

# AUTONOMOUS ROBOTICS VACUUM CLEANER

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# **AUTONOMOUS ROBOTICS VACUUM CLEANER**

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**JUNE 2017**

# *Certificate of Authenticity*

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## **Abstract**

The name for this project is Autonomous Robotics Vacuum Cleaner for the purpose of taking about cleaning the floor. Autonomous Robotics Vacuum Cleaner is a device that use to cleaning applications at home, hotel, restaurants, offices, hospital, workshop and other places. This Autonomous Robotics Vacuum Cleaner is design a vacuum cleaner that can be used in sponge to clean and also to be considered in scope is household and similar use. More than that, this Autonomous Robotics Vacuum Cleaner also aim to decrease the workload of worker and also help the worker saving time.

## **Abstrak**

Nama untuk projek ini ialah Autonomous Robotics Vacuum Cleaner untuk tujuan membersihkan lantai. Autonomous Robotics Vacuum Cleaner adalah peranti yang digunakan untuk membersihkan aplikasi di rumah, hotel, restoran, pejabat, hospital, bengkel dan tempat lain. Autonomous Robotics Vacuum Cleaner ini merancang pembersih vakum yang boleh digunakan dalam span untuk membersihkan dan juga untuk dipertimbangkan dalam skop adalah rumah tangga dan penggunaan yang sama. Lebih daripada itu, Autonomous Robotics Vacuum Cleaner ini juga bertujuan untuk mengurangkan beban kerja pekerja dan juga membantu pekerja menjimatkan masa.

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### LIST OF ABBREVIATION

Abbreviation	Word
DC	Direct Current
IC	Integrated Circuit
PCB	Printed Circuit Board
UV	Ultra Violet
IEC	International Electro technical Commission

# CHAPTER 1

## INTRODUCTION

### 1.1 Introduction

In recent year's robotic cleaner have taken major attention in robotics research due to their effectiveness in assisting humans in floor cleaning applications at home, hotel, restaurants, offices, hospital, workshop and other places. Basically, robotic cleaners are distinguished on their cleaning expertise like floor mopping, dry vacuum cleaning or other functions that can help to cleaning. Some products are based on simple obstacle avoidance using infrared sensor while some utilize laser mapping technique. Each cleaning and operating mechanism of robotic floor cleaner has its own advantages and disadvantages. For example, robots utilizing laser mapping are relatively faster, less time consuming and energy efficient but costly, while obstacle avoidance based robots are relatively time consuming and less energy efficient due to random cleaning but less costly. Countries like Pakistan are way back in manufacturing robotic cleaners. Importing them from abroad increases their costs.

We recognize that robot is a good thing in our human further because robot can help us solve a lot of problem and reduce the workload. One of those robot is a vacuum cleaner. Vacuum cleaner can help some worker or housewife easier their workload and faster to clean up. Vacuum cleaner is easy to make if got some knowledge about making a robot, everyone can make a vacuum cleaner by themselves. Vacuum cleaners are made in a variety of shapes and sizes for domestic and commercial use and for different applications. Generally, a vacuum cleaner can be defined as: "An electrically operated appliance that removes soiled material (dust, fibre, threads) from the surface to be cleaned by an airflow created by a vacuum developed within the unit by an electrically powered vacuum generator or fan. The material thus removed is separated and stored in the appliance and the cleaned suction air is returned to the ambient.

## **1.2Objective**

- To design and carry out an autonomous robotics vacuum cleaner prototype.
- To design an autonomous robotics vacuum cleaner with using Arduino UNO and Bluetooth module
- To design a cleaning system of autonomous robotics vacuum cleaner with using sponge and mini water pumper

## **1.3Problem Statement**

We design and build our own vacuum cleaner and we had to study some knowledge about making a vacuum cleaner. We make this vacuum cleaner because we need to solve some problem like a housewife or a worker don't have enough time to do housekeeping or clean up the house.

If we use the traditional method, maybe the floor is still not clean or still sticky. Our vacuum cleaner can solve this problem, because our vacuum cleaner using water and sponge to clean up the floor.

Apart from this, our vacuum cleaner can use anytime. For example, some people lazy to clean up the floor after work or lazy to clean up when the floor dirty, so they can use this vacuum cleaner to help them clean the floor.

#### **1.4 Research Question of the Project**

- How does a vacuum cleaner work?
- Why we need vacuum cleaner?
- How to make the water pumper system and cleaning system?

#### **1.5 Project Scope**

- To design a vacuum cleaner that can be used in sponge to clean.
- Vacuum cleaner to be considered in scope, is household and similar use vacuum cleaners of all types found in homes, offices, hospitals, hotels, and shops.
- To make a vacuum cleaner that can function well with water pumper system with dc current and 9V power to function the cleaning system with using Arduino Uno.

#### **1.6 Project Importance and Impact**

This is an activity to inform supervisor be aware of possible preferences of students while making decisions for meeting tasks. This activity also can let the student brainstorming, the inquiry, planning and design become more creative.

The task has a direct connection to the world of work. Students explore the nature of some basic products such as vacuum cleaner. They generate creative solutions to a challenging problem and works like engineers. Students work in groups as designers and engineers to produce an artefact. Student also able to find out actual materials that are necessary to carry out the activity.

## CHAPTER 2

### LITERATURE REVIEW

#### 2.1 Background of Project

Vacuum cleaners are made in a variety of shapes and sizes for domestic and commercial use and for different applications. Generally, a vacuum cleaner can be defined as: "An electrically operated appliance that removes soiled material (dust, fibre, threads) from the surface to be cleaned by an airflow created by a vacuum developed within the unit by an electrically powered vacuum generator or fan. The material thus removed is separated and stored in the appliance and the cleaned suction air is returned to the ambient." The project team understands that IEC are considering a definition along these lines for the next edition of standard IEC 60312.

Vacuum cleaners filter the dust and dirt from the water after picking up from the surface being cleaned. This prevents any dirt being blown back into the atmosphere after cleaning. There are various types of filtration used and these are defined here.

##### 2.1.1 Table of Component

- |                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <ul style="list-style-type: none"><li>• IC L293D</li><li>• Arduino Uno</li><li>• DC motor</li><li>• 9 Volt Battery</li><li>• Battery Connector</li><li>• Jumper Wire</li><li>• Ceramic Capacitor</li><li>• Bluetooth Module</li><li>• Mini water pumper</li></ul> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

Table 1 shows component of project



## 2.2 Components on Board

In this topic, we will explain further about the components we used to develop the project

### A. L293D Motor Driver IC

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 you can control two DC motors 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 you need to enable pin 1 to high. And for right H-Bridge you need to make the pin 9 to high. If anyone of the either pin1 or pin9 goes low then the motor in the corresponding section will suspend working. It's like a switch.

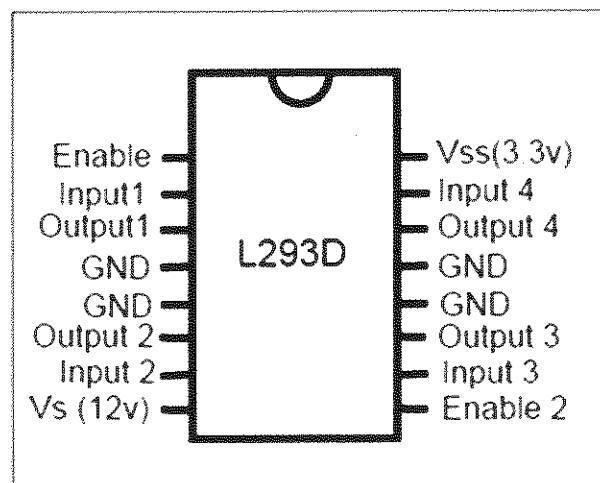


Figure 1 show L293D Pin Diagram

There are 4 input pins for L293d, pin 2, 7 on the left and pin 15, 10 on the right as shown on the pin diagram. Left input pins will regulate the rotation of motor connected across left side and right input for motor on the right hand side. The motors are rotated on the basis of the inputs provided across the input pins as LOGIC 0 or LOGIC 1.

VCC is the voltage that it needs for its own internal operation 5v; L293D will not use this voltage for driving the motor. For driving the motors it has a separate provision to provide motor supply VSS (V supply). L293d will use this to drive the motor. It means if you want to operate a motor at 9V then you need to provide a Supply of 9V across VSS Motor supply.

The maximum voltage for VSS motor supply is 36V. It can supply a max current of 600mA per channel. Since it can drive motors Up to 36v hence you can drive pretty big motors with this L293d. VCC pin 16 is the voltage for its own internal Operation. The maximum voltage ranges from 5v and up to 36v.

### **B. Arduino (Microcontroller)**

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. You can tell your board what to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Over the years, Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to new needs and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments. All Arduino boards are completely open-source, empowering users to build them independently and eventually

adapt them to their particular needs. The software, too, is open-source, and it is growing through the contributions of users worldwide.

Due to its simple and accessible user experience, Arduino has been used in thousands of different projects and applications. The Arduino software is easy-to-use for beginners, yet flexible enough for advanced users. It runs on Mac, Windows, and Linux. Teachers and students use it to build low cost scientific instruments, to prove chemistry and physics principles, or to get started with programming and robotics. Designers and architects build interactive prototypes, musicians and artists use it for installations and to experiment with new musical instruments. Makers, of course, use it to build many of the projects exhibited at the Maker Faire, for example. Arduino is a key tool to learn new things. Anyone - children, hobbyists, artists, programmers - can start tinkering just following the step by step instructions of a kit, or sharing ideas online with other members of the Arduino community.

There are many other microcontrollers and microcontroller platforms available for physical computing. Parallax Basic Stamp, Net media's BX-24, Phi gets, MIT's Handy board, and many others offer similar functionality. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

**Inexpensive** - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module can be assembled by hand.

**Cross-platform** - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

**Simple, clear programming environment** - The Arduino Software (IDE) is easy-to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programming environment, so students learning to program in that environment will be familiar with how the Arduino IDE works.

**Open source and extensible software** - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the

leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to.

Open source and extensible hardware - The plans of the Arduino boards are published under a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

However, the Arduino board that we use in this grass cutter robot is Arduino/Genuine Uno. Arduino is a microcontroller board based on the ATmega328P (datasheet). 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 an AC-to-DC adapter or battery to get started. You can tinker with your UNO without worrying too much about doing something wrong, worst case scenario you can replace the chip for a few dollars and start over again.

"Uno" means one in Italian and was chosen to mark the release of Arduino Software (IDE) 1.0. The Uno board and version 1.0 of Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or outdated boards see the Arduino index of boards.

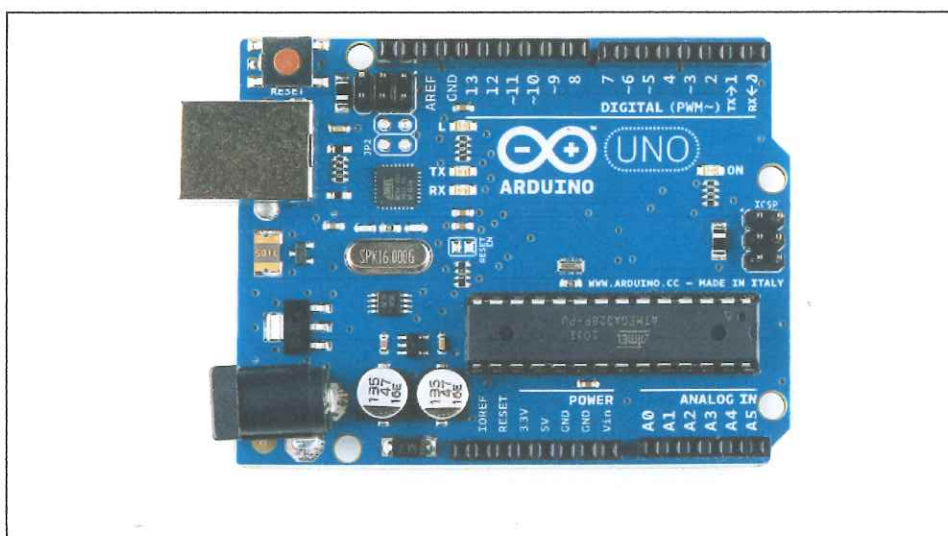


Figure 2 shows Arduino Uno

### C. DC Motor

A DC motor is a class of rotary electrical machines that converts direct current electrical energy into mechanical energy. The most common types rely on the forces produced by magnetic fields. Nearly all types of DC motors have some internal mechanism, either electromechanical or electronic, to periodically change the direction of current flow in part of the motor.



Figure 3 shows dc motor

### D. 9 volt battery

The 9 volt battery in its most common form was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in walkie-talkies, clocks and smoke detectors.

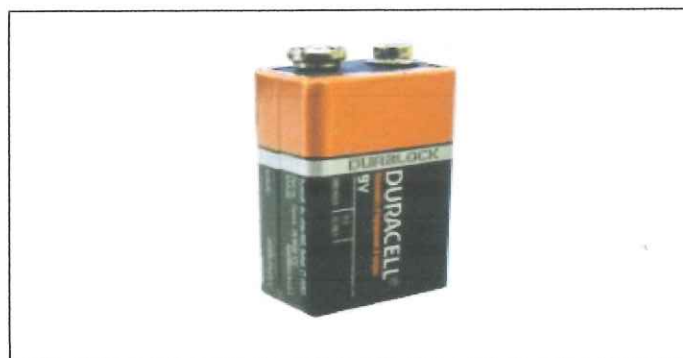


Figure 4 shows 9 volt battery



### **E. Battery Connector**

Battery Connector are the electrical contacts use to connect a load or charger to a single cell or multiple-cell battery. These connectors have a wide variety of designs, sizes and features that are often not well documented.

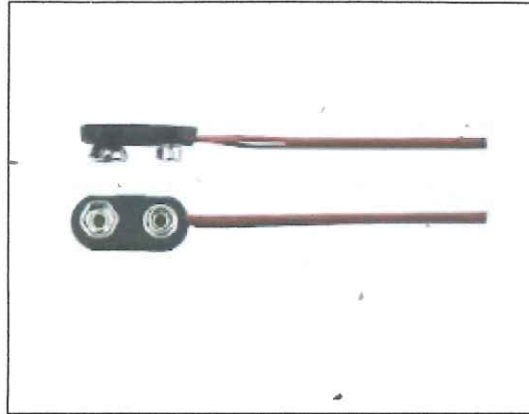


Figure 5 shows Battery Connector

### **F. Jumper Wire**

A jump wire also known as jumper, jumper wire, jumper cable. DuPont wire, or DuPont cable is an electrical wire or group of them in a cable with a connector or pin at each end, which is normally used to interconnect the component of a breadboard or other prototype or test circuit, internally or with other equipment or component, without soldering.

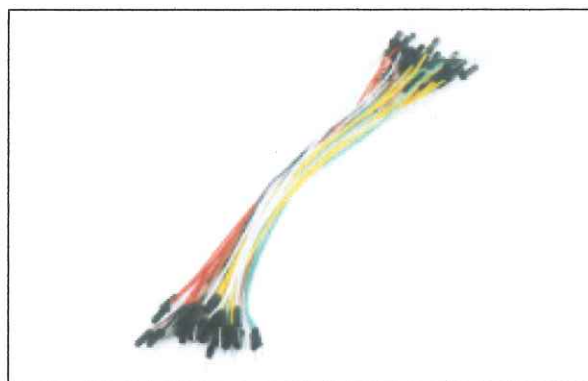


Figure 6 shows Jumper Wire