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Survey on: Smart Vacuum Cleaner

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ABSTRACT– *Robots are an integral part of the 21st century, due to their excessive use in households, hotels, offices, etc. With the increase of technologies households of today are becoming smarter and more automated. As the robot enters in human-environment it has got more attention from researchers to make our life comfortable. As we have faced pandemic in 2020 and we all come to know that how cleaning and hygiene are important for healthy living and which is being neglected due to lack of time from a busy lifestyle, so this vacuum cleaner is a type of robot which made home cleaning easier and less time-consuming. Taking this into consideration we are come up with an automatic vacuum cleaner that can perform all the activities without any human guidance. Even though various cleaners are available today, their high cost and low versatility are the main reasons that hold back their selling rates.*
Keywords- *Cleaning, Collision Control, Corner Mapping, Dry Cleaning, Floor Mapping, Wet Cleaning.*

I.INTRODUCTION

Robots play a significant role in our daily lives. They're employed in practically everything, including children's toys, home security, and industrial applications where a human interface isn't viable, as well as cleaning. As a result, for every tiny task, robots take the place of humans.

Floor cleaning is a common household duty that is often regarded as unpleasant, demanding, embarrassing, and dull. Despite the fact that there has been a lot of work done in this area of robotics, none of it has done the cleaning of both dry and wet floors by detection.Traditional vacuum cleaners have large mechanical and electrical parts that are more expensive and consume more power, whereas autonomous cleaner robots have low power consumption, can work during power outages, and do not require human supervision.Robotic cleaners are classed according to their cleaning capabilities, which include floor mapping, dry vacuum cleaning, and wet cleaning, among others.

II.LITERATURE REVIEW

An automatic vacuum cleaner robot is an electronic device that is programmed to clean the floor using a vacuum cleaning mechanism. Various studies outlining how to clean a given floor and develop a robot mechanism are discussed here.

T.B. Asafa and T.M. Afonja designed the "Vacuum cleaning robot" using Arduino 2560, which is spherical in shape and sucks dirt through a retractable trash bin on the top. It also has a cooling fan and a suction fan that can produce a vacuum that sucks 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.

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 [2]. 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" published by author "N. M Borkar, Pragya Mishra, Anjali" in paper [3] is based on ATmega8. 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.

M. Ranjit Kumar and N. Kapilan collaborated on "Design and implementation of smart floor cleaning robot using Android App" in paper [4. 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.

Author Sewan Kim's paper [5] was titled "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.There are a total of 14 ultrasonic sensors installed in this device, 5 of which are mounted on the device's upper portion for identifying tall obstacles and 9 on the lower portion for detecting flat obstacles and general navigation. On the device's top are four infrared seeking sensors. A turret mechanism on the sensor mounting plate rotates and scans the position of the IR signal emitting charging station. On the bottom of the robot, four cliff sensors are employed for infrared distance measurement sensors, which helps to protect Roboking from slipping down. Two tactile sensors have been fitted in the bumper to detect small or skinny items that ultrasonic sensors are unable to detect.The benefit of this method is that a user can manually enter cleaning time through the control panel, but the disadvantage is that the user interface menu layout is complex.

Adeel Saleem and Atif Iqbal created the system "Design and Implementation of an Intelligent Dust Cleaner Robot for Uneven and Nonstructural Environment" in their article [6]. This paper depicts a room cleaning robot with map storing and wall following capabilities, all of which is accomplished using an Arduino Uno Atmega328.The combination of the sensor assembly, algorithm, and intelligent dust cleaner shape makes him possible and effective for all types of contexts, including complicated and sensitive situations such as medical diagnostics, generalisation, and abstraction activities.Furthermore, an intelligent dust cleaner robot is capable of documenting the cleaning path as well as performing the cleaning function automatically. The H Bridge driver module is used by the controller to receive the signal and control the geared DC motor with quadrature encoders.The intelligent dust cleaner operation takes data as an input and uses infrared sensors to determine if the surrounding area conditions are workable or not. The data fed into the chip leads to a programme logic that determines which direction the robot will travel, and then these control signals are sent to the drive motors.

The Raspberry Pi and Arduino Mega were utilised in tandem as the robot's processor in paper [7] author H. A. ShakhawatHossenPrayash, &*et.al.* studied on "Designing and Optimization of an Autonomous Vacuum Floor Cleaning Robot." .LIDAR is used for accurate mapping, but proximity sensors are used for immediate detection of any impediments. The Arduino input pins are connected to proximity sensors. The approach is based on Genetic Algorithms (GA), which are used to determine the optimal path in multiple processes, including room modelling, path planning, fitness function and selection, crossover, and mutation.The mapping methods that use a GPS module are fairly complicated. It is slightly more difficult to follow the robot using GPS while functioning in an indoor environment.

"A Robust Obstacle Detection Method for Robotic Vacuum Cleaners" was created by Mun-Cheon Kang&*et.al.* in paper [8]. RVC's wide angle camera captures an image with the IR line reflected via the floor or a barrier, and this is based on image processing.Obstacles obtain with the help of the coordinates of image in the pixel's format that can be supposed to the IR line in the captured images. Higher the intensity value of IR line in the image. Images indicated to the Proposed the method exhibits a more robust and accurate.

P. B. Jarande, &*et.al.* devised the "Robotic Vacuum Cleaner Using Arduino with Wi-Fi" system in their paper [9.] In this system, technology-based vacuum cleaners that may overcome existing vacuum cleaner shortcomings also deliver novel vacuuming sanitizing capabilities using UV light.. The controller used here is an ATmega328 with a Wi-Fi module (ESP8266EX), therefore they were able to construct an autonomous system that could be controlled from afar via Wi-Fi.

Swati Pawar, &*et.al.*have designed a "Cleaning Robot Based On PIC Controller" in their paper [10]. They use the PIC18F4550 and the C programming language to control the system. The DC motors that drive the wheels are powered by two batteries connected in series. It produces the results shown in the table (table 2). It demonstrates that the developed ultrasonic driver, which has been tested and used for lateral positioning error correction and map creation, has a high level of accuracy. The project's disadvantage is that it cannot be controlled automatically.

Swati Pawar, et. al. designed "Review Paper Based On Cleaning Robot" in paper [11]. It has a minimal cost and high precision. They're employing a PIC18F4550 with a Bluetooth model in this project. The robot follows a straight-line parallel course in this paper's methodology.

The system is called "Development of Small Robot for Home Floor Cleaning" in article [12] by authors Yong-Joo Oh and Yoshio Watanabe. The navigation system relies on a simple switch sensor. It features an

excellent navigation system algorithm robot that can adjust the track without the use of eyesight or range sensors. It comes in handy when scrubbing the floors.To avoid colliding with an obstruction, this robot used two switch sensors to detect the direction and distance.

Iwan Ulrich, Francesco Mondada, and J. D. Nicoud invented the "Autonomous vacuum cleaner" in paper [13]. It operates in real-time in a real-world setting. With the ready to interfere sensor, it enhances the speed. It can be used for mobile control navigation systems, the robot has one arm for cleaning, and it can also be used to crash through walls.As a result, it is efficient, but because it is enormous, it will not fit into a small space. This vacuum cleaner uses a mobile navigation system for direct navigation and obstacle detection.

A. Vimala, S. Manikandan, T. S. Aravinth, S. Birundh Devi, and S. SathiyaGopika designed "Microcontroller Based Floor Cleaning Robot" in their paper [14]. As a controller, they employ the PIC16F877A. Information about the robot is shown on an LCD. The disadvantage is that it is manual, has limited cleaning capabilities, and is expensive. Before operating the equipment, we need to clean it first.

Authors D. C. Patel and H. S. Patil developed the "vacuum cleaner robot employing artificial intelligence" in paper [15]. They used an Arduino mega2560, which isn't powerful enough to control vacuum cleaner robots' input and output signals. For floor cleaning, it uses an 18,000 rpm dc motor. It uses an Arduino Mega to control the switch and an IR sensor for object detection. A cleaning robot is upgraded with a distance sensor, GPS sensor, and automatic charging system in this artificial intelligence vacuum. It was controlled by an Arduino and a Windows application.It requires a 5V, 12V 1power supply, which is converted to 5V using a controlled IC 7805. The cleaning robot's autonomous movement was generated by the control system.

III.CONCLUSION

In this study, we looked at a variety of papers in which the robot is designed for usage in the home. With the use of several methodologies, we were able to identify various jobs performed by the robot. We learned from this poll that the cleaning robot has various advantages and disadvantages. As a result, we can create a cleaning robot that can do a variety of duties.

Using borderline analysis, we can do cleaning such as dry cleaning, wet cleaning, and floor mapping in this robot. This vacuum cleaner robot can clean the room using three different modes of operation: zig-zag, point, and cell to cell.Additional functions such as time scheduling, dustbin, scanned cleaning area, auto charging via docking, collision control when particular algorithms for path planning and navigation identify any obstruction surrounding it can be incorporated. We may utilize the solar panel to save electricity in this system, and we can use the Android App or Google help for instructions.

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