Robotic Vacuum Cleaning car

Portfolio's link: https://retro-hue.github.io/Portfolio/

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Table of Contents

Abstract

This project focuses on the design and development of a remote-controlled vacuum cleaning robotic car. The robot integrates mobility and suction mechanisms to clean flat surfaces efficiently. Powered by a DC battery and controlled via a remote, the system incorporates a microcontroller for precise motor control. This affordable and functional prototype demonstrates the potential of combining microcontroller programming and robotics for practical cleaning applications.

Introduction

With increasing automation in daily life, robotics has emerged as a significant field of innovation. The remote-controlled vacuum cleaning robotic car is a step towards integrating automation into cleaning tasks. The robot can be maneuvered using a remote control to navigate surfaces while cleaning debris using an onboard vacuum fan.

Components

1. **Car Chassis**: Serves as the structural base for mounting all hardware.
2. **DC Gear Motors**: Drive the wheels for movement.
3. **Motor Wheels**: Allow smooth and stable motion.
4. **Motor Driver Module**: Facilitates control of motor speed and direction using the microcontroller.
5. **Remote Control System**: Allows the user to control the robot's movement.
6. **DC Battery**: Powers all electrical components, including motors and the vacuum fan.
7. **Power Vacuum Fan**: Provides suction for debris collection.
8. **Relay Module**: To make switching for remote controlled power vacuum fan. 9. **Microcontroller**: Processes remote signals and controls motors and the fan.

Methodology

1. **Remote Control Signal Processing**:

   Signals from the remote are received by the microcontroller, which processes commands for motor movement.

2. **Mobility**:

   The motor driver controls the movement of DC motors, enabling forward, backward, and turning operations.

3. **Vacuum Cleaning**:

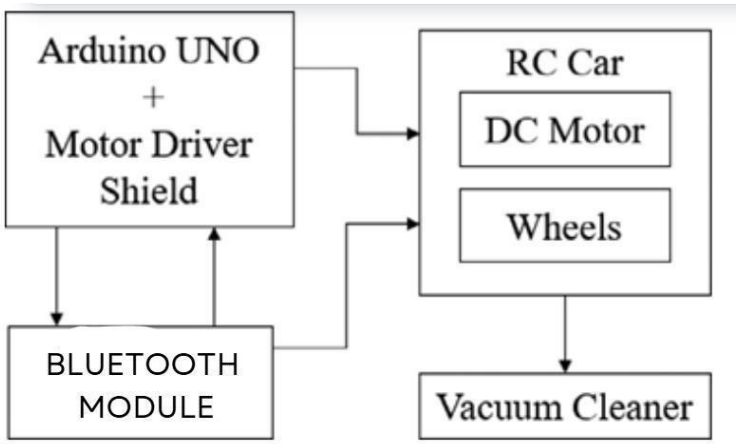
   The vacuum fan collects dust and debris during operation, storing it in an onboard container.

4. **Power Distribution**:

   A rechargeable DC battery supplies power to the motors, fan, and microcontroller, ensuring efficient operation.

Block Diagram

The block diagram illustrates the interconnection of components, including the remote control, microcontroller, motor driver, motors and vacuum fan.



Implementation

1. **Hardware Assembly**:
    - The car chassis was assembled, and the motors, wheels, and vacuum fan were mounted.
    - Electrical components were securely attached and connected with jumper wires.
2. **Software Development**:
    - The microcontroller was programmed to process remote commands and control motor movements and vacuum fan operation.
3. **Integration**:
    - The hardware and software were integrated, and initial testing was conducted to ensure functionality.

Testing and Results (with Outcome Picture) Testing:

- **Motor Movement**: Directional movement (forward, backward, left, right) was successfully tested using the remote control.
- **Vacuum Operation**: The vacuum fan was tested for its ability to collect dust and debris effectively.

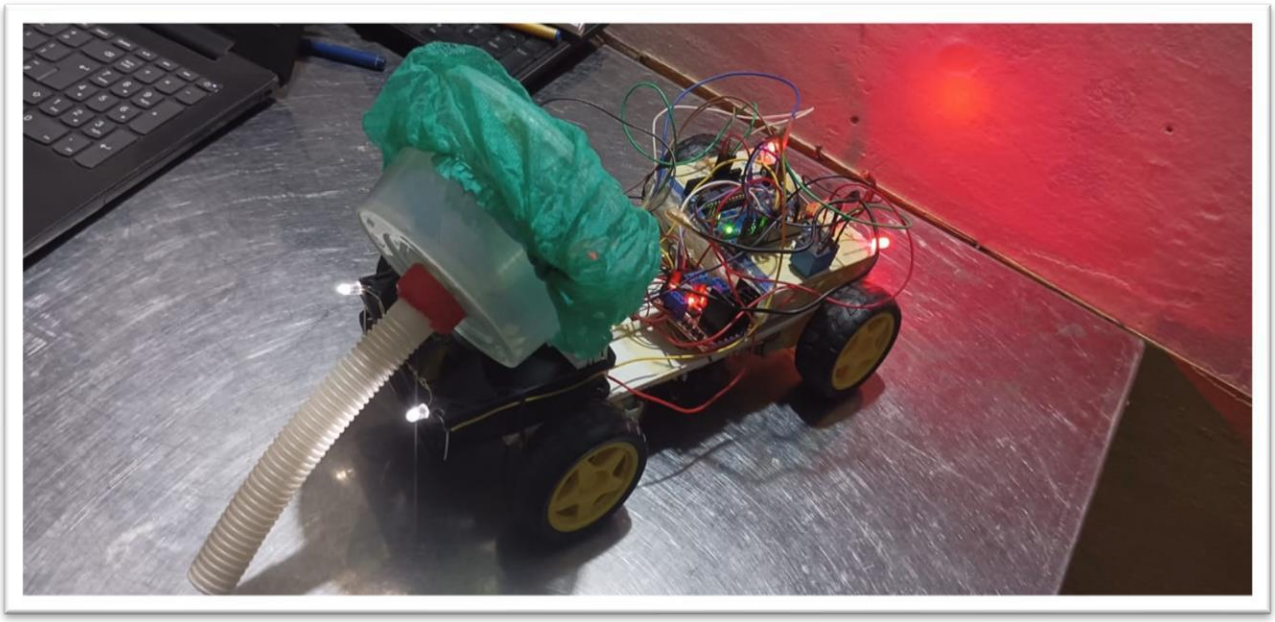
Challenges Faced:

1. Initial motor control programming resulted in erratic movements due to timing errors in PWM signals.
2. Loose wire connections caused intermittent power loss, which required rewiring.
3. Synchronization of vacuum operation with movement required several adjustments for efficient cleaning.

Results:

The robotic car successfully responded to remote commands and demonstrated effective cleaning capabilities. The vacuum fan collected debris while the car navigated smooth surfaces.

Outcome Picture:



Conclusion

The development of the remote-controlled vacuum cleaning robotic car achieved its primary goals. The project demonstrated the integration of microcontroller programming, hardware assembly, and robotics in creating a functional prototype. Challenges faced during the process were resolved, improving the system's overall performance. This project serves as a foundation for exploring more advanced robotic applications in cleaning and automation.