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Smart Vacuum Cleaner

Dr B Leena[1], A. Anjana Sree[2], P. Pavithra[3], B. Swetha[4], SPB. Ragul Subramaniyan[5]

[1]Assistant Professor/ ECE KGiSL Institute of Technology, Saravanampatty, Coimbatore, Tamil Nadu, India

[2-5]UG Student/ECE, KGiSL Institute of Technology, Saravanampatty ,Coimbatore, Tamil Nadu, India

ABSTRACT*:* Our project revolves around a smart vacuum cleaner that transforms a conventional cleaning method by integrating RFID-authorized access for room-specific cleaning operations. This next-generation device not only aptly removes dust and mops the floor but also streamlines the cleaning process through the seamless integration of RFID technology. Users can effortlessly scan room numbers for access authorization, triggering the automated movement of our intelligent cleaning robot into action. Upon completion of the cleaning task, detailed cleaning data specific to the authorized room is promptly transmitted via IoT or a dedicated mobile application. This makes sure that users are informed about the cleaning status as soon as possible, which improves ease and openness in home maintenance. Our creative solution revolutionizes house cleaning by fusing state-of-the-art cleaning technology with safe access control systems, providing unmatched effectiveness and efficiency. This revolutionary method enables users to easily maintain immaculate living spaces, appealing to the current lifestyle when efficacy and convenience are crucial.

KEYWORDS: Smart Vacuum Cleaner, RFID-authorized Access, IoT Integration, Room-specific Cleaning, Automated Cleaning System

I.INTRODUCTION

An Arduino-based vacuum cleaner is a cleaning device that is powered and controlled by an Arduino microcontroller. The Arduino board is programmed to control the motors, sensors, and other components that make up the vacuum cleaner. This allows for a high degree of customization and control over the cleaning process, making it possible to program the vacuum cleaner to clean specific areas, adjust the suction power, and even navigate around obstacles. Additionally, an Arduino-based vacuum cleaner can be connected to other devices and systems, such as a smartphone or a home automation system, to provide remote control and monitoring capabilities. This makes the vacuum cleaner not only a practical cleaning tool, but also a fun and educational project for makers and hobbyists interested in robotics and home automation.

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II.EXISTING METHODOLOGY

Traditional vacuum cleaners rely on manual operation and lack autonomous functionality. They require constant supervision and user intervention, leading to inefficiency and inconvenience. Limited connectivity options make it challenging to monitor and control cleaning tasks remotely.

Robotic Vacuum Cleaners (Without IoT):

While robotic vacuum cleaners offer automated cleaning capabilities, many lack IoT integration. Without IoT connectivity, these cleaners cannot be controlled remotely or provide real-time status updates. They may lack advanced features such as room recognition and customized cleaning patterns based on user preferences.

IoT-Enabled Vacuum Cleaners (Without Robotic Features):

Some vacuum cleaners offer IoT connectivity but lack robotic capabilities for autonomous navigation and obstacle avoidance. While users can control these cleaners remotely and receive notifications, they still require manual intervention for navigation and obstacle avoidance. This limits their efficiency and effectiveness, especially in larger spaces or complex environments.

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Custom-Built Solutions (Without Integration):

Some enthusiasts may attempt to build custom vacuum cleaner systems using individual components and microcontrollers like Arduino. However, without proper integration of robotic features, IoT connectivity, and sensors, these solutions may lack efficiency and reliability. Building a custom system from scratch requires significant technical expertise and may not always yield optimal results compared to commercially available products.

III. PROPOSED METHODOLOGY

Robotic IoT Integration:

The proposed method integrates robotics and IoT technology, combining the autonomous navigation capabilities of a robotic vacuum cleaner with the connectivity and remote-control features of IoT.This integration enables the vacuum cleaner to operate autonomously while also being remotely monitored and controlled via a mobile application or web interface.

Autonomous Navigation and Obstacle Avoidance:

Utilizing sensors such as ultrasonic or infrared, the vacuum cleaner autonomously navigates through the environment, avoiding obstacles and adjusting its cleaning path accordingly. This autonomous navigation capability enhances efficiency and ensures thorough cleaning without requiring constant user supervision or intervention.

RFID-Based Room Recognition:

Incorporating an RFID reader allows the vacuum cleaner to recognize different rooms based on pre-defined RFID tags. This feature enables customized cleaning patterns for each room, optimizing cleaning efficiency and adapting to specific room layouts and cleaning requirements.

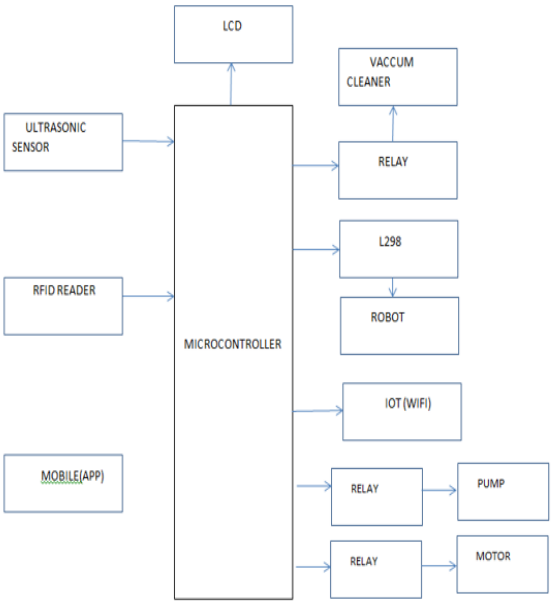

Figure 1: Block diagram of proposed ideology

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IoT Connectivity and Mobile Application:

The inclusion of NodeMCU or similar IoT modules enables connectivity to the internet, allowing users to remotely monitor and control the vacuum cleaner. Through a dedicated mobile application or web interface, users can schedule cleaning tasks, receive real-time status updates, and adjust cleaning settings from anywhere, enhancing convenience and flexibility.

Enhanced User Experience:

The proposed method offers a seamless and intuitive user experience, combining the convenience of autonomous cleaning with the flexibility of remote control. Users can enjoy hassle-free cleaning operations while also having the ability to customize cleaning schedules, monitor cleaning progress, and receive notifications, contributing to improved productivity and peace of mind.

Efficient Cleaning Performance:

By leveraging robotic autonomy and advanced sensors, the proposed method ensures efficient and thorough cleaning of various surfaces and environments. The vacuum cleaner adapts its cleaning pattern based on room layout, avoids obstacles, and navigates efficiently, resulting in optimal cleaning performance and enhanced cleanliness.

4. Schematic structure of Smart Vacuum Cleaner

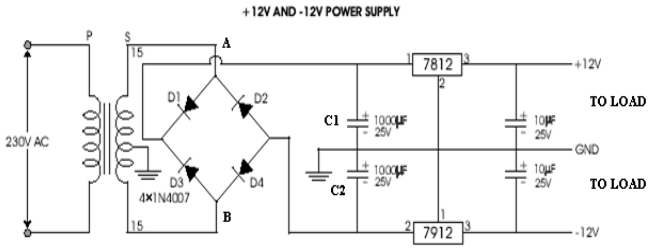


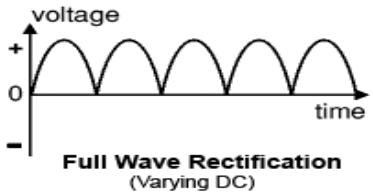
Figure 2: Circuit diagram of Smart Vacuum Cleaner

Transformer

The potential transformer will step down the power supply voltage (0-230V) to (15-0-15) level. If the secondary has less turned in the coil then the primary, the secondary coil's voltage will decrease and the current or AMPS will increase or decreased depend upon the wire gauge. **This is called a STEP-DOWN transformer.** Then the secondary of the potential transformer will be connected to the rectifier.

Bridge rectifier

When four diodes are connected as shown in figure, the circuit is called as bridge rectifier. The input to the circuit is applied to the diagonally opposite corners of the network, and the output is taken from the remaining two corners.



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Let us assume that the transformer is working properly and there is a positive potential, at point A and a negative potential at point B. the positive potential at point A will forward bias D3 and reverse bias D4.

The negative potential at point B will forward bias D1 and reverse D2. At this time D3 and D1 are forward biased and will allow current flow to pass through them; D4 and D2 are reverse biased and will block current flow.

The path for current flow is from point B through D1, up through Load, through D3, through the secondary of the transformer back to point B.

One-half cycle later the polarity across the secondary of the transformer reverse, forward biasing D2 and D4 and reverse biasing D1 and D3. Current flow will now be from point A through D4, up through Load, through D2, through the secondary of transformer, and back to point A. Across D2 and D4. The current flow through Load is always in the same direction. In flowing through Load this current develops a voltage corresponding to that. Since current flows through the load during both half cycles of the applied voltage, this bridge rectifier is a full-wave rectifier.

One advantage of a bridge rectifier over a conventional full-wave rectifier is that with a given transformer the bridge rectifier produces a voltage output that is nearly twice that of the conventional half-wave circuit.This bridge rectifier always drops 1.4Volt of the input voltage because of the diode. We are using 1N4007 PN junction diode, it cut off region is 0. 7Volt.So, any two diodes are always conducting, total drop voltage is 1.4 volt.

The unregulated AC/DC power supply part of the circuit consists of a transformer that steps down 230VAC to 15 volts across a centre tapped secondary winding 15V AC individually across the two halves of the secondary winding with opposite polarities, diodes (D1) to (D4) that rectify the AC appearing across the secondary with (D1) and (D3) providing ‘full wave rectification to produce a positive output, (D2) and (D4), providing full wave rectification to produce a negative output, capacitors (C1) and (C2 providing the filtering action. 7812 is a fixed output positive three terminal regulator whereas 7912 is a fixed output negative three terminal regulator.

V. CONCLUSION

The development of the Smart Vacuum Cleaner represents a significant advancement in the field of automated cleaning technology. By integrating robotics, IoT connectivity, and advanced sensors, this intelligent cleaning solution offers unprecedented convenience, efficiency, and flexibility for modern households and commercial environments. With autonomous navigation, obstacle avoidance, RFID-based room recognition, and remote-control capabilities, the Smart Vacuum Cleaner streamlines cleaning operations and enhances cleanliness without requiring constant user supervision. Moreover, its potential for future development, including AI integration, multi-room mapping, and eco-friendly design, promises even greater innovation and functionality. As we continue to strive for smarter, more sustainable solutions in everyday life, the Smart Vacuum Cleaner stands as a testament to the possibilities of technology in improving our living environments and enhancing our quality of life.

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