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Design and Analysis of Robotic Vacuum Cleaner

¹Swapnali R. Gangurde, ²Komal R. Gangurde, ³Jagruti P. Kshirsager, ⁴Ubed A. Khatik, ⁵Prachi Kulkarni, ⁶Namrata M.Sonawane, ⁷Saubhagiya S.

[1,2,3,4]Student, [5,6,7]Assistant Professor
Department of Electrical Engineering, Sandip Polytechnic, Nashik

ABSTRACT

The aim of this project is to design an autonomous robotic vacuum cleaner that can make cleaning process easier rather than manual vacuum cleaner. The idea here is to detect the object using sensors and send the output to the microcontroller that will control the movement of the robot vacuum cleaner. By using robovac, user can just turn on the device to clean without any human interaction to operate the vacuum cleaner.

Automatic vacuum cleaners use open CV (Image based processing), raspberry pi camera, dc motor and control driver and node mcu, ultrasonic sensor. It also contains mop for wet cleaning, autonomously vacuuming and wet-mopping a floor in one pass (sweep and mop combo). By using image processing technique our vacuum cleaner is able to detect obstacle and able to find correct path for proper cleaning of floor. Vacuum cleaner is of truncated shape .It uses image processing which has several criteria that makes it user-friendly.

Key word: - Cleaning, Collision Control, Corner Mapping, Dry Cleaning, Floor Mapping, Wet Cleaning.

Introduction

A robotic vacuum cleaner, often referred to as a "robovac" or "robotic vacuum," is a cutting-edge household appliance designed to automate the process of cleaning floors in homes and businesses. These compact, self-propelled devices are equipped with a range of sensors, brushes and motors that enable them to autonomously navigate and clean various types of flooring surfaces, including hardwood, tile, carpet, and linoleum.

The primary objective of a RVC is to simplify and streamline the task of floor cleaning. User can set up cleaning schedules, control the device remotely using smartphone app, or let it work independently. As the robovac moves around a space, it uses sensors to detect obstacles and adjust its cleaning path accordingly, ensuring that it thoroughly cleans an area. Some models also incorporate advanced features such as room mapping and obstacle avoidance to enhance their efficiency.

The introduction of robotic vacuum cleaners has transformed the way we approach household chores. These devices save ti me and effort, making it easier for people to maintain a clean and tidy living environment. With their growing popularity and continuous advancements in technology, robotic vacuum cleaners have become an integral part of modern homes, contributing to the automation and convenience of daily life.

Technology has advanced a lot to provide ease and comfort for the humans to perform their daily tasks. Robovac will assist people who are too busy to clean the house daily or weekly. Robovac on just push of a button will make the cleaning process easy and without any human interaction. Products already available in the market are very expensive. This project aims to design a cheap and convenient product that can clean a room on its own, saving a person valuable time. The robot will be programmed to sense the direction of a collision with an obstacle using onboard infra-red sensors. If the robotic vacuum hits an object head-on, it backs up and changes direction. If an obstacle is hit at an off-angle, the robotic vacuum turns away from the direction of the impact. The robotic vacuum movement is based upon a random walk around a room, which will cover the entire area of a room given enough time. The robot is programmed to drive straight until an obstacle is hit. At that point, it will turn and continue driving straight until another obstacle is hit.

Survey and Specification

1. Vacuum cleaning robot using Arduino 2560

2. Lessons learnt from Robotic vacuum cleaners entering the home ecology

3. Automatic vacuum cleaner with Smartphone compatibility

4. Design and implementation of smart floor cleaning robot using Android App

5. Autonomous cleaning robot: Roboking system Integration and Overview

Literature Review

The "Vacuum cleaning robot" using Arduino 2560,It also has a cooling fan and a suction fan that can produce a vacuum that suc ks or attracts dirt within the dustbin. The ultrasonic sensor detects the barrier, and the power supply utilised in this project is 28.8V.The disadvantage of this vacuum cleaner is that it has a smaller dustbin than other modern vacuum cleaners.

"Lessons learnt from Robotic vacuum cleaners entering the home ecology" It prioritises power consumption, navigation, cleaning performance, and energy efficiency, and it covers all of the useful cleaning regions, but it is inaccurate.Also mentioned in this document are seven various types of cleaners, each with its own manufacturer.

The "Automatic vacuum cleaner with Smartphone compatibility" One of its features is that it may operate in two modes: manually and automatically. It covered a huge cleaning area. It uses the HC-05 Bluetooth model to connect to the smart phone. This can be utilised in hospitals, businesses, and other settings.

"Design and implementation of smart floor cleaning robot using Android App" The Arduino UNO was used to control their project. It's a wireless robotic system that's also a manual system because it's controlled by an android app that's run by a person.The restriction is that it does not clean damp floors, does not reach small areas, and leaves unclean areas.

"Autonomous cleaning robot: Roboking system Integration and Overview." The 320LF2406A digital signal processor from Texas Instruments is used to make decisions in this system. It has a frequency of 40 MHz and a data rate of 40 megabits per second. All onboard motors and the battery management system are controlled by DSP.
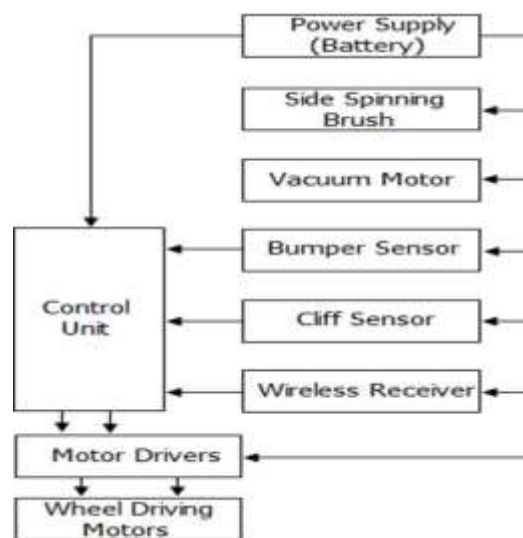
Discussion and Methodology

Fig. Block Diagram of RVC

Conclusion

The developed robot is developed is fully operational that navigates according logic. . It is operated to achieve

cleaning of dry dust particles with more efficiency. Since robot is wireless device it can navigate to cover the large area. It also make less human interaction which reduces the human work The robot can be further used to upgrade with the functionalities such as to sense and detect as well as to move in the direction of dust which results in better cleaning, self charging, self dust disposal and to schedule timing for cleaning.

References

- • T.B. Asafa and T.M. Afonja designed the "Vacuum cleaning robot" using Arduino 2560.

- • F. Vaussarda, J. Finkb, V. Bauwens, P. Retornaza, and D. Hamela produced the "Lessons learnt from Robotic vacuum cleaners entering the home ecology" in their study.

- • The "Automatic vacuum cleaner with Smartphone compatibility" published by author "N. M Borkar, Pragya Mishra, Anjali" in paper is based on ATmega8.

- • M. Ranjit Kumar and N. Kapilan collaborated on "Design and implementation of smart floor cleaning robot using Android App" in paper.

- • Author Sewan Kim's paper was titled "Autonomous cleaning robot: Roboting system Integration and Overview."