

# Automatic Table Cleaning Robot



S. J. Shanmugavel, L. Siva Balaji, P. Siva Sankar, K. Subash, K. Gowthami

**Abstract** – In cities mostly husband and wife are working to leads their day to day life. Generally they are having irregular and long working times. Due to long working time they may not able to do their house works properly. So in this paper, to reduce part of the work of couples at home, an autonomous robot is proposed to clean the table automatically. Nowadays robots are involved in most of the activities in which human cannot be involved and also involved in activities which human can perform. An autonomous device which performs cleaning operation based on the commands received from the controller. It can do sucking and mopping tasks and obstacle detection duties on the table. Sensors are used to avoid the robot dropping down from the table. Sensors and motors are connected to the input/output ports of the controller. Robot roams around the table, if any obstacles available on the table it sucks and spray water to clean the surface. Wiper based wheels are attached with the robot to remove dust on the surface.

**Index Terms:** Arduino Mega, Ultrasonic sensor, L293D Motor driver, Motors, Power supply.

## I. INTRODUCTION

We have designed a hygienic “AUTOMATIC TABLE CLEANING ROBOT” for table cleaning purpose on hotels, schools, colleges, industries, hospitals and also for houses where many tables are used, Hence it is difficult to clean and also cleaning process will take more time. It is also useful for aged people. We have provided two cleaning wheel in front of the robot. They are connected in anti-parallel to each other which will make assure that the robot will not deviate from the path and keep the cleaning process correctly. An ultrasonic sensor is placed on the front middle and somewhat in front of the cleaning wheels. It will make sense the robot that is at the edge of the table. It can avoid cleaning the wastes with hand and helps to be hygienic for the workers, reduces the need of more workers and make pleasant feel for the customers and people. This paper discuss about a floor cleaner robot based on Arduino MEGA. This autonomous robot can perform mope and cleaning function. Ultrasonic sensor is used to sense the obstacles.

Revised Manuscript Received on March 30, 2020.

\* Correspondence Author

**S. J. Shanmugavel\***, currently pursuing bachelor degree program in Electrical and Electronics Engineering in National Engineering College, India, E-mail: [1613095@nec.edu.in](mailto:1613095@nec.edu.in)

**L. Siva Balaji**, currently pursuing bachelor degree program in Electrical and Electronics Engineering in National Engineering College, India, E-mail: [1613095@nec.edu.in](mailto:1613095@nec.edu.in)

**P. Siva Sankar**, currently pursuing bachelor degree program in Electrical and Electronics Engineering in National Engineering College, India, E-mail: [1613095@nec.edu.in](mailto:1613095@nec.edu.in)

**K. Subash**, is currently pursuing bachelor degree program in Electrical and Electronics Engineering in National Engineering College, India, E-mail: [1613095@nec.edu.in](mailto:1613095@nec.edu.in)

**K. Gowthami**, is currently working as an Assistant Professor in department of Electrical and Electronics Engineering in National Engineering College, India, E-mail: [gowthami@nec.edu.in](mailto:gowthami@nec.edu.in)

© The Authors. Published by Blue Eyes Intelligence Engineering and Sciences Publication (BEIESP). This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

If any obstacle found in a robotic path, then the robot take diversion and cleans the remaining surface. Automatic water sprayer attached on top of the system which automatically supplies the water for cleaning operation. In future, it is planned to add extra features with this cleaning robot like the robot is made to control with mobile by using node MCU and there will be two options; they are manual and auto mode. In auto mode, it will be programmed to clean tables automatically. In manual mode, it will be operated by mobile that can be used to both table and floor.

Additionally, we are going to add one wiper on the front or small size vacuum cleaner for the solid particles sucking purpose. Another idea for future work is to use artificial intelligent technique to recognize the difference between useful objects and unwanted particles on the table. After the process of separation of useful object and unwanted particles, the robot will pick them and place the useful object and unwanted particle in different containers and continue the cleaning process. This will definitely make some revolution on future products.

## II. LITERATURE SURVEY

Referring various research papers, got an idea about the floor cleaning robots and implemented the ideas into this work. The reviewed literature papers are discussed below,

An autonomous robot is proposed for floor cleaning in [2]. Transmitter operation is performed using the android application which was developed in mobile. Based on the commands received from the android app the arduino performs some controlling operation.

A robot was used for floor cleaning and robot kinematics was discussed in paper [7]. Air ring sensor and optical sensors was helps robot to avoid obstacles. To increase the efficiency of cleaning after completion of longitudinal cleaning the robot will clean in lateral way. While lateral cleaning the robot does not turn right or left.

The robot was named as sweepy in paper [3]. Water pump and vacuum cleaner was attached with the robot to clean the surface. Ultrasonic sensor was proposed to detect an obstacle. Push button is provided to select manual or automatic operation of cleaning. Drier was fixed in front of the robot to dry the cleaned surface.

Algorithm for path planning was proposed in paper [8] to cover the entire surface. Arm processor was used for controlling purpose and FPGA based Virtex-4 was used for signal processing purpose in the proposed work.

## III. BLOCK DIAGRAM

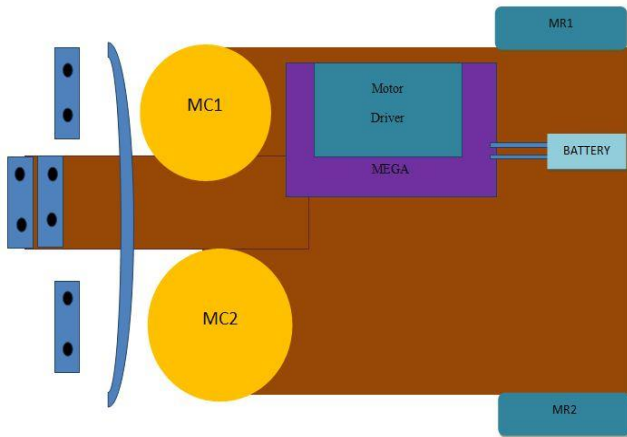


Fig.1 Block Diagram

## IV. ARDUINO MEGA

Arduino microcontroller is proposed to control the devices used for the design of robot. The microcontroller is having I/O pins where fourteen numbers of pins can be used for pulse width modulation, analog connections are sixteen, four pins for serial communication. The controller can be connected with the computer through USB and it is having 5V power supply pin and also has ground pins. 50, 51, 52, 53 pins helps to serial peripheral interface communication. LED at pin 13 used to pin value indication. AREF pin for reference voltage.

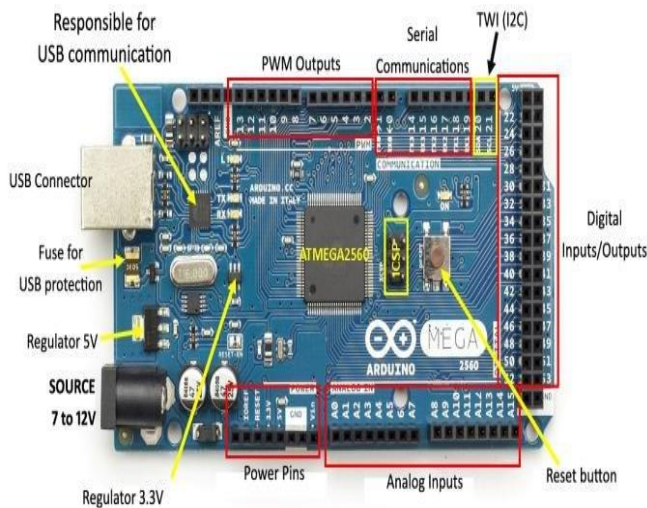


Fig.2 Arduino Mega

## V. ULTRA SONIC SENSOR CIRCUIT

Ultrasonic sensor is a module for measuring distance. It consists of power supply, GND, Echo pin and trigger pin. It is mostly used in applications which involve distance calculation. It is having two main parts in its structure such as receiver and transmitter. The following formula representing distance calculation,

$$DISTANCE = SPEED \times TIME.$$

Generally ultra sonic sensor sends ultrasonic waves. If that waves falls on any object or obstacle, then the signals get reflected from the obstacles. Based on the time taken to receive the reflection signal the ultrasonic sensor calculates the distance of the obstacle. This sensor plays major role in our project. We have placed it in the front middle of the robot. And it is placed as facing downwards for sensing the distance of the table. To avoid the robot to getting down from the table, sensor is placed in front of the device to sense the distance of the table that is considered as obstacle. Whenever the robot comes to the edges of the table it will gives the distance data as digital signal to the Arduino. Additional three Ultrasonic sensors are attached for the obstacle detection and make the cleaning path on different direction.

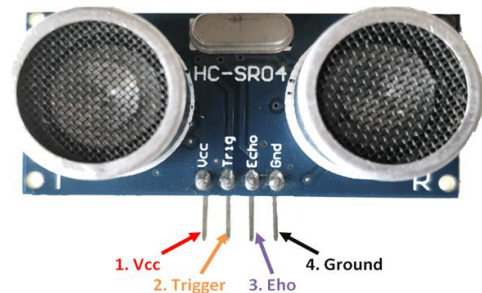


Fig.3 Ultrasonic Sensor

## VI. MOTOR DRIVER

The controller cannot be directly connected to the motor because the controller is not able to supply enough current to drive the motor and also another reason is the back emf of the motor may damage the controller. So in order eliminate those two drawbacks motor driver is used. Here two wheel DC motors are connected in the terminals M1 and M2 of the driver. Then, the cleaning wheels are connected anti-parallel to each other in the terminal M4 of the driver. Because, they will rotate in opposite direction that helps to avoid deviation from the path by compensate the effect of each other. Enable pin 1-2 HIGH will work the left side wheel. Current at Input 1 will be high. Output 2 will connect to one side of motor. 4, 5 are grounded pins. Input 2 will high the current flow. Input 2 will high the current flow. Enable 3-4 high will help to work the right side. Output 3 will connected to the another motor terminal. 12, 13 are ground pins. Other pins will works as per the previous respective pins.

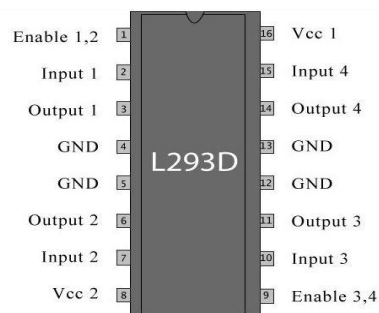


Fig.4 Motor Driver L293D



**VII. 12V DC MOTOR**

**A. 30RPM DC Motor**

These motors are used as wheel motor for proposed product. Because of 30rpm, the wheel can overcome small obstacles and roll over them.

**B. 150rpm DC Motor**

. 150 rpm DC motors are mostly preferred for simple robot function because of its low cost. The minimum and maximum supply voltage may given to this motor is in the range of 2V and 12V respectively. These motors are used as cleaning wheels in our product. Instead of using 30rpm, we have used 150rpm motor for little bit fast rotation for cleaning purpose.

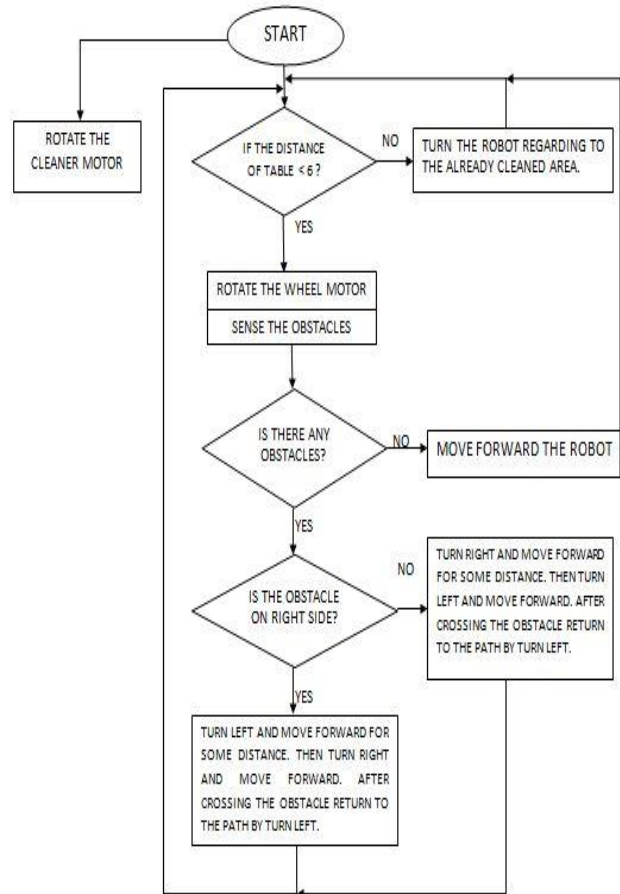


**Fig.5 DC Motor**

**VIII. WORKING OF THE ROBOT**

In the automatic table cleaner, Arduino and Ultrasonic sensor, motor driver and motors are used to control the robot movement. 5v battery power is connected to the motor driver. The cleaning wheels are connected anti-parallel to each other on M4 terminal of driver. The controller gives forward command for M4 terminal always for continuous cleaning of the cleaner wheels. The program written and is uploaded in controller with the help of integrated development environment. It reads the output value of the ultrasonic sensor continuously. According to the program uploaded, that gives command to the driver continuously for the robot movement. While the output of the ultrasonic sensor less than 6cm, it gives the command to the driver forward movement to M1 and M2. By the forward command, wheels will move forward. This forward movement is continuously carried out by the arduino without any delay time. Whenever the robot reaches the edges of the table, the distance measurement sensor senses the detachment then gives output to the controller. It reads the output of the ultrasonic sensor, while the distance exceeds 6cm, command is given to the driver differs to turn the robot. It gives forward command to M1 terminal and backward command to M2 terminal. By giving alternative command to the wheels, they rotates opposite to turn the robot. 8second delay time is provided for complete turning. After the delay time, the process of reading the ultrasonic sensor output and the continuous movement of the robot is repeated. If any obstacles detected by the any of the three Ultrasonic sensors in the front of the robot, that will alert the controller. Then it will change the direction of path of the robot according to the given program.

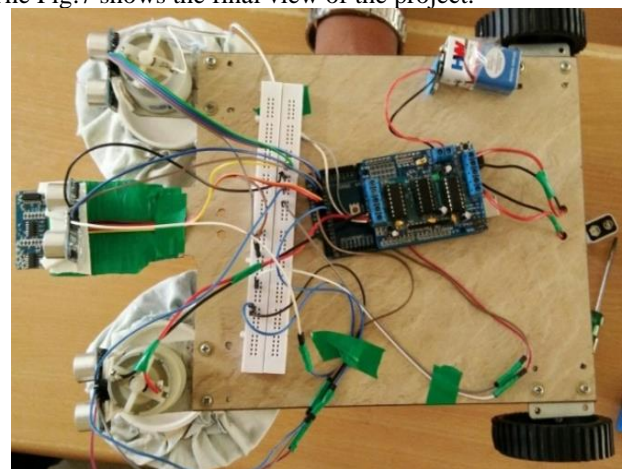
**IX. FLOW CHART**



**Fig.6 Flow Chart**

**X. EXPERIMENTAL SETUP AND RESULTS**

The system consists of arduino mega, dc motors, ultrasonic sensors, motor driver, and battery. As for the model which is a grouping of both hardware and software and the result of the program had no divergence with the expected output. The result was that the sensor checks the distance and cleans automatically without falling from the table. The Fig.7 shows the final view of the project.



**Fig.7 Automatic Table Cleaning Robot**

## XI. CONCLUSION

The proposed product is built with remoteness measurement sensor which measures detachment between table & floor, if it is higher than 6cm, and then the cleaner motor should turn right appropriately. So that the robot will not fall down from the table. If it detects other objects on the table, it will turn automatically and then move appropriately. The proposed product is more helpful to the aged people, hotels and schools or colleges for hygienic maintenance of tables or floors. Definitely the cost spent for labours are reduced by this product.



**Subash. K.** is pursuing B.E. final year Electrical and Electronics Engineering in National Engineering College. Field of interest is Embedded Systems.



**Gowthami.K** Pursuing her doctorate in Electrical and Electronics Engineering from Anna University, Chennai. Currently working as an Assistant Professor in Electrical and Electronics Engineering department of National Engineering College, India. She has five international conferences publications. Currently, her research interest is embedded systems.

## REFERENCES

1. K ArunaManjusha, S Monika, "Design and Implementation of Smart Floor Cleaning Robot using Android App", International Journal of Innovative Technology and Exploring Engineering (IJITEE) ISSN: 2278-3075, Volume-8 Issue-4S2 March, 2019.
2. T.S.Aravinth, S A. Vimala, S. Sathiyagopika, Birundha Devi, S.Manikandan, "Microcontroller Based Floor Cleaning Robot" (International Journal of Innovative Technology and Exploring Engineering (IJITEE)ISSN: 2278-3075, Volume-8 Issue-4S, February 2019.
3. Sneha.R, Varsha.P.H, Rohan.P.S, Lavanya.V, Meghana.K, , "Sweepy – The Smart Floor Cleaner", IEEE International Conference on Design Innovations for 3cs compute communicate control, 2018.
4. Naman Aggarwal, Prof.Ms. Swati Pawar, Akshay Mahalkar, Anshul Mishra, Priyusha Chaudhari, "Review Paper Based on Cleaning Robot" by Electronics and Telecommunication Department, Savitribai Phule Pune University, Sandip Institute of Technology and Research centre (IJRE), Nashik-422005. Vol. 03 No. 05<sup>th</sup>, May 2016.
5. Ms.Renu Mary George, Rohith M.S, Ajith Thomas, JeesonCheriyann, Febin Jolly, "An Advanced Mobile Robot for FloorCleaning" Dept. of EEE, Mar Baselios Institute of Technology and Science, Nellimattom, Kerala, India. Assistant Professor, Dept. of EEE, Mar Baselios Institute of Technology and Science,Nellimattom, Kerala, India. ISSN: 2320 – 3765, Vol. 5, Special Issue 3, March 2016.
6. JyotiMorbale, Manya Jain, Pankaj Singh Rawat, Assist. Prof. "Automatic Floor Cleaner", BVDUCOE, Pune, Maharashtra, Indi ISSN: 2395 -0056 **Volume:** 04 Issue: 04<sup>th</sup> Apr -2017.
7. Dawei Zhou, XueshanGao, Yan Wang, Guangliang Men, and Kejie Li "A Floor Cleaning Robot Using Swedish Wheels" byIntelligent Robotics Institute, Beijing Institute of Technology, Beijing, China and Koki Kikuchi Department of Advanced Robotics, Chiba Institute of Technology, Narashino, Japan, 2007 IEEE International Conference on Robotics and BiomimeticsDecember 15 -18, 2007, Sanya, China.
8. GuangZhou, China, Guangzhi Dai, South ChinaUniversity of Technology, "Design on Measurement and Control System of Cleaning Robot Based on Sensor Array detection" by. (Special Issue 1 ThB8-2)IEEE International Conference on Control and Automation ThB8-2 Guangzhou, CHINA - May 30 to June 1, 2007.

## AUTHORS PROFILE



**Shanmugavel. S. J** is pursuing bachelor degree in Electrical and Electronics Engineering in National Engineering College. His area of interest is Embedded Systems.



**Siva Balaji. L.** is pursuing B.E.final year Electrical and Electronics Engineering in National Engineering College. His interest is Embedded Systems.



**Siva Sankar. P.** is pursuing bachelor degree in Electrical and Electronics Engineering in National Engineering College. Interested domain area is Embedded Systems.