Floor Cleaning Robot using Android App

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Abstract: *The contemporary household landscape is witnessing a paradigm shift towards enhanced intelligence and automation. The integration of home automation systems not only provides increased convenience but also affords individuals more time for other pursuits. This project endeavors to conceptualize and actualize a Vacuum Robot that operates autonomously and manually through a designated mobile application. The Vacuum Cleaner Robot, utilizing components such as Arduino Mega, Arduino Shield, LDR Sensor, Real-Time Clock, Motor Shield L293D, Ultrasonic Sensor, and IR Sensor, aims to streamline the cleaning process, replacing manual vacuuming with an efficient automated solution. The primary objective of this initiative is to successfully design and implement a prototype Vacuum Robot that adheres to user-friendly criteria outlined in the aforementioned context.*

Keywords: Home Automation, Robotic Vacuum Cleaner, LDR Sensor, L293D, Android Phone, Arduino UNO, Floor Cleaning, ESP8266

I. INTRODUCTION

The modern era has witnessed the pervasive integration of smart machines, commonly known as robots, across diverse domains such as manufacturing, industry, production lines, and healthcare. These intelligent machines are adept at undertaking arduous, hazardous, and precision-demanding tasks, thereby enhancing efficiency and productivity. Unlike their human counterparts, robots operate tirelessly, contributing to 24/7

workflow and achieving unparalleled precision in a significantly reduced timeframe. One prominent application of robots is found in the realm of assistive mobile robotics, where these machines perform a myriad of functions across various sectors, including industry, manufacturing, and healthcare, ultimately aiming to improve human life. This research seeks to extend the utility of robotics into the domain of household chores, where the potential impact on daily life is significant. Leveraging the capabilities of smartphones, advanced mobile devices equipped with powerful computing platforms, this project integrates hardware and software components to create a collaborative system. The combination includes a microcontroller, motor shield, sensors, an Android application, and a Bluetooth module, establishing a seamless connection between the physical robot and its software control. The design rationale is rooted in the idea of making household tasks, specifically the cleaning process, more accessible through a human-machine collaborative effort, ultimately driven by the efficiency and affordability of smartphone technology. The transformative power of smartphones in redefining traditional human-machine interactions cannot be overstated. As compact yet potent devices, smartphones have evolved beyond their conventional roles and are becoming instrumental in supporting collaborative activities within communities. The advent of the Android platform has revolutionized mobile application development, opening avenues for technical exploration and innovation. In the context of this project, the Android smartphone serves as a dynamic interface, providing real-time, three-dimensional signal data derived from its built-in 3-axis acceleration sensor. This data, transmitted via a Bluetooth module, facilitates communication with the robotic system, wherein a microcontroller processes the information to execute specific motions. The intersection of robotics and smartphone technology exemplifies a paradigm shift in how we interact with machines, showcasing the potential for enhanced human-machine collaboration in various domains.
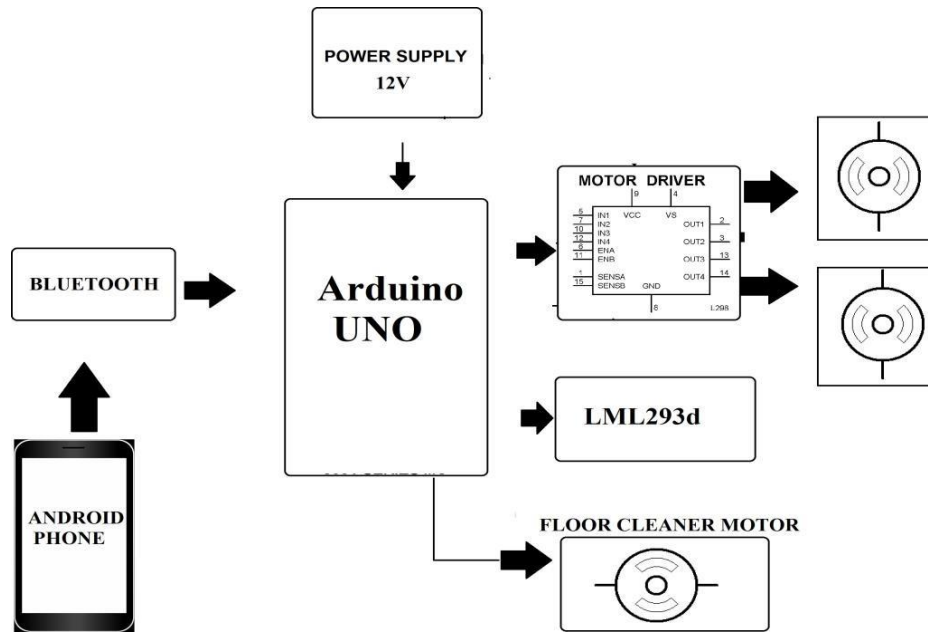
II. GENERAL BLOCK DIAGRAM

Fig 1. Proposed System Architecture

III. PROJECT DISCRIPTION

The proposed system is centered around a transmitter app running on an Android mobile phone, serving as the user interface for commanding the floor cleaning robot. This app enables users to transmit specific commands based on their input preferences, initiating movement instructions for the robot. The transmitter app functions as a remote control, facilitating seamless communication between the user and the cleaning robot. The utilization of an Android mobile phone as the transmitter not only provides a user-friendly interface but also capitalizes on the device's computing power and connectivity features. The floor cleaning robot itself is equipped with two cleaning pads and a water sprayer designed for efficient cleaning. Comprising two motorized rotating cleaning scrubs, the robot is adept at tackling various types of dirt and debris. The cleaning mechanism is further enhanced with the inclusionn of a water sprayer, contributing to the overall effectiveness of the cleaning process. The robot's design ensures thorough coverage and optimal cleaning performance. The integration of the cleaning pads, rotating scrubs, and water sprayer attests to the versatility of the robot in addressing different cleaning requirements.

The communication between the Android mobile phone and the robot is facilitated through a Bluetooth receiver. Upon receiving movement commands from the transmitter app, the microcontroller within the robot decodes and processes these commands. Subsequently, the microcontroller operates the motors, enabling the robot to execute the desired motion as instructed by the user. The responsiveness of the system allows for real-time control and adjustments, ensuring that the robot adapts swiftly to the user's cleaning preferences.

Notably, the proposed working of the system extends beyond basic movement control. The Android app provides users with the capability to control the sprayer and cleaning mechanism, offering a comprehensive and customizable cleaning solution. This integration of user-controlled functionalities enhances the efficiency and versatility of the floor cleaning robot, making the entire floor cleaning process remarkably easy, fast, and virtually effortless for the end user. The proposed system involves the design and implementation of an RC car equipped with a vacuum cleaner, integrating advanced features to ensure autonomous and obstacle-avoidant operation. The foundation of the system lies in the installation of four DC motors on the RC car, each connected to wheels to facilitate movement. The motors are meticulously soldered with positive and negative wires, creating a robust and reliable connection. The control of motor speed and direction is achieved through Arduino IDE code, leveraging a motor shields to realize the desired

performance. This configuration allows the RC car to navigate with precision and agility based on the instructions embedded in the Arduino code, offering a dynamic and customizable driving experience. A key innovation in the proposed system is the incorporation of an ultrasonic sensor, strategically placed on the RC car to detect obstacles in its path. This sensor plays a crucial role in preventing collisions with walls, tables, chairs, or any sizable obstacles that may pose a threat to the RC car or its attached vacuum cleaner. When an obstacle is detected, the Arduino code triggers a change in the RC car's direction, ensuring a swift and effective avoidance maneuver. This obstacle avoidance mechanism is vital for preserving the integrity of the RC car and preventing potential damage, especially when navigating through confined spaces or cluttered environments. The continuous execution of the Arduino code ensures that the RC car operates seamlessly, constantly monitoring its surroundings with the ultrasonic sensor. The cycle repeats at regular intervals, allowing the system to respond promptly to obstacles and navigate through the environment with adaptability. By integrating a vacuum cleaner with obstacle avoidance capabilities, this proposed system offers an innovative solution for automated floor cleaning in varied settings, promising efficiency and safety in its operation

IV. WORKING MODULE

The proposed methodology involves the integration of various hardware components and technologies to create an innovative floor cleaning robot and an obstacle-avoiding RC car, both controlled by an Android mobile application. The core components include the Arduino Uno board, Bluetooth module, L293D motor driver, four-wheeler robot chassis, and a servo motor for precise control. Additionally, the floor cleaning robot incorporates cleaning pads, water sprayer, and motorized rotating cleaning scrubs, while the RC car integrates ultrasonic sensors for obstacle detection.
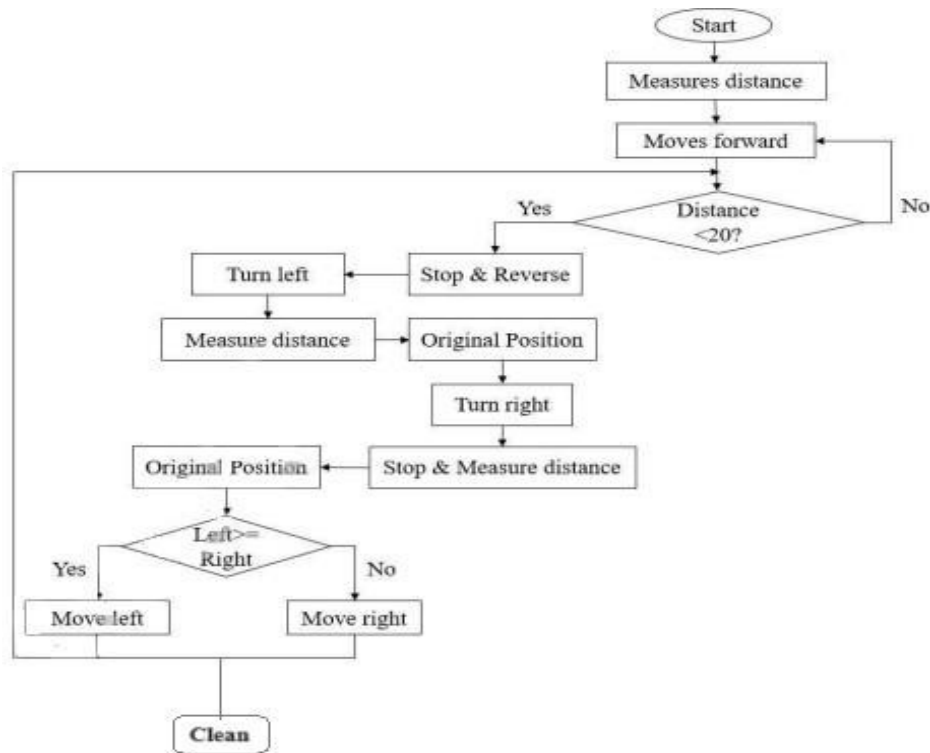

Fig 2. System Flow Diagram

The first step in the methodology is to assemble the hardware components for both the floor cleaning robot and the obstacle-avoiding RC car. This includes connecting motors to the Arduino Uno board using the L293D motor driver for controlled movement. The Bluetooth module is integrated to establish wireless communication between the Android mobile application and the robotic systems. The four-wheeler robot chassis provides a stable platform for the cleaning

robot, allowing it to move in various directions, while the servo motor ensures precise control for specific tasks. Next, the Android mobile application is developed to serve as the transmitter for both the floor cleaning robot and the RC car. This application enables users to transmit commands based on their input preferences,activating movement commands and controlling additional functionalities such as the water sprayer and cleaning mechanism. The Bluetooth module facilitates communication between the Android app and the Arduino Uno board, providing a seamless interface for users to interact with the robotic systems For the floor cleaning robot, the Android app transmits movement commands to the Arduino Uno board, which then decodes these commands. The microcontroller on the robot processes the instructions and operates the motors, allowing the robot to achieve the desired motion. Simultaneously, the cleaning pads, water sprayer, and rotating cleaning scrubs are controlled based on user input through the Android app, streamlining the floor cleaning process.

In the case of the obstacle-avoiding RC car, the ultrasonic sensor detects obstacles in the car's path. Upon detecting an obstacle, the Arduino Uno board receives signals from the sensor and triggers a change in the RC car's direction using the motor driver. This continuous cycle of obstacle detection and direction adjustment ensures that the RC car with the attached vacuum cleaner can navigate through the environment without collisions, optimizing safety and efficiency. In summary, the proposed methodology involves the systematic integration of hardware components, development of an Android mobile application, and utilization of sensors to create versatile and efficient robotic systems. The combination of Arduino-based control, Bluetooth communication, and obstacle detection technologies aims to deliver user-friendly, autonomous, and effective floor cleaning and obstacle-avoidance, capabilities.

V. FUNCTION

- Remote Control: Start/stop cleaning and schedule cleanings.
- Navigation: Real-time mapping, set no-go zones, and room-specific cleaning.
- Cleaning Modes: Different modes and adjustable suction power.
- Alerts: Battery status and maintenance notifications.

Advantage

- Convenience: One of the primary advantages is their convenience. Floor cleaning robots can be programmed to clean at specific times, so you don't have to manually clean your floors every day.
- Accessibility: They make floor cleaning accessible to people who may have difficulty with traditional cleaning methods due to physical limitations or disabilities.
- Customization: Some models allow for customization of cleaning schedules and patterns, allowing you to tailor the cleaning to your specific needs and preferences.

Application

- Residential Use: The most common application of floor cleaning robots is in house- holds. They can effectively clean various types of flooring, including hardwood, tile, laminate, and carpet, providing convenience and saving time for homeowners.
- Commercial Spaces: Floor cleaning robots are increasingly being used in commercial settings such as offices, hotels, restaurants, and retail stores. They help maintain cleanliness in high-traffic areas and reduce the need for manual labor.
- Healthcare Facilities: In hospitals, clinics, and other healthcare facilities, maintain- ing a clean and hygienic environment is crucial for patient safety. Floor cleaning robots can help sanitize floors efficiently, reducing the risk of infections.

VI. FUTURE DEVELOPMENTS

- Artificial Intelligence (AI) and Machine Learning: Integrating advanced AI algo- rithms and machine learning capabilities can enable robotic vacuum cleaners to adapt to the user's cleaning preferences, learn from their

environment, and opti- mize cleaning routes over time. This can lead to more efficient and personalized cleaning experiences.

- Smart Home Integration: Future robotic vacuum cleaners may have enhanced con- nectivity and compatibility with smart home ecosystems. Integration with plat- forms like Amazon Alexa, Google Assistant, or Apple HomeKit would enable users to control and monitor their robotic vacuum cleaners using voice commands or mobile apps.
- Energy Efficiency and Battery Technology: Advances in battery technology can lead to longer-lasting batteries and faster charging times. This would result in robotic vacuum cleaners that can cover larger areas on a single charge and spend less time recharging.

VII. CONCLUSION

In this project Smart Vacuum Cleaner has been implemented. It was works on a pre-defined code inserted in Arduino UNO. Whenever RC car encounters any obstacle, it turns to the side where the distance between obstacle and car is more. This project helps collect the dust using a vacuum cleaner made using CPU fan and batteries without human intervention thereby reducing the hazards to human health. This is a simple and cost- effective cleaner. However, using a detachable bag may be better as removing the dust becomes simpler.

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