International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 2420-2423 www.ijaem.net ISSN: 2395-5252

Automatic Blackboard Cleaner Using Suction Technology

Vishal Sanjay Kumar, Reenu, S Muskan, N. Chandraprabha
Dept. of ECE., AMC Engineering College, Bangalore
Dept. of ECE., AMC Engineering College,Bangalore
Dept of ECE., AMC Engineering College,Bangalore
Dept of ECE., AMC Engineering College, Bangalore

Submitted: 20-06-2022 Revised: 27-06-2022 Accepted: 30-06-2022

ABSTRACT-One of the traditional ways of the learning process is carried out by using blackboards in classrooms. Blackboard and chalks are inseparable from classrooms. Thus, the dust from chalk can cause some health hazards when humans inhale it over a long period. Hence an attempt has been made by introducing blackboard cleaner which can be controlled by an application through any mobile device or an attempt can be made for automating the processes using image processing and edge detecting sensors. It reduces the potential work of the person who erases the board and reduces the time consumption in cleaning the blackboard. It also prevents the exposure of chalk dust to atmospheric air and helps to create a dust-free classroom.

Keywords- Blackboard cleaner, vacuum, suction.

I. INTRODUCTION

The robot is certainly considered one of present-day science's important and progressive inventions. It is a form of electro-mechanical tool which could perform several duties routinelywith the set of programmable commands. Robots can perform wonderful duties in an unfriendly surrounding in which it's tough for people to carry it out.In the cutting-edge modern era, robots are one of the mostexceptional innovations through which our existence has become less difficult and comfortable.From our childhood the day we entered college, the first thing we've got visible are blackboards. They set up the critical frameworks of our perception from the essential alphabets to what we comprehend even today. India is a country underscoring preparation due to the fact that ages. In any case, the chalks we use on slates or the markers on whiteboards ought to be eliminated if the subsequent issue is to be taught.Most of the time blackboards are cleaned by manual power. Chalk dust consists of calcium carbonate and sulphate which causes eye irritation, skin irritation, irritation in the respiratory tract, and could be harmful to allergic person. Substances that come into contact with the skin are absorbed and eventually find their way into the bloodstream.The project automatic blackboard eraser is a device that cleans the blackboard automatically and reduces the time consumed in hand erasing by using the vacuum technique by suction. Here we make use of the Atmega328P-U chip, motor driver, battery, and suction fan as main components.The problem is really well worth fixing due to the fact chalk dirt includes calcium carbonate and sulphate reasons fitness problems associated with breathing if uncovered for an extended period. So by solving this problem we can save time and also effort made by erasing the blackboard.

II. HISTORICAL BACKGROUND

More research has been going on with the wall-climbing robot, and many types of experimental models have been proposed. There are different kinds of wall-climbing robots that have been designed and developed over the past few years. Wherein each wall climbing robots are unique in its methods and are developed based on the requirements. Some of the mechanisms arelegged mechanism, sliding mechanism, tracked wheel mechanism, and suction-based mechanism.The legged mechanism is used to buildsuch robots that may conquer choppy surfaces. Due to their heavy weight and complex management system, those effects are in low speedanddiscontinuous motion.In recent years, numerous unique processes had been taken to develop robots that have the cap potential to climb vertical surfaces in opposition to the gravitational pressure like Wallbots, Stickybots, etc. Wallbots are using magnetic pressure to run at the vertical

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 2420-2423 www.ijaem.net ISSN: 2395-5252

planes.Recently, automated inspection technology ends up an eager hobby in robot applications. Itis broadly utilizedin diverse social infrastructures consisting of buildings, bridges, nuclear energy plants,and marine structures.Conventional wall climbing robots are categorized into 4 groups relying at the adhesiontechniques which include magnetic, hand–hold, biologically inspired and vacuum suction pad.The vacuum suction method is quite simple and smooth to manipulate however it could have trouble relying at the floor situations like cracked and tough surfaces. In order to design a wall climbing robot, there are numerous problems to be considered. The first one is the dimensions of the robot due to the fact it's far constrained through the geometry of synthetic structures, for example, girders, crossbeams, poles, etc.

III. METHODOLOGY

The concept was acquired while very well learning the modern-day trouble confronted in our university and after quick research, we could come up with this idea. The idea and the knowledge were obtained through various research papers and various development in this field. Theoretical research was done on electrical and electronic components. Required rpm, torque, speed, and power distribution. A prototype was designed using Fusion 360 and the placement of the components.The difference between the simulation end result and theoretical calculation was thoroughlyobserved and the correction was made.The project work had been divided into two important parts: mechanical and electrical.

IV. DESIGN AND DEVELOPMENT

The design was first made with simple cardboard for testing purposes and to check whether the suction is happening. The results were unfortunate, there were a lot of drawbacks and one of them was the stability of the body, the vibrations, the flexibility ratio, and the strength of the material. Later, we designed a plywood model of a 3mm base in fusion 360 which gave good stability.

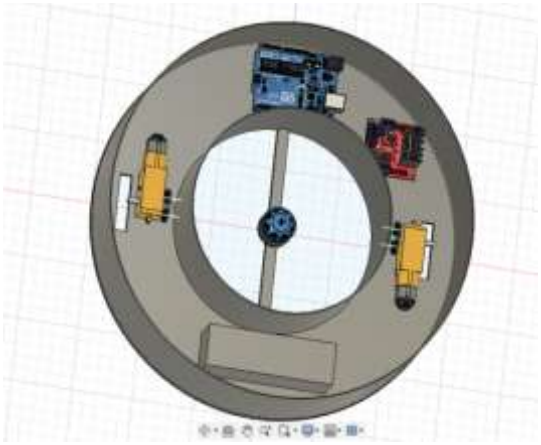

Fig. 1. Prototype designed in Fusion 360

4.1 ELECTRONICS PART

In order to control the robot, we are using a microcontroller and wireless technology. For passing the commands from android to the Bluetooth module, we are using an application called Arduino Automation. HC-05 Bluetooth module has been used to receive the commands from the android device. A test program was written to make sure that the Bluetooth module is working correctly. The HC-05 module works with a 5v supply to Vin and a 3.3v is regulated and provided to the Rx terminal. The ATmega328P-U is programmed to run a 12v DC motor according to the commands using an L298N Motor Driver. The L298N Motor Driver can drive 2 motors. Arduino Automation allows the user to set a UUID of his own Bluetooth module in order to connect the android application with the project. The application contains 4 different command modes which enabled precise control of the robotin vertical plane.

Fig. 2. Block Representations of Electronics Parts Of The Project.

4.2 MECHANICAL PART

The of the robot is constructed using Aero ply. A vacuum chamber is created in the middle of the body, where suction is created by using vacuum impellers to stick the robot on the blackboard. The

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 2420-2423 www.ijaem.net ISSN: 2395-5252

diameter of the vacuum chamber is 3.26 inches. The total base size is 12.59 inches. A suction mechanism where a servo tester is used to control the speed of the BLDC Motor. The rotating impeller with a high-speed BLDC motor inside the vacuum chamber flows the air in the outside direction. Thus, the air pressure inside the vacuum chamber becomes low compared to atmospheric pressure. This high atmospheric pressure exerts a force on the robot in the direction of the wall to stick to the wall. A 2300 KV BLDC motor with 30A ESC powered by 3 cell Li-Po (Lithium-Polymer) battery is used to control the motor according to the required adhesion. Four Geared Motor with a gear ratio of 48:1 has been used to move the robot against the adhesion on the vertical plane. A single motor has a torque of 800g/cm.

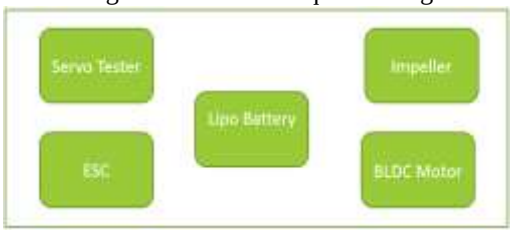

Fig. 3. Block Representation of Mechanical Parts of the Project.

Fig. 4. Illustrates the whole setup, how the connection is established and how the robot moves on the horizontal and vertical plane.

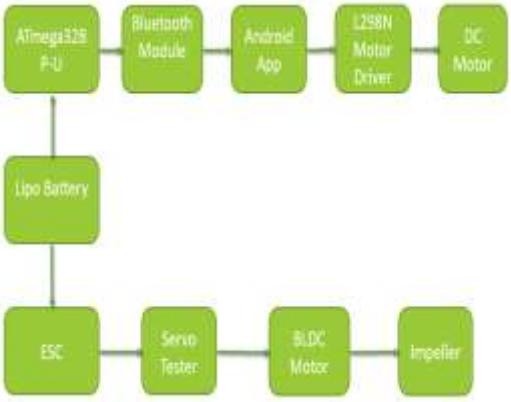

Fig. 4. Flow Diagram of the project.

Specifications	
Dimension	12.59x3.94 inch
Weight	500 g
Maximum climbing speed	10 inch/sec
Driving Motor	DC Geared Motor
Power Supply	Li-Po (11.1v , 3s, 2300 mAh)
BLDC Motor	2300KV , 30A ESC, 30000 RPM
Vacuum Pressure	900 g

Table. 1. Specifications of Suction based Robot

V. DESIGN AND IMPLEMENTATION

The Arduino Integrated Development Environment - or Arduino Software (IDE) is used to upload the program into the ATmega328P-U chip. Fig.5. illustrates the initial design of the robot and finally all the components are mounted on the body shown in fig.6.The impeller is mounted to the BLDC motor which is powered from Lipo battery and its speed is controlled by a simple servo tester. The circuit connection of the Atmega328P-U with a motor driver and two DC Motor is shown in figure fig.7. After getting commands from android application the Bluetooth module passes these commands to the Atmega328P-U and the motors are controlled accordingly.

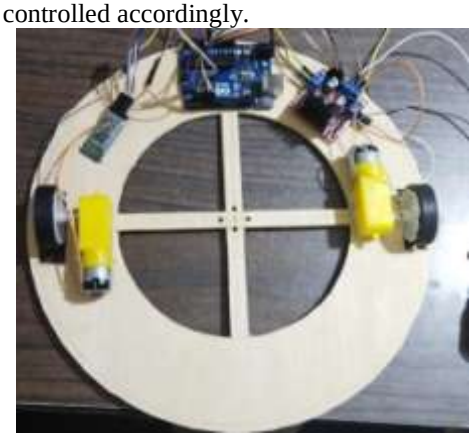

Fig. 5. Initial design of the robot.

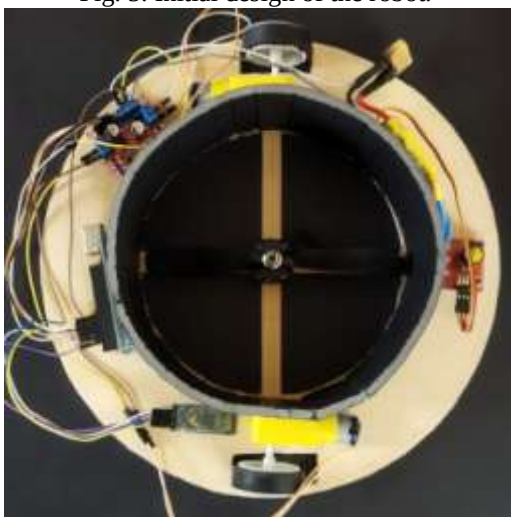

Fig. 6. All Components Mounted.

International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 6 June 2022, pp: 2420-2423 www.ijaem.net ISSN: 2395-5252

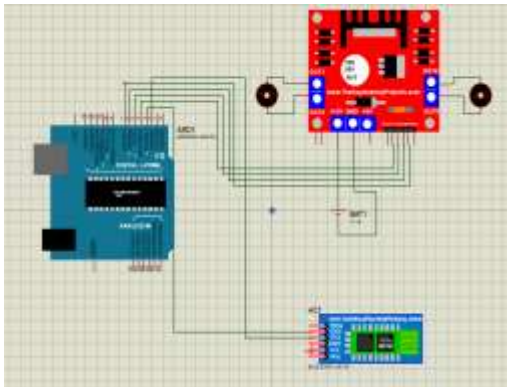

Fig. 7. Circuit simulation of Atmega328P-U

VI. CONCLUSION

This automated blackboard cleaner is mainly used to clean the board using suction process. One of the most important things that need to take care is the weight of the Robot. Use lightweight parts. Instead of using the large controller boards, like Arduino UNO or Mega2560, make a custom-made controller board. This reducesthe price, size, and weight of the circuit board. Use very small Dc Gear Motors.Further enhancement can be made by designing a more compact body and a better battery pack can be used to increase run time of the robot.

REFERENCES

[1] Nagakubo, A., Hirose, S.: Walking and running of the Quadruped wall–climbing robot. In: Proceeding of IEEE International Conference on Robotics and Automation, vol. 2, pp. 1005–1012 (1994).

[2] Lal, R., Tummala, Mukherjee, R., Ning, X., Aslam, D., Dulimarta, H., Jizhong, X., Minor, M., Dang, G.: Climbing the walls [Robots]. IEEE Robot. Autom. Mag. 9(4), 10–19 (2002).

[3] Longo, D., Muscato, G.: The Alicia/sup 3/ climbing robot: a three-module robot for automatic wall inspection. IEEE Robot. Autom. Mag. 13(1), 42–50 (2006).

[4] Xiao, J., Sadegh, A., Elliott, M., Calle, A., Persad, A., Chiu, H.M.: Design of mobile robots with wall climbing capability. In: Proceeding of IEEE/ASME International Conference on Advanced Intelligent Mechatronics, pp. 438–443 (2005).

[5] Wu, S., Li, M., Xiao, S., Li, Y.: A wireless distributed wall climbing robotic system for reconnaissance purpose. In: Proceeding of IEEE International Conference on Mechatronics and Automation, pp. 1308–1312 (2006).

[6] Zhi–yuan, Q., Yan–zheng, Z., Zhuang, F., Ya, W.: Fluid model of sliding suction cup of wall–climbing robots. Int. J. Adv. Robot. Syst. 3(3), 275–284 (2006).