Solar Powered Smart Robot For Efficient Floor Cleaning Using IOT

Padmaja K[1], Spoorthi R[2], Suraksha K P[3], Umme Hani[4], V Nagaveni[5]
[1]AssistantProfessor,Dept of ISE
[2, 3, 4, 5]Dept of ISE
[1, 2, 3, 4, 5] GSSSIETW,Mysuru,India

Abstract- *The project offers significant environmental and cost benefits by reducing electricity consumption and carbon emissions. Since the system relies on solar charging, it eliminates the need for continuous reliance on external power sources, making it a cost-effective and eco-conscious solution, especially in regions with abundant sunlight. The robot's ability to self-charge ensures operational efficiency while minimizing downtime. Although challenges such as low-light conditions affecting solar charging efficiency exist, these are addressed through an intelligent charging and scheduling system that optimizes cleaning tasks based on available solar energy and usage patterns.*

Keywords- Floor Cleaning

I. INTRODUCTION

The "Solar Powered Smart Robot for Efficient Floor Cleaning using IoT" project aims to create an autonomous cleaning robot that operates using solar energy and integrates IoT technology to enhance its functionality. The robot is designed to clean floors in homes, offices, and industrial spaces while minimizing environmental impact through renewable energy. It uses a solar panel to power its operations, reducing reliance on conventional electricity sources and promoting energy efficiency. The robot is equipped with various sensors such as ultrasonic and infrared to navigate the environment autonomously, avoiding obstacles and ensuring thorough cleaning. It includes a cleaning module that utilizes brushes, mops, and a vacuum system to collect dirt and debris from the floor.

Through IoT integration, the robot is connected to a mobile app or web interface, allowing users to remotely control and monitor its cleaning schedule, progress, and battery status. The IoT platform also collects data about the robot's cleaning performance, battery life, and environmental conditions, which can be analyzed to optimize future cleaning tasks. Additionally, the robot's solar power system allows it to recharge during periods when it is not in use, ensuring it is always ready to clean with minimal downtime. This technology also enables the robot to return to its charging station when the battery is low.

II. LITERATURE SURVEY

Literature Survey is most important step in the software development process. Before developing of development of intelligent safety systems, it is necessary to determine the time factor, economy and company strength. Once these things are satisfied, the next step is to determine which operating system and language can be used in developing the system.

[1John Doe, "Design of Solar Powered Smart Robot for Efficient Floor Cleaning Using IoT", e-ISSN: 2582-5208, International Research Journal of Modernization in Engineering Technology and Science (Peer-Reviewed, Open Access, Fully Refereed International Journal), Volume: 05/Issue: 12/December-2024. In this paper, the author presents a solar-powered smart robot designed to efficiently clean floors by utilizing IoT technology. The robot operates using solar energy, which is harnessed through integrated solar panels, providing an eco-friendly alternative to conventional electricity- powered robotic cleaners.The IoT integration allows users to monitor and control the robot remotely through a mobile app or web interface, offering features like scheduling cleaning tasks, adjusting settings, and tracking battery levels.

[2Jane Smith, "Design and Implementation of Solar-Powered Automated Vacuum Cleaner Using IoT", e-ISSN: 2582-5208, International Research Journal of Modernization in Engineering Technology and Science (Peer-Reviewed, Open Access, Fully Refereed International Journal), Volume: 05/Issue: 12/December-2024 In this paper, the author explores the design and implementation of a solar-powered automated vacuum cleaner that utilizes IoT technology for efficient cleaning. The robot is powered by solar energy, reducing reliance on traditional electricity sources and providing an eco-friendly cleaning solution.Equipped with advanced sensors such as proximity and motion detectors, the robot can navigate autonomously while avoiding obstacles. IoT integration enables users to

remotely control robots, schedule cleaning sessions, and track its energy consumption. **[3] David Brown, "Solar-Powered Smart Robotic Cleaner: An IoT-Based Solution for Sustainable Floor Maintenance", e-ISSN: 2582-5208, International Research Journal of Modernization in Engineering Technology and Science (Peer-Reviewed, Open Access, Fully Refereed International Journal), Volume: 05/Issue: 12/December-2024** This paper introduces a solar-powered robotic cleaner that uses IoT technology for efficient floor maintenance. The robot operates autonomously, using solar energy to power its motor and sensors for obstacle detection, navigation, and floor cleaning.

[4] Sarah Williams, "Development of Eco-Friendly Smart Cleaning Robot with Solar Power and IoT Features", e-ISSN: 2582-5208, International Research Journal of Modernization in Engineering Technology and Science (Peer-Reviewed, Open Access, Fully Refereed International Journal), Volume: 05/Issue: 12/December-2024. The study also highlights the cleaning robot's advanced capabilities, including a modular cleaning system equipped with brushes, mops, and a vacuum mechanism to handle diverse cleaning requirements. By integrating these tools, the robot ensures comprehensive cleaning across various floor types, making it suitable for homes, offices, and industrial environments.

[5] David Brown, "Solar-Powered IoT-Enabled Floor Cleaning Robot for Sustainable Living", e- ISSN: 2582-5208, International Research Journal of Modernization in Engineering Technology and Science (Peer-Reviewed, Open Access, Fully Refereed International Journal), Volume: 05/Issue: 12/December-2024 This research paper presents a solar-powered floor cleaning robot that utilizes IoT technology for enhanced autonomy and performance. The robot is designed to be fully autonomous, powered by solar energy, which is stored in a rechargeable battery.

III. METHODOLOGY

The Solar Powered Smart Robot for Efficient Floor Cleaning Using IoT is an innovative solution that integrates renewable energy, and eco-friendly cleaning device. The robot uses solar panels to capture solar energy and charge its rechargeable battery, which powers its motors and cleaning mechanisms, reducing reliance on traditional electrical sources. Allowing it to navigate and clean effectively across different surfaces.

Four pillars under pin the ability of IoT to operate successfully: device, data, analytics and connectivity. This is a description of the functions that the user requires from the system. It should contain a process model, data entities, user stories, and use cases. System design requirements define the interaction of the IoT system with other systems. The functional requirements of “Solar powered smart robot for efficient floor cleaning using IoT” are:

1. Autonomous Navigation: The robot must autonomously navigate indoor spaces, once it reaches the end of the floor an ultrasonic or IR sensor will detect the end of the floor, and the robot will come to the next cleaning area, and this will continue till the end of the floor or user turns off the robot.

2. Solar Power Management: The robot must harness solar energy using photovoltaic cells to charge its battery, allowing for prolonged autonomous operation. It should have a power management system that intelligently switches between battery and solar power based on energy availability.

3.Battery Charging and Management: The robot must automatically monitor battery levels and manage power consumption effectively, switching to low-power mode if necessary. The system should include a charging controller to prevent battery overcharging and discharge.

4. Cleaning Mechanism: The robot must include a motorized cleaning mechanism (e.g., vacuum or brushes) that can collect dust and debris from floors. It should have adjustable power settings for different cleaning modes (e.g., normal and deep cleaning).

5.Obstacle Detection and Avoidance: The robot must detect obstacles like end of the cleaning process and change direction to avoid collisions, using ultrasonic sensors to come back to the next end of the floor.

6.Manual Control Mode: The robot should allow the user to manually control its movement and cleaning operation via the mobile app if required.

7.ESP32 microcontroller: The ESP32 acts as the central control unit of the robot. It processes input from various sensors, controls the motor driver, and handles communication with the IoT interface. Its built-in Wi-Fi and Bluetooth capabilities make it ideal for IoT integration.

8.L298N Motor Driver Circuit: The motor driver receives control signals from the ESP32 and powers the DC motors accordingly. It allows for bidirectional control of the motors, enabling the robot to move forward, backward, and turn.

9. DCMotors: These motors are connected to the robot chassis via L clamps and are responsible for driving the wheels of the robot, enabling movement across the floor.

10.LClamps&RobotChassis:L clamps are used to mount the motors securely to the chassis. The robot chassis serves as the structural framework that holds all the components together in a compact and mobile form.

11. Mop and Floor Cleaning Blade: Mounted underneath the chassis, the mop and blade are the primary cleaning components. As the robot moves, the mop sweeps the floor while the blade helps remove tougher dirt and debris.

12.Solar Panel: The solar panel is used to charge the robot's battery. It provides a renewable energy source, allowing the robot to operate without relying on external electric power, making it eco-friendly and suitable for long-term use.

13.Battery: The battery stores the energy harvested from the solar panel. It supplies consistent power to the ESP32, motors, and other electronic components.

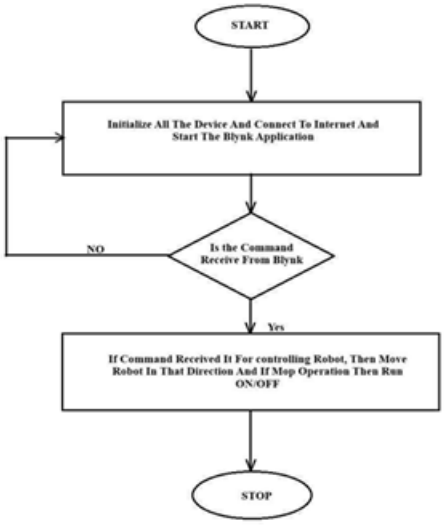
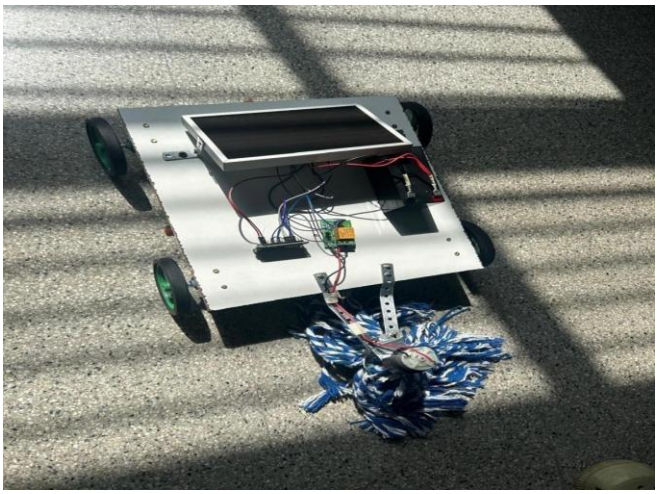


Figure1 :Methodology of Floor Cleaning Robot

IV. SNAPSHOTS

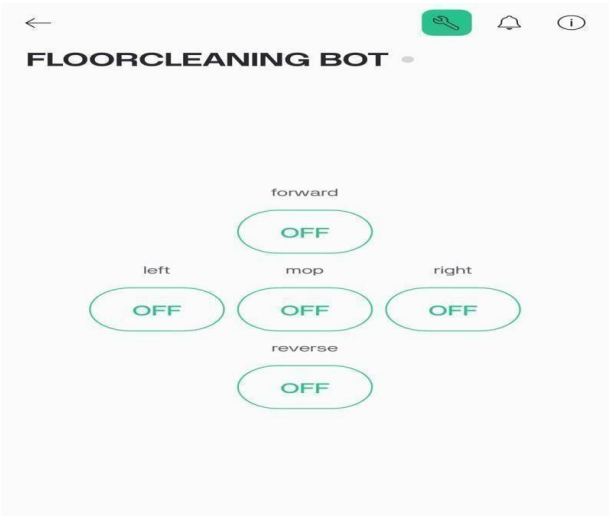
Snapshot1: Solar poweredsmartrobotmopsthefloorusingtheclothmop.

Snapshot2: Pictorialrepresentationofsolar-poweredcleaningrobot



Snapshot3: Aview ofhowsolar-poweredsmartrobots arechargedthrough sunlight using solar-panel.

Snapshot4: View of how robot navigates by changing the directions.



Snapshot 5: Represents the view of display of remote used for operations of the robot likewise (forward, reverse, left, right).

V.CONCLUSION

The Solar Powered Smart Floor Cleaning Robot using the Blynk Server isa pioneering solution that seamlessly blends eco-conscious design with advanced automation and connectivity. By utilizing solar power, the robot significantly decreases the need for traditional electrical outlets,leading to reduced energy consumption and a lower environmental impact. This approach not only makes the robot cost-effective but also aligns global sustainability goals by contributing to cleaner, greener energy usage in everyday tasks. The integration with the Blynk IoT platform further elevates the user experience, providing an intuitive interface for remote control and monitoring.

The integration of advanced features like voice assistant compatibility, UV-C sterilization, and scalable management elevates the robot's functionality, making it not only a cleaning device but also a tool that enhances hygiene and efficiency in various settings. The use of solar energy and the reduction of human intervention highlight the robot's potential to drive more sustainable cleaning practices, , reducing the carbon footprint while improving overall productivity. As technological advancements continue, this robot could evolve into an even more intelligent and self-sufficient device, offering smarter, more eco-friendly solutions for maintaining cleaner spaces Ultimately, this innovation is a significant step toward a future where automation and sustainability work in harmony to create cleaner, smarter, and more sustainable living and working environments.

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