

DEVELOPMENT OF SOLAR POWERED FLOOR CLEANER ROBOT WITH VAACUUM CLEANING

Krunal Rode^{*1}, Prajwal Pochampalliwar^{*2}, Ayush Bagde^{*3}, Mohammad Irfan Sheikh^{*4}, Sujal Lohakare^{*5}, Dr. I. A. Khan^{*6}, Prof. M. S. Matey^{*7}

^{*1*2*3*4*5}Final year ME students, Priyadarshini college of engineering, Nagpur, Maharashtra, India

^{*6}HOD Dept. of ME, Priyadarshini college of engineering, Nagpur, Maharashtra, India

^{*7}Professor Dept. of ME, Priyadarshini college of engineering, Nagpur, Maharashtra, India

----- *** -----

ABSTRACT

In recent years, homes have become increasingly smart and automated, making everyday tasks more convenient and saving valuable time. One such advancement is the introduction of domestic robots, which are gradually becoming a part of daily life. Although this technology is still developing, its adoption is expected to grow rapidly in the coming years. While many robotic vacuum cleaners are already available in the market, only a limited number offer both dry and wet floor cleaning capabilities. The proposed vacuum cleaner robot is intended to simplify the cleaning process compared to traditional manual methods. The system is developed using components such as an Arduino Uno, sensors, DC motors, an L298N motor driver, an ultrasonic sensor, and a vacuum suction unit. The primary goal is to create a functional prototype that meets user-friendly requirements, making cleaning tasks easier and more efficient for users.

INTRODUCTION

A robot can be described as an intelligent machine that operates based on programmed logic and algorithms. It is capable of performing tasks automatically according to predefined instructions. In mobile robotic systems, movement is controlled by a logic-based controller that guides the robot to function efficiently in different environments. Today, robots play a significant role in various areas such as industries, households, and educational institutions. With advancements in technology, robots are becoming more capable and intelligent, assisting humans in daily activities. In fact, an average person interacts with multiple automated or robotic systems in everyday life, often without realizing it. A typical robotic system consists of several essential components, including sensors, actuators, control mechanisms, and a microcontroller. Sensors are responsible for detecting environmental conditions and sending signals to the controller. Actuators convert these signals into physical actions, enabling the robot to perform tasks. Mechanical control devices help regulate movement or flow within the system. At the core of the robot is the microcontroller, which acts as the brain, processing inputs from sensors and controlling outputs to actuators based on the programmed instructions.

The behaviour and performance of robots are governed by various control algorithms such as fuzzy logic, machine learning techniques, and artificial neural networks. These algorithms help the system make decisions, reduce errors, and adapt to changing conditions. Based on the input received from the environment, the controller adjusts the robot's operation to achieve accurate and efficient performance.

In general, control systems used in robotics can be classified into continuous controllers and PID (Proportional-Integral-Derivative) controllers. Continuous controllers are simpler but less precise, while PID controllers provide better accuracy by continuously adjusting the system based on current conditions, resulting in improved efficiency and stability.

COMPONENT LIST

1. Power Supply: Includes a solar panel, 12V battery, charge controller, and voltage regulator to provide stable power.
2. Control Unit: ESP32 microcontroller used to control and manage all system operations.
3. Drive System: Consists of an L298N motor driver, two DC motors, wheels, and a caster wheel for movement and balance.
4. Cleaning System: Comprises a vacuum blower, dust collection chamber, and an optional filter for effective cleaning.
5. Switching Unit: A relay module is used to control high-power components.
6. Sensors: Ultrasonic sensor helps in detecting obstacles and avoiding collisions.
7. Output Devices: LCD display shows system status, and a buzzer provides alerts.
8. Communication: Bluetooth module (built-in or external) and a mobile app enable manual control.

LITERATURE SURVEY

1. Recent studies on mobile-operated cleaning systems show major improvements in automation and smart control technologies.
2. Solar-powered robotic systems are gaining attention due to their ability to use renewable energy, reducing both cost and environmental impact.
3. Research highlights that such robots are suitable for long-term use, especially in industrial and outdoor applications.
4. Studies on cleaning robots indicate that brush mechanisms, efficient water usage, and motor-driven systems improve cleaning performance.
5. Cleaning robots are also used for maintaining solar panels, helping to increase their efficiency by removing dust and dirt.
6. Various sensors like ultrasonic and infrared sensors are widely used for obstacle detection and safe navigation.
7. Sensor-based systems help in better path planning and allow robots to work effectively in different environments.
8. Integration of IoT technology enables real-time monitoring, data collection, and remote control through cloud platforms.
9. Overall, previous research supports the development of a solar-powered, IoT-based cleaning robot as an effective and sustainable solution.

OBJECTIVES

- 1.To design a mobile-controlled cleaning robot that operates using solar energy, reducing reliance on conventional power sources and supporting eco-friendly operation.
- 2.To ensure effective cleaning of floors and solar panels, particularly in industrial areas where dust can reduce efficiency.
- 3.To incorporate smart navigation and obstacle detection using sensors and a microcontroller for safe and efficient movement.
- 4.To enable IoT-based monitoring for real-time tracking of system performance, cleaning activity, and overall status through a cloud platform.

REFERANCES

1.P. Ravikumar, K. Abirami, R. Anushiya, M. Elakkiya and P. R. Harshidha, “Solar Powered Unmanned Cleaning Robot,” International Journal of Engineering and Advanced Technology (IJEAT), vol. 9, no. 6, Aug. 2020.

2.M. Vijayalakshmi et al., “Design and Development of a Solar-Powered Vacuum and Wet Cleaning Robot using Arduino UNO,” International Journal of Information Technology Infrastructure, vol. 12, no. 3, pp. 1–4, Jun. 2023.

3.A. Irawan et al., “Automatic Floor Cleaning Robot Using Arduino and Ultrasonic Sensor,” Journal of Robotics and Control, Jul. 2021...

4.N. Nireekshana et al., “An Innovative Solar Based Robotic Floor Cleaner,” International Journal of Innovative Science and Research Technology, vol. 8, no. 4, pp. 1880–1885, Apr. 2023.

5.M. Kaur and P. Abrol, “Design and development of floor cleaner robot (automatic and manual),” International Journal of Computer Applications, vol. 97, no. 19, 2014.

6.L. Sharma et al., “Solar Powered Vacuum Cleaner,” International Journal of Innovative Research in Technology (IJIRT), vol. 9, no. 7, Dec. 2022.