumah-rumah yang lebih besar. Seterusnya, pembersih vakum robot boleh melakukan kerja dengan sendiri tanpa pengawasan. Dengan membeli salah satu daripada model-model ini, anda mungkin dapat menjimatkan masa dan tenaga. Tujuan perlaksanaan projek ini adalah untuk pemahaman yang awal untuk mencipta serta menggunakan vakum pembersih vakum robot. Robot pembersih yang direka untuk membantu untuk membuat kaedah pembersihan menjadi lebih mudah berbanding dengan menggunakan manual vakum. Sistem robot vakum menggunakan bateri berbanding vakum manual yang menggunakan elektrik .Selain itu, kita boleh menjimatkan wang untuk membayar elektrik. Terdapat beberapa prosedur yang diambil kira oleh pengesan untuk mengetahui hanya beberapa perkara dan juga menghantar hasil akhir yang sebenar kepada PIC yang akan menguruskan pergerakan robot vakum. Dengan menggunakan vakum robot pembersih, dengan hanya menghidupkan vakum robot pembersih untuk membersihkan tanpa perlu mengawasi vakum robot. Metodologi adalah mengenai kajian biasanya dijalankan hanya dengan mencapai buku pendapat serta penyelidikan mengenai pelbagai sensor, motor, PIC, pengaturcaraan untuk PIC. Salah satu contoh penting mengenai pembersih vakum robot mempunyai banyak standard yang mungkin berguna, berstruktur dan juga mesra pengguna, yang biasanya memenuhi keperluan individu.

DEDICATION

Dedicate in thankful appreciation for support, encouragement and understandings to my beloved mother, father, lecturers and brothers.

ACKNOWLEDGEMENT

First of all, I would like to express my deepest gratitude to my supervisor, Khalil Azha Bin Mohd Annuar, for accept and giving me this wonderful and yet interesting final year project. His supervision both aided me to channel and specify the discussed ideas and at the same time provided much appreciated freedom and support to explore new concepts. However, his endless drives for new and better results is highly appreciated, instead of willing to share her own experience and spend her free time to supervise me throughout the implementation of this project.

My appreciation also goes to my parents who bore immense difficulties to educate their children at the highest level. Their affection and love has brought happiness and joy to my life and therefore made this task becomes much easier to be implemented.

Nevertheless, my great appreciation dedicated to my friend Muhammad Faiq , who gave technical support and suggestion in this project. I am grateful to my classmates and those whom involve directly or indirectly with this project. Finally, I hope that all the knowledge and experience gained through this project can be shared and bring benefit to all. Thank you.

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LIST OF SYMBOLS AND ABBREVIATIONS

PWM = Pulse Width Modulation

PIC   = Peripheral Interface Controller

DC   = Direct current

TX   = Transmitter

RX   = Receiver

MCU = Microcontroller Unit

GND = Ground

VCC = Collector Supply Voltage

VSS   = Source Supply

VDD = Drain Supply

VEE   = Emitter supply

LCD   = Liquid Crystal Display

LED   = Light-Emitting Diode

ABS   = Acrylonitrile Butadiene Styrene

PLA   = Polylactic acid

3D   = 3 Dimensional

I/0   = Input Output

IC   = Integrated Circuit

IR   = Infrared

ICSP = In-Circuit Serial Programming

RVC   = Robot Vacuum Cleaner

CHAPTER 1
INTRODUCTION

1.1   Background

Cleaning a house can be exhausting in daily routine. Nowadays, time is valuable. But with this smart cleaning machine, you can vacuum your home with less energy. You can just turn on this robotic vacuum cleaner to clean up your floor without human guidance. By getting this modern vacuum cleaner, you can save a lot of energy and time. Smart Vacuum Cleaner Robot is very popular in Korea and Japan with cleaning function almost 90 % of citizen using this smart vacuum cleaner robot.

Vacuum Cleaner Robot design to generate clean-up practice come to be much easier regarding human being task and needs. This kind of undertaking comprise software package along with equipment. The key component of this undertaking will be the microcontroller, type of sensors, ability of motor and power distribution. Software, Micro C is used to write the programming and for simulate the circuit design used Proteus. Modeling the project is using the solid works software. PIC"s microcontroller 16F877A would make as brain of this system.

This project is programmed to clean up the dust on the floor. The movement of this robot by turns left and right for collecting the dust. It used ultrasonic sensor to avoid the obstacle and wall. The range of ultrasonic sensor is between 2cm-400cm. In Addition, ultrasonic produce analog signal which can use in microcontroller coding.

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1.2 Problem statement

These days, part of individuals utilized manual vacuum cleaner to do their cleaning at home. At the same time, manual vacuum are utilized power utilization. As we probably aware, that is squandering cash and need human vitality to moving. So that's, it not handy for working individual to handle with manual vacuum and did not have enough time to clean.

An addition, many of a designations regarding vacuum robot for the market are generally costly and significant within size. Therefore this really is tricky for you to clean anywhere, under beds, and also kitchen baseboards. It also exhausting task for human. So design the vacuum cleaner robot to make human task become easier and save time. It also had a minimal maintenance and use green technology. Therefore, the actual project is actually created to be single of an introduction for human for you to clean your current floor inside small period and also added effective.

1.3 Objective

i. To build and design a working Vacuum Cleaner Robot prototype
ii. To test the functionality of Vacuum Cleaner Robot.
iii. To analyze the performance of the Vacuum Cleaner Robot.

1.4 Scope

i. This project using microcontroller PIC16F877A.
ii. The sensor use is ultrasonic sensor. The total sensor used is 3 sensors. It will place in front of body vacuum cleaner robot to detect obstacle. The range of detection obstacle between 25 cm.
iii. The suitable area for vacuum cleaner robot is on flat area.

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iv. The design of vacuum cleaner robot is round shaped.

v. Area covers only 3m x 3m.

vi. Vacuum cleaner robot dimension is 180mm x 180mm.

vii. Battery LiPo 11.1 V with capacity 2200mAh is used for the robot.

CHAPTER 2
LITERATURE REVIEW

2.1   Introduction

This chapter about to give the overview points concerning the research previous robot continues to be set up. This study is important to avoid errors during the project and understanding the design, sensor, motor and microcontroller configuration and get the best decisions are made to implement to the project. Further, the comparisons of all journals need to be made as a reference.

2.2   Literature review

2.2.1   Cleaning robot

The study of vacuum cleaner robot should be done before the project started. According to Rodrigo Montu'far-Chaveznava and Yazid L. Fernafndez (2005), created the present perform purchases because of the design and also structure associated with an educational interior cleaner automatic robot: Crabot. The restrictions the distinct automatic robot symbolize a great problem due to the fact the duty relating to Crabot is actually clean-up the bedroom staying away from rooms along with pieces of furniture however That is certainly working. Crabot is really a Lego centered autonomous cell phone automatic robot, which symbolizes the particular prototype in the specific

automatic robot with regard to home cleaning, through which involves at least intelligence. Crabot is actually supplied using essential items created for floorboards clean-up these types of to be a little vacuum cleaner in addition to a brush. The control approach might be centered with the subsumption architectural mastery within memory space along with provides the particular repertoire of conducts with regards to course-plotting together with clean-up. This particular manage approach will allow for pairing real-time allocated manage during conducts activated through automatic robot receptors. kinds processing is actually finished with a number of Lego RCX microcomputers. Crabot accredited inside of an unnatural world and in addition inside of competition where the functionality ended up being extremely suited.

In a follow-up study, Kazi Mahmud Hasan et al (2014) found that a vacuum cleaner automatic robot, usually termed any robovac, is surely an autonomous automatic robot that's controlled through wise method. Autonomous cleaner washing automatic robot will certainly execute activity like capturing as well as a vacuum in one cross. The DVR-1 cleaner washing automatic robot involves 2 DC power plant handled trolley wheels which make it possible for 360 level revolving, any castor tire, side spinning brushes, any entry bumper as well as a little cleaner push. Sensors in the bumper are widely-used regarding producing binary data involving hurdle discovery chances are they'll are generally refined through some curbing algorithms. These kind of algorithms are widely-used regarding way setting up as well as routing This particular robot's bumper stops these by means of thumping in dividers along with furnishings simply by fixing along with adjusting way as a result.

According to Mun-Cheon Kang et al (2014), This paper provides the powerful obstacles detection (OD) approach while using triangulation theory with regard to RVCs(robot vacuum cleaner cleaner) running in numerous residence environments. The suggested approach utilizes the particular IR emitter with the RVC to be able to undertaking the side to side IR column to a floor, next that your RVC"s wide-angle vision digital reflects a graphic that includes the particular IR series resembled by the bottom or maybe a great barrier. Limitations usually are recognized by using the picture

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coordinates with the pixels which are part of the particular IR series inside the grabbed picture. Exact separation with the IR series through the picture background is actually done through understanding and also lessening electricity performs while using characteristics with the IR series. The suggested approach had been tried within the embedded RVC program and also had been found able to attaining OD effectiveness balanced with present procedures.

2.2.2 Microcontroller

Microcontroller is a device function as brain for the robot. This part is important to identify which microcontroller is the best product. According to Md. Akhtaruzzaman et al (2009), The Microchip's PICI6F877A, with 45 personal identification number 8-bit CMOS Flash Microcontroller is actually aimed at present sole chips strategy to control a digital motion. The chips possesses 8 Kbytes involving THUMB programmable memory space, 360 byte involving information memory space (RAM), 256 byte involving EEPROM Info Memory space, thirty-three enter or even output pins. The controller may well obtain analog signal enter by nearly 8 programs. The functioning rate with the controller is actually supplied by 20MHz time enter DC.

Gow Moh Kee (2008), this kind of paper present PIC 16F877A, which often consists of 5 Input/Output (1/0) locations along with thirty three I/0 pins. These locations are usually interface A, T, C, Deb in addition to E. Using the advanced 16F877A, the trading program controller mother board uses fewer ingredients that may are already necessary before. This specific microcontroller might be reprogrammed as it uses adobe flash read-only ram pertaining to method safe-keeping. This specific can make it ideal for trial and error mainly because this kind of processor does not need being wiped out having an ultraviolet source of light every time fresh method is submitted.

Yusuf Abdullahi Badamasi (2014), This paper has analyze this doing the job theory of arduino. These days many people attempt to utilize arduino because doing so tends to make items less difficult due to made easier model regarding C++ as well as the

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previously made Arduino microcontroller (atmega328 microcontroller you could developed, removed and also reprogrammed at any time. Within this report we all will probably discuss this hardware components found in this arduino mother board, the application accustomed to developed it (Arduino board) with the guide on what to post and also develop your own personal tasks, and also some degrees of an arduino task. This may supply the entire watch of arduino uno, of which after looking over this report you will definately get the essential principle and also by using an arduino uno.

Figure 2.1: PIC 16F877A

Figure 2.2: Arduino

After compare between the microcontroller, PIC 16F877A will be more desirable to work with in this particular project considering that the overall performance on the microcontroller throughout speed benefits. It's also simple carry out to this project.

2.2.3 Distance sensor

This study of distance sensor is very importance in this project, which is used to sense the obstacles in front and end of the floor. Before that, there are several specification need to consider such as sensitivity of sensor, range of sensor and reliability of sensor. An useful examples are of distance sensor in a market such as ultrasonic sensor and infrared sensor.

According to Sungbok Kim and Hyunbin Kim (2011), this paper present gifts an ideal ultrasonic sensor wedding ring using column overlap regarding high res obstacle detection of a cellular robot. The assumption is which a collection of small directivity ultrasonic sensors in the very same variety usually are arranged in a very group connected with nonzero radius on normal spacing making use of their supports overlapped. Primary, the idea of useful column overlap amongst a few adjoining ultrasonic sensors can be introduced, along with the structural rules with an overlapped ultrasonic sensor wedding ring regarding useful column overlap usually are taken. Secondly, the particular successful column widths associated with an overlapped ultrasonic sensor wedding ring usually are examined, along with the ideal design details associated with an overlapped ultrasonic sensor wedding ring regarding minimal positional uncertainness usually are determined. 3rd, the particular high res obstacle detection in line with the inequality relationships amongst a few adjoining obstacle kilometers can be proposed, and also using the ending determination kitchen table regarding uncertainness arc, the particular describe removal in a very somewhat complex obstacle environment is performed.
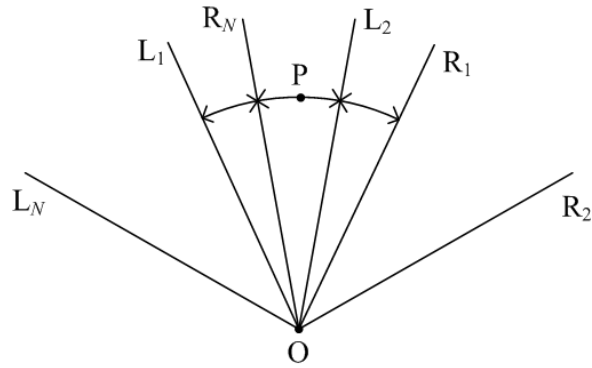
Figure 2.3: Positional adjacent ultrasonic sensors

According to Danilo Navarro (2008) Infrared sensors are typically used in obstacle staying away from techniques because they're quickly and low-cost, and demand only uncomplicated signal digesting a challenge together with such a sensor is actually their brief variety. This kind of IR sensor is utilized pertaining to line-based guide developing purposes, therefore many of us additionally present a new technique pertaining to line extraction, variety information clustering and line segmentation. Infrared sensors are trusted while area sensors and pertaining to obstacle avoidance in robotics.

Figure 2.4: Ultrasonic sensor