Grenze International Journal of Engineering and Technology, Jan Issue

Arduino-Bluetooth Vacuum Cleaner

Priyanka Bhatele[1], Siddhika Bhagat[2], Bikramjeet Singh[3], Lakshya Singh[4] , Siddhesh Mengane[5], Faizan Siddiqui[6] and Omkar Sirsat[7]
[1-7]Vishwakarma Institute of Technology, Pune, India
Email: priyanka.11212@gmail.com, {ravindra.siddhika22, bikramjeet.singh22, lakshya.singh222, siddhesh.mengane22, faizanoddin.siddiqui22, omkar.sirsat22}@vit.edu

***Abstract*— Maintaining cleanliness is not only a daily routine but a fundamental aspect that profoundly impacts our overall well-being. While traditional cleaning methods like dusting and sweeping are commonly employed, it's important to acknowledge that these practices can inadvertently expose us to harmful particles and allergens, potentially compromising our health in the process. In response to this challenge, an automated vacuum cleaner operated through remote control using an Android device. This solution allows to easy operation via Android devices by combining essential components including the Arduino Uno microcontroller, HC-05 Bluetooth module, and Motor Driver Shield L293D. By offering a novel, user-friendly, and cost-effective approach to cleaning, this automated vacuum cleaner prototype has the potential to revolutionize how we maintain our living spaces.**

***Index Terms*— Arduino uno, Motor driver shield, Bluetooth module and vacuum cleaner**

I. INTRODUCTION

The use of technology has improvised many aspects of our day-to-day lives, including the way we clean our homes and workspaces. Vacuum cleaners make the cleaning process easier and comfortable by using various technological advancements. The vacuum cleaners available in the market requires human intervention for its efficient working. They are also not very economical and has some limitations.

The automatic floor cleaners are not very popular in the market because of its size. They are usually huge in size. This huge size makes it inconvenient for usage. Most of the available cleaners are usually very expensive and are not affordable for everyone. These cleaners are not even completely automated. They require human efforts for their working.

To overcome these limitations, we have proposed an Arduino-Bluetooth controlled vacuum cleaner. This project aims to develop a vacuum cleaner that can be operated remotely using their smartphones reducing human efforts. This project makes the overall cleaning process more convenient and user friendly.

The project involves the integration of several components, including an Arduino board, a Bluetooth module, a Motor Driver Shield and a vacuum cleaner motor, to create a compact and efficient vacuum cleaner. The use of Arduino technology makes the cleaner more accessible and affordable.

The Bluetooth module helps to control the movement of the vacuum cleaner. The Motor Driver Shield regulates the movements of the motors. It acts as a linkage between Arduino shield and motors.

II. HELPFUL HINTS

A. References

Grenze ID: 01.GIJET.10.1.309

Long chord wires attached with the vacuum cleaner and the controller. This is a big drawback and makes the cleaner less efficient. A vacuum cleaner was designed in such a way that it can be operated from android mobile phone through blynk app, such a cleaner is called as the robot vacuum cleaner.[1] A Robotic device
A Robotic device being made by ultrasonic sensors used to avoid any sort of obstruction. Power consumption here is minimized to make it cost effective and efficient for use. A motor driver shield is being used to control the motors and its movement in the robots. It works on the instructions received from the Arduino and uses them to instruct the motors. [5]
Radio Frequency Harvesting Energy is implemented to produce electricity in an environment-friendly way. This system can help to achieve wireless communication by the transmission of information or emitting electrical power from one point to another or more points in distance without the use of medium or wires.[3]

B.Components

1. *Arduino Uno*

Arduino Uno as shown in Fig 1 is an open-source microcontroller. It is user friendly and has various application. The board contains 14 digital input/output pins, six analog pins, a USB connection port. It can be programmed using Arduino IDE (Integrated Development Environment) in the C language.

Fig 1. Arduino Uno board

2. HC-05 Bluetooth Module

The HC-05 Bluetooth module as shown in the Fig 2 is a wireless communication module. It supports the Serial Port Profile (SPP). It has a great compatibility with the Arduino platform and can be easily connected to it. It is cost effective, easy-to-use wireless communication module.

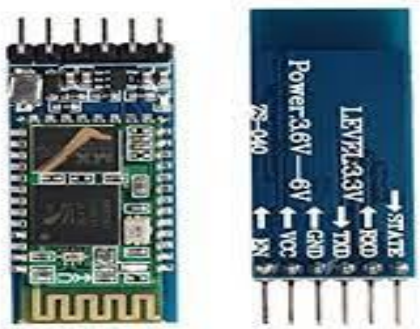

Fig 2. HC-05 Bluetooth Module

3. Motor Driver Shield

A motor driver shield as shown in the fig 3 is a device that is designed to control the motion of a motor. It is mounted on top of a microcontroller board such as an Arduino. The motor driver shield contains one or more motor driver chips, which are integrated circuits designed specifically to drive motors. The shield connects to a variety of different motors and power sources. Motor driver shields are commonly used in applications that require precise control of motor motion.

Fig 3. Motor Driver Shield

4. DC Motor:

DC Motors as shown in the Fig 4 are used to drive the vacuum cleaners suction fan. DC motors are used because they are compact and easy to control using Arduino.

Fig 4. DC Motor

C. Motor car

To design a prototype of a vacuum cleaner, the above-mentioned components are used. Firstly, a chassis is made and the vacuum suction mechanism is mounted over it. For making a chassis, a wooden board is taken and 4 DC Motor holders are attached to it as shown in the fig 6. Then, the wheels are attached to each of the DC motors. This makes the Chassis of the bot. Now, the chassis is attached to the Motor Driver Shield. And this shield is mounted on the top of the Arduino. The HC-05 Bluetooth module is then connected to the Arduino board. This is the part of the bot that makes its movement possible. This gives its user the control of the Bot's movement.

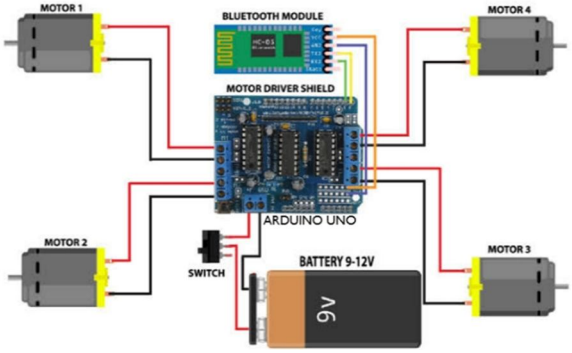

Fig 6. Interaction between Arduino, Bluetooth module, Motor driver Shield, Battery and DC motors

For the power supply, a 9V battery is used. The negative terminal of the battery is connected to the GND (ground) pin of the Arduino. And the positive terminal of the battery is passed through the switch and is connected to the 5V (voltage) pin of the Arduino. The switch allows the control over the flow of the voltage through the bot.

D. Vaccum Cleaner:

For the cleaning purpose, a vacuum suction is built using a water bottle, a DC motor, rotating fan, a piece of net and a few pipes. The bottle is cut in two pieces, the net and the fan attached to the DC motor is placed inside the bottle. The pipes are arranged as shown in the fig. 7. This arrangement of pipes forms the inlet used for cleaning.

When the power is supplied to the motor, that drives the suction fan. When the motor is running in an area of low pressure behind the fan creates the suction needed to draw the dirt through the intake port.

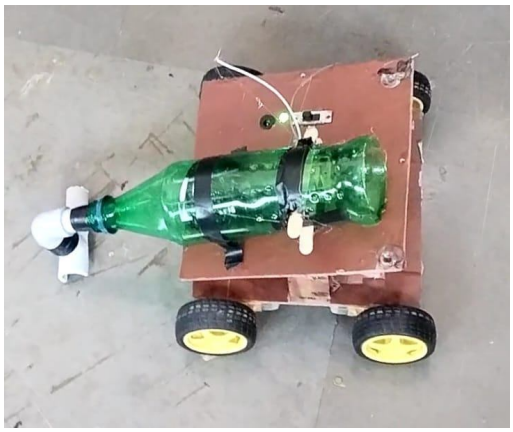

Fig 7. Assembly of the vacuum suction cleaner

E.. Results

On providing the power supply of around 12V, the circuit is turned on, the motors can be operated using the smartphone and the DC motor is also turned on. This drives the suction fan. When the motor is running an area of low pressure behind the fan creates the suction needed to draw air through the intake port. This set up can now successfully draw the dust and waste particles in. The motors can also move in all the directions making this system efficient and user-friendly.

TABLE III. PERFORMANCE ACCURACY OF THE VACCUM CLEANER

Time (unit: seconds)	Garbage Amount (unit: bits of paper)	Garbage Collected (unit: bits of paper)	Accuracy (in Percentage)
10	30	22	73.34
20	30	25	83.34
30	30	28	93.34
40	30	29	96.67

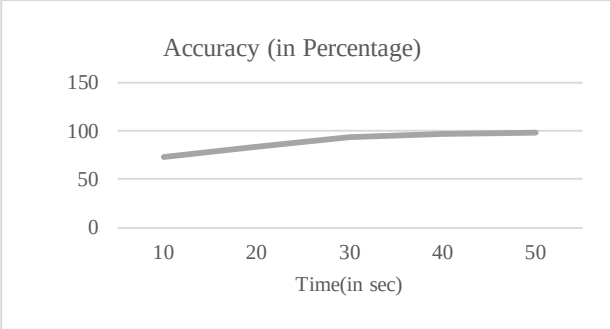

Fig 9. Graph depicting the accuracy of the cleaning capacity of the cleaner

III. CONCLUSIONS

The Arduino-Bluetooth-controlled vacuum cleaner represents a remarkable fusion of technological progress and practical utility. This innovation redefines conventional cleaning methodologies. This novel approach empowers users to effortlessly regulate the device from a distance, affording them the luxury of customizing cleaning preferences and circumventing obstacles with precision. This focuses on the ability to control the vacuum cleaner through a mobile application via Bluetooth technology can make it easier for users to operate the device from a distance, adjust its cleaning settings, and avoid obstacles. The use of DC Motor creates enough suction required to

intake the dust and waste particles. It has the potential to improve the cleaning experience for users while also showcasing the versatility and potential of open-source technology.
This system can be upgraded using various technologies. Ultrasonic sensor can be added to avoid obstacles. The combination of ultrasonic and proximity sensor can make it completely automated. The ultrasonic sensors can also be added to the storage tank that will send some notification in the form of buzzing sound on filling of the storage tank. This can also be operated on voice commands and various more technologies can be used to it even more efficient.

ACKNOWLEDGMENT

We extend our sincere gratitude to Prof. Priyanka Bhatele for their invaluable contributions to our project. Their expertise in writing and formatting the paper helped us write and present our research paper. We would also like to express our appreciation for their guidance in presentations, suggestions for improvements in design, in-depth research of the problem statements, and for providing us with resources for study.

REFERENCES

[1] RAHAYU, E., MARDIONO, M., & AZIS, D. (2020). Design of Vacuum Cleaner Dual Mode Robot Prototype Based on Arduino Uno with Bluetooth and Smartphone Communication. JournalNX, 6(08), 26-35.
[2] Yatmono, S., Khairudin, M., Pramono, H. S., & Asmara, A. (2019, November). Development of intelligent floor cleaning robot. In Journal of Physics: Conference Series (Vol. 1413, No. 1, p. 012014). IOP Publishing.
[3] Indra, W. A., & Yang, C. H. (2019). Development of multi-controlled floor vacuum cleaner using RF energy harvesting. ARPN Journal of Engineering and Applied Science, 14(21), 3738-3742.
[4] Goon, Li Hung, A. N. I. M. Isa, Chia How Choong, and W. A. F. W. Othman. "Development of Simple Automatic Floor Polisher Robot using Arduino." International Journal of Engineering Creativity & Innovation 1, no. 1 (2019): 17-23. Journal of Engineering Creativity & Innovation 1, no. 1 (2019): 17-23.
[5] Das, N. R., Daga, R., Avte, S., & Mhatre, K. (2019). Robotic automated floor cleaner. Int Res J Eng Technol (IRJET), 6(3), 4715-4721.
[6] Shaharuddin, M. F. M., Setafa, M. S., Sidek, N. A., & Kusairy, A. (2022). Robotic Vacuum Cleaner Prototype Integrated with Arduino Uno. Multidisciplinary Applied Research and Innovation, 3(2), 455-462.
[7] Bhingare, K. M., Ransing, V. S., Palve, A. B., & Misal, H. M. (2018). Vacuum cleaner using microcontroller. Open Access Int J Sci Eng (OAIJSE), 3, 15-17.
[8] Manasa, M., Vidyashree, T. S., Bindushree, V., Rao, S., & Gowra, P. S. (2021). Smart vacuum cleaner. Global Transitions Proceedings, 2(2), 553-558.