

Robotic Vacuum Cleaner Using Arduino with wifi

P. B. Jarande.

Assistant Professor, Dept of EXTC
SSPM's College of Engineering Kankavli
pravin.jarande@yahoo.co.in

S. P. Murakar.

UG Scholar, Dept of EXTC
SSPM's College of Engineering Kankavli
shreyashmurakar@gmail.com

N. S. Vast.

UG Scholar, Dept of EXTC
SSPM's College of Engineering Kankavli
neha.vast12@gmail.com

N. P. Ubale.

UG Scholar, Dept of EXTC
SSPM's College of Engineering Kankavli
nikitapubale16@gmail.com

S. S. Saraf.

UG Scholar, Dept of EXTC
SSPM's College of Engineering Kankavli
siddheshsara@gmail.com

Abstract— In last few years, robotic cleaners have taken major attention in robotics research due to their effectiveness to helping humans or cleaning applications at various areas in society. Generally, robotic cleaners are differentiating on their cleaning expertise. Some products are based on obstacle avoidance using infrared sensors while some uses laser mapping technique. Every cleaning mechanism of robotic cleaners has its own pros and cons. Robots uses 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. The prime objective of this work is to provide a substantial solution to the problem of manufacturing robotic cleaner utilizing local resources while keeping.

Keywords— Robotics vacuum cleaner, obstacles avoidance, assisting human.

I. INTRODUCTION

Household cleaning is a repetitive task carried out by number of people every day. Hence there is a need of bringing revolution in the area of science and technologies, which could help easily in repetitive tasks which we perform daily and also giving consideration to the intensity of the labor required and improving qualities to its optimum level. Existing vacuum cleaner systems equipped with limited suction power. They are costly, complex. Vacuum cleaner was manual. There are already several big bulky cleaning machines available in the market which is capable of cleaning the remote area which is not in the reach. The need of designing new technology based vacuum cleaner which could overcome the short coming of existing vacuum cleaner also provide a new facilities of vacuuming sanitizing using UV light. They need to be work manually because they were not automated. Vacuuming is one of the most hated chores in existence. It is laborious, monotonous and

boring and in today's fast-paced society it is simply too time consuming. For many peoples buying robot vacuum is a wonderful way to clean their home without devoting large amount of time and energy. Robotics vacuum are small usually small shaped appliances that help to clean your Home. They are available every price point. With the prices are decreasing as the technology continues to develop.

II. REVIEW OF LITERATURE

A robotic vacuum cleaner is an autonomous electronic device that is intelligently pro-gramed to clean a specific area through a vacuum cleaning assembly. Vacuum cleaner which could smartly avoid obstacles .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. The idea is inspired by the famous vacuum cleaner Robot \ Roomba". The vacuum Cleaner is the most important part in placement of Robot. It has to be placed at tilted angle, so that it can provide proper vacuum action. Once you power on the robot the vacuum is also turned on [1].

The arduino is the main processing unit of the robot out of 14 available digital input output pins; 6pins are used in this project design [2].

Three numbers of IR sensors connected for obstacle detection at front, left and right side of robot which is connected to pin number 25, 26 and 27th of arduino uno[3].

The L293D is a 16 pin motor driver IC pin 1 and 9 are enable pin. They are connected to VCC. Pin 2 and 7 are control input pin of motor driver IC L293D for 1st motor. They are connected to pin no 9 and 8 of arduino respectively. Similarly pin no 10 and 15 are control input to 2 motors. They are connected to pin no 4 and 3. and pin no

4, 5, 12, 13 are ground pin of L293D are connected to arduino ground pin [4].

First motor is consider as left wheel is connected across pin no 3 and 6 of L293D. Second motor which act as right wheel is connected to the 11th and 14th pin of L293D .16th pin of L293D is VCC is given to 5V of supply of arduino [5].

III. PROPOSED METHODOLOGY

When the robot is switched ON, both the motors of robot will run normally and the robot moves forward. During this time the proximity (IR) sensor continuously calculate the distance between the robot and the reactive surface. This information is processed by the arduino; if the distance between the robot and the obstacle is less than 3 cm the left wheel motor is reversed in direction and right wheel motor operate normally. This will rotate the robot towards right. This rotation continues until the distance between the robot and obstacle is greater than 3cm.This process continues forever and the robots keeps on moving without hitting any obstacles The motors with motor driver IC (L293D) which will be able to supply 1A supply current hence this driver will get the information from arduino and makes the motor work as desire.

IV. WORKING

Robotic vacuum cleaner works on the principle of Internet of things. This wheeled vacuum cleaner is runed by wheel by using DC Geared motor. When the switch is power on from website, the dust Sucker motor and Wheels attached motor automatically operates and the movements for the robotic vacuum cleaner.

The user can operate the vacuum cleaner by having a direct click at particular website (i.e. www.adafruit.io) account id connected to the vaccum cleaner. The on/off click from the user is automatically attended by the server connected to the vacuum cleaner by having an MQTT (Message Queuing Telemetry Transport) client ID. This is done using wi-fi module attached to the robotic vacuum cleaner.

Thus we get a accurate movement for vacuum cleaner on our desired path. There are three IR proximity sensors connected at the top of the vacuum cleaner which is fitted at the front, right and left side. Each sensor detects the obstacle from three sides of robot.

Once the Robot gets ON from the Server side the Wi-Fi modle sends command to the Atmega328 controller to start the robot. Initially the robot starts running in forward direction. Its direction changes according to the obstacle detected by IR sensor. It has beautifully designed algorithm to handle obstacle and move to desired path and clean the floor.

Along with cleaning it also checks the battery status of the robot and accordingly sends the battery status to the MQTT server, So that a user can easily know the battery status even if he or she is far away (in any country) from the robot.

The block diagram of robotic vacuum cleaner using arduino with wifi is as shown in figure 1.

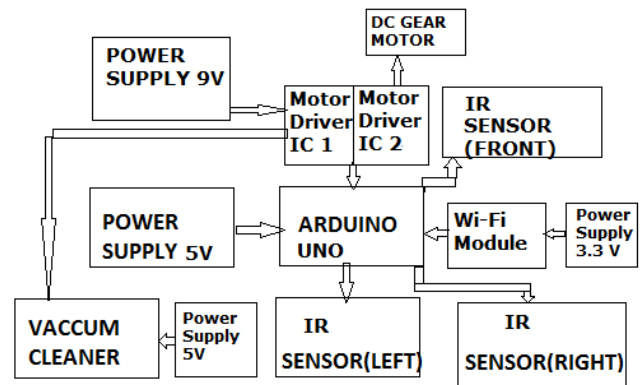


Figure 1 Block diagram of robotic vacuum cleaner

V. TECHNICAL DETAILS OF ROBOT

The technical details of robot is as following
It is described according to block diagram shown in figure

a. Arduino Uno (ATmega 328)

The specification of Arduino uno is as follows

- Microcontroller board based on ATmega 328
- 14 digital input and output pin
- USB power connection
- Include PWM, analog input, reset pin.[6,7,8]

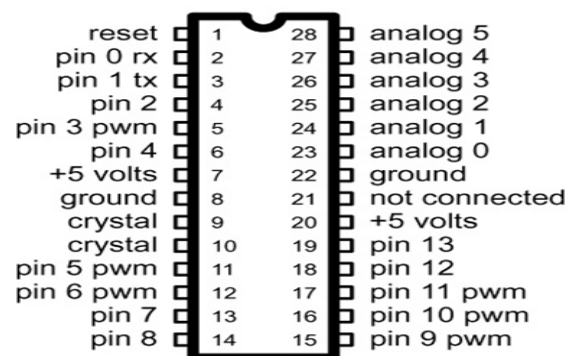


Figure 1 Pin diagram of ATmega 328

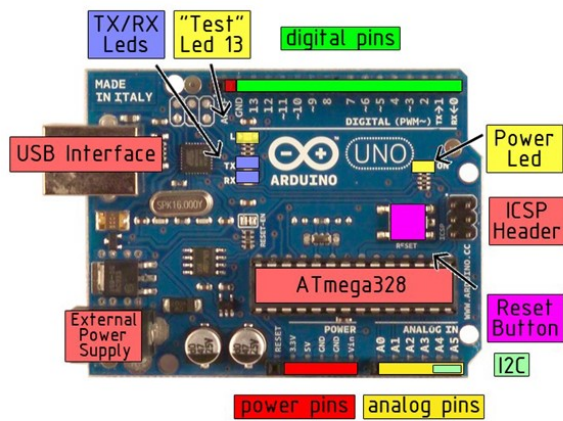


Figure 2 Picture of Arduino Uno ATmega 328

b. Motor driver IC(L293D)

Two motor driver IC's are used one motor driver IC is used to operate two wheels of robot and second motor driver IC is used to operate motor of vacuum cleaner which is connected at bottom of robot [9].

The motor driver IC pin diagram is as shown in figure 3.

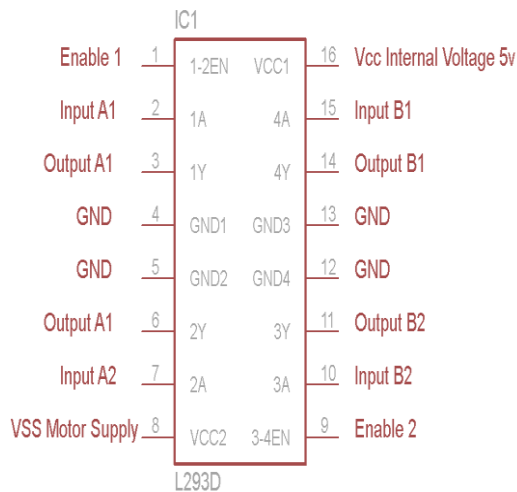


Figure 3. Pin diagram of motor driver IC L293D

c. DC gear Motor

The specification of DC gear Motor is as follows

- 100 rpm side shaft
- 37 mm diameter
- 5V DC supply
- Torque 500 gm [10]

The Picture of DC gear motor is as shown in figure 4.



Figure 4. Picture of DC gear motor

d. IR (Proximity) sensor

The IR sensor obstacle Detection module pin is as shown in figure 5.

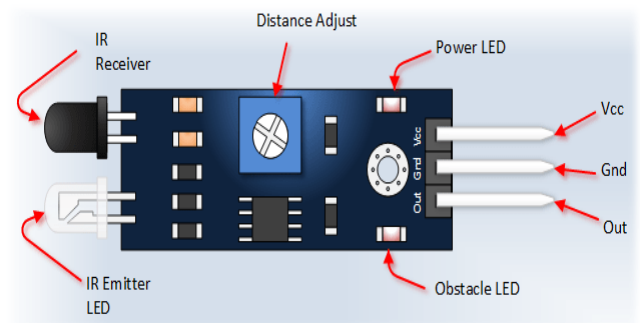


Figure 5. IR sensor obstacle Detection module pin

The specification of IR sensor is as follows:-

There are three number of sensors are used (Left, right and front)

- Transmitter – IR LED, Receiver- Photo diode
- Vcc =5 V dc supply input
- Gnd- Ground input
- Out = output that goes low when obstacle is in range
- Distance Adjust- Adjust detection distance

- Emitting angle approximately $20-60^{\circ}$
- Obstacle detection distance – 3cm

VI. DESIGN OF ROBOT

The design of robot is as shown in following circuit diagram

e. Wi-Fi Module (ESP8266EX)

The picture of wi-fi module ESP8266EX is as shown in figure 6.

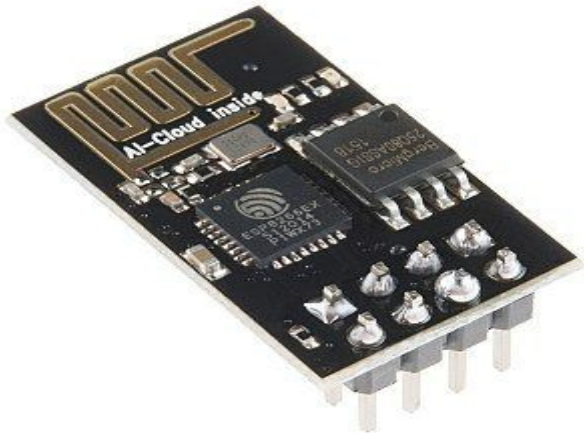


Figure 6. Picture of wi-fi module ESP8266EX

The specification of wi-fi module ESP8266EX is as follows:-

- Type 32 bit RISC microcontroller
- CPU clock frequency- 80MHz
- Memory- 32+80 KiB
- Input- 16 GPIO pin
- Power – 3.3V DC
- IEEE 802.11 b/g/n
- Wi-Fi Direct(P2P) Soft-AP [11]

f. Power supply

The specification of required four DC power suppl is as follows:-

- For arduino uno = 5V DC
- For Motor Driver = 9V DC
- For Wifi Module = 3.3 V DC
- For proximity IR sensor = 5V DC

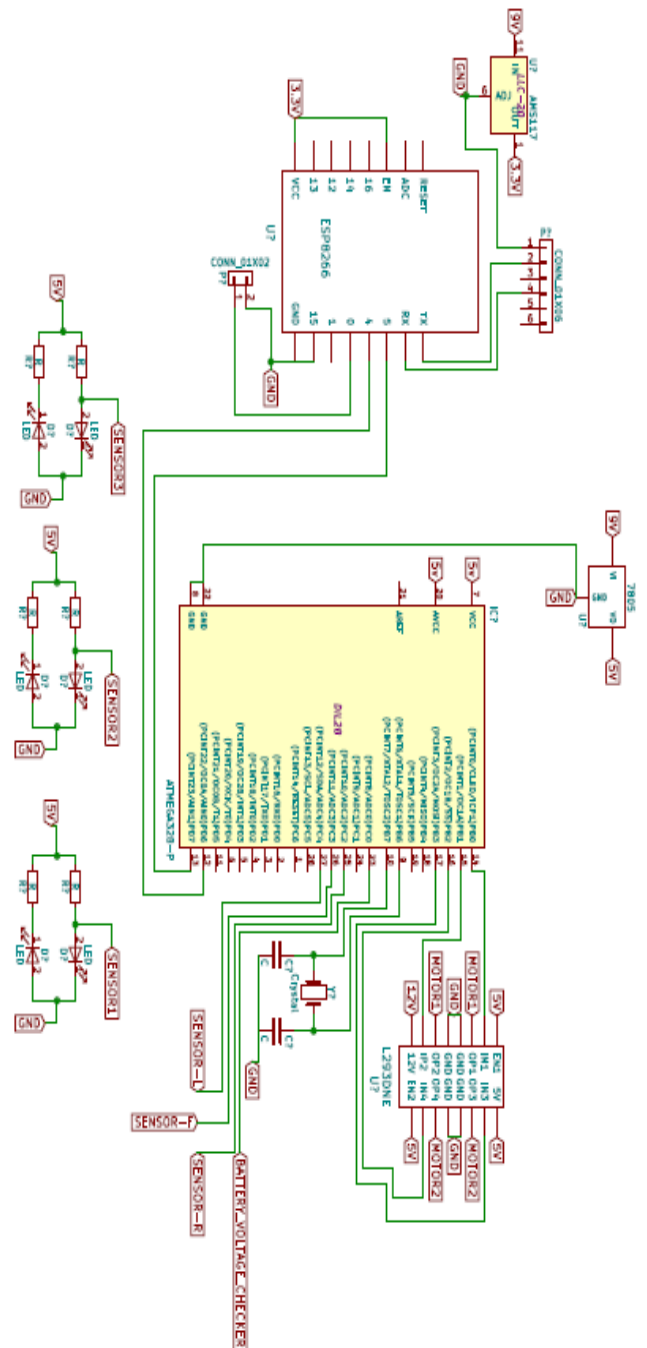


Figure 7. Design circuit of robotic vacuum cleaner using arduino with wifi

VII. FLOW CHART

The flow chart of the program written in arduino uno editor is as shown in following figure 8

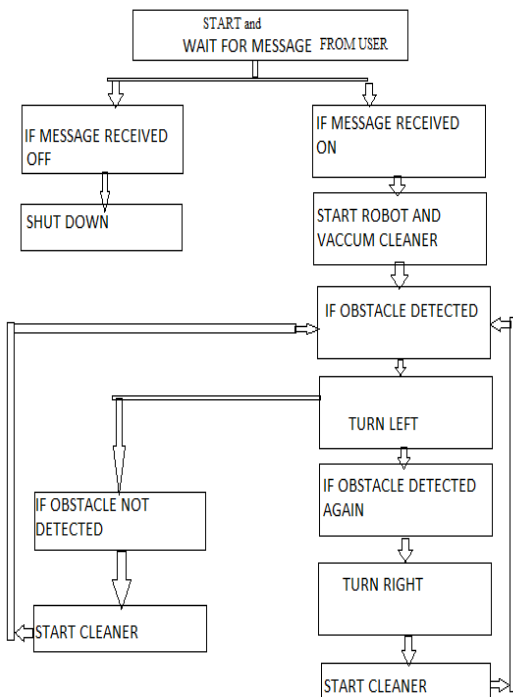


Figure 8.Flow Chart

The user can start the vacuum cleaner by having a direct click at www.adafruit.io account id connected to the vacuum cleaner. This is done using wi-fi module attached to the robotic vacuum cleaner.

When message is received from server robot and vacuum cleaner will start.

When obstacle is detected then robot will move left then if obstacle is again detected then robot will move right and then vacuum cleaner will start. while cleaning when robot detect the obstacle then it again move left and so on.

In this way robotic vacuum cleaner will work which is shown in above flow chart.

VIII. TESTING AND RESULT

The testing of the robot is done on rough surface as well as plain surface and test result shows that it clean the surface. Robot is as shown in following figure 9

Test result shows that robot can be used at public places. As well as railway station, bus stations, crowded areas. Robotic vacuum cleaner using arduino with wifi is helpful for people who are busy and don't have enough time.

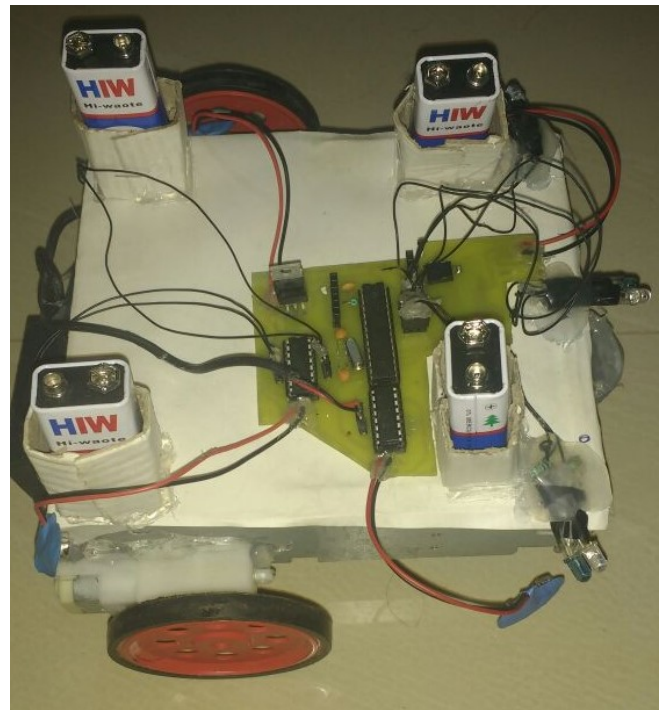


Figure 9.Robotic vacuum cleaner using arduino with wifi

IX. CONCLUSION

There are different types of robotic vacuum cleaner are available now a days. But all these systems are useless without user cooperation also consume a lot of time. So we have designed this system which is automatic and operate from far distance using wifi.

X. REFERENCES

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