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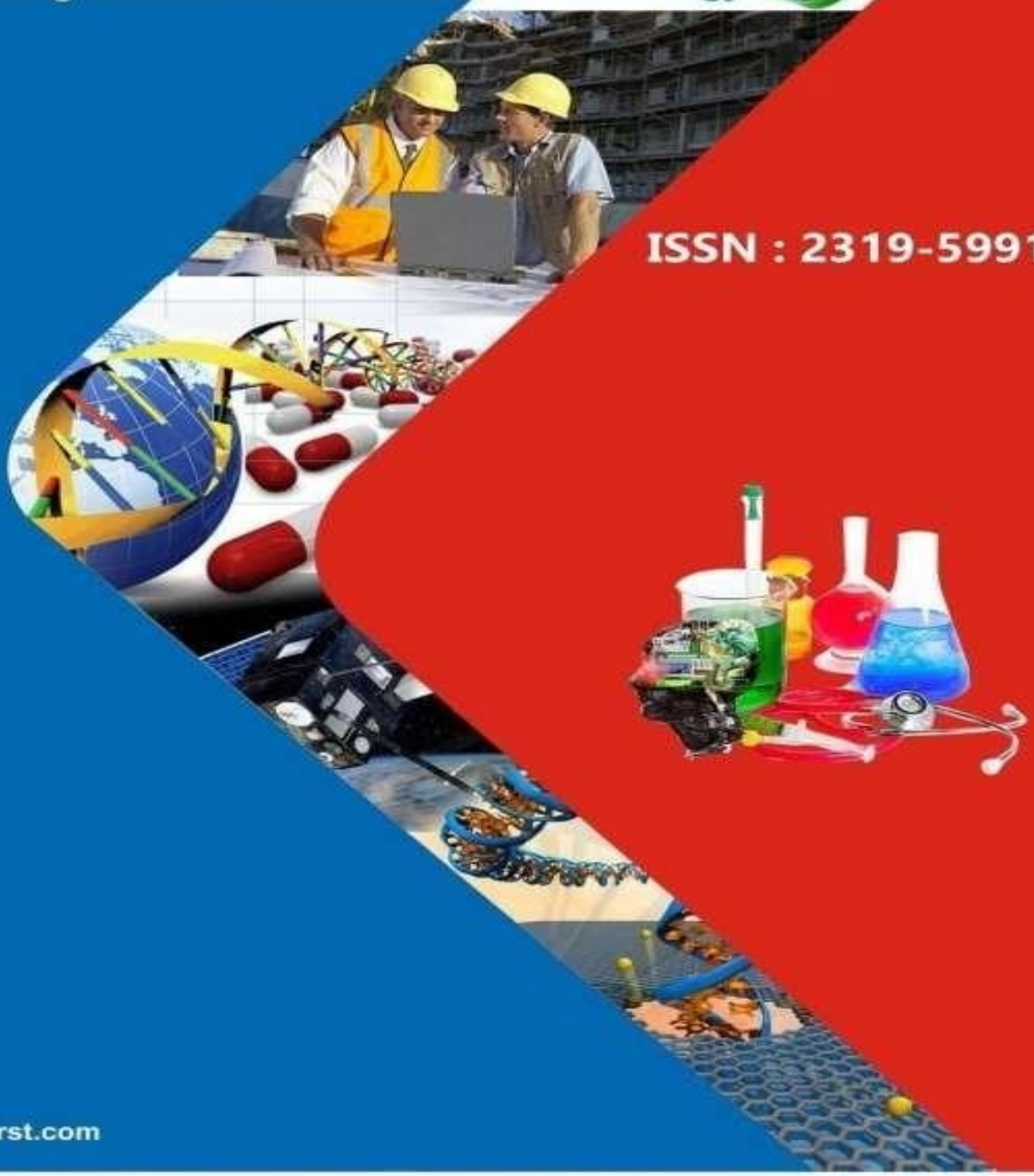

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SOLAR HOME DUST COLLECTING ROBOT WITH VACUUM SYSTEM

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ABSTRACT

Cleaning is important work in every place of our house. Sometimes this is easy and sometimes it is difficult. Sometimes we assigned people for the purpose of cleaning and pay money for them. But sometimes cleaning is required in areas where presence of living being dangerous so we cannot assigned living being. So we required some technique to compensate these problems. We make a Robotic vacuum cleaner as a vacuum cleaner, which is operated using dual mode that is automatically and manually. In Automatic mode the robotic vacuum cleaner will cause the robot to move randomly on the floor of a room by avoiding the obstacles infront of the robot by using ultrasonic sensor (HC-SR04).In manual mode the robotic vacuum cleaner moves following commands that are controlled by the android-based smartphone using the Bluetooth module(HC-05).Vacuum cleaner robot is designed to make cleaning process become easier rather than by the using manual vacuum.

KEYWORDS: Arduino UNO, Ultra Sonic sensor, Bluetooth HC-05 Module, Portable suction motor, Geared motors,3 pin slide switch.

1.INTRODUCTION

1.1 Introduction:

Households of today are becoming smarter and more automated. Home automation delivers convenience and creates more time for people. Domestic robots are entering the homes and people's daily lives, but it is yet a relatively new and immature market. However, a growth is predicted and the adoption of domestic robots is evolving. Several robotic vacuum cleaners are available on the market but only few ones implement wet cleaning of floors. The purpose of this project is to design and implement a Vacuum Robot Manual via Phone Application. Vacuum Cleaner Robot is designed to make cleaning process become easier rather than by using manual vacuum. The main objective of this project

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is to design and implement a vacuum robot prototype by using Arduino Mega, Arduino Shield, Motor Shield L293D and to achieve the goal of this project.

Vacuum Robot will have several criteria that are user-friendly.

1.2 Project Overview:

An embedded system is a combination of software and hardware to perform a dedicated task. Some of the main devices used in embedded products are Microprocessors and Microcontrollers. Microprocessors are commonly referred to as general purpose processors as they simply accept the inputs, process it and give the output. In contrast, a microcontroller not only accepts the data as inputs but also manipulates it, interfaces the data with various devices, controls the data and thus finally gives the result.

2.LITERATURE SURVEY

The integration of solar power with robotic cleaning systems, specifically for dust collection in homes, has emerged as a promising area of research. This approach combines automation, renewable energy, and home cleanliness, enhancing both efficiency and sustainability. In this literature survey, we explore significant advancements, challenges, and applications in the field, referencing key authors and their contributions to the development of solar-powered dust-collecting robots.

Robotic Cleaning Technologies

Robotic vacuum cleaners have revolutionized the way homes are cleaned, offering convenience and autonomy. The foundational work in this field can be traced back to **iRobot**, who introduced the Roomba in 2002, one of the first commercially successful robotic vacuum cleaners (Roomba, 2002). Roomba incorporated basic navigation and vacuum systems, utilizing sensors to avoid obstacles and a rotating brush to collect debris. Over time, advancements by **Kim et al. (2015)** have improved the autonomy and functionality of robotic vacuum cleaners, integrating features such as mapping technology, which allows the robot to learn the layout of a home and clean in an efficient manner.

A significant advancement was the inclusion of HEPA filters and rotating side brushes in models by **Jiang et al. (2018)**, which enhanced the robots' ability to collect fine particles, including dust mites and allergens.

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Despite these advancements, most robotic vacuum cleaners still face challenges related to battery life and reliance on electrical outlets, limiting continuous operation.

Solar-Powered Robotics

Integrating solar power into robotic systems is gaining attention as an environmentally friendly way to extend the autonomy of robots. **Sharma et al. (2019)** have conducted research on solar-powered robots, particularly for outdoor cleaning tasks. Their work shows that solar-powered robots can be employed in applications such as cleaning solar panels or maintaining gardens, areas where the robots can operate independently and sustainably without relying on traditional power sources.

One of the key challenges identified by **Zhao et al. (2020)** in their review of solar-powered robots is the difficulty in ensuring that the robot can continuously operate using only solar energy, especially in indoor environments where sunlight is often limited. Solar robots are highly efficient when exposed to consistent sunlight, but managing energy consumption effectively in indoor spaces remains a challenge. **Hussain et al. (2021)** explored hybrid power systems combining solar energy with rechargeable batteries to address this limitation, ensuring that the robot can still operate even when sunlight exposure is inconsistent.

3.BLOCK DIAGRAM

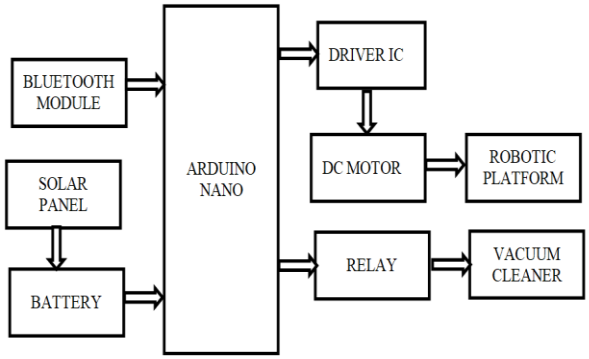

Fig 3.1: Block Diagram Of Solar Vaccum Robot Using Bluetooth

4.HARDWARE DESCRIPTION

1. Arduino UNO

The **Arduino UNO** is the central microcontroller that acts as the brain of the dust-collecting robot. It controls all the processes and coordinates the communication between various hardware components. The Arduino UNO processes the sensor inputs, controls the DC motors for movement, and manages the vacuum system's activation through a relay. The Arduino is programmed to execute the

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robot's movement patterns and vacuum operation based on inputs from the ultrasonic sensor and user commands received through Bluetooth. With its versatility, ease of programming, and ample I/O pins, the Arduino UNO provides an excellent platform for prototyping the robot's functionality.

2. Ultrasonic Sensor (HC-SR04)

The **ultrasonic sensor** is used to detect obstacles and measure the distance between the robot and any object in its path. It works by emitting high-frequency sound waves and measuring the time it takes for the waves to bounce back after hitting an object. The Arduino UNO uses this information to avoid obstacles, ensuring the robot navigates around furniture, walls, and other barriers. This sensor helps the robot maintain an efficient and smooth cleaning path by adjusting its direction when an obstacle is detected.

3. Bluetooth HC-05 Module

The **Bluetooth HC-05 module** allows for wireless communication between the robot and a smartphone or other Bluetooth-enabled devices. Through an Android app or Bluetooth terminal, users can control the robot remotely, issuing commands such as starting, stopping, or changing cleaning modes. The Bluetooth module enables easy setup and operation, allowing for real-time monitoring and control of the robot without needing a physical connection.

4. Battery

A **battery** powers the entire robot when it is in operation. In this setup, a **rechargeable lithium-ion battery** is commonly used to store and supply energy. The battery powers the Arduino, ultrasonic sensor, DC motors, and other components. A key feature of the design is that the robot can recharge its battery using a solar panel, allowing it to run autonomously for longer periods without human intervention.

5. Relay

A **relay** is used to control the activation of the robot's vacuum system. The relay acts as an electronic switch that is controlled by the Arduino. When the Arduino detects the need for vacuuming or receives a user command via Bluetooth, it sends a signal to the relay, which, in turn, activates the vacuum motor. This allows the robot to efficiently switch the vacuum on or off without drawing

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excessive power from the battery unnecessarily.

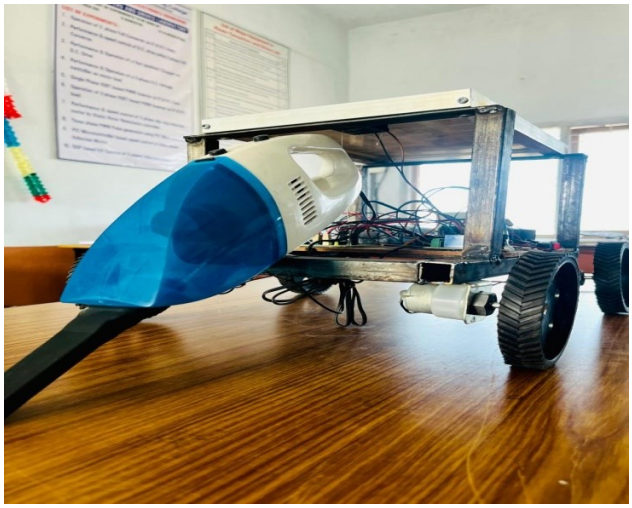
6. Solar Panel

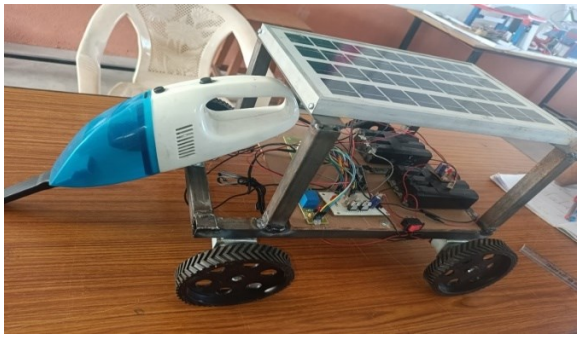
The **solar panel** is an essential component of the robot's power management system. It is used to charge the battery during sunlight hours, ensuring that the robot remains operational for long periods without requiring an external power supply. The solar panel converts solar energy into electrical energy and stores it in the battery, allowing for sustainable, eco-friendly operation. The efficiency of the solar panel depends on the size and quality of the panel, and it plays a critical role in ensuring the robot's autonomy and reducing reliance on non-renewable energy sources.

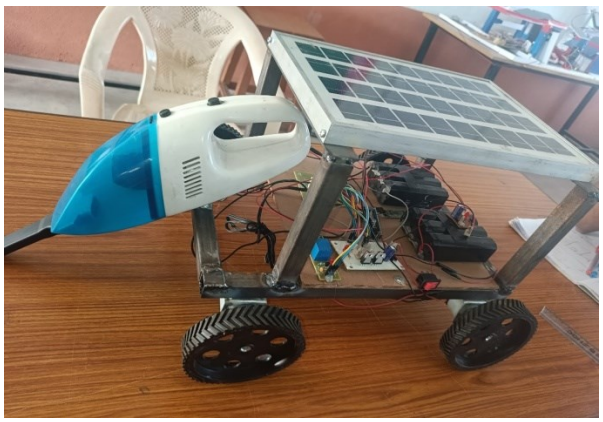
7. DC Motors

The **DC motors** are responsible for driving the wheels of the robot, enabling it to move and navigate the cleaning environment. These motors are controlled by the Arduino through a motor driver or relay. The speed and direction of the motors can be adjusted, allowing the robot to move in a straight line, turn, or avoid obstacles. The DC motors provide the mobility needed for the robot to cover various areas in a room, while also contributing to its ability to maneuver around furniture and obstacles as it cleans.

5.OUTPUT RESULTS







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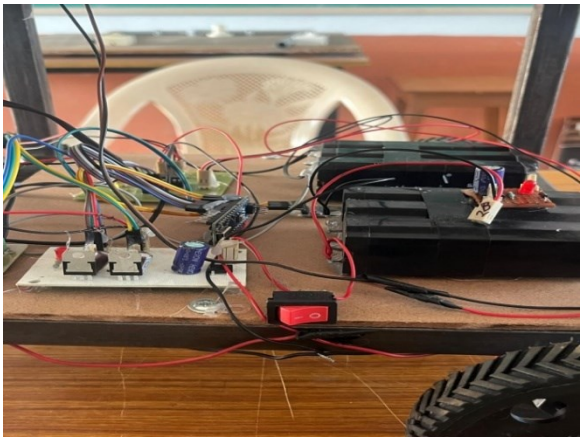

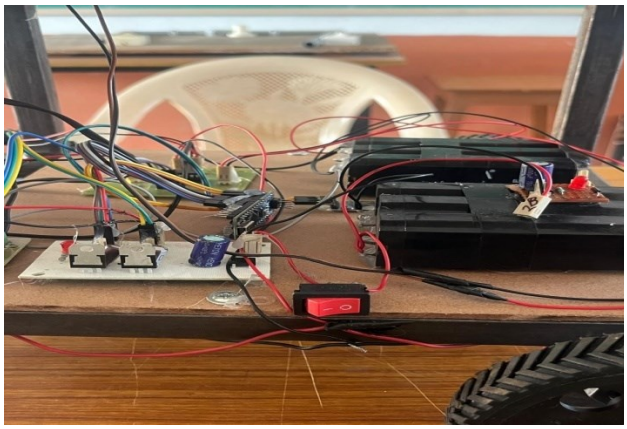

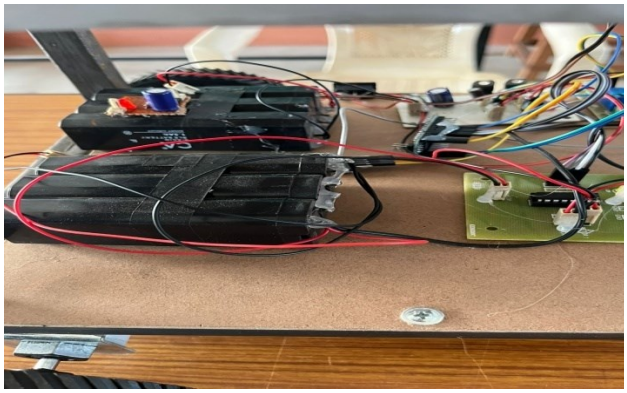

6.CONCLUSION

Cleaning is important work in every place of our house. Sometimes this is easy and sometimes it is difficult. Sometimes we assigned people for the purpose of cleaning and pay money for them. But sometimes cleaning is required in areas where presence of living being dangerous so we cannot assigned living being. So we required some technique to compensate these problems. We make a Robotic vacuum cleaner as a vacuum cleaner, which is operated using dual mode that is automatically and manually. In Automatic mode the robotic vacuum cleaner will cause the robot to move randomly on the floor of a room by avoiding the obstacles infront of the robot by using ultrasonic sensor (HC-SR04).In manual mode the robotic vacuum cleaner moves following commands that are controlled by the android-based smartphone using the Bluetooth module(HC-05).Vacuum cleaner robot is designed to make cleaning process become easier rather than by the using manual vacuum.

7.FUTURE SCOPE

The future of solar-powered dust-collecting robots holds significant potential as advancements in both robotics and renewable energy continue to progress. As energy efficiency and sustainability become more central to technological development,

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solar-powered robotic cleaning systems will likely see widespread adoption in residential and commercial spaces.

One of the key areas for future development is improving solar energy harvesting efficiency. Current solar panels used in robotic systems are often small and may not provide enough energy to operate the robot continuously, especially in environments with limited sunlight. As solar technology advances, higher efficiency, compact solar panels will become more feasible, allowing robots to operate longer on solar power alone. Additionally, integrating energy storage systems, such as advanced lithium-ion or solid-state batteries, will enable these robots to store excess solar energy, ensuring uninterrupted cleaning even in low-light conditions.

Another crucial aspect is enhanced navigation and AI algorithms. Future robots could integrate more advanced machine learning techniques to improve their ability to map complex home environments, recognize and adapt to obstacles, and clean with greater precision. The integration of LiDAR (Light Detection and Ranging) and vision-based navigation could allow robots to clean more efficiently and avoid collisions, particularly in cluttered or densely furnished spaces. Multi-floor navigation and cleaning will also become more sophisticated, allowing robots to seamlessly transition between different levels of a house or office.

The integration of additional features, such as air purifiers or UV sterilization systems, could make these robots even more effective by improving indoor air quality while they clean. Furthermore, the reduction of cost for both robotic systems and solar technology will make solar-powered dust-collecting robots more accessible to a wider range of consumers.

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