

Solar-Powered Vacuum Cleaner

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Abstract

Homes in the modern day are becoming more intelligent and automated. People have more time and a simpler existence thanks to home automation. The sector is still in its infancy, despite the growing use of household robots. However, an increase is expected, and home robot usage is growing. Few robotic vacuum cleaners can mop and clean floors, despite the fact that there are currently many of them in the market. Designing and implementing a robotic vacuum cleaner featuring two cleaning modes—an autonomous mode and manual mode, as well as a manual mode via a mobile application, are the goals of this project. To make cleaning easier than manual vacuuming this robot vacuum cleaner is developed. In comparison to manual vacuuming, the robot vacuum cleaner is made to make cleaning easier. The design and implementation of a robot vacuum cleaner prototype is the primary objective of this project. This project's objective is accomplished with an Arduino Uno, an ultrasonic sensor, a DC motor, an L298N motor driver, a solar module, and a vacuum cleaning unit. The robotic vacuum cleaner will satisfy a number of user-friendly requirements.

Keywords

Arduino Uno, Arduino, IoT, Infrared sensor, Solar Energy, Ultrasonic sensor, Vacuum cleaner.

INTRODUCTION

Many urban families find it challenging to maintain their homes clean as life becomes busier. Particularly in today's nuclear couples where both the husband and the wife work, we frequently observe modern families waiting for the maid to arrive early in the morning and being content despite the fact that nothing has been cleaned thoroughly. The automated robot floor cleaner seems to be a gift from the robotics industry to such families. The vacuum cleaner charges itself while it vacuums the house's floors automatically while you are at work. An electronic and mechanical control system that is highly stabilized and quickly functionalized allows for floor cleaning with the aid of an automatic floor cleaner. Different cleaning methods, which may be of different kinds, are used to clean floors. Different floor kinds require different cleaning procedures. Once the floor has been cleaned, it should be completely dry. In any other case, there can be risks. Today's technology includes a variety of floor cleaning tools like extractors, motorized floor scrubbers, and floor buffers that can clean practically any type of hard flooring or carpeted flooring in a fraction of the time it would have taken using conventional methods. For various floorings, cleaning would again vary. In order to keep things clean, cleaning must be a regular part of our routine. On a general level, floors in homes require routine cleaning. As Indians, we always view wet cleaning as the last stage in the cleaning process. The average household is becoming increasingly automated and intelligent. Convenience is provided through home automation, and people have more time. Although the use of domestic robots is becoming more commonplace, the sector is still young and in its infancy. Only a small percentage of the robotic vacuum cleaners available employ wet floor cleaning. In daily life, cleanliness is crucial. For the sake of our social and intellectual health, it is the process of preserving our environment dust- and

disease-free. There are now several cleaning products available to keep your home dust-free. For the benefit of improving humankind, machine-controlled floor cleaners were introduced. One of the best and most useful pieces of equipment that help homeowners maintain their floors clean is the vacuum cleaner. Each of the vacuum cleaners on the market has advantages and disadvantages. In order to keep one's home clean, one must perform the daily chores of sweeping and dusting. In recent years, maintaining cleanliness has grown in importance for supporting one's health and in order to facilitate this, we have suggested a robotic floor cleaning. In essence, because it is a robot, it reduces human mistakes and performs cleaning tasks more effectively. The foundation of this robotic device is straightforward obstacle avoidance using ultrasonic sensors. We will make it cost-effective by utilizing local resources and so decreasing power use. Here, in order to accomplish the necessary motion and avoid obstructions, image processing techniques will be used. We will use wireless communication to communicate with our device to simplify it. We will introduce a motor Driver IC, which will be utilized to operate motors in autonomous robots, in order to ensure the device's dependable mobility. For hardware projects, it serves as an interface between Arduino and motors. Arduino is excellent for making things react to manual input and different sensor readings. In the event that the machine's owner is without a remote control, the wireless application is linked to the Android application to allow manual operation. A robot's design is dependent on the creativity and imagination of its creator, and the problem at hand needs to be solved. The finalized robot model can then be produced utilizing a range of components and methods. Some of the elements that frequently take part in the physical structure of a device include the various types of sensors, power transmission through gears, controller feedback actuators, power transmission through gears, and undoubtedly a

semiconductor mechanism that led to the design of microprocessors and other electronic mechanisms. Technological advancement has had a significant impact on the evolution of robots. For instance, whereas initially robots were created solely to increase the strength of human muscles, they are today capable of processing vast amounts of data and making independent judgments, complementing or even replacing human beings in intellectual tasks. Typically, these robots are more expensive, making them an unaffordable option. At the same time, the price margin is the key consideration in the design of this affordable robotic floor cleaner. In order to obtain ideal cleaning rather than the satisfactory cleaning provided by an expensive, already-existing machine, a highly effective and agile cleaning system is created. This project is the product of extensive research, comparisons to the traditional designs, and performances of various kinds.

SURVEY ON RELATED WORKS

[1]. Vijayalakshmi M., Bhargavi Baljoshi, G. Lavanya, Gouri Master, and Gurav Sushil had publish "Smart Vacuum Robot" in 2022. In this design, a microcontroller controls motors and ultrasonic sensors so that they may move along a specified course and detect obstacles. When utilizing dashboards to turn the robots ON and OFF, the Wi-Fi Adapter is used to connect to the internet. Before using dashboards to control the robot, the subscriber must first authenticate themselves when the programme is activated. The robot's ultrasonic sensors start searching for obstacles as soon as it is switched on. If it notices an obstruction, the robot briefly stops and then adjusts its course as instructed. The robot never stops cleaning and is always scanning its path for impediments. If the battery is less than 40%, either continue cleaning or alert the user via the software. The procedure with the intelligent cleaning robot begins by signing into the Wi-Fi base stations and identifying the node. Three ultrasonic sensors and an H-bridge are turned on when the robot starts to move, and it then moves coherently thereafter. This model is unable to charge itself, detect and recognize dust, navigate in the direction of dust particles, and dispose on its own. The major source of energy used in the model is derived from non-renewable resources, which have severe drawbacks such as accelerating global warming, exhausting other energy sources, and producing greenhouse gases.

[2]. "Design Of IoT-Based Vacuum Cleaning and Mopping Robot"- Dr. S. Sridhar, R. Himabindu, P. Ashok Kumar, R. Vasu. Upon activation of the suggested vacuum cleaning robot, the 12V dc battery powers the Arduino board. Both the IR sensor as well as an ultrasonic range module supply signals to the Arduino. The input collected by the front left and right sensors is sent simultaneously to the Arduino. When the IR sensor detects an impediment, the output varies from low to high. The obtained electrical data is transformed into binary and then to decimal, before being utilized to regulate the robot's locomotion. The blade of the vacuum cleaner begins to operate as immediately as the dc

power source is switched on. Dust is collected as the robot moves forth by brushes that are mounted to its rear. The robot's back pipe is contemporaneously being sprayed with water from the water tank. A cloth is used to sweep up the water and mop it up. The user won't be aware of the model's battery level or the amount of dust in the bag, which has an impact on the functioning of the model.

[3]. "Design and Implementation of Smart Floor Cleaning Robot using Android App"- S Monika, K Aruna Manjusha, S V S Prasad, B. Naresh -2019. The smart floor cleaning robot is set up to clean certain regions of the floor as described in this study. This robot employs a wireless robotic cleanup device to make cleaning floors simple and quick. The underpinning of this wi-fi network is a transmission app that runs on an Android smartphone device, which permits the robotics to obey instructions from the user through the emitter platform. The designed robot features a water sprayer for excellent cleaning, an Arduino UNO controller, and a mechanical arm with a washing pad. After getting feedback from an Android smartphone using a Bluetooth recipient, the Arduino enables the rotors to operate in the specified direction and pace. This model solely functions in manual mode, which requires the user to invest time and energy.

[4]. "Design and Application of D.C. Vacuum Cleaner using Axial Flow Fan" -Vijit Gajbhiye, Naved Ahmad, M. S. Tufail-2019. A vacuum cleaner device that runs on D. C. and has a 0.17 Bar suction pressure is constructed using an axial flow fan. It also cleans extremely well and utilizes minimal Power supply. Having to clean floors with a vacuum cleaner is more economical because it is rechargeable. The vacuum cleaner is designed to have wheels that can be manually pushed from one location to the desired location. The handle can be used to guide the cleaner. Assuming references are regarded, the constructed vacuum cleaner operates admirably. As stated in the survey, this model operates with human assistance, and any damage to the axial fan will result in model failure.

[5]. "Design Of Vacuum Cleaner Dual Mode Robot Prototype Based on Arduino Uno With Bluetooth And Smartphone Communication" -E.S. Rahayu, D. A. Azis, Martino, -2020. Vacuum cleaners are either operated manually or automatically and are intended to remove dust and other contaminants from the surface of a house. The automated mode of the robot vacuum cleaner will make the device move wildly over a room's floor and automatically avoid items in its path. Whereas in manual mode, the Android smartphone attached to the Bluetooth HC-05 communication module functions as that of the operator's principal control device, permitting the operator to change in accordance with the robot vacuum cleaner. The sharp GP sensor that was mounted to the robots functioned as a sensor to avoid impediments while cleaning the floor of the house. The Android smartphone is first linked to Bluetooth and then the Arduino reads the input data for the subscriber in automated or manual mode. While operating in automated mode, Arduino will set up the Sharp GP distance sensor to

recognize objects nearby and trigger the vacuum motor. The robot will stop and alter its path to escape an obstacle if it is more than 8 centimeters away from it. In manual mode, the robot will remain still until the user gives the instruction to move it using the smartphone app before turning on the controlled vacuum motor. In this research, the robots cannot move over slope circumstances that are greater than 25 degrees.

[6]. "Solar Floor Cleaner Robot"-Abhishek Pandey-2020. This research looked at the need for a robot that cleans homes. To keep time, we need a designed system that cleans without assistance from humans. This essay seeks to discuss the most effective ways to help individuals who are physically impaired. Since they had to make this happen, they required a purification system that could support a physical person and add support to what they were saying.

[7]. "The vacuum cleaning robot" was created by T.B. Asafa and T.M. Afonja using an Arduino 2560. It has a spherical structure and sucks dust via a retractable garbage can on top. Additionally, it features a fan that helps in cooling and another fan for suction which helps in creating a vacuum that sucks dust into the bin. Also, the ultrasonic sensor detects the obstacle, which uses a 28.8V power supply in this project. This vacuum cleaner's smaller dustbin compared to other contemporary vacuum cleaners is a drawback.

[8]. J. Fink, F. Vaussarda V. Bauwens, D. Hamela, and P. Retornaz carried out the research named "Lessons learned from Robotic vacuum cleaners entering the home ecology". It highlights resource efficiency, power usage, navigation, and efficient cleanliness, however, it is inaccurate. It incorporates each and every essential cleaning section.

[9] As in the publication, Researcher H. A. Shakhawat Hossein Prayash, &et.al. analyzed "Designing and Optimization of an Autonomous Vacuum Floor Cleaning Robot." The robot's processor was developed using a combination of the Raspberry Pi and Arduino Mega. Though proximity sensors are deployed for immediate detection of any obstacles.

METHODOLOGY

Manual mode: It first analyzes whether it is in manual mode. If so, the keypad is checked. It checks to see if the Left, Right, or Center keys on the keypad have been depressed. The information is sent to the bot. Then it determines if any obstacles have been found. If so, the robot is told to stop and switches back to manual mode while the signal is displayed. The robot checks for the received data signal if there is no obstacle present. If the data signal is received, the data decoding process begins, and the data is then displayed. If the data signal is not received, it verifies the transmitted data signal again.

Autonomous mode: By adjusting the mode selection switch's setting, the robot can be made to move in automated mode. The suction unit can be turned on or off depending on the cleaning method required, such as dry or wet cleaning. A control system will be used to guarantee the robot's automatic

mobility. To give the robot what it needs, an on-off control system based on an Arduino microcontroller, motor controller, and infrared sensors will be used. As a result, the robot is forced to stop before the edge. The infrared sensor signals will be processed by the mode filter to allow the robot to halt before hitting the edge.

BLOCK DIAGRAM

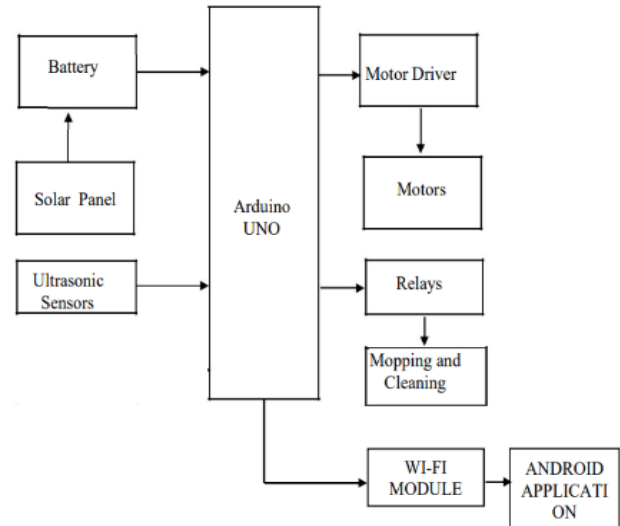


Figure 1: BLOCK DIAGRAM

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