WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Automatic Vacuum Cleaner Robot

Abhishek Solanki [1], Ved Chinchay [2], Shifa Khan [3] , Shruti Pandya [4], Asst. Prof. Shikha Malik[5]

B.E Student, Department of Electronics and Telecommunication, Atharva College Of Engineering, Mumbai, India
Assistant Professor, Department of Electronics and Telecommunication, Atharva College Of Engineering, Mumbai, India

ABSTRACT

In the quest for enhanced home automation, the development of an all the robot's functions. The L293D motor driver controls Automatic Vacuum Cleaner Robot emerges as an innovative and practical solution. This project incorporates an ESP32 microcontroller, L293D motor driver, single-channel relay, ultrasonic sensor, IR sensors, and a buzzer to create a fully autonomous cleaning device. The ESP32 serves as the central processing unit, coordinating the motion of the robot, allowing precise manoeuvring in different directions. A single-channel relay is employed to operate a 12V vacuum cleaner, ensuring effective cleaning. Ultrasonic sensors are utilized to detect obstacles and calculate distances. This enables the robot to navigate around obstacles and adjust its path. Additionally, the system employs four IR sensors to maintain consistent proximity to walls or objects, ensuring comprehensive cleaning coverage. A buzzer provides alert notifications, enhancing user-friendliness by signalling the completion of cleaning tasks or warning of obstacles in the robot's path. This project embodies the synergy of various technologies to create an automatic vacuum cleaner robot, offering the convenience of hands-free, intelligent cleaning. The integration of ESP32 and a sensor array elevates the efficiency, manoeuvrability, and user experience of this autonomous cleaning solution.

Keywords: Home Automation, L293D motor driver, ESP32, hospitality industry.

INTRODUCTION

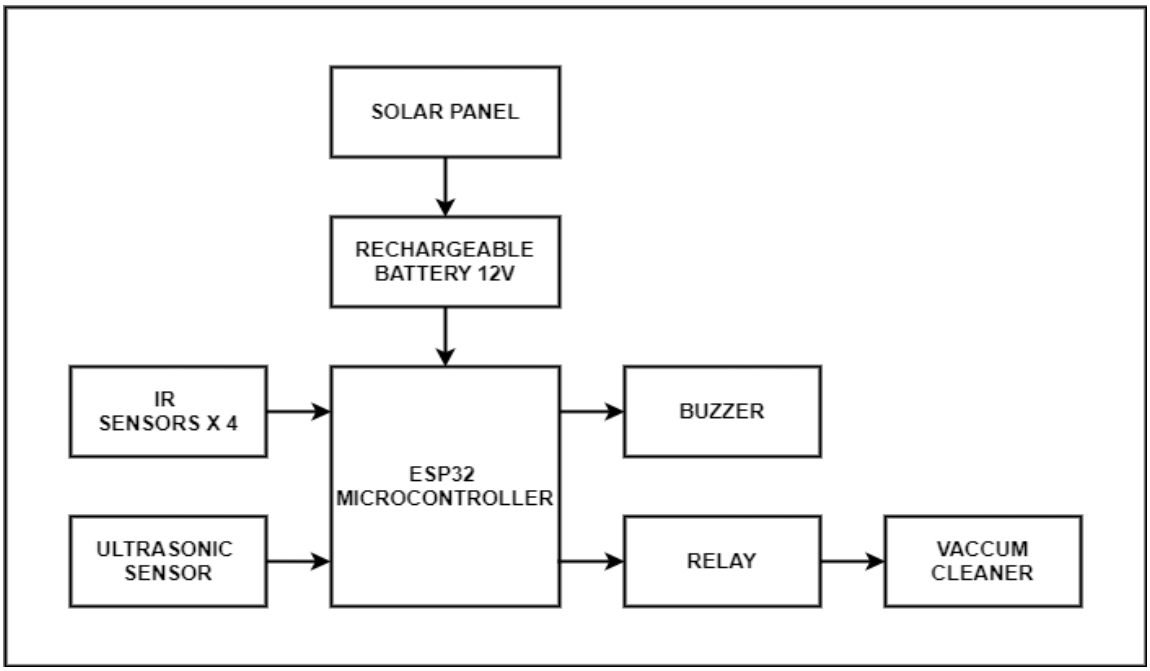
Imagine a vacuum cleaner that not only cleans your home but does so automatically, making decisions on its own. Our robot does just that. It uses the power of an ESP32, a super-smart microcontroller, to coordinate its actions. The L293D motor driver propels the robot gracefully across your floors, ensuring a thorough clean. With its single-channel relay, it can control your 12V vacuum cleaner efficiently. Our robot is equipped with an ultrasonic sensor that gauges the level of waste collected, ensuring it doesn't spill a speck. But that's not all – our robot doesn't just clean silently; it communicates with you. It features a buzzer for alerts, notifying you when it needs assistance or when it's done with its job. Its precision is thanks to four infrared (IR) sensors that help it navigate and avoid obstacles, ensuring a smooth and efficient cleaning routine. No more bumping into walls or furniture. In sum, our Automatic Vacuum Cleaner Robot is not just a gadget; it's a time-saver, a smart helper, and a cleaner of your dreams, making your life simpler and your home cleaner.

LITERATURE REVIEW

- Mohd. Shahbaz Khan et al. displayed a "Bluetooth control cleaning robot utilizing Arduino". The robot is controlled utilizing Bluetooth show at both transmitter and collector ends.
- Vijayalakshmi M et al. proposed a "Savvy Vacuum Robot" with energetic development. S-curve organizing is utilized for compelling working along with sensors to avoid obstacles.
- Gaurav Dhariwal et al. have proposed the "Headway of Driverless RC Car". An modified car is built utilizing the concept of neural frameworks. It distinguishes obstructions utilizing sensors, with Arduino and Raspberry Pi being utilized in this model.
- S Yatamono et al. proposed a paper on the "Change of Cleverly floor cleaning Robot". They made a quick floor cleaning Robot that can clean by investigating, sucking the clean, and cleaning the floor. Arranged with an omni wheel, a vacuum cleaner, and a floor cleaning motor, it is coded in Arduino IDE utilizing Arduino microcontroller and arranged with Bluetooth to work from a smartphone related through Bluetooth.
- Sabir Hossain et al. proposed the "Significant Fortress Learning-based ROS-Controlled RC Car for Autonomous Way Examination in the Darken Environment". LiDAR arranged car utilizing the concept of significant learning is talked almost. The program utilized here is ROS and Arduino.

- R J Ong and K N F Ku Azir proposed the "Low-Cost Autonomous Robot Cleaner utilizing Mapping Calculation based on Web of Things (IoT)". Sensors are utilized to recognize any obstruction and Arduino is utilized to control the robot. Mapping is associated so that the robot can clean without any human interventions once it is traded on.
- Anbumani V et al. proposed a paper on the "Progression of Shinning Floor Cleaner utilizing ARDUINO". Unmistakable modes of cleaning such as cleaning, clearing, or both wiping and clearing are talked approximately. For controlling the robot, a Bluetooth module is utilized and other capacities are coded in Arduino. It can without a doubt clean corners of the floor.
- Adeel Saleem et al. proposed the "Arrange and Utilization of an Brilliantly clean cleaner robot for uneven and nonstructural environment". A robot has been arranged which stores the orchestrate of the room and makes the working doable. This can be utilized for diverse circumstances as well. It is a cost-effective system.
- Md. Farhanul Islam et al. have proposed "Arranging and Optimization of An Free Vacuum Floor Cleaning Robot". An monetary demonstrate is arranged utilizing Arduino Mega and Raspberry Pi. A GPS module is besides show which makes a contrast the bot to move in the right direction.
- Anshu Prakash Murdan et al. proposed "A smart free floor cleaner with an Android-based controller". A bot is arranged which can be controlled through Android. By utilizing the application, the bot can be turned in the needed direction.
- Amir Talebi Sheik Sarmast et al. have proposed "Arranging a Quick Vacuum Cleaner in Two Modes of More distant and Modified". In this paper, a vacuum cleaner is executed which works normally or through an android application. If the battery rate is less, a message is sent to the enrolled versatile number with regard to the same.
- Md. Rawshan Habib et al. proposed the "Modified Sun fueled Board Cleaning System Based on Arduino for Clean Ejection". A bot is arranged to clean the sun fueled sheets utilizing a DC Motor which powers the wiper. Water is not utilized to clean the sheets. This system's capability is around 87 to 96 percent.

BLOCK DIAGRAM



Circuit Components:

1. ESP32 Module: You'll require an ESP32 improvement board.

2. 3.5" TFT LCD Show: Guarantee its congruous with the ESP32 and gives a touch screen interface.

3. Association Wires: Jumper wires to interface the components.

Circuit Connections:

1. Control Supply: - Interface the 3.3V yield from the ESP32 to the display's 3.3V pin. - Interface the ESP32's GND to the display's GND pin.

2. SPI Communication: - Interface the ESP32's SPI pins (SCK, MOSI, MISO) to the comparing pins on the TFT display. - A few TFT shows might too have a Data/Command (D/C) stick, which ought to be associated to a GPIO stick on the ESP32.

3. Touch screen: - If your show has a touch screen, it may utilize extra pins for touch input. Interface these pins to the ESP32's GPIO pins.

4. Backlight: - If the show has an Driven backdrop illumination, interface it to a GPIO stick on the ESP32 to control backdrop illumination brightness.

OBJECTIVES

The objectives of the Automatic Vaccum Cleaner Robot are as follows:

- Objectives for an Automatic Vacuum Cleaner Robot using ESP32:
- Motion Control: Implement precise motion control using the L293D motor driver to enable the robot to navigate and clean effectively.
- Obstacle Detection: Utilize the ultrasonic sensor to detect obstacles in real-time and implement obstacle avoidance for safe and efficient operation.
- Fully Automatic Operation: Ensure the robot operates autonomously, requiring minimal human intervention, by using the ESP32 to coordinate all tasks.
- Reliable Alert System: Employ a single-channel relay to operate a 12V vacuum cleaner and a buzzer for alerting the user when the cleaning task is complete or when there is an issue.
- Efficient Cleaning: Utilize four IR sensors to help the robot map and navigate the environment, ensuring comprehensive and efficient cleaning.

COMPONENTS USED:

1. ESP32 Microcontroller Board:

ESP32 is a series of low-cost, low-power system on a chip microcontroller with integrated Wi-Fi and dual-mode Bluetooth.ESP32 is created and developed by Espressif Systems, a Shanghai-based Chinese company, and is manufactured by TSMC.ESP32 can perform as a complete standalone system or as a slave device to a host MCU, reducing communication stack overhead on the main application processor. ESP32 can interface with other systems to provide Wi-Fi and Bluetooth functionality through its SPI / SDIO or I2C / UART interfaces.

2. ULTRASONIC SENSOR:

An ultrasonic sensor is a sensor that measures distances through ultrasound which travels through the air. If the ultrasound hits an object or obstacle on its path, it will then bounce back towards the sensor. One of the most popular ultrasonic sensors would be the HC-SR04. The configuration pin of HC-

SR04 is VCC (1), TRIG (2), ECHO (3), and GND (4). The supply voltage of VCC is 5V and you attach TRIG and ECHO pin to any Digital I/O in your Arduino Board to power it.

Power Supply : DC 5V

Working Current : 15mA

Working Frequency : 40Hz

Ranging Distance : 2cm – 400cm/4m

Resolution : 0.3 cm

Measuring Angle : 15 degree

Trigger Input Pulse width : 10uS

2. IR SENSOR:

Infrared (IR) sensors are devices that detect or measure infrared radiation in their surroundings.IR sensors work based on the principle that all objects emit some level of infrared radiation. These sensors detect this radiation and convert it into an electric signal, which can then be processed.

Type of IR Sensor

•Passive Infrared (PIR) Sensors: These sensors detect changes in infrared radiation caused by movement of objects.

•Infrared Photodiodes and Phototransistors: These sensors respond to variations in infrared light intensity.

•Infrared Thermopiles: Used for measuring temperature by detecting the infrared radiation emitted by an object.

IR sensors play a crucial role in various applications, offering advantages such as non-contact sensing, reliability, and cost-effectiveness. Their versatility makes them suitable for a wide range of tasks, from simple object detection to more complex applications like motion sensing and temperature measurement.

3. I2C LCD DISPLAY 16x2:

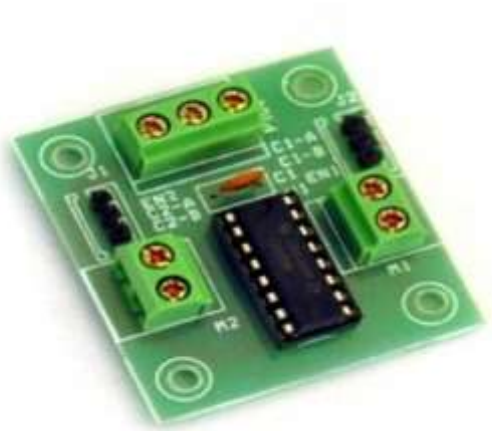
I2C_LCD is an easy-to-use display module; it can make display easier. Using it can reduce the difficulty of make, so that makers can focus on the core of the work. The Arduino library for I2C_LCD, user just need a few lines of the code can achieve complex graphics and text display features. It can

replace the serial monitor of Arduino in some place, you can get running information's without a computer. Through the bitmap convert software you can get picture displayed on I2C_LCD, without the need for complex programming.

4. Single Channel Relay Module:

The Single Relay Board will be used to turn pump motor on/off while keeping them isolated from your microcontroller. The Single Relay Board allows you to control high-power devices (up to 10 A) via the on-board relay.

5. L293D Motor Driver:



L293D is a typical Motor driver or Motor Driver IC which allows DC motor to drive on either direction. L293D is a 16-pin IC which can control a set of two DC motors simultaneously in any direction. It means that you can control four DC motor with a single L293D IC.

6. 12V DC Geared Motor:

DC Motor – 200RPM – 12Volts geared motors are generally a simple DC motor with a gearbox attached to it. This can be used in all-terrain robots and variety of robotic applications. These motors have a 3 mm threaded drill hole in the middle of the shaft thus making it simple to connect it to the wheels or any other mechanical assembly.200 RPM 12V DC geared motors widely used for robotics applications. Very easy to use and available in standard size. Also, you don't have to spend a lot of money to control motors with an Arduino or compatible board. The most popular L298N H-bridge module with onboard voltage regulator motor driver can be used with this motor that has a voltage of between 5 and 35V DC or you can choose the most precise motor diver module from the wide range available in our Motor drivers' category as per your specific requirements.

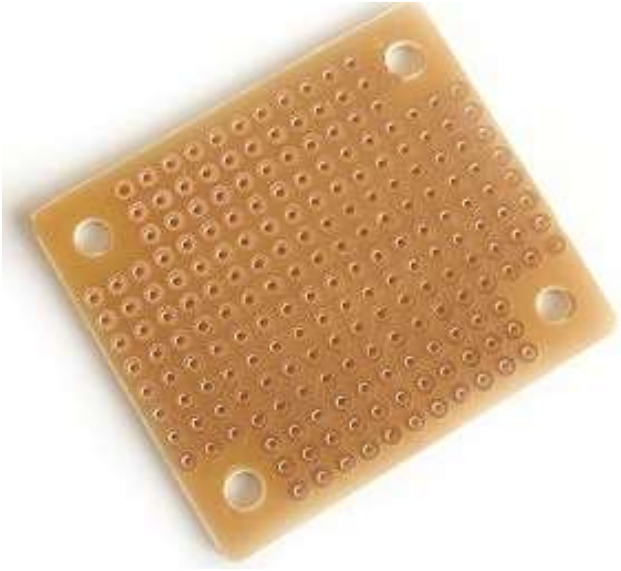
7. Solar Panel:

Solar panels are those devices which are used to absorb the sun's rays and convert them into electricity or heat. A solar panel is actually a collection of solar (or photovoltaic) cells, which can be used to generate electricity through photovoltaic effect.

8. 12V Rechargeable Battery:

A rechargeable battery, storage battery, or secondary cell, (or archaically accumulator) is a type of electrical battery which can be charged, discharged into a load, and recharged many times, as opposed to a disposable or primary battery, which is supplied fully charged and discarded after use. It is composed of one or more electrochemical cells. Rechargeable batteries typically initially cost more than disposable batteries, but have a much lower total cost of ownership and environmental impact, as they can be recharged inexpensively many times before they need replacing. Some rechargeable battery types are available in the same sizes and voltages as disposable types, and can be used interchangeably with them.

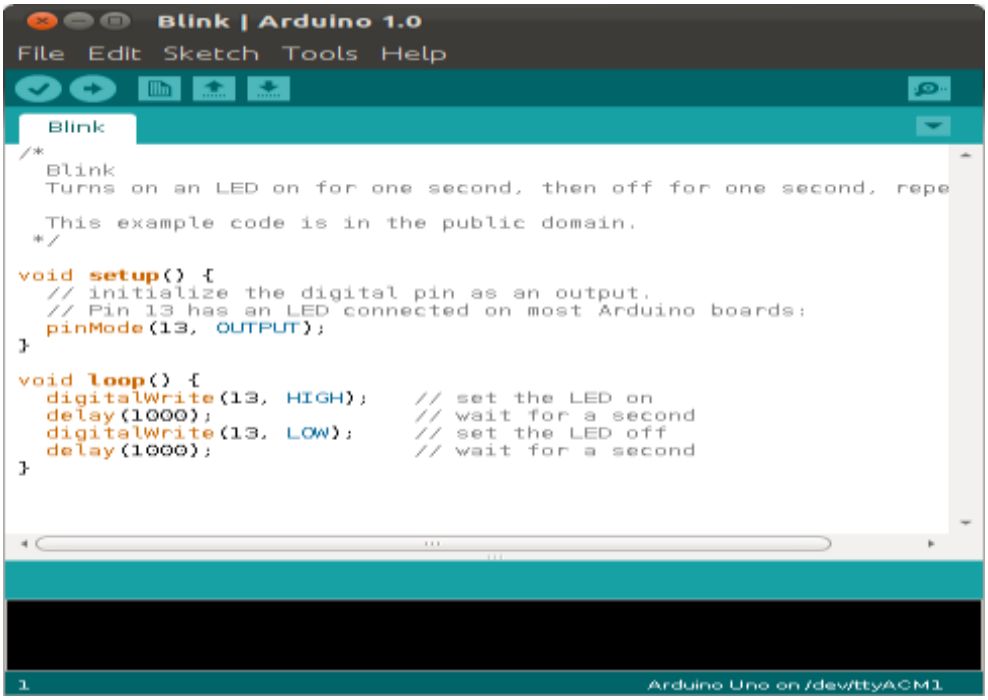
9. Zero PCB:



Perfboard or Zero Pcb is a material for prototyping electronic circuits (also called DOT PCB). It is a thin, rigid sheet with holes pre-drilled at standard intervals across a grid, usually a square grid of 0.1 inches (2.54 mm) spacing. These holes are ringed by round or square copper pads, though bare boards are als available. Inexpensive perfboard may have pads on only one side of the board, while better quality perfboard can have pads on both sides (plate-through holes). Since each pad is electrically isolated, the builder makes all connections with either wire wrap or miniature point to point wiring techniques. Discrete components are soldered to the prototype board such as resistors, capacitors, and integrated circuits. The substrate is typically made of paper laminated with phenolic resin (such as FR-2) or a fiberglass-reinforced epoxy laminate (FR-4).

SOFTWARE USED

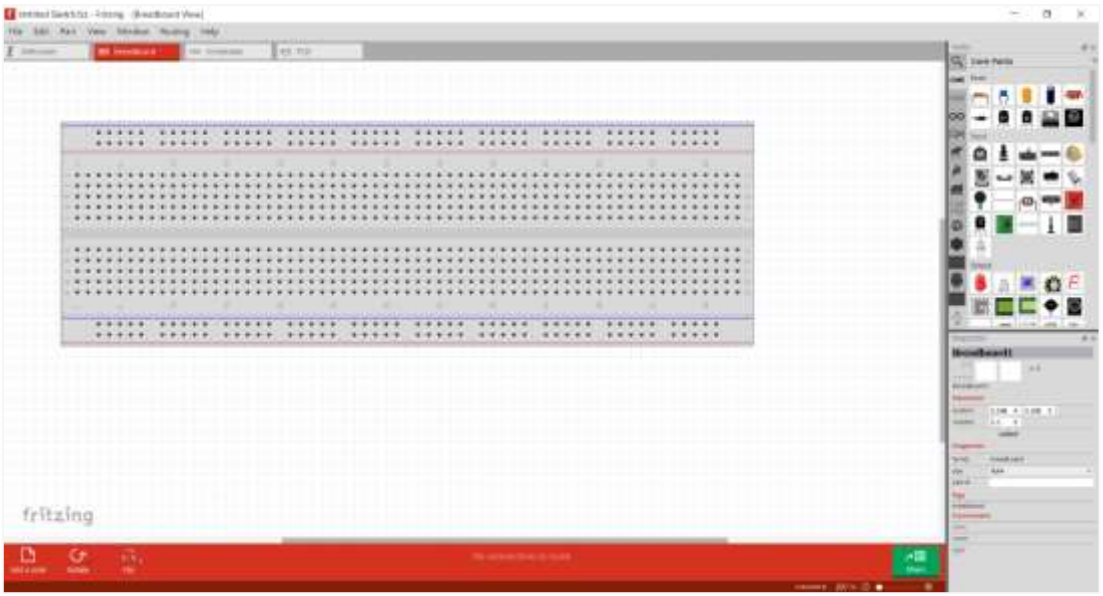
1. Arduino IDE



The Arduino integrated development environment (IDE) is a cross-platform application (for Windows, macOS, Linux) that is written in the programming language Java. It is used to write and upload programs to Arduino board. The source code for the IDE is released under the GNU General Public License, version. The Arduino IDE supports the languages C and C++ using special rules of code structuring. The Arduino IDE supplies a software library from the Wiring project, which provides many common input and output procedures. User-written code only requires two basic functions, for starting the sketch and the main program loop, that are compiled and linked with a program stub main() into an executable cyclic executive program with the GNU tool chain, also included with the IDE distribution. The Arduino IDE employs the program avrdude to convert the executable code into a text file in

hexadecimal encoding that is loaded into the Arduino board by a loader program in the board's firmware. In our project, it is used for uploading code to NodeMCU ESP12-E Board.

2. Fritzing



Fritzing is an open-source hardware initiative that makes electronics accessible as a creative material for anyone. We offer a software tool, a community website and services in the spirit of Processing and Arduino, fostering a creative ecosystem that allows users to document their prototypes, share them with others, teach electronics in a classroom, and layout and manufacture professional pcbs.

METHODOLOGY

The proposed methodology for implementing the Smart Hotel Ordering System with TFT LCD, ESP32, and machine learning-based waiting time predictions consists of several key steps:

- Utilize an ESP32 microcontroller to coordinate the various components.
- Control the robot's motion using the L293D motor driver, enabling it to navigate in different directions.
- Place four IR sensors around the robot to detect obstacles and ensure safe movement.
- Equip the robot with an ultrasonic sensor facing downward to monitor the level of waste collected in its dustbin.
- When the waste reaches a specified threshold, the ultrasonic sensor triggers the ESP32 to activate the single-channel relay, turning on a 12V vacuum cleaner to suction the waste into the bin.
- Continuously measure the distance to the waste level using the ultrasonic sensor, ensuring efficient waste collection.
- When the dustbin is full, stop the vacuum cleaner and activate a buzzer to alert users that the robot requires attention using the ESP32.
- Help the robot navigate its surroundings by detecting obstacles and adjusting its path accordingly using the IR sensors.
- If an obstacle is detected, use the L293D motor driver to change the robot's direction and continue cleaning.
- This methodology outlines a fully automatic vacuum cleaner robot that can efficiently collect waste and navigate autonomously. It incorporates sensors and control systems to ensure safe, effective, and user-friendly operation.

FUTURE SCOPE

- Enormous potential lies in the future of autonomous vacuum cleaner robots integrating ESP32, L293D motor driver, single-channel relay, ultrasonic sensor, and IR sensors.
- Further advancements can focus on:
- AI-driven navigation
- Enhanced obstacle detection

- Improved battery efficiency
- Smart home integration
- These robots could evolve into multifunctional devices for cleaning and maintenance tasks, while also seamlessly connecting to smart home ecosystems, offering a more convenient and automated lifestyle.
- Continuous research and development will refine their capabilities, making them indispensable household appliances and revolutionizing the cleaning industry**.**

INITIAL RESULT

CONCLUSION

• Implementation of the Savvy Vacuum Cleaner project.

• The extend works on pre-defined code embedded in the ESP32 Microcontroller.

• Whenever the RC car experiences any deterrent, it turns to the side where the remove between the impediment and the car is greater.

• The extend encourages clean collection utilizing a vacuum cleaner made utilizing a CPU fan and batteries without human mediation, in this manner decreasing dangers to human health.

• This is a straightforward and cost-effective cleaner.

• However, utilizing a separable pack may be way better as evacuating the tidy gets to be simpler.

RFERENCES

[1] M.S Khan, M. Nagageetha, G. Babu, Bluetooth control cleaning robot utilizing arduino, Int. J. Innov. Technol. Explor. Eng. (IJITEE) 8 (11S2) (September 2019).

[2] M. Vijayalakshmi,G. Bhargavi Baljoshi.G. Lavanya G. Ace Sushil, Shrewd Vacuum Robot, Division of Computer Science and Designing, KLE Innovative Uni- veristy, Vidyanagar, Hubballi.

[3] G. Tambe, D. KanadeDhariwal, Guarav & Uzairqazi, Improvement of Driverless RC Car, Office of Mechatronics Building, Terna Building College, Navi Mumbai India, Universal Diary of Intrigue Imaginative Inquire about & De- velopment (IJIIRD), 2019.

[4] S. Yatmono, M. Khairudin, H.S. Pramono, A. Asmara, Advancement of Brilliantly Floor Cleaning Robot, Electrical Designing Instruction Division, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia, 2019 ICE-ELINVO.

[5] S. Hossain, O. Doukhi, Y. Jo, D.-J. Lee, Profound support learning-based ROS-con- trolled RC car for independent way investigation in the obscure environment, 2020 20th Universal Conference on Control, Robotization and Frameworks (ICCAS), 2020.

[6] R.J. Ong and KNFKu Azir, Moo fetched independent robot cleaner utilizing mapping algo- rithm based on Web of Things (IoT), IOP Conference Arrangement: Materials Science and Engineering.

[7] V. Anbumani, V. Geetha, V. Renugha, V. Praveenkumar, Improvement of bright floor cleaner utilizing ARDUINO, Int. J. Later Technol. Eng. (IJRTE) 8 (4) (2019) November.

[8] A. Saleem, A. Sabir, A. Iqbal, A. Hussain, Plan and execution of an intel- ligent tidy cleaner robot for uneven and nonstructural environment, Worldwide Conference on Computing, Science and Designing Advances – iCoMET, 2019.

[9] Md.F. Islam, S. Islam, N. Hossain,S. Datta, Planning and Optimization of An Au- tonomous Vacuum Floor Cleaning Robot, School of Electrical and Electronic Engi- neering, Shahjalal College of Science & Innovation, Sylhet, Bangladesh.

[10] A.P. Murdan, P.K. Ramkissoon, A keen independent floor cleaner with an An- droid-based controller, 2020 3rd Worldwide Conference on Rising Patterns in Electrical, Electronic and Communications Building (ELECOM), 2020.

[11] A.T.S. Sarmast, T. pourseif, R.E. Nezhad, M. Mohajeri, S. Mohammadi, A. Vaezi, Planning a savvy vacuum cleaner in two modes of inaccessible and programmed, Int. Res. • J. Eng. Technol. (IRJET 7 (7) (July 2020).

[12] M.R. Habib, et al., Programmed sun oriented board cleaning framework based on arduino for tidy expulsion, 2021 Worldwide Conference on Fake Insights and Keen Frameworks (ICAIS), 2021.