

AUTOMATIC INTELLIGENT CLEANER

FOO ZHONG WEI
TERRANCE PRASATH

DIPLOMA OF ELECTRICAL ENGINEERING
(COMPUTER)
DEPARTMENT OF ELECTRICAL ENGINEERING
POLYTECHNIC SEBERANG PERAI
JUNE 2017

AUTOMATIC INTELLIGENT CLEANER

BY

FOO ZHONG WEI

TERRANCE PRASATH

A proposal project submitted in fulfillment of the requirement for the award of the diploma of Electrical Engineering (Computer) Department of Electrical Engineering Polytechnic Seberang Perai (PSP).

JUNE 2017

PROJECT REPORT COMFORMATION

I hereby declare that the work in this report is my own except for quotations and summaries
which have been duly acknowledged.

Student:


.....

(FOO ZHONG WEI)


.....

(TERRANCE PRASATH)

Date: 13/10/2017
.....

Supervisor: 
.....

MS. ROSLINA BT SAAD

Dedicated to,

Thanks to God,

For give us a good health and strength while making this report.

Our beloved father and mother,

Foo Yook Man & Eng Sim Looi

Udhaya Suriyan & Christina

Who has always been our epitome of love and always pray for my strength to finish up this report.

Our beloved relatives,

Our siblings,

Thank you for your support and pray.

The person who has been very understanding and helpful,

Mrs. Roslina Bt Saad

For the support and guidance. Hope that we always be remembered.

Our unforgettable friends,

Our housemate, our course mate and all DTK students intake June 2015,

Our struggle not yet ends.

Finally, friends that always together during this third years study,

Hopefully achieved what we aspired.

ABSTRACT

Automatic Intelligent cleaner is a smart and friendly user cleaner and the automatic intelligent cleaner is simple to use. In this moment, people has less time to keep their house clean and not keeping the house clean can cause huge health problem and cause diseases. Thus, this will result in bad impact for every household. Our system is optimal for cleaning the house floors, carpets, and other surfaces. The automatic intelligent cleaner does 3 task at once which is vacuum, cleaning and mopping. This system is design as an autonomous it means the system work its self without any controller. With help of this system, it helps the user or the owner to save time and reduces human power basicly in cleaning.

Accordingly, the purpose of this system is to help the senior citizen who has limited human power and human that busy with their job scope. This system will encourage or boost people to keep their house clean and tidy easily. With the help of 3 ultrasonic sensor which is in this system will keep the automatic intelligent cleaner to move autonomously and avoid obstacle. This system will inspire, engage and support people to take their personal responsibility in keeping their household hygienic. This system is a great innovation for every household. This project will be implementing using Arduino-Uno microcontroller by using both C and C++ programming languages.

ABSTRAK

Pembersih Pintar Automatik adalah pembersih pengguna yang bijak dan mesra dan Pembersih Pintar Automatik adalah mudah digunakan. Pada masa ini, orang mempunyai masa yang kurang untuk menjaga rumah mereka bersih dan tidak menjaga rumah bersih boleh menyebabkan masalah kesihatan yang besar dan menyebabkan penyakit. Oleh itu, ini akan memberi kesan buruk kepada setiap isi rumah. Sistem kami adalah optimum untuk membersihkan lantai rumah, permaidani, dan permukaan lain. Pembersih pintar automatik melakukan 3 tugas sekaligus yang merupakan vakum, membersihkan lantai dan mengemop. Sistem ini direka bentuk sebagai autonomi ia bermakna sistem berfungsi sendiri tanpa pengawal. Dengan bantuan sistem ini, ia membantu pengguna atau pemilik untuk menjimatkan masa dan mengurangkan kuasa manusia pada dasarnya dalam pembersihan rumah.

Sehubungan itu, tujuan sistem ini adalah untuk membantu warga emas yang mempunyai tenaga manusia yang rendah dan manusia yang sibuk dengan skop pekerjaan mereka. Sistem ini akan menggalakkan atau meningkatkan orang ramai agar rumah mereka bersih dan kemas dengan mudah. Dengan bantuan 3 sensor ultrasonik yang berada dalam sistem ini akan memastikan pembersih pintar automatik untuk bergerak secara autonomi dan mengelakkan halangan. Sistem ini akan memberi inspirasi, melibatkan diri dan menyokong orang ramai untuk mengambil tanggungjawab peribadi mereka dalam menjaga kebersihan isi rumah mereka. Sistem ini merupakan inovasi yang hebat untuk setiap isi rumah. Projek ini akan dilaksanakan menggunakan mikrokontroler Arduino-Uno dengan menggunakan kedua-dua bahasa pengaturcaraan C dan C ++.

ACKNOWLEDGEMENT

First of all, I would like to take this opportunity to express my appreciativeness to each and every one who supported and give motivation to me throughout the course of this project. I would like to say a gratitude to our supportive and friendly supervisor, Mrs. ROSLINA BINTI SAAD for her aspiring guidance, invaluable constructive criticism and friendly advice during the project work. A sincerely grateful to her for sharing his trustworthy and illuminating views on a number of issues related to the project.

Furthermore, I would like to express my gratitude toward my parents and my friends for giving me encouragement, co-operation, their willingness and finance help to help out to complete this project in a successful manner.

It would have been impossible to complete this project without their support and help of many individuals and organization. I would like to express our sincere appreciation and thanks to all of them.

CONTENT

Content	Page
1.0 INTRODUCTION	1-5
2.0 LITERATURE REVIEW	6-25
3.0 METHODOLOGY	26-32
4.0 PROJECT ANALYSIS AND DISCOVERY	33-38
5.0 SUGGESTION AND CONCLUSION	39-41
REFERENCE	42-43

CHAPTER 1

INTRODUCTION

1.1 MOBILE ROBOT

A mobile robot is an automatic machine that is capable of locomotion. Mobile robots have the capability to move around in their environment and are not fixed to one physical location. Mobile robots can be "autonomous" (AMR - autonomous mobile robot) which means they are capable of navigating an uncontrolled environment without the need for physical or electro-mechanical guidance devices. Alternatively, mobile robots can rely on guidance devices that allow them to travel a pre-defined navigation route in relatively controlled space (AGV - autonomous guided vehicle). By contrast, industrial robots are usually more-or-less stationary, consisting of a jointed arm (multi-linked manipulator) and gripper assembly (or end effector),

attached to a fixed surface. The components of a mobile robot are a controller, control software, sensors and actuators. The controller is generally a microprocessor, embedded microcontroller or a personal computer (PC). Mobile control software can be either assembly level language or high-level languages such as C, C++, Pascal, Fortran or special real-time software. The sensors used are dependent upon the requirements of the robot. The requirements could be dead reckoning, tactile and proximity sensing, triangulation ranging, collision avoidance, position location and other specific applications.

I hope the final year project that I invented would help anyone in anytime

1.2 BACKGROUND

iRobot Corporation is an American advanced technology company founded in 1990 by three MIT graduates who designed robots for space exploration and military defense. Incorporated in Delaware, the company designs and builds consumer robots for inside and outside of the home, including a range of autonomous home vacuum cleaners (Roomba), floor moppers (Braava), and other autonomous cleaning solutions. iRobot is a public corporation, based in Bedford, Massachusetts.

iRobot was founded in 1990 by Rodney Brooks, Colin Angle and Helen Greiner after working in MIT's Artificial Intelligence Lab. In 1998 the company received a DARPA research

contract which led to the development of the PackBot. In September 2002, iRobot unveiled its home robots flagship, the Roomba, which sold a million units by 2004.

iRobot began being traded on the NASDAQ in November 2005, under ticker symbol IRBT. On September 17, 2012, iRobot announced that it had acquired Evolution Robotics, manufacturer of automated floor mopper Mint. iRobot has sold more than 8 million home robots, and has deployed more than 5,000 defense & security robots, as of 2012.

In addition to deployment as bomb-disposal units with the US military in Iraq and Afghanistan, PackBots have been used to gather data in dangerous conditions at the Fukushima Daiichi nuclear disaster site, and an IRobot Seaglider detected underwater pools of oil after the Deepwater Horizon oil spill.

iRobot has been criticized for attempting unregulated use of 6240-6740 MHz band, and asking for an FCC exemption to do so. This band is for use for the lawn mowing robot without needing to use an electronic fence as a boundary marker, instead by using radio beacons. The band falls into a band reserved for radio astronomy use, thus interfering with radio telescope observations of methanol's 6.66852 GHz emissions.

In February 2016, iRobot announced that it would sell its military robotics business to Arlington Capital Partners, in order to focus more on the consumer market.

1.3 PROBLEM STATEMENT

The common process of floor cleaning has become a menial, labor demanding, and time consuming task, which can be accomplished without an overwhelming amount of skill. We have realized that people at home are too busy for daily or weekly floor cleaning, especially for families with children. The elderly who lives by themselves do not have the strength or ability to clean by themselves, and the cost of hiring a maid is expensive. Out in the industry, nightly office cleaning almost always includes vacuuming of the floor which takes efforts away from other cleanups or becomes an entire person's task. Labor costs are expensive and quickly adds up. We believe an autonomous robotic vacuum cleaner can help by automating this task. A robotic vacuum can vacuum a floor space on its own without the help of anyone. And the cost of using one has a fixed price rather than paying an escalating price on workers. The device has to be simple enough for any adult to use. For this product to succeed, it needs to do its job well by covering the entire floor space in a timely fashion.

1.4 OBJECTIVES

- To develop an automatic cleaner which could perform vacuum and mopping process.
- To develop an Automatic Intelligent Cleaner that able to move automatically without any technical problem and it could prevent obstacle when performing cleaning process

1.5 SCOPE

- To build an intelligent vacuum cleaner which carries out multiple function mainly to reduce human power and to help the senior citizens by reducing their cleaning work.
- The vacuum cleaner has its advantages and its disadvantages, the advantages is that the vacuum cleaner is automatic, which can clean up a single hall with a single charge of battery.
- The disadvantages of the cleaner is that it ran out of battery charge after certain period of time, this vacuum cleaner could not clean stair and it take long time to clean as it is automated.
- This vacuum cleaner only be used indoor because it design for indoor usage such as floor.

CHAPTER 2

LITERATURE REVIEW

2.1 INTRODUCTION

In today's world, time is money. Most families consist of young children and working parents. In such a scenario, cleaning becomes a time-consuming and exhausting task, especially in larger homes. A robotic vacuum cleaner does all the work by itself and requires no

supervision. By investing in one of these machines, you can save yourself a lot of time and effort. People keep on busying on their and they have no enough time to clean their house. Employ a maid, it will be quite costly and unsecure for those who have kids or senior citizens at home. There might be cases happen which we cannot predict for example kids been kidnaped or abuse, senior citizens been bully and so on. So I hope my invention would help those who are facing situation.

A robotic vacuum cleaner is an autonomous electronic device that is intelligently programed to clean a specific area through a vacuum cleaning assembly. Some of the available products can brush around sharp edges and corners while others include a number of additional features such as wet mopping and UV sterilization rather than vacuuming. Some of the available products are discussed below.

A. iRobot In 2002, iRobot launched its first floor vacuum cleaner robot named Roomba. Initially, iRobot decided to manufacture limited number of units but Roomba immediately became a huge consumer sensation. Due to its increased market demand, a series of following robots have been launched in the market:

2.2 THE STUDY OF EXISTING PRODUCT

A robotic vacuum cleaner is an autonomous electronic device that is intelligently programed to clean a specific area through a vacuum cleaning assembly. Some of the available products can brush around sharp edges and corners while others include a number of additional features such as wet mopping and UV sterilization rather than vacuuming. Some of the available products are discussed below.

A) IRobot. In 2002, iRobot launched its first floor vacuum cleaner robot named Roomba. Initially, iRobot decided to manufacture limited number of units but Roomba immediately became a huge consumer sensation. Due to its increased market demand, a series of following robots have been launched in the market:

2.2.1 ROBOTIC VACUUM CLEANER



1. Roomba

- Launch Date: 2002
- Manufacturer: iRobot (American)
- Type of Use: Dry Vacuum
- Technology: IR, RF and auto-charging mechanism
- Price: \$500



2. Neato XV-11

- Launch Date: 2010
- Manufacturer: Neato-Robots XV series (California)/China
- Type of Use: Vacuum Cleaning
- Technology: Laser range finder technology, SLAM (Simultaneous localization and mapping) and auto-charging
- Price: \$399



3. Scooba

- **Launch Date:** 2005
- **Manufacturer:** iRobot (American)
- **Type of Use:** Wet Washing of Floor
- **Technology:** IR with virtual wall accessories
- **Price:** \$500

A comparison of robots that we researched with the top selling robotic cleaners in international market on the basis of general specifications like operating time, charging time, scheduling, floor type, battery indicators and navigation features is summarized in Table below.

FEATURES	NEATO -XV	ROOMBA	SCOOBA
OPERATING TIME(HRS)	1.5	2	1.2
CHARGING TIME(HRS)	3	4	2
SCHEDULING	YES	YES	YES
BATTERY INDICATORS	YES	YES	YES
FULL-bin INDICATOR	YES	YES	YES
REMOTE CONTROL	YES	YES	YES

From this table, we know that the NEATO-XV has more operating hours compare to others which means its battery is better than others of the smart cleaner. Furthermore, it only takes 3 hours of charging the NEATO-XV compare to ROOMBA but the SCOOBA only takes 2 hours to charge and it only operate 1.2 hours. We can conclude that all this smart cleaners

above carry out the similar function but it has different battery lifetime of each of the cleaner. NEATO-XV is the only robot has battery efficiency and less power consumption because it only takes 3 hours to charge and it can operate for 1.5 hours. Based on this specification that had inside NEATO-XV we can take it as a reference to improvise our project.

This section describes the related projects are generally particularly in terms of throughput. The robot that we create is autonomous which can move automatically without being controlled by owner. The purpose that creating this robot is to help those senior citizens who cannot move physically and for those who don't have time to clean their houses. This robot has multiple functions which is brushing, vacuum and mopping. The size of the robot that we create is more likely size of unique which can spin easily. This robot can be charged anytime because it has a rechargeable battery built-in it. There are buzzer built-in the robot which makes sound whenever there is obstacles.

The control process of the Automatic Intelligent Cleaner is control by a few categories:

- Arduino UNO
- Ultrasonic sensor
- L293D Motor Driver
- Mini water pump

2.2.2 ARDUINO UNO

Arduino/Genuine Uno is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Technical specs

ARDUINO MICROCONTROLLER

Microcontroller	ATmega328
Architecture	AVR
Operating Voltage	5 V
Flash memory	32 KB of which 0.5 KB used by

	bootloader
SRAM	2 KB
Clock Speed	16 MHz
Analog I/O Pins	6
EEPROM	1 KB
DC Current per I/O Pins	40 mA on I/O Pins; 50 mA on 3,3 V Pin

2.2.3 ULTRASONIC SENSOR

Ultrasonic sensors (also known as transceivers when they both send and receive, but more generally called transducers) work on a principle similar to radar or sonar which evaluate attributes of a target by interpreting the echoes from radio or sound waves respectively. Ultrasonic sensors generate high frequency sound waves and evaluate the echo which is received back by the sensor . Sensors calculate the time interval between sending the signal and receiving the echo to determine the distance to an object. This technology can be used for measuring wind speed and direction (anemometer), tank or channel level, and speed through air or water. For measuring speed or direction a device uses multiple detectors and calculates the speed from the relative distances to particulates in the air or water. To measure tank or channel level, the sensor measures the distance to the surface of the fluid. Further applications include: humidifiers, sonar, medical ultrasonography, burglar alarms and non-destructive testing. Systems typically use a transducer which generates sound waves in the ultrasonic range, above 18,000 hertz, by turning electrical energy into sound, then upon receiving the echo turn the sound waves into electrical energy which can be measured and displayed. The technology is limited by the shapes of surfaces and the density or consistency of the material. Foam, in particular, can distort surface level readings.

2.2.4 L293D MOTOR DRIVER

L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that it can control two DC motor with a single L293D IC. Dual H-bridge *Motor Driver integrated circuit (IC)*. It works on the concept of H-bridge. H-bridge is a circuit which allows the voltage to be flown in either direction. As you know voltage need to change its direction for being able to rotate the motor in clockwise or anticlockwise direction, Hence H-bridge IC are ideal for driving a DC motor. In a single L293D chip there are two h-Bridge circuit inside the IC which can rotate two dc motor independently. Due its size it is very much used in robotic application for controlling DC motors. Given below is the pin diagram of a L293D motor controller. There are two Enable pins on l293d. Pin 1 and pin 9, for being able to drive the motor, the pin 1 and 9 need to be high. For driving the motor with left H-bridge we need to enable pin 1 to high. And for right H-Bridge we need to make the pin 9 to high. If any of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch

2.2.5 MINI WATER PUMP

A **pump** is a device that moves fluids (liquids or gases), or sometimes slurries, by mechanical action. Pumps can be classified into three major groups according to the method they use to move the fluid: direct lift, displacement, and gravity pumps. Pumps operate by some mechanism (typically reciprocating or rotary), and consume energy to perform mechanical work by moving the fluid. Pumps operate via many energy sources, including manual operation, electricity, engines, or wind power, come in many sizes, from microscopic for use in medical applications to large industrial pumps. Mechanical pumps serve in a wide range of applications such as pumping water from wells, aquarium filtering, pond filtering and aeration, in the car industry for water-cooling and fuel injection, in the energy industry for pumping oil and natural gas or for operating cooling towers. In the medical industry, pumps are used for biochemical processes in developing and manufacturing medicine, and as artificial replacements for body parts, in particular the artificial heart and penile prosthesis.

Technical specs

- Waterproof level: IP68
- Rated voltage: DC12V
- Service voltage: DC5V~DC12V
- Working current: 1050Ma±10%

- Lift: 5m \pm 10%
- Flow: 800L/H \pm 10%
- Noise: 38dB within 0.5M
- Fluid temperature range: 0-100 Celsius degree
- Size: 8 x 5 x 6.5cm
- Weight: 220 grams
- Cable length: 50cm

2.2.6 IN TERM OF COST

Manufacturing cost for this item is quite expensive because it effectively cleans your floors – both carpeted and hard surfaces – and gives you power to name your bot, schedule cleanings and get data on when and where your robot has cleaned and even locate your robot all from your smartphone. The iRobot Roomba 980 added a smartphone and tablet app that gives you more control over your robot, and the robot vacuum itself is smarter than ever. The Roomba 980 can find new ways over the thresholds in your house, and it includes a new mode that forces the robot to use even stronger suction as it rolls over carpet. Although it is missing some desirable features and options, the iRobot Roomba 980 is still one of the best robot vacuums we've tested, and it earns the Top Ten Reviews Silver Award

2.3 STUDY OF EQUIPMENT HAS RELATED TECHNOLOGY

In this chapter will explain the study things has been used in the project

Among the components of the material has used

- BUZZER
- RECHARGEABLE BATTERY
- ARDUINO UNO
- ULTRASONIC SENSOR
- MINI WATER PUMP
- L293D MOTOR DRIVER

2.3.1 BUZZER



A **buzzer** or **beeper** is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.