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# Autonomous Vacuum Cleaning Robot

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## Abstract

In recent years, robotic cleaners have taken major attention in robotics research due to their effectiveness in assisting humans in floor cleaning applications at homes, hotels, restaurants, offices, hospitals, workshops, warehouses and universities etc. Basically, robotic cleaners are distinguished on their cleaning expertise like floor mopping, dry vacuum cleaning etc. Some products are based on simple obstacle avoidance using infrared sensors while some utilize laser mapping technique. Each cleaning and operating mechanism of robotic floor cleaners 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. The main objective of this work is to provide a substantial solution to the problem of manufacturing robotic cleaner utilizing local resources while keeping it low costs.In this project we will use the power of Embedded Systems and Electronics to make our own robot which could help us in keeping our home or work place neat and tidy. This robot is simple four wheeled Vacuum Cleaner which could smartly avoid obstacles and vacuum the floor at the same time. The idea is inspired by the famous vacuum cleaner Robot Roomba**.**

*Keywords—cleaning robot; obstacle avoidance: rectangular path algorithm; sensors;*

## 1. INTRODUCTION

In recent years, robotic cleaners have taken major attention in robotics research due to their effectiveness in assisting humans in floor cleaning applications at homes, hotels, restaurants, offices, hospitals, workshops, warehouses and universities etc. Basically, robotic cleaners are distinguished on their cleaning expertise like floor mopping, dry vacuum cleaning etc. Some products are based on simple obstacle avoidance using infrared sensors while some utilize laser mapping technique.

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## 2. LITRATURE REVIEW

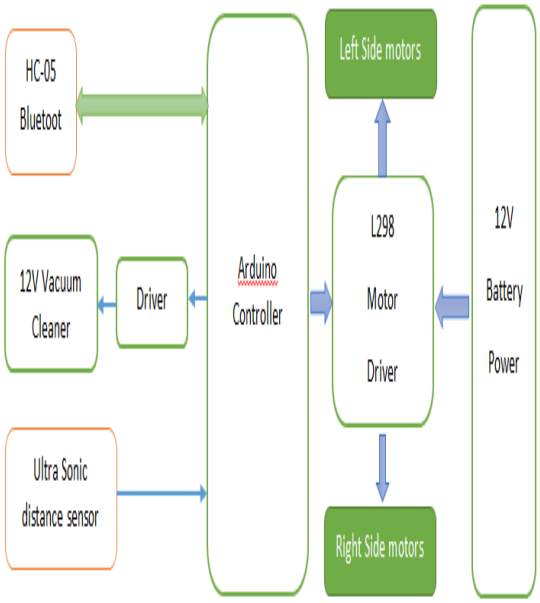
This chapter explain about the function of the main component that being uses to build the vacuum cleaner robot .This project also exposed on research to build the cleaner system that can vacuum the carpet and can clean the floor. The unwanted particle that lay on the floor will be brushed away the suck through a hole then filtered. Therefore, this method is very familiar for most of engineering student in this country where I believe it will bring a lot of challenge and creativity and I like to modify something that can become useful. This project is divided by two part which is vacuuming and cleaning system and controlling the movement of robot.

The literature review can give some rough ideas to help on developing the project successfully and be able to achieve the objectives that have been outlined. Before any development can take place, a research must be carried out on all the possible components that will be used in the autonomous robot. The internet is the place where detailed explanations on a few reference and terminologies of similar projects previously created by others can be found and there is no other place to easily get the data sheets of the components used. Besides of the internet resources, the thesis room in FKE also provides.

Other than that, the autonomous robot competitions themselves are also another good source of information. The information is very

useful and helpful to this project, especially only the issues such as microcontroller, mobile platform design, circuit layout and sensor placement. Below are some of the important theories that related to this project, such as IR reflection law that lead to line detection of the robot, LCD functions, basic idea of line following and maze solving theory, PMW, H-bridge used in motor driver and so forth. These theories should be fully understood before starting the project.

## 3. SYSTEM DESING



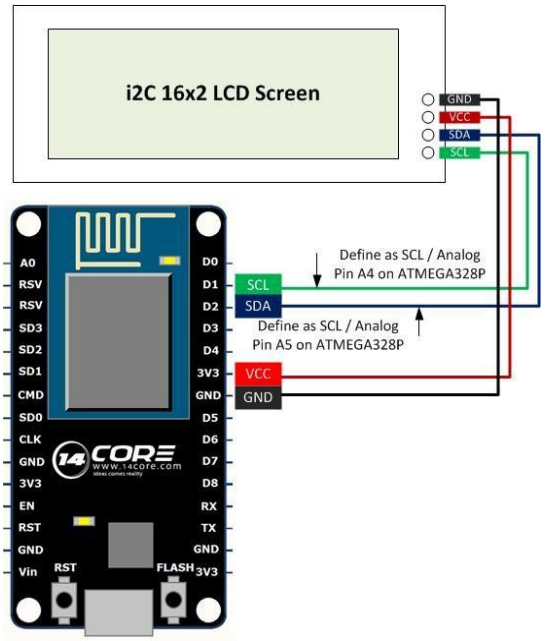

### *3.1 System Features*

1. It is an autonomous robot.
2. For controlling purpose we are using Bluetooth wireless technology.
3. This robot can be operated in Automatic mode or manual mode.
4. In Automatic mode it will clean randomly without any commands.
5. In manual mode it will follow user commands from Android application like, FORWORD, REVERSE, LEFT, RIGHT, STOP, START_VACUUM, STOP, and VACUUM.
6. This will also sense any obstacle in path and stop going in that path in manual mode, but in automatic mode it will try to go left and right or reverse.

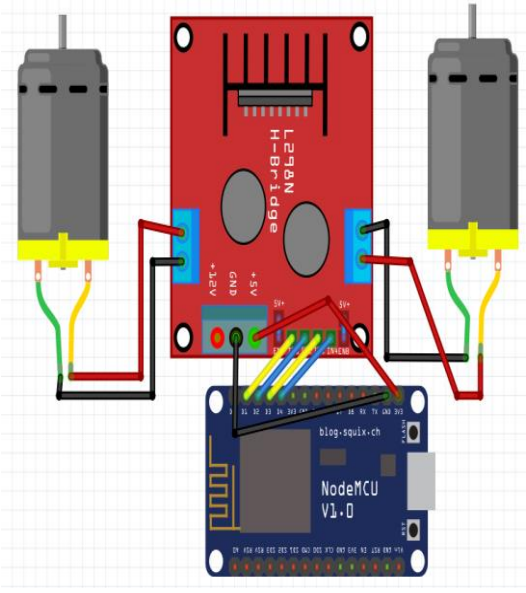
### *3.2 Circuit diagram*

#### *3.2.1 LCD interfacing With Node MCU*

- The **LCD's registers** from D0 to D7 and Vcc GND, RS, R/W pins will be connected to**I2C**.
- **GND** pin of I2C is connected Ground pin (**GND**) of the NodeMCU.
- **VCC** pin of I2C is connected **Vin** pin of the Node MCU. (Because we need to supply 5v to LCD)
- **SDA** pin of I2C is connected **D4** of the Node MCU.
- **SCL** pin of I2C is connected **D3** pin of the Node MCU.
- Before you get started with coding you need Arduino IDE.To download Arduino IDE and for Node MCU setup, you can check my previous instructacle.



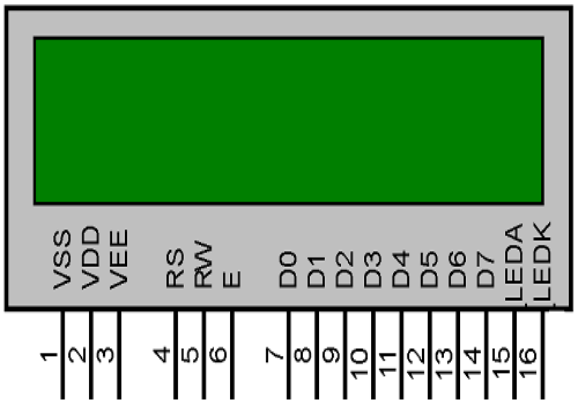

#### *3.2.2 Motor Driver Interfacing*



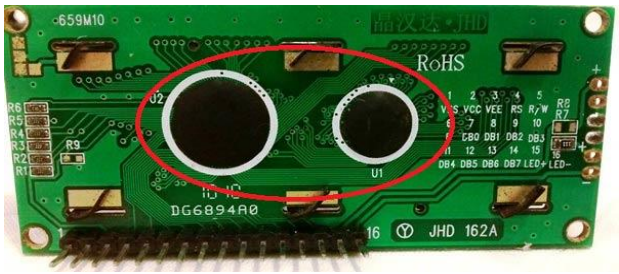
## 4. HARDWARE EXPLANATION

*4.1 16x2 LCD*

**16×2 LCD** is named so because; it has 16 Columns and 2 Rows. There are a lot of combinations available like, 8×1, 8×2, 10×2, 16×1, etc. But the most used one is the 16*2 LCD, hence we are using it here. All the above mentioned LCD display will have 16 Pins and the programming approach is also the same and hence the choice is left to you. Below is the Pinout and Pin Description of 16x2 LCD Module.




*4.2 What is this two black circle like things on the back of our LCD?*




These black circles consist of an interface IC and its associated components to help us use this LCD with the MCU. Because our LCD is a 16*2 Dot matrix LCD and so it will have (16*2=32) 32 characters in total and each character will be made of 5*8 Pixel Dots. A Single character with all its Pixels enabled is shown in the below picture.So Now, we know that each character has (5*8=40) 40 Pixels and for 32 Characters we will have (32*40) 1280 Pixels. Further, the LCD should also be instructed about the Position of the Pixels. It will be a hectic task to handle everything with the help of MCU, hence an **Interface IC like HD44780** is used, which is mounted on LCD Module itself. The function of this IC is to get the **Commands and Data** from the MCU and process them to display meaningful information onto our LCD Screen.

## 5 . RESULT

By using the wireless transmission module in a series port (802.11b),4 the user can monitor the robot's path and remotely manipulate the movements of the robot with a pc interface.In order to move forward in an unknown environment during the robot's operation, signals submitted from three kinds of infrared-ray-8 distance-detectors at the right, the left, and the front side sareessential. By calculating the data with a PIC18F452 micro controller, two DC motors10 can be controlled during edge-searching, obstacle-avoiding, and path searching.

For the auto-vacuuming mode, two kinds of algorithms in12 path-searching are developed in this paper — one is the right-side edge searching and obstacle-avoiding, the other is the S-type vacuuming and14 obstacle-avoiding. A prototype robot has been manufactured and tested. In addition, the system program for plotting the robot's path has been16 developed. By calculating data submitted from a micro controller and an error compensator, the immediate path of a running robot is shown on a18 pc monitor.

## 6 . CONCLUTION

In this paper, an interactive robot has been presented. The preliminary goals of our research (a vacuuming function, plotting and monitoring 22 a path, and manipulation and control from a pc server) have been achieved. Some aspects of our research which can be improved for an24 interactive robot are proposed below

(1) If there is an infrared light already in the environment, the infra-red ray-distance-detector can be interfered with and errors might occur. To deal with this problem, an image guiding system in the robot is suggested.

(2) A rotating angle calculated by the angle feedback system is used in this research. To increase its accuracy, an electrical compass with a6 feedback system is recommended.

As suggested in the first item (image guiding system), although the robotics some times not in the vacuuming mode, the image guiding system can be use dasamonitoring system which will provide a security function.

## 7 . REFERENCES

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