

DESIGN & FABRICARTION OF AUTOMATIC FLOOR CLEANING MACHINE

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ABSTRACT

In the present day scenario all the members of family are busy with their work and are not getting proper time to clean the house. The cleaning robot helps to clean and mop the floor. This is done by simply pressing a switch and the robot does the work. This also cuts down the labor used in factories for cleaning floor. Above being the case, motivated for the design and development of an automatic cleaning and mopping robot that does all the cleaning and mopping work with a simple press of a button. This robot can be controlled manually with the help of a mobile Bluetooth. The main moto of the project is to make this affordable and suitable for the Indian users and factories. The development of the robot starts with the design of a simple and most effective chassis for the robot which is a very important part as it has to carry all the weight on the robot. The electronics part where, the type of motor and its specification that should be used to run the bot , the sensors to be used, the microcontroller, the motor drivers, the wheels and other electronic components to be used on the robot are decided. Further, the assembling of the components will be done and finally testing and calibrating the device. A robot which is capable of efficient dust cleaning and moping of the floor of a given room is the main aim of the robot. It is aimed to make the robot economic and feasible for the economic class society. The target time of operation of the robot is one hour. The developed robot will be useful for the household application and industries. This helps to keep the work space and house clean without the physical labor. Also the device will clean the room with a single switch of button. Automatic floor cleaner is an automated machine that facilitates the user to keep their place clean and hygienic. Many industries are working in the automation field to make autonomous cleaners. This paper deals with the development of automatic floor cleaner. Now a day's major emphasis is given on the field of robotics for decreasing human efforts.

Keyword: *Cleaning Robot, Mopping Robot, Automatic Robot.*

INTRODUCTION

Robots are machines which are programmable and are able to carry out complex tasks with minimal human interventions. Robots find applications on many domains, even for house hold applications. Robots for domestic application have been rising. Vacuum cleaning robots are especially famous. Among various robots present in the world only some robots can be used especially for doing the house hold chores of man. Among those robots, one special kind of robot that is very use ful for everyone is cleaning and mopping robot. A simple automatic robot that uses some prefixed algorithms and programs to clean the specified area is called a cleaning robot. The main use of this robot is to reduce the human interaction in the cleaning process which can be a time taking process. These robots can be used anywhere i.e., in offices, houses, industries etc. These robots can be activated with the press of a single button or can be pre-set to activate at a particular time. There are many successful products in the market. The leading products are IRobot Roomba, Riming Smart Vacuum Cleaners Intelligent Automatic Sweeping Clean Robots, Excipient Ready Maid Robotic Vacuum Cleaner and many more. For cleaning the houses, offices, streets, industries we mostly use the broom. But by using broom some health issue can occur like skin disease, back pain etc. It also requires more mankind power and time. Hence now in present days as technology is growing in every field, we also use robots for cleaning purpose. But cleaning robots are very costly and only some of them give facility of dry cleaning as well as wet cleaning. In India for houses cleaning robots are not used because a normal person cannot afford it due to high cost. In India, robots are used for street cleaning, railway station and airport cleaning which are controlled manually. In this paper, we are designing a fully automatic floor cleaner. which is capable of wet cleaning as well as dry cleaning. In this, we also use UV lamp for germ sterilization by which we can avoid acid or other hazardous liquid. For mapping of room, we use different technology. But here we use IR sensor for edge detection and obstacle detection. In this project we also use Arduino UNO microcontroller. By this project, we tried to reduce the cost of mopping robot as compare with other mopping robot.

LITRETURE SURVEY

1. AKASH NAG TODE [2017] Solar operated floor cleaning machine. He had made a project on cleaning system based on solar power. For this he has used PV Panel which convert particle of energy (photons) into electricity. He use this clean energy to power his cleaning machine”.
2. MRANJIT KUMAR [2016] The regular floor cleaning machines is most generally utilized as a part of airplane terminalstages,railroadstages,healingcenters,Transportstands,andshoppingcenters and in numerous other business places. These gadgets require an electrical vitality for its Activity and not easy to use. In India, particularly in summer, there is control emergency and the vast majority of the floor cleaning Machine isn't utilized successfully because of this issue, especially in transport stands. In this work, demonstrating and investigation Of the floor cleaning machine was finished utilizing appropriate financially accessible programming.
3. SANDEEP. J. MESHRAM ET AL [2016] Design and Development of Tricycle Operated Street Cleaning

Machine – They developed the street cleaning machine by tricycle operated. In this research article .He framed a model especially for rural area. He concluded that the cleaning is less effective in streets.

4. MOHSEN AZADBAKHT ETAL [2014] Design and fabrication of a tractor powered leaves collector machine equipped with suction-blower system. The authors explained about the fabrication of leaves collector machine by tractor powered blower. He has frame the machine by using chassis, pump, blower, gearbox, hydraulic jack. They concluded total power consumption of that machine is around 14634 W which can cover up to 20m range in distance.

EXPERIMENTAL PROCEDURE

I) Making of chassis

For chassis build we have to be consider the material we will used to build chassis that should be light,tough , & reliable to use. Properties of the material should be water resistance, high toughness, tearless material like polycarbonate or mica sheet. Also the material is cost effective & easily available in everywhere. The second item we used here is nut & bolt if diameter 10mm for joining the sheet each other. We cut the polycarbonate sheet into 36x26(LXW) RATIO and makes 4 drill hole at 4 corner of sheet in such a way that the bolt should be perfectly insert with the hole. Then we join the two sheet at the distance of 6cm to 7cm apart from each other . For protecting the inside micro components we used acrylic sheet to embedded 4 side of the sheet which is transparent easy to visualize whether all the components should be working properly or not. The length and width of the acrylic sheet is 6cmx26cm(x2) at one side and other 2 side is 6cmx36(x2) at other side of the body. For motor installment we used 4 metallic clamps to hold the motor .the clamps are drilled and fitted with the nut and bolt.

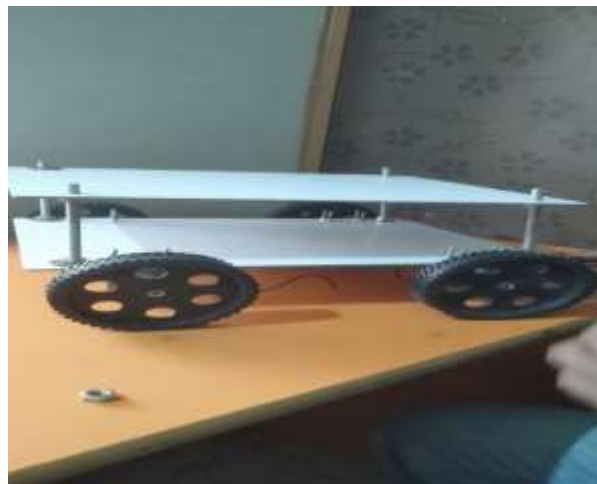


Fig: Frame

Design of the circuit board

We made the mother board (breed board) made of the material mica sheet . The dimension is about 6cmx8cm. We

used to mount all the micro electrical components in it by inserting into the small hole & soldering them each other. The micro components we used here are shown below.

Hardware components

Arduino Nano:

The Arduino nano board consists of fourteen digital input/output pins and six analog input pins. It can be programmed using Arduino IDE via a type B USB cable. Input voltage range of Arduino nano lies between 7 to 20 volts but the operating voltage of Arduino nano is 5V. The Clock speed of Arduino nano is 16MHz. It has 32KB flash memory, 2KB SRAM and 1KB EEPROM.

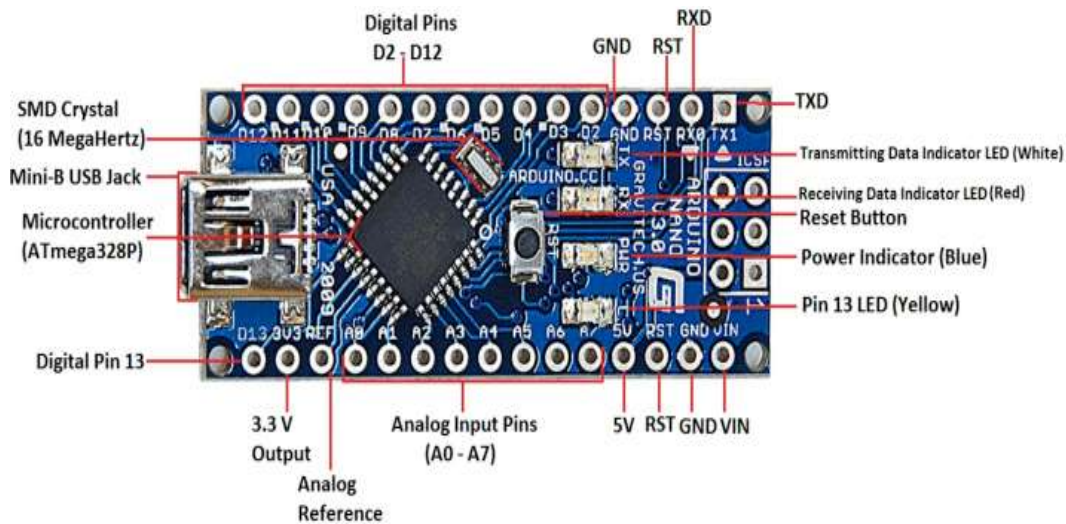


Fig 1.1 : Arduino Nano

Bluetooth Module

Bluetooth operating range is 2400-2483.5MHz. Frequency-hopping spread spectrum technology is used by Bluetooth. The data transmission is done in packets and each packet is transmitted on any one of the Bluetooth channel which has a bandwidth of 1MHz. Bluetooth 4.0 allows spacing of 2MHz for 40 channels. The starting frequency of first channel starts at 2402MHz and continues up to 2480MHz in 1MHz steps. It performs 1600 hops per second, with adaptive frequency-hopping (AFH) enabled.

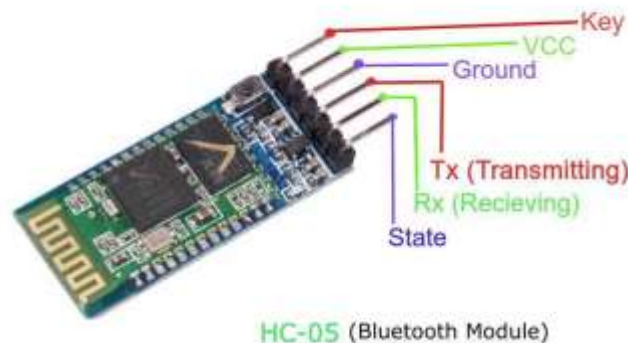


Fig 1.2 : Bluetooth module

L293D Motor Driver IC

L293D is a Motor Driver IC which allows DC motor to drive on either direction. L293D motor driver IC has 16 pins which are used to control a set of two DC motors simultaneously in any direction. It is based on the concept of H-bridge. The direction of voltage or current flow will be decided by the H-bridge.

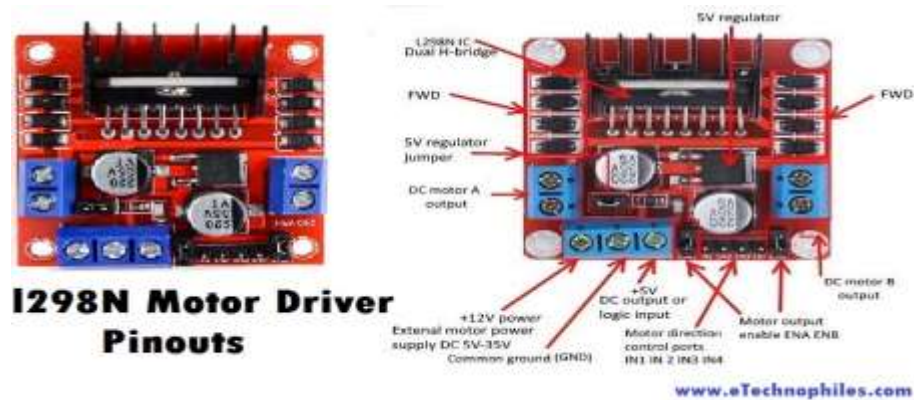


Fig 1.3 : Motor driver

Gear motor

Geared DC motors can be defined as an extension of DC motor which already had its Insight details demystified here. A geared DC Motor has a gear assembly attached to the motor. The speed of motor is counted in terms of rotations of the shaft per minute and is termed as RPM. The gear assembly helps in increasing the torque and reducing the speed. Using the correct combination of gears in a gear motor, its speed can be reduced to any desirable figure. This concept where gears reduce the speed of the vehicle but increase its torque is known as gear reduction. This Insight will explore all the minor and major details that make the gear head and hence the working of geared DC motor.



Fig 1.4 : DC Gear motor



Fig 1.5: Rechargeable lead acid battery

Lead-acid rechargeable battery

The lead–acid battery is the first type of rechargeable battery ever created. Compared to modern rechargeable batteries, lead–acid batteries have relatively low energy density. Despite this, their ability to supply high surge currents means that the cells have a relatively large power-to-weight ratio. These features, along with their low cost, make them attractive for use in motor vehicles to provide the high current required by starter motors.

Water pump

DC Water pump is a machine that transports liquid or pressurizes liquid. When the water pump is working, the coil and commutator rotate, but the magnetic steel and carbon brushes do not rotate. The alternating current direction of the coil is changed by the commutator and brushes that rotate with the motor.



Fig 1.6 : DC Water pump

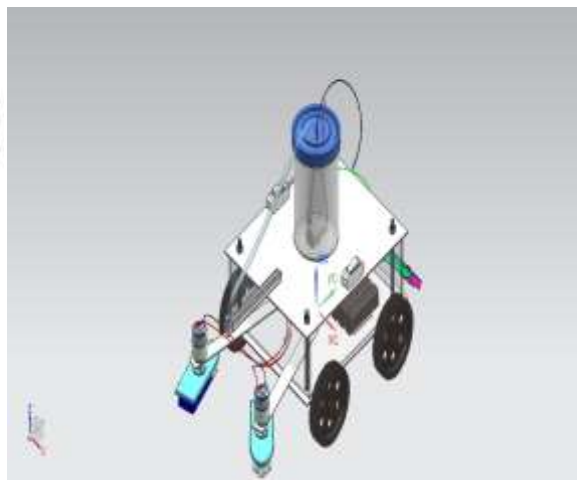


Fig 1.7: 3D model

CONCLUSION

The use of innovative technology not only reduces cost significantly but also reduces the human effort while increasing the effectiveness of floor cleaning. Reduced human effort means more frequent floor cleaning which results in increase in overall cleanliness and supports healthy well-being.

Small steps in technological advancement like this will have higher impact in long run in future, making India a better country.

This research facilitates efficient floor cleaning. Since in project the floor cleaner is incorporated with different devices like DC motor(s), ultrasonic sensors etc., so It will be easy to handle it also saves time and will work automatically for cleaning purpose at homes and offices.

With simple algorithm and program, the cleaner will be able to cover large floor areas as well as find its way into and out of small corners. As the cleaner traverses the room, the sweeper installed in it will manage to pick up a significant amount of dirt.

FUTURE SCOPE

There are so many cleaning and mopping robots present in the market but only some of them are affordable and economic.

There are very few robots that include both cleaning and mopping. With this work, we tried to reduce the cost of the robot and make it more compatible with the Indian Users and the Industries.

To further enhance the navigation performance of the robot, feedback sensors such as optical encoders can be integrated. Cleaner brushes can be added to vacuum cleaning mechanism to increase the efficiency of dust collecting.

Lithium polymer batteries can be used to reduce the weight of the robot which can further lead to the reduction of power consumption.

REFERENCE

- [1] Sandeep. J. Meshram, Dr. G.D. Mehta - "Design and Development of Tricycle Operated Street Cleaning Machine" - Journal of Information, Knowledge And Research In Mechanical Engineering Volume– 04, Issue- 01.
- [2] M. Ranjit Kumar, India. ISSN: 2278-0181 Vol. 4 Issue 04, April-2015
- [3] Liu, Kuotsan, Wang Chulun, A Technical Analysis of Autonomous Floor Cleaning Robots Based on US Granted Patents, European International Journal of Science and Technology Vol. 2 No. 7 September 2013, 199-216.
- [4] Mohsen Azadbakht, Ali Kiapey, Ali Jafari - "Design and Fabrication of a tractor powered leaves collector equipped with suction blower system" - September, 2014 AgricEngInt: CIGR Journal Open access at <http://www.cigrjournal.org> Vol. 16, No.3.
- [5] Haslam, R.A. and Williams, H.J, "Ergonomics considerations in the design and use of single disc floor cleaning machines", Applied Ergonomics, 30, 391- 399. 2010.
- [6] Ajay P John - "Implementation of an Automated Smart Robotic Floor Cleaner".

- [7] Abhishek Chakraborty, Ashutosh Bansal, Design of Dust Collector for Rear Wheel of Four-Wheeler, International Journal of Emerging Technology and Advanced Engineering, Volume 3, Issue 7, July 2013, 199-216
- [8] Jens-Steffen Gutmann, Kristen Culp, Mario E. Munich and Paolo Pirjanian. The Social Impact of a Systematic Floor Cleaner. In IEEE international workshop on advance robotics an its social impacts ,Technische University munchen, Germany May 21-23,2012.
- [9] E. Carrera, Finite Elements in Analysis and Design, Volume 95, March 2014, Pages 1–11
- [10] William D. Callister, Materials Science and Engineering, 7th edition, 2006, Pages 134- 174K. Elissa,
- [11] Peter R.N. Childs, Mechanical Design Engineering Handbook, 2014, Pages 121–137
- [12] Michael R. Lindeburg, Mechanical Engineering Manual for sprocket and pinion, 2013, Page 6-60 [9] H.H. West, Analysis of Structures, John Wiley & Sons, 1984