AUTONOMOUS VACUUM CLEANER BOT

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Abstract:
Over the years, science and technology have changed the way we live. Modern households are heading towards saving time and effort. In this scenario, vacuum cleaners play a vital role in making home cleaning easier. Here we present the development of an economical autonomous vacuum cleaner robot and the system is controlled by an Arduino. This autonomous vacuum cleaner is composed of a mobile robot and a suction device. The robot is navigated according to a controlling algorithm and it avoids obstacles using ultrasonic sensors.

Keywords: Vacuum Cleaner Robot, Random walk algorithm, Spiral algorithm, Ultrasonic sensor, Arduino.

Introduction:

The Internet of Things (IoT) is a network of physical items equipped with electronics, sensors, software, and network connectivity for data sharing. The Internet of Things allows users to sense and control objects over a network, allowing for direct integration of the physical world into computer-based systems. The robotics section covers robot design, operation, construction, and application. Individual growth and development have been aided by the Internet of Things and Robotics working hand in hand.

As people's desires grow, robots have recently emerged as a home appliance. More than ever, home appliance robotics research is gaining attraction. Several large cleaning equipment are already available for both residential and industrial use. However, their actions are non-autonomous, costlier and they can only conduct a limited number of cleaning functions. Hence, in this current hectic schedule, vacuum cleaners without human intervention and economical are more essential.

Literature review:

[1] Robots are human-like machines that can execute all of the tasks that people can in a fraction of the time. They cannot replace humans, but they can assist humans in performing many of their everyday tasks.

[2] Handheld robots need to be handled manually by applying push force to move from one position to another position.

[3] The creation of an efficient and automated robot increases home automation, resulting in greater convenience.

[4] The development of vacuum cleaner robot with robotic arm detects the obstacles with its tactile sensing system, but this system is costlier than conventional system.

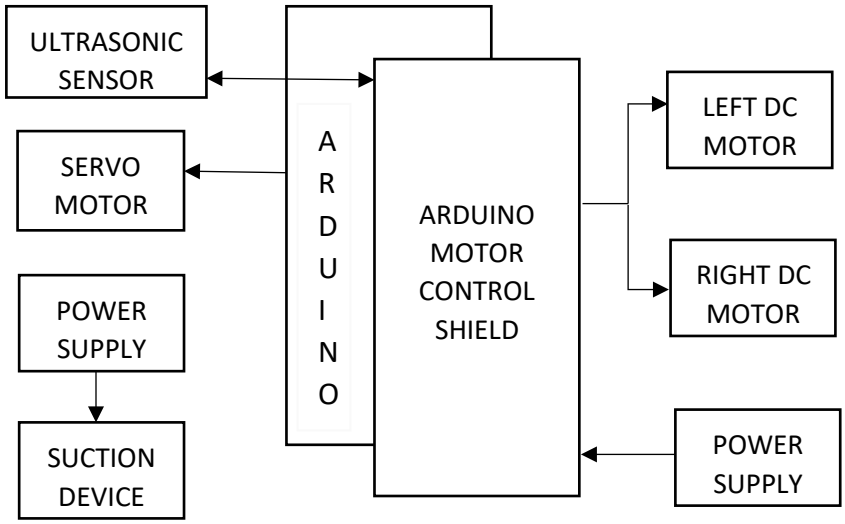
[5] The robot detects obstacles and hurdles through ultrasonic sensors and can also be navigated using Bluetooth.

[6] The robot is navigated by some controlling algorithms. Path planning algorithms are used to identify safe, efficient and collision free path origin to a destination. There are different path algorithms like random walk, spiral, s-shape, wall follow algorithm.

[7] Genetic algorithm assists the robot in traversing the whole area by avoiding obstacles utilising several sensors, but this algorithm is complex and consists of several steps to determine the path.

[8] The application of the indices to the VC case study revealed that the lifetime of a VC is better and more cost effective in the vast majority of cases evaluated. It's both ecologically friendly and feasible.

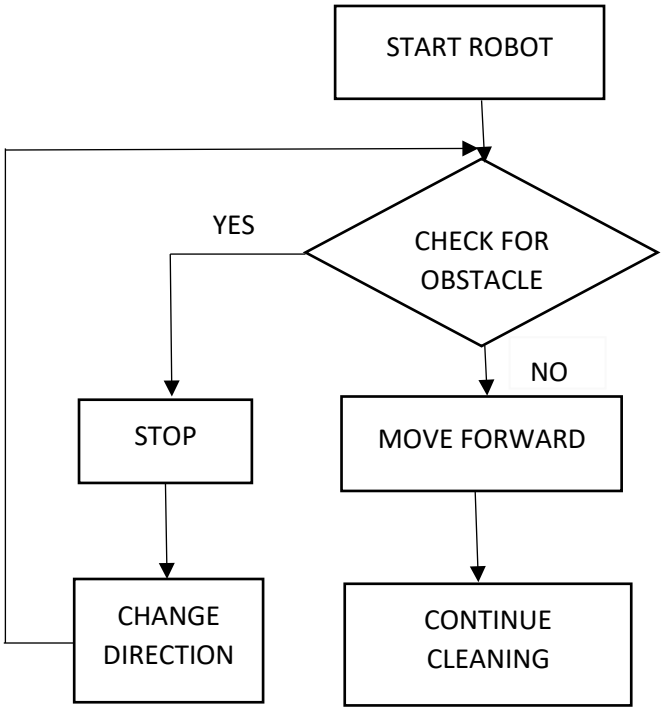
Block Diagram:



The proposed robot is a battery-operated electronic device with an ultrasonic sensor which is directed by a servo motor generates binary data. This data is then transferred to the control unit, i.e., Arduino, which is considered the robot's brain. Based on information provided by the sensor, this unit generates control signals automatically. Finally, the wheel motor drivers get these control signals.

While the robot moves, the suction device sucks up the dust by creating a negative pressure and thus cleaning the floor.

Flow Chart:



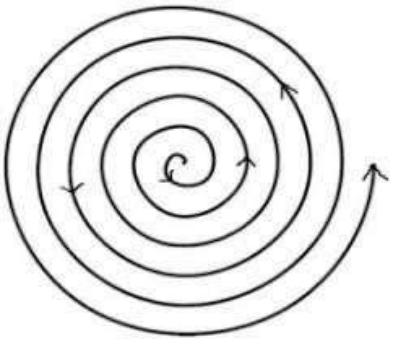
Working:

The RC car is made up of four DC motors that drive at the speed specified in the Arduino IDE code and are controlled by the motor shield. The RC car's ultrasonic sensor detects the distance between it and the obstacle in front of it. So, whenever it comes across any obstacles, such as walls, tables, chairs, or anything else that isn't garbage or dust, the RC car carrying the vacuum cleaner changes its direction to avoid crashing and destroying itself. When an obstacle is detected, the code fed to the Arduino runs continuously, and the cycle repeats at regular intervals. On the acrylic sheets, the batteries are placed.

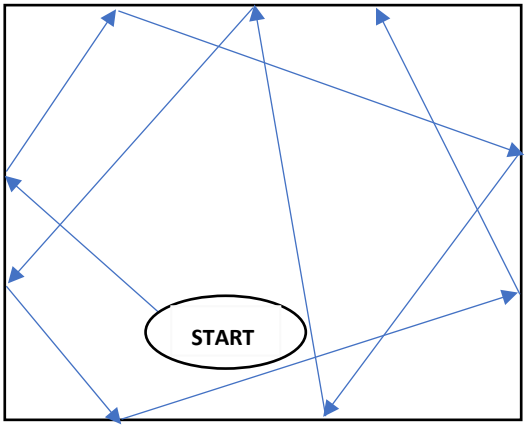
Path planning algorithms:

Spiral Algorithm:

This algorithm enables the robot to form a larger circle. First, the robot determines whether there is sufficient space to begin spiraling. If so, the robot convolutes in an LHS direction, expanding the radius from the center point until it detects an impediment. When the robot detects an obstruction, the algorithm is terminated. This algorithm aids in the rapid coverage of the room. The right wheel driving motor is assumed to be running at maximum speed for this algorithm, while the left motor's speed is progressively increasing over time.



Random Walk Algorithm:



A robot following a random path is considered to use random walk algorithm. A random walk algorithm doesn't require any precise realization of the route plan. This algorithm is entirely random, i.e., after each collision with an obstacle, the robot randomizes and heads towards another direction without regard to where it has come from or been, see fig. This algorithm can be configured via sensors to be able to decide which direction to turn when it hits an obstacle. In this manner, the robot creates its own path, and the path depends firmly on its surroundings.

Comparison of Path Algorithms:

Spiral algorithms have trouble reaching the corners and are unable to clean the room's corners, whereas the random walk algorithm can reach any corner. Random walk can clean whole room whereas spiral algorithm can clean only 80% of the room. As a result, the random walk method outperforms the spiral algorithm.

Conclusion:

The goal of this project is to develop an autonomous vacuum cleaner that could function inside a provided area. The developed robot is economical and simple to use. The robot navigates using a random walk algorithm through which it can reach and clean each and every part of the area. Because it is a wireless device, the robot can traverse a broad region. It also decreases human effort by reducing human interaction, making it unfit for the present world.

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